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S. No. 10/1, Ambegaon (Budruk), Off Sinhgad Road, Pune 411041
Sinhgad Institutes
Tel. : +91-20-24355042 / 46, +91-20-24610880/881 • Tele Fax : +91-20-24355042 • Website : www.sinhgad.edu
• Email : nbnssoe@sinhgad.edu / nbnssoms@sinhgad.edu / nbnssocs@sinhgad.edu

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REVIEW OF RESEARCH
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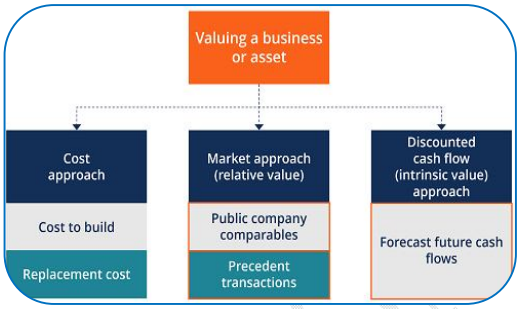
ANALYSIS OF CORRELATION IN BUSINESS VALUATION BY PRICE EARNING MULTIPLE METHOD AND CURRENT MARKET VALUE METHOD



Dr. Mahesh Abale[1] and Dr. Avinash H. Ghadage[2]
[1]Professor & HOD, MAEER's MIT MBA Dept. Pune.
[2]NBN Sinhgad School Of Management Studies, Ambegaon.

ABSTRACT:

A business valuation compares a firm's value with its competitors to determine the firm's financial worth. There are various business valuation models but Relative valuation model is a very useful and effective tool in valuing an asset, businessman may use relative valuation models for determining whether a company's stock is a good to buy of not.

KEYWORDS: *Business valuation, P/E multiple, Earning per Share, Market Value, Book Value.*

1. INTRODUCTION:

Valuing a business is a pivotal function while acquiring a company as the buyer will be willing to pay. Valuation is used for stock selection, concluding market expectation, evaluating corporate events, setting up an opinion, evaluating business strategies, as a communication among management, and appraisal etc.

Business valuation is a powerful tool to find out intrinsic value of business. It guides to the managers to run their companies in an increasingly competitive world. By integrating accounting and performance measures with strategic thinking and day-to-day operations, managers can learn to take decisions that enhance their businesses and add real value. Investors are paying great attention to non-financial factors in their efforts to assess the value of corporations. If the economic environment in which the company operates is unstable, there is much risk in valuation of such company because it affects on market value of company and estimation may go wrong in future.

1.1 Business valuation by Relative valuation methods

In the process of business valuation, when accounting information is not easily available relative valuation is most useful tool for quick assessment of the company's value. This method does not consider the time value of money. In this method the experts calculate ratio or multiple to express the value of a company in relation to a certain variable. Following Multiples may be used to find business valuation

1. Price Earnings Multiples
2. EV/EBITDA Multiples
3. Price to Book Value Multiple (P/B)
4. Current Market Value

1.1.1 Price/Earnings Multiple (P/E):

The P/ E Multiple is one of the most common indicator to judge the worth of a company's share. Most of the investors generally watch the progress of stock indices like Sensex & Nifty to understand whether the market is falling or rising.

This multiple basically tells investor what is the price to be paid per share for one rupee of earning generated by Target Company. If the P/E multiple is high, it means that, investors are optimistic and are expecting higher earnings growth in the future and if P/E multiple is low, it means that the stock is undervalued and there is a scope for appreciation in future. Stocks with P/E ratio less than 10 are often considered as cheaper. These types of stocks often provide a good opportunity for buying.

Formula:

P/E Ratio = Market Price per share / Annual Earnings per share

P/E ratios alone cannot be used for decision making and an investor should also check the quality of profits as well as its sustainability before taking a final call.

APPLICABILITY OF THIS MULTIPLE:

i. If company is in profit then only this multiple can be considered, in case of loss making company it is not applicable.
ii. This multiple is used when investor wanted to know, by how much times he should pay with respect to earning of company when buying the shares of company.
iii. When investor or buyer wants to know the lowest minimum amount at which deal would be carried, in such circumstance this method is applied.
iv. High Price to earnings ratio indicates that investors are expecting high earning growth in future. But while investing purpose, only P.E ratio should not be considered as a standalone parameter.

Limitations of Price to Earnings Multiple

i. A multiple represents a snapshot of where a firm is at a point in time, but it fails to capture the dynamic and ever-evolving nature of business and competition.
ii. As a company, it can manipulate its earning, so EPS as well as Price to earnings ratio can be distorted.
iii. Trailing P.E ratio takes the past earnings of a company into consideration. So, this ratio won't provide investor a clear idea of future earning prospective of a company.
iv. Multiples are based on historic data hence valuations based on multiples will therefore fail to capture differences in projected performance over the longer term, and will generate difficulty to value correctly cyclical industries unless somewhat subjective normalization adjustments are made.

Risk involved in this method

i. Price to earnings ratio is a good and simple measure of stock valuation, but investor should not consider this multiple alone, during investment decision.
ii. Investor should check out all other fundamental parameters in conjunction with P.E ratio before investing.
iii. If Investor find that the Earning per share is increasing at a certain rate, but P.E ratio is not increasing due to bad market condition then consider it as a good opportunity to buy the stocks.

1.1.2 Current Market value Method

Market value is the value of a company as reflected by the company's stock price. A company's market value is a good indication of investors' perceptions of its business prospects. Market value can fluctuate a great deal over periods of time, and is substantially influenced by the business cycle. Market

values plunge during the bear markets that accompany recessions, and rise during the bull markets that are a feature of economic expansion.

2. REVIEW OF LITERATURE:

i. Damodaran Aswath (2005), in his research paper **"*Valuation Approaches and Metrics: A Survey of the theory and Evidence*"**, focused on theory and evidence on valuation approaches. In the first part, The author surveyed the literatures on discounted cash flow valuation models, from dividend discount model to value stocks to the use of excess return models in more recent years. In second part, he focused on relative valuation models and use of multiples and comparables in valuation to know whether relative valuation models gives more or less clear-cut prediction of value than discounted cash flow models.

ii. Berkman Henk et.al (2000) in research article "***The Accuracy of Price-Earnings and Discounted Cash Flow Methods of IPO Equity Valuation"***, they compared valuation resulting from conventional discounted cash flow and price earnings valuation methods to the market price. They took newly listed 45 companies on New Zealand Stock Exchange to compare valuation and they concluded that, the discounted cash flow method and price earnings comparable do not produce the same result.

iii. Platt Harlan, et al.,(2010) in research paper ***"Free Cash Flow, Enterprise Value, and Investor Caution",*** they compared actual cash flows with enterprise values and found that the equity market is an extremely high discount rate which reduces future earnings of firm value. In of case high discount rate the huge amount of future cash flows is practically ignored. They found that stock prices do not reflect future corporate earnings, this finding contrast with the well known statement in finance textbooks that "the value of a firm equals the present discounted value of future cash flows." In fact, they found that enterprise value is substantially less than the present value of future cash flows.

iv. Fernandez Pablo (2007) in research paper **"*Company Valuation Methods: The most common errors in Valuation",*** author described four main, frequently used company valuation methods such as balance sheet methods, income statement based methods, mixed methods and cash flow discounting based methods. The author says that, cash flow discounting based methods most conceptually correct methods. This paper gives the list of most common errors in valuation which are found in more than one thousand valuations when he worked as a business consultant and professor.

RESEARCH GAP:

Business analysts are still facing estimation challenges due to lack of clear guidelines about estimation practices. By referring the literature it is seen that valuation practitioners ignore the recommendations provided by the theory which creates ambiguity in final business valuation. There is a need of more accurate and suitable models which will minimize risk in valuation by giving same value of business. Valuation estimates can vary widely among experts, these variations arise because, experts use different valuation models or make different assumptions because estimating parameters in the models are not clear.

3. Research Methodology:

3.1 Research Type:

This research comes under exploratory research type, because it is a kind of post martum analysis of annual reports of the targeted company

3.2 Hypothesis of the Study

H0: Business valuation by Price Earning Multiple method and Current Market Value method is not positively correlated

H1 Business valuation by Price Earning multiple method and Current Market Value method is positively correlated

3.3 Target population

There are 23 listed automotive companies which have manufacturing plants around Pune region which are listed in either at Bombay Stock Exchange or National Stock Exchange.

3.4 Sampling Technique

This research comes under Non-Probability sampling type where researcher has used Convenience Sampling method while selecting a sample.

The sample is selected on the basis of listing on stock exchange, group it belongs to and growth prospects.

3.5 Determination of Sample size

There are 23 listed automotive companies in Pune region, here researcher has selected Bajaj Auto Ltd for the study.

3.6 Data Collection Sources:

This research requires only secondary data, which is collected through Research journals, published articles, and consolidated annual reports of company, BSE and NSE Websites.

3.7. Tools used for Data Analysis

a) Financial Tools

1. Price/Earnings Multiple (P/E):
2. Current Market value Method

b) Statistical Tools

Karl Pearsons Correlation Coefficient

4. Data Analysis

Company Name: Bajaj Auto Ltd

4.1 Method 1: Business Valuation By Price Earning Multiple Method

Amount in Crores

Particulars	2013-14	2014-15	2015-16	2016-17	2017-18
Market price per share	2083.60	2016.60	2,422.45	2948.70	3080
Earning per share	116.80	104.60	135.8	132.30	140.6
(a) P/E Ratio	17.8	19.3	17.8	22.3	21.9
(b) Net profit Earned (In Cr.)	3380.28	3025.63	4061.24	4079.49	4218.95
Value of firm (Cr.)= (a)*(b)	**60301.0**	**58331.6**	**72445.9**	**90923.6**	**92420.8**

Table no 1

4.2 Method 2: Business Valuation By Current Market Value Method

Amount in Crores

Particulars	2013-14	2014-15	2015-16	2016-17	2017-18
Equity shareholders capital	144.68	289.37	289.37	289.37	289.37
No of shares in Crores	14.46	28.94	28.94	28.94	28.94
Market price per share	1981.00	1463.25	1678.8	2948.70	3080
(a)Market value of Equity= No of Equities* market price per share	28645.26	42342.07	48579.44	85326.53	89125.96
(b)Market Value of Debt	1361.03	347.45	438.96	568.2	604.34
Value of firm= (a)*(b)	30006.29	42689.52	49018.40	85894.71	89730.30

Table no 2

4.3 Analysis of Correlation between Business Valuation by Price Earning multiple method and Current Market Value method

Amount in Crores

Year	2013-14	2014-15	2015-16	2016-17	2017-18
Valuation by P/E Multiple Method (x)	60300.95	58331.6	72445.9	90923.6	92420.8
Valuation by Current market value (y)	30006.29	42689.5	49018.4	85894.7	89730.3

Table no 3

4.4 Karl Pearson's Correlation Formula

$$r = \frac{n(\Sigma xy) - (\Sigma x)(\Sigma y)}{\sqrt{[\, n\Sigma x^2 - (\Sigma x)^2 \,][\, n\Sigma y^2 - (\Sigma y)^2 \,]}}$$

r= Correlation Coefficient
n= Total number of observations
x = variable 1 (Valuation by P/E Multiple Method)
y = variable 2 (Valuation by Current market value)

Meaning of r

- If r= 1 means that for every positive increase in one variable, there is a positive increase of a fixed proportion in the other.
- If r= -1 means that for every positive increase in one variable, there is a negative decrease of a fixed proportion in the other.
- If r= 0 means that for every increase, there isn't a positive or negative increase. The two just aren't related.

4.5 Calculated value of coefficient of Correlation by using formula r= 0.968

Interpretation:

1. Correlation coefficient r= 0.968, it is approximately equal to 1. It means that there is strong positive correlation between Business valuation calculated by Price Earning multiple method and Current market value method.
2. It rejects the null hypothesis i.e. Business valuation by Price Earning multiple method and Current market Value method are not positively correlated.
3. Hence we conclude that Business valuation by Price Earning multiple method and current market value method are positively correlated.

5. FINDINGS

1. Relative valuation method is useful to find out fundamental value of business.
2. A method available under relative valuation methods such as Price earning multiple, price to book value multiple, current market value method gives realistic valuation.
3. Discount rate is not considered in such valuation so it shows basic value of business from which buyer or seller can start bid.

6. CONCLUSION

Business valuation by Price Earning Multiple method and Current Market Value method are positively correlated, as a businessman or investor by using above mentioned business valuation methods, he can check value of his business to understand the progress of his business. Business

valuation by relative valuation methods are relatively easy as compared with discounted techniques of valuation.

7. SCOPE FOR THE FUTURE RESEARCH:

Present research work is only calculation of fundamental value of business by considering Relative valuation techniques such as Earning price Multiple and Current market vlue method, wherein goodwill of the organization is not considered. Researcher can do further research work by considering goodwill of the organization in final value of business.

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Website:

www.bajajauto.com

Dr. Mahesh Abale
Professor & HOD, MAEER's MIT MBA Dept. Pune.

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STUDY THE FACTORS CONTRIBUTING TOWARDS NURSES ENGAGEMENT WITH REFERENCE TO DISTRICT HOSPITAL KARAD

Dr. Reshma Ramnath Kabugade
Associate Professor , NBN Sinhgad School of Management Studies, Ambegaon , Bk Pune.

ABSTRACT:

This research article predominantly focused on engagement of nurses staff which is working in Venutai Chavan District Hospital Karad. Many Research has been done in employee engagement based on that various Research material, there are some identified factors which contributing towards employees engagement, those factors has been utilized for studying the nurses engagement in district Hospital Karad. Data analysis has been done by randomly collected 40 sample of nurses staff as well as mentorn. Nurse engagement with the organization and the profession reduces compassion fatigue, burnout, and turnover while improving teamwork.

KEYWORDS: *nurses engagement , burnout and turnover , improving teamwork.*

INTRODUCTION

The idea of medical attendant commitment is frequently used to depict medical attendants' promise to and fulfillment with their occupations. In all actuality, these are only two features of commitment. Extra contemplations incorporate medical attendants' dimension of pledge to the association that utilizes them, and their promise to the nursing calling itself. Since medical caretaker commitment connects legitimately with basic security, quality, and patient experience results, understanding the ebb and flow condition of attendant commitment and its drivers must be a vital objective.

This Project was talked about the present condition of attendant commitment in VenutaiChavan Government clinic Karad, including factors that effect commitment. We additionally quickly depict the potential effect of sympathy weariness and burnout, and approaches to offer empathetic associated care for the parental figure. Such knowledge is essential to the calling's manageability under the heaviness of statistic, monetary, and mechanical weights being felt over the business, and is likewise basic to the accomplishment of methodologies to improve human services conveyance results over the continuum of consideration.

The importance of nurse engagement

- Overall engagement of these qualified Nurse staff members also plays an important role in improving quality across a health system.
- A wide variety of peer-reviewed studies, patient surveys, and data-driven reports have documented the impact nurses have on both patient satisfaction and health outcomes.
- A recent study showed that nurse engagement is the number one predictor of mortality variation across hospitals.

- This means that it's not enough for hospitals to simply add more staff; instead, they must look closely at the engagement levels of current staff in order to maintain optimal care practices.

Problem Statement: Study the factors contributing towards Nurses Engagement with reference to District Hospital Karad.

Identified Factors of Nurses Engagement:

1. **Impact of Tenure and Level of Care**Impact of Tenure of employee or it may be related to more significant issues of employee empowerment, work design, or leadership
2. Differences in Drivers of Nurse EngagementThe key drivers of medical caretaker commitment included:

- This association gives amazing consideration and administration.
- This association approaches representatives with deference.
- I like the work I do.
- The condition at this association makes representatives in my work unit need to go well beyond what's anticipated from them.
- My pay is reasonable contrasted with other human services bosses around there.
- My employment utilizes my aptitudes and capacities.
- I get the apparatuses and assets I have to give the best consideration/administration for our customers/patients.
- This association gives profession advancement openings.
- Patient security is a need in this association.
- These key drivers offer understanding into the most basic factors that impact commitment.

As a gathering, they speak to the kinds of things that have the best effect on by and large commitment of medical attendants. Separately, every thing tells a bit of the commitment story. Acknowledge that these drivers depend on a locale medical clinic.

2. **Length of Shifts**
3. **Compassion Fatigue and Burnout**
4. **Compassionate Connected Care™ for the CareGiver**
5. **Acknowledge the Work**
6. **Support Teamwork**
7. **Encourage Work/Life Balance**
8. **Ensure Communication**

OBJECTIVES:

1. To understand the concept of Nurses engagement
2. To identify the factors contributing towards Nurses engagement
3. To Know the opinion of Nurses staff on various factors of Nurses engagement
4. To invite valuable suggestion from Nurses staff towards their engagement.

Scope:

1. Conceptual Scope:

The term employee engagement was firstly used by the human resource practitioners and business firm, but in academic community the concept was rarely discussed. Kahn (1990) was the first academic researcher to define the concept of employee engagement. According to Kahn (1990) employee engagement is the level of commitment and involvement of the employees towards their organization and its values. While Perrin (2003) defined engagement "as willingness or enthusiasm that the employee holds to spend optional effort towards the job." In a study about antecedent and consequences of employee engagement, Saks (2006) defines employee engagement as the extent to

which an individual is attentive and absorbed in the performance of his/her roles. It is the positive feeling that employees have towards their jobs and also the motivation and effort they put into it.
2. Geographical Scope:This project study is limited to Cottage Hospital, Karad

RESEARCH METHODOLOGY:

Descriptive research involves gathering data that describe events and then organizes, tabulates, depicts, and describes the data collection (Glass & Hopkins, 1984).Simple random sampling technique was used to select sample size. In this Research study total 40 sample size has been used for this study.

DATA COLLECTION METHODS

A) Primary Sources: The data collected through the primary source from the Nurses staff with the help of Questionnaire. This is the first hand information. The subject was thoroughly discussed with the staff concerned.

B) Secondary Sources: The secondary data is published material such as, text book, register of nurses staff, duty allotment sheet , book, and research paper.

The Tabulation, Bar Chart, Percentage, and Pie Chart was used for data analysis and interpretation

Data Analysis:

Demographic Characteristics

1. Gender

Table no. 1 Gender

Gender	No. of Respondents	Percentage
Male	4	10
ale	36	90
Total	40	100

Interpretation:

The above table and graph shows that 90 Percent respondents are Female candidates and only 10 percent are male candidates.

2. Education

Table No.2 Education

Education	No. of Respondents	Percentage
GNM	32	80
B.Sc. Nursing	8	20
M.Sc. Nursing	0	0
Ph.D.	0	0
Total	40	100

Interpretation: The above table and graph shows that 80 % of respondents are taken education as GNM and 20 % of them have done B.Sc. Nursing.

3. Position

Table No. 3 Position

Particulars	No. of Respondent	Position
staff nurses	32	80
Mentron	8	20
Total	40	100

Interpretation: The above table and graph shows that 80 % of respondents are working as staff nurses and 20 percent of respondents are working as Mentron

4. Experience

Table no. 4 Tenure

Particulars	No. of Respondent	Tenure
0 to 2	11	27.5
3 to 5	21	52.5
6 to 8	4	10
9 to 11	4	10
Total	40	100

Interpretation: The above table and graph shows that, 10 % of respondents are having 9 to 11 years of experience, 10% of respondents are having 6 to 8 years of experience, 27.5% of respondents are having 0 to 2 years of experience and 52.5% of respondents are having 3 to 5 Years of experience.

5. Differences in Drivers of Nurse Engagement

Table No. 5

Particulars of Differences in Drivers of Nurse Engagement	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. This organization provides high-quality care and service.	5	30	5	0	0
2. This organization treats employees with respect.	10	30	0	0	0
3. I like the work I do.	10	30	0	0	0
4. The environment at this organization makes employees in my work unit want to go above and beyond what's expected of them.	0	0	25	10	5
5. My pay is fair compared to other healthcare employers in this area.	0	0	10	18	12
6. My job makes good use of my skills and abilities.	11	19	7	3	0
7. I get the tools and resources I need to provide the best care/service for our clients/patients.	0	0	10	18	12
8. This organization provides career development opportunities.	0	0	10	18	12
9. Patient safety is a priority in this organization.	0	0	10	18	12
10. These key drivers offer insight into the most critical factors that influence engagement.	15	15	10	0	0
Mean	**5.1**	**12.4**	**8.7**	**8.5**	**5.3**
SD	**5.87745**	**13.938**	**7.008725**	**8.7082**	**5.96378**

Interpretation :

From above table it reveals that this organization provides high-quality care and service, organization treats employees with respect. Respondents are like their job, Respondents are not satisfy the work environment. Respondents opinioned that they are not having fair pay compared to other healthcare employers in this area. This job makes good use of their skills and abilities. Respondents are not satisfy with the tools and resources which they get. Respondents ate also dissatisfy regarding career development opportunities. Repondents are partially agree with Patient safety is a priority in

this organization. Respondents are opinioned that these key drivers offer insight into the most critical factors that influence engagement.

6. Compassion Fatigue and Burnout

Table no.6

Compassion Fatigue and Burnout	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. Working during hurricane caused me to question spiritual/religious beliefs	10	30	0	0	0
2. Working during hurricane disrupted my family/ personal life	10	30	0	0	0
3. I would have preferred to work less time than I did	0	0	35	5	0
Mean	**6.66667**	**20**	**11.66667**	**1.6667**	**0**
SD	**5.7735**	**17.321**	**20.20726**	**2.8868**	**0**

Interpretation:

The above table shows that working during hurricane caused respondents to question spiritual/religious beliefs. Working during hurricane disrupted respondent's family/personal life. Respondents are having neutral opinion on they would have preferred to work less time than theycan.

7. Compassionate Connected Care for the Care Giver

Table no. 7

Compassionate Connected Care for the Care Giver	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Stongly Disagree
1. My job makes a good use of my skills and abilities	9	31	0	0	0
2. My job Responsibilities are clear	10	30	0	0	0
3. I get the training I need to do a good job	8	32	0	0	0
4. This organization provides career development opportunities	9	31	0	0	0
5. I get the tools and resources	0	0	10	18	12
6. My work unit is adequately staffed	10	30	0	0	0
7. I have sufficient time to provide best care of patients	10	30	0	0	0
8. The person I Report gives me useful feedback	8	32	0	0	0
9. When appropriate , I can act on my own without asking an approval	0	0	10	18	12
10. Patient Safety is priority for the organization	10	30	0	0	0
Mean	**7.4**	**24.6**	**2**	**3.6**	**2.4**
SD	**3.97772**	**12.989**	**4.21637**	**7.5895**	**5.05964**

Interpretation:

From Above table it reveals that, this job makes a good use of respondents skills and abilities, job Responsibilities are clear. Respondents get the training and this job provides career development opportunities as well as gives the tools and resources. Their work unit is adequately staffed and they have sufficient time to provide best care of patients. The person they Report gives them useful feedback When appropriate, Patient Safety is priority for the organization but they cannotact on my own without asking an approval Patient Safety is priority for the organization.

8. Acknowledge the Work

Table No.8

Acknowledge the Work	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Stongly Disagree
1. I get acknowledgement from patient	9	31	0	0	0
2. My leaders acknowledge my work	10	30	0	0	0
3. My colleagues are also recognize my efforts	8	32	0	0	0
Mean	**9**	**31**	**0**	**0**	**0**
SD	**1**	**1**	**0**	**0**	**0**

Interpretation: From above table it predicts that they get acknowledgement from patient even their leaders acknowledge the respondent's work , their colleagues are also recognize their efforts

9. Support Teamwork

Table No.9

Support Teamwork	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
1. Our teams must be coordinated around the patients' needs	8	32	0	0	0
2. Our Teams that work together consistently	9	31	0	0	0

Interpretation: The above table and graph shows that ,32 number of respondent out of 40 are agree strongly agree with statement that their teams must be coordinated around the patients' needs and 8 respondents are strongly agree.
The above table and graph shows that ,31 number of respondent out of 40 are agree strongly agree with statement that their Teams that work together consistently.

10. Encourage Work/Life Balance

Table No. 10

Encourage Work/Life Balance	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
Encourage Work/Life Balance	0	0	10	25	5

Interpretation: The above table and graph shows that , 25 number of respondent out of 40 are disagree with statement that nurses job engagement encourage their work life balance and 5 are strongly disagree.

FINDINGS:

1. Majoritynurses staff are Female candidates and few are male candidates.
2. Majority nurses staffare taken education as GNM and few of them have done B.Sc. Nursing.
3. Majority nurses staff are working as staff nurses and few of employees are working as Mentron

4. 10 % of nurses staff are having 9 to 11 years of experience, 10% of respondents are having 6 to 8 years of experience, 27.5% of respondents are having 0 to 2 years of experience and Majority of respondents are having 3 to 5 Years of experience.
5. This organization provides high-quality care and service, organization treats employees with respect. Respondents are like their job, Respondents are not satisfy the work environment. Respondents opinioned that they are not having fair pay compared to other healthcare employers in this area. This job makes good use of their skills and abilities. Respondents are not satisfy with the tools and resources which they get.Employees are also dissatisfy regarding career development opportunities. Employees are partially agree with Patient safety is a priority in this organization. Respondents are opinioned that these key drivers offer insight into the most critical factors that influence engagement.
6. Working during hurricane caused respondents to question spiritual/religious beliefs. Working during hurricane disrupted respondent's family/personal life. Respondents are having neutral opinion on they would have preferred to work less time than they can.
7. This job makes a good use of respondents skills and abilities, job Responsibilities are clear. Respondents get the training and this job provides career development opportunities as well as gives the tools and resources. Their work unit is adequately staffed and they have sufficient time to provide best care of patients. The person they Report gives them useful feedback when appropriate, Patient Safety is priority for the organization but they cannot act on my own without asking an approval Patient Safety is priority for the organization.
8. Nurses staffget acknowledgement from patient even their leaders acknowledge the respondent's work , their colleagues are also recognize their efforts
9. Majority nurses staff were agree that their teams must be coordinated around the patients' needs. Majority employees are agree that their Teams that work together consistently.
10. Majority nurses staff are disagree that nurses job engagement encourage their work life balance.

RECOMMENDATION:

As the data and research have demonstrated, nurse engagement is critical to the patient experience, clinical quality, and patient outcomes. Nurse engagement with the organization and the profession reduces compassion fatigue, burnout, and turnover while improving teamwork,

1. Majority nurses staff having good experience, ability and skill to tackle the job hence they should fair salary as per the workload and their engagement at workplace.
2. They should get opportunity to develop their career in terms of study leave facility, concessional fees for various courses etc.
3. There should be enhancing work life balance of nurses in that motive organization of a family orientation programme so organizational members can interact with staff's family members so they will get support from family members by understanding which kind difficulties facing at work place.
4. There should be family friendly policies should be provided by organization to uplift the status of work life balance of nurses staff.

CONCLUSION:

These key drivers offer insight into the most critical factors that influence engagement. Nurse engagement with the organization and the profession reduces compassion fatigue, burnout, and turnover while improving teamwork, the patient experience, and organizational outcomes across multiple measures.

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A Study on Critical Analysis of Digital Channels with special reference to Indian Films

Prof. Jyoti Howale[1] Prof. Ankita Jeewankar[2]

Assistant Professor[1] NBN Sinhgad School of Management Studies , Pune

Assistant Professor[2] NBN Sinhgad School of Management Studies , Pune

Abstract

The objective of this research paper is to analyze selected top digital channels with special reference to Indian films from the perspective of movie viewers. The researcher has collected the data from 200 respondents using survey method with the help of well-structured questionnaire. The researcher has used descriptive research design and non-probability convenience sampling method for the present study. The findings of this study will be useful to different digital channels in India who are broadcasting Indian films and also to movie producers.

Introduction

The entertainment industry is one of the fastest growing sectors in the Indian economy. India produces more films than any other country in the world. Indian film industry is booming like never before in last decade on both domestic as well as overseas market. In more than 90 countries Indian films are broadcasted. Box office collection, satellite rights, digital rights, product placement in movies and corporate sponsors are the major revenue generation sources for Indian movies.

Digital rights are related to copyright agreement of digital works between the producer and user. At present Amazon, Netflix, Zee, Voot and hotstar are the major

digital channels for digital rights of Indian movies. While satellite rights are related to copyright agreement of movies between the producer and user. Indians spend more time watching films on television than going to the cinema. And now a day's people started to prefer digital channels for the same. Indians movie viewers are more and more using Internet devices to access movies.

Literature Review

Nigel Culkin & Keith Randle (2003), in the research paper entitled "Digital Cinema: Opportunities and Challenges" the researchers focused on transition of film industry from film to digital media. They suggested that both the media must have to go hand in hand for the growth of industry.

Nilanjana Sensarkar (2007), in the research paper entitled, "The potential impact of digital rights management on the Indian entertainment industry" the researcher has explored the impact of digital rights management in the Indian Copyright Act, 1957 with special reference to bollywood and the related music sector.

Gautam Mandal, et.al. (2017), in the research paper entitled "Netflix: An In-Depth Study of their Proactive & Adaptive Strategies to Drive Growth and Deal with Issues of Net-Neutrality & Digital Equity", the researcher has studied various problems faced by Netflix worldwide and also suggested few remedies for it.

Nilesh Anute and Dr. Devyani Ingale (2018), in their research paper entitled "A Study on Customers Perception about Digital Marketing Practices in Bollywood Movies" the researcher has explored digital marketing practices used by various movies. They identified that most of the movie production houses are using digital media for marketing and it is becoming profitable for the organizations.

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Research Methodology

Objectives of the study

1. To study the awareness and usage of movie viewer's about selected digital channels broadcasting Indian films.
2. To study the movie viewer's perception about selected digital channels broadcasting Indian films.

Hypothesis of the Study

H1: Netflix has more awareness and usage as compared to other digital channels.

Scope of the study

The scope of the study is limited to selected top five digital channels broadcasting Indian films. (Netflix, Amazon Prime Video, hotstar, Zee, Voot).

The Major factors identified for detailed study are awareness, usage, digital rights, broadcasting, perception etc.

Sampling

Researcher has used non probability convenience sampling method to collect the data from 200 respondents in Pune city.

Methods of Data collection

Primary data is collected using the well structured questionnaire and having interaction with the respondents. Secondary data is collected from various sources like internet, books, magazines, and articles etc.

Method of analysis and statistical tools

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A structured questionnaire is used to collect data and IBM SPSS-20 and Ms Excel-2007 has been used to analyse the data.

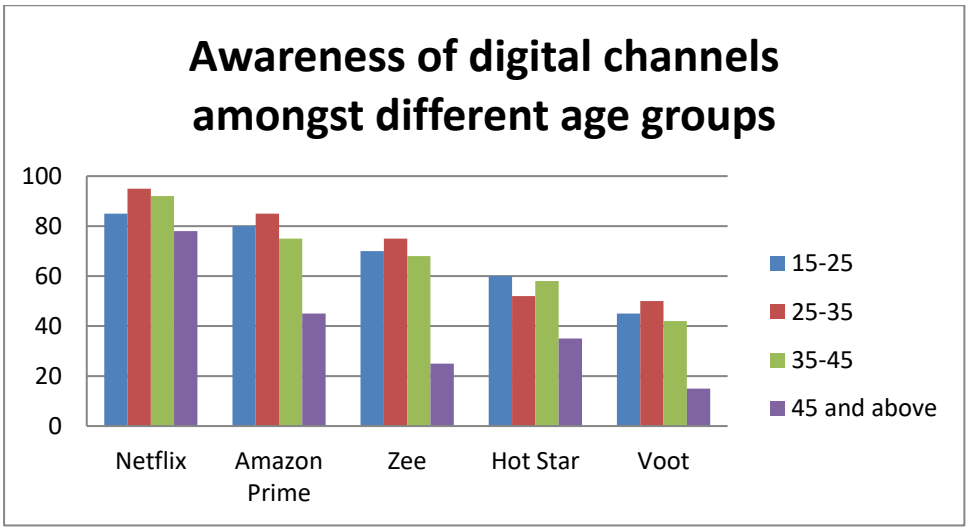
Reliability and Validity

The researcher has carried out reliability test using SPSS. The Cronbach's Alpha observed is 0.875, which is more than 0.700, so the Questionnaire is measured to be reliable. The researcher has used content validity and identified the research instrument is valid for the present research study.

Research design

Type of Research Design	Descriptive Research Design
Sampling Technique	Non Probability Convenience Sampling
Sampling Area	Pune City
Sample Size	200
Primary Data	Well structured questionnaire
Secondary Data	Research papers, Articles, Books, Journals etc.

Tabulation & Data Analysis



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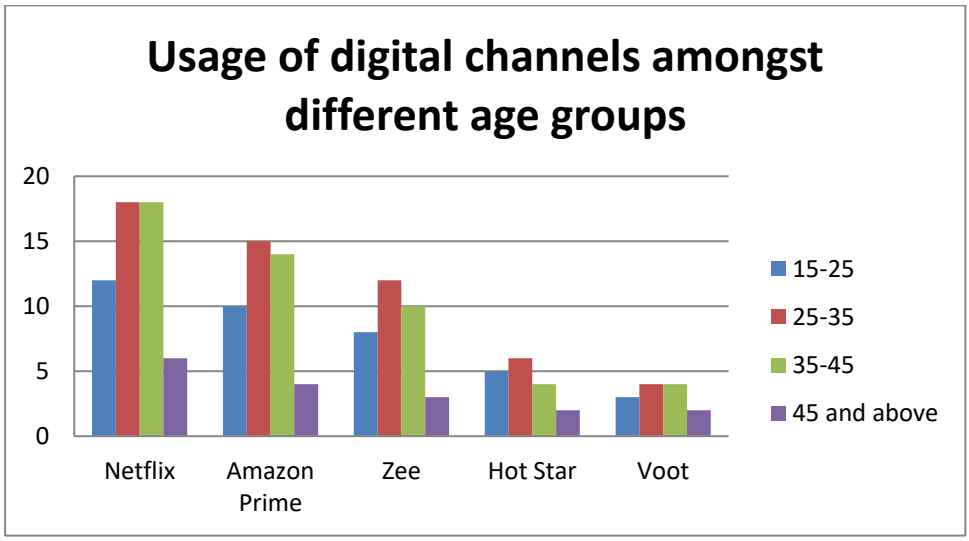

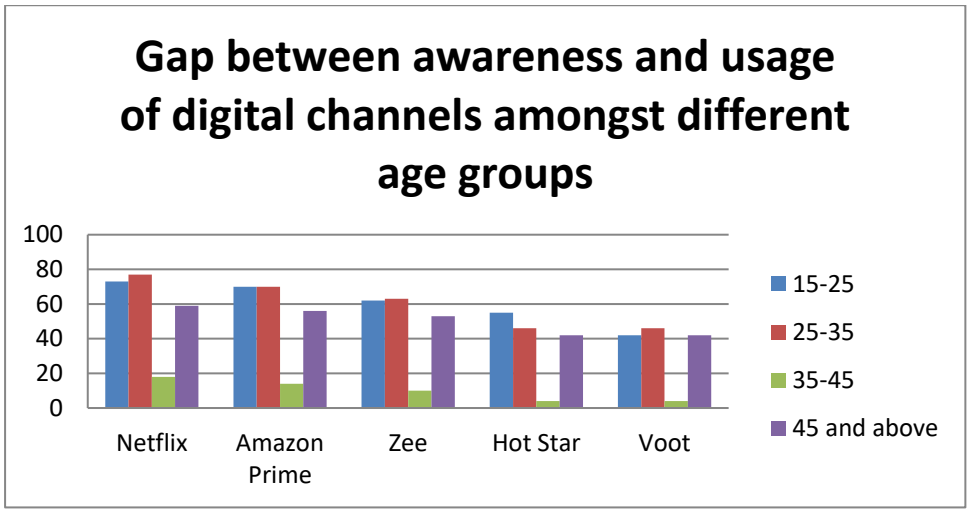

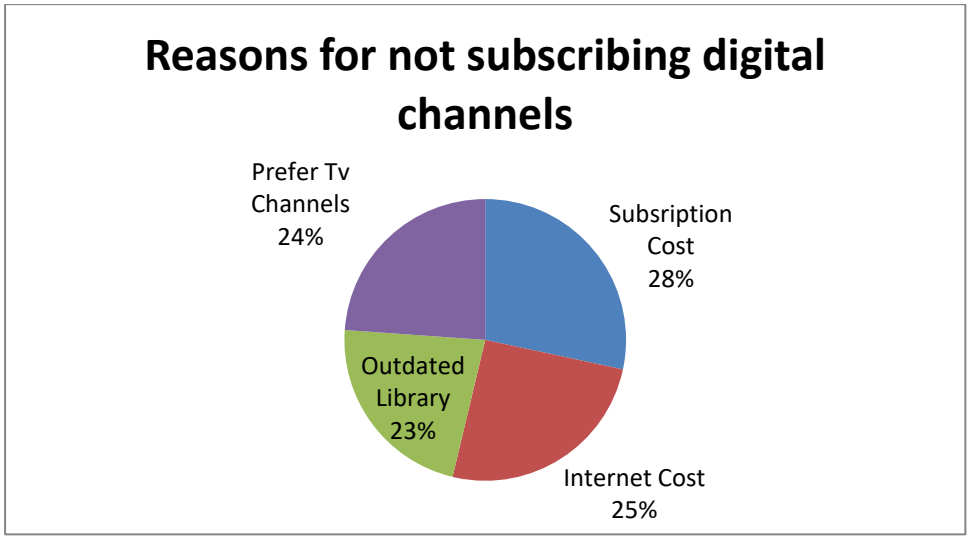

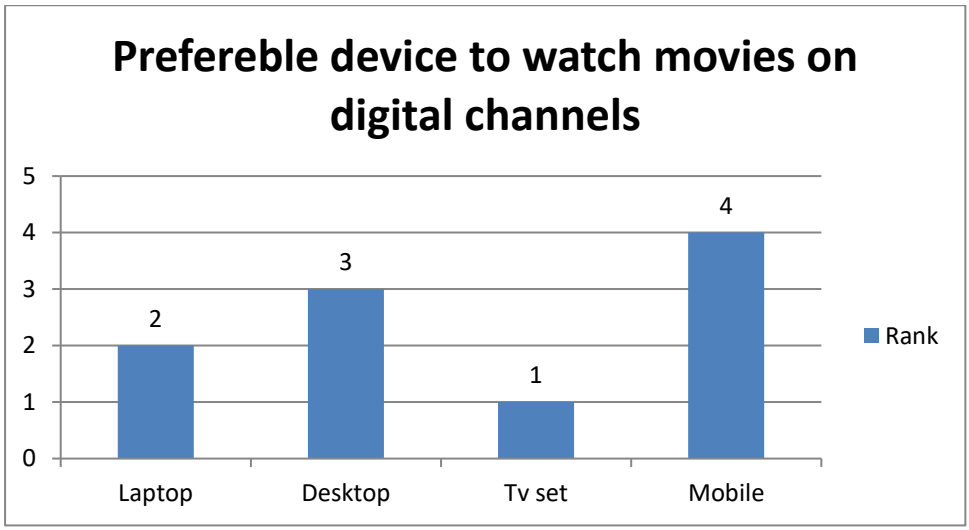

Hypothesis Testing

- Null Hypothesis (H0): All digital channels have equal awareness and usage.
- Alternative Hypothesis (Ha): Netflix has more awareness and usage as compared to other digital channels.

- The researcher has tested the null hypothesis with the help of IBM SPSS 20. The researcher has applied ANOVA test to check the null hypothesis. The P value identified is 0.01 which is less than 0.05 so the null hypothesis is rejected and alternative hypothesis is accepted at 5% level of significance.

Findings

- Netflix has high awareness amongst all age groups as compared to other digital channels broadcasting Indian movies.. Awareness of digital channels is high in the age group of 25-35 and 35-45.
- Netflix has high usage amongst all age groups as compared to other digital channels broadcasting Indian movies. Usage of digital channels is high in the age group of 25-35 and 35-45.
- Gap between awareness and usage is higher in the age group 15-25 and 25-35.
- People are not subscribing digital channels because of its subscription cost (28%), internet cost associated with it (25%), they prefer TV channels (24%), and outdated movie library (23%).
- Respondents have given first rank to Tv sets to watch Indian movies on digital channels.

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A Study on Influence of Workplace Telepressure on Organizational Effectiveness wrt Selected Industries in Pune city.

Dr. Smeeta Kabadi
Asst. Professor,

Sinhgad School of Management Studies , Pune

Abstract

This research paper is aimed to study the influence of workplace Telepressure on organizational effectiveness of selected five industries in Pune city. The researcher has used survey method to collect the data from 150 employees by using well-structured questionnaire. Descriptive research design and non probability convenience sampling method is used for this study. The scope of the study is limited to only five selected industries IT, Automobile, Retail, Banking and Education. The findings of this study will be helpful to various industries to increase their organizations effectiveness and overall performance.

Introduction

Workplace Telepressure

Changing technology has given rise to communication on internet and mobile media, which results into less face to face communication and boosts the email and messaging culture in the corporate world. Workplace telepressure is related to fast response on to seniors and top management in the organization. Telepressure is nothing but an urge to work related emails no matter when they are sent.

Due to an intensified use of information and communication technology (ICT) at work,employees often suffer from a continuous urge to respond quickly to ICT messages – a phenomenon known as workplace telepressure (Barber & Santuzzi, 2015).

Organizational Effectiveness

Organizational effectiveness is totally dependent on its employees. If organizations keep employees happy by implementing good HR practices it leads to effective organizational performance.

IT Industry

Information Technology sector is increasing day by day in most othe parts of the country. Pune city is third biggest hub for IT services after Bangalore and Hyderabad. Lots of employment opportunities are available in this sector in Pune.

Automobile Industry

The Indian auto industry is considered as 4th biggest in the world, in Pune also automobile manufacturing sector has established in most of the MIDC areas. They have large number of employees.

Retail Industry

The Indian retail industry fastest growing in the world, in Pune also there are so many malls, supermarkets and hypermarkets which has given boost to employment generation.

Banking Industry

The highly capitalized and regulated industry in India is banking industry. In Pune this sector has created lots of opportunies to people to work with.

Education Sector

Indian education sector is popular in the world since ancient era. Pune is the cultural capital and educational hub of the Maharasthra state. More than than lakhs of employees are working in education sector in Pune.

Need of the Study

As the number of employees working in above selected industries in Pune city is high there is need to study what kind of telepressure they have and what is its influence on organizational effectiveness and overall performance of the individual and organization.

Literature Review

Marie Sophie Thommes (2014), in her PhD thesis entitled "The Effect of Workplace Telepressure on Recovery Processes and the Benefits of Mindfulness", she observed that workplace telepressure was pessimistically associated to sleep quality, whereby psychological disinterest partially mediated the relation.

Larissa K. Barber and Alecia M. Santuzzi (2014), in the research paper entitled "Please Respond ASAP: Workplace Telepressure and Employee Recovery", the researchers has first dicussed the need of technological media in corporate world and then discussed its negative effects on employee workpresure.

Michelle Van Laethem et.al, (2018), in he research appear entitled "Daily Fluctuations in Smartphone Use, Psychological Detachment, and Work Engagement: The Role of Workplace Telepressure", the researchers identified that interaction through smartphones about work related tasks during job hours is effective for the organization but it makes employee dissatisfied if it is done after working hours.

Cambier, R., et al. (2019), in the research paper entitled "A Diary Study on Telepressure, Smartphone Use and Empathy", the researcher highlights the importance of a policies regarding work-related smartphone use during off-job hours and provides valuable input for strategies aiming to improve employees' psychological disinterest and proper smartphone use.

Research Methodology

Objectives of the study

1. To study the concept of workplace telepressure.
2. To study the influence of workplace telepressure on organizational effectiveness.

Hypothesis of the Study

H1: Workplace telepressure have high influence on organizational effectiveness.

Scope of the study

The scope of the study is limited to only five selected industries IT, Automobile, Retail, Banking and Education.

The Major keywords identified for the detailed study are telepressure, effectiveness, influence etc.

Sampling

Non probability convenience sampling method is used to collect the data from 150 employees of various selected industries.

Methods of Data collection

The researcher has collected primary data from the employees of selected organizations using the well-structured questionnaire. The researcher has visited different organizations in the city to collect the primary data from 150 respondents. The secondary data is collected from internet, books, magazines, and articles etc.

Method of analysis and statistical tools

A well structured questionnaire is used to collect data and IBM SPSS-20 and Ms Excel-2007 has been used to analyse the data. The researcher has also used rating scale technique to get the responses from employees. The researcher has used statistical tools like Mean, Percentage and Std. Deviation for data analysis.

Reliability and Validity

The researcher has carried out reliability test using SPSS. The Cronbach's Alpha observed is 0.795, which is more than 0.700, so the questionnaire is considered to be

reliable. Content validity is used for the present research and identified the research instrument is suitable for the present research study.

Tabulation & Data Analysis

Sample Size

Industry	Sample Size
IT Industry	30
Automobile	30
Retail	30
Banking	30
Education	30
Total	150

Rating Method

Parameter	Rating
Very low influence	1
Low influence	2
Average	3
High influence	4
Very high influence	5

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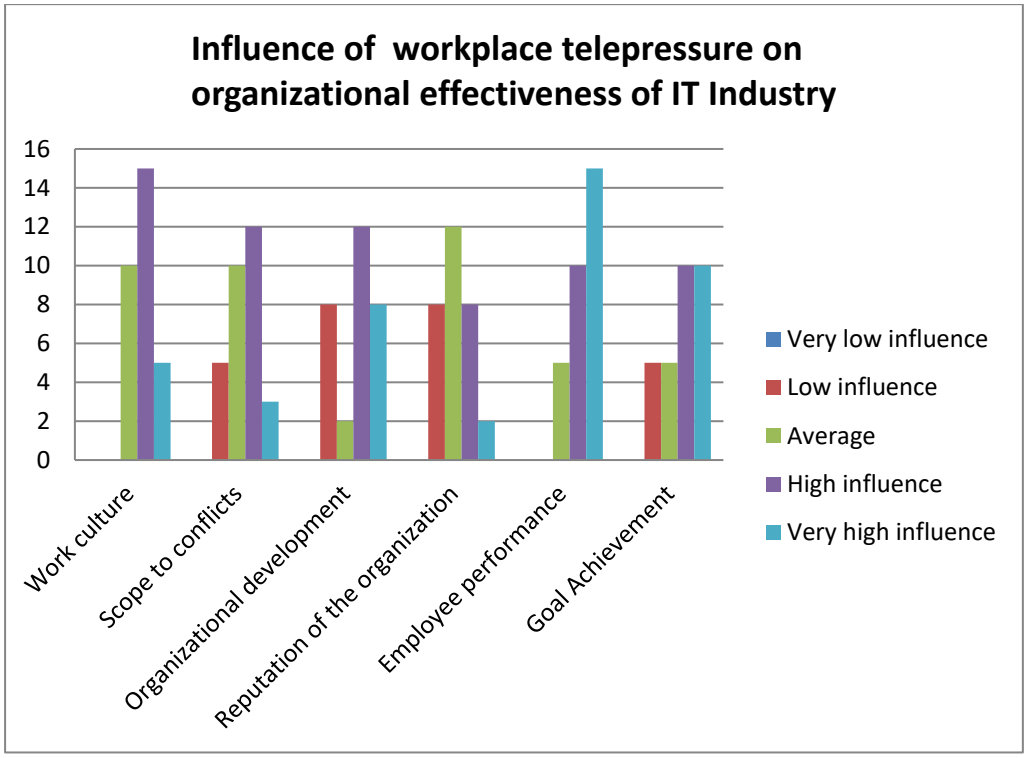

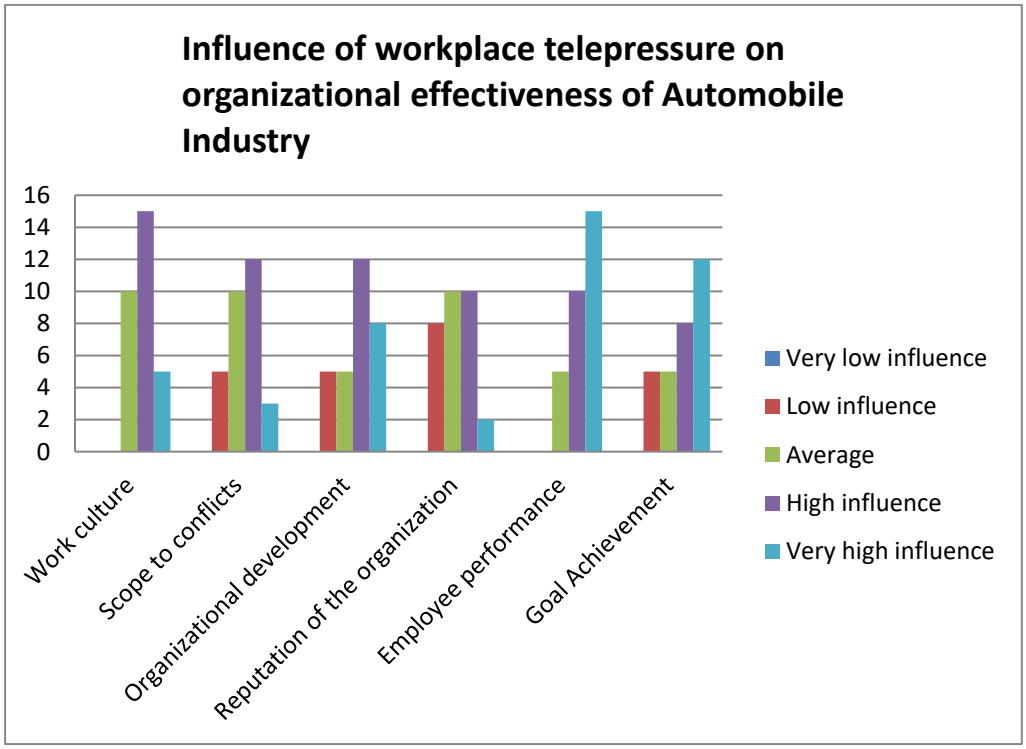

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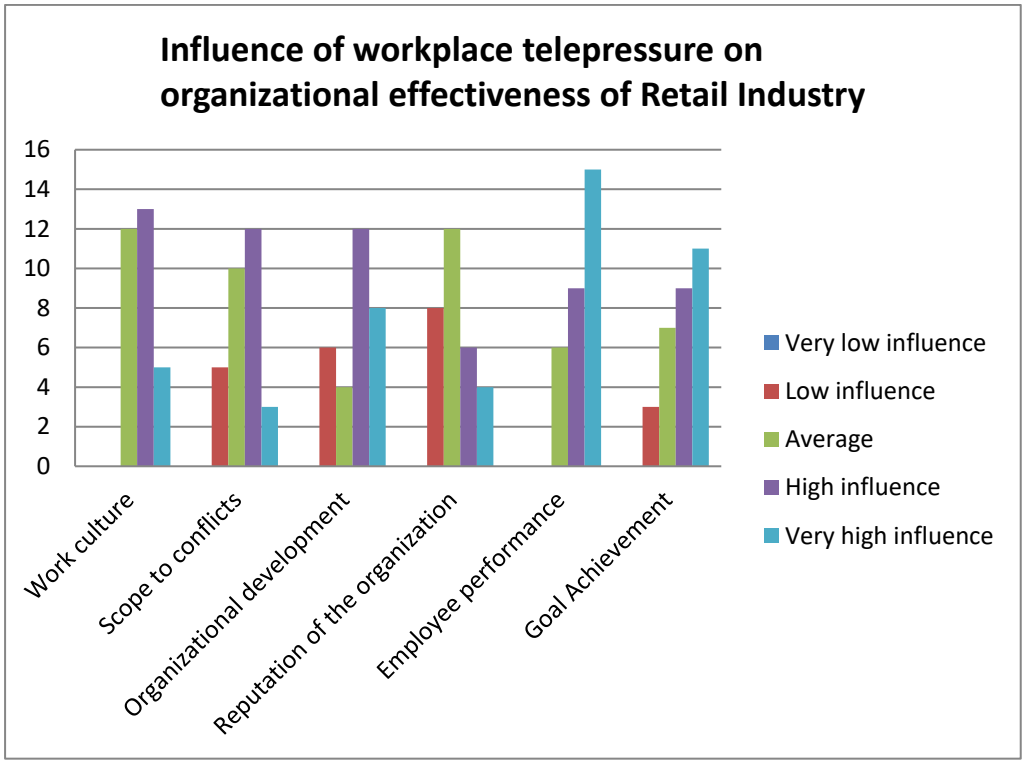

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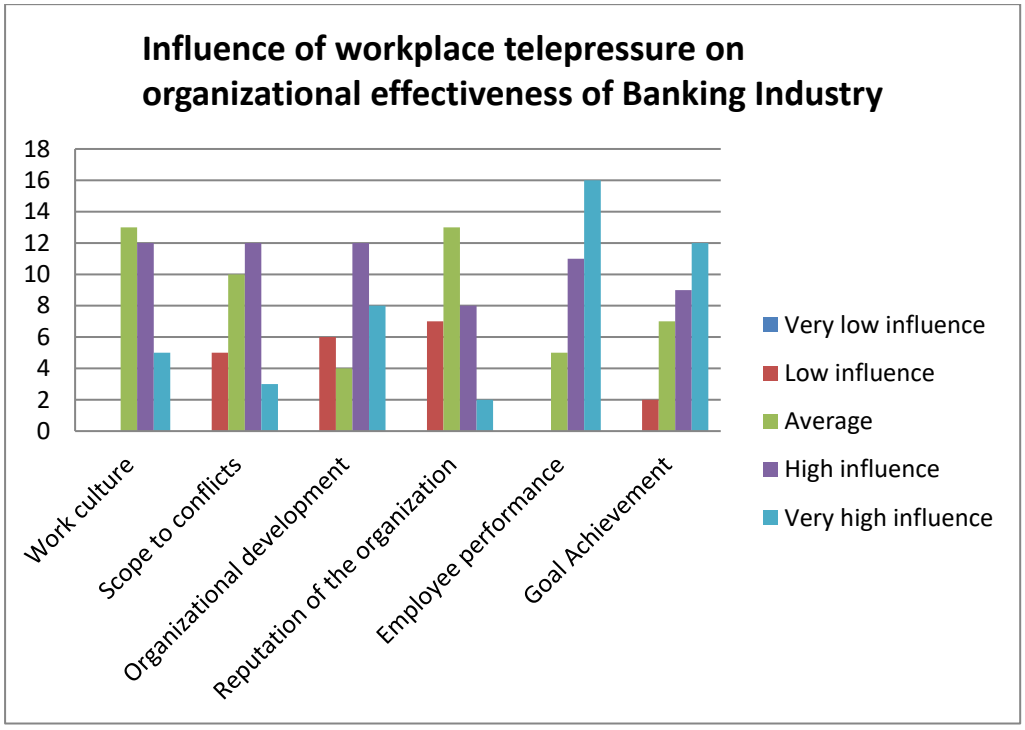

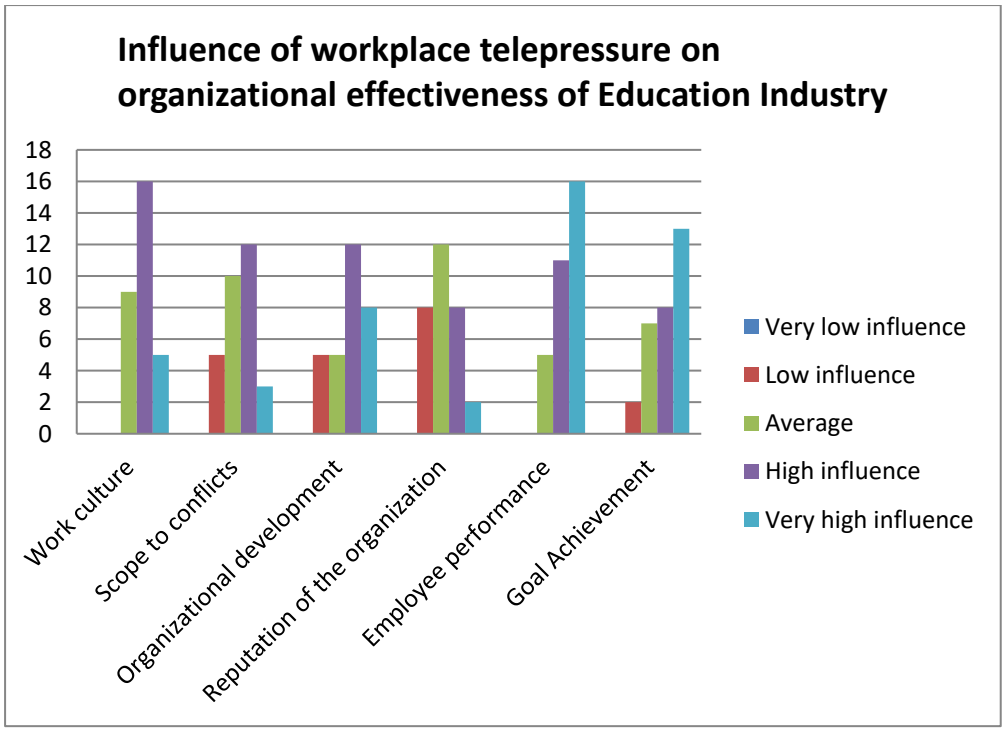

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Hypothesis Testing

- Null Hypothesis (H0): There is no influence of workplace telepressure on organizational effectiveness.
- Alternative Hypothesis (Ha): Workplace telepressure have high influence on organizational effectiveness.
- The researcher has used Z test to check the null hypothesis with the help of SPSS 20, the P value observed is 0.01 which is less than 0.05 so the null hypothesis there is no influence of workplace telepressure on organizational effectiveness is rejected and alternative hypothesis workplace telepressure have high influence on organizational effectiveness is accepted at 5% level of significance.

Findings

- In IT industry workplace telepressure have high influence on employee performance and goal achievement.
- In Automobile industry workplace telepressure have high influence on employee performance and work culture.
- In Retail industry workplace telepressure have high influence on employee performance and organizational development.
- In Banking industry workplace telepressure have high influence on employee performance, organizational development and goal achievement.
- In Education industry workplace telepressure have high influence on employee performance and goal achievement.
- Overall in all industries workplace telepressure have high influence on employee performance which leads to employee dissatisfaction which directly decrease the organizational effectiveness.

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Personal Iris Recognition from an Image at Long Distance using Back Propagation Neural Network

Swati D. Shirke, C.Rajabhushanam

Abstract: ***Now days, most reliable system for person identification is Iris recognition technique. Most of other systems are also presents for person identification like as identification cards or tokens, secret codes, passwords, etc. But the problems of these types of systems are, the secret codes and passwords can be cracked, the identification cards can be damaged. Therefore the effective method for the person identification is necessary. The iris recognition is treated as the most accurate method for personal identification. The person's biometric physical and behavioral features are considered for the identification. This is most efficient technique, because the iris characteristics of a person cannot be change due to the age and environment. Therefore automatic systems are based on the iris recognition. In this paper, an effective technique for iris recognition is present to identify the individual. For the implementation of this system, the iris images are taken from UBIRIS.v1 database. This iris image is then segmented, normalized and features are extracted by using Hough Transform, Daugman rubber sheet modal and median filter. The matching of an iris is done with the help of back propagation neural network model. Also, the Chronological Monarch Butterfly Optimization -based Deep Belief Network (Chronological MBO-based DBN) is proposed for iris recognition to get better accuracy. All these operations are done on the MatLab.***

Keywords : Back Propagation Neural Network, Cronologival Neural Network, Deep Belief Network(DBN), Iris Recognition, Image Segmentation, Biometric Identification.

I. INTRODUCTION

Now a days, in world most of the countries faces the problem of fake identity. This is a very serious problem and it is quite difficult to identify the fake person. But the biometric system can solve the above problems. Therefore most of the countries uses biometric system for security purpose such that in custom clearance, airport boarding, congregation entrance and so on. The Indian government also uses biometric system for identification of citizen in different applications like as in rashan shop, Aadhar project, in different government exam forms and registration dept. etc. There are different types of biometrics are presents such as voice, palm, finger, face, DNA, etc. But the iris recognition is the most accurate and stable biometric system for individual identification. Because the Iris is a unique thing of a person, it does not change with time and environment. It remains fixed and constant.

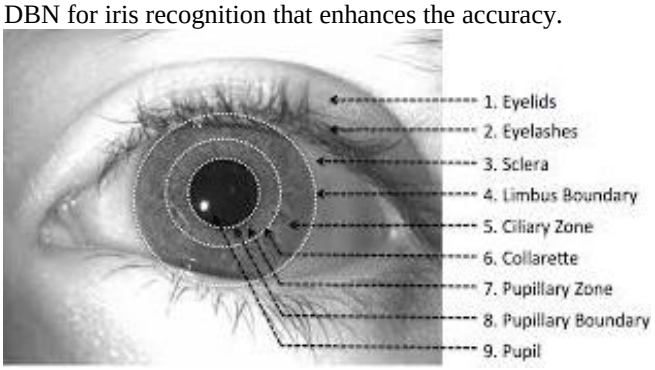
Revised Manuscript Received on July 10, 2019.

Ms. Swati D. Shirke, Ph.D.Scholor, Bharath Institute of Higher Education and Research Chennai, Tamil Nadu, India .Email:shirke.swati14@gmail.com

ajabhushanam, Professor, Computer Science & Engineering, itute of Higher Education and Research, Chennai, Tamil Nadu, ıushanamc.cse@bharathuniv.ac.in

throughout the life of person. Also the error rate, applicability and accuracy of iris recognition system better than the other biometric systems. Therefore for achieving and maintaining security, the iris recognition system plays an important role.

The portion lies in between the white sclera and the pupil of eye is called iris texture or iris region. Different features of an eye are presents in this iris region. These features are crypts, furrows, stripes, coronas, freckles, etc. These features are vary to person to person. The irises of identical twins are also entirely dissimilar. Figure 1 shows the different features of an eye.In a literature survey different encoding techniques are presents, but in case of matching of an iris image stage very less work is present. Therefore in this paper a successful matching is done with the help of deep neural network. The deep neural network is a pattern recognition method which classifies the data. The main goal is to design a system which is capable to classify different iris images. The superb-resolution technique is used to get the information from iris image. The superb-resolution technique is the most important technique and it can get the information from poor quality iris image. To solve the iris recognition and image processing problems, the localization of pupil and iris region a Hough transform is used with the help of normalization and automatic segmentation. And for the normalization and automatic segmentation purpose a Daugman's Rubber Sheet Model is used. The iris features are effectively extracted by using the ScatT-Loop descriptor and the Local Gradient Pattern (LGP), which is fed to the Chronological MBO-based DBN for iris recognition that enhances the accuracy.



1. **Features of eye [1].**

The iris recognition and image processing problems can be solved by using Hough transform the localization of pupil and iris region is achieved with the help of normalization and automatic segmentation. For iris image normalization the

Daugman's Rubber Sheet Model is designed.

Following is the structure of the current work. The related work is presents in the section 2. In section 3, the flow of proposed system is present. The building blocks of proposes structure is presents in section 4. The experimental results and the discussion are offered in Section 5. Conclusions are provided in Section 6.

II. Related Works

In last decade, most of the researchers are work on the iris recognition systems for the identification of person. They use different methods for localizing the iris. An effective algorithm designed by Daugman [2] for iris recognition. The internal and external borders iris image is detected via Integro-differential operators by using this Daugman algorithm. The 2DGabor wavelets filters are used for the feature extraction and for demodulation of iris's texture construction. It shows 1024 complex values of an iris image after applying the set of filters. Then each of these values quantized into complex plane of four quarters. And then the Hamming distance is calculated.

The weighted gradients are used in the paper Masek and Kovesi [3] for the iris recognition. The circular Hough-transform and modified canny edge detector are also used in this paper.

The iris conformity depending on two variation functions and the Hough transform to localization the iris are used by Boles [4].

The pyramid of Laplacian with four resolution levels are used to produce the code of the iris and Hough transform is used to localize the iris is employed in Wildes [5].

The different features of an iris image are extracted in the paper written by Ma, Wang, and Tan [6]. They use 2D Haar wavelet used to perform the matching process.

In a paper [7], A. E. Hassanien, A. Abraham, and C. Grosan identified patterns of iris via ICA coefficients, the reasonable learning device for identification of center of each class and the Euclidean distances are used to recognize the pattern of iris. Also in this paper the different noises like as noises occurs due to light are removed from eyelashes and eyelids. The blurred iris image is also accurately recognized by this method.

The globular Hough transform are presented in [8] by O. F. Soylemez, and B. Ergen are used for recognition purpose.

The internal and external borders of the iris image area were extracted in paper Altunkaya and Abiyev [9]. The normalization and enhancement algorithms are also presents in this paper to extract the different features of an eye image and embodied. To classify the iris patterns of iris image, an ANN classifier is designed in this paper. An adaptive learning tactic

is used to train the ANN classifier. The experimental results obtained from this ANN classifier shows the proficient identification of individuals.

An iris identification technique that is based on distinct ovariance employing competitive ANN presented et al, [10]. The construct a covariance matrix by means of distinct wavelet transform by ANN are used to identify a group of boundaries of iris profiles.

A cascade forward back propagation ANN model (CFBPNN) and an FFBPNN model were used to identify patterns of the iris image in paper written by Gopikrishnan and Santhanam [11]. Based on their results, they concluded that the CFBPNN model is more proficient than the FFBPNN model.

On the other hand, K. A. Raghavi, M. V. Priya, G. P. M. Paiva et al., [12] formed an better system of iris recognition with the purpose be able to overcomes the limits of individual's identification approaches. They employed a speedy algorithm for the reason of locating the area of the iris. They employed an indefinite neural network algorithm to obtain iris deterministic shapes taking the form of feature routes. These characteristic features can be equate based on weighted hamming distance to show the individuality. They adopted a twofold coding system to achieve more efficiency.

III. Flow of Proposed System

A. *Image Acquisition*

Iris imaging at a distance for an optical system design is critical. Therefore for iris image acquisition, the lens based on the geometry optics and the required parameters of camera are calculated. Let the height of person is H, the digital sensor's width as W and focus of lens are indicated by F, the object-image ratio as M and sensor pixel size as S.

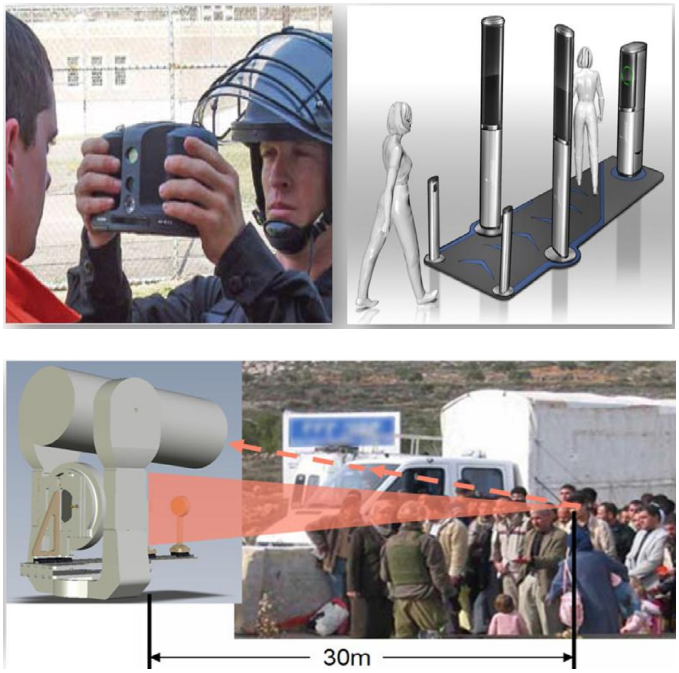


Fig.2 Different iris recognition systems examples close-range and long-range.

The distance D of an objected can be calculated from equation 1.

$$D = F\frac{M}{S} \tag{1}$$

The equation 2 shows the field depth in which the capturing volume is V × A.

$$V = MW$$
$$A = MH \qquad (2)$$
$$B = 2F\,\frac{(M-S)(M-S)}{S}$$

Fig.3 Process Of Capturing The Human Face Image.

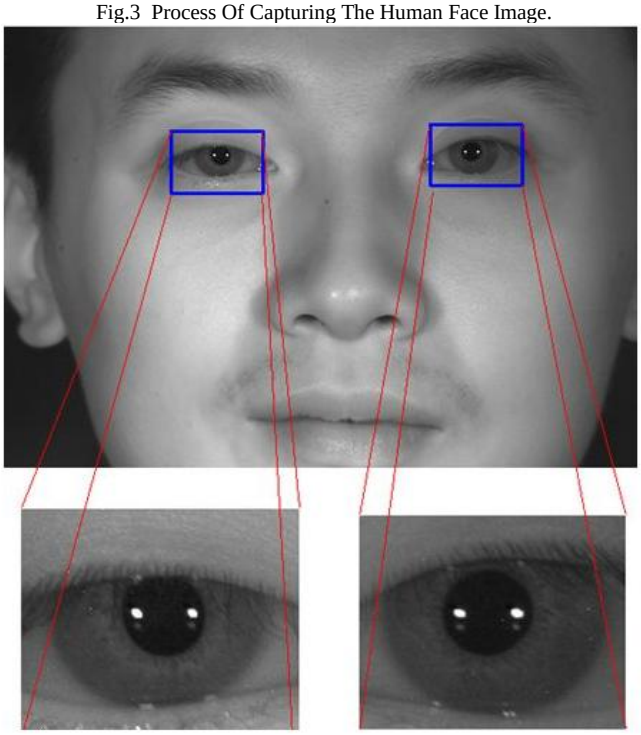


Fig.4 Process Of Extracting The Eye From The Face.

By considering the above geometry optics, the lens and the camera used in this article with frame rate of 30 frames per second and the pixel size is 4-mega pixels. This camera can takes a picture of human face completely with high-resolution. The lenses with its aperture size F is 15 and focal length 300 mm. So it can capture the iris image clearly up to distance 4m to 6m. Figure 2 shows different iris recognition systems examples close-range and long-range.

UBIRIS.v1 are the iris images which are captured from a distance from 3 meters away by actively searching iris, face or palmprint patterns. Therefore in this article, the UBIRIS.V1 database are used for the iris recognition. The process of capturing the human face image is shown in figure 3 the process of extracting the eye from the face is

B. *Processing of an Image*

The quality of iris image obtained from the camera is poor. This can be happen due to the motion of person, distance, blur or occlusions. Therefore it is necessary to pre-process the iris image to enhance the different parameters an iris image such as contrast, intensity, signal to noise ratio, etc. for further processing. The technique which is used to enhance the iris image parameters are contrast stretching and histogram equalization. It only enhances the quality of image, it does not increases the information content of an image. The intensity range of an iris image is normalized to [0 1]. The signal to noise ratio of iris image is improved with the help of anisotropic diffusion filter. The tool which is used for this purpose is MatLab realize the many brightness transformations. To find the rank-order information and spatial information of an iris image a weighted median (WM) filter is used and this is one of the type of median filter. The noises shot and impulse noise are rejected by the median filter.

Segmentation

In a segmentation step the inner and outer boundaries of the iris region are detected. This can achieved by Hough transform. The Hough transform finds different shapes like as circles or ellipses of an image. It is the first step in the Iris recognition system also the backbone of the complete recognition system. It aims to detect layout, centers, eyelids, eyelashes and radii, of the two iris borderline. Locating the lower as well as upper eyelid also separate eyelashes. With the help of the Daugman's Rubber Sheet Model the image segmentation, acquisition and feature encoding of an iris image can takes place. It is also used to improve the quality of edges presents in the image. The most commonly used circle detector is integro-differential operator and it is mathematically expressed as.

$$MAX\,/\,G(r) * \frac{d}{dr}\int \frac{I(x,y)}{2\pi r} \qquad (3)$$

Where I (x, y) denotes the input iris image, G(r) denotes Gaussian with a standard deviation, r is the radius of circular arc. It is the convolution operation which is shown in symbol *. The line an iris image can be detected by the formula

$$r = x\cos\theta + y\sin\theta \qquad (4)$$

where, r is quantized distance and θ is quantized angle.

The r and θ are considering quantized values in the pair (r,θ).

The boundary of the inner pupil and outer pupil of an iris image can be detected by using the equation,

$$(m - m_0)^2 + (p - p_0)^2 = a^2 \qquad (5)$$

where, (m_0, p_0) denotes the coordinates of a circle with radius a. The results obtained from Hough transform shows the boundary of pupil, eyelid extraction of iris image and the center of pupil.

Normalization

In this the segmented iris image is normalized into the block with equal in size respect to the block width x and angular displacement θ. The

Daugman's rubber sheet is an linear model that is assigned to the iris of the individual pixel based on the dilation, size and the real coordinates (x, θ), where x is the unit interval and θ ranges from 0 and 2π. The iris image is remapped into the polar coordinate (x, θ) system from cartesian coordinated (r, s) system. Therefore the normalized polar coordinates are (x, θ) and the normal coordinates are (r, s).

Let the iris coordinates and iris boundaries of the pupil are represented as (r_b , s_b) and (r_e , s_e) along θ direction. The coefficient of an iris ime age will not be shifted even if the signal is distorted due to the camera and persons position.

Feature Extraction & Feature Matching using ScatT-loop

In feature extraction step, the iris image is classified into new vessels image. The normalized iris image is subjected to perform the feature extraction by using ScatT-loop descriptor. The ScatT-loop generates the texture features for accurate iris recognition to uniquely identify the individuals. In this, the image region contains many vessel segments that are closely spaced with multiple orientations and have a twisted in nature. So for the measurement of feature characteristics, the new vessel segments are generated from a binary vessel maps. In order to find out local features, a sub window of size 4 x 4 is created. The iris image are examined through this sub window. And for every sub window the number of vessel pixels and pixel passion can calculated. The Kirsch mask is designed for the future extraction. The loop value for the corresponding pixel is represented as,

$$LOOP\left(r^*, s^*\right) = \sum_{k=0}^{7} h\left(G^k - G^*\right).2^{\upsilon} \tag{6}$$

Where,

$$h(d) = \begin{cases} 1 & ; \quad if\ d \geq 0 \\ 0 & ; \quad Otherwise \end{cases}$$

(r , s*)* is the centre of the intensity of iris image. G_k is the neighborhood pixel intensity, G is the original image pixel intensity, and *k* takes the value ranges from 0 to7.

Extraction of features using Local Gradient Pattern (LGP)

The LGP generates the constant patterns of face representation of person, which is irrespective to the intensity variation with the edges. The intensity values of a pixel are determined by gradient pixel values which is operated by LGP operator. The minimum value of the gradient among the eight neighboring pixels is considered as the threshold value. When the gradient value of the neighboring pixel is higher against the threshold, then the value assigned to the pixel is '1' otherwise the value is '0'. The LGP can be represented as the formula

$$LGP_{b,m}\left(r_a, s_a\right) = \sum_{i=0}^{b-1} p\left(y_i - \bar{y}\right)2^n \tag{7}$$

where,

$$p(r) = \begin{cases} 0, & if\ r < 0, \\ 1. & otherwise. \end{cases}$$

m is the centre of a circle, *b* are the sample points on the circle, LGP uses the bilinear interpolation to compute the neighborhood pixel values for *m* and *b*. It uses *(2* x *m + 1)* and *(2* x *m + 1)* kernel to summarize the structure of the iris. Gradient value between the neighboring pixel n_i and the center pixel n_a is denoted as, $y_c = |n_i - n_a|$ and define the average gradient value of *b* as,

$$\bar{y} = \frac{1}{b}\sum_{i=0}^{b-1} y_i \tag{8}$$

The feature vector is represented as,

$$Y = \left\{Y_1, Y_2, ... Y_w \right\} \ ; \quad for\ (1 < \tau < w) \tag{9}$$

where, dimension of features computed from the input image X_i is represented as [1 x w] and w is the total feature dimension.

Principal Component Analysis (PCA)

Principal Component Analysis (PCA) is a method which is used to decrease the dimensionality of an image. This method is also used for multivariate analysis of an image. PCA is a compression technique which compresses the high dimensional vectors of an image into the low dimensional vectors and compute the parameters from the data directly. To reduce the dimensionality of an image, PCA extracts less number of component. The principal components of an image can be extracts by using covariance matrix or multivariate set. The compression and decompression operations of an image ca perform by using matrix multiplication. The PCA model is represented as,

$$z_{oc1} = D_{ocw}\, c_{wc1} \tag{10}$$

Where, z is an zero dimensional vector with the projection c, and w is the feature vector dimension as (0 < w). The covariance matrix E is denoted as,

$$E = \frac{1}{\rho - 1}\sum_{\tau=1}^{\rho}(c - \kappa)(c - \kappa)^{G} \tag{11}$$

where, *K* denotes the mean vector of *C*. The Eigen vectors $ß_T$ is expressed as,

$$(E - \phi_\tau \vartheta)\beta_\tau = 0 \quad ; \quad \tau = 1, 2, ...w \tag{12}$$

Where, $Ø_T$ denotes the Eigen vectors of *E*. The projection matrix is calculated as,

$$D = J^G \tag{13}$$

where, *J* has 0 Eigen vectors and D is the *ocw* matrix.
The dimensionally reduced feature vector is represented as,

$$\gamma = \left\{\gamma_1, \gamma_2, ..., \gamma_\tau ..... \gamma_o \right\} \ ; \quad for\ (1 < \tau < o) \tag{14}$$

where, 0 is the dimensionally reduced features with 0 < w.

BPNN Based Iris Recognition

For categorization purpose the artificial neural network (ANN) is used. The ANN is a computational model

which is based on biological neural network. It is used to extract the information from image with the help of interconnected group of artificial network. For training multi-layer artificial neural network Back Propagation Neural Network (BPNN) is commonly used. The fundamental arrangement of the BPNN presents 1 input layer and minimum 1 hidden layer followed by output layer. Figure 5 shows the model of Back Propagation Neural Network.

The detailed steps by using the BPNN ANN for Iris recognition are given below.

- Fill normalized Iris images data set which contains the feature vector values of different subjects and these are ranges from 0 to 1.
- The normalized iris images obtained in previous section are used for training set and testing set by arbitrarily depiction out the data for training and testing.
- Generate 3 layers of iris normalized image an input, an output and a hidden layer. The dimension of the feature vector that characterizes the iris image information is equal to the number of nodes in the input.

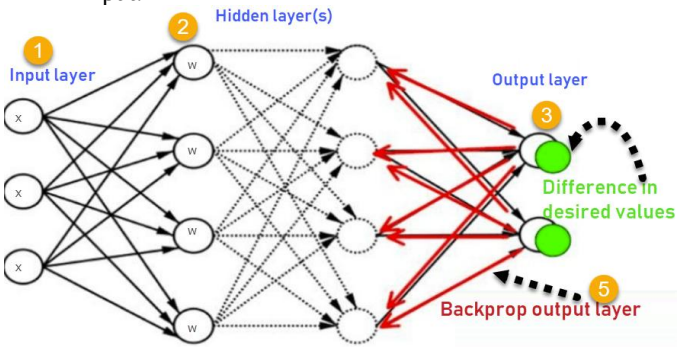


Fig.5 Model of Back Propagation Neural Network.

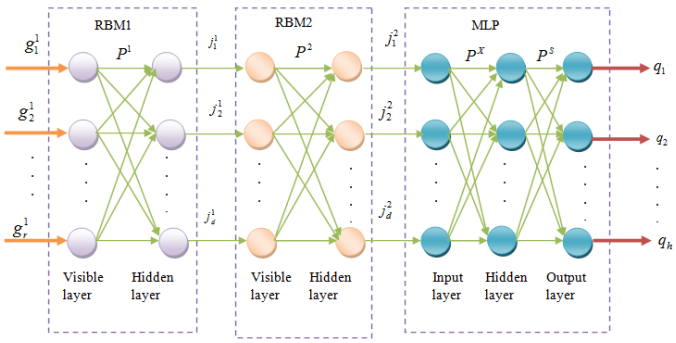


Fig.6 Architecture of DBN classifier

- Arbitrarily generates the nodes of the hidden layer. Arbitrarily generates all connection weights within a certain range. The output layer contains one node.
- Use Back Propagation algorithm to train the network. This algorithm is applied until the error is smallest amount for a certain number of training epochs specified by the user.
- Evaluate the performance and the test data to the trained network

Chronological MBO-based DBN Neural Network

classifier using the Chronological MBO algorithm
or the identification of a person. The non-linear complex relation presents in the real life are removed by using DBN classifier and the chronological MBO algorithm trains the DBN classifier. The iris recognition is performed using the chronological MBO-based DBN, which is the integration of the chronological concept with the MBO algorithm to train DBN that depends on the migration features of the monarch butterfly. The standard MBO incorporates the fine tuning of parameters and the complex free computation to enhance the performance of the proposed chronological MBO-based DBN, and the high dimensional issues are effectively dealt using MBO. Figure 6 shows the Architecture of DBN classifier.

However, the searching speed and the convergence speed are enhanced by integrating the chronological concept, which defines the solutions (biases and weights) from the preceding iterations to revise the new biases and weights.

Performance metrics

The metrics used to evaluate the methods, are FRR, FAR, and accuracy are explained below.

1) Accuracy: The accuracy measures the accurateness of iris recognition based on iris modality and is represented as,

$$Accuracy = \frac{Jc + Ju}{Jc + Rc + Ju + Ru} \quad (12)$$

where, *Ju* denotes the true positives, and *Jc* is the true negatives. *Ru* denotes the false positives and *Rc* is the false negatives.

2) Sensitivity: Sensitivity is otherwise called True positive Rate (TPR), which is the measure of positive-ness identified correctly, and is calculated using the below equation.

$$Sensitivity = \frac{Ju}{Rc + Ju} \quad (12)$$

3) False Rejection Ratio (FRR): FRR is the ratio of false rejection to the genuine attempts, and is expressed as,

$$FRR = \frac{Rc}{Ju + Rc} = 1 - TPR \quad (13)$$

4) Specificity: Specificity or True Negative Rate (TNR) is the measure of false negatives, which are correctly located. Specificity is expressed as,

$$Specificity = \frac{Jc}{Jc + Ru} \quad (14)$$

5) False Acceptance Rate (FAR): FAR is the ratio of false attempt to imposter attempts, and is represented as,

$$FAR = \frac{Ru}{Ru + Jc} = 1 - TNR \quad (15)$$

6) Receiver Operating Characteristics (ROC): ROC refers to the relationship between TNR and TPR, which is used to compute the performance of the system.

IV. BUILDING BLOCK DIAGRAM OF PROJECTED STRUCTURE

Here during this unit diagram of prompt structure is given. The implementation of this work is given in this step. Figure 7 shows suggest Method For Iris Recognition.

Images Which are Test

Here there are 20 people groups dataset is to be considered for the examination. The database utilized for this object is UBIRIS.V1 .V1 .V1.V4. The total database of this segment was searched for Iris pictures.

Pre-processing and De-noising

In pre-handling, the sign to-commotion portion of iris picture profile is upgraded additionally for this goal. Iris Recognition a ways off (IAAD) is utilized to improve the differentiation of the picture. Middle based channels are utilized to evacuate the sound introduces in the debased iris pictures.

Hough Transform

The Hough transform is used to extracts the different curves or shapes of an iris image.

Segmentation and Normalization

In this division step, the iris picture is part into disparate outskirts. The division of the districts can occur by considering comparable properties of an iris picture. A portion of the comparable properties are shading, brilliance, differentiate, surface, dark level, and so forth. The portioned iris picture is set up by utilizing a standardization calculation.

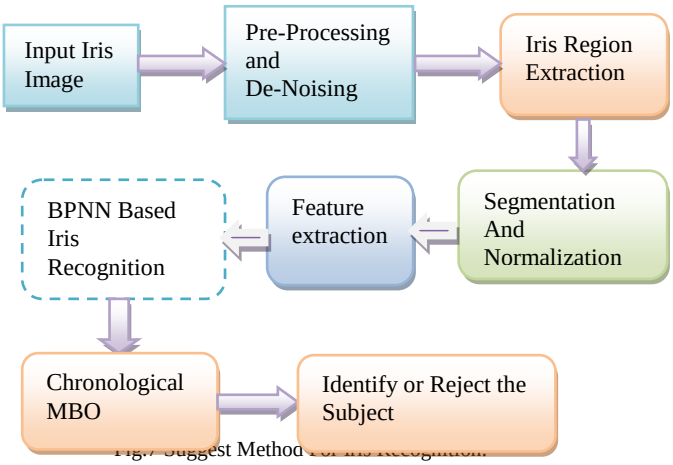


Fig.7 Suggest Method For Iris Recognition.

The fragmented iris picture is utilized for the future extraction process. Because of the shifting position of an individual and the camera, the iris picture is exceptionally influenced by mutilation [20]. Along these lines standardization is utilized to make up for this issue. The Daugman's Rubber Sheet Model is use for this reason.

Feature Extraction

For preparing multi-layer artificial neural system Back Propagation Neural Network (BPNN) is normally utilized. The major plan of the BPNN presents 1 info layer and least 1 shrouded layer pursued by yield layer.

The ScatT-Loop generator is use to remove the various of an iris image.The ScatT-Loop creates the ighlights for precise iris acknowledgment to remarkably recognize the people. Administrator in LGP uses the angle pixel esteems and is resolved as the force esteem. Distinctive changes shows in this progression are utilized to compute the surface highlights for the iris picture. PCA is an ideal plan to pack the high dimensional vectors into the low dimensional vectors and register the parameters from the information legitimately.

Deep Belief Network (DBN)

The dimensionally decreased highlights got utilizing PCA is bolstered as contribution to DBN to perceive the people. The powerful acknowledgment is acquired by the ideal tuning of the DBN classifier utilizing the Chronological MBO calculation. By utilizing Chronological MBO calculation we can gauge or characterize exact Iris picture.

V. EXPERIMENTAL RESULTS

Here observational results are characterized in this unit of proposed framework. The step by step execution of the proposed framework is displayed. Right off the bat we take info test iris picture. In this paper, there are Around 22,035 iris images from 700 individuals people group's dataset is to be considered for the trial. The database utilized for this design is UBIRIS.v1 [26]. Figure 3 demonstrates the key in iris acknowledgment picture having the measurement 512 x 512. This picture can be chosen by utilizing the GUI in MatLab.

This info test picture of the iris is connected for the pre-processing. In this stage, the diverse commotion introduces in an iris picture are evacuated and increment the nature of a picture.

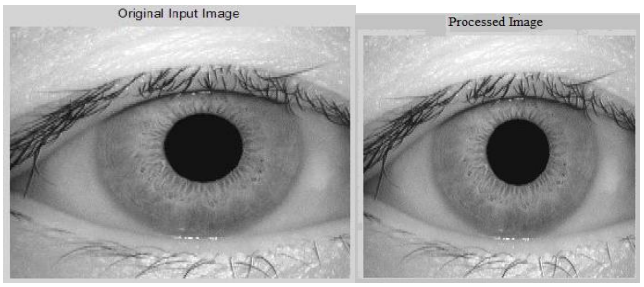


Fig.8 Input Iris Picture and Prossed Image.

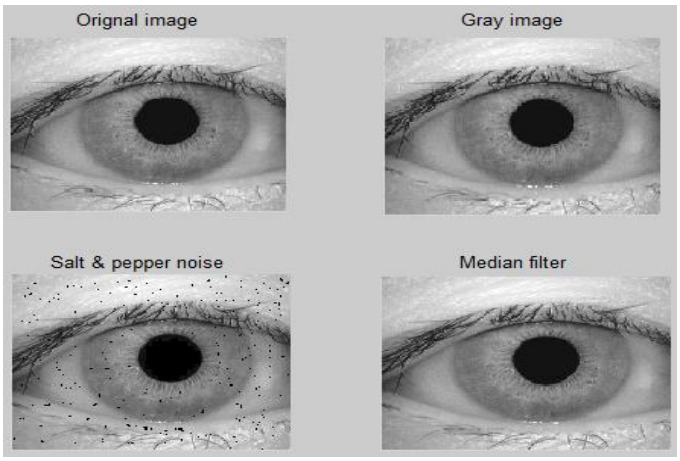


Fig.9 Operations On Iris Image.

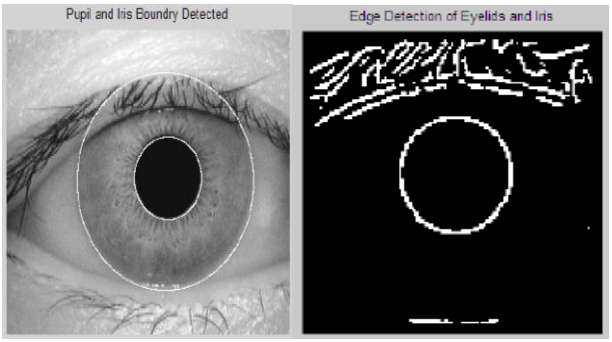


Fig. 10 Boundary detection of an Iris Image and Edge Detection Of An Iris Image.

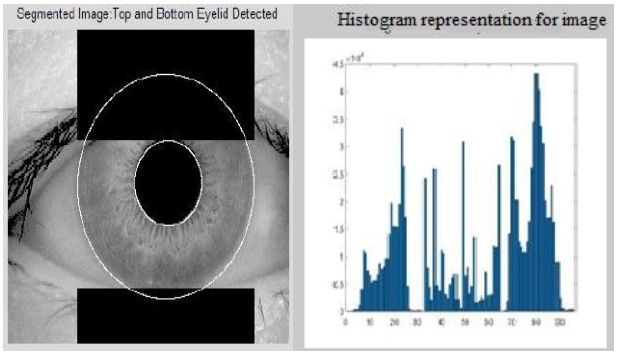
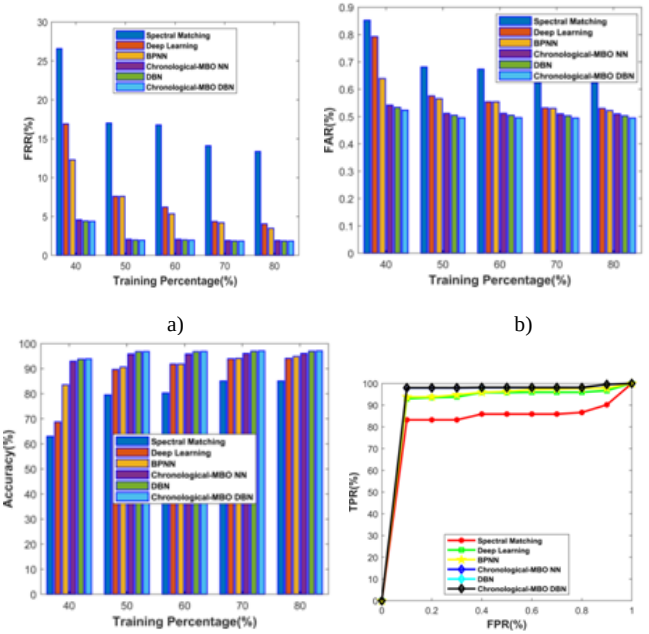


Fig.11 Eyelid of the bottom and top segmentation of an Iris Image and histogram representation for image.



a) b)

Fig. 12 Comparativbe analysis based on k-fold using image,a)FRR,b)FAR c)Accuracy and d) ROC analysis.

Figure 8 shows the input image and preprocessing image, which enhances the iris part of the eye (black portion). To eliminate the sound from iris images median filter is used. Figure 9 represents colors to gray as well as resounding image. Color image is the real image, besides of real image is gray image, salt also pepper sound is at the lower level of the original image, also the last one is the Median Filter image. In entation and Normalization process detection of Iris boundary of the original image is takes place.

The detection is done with the help of Hough circles. Figure 10 shows the detected boundaries of an iris image. The white border presents in this image is the corresponding boundaries of the iris image. After boundary detection, the edge of an iris image is detected by using Normalization and Segmentation process.

Figure 11 shows the corresponding edges of the pupil of an iris image. For finding edge of canny edge detection algorithms are used to show the eyelid of the bottom and top segmentation of an Iris profile. Figure 12 depicts the comparative analysis for the metrics, a) shows FAR, b) shows accuracy, c) FRR and d) ROC analysis with respect to the k-fold validation.

TABLE I. TABLE STYLES

Methods	FRR (%)		FAR (%)		Accuracy (%)	
	k-fold	*Training*	*k-fold*	*Training*	*k-fold*	*Training*
Spectral Matching	1.30	10.912	0.52	0.5964	85.0	63.002
Deep learning	1.03	2.9	0.51	0.5261	86.3	68.764
BPNN	0.85	0.786	0.51	0.5040	91.5	83.554
Chronological-MBO-NN	0.5	0.786	0.5	0.5040	95.0	92.942
DBN	0.47	0.745	0.49	0.4972	95.9	93.8
Chronological-MBO based DBN	0.47	0.4745	0.47	0.4889	96.0	93.886

Table 1 demonstrates the comparative discussion of the existing and the proposed Chronological MBO-based DBN method. Based on k-fold validation, the FRR rate obtained by the methods, spectral matching, deep learning, BPNN, Chronological-MBO-NN, DBN, and the proposed Chronological MBO based DBN is 1.3055%, 1.0372%, 0.8577%, 0.5%, 0.4798%, and 0.4745%, respectively.

VI. CONCLUSION

A powerful iris acknowledgment framework for individual distinguishing proof is available in this article. With the assistance of the double iris division false reaction is decreases. The pointless foundation pictures are additionally expelled with the assistance of picture division process. A technique for IAAD is presented for iris acknowledgment utilizing Chronological MBO-based DBN is proposed in this exploration work. The ideal loads are resolved to prepare the ordered MBO calculation utilizing DBN. Various strategies introduces in Hough change are utilized to for division, for example, straight, roundabout and illustrative. With the assistance of iris picture standardization the extraction of fixed number of highlights is finished. The UBIRIS.v1 database is utilized for testing reason for this iris acknowledgment framework. Additionally the Daugman model is utilized for iris division, standardization, include encoding and highlight coordinating. The iris acknowledgment dependent on the highlights of the biometric is performed utilizing the

proposed Chronological MBO calculation, which is prepared utilizing the profound learning approach named as DBN. A robotized framework which is equipped for perceiving the iris is available in this paper. This framework decreases false reactions to brilliant sores and other retinal element of eye. The device utilized for this reason for existing is MatLab computerized picture handling. This paper presents iris acknowledgment framework that expels every past disadvantage. Likewise numerous issues of iris acknowledgment was illuminated like as human machine interface, picture handling and picture securing issues. The exhibition investigation demonstrate that the iris acknowledgment strategy is exact and effectively perceive the iris a good ways off 4 to 8 meter long. The proposed Chronological based DBN approach achieved insignificant FRR of 0.4745%, negligible FAR of 0.4847%, and maximal precision of 96.078%. The future augmentation of this work can be made by utilizing any streamlining calculation to improve the presentation of iris acknowledgment.

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AUTHORS PROFILE

: Ms.Swati D. Shirke holds an M.E.degree in Computer Science and Engineering from Pune University and is a research fellow in the Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Bharath University. Her main area of interest includes pattern recognition, image processing, machine learning, She has published several papers in well known peer-reviewed journals.

: Dr. C. Rajabhushnam holds a Ph.D. in Neural Networks, from Louisiana State University, USA And he is a professor in the Department of In the Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Bharath University. His main area of interest includes pattern recognition, image processing, and machine learning he has published several papers in well known peer-reviewed journals.

Biometric Iris Recognition of Person from an Image at Long Distance using Chronological Monarch Butterfly Optimization based Deep Belief Network

Swati D. Shirke, C.Rajabhushanam

Abstract: ***Now days, for the identification of personal information of a person, biometrics is mostly used. Also for the personal identification, the recognition of eye based biometric feature extraction is the most powerful tool. The biometric is an important identity to identify the individual. But in real time it is quite difficult to capture the better quality of iris images. The images obtained are more degraded due to the lack of texture, blur. In this paper, more convenient method is presented for extracting the features of biometric images. The method Iris Recognition at-a Distance (IAAD) is used to extract the iris features of biometric image and to enhance the quality of an image in a biometric system. The Chronological Monarch Butterfly Optimization -based Deep Belief Network (Chronological MBO-based DBN) is proposed for iris recognition to get better accuracy. The Monarch Butterfly Optimization algorithm is used to arrange the Chronological assumption of an iris image. Also, the Hough Transform algorithm is used for detection of iris circle and edge. The scaT T loop descriptor and the Local Gradient Pattern (LGP) are used for feature extraction, which is fed to the Chronological MBO-based DBN for iris recognition that enhances the accuracy. The Daugman's rubber sheet model, median filter and trained neural network are used for normalization and segmentation. The UBIRIS.v1 database is used to take an iris recognition images and MATLAB is used for programming of for reading the iris images and for performing the Hough transform operations. The iris recognition at a distance 4 to 8 meter is done with the help of simulation result. The performance is analyzed based on the metrics, like False Acceptance Rate (FAR), accuracy, and False Rejection Rate (FRR) with the value of 0.4847%, 96.078%, and 0.4745%.***

Index Terms: ***Deep Belief Network, Matlab, Iris recognition, Hough Transform, ScatT-Loop, LGP, Feature Extraction, Dougman's Rubber Sheet Model, etc.***

I. INTRODUCTION

In most of the practical based applications like as congregation entrance, airport boarding, custom clearance and so on requires high security. For this high security purpose most of the companies uses iris recognition system.

The government of India uses this system to identify the citizen in many applications like as Aadhar project, in rashan shops, while filling different government exam forms, registration department, etc. But most of these face one problem that, iris at a distance and getting an iris image, also the motion of camera and person. Therefore, the iris recognition requires the intelligent system with high reliability and less coefficient errors [1]. There are two classifications of biometric system namely unimodal and multimodal biometric systems. In unimodal biometric system the identity of the person is based on the single information source, such as left iris, right iris and face etc. [2]. The multimodal biometric system uses the classifier to match the specific person [2]. Iris recognition system uses the following three processing components, namely acquisition, pre-processing, feature extraction [3]. Figure 1 shows the eye sample introduction. Iris uses the gabor filters to extract the global and local facts of the image as the feature vector.

The main objective of this article is to design a method using the machine learning approach. Initially, the iris image is fed into the pre-processing step. In this step the Hough Transform (HT) is used to extract the region of iris and the localization of pupil. For iris image normalization and automatic segmentation the Daugman's Rubber Sheet Model is designed.

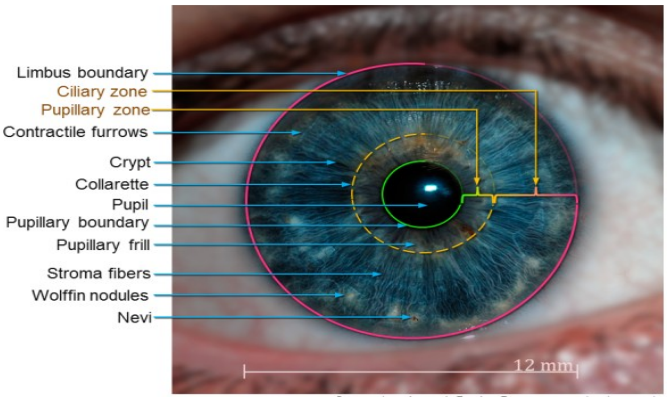

Fig.1 Eye Sample Introduction

The ScatT-Loop descriptor and LGP are used to extract the different features of iris image, where the ScatT-Loop is developed using the Scattering transform (ST), Tetrolet transform (TT),

and Loop descriptor. Once the features are extracted, the recognition is performed using

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Ms. Swati D. Shirke, Ph.D.Scholor, Bharath Institute of Higher Education and Research Chennai, Tamil Nadu, India .Email:shirke.swati14@gmail.com

abhushanam, Professor, Computer Science & Engineering, itute of Higher Education and Research, Chennai, Tamil Nadu, ushanamc.cse@bharathuniv.ac.in

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the DBN based on the proposed Chronological MBO algorithm.

The organization of different sections of the paper is given below. For designing the system the various methods used are presents in the section II. Section III represents the block diagram of proposed system. The experimental results are presents in the section IV. Finally the conclusion of the proposed system is presents in the section V.

II. METHODS USED IN PROPOSED SYSTEM

The iris recognition plays an important role to identify the person based on the features of the iris texture of a person. In this section the different methods used in this iris recognition system are presents.

A. Preprocessing

The preprocessing stage is used to enhance the different parameters an iris image such as contrast, intensity, signal to noise ratio, etc. Also it is used to increase the quality of an image due to undesired distortions. This step enhances the features of iris image which are required for further processing. It only enhances the quality of image; it does not increases the information content of an image. The intensity range of an iris image is normalized to [0 1]. This range of intensity values shows the maximum intensity value by dividing all intensity values. The diffusion filter process is explained in [11] is used to increase the intensity and contrast of an iris image. The signal to noise ratio of iris image is improved with the help of anisotropic diffusion filter. The tool which is used for this purpose is MatLab realize the many brightness transformations. To find the rank-order information and spatial information of an iris image a weighted median (WM) filter is used and this is one of the type of median filter. The noises shot and impulse noise are rejected by the median filter.

B. The Hough Transform

To find the edges and lines of an image, the Hough transform is used.The Hough transform finds different shapes like as circles or ellipses of an image. It is also used to improve the quality of edges presents in the image.

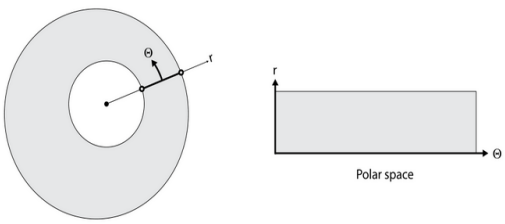

Fig.2. Daugman's rubber sheet model

In this dissertation the Hough transform is used to the iris region from the pre-processed image in order to perform the feature extraction effectively. The line an iris image can be detected by the formula

$$r = x \cos\theta + y \sin\theta \qquad (1)$$

; quantized distance and θ is quantized angle. The r considering quantized values in the pair (r,θ).

The boundary of the inner pupil and outer pupil of an iris image can be detected by using the equation,

$$(m - m_0)^2 + (n - n_0)^2 = r^2 \qquad (2)$$

Where, (m_0, n_0) denotes the coordinates of a circle with radius r. The results obtained from Hough transform shows the boundary of pupil, eyelid extraction of iris image and the center of pupil.

C. The Normalization and Segmentation

The normalization and segmentation is the first step of this iris recognition system. The main aim of this method is to detect the two iris borderline, layout, centers, eyelids, eyelashes, radii, etc. This method is also used for to find the location of lower as well as upper eyelid and to separate the eyelashes. The feature encoding, acquisition and image segmentation of an iris image can takes place by using the Daugman's Rubber Sheet Model [12]. Segmentation is performed to retrieve the interested region and the normalization is carried out to minimize the noise in iris to improve the efficiency of recognition. This method uses the Canny edge detection techniques to find the Hough circles on iris images. Figure 2 shows the Dougman's Rubber Sheet Model. After the segmentation, the processed iris image is applied for normalization. In this the segmented iris image is normalized into the block with equal in size respect to the block width *x* and angular displacement *θ*. The Daugman's rubber sheet is an linear model that is assigned to the iris of the individual pixel based on the dilation, size and the real coordinates (m, θ), where m is the unit interval and θ ranges from 0 and 2π. The iris image is remapped into the polar coordinate (m, θ) system from cartesian coordinated (p, q) system. Therefore the normalized polar coordinates are (m, θ) and the normal coordinates are (r, s).

Let the iris coordinates and iris boundaries of the pupil are represented as (r_b , s_b) and (r_e , s_e) along θ direction. The coefficient of an iris image will not be shifted even if the signal is distorted due to the camera and persons position.

D. ScatT-loop for Feature Extraction & Feature Matching

The classified new vessels image of an iris image can be obtained in the feature extraction step. The normalized iris image is subjected to perform the feature extraction by using ScatT-loop descriptor. The ScatT-loop generates the texture features for accurate iris recognition to uniquely identify the individuals. In this, the image region contains many vessel segments that are closely spaced with multiple orientations and have a twisted in nature. From a binary vessel maps, the new vessel segments are generated for the measurement of feature characteristics. Also, a sub window of size 4 x 4 is created to find out the local features iris image. This sub window examines the iris image and window the number of vessel pixels and pixel passion can be calculated for every sub window.

The Kirsch mask is designed for the future extraction. The loop value for the corresponding pixel is represented as,

$$LOOP(P^*,Q^*)=\sum_{i=0}^{7}h(R^k-R^*).2^{\upsilon} \quad (3)$$

Where,

$$h(d)=\begin{cases}1 & ; \quad if\ d\geq 0\\ 0 & ; \quad Otherwise\end{cases}$$

(P , Q*)* is the centre of the intensity of iris image. R_k is the neighborhood pixel intensity, R is the original image pixel intensity, and *k* takes the value ranges from 0 to7.

E. Extraction of features using Local Gradient Pattern (LGP)

The LGP generates the constant patterns of face representation of person, which is irrespective to the intensity variation with the edges. The intensity a value of a pixel is determined by gradient pixel values which is operated by LGP operator. The minimum value of the gradient among the eight neighboring pixels is considered as the threshold value. When the gradient value of the neighboring pixel is higher against the threshold, then the value assigned to the pixel is '1' otherwise the value is '0'. The LGP can be represented as the formula

$$LGP_{b,0}(x_a,\bar{x}_a)=\sum_{i=0}^{b-1}p(y_i-\bar{y})2^n \quad (4)$$

where,

$$p(r)=\begin{cases}0, & if\ r<0,\\ 1, & otherwise.\end{cases}$$

0 is the centre of a circle, *b* are the sample points on the circle, LGP uses the bilinear interpolation to compute the neighborhood pixel values for *0* and *b*. It uses *(2* x *m + 1)* and *(2* x *m + 1)* kernel to summarize the structure of the iris. Gradient value between the neighboring pixel n_i and the center pixel n_a is denoted as, $y_c = |n_i - n_a|$ and define the average gradient value of *b* as,

$$\bar{y}=\frac{1}{b}\sum_{i=0}^{b-1}y_i \quad (5)$$

The feature vector is represented as,

$$\gamma=\{\gamma_1,\gamma_2,.....\gamma_w\}\ ;\ for\ (1<\tau<w) \quad (6)$$

where, dimension of features computed from the input image X_i is represented as [1 x w] and w is the total feature dimension.

F. Principal Component Analysis (PCA)

Principal Component Analysis (PCA) is a method which is used to decrease the dimensionality of an image. This method is also used for multivariate analysis of an image. PCA is a compression technique which compresses the high dimensional vectors of an image into the low dimensional vectors and compute the parameters from the data directly. To ɛ dimensionality of an image, PCA extracts less f components. The principal components of an image can be extracts by using covariance matrix or multivariate set. The compression and decompression operations of an image ca perform by using matrix multiplication. The PCA model is represented as,

$$a_{oc1}=E_{ocw}\,c_{wc1} \quad (7)$$

Where, a is an zero dimensional vector with the projection c, and w is the feature vector dimension as (0 < w). The covariance matrix a is denoted as,

$$A=\frac{1}{\rho-1}\sum_{\tau=1}^{\rho}(c-\kappa)(c-\kappa)^{G} \quad (8)$$

where, *K* denotes the mean vector of *C*. The Eigen vectors $ß_T$ is expressed as,

$$(E-\phi_\tau\vartheta)\beta_\tau=0 \quad ; \quad \tau=1,2,.....w \quad (9)$$

where, $Ø_T$ denotes the Eigen vectors of *E*. The projection matrix is calculated as,

$$D=J^G \quad (10)$$

where, *J* has 0 Eigen vectors and D is the *ocw* matrix.

The dimensionally reduced feature vector is represented as,

$$\gamma=\{\gamma_1,\gamma_2,.....\gamma_\tau.....\gamma_o\}\ ;\ for\ (1<\tau<o) \quad (11)$$

where, 0 is the dimensionally reduced features with 0 < w.

G. Chronological MBO-based DBN

The DBN classifier using the Chronological MBO algorithm is used for the identification of a person. The non-linear complex relation presents in the real life are removed by using DBN classifier and the chronological MBO algorithm trains the DBN classifier. The iris recognition is performed using the chronological MBO-based DBN, which is the integration of the chronological concept with the MBO algorithm to train DBN that depends on the migration features of the monarch butterfly. The standard MBO incorporates the fine tuning of parameters and the complex free computation to enhance the performance of the proposed chronological MBO-based DBN, and the high dimensional issues are effectively dealt using MBO. Figure 3 shows the Architecture of DBN classifier.

However, the searching speed and the convergence speed are enhanced by integrating the chronological concept, which defines the solutions (biases and weights) from the preceding iterations to revise the new biases and weights.

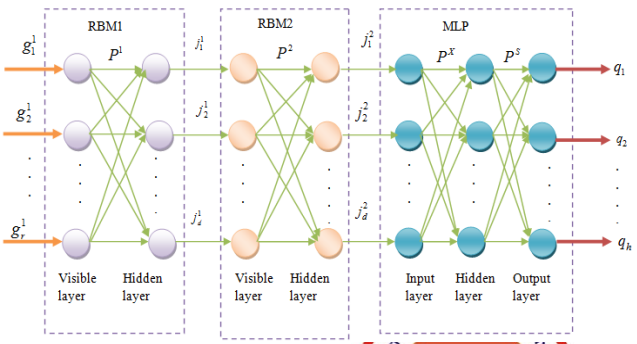

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Fig. 3 Architecture of DBN classifier

H. *Performance metrics*

The metrics used to evaluate the methods, are FRR, FAR, and accuracy are explained below.

1) Accuracy: The accuracy measures the accurateness of iris recognition based on iris modality and is represented as,

$$Accuracy = \frac{Tc + Tu}{Tc + Sc + Tu + Su} \quad (12)$$

where, *Tu* denotes the true positives, and *Tc* is the true negatives. *Su* denotes the false positives and *Sc* is the false negatives.

2) Sensitivity: Sensitivity is otherwise called True positive Rate (TPR), which is the measure of positive-ness identified correctly, and is calculated using the below equation.

$$Sensitivity = \frac{Tu}{Sc + Tu} \quad (13)$$

3) False Rejection Ratio (FRR): FRR is the ratio of false rejection to the genuine attempts, and is expressed as,

$$FRR = \frac{Sc}{Tu + Sc} = 1 - TPR \quad (14)$$

4) Specificity: Specificity or True Negative Rate (TNR) is the measure of false negatives, which are correctly located. Specificity is expressed as,

$$Specificity = \frac{Tc}{Tc + Su} \quad (15)$$

5) False Acceptance Rate (FAR): FAR is the ratio of false attempt to imposter attempts, and is represented as,

$$FAR = \frac{Su}{Su + Tc} = 1 - TNR \quad (16)$$

6) Receiver Operating Characteristics (ROC): ROC refers to the relationship between TNR and TPR, which is used to compute the performance of the system.

III. Block Diagram Of Proposed System

Here in this unit block diagram of suggested structure is given. The implementation of this work is given in this Step and the details of subparts and algorithms.

A. *Test Images*

Here there are 20 peoples dataset is to be considered for the experiment. The database used for this purpose is CASIA.V4 [21][22]. The complete database of this section was looked for Iris images.

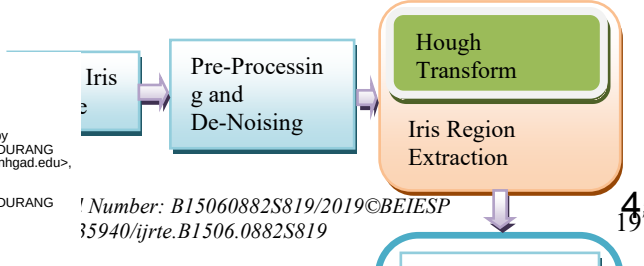


Fig.4 Suggest Method For Iris Recognition.

B. *Pre-processing and De-noising*

In pre-processing, the iris image profile is enhanced by calculating signal-to-noise fraction. Iris Recognition at-a Distance (IAAD) is used to enhance the contrast of the image. Median based filters are used to remove the sound presents in the degraded iris images.

C. *Hough Transform*

The Hough transform is used to extracts the different curves or shapes of an iris image.

D. *Segmentation and Normalization*

In this segmentation step, the iris image is split into dissimilar borders. The division of the regions can take place by considering similar properties

of an iris image. Some of the similar properties are color, brightness, contrast, texture, gray level, etc. The segmented iris image is prepared by using a normalization algorithm.

The segmented iris image is used for the future extraction process. Due to the varying position of a person and the camera, the iris image is highly affected by distortion [20]. Therefore normalization is used to compensate for this problem. The Daugman's Rubber Sheet Model is use for this purpose.

E. *Feature Extraction*

The ScatT-Loop generator is use to extract the different features of an iris image. The ScatT-Loop generates the texture features for accurate iris recognition to uniquely identify the individuals. Operator in LGP utilizes the gradient pixel values and is determined as the intensity value. Different transforms presents in this step are used to calculate the texture features for the iris image. PCA is an optimal scheme to compress the high dimensional vectors into the low dimensional vectors and compute the parameters from the data directly.

F. *Deep Belief Network (DBN)*

The dimensionally reduced features obtained using PCA is fed as input to DBN to recognize the individuals. The effective recognition is obtained by the optimal tuning of the DBN classifier using the Chronological MBO algorithm. By using Chronological MBO algorithm we can forecast or classify accurate Iris image.

IV. EXPERIMENTAL RESULTS

Here observational outcomes are defined in this unit of suggested system. The step by step execution of the proposed system is presented. Firstly we take input test iris image. In this paper, Around 22,035 iris images from 700 individuals dataset is to be considered for the experiment. The database used for this purpose is UBIRIS.v1 [26]. Figure 3 shows the key in iris recognition image having the dimension 512 x 512. This image can be selected by using the GUI in MatLab. This Input Test Image Of The Iris Is Applied For The Pre-Processing. In This Stage, The Different Noise Presents In An Iris Image Are Removed And Increase The Quality Of An Image.

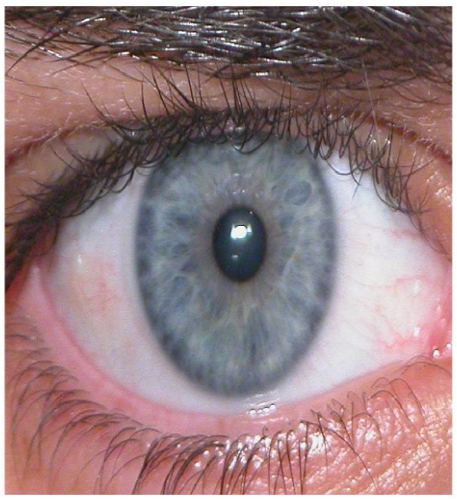


Fig.5 Input Iris Image.

Fig. 6 Processed Iris image.

Figure 5 shows the input image. Figure 6 shows the output of preprocessing the image, which enhances the iris part of the eye (black portion). To eliminate the sound from iris images median filter is used. Figure 7 represents colors to gray as well as resounding image. Color image is the real image, besides of real image is gray image, salt also pepper sound is at the lower level of the original image, also the last one is the Median Filter image. In the Segmentation and Normalization process detection of Pupil and Iris boundary of the original image is takes place.

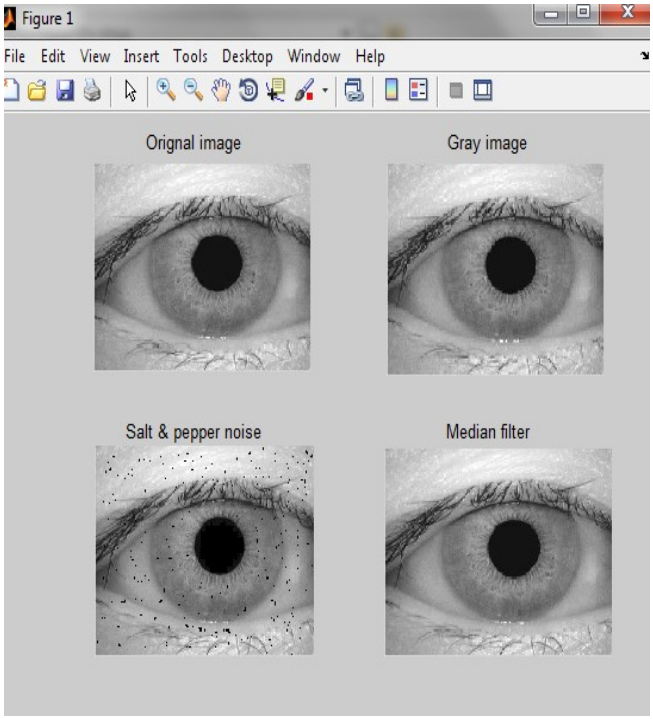
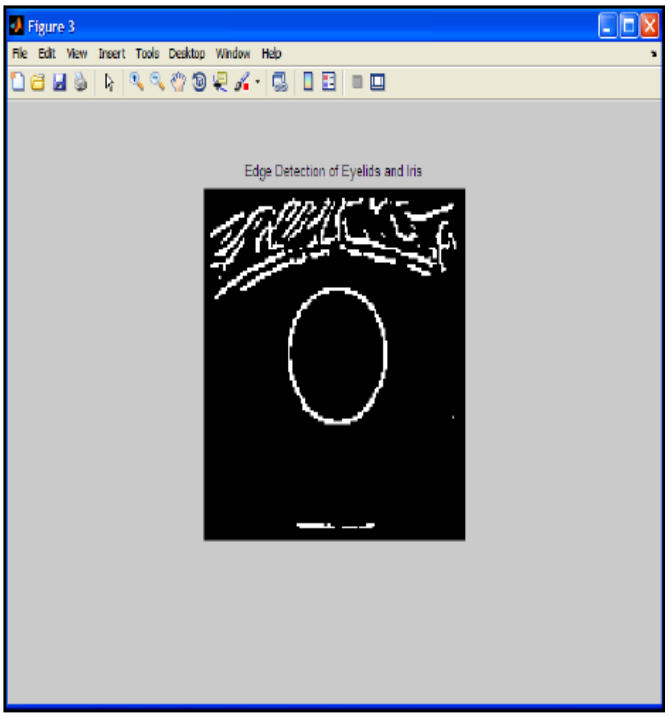


Fig.7 operations on Iris image.



Fig, 9 Edge detection of an Iris Image.

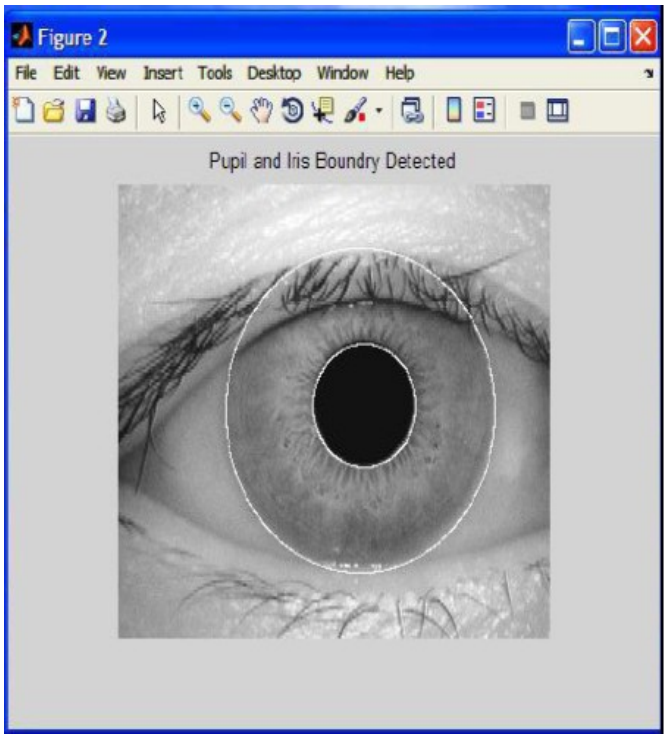


Fig.8 Boundary detection of an Iris Image.

The detection is done with the help of Hough circles. Figure 8 shows the detected boundaries of an iris image. The white border presents in this image is the corresponding boundaries of the iris image. After boundary detection, the edge of an iris image is detected by using Normalization and Segmentation process. Figure 9 shows the corresponding edges of the pupil of an iris image. For finding edge of canny edge detection algorithms are used Figure 10 shows the eyelid of the bottom and top segmentation of an Iris profile.

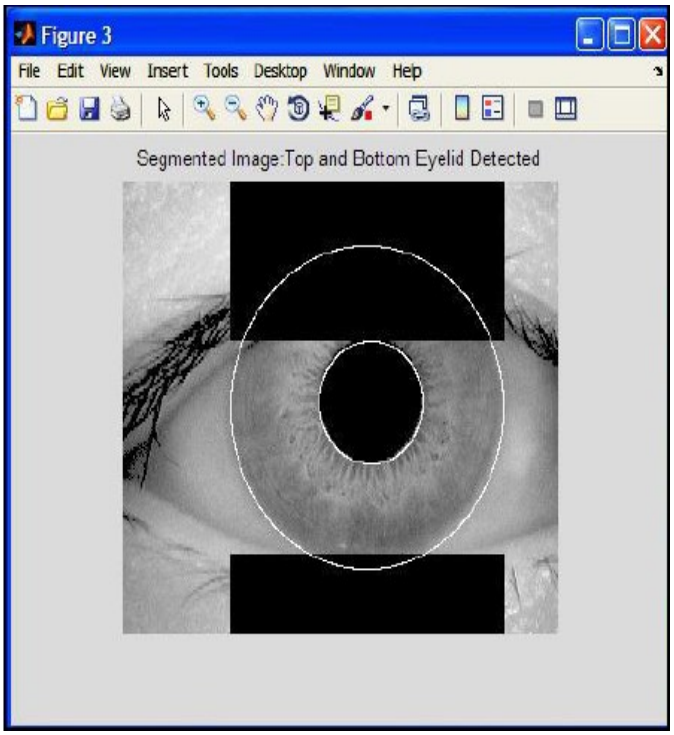


Fig.10 Eyelid of the bottom and top segmentation of an Iris Image.

Figure 9 shows the normalized output image after detection of Iris boundary and Pupil along with bottom and top eyelid recognition and exclusion for Iris Image Normalization and Segmentation. The division of the regions can take place by considering similar properties of an iris image. Some of the similar properties are color, brightness, contrast, texture, gray level, etc. The segmentation identifies the region of interest, finds the location of the tumor, lesion and other abnormalities.

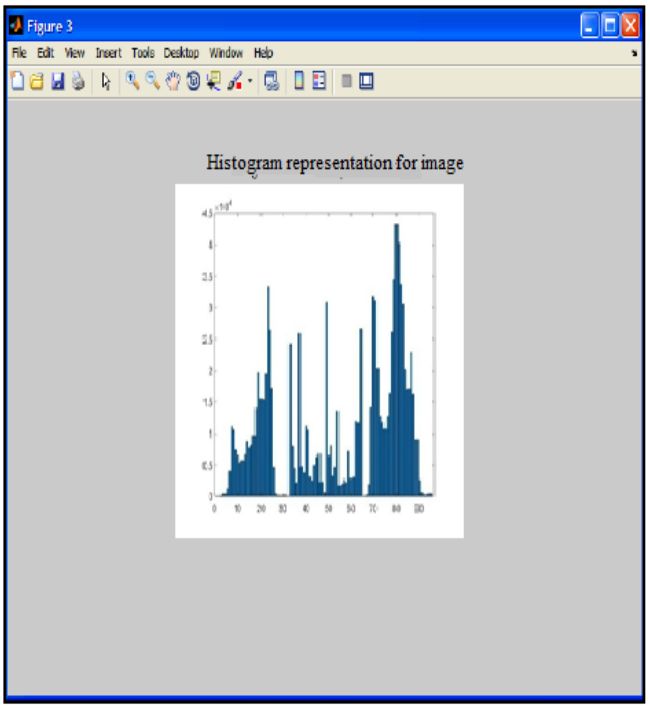


Fig.11 Histogram representation for image.

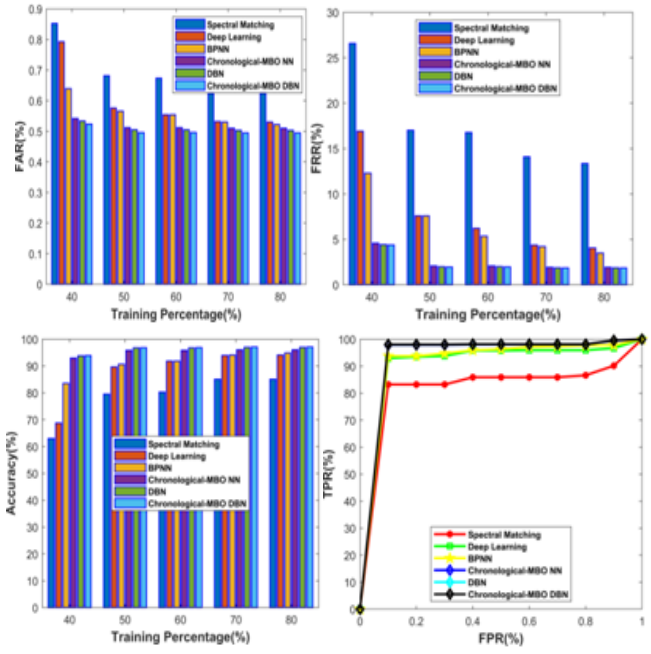


Fig.12 Comparative analysis based on k-fold using image , a) FRR, b) FAR, c) Accuracy and d) ROC analysis.

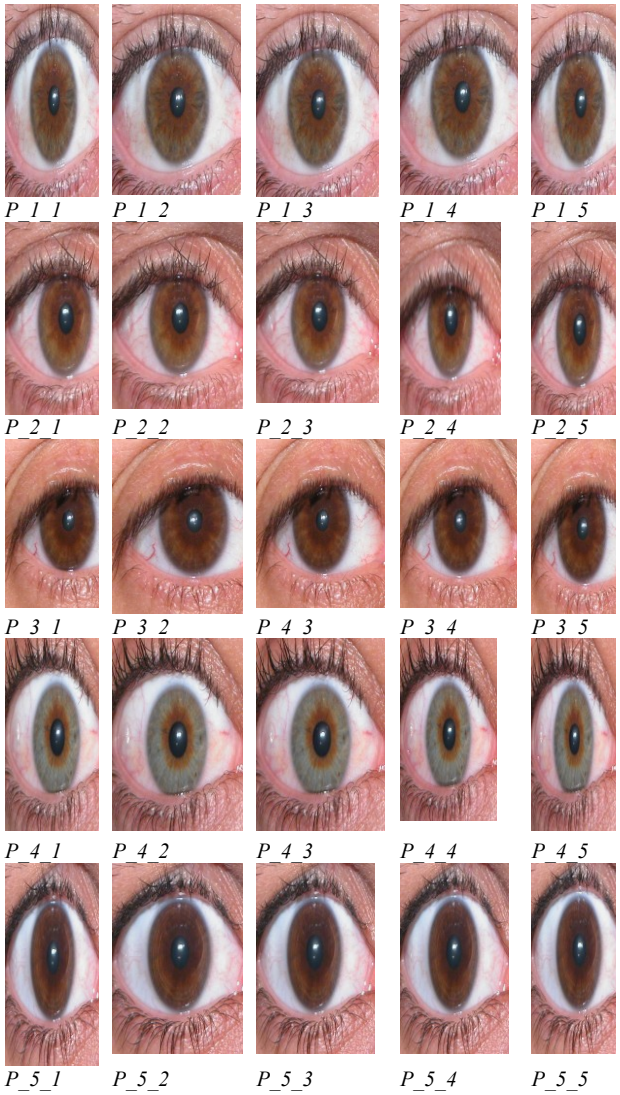


Fig.13. UBIRIS.v1 Database

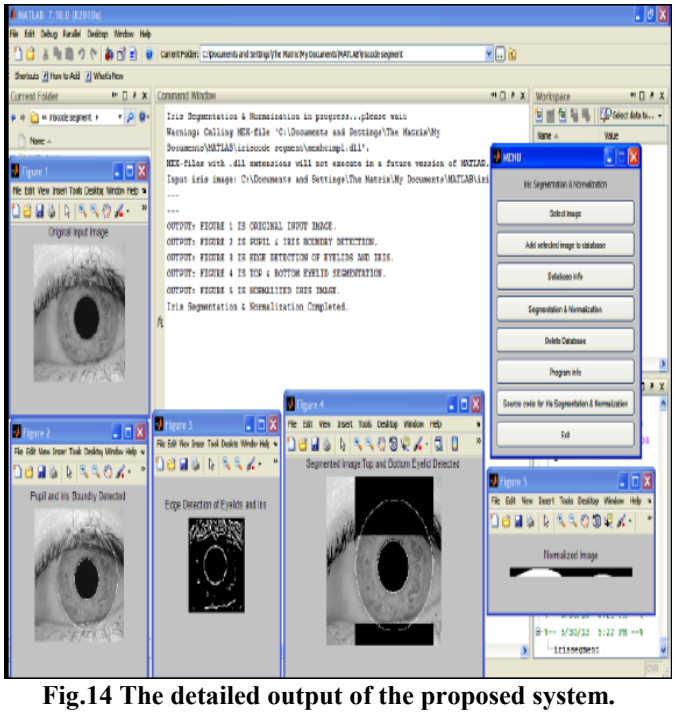


Fig.14 The detailed output of the proposed system.

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Figure 11 shows histogram representation for image. Figure 12 depicts the comparative analysis for the metrics, a) shows FAR, b) shows accuracy, c) FRR and d) ROC analysis with respect to the k-fold validation. Figure 14 shows the dataset of different iris images. Figure 14 shows the detailed output of the proposed system.

TABLE I. TABLE STYLES

Methods	FRR (%)		FAR (%)		Accuracy (%)	
	k-fold	*Training*	*k-fold*	*Training*	*k-fold*	*Training*
Spectral Matching	1.30	10.912	0.52	0.5964	85.0	63.002
Deep learning	1.03	2.9	0.51	0.5261	86.3	68.764
BPNN	0.85	0.786	0.51	0.5040	91.5	83.554
Chronological-MBO-NN	0.5	0.786	0.5	0.5040	95.0	92.942
DBN	0.47	0.745	0.49	0.4972	95.9	93.8
Chronological-MBO based DBN	0.47	0.4745	0.47	0.4889	96.0	93.886

Table 1 demonstrates the comparative discussion of the existing and the proposed Chronological MBO-based DBN method. Based on k-fold validation, the FRR rate obtained by the methods, spectral matching, deep learning, BPNN, Chronological-MBO-NN, DBN, and the proposed Chronological MBO based DBN is 1.3055%, 1.0372%, 0.8577%, 0.5%, 0.4798%, and 0.4745%, respectively.

V. CONCLUSION

In this paper an effective iris recognition system for person identification is present. The false responses are reduces with the help of binary iris segmentation and in image segmentation process, the unnecessary background images are removed. A method for IAAD is introduced for iris recognition using Chronological MBO-based DBN is proposed in this research work. The optimal weights are determined to train the chronological MBO algorithm using DBN. For the segmentation Hough transform is used. It finds the linear, circular and parabolic segments if an iris image. The extraction of fixed number of features are done with the help of normalization. For testing purpose of this iris recognition system, UBIRIS.v1 database is used. For iris segmentation, normalization, feature encoding and feature matching a Daugman's rubber sheet model is used. The iris recognition based on the features of the biometric is performed using the proposed Chronological MBO algorithm, which is trained using the deep learning approach termed as DBN. The false responses to bright lesions and other retinal feature of eye are reduces by this system. MatLab digital image processing tool is used for this purpose. The human machine interface, image processing and image acquisition problems of an iris image are solved by this proposed system. The experimental results show accurate and successful reorganization the iris upto 4 to 8 meter long. The proposed Chronological based DBN approach attained minimal FRR of 0.4745%, minimal FAR of 0.4847%, and accuracy of 96.078%. The future extension of this work can be made by using any optimization algorithm to enhance the performance of iris recognition.

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AUTHORS PROFILE

First Author : Ms.Swati D. Shirke holds an M.E.degree in Computer Science and Engineering from Pune University and is a research fellow in the Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Bharath University. Her main area of interest includes pattern recognition, image processing, machine learning, She has published several papers in well known peer-reviewed journals.

Second Author : Dr. C. Rajabhushnam holds a Ph.D. in Neural Networks, from Louisiana State University, USA And he is a professor in the Department of In the Department of Computer Science and Engineering, Bharath Institute of Higher Education and Research, Bharath University. His main area of interest includes pattern recognition, image processing, and machine learning he has published several papers in well known

Grapes Leaf Disease Detection using Convolutional Neural Network

Tanmay A. Wagh
Information Technology,
NBN Sinhgad School of Engineering,
Pune, India

R. M. Samant
Assistant Professor
Department of Information Technology,
NBN Sinhgad School of Engineering,
Pune, India

Sharvil V. Gujarathi
Information Technology,
NBN Sinhgad School of Engineering,
Pune, India

Snehal B. Gaikwad
Information Technology,
NBN Sinhgad School of Engineering,
Pune, India

ABSTRACT
Grapes (*Vitis Vinifera*) is basically a sub-tropical plant having excellent pulp content, rich color and is highly beneficial to health. Generally, it is very time-consuming and laborious for farmers of remote areas to identify grapes leaf diseases due to unavailability of experts. Though experts are available in some areas, disease detection is performed by naked eye which causes inappropriate recognition. An automated system can minimize these problems. The disease on the grape plant usually starts on the leaf and then moves onto the stem, root and the fruit. Once the disease reaches the fruit the whole plant gets destroyed. The approach is to detect the disease on the leaf itself in order to save the fruit. In our proposed system we have used a Deep Learning model named Convolutional Neural Network. Feature extraction and model training of the leaf images is performed using pre-defined AlexNet architecture. The image Dataset is taken from "National Research Centre for Grapes" (ICAR). It consists of images of diseases named Powdery mildew, Downy mildew, Rust, Bacterial Spots and Anthracnose. Image of the leaf is captured using the built-in camera module of a mobile phone. The accuracy achieved is 98.23% for powdery mildew vs bacterial spots.

Keywords
Deep Learning, Artificial Intelligence, Convolutional Neural Network, Alex-Net, Grapes leaf Disease

1. INTRODUCTION
Grapes are a popular fruit in India. Maharashtra is a leading state in production of grapes in India. Area under grapes in Maharashtra is about 86 thousand hectors and production is around 774 thousand tons of grapes annually [2]. While they are grown world-wide for making wines and raisins, they are mainly consumed as fresh fruits in India. Grapes also possess several health benefits due to their high nutrients content and can be used as natural remedies for several health problems. Due to their extensive use and benefits, and ease of growing in variable climatic conditions, cultivation of grapes has proved to be very profitable [1]. According to a report of 2011-12 from AgriXchange [2], India was the 18th largest, grapes producing country in the world, contributing to around 1,234.9 thousand tons world's grapes production.

This report also presents an increasing trend of grapes production in the country in the years 2001-2011. This crop however is very susceptible to different diseases which have caused significant yield losses during this time. Though the disease severity varies from year to year, early and proper identification of diseases has proved to be a key factor for preventing high yield losses and maintaining quality of the crop through proper usage of pesticide. Proper disease-identification becomes difficult because of (i) similar symptoms of different diseases, (ii) different symptoms for a single disease at different stages of the crop, and (iii) presence of different diseases at the same time. So, a reliable and automatic method is required to avoid subjective errors in disease identification.

We have mainly focused on four diseases in grapes causing devastating yield losses in most of the years. These are Bacterial Spots, Powdery Mildew, Downy Mildew and Rust. The system will give more accurate results for the detection of these diseases using the CNN.

2. LITERATURE SURVEY
The automated method for the detection of disease affected on leaf is one of the important research areas as it provides many advantages in saving the fruit. Lots of research is carried out in this area but Artificial Intelligence is rarely seen being applied for this purpose.

In [3] Authors have proposed detection of diseases in the early stage by developing continuous monitoring system using various sensors like temperature, humidity, leaf wetness. Zig-Bee is used for wireless Data transmission between the farmer and the sensors. Hidden Markov Model is used to asses and to predict the disease at early stage.

In [4] multi-class SVM is used as a classifier and for feature extraction the RGB signal are converted into LGB form. In image pre-processing resizing, enhancing and smoothening of image is carried out to save the memory and reduce the processing time. For image Segmentation K- means clustering is carried out. Maximum 90% accuracy was obtained in testing the Black rot.

In [5] 120 images are taken directly from farms through mobile camera. Accuracy between different methods like SVM, BPN and fuzzy is compared and then SVM is used. In image preprocessing the image is resized to 226 x 226. RGB images are converted to HSV color space. Background subtraction is carried out to remove unwanted background in the image and to focus on leaf section. The average accuracy obtained is 89.3%.

In [6] Authors have used CNN model to recognize and classify phenological stages of different types of plants based on the visual data i.e images which are captured every half an hour by the mounted cameras. Pre- trained Alex Net architecture is used in order to classify. The maximum

accuracy obtained is 87.14% for Pepper which is more as compared to other traditional Machine Learning Approach.

In [7] a public dataset of 86,147 images of diseased and healthy plants are taken which consists of 57 different classes. In addition to the CNN architecture author have used generative Adverserial Networks where background segmentation is carried out and discriminator is used as a Classifier. Resnet was able to obtain 80% accuracy on the unsupervised dataset.

In [8] Authors have used 2 types of Flower dataset. Automated system is developed for the detection of the type of flower using CNN and Transfer Learning. Instead of building the model from scratch transfer learning provides easy access to pre-trained models like GoogleLeNet, OverFeat, Inception-v3, Xception etc. The trained model resides on the server side. User click the image which is converted to base 64 which is send to cloud storage. The converted image is send to CNN where the output class label is predicted. The proposed model achieved maximum accuracy of 98.66% for Inception-v3 model.

3. CONVOLUTIONAL NEURAL NETWORK

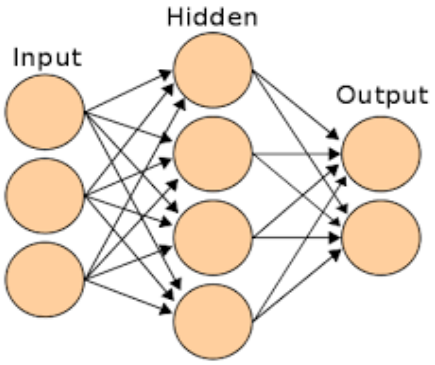

Figure 1.a

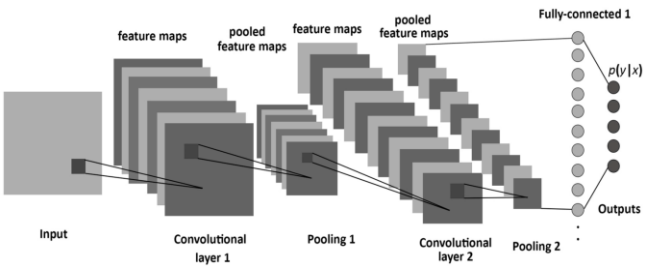

Figure 1.b

Artificial neural networks are motivated by the learning capabilities of the human brain which consists of neurons interconnected by synapses. ANNs are not suitable for images because these networks lead to over-fitting due to size of image. The major difference between a traditional Artificial Neural Network (ANN) and CNN is that only the last layer of a CNN is fully connected whereas in ANN, each neuron is connected to every other neuron as shown in Fig.2 Convolutional neural networks use images directly as input. Instead of handcrafted features, convolutional neural networks are used to automatically learn a hierarchy of features which can then be used for classification purposes. This is accomplished by successively convolving the input image with learned filters to build up a hierarchy of feature maps. The hierarchical approach allows learning more complex, as well as translation and distortion invariant, features in higher layers.

A Convolutional Neural Network (CNN) has four Type of layers as follows –

1. Convolutional Layer (CONV)
2. Rectified Linear Unit Layer (Re Lu)
3. Pooling Layer (POOL)
4. Fully-Connected Layer (FC)

3.1 Convolutional Layer

Convolution is the first layer which is used to extract features from an input image. It preserves the relationship between pixels by learning image features using small squares of input data. The Layer contains N filters which are small in size (for example [3x3] as in fig). These 3x3 filters are convoluted with the input image matrix by sliding the filter slide through the width and height of the image. Firstly, the feature matrix is multiplied pixel by pixel with the selected square from the image. Then the values are added and finally divided by the total number of pixels (in our example it is 9 due to 3x3 filter size). The obtained value is inserted in a new matrix. This process helps to reduce the image without loss of any feature.

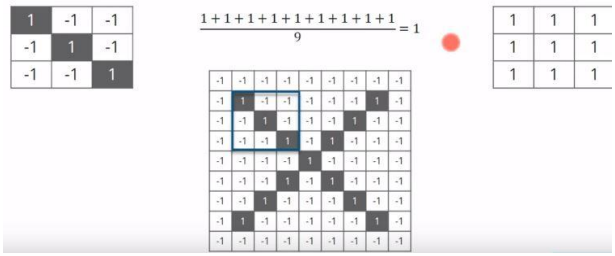

Figure 2

3.2 Rectified Linear Unit Layer

In Re Lu layer the pixels which are not necessary are deactivated and only the important pixels are kept. From Conv layer we get positive as well as negative pixel values. The positive pixels are important for the further finding of features and the negative values are of less importance. The Re Lu layer either converts the pixel to 0 or 1. If the value of pixel is negative then it is converted to 0 and for any value greater than 0 it retains the same value.

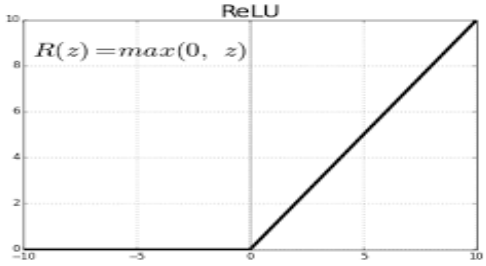

Figure 3

3.3 Pooling Layer

The Pooling layer does a simple job of down sampling or compressing the dimensions of the input image. A stride is selected which can be 2x2 or 5x5 etc. After the selection of stride it is applied to the dimension matrix obtained from the Conv Layer. Maximum value is taken from each stride and stored in a new matrix. Depending on the stride Pooling is of two types Max Pooling and Minimum Pooling. When the stride is large such Pooling is known as Max Pooling whereas

small stride is known as Minimum Pooling. For example, if the input is [64*64*12] and if a stride of 2x2 is applied then after down sampling the output will be [32*32*12]. Figure 4 shows max Pooling Layer

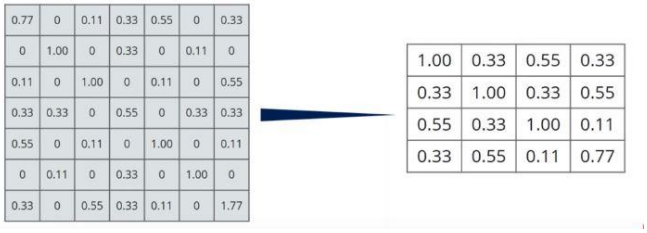

Figure 4

3.4 Layer Stacking

Multiple Layers are stacked of Convolution, Re Lu and Pooling according to the architecture. The number of layers to be stacked varies as per use of the predefined architectures like Google Le Net, Alex Net etc. The output obtained is the minimized matrix of the input image.

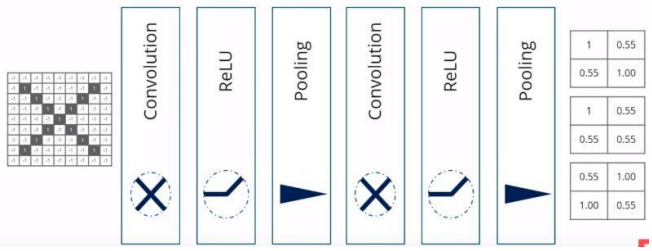

Figure 5

3.5 Fully Connected Layer

The Fully Connected Layer in CNN has neurons that are fully connected to all the neurons of the previous layer. Multiple FC layers are stacked as per the architecture used. It is often the last layer used in CNN which is responsible to predict the output or the label of the input class. Different activation functions are used like SOFTMAX which is used to classify multi-class problems. Hence, it has an output dimension of [1x1xM] where M is the number of classes or labels used for classification.

3.6 AlexNet Architecture

In this paper we have used the AlexNet architecture [10] which strictly bounds us to use 227x227x3 dimension. AlexNet consist of 5 convolution layers and 3 fully connected layers. The first two Convolutional layers are followed by the Overlapping Max Pooling layers. The third, fourth and fifth convolutional layers are connected directly. The fifth convolutional layer is followed by an Overlapping Max Pooling layer, the output of which goes into a series of two fully connected layers. The second fully connected layer feeds into a softmax classifier with 1000 class labels. Re LU nonlinearity is applied after all the convolution and fully connected layers.

Table 1. Architecture of pre-trained cnn, alexnet

Layer	Sizes	Output †
Input	-	227×227×3
Conv 1	11×11×3	55×55×96
Relu 1	-	55×55×96
Norm 1	-	55×55×96
Pool 1	2×2×96	27×27×96
Conv 2	5×5×48	27×27×256
Relu 2	-	27×27×256
Norm 2	-	27×27×256
Pool 2	2×2×256	13×13×256
Conv 3	3×3×384	13×13×384
Relu 3	-	13×13×384
Conv 4	3×3×192	13×13×384
Relu 4	-	13×13×384
Conv 5	3×3×192	13×13×256
Relu 5	-	13×13×256
Pool 5	2×2×256	6×6×256
Fc 1 ††	6×6×4096	1×1×4096
Relu 6	-	1×1×4096
Fc 2	1×1×4096	1×1×4096
Relu 7	-	1×1×4096
Fc 3	1×1×4096	1×1×1000
Softmax	-	1×1×1000

† : width of the map×height of the map×# of color channels (or # of feature maps)
†† : Fully-connected layer

4. PROPOSED SYSTEM

4.1 Dataset

The Dataset is taken from Indian Council of Agriculture Research (ICAR) - National Research Grape Centre (NRGC) situated at Majri, Solapur Road India. Dataset consist of 1000 images each of Powdery Mildew, Bacterial Spots, Downy Mildew, Anthracnose, Rust and 1500 images of Healthy Leaves. Training set is chosen in such a way so that each class consist of same number of observation.

4.2 Preprocessing

The image dataset obtained consist of variable dimensions of images which are not accepted for the AlexNet framework. Hence, the images are broken into multiple images of dimensions 227*227. Data Reduction is carried out where unnecessary images are removed. The unwanted data is to be removed to increase the performance after applying the model on the dataset.

4.3 System Overview

In figure 6 the proposed system overview is shown. The user simply captures the image of the grape leaf using a smartphone. User can also upload image from the gallery. Image can be cropped without processing further. Once, cropping is done the image is send to Node.js server through http Post method. The image path is saved on MySQL Database. Meanwhile, Acknowledgement is send to mobile by the Node.js server. Another server is already created in Python, on server side the trained CNN system on Grapes Leaf dataset is loaded which has

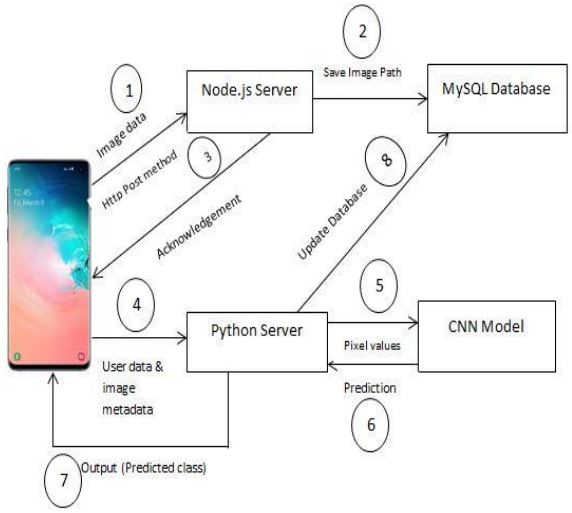

Figure 6

Extension as HDF5 file which contains the weights and biases of the pre-trained CNN model. Now, the server receives the User data and the image metadata. The pixel values of images are send to the pre-trained CNN model which returns the predicted output. Finally, Database is updated and the predicted output class are send to the mobile device.

4.4 Software and Hardware Requirements

8 Gb Ram is used to train the CNN model. Two programming language are used in the proposed system. Python 3.6 is used to build the CNN model. Java is used for the android application development, to make user compatible to use the system. Efficient library of Python i.e 'Keras' is used to implement the AlexNet architecture. Other Python libraries like Numpy, h5py, sciPy are used. After training the model the resulting feature matrix is stored locally in .hdf5 format which is of 700mb.

5. MATHEMATICAL MODEL

Let S be Closed system defined as,

S = { Ip, Op, Ss, Su, Fi, A}

Training a Convolutional Neural Network using images of grapes disease leaf and performing various actions from the set of actions A so that Su state can be attained.

S ={Ip, Op, Ss, Su, Fi, A}

Where,

Ip1= {Dtr | Dtr € D }

Where,

Dtr – Images of an affected leaf

D – Dataset containing Images of grapes leaf

Output set :

Op1= {F | F is Acceptance of relevant Data}

Op2= { F' | F' is a set of features selected for extraction}

Op3= {F'' | F'' is a set of features learned by the CNN through Training}

Op4= { c | c is a trained model used to make predictions}

Set of actions = A= {F1,F2,F3,F4}

Where,

F1 = Accepting Relevant Data

F2 = Using Convolution Layer to extract features

F3 = Training the Deep Neural Network

F4 = Model Architecture Successful

Ss- Loading Images → Extracting Features → Training Model → Making Predictions

Su- Success state is when the CNN can accurately detect and classify the type of Disease.

Fi- Failure state is when the trained model makes an incorrect prediction.

6. RESULTS

The overall Grapes Leaf Disease Detection problem is divided into two parts. Firstly, the features from the images in the training dataset are extracted using the CNN network and is saved in a HDF5 format. Secondly, random test images are given to the network through android application. Two diseases at a time are tested. The maximum accuracy of 98.23% is obtained from Bacterial Spots vs Powdery Mildew where 1000 images of each disease were taken to train. Table shows all the results obtained from this model.

Diseases	Accuracy
Bacterial Spots VS Rust	62.14%
Downey Mildew VS Powdery Mildew	78.26%
Rust VS Powdery Mildew	89.67%
Bacterial Spots VS Powdery Mildew	98.23%

7. CONCLUSION

The objective of this paper is to predict the type of Disease on the image of grape leaf. To predict this Convolutional Neural network is used which is an unsupervised method. Alex-Net Architecture is used to train the model. It is observed from the results that Bacterial Spots Vs Powdery Mildew achieves maximum accuracy of 98.23%.

8. ACKNOWLEDGMENTS

We greatly acknowledge Dr. Sawant and the Indian Council of Agriculture Research (ICAR) - National Research Grapes Centre (NRGC) for providing us information related to the diseases and most importantly giving accesses to the Image Dataset of the grapes Leaf.

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SOIL NUTRIENT DETECTION AND SUITABLE CROP SUGGESTION USING IOT

1.Sonali C. Sethi, Assistant Professor, Computer Engineering Department, NBNSSOE, Ambegaon, Pune

2. Prof. Sheetal T Patil, Assistant Professor, Information Technology department, NBNSSOE, Ambegaon, Pune

Abstract — Development of agriculture using technology will be very much useful in cultivation. For a new agricultural area, without knowing or monitoring the important parameters of the soil, cultivation will be difficult and so the farmers suffer financial losses. This project provides a brief overview of the soil monitoring system using sensors. Various soil sensors are used to measure temperature, moisture and light, humidity and ph value. The information from the sensors in the soil is sent to the MCP3204 A/D converter then from A/D converter it sends to the cloud through Raspberry pi. Finally we can see the information saved to cloud on mobile phone as well as laptop. On the basis of information we know which crop is suitable with given soil parameter. Thus this advanced technology helps the farmers to know the accurate parameters of the soil thus making the soil testing procedure easier

Technical Keyword: soil monitoring system, MCP3204 A/D converter, Raspberry pi.

I. INTRODUCTION

Soil monitoring is a basic procedure which is required for farming. 26% of the Earth's surface is uncovered as land. All mankind lives on the earthbound, strong Earth included bedrock and the weathered bedrock called soil. Soil is a blend of inorganic mineral particles and natural matter of differing size and arrangement. The particles make up around 50 % of the dirt's volume. Pores containing air and water involve the rest of the volume. The vital parameters should have been measured in the dirt are temperature, dampness, mugginess and light. At long time past days, the agriculturists used to see the dirt and will develop the required harvest so the parameters are not precisely known to them to test the dirt. At that point after the dirt testing labs are utilized to test the highlights of soil in which numerous dull procedures happens to gauge every parameter of the dirt. After that numerous continuous activities for self-sufficient soil observing reason for existing were finished utilizing test frameworks and wired sensors. The information gathered is transmitted through ZigBee, GSM, GPS and different advancements.

The current creation for soil observing is the four-wheel meanderer which is a robot that has complex usage that requirements to fuse a suspension outline and high cost. To conquer the impediments of this wanderer, a brilliant remote sensor based soil checking application "Savvy AGRO" is produced for the simplicity of measuring soil highlights. The framework is utilized to quantify the vital parameters of soil, for example, temperature, dampness and light utilizing sensors which is appropriate for a wide range of soil. These dirt sensors can be utilized at multilayer's and multi purposes of the dirt. The information gathered is transmitted to the thing speak utilizing Wi-Fi innovation. The MCP3204 A/D converter is utilized to interface the sensors with the raspberry pi. By knowing the highlights of soil, the development of products can be made less demanding and proficient.

Nowadays, an agricultural industry is one part that is an imperative wellspring of economic growth. Horticulture is viewed as the nation's best field that productive. A rural part utilizes the labor to work, for example, utilizes the manual framework to screen the dirt condition yet they not effectiveness and temperamental to gather information. What's more, by utilizing the manual framework; a great deal issue can happen, and for instance, it will diminish the efficiency and nature of the item. No sensor to control the clammy and makes trouble to people to investigate the dirt condition. It will take more expenses to research or screen the issue and sit around idly or vitality to get the outcome. In the meantime, the client will rely upon the lab framework to know the past information. Besides, in farming, for example, seed palm oil need to watch the dirt for development. Envision when the plant has debased, the buyer or rancher will have less cash and how much time that they have to recoup. So to diminish such drawback we need such framework which is helpful for development of agriculture field.

The main objective of this project is to implement Wireless sensor network (WSN) for monitoring agricultural data using sensors such as soil, moisture etc.

II. RELATED WORKS

In literature, the problem and the previous techniques of pedestrian crossing is described. In this paper Embedded Based Soil Analyzer is utilized to investigate different soil supplements with the assistance of pH esteem. As per the accessibility of supplements, proposals of developing the specific product will be given. This venture utilizes microcontroller which decides PH of weakened soil. The framework incorporates Microcontroller Unit, Signal molding, Sensors, Display, Warm Printer and Power supply. In this

framework, keypad is utilized to associate the client and the framework. [1]

In this paper it was proposed to actualize a remote sensor organize associated with unified essential hub utilizing ZigBee, which was Central Monitoring Station (CMS) through Global System for Mobile (GSM) technologies or General Packet Radio Service (GPRS). This framework infers checking different factors, for example, moistness, soil dampness and give remote observing utilizing ZigBee which sends information remotely to a focal server which gathers information store it and enable it to be shown as required and furthermore be sent to the customer versatile.[2]

W.S. Lee et al. [3] proposed different detecting innovation that are exceptionally valuable for assurance of different soil physical and concoction data and properties. They proposed different detecting framework like field-based electronic sensors, photospectro meters, machine vision, remote detecting, satellite symbolism, warm imaging, RFID, and machine olfaction framework. These all detecting advancements are valuable for recognition of soil supplements; trim water content, and edit discovery, weed and biomass location.

Bah A. et al. [4] discussed the potential of various on the go sensor like electrochemical sensors, optical and radiometric sensors, acoustic sensors and mechanical sensors and they can play an important role for nondestructive and rapid characterization of soil nutrient variability and various soil nutrients. They proposed different sensors that are exclusively appropriate to decide maybe a couple soil traits. Acoustic sensors are helpful to separate the physical and mechanical attributes of soil.

Hak-Jin Kim et al. [5] talked about the two detecting advances for assurance of soil macronutrients like nitrogen, phosphorous and potassium. In a hurry vehicle based detecting framework additionally can effectively and quickly describing changeability of soil supplements in the field. In electrochemical technique nitrate particle layers and cathodes gives the best reaction to the nitrate in the dirt

Sinfield et al. [6] talks about different techniques for assurance of soil micronutrients. This strategy gives the great consequence of aggregate phosphorous substance in the soil having the r2 esteem almost around 0.63 to 0.68. For potassium assurance they examined the reflectance spectroscopy and potassium particle particular terminal strategies giving r2 esteem almost around 0.7.

III. PROPOSED ARCHITECTURE

The below figure shows the block diagram of soil nutrient detection and suitable crop suggestion.

In this project we design the system which is useful for the agriculture. The temperature sensor, analog moisture sensor, humidity sensor and ph value should be kept in the soil of two samples i.e. one with chemical pesticides and another with compost which has to be tested. Each sensor is separately connected to the MCP3204 (ADC) transmit the information on about the parameters to the raspberry pi. This raspberry pi Module sends the information to the cloud then the user can see the soil parameter information on the mobile phone as well as laptop using web browser in the form of graph. On the basis of this soil parameter we will get which crop is suitable with such soil parameter.

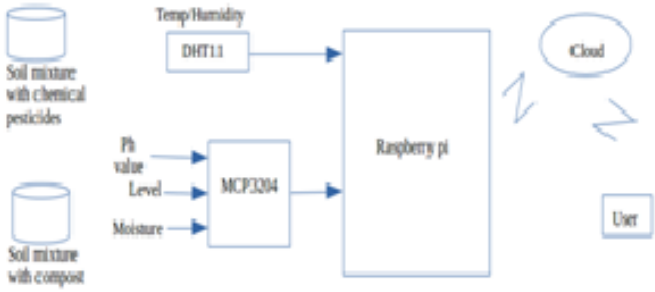


Fig.1. Block Diagram of proposed system

Atmospheric Digital Temperature & Humidity Sensor: DHT11 sensor is chosen to monitor ambient temperature and humidity. This sensor proved to be reliable and stable. The output from DHT11 is a calibrated digital signal which can be interfaced directly to Arduino Uno port pin. It utilizes exclusive digital-signal-collecting-technique and humidity sensing technology that calibrates automatically. With its small size, low power consumption, and ability to function in all kinds of harsh application occasions, makes the DHT11 suitable to use as a drought monitoring sensor.

Soil Moisture Sensor:

In spite of the significance of soil moisture data, broad and additionally ceaseless estimation of soil dampness is everything except non-existent. "The absence of a persuading approach regarding estimation of soil dampness is a significant issue". Unmistakably, a need exists for ceaseless estimations of surface soil dampness. Additionally, remote soil dampness detecting expands the efficiencies of water system frameworks by counteracting over watering and filtering of composts and different chemicals offsite. Soil Moisture sensor FC-28 accompanies a couple of tech tests that can be embedded in the dirt. A little current stream through the tests and the level of protection will be measured. The protection increments if the dirt is dryer. The yield from the sensor is a simple yield that can be associated with one of the simple to advanced port (ADC) accessible on the microcontroller board. FC-28 soil dampness sensor module has been adjusted keeping in mind the end goal to confirm precise operation of the gadget. A pot with gardening soil was taken and the dampness levels are changed frequently. The pot was presented to hot sun with a

specific end goal to dispose of the dampness. This enabled us to reenact a dry, parched soil condition.

IV. SYSTEM ALGORITHM

We propose an algorithm to describe the operation of the system.

a. Algorithm

Below is the algorithm of the proposed system

Step 1	Start
Step 2	Fit the sensors in soil.
Step 3	Digitally converted values are sending to the raspberry pi via MCP3204.
Step 4	Raspberry communicates with Apache server and sends the data of all sensors.
Step 5	Suitable crop and nutrients values are display on mobile application.
Step 6	Stop.

b. Flow Chart

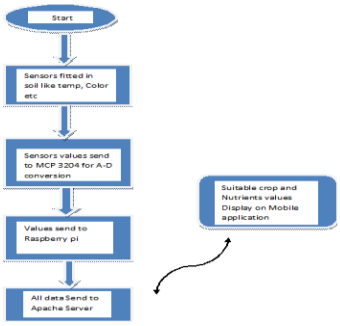


Fig 2 Flow of system operation

If either of the gas sensor or the LDR value goes beyond the optimum value of the system (i.e. predefined threshold) then the system took appropriate action against it. If LDR value is less that means there is dark outside therefore ON Street light and if after making that light ON it is still in off condition, suggest that the light is faulty. Similarly when gas sensor value goes beyond the threshold shows that gas is detected. If anyone of the above mention condition happens then the this information is updated on webpage.

V. RESULT

a. Hardware Model

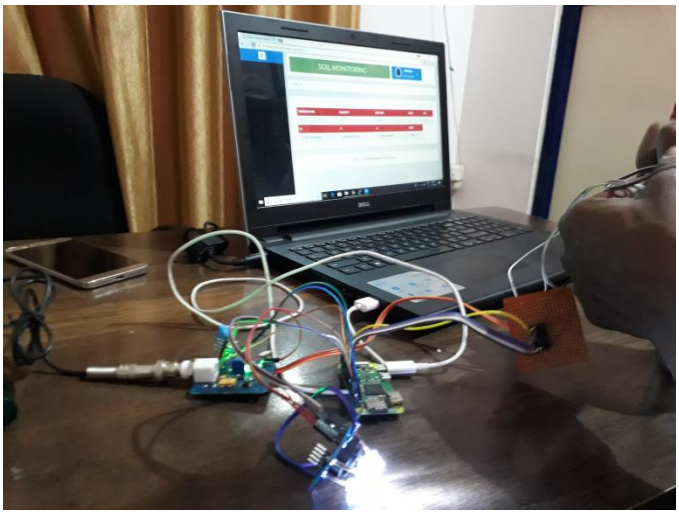
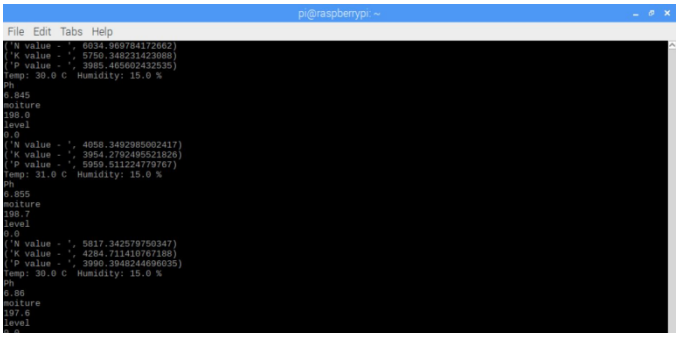


Fig 3 Hardware model of the system

Figure 3 shows the actual hardware model of the proposed system which consist of



b. Web page

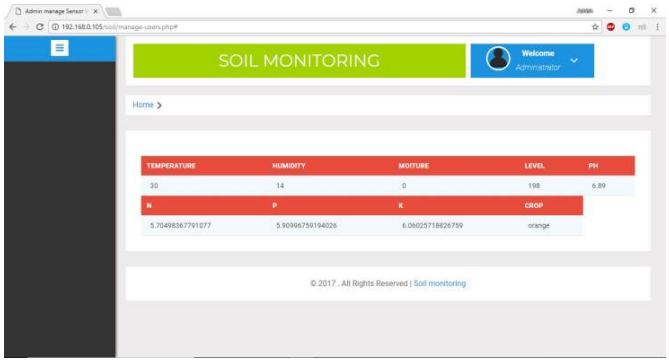


Fig 4: login page and status of Street light.

VI. CONCLUSION

This approach for measuring the soil parameters is used for the efficient plant growth. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. The important parameters of the soil such as temperature, moisture, humidity and ph value are checked by the respective sensors. The measured parameters are transmitted to the cloud through the raspberry pi wifi. Finally we can see the graph of soil parameter and suitable crop for this parameter on mobile phone as well as laptop through browser.

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A Machine Learning Approach to Building a Tourism Recommendation System using Sentiment Analysis

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A Machine Learning Approach to Building a Tourism Recommendation System using Sentiment Analysis

Abhishek Kulkarni
Department of Information Technology
NBN Sinhgad School of Engineering, Pune, India

R. M. Samant
Assistant Professor
Department of Information Technology
NBN Sinhgad School of Engineering, Pune, India

Prathamesh Barve
Department of Information Technology
NBN Sinhgad School of Engineering, Pune, India

Aarushi Phade
Department of Information Technology
NBN Sinhgad School of Engineering, Pune, India

ABSTRACT
Opinions have become extremely vital in today's "ratings" driven technological services. An android application, a top-tier restaurant or any service for that matter thrives or wanes away on the reviews it gets. A good review can help attract potential users while a bad one may drive them away. Thus, it is essential to analyze these reviews to better understand the user's experience and work towards improving it. The general system that most services use today is based on star-ratings or a score out of 5 or 10. Although these serve the most basic purpose, text-based reviews allow one to understand the reason behind the ratings and are useful to both the user and the service provider to gain more insight. It is impractical for a human to go through thousands of reviews and comprehend the user's sentiment. Instead, training an algorithm to do this job is much more pragmatic and the advances in machine learning allows one to do so. This is where sentiment analysis comes in. In this paper, analysis of various machine learning algorithms like Multinomial Naïve Bayes, Random Forest Classifier and Bernoulli's Naïve Bayes has been done and their behavior has been studied. In addition, study of Convolutional Neural Networks and Recurrent Neural Networks is done to find out if deep learning algorithms perform better. Using these results, a recommendation system is built that maps an individual user's interests to the highest rated tourist places and generates a unique tour plan that is tailored to the user's needs.

Keywords
Machine Learning, Sentiment Analysis, Tourism, Recommendation System, Recurrent Neural Network

1. INTRODUCTION
The tourism industry has exploded in recent years. This explosion has led to the industry becoming more dynamic and user driven. With the advent of new technology, it becomes imperative to entwine the two and create better, more efficient solutions to these dynamic problems. As with any technology, its design revolves around the user. The user's capabilities and proficiency become a major factor which decides the complexity and usefulness of any technology. Various factors like businesses coming online, increase in the quality of

global positioning systems and the popularity of social media has led to the tourism industry becoming multifaceted. In the 20th and early 21st century, planning a trip would take immense efforts on the user's part. This included contacting every hotel for booking information, arranging travel and deciding on various places to visit. The world wide web completely changed the scenario. Tourists came online and wrote reviews of places, businesses came online, and it became easier to book travel and accommodation. These developments led to ease on the part of the user. Still, the users must manually go through reviews and decide on the best resources among the hundreds available.

The proposed system in this paper eliminates this effort. The proposed system analyses various reviews of tourist places and creates a recommendation list. After taking the interests of the user, the system creates a tailored tour plan for the user. The user can search for information of various tourist places as well as explore resources relevant to her/him.

To generate the said recommendation list, various machine learning and deep learning algorithms have been tried out. These include Bernoulli Naïve Bayes, Multinomial Naïve Bayes, Random Forest Classifier, Recurrent Neural Networks and Convolutional Neural Networks. The basic concept used for this work is Sentiment Analysis. Using existing reviews, the model is trained to identify to what extent a review is positive and negative. This positivity or negativity decides the rating of the tourist place in the system. Further, the recommendation list considers both the rating and user's interests to find the best trade-off between the two.

2. LITERATURE SURVEY
In [1] it gives us an outline of intelligent tourism system. Different modules of intelligent tourism system like place recommender system, database thinking, information delivery for tourism etc. are described and their points of interest and breaking points are tended to. It looks at two best recommender framework advancements, Tripplehop's TripMatcher and VacationCoach's Expert Advise Platform, MePrint.

In [2] Hybridization of collaborative filtering and content- based recommendation system is studied. They have utilized IMDB dataset to suggest, having a set of 13 features to recommend a movie. Optimal feature weights are considered, and a regression framework is described. Additionally, execution of the framework is examined.

In [3] multiple content-based recommendation models like TFIDF profile model, BM25 profile model are presented and assessed. So as to investigate the performance of the methodologies these two recommenders are thought about utilizing two diverse datasets acquired from Delicious and Last.fm social frameworks.

In [4] a positioning framework for suggestion of items that gives best incentive to shoppers' cash is proposed to be created. It utilizes novel dataset of US lodging reservation. In view of evaluations from the model, monetary effect of different administration and area qualities of lodging is inferred.In [5] contrasts and subtleties between two distinct methodologies for

text classification, for example Multivariate Bernoulli model and Multinomial model are portrayed. In result it states, Multivariate Bernoulli algorithm performs good on little vocabulary sizes and Multinomial performs better at large vocabulary sizes. Execution of Multinomial Naïve Bayes can be upgraded by utilizing locally weighted learning.[7]

In [6] various ways to deal with make a recommendation list for the travel industry are examined. It expresses that by utilizing content-based scoring, framework can utilize typical tourist media information to include scores-based contents and its semantics to the general inference process.

In [8] Ensemble classification is used to analyze sentiment analysis on twitter dataset. Ensemble classification includes joining the impact of different autonomous classifiers on a specific issue which beats traditional Machine Learning classifiers by 3-5%

[9] This paper actualizes Sentiment Classification task on Amazon Fine Food reviews dataset and Yelp challenge dataset. James Berry thought about two methodologies, first - conventional Bag of Words approach using Multinomial Naïve Bayes and Support Vector Machine Classifiers and second – Long Short-Term Memory (LSTM) Recurrent Neural Network with GloVe Embeddings and self-learned Word2Vec embeddings. This paper concludes LSTM is best performing algorithm.

3. PROPOSED METHODOLOGY

3.1 Overview of the System

The proposed system aims to reduce the effort on the user's part. The system will create a recommendation list which is curated using the results of analysis of numerous user-reviews and the inputs given by the user. The deep learning algorithm will determine the extent to which the review of a place is positive and negative. Based on the result, the rank of the place in the recommendation list will be decided. A more positive result will rank the place higher and increase the chances of it being recommended while a more negative result will rank the place lower, thereby decreasing the likelihood of it being recommended. Each of these places is categorized based on what it offers, for instance the Taj Mahal being a

historical site offers a historical and heritage value. A user will enter their preference. This includes the type of location they want to visit (adventurous, historical, architectural, etc.), the number of people traveling and children (if any), and the number of days they plan to take the trip for. Based on these parameters and the user reviews for each place, the recommendation list will be generated uniquely for that user. It will be mapped to the individual user's requirements and a tailored trip will be generated. Thus, the user won't have to settle for generalized plans that tour businesses generally offer.

This system works in two phases. In the first phase the reviews and other relevant data is gathered, and an average rating is assigned to each place. In the second phase, the ratings assigned in the previous phase and other parameters taken from the user are utilized to generate a unique recommendation list. Thus, every user gets a tailored tour plan that actually considers their opinions.

3.2 Design of the Recommendation List

The crux of the system is the recommendation list which maps user's interests to ratings analyzed from reviews. Ratings, ambience, cleanliness, must-visit, nightlife, parking and peacefulness are the factors considered while generating the recommendation list. For features which a user would generally want, a full score is given. Following formula has been devised for the same,

Score(place=X) = 10*ambience + 10*cleanliness + 10*must-visit + nightlife*NightlifeUserValue + parking*ParkingUserValue + peacefulness*PeacefulnessUserValue + childSafety*ChildSafetyUserValue + 10*ratings

Here, the maximum value of each feature is 5, thus the maximum total score of any place will be 400. The features ambience, cleanliness, must-visit status and ratings are preferred by most of the users, so it is assumed that its value will be maximum. For the other features, user's inputs will determine the value. Thus, the summation of these values will result in a holistic score of each tourist place and arranging these scores in descending order will generate the recommendation list.

3.3 Getting Data

Deep learning algorithms used for Sentiment analysis require a vast dataset. For this reason, Amazon Product Reviews dataset from Kaggle having 3.6 million reviews has been used. From this dataset, 1 million reviews are taken. These 1 million reviews contain 600,131 positive reviews and remaining 399,869 negative reviews. Along with these surveys have been gathered of better places utilizing Google API. When one looks through a spot-on Google, Google API returns data about that place alongside 5 most recent surveys for each spot. Additionally, reviews on destinations like TripAdvisor, Google which are openly accessible and are taken to assemble the dataset. Likewise, to get the reviews a survey was conducted getting reviews about various places. Utilizing these, a sum of 30,000 surveys of better places were accumulated. These accumulated surveys are given classification as positive or negative manually.From above dataset, 1 million surveys of Amazon Product Reviews dataset and 20,000 reviews of places are used as training set for algorithm, while remaining 10,000 reviews are used for testing.As a model for the recommendation system, the state of Goa from India is considered. 26 places from Goa are chosen. Values for features like ambiance, cleanliness, peacefulness of each spot are given physically by perusing surveys.

3.4 Model Building

To find out the best performing models, the following machine learning and deep learning algorithms were considered and implemented on the Amazon Reviews dataset:

I) Bernoulli Naïve-Bayes

In the multivariate Bernoulli event model, features are independent Booleans (binary variables) describing inputs. Like the multinomial model, this model is popular for document classification tasks, where binary term occurrence features are used rather than term frequencies. If x_i is a Boolean expressing the occurrence or absence of the i^{th} term from the vocabulary, then the likelihood of a document given a class C_k is given by

$$(x|C_k) = \prod_{i=1}^{n} p_{ki}^{xi} (1 - p_{ki})^{(1-xi)}$$

where p_{ki} is the probability of class C_k generating the term x_i. This event model is especially popular for classifying short texts. It has the benefit of explicitly modelling the absence of terms. When implemented on the Amazon dataset, it had an accuracy of 82.75% and an f1-score of 0.83.

II) Multinomial Naïve-Bayes

With a multinomial event model, samples (feature vectors) represent the frequencies with which certain events have been

generated by a multinomial (p_1...,p_n) is the probability that event i occurs (or K such multinomials in the multiclass case). A feature vector x = (x_1,.....,x_n) is then a histogram, with x_i counting the number of times event i was observed in a particular instance. This is the event model typically used for document classification, with events representing the occurrence of a word in a single document. The likelihood of observing a histogram x is given by

$$p(x|C_k) = \frac{(\sum_i x_i)!}{\prod_i x_i!} \prod_i p_{ki}{}^{xi}$$

If a given class and feature value never occur together in the training data, then the frequency-based probability estimate will be zero. This is problematic because it will wipe out all information in the other probabilities when they are multiplied. Therefore, it is often desirable to incorporate a small-sample correction, called pseudo count, in all probability estimates such that no probability is ever set to be exactly zero. This way of regularizing Naïve Bayes is called Laplace smoothing. Implementing this algorithm on the

Amazon dataset yields an accuracy of 84.48% and an f1-score of 0.85.

III) Random Forest Classifier

Random Forest learning is the construction of a decision tree from class-labelled training tuples. A random forest is a flow-chart-like structure, where each internal (non-leaf) node denotes a test on an attribute, each branch represents the outcome of a test, and each leaf (or terminal) node holds a class label. The topmost node in a tree is the root node. Classification and Regression Tree (CART), Iterative Dichotomiser 3(ID3) and Chi-squared Automatic Interaction Detector (CHAID) are few types of decision tree learning algorithms.

The Amazon Reviews dataset when used to train this algorithm outputs an accuracy of 84.60% and an f1-score of 0.85.

A problem arises when using traditional RNNs for NLP tasks because the gradients from the objective function can vanish or explode after a few iterations of multiplying the weights of the network. For such reasons, simple RNNs have rarely been used for NLP tasks such as text classification [7]. In such a scenario one can turn to another model in the RNN family such as the LSTM model. LSTMs are better suited to this task due to the presence of input gates, forget gates, and output gates, which control the flow of information through the network.

Table 1. Results

Algorithm Used	Accuracy
Bernoulli Naïve-Bayes	82.75%
Multinomial Naïve-Bayes	84.48%
Random Forest	84.60%
Convolutional Neural Network	94.40%
Recurrent Neural Network	94.56%

Thus, from the analysis it is observed that Recurrent Neural

IV) Convolutional Neural Network

A convolutional neural network consists of an input and an output layer, as well as multiple hidden layers. The hidden layers of a CNN typically consist of convolutional layers, RELU layer i.e. activation function, pooling layers, fully connected layers and normalization layers.

Description of the process as a convolution in neural networks is by convention. Mathematically it is a cross-correlation rather than a convolution. This only has significance for the indices in the matrix, and thus which weights are placed at which index. Convolutional networks were inspired by biological processes in that the connectivity pattern between neurons resembles the organization of the animal visual cortex. Individual cortical neurons respond to stimuli only in a restricted region of the visual field known as the receptive field. The receptive fields of different neurons partially overlap such that they cover the entire visual field.

As expected, the CNN model yielded an accuracy of 94.40%.

V) Long Short-Term Memory RNN

For the neural network approach, LSTM RNNs have been used because they generally have a superior performance than traditional RNNs. A problem arises when using traditional RNNs for NLP tasks because the gradients from the objective function can vanish or explode after a few iterations of multiplying the weights of the network. For such reasons, simple RNNs have rarely been used for NLP tasks such as text classification In such a scenario, one can turn to another model in the RNN family such as the LSTM model. LSTMs are better suited to this task due to the presence of input gates, forget gates, and output gates, which control the flow of information through the network.

An accuracy of 94.56% was obtained using this algorithm on the Amazon Reviews dataset.

4. RESULTS

For the neural network approach, LSTM RNNs is used because they generally have a superior performance than traditional RNNs for learning relationships.

Network performs the best.

5. CONCLUSION

Thus, to develop the recommendation list, various machine learning and deep learning algorithms have been discussed to analyze the reviews of the Amazon Reviews dataset. As can be seen from the evidence above, the Recurrent Neural Network proves to be the model which yields the highest accuracy of 94.56%. Thus, in this experiment a deep learning algorithm outperforms the machine learning algorithms and is consequently chosen to classify the user reviews. The proposed system will thus take the output of this analysis and map it with the user's interests.

In the proposed system, the reviews are looked at holistically. Breaking this review down based on multiple core properties may result in a more in-depth and accurate classification. For instance, in a review about a tourist spot, extracting features like parking availability, cleanliness, child-safety may prove to be helpful and needs further exploration in the future.

6. ACKNOWLEDGEMENTS

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Forest Cover Type Prediction using Cartographic Variables

Tejas Anant Wagh
Kogentix technologies,
Hyderabad, India.

R. Bhargavi
Associate Professor
Schools of computer Science and Engineering,
Vellore Institute of Technology,
Chennai Campus,
Chennai, India

Tanmay Anant Wagh
Information Technology,
NBN Sinhgad School of Engineering,
Pune, India

R. M. Samant
Assistant Professor
Department of Information Technology,
NBN Sinhgad School of Engineering,
Pune, India

ABSTRACT
Information regarding forest land is highly required for developing ecosystem management. This paper provides an analysis related to classification and prediction estimation using machine learning techniques. The approach is to predict the forest cover type using the cartographic variables like aspect, slope, soil type, wilderness area etc. Various Data mining techniques such as decision tress, random forest, regression trees, and gradient boosting machines are used for prediction of the forest cover type. Using these machine learning methods models have been developed and tested for accuracy ranging from 19.4% to 74.8%. Kaggle dataset which is the standard benchmarking dataset, is taken for comparison studies. The comparisons of these models are done to identify a better model for predicting the forest cover type with better accuracy. For performance comparison, metrics like accuracy and error rate are used. An important aspect of the study is the use of different performance measures to evaluate the learning methods.

Keywords
Machine learning, classification and regression, decision trees, random forest, gradient boosting machines.

1. INTRODUCTION
Machine learning is a scientific discipline that explores the construction and study of algorithms that can learn from data. Machine learning effectively learns from train dataset and apply transformation on the test data to get the estimated results. In this new learning algorithms have emerged (e.g. Random forest, bagging and boosting, neural networks) that has given an excellent performance, accuracy and results.

The machine learning algorithms are now used in many domains and different performance metrics are appropriate for the particular domain [12]. The different performance metrics measure different tradeoffs in the predictions made by the classifier and this is important to evaluate the results which are predicted on dataset using this algorithms. Machine learning is improving by acquisition of

knowledge from experience. The industrial perspective has also turned towards the domain specific and knowledge engineering in machine learning. It consumes less time and human activity with automatic techniques that improves performance and accuracy and efficiency by discovering and exploiting regularities in the dataset using training and testing. The main challenge machine learning has its ability to produce system that are used in industry, education etc. Most experiments done in machine learning on the separate test set in more than one [illegible] i.e. better than performing on the data without learning.

Machine learning is mostly based on the statistics. There are various algorithms which have connections with the statistics. For example, the boosting which is one of the prediction algorithm used for forest cover type is now widely thought to be in stage wise regression using loss function. There are various applications of machine learning including medical, bioinformatics, search engines, credit card fraud, natural language processing, speech and handwriting recognition, robotics and game playing.

The forest cover dataset which consist of predominant kind of tree cover and various attributes which are cartographic and we used different algorithms for predicting the cover type using cartographic variables. The algorithms used are firstly regression. The Linear regression is a tool in statistics and machine learning [3]. It functionality is to create a relationship between the sets of attributes or variables i.e. dependent and independent variables and predict the values of dependent variables given new values of independent variables. Secondly decision tree are used which are produced by algorithm that identify various ways of splitting a data into branch like segments [4] [14]. The output is predicted by each and every iteration in the tree. Thirdly Random forest algorithm which are used for classification and predication in which multiple decision tree are made by averaging at every iteration and the values are classified and predicted [5][8]. Fourthly, Gradient boosting machines are newly developed algorithm which gives much good accuracy. These are the ensemble or committee classifiers. Popular approaches for ensemble classifiers are bagging and boosting which are also a type of a decision tree but it mainly focusses on the loss function or error prone areas by which it can predict accurate results[9][10].

2. LITERATURE SURVEY
The attempt to explore the space of parameters and common variations for each learning algorithm as thoroughly as it is computationally feasible. This section summarizes the parameters used for each learning algorithm.

2.1 Methodologies
In [3], it tells about the linear and multiple and multivariate regression which is an important analysis tool in statistics and machine learning. It aims to create the linear relationship between two sets of variables, namely the dependent/response and the independent/predictor variables, and then to predict the values of the dependent variables given new values of independent variables. In recent decades, regression analysis has been widely used for prediction and forecasting, and intersects much with the field of pattern recognition and machine learning.

The multivariate linear regression is another important because this model models the relationship between the multiple dependent variables and set of independent variables.

In [4][14], Decision tree is another approach for classification. Decision trees are created by algorithms that distinguish various ways of dividing a data set into branch-like sections. These sections form an inverted decision tree that starts with a root node at the tip of the tree. The aim of analysis is reflected in this root node as a simple, linear display in the decision tree interface. The epithet of the field of data that is the object of analysis is usually exposed, along with the spread or distribution of the values that are contained in that area.

Decision trees are the form which consist of multiple variable with multiple effects analyses. This multiple variables allow us to predict, explain, describe, or classify a target or outcome. Decision trees attempt to see a solid relationship between input values and the target values in a group of observations that form a data set. When a set of input values is identified as possessing a solid relationship with a target value, then all of these values are grouped in a bin that becomes a branch of the decision tree. These groupings are defined by the observed shape of the kinship between the bin values and the object [13].

In [5], it gives importance of applying random forest on dataset. Random forest is statistical method for classification and decision–tree based supervised learning algorithm. Its algorithm is an ensemble classification which is unsurpassable in accuracy among current data mining algorithms. It has been used for Microarray cancer [6], android malware [7], and intrusion detection.

The random forest consists of many individual trees [5]. Each tree votes on an overall classification for the given set of data and the random forest algorithm chooses the individual classification with the most ballots. There are two different sources of randomness in Random Forests: random training set (bootstrap) and random selection of properties.

In [9][10], Gradient boosting machines (GBM) is another methodology discussed. Boosting is used to bring down the prediction error of any weak learner that consistently generates classifiers only a little safer than random guessing. Boosting works by repeatedly passing a given weak learner on various distributions over the training data, and then combining the classifiers produced by the weak learner into a single composite classifier. In each iteration, the distribution of the training data depends on the operation of the classifier trained in the former iteration. The method to calculate the distribution of the training data and to combine the predictions from each classifier is different for various boosting methods.

GBM is mainly used for the binary classification but now a days it known for good prediction, but the drawback is it requires a huge training dataset then the test data [11].

3. PROPOSED METHODOLOGY

The methodology applied is essential step for any data analysis for any dataset and applying models.

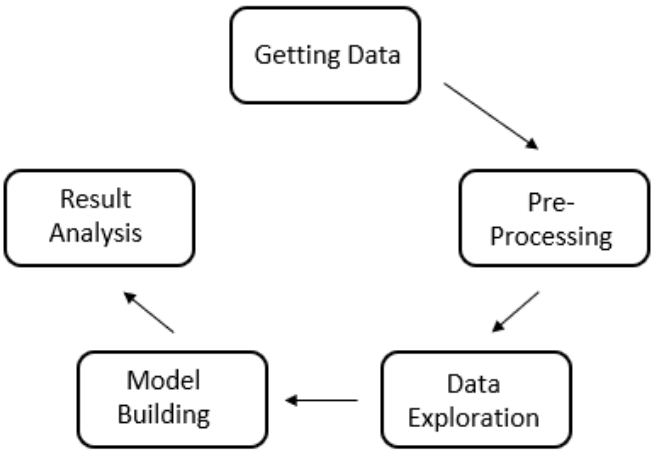

Fig. 1 Workflow Design for Data Analysis and Model Building

The Proposed methodology is explained in Fig 1. Where it shows the complete workflow design starting from taking input dataset to pre-process and Explore the data for better understanding. After that model building and Result Analysis.

As shown in Fig 1, below is explanation of each block consisting in the Workflow Design

3.1 Getting Data

The data has been taken from Kaggle competition 'Forest Cover Type Prediction. This data is obtained from the US Geological Survey (USGS) and the US Forest Service (USFS) which is in open domain and includes four wilderness areas located in Roosevelt National Forest of northern Colorado, and provided by Machine Learning Laboratory of University of California Irvine. Dataset contains 581012 entries with 54 attributes each. However, there are only 12 real features because two of them are represented as a vector opposed to number notation [1].

Each entry is observation on 30 X 30 m^2 patch of forest land and goal for this dataset is to predict cover type of this patch. Training set is chosen in such a way so that each class has the same number of observations.

3.2 Pre- Processing

There is a need of data pre-processing because the data may be incomplete or inconsistent or noisy [2]. There are many ways to deal with un-processed data via:

3.2.1 Data Cleaning

By this term we mean to fill the missing values in data, identifying and removing outliers in data, smoothing data. In this data there are no missing values but when we eliminate sum attributes it is require levelling it .

3.2.2 Data Transformation

In this stage operations like normalization and aggregation are performed. It is the most important step as we use normalization in our data to aggregate 4 wilderness area attributes and 40 soil type into a single Normalized forming the dataset of forest cover type.

Standard Normalization= $x' = (x-\mu)/\sigma$ (1)

Where x is value of the element, μ is the Mean and σ represents the standard Deviation.

Min/Max Normalization= $x' = (x-min)/(max-min)$ (2)

Where min and max are the minimum and maximum values in x given its range.

Table 1. Dataset Description

1	Data_field	Description
2	Elevation	Elevation in meters
3	Aspect	Aspect in degrees azimuth
4	Slope	Slope in degrees
5	Horz_ hydro	Horz Dist to nearest surface water feature
6	Vert_hydro	Vert Dist to nearest surface water features
7	Horz_road	Horz Dist to nearest roadway
8	Hillshade_9am	Hillshade index at 9am, summer solstice (0 to 255 index)
9	Hillshade_noon	Hillshade index at noon, summer solstice (0 to 255 index)
10	hillshade _3pm	Hillshade index at 3pm, summer solstice (0 to 255 index)
11	horz _fire	Horz Dist to nearest wildre ignition points
12	Wild	Wilderness area designation (4 binary columns)
13	Soil_ type	Soil Type designation (40 binary columns)

3.2.3 *Data Reduction*

In this stage the data set is modified such that the results produced by the model are almost the same but unnecessary values in dataset are removed. The attribute soil type 7 and 15 are reduced as it contains zero values in it. The data is to be reduced to increase its performance after applying the models on the dataset.

3.2.4 Data Integration

In this stage data is merged from different sources if needed, again redundancies are removed too. Sometimes it is required to aggregate the training and testing data to apply models and again separate it.

3.3 Exploratory Data Analysis

Exploratory data analysis is a statistical way of understanding the data which is usually done in a visual way. The graphs plotted in exploratory data analysis are for better understanding of data to the analyst. The graphs and plots plotted for the data are essentially use for understanding the data and values consisting in the attribute. It helps in understating the co-relation between the variables and how their values differ with each other.

Exploratory data analysis (EDA) is the critical first step in analyzing the data from experiment. The main reasons we use EDA:

- Detection of mistake
- Checking of assumptions
- Preliminary selection of appropriate model
- determining relationships among the explanatory variables, and
- Assessing the direction and rough size of relationships between explanatory and outcome variables.

3.4 Models

3.4.1 Logistic Regression

The very first model that was applied was a logistic regression in one vs. others mode. For each class $y^{(K)}$ we train Regression on items that belong to class vs. all other items. Logistic regression assumes that probability of observation

X belonging to class y is given by

$$P(x/y) = \sigma(x) = 1/\ 1+e^{-\Theta.x} \qquad \ldots(3)$$

$$L\ (data) = \log P\ (data/\Theta)$$

$$= \sum_{i=1}^{N} (y(i) \log \sigma\, x^{(i)}) + (1- y\ (i))\ \log\ (1-\sigma(x^{(i)})) \ \ldots(4)$$

Maximizing it with respect to Θ will give as classier for class

yk Then, Bayes optimal classier h(x) for observation x is:
Maximizing it with respect to Θ will give as classier for class yk Then, Bayes optimal classier h(x) for observation x is:

$$H(x) = \arg\max P\ (x/y^{(k)}) \qquad \ldots(5)$$

Unfortunately, performance of Logistic regression on this train set is not satisfactorily. But more importantly, analyzing the learning curve suggests that even if we had more labeled data, it would not improve performance of this Model. One of the advantages of this model is it works very fast and actually for simple models, it classifies with good accuracy.

3.4.2 Decision Trees

A decision tree is a flow chart structure which consist of internal node which represents a test in attribute and that comes with each branch out i.e. the result of the test and each leaf represents a category label (a decision taken after testing all attributes in the path from the beginning to the leaf). Each path from the source to a leaf can also be interpreted as a sorting rule.

When establishing a supervised classification model, the frequency distribution of attribute values is a potentially

significant component in deciding the proportional importance of each attribute at various levels in the model construction procedure.

In data modeling, we can use frequency distributions to compute entropy. We calculate the entropy of multiplying the proportion of cases with each category label by the log of that proportion, and then getting the negative essence of those conditions.

Entropy (S) =−p1log2 (p1) − p2log2 (p2)
Where pi is proportion (relative frequency) of class *i* within the set *S*.

A decision tree is constructed algorithm that selects the best attribute, splits the data into subsets based on the values of that attribute present in the dataset and repeats the process on each of these subsets until a stopping condition is met.

Information gain measures the decrease in entropy that results from splitting a set of instances based on an attribute.
IG (S, a) = entropy (S) – [p (s1) x entropy (s1) + p (s2) x entropy (s2)… +p (sn) x entropy (sn)].
Where n is the number of distinct values of attribute a, and si is the subset of S where all instances have the ith value of a.

3.4.3 Gradient boosting machines

In gradient boosting machines, or simply, GBMs, the learning procedure consecutively fits new models to provide a more accurate estimate of the response variable. The principle idea behind this algorithm is to construct the new base-learners to be maximally correlated with the negative gradient of the loss function, associated with the whole ensemble. The loss functions applied can be arbitrary, but to give a better intuition, if the error function is the classic squared-error loss, the learning procedure would result in consecutive error-fitting. In general, the choice of the loss function is up to the researcher, with both a rich variety of loss functions derived so far and with the possibility of implementing one's own task-specific loss.

The algorithm is implemented in R studio under the Gbm package which fits generalized boosting regression models. The formula consists of the train data, the type of distribution, shrinkage factor no. of trees etc. The number of tress varies. The algorithm has been tried with 500 and 1000 trees and found to give good performance with 1000 trees. The models work best when the training data is huge and small test set. But for our dataset it is totally opposite of it though it gives good result but not better than random forest and decision tree.

3.4.4 Random Forest

Random forest is an ensemble classifier. An ensemble consists of a set of individually trained classifiers whose predictions are combines for classifying new instances.

Random Forest is a classifier consisting of a collection of tree-structured classifiers {h(x, Θk) k=1, 2, ….}, where the {Θk} are independent identically distributed random vectors and each tree casts a unit vote for the most popular class at input x.

For building a decision tree in random forest the steps have to be followed. If the number of records in the training set is N, then N records are sampled at random but with replacement, from the original data, this is bootstrap sample. This sample will be the training set for growing the tree. If there are M input variables, a number m << M is selected such that at each node, m variables are selected at random out of M and the best split on these m attributes is used to split the node. The value of m is held constant during forest growing. Each tree is grown to the largest extent possible. There is no pruning. In this way, multiple trees are induced in the forest; the number of trees is pre-decided by the parameter Ntree. The number of variables (m) selected at each node is also referred to as mtry or k in the literature. The depth of the tree can be controlled by a parameter node size (i.e. number of instances in the leaf node) which is usually set to one.

For random forest python libraries like pandas and numpy are used which consist of set random forest classifier function in that tree estimators have to add to get good results.

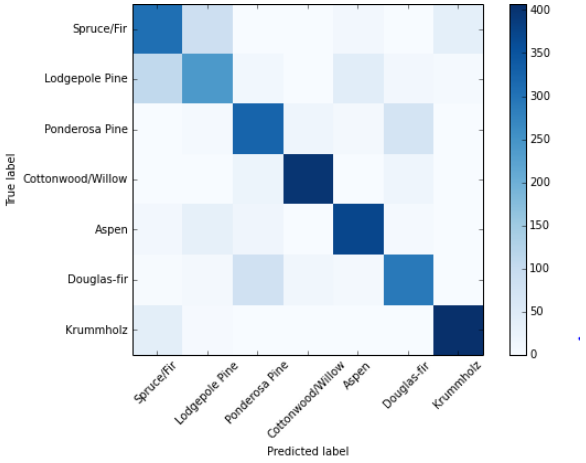

Fig. 2 Confusion Matrix for Random Forest

Confusion matrix is used to check the performance of a classification model. The diagonal elements are the number of points for which the predicted label is equal to the true label, while off-diagonal elements are those that are mislabeled by the classifier. The higher the diagonal values of the confusion matrix the better, indicating many correct predictions. Fig 2. shows the visualization of confusion matrix for the random forest model. As we can infer from Fig 2. Random forest is giving the best predictions**.**

4. RESULTS

The four algorithms are applied on the forest cover dataset for predicting the cover type. We got some good results and accuracy with decision tree, random forest and gradient boosting machines.

The accuracy and performance have been compared between the models using Root Mean Squared Logarithmic Error (RMSLE). R is used for implementing the models and RMLSE for computing the performance.

It is given by:

$$\sqrt{\frac{1}{n}\sum_{i=1}^{n}(\boldsymbol{log}(\boldsymbol{p_i}+\mathbf{1})-\mathbf{log}(\boldsymbol{a_i}+\mathbf{1}))^2} \qquad \ldots(6)$$

Where:

- n is the number of hours in the test set
- pi is your predicted count
- ai is the actual count
- log(x) is the natural logarithm

And we use Cross-Validation to estimate $\mathbf{R^2}$ and reduce over fitting. These are mainly used to compare accuracy for two or more models and select the most accurate model.

Table 2. Results

Algorithms Used	Accuracy %
1) Logistic Regression	19.4%
2) Decision Trees	35.6%
3) GBM	60%
4) Random Forest	74.8%

From the analysis it is observed that **Random forest** gives the most accurate predictions from all four models.

5. CONCLUSION

The objective of this paper is to predict the forest cover type based on cartographic variables. To predict forest cover type four different techniques are applied Regression, Random Forest, Decision tree and GBM and their accuracy and performance has been compared. It is obtained that Random Forest gives better prediction with 74.8% accuracy.

6. ACKNOWLEDGMENTS

We greatly acknowledge Machine Learning Laboratory of University of California Irvine for making the data of the US Geological Survey(USGS) and the US Forest Service(USFS) openly available.

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A Review Paper: Optimization of Two Wheeler Foot Rest Using Composite Natural Fibre Reinforcement

Niranjan D. Kandhare[#1], VinodM.Bansode[*2]

[12]*Mechanical Engineering Dept., NBNSSOE, Pune*

Abstract-The sisal fibre used to increase the strength of any component. The actual two-wheeler foot rest study will be carried out. The sisal fibre layer will be provided to the actual foot rest and then the study will be carried out between the original and sisal fibre model of foot rest. The main aim of our project is the optimization of composite two-wheeler footrest using natural fibre reinforcement. The foot rest will be composed of natural fibre reinforcement. The 3D model will be drawn with the help of CATIA software. The analysis will be carried out by using ANSYS software. The three-point bending experimental testing will be carried out with the help of Universal Testing Machine. The result & conclusion will be drawn by making the comparison between the experimental & analytical results. After making the result & conclusion the suitable future scope will be suggested.

Keywords- Sisal Fiber Composite, Optimization, Reinforcement, ANSYS.

I. INTRODUCTION

Characteristic fiber is a kind of sustainable sources and another age of fortifications and enhancements for polymer based materials. The improvement of normal fiber composite materials or ecologically inviting composites has been a hotly debated issue as of late because of the expanding natural mindfulness. Regular strands are one such capable material which replaces the engineered materials and its related items for the less weight and vitality preservation applications. The utilization of normal fiber fortified polymer composites and regular based pitches for supplanting existing manufactured polymer or glass fiber strengthened materials in colossal. Car and flying machines businesses have been effectively creating various types of common strands, chiefly on hemp, flax and sisal and bio resins frameworks for their inside parts. High explicit properties with lower costs of regular fiber composites are making it alluring for different applications.

The uses of common filaments are developing in numerous parts, for example, cars, furniture, pressing and development. This is for the most part because of their preferences contrasted with engineered filaments, for example minimal effort, low weight, less harm to handling hardware, improved surface completion of shaped parts composite, great relative mechanical properties, plenteous and inexhaustible assets . Common are utilized in different applications, for example, materials, molecule sheets, protection sheets, sustenance and creature feed, makeup, drug and erent biopolymers and fine synthetic compounds.

Table 1 demonstrates the correlation among regular and manufactured strands.

Table 1. Correlation between regular strands and engineered filaments

Aspects	Property	Natural fibers	Synthetic fibers
Technical	Mechanical properties	Low	High
	Moisture sensitivity	High	Low
	Thermal sensitivity	High	Low
Environm-ental	Resource	Infinite	Limited
	Production	Low	High
	Recyclability	Good	Moderate

A) Sisal Fiber

Sisal Fiber is a standout amongst the most generally utilized characteristic fiber and is effectively accessible. It is get from sisal plant. The plant, referred to formally as Agave sisalana. These plants produce rosettes of sword-molded forgets which begin toothed, and slowly lose their teeth with development. Each leaf contains various long, straight filaments which can be evacuated in a procedure known as decortication. Amid decortication, the leaves are beaten to evacuate the mash and plant material, deserting the extreme strands. The strands can be spun into string for twine and material creation, or pulped to make paper items.

Sisal fiber is completely biodegradable, green composites were created with soy protein sap altered with gelatin. Sisal fiber, adjusted soy protein tars, and composites were portrayed for their mechanical and warm properties. It is exceptionally inexhaustible asset of vitality. Sisal fiber is particularly tough and a low support with insignificant mileage. Its fiber is unreasonably intense for materials and textures. It isn't appropriate for a smooth divider complete and furthermore not suggested for wet territories.

The fine surface of Sisal takes colors effectively and offers the biggest scope of colored shades of every common fiber. Zero pesticides or substance composts utilized in sisal farming. It is a hardened fiber generally utilized in making twine, rope and furthermore dartboards Sisal fiber is produced from the vascular tissue from the sisal plant (Agave sisalana). It is utilized in car contact parts (brakes, grips), where it grants green solidarity to performs, and for upgrading surface in coatings application.

B) Properties of Sisal Fiber

1. Sisal Fiber is extraordinarily solid with a low support with insignificant mileage.

2. It is Recyclable.

3. Sisal strands are acquired from the external leaf skin, evacuating the internal mash.

4. It is accessible as plaid, herringbone and twill.

5. Sisal strands are Anti static, does not pull in or trap dust particles and does not assimilate dampness or water effectively.

6. The fine surface takes colors effectively and offers the biggest scope of colored shades of every characteristic fiber.

7. It displays great sound and effect engrossing properties.

8. Its leaves can be treated with normal borax for imperviousness to fire properties.

C) Utilizations of Sisal Fiber

From old occasion's sisal has been the main material for horticultural twine in view of its quality, strength, capacity to extend, proclivity for specific dyestuffs, and protection from weakening in salt water.

1. Sisal is utilized regularly in the delivery business for mooring little art, lashing, and dealing with freight.

2. It is utilized in vehicle industry with fiberglass in composite materials.

3. Other items created from sisal fiber incorporate spa items, feline scratching posts, lumbar help belts, floor coverings, shoes, fabrics and circle supports.

4. Sisal is utilized without anyone else in rugs or in mixes with fleece and acrylic for a milder hand.

II. Problem Statement

The optimization of foot rest by using Composite Sisal fibre reinforcement.

A)Objective

- To study the optimization of footrest by using sisal fiber reinforcement.
- Analysis of footrest using ANSYS software.
- 3D model using CATIA software.
- Three-point bending test using UTM.
- Validation of Simulation and experimental results.

B) Scope

- Sisal fiber is considered as a Reinforced material for footrest
- Simulation of Reinforced footrest using ANSYS software

  Experimental Validation for ANSYS Results

C) Methodology

- Step 1:- Literature survey.
- Step2:- Components required for the project are decided
- Step 3:- 3 D Model and drafting in CATIA software.
- Step 4:- The Analysis of the component will be done with the help of ANSYS using FEA.
- Step 5:- After Manufacturing the Model with sisal fiber reinforcement the Experimentational testing carried by using Universal Testing Machine.
- Step 6:- Comparative analysis between simulation and experimental results and then Results and conclusions will be drawn.

III. LITERATURE REVIEW

J. Naveen Presented the Paper on Mechanical and physical properties of sisal and crossover sisal fiber-fortified polymer composite[1] in this sisal fiber might be a potential safeguard for polymer composites. past its antiquated applications ropes mats and so on sisal fiber includes potential applications inside the flying machine and vehicle divisions. the physical and mechanical practices of sisal fiber rely upon the supply age and area in any case in like manner on their fiber measurement primer temperature check length and strain rate. fiber surface modification or treatment improves surface relationship between the deliquescent sisal fiber and furthermore the hydrophobic substance compound network. this prompts a markdown in wetness absorption Associate in Nursingd an improvement of mechanical properties. surface modification wires: one peroxide impels change of respectability responses a couple of silane treatment deliquescent attributes are frequently modified by indicating long chain structures onto the sisal fiber three stomach area dying down specialist and salt treatment shaping a brutal sisal fiber surface that improves the contact a district of the fiber with the framework and four warmth treatment. the mechanical and physical practices of sisal fiber-based synthetic compound composites are hard to the gathering approach fiber length fiber introduction fiber volume division and sort of lattice utilized either thermosetting or thermoplastics sisal fiber-based cream composites take pleasant states of their individual constituents. dead all the split mechanics and break strength of sisal fiber-based composites ought to be thought of altogether. the relationship between the mechanical properties and furthermore the social event methodology ought to be created to utilize sisal fiber successfully in various applications. glass sisal fiber cream composites were conveyed and their mechanical properties were reviewed. consequently to boot the aftereffects of dealing with parameters medications check length and structures on overall and amazing cost kevlar carbon fiber sisal fiber cross breed composites still can't be examined. the reusing methodology and life-cycle appraisal of sisal fiber and crossover sisal fiber-based composites must be asked in regards to inside and out. reusing of composites might be an enchanting subject of investigation directly that may offer reserve benefits

B. ZuccarelloPresented the Paper on Optimal Manufacturing And Mechanical Characterization Of High Performance Biocomposites Reinforced By Sisal Fibers.[2] The developing energy in regards to eco-

sensible materials inside the main edge age vehicle customary improvement bundling has affected the augmentation of the examination works directing biocomposites. in any case starting at as of late the first idea has been committed to the improvement of short fiber biocomposites for non-right hand applications while exclusively 2 or 3 works have contemplated winning biocomposites for essential applications. thusly the movement of essential biocomposites from liberal fundamental strands as sisal filaments might be an outcome anticipated from built up pros in any case not yet developed. to pass on a guarantee to the utilization of tip prime biocomposites contained by an unpracticed structure strengthened by sisal filaments this work proposes an accumulation technique that licenses to initiate exceptional quality unidirectional biocomposites with fiber volume partition up to seventieth. altogether it utilizes unidirectional sewed surfaces appropriately secured in investigation working environment from driving edge strands Associate in Nursingd a restoring underneath a bona fide weight cycle. the examination with free learning low down recorded as an extreme duplicate has exhibit anyway the anticipated biocomposites show mechanical properties over a concentrated smidgen of biocomposites portrayed recorded as a printed version so they will totally substitute not exclusively materials as steel nuclear number 13 and optical fiber reinforced plastics in any case moreover phenomenal biocomposites revived by consistently costly filaments.

M. Aslana Presented the Paper on Tribological And Mechanical Performance Of Sisal-Filled Waste Carbon And Glass Fiber Hybrid Composites.[3] This examination has been done to show utilization of trademark filaments in light of the fact that the potential substitute of built strands in tribo-composites. the terrible wear lead and mechanical properties of waste sisal/glass sisal/carbon blend fiber invigorated plastic pp composites were inquired about amid this examination. results demonstrated that broadening the sisal fiber weight content inside the composites builds the consistent of breaking down. the scratched spot volume of sisal/glass cross breed composites demonstrated normally not up to those of sisal/carbon ewer composite for an equivalent blend degrees. this gathers expansion of sisal strands on waste carbon and optical fiber propped pp composites diminished the adaptability of tribological execution. notwithstanding the implies that just as of sisal strands as a trademark substitute fiber supply to abuse short carbon fiber composites cause normal properties Associate in Nursing expansion of sisal filaments to abuse glass composites shows lower densities tantamount mechanical and scratched zone volumes than that of waste optical fiber composites. this shows sisal strands are regularly utilized rather than glass filaments. the checking negatron micrographs of the break surfaces display that the wetting relationship of sisal and optical fiber with pp framework is best than those of the sisal carbon cross breed composites. furthermore the depleted surfaces of the sisal and its cross breed composites show vertical segments free sections humbler scale wrinkling and exchange layers.

FrazaoPresented the Paper on Development Of ch Panels Combining Sisal Fiber-Cement sites And Fiber-Reinforced Lightweight e.[4] In This exploration proposes the advancement of an imaginative auxiliary boards dependent on the utilization of meager external layers of Sisal Fiber-Cement Composites (SiFCC) together with a center layer of Polypropylene Fiber-Reinforced Lightweight Concrete (PFRLC). The impact of sisal filaments was concentrated in two distinctive ways, short sisal strands (50 mm) arbitrarily conveyed in the lattice, and long unidirectional adjusted sisal strands (700 mm) connected by a cast hand layup method. Lightweight totals and polypropylene strands were utilized in the solid layer shaping the board's center so as to lessen its thickness and improve its post breaking rigidity and vitality retention limit. The conduct of the sandwich boards in four-point twisting test is depicted, and the different disappointment instruments are accounted for. Mechanical properties of both SiFCC and PFRLC were acquired, which were additionally utilized in the numerical reenactments. Draw off tests were performed to assess the bond quality between the external SiFCC layers and the center PFRLC. The outcomes uncovered that the long sisal filaments were increasingly successful regarding giving to the board higher flexural limit than when utilizing short sisal strands, long strands guaranteed the improvement of an avoidance solidifying conduct pursued by the arrangement of various breaks, while short sisal filaments advanced a conditioning reaction in the wake of splitting.

Luciano Machado Gomes Presented the Paper on Novel Fiber Metal Laminate Sandwich Composite Structure With Sisal Woven Core.[5] In this Fiber metal covers (FMLs) have been broadly used to fabricate airframe parts. This work portrays novel sisal fiber fortified aluminum overlays (SiRALs) that have been set up by virus squeezing procedures and tried under elastic, flexural and sway stacking. The immaculate sisal texture and the sisal fiber strengthened composites (SFRCs) were likewise tried to comprehend the distinction in mechanical execution of the sisal fiber metal overlays. The SiRALs accomplished the most noteworthy modulus and quality, yet in addition the most elevated explicit properties. The mean explicit elasticity and modulus of the SIRALs achieved increments of 132% and 267%, individually, when contrasted with the sisal fiber strengthened composites (SFRCs). In addition, the mean explicit flexural quality and modulus of the SiRALs were altogether higher than SFRCs, uncovering increments of 430% and 973%, individually. A delamination crack mode was noted for SiRALs under twisting testing. The SiRALs can be viewed as promising and reasonable composite materials for auxiliary and multifunctional applications.

M. R. Sanjay Presented the Paper on Applications of Natural Fibers and Its Composites: An Overview[6]. In the present situation, there has been a quick consideration in innovative work in the regular fiber composite field because of its better formability, bounteous, inexhaustible, financially savvy and eco-accommodating highlights. This paper shows a blueprint on common strands and its composites used as a piece of various business and designing applications. In this survey, numerous articles were identified with utilizations of regular fiber strengthened polymer composites. It gives insights regarding the potential utilization of normal filaments and its composite materials, mechanical and physical professional perties and a portion of their applications in building parts.

Malla Surya Teja Presented the Paper on Experimental Investigation of Mechanical and Thermal properties of sisal fiber fortified composite and impact of SiC filler material [7]. With a perspective on investigating the potential utilization of characteristic recourses, we made an endeavor to create sisal fiber polymer composites by hand lay-up strategy. Common fiber composites are inexhaustible, shabby and biodegradable. Their simple accessibility, lower thickness, higher explicit properties, lower cost, agreeable mechanical and warm properties, non-destructive nature, makes them an appealing environmental choice to glass, carbon or other man-made engineered strands. In this work, the impact of SiC on mechanical and warm properties of common sisal fiber composites are researched. The composite has been made with and without SiC consolidating common sisal fiber with polyester as holding material. The trial results displayed that the elasticity of composite with 10%SiC 2.53 occasions more noteworthy than that of composite without SiC. The effect quality of composite with 10% SiC is 1.73 occasions more prominent than that of composite without SiC plain polyester. Warm properties examined incorporate warm conductivity, explicit warmth limit, warm diffusivity, warm debasement and solidness. Three unique examples with 0%, 5%, 10% SiC powder are considered. With the expansion of SiC filler powder, warm conductivity builds, explicit warmth limit steadily expands then reductions, warm diffusivity increments and warm strength improves with Sic powder.

M. Ramesh Presented the Paper on Comparative Evaluation on Properties of Hybrid Glass Fiber-Sisal/Jute Reinforced Epoxy Composites[8]. The fuse of common strands, for instance, sisal/jute with optical fibre composites has hyperbolic increasing applications each in varied regions of Engineering and Technology. the purpose of this investigation is to assess mechanical properties, for instance, ductile and flexural properties of cross breed glass fiber-sisal/jute fortified epoxy composites. little examinations are done to interrupt down the surface qualities of materials, inward structure of the cracked surfaces and material disappointment morphology by utilizing Scanning microscope (SEM). The outcomes showed that the connexion of sisal fiber with GFRP displayed unmatched properties than the jute fiber reinforced GFRP composites in pliable properties and jute fiber fortified GFRP composites performed higher in flexural properties.

M. Indra Reddy Presented the Paper on Comparative Evaluation on Mechanical Properties of Jute, Pineapple leaf fiber and Glass fiber Reinforced Composites with Polyester and Epoxy Resin Matrices.[9]during this Environmental cognizance associate degreed an increasing worry with the nursery impact have refreshed the event, car, and pressing enterprises to look for economical materials which will supersede customary designed chemical compound filaments. traditional strands seem to be an honest choice since they're promptly accessible in stringy structure and may be faraway from plant leaves at very low expenses. during this work we've got contemplated the mechanical properties of the composites created by invigorating Jute, ple leaf fiber and optical fibre as 1:1:1 proportion olyester and epoxy gum. The fiber content within nposite was fluctuated from zero.18 to 0.42 by portion and also the sort of mechanical properties, for instance, pliable, flexural and sway properties for every state of affairs were examined. The outcomes demonstrate that the Jute, Pineapple leaf fiber and optical fibre fortified epoxy composite displayed desirable mechanical properties over Jute, Pineapple leaf fiber and optical fibre polyester composite.

CONCLUSION

The assortment utilizations of normal fiber and its composites are examined. We reason that the regular fiber composites structure one of the developing territories in material science that makes mindfulness for use in different applications. Strengthened polyester and epoxy composites were observed to be light in weight would do well to mechanical properties. the tensile flexural and impact properties of the polyester and epoxy composites with the strands were observed to be expanded with fiber content acclimating the strengthening activity of the filaments. Polyester composites have preferable mechanical properties over epoxy composites. Strengthened polyester and epoxy composites were observed to be light in weight would do well to mechanical properties. henceforth these composite materials can be utilized for applications for example vehicle parts electronic packages building development and so on.

ACKNOWLEDGMENT

It is indeed a great pleasure and moment of immense satisfaction for me to present a Project report on “Optimization of Two Wheeler Foot Rest Using Composite Natural Fibre Reinforcement” amongst a wide panorama that provided us inspiring guidance and encouragement, I take the opportunity to thanks to thanks those who gave us their indebted assistance. I wish to extend my cordial gratitude with profound thanks to our internal guide Prof. Vinod M. Bansode It was his inspiration and encouragement which helped us in completing my work.

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At last but not least I express my sincere thanks to the Institute’s Principal Dr. Y. P. Reddy, for providing us infrastructure and technical environment.

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Design, analysis and manufacturing of semi automatic book binding machine

Akshay Dharpale
akshaydharpale9595@gmail.com
NBN Sinhgad School of Engineering, Pune, Maharashtra

Swapnil Dimble
swapnildimble07@gmail.com
NBN Sinhgad School of Engineering, Pune, Maharashtra

Akshay Dalvi
akshay0833@gmail.com
NBN Sinhgad School of Engineering, Pune, Maharashtra

Kiran Desai
kirankd1997@gmail.com
NBN Sinhgad School of Engineering, Pune, Maharashtra

V. M. Bansode
vinodbansode123@gmail.com
NBN Sinhgad School of Engineering , Pune ,Maharashtra

ABSTRACT

This semi-automatic book binding machine can be used to bind pages which is very important in libraries, govt. departments, offices, companies, lawyers, and book covers generally to maintain their books and records in good condition. This book binding machine is designed to performed operations semi-automatically. In term of the semi-automatic machine, it uses a different mechanism such as gripping mechanism, nut and bolt mechanism, folding mechanism, etc. This machine is designed and construct that can bind book which is in A4 size. It can minimize human energy consumption in order to bind books

Keywords— *Gripping mechanism, Folding mechanism, Vacuum gripper, Nut and Bolt mechanism*

1. INTRODUCTION

There are many types of Book Binding Machine available to bind the book. All these types of binding machine are designed to bind books manually. It uses human energy to bind the book. Human has limited capabilities and these may lead to consuming human energy and more time. This semi-automatic book binding machine is designed to minimize the usage of human energy in binding the book. This machine combines all operations together which reduces fatigue to the operator. It has the following objectives:

- To modify an existing machine in such a way that it will lead to reduction in space requirement.
- To combine all operations on the single workstation so that one single operator can handle the machine.
- To make it versatile by providing some controllable parameters in the machine itself.
- To reduce the cost by arranging all operations on a single workstation with better design.
- The operation should be smooth and minimize human efforts by making some operation automatic.
- The single operator should able to handle the machine.

Fig. 1: Setup of Book binding machine

1.1 Gripper mechanisms

The gripper used in this machine are as follows:

1.1.1 Vacuum gripper: It is used to grasp cardboard sheet and cover page and place it over folding mechanism. Gripper mechanism should be light weight as possible and should carry load easily. Therefore vacuum gripper is selected. For cost estimation, the gripper should be simple designed and manufactured, easy to maintain and reliable.


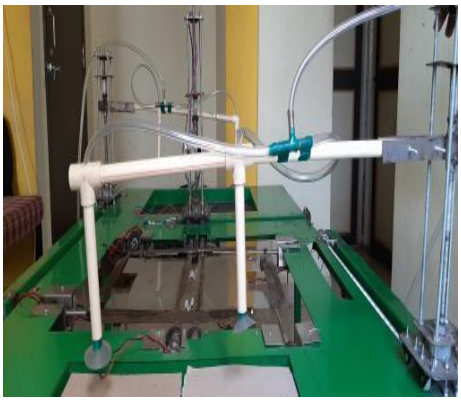

Fig. 2: Vacuum gripper

1.1.2 Mechanical gripper: It is used to grasp a bunch of paper and hold it properly until it is released. For these purpose mechanical gripper is used which is operated by nut and bolt mechanism

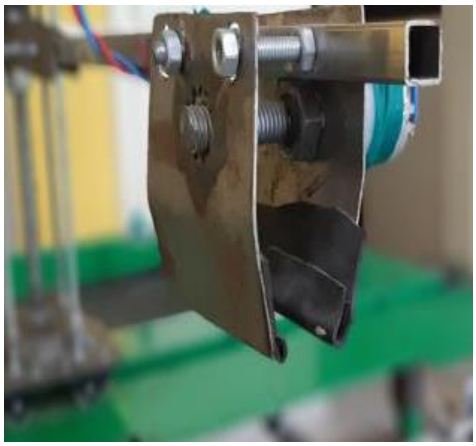
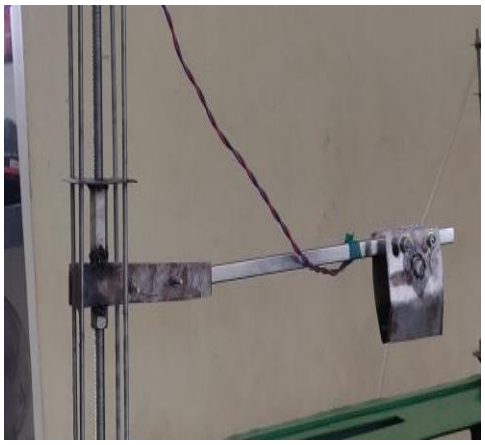

Fig. 3: Mechanical gripper

1.2 Folding and Flipping mechanisms

Angular motion of the folding plate is achieved by using two gears in which one is driven by 3rpm dc motor. The flipping plate is placed at the edge of the plate for the flipping purpose of cover page over cardboard which is also driven by 30rpm dc motor to rotate it in 180^0. Due to movements of plates, resin paper is stick to hard cover. Return movement of plates is done by anticlockwise movements of motors.

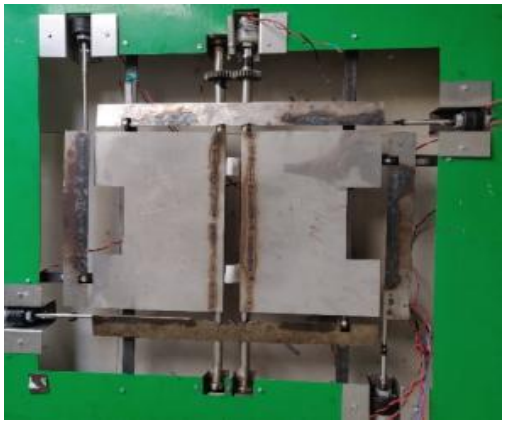

Fig. 4: Folding and flipping mechanism

1.3 Mechanisms for linear motion

inear motion, nut and bolt mechanism is used which convert the rotational motion of dc motor into linear motion. Dc ched to 12 mm threaded rod which drive nut whose rotational motion is prevented and free to travel linearly. By direction of rotation of dc motor the linear motion direction is changed. The nut carries mounting over as shown in fig.

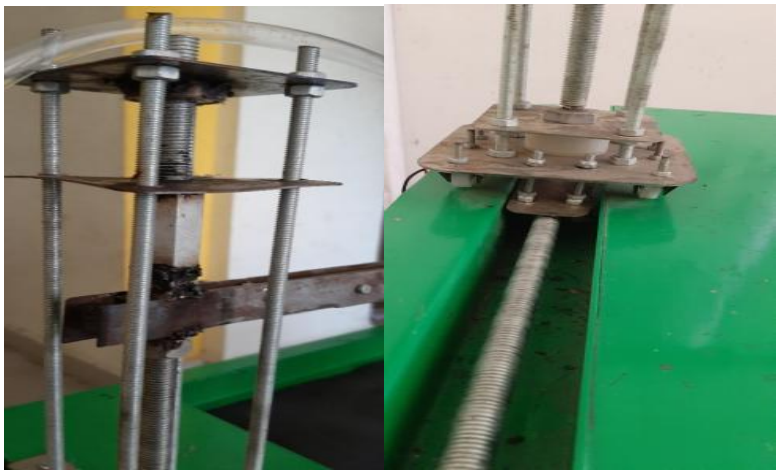

Fig. 5: Nut and bolt mechanism for linear motion

2. CONCLUSION

This book binding machine is designed to performed operations semi-automatically. In term of the semi-automatic machine, it uses a different mechanism such as gripping mechanism, nut and bolt mechanism, folding mechanism, etc.
This machine is designed and construct that can bind book which is in A4 size. It can minimize human energy interference in order to bind books. The consumer only just push the button to make this machine functioning.

3. FUTURE SCOPE

- We can make it fully automatic by using PLC and microcontroller.
- Various sensors can be used to increase accuracy.
- Making it flexible to accommodate different size of pages.

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Non-linear static structural analysis of a butt weld joint in a drum pulley assembly

Mr.Vinod M. Bansode[1], Mr. Ramesh B. Mali[2], Mr. Dattatraya P. Mali[3], Mr. Yogesh C. Jadhav[4]
Asst. Professor, Dept. of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune

Abstract— Drum Pulley Assembly used for material handling, conveyor systems, the most critical region for fatigue damage and failures are reported at the weld joint connecting plate and shell, hub and endplate as well as seam weld in drum shell. A failure analysis based on stress life approach may be useful for predicting the life time of weld in the structure. This study presents an upcoming methodology in new three dimensional Finite Element Model to calculate the fatigue life of weld. Ansys 12.1 simulation software uses stress-life method, based on a static non-linear Structural analysis. The weld material S-N curve were experimentally determined by the Fatigue testing of the dumbell specimen as per 7608 standard. This study assumes that a flaw exist in weld due to welding process, material in-homogeneity, air voids, slugs or impurities in weld, improper surface machining and many more. This material curve is used in simulation to get more accurate results. Thus the fatigue life prediction with the material curves from experimentation will give us more accurate and close to actual failure results.

KEYWORD: Drum Pulley Analysis, Fatigue Life by S-N approach, Equivalent Stress, Weld fatigue.

I. INTRODUCTION

Failures due to fatigue in welded structures lead to loss of life and substantial costs. Remedies to this situation include the introduction of various standards and fatigue design codes. The foundation of such codes rely, in some cases, on old concepts that do not easily translate to the output from modern computer programs and are also limited to rather simplified structures.

The development of new generations of products means, in general, increased capacity, increased speed and increased demands on life. Improved maintenance and higher utilization place additional demands on the supporting structures.

The requirements in society towards improved functionality and minimizing of Life Cycle Cost (LCC); force companies to design structures with reduced weights and "optimum" fatigue resistance. Actions to meet these demands are to introduce high strength steel, weld and/or surface improvement technologies and high productivity manufacturing technologies. The introduction of high strength steel in structures normally means higher stress levels and, hence, an increased sensitivity to defects, deviations in weld geometry (e.g. penetration, throat thickness, undercuts) and variations in material strength.

Expertise in developing and manufacturing fatigue loaded welded structure with low LCC is a key aspect in order to stay competitive. Shorter development time for new products means that it is important to make the correct design and fatigue assessment early on in the project.

A better understanding of the limits of the different fatigue design methods and the influence of fatigue strength due to the weld quality will improve the development of new fatigue loaded products. The understanding of the link between weld he welding process would enable manufacturers to increase the utilization of high strength steel in fatigue loaded welded structures.

Being able to determine the rate of crack growth, an engineer can schedule inspection accordingly and repair or replace the part before failure happens. Being able to predict the path of a crack helps a designer to incorporate adequate geometric tolerance in structural design to increase the part life.

II. Objectives

The aims at design validation of a drum pulley assembly and fatigue analysis of weld joint which is most probable part to fail against fatigue. Hence it needs to find out the stresses in various components by nonlinear static analysis of the drum pulley assembly. Currently there are two models for the same application working under same conditions hence needs to suggest a model which will survive for a longer life.

The following are the main objectives

- Conventional design criteria:-

The conventional design procedure against static strength, fatigue strength is set for client use. Manufacturing criteria's that should be satisfied during fabrication of assembly are also mentioned here.

- Non-linear Static Structural Analysis:-

To carry out non-linear static analysis of the conveyor pulley assembly using ANSYS Classic Version 12.1. This is done to find out safe value of resultant displacement (stiffness) and Von Misses stresses. A special attention is required to get convergence of non-linear system and then validation of converged results.

- Fatigue Life Calculation:-

To carry out the fatigue life prediction of welded joint using conventional methods. (S-N approach Method)

- Conclusions:- To conclude results obtained by each process and make a final remarks for the benefits of company and society.

III. THEORY OF DRUM PULLEY

The cost of a catastrophic failure in this power range can have grave consequences on personnel safety and on the plants profit and loss statement.

Manufacturers differ on the following criteria:

- Types of stresses that are important
- Fatigue stress range criteria
- Allowable stress limits in welded and non-welded members,
- Allowable load limits on the pulley components
- Material surface finish criteria in critically stressed areas
- Materials of construction and their limitations
- Fabrication techniques, constructed tolerances and tolerance controls.

IV. DESCRIPTION OF COMPONENTS OF DRUM PULLEY

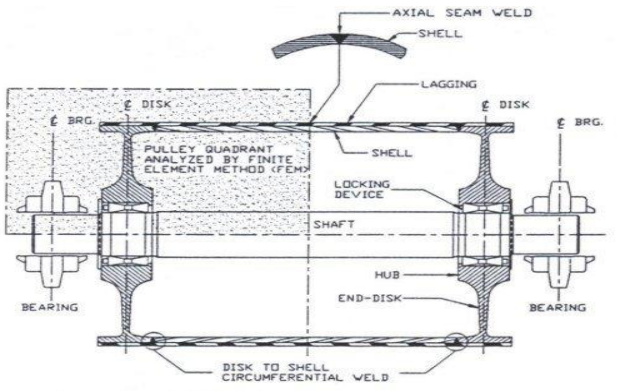

Figure 1. Components of Drum Pulley Assembly(9)

The main components of a pulley for a conveyor belt application are shown in Figure 1.

- Shell
- End-disk And Hub Assembly
- Locking Mechanism
- Shafts
- Lagging

A. *Design Criteria's for Pulley Components*

The stress criteria comprise of static and fatigue strength analyses. These stress criteria consist of setting limits on both the maximum stresses and on the stress range that can occur in different components of the pulley (shell, disk, hub and shaft). The three dimensional stress fields consist of radial, tangential and axial stresses, which are analyzed in the pulley.

B. *Static Strength Criteria*

While evaluating ductile materials, yield strength of the material is usually used as the failure criteria. In the case of brittle materials, like cast iron, which do not have a yield point, the ultimate strength of the material is used as the failure criteria. In general the Distortion Energy Theory for performing static strength analyses is used. This theory is meant for ductile materials as it predicts the initiation of yield. The Von Misse's stress is used in the theory. For a tri-axial stress state, the Von Misses stress is defined in terms of the principal stresses as:

$$\sigma_{von-misses} = [0.5 * \{(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2\}]^{0.5}$$

Principal stresses σ_1, σ_2 and σ_3 are normal stresses that act on planes that do not carry any shear stress. Maximum and minimum principal stresses act on mutually perpendicular planes, and are the algebraically largest and algebraically smallest normal stresses to be found at a paint in a given stress field.

According to this theory, yielding occurs when the Von Misses stress equals the yield stress. Experiments have shown that the distortion-energy theory predicts yield with the greatest accuracy amongst the accepted stress theories. The design criterion uses the Distortion Energy theory with a multiplier of 0.7 which accounts for probabilistic conditions such as variations in metallurgy, metal porosity, inclusions, and other uncertain conditions. This multiplier of 0.7 is slightly higher than the 0.6 to 0.66 multiplier used for welded structures. Thus the maximum acceptable Von Misses' stress in the shaft, end-disk and shell is (0.7 X yield stress of the component).

C. *Fatigue Strength Criteria*

1) *Shell*

In the case of most pulleys, the largest range stresses in the shell are usually in the tangential or hoop direction and occur close to the centreline of the pulley. Pulleys with wide shell faces may have the largest range stress in the axial direction due to bending in a region close to the shell/disk connection. The British Standard BS5400 Part 10 is used to determine the allowable stress ranges for the circumferential and seam welds in the shell for infinite fatigue life as shown in Figure 2.

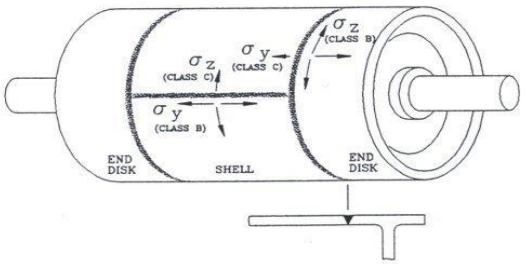

Figure 2. Circumferential and Axial Weld Classifications(9)

2) *Weld*

Shell Circumferential Welds have an allowable axial stress range of 77 MPa (11165 psi) (Class C weld) and allowable hoop stress range of 100 MPa (14500 psi) (Class B weld). These values apply if the welds are full penetration and have been ground flush and proven free of defects. If they are not ground flush and proven free of defects, the allowable axial stress range reduces to 55 Mpa (7975 psi) (Class D weld) and the hoop stress range to 77 MPa (11165 Ps) (Class C weld).

Shell Axial Seam Welds have an allowable axial stress range of 100 MPa (14500 psi) (Class B weld) and hoop stress range of 77 MPa (11165 psi) (Class C weld) if they are full penetration and have been ground flush and proven free of defects. If not, the allowable axial stress range reduces to 77 MPa (11165 psi) (Class C weld) and hoop stress range to 55 MPa (7975 psi) (Class D weld). These allowable stress ranges are for 10 million load cycles with a 97% confidence level. Radiographic and/or a full ultrasonic inspection must be performed to evaluate the welds.

3) *Disk*

For most pulleys, the largest fluctuating or range stresses in the disk are in the radial direction and are due to end-disk bending. The fatigue strength criteria used here is that the maximum stress should not exceed the endurance stress, Se, for infinite life. The endurance stress, Se is dependent on numerous factors including material type, surface finish, stress concentration effects, type of loading, failure mode, etc. A conservative endurance stress of 40% of yield stress (20% for shear) is used for ductile materials to account for the following possibilities, some of which are difficult to quantify:

Unlimited number of starts and stops
Dynamic loads
Irregularities in lagging thickness
Material buildup
Overloading of the conveyor

4) *Shaft*

As the pulley rotates the shaft contact pressure under the locking device changes at the inside and outside shoulders. The

alternating stress introduced due to this can lead to fatigue failure if the range is large. Therefore limits are placed on how large this range stress can be this range stress should not exceed the limits imposed in the modified Goodman diagram.

V. NON-LINEAR STATIC STRUCTURAL ANALYSIS OF A DRUM PULLEY ASSEMBLY

Mathematically, the finite element method (FEM) is used for finding approximate solution of partial differential equations (PDE) as well as of integral equations. The solution approach is based either on eliminating the differential equation completely (steady state problems), or rendering the PDE into an equivalent ordinary differential equation, which is then solved using standard techniques such as finite differences, etc.

In solving partial differential equations, the primary challenge is to create an equation which approximates the equation to be studied, but which is numerically stable, meaning that errors in the input data and intermediate calculations do not accumulate and cause the resulting output to be meaningless. The Finite Element Method is a good choice for solving partial differential equations over complex domains or when the desired precision varies over the entire domain.

To perform an accurate analysis a structural engineer must determine such information as structural loads, geometry, support conditions, and materials properties. The results of such an analysis typically include support reactions, stresses and displacements. This information is then compared to criteria that indicate the conditions of failure. Advanced structural analysis may examine dynamic response, stability and non-linear behaviour.

Performing a Static Analysis

Following are the steps in brief to perform a static analysis:

1) *Build Geometry*
2) *Define Material Properties*
3) *Generate Mesh*
4) *Apply Loads*
5) *Obtain Solution*
6) *Present the Results*

B. Solid model details

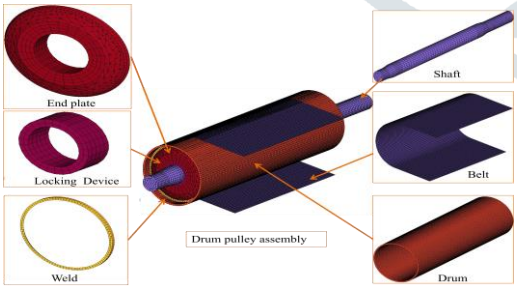

Figure 3. Exploded View of Meshed Drum Pulley Assembly

TABLE I. DIMENSIONS OF VARIOUS COMPONENTS

Sr. No.	Component	Dimension in mm				
		ID	OD	Length / Width	Thickness	Type
1.	Belt	-------	--------	1400	20	GRADE N
2.	Drum	598	630	2000	16	IS:2062 E250 B
3.	Weld	19 Face	5 root	35°	20	Single bevel E6013
4.	Endplate	260	588	---	Varying	ASTM 516 GR 70
5.	Locking Device	190	260	160	-------	BIKON 2006 190 X 260
6.	Shaft	-----	190 & 180	3005	--------	C45E+N / 080M40 BS:970

TABLE II. MATERIAL PROPERTIES OF COMPONENTS

Sr. No.	Component	E (GPa)	Poisson's Ratio	Syt (MPa)	Specification
1.	Belt	210	0.30	--	EP 800/4 GRADE N
2.	Drum	250	0.3	410	IS:2062 E250 B
3.	Weld	210	0.3	350	E6013
5.	Endplate	197	0.3	335	ASTM 516 GR 70
7.	Locking Device	210	0.3	410	BIKON 2006 190 X 260
9.	Shaft	210	0.3	340	C45E+N / 080M40 BS:970

C. Meshing

The process for generating a mesh of nodes and elements consists of three general steps:

- Set the element attributes.
- Set mesh controls (optional). Hyper mesh offers a large number of mesh controls from which you can choose as needs dictate.
- Meshing the model.

It is not always necessary to set mesh controls because the default mesh controls are appropriate for many models. Alternatively, you can use the Smart Size feature to produce a better quality free mesh.

Following are details of the elements used for meshing of given assembly.

a) SOLID186 Element
b) SHELL181 Element
c) TARGE170 Element
d) CONTA174 Element

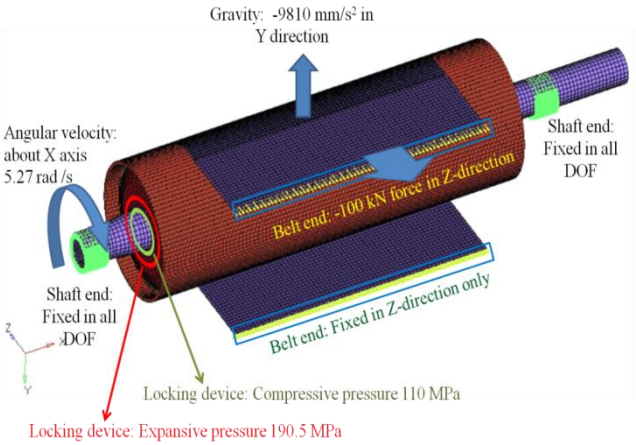

Figure 4. Boundary Conditions

D. Result Interpretation

Von misses stress = SEQV i.e. equivalent stress.

$$\sigma_v = \sqrt{\frac{[(\sigma_x - \sigma_y)^2 + (\sigma_y - \sigma_z)^2 + (\sigma_x - \sigma_z)^2]}{2}}$$

Where, σ_x, σ_y, σ_z are the corresponding stresses in X, Y and Z directions.

The von Mises Criterion, also known as the maximum distortion energy criterion, octahedral shear stress theory, or Maxwell-Huber-Hencky-von Mises theory, is often used to estimate the yield of ductile materials. The von Mises criterion states that failure occurs when the energy of distortion reaches the same energy for yield/failure in uniaxial tension. Mathematically, this is expressed as,

$$\frac{1}{2}[(\sigma_1 - \sigma_2)^2 + (\sigma_2 - \sigma_3)^2 + (\sigma_3 - \sigma_1)^2] < {\sigma_y}^2$$

This equation represents a principal stress ellipse as illustrated in the following Figure

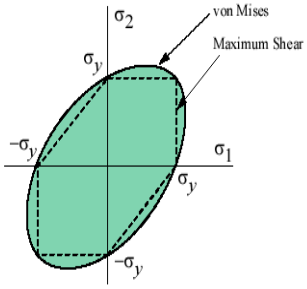

Figure 5. Von-Mises Criteria

Also shown on the Figure 5 is the maximum shear stress criterion (dashed line). This theory is more conservative than the von Mises criterion since it lies inside the Von Misses ellipse.

In addition to bounding the principal stresses to prevent ductile failure, the von Misses criterion also gives a reasonable estimation of fatigue failure, especially in cases of repeated tensile and tensile-shear loading.

E. Result Plots

1) Deformation Plot

Following figures are the Total Deformation Plots for different parts of the Drum Pulley Assembly.

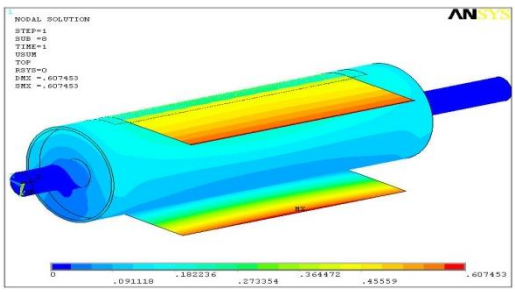

Figure 6. Total Displacement of assembly

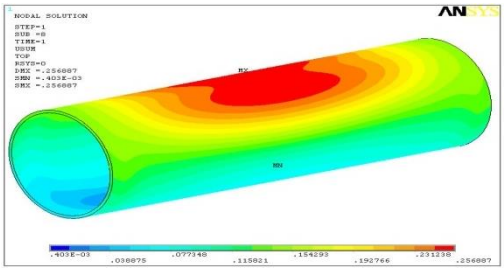

Figure 7. Total Displacement of Drum

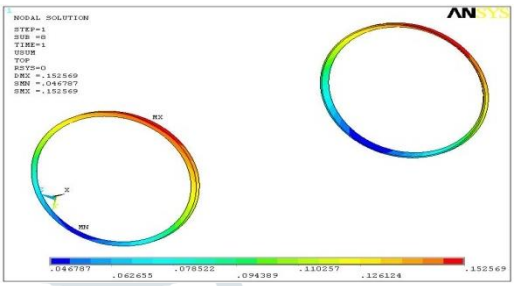

Figure 8. Total Displacement of Weld

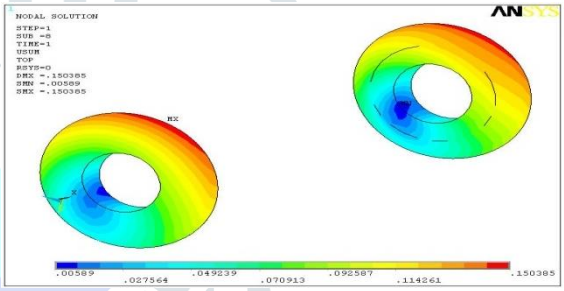

Figure 9. Displacement Plot of End disks

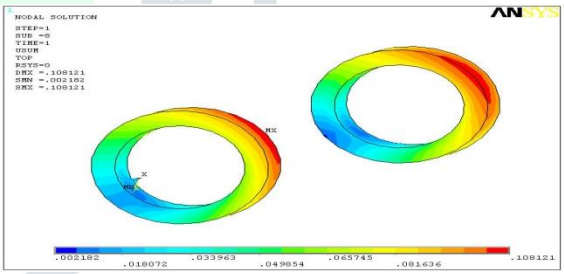

Figure 10. Displacement Plot of Locking Device

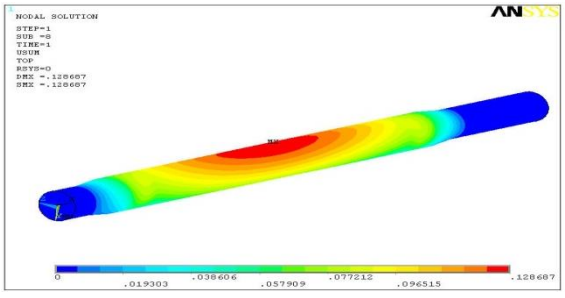

Figure 11. Displacement Plot of Shaft

2) Equivalent (Von-Misses) stress plot

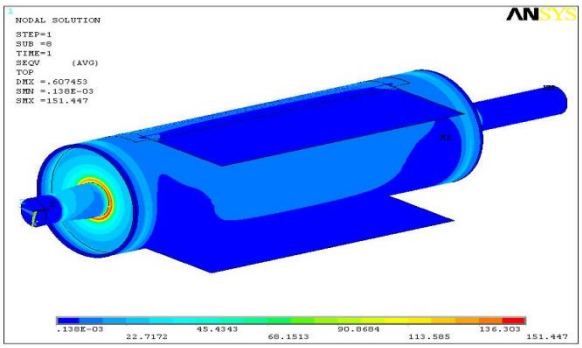

Figure 12. Stress Distribution for the total Assembly

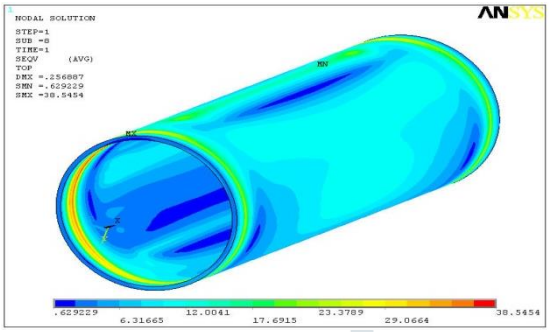

Figure 13. : Stress Distribution in Drum

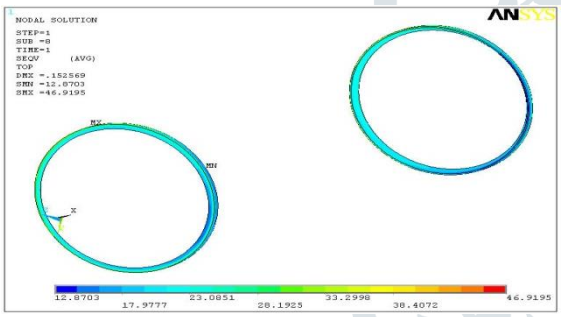

Figure 14. Stress Distribution in Weld

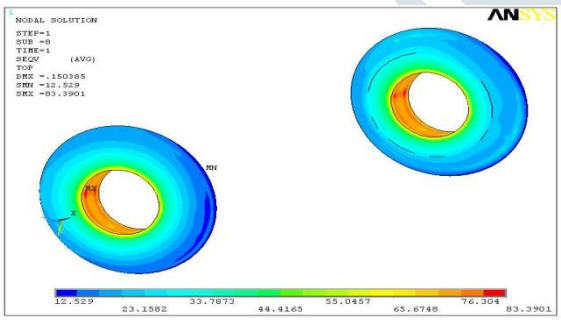

Figure 15. Stress Distribution in End Disks

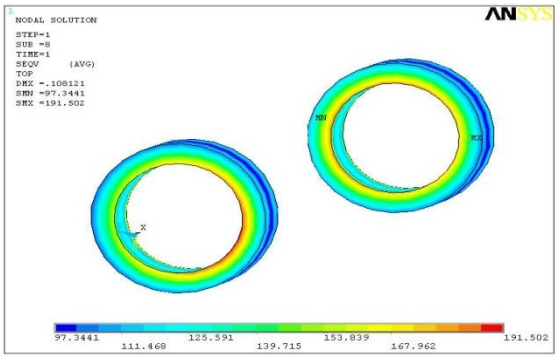

Figure 16. Stress Distribution in locking device

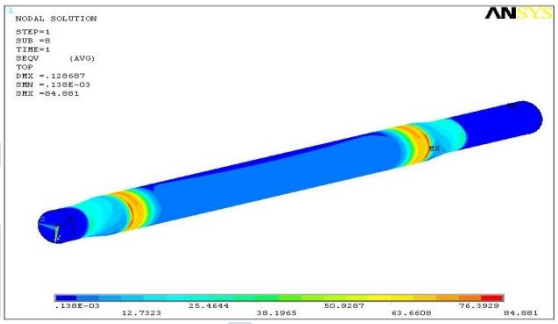

Figure 17. Stress Distribution in Shaft

F. Result Table

Result table is prepared with the current design criteria for static strength and fatigue strength as discussed. On the basis of these criteria safe or failure limit is also discussed here.

Static strength criteria = 0.7 x S_{yt}

Static strength criteria (for weld) = 0.6 x S_{yt}

A fatigue strength criterion is given for life of 1 E +06 cycles with 97% confidence level.

TABLE III. NON-LINEAR STATIC STRUCTURAL ANALYSIS RESULT TABLE

Component Name	Von-mises Stress (MPa)	Allowable Stress (MPa)		Factor of Safety		Remark
		Static Criteria	Fatigue Criteria	Static	Fatigue	
Drum	38.545	287	143.5	7.45	3.72	Safe
Weld	**46.919**	**210**	**55**	**4.48**	**1.17**	**Safe**
Endplate	83.390	234.5	134	2.81	1.61	Safe
Locking Device	191.502	300	280	1.57	1.46	Safe
Shaft	84.881	238	143.5	2.80	1.69	Safe

VI. CONCLUSIONS

1. This work succeeds to predict the fatigue failure of drum pulley assembly, with the analytical background of concepts, its analogy in simulation software and analytical calculations to validate the concept of analysis.
2. The drum pulley assembly has complex type of loading hence it is impossible to obtain analytical

solution. Also, there are many limitations to perform experimental analysis like cost of an assembly, cost of experimental setup, time required for fatigue testing and hence overall testing cost required is very high. Hence only simulation was done which is less expensive and more accurate.

3. At the end it is concluded that the design is strong enough to sustain 0.5 millions cycle for operating loading conditions with various cracks. The failure cause can be stated as the bad quality of weld material, improper welding, occurrences of multiple cracks, overloading, improper surface preparation, too much corrosive environment variables may have amplified the stress intensity by 20 times. At this amplified stress intensity weld component has failed to survive 0.5 millions cycles.
4. This simulation concept is not yet thoroughly implemented in industry as well as in academics because the simulation software's like ANSYS which are designed and developed on fatigue failure concepts are in initial stage of development. But definitely this will be the future asset of fatigue prediction for all FEA engineers.

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Design Optimization of Mirror Post Assembly for Achieving Desired Natural Frequency

Pavan Jagdale[1], Prof. V. K. Kulloili [2], Prof. S. M. Jadhav[3]
[1]PG Student, [2]Asst Professor, [3]Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune, India.

Abstract: ***The automobiles experience a lot of vibration which causes the mountings to vibrate. These vibrations may hamper the working of the parts. Mirrors are the mounting which is the most reliable source to check the rear sides of the vehicle. The rear-view mirrors must have provided a stable view to the driver when driving. As it's seen that from literature study, Mirrors tends to resonance at low excitation frequency because of vibration coming from engine and road conditions thus it is necessary that design should be robust to avoid resonance. To study the vibrations, finite element method and experimental approaches are the only approaches for complex shapes. The finite element analysis method provides helps in determining the natural frequencies and mode shapes. In this study, we perform modal analysis of rear-view mirror post assembly using Ansys to check the natural frequency at where resonance problem occurs, which effects on the performance of a mirror and made the design optimization by finding 4 iterations. Selection of optimize iteration done on the basis of targeted natural frequency which has achieved the desired goal of a project that is sharp reflected images from the mirror***

Keywords: ANSYS, Excitation frequency, FEA, Modal analysis, Natural frequency, Finite Part Methodology (FEM), Rear view side mirror (RVSM), Vibration

I. INTRODUCTION

In India public transport is mostly through passenger commercial vehicle. The working area of people is not near to the living area. Many cities are specially designed in which residential area and industrial area is separately located. Many people come from small town to big cities for a job every day. Town people have to use a commercial vehicle for transit. According to safety commercial vehicle is very useful for long distance. In rural areas commercial vehicles used within town also. It is not possible for everyone to use their own vehicle or have their own vehicle. Cities like Delhi, Mumbai, and Pune most people use public transport services. Public transport is a necessity in bigger cities. Passenger commercial vehicles are specially designed for transporting. The bus is a type of passenger commercial vehicle. The bus is a road vehicle which carries passengers as much as possible with comfort and safety. Buses have the capacity as high as possible. The bus is a good option for commutation and it is economical also. Safety of passengers is the main concern in designing of buses. Driver has to deal with many things during his job. Our cities are crowded having a huge number of vehicles on road especially at peak hours. Everyone is in a hurry to reach somewhere and lack of discipline is also at its peak at this time. Its driver's responsibility to make the journey safe for passengers. Passenger safety starts from an entry in the bus up to exit from the bus. Passenger should feel safe during the journey. Problems occur during entry and exit of the bus. More rush leads to an accident while entering and taking the exit from bus. Bus provides wide doors for entry and exit.

Driver has some controls to drive safely. Bus has very good arrangement for safe entry of passengers as shown in Fig 1. But only this provision is not sufficient for the safety of the passenger in rush hours. Driver has to look after the outlets while stopping and leaving at the bus stops. Rear mirror arrangement is provided to the bus for driver's help. Arrangement of side mirrors is designed so that he can able to judge correctly what is around of the vehicle.

II. LITERATURE SURVEY

Zhiping Zhang, [1] presented work on car rear view mirror simulation and analysis of the dynamic characteristics; they used ANSYS to simulate the vibration frequency and vibration modals of the car rear-view mirror under the condition of excitation sources. The results show that because of low modal frequency of mirror its easily inspired by the engine , powertrain system and road to vibrate, on the basis geometric measurements, guidelines and requests, a sensible decision of the mirror size and introducing position design iterations made for get reed of low modal frequency. Antoine Larchez [2] presented work on initial development of a predictive ways to compensate vibrations of a mirror the new concept for new approach had been developed and the online performance of prediction algorithm is shown. The mean and time-varying characteristics of the vibration signal are measured by ssive-Integrated-Moving-Average model. Experimentation was first done to measure the Vibration threshold of human

perception. As well as, tests conducted to gets the actual vibration of the Mirror. The comparison of those two frequency responses has shown that perception was the most affected by frequencies in the range of [0,40Hz]

Yogesh kothawade [3] presented work on outside rear view mirror to eliminate the resonance from mirror. In these they use Numerical analysis to finding natural frequency and compared it with excitation frequency coming from engine and road conditions and its found that natural frequency of mirror is below the excitation frequency they change design using two basic things, structural modification either or changing the material properties. material properties like mass density and young's modulus were modified and the natural frequency increased.

Trupti Nirmal [4] Focused on Finite element model for the automobile rearview mirror was created to predict mirror vibration response based on modal analysis study. The materials used in this Experiment were initially provided by the mirror manufacturer and also some modification was done to create the desired output. Hyper mesh Optistruct solver used to build the complete FEA. Vibration modes are predicted for the mirror with a focus on the mirror mounting bracket. The natural frequency obtained from FEA results were co-related with experimental results and after that Iteration was made to get desired natural frequency.

Santosh S. Mangade1 [5] presented work on Vibration analysis on two-wheeler mirror, In that paper mentioned that according to Indian standard the frequency range given for the back view reflect is extending from 0-45Hz however results gotten by the primary characteristic frequency of the mirror is more than the 50Hz. The motor excitation frequency is around 58 to 67Hz so there are chances of resonance. From experimental analysis concludes that the first normal frequency of the mirror gets together is at 59Hz and the main mode shape is interpretation and pivot about Y-hub and

Opposite to Z-hub. There is a great relationship between experimental outcome and FEA results for first common frequency and mode shape. To resolve this problem that tried to reduce the weight of mirror Increase the stiffness of the rod, Reduce the mass of the mirror, Use the material with higher elastic modulus, Add the rib structure inside the mirror, Mount the mirror at the handlebar end so overhang can be reduced of the cantilever beam, Use of spring mass damper system to reduce the vibration, Isolator between glass and mirror holder.

Pravin Patil [6] this paper manages the methodical investigation of the relationship amongst test and FEA results utilizing RADIOSS. Modal analysis is performed to find natural frequency and mode shape of system. Modal analysis results are utilized to give input for response analysis contribution to reaction investigation. Modal analysis performed and found natural frequencies is between 25Hz to 44Hz. In frequency response analysis the excitation given to mirror by accelerating at the turbocharger outlet. 25% engine vibrations were transmitted to frame through isolators and found that High displacement on standard mirror post during engines idle frequency range.

Birajdar Suraj Sadadeo[7] In this paper they performed the vibration analysis of automobile outer rear view mirror with its development and optimization. The existing actual mirror assembly has a first natural frequency of 22 Hz. The target is to suggest and do the modifications in the mirror assembly to bring the frequency value close to 45Hz. They used following method to obtained desired natural frequency, Adding stiffeners to parts that are less stiff in response, Selecting the materials with higher Elastic Modulus, Adding additional clamping/connection points in the assembly to stiffen it, Adding new parts without much affecting the base cad maximum outer dimensions, By removing material in such a way that the stiffness won't reduce, By thinning of the existing rib structure, By using materials with lower density, By introducing cut-outs or holes without affecting the structures stiffness.

M. O'Grady [8] presented work on Automobile Internal Rear-View Mirror, Finite element model were uses to check mirror vibration response. For this they uses ANSYS package. Vibration analysis done on alone bracket and mirror assembly. To verify results of ANSYS experiment method is used. And the results shows good correlation between experimental and FEA results.

Shigeru Ogawa [9] presented work on Side-View Mirror Vibrations Induced Aerodynamically by Separating Vortices In this using experimental method they clarify the side view mirror vibration due to separating vortices its found that mirror has primary natural frequency of 25,30 and 33 Hz, and intensity of vibrations of the mirror is increases with proportion to flow velocity and their frequencies have peak values at 120 and 140 km/h. after that numerical study of mirror was done to capture the external forces vibrating the mirror.

1) *Literature Summary:* Automobile and Ancillary industry design parts with considering its standards. Each design has minimum 3/4 alternatives while designing. The finalized design is the optimized one. Optimum design is decided on basis of part's functional ability and its cost. Every different structure has its own natural frequency. If Natural frequency coincides with source vibration frequency then structure starts vibrate with large amplitude at its peak. It is necessary to find out natural ıcy of every proposal for vibration proof structure during working condition. Natural frequency can be found out by testing method which means testing of proposals under actual working condition in test lab on test rig. But it is not

economical to manufacture every proposal for testing. Then second method is to do analysis through software. It saves cost and it is very much important in competitive market. Vibration analysis is carried out for finding its dynamic behaviour. In that Modal analysis is way to find out natural frequency and its mode of vibration. In most of paper it's mentioned that mirror is gets vibrate with high amplitude at low modal frequency because of excitation from engine (0 to 45 Hz) and road conditions, so our aim is to eliminate low frequencies to avoid resonance.

III. PROBLEM STATEMENT

Mirror vibration, particularly in passenger buses and the heavy vehicle has a major complaint. Such vibration results in blurry images and this affects driver, vehicle control and safety of the driver and passenger

A. Objectives

1) Design optimization of mirror post to keeps natural frequency of mirror post above the targeted frequency(forty-five Hz) which is excitation frequency coming from engine vibration and road conditions.
2) To obtain optimized mirror post design by FEA.
3) To validate FEA modal analysis results with experimental modal analysis

B. Scope

During this venture vibrational study using FEA and FFT analyzer to be done. To examine which methods are available for measuring natural frequency. Find out which parameter will affect the natural frequency of the mirror post Know how to eliminate vibration of sources to get affected on automotive accessories. Finding the best iteration of design on the basis of natural frequency.

C. Methodology

1) To find the natural frequency and Mode shapes of existing RVSM FEA analysis will do using the ANSYS package.
2) Experimentation of existing design: The modular investigation of the RVSM to be done to locate the principal examination. The setup to be made for the free vibration. The RVSM will fix in the setup and hammer will be utilized to bang the mirror. The underlying excitation was given and vibrations were noted utilizing FFT analyser. From the experimental examination, it will see that characteristic frequencies of the current structure were closing as far as possibly depicted by JIS. As there is reverberation, the abundance vibrations will be seen in the current design.
3) Modification of design: To avoid the vibrations in view of the mirror, it is important to add the stiffness to the mirror. Regular frequency is relying upon the stiffness of mirror section structure and mass of the entire structure. From the connection, we can say that regular frequency is specifically relative to solidness and contrarily extent to the mass of the structure. On the off chance that solidness of structure expands, at that point common frequency of structure increments. In the event, that firmness of structure diminishes, at that point, the normal frequency of structure diminishes (Mass kept constant)
   Fn α K and Fn α 1/m
   Fn = Natural Frequency
   K = Stiffness
   M = Mass
   If the mass of structure increases, then the natural frequency of structure decreases. If mass of structure decreases then the natural frequency of structure increases (Stiffness kept constant).
4) Preparation of proposals and analysis of same.
5) Selection of optimum solution from proposals.
6) Experimental analysis of the optimum design iteration. To validate results.

IV. MODAL ANALYSIS OF EXISTING MODEL

The design of the automotive mirror assembly is carried out using 'FEA'. The automotive mirror assembly is modelled using ANSYS 19.1 software using SOLID 187 element. The advantages of this automotive mirror assembly are that it can be easily tuned to the excitation frequency, so it can be used to reduce the vibration of the system subjected to the variable excitation frequency.
Some new design ideas are created. There are two different ideas that can work out. First one is to change material and see for what is good for automotive mirror assembly and the second option is to change the structure design and to observe the change in natural frequency. Material change doesn't change the natural frequency in long range. So, design change option is good for natural increase.

A. MESH

Meshing is done by using tetrahedral program-controlled elements. Meshing size is decided as per fine result required with soft behaviour. Meshing size 8 mm is decided and kept the same for all proposals. Meshing is one of the important parts of the analysis. It decides how accurate results are going to come.

Statistics		
Nodes	57765	31863
Elements	38914	17193
Mesh Metric	None	

Fig no. 1: Meshing of Existing Mirror post

B. Material Assignment

Then CAD geometry is imported into ANSYS 19.1 software for modal analysis. Mirror with plastic nylon derivative and other rest of the structure is of structural steel. Density and other isentropic properties have been entered.

Material		
Assignment	mirror	Structural Steel
Nonlinear Effects	Yes	
Thermal Strain Effects	Yes	

Fig no. 2 Existing RVSM material properties

C. Boundary Conditions

Fixed Support type fixity is given to the one end of the frame for modal analysis.

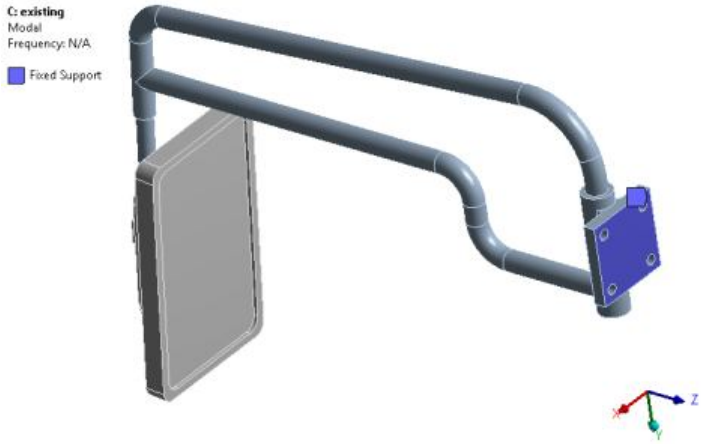

Fig no. 3 Existing RVSM Fixed support

The software provides total deformation of the automotive mirror assembly. An understanding of automotive mirror assembly mode shapes is required so that significant parameters that affect each mode can be determined to allow for the possibility for adjusting different modal frequencies. Following mode, shapes were found using the model developed in ANSYS. The first six natural frequencies obtained are tabulated in the following table and corresponding mode shapes of the absorber are evaluated using finite element analysis by writing an ANSYS program as shown in Fig.

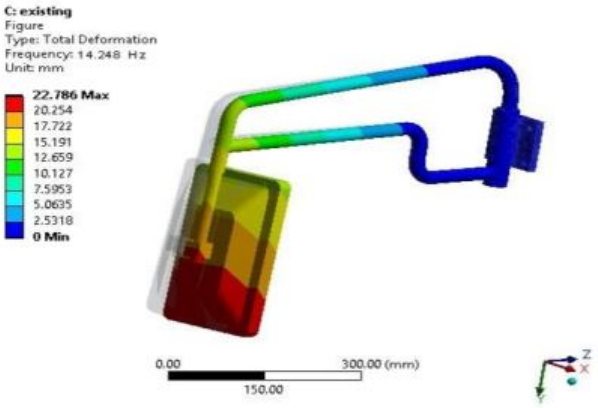

Fig no. 4 Existing RVSM First Mode Shape 1

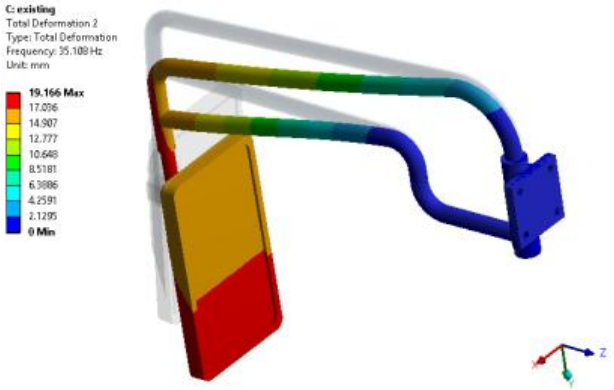

Fig no. 5 Existing RVSM Second Mode Shape 2

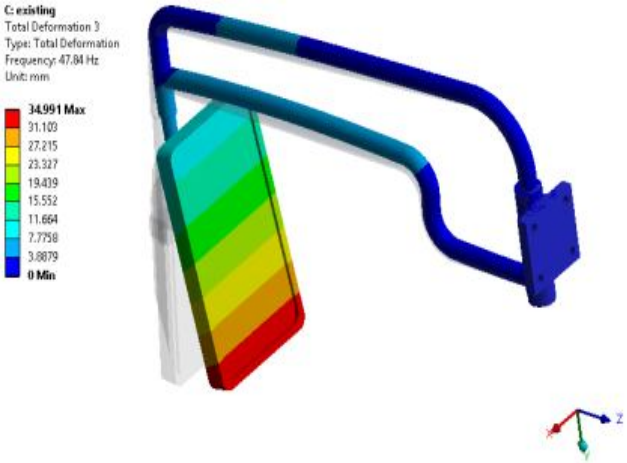

Fig no. 6 Existing RVSM Third Mode Shape 3

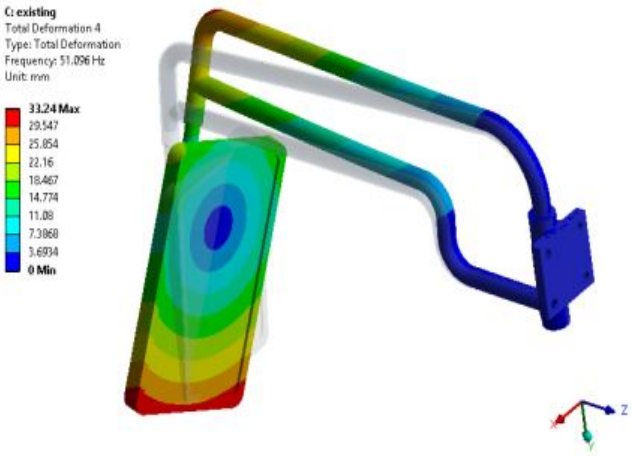

Fig no. 7 Existing RVSM Fourth Mode Shape 4

D. Results From Ansys

Table no. 1 Natural frequency of Existing RVSM

Results						
Minimum	0. mm					
Maximum	22.786 mm	19.166 mm	34.991 mm	33.24 mm	45.727 mm	35.411 mm
Average	13.689 mm	13.397 mm	13.8 mm	11.679 mm	13.798 mm	12.731 mm
Minimum Occurs On	STEM_0					
Maximum Occurs On	MIRROR_0					
Information						
Frequency	14.428 Hz	35.108 Hz	47.84 Hz	51.096 Hz	142.27 Hz	162.92 Hz

The natural frequency calculated through numerical analysis and its seems that the natural frequency is matching with engine vibrations so, It needed to avoid the resonant frequency of existing design and vibration range (0 to 45 Hz) coming from engine. So need to make design iteration for RVSM

V. MODAL ANALYSIS OF ALTERNATE DESIGN

A. Iteration No.1

For Iteration No.1 simply supported frame is used. Its advantage that its mass got reduced than the existing model so, reduction in mass helps in increasing natural frequency. But stiffness also got change. The solution is carried out using the same criteria.

1) CAD Model

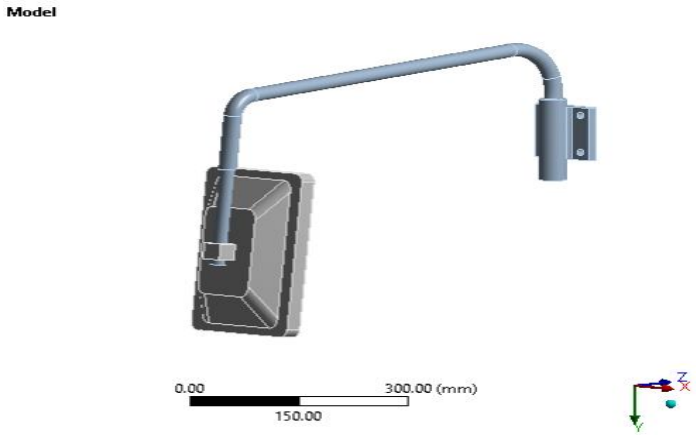

Fig no. 8 CAD model for Iteration 1

2) The First Six Natural Frequencies Obtained Are As Below

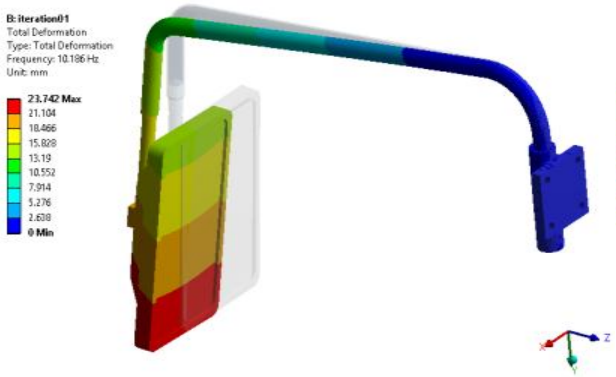

Fig no. 9 Mode shapes 1 for Iteration 1

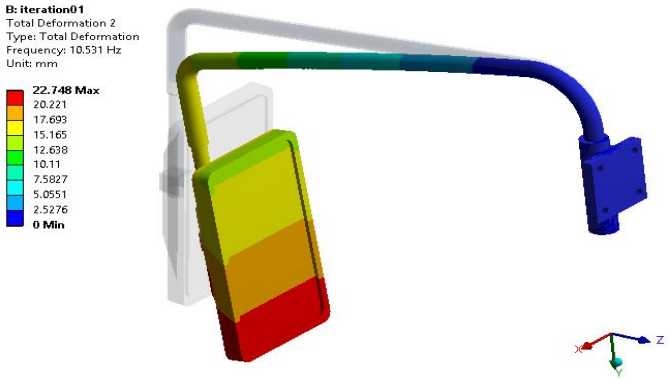

Fig no. 10 Mode shapes 2 for Iteration 1

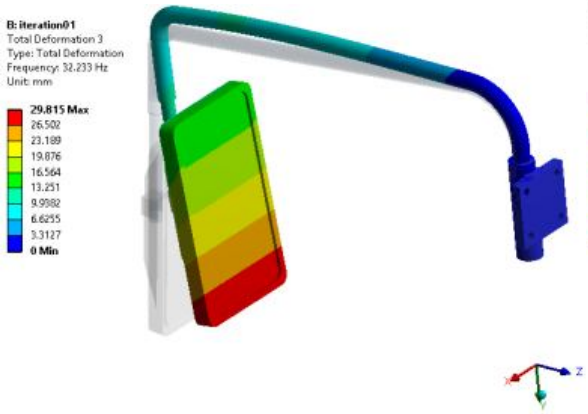

Fig no. 11 Mode shapes 3 for Iteration 1

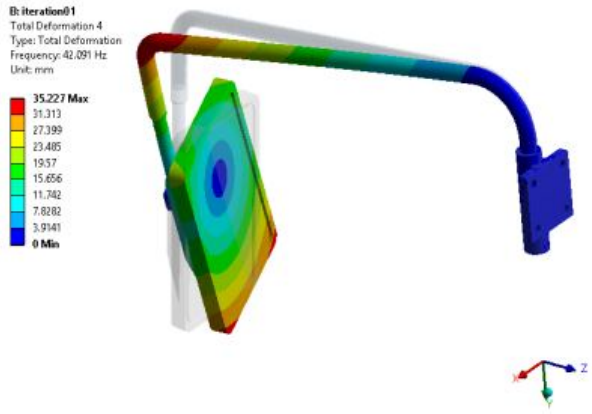

Fig no. 12 Mode shapes 4 for Iteration 1

Natural frequency obtain for mode shapes 1 to 6 are 10.186, 10531, 32.233, 42.091, 122.09 and 149.08 Hz resp. and maximum deflection is 23.742, 22.748, 29.815, 35.227, 44.586 and 35.776 Resp.

3) Results from ANSYS

Table no. 2 Natural frequency of Iteration 1

Results						
Minimum	0. mm					
Maximum	23.742 mm	22.748 mm	29.815 mm	35.227 mm	44.586 mm	35.776 mm
Average	15.14 mm	14.972 mm	15.619 mm	12.292 mm	15.072 mm	13.579 mm
Minimum Occurs On	STEM					
Maximum Occurs On	MIRROR			STEM	MIRROR	
Information						
Frequency	10.186 Hz	10.531 Hz	32.233 Hz	42.091 Hz	122.09 Hz	149.08 Hz

B. Iteration no. 02

To eliminate drawbacks of existing model two separate mounting provided for better stiffness and firm support. Supports are in the same plane but not parallel to the plane of the mirror. First support remains the same and another support arm is attached with the support.

CAD model geometry is completed in the same software used before creo. Then this CAD model is used for modal analysis. Analysis details kept same for Iteration No. 02 as well so we can compare all analyses of models. Material kept same. The density of parts entered correctly. Meshing has been done with the same meshing control details. Fixed supports added as per new design. Modal analysis has been carried out and compared with the previous one.

Iteration No. 02 model has more mass than Iteration No. 01. So it will reduce natural frequency. But, stiffness got increase so natural frequency may also increase. Iteration No. 02 has a very stable structure than Iteration No. 02. Natural frequency is going to increase than before because of one supporting arm added with support.

1) Cad Model

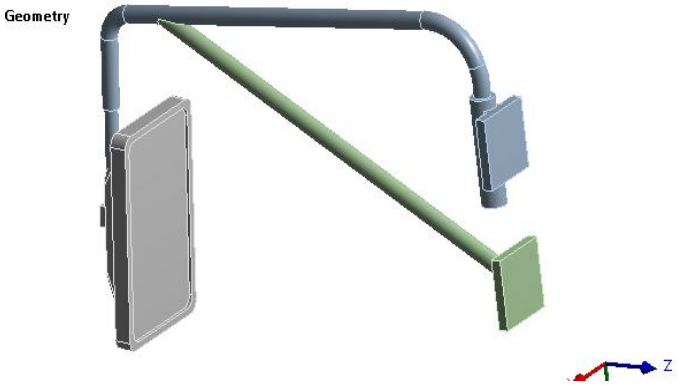

Fig no.13 CAD model for Iteration 2

2) The First Six Natural Frequencies Obtained Are As Below

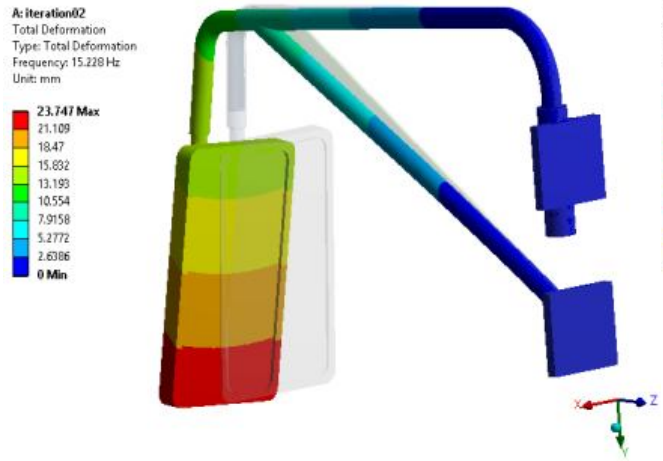

Fig no.14 Mode shapes 1 for Iteration 2

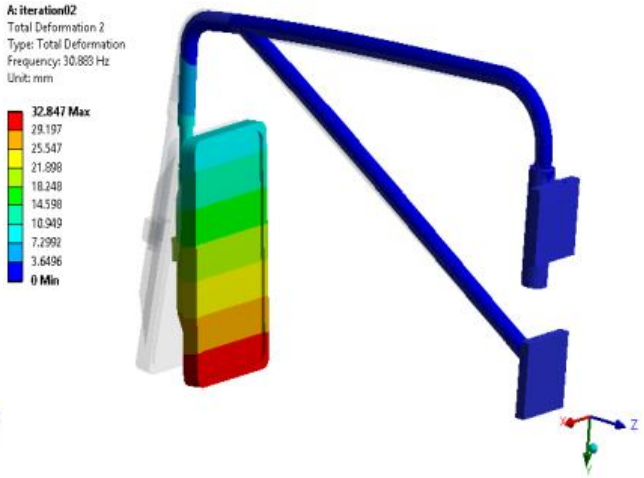

Fig no. 15 Mode shapes 2 for Iteration 2

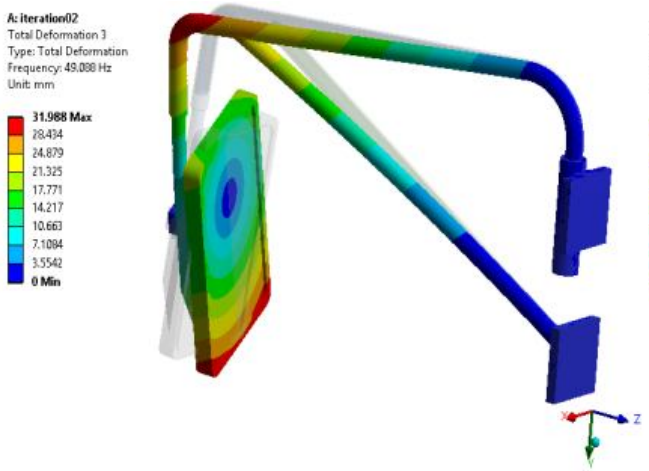

Fig no. 16 Mode shapes 3 for Iteration 2

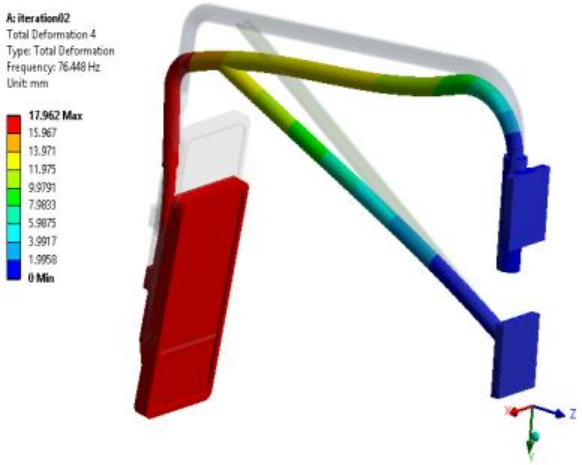

Fig no. 17 Mode shapes 4 for Iteration 2

Natural frequency obtain for mode shapes 1 to 6 are 15.228, 30.883, 49.088, 76.448, 126.68 and 150.44 Hz resp. and maximum deflection is 23.747, 32.847, 31.988, 17.962, 44.553 and 35.829 Resp.

3) Results from ANSYS

Table no. 3 Natural frequency of Iteration 2

Definition						
Type	Total Deformation					
Mode	1.	2.	3.	4.	5.	6.
Identifier						
Suppressed	No					
Results						
Minimum	0. mm					
Maximum	23.747 mm	32.847 mm	31.988 mm	17.962 mm	44.553 mm	35.829 mm
Average	13.198 mm	12.914 mm	10.959 mm	13.095 mm	13.168 mm	12.397 mm
Minimum Occurs On	STEM					
Maximum Occurs On	MIRROR					
Information						
Frequency	15.228 Hz	30.883 Hz	49.088 Hz	76.448 Hz	126.68 Hz	150.44 Hz

C. Iteration No.3

For Iteration No.3 single vertical bar used which is fixed to framed supports at the ends.

1) CAD Model

Fig no.18 Cad model for Iteration 3

2) The First Six Natural Frequencies Obtained Are As Below

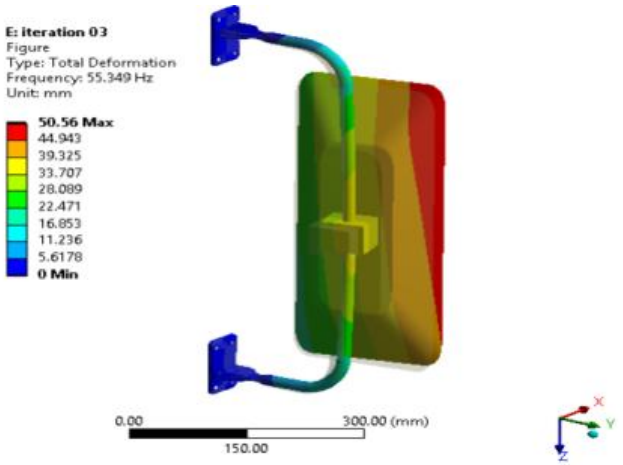

Fig no.19 Mode shapes 1 for Iteration 3

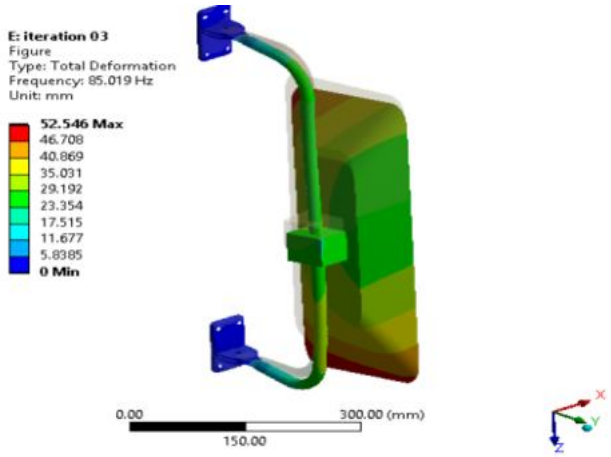

Fig no.20 Mode shapes 2 for Iteration 3

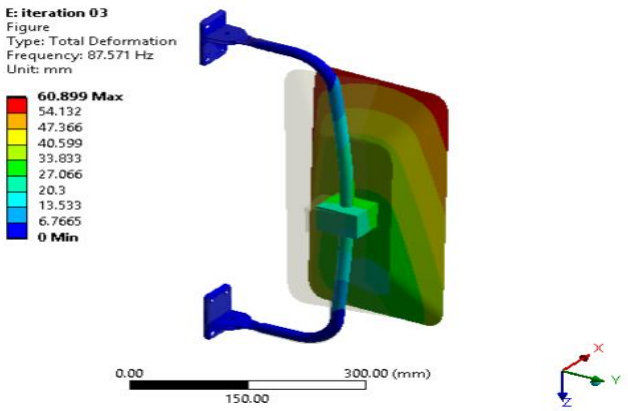

Fig no.21 Mode shapes 3 for Iteration 3

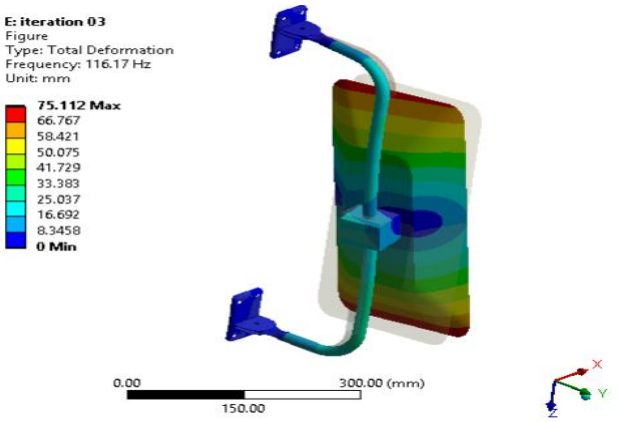

Fig no..22 Mode shapes 4 for Iteration 3

Natural frequency obtain for mode shapes 1 to 6 are 55.349, 85.019, 87.571, 116.17, 14.668 and 169.32 Hz resp. and maximum
s 50.56, 52.546, 60.899, 75.112, 72.633 and 79.656 Resp.

3) Results from ANSYS

Table no. 4 Natural frequency of Iteration 3

Definition						
Type	Total Deformation					
Mode	1.	2.	3.	4.	5.	6.
Identifier						
Suppressed	No					
Results						
Minimum	0. mm					
Maximum	50.56 mm	52.546 mm	60.899 mm	75.112 mm	72.633 mm	79.656 mm
Average	26.686 mm	27.26 mm	26.735 mm	24.809 mm	26.28 mm	26.105 mm
Minimum Occurs On	MOUNTING_BRACKET_BIG					
Maximum Occurs On	mirror					
Information						
Frequency	55.349 Hz	85.019 Hz	87.571 Hz	116.17 Hz	146.68 Hz	169.32 Hz

D. Iteration No.4

For Iteration No.4 Plane of mounting is changed which is parallel to the plane of the mirror. Two supports are kept in the same situation. Supports are vertical. A structure like cantilever is changed and became stiffer so that less vibration it can face during working. Mirror kept same. Dimensionally support length is also changed. Position of mirror fixing is also changed.

1) CAD Model

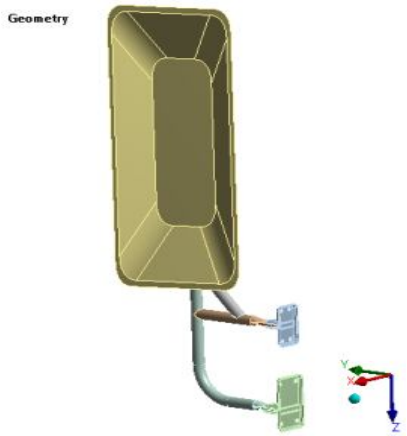

Fig no.23 Cad model for Iteration 4

2) The First Six Natural Frequencies Obtained Are As Below

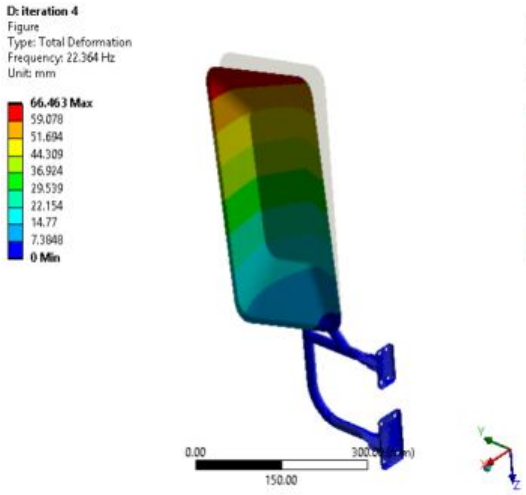

Fig no.24 Mode Shapes 1 for Iteration 4

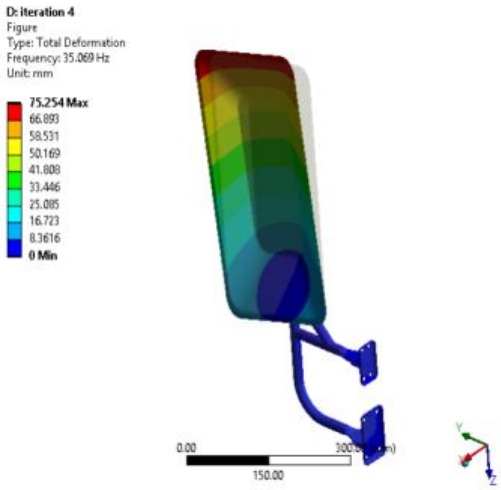

Fig no.25 .Mode Shapes 2 for Iteration 4

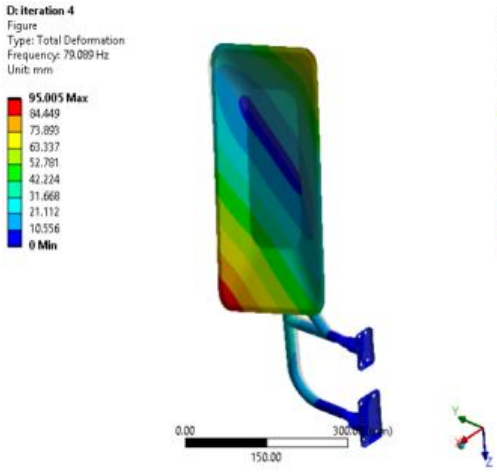

Fig no.26 Mode Shapes 3 for Iteration 4

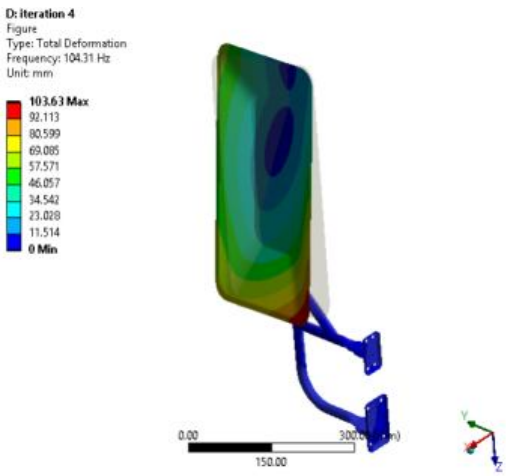

Fig no.27 Mode Shapes 4 for Iteration 4

Natural frequency obtain for mode shapes 1 to 6 are 22.364, 35.069, 79.089, 104.31, 11.851 and 190.26 Hz resp. and maximum deflection is 66.463, 75.254, 95.005, 103.63, 59.246 and 61.049 Resp.

3) Results from ANSYS

Table no. 5 Natural frequency of Iteration 4

Definition						
Type	Total Deformation					
Mode	1.	2.	3.	4.	5.	6.
Identifier						
Suppressed	No					
Results						
Minimum	0. mm					
Maximum	66.463 mm	75.254 mm	95.005 mm	103.63 mm	59.246 mm	61.049 mm
Average	24.811 mm	23.736 mm	25.235 mm	23.937 mm	27.389 mm	27.137 mm
Minimum Occurs On	MOUNTING_BRACKET_SMALL					
Maximum Occurs On	mirror					
Information						
Frequency	22.364 Hz	35.069 Hz	79.089 Hz	104.31 Hz	118.51 Hz	190.26 Hz

E. Conclusion Of FEA Results

Table no. 6 Natural frequency of Existing RVSM

Mode No.	Natural Frequencies				
	Existing Design	Iteration No.1 Model	Iteration No.2 Model	Iteration No.3 Model	Iteration No.4 Model
1	14.428	10.186	15.228	55.349	22.364
2	35.108	10.531	30.883	85.019	35.069
3	47.84	32.233	49.088	87.571	79.089
4	51.096	42.091	76.448	116.17	104.31
5	142.27	122.09	126.68	146.68	118.51
6	162.92	149.08	150.44	169.32	190.26

Existing Design of model has a natural frequency above that Japanese Industrial Standard recommended natural frequency. So, the Existing Design of model leads to be an optimized solution for automotive mirror assembly.

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VI. EXPERIMENTAL ANALYSIS

To validate FEA results it must use experimental analysis and in this, we have used FFT analysis for finding the Natural frequency of the existing model. For analysis, we used Dewe- 43 FFT analyser, acceleration sensors, hammer with load cells.

A. Procedure For Experimentation

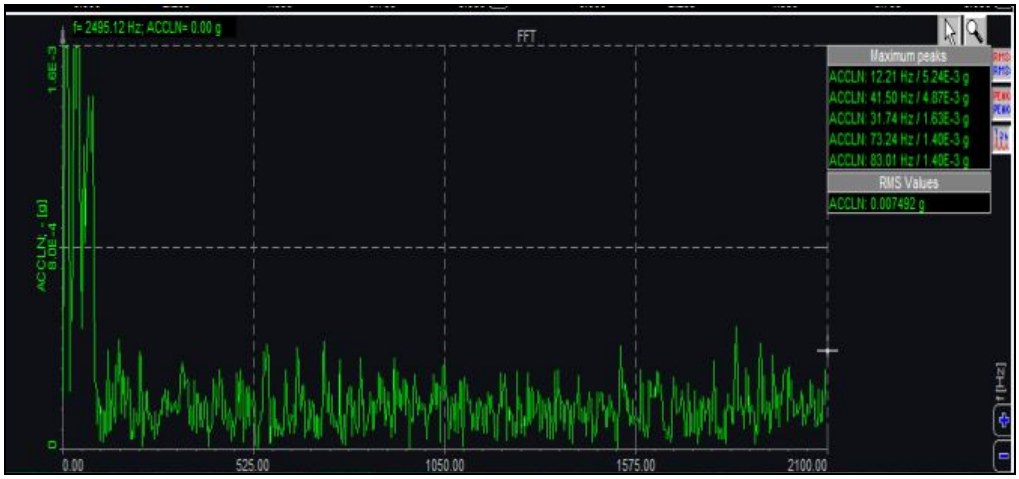
1) At first, it was found out by FEA that Natural Frequency of rear view mirror is less than the standard.
2) In order to carry out the modal analysis of rear view mirror, the assembly was fixed using clamps to the Table in Workshop.
3) After assembly of apparatus in vibration analyser, measurement scheme has to be made, in analyser proper selection of sensors and their channel is made. Measurement parameters are defined.
4) All sensors should be attached to vibration analyser when it is in power-off mode. Proper connections of all sensors are made. Various sensors used are accelerometers and digital stroboscope.
5) The accelerometers are attached to mirror assembly as shown in Figure to measure the natural frequency of mirror assembly.
6) Impact Hammer is used to giving initial excitation.
7) Natural Frequency is measured with the help of FFT Analyser.
8) After data acquisition data is further transferred to Computer for data processing.

B. Experimental Setup For Existing RVSM

Impact hammer was used to excite the RVSM frame at selected points and the resulting vibrations were recorded by means of an Accelerometer held to the specimen through the clamp. At each selected point, the hammer was made to strike for three times means the total length.

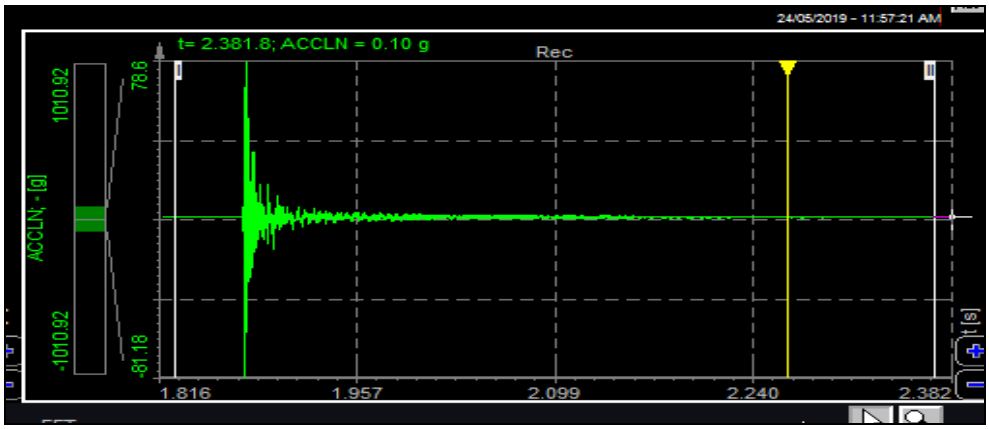
Fig no.28 Experimental setup

1) Experimental Results for Existing RVSM: The figure shows the experimental result for Acceleration vs. Frequency Graph



Graph no. 1 Graph of Acceleration vs. Frequency

From the following graph natural frequency for existing mirror post obtained from experimental analysis



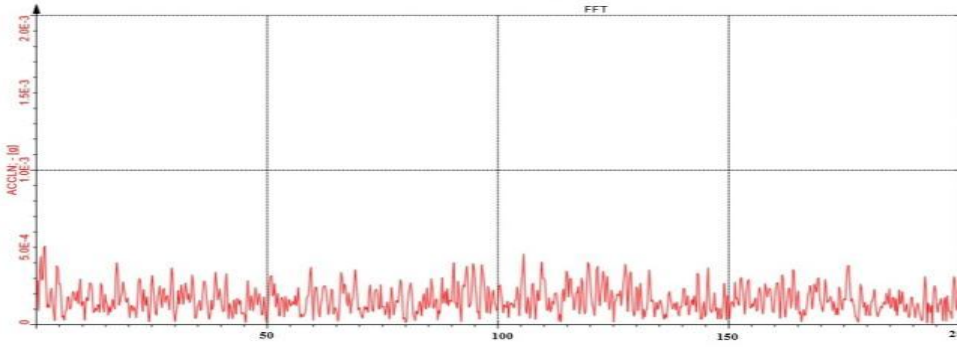
Graph no. 2 Graph of Acceleration vs. Time

C. Experimental Setup For Iteration 3

For Iteration 3 same procedure and rules are followed in these two ends of the post are fixed by using Clamp and noted the Value and frequencies using FFT analyzer.

Fig no. 29 Experimental setup for Modal Analysis for Iteration 3 Design.

1) Experimental Results for Iteration 3: From the following graph natural frequency for Iteration 3 obtained from experimental analysis



Graph no.3 Graph of Frequency vs. Acceleration for Iteration 3

Table no. 6 Experimental analysis results

Mode	Frequencies from Experimental Modal Analysis for Existing RVSM [Hz]	Frequencies from Experimental Modal Analysis for Iteration 3 [Hz]
1	12.31	52.24
2	31.74	86.54
3	41.50	122.56

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VII. RESULTS AND DISCUSSIONS

A. Results

Results obtained from FEA modal analysis and Experimental analysis found satisfactory
Below are the results obtained from FEA and Experimental Analysis.

Table no. 7 FEA results for Mirror designs

Modes	Natural Frequency (Hz)				
	Existing Design	Iteration 1	Iteration 2	Iteration 3	Iteration 4
1	14.428	10.186	15.228	55.349	22.364
2	35.108	10.531	30.883	85.019	35.069
3	47.84	32.233	49.088	87.571	79.089
4	51.096	42.091	76.448	116.17	104.31
5	142.27	122.09	126.68	146.68	118.51

The analytical and experimental results show similar values with some deviation. This deviation can be found out in terms of percentage.

Table no. 8 Percentage Difference In Analytical And Experimental Values for Existing Design

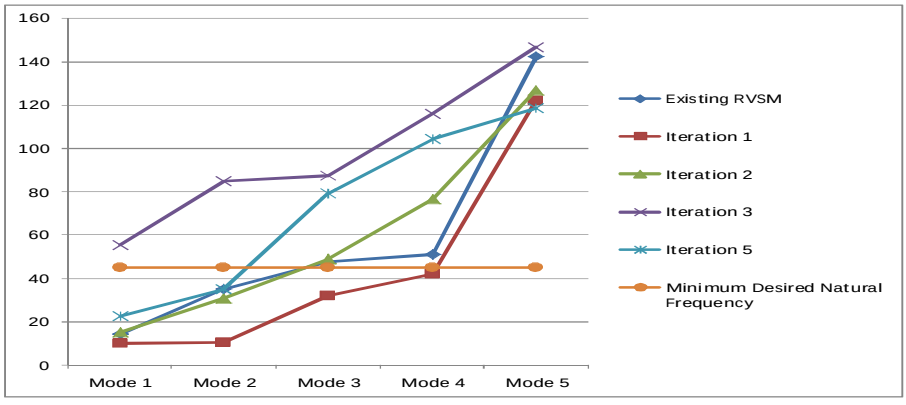
FEA Natural Frequency of Existing RVSM (Hz)	Experimental Natural Frequency of Existing RSM (Hz)	Difference between analytical and experimental values	Percentage difference
14.428	12.31	2.118	14.67%
35.108	31.74	3.368	9.59%
47.840	41.50	6.34	13.25%

It is observed that the least percentage deviation is 14.67% and it is for 14.428 Hz frequency

Table no. 9 Percentage Difference In Analytical And Experimental Values for Iteration 3

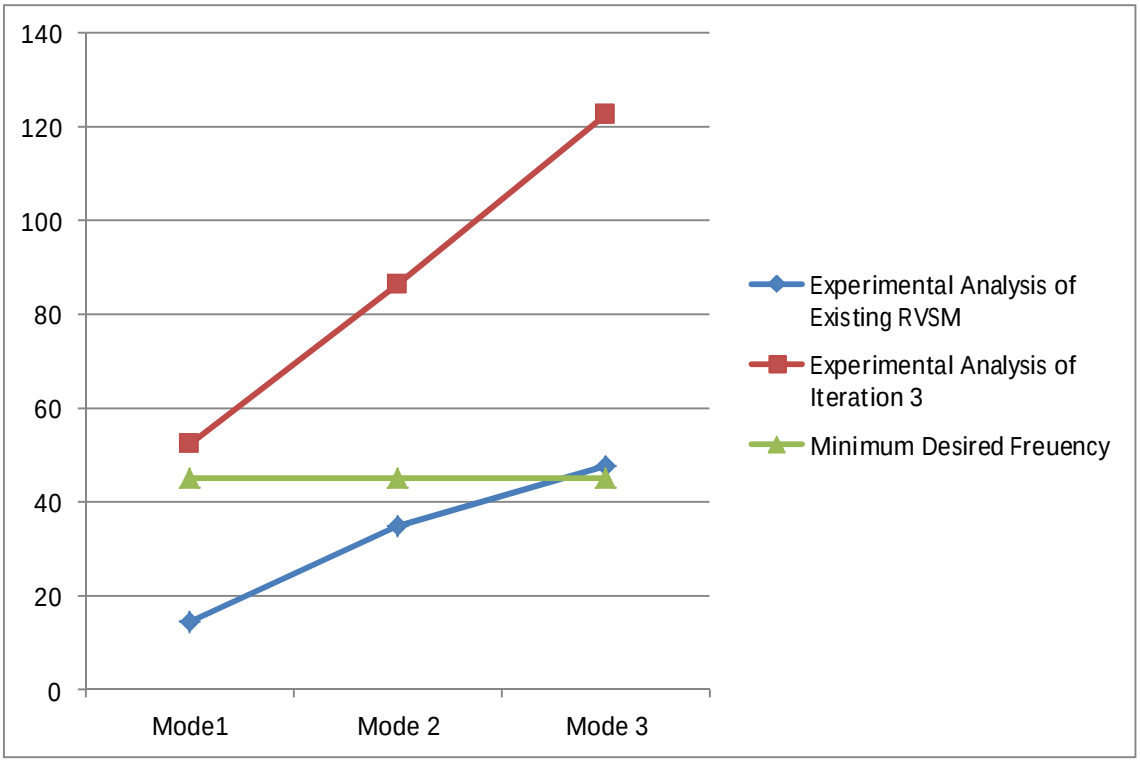
FEA Natural Frequency of Iteration 3 (Hz)	Experimental Natural Frequency of Iteration 3 (Hz)	Difference between analytical and experimental values	Percentage difference
55.349	52.24	3.109	5.61%
85.019	86.54	1.521	1.78%
116.17	122.56	6.39	5.50%

Graphical Comparison of Existing and Iteration Natural frequency



Graph no. 4 Graphical Comparison of Existing and Iteration Natural frequency

Existing RVSM FEA and Experimental analysis Graphical comparison is shown below



Graph no. 5 Graphical Comparison of Experimental analysis for Existing and Iteration Natural frequency

B. Discussions

1) By doing FEA and experimental analysis of existing RVSM we confirmed that it has resonance problem and from results, it's proved.
2) The existing design has a natural frequency which is below Forty-five Hz excitation frequencies.
3) Above that after doing Iteration for RVSM FEA results obtained to get the optimum design on the basis of desired natural frequency.
4) Iteration 1 has its first natural frequency is 10.186 Hz which lower than the desired limit.
5) Iteration 2 has its first natural frequency is 30.883 Hz, it has also natural frequency lower than the desired limit.
6) From Iteration 3, FEA results have obtained natural frequency which is above than desired frequency it's selected as optimum design,
7) Results obtained from FEA and Experimental analysis are matching.

VIII. CONCLUSION

The following conclusions were made from the work presented here from the study

A. From FEA and experimental analysis, it's understood that the resonance problem is due to the faulty design of the mirror post, not the mirror.
B. The base design was studied for natural frequency and found that natural frequency of the base model was below the Forty-five Hz which is needed to be more than Forty-five Hz as studied in the literature survey.
C. Experimental analysis results were matching with FEA analysis so we can correlate that base design is faulty. From the results of FEA analysis, Proposal 3 has a range of natural frequency from 55.349 to 146.68 Hz. Which avoiding existing model resonance frequency and more than Engine excitation frequency.
D. Mirror post design iteration 1, 2 and 4 is not giving satisfactory results.

ved that Iteration 3 is an optimized solution for rear-view side mirror

IX. FUTURE SCOPE

A. In future the study the effects of air drag can be considered while designing.

B. Further the design can be modified by carrying out weight reduction using composite material without affecting its primary function.

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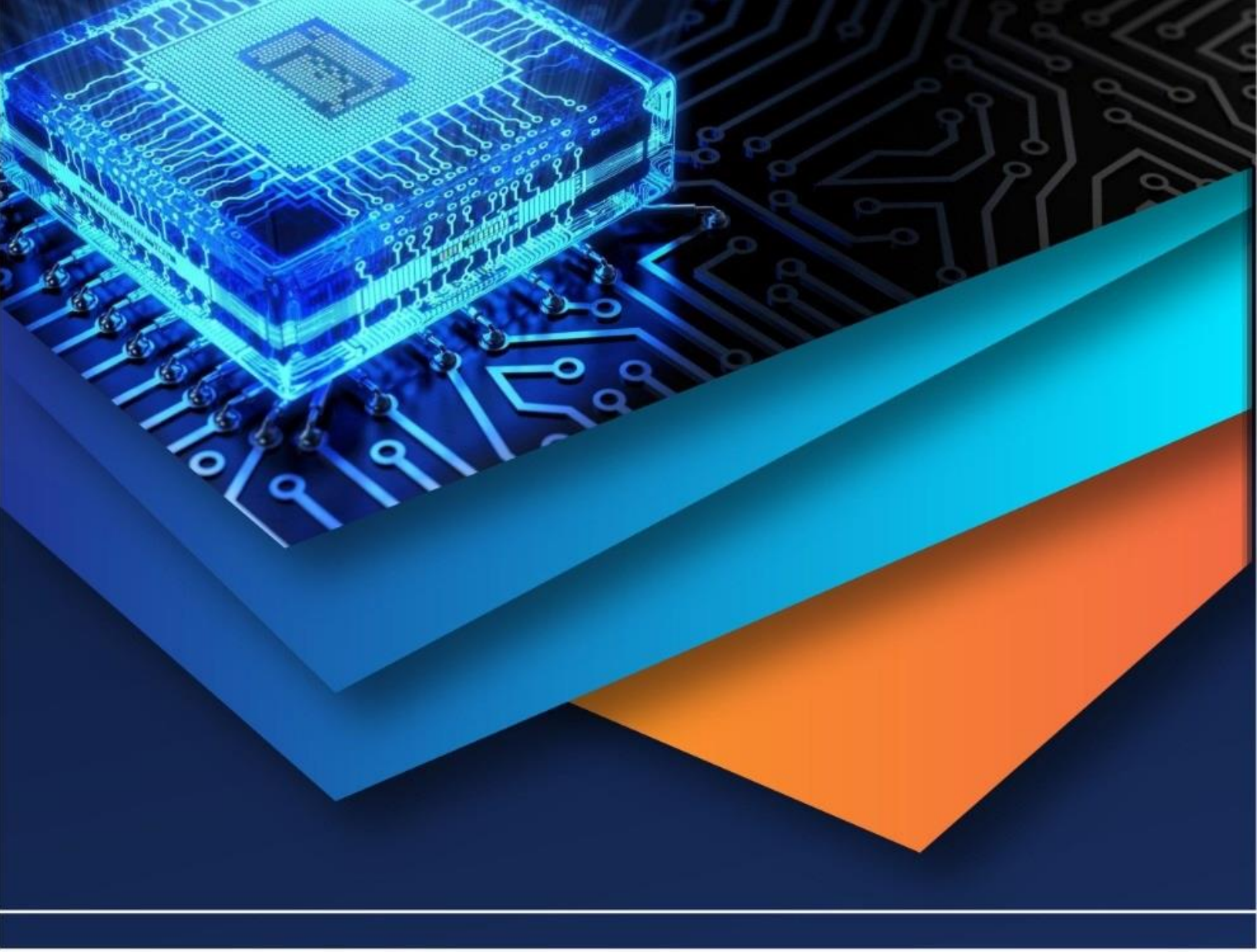

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Vibration and Experimental Analysis of an Automobile Fender and its Optimization

Raghvendra Patil [1], Prof. G. L. Suryawanshi [2], Prof. S. M. Jadhav[3]
[1]*PG Student,* [2, 3]*Asst Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune, India.*

Abstract: ***In today's scenario, most of the Automobile Industries focus is on strength enhancement of automobile parts & reduction in the weight of the body parts of the vehicle. Normally Fender is used to avoid mud, sand, liquids and rocks and other road sprays from rotating tire that are thrown into the air. Fenders of heavy automobiles are manufactured from sheet metal which is having thickness less than 6 mm & are often subjected to vibratory loads which leads to Structural Failures. The 3D model of fender was made in the CATIA Software with the help of various tools. The Modal and Harmonic Analysis was carried out using ANSYS19.2. In Modal Analysis various mode shapes indicating minimum to maximum deformation with images were obtained and also Natural frequencies were known, In Harmonic Analysis it was seen whether the plane sheet fender or sheet with parallel ribs or sheet with cross ribs performs better. The experimental Fast Fourier Transform was carried out. Comparative analysis was carried out between Analysis results and experimental results for frequencies. FEA of Original Fender and Original Fender with Parallel vertical ribs was carried out. In result, output acceleration for sheet with vertical parallel ribs was found to be optimized.***

Keywords: Automobile Fender, Vibratory loads, Structural Failure, Modal analysis, Vibrational Analysis

I. INTRODUCTION

The fender's component used for the wheel wells will be always larger than the diameter of the tire, that's why, they do not move with the consequently and tire suspension must be broad enough to allow the full range of tire motion on the suspension avoiding the touch of the interior of the wheel well. The streamlined 1949 Nash 600 and Ambassador design was first to feature fenders that were used for the front wheels. More elaborate designs include fender skirts for encasing the external edge of the wheel well, and stylized pontoon fenders for exposed fenders. The panel which covers along with bolts on the wheel of dual rear and frontal wheel pickup trucks also heavy load trucks and other vehicles is called as a fender. An automotive truck with a different bed but excluding bolt on fenders has a bedside, which will be acting as if it is doing work of a fender. When the side bed of truck is attached by welding to the cab, as with the Cadillac's Escalade model and Chevrolet's Avalanche model, it is called a quarter panel. The automotive industry is determined to make the lightweight designs to get the cost and weight advantages along with customer delight. So main priority is given on how less thick the of frame or body panels that is its minimum thickness and utilization of substitute materials.

II. LITERATURE SURVEY

S.M. Chavan and Dr. R.B. Hiremath did their research on Simulation analysis and dynamic dent research in which say, In automotive industry there is an changing and increasing demand for higher quality external panels. Will better function i.e. will have better functional properties and also have lower weights. The wants for weight minimization has led to thinner sheets, shifting the use of high strength steels and a change from steel material to aluminum grades. This thickness minimization, which causes decrement in the dent resistance, inspired examination of the dent resistance against static and dynamic concentrated loads. This paper gives an idea of an investigation of how suitable is the explicit dynamic Finite Element Analysis as a way to obtain and understand the dynamic dent properties of the panel. This test performance is carried out on the body's external panel of utility kind of vehicle and covers two parts, in initial experimental test and analysis is done on developed test rig, this is interfaced and attached with the computer.[1]

Pankaj K. Bhoyar, C. M. Sedani and Monika S. Agarwal carried out their research on Superplastibility FEA ,in which they say excessively plastic forming is a near net-shape forming process which gives many advantages and perks over conventional forming activities including very low forming pressure under low die cast, low flow stress, more design flexibility, and the ability to shape hard metals to form complex shapes. However, low production rate due to slow forming process and less predictive capabilities smaller number of accurate constitutive models for super plastic deformation, treated as a hurdle to the widespread

utilization of SPF. Late headways in finite element tools have shown while analyzing the complex super plastic forming performance. These tools can be utilized skillfully in order to develop optimized super plastic forming techniques to build up the future materials.[2] Mehmet Calisken and Vahdet Ucar in their work in Structural optimization with CADO states that, the aim here in this study and objective is to increase power to weight ratio of an alloy of a steel vehicle body without any structural weakness and to use an integrated engineering solution of ‘‘computer-aided design, engineering & optimization (CADO)’’. In this optimization study, firstly the body’s ‘‘computer-aided design (CAD)’’ parametric model has been made first for some static analyses are necessary for the design study. In the next step, some critical dimensions of the structure’s parts have been defined as design parameters. The aim of the optimization study is a depreciation as much as possible of critical equivalent stress value is under the yield limit. In addition, study of sensitivity has to be studied on the model body with stress measures for a deep and clear analysis. In variety of steps, Pro/Engineer CAD and Pro/Mechanica computer aided engineering (CAE) software has been utilized.[3] Sathish.K, Justin Dhiraviyam, Baskaran.s in their research study on Design and the fabrication of two-wheeler mudguard with Sisal natural fibre states that, In the todays context scenario automobile industries are enthusiastically focusing on enhancing the strength of a body and reducing its weight of body parts. In two wheelers mudguards are provided to prevent and to be protected from the dirt’s particle and sand particles in tire from entering and ruining and damaging other parts. Now a days most of which are made from ABS/Polypropylene plastics. They are of high cost already and not completely degradable that’s the disadvantage. In their work an attempt has been made to use strong and abundantly and amply available sisal plant fibers as reinforcement in epoxy resin to make low-cost, higher strengths and less weight substitute for mudguards.[4]

Gujja Sunil Kumar, B. Naresh, Ch. Sunil in their research study on Fabrication using carbon fibre for bike mudguard state that, Carbon fiber composites are moving into the main stream for the automobile industry, and also in aircraft industries, they are even finding more places to discover themselves and to be used in other various industries. Basically, Carbon fibers are the man-made materials and are artificial fibers. These fibers have high strength to weight ratio when compared to that of Natural fibers and also some artificially made fibers such as Glass, Kevlar and Aramid etc. In this research project carbon fiber is embedded and mixed in a biopolymer matrix system (epoxy), the work of which is to hold the fibers with each other, this gives and stabilizes the shape of the composite structure and transmits the shear forces mechanically in between the high-quality fibers, and safeguards them against radiation and other aggressive and hazardous media and the specimen preparation is done. The components conditions are fixed and are prepared for testing and tensile test and bending tests are done and compared to the existing part.[5]

Sanjay Kumar S.M, D.P. Girish in their study on Design and Fender analysis states that, Fender is a front and rear outer sider member of a car situated on wheels, which covers the wheel side. It has so many small features with crests and troughs. The surface binding is not a planer one in this case. This is because to decrease the draw depth and it has two rows of draw beads. It looks to be non easy to form because of their small radius fillets. In this analysis, there is a need to find out the forming feasibility of this component and if impossible in single stage then we have to modify and change the die design with very much low numbers of modification and need to optimize the draw bead profile and draw radius in such a way that we can get the good component in a single stage only. For thin and very big forming dies, we have to do gravity analysis. If our die face is profiled one, then we may have to do binder wrap analysis. The binder wrap analysis results are taken to the forming analysis. After this is done, if trimming is there means just before trimming the analysis we must have do mesh coarsening. Then the coarsened mesh and its results are taken for trimming analysis. The results obtained out of the trimming analysis are given to the spring back analysis. From the results of the spring back analysis, next we can cross check the spring back of the real component. The analysis results obtained is used in sheet metal industry for metal forming process.[6]

III. PROBLEM STATEMENT

Mudguards are subjected to vibratory loads which lead to structural failures. Hence, achieving the optimum design through FEA helps in reduction of structural failures which increases the life span of mudguard or a Fender**.**

IV. OBJECTIVES

A. To Optimize the Fender by modification in design.

B. Finite Element Analysis.

1) Obtaining natural frequencies and mode shapes for the fender plates with plane sheet, sheet with parallel vertical ribs and plate with cross ribs.

2) With base excitation of 5g, obtaining the frequency responses for the plane sheet fender, Fender plate with vertical parallel ribs .der plate with cross ribs.

3) Observing the output acceleration for all 3 plates, and to find out optimum result from FEA.

C. To perform Experimental Validation for optimum design, which we have obtained using FEA, and maintaining error between the frequencies below 10%.

V. SCOPE

A. The present system of dissertation work represents correlation between the results of theoretical analysis and experimental analysis of an automobile Fender.

B. Theoretical results have been validated with the experimental results. Finite element modeling, Modal shapes and Harmonic analysis of an Flat plate fender and Fender plate with parallel ribs and cross ribs has been completed in ANSYS Workbench.

C. Simulation results are used for result verification in colored visual manner.

VI. METHODOLOGY

A. Literature survey was done with the help of research papers relevant to the fender optimization. From that the importance of the FEA and structural analysis, Importance of Mode Shapes and Vibration Analysis was noted and according to that some basic concepts were considered.

B. After that the components which are required were decided.

C. After deciding the components, the drafting and 3 D Model is obtained with the help of CATIA software.

D. The Modal & Harmonic Analysis of the component are done with the help of ANSYS using FEA.

E. The experimental observations are taken on FFT Analyzer.

F. Comparative analysis is made between simulation and experimental results and then Results and conclusions will be drawn.

VII.FENDER OPTIMIZATION- PLANE SHEET

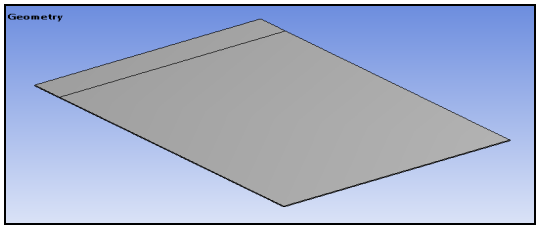


Fig.No.1 Geometry of fender with plane sheet

A. Mesh

ANSYS Meshing is an intelligent, automated for very high performance, general-purpose, intelligent, product. It gives out the most appropriate meshes for defect-free, accurate, very efficient Multiphysics solutions. A mesh which will be suiting for a specific analysis can be obtained with an ease with a single mouse click on ANSYS for all parts in a model. Full controls over the options that which can be modified, are used to generate the mesh and that are available for the experts in industry who wants to use it on full tune. The feature of parallel processing is automatically used to decrease the time when operate, and if not, you have to wait for mesh generation. Hex meshing is done on plane sheet as well as parallel ribs sheet and cross ribs sheet.

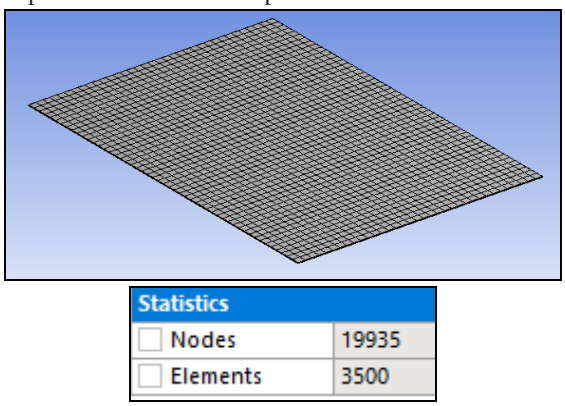


Fig.No.2 Meshing of fender with plane sheet.

B. Boundary Condition

A boundary condition for the model is the setting of a known value for a displacement or an associated load. For a particular node you can set either the load or the displacement but not both. The main types of loading available in FEA include force, pressure and temperature. These can be applied to nodes, edges, elements, points and surfaces or remotely offset from a feature.
A Fixed support is provided at one end and another end is set free.

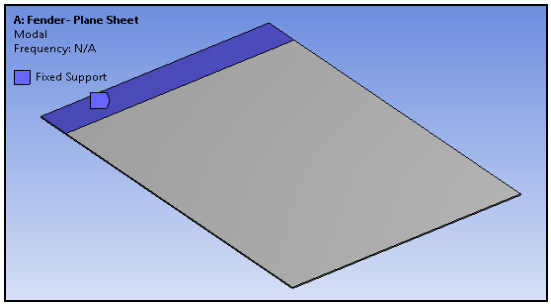
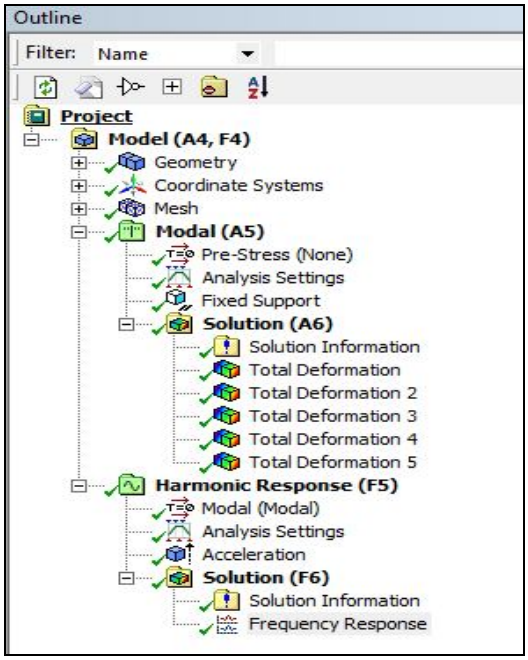


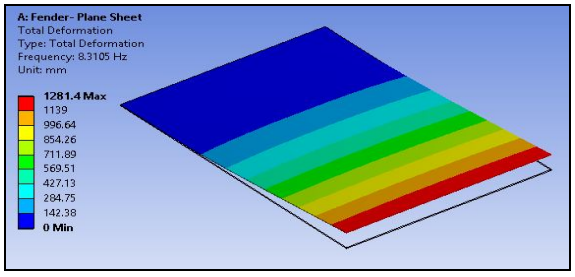
Fig.No.3 boundary condition of fender with plane sheet

C. Analysis Procedure



D. Total Deformation

The total deformation & directional deformation are general terms in finite element methods irrespective of software being used. Directional deformation can be put as the displacement of the system in a particular axis or user defined direction and total deformation is the vector sum of all directional displacements of the systems.



Total deformation of mode 1 fender with plane sheet.

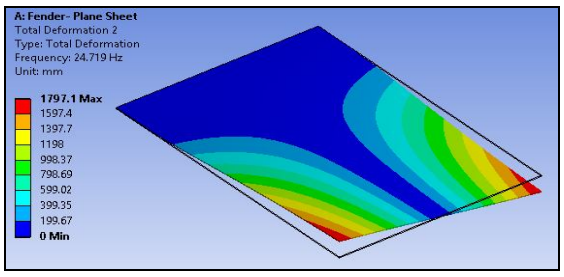


Fig.No.5: Total deformation of mode 2 fender with plane sheet.

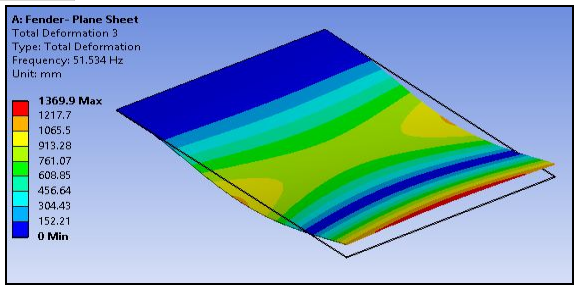


Fig.No.6: Total deformation of mode 3 fender with plane sheet

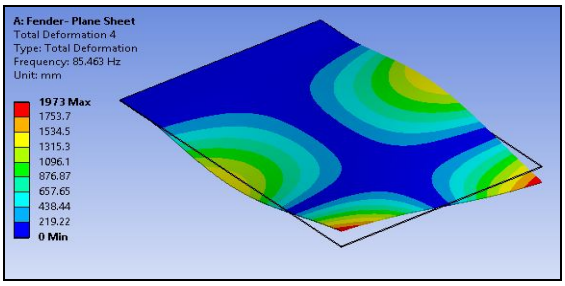


Fig.No.7: Total deformation of mode 4 fender with plane sheet

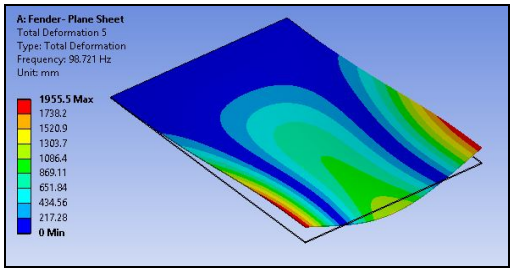


Fig.No.8: Total deformation of mode 5 fender with plane sheet

VIII. FENDER OPTIMIZATION OF SHEET WITH PARALLEL RIBS

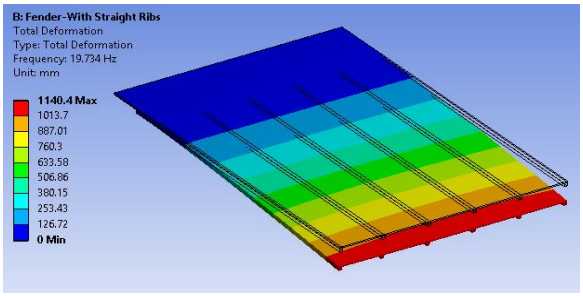


Fig no.9: Total deformation 1 of sheet with straight parallel ribs.

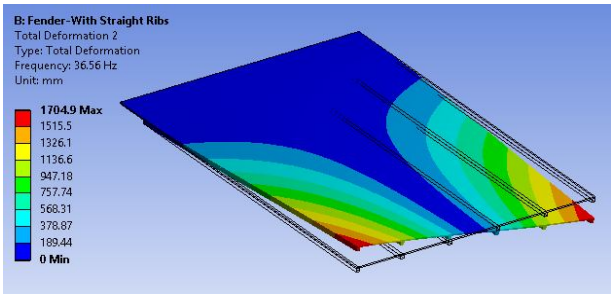


Fig no.10: Total deformation 2 of sheet with straight parallel ribs

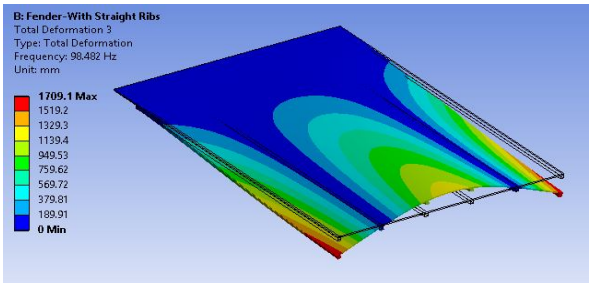


Fig no.11: Total deformation 3 of sheet with straight parallel ribs

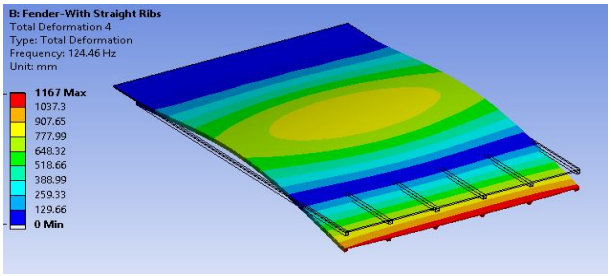


Fig no.12: Total deformation 4 of sheet with straight parallel ribs

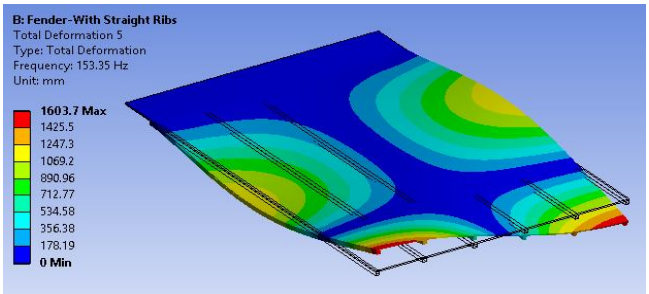


Fig no.13: Total deformation 5 of sheet with straight parallel ribs

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IX. HARMONIC ANALYSIS OF FENDER WITH PLANE SHEET

We are using plane sheet for the purpose of the harmonic analysis here in the first case, here for doing harmonic analysis we are giving excitation in the terms of acceleration of 5g at the fix end. It will give frequency response at the free end at different nodes, which will be analysed for plane sheet as well as with parallel ribs and cross ribs sheet.

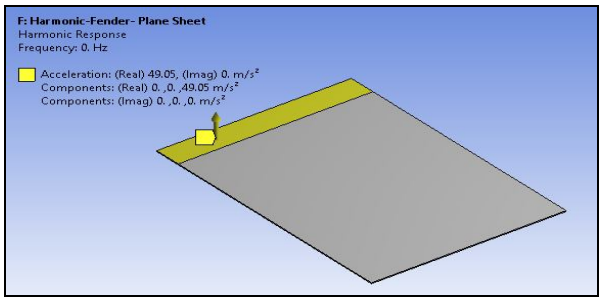

Fig no.14 Base Excitation- 5g acceleration

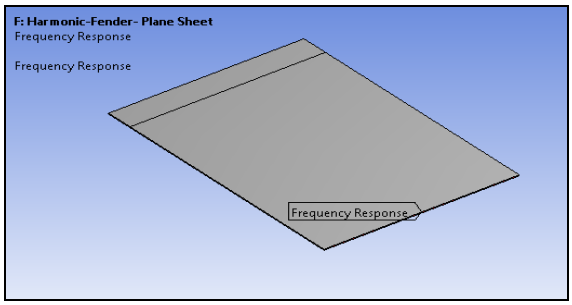

Fig No.15: Frequency Response

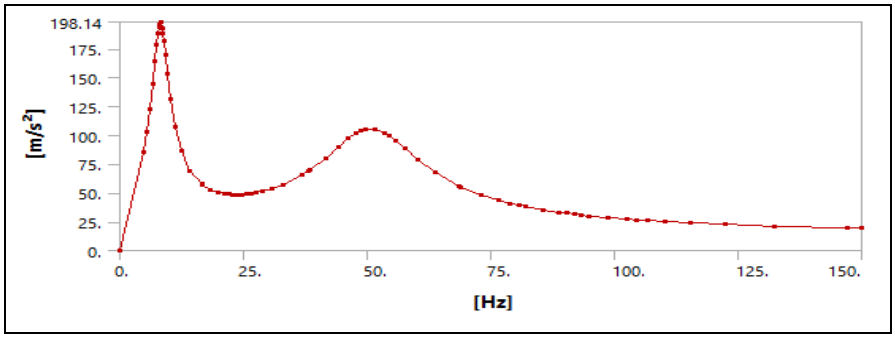

Fig No. 16: Acceleration Vs Frequency Response

X. HARMONIC ANALYSIS OF FENDER SHEET WITH PARALLEL RIBS

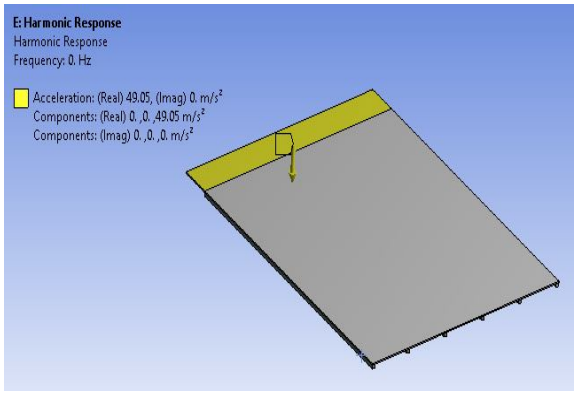

Fig no. 17 Basic Excitation 5g

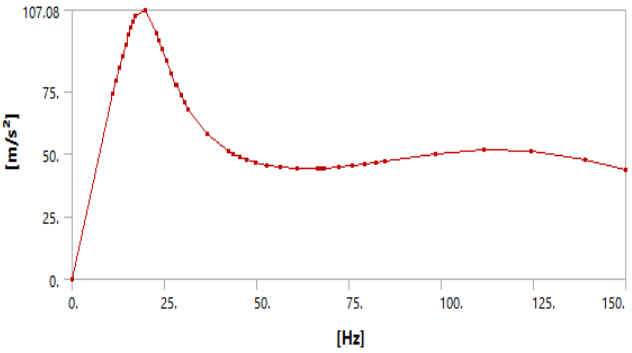

Fig No. 18 Acceleration Vs Frequency Curve

Table No. 1 : Natural Frequencies Result table

Mode no	Natural Frequency Plane sheet (Hz)	Natural Frequency Vertical ribs (Hz)	Natural Frequency Cross ribs (Hz)
1	8.3105	19.734	17.154
2	24.719	36.56	55.654
3	51.534	98.482	104.98
4	85.463	124.46	182.27
5	98.721	153.35	191.76

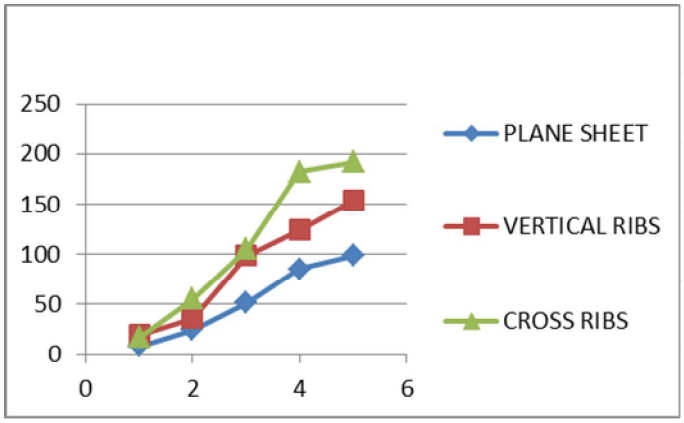

Table No. 2: Harmonic analysis result table

Sr.No	Characteristics	Plane Sheet	Vertical Rib	Cross Rib
1	Nodes	19935	23223	34750
2	Elements	3500	3770	17289
3	Acceleration(m/s^2)	198.14	107.08	194.31

XI. FFT ANALYSIS

FFT is one main characteristic in any sequence being utilized in general. To discover this property of FFT for any given sequence, many transforms are being utilized. The serious issues to be noticed in discovering this property are the time and memory management. Two unique algorithms are written for calculating FFT and Autocorrelation of some random arrangements. In between the two algorithms correlation is carried out with respect to the memory and time managements and the better one is obtained. Examination is done in between the two algorithms and is written, considering the time and memory as the only main primary requirements. Time taken by the two changes in obtaining the fundamental frequency is noted. In the meantime, the memory absorbed while using the two algorithms is also verified. Based on these aspects it is decided which algorithm is to be used for better results.

A. DEWE-43 Universal Data Acquisition Instrument

When connected to the high speed USB 2.0 interface of any computer the DEWE-43 becomes an amazing measurement instrument for data obtaining of analog, digital, counter and CAN-bus. Eight immediate analog inputs sample data at up to 204.8 kS/s and in combination with DEWETRON Modular Smart Interface modules (MSI) a wide scope of sensors are upheld Voltage Acceleration Pressure Force Temperature Sound Position RPM Torque Frequency Velocity And more The included DEWESoft application software adds incredible measurement and analysis capability, turning the DEWE-43 into a good and powerful recorder, scope or FFT analyser.

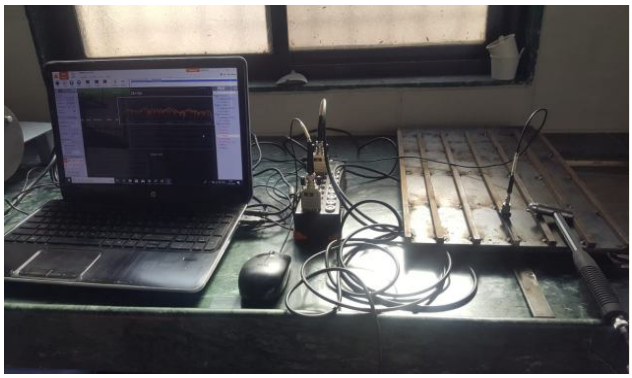

Fig.No.19 Experimental setup of FFT

XII. TEST FFT RESULTS

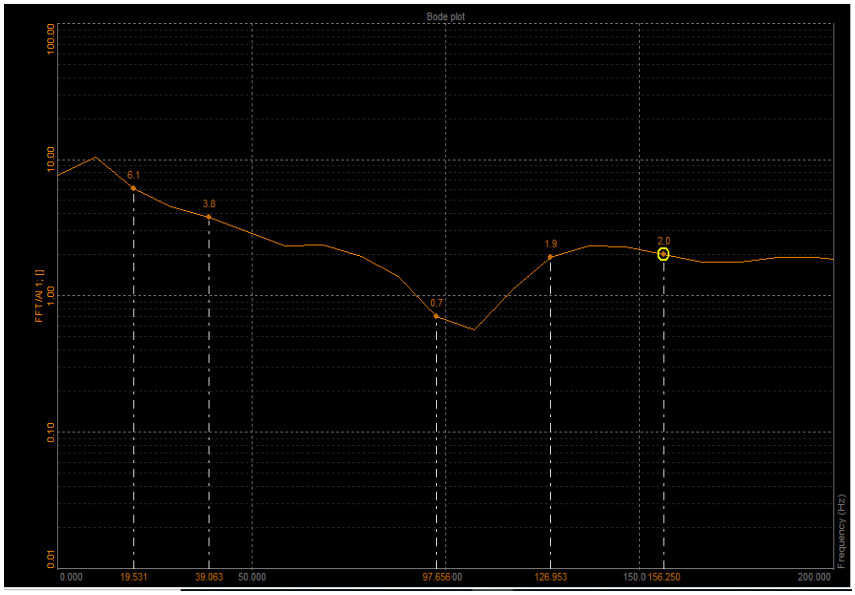

Fig.No.20 Testing result of Fender harmonic analysis

XIII. RESULT -TEST AND FEA COMPARISON

Table No.3: Result- Test and FEA Comparison

Mode No	Natural Frequency of vertical parallel ribs (FEA) (Hz)	Natural Frequency of vertical parallel ribs (FFT Test) (Hz)
1	19.734	19.53
2	36.56	39.06
3	98.482	97.65
4	124.46	126.95
5	153.35	156.25

XIV. CONCLUSION

A. The output acceleration for fender sheet with parallel ribs was least, Hence giving maximum stiffness.

B. Performing Finite Element Analysis on plane fender sheet, Fender sheet with vertical parallel ribs and fender sheet with cross ribs, following conclusions can be made.

1) Mode shapes and frequencies for all 3 fender sheets were noted and in FEA it is seen that maximum natural frequencies were given by sheet with cross ribs. Also Angular model and Angular ribbed optimized Fender's frequencies were noted and maximum frequencies were given by Angular model fender with optimized design. (With vertical parallel ribs).

2) With base excitation of 5g, maximum output accelerations for plane sheet, sheet with parallel ribs and cross ribs sheet were observed. And least output acceleration was observed for sheet with vertical parallel ribs.

C. For sheet with Vertical Parallel Ribs, the FFT testing was done and frequencies obtained from both analytical and experimental results were found matching with less than 10% error.

XV. ACKNOWLEDGMENT

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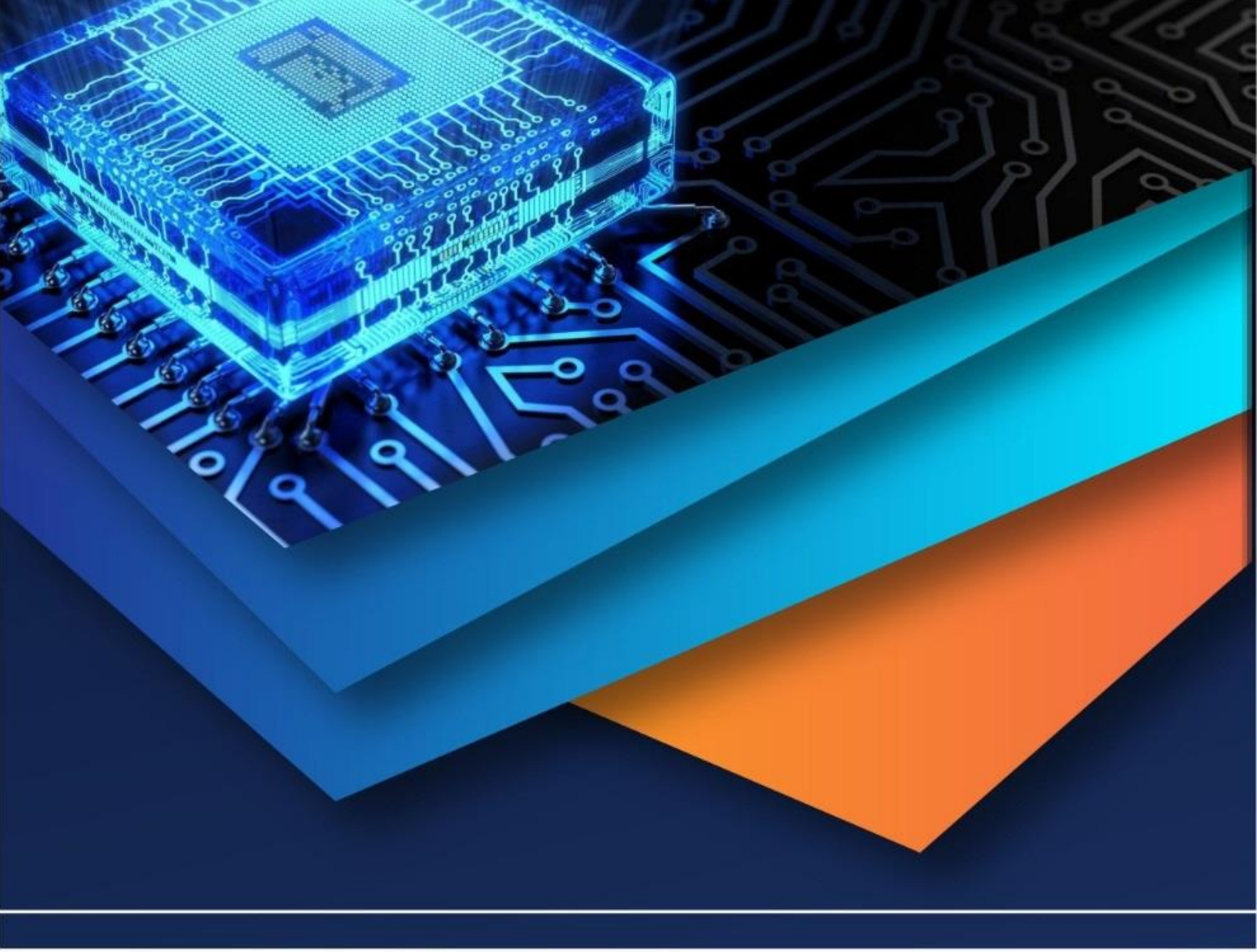

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Review Paper on Optimization of Meter Body with Flanges

PADMANABH JOSHI[1], DIGAVIJY MAHAJAN[2], SAINAND JADHAV[3]

[1]PG Student, [23] Prof. at M.E. Mechanical Engineering, NBN College of Engineering, Pune

Abstract- *Daniel flow meters are optimized for the thickness in the meter body. The meters are of different types starting from the 2" size to 36" size. Mainly used for liquid and Gas flow in the industrial application. The meter body is evaluated for the thickness measurement for the assigned pressure.*

The meters are designed as per ASME standards. The newly Designed eight path (4+4) and six path (4+2) Gas and liquid ultrasonic flow meters are having reduced weight and thickness at the center section of the meter body. Due to its reduced weight the need of Analyzing the center section is raised.

In the current project the meter body with the flanges is tested for the assigned pressure of 1800 psi and checked at three different sections along with the welded flanges and the bolts. The Bolts are having the pretension and selected as per ASME. Methodology adopted to achieve objectives

The meter Body is analyzed as per ASME Section VIII - Elastic plastic method and the linear solution is obtained and the stress developed at three pleases

1) Transducer mounts area
2) Bolt which is having pretension
3) Welding joint at flange and meter body joining section is evaluated

***Key Words*:** Optimization. Flanges and bolts, ultrasonic Flow meter. ANSYS, UG-NX,

I. INTRODUCTION

Ultrasonic flow meter used for determining fluid flow velocity within a conduit by determining the difference in transit time between interrogating ultrasonic pulses transmitted upstream between a pair of transducers and transmitted downstream between them. A high frequency clock pulse operating for one or more cycles of interrogation allows for accurate digital computation

A flow meter includes a meter body through which the fluid is passing. Bracket is used to mount the electronic enclosure assembly .The bracket is mounted on the top of the meter body through which the cables are routed till the electronic enclosure assembly. The meter body is welded by two flanges on the side. These flanges are then connected to the lined pipe flanges.

Fig. 1- Daniel Liquid and Gas Ultrasonic flow meters
Source: Emerson product catalogue

Daniel Model 3415 (4+1) and 3416 (4+2) Gas Ultrasonic Meters combine a four-path fiscal meter with an added er, while the 3417 (four-path plus four-path) ides two fiscal meters for full redundancy and acy in one meter body.

lata from two independent transmitters help ibration cycles, enabling maintenance to be condition-based instead of calendar-based. With built-in diagnostics, operators can easily track meter performance to baseline to help streamline maintenance and reduce inspection in the field for significant cost savings.

In the construction of the meter it consist of meter body to which flanges are welded and the flanges are subsequently attached to the pipeline.

II. FLOW MEASUREMENT PRINCIPLE

Fig. 1 shows the general representation of ECAP process. As we can see there are very less components required for this process like die and plunger with press.

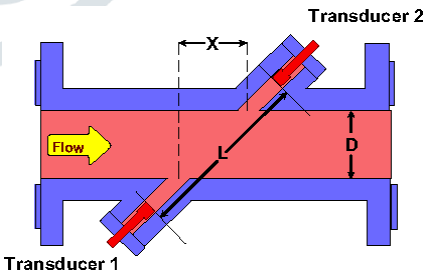

Fig 2 - Showing the mathematical form of fluid calculation in ultrasonic flow meter
Source : Emerson online catalogue

Ultrasonic flow meters measure the difference of the transit time of ultrasonic pulses propagating with and against flow direction. This time difference is a measure for the average velocity of the fluid along the path of the ultrasonic beam.

By using the absolute transit times both the averaged fluid velocity and the speed of sound can be calculated. Using the two transit times tup and tdown and the distance between receiving and transmitting transducers and the inclination angle L one can write the equations:

$$v = (L / \text{Cos}(\alpha)) \times (tup - tdown / tup \times tdown)$$
$$C = (L / 2) \times (tup + tdown / tup \times tdown)$$

Problem statement

Meter body is designed and evaluated for the applied pressure of 1800 psi. Its evaluation is done to satisfy the meter strength and to study the effect of pressure on the different cross sections. The meter body thickness is reduced, due to reduction in thickness extra amount of stress may be applied to the bolts so to understand the bolt behavior under pretension Fluid with certain pressure is flowing through the meter body and flanges are welded to the meter body. Pair of transducer is also attached to the meter body. To evaluate & study the effect of fluid pressure on the weld, transducer mount area and flanges attached to it at temperature of -425 to 100°F. How the weld joint behaves under the action of applied pressure this study is done The flanges are joined to the pipe with pipe flange So to Check the weld joint between flange to body center section at 1800 PSI applied working pressure and bolt pretension of 79406 lbf Understand the stresses developed at transducer mount area this study is done

Scope and Methodology

Liquid Ultrasonic Meter is a device which is used to measure the liquid flow rate through pipes. Meter needs to evaluate for its strength. This product should be in compliance with ASME BPVC, Section VIII, Division 2, and Part 5. As per the ASME requirement, thick vessels should be evaluated for strength as per following clauses:

This problem is solved by two types Type-1: Linear Analysis of Flange and meter bodies against the applied pressure validated by analytical method, & supported by experimental methods

Type-2: 5.2.4: Elastic-Plastic Analysis Method for protection against plastic collapse 5.3.3: With acceptance criteria for protection against local failure

III. LITERATURE REVIEW

[1 Stress analysis by elastic plastic method had described many researches in past many years, these methods help the engineers to identify the area of coarsen. [1] Discussed an overview of working principal and over all view of the meter from the catalogues of Daniel Measurement control to understand the product categories and the working methodology as well as the construction of the product

[2] Patent of Daniel measurement control by Padmanabh Joshi on the meter Flow Meter having electronic enclosure assembly to understand the changes in the existing meter, An ultrasonic flow meter includes a meter body having a central conduit that serves as a fluid passageway for conducting the fluid (liquid or gas) that is being transported in the pipeline, and a pair of flanges for connecting the meter between aligned sections of the pipeline. The body of the flow meter may also be referred to as a spool piece. The ultrasonic flow meter further includes two or more transducer assemblies, each secured in a dedicated port that is formed in the meter body. To measure fluid flow through the meter, the transducer assemblies of the pair are positioned such that the piezoelectric elements of the transducers are adjacent to the inner surface of the spool piece, and such that each transducer faces the other of the pair, which is positioned

oposite side of the fluid passageway. The assemblies transmit and receive electric signals orth across the fluid stream. Understanding of n of meter is done through this paper.

[3] Wiley-ASME Press Series List from Maan H. Jawad regarding the ASME codes studied the chapter 3 and chapter1 regarding the stress distribution and the membrane stress developed in the cylindrical shell.

[4] ASME section 5.3.3 and 5.3.2 is studied for the Elastic analysis and elastic plastic analysis it states that use of elastic stress analysis combined with stress classification procedures to demonstrate structural integrity for heavy-wall pressure containing components may produce non conservative results and is not recommended".

[5] Thesis of Frode Tjelta on "comparison study of pressure vessel design" using different standards due to a recent pressure vessel design error the design methods used for pressure vessel design is investigated. Several codes are currently available for design and analysis of pressure vessels. Two of the main contributors are the American Society of Mechanical Engineers providing the ASME VIII code, and the Technical Committee in Brussels providing the European Standard.

Methods written in bold letters will be considered in this thesis .The ASME VIII code contains three divisions covering different pressure ranges:

Division 1: up to 200 bar (3000 psi)

Division 2: In general

Division 3: for pressure above 690 bar (10000 psi)

In this thesis the ASME division 2 Part 5 will be considered. This part is also referred to in the. Here different analysis methods are described, such as:

Elastic Stress Analysis Limit Load Analysis

Elastic Plastic Analysis. The Elastic Stress Analysis method with stress categorization has been introduced to the industry for many years and has been widely used in design of pressure vessels. However, in the latest issue (2007/2010) of ASME VIII div. 2, this method is not recommended for heavy wall constructions as it might generate non-conservative analysis results. Heavy wall constructions are defined by ($R/t \leq 4$)

[6] Paper on The e valuation of nuclear components using finite element analysis (FEA) does not generally fall into the shell type verification adopted by the ASME Code. Consequently, the demonstration that the modes of failure are avoided sometimes is not straightforward. Allowable limits, developed by limit load theory, require the Computation of shell membrane and bending stresses. How to calculate these Stresses from FEA are not necessarily self-evident. One approach to be considered is to develop recommendations in a case-by-case basis for the most common pressure vessel geometries and loads based on comparisons between the results of elastic and plastic FEA.

IV. CONCLUSION

Meter Body with pair of flanges is safe under the application of 1800 PSI internal pressure and bolt pretension of 79406 lbf

The Flange joint area under the bolt pretension and the transducer mount area are safe and justified by ASME

ACKNOWLEDGMENT

It is indeed a great pleasure and moment of immense satisfaction for me to present a Thesis report on "Optimization of Meter Body with Flanges" amongst a wide panorama that provided us inspiring guidance and encouragement, I take the opportunity to thanks to thanks

those who gave us their indebted assistance. I wish to extend my cordial gratitude with profound thanks to our internal guide Prof. Digavijy mahajan it was his inspiration and encouragement which helped us in completing my work.

I am also thankful to Prof. S. M. Jadhav, PG Co-ordinator for his overwhelming support and invaluable guidance. My sincere thanks and deep gratitude to Head of Department, Prof. D. H. Burande and other faculty members; but also to all those individuals involved both directly and indirectly for their help in all aspect of the Project.

At last but not least I express my sincere thanks to the Institute's Principal Dr. Y. P. Reddy**,** for providing us infrastructure and technical environment.

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[4] ASME section 5.3.3 and 5.3.2 is studied for the Elastic analysis and elastic plastic analysis it states that use of elastic stress analysis combined

[5] A Comparison Study of Pressure Vessel Design Using Different Standards

[6] Investigating ASME allowable loads with Finite element Analyses

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Vibration Analysis of Laminated Hybrid Composite Material for Racing Car Panels

Akshay K. Jadhav [1], Manoj M. Joshi [2] Prof. S. M. Jadhav[3]
[1, 2, 3]*PG Student, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune-411041, India*

Abstract: ***The present study deals with the vibration analysis of the E-Glass fiber (60%) and Kevlar (40%) composite material plate subjected to free vibrations. The analysis commences with the review of the previous works done in order to gather a rough idea regarding the said matter. The study proceeds with the determination of elastic constants of the bar used for characterization, prepared in the laboratory by performing the mechanical testing of the specimen. Vibration behavior of composite materials using FFT analyzer, using impact hammer for excitation. The modal testing of the Composite material is done in the laboratory and the results obtained experimentally are compared with the results obtained from the program based on FEM. The analysis further proceeds with the study of the effects of the various parameters such as increase in the strength, Different ply orientation, changing the layer of composite material etc. using FEA. From the convergence studies, a mesh is found to supply good accuracy. The vibration behavior of Composite material plate studied. This paper elaborates the design and analysis of car body panel of team NBN Sinhgad which has participated in 2019 racing.***

Keywords: Natural frequency, Hybrid composite materials (E-glass and Kevlar-29fibre), finite part methodology (FEM), excitation frequency, Solid Works Simulation, etc.

I. INTRODUCTION

Composite materials Kevlar Fiber- 29 (40%) and E-Glass Fiber (60%) are extending the horizons of all branches of engineering as they have marked their presence in different engineering structures with the domain ranging in the field of mechanical, aerospace, marine, civil, and biomedical, Oil and petroleum industry, mining process, etc. The Composite undergo the process of optimization where materials are combined in such a way that their virtues such as very well specific strength, good fatigue resistance, and good resistance, can be put to use in a better way while reducing the effect of their deficiencies. The term “car chassis panel” is a quite a renowned one owing to its applications in chassis cover panels, car dashboard , engine safety guards, etc. composite plate play a pivotal role as the structural units in the heavy machinery and tools used in product manufacturing heavy engineering industries. Static structures employing cantilever panels have significant applications used in car decor, fan blades, interior design parts, home appliances and industrial instruments, particularly in design for racing car chassis cover panels.

A. Importance of The Present Study

The structures implementing of car chassis panel are subjected to high Static loadings. The composite plates are also subjected to different types of loads due to transverse loads. The bar is constantly subjected to axial periodic forces as they form the part of the axial components of aerodynamic or hydrodynamic forces acting on the plates.

It is therefore, quite significant for design, safety and life of the machinery. Failure of bar often occurs as a result of sustained bar vibration at or near natural frequencies; hence knowledge of these frequencies is of fundamental importance. Moreover, to ensure reliable and economic delivery of the designs of the structures, it is necessary to estimate the vibration characteristics of those structures accurately.

B. Problem Statement

Vibration analysis of plate is required for efficient performance prediction and high specific strength. Complexity of configuration such as reduced weight of material, increased strength of plate etc. need to be studied for better functioning of such bar. Its validation using experimental and FEA approach.

1) Objectives

a) Experimental analysis of plates using free vibration testing at Static conditioning using FFT analyzer.

b) FEA modal vibration analysis of composite plates.

l out the good alternate composite material as compare to previous material.

2) Scope

a) In this project element considered is a thin plate.
b) The present study is aimed to analyze the Static properties of composite material.
c) Find vibration parameters of plates analyzed for computational simplicity.
d) Find natural frequency of plate testing free vibration test.
e) Find natural frequencies hybrid composite material plates will be found using experimental and FEA approach, no external load is applied to the plate element.
f) Tests to study the effect of parameters such changing layer sequence, ply orientation of material.
g) In this project, main aim is to find out high strength of material after testing the 2 different composite materials combination samples. Selected the best material result we are found in these 2 different composite materials. We are using these experimental results to compare with FEA model.

3) Limitations

a) To analyzed the vibration in composite plates in set at particular set parameter.
b) The plate's element is restricted to be flat and uniform in thickness without changing the length and thickness.
c) For this project the plates is single sectors with rectangular shape.

II. LITERATURE REVIEW

A. R. Chandra et al "Damping studies in fiber-reinforced composites" [18] research on damping in fiber-reinforced composite material and structures with polymer composites has been reviewed in this paper. Selecting composites material checking which methodology applicable is to damping analysis is described. Further, paper presents some important works related to improving the damping models, improving the damping composite material are reviewed.

B. E.C. Botelho et al "Damping behavior of continuous fiber/metal composite materials by the free vibration method" [16] researcher has improved the current material Fiber metal laminates (FML) for aircraft structure with their mechanical characteristics and low density. Vibration testing was conducted and that experimental results were compared with experimental values showed good as compare to theoretical values.

C. J. Chandra das et al "Effect of nano-clay addition on vibration properties of glass fiber reinforced vinyl ester composites" [15] researcher represents the experimental study of hybrid nano-composite laminates by reinforcing materials free vibration and damping characteristics. Dynamic results show that the nano-scale dispersion in the matrix and E-glass fiber enhances the internal damping of hybrid composites.

D. Thingujam Jackson Singha et al "Characterization of Kevlar Fiber and Its Composites: A Review" [10] interest of using fiber reinforced composite has to replacing the traditional materials in various applications. Kevlar fiber, due to its unique properties and strength of material and modulus has become very common for reinforced composite material.

E. Mehmet Bulut et al "Experimental investigation on influence of Kevlar fiber hybridization on tensile and damping response of Kevlar/glass/epoxy resin composite laminates" [9] to study the investigation of tensile and damping behavior of this composite materials. To calculating the damping propriety forms logarithmic decrement method to determine the dynamic characteristics samples. Examine the fiber angle and frequencies using ANSYS.

F. Mohit Sinha et al "Design, Material Selection and Fabrication of a Race Car Body Panel" [6] researcher aims at the developed of FRP body panel for FSAE race car. Without losing the strength of vehicle to achieve the high power. Body panel is an internal part of body but main aim is to improve the aesthetic look of vehicle. Weight reduction in this are also become important factor.

III. METHODOLOGY

A. The project aims to study the vibration characteristics of plates with different composite materials. Experimental analysis of composite plate element using FFT analyzer for plate vibration analysis with respect to boundary conditions.

B. The study commences with the development of a model of the composite material which is subjected to free-free vibrations and cantilever type boundary conditions.

C. FEA analysis using plates for comparing the Experimental results and FEA results and location as specified in above point where is the maximum stress

Developed and finding natural frequencies with respect to respective mode shapes.

odal analysis is done with a frequency range of 0 Hz to 2500 Hz. The above procedure is adopted to investigate the ce of various parameters.

IV. MATERIALS DETAILS

Table.1 Material properties

Sample 1: Glass fiber-E and Kevlar-29

Tensile strength	ASTM D 638-2014	2900 Mpa
Modulus of Elasticity	ASTM D 638-2014	70 Gpa
Shear strength	ASTM D 5379-12	36.84 Mpa
Izod impact test	ASTM D 256-2005	450 kj/ m^2
Density	ASTM D 792-2000	1.44g / cm^3
Poisons ratio	-	0.3

Table.2. Sample 2: Glass fiber-E and Kevlar-29

Tensile strength	ASTM D 638-2014	2758 Mpa
Modulus of Elasticity	ASTM D 638-2014	62 Gpa
Shear strength	ASTM D 5379-12	30.5Mpa
Izod impact test	ASTM D 256-2005	300 kj/ m^2
Density	ASTM D 792-2000	1.66g/ cm^3
Poisons ratio	-	0.3

Table.3.Sample 3: Glass fiber –E (Source-internet)

Tensile strength	3450 Mpa
Modulus of Elasticity	76 Gpa
Shear strength	34 Mpa
Izod impact test	-
Density	2.58g/ cm^3
Poisons ratio	0.2

Before starting the Experiment testing on hybrid composite plates, we are testing the design model in FEA software. Required such Mechanical properties in E-glass fiber and Kevlar fiber-29 to analyzing the composite material. We are manufacturing specimen plates as per standard dimensions for testing and after getting testing results value we have used values in FEA software.

V. SPECIMEN DESIGN

When selecting final Hybrid composite material we have manufacture composite material specimen for solving the modal analytical results. We have manufactured specimen which are basic sample at different ply orientation, different layer sequence. While getting the mechanical properties of hybrid composite materials to solve in FEA. We are analyzing 3 samples by using FEA with same methods to finding the best frequency of material which is suitable for manufacturing racing car panels.

Fig. 1. Tensile strength testing (ASTM D638-2014)

Fig. 2. Shear strength (ASTM D5379-12)

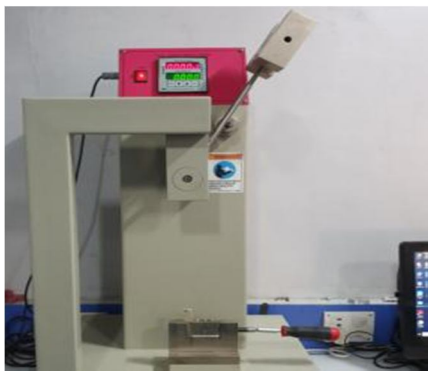
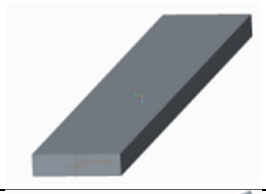
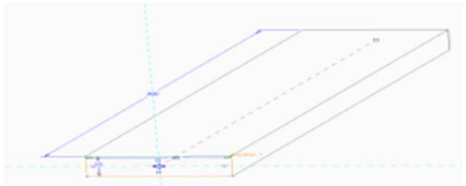
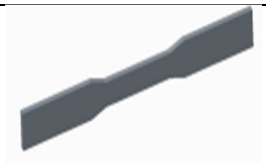
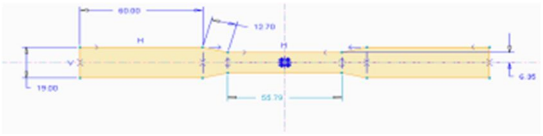
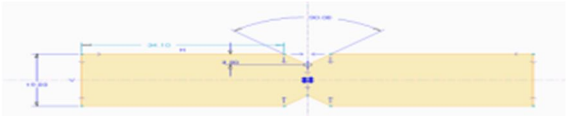
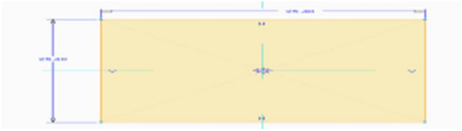
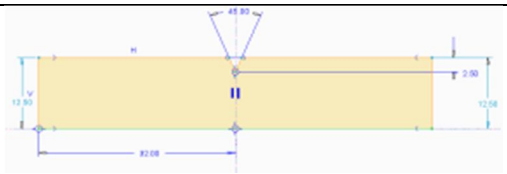


Fig.3. Izod impact test (ASTM D 256 - 2005)

As shown in above (fig.1,2 and 3) our hybrid composite material testing experiment required material properties is tensile strength, modulus of elasticity, shear strength, density of material and poison's ratio etc. this specimen plate test has done by material laboratory.

Table.4. Specimen design

Name	Testing Specimen	Specimen Dimensions (CAT Part)
Hybrid Composite plate		
Tensile test		
Shear strength		
Density		
Izod impact test		

VI. FEA RESULTS

When selecting final Hybrid composite material we have manufacture composite material specimen for solving the modal analytical results. We have manufactured specimen which are basic sample at different ply orientation, different layer combination. While getting the mechanical properties of hybrid composite materials to solve in FEA. We are analyzing 3 samples by using FEA with same methods to finding the best frequency of material which is suitable for manufacturing racing car panels.

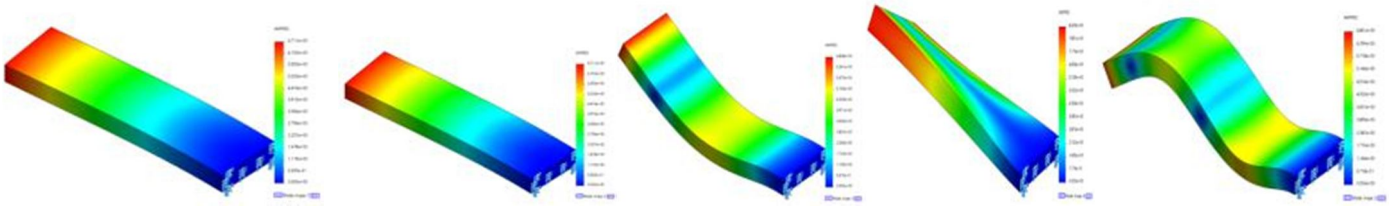


Fig.4. Mode shape of Hybrid composite materials Kevlar - 29 + E- glass fiber-sample 1

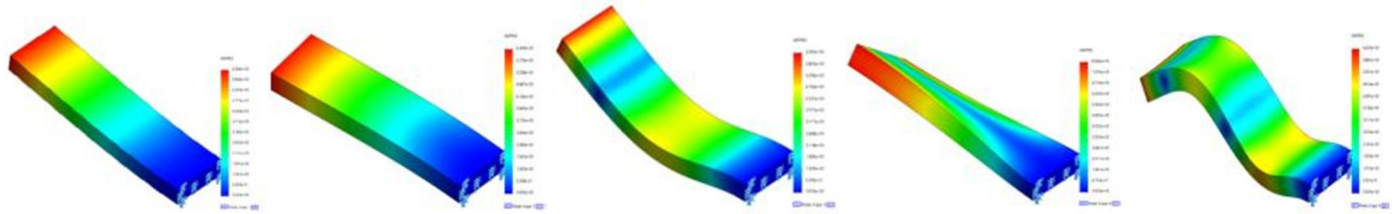


Fig.5. Mode shape of Hybrid composite materials Kevlar - 29 + E- glass fiber-sample 2

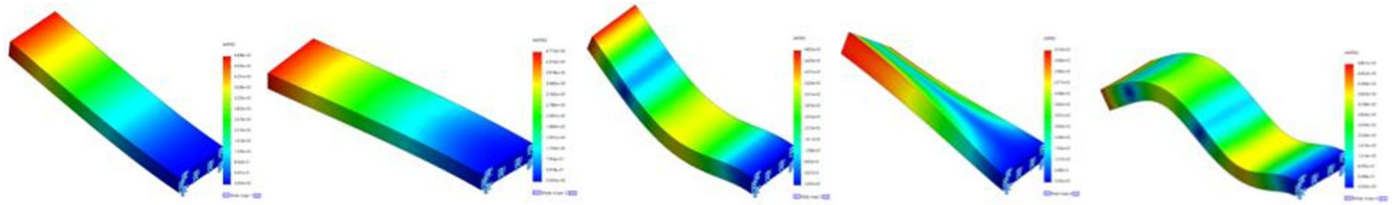


Fig.6. E-Glass fiber results

Table.5. Mode shape of Hybrid composite materials Kevlar - 29 + E- glass fiber

Materials	Frequency (HZ)				
Kevlar-29 + E-Glass fiber (Sample 1)	1.28	60.2	305.8	380.1	1648.1
Kevlar-29 + E-Glass fiber (Sample 2)	1.34	28.9	141.2	385.1	1422.7
E- Glass fiber	2.44	80.1	175.3	345.1	1210.8

Above the Mode shape table. 5. FEA results we are analyzing, Kevlar-29 + E-Glass fiber (Sample 1 and sample 2) hybrid composite materials results is better frequency given as compare to the E-Glass fiber. We are selecting the Kevlar-29+ E-Glass fiber hybrid composite materials for experimental testing. In this FEA results we have help to find out another best composite material which is used in manufactured racing car front panels to protect chassis.

A. Weight Reduction

Table.6.Weight reduction

Plates	Mass	Weight
Kevlar-29 + E-Glass fiber (Sample 1)	0.0996 kg	0.97608 N
Kevlar-29 + E-Glass fiber (Sample 2)	0.0702 kg	0.68796 N
E- Glass fiber	0.171 kg	1.6758 N

As shown in above weight reduction table 6.Indicate that the hybrid composite Kevlar -29 + E-glass fibre material weight reduced in sample-1is 0.996 kg and sample-2 is 0.0702 kg as compared to previous composite E-glass fibre material weight is 0.171kg. Above table prove that the selecting material is good and reduced weight as compare to existing material.

B. Ply Orientation

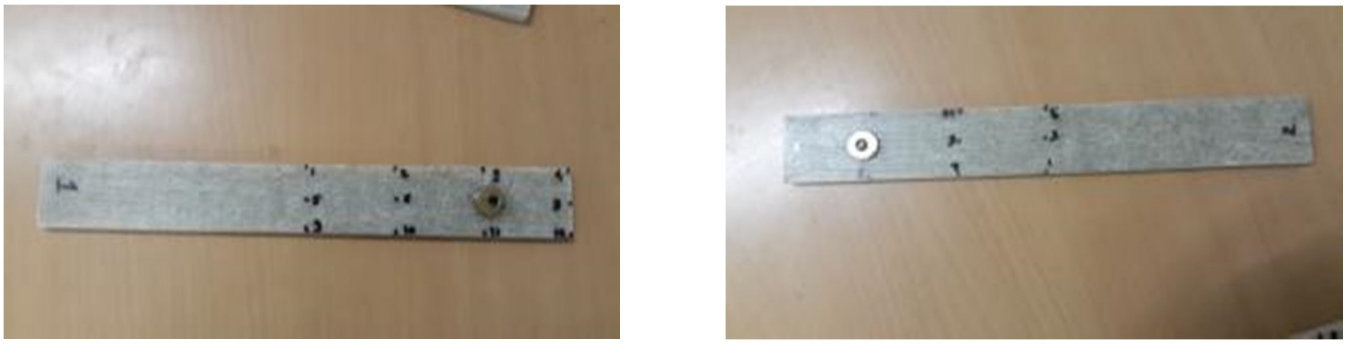
Table.7.Ply orientation

Sr. No.	Ply orientation	Details
1	0°	Makes tubes resistant to longitudinal bending and axial tension/ compression.
2	90°	Resist internal / external pressure.
3	±45°	Resist pure torsion.

We are conducted this test for finding out alternate good hybrid composite material for manufacturing chassis front panels. Complete chassis panels manufacturing is not possible because chassis design are under working process and our main aim to given another suitable composite material. We are only fabricated sample plates of 29-Kevlar fiber (**K**) + E- glass fiber (**G**) material.
ome composite material properties to use in FEA results analyzing, we have fabricated specimens according to their
dard.

Table.8. Fabrication of plate's procedure

Materials	No. of layers	Layer sequence	Ply-Orientation	Aspect ratio of plates
Kevlar29 + E-Glass fiber Sample1	8	G-K-G-K-G-K-G-K	0/+45/-45/90/90/-45/+45/0	1:2
Kevlar-29 + E-Glass fiber Sample2	8	G-G-K-G-G-K-G-G	0/-45/+45/90/90/+45/-45/0	1:2



a)Sample -1 b)Sample -2

Fig.7. Kevlar-29 (K) + E-Glass fiber (G) (sample 1and 2)

VII. EXPERIMENTAL SETUP

After getting the FEA results we have manufactured hybrid composite sample plates. The test frame used in the system is designed for different boundary conditions i.e. free-free, cantilever and fully clamped The procedure began with the proper fitting of the test specimen followed by ensuring of connections of FFT analyzer, transducers, laptop, cables and modal hammer or exciter to the system. Impact hammer was used to excite the plate at selected points and the resulting vibrations were recorded by means of an Accelerometer held to the specimen through the plate. At each selected point, the hammer was made to strike for three times means total length of composite plate is 300 mm, width 40 mm and thickness 10 mm. After 150 mm we are given boundary condition remaining plate divided into 3 part 50mm each plate distance to obtain the Frequency Response Function (FRF).

Fig.8. Experimental setup

The screen displayed the average value of the response. The modal Hammer, Accelerometer, FFT Analyzer and the FRFs, FEA are described and shown in the above Fig.8. The strokes made were ensured to be perpendicular to the surface of the plate. To maintain the coherency of the results, the strokes should be made at approximately same points. The peaks of the FRFs provide the frequencies. Output is shown on the analyzer screen by means of pulse software. Then same procedure is carried out by finite thod, given the boundary condition on this plate and getting the FEA results.

VIII. RESULTS OF VIBRATION ANALYSIS

A. Kevlar-29 + E-Glass fiber (Sample 1)

Table.9: Comparison of the experimental results with the results obtained from numerical analysis in terms of frequencies for plates.

Frequency number	Experimental values (HZ)	Numerical values (HZ)
1	2.44	1.28
2	95.21	60.2
3	361.3	305.8
4	419.9	380.1
5	1945.8	1648.1

Graphical-Comparison

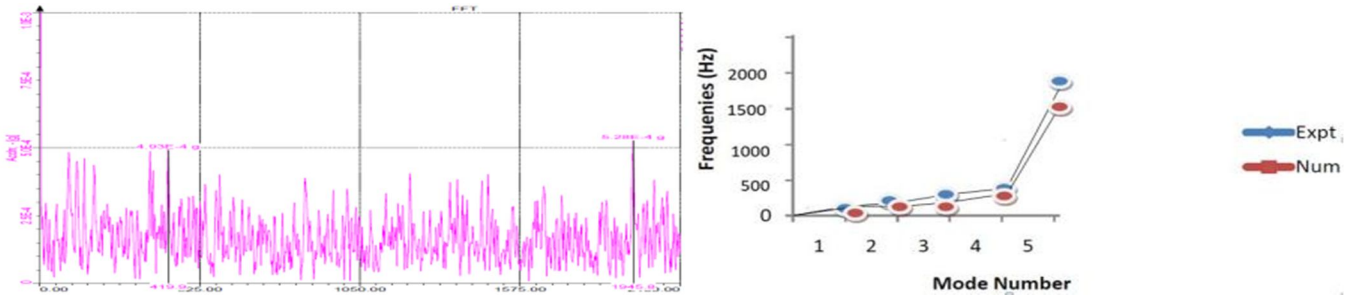


Fig.9. comparison of the experimental results with the results obtained from analysis results

Above Fig.9 shows the comparison between the Experimental and FEA results of various frequency in different mode shapes it's almost near the experimental values but the difference between the frequencies is 9% - 11 %. Which is indicates that the selection of hybrid composite material Kevlar-29 + E-Glass fiber (sample -1) composition is suitable for the practical purpose as compare to E-glass fiber.

B. Kevlar-29 + E-Glass fiber (Sample 2)

Table.10: Comparison of the experimental results with the results obtained from numerical analysis in terms of frequencies for plates.

Frequency number	Experimental values	Numerical values
1	2.44	1.34
2	141.6	128.9
3	151.4	141.2
4	417.5	385.1
5	1989.7	1422.7

Graphical-Comparison

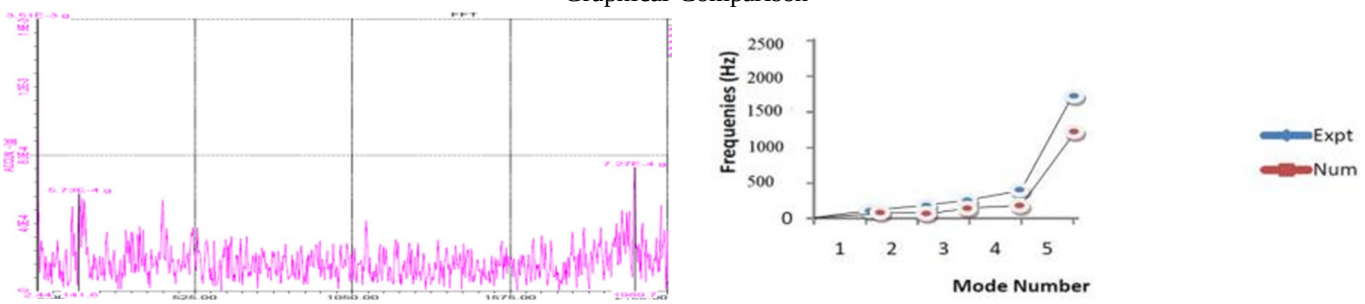


Fig.10. comparison of the experimental results with the results obtained from analysis results

Above fig.10. Shows the comparison between the Experimental and FEA results of various frequency in different mode shapes it's almost near the experimental values but the difference between the frequencies is 6% -8 %. Which is indicates that the selection of hybrid composite material Kevlar-29 + E-Glass fiber (sample -2) its natural frequency of material is less than the sample 1 in different mode shape.

IX. CONCLUSION

The study shows the development of new hybrid composites using Hand-lay-up method with the combination of Kevlar-29 fiber (40%) and E-Glass fiber (60%). The static mechanical, free vibration and chemical resistance properties were examined with the effect of particle strength of material and weight percentage of fiber content by standard experiments. The following conclusions can be drawn.

A. From the results presented it is clear that the change in fiber orientation and laminate stacking sequence yield to different static behavior of the component .Different layers sequence apply different contributions to the overall stiffness of the plate depending upon the location from midline.

B. From FEA mode list sample-2 table 5. show the increase in number of layers sequence from (G-G-K-G-G-K-G-G) an increase in the flexural frequencies and for stacking sequence of (0/45/+45/90/90/-45/+45/0) are observed. Also sample-2 reduced weight and increase strength shown that the FEA Weight reduction table 6.For stacking sequence of sample-1(0/+45/-45/90/90/+ 45/-45/0) decrease in modal frequency and flexural are observed. Which is also sample-2 experimental process shown in Fig.10.Comparison of the experimental results with the results obtained from analysis results 6% - 8% error is occurred as compared to sample-1 is 9%-11%.

C. The laminate only (0/45) of fibers has lowest frequency than the other lamination schemes and most of the fibers are oriented at 0deg. direction and thus appropriate for flexural modes Infect this can be applied that the fibers oriented at 0deg. Are appropriate for flexural loads and fibers oriented at 45deg. are appropriate for tensile loads. Finally an optimum number of layer sequences are selected to attain increase in strength of hybrid composite material. The desired vibration characteristics can be attained for the blade without modifying the shape.

X. ACKNOWLEDGMENT

It is indeed a great pleasure and moment of immense satisfaction for me to present a dissertation report on **"Vibration Analysis of** Laminated Hybrid Composite Material for Racing Car Panels" amongst a wide panorama that provided us inspiring guidance and encouragement, I take the opportunity to thank those who gave us their indebted assistance. I wish to extend my cordial gratitude with profound thanks to our internal guide Prof. M. M. Joshi. It was his inspiration and encouragement which helped us in completing my work.

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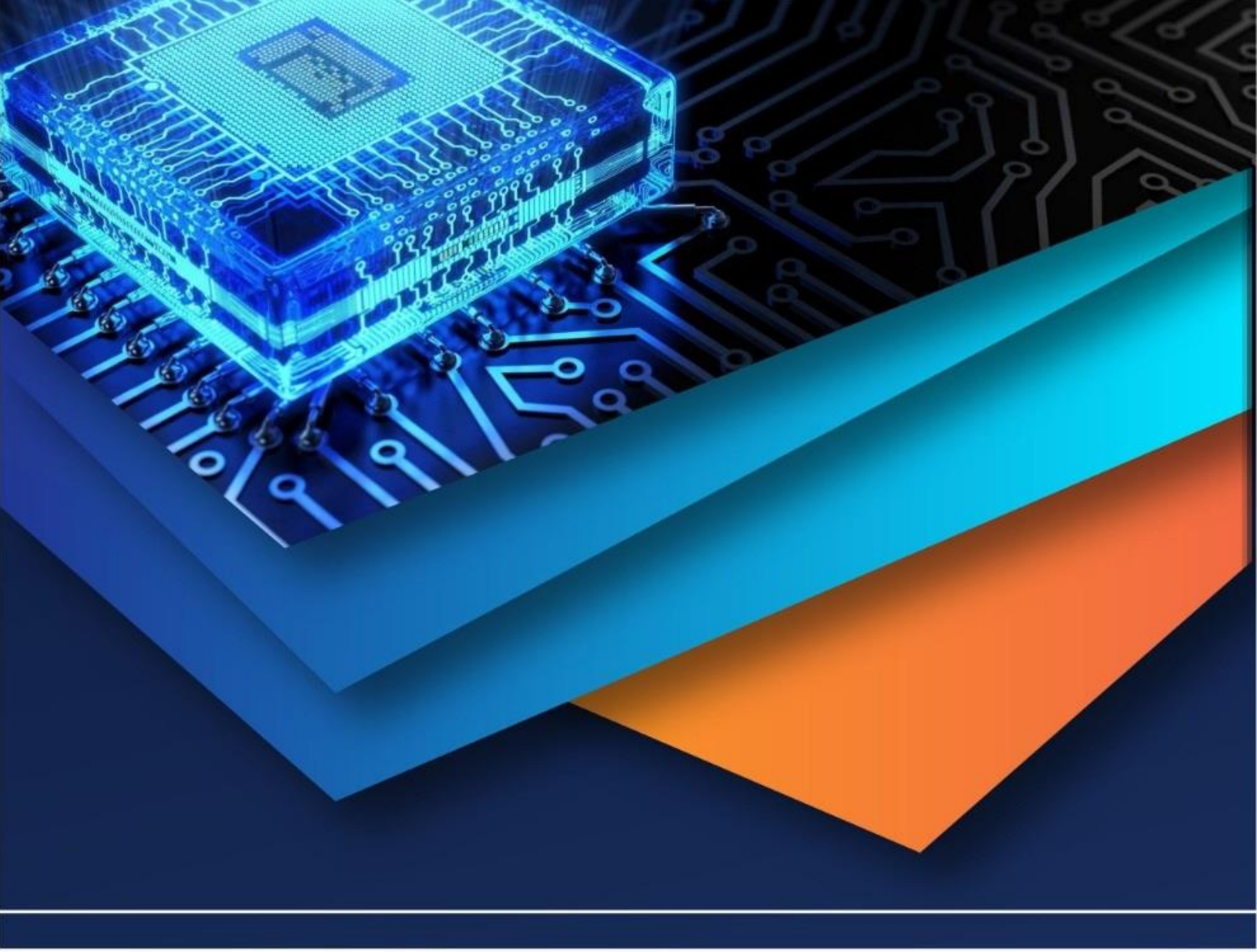

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Experimental Analysis of Trapezoidal Corrugated Web Beam with Stiffener with Hole for its Strength and Modes

Prathmesh K Bhadane[1], Prof. Manoj M Joshi[2], Prof. Sainand. M .Jadhav[3]
[1]*PG Student,* [2, 3]*Professor,Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune-411041, India*

Abstract: ***Trapezoidal beam have been employed in building construction as floor joist & as arched roof girder of 90 feet span. Their use has been also expanded to many industrial & commercial structures., the advantages of Trapezoidal construction have been well recognized & they have been used extensively in Europe because of limited range of rolled wide flange sections available & the lower cost of labour. To govern lateral torsional buckling of web, shape of web can be changed in to trapezoidal or triangular sinusoidal to increase area of contact between web and flange. The project deals with modal analysis of I-section beam and also trapezoidal beam with circular opening having stiffener. Comparing the working frequencies of beam to avoid resonance with earthquake frequencies.***

Keywords: Finite element analysis, modal analysis, I-Section Beam, Trapezoidal Corrugated Web Beam

I. INTRODUCTION

The expanded beams have been widely used in the past in different countries of the world like the U.S.A, the U.K, Japan, Germany & other European countries for building, bridges, industrial structures & ship construction under various names, such as 'castellated' beam,'Serrated' cannels & angle & others. The idea of splitting & expanding beams to increase their sections modulus was first used, however, in about 1910, by H.F Horton of the Chicago Bridge & Iron Works. Castellated beam have been employed in building construction as floor joist & as arched roof girder of 90 feet span. Their use has been also expanded to many industrial & commercial structures. Since 1949, the advantages of castellated construction have been well recognized & they have been used extensively in Europe because of limited range of rolled wide flange sections available & the lower cost of labor. In United States, castellated beams have been used as floor joists, roof girders & in trailer & cranes. Also in 1952, the Texas State Highway Department adopted the castellated beam method for the two simple span bridge with span length of 100 feet & 65 feet respectively. In Zealand the castellated beams were used in 1956 for a three span continuous bridge over the Mangaturange stream. The concrete slab was placed on top. These beams also have been used in composite construction. An excellent example of modern composite construction is the twenty-one storied office building in Seattle named the Washington building. The beams were castellated & reinforcing bars bent & welded to the top flange. In short, castellated beams have been used in a wide variety of applications, such as roof beams & rafter in both simple span & cantilever construction, floor beams, tier building, rafter portions of rigid frames, pipe bridges, crane bridges, bog under frames, grift & other special applications.

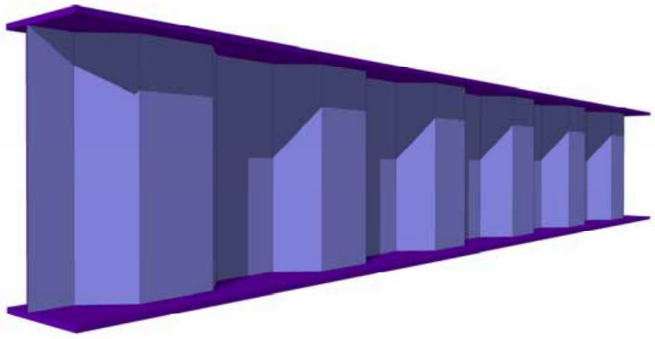


Fig.1. Trapezoidal Corrugated web Beam.

II. METHODOLOGY

The design of selection of standard I- section beam as per BIS (808:1989) as shown in fig.1 To build up a 3-D solid model and perform stress analysis of I-section beam as per BIS (808:1989) by using FEA software, such as ANSYS.To perform vibration analysis of I-section beam as per BIS(808:1989) by using FEA software's such as ANSYS are also compared with theoretical calculation.To perform strength and modal analysis of modified I-section beam hole with stiffner by using FEA software's such as ANSYS. To perform strength and modal analysis of modified Trapezoidal corrugated web beam hole with stiffener by using FEA software's such as ANSYS. To perform the vibration analysis of modified Trapezoid corrugated web beam and modified I-section beam by using FFT analyzer as shown in fig.To compare and validate the result obtained by using software analysis with results obtained by experimental Analysis for vibration for modified Trapezoidal corrugated web beam and modified I-section beam.

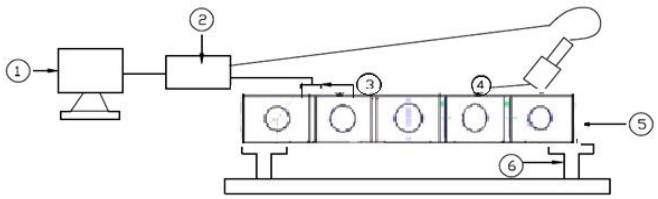


Fig.2. Proposed experimental set-up for vibration analysis
1. Computer, 2.Analyzer, 3.Accelerometer, 4.Hammer, 5.Test specimen, 6.Support

III.OBJECTIVES OF WORK

A. To Study Structural Behaviour of trapezoidal corrugated web Beam with stiffeners with hole and comparison with I- section beam with stiffener stiffeners with hole also find out working natural frequencies of both beams.
B. To improve the performance of trapezoidal castellated web beam hole with stiffener by transverse stiffeners.
C. To increase natural frequencies of I-section beam with change in web with hole and stiffener to avoid resonance with earthquake frequencies.

IV.PROBLEM DEFINITION

The failure modes comprise shear, flexural, lateral torsional buckling, rupture of welded joints and web post buckling failure modes were investigated by numerically experimentally & analytically. But detailed experimental work of beam with stiffeners for trapezoidal corrugated web beam was not carried out. Therefore in this project behaviour of trapezoidal castellated web beam with Stiffeners under loading and Vibration analysis are carried out experimentally.

V. LITERATURE REVIEW

The project deals with experimentation and analysis of Trapezoidal corrugated web beam hole with stiffener and I-section beam hole with stiffener so number of papers are available which describes the limitations of using I section beams, benefits of built up section, according effect, various shapes that can be used as web, design consideration in trapezoidal corrugated web and also effect of corrugation angle into strength of beam.

Khalid et.al,[1]The paper is devoted to the behavior of mild steel structural beams with corrugated web subjected to three-point bending. Semicircular web corrugation in the cross-sectional plane (horizontal) and across the span of the beam (vertical) were investigated each experimental and computationally using finite element technique. In the finite element analysis, test specimen was modeled using commercially available finite element software and a non-linear analysis was performed. This attributed to the increment of the second moment of area that has influence on the direct bending stresses.

Ngoc Duong Nguyen et.al.[2]--Moment modification factors of the I-girder with trapezoidal web corrugations subjected to concentrated load applied at different heights on the cross section and various end restraint conditions, are investigated. The moment modification factors are obtained by finite element buckling analyses. The new FEM program is developed by using beam elements and new general formulas of cross-section properties as well as a new warping constant of the I-girder with trapezoidal web corrugations.

Jae-Yueloh et.al.[3]--Various types of composite members have been developed to utilize the combined advantages of existing reinforced concrete and steel structures, and to actively improve ductility and serviceability of structural members. One of them is the hybrid-type steel beam, in which the pre-stressing method is applied to a steel beam. Introducing pre-stress to the existing I-
l beam, however, results in a very low pre-stress efficiency due to the large axial stiffness of the section.

LincyPabraham et.al. [4]This paper deals with the investigation on Behaviour of encased cold formed built up I-section with trapezoidal corrugated web and encased cold formed built up I-section with plane web, under two point loading by varying height to thickness ratio of the beam specimen. The experimental results of encased trapezoidal corrugated web and that of plane web are compared and the behaviour and failure modes are discussed. Encasing the corrugated web of steel beam with concrete could improve the resistance to transverse deflections.

Magnucka et.al.[5]--Devoted to the mathematical modeling of transverse shearing effect for sandwich beams with sinusoidal corrugated cores. Bending and buckling problem of two sandwich beam are found out by theoretical.

Pankaj Kumar et.al.[6]--Beams under study include cantilever, simply supported and fixed beam. Mode shapes and natural frequencies of these three types of beams are obtained using theoretical analysis, simulation in ANSYS and experiment using FFT analyzer. Finally natural frequencies obtained from simulations and experiments are compared with theoretical values of natural frequencies. The mode shapes obtained from simulations and experiments are matching closely with analytical ones.

Bureau of Indian Standards[7] -IS808:1989(Reaffirmed 1999)This normal covers the nominal dimensions, mass and sectional properties of hot rolled sloping flange beams and column sections, sloping and parallel rim channel sections and equal and unequal leg angle sections. The Indian Standard IS 1852: 1985 'Rolled and cutting tolerances for hot rolled steel products (fourth revision)' are necessary adjunct to this standards.

VI. STIFFNER

Stiffeners are those structural components which are used to strengthen shear & moment resistance of steel plates along the longitudinal & transvers or/and along the edge of opening, but if castellated beams are subjected to concentric loading in such beam prove to be inappropriate. In such cases castellated beams must be reinforced at the places where these load concentrations occur.

VII. DESIGN AND CONSIDERATION PARAMETER

From bureau of Indian standard I section beam is selected which is MB100.then for calculated is various parameters like mass, volume, area. These are as follows.

Standard Beam Dimensions (I section)

D- Depth of the beam=100mm

b - Flange Width of beam, column or channel section=50mm

tw - Web thickness of beam=4mm

tf -Flange Thickness of beam=6mm

Density of Structural Steel=8050kg/mm^3

Poisons ratio-0.26

Y- Young's modulus of structural steel=200GPa

G- Modulus of Rigidity=75GPa

L- Length of the Beam=1000mm

a- Sectional area of beam=882.4mm^2

V- Volume= 882.4* 103mm^3

M- Mass of the beam=7.1 kg/m

• Area, Volume and Mass are calculated by Following Equations

• Area=[Dt + 2TB]

• Volume =[Dt + 2TB]*L

• Mass=[Dt+2TB]*L*Density.

For our project analysis, we have used castellated web beam with circular opening. So our modified shape of beam as follows

1) Dimensions of I-section beam

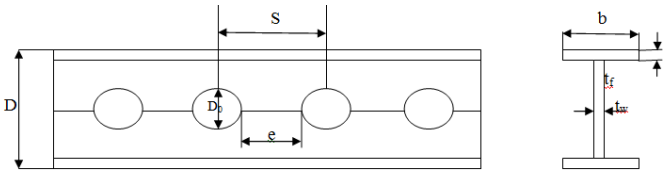


Fig.3. Typical cross section of the beam

Various dimensional parameters involved in the castellated beam with hexagonal openings (Fig.1.4) are defined as given below:
Do = Depth of opening provided=50mm
D = Overall depth of the beam=100mm
e = Clear distance between two opening=200mm
b = Width of flange of I beam=50mm
t_f = Thickness of flange of I beam =6mm
t_w = Thickness of web of I beam=4mm

2) Dimensions of Trapezoidal Corrugated web be Beam

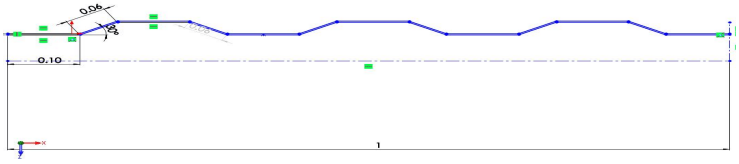


Fig.4. Top view of trapezoidal corrugated web

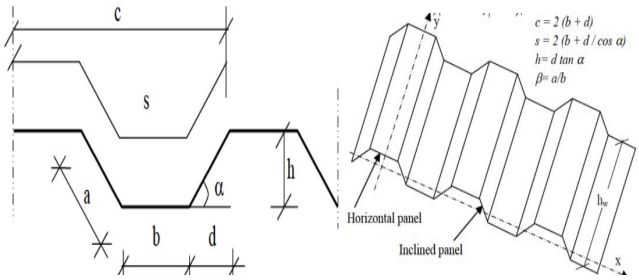


Fig.5. Terminology trapezoidal corrugated web

b=100mm. $\alpha=30^0$ a=60mm.
Depth of opening provided= Do =50mm
Overall depth of the beam=D =100mm
Clear distance between two opening=e =200mm
Width of flange of I beam=b =50mm
Thickness of flange of I beam =tf =6mm
Thickness of web of I beam=tw =4mm

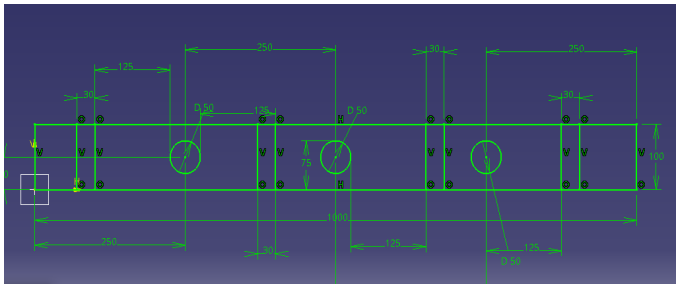


Fig.6. Front view of web for the I-section and Trapezoidal section

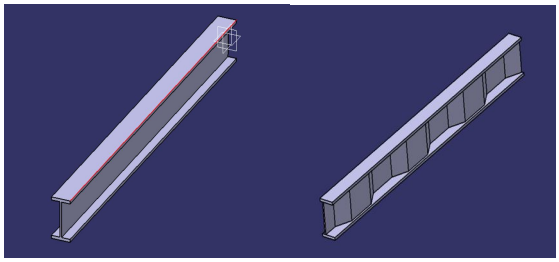
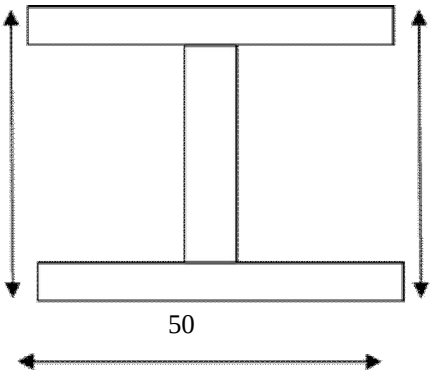


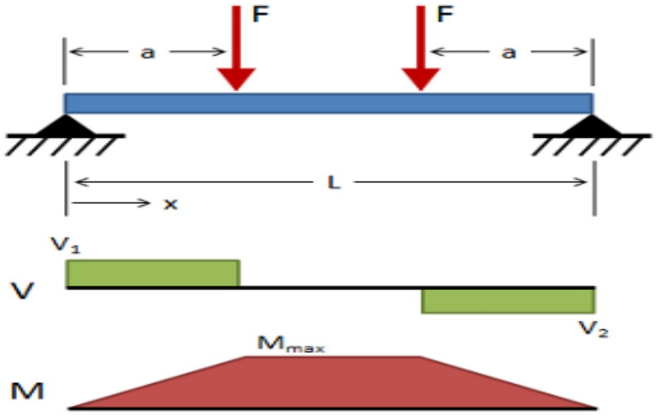
Fig.7. Cad Model of I Section & Trapezoidal Section Beam

This is the cad model of I-Section of beam and corrugated web beam this is not modified and optimized without stiffener structure of beam. They are used in regular manner.

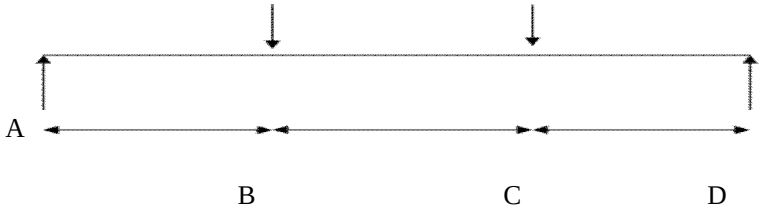
3) Theoretical Stress calculation for I-Section Beam



A1=50×6=300mm2
A2=4×88=352 mm2
A3=50×6=300 mm2
To find the moment of inertia about X-X axis, we have to divide area A1, A2, A3
By using parallel axis theorem
Ixx=I1+I2+I3
=[(Ixx1+A1h12) + (Ixx2+A2h22) + (Ixx3+A3h32)]
=[(b1d13/12)+A1h12+(b2d23/12)+A2h22+(b3d33/12)+A3h32]
= [(50×63/12)+300×(50-3)2+(4×883)/12+(50×63)/12+300(50-32)]
=663600+209683.69+663600
=1536883.69mm4
Ixx=1.5368 $\times 10^6 mm^4$



Simply supported I-section beam, two point loading with shear force and bending moment



Beam span under loading

To find reaction at support

RA+RB=20+20=40KN ……1)

Taking moment about 'A'

RB ×1=20 ×1/3+20 ×2/3

RB=20KN

RA=20KN……Putting in case

a) Shear force diagram

At point 'B' Before=0

After=-20KN

At point 'D' Before=-20KN

After=20-20=0

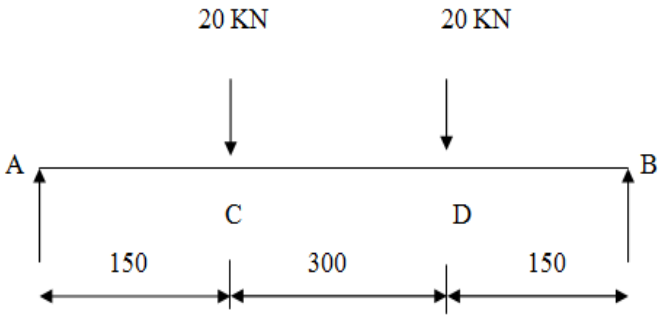
At point 'C' Before=-20-20=0KN

After=20-20+20=20

At point 'A' Before=20-20+20=20

After=20-20+20-20=0

To find maximum bending moment



Beam span under loading

About point B=Bending moment is zero

About point D=20 ×0.150=3 KNm

About point C=20 ×0.450-20 ×0.150=6 KNm

About point A =20 ×0.6 - 20 ×0.150 - 20 ×0.450=0 KNm

M/I = ϭb/y

Y=Distance of Extreme flange from neutral axis,

Y=50

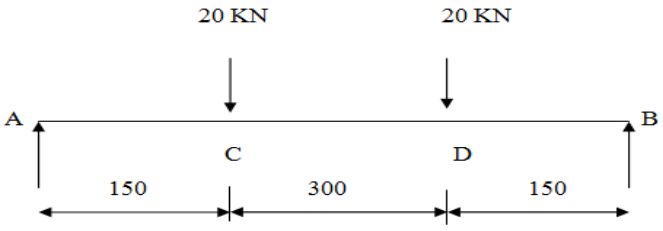
M/I = ϭb/y

ϭb = (M/I) ×y

ϭb= (6) $\times 10^6$ × 50/ (1.5368 $\times 10^6$)

ϭb=195.21 N/mm^2

To find the deflection of Beam



Deflection:

$$\delta = -\frac{Fx}{6EI}\left(3aL - 3a^2 - x^2\right) \qquad (0 \le x \le a)$$

$$\delta = -\frac{Fa}{6EI}\left(3Lx - 3x^2 - a^2\right) \qquad (a \le x \le L - a)$$

$$\delta_{max} = \frac{Fa}{24EI}\left(3L^2 - 4a^2\right) \qquad @\ x = L/2$$

Maximum deflection occurs at mid-point of beam so at a = 0.3 m

$$\Delta = \frac{10 \times 1000 \times 0.3(3 \times 0.6 \times 0.6 - 4 \times 0.3 \times 0.3)}{24 \times 2 \times 1011 \times 1.5368 \times 10 - 6}$$

δ= 10000×0.3×0.72/7376640

= 0.002968 m

= 2.9 mm

4) Theoretical Natural Frequencies Calculation

a) To find the natural frequencies of I-section beam Formula for natural frequency –

$\omega n = \beta^2 \sqrt{\frac{EI}{pA}} = (\beta l)^2 \sqrt{\frac{EI}{pAl4}}$

ωn- Natural Frequency

I-section beam and Trapezoidal corrugated web beam both are cantilever supported and impacting Hammer on it, Natural frequency are taken.

By using theory of cantilever condition

$\beta_1 l$=1.875, $\beta_2 l$=4.694, $\beta_3 l$=7.

The sectional properties of Beam—

E--- 200 GPA.

p—8050 kg/m3

For I-section Beam---

I— 1.5368 * 106 mm4

A— 952mm2

L----1000mm.

$\sqrt{\frac{EI}{pAl4}}$ = (2*10^11 *1.5368*10^-6/8050*952*10^-6*1^4)$^{0.5}$

= 196.95

$\omega n = (\beta l)^2 \sqrt{\frac{EI}{pAl4}}$

For 1st mode $\beta_1 l$=1.875, for second mode $\beta_2 l$=4.694,

By using above values

ωn_1= 692.40 rad/s so f=110.25 Hz, ωn_2 =4339.52 rad/s so f=691.12 Hz

Modified Cad Model of I-Beam and Corrugated Trapezoidal Web Beam

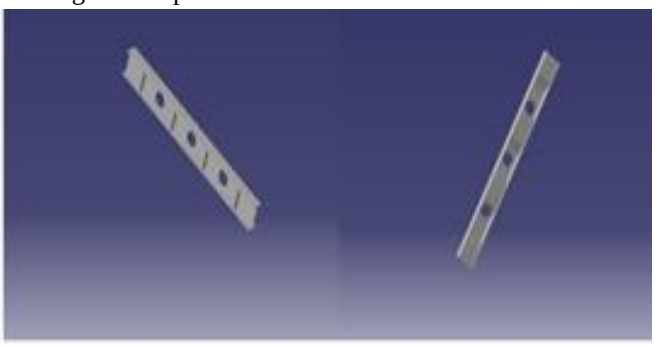


Fig. 8. Cad Model

VIII. SIMULATION WORK

Modal Analysis -: Modal analysis is that the method of determinant the inherent dynamic characteristics of a system in kinds of natural frequencies, damping factors and mode shapes, and using them to formulate a mathematical model for its dynamic behavior. The developed mathematical model is referred to as the modal model of the system and therefore the information for the characteristics are referred to as its modal information. The dynamics of a structure are physically decomposed the frequency and position. This is clearly evidenced by the analytical resolution of partial differential equations of continuous systems such as beams and strings. Modal analysis is predicated upon the actual fact that the vibration response of a linear time-invariant dynamic system may be expressed as the linear combination of a collection of easy harmonic .

Modal analysis of without Hole and with hole stiffener of I-section And trapezoidal Corrugated web Beam :-

1) Modal Analysis I- Beam Without Hole and Stiffner

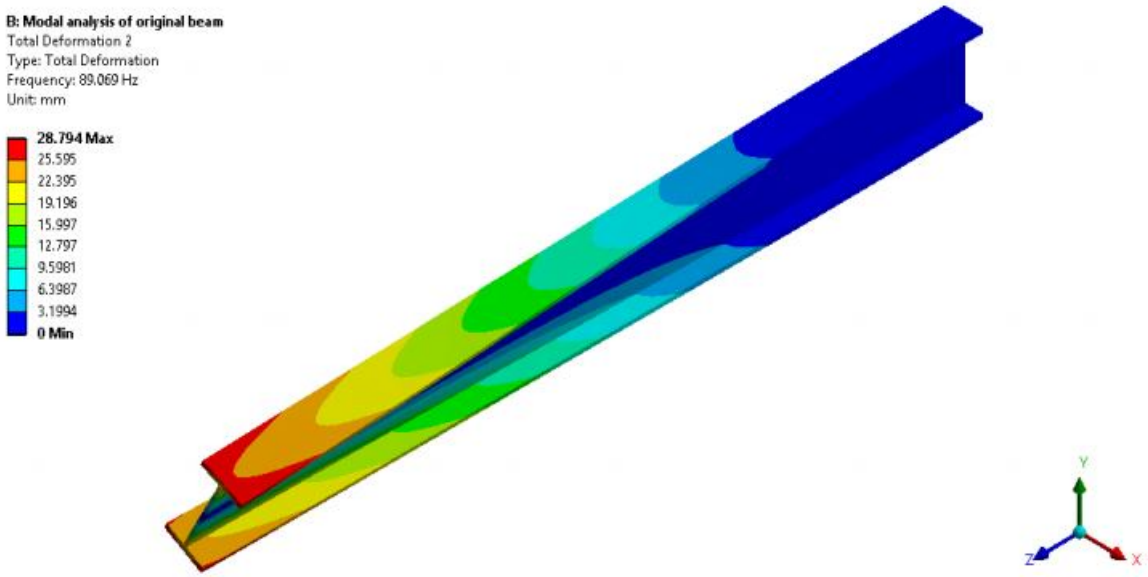


Fig.9. 1st Natural frequency 89.06 Hz

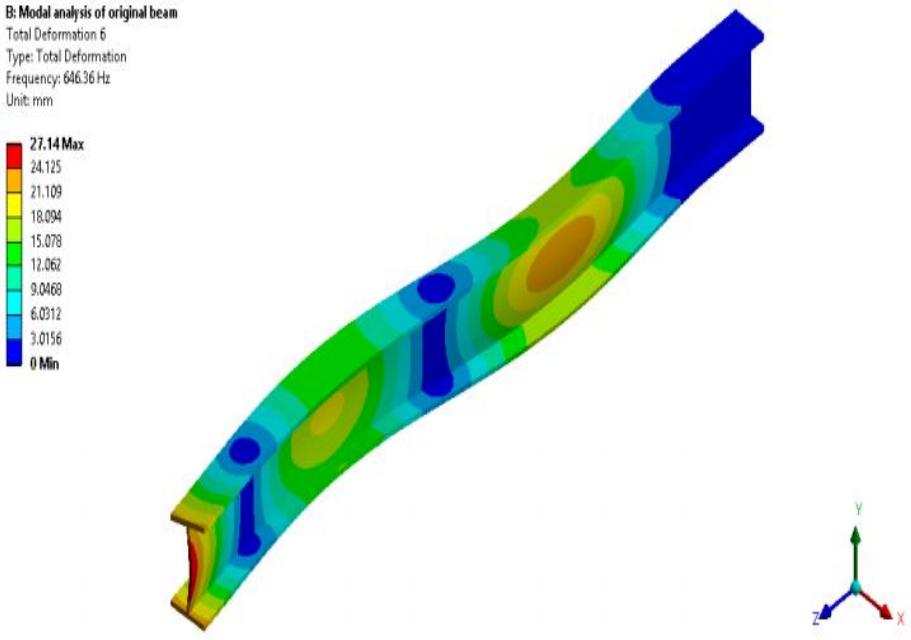


Fig.10. 2nd Natural frequency 646.36 Hz

2) Modal Analysis I-Beam with Hole And Stiffener

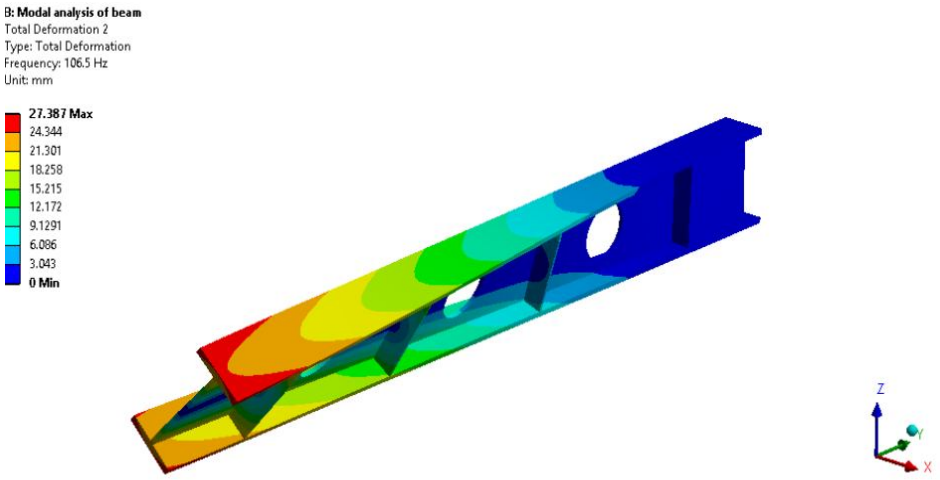


Fig.11.1st Natural frequency 106.5 Hz

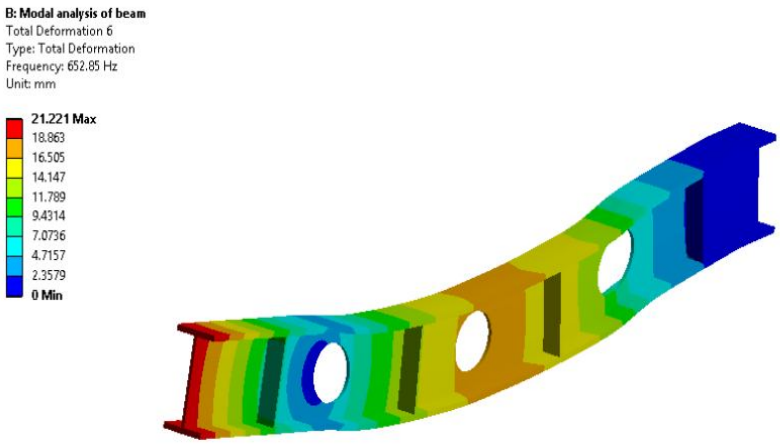


Fig.12. 2nd Natural frequency 652.85 Hz

3) Modal analysis of Trapezoidal beam hole with Stiffener

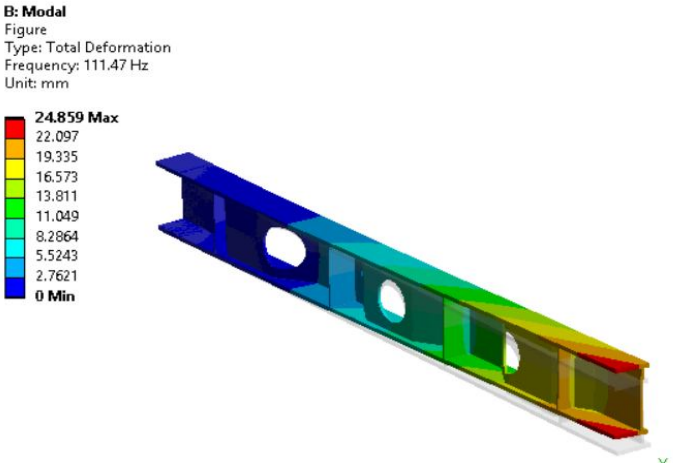


Fig.13.1st Natural frequency 111.47 Hz

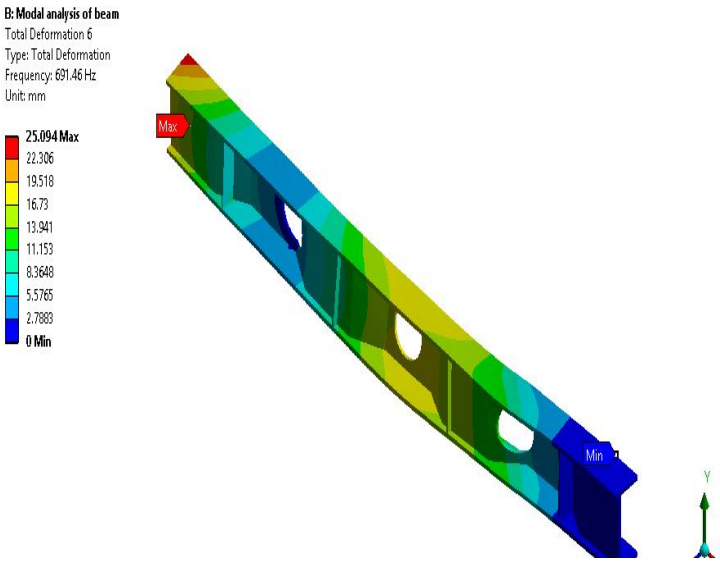


Fig.14. 2nd Natural frequency 691.094

4) Strength Analysis of I-Section Beam: The model of I-section beam and Trapezoidal beam is prepared in solid works and catia as mentioned dimension in above and saved. Strength analysis is carrying out to find out the load carrying capacity of beams and stress induced at critical location in ANSYS software.

Following steps are performed on the ANSYS

a) Preference: A static structural analysis gives the deflection, stresses, strains, and forces in structures or elements caused due to loads.

b) Pre-processor: A) Element type- Solid 185 is used for 3-D modeling of solid structures. It is defined by eight nodes having three degrees of freedom at each node.

c) Material Properties: Material properties are entered for structural steel (A36).

Fig.14.Mesh Model of I-Section Beam

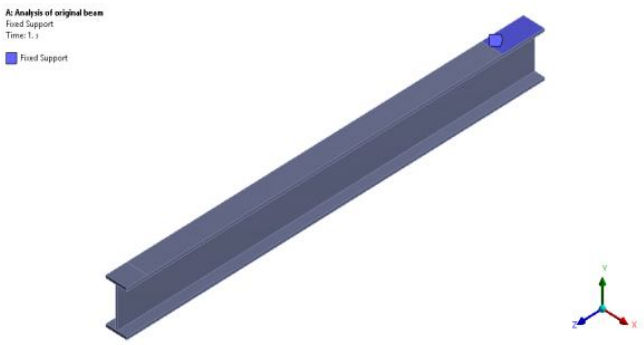


Fig.15. Boundary condition Model

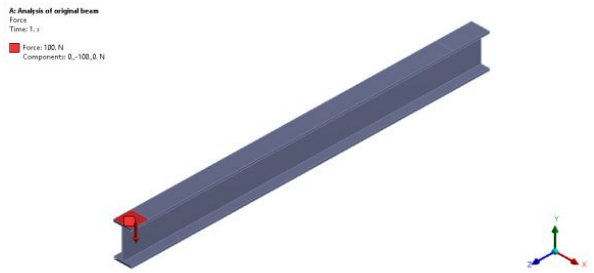


Fig.16. Load Application model

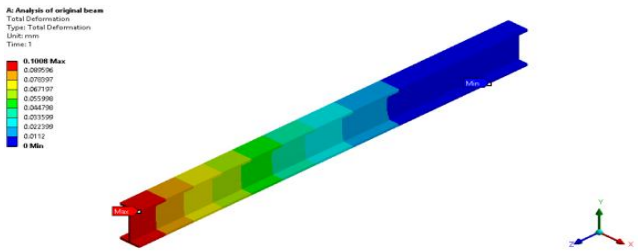


Fig.17. 0.1008 mm Deflection of beam at 100N

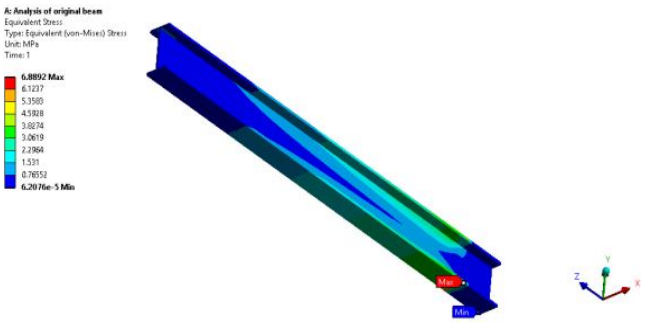


Fig.18. 6.8892MPa Von-Mises stress

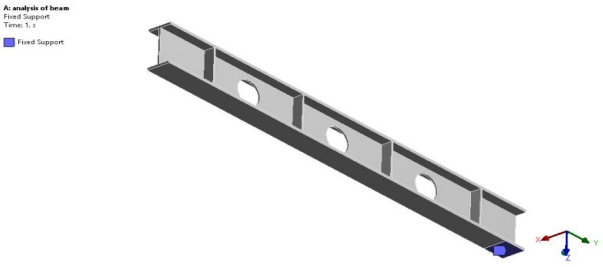


Fig.19. Boundary condition of modified I-section beam

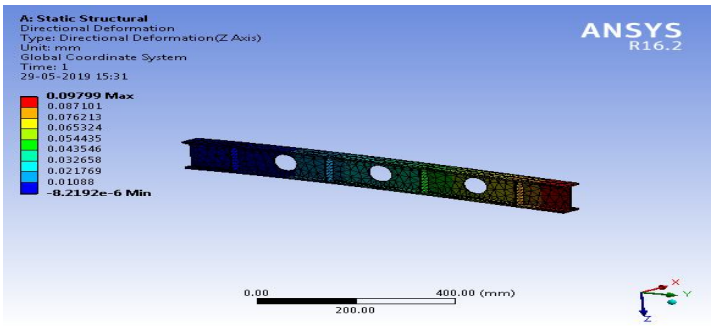


Fig.20. 0.09799 mm Deformation of Modified I-section beam

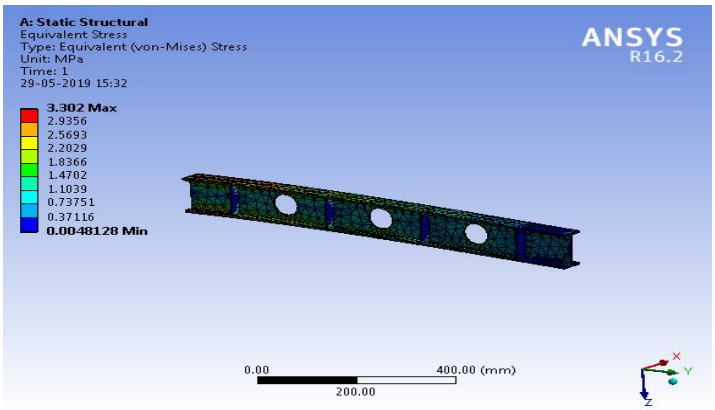


Fig.21. 3.302 MPa Von-Mises stress in modified I-section beam

5) Stress Analysis of Trapezoidal Beam

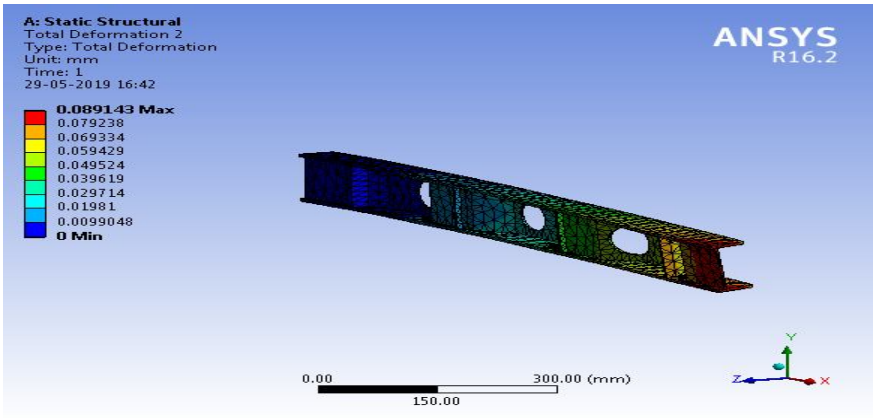


Fig.22. 0.0891mm Deformation of Modified Trapezoidal beam at 100N

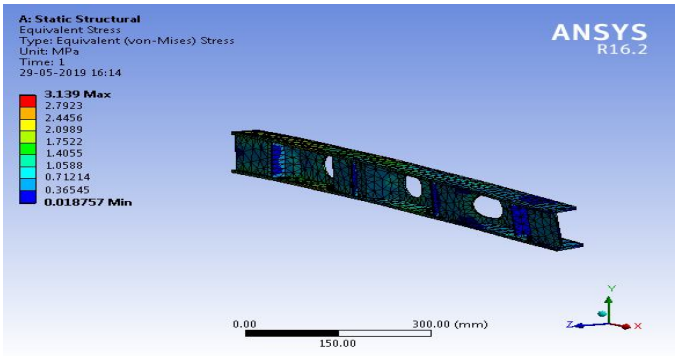


Fig.23. 3.139 MPa Von-Mises stress in Trapezoidal beam

IX. EXPERIMENTAL INVESTIGATION

Vibration Measurement System:-Motion of the vibrating body is converted into an electrical signal by the vibration transducer .In general a transducer is a device that transforms the signal changes in mechanical quantities(such as displacement, velocity, acceleration, force) changes into electrical quantities (such as voltage, current).Since the output signal conversion instrument is utilized to amplify the desired price. The output from the signal conversion instrument can be presented on display unit for visual inspection, or by recorder by recording device or stored in a computer for later use. Depending upon the quantity measured vibration measuring device is termed a Vibrometer, a velocity meter, an accelerometer, a phase meter, or a frequency meter. The following consideration usually dictates the kind of measuring device to be used in a vibration test.

ıption in experimental analysis

A. The structure is assumed to be linear i.e. the response of the structure to any combination of forces, simultaneously applied, is the sum of the individual responses to each of the forces acting alone.

B. The structure is time invariant, i.e. the parameters that are to be determined are constants. In general, a system which is time invariant has components that's mass, stiffness, or damping depend on factors that are not measured or not included in the model.

C. The structure obeys Maxwell's reciprocity, i.e. a force applied at degree of freedom p causes a response at degree of freedom q that is the same as the response at degree of freedom p caused by a similar force applied at degree of freedom q.

D. The structure is observable; i. e. the input output measurements that are created enough information to get an adequate behavioural model of the structure.

1) FFT Analyzer

Top side connectors

Side connectors

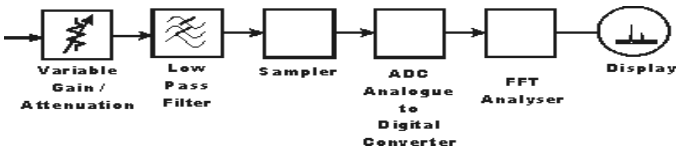


Fig.24. FFT Analyzer Block Diagram

Following apparatus will be used to perform the real experiment:

a) Impact Hammer
b) Accelerometer
c) Multi-channel Vibration Analyzer (DEWESoft-DEWE-43)
d) A PC or a Laptop loaded with software for modal analysis.
e) Test-specimen (A cantilever held in a fixture)
f) Power supply for the PC and vibration analyzer, connecting cables for the impact hammer and accelerometer, fasteners and spanner to fix the specimen in the fixture, and adhesive/wax to fix the accelerometer).

2) Actual Setup FFT Analyzer

Fig.25. Experimental Testing of Modified I-section Beam

Fig.26. Experimental Testing of Trapezoidal corrugated web Beam

X. RESULT ANALYSIS

A. *Modal Analysis*

1) Modal analysis done by ANSYS software of I-section and modified I-section under same boundary condition as cantilever beam and following results are observed

Table .1. Modal analysis of I-section and Modified I- section

Natural frequency	I-section	Modified I-section
1st	89.06	106.5
2nd	646.36	652.85

Natural frequency of modified I-section beam is increased by 10% as comparison with I-section beam by using ANSYS results.

2) Modal analysis done by ANSYS software of modified I-section and Trapezoidal corrugated web beam hole with stiffener under same boundary condition as cantilever beam and following results are observed

Table 2. Modal analysis of Modified I- section andTrapezoidal corrugated web beam

Natural frequency	Modified I-section	Trapezoidal corrugated web beam
1st	106.50	111.47
2nd	652.85	691.094

Natural frequency of Trapezoidal corrugated web beam is increased by 4% as comparison with Modified I-section beam by using ANSYS results.

B. *Strength Analysis*

1) By using Ansys software I-section and modified I-section loaded with same boundary condition as cantilever beam at 100N and following results are observed

Table .3.Strength analysis of I- section and Modified I- section

Sr. No	I-section	Modified I-section
Von-Mises Stress in MPa	6.88	3.3020
Deflection in mm	0.1008	0.0979

Deflection observed in I-section beam is 3% more than modified

I-section beam and Von-Mises stress observed in I-section beam is 35% more than Modified I-section beam at 100N by using ults.

2) By using Ansys software modified I-section and Trapezoidal corrugated web with hole with stiffener loaded with same boundary condition as cantilever beam at 100N and following results are observed

Table .4.Strength analysis of Modified I- section and Trapezoidal corrugated web

Sr. No	Modified I-section	Trapezoidal web beam
Von-Mises Stress in MPa	3.3020	3.139
Deflection in mm	0.0979	0.0891

XI. EXPERIMENTAL RESULT ANALYSIS

By using FFT software both beam modified I-section and Trapezoidal corrugated web beam hole with stiffener under same boundary condition as cantilever beam tested Experimentally and following results are observed

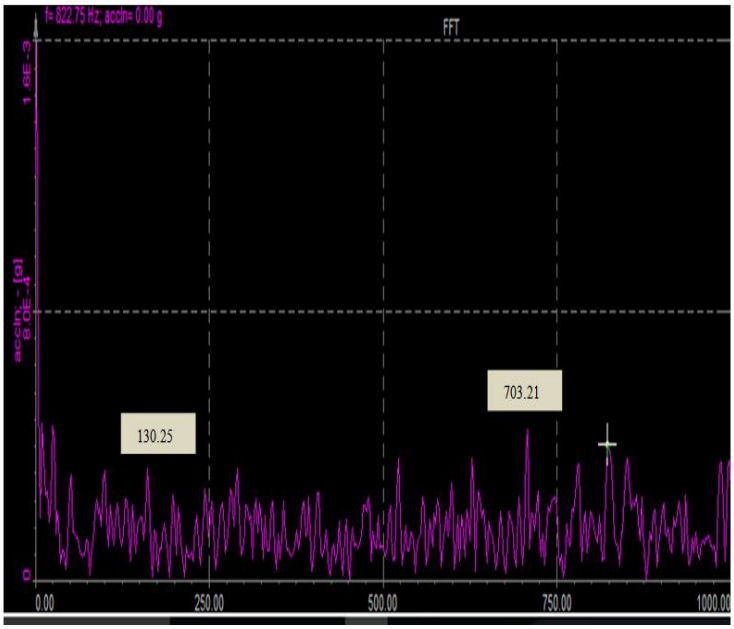


Fig.27.FFT Graph of Modified I-section beam

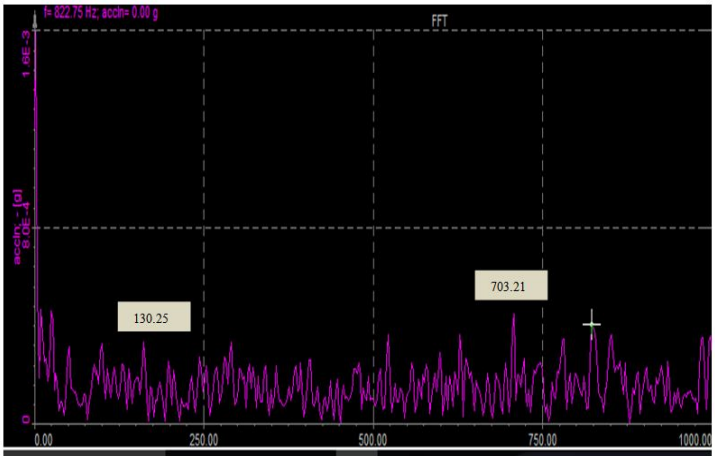


Fig.28. FFT Graph of Trapezoidal corrugated web beam

Table.5. Natural Frequency of Trapezoidal corrugated web
And Modified I-section By FFT

Natural frequency in Hz	Modified I-section	Trapezoidal corrugated web beam
1st	128.2	130.25
2nd	665.5	703.21

Natural frequency of Trapezoidal corrugated web beam is increased by 5% as comparison with Modified I-section beam by using Experimental result analysis by FFT

XII. RESULTS & DISCUSSION

Table.6. Comparing the variation in natural frequencies of modified I-section beam by FEA and Experimental result.

Results	1st Natural Frequency in Hz	2nd Natural Frequency in Hz
FEA	128.2	130.25
Experimental	665.5	703.21

Variation in natural frequencies of modified I-section beam by FEA and experimental results 10% which is in acceptable range.Variation may present due to boundry condition applied in FEA and Experimentation are not equal.

Table.7. Comparing the variation in natural frequencies of Trapezoidal corrugated web beam by FEA and Experimental result.

Results	1st Natural Frequency in Hz	2nd Natural Frequency in Hz
FEA	111.47	691.09
Experimental	130.25	703.21

Variation in natural frequencies of modified I-section beam by FEA and experimental results 8% which is in acceptable range.Variation may present due to boundry condition applied in FEA and Experimentation are not equal.

XIII. CONCLUSION

By using theory of deflection of beam the deflection is directly proportional to square of length beam and inversely proportional to moment of Inertia. The length of Trapezoidal web increases which bears most of compressive stress which resists the deflection of beam. The shear stress are dependent upon the area of contact between the flange and web, for trapezoidal beam more area of contact is present as compare to I-section beam. Experimental results of FFT are with some variation matching with the FEM hence we can replace modified I-section beam with Trapezoidal corrugated web beam hole with stiffener. The Natural frequencies of Trapezoidal corrugated web beam with hole with stiffener increases as compared to natural frequencies of modified I-section beam to avoid resonance with earthquake frequencies.

XIV. ACKNOWLEDGMENT

It is indeed a great pleasure and moment of immense satisfaction for me to present a Project report on“Experimental Analysis Of Trapezoidal Corrugated web beam with stiffner for its strength and modes” amongst a wide panorama that provided us inspiring guidance and encouragement, I take the opportunity to thanks to thanks those who gave us their indebted assistance. I wish to extend my cordial gratitude with profound thanks to our internal guide Prof. M. M. Joshi It was his inspiration and encouragement which helped us in completing my work. I am also thankful to Prof. S. M. Jadhav, PG Co-ordinator for his overwhelming support and invaluable guidance. My sincere thanks and deep gratitude to Head of Department, Prof. D. H. Burande and other faculty members; but also to all those individuals involved both directly and indirectly for their help in all aspect of the Project. At last but not least I sincere thanks to the Institute’s Principal Dr. Y. P. Reddy, for providing us infrastructure and technical environment.

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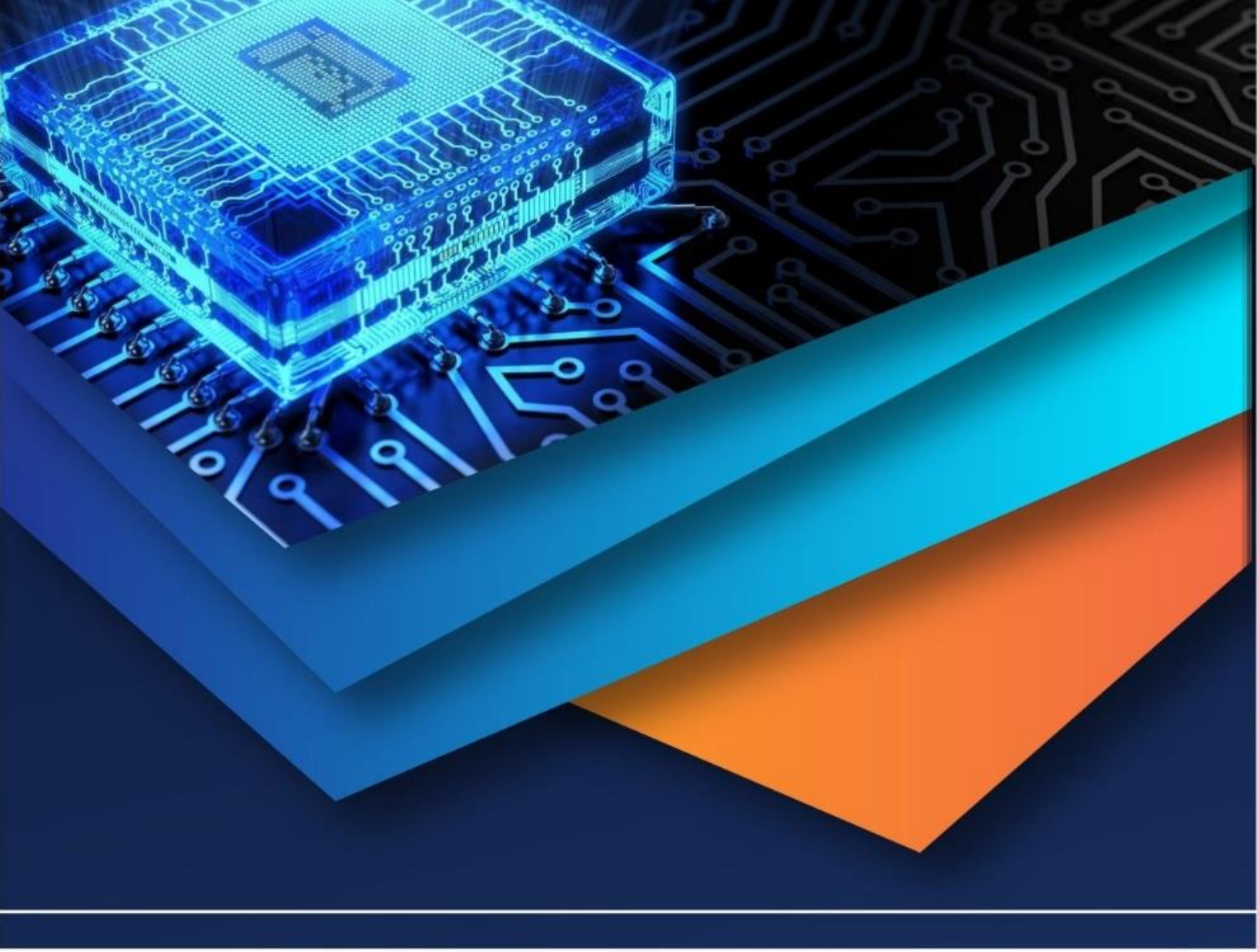

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Topology Optimization of Lower Control Arm for LMV

S. V. Yende
Mechanical Department (Automotive Engineering)
Sinhgad College of Engineering
Pune, India

A. P. Tadamalle
Mechanical Department
Sinhgad College of Engineering
Pune, India

D. H. Burande
Mechanical Department
NBN Sinhgad School of Engineering
Pune, India

***Abstract*—Lower control arm is an important part in the suspension system. It is connected between subframe and knuckle. It holds the vehicle wheels in alignment. High unsprung weight complicates steering control and traction control issues. This paper deals with the reduction of unsprung mass of vehicle by topology optimization of lower control arm. For analysis existing lower control arm of Mac- Pherson suspension system is selected. CATIA software is used for CAD modelling. Ansys software is used for static structural analysis of existing model to find out Von- mises stress and deformation by applying required boundary conditions and loading. On the basis of stress developed, topology optimization is carried out by removing excess material from CAD model. Lower control arm is redesigned and is analysed for stress distribution and deformation. It is observed that total reduction of weight in existing model is found to be 13.46 %.**

Key Words*—Lower control arm, Static structural analysis, Topology optimization, Unsprung mass.

I. INTRODUCTION

Suspension system is an integral part of automobile. It is used to prevent the road shocks being transmitted to vehicle frame and other components of vehicle. Its main function is to provide stability, safety and comfort. It maintains traction between the tyre and road surface. Lower control arm is an important component in the suspension system. It is present in both Mac- Pherson suspension and Double wishbone suspension system [2]. Control arm connect the cars suspension to the actual vehicle frame. One end of lower control arm is connected to knuckle through a ball joint and other end is attached to vehicle subframe. Lower control arm forms the unsprung weight of vehicle. High unsprung weight complicates wheel control issues under hard acceleration or braking. It may cause severe wheel hop, compromising traction and steering control. Unsprung weight increases the overall weight of suspension system and finally of vehicle. The main objective of paper is to reduce the unsprung weight of vehicle; by reducing weight of lower control arm using topology optimization. The cost of manufacturing is also reduced. Topology optimization include removing unnecessary material from the base model to reduce weight using given sets of objectives and constraints.

Excess material is removed from the low stressed region of lower control arm. The existing design of left lower control arm from one of the light motor vehicle having Mac-Pherson suspension system is selected for the study (Maruti Suzuki Swift Dzire). It is essential to focus on the stress and deformation study to develop the changes in existing design. FEA approach is used for static structural analysis and topology optimization.

Balasaheb Gadade et. al. [1] The paper aims at Design and analysis of A-type front lower control arm in commercial vehicle. Objective of the study is to calculate working life of the component under static loading. M.Sridharan et. al. [2] Objective of the paper is to model and perform structural analysis of a LCA in front suspension system, which is a sheet metal component. LCA is modelled in Pro-E software while for analysis, CAE software is used. Bharatesh M Goudra1 et. al. [3] The paper deals with structural analysis of lower control arm using Kevlar and SAE J2340. CAD model is generated in CATIA and finite element analysis is done using ANSYS. Bhushan Kumar [4] The research work involves the development of sheet metal lower control arm, that has many advantages over forged metal. The model is translated into IGES file, which is used for analysis. M. Viqaruddina [5] The paper focuses the static analysis and torsion analysis of the LCA using Radioss software and improve the stiffness and weight reduction of component by changing structural properties and the geometrical dimension as well. The design is given by topology optimization to compare analysis of existing and optimized model. Sagar Darge [6] The paper aims to perform FEA of control arm which consist the stress optimization under static loadings.

II. METHODOLOGY

In order to carry out analysis, left lower control arm from one of the LCV is selected having Mac- Pherson suspension system. Reverse engineering of existing lower control arm is done using Coordinate Measuring Machine (CMM). With the help of the coordinates obtained CAD model is generated in CATIA software. In Ansys static structural analysis of control arm is carried out by applying required loading and boundary conditions. Excess material is removed from low stressed region by Topology optimization and the model redesigned and optimized. Static structural analysis of

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optimized CAD model is done to evaluate stresses and total deformation.

A. *Analytical Calculation*

For research work Left lower control arm of Maruti Suzuki Swift Dzire is selected. Gross weight (m) is 1505 Kg.

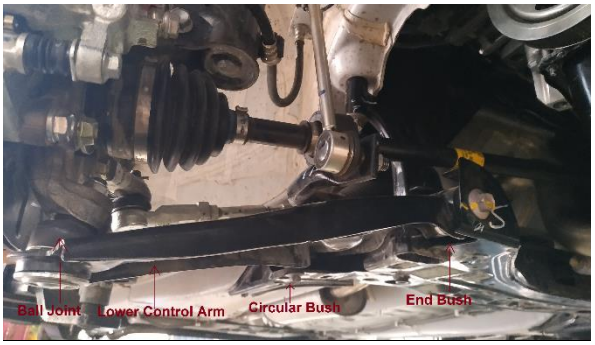

Fig. 1 Position of Lower Control Arm

Load calculation for a given vehicle model is as follows:

Weight of vehicle acting at its centre of gravity is given by,

$W = m.g$ ----- (1)

As we know that approximately 52% of weight of the whole car is carried by front wheels and 48% weight carried by rear wheels [7].

Weight on front axle is,

$F_f = 0.52*m*g$ N

Reaction at each front wheel is,

R_{fw} = Weight on front axle /2

From above calculation load acting on front wheel is 3838.65 N.

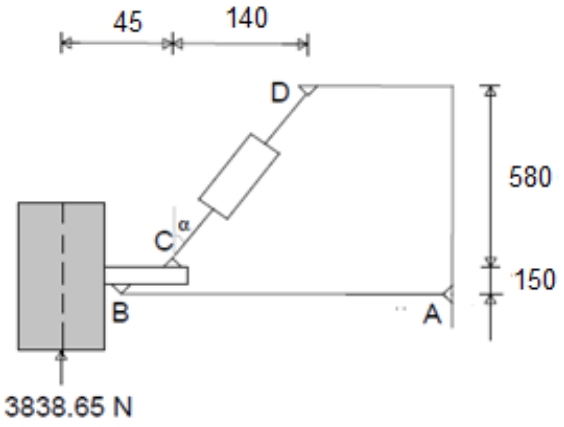

Fig. 2 Front Mac- Pherson Suspension schematic

From Fig. 2,

$$\alpha = \tan^{-1}\left(\frac{140}{580}\right) = 13.57° \quad \text{----- (2)}$$

$\Sigma M_B = 0$

CD = 1204.09 N

$\Sigma F_x = 0$

B_x = -1170.37 N

$\Sigma F_y = 0$

B_y = - 4120.40 N

Resultant force is given by,

B_{xy} = 4283.39 N ----- (3)

B. *Reverse Engineering of Lower Control Arm*

Coordinate measuring machine (CMM) is used to measure all the dimensions of lower control arm. A coordinate measuring machine (CMM) measures the geometry of physical objects by sensing discrete points on the surface of the object with a probe. CMM allows probe movement along X, Y and Z axes which are orthogonal to each other in a three-dimensional Cartesian coordinate system. Each axis has a sensor that monitors the position of the probe on that axis. When the probe contacts .a particular location on the object, the machine samples the three position sensors, thus measuring the location of one point on the object's surface. As the probe touched the surface of the component the stylus deflected and simultaneously sent the X, Y and Z coordinate information to the computer.

Lower control arm is fixed by clamping and a reference is selected for datum. 449 coordinates are obtained by moving the probe over the lower control arm. These coordinates are plotted for creating a sketch. Tangram software is used for CMM.

Fig. 3 CMM of Lower Control Arm

C. *CAD Modelling*

CAD model of the front lower control arm is generated using CATIA V5 software. CATIA has a special tool of generative surface design to construct typical surfaces, which is then converted into solid model. CAD model is exported to meshing software in igs format.

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Fig. 4 CAD Model of LCA

D. *Finite Element Analysis*

Ansys software is used for meshing of CAD model. Solid tetrahedron elements are used for generating mesh to lower control arm. No. of nodes is 42549 and no. of elements is 42885 with an element size of 3 mm.

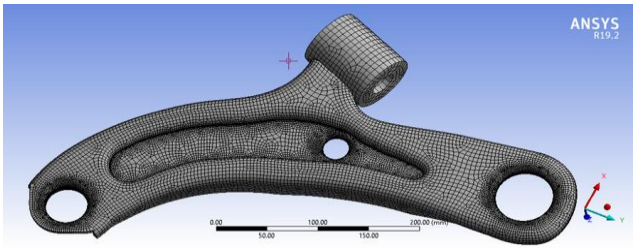

Fig. 5 Meshing of CAD Model

Boundary conditions are applied after carrying out meshing on CAD model. Circular bush is free in rotational Z direction and its other DOFs are fixed. End is free in Y direction and its other DOFs are given fixed constraints [3]. The force of 4283.39 N is applied on a ball joint in downward direction.

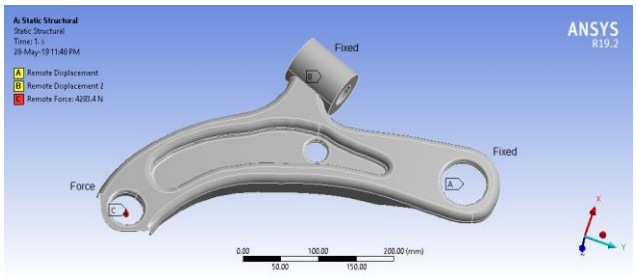

Fig. 6 Boundary Conditions to CAD Model

Table I- Material Properties

Material	**AISI 1040**
Young's modulus	2.1e5 MPa
Poisson's ratio	0.3
Density	7850 Kg/m3
Yield strength	415 MPa
Tensile strength	620 MPa

E. *Static Structural Analysis*

Static structural analysis is used to determine the forces stresses, strains and displacements in the component caused by loads that do not induce significant inertia and damping effects [1]. Steady conditions of loading and response are assumed; this means that the loads and response of the structures vary slowly with time.

1. *Von- Mises stress in Existing Model*

The curvature near the end bush and the circular bushing regions are subjected to a high level of stress as indicated by the red zone. Whereas the remaining portion undergoes a lower level of stress and is indicated by blue zone. Maximum stress is found to be 384.75 MPa.

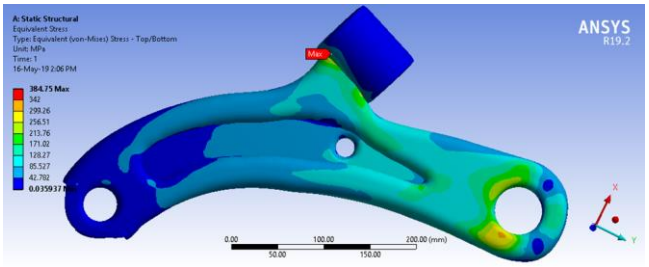

Fig. 7 Von- Mises Stress in Existing LCA

2. *Deformation in Existing Model*

Maximum deformation occurs at the ball joint portion since load is applied at the ball joint. It is indicated by red zone. Maximum deformation is found to be 6.45 mm.

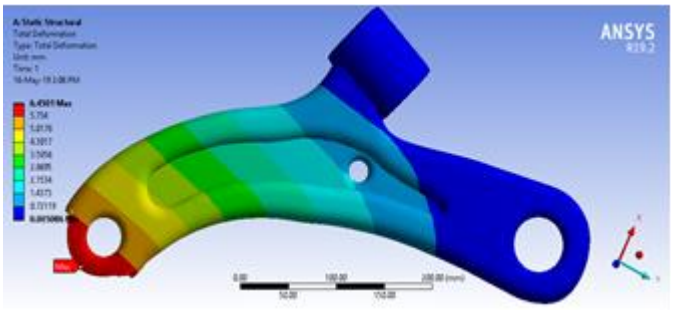

Fig. 8 Deformation in Existing LCA

III. TOPOLOGY OPTIMIZATION

The Topology optimization gives the optimum material layout according to the design space and loading condition using given sets of objectives and constraints. The main aim of topology optimization is to reduce weight by removing excess material from low stressed region. To solve any topology optimization problem, three parameters must be specified, namely design variables (material density), design objective (weight reduction) and design constraints (volume) Topology optimization is used to generate optimal shape of mechanical
structure[5].

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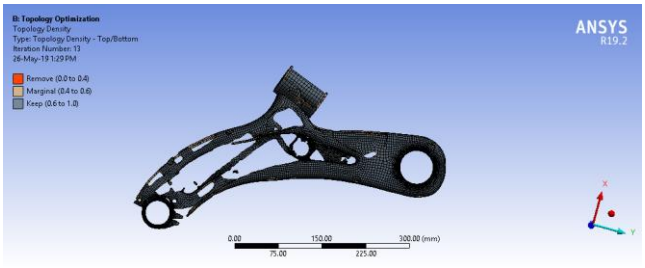

Fig. 9 Topology Optimization

A. *Optimized CAD Model*

After topology optimization the existing model is re-design and optimized. Re-design of the optimized model is done in CATIA V5 and the model is imported in Ansys for further static structural analysis by applying necessary boundary condition and loading.

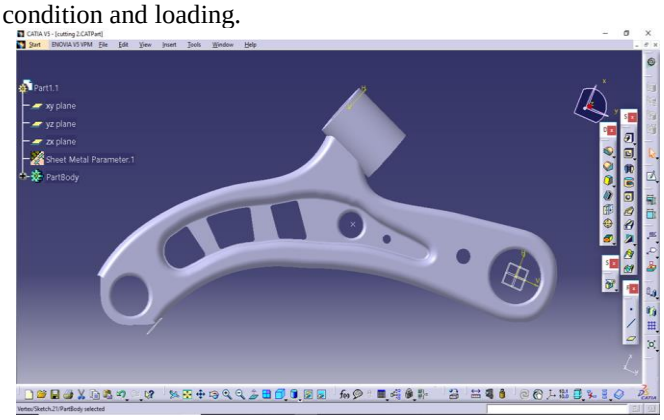

Fig. 10 CAD Model after Optimization

B. *Meshing of Optimized Model*

Solid tetrahedron elements are used for generating the mesh to lower control arm. Node population count is 41339 and element population count is 41732 with an element size of 3 mm.

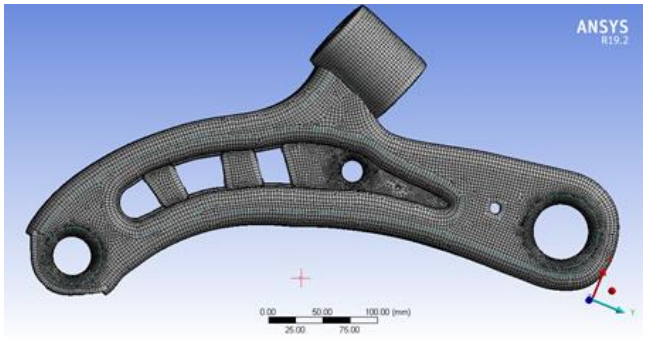

Fig. 11 Meshing of Optimized CAD Model

C. *Static Structural Analysis of Optimized Model*

Structural analysis is done to determine the stress distribution and deformation by applying mechanical load. Critical areas of location predicted where the stress distribution is high. The yield strength of material is 415 MPa and generated von-Mises stress in lower control arm should be less than yield strength of material.

1. Von- Mises stress in Optimized Model

Stress induced in lower control arm is 398.86 MPa. It is well below the critical limit of the material.

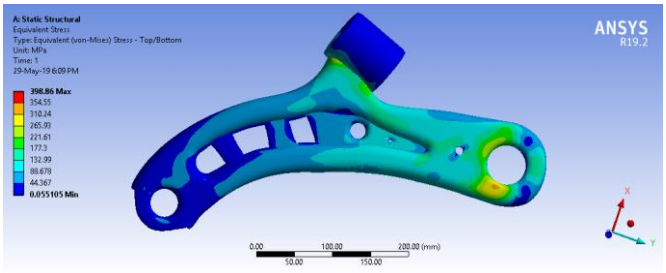

Fig. 12 Von- Mises Stress in Optimized Model

2. Deformation in Optimized Model

Deformation in optimized model is found to be 8.84 mm. The maximum deformation of optimized design and existing design are not varying by considerable amount.

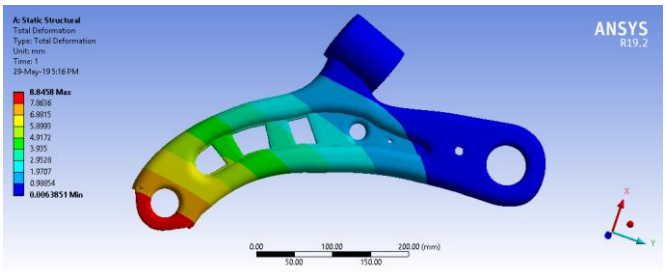

Fig.13 Deformation in Optimized model

IV. EXPERIMENTAL VALIDATION

The actual lower control arm is designed by analyzing CAD model. Pockets are made on the surface of control arm according to the CAD model.

Fig. 14 Optimized Lower Control Arm

For testing the tensile strength and compressive strength of materials, Universal Testing Machine (UTM), also known as a universal tester, is used. The loading conditions are applied on the lower control arm for testing purpose using load cells of universal testing machine. Loading is increased gradually from 1N to 4298 N and the displacement in the control arm seen on the desktop of a computer. The graph increases

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slowly with deflection. Deformation in optimized LCA from testing is found to be 10 mm. From FEA deformation is found to be 8.84 mm. Therefore, the percentage of error is 11.6%.

Fig. 15 Testing of LCA under UTM

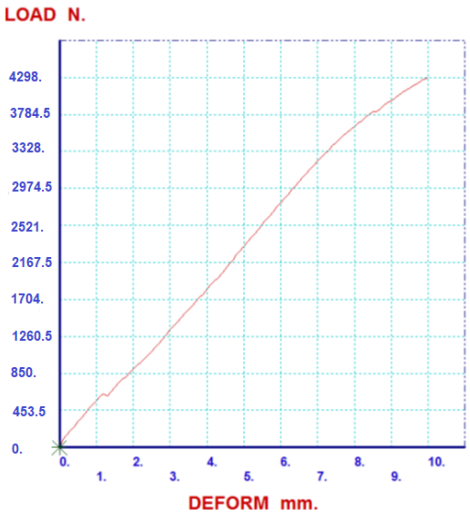

Fig. 14 Variation of Deforamation with respect to Load from UTM

V. RESULT AND DISCUSSION

The existing model of lower control arm is analysed in Ansys to find out stresses and deformation. In existing model maximum stress is 384.75 MPa and maximum deformation is 6.45 mm. Then existing model is optimized by making pockets on the surface of model. The maximum stress value for optimized upper control arm is 398.86 MPa and maximum deformation is 8.84 mm. Since the material's permissible stress is 415 MPa, this means that the design under the given load is safe. It is observed that there is an increase in stress occur in optimized model due to reduction in mass but this increased stress is below the yield limit of the material.

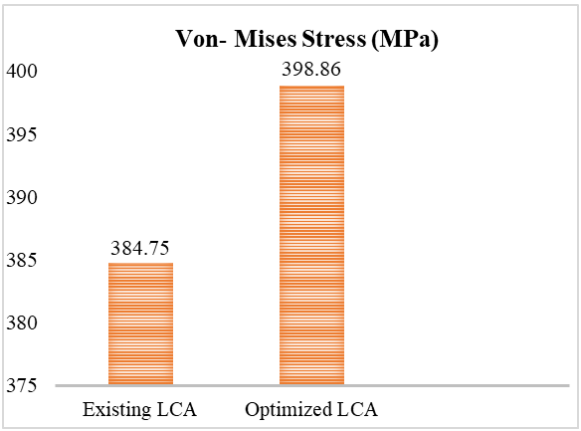

Fig. 17 Comparison of Von- Mises Stress in Existing and optimized LCA

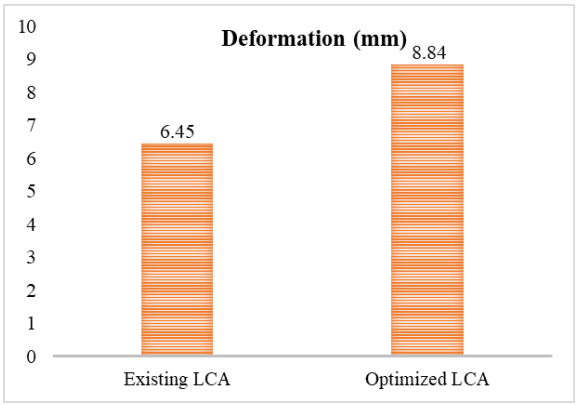

Fig. 18 Comparison of Deformation in Existing and Optimized LCA

Table II- Mass Comparison of Existing and Optimized Model

Existing Model	2.70 Kg
Optimized Model	2.25 Kg
% Mass Reduction	16.66 %

It is observed that mass reduction of 450 gm which is 16.66 % leads to large amount of material saving. It also saves time as well as cost of manufacturing control arm.

The cost of AISI 1040 material is Rs. 65 per Kg. Existing lower control arm weighs 2.60 Kg. Hence the raw material cost for existing lower control arm is Rs. 175. The optimized lower control arm weighs 2.25 Kg. Raw material cost for optimized lower control arm is Rs. 146.

Cost saving in material of one control arm
= Cost of material for existing LCA – Cost of material for optimized LCA
=Rs. 175 – Rs. 146
=Rs. 29

For a given vehicle having Mac-Pherson suspension system there are two lower control arm. Hence, the total cost saving in material for two LCA is Rs. 58. The percentage of cost saving in material for optimized lower control arm over existing is 16.57 %.

A comparative study of FEA and Experimental results is made. From the results it can be concluded that the validation of results shows resemblance with an error of 11.6%.

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VI. CONCLUSION

The stresses in optimized lower control arm is within the allowable limit. Hence, design is safe according to yield strength criteria. The deflection dose not vary by considerable amount. Weight reduction of lower control arm is done without varying the performance. By topology optimization of lower control arm weight reduction of 16.66 % is observed over existing model. The cost saving in material for two lower control arm is Rs. 58 which is very high. Thus, the objective of weight reduction of unsprung mass and the cost reduction has been achieved.

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Evaluation of Deep Drawing Force in Sheet Metal Forming

V.S.Vedpathak
Mechanical Department (Automotive Engineering)
Sinhgad College of Engineering
Pune, Maharashtra

Dr. A.P. Tadamalle
Mechanical Department
Sinhgad College of Engineering
Pune, Maharashtra

Prof. D. H. Burande
Mechanical Department
NBN Sinhgad School of Engineering
Pune, Maharashtra

***Abstract*— Sheet metal forming is widely used in automotive and aerospace sector. This paper shows the analysis of sheet metal forming process mainly deep drawing. Ansys simulation is used to carry out the results of difficult behaviour of the product. Main purpose of this project is to predict the required force use to perform the deep drawing operation. It also shows the required machine capacity to fulfil the production requirement. From theoretical values the dimensions of die and punch are obtained. Using these dimensions the CAD model is generated in CATIA. This assembly is then converted into igs format and imported in Ansys. The force required to develop the part, deformation and defect like tearing, wrinkles etc. can be obtained through simulation. By using this method it is easy to find the required force in minimum steps as compare to conventional trial and error method, which leads to save in time money and wastage of material.**

Keywords*— *Ansys simulation, Deep Drawing, Part Development and simulation, Punch Force, Use of force probe in Ansys. Introduction (*HEADING 1*)

I. INTRODUCTION

Deep drawing is a process of forming sheet metal component through dies and punching action. This is zero forming process which provide the component closer to required tolerance dimensions, good surface finishing, also it provide good strain hardening, higher strength. On the basis of geometry, volume and the material, sheet metal forming operation can be divided into categories like stamping, deep drawing, and super plastic forming. Among these stamping and deep drawing are frequently used operations. If the depth of forming cup is more than the diameter then this forming process is knows as deep drawing. Products like automotive components, aircraft parts, cans, cylinder cup, and submarine hulls are manufactured using deep drawing procedure. [3] The important variable in deep drawing is property of sheet material, surface finishing of punch and die, lubrication, BHF, clearance between punch and die, stages of drawing, coefficient of friction between blank and rigid parts etc. Punch force play an important role to draw blank into desired shape. It is very difficult to obtain exact required force on the punch to draw blank into desired depth. The sheet metal industry faces a number of challenges during development of the Die Punch and other parameters of required part manufacturing. These operations are complicated and calls high competency on the part design, material selection and process factors. If the process parameters are not correct then defects like Wrinkling, Tearing, Fracture, Thinning, Spring Back may be occur. These defects can be minimised by using correct process parameters like punch force, BHF, clearance between die and punch, number of drawing stages etc. This paper shows the FEA method to predict the required force for drawing operation using Ansys simulation. It also shows the significance of joint probe in Ansys and importance in the development process in forming operations.

Shishir Anwekar, [1] discussed the process of development of die and punch. Also they stated that it is complicated process and needs highly skilled workers to produce error free assembly. To overcome the trials and error procedure used the simulation technique. Shambhuraje Jagatap [2] discussed the temperature effect on die, blank, blank holder consider in the process. It stated that as temperature increases contact pressure decreases. Hakim S. Sultan [3] perform the work by using LUSAS simulation software and conclude that The increment of die radius causing decrement in the load needed to deform the same pattern some and at the same time increasing the maximum stress concentration on curve region. Akshay Chaudhari [4] This paper is based on the calculation of different part use in deep drawing process such as blank diameter, draw ratio, draw force, clearance, machine tonnage etc. Mathews Kaonga [5] discussed about the forming processes such as punching, blanking and drawing and also stated the reason behind the variation of calculated and simulated values with significance of constants. S. Schneider [6] provides the use of Ramberg-Osgood equation to find the tangent modulus property of material. In above referred papers feed the basic required data but not shows the actual procedure to find the punch force require to develop defect free component.

II. PROCEDURE FOR PART DEVELOPMENT

Die development for component is very costly process and it takes lot of time as we go for conventional methods. So use the technology like CAE during the designing of actual components to detect the problem areas in forming. This technology saves work, time and cost. During the development of deep drawing component (Emergency cup) first theoretical calculation is carried out for cup height 35mm, cup diameter 125mm,sheet thickness 1.2mm to get the dimensions of parts such and blank diameter, clearance

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between die and punch, blank holing force, drawing force etc. From this data cad model is generated using 3D cad software like CATIA. From this 3D parts deep drawing process assembly generated. This assembly imported in Ansys software in igs format, by applying material property and boundary conditions values simulation is carried out. As results from simulation finally we get the required punch force by using force probe tool.

A. Theoretical Calculation

Important deep drawing process parameters are calculated by using standard formulas as follows

Blank Diameter $D = (d^2 + 4dh)^{0.5}$ -------(1)

Draw Ratio $= h/d_p$ -------(2)

Table I – The relationship between (H/d) ratio & number of draws

If $h/d_p < 0.75$	Then no. of draws = 1
If $0.75 < h/d_p < 1.5$	Then no. of draws = 2
If $1.5 < h/d_p < 3.0$	Then no. of draws = 3
If $3.0 < h/d_p < 4.5$	Then no. of draws = 4

From Equation (2) and table I indicate that drawing process requires only one stage for completion i.e. this is single stage deep drawing process.

Punch and Die Clearance $C = T + k(10\ T)$ -------(3)

Drawing Force empirical relation

$p = \pi * d_p * t * S * ((D_0/d_p) - C)$ -------(4)

FOS taken as 1.5,

Blank Holding Force is approx. 20% to 30 % of Draw Force (B.H.F.) = 30 % of Draw Force -------(5)

Press Tonnage P = p + (B.H.F.) -------(6)

Table II- Design calculation values

Equation No.	Parameters	Values
1	D	182 mm
2	h/d_p	0.3549
3	C	2.04 mm
4	p	26 ton
5	B.H.F.	8 ton
6	P	34 Ton

B. CAD Model And Deep Drawing Assembly

The solid model of Emergency cup is modeled using 3D modeling software CATIA (generative sheet metal design workbench) based on drawing provided by company.

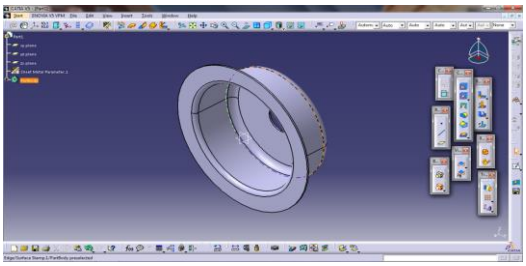

Fig. 1 CAD Model in Catia

This model is then imported in SolidWork. This software has advantage to generate punch and die assembly using user friendly mold tools. Final assembly is export in igs format to carry out simulation.

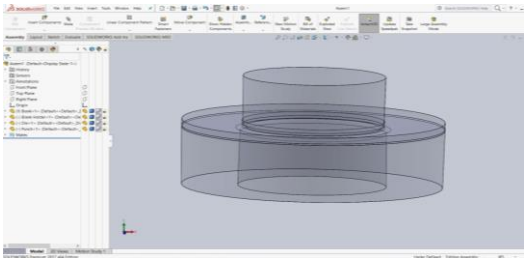

Fig. 2 Die & Punch Assembly in SolidWork

C. Blank Material Property

For deep Drawing process low carbon material is required to minimize the defect generation. Generally for deep drawing process EDD (Extra Deep Draw) material is used. There are some types or grade of materials like CR1, CR2, CR3, CR4, and CR5. As per the company (Priya Autocomponents Pvt. Ltd.) requirements and suggestions CR4 material is used for deep drawing process. CR4 is cold rolled steel with high elongation and lower carbon content. It is good for cold forming process. CR4 material Chemical and Mechanical properties are shown in following tables [7]

Table III – Mechanical properties of material

Quality		Yield Stress R_e Mpa	Tensile Strength R_m Mpa	Elongation Percent A Min		Hardness
Designation	Name	Max		L_o = 80 mm	L_o = 50mm	HR (30T)
CR4	Extra Deep Drawing Aluminum Killed	210	350	36	37	50

The tangent modulus is the slope of the stress strain curve. Below the proportional limit the tangent modulus is equivalent to young's modulus. Above the proportional limit the tangent modulus changes with strain and it is accurately calculate by using actual from test data. The Ramberg–Osgood equation state the relation between young's modulus to the tangent modulus and this is one of the methods for obtaining the tangent modulus. The tangent modulus is playing an important role in describing the behavior of materials that have been stressed beyond the elastic region. When a material is plastically deformed there is no longer a linear relationship between stress and strain as there is for elastic deformations. The tangent modulus determines the "softening" or "hardening" of material that generally occurs when it begins to yield. Tangent modulus is calculated by using constant n is 5, modulus of elasticity 200Gpa for Ramberg–Osgood Equation [6]

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$$Et = \frac{E * \sigma ys}{\sigma ys + 0.002 * n * E\left(\frac{\sigma}{\sigma ys}\right)^{n-1}} \quad \text{-----(7)}$$

Tangent modulus for CR4 material is computed by using equation (7) is 2685061000 Pa = 2.68 * 10^9 Mpa

D. Finite Element Analysis

Assembly in igs format, file generated from SolidWork is imported in Ansys software. CR4 material properties such as density, young's modulus, poisons ratio, bulk modulus, shear modulus, tangent modulus, yield strength, ultimate strength are missing in Ansys material library so it is necessary to create custom material properties for CR4 in material library. Following table shows the material property assign to blank.

Table IV – Material property of CR4

Properties of Outline Row 3: CR4

	A	B	C
1	Property	Value	Unit
2	Material Field Variables	Table	
3	Density	7861.1	kg m^-3
4	Isotropic Elasticity		
5	Derive from	Young's Modulus an...	
6	Young's Modulus	2.0484E+11	Pa
7	Poisson's Ratio	0.29	
8	Bulk Modulus	1.6257E+11	Pa
9	Shear Modulus	7.9397E+10	Pa
10	Bilinear Isotropic Hardening		
11	Yield Strength	2.1E+08	Pa
12	Tangent Modulus	2.6851E+09	Pa
13	Tensile Yield Strength	2.1E+08	Pa
14	Tensile Ultimate Strength	3.5E+08	Pa

Meshing is done by using Ansys Mechanical APDL with element size for blank and other body parts are 2mm, and 3mm respectively. For this element size node and element counts are 98538 and 21557 respectively. Contact between the punch and blank, blank holder and blank is frictional also die is stationary and punch, blank holder are translational in motion. Punch travels to positive Y axis; displacement is set as 35mm from the contact of blank. The transient simulation is carried out for better convergence of the problem for deflection, stresses, joint probe force.

The results are as follows:

1. Total Deformation is 33.9mm and the thickness of bottom circle is around 9 mm. this shows the total deformation is within acceptable value.

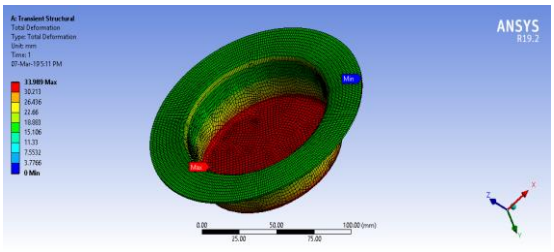

Fig. 3 Total deformation of Cup

2. Equivalent Elastic Strain is 0.009. This value shows the ratio of change in dimension with original dimension. From the results we can say that wall is not too thin.

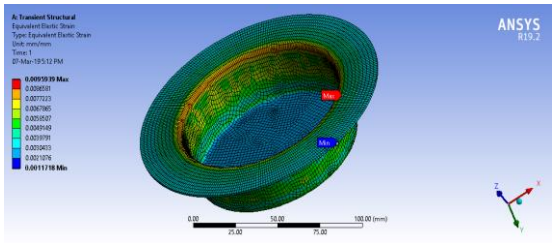

Fig. 4 Equivalent Elastic Stain of Cup

3. Following fig.5 shows the von misses stress generated on component. Maximum stresses occur at the curve or neck of cup. This leads to tearing of component from neck. But in this simulation not single tearing evidence found at neck while checking animated simulation video.

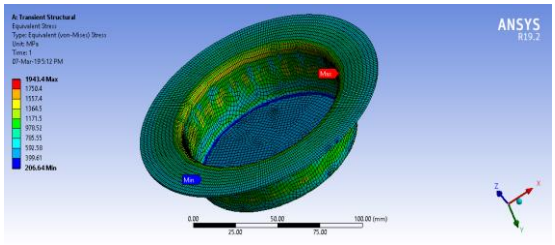

Fig. 5 Equivalent Stress of Cup

4. Shear stress indicates the fracture or failure in material. If shear stress is large then tearing or surface distortion defect generate in product. In this case shear stress is within limit, but on the edge of neck region surface shows the chances of tearing.

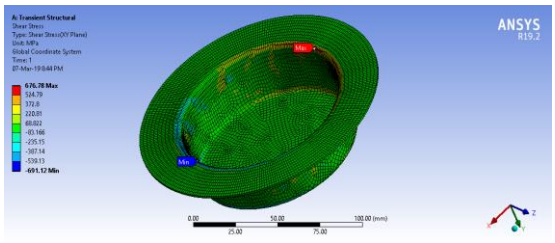

Fig. 6 Shear Stress of Cup

5. Fig 7 shows the load required for the deformation of blank. With respect to the punch targeted elements the load results are calculated by using the reaction values. The load value represented in all axis. The resultant load/force is obtained using mathematical formula.

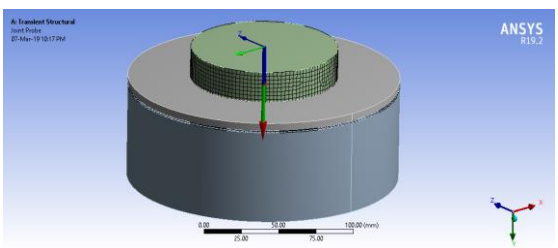

Fig. 7 Local coordinate system of punch probe

Table V shows the reaction force generated on X, Y, Z axis of the punch. Considering this value and mathematical formula resultant is calculated which shows the 30.37 ton force to positive y axis.

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Table V – Punch Joint Probe Result

Definition	
Type	Joint Probe
Result Type	Total Force
Results	
X Axis	2.9783e+005 N
Y Axis	-47.583 N
Z Axis	763.65 N
Total	2.9783e+005 N

6. In deep drawing process due to stretching phenomenon of sheet thickness varies from region to region. Thinning parameter mostly depend on the depth of drawing. As depth of drawing increases thinning increases i.e. wall thickness reduces. This results are calculated with the help of altair inspire form software.

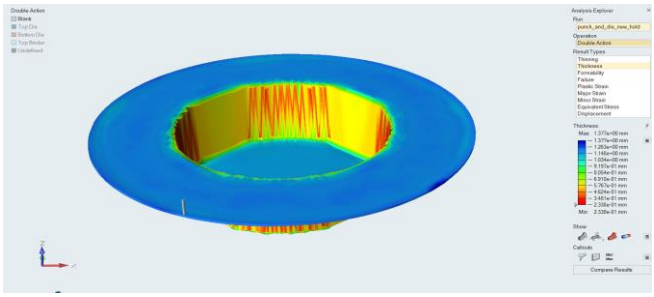

Fig. 8 Thickness of cup at various regions

III. RESULT AND DISCUSSION

Below table shows the strain stress and resultant punch force generated as particular deformation value.

Table VI –Result Table

Total Deformation (mm)	Equivalent Elastic Strain x10^{-3}	Equivalent Stress (MPa)	Shear Elastic Strain x10^{-3}	Shear Stress (MPa)	Total Force (Ton)
Results					
0.1258	1.52	206.64	1.08	85.852	0.976
12.492	6.49	1328.2	6.8	539.9	19.257
20.310	7.78	1581.6	7.94	636.99	23.942
31.238	9.52	1884.5	8.13	645.51	28.522
33.989	9.59	1943.4	8.52	676.78	31.02
36.270	9.89	2086.2	8.88	704.68	31.437

Below graph shows the increase in von-mises stress and shear stress increases with deformation. This graph increases up to the fracture occur in wall surface. Behaviour of graph is non-linear.

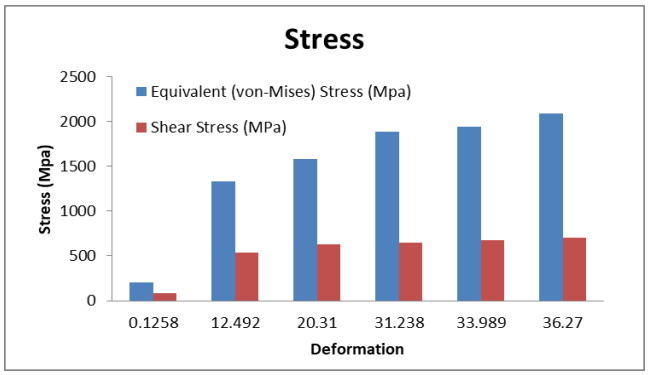

Fig. 9 Stress analysis with change in deformation

This graph shows the relationship with change in deformation with change in strain value. As deformation increases strain also increase. The behaviour of this graph is non- linear.

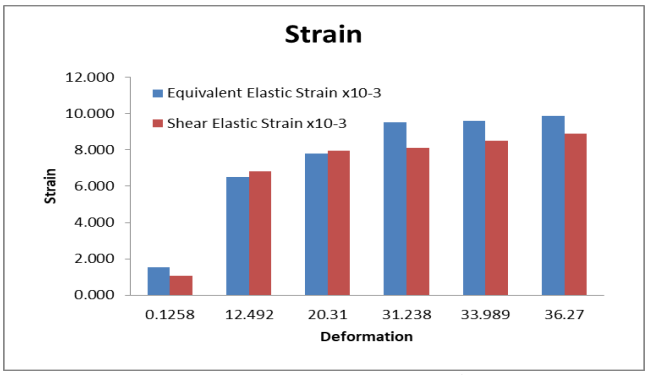

Fig. 10 Strain analysis with change in deformation

The main finding of this paper is to find the punch force required in forming operation like deep drawing which is calculated by using ansys force probe tool. Below graph shows the as increase in deformation punch force also increases. It increases up to the tearing of component wall then it decrease. Next graph shows the force values in tones for specific deformation.

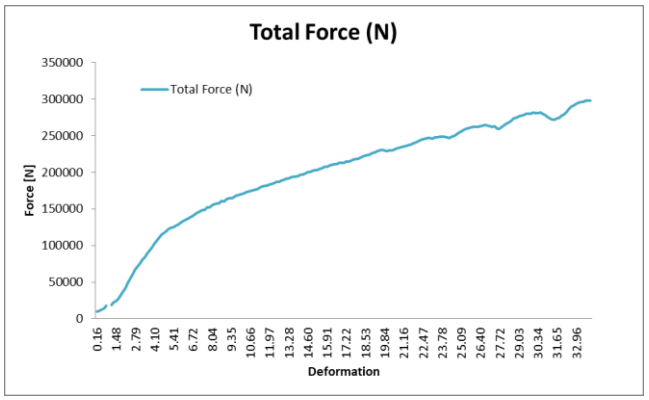

Fig. 11 a) Required force as deformation increases

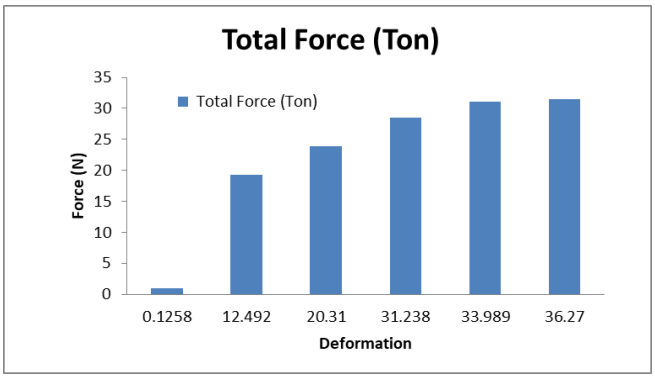

Fig. 11 b) Force values for specific deformation

Joint probe table and chart shows the required force to draw blank into desired shape, i.e. Required Punch Force is 2.978 * 10^5 Newton which is nothing but 30.37 ton

This punch force is calculated from Ansys transient structural simulation solver. For full body we required punch force 31 ton.

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Factor of safety should be taken 1.5, Therefore, Draw Force (P) = 46 ton

Press Tonnage = Draw Force + (B.H.F.) = 54 ton -----(8)

From the theoretical calculation the required force is 34 ton and from the Ansys simulation we get required force as 54 ton. In actual production the required machine force is in the range of 54 to 55 ton. The maximum forces are however very different in magnitude from the theoretical deep drawing force calculated from the equation is 34 ton. This difference can be attributed to the average value of the constant *C*, used in the equation (4) which is dependent on die angle, friction and lubrication. [5]

The problem areas such as wrinkling, tearing thinning are the biggest challenges in the industry now a days but these problems is minimized and sorted out in the initial stages of the design by using simulation techniques. In this simulation there is no single evidence is found about wrinkle. In case of tearing as shown in fig 6, shear stress is maximum on the neck of cup but it indicates the initial stage of tearing not a proper teardown on neck. Fig 8 shows the thickness of cup which is 1.2mm max i.e. original sheet thickness and 0.7mm minimum thickness. From this value thinning is approximately 41 percentages.

IV. EXPERIMENTAL VALIDATION

Fig. 12 Experimental setup

Die and Punch are mounted on the Digvijay power press 60 ton capacity machine with the help of the guide pin and alignment tool on work bed. Experiment setup is prepared as shown in above fig. Conducting the actual experiment first ensured the machine setting parameter then checks the surface finishing and alignment of punch and die, check the edges and ensure the proper oil application on the surface of component. In actual validation the machine is set to different tones from 40ton to increases with 5ton up to 60 ton. Five components are manufactured for every force set on the punch. Deformation of cup is measured using height gauge, form these five values most repeated deformation value is considered which is mentioned in below table (Table-VII). As force increases we get higher distortion of cup base. At the exact depth of 35mm as per real time experimentation process is required the deformation as shown in table VII are actual value calculated from the experimental work. Wrinkle defect is not observed in any iteration also all parts are safe from tearing problem. From the simulation it shows the signs of tearing at neck region but experimentally not a single part get tear at neck or at bottom region. Maximum thickness of cup is 1.2 mm and minimum thickness is 0.8 at the wall region. Maximum percentage thinning is approximately 33 percentages, which is acceptable.

Table VII – Actual Deformation as Force Increases

Force in ton	Deformation in mm
40	12.58
45	20.26
50	31.15
55	34.31
60	36.80

V. CONCLUSION

The maximum force recorded in the simulation deep drawing processes (Equation 8) is calculated as 54ton, and this force is validate by conducting experimental process at 55ton force (shown in table VI). The experimental and computational value of force obtained matches well with each other. From the results it can also be concluded that the computational method used in this paper is much acceptable for deep drawing.

From the experimental results it is observed that the part manufactured is wrinkle free hence equation (5) provides correct blank holding force to produce defect free production of deep drawing forming parts. Tearing defect is also absent in whole experimentation process. Maximum thinning of cup is 33 percentages i.e. wall thickness is 0.8mm which is acceptable. Therefore press machine up to 60 ton capacity can be used for the required process.

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It is precious moment to acknowledge all the personalities who had helped me in my final project work. Firstly, I am very thankful of my guide Prof. D. H Burande for his valuable time and support for completion of project work. I am very thankful to Ms. Priya Gogawale from Priya Autocomponents Pvt. Ltd. Chakan, Pune for giving me an opportunity to do this project and believing me that I am capable of doing this project successfully. I am also very thankful of my coordinator Dr. A. P. Tadamalle for guiding me time to time.

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Real Time Force Monitoring in Resistance Spot Welding

R. S. Sakpal
M.E Automotive Engineering,
Mechanical Department
Sinhgad College of Engineering,
Vadgaon Pune, Maharashtra

D. H. Burande
Mechanical Department
NBN School of Engineering
Pune, Maharashtra

***Abstract*— Resistance spot welding has vital applications; its main function is for joining the sheets in automobile companies. Resistance spot welding process parameters are optimized to improve spot weld quality. Real Time Force Monitoring is all about monitoring the actual force during the time of spot welding and to set the required amount of weld force. Resistance spot welding is necessary to improve the quality of spot welds and to measure the force during welding. Experimental studies are conducted under varying force of electrode, welding current flow and its time duration. The resistance spot welding is studied and the spot welding gun used for welding purpose is optimized. The spot welding gun is integrated with the customized high capacity compression load cell. A regular automobile includes more than 3000 spot welds. When the current is passed through the metal sheets, heat is generated due to resistance. This heat is used for melting the metal sheets and to join them together. Resistance spot welding is a high speed process; whereas the actual welding process occurs within the fraction of seconds. It is simple and clean method. It also joins multiple metal sheets together at same time. It has wide application for joining purpose in manufacturing industries, car batteries, utensils and dental purpose respectively.**

Keywords*— *Electrode Force, Expulsion, Real Time, Resistance Spot Welding, Spatters

I. INTRODUCTION

In the automobile industry, and the transportation industry, the resistance spot welding (RSW) has been used for decades for the main joining purpose. The method has a low cost, highly reliability, higher time efficiency, high ability for robot atomization and high accessibility compared to all other joining methods, it made an ideal for the automotive production companies. A conventional modern automobile has around 3000 – 5000 resistance spot welds, while other joining methods, such as arc welding, mechanical fastenings and laser welding is used in a much more limited scale. Resistance spot welding in manufacturing industries results highly important for product and their properties, including with the critical properties such as vehicle safety, fuel efficiency and crashworthiness. To ensure robustness in resistance spot welding the applications, variations of process result is minimized. To measure the process robustness and weld quality of RSW, the main measurements are nugget weld size (the lateral size of the solidified joint zone) and the occurrence of weld expulsion. Expulsion is the phenomenon which occurs when molten metal is subjected from the weld. While, the two measurements do not fully measure all aspects of weld quality, they indicate several important factors and are relatively easy to attain the n.

Zygmunt Mikno [1] the article presents the process of resistance welding in relation to the expulsion of liquid metal from the weld nugget. The related tests involved the synchronic recording in research of welding process parameters like welding current and electrode force. Xiaodong Wan et al [2] our study aims at developing an effective quality monitoring system in small scale resistance spot welding of titanium alloy. The measured electrical signals were interpreted in combination with the nugget development. Shaik Shafee [3] Resistance spot welding process parameters are optimized to improve spot weld quality. The experimental studies are arranged for varying force of electrode, its time duration and welding current flow. Fan Qiuyue [4] the effects of different expulsion conditions on the dynamic resistance and weld tensile-shear strength under shop expulsion conditions in resistance spot welding were investigated. S. Chen [5] Resistance spot welding is an important branch of the welding subject, and has been widely used in aviation, aerospace, automotive and other industrial areas due to its high efficiency, low cost and small deformation. The improvement due to online monitoring the product quality, of welding has become an urgent issue. Kang Zhou [6] Resistance spot welding (RSW) is frequently employed in current industrial occasions. This paper presents process analysis. It advances the quality control of the RSW operations. High capacity compressive load cell is customized and integrated inside the gun and display unit is attached to monitor the readings during the actual time of resistance spot welding.

II. PROCEDURE

Resistance spot welding is considered as good method for joining the metal parts. These method results expulsions spatters and bad quality of spot weld due to default changes in electrode force. To know the electrode tip force during the time of resistance spot welding it is decided to optimize the gun design with the help of load cell by integrating inside the Nash gun and with the help of digital indicator to display the electrode force. The exact required electrode force during the time of spot welding is obtained. And continue with monitoring the electrode force results gained by display unit and comparing them with previous results obtained by the force gauge.

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A. Customised Load Cell for integrating inside the Nash Gun.

Fig. 1 Customized Load Cell

In above image we can see the high capacity compression load cell is customized in such a manner that it is easily fitted in welding gun. The compression load cell is at the top and copper metal is attached with the help of welding process. This type of arrangement is fitted inside the gun. The requirement behind the customization of load cell is to make the load cell fit inside the area where the linkage of movable shank and piston rod is connected with the help of knuckle joint. After studying and taking the dimension it is observed that the load cell requires particular amount of dimensions to make a proper arrangement inside the gun. The cross sectional area of piston rod hitting the load is calculated. Hence, some amount of clearance is added in the diameter of customized load cell around 15 mm approx. The same dimensions are used for the copper block below the load cell and it is chamfered around 2 mm from all four sides.

B. Optimize the gun design.

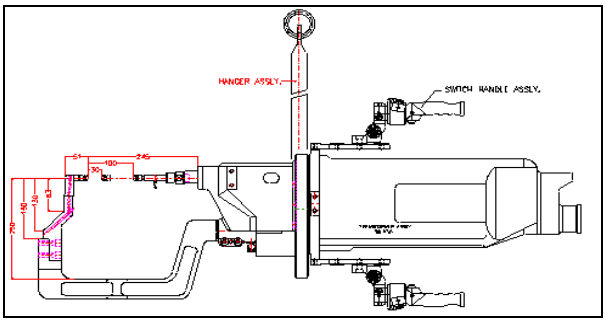

Fig. 2 Gun Design

The Nash Gun is most commonly used for the resistance spot welding in automobile industries. The customized load cell is integrated inside the cover box in between both the shanks where the upper one is fixed and lower one is movable. The gun operates on two phase 415 volts AC supply. Green and Red tubes are connected to electrodes from inside for water in and out for cooling purpose. 5/2 solenoid valve is used as it has two independent exhaust port as it helps to return back the piston rod back to rest position and it is connected with blue wire for air supply with high pressure for the movement of the piston rod which helps the movable shank to move.

C. Experimental Setup

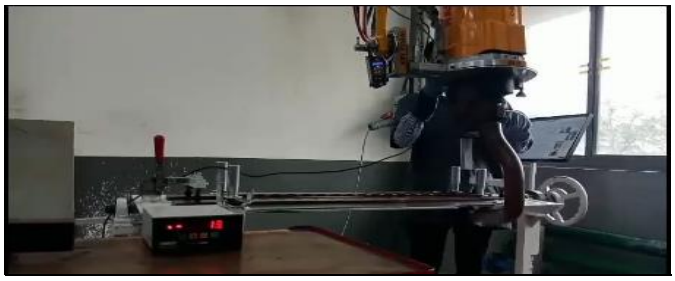

Fig. 3 Experimental Setup

The experimental setup is arranged using two dual phase steel sheets which are kept on each other and held together with the help of C clamps from both sides. The Nash gun is placed perpendicular over the sheet where the spot welding is required. The digital display unit is connected to the Nash gun with the help of connecting wire and placed within the operational area. And the electrode force generated is calculated by using formula,

$$F = PA = P\frac{\pi d^2}{4}$$

Where F is Force, P is pressure, A is area

Table I Results for Electrode Force for Thickness (T-1)

Pressure (N/mm^2)	Diameter (mm)	Force (kgf)
3.77	30.2894	277
3.92	33.4340	351
3.63	35.9139	375
4.45	22.3350	178
3.77	28.9475	253
3.92	28.2166	250
3.63	33.3318	323

From the above table it is seen that at different pressure and different diameter, we get the values of electrode forces thickness (T-1). These values obtained are compared with the previous data available of the process.

Table II Results for Electrode Force for Thickness (T-2)

Pressure (N/mm^2)	Diameter (mm)	Force (kgf)
3.26	30.2894	240
3.35	33.4340	300
4.24	35.9139	438
4.38	22.3350	175
3.81	28.9475	256
4.36	28.216	278
3.72	33.3318	331

From the above table it is seen that at different pressure and different diameter we get the values of electrode forces for thickness (T-2). These values obtained are compared with the previous data available of the process

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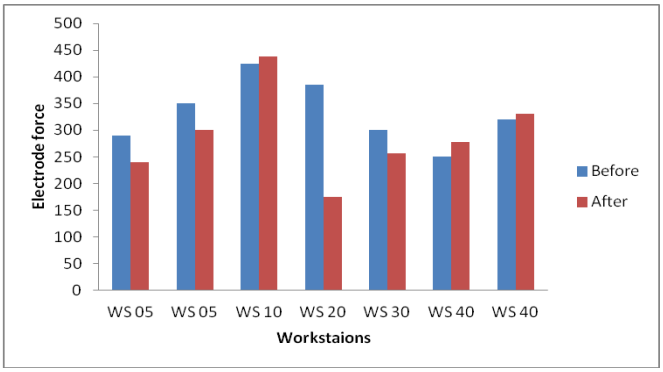
III. RESULTS AND DISCUSSIONS

A. *Weld Force Results*

Graph 1 Weld Force Comparison for One-T

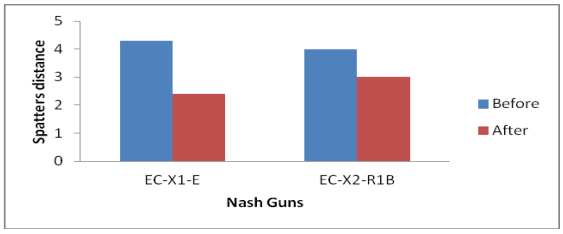
Weld force comparison before & after integration of load cell of ONE-T (sheet thickness) without load cell the weld force we noted was high later after integrating load cell less force is enough at some workstations which results less expulsion and spatters too.



Graph 2 Weld Force Comparison for Two-T

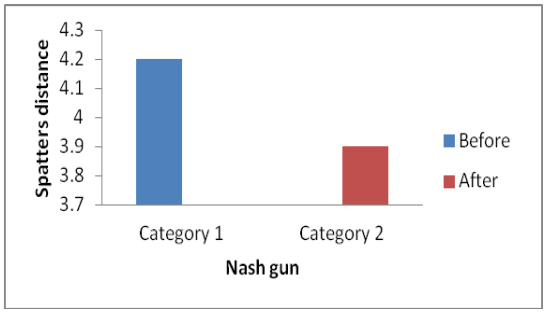
Weld force comparison before & after integration of load cell of TWO-T (sheet thickness) without load cell the weld force noted was high and less on some workstations later after integrating load cell some workstation needs much force and some needed less weld force.

B. *Spatters Results*



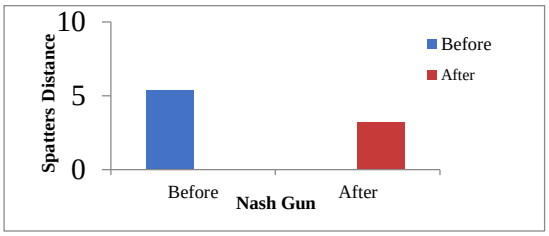
Graph 3 Spatters Result at Workstation 05

These readings are the distance of spatters from the origin of spot welding in which we can see that they are reduced 52% in first gun & 25 % in second gun.



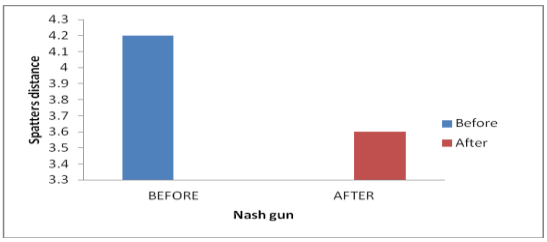
Graph 4 Spatters Results at Workstation 10

These readings are the distance of spatters from the origin of spot welding in which we can see that they are reduced 8%



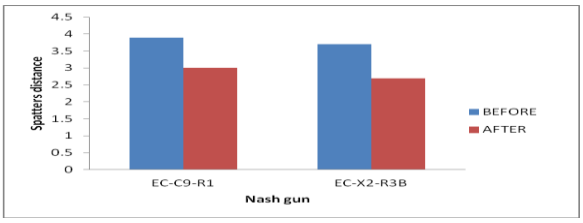
Graph 5 Spatters Results at Workstation 20

These readings are the distance of spatters from the origin of spot welding at workstation 20 in which we can see that they are reduced 23%



Graph 6 Spatters Results at Workstation 30

These readings are the distance of spatters from the origin of spot welding at workstation 30 in which we can see that they are reduced 15%



Graph 7 Spatters Results at Workstation 40

These readings are the distance of spatters from the origin of spot welding at workstation 40 in which we can see that they are reduced 15% & 10%

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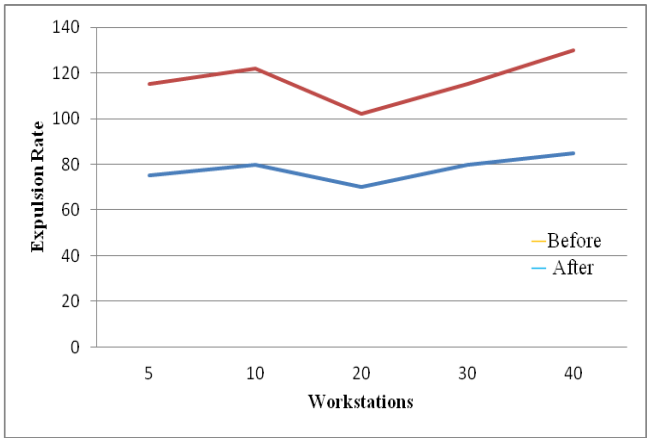
C. Expulsion Results



Graph 8 Expulsion Rate

These are the results of expulsion rates in which they are reduced certainly more than 50% at workstation 05, 10, 20, 30 & 40 respectively.

D. Spot Weld Quality Results

Fig. 4 Spot Weld Quality before Integrating Load Cell

The work piece used for the trail shows the spot quality before integrating the load cell with the shunting effects and darker region around the spot weld.

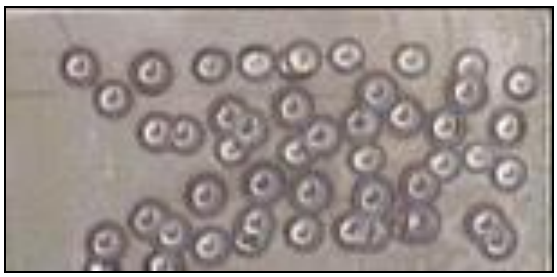


Fig. 5 Spot Weld Quality after Integrating Load Cell

The work piece used for the trail shows the spot quality before integrating the load cell with the shunting effects and dark region around the spot weld.

IV. CONCLUSION

As per the studies and results related to resistance spot welding gun it was necessary to make the changes to he issues which are related during required operating time for the resistance spot welding gun. The idea of integrating the load cell inside the spot welding gun gives successful results regarding electrode force and the spatters and expulsion were reduced. The studies and investigation of welding gun in a proper way to customize the load cell and to integrate the same in proper way so that accurate results during experimental trails are observed.

The experimental results were the first priority to the team. The earlier parameters were noted and new parameters were introduced and we found the changes at the particular workstations and the results were compared with the previous parameters. It was found that the changes in previous parameters has the positive effect on work piece and the digital display unit was introduced so that we can see the exact electrode force during the time of spot welding which reduces the NVAs (Non Added Values Activities) and also the successful results in reducing the expulsions and spatters during spot welding where achieved. Good quality of spots during resistance spot welding is observed.

Table III Conclusion of Electrode Forces at Engine Compartment Section

Work station	WS 05	WS 05	WS 10	WS 20	WS 30	WS 40	WS 40
Forces Before	277	351	375	178	253	250	323
Forces After	240	300	438	175	256	278	331

These are results of electrode forces at Engine compartment section where the experiment was carried out and comparison shown in above Graph 1 & 2 respectively. There are five workstations in this section with two Nash guns at workstation 05 & 40 and one Nash gun at workstations 10, 20 & 30 each. The experiment was carried out in this section because two or more child parts are joined together at this section. There are less expulsions and spatters as shown in expulsions rate Graph 8 and spatters results Graphs 3, 4, 5, 6 & 7. Good qualities of spots are shown in the above Fig. 5 as compared to Fig. 4 respectively.

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It is an important moment to acknowledge that personalities who had helped me in my final project work. Firstly, I am very thankful of my guide Prof. D. H Burande for his valuable time and support for completion of project work from Mahindra Vehicle Manufacturing LTD, Pune. I am also very thankful of my co-guide Mr. Sameer Sawant for giving me an opportunity to do this project and believing me that I am capable of doing this project successfully.

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Aerodynamic Drag Force Analysis for Light Commercial Vehicle

M. H. Tonpe
Mechanical Department (Automotive Engineering)
Sinhgad College of Engineering
Pune, Maharashtra

A.P. Tadamalle
Mechanical Department
Sinhgad College of Engineering
Pune, Maharashtra

D. H. Burande
Mechanical Department
NBN Sinhgad School of Engineering
Pune, Maharashtra

***Abstract*— Aerodynamic drag is considered as the main obstacle to accelerate the solid body when it moves in the air. It deals with the study of stationary objects with the moving air, or in a motion on which the forces are acting by the air on the object. This paper describes the assessment of aerodynamic drag of LCV (Light commercial vehicle-Tata Winger) with the basic dimensions and modified changes in the exterior design of the vehicle. SolidWork tool is used for designing the CAD models while Ansys is used for the simulation to find the drag values. Three different models are made and simulation is carried out. The drag at different velocity ranging from 5 m/s to 25 m/s is calculated for the vehicle model. For better drag reducing compatible model all the three models are compared to each other with the drag values obtained through the simulation done in Ansys (Fluent). Experiment is performed in a subsonic wind tunnel with the model which shows better results in terms of drag. By using ansys it is easier to find the aerodynamic properties, time and material both are saved using this process.**

Keywords—Aerodynamics, Computational fluid dynamics, Drag coefficient, Drag Force, Fuel efficiency, Tata winger, Vehicle design.

I. INTRODUCTION

Aerodynamics is a field of fluid dynamics and gas dynamics which shares the theory between them. Aerodynamics can also be said the study of passing the air flow over the vehicle body and also studying the behavior of the flow with the use of CFD approach respectively. The aerodynamic properties of the vehicle body effects the performance, comfort and safety of the vehicle. While designing a vehicle the aerodynamic concept holds an important part. A drag reduced vehicle is only acceptable during the design of vehicle. Aerodynamic drag is considered as one of the main obstacle to accelerate the solid body when it moves in the air. Researchers have used the CFD techniques to perform numerical simulations related to the automobile.

The study in this paper presents the development process of aerodynamic in the vehicle external body. Various simulations are carried out to analyze the pressure field, velocity vector field, and aerodynamic force prediction related to a LCV. The stability of the aerodynamic forces caused by the airflow outside the car is identified. After that, the modification to the vehicle body that leads to lower wind drag was carefully evaluated. Experimentation is done in a subsonic wind tunnel using the model which gives better results in terms of drag. The model used is scaled according to the dimensions of the wind tunnel available for the experimentation.

An aerodynamic car consumes less fuel and also overcomes the drag exerted by air when running at high speed and it provide good stability and handling behavior [1]-[2]. The reduction technique of aerodynamic drag can be used in all types of vehicles like cars, busses, vans, sports car etc. The aerodynamic drag on LCV is very less researched. Aerodynamic drag consist mainly two component skin friction drag and pressure drag. Among the total aerodynamic drag Pressure drag account most which depends on the external geometry due to boundary layer flow separation from rear window surface and wake region generated behind the vehicle body [3]. The two major part of aerodynamics are external aerodynamics and internal aerodynamics. External aerodynamics deals with the flow of air over the solid body having different shapes. While the internal aerodynamics deals with the flow that passes through inner compartment of solid body. The flow around a car is asymmetric due to which there is a separation region generated at the rear end of the vehicle. There are two different type of separation which occur (a) Quasi-two dimensional which occurs at the edge of the vehicle between grill and hood. It is characterized by high degree of turbulence. (b) Three dimensional separations which occur around the edges of the vehicle body where the air flows with an angle [4].

II. CAD MODELLING

The model of vehicle used is a replica of Tata-winger which is used as ERV and also for passenger vehicle. The dimension of the vehicle is as 4520 mm in length, 1560 mm in width and 2050 mm in height. The model used for the project work is scaled to the ratio of 1:30 according to the wind tunnel dimensions. The wind tunnel dimension used for the analysis is of cross sectional area 100 cm x 30 cm x 30 cm. The CAD model with all the modification is shown in the Fig.1 (a, b, and c) as below.

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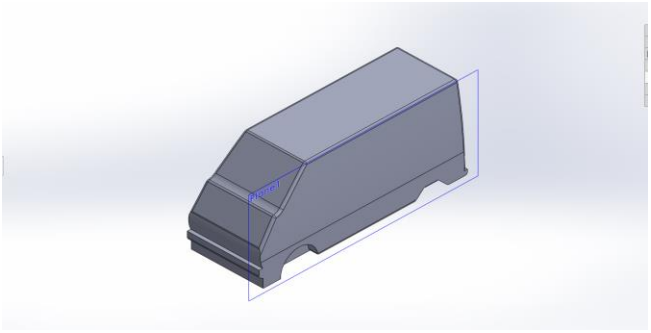

Fig. 1 (a) Base Model

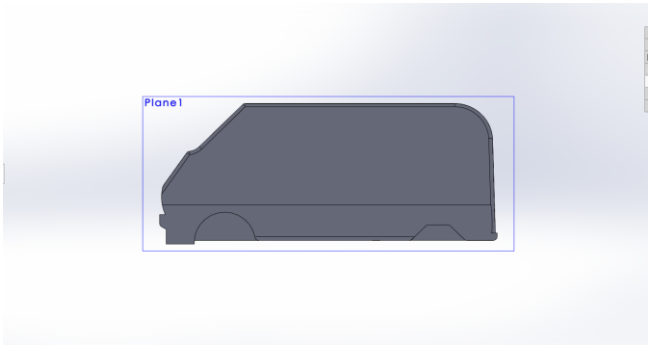

Fig. 1(b) Modified Model with Upper Rear End Cut

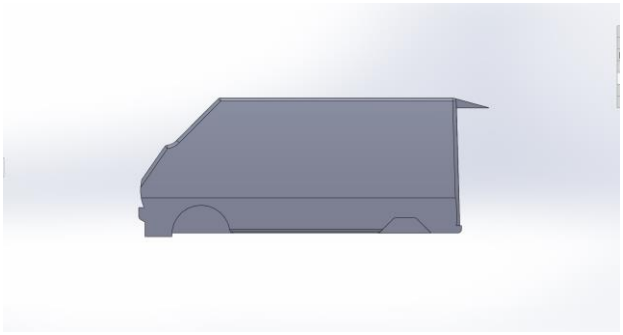

Fig. 1 (c) Modified Model with upper Rear End Tale Plate

The first modification is done with an upper rear cut of 508 mm in radius. Second modification is done by attaching an upper rear tale plate of 508 mm in length which has an inclination of 15^0 from the top surface.

III. CFD ANALYSIS

The models made are mesh in the software and analysis is done using CFD (Fluent) approach to find the drag coefficient and drag force. The effect of wheels, side mirrors, and rear surface body parts are not studied in this paper. The side friction is so less that if not considered then also the value of drag obtained is acceptable for the particular shape of the body.

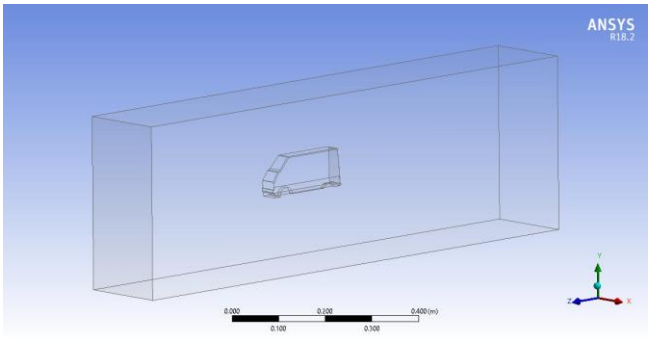

Fig. 2(a) Wind Tunnel Orientation

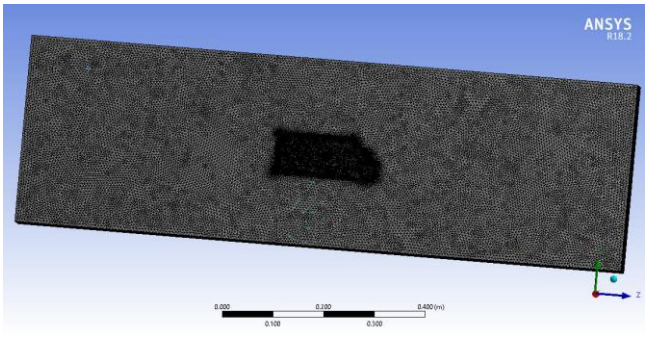

Fig. 2(b) Meshed Base Model

The remaining two models are also meshed in the same way as done for the base model. CFD analysis of the test model provides the result of drag coefficient and drag forces. [6] Boundary conditions are applied as the velocity inlet where the readings are calculated using different air velocities (5, 10, 15, 20, 25 m/s) and constant pressure outlet at atmospheric pressure 1 atm. [7]. A steady state incompressible Navier-stokes equation is obtained by implementing turbulent modeling with realizable k-epsilon (2 equations) and non-equilibrium wall function. Second order upwind discretization method is used in the solution method which goes to a peak value at first and then gives accurate result.

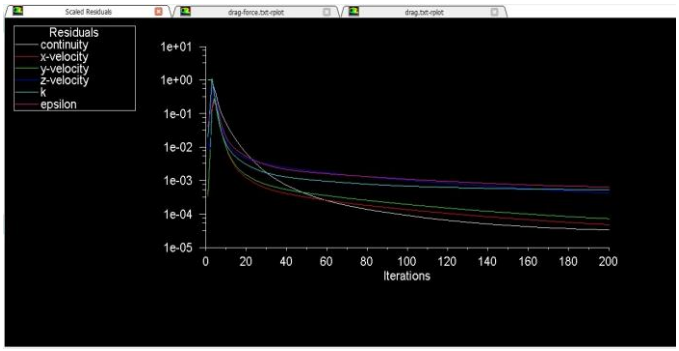

Fig. 3 Processing`

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A. CFD Analysis of base model

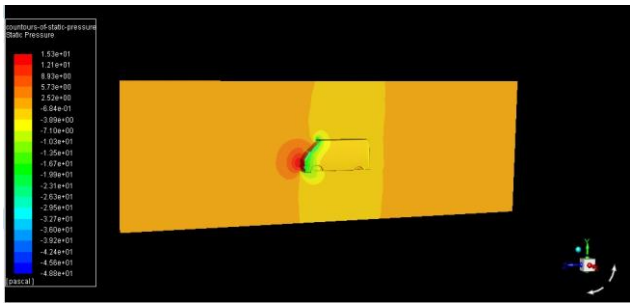

Fig. 4 Contours of Static Pressure

From Fig.4 it is seen that the maximum pressure occurs at the front of the vehicle. The maximum Static pressure acting on the model is 15.3pascal which is at the front surface of the model.

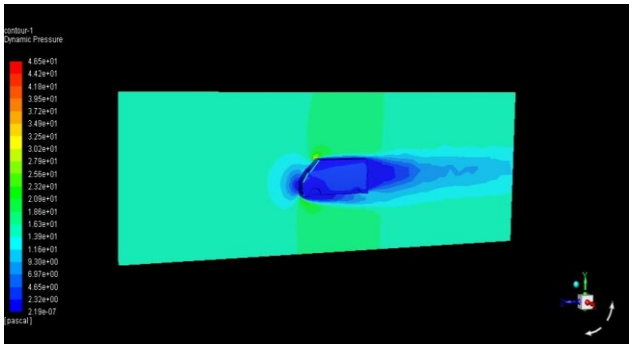

Fig. 5 Dynamic Pressure

Fig.5 represents the dynamic pressure of the base model. The maximum pressure acting on the model is 4.65pascal which acts at the front surface of the model.

B. Velocity Analysis of base model

Fig. 6(a and b) show the velocity streamline at different velocities 10 m/s and 20 m/s for the base model. Similarly velocity streamline for 5m/s, 15 m/s, and 25 m/s are also calculated.

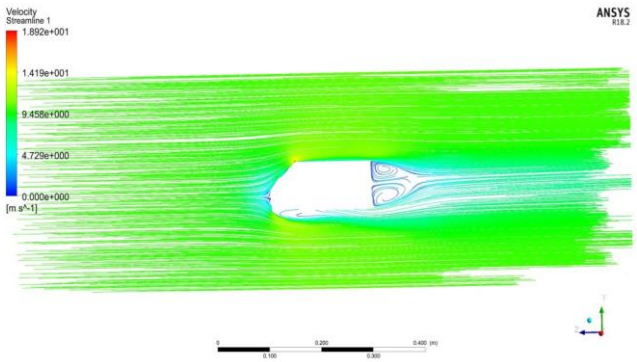

Fig. 6(a) Velocity Streamline at 10m/s

From the above Fig. 6(a) it is observed that the wake region is generated at the rear end of the vehicle. This wake region is the reason for the drag of vehicle. The air flow at this region is in separated form which decreases the pressure at the rear end.

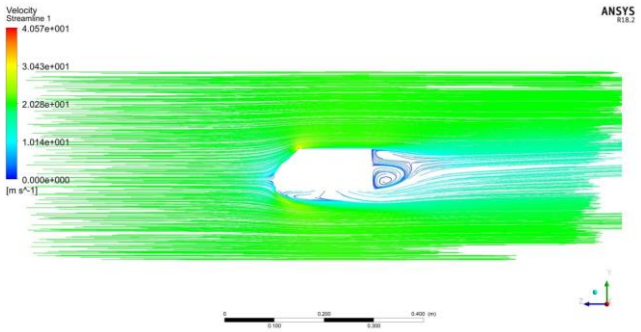

Fig. 6(b) Velocity Streamline at 20m/s

From the Fig. 6(b) it is seen that the wake region is reduced to some extent as the velocity inreases but with increase in velocity the shape of the wake region also changes. The flow at the upper rear end of the vehicle at 20 m/s is different as compared to the velocity at 10 m/s. The results obtained from the analysis are shown in Table I as shown below.

Table I: Result of base model using Ansys

Velocity (m/s)	Velocity (km/hr.)	Drag Coefficient	Drag Force (N)
5	18	0.60863	0.026219
10	36	0.54712	0.094278
15	54	0.51118	0.19819
20	72	0.49916	0.34406
25	90	0.48887	0.5265

C. Velocity Analysis of Modified Model with upper rear end cut.

Fig. 7(a and b) show the velocity streamline for the modified model with upper rear end cut of 508 mm radius.

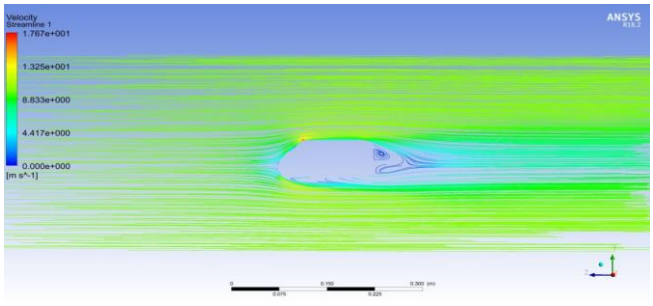

Fig. 7(a) Velocity Streamline at 10m/s

From Fig. 7(a) it is seen that the wake region generated for the model is different from the base model at similar velocity. The velocity streamline after the wake region also shows the decrease in velocity in that region.

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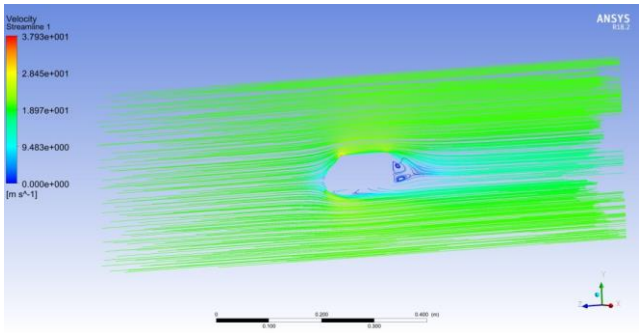

Fig. 7(b) Velocity Streamline at 20m/s

When the velocity is increased for this model the wake region generated is small but with more space area behind the vehicle which has less pressure as compared to the front. This increases the drag force of the vehicle. The analysis results of drag force and coefficient are shown in the Table II for the first modification done to the base model.

Table II: Result of modified model with upper rear end cut using Ansys

Velocity (m/s)	Velocity (km/hr.)	Drag Coefficient	Drag Force (N)
5	18	0.6616	0.01619
10	36	0.53721	0.052582
15	54	0.5075	0.111767
20	72	0.5043	0.19745
25	90	0.49806	0.30468

D. Velocity Analysis of Modified Model with upper rear end cut.

Fig. 8 (a and b) show the velocity streamline of the modified model with upper rear end tale plate with 508 mm in length and 15^0 inclination from the top surface.

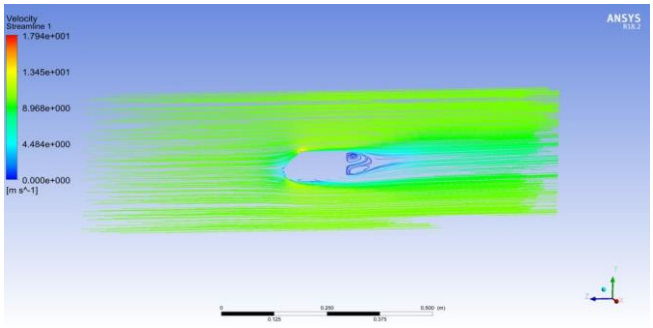

Fig. 8(a) Velocity Streamine at 10m/s

It is seen from the above Figure 8(a) that the wake region generated by the modified model at the rear end of the vehicle is close to the upper rear end of the vehicle due to which the flow of the air is attached to the surface of the vehicle.

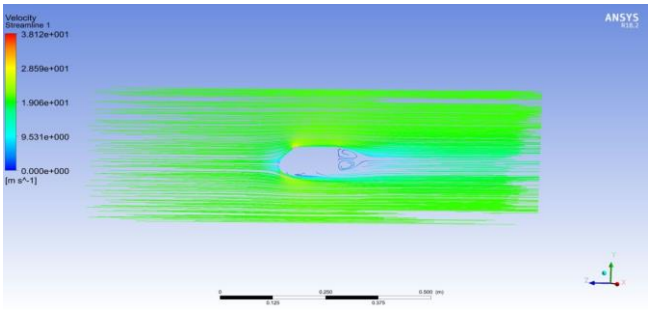

Fig. 8(b) Velocity Streamine at 20m/s

All the figures shows the flow of velocity over the surface of the base modle and modified models. Its seen that at each velcity there is a different formation of wake reagion at the rear end of the vehicle. The results obtained for the second modification done to the base model are shown in the Table III. Velocity vector colored by velocity magnitude can also obtained from this analysis for all the different velocitiees for all the three models of vehicle. Its is seen that the seperation of flow takes a the rear end of the vehicle due to which the wake region is generated. The formation of wake region is diffirent at different velocites.

Table III: Result of modified model with upper rear end tale plate using Ansys

Velocity (m/s)	Velocity (km/hr.)	Drag Coefficient	Drag Force (N)
5	18	0.60562	0.01489
10	36	0.53015	0.05189
15	54	0.49723	0.1095
20	72	0.48567	0.19014
25	90	0.47861	0.292785

From the results obtained through the analysis the second modification of rear tale plate attachment shows better drag reducing capability as compared to the base model and first modification done to the vehicle. Hence the vehicle model with second modification done to the base model is used for the experimentation.

IV. EXPERIMENTAL METHOD

The experimental test was carried out using a subsonic wind tunnel of cross section 100 cm x 30 cm x 30 cm. The model was placed at a height of 14.2cm from the bottom of the wind tunnel. An anemometer was placed at the rear end of the model to measure air flow velocity. Readings were taken at different velocity for the modified model with rear tale plate attachment as it gives us the good results compare to the other model as per the simulation work done. The following Figure shows us the Experimental setup of the wind tunnel.

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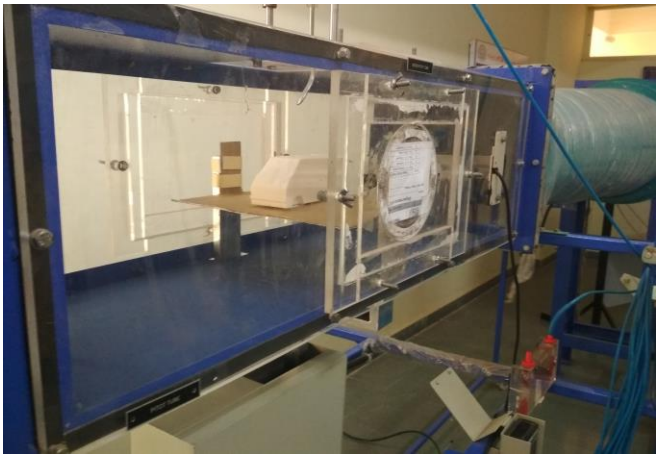

Fig. 9 Wind tunnel Experimental Setup

The setup was connected to a pitot tube and annemometer which is used to calculate the Drag force as shown in the Figure 10.

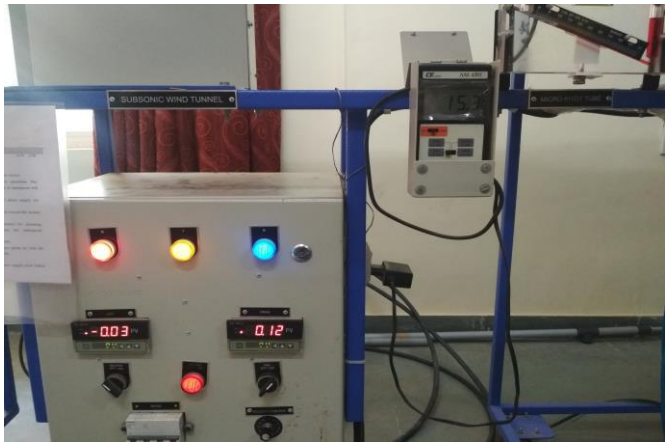

Fig. 10 Wind Tunnel Setup with Annemometer

The experimental formula to calculate the drag coefficient is given by,

Drag (C_d) = $\frac{2*F_D}{\rho V^2 A}$

Where, C_d is Coefficient of drag, F_D is Drag force, ρ is Density of air, V is Velocity of air, and A is the frontal area of the vehicle [1]. The drag values for different velocities are calculated for the second modified model and compared with the simulation results obtained. The results obtained by the experiment performed for the modified model are shown in below Table IV.

Table IV: Experimental Results of the Modified Model.

Velocity (m/s)	Velocity (km/hr.)	Drag Coefficient	Drag Force (N)
5	18	0.6130	0.03
10	36	0.5108	0.05
15	54	0.59031	0.13
20	72	0.4342	0.17
25	90	0.408676	0.25

V. RESULTS AND DISCUSSION

From the analysis of the models it is observed that when the flow is separated it gets reattach further downstream. This type of separation occurs at the rear side of the vehicle and a big wake region is generated behind the car. The circulation depends upon the shape of the edge where separation occur and the direction of the air that moves from the high pressure region to low pressure region. When a fluid flows around the body it slows down nearest to the body due to the friction with the surface. The decreased velocity of air results in an increased pressure on the surface which means that the force to slow down the vehicle increases to the force to carry the vehicle forward. A wake is created at the place of separation which has low pressure then the surrounding. The low pressure behind the vehicle is a combination with the high pressure in front of it which leads to the increase in drag resistance.

The drag coefficient and drag force at different velocities for all the models of the vehicle are calculated. The drag values obtained in the Table I, II, and III shows that the drag coefficient is affected by change in velocity. From the results obtained it is also observed that as the velocity increases the drag force also increases.

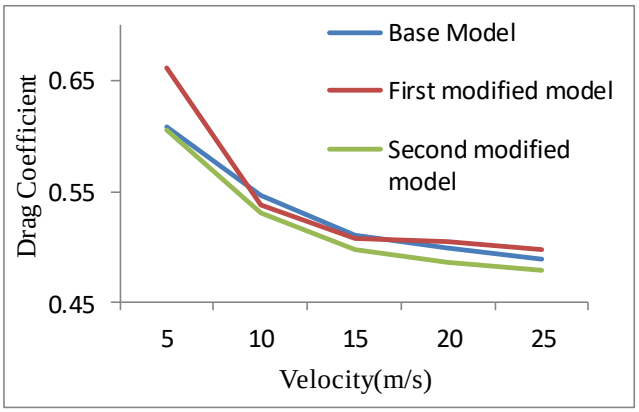

Fig. 11 Drag Coefficient with Change in Velocity

The graph of drag coefficient and velocities is plotted for all the three models. It is seen that the modified model with the upper rear tale plate attachment reduces the drag at some extent which can be considered as good from the aerodynamic point of view. The experimental results are calculated for the modified model with rear tale plate attachment and compared with the simulation results for validation. It is seen that the values matches well with the simulation results for the series of velocity. The minor changes in the values are due to the mesh generation and grid size used in the computational method [2].

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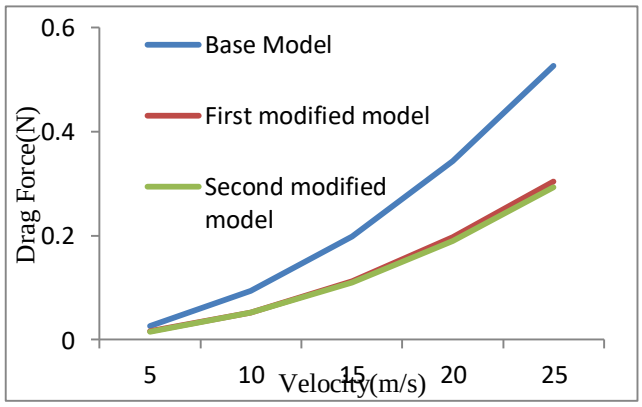

Fig. 12 Drag Force with Change in Velocity

The graph of drag force and drag coefficient with change in velocity obtained by experimental method and computational method for the second modified model with rear tale plate attachment is shown in Fig. 13 and Fig. 14 respectively.

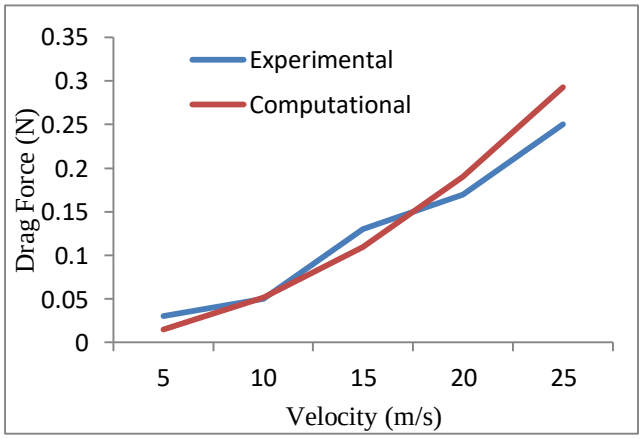

Fig. 13 Experimental and Computational Drag Force

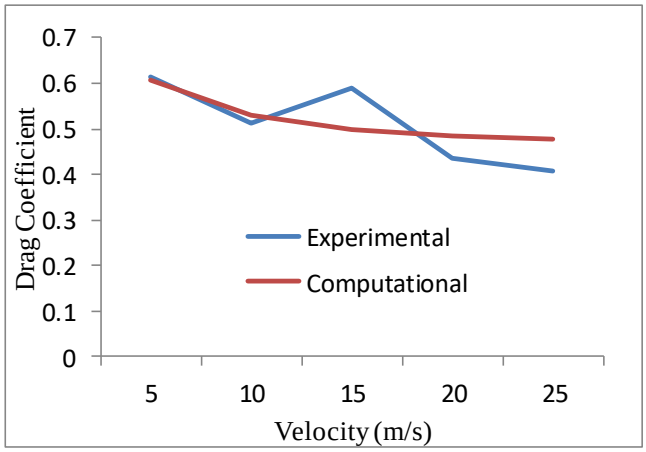

Fig. 14 Experimental and Computational Drag Coefficient

VI. CONCLUSION

From the results it can be concluded that the drag is affected by change in velocity. Drag force increase with increase in velocity. Among the two modifications the second modification with rear tale attachment shows better drag reducing capability as compared to the base model and first modified model. The computational value matches well with the experimental values performed for the modified model. The percentage reduction of 2.17% is obtained from the results by implementing the second modification for the base model. It is also seen that these types of changes can be used to improve the drag of the different light commercial vehicles. A small reduction in aerodynamic drag of a vehicle gives better performance and handling behavior of the vehicle.

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Design and Analysis of Bumper using Carbon Fibre 395

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S.D. Waghmode[1], D H Burande[2]

[1]M.E Student, Department of Mechanical Engineering (Automotive Engineering), SCoE, Pune, Maharashtra
[2]Professor D.H.Burande, Department of mechanical Engineering, NBN SCoE, Pune, Maharashtra

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Abstract - *Bumper is one of the key structural parts, which plays an important role in the frontal crashes of a Vehicle. The most important parameters of an automotive front bumper Such as material, shape and impact condition are to be studied to improve the bumper. The aim of paper is to increase the strength of bumper by using composite material carbon fibre 395. In recent years, security regulation has been very crucial t hat enforces the manufacturer to decrease passenger vehicle w eight. Carbon fiber 395 has low price and excellent strength. The 3D model of bumper is done on Catia V5 software and Explicit Dynamics is done on Ansys 19.2 Software to find out the deformation, Stress and Strain. The main problem of bumper during collision is the wear and tear of bumper at high speed so to increase in the strength and reduce the wear and tear of the 3 bumper for that the new bumper with proper new material is manufactured.*

***Key Words*: Carbon fiber, Bumper, Ansys, Catia, Strength**

1. INTRODUCTION

Bumper is a structure that is attached to or integrated with the front and rear end of the vehicle to absorb small and large impacts and thud minimize repair costs. Rigid metal bumpers appeared on motor vehicles as early as 1904, which was predominantly decorative. The bumper have changed over the years with numerous developments, improvement in material and technology as well as a stronger focus on functionally to protect vehicle components and improve safety. Ideally, bumpers minimize vehicle height difference and protect pedestrians against injury. Regulatory rule measure had been taken to reduce the repair costs of vehicle. Bumper's purpose is to reduce physical damage during slow accidents to the rear and front of vehicle. The bumpers protect the system, grill, fuel, cap, trunk, and exhaust and cooling. A bumper is a shield made of aluminum, steel, and plastic. The attributes of a good bumper system are geometry, stability and energy absorption. Bumpers on colliding vehicles should be geometrically aligned to inter mesh with a slow impact to absorb the impact energy. Bumpers are designed to anticipate or decrease physical damage to traveler vehicles ' front or backsides in collision condition. It secures sub-systems, fuel line, gas flow system out, and cushion or radiator refrigeration. Distinctive countries have similar executions and guards gauges. In the originally generated global security controls as European gauges & now usually adopted by countries. The usefulness of vehicle bumpers has greatly altered over the past seventy years. A mixture of cautious plan, material selection to attain impression of adjusting firmness, quality and ingestion of vitality, is achieved not long after execution.

Tie Wang and Yonggang Li [1] discussed the process of the Design & analysis of Bumper. Also they stated that the bumper and beam analysis is accomplished for the carbon fiber composite material to analyze impactor deformation, absorption of energy, impact strength, weight and acceleration. It has been specified that the weight is reduced to enhanced bumper beam and the impact performance is not weak. Gandla Pradeep [2] discussed the main strength criteria for minimizing bumper costs through the use of composite materials. Meanwhile, the design should be in passenger safety with the low weight. K Suneetha [3] Aim of this paper was to analyze & study the structure & material employed for car bumper. In the most important parameters of the front bumper beam in this paper, i.e. to improve the bumper's crashworthiness, shape, impact, material and condition should be studied. Vysyaraju Neelima [4] the heavy-duty vehicle bumper beam is designed and analyzed using steel materials and the design is modified and improvised using the shape of optimization tool in Ansys. P. Ravinder Reddy [5] this project is for the design of bumper system summarized as a degree of absorption of impact energy in a limited clearance between back face of bumper, body parts of vehicle. This project attempts to show a method using computer simulation which has been broadly adapted in the various design stages of vehicle development. Rajesh. B. Buktar [6] in this paper, the most important parameters of automotive front bumper beam i.e. Shape, impact, material and condition are to be studied to improve crashworthiness of the bumper. Sachin Manojkumar Jain [7] the frontal beam of the automotive bumper plays a major role in the absorption of impact force. In the new car assessment program (NCAP), bumper absorbs 15% of total energy from the crash test.

2. METHODOLOGY

Bumper manufacturing is very costly process and it takes lot of time as we go for conventional methods. So use the technology like CAE during the designing of actual components to detect the problem. This technology saves work, time and cost. During the development of bumper design. First theoretical calculation is carried out for bumper. From this data CAD model is generated using 3D cad software like CATIA. From this 3D parts bumper assembly generated. This assembly imported in Ansys software in igs format, by applying material property and boundary cognitions values and simulation is carried out. From the results of simulation finally deformation, stress, strain are obtained.

3. MODEL GENERATION

The following data is collected from the front bumper of passenger bus. Total length 2.59m, Thickness 0.006m, Total breath 0.1524 m, Profile of Bumper is C type.

The following Geometry model of passenger bus front Bumper has been made of using CATIA V5 software.

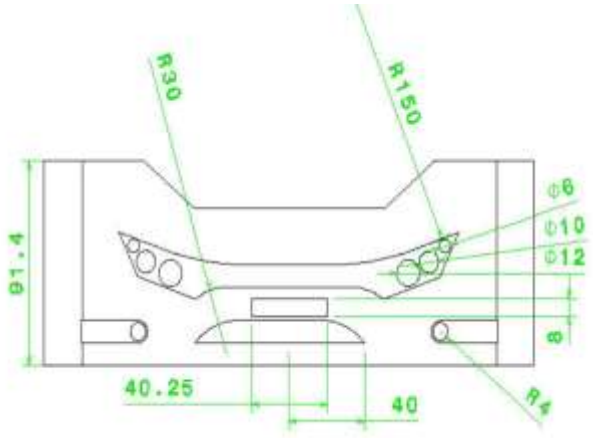

Fig -1: 2-D Diagram of Bumper

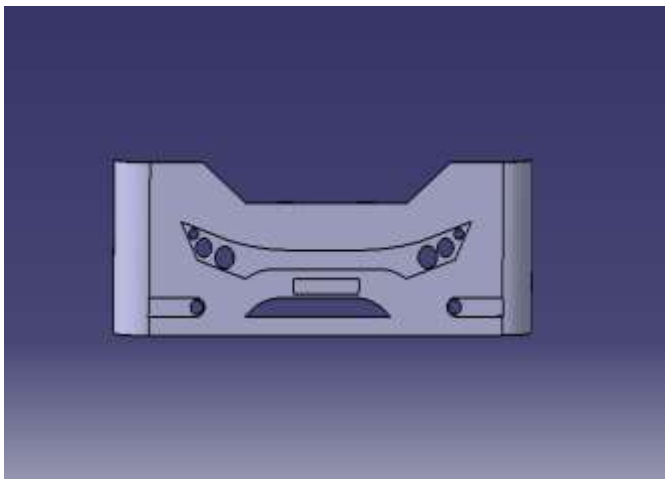

Fig -2: Front View Bumper

4. MATERIAL PROPERTIES

Carbon Fibre 395 has high strength and lightweight properties, the benefits of carbon fiber and its composites include: A unique and distinct appearance that's nearly impossible to replicate. Excellent strength to weight ratio, compared to other materials. Material Properties of Carbon fibre 395 is not available in Ansys material library. That's why new material property is created with help of company data. The material properties of carbon fibre 395 is shown in below table.

Table -1: Material Properties of carbon fibre 395

	A	B	C
1	Property	Value	Unit
2	Density	14000	kg m^-3
3	Isotropic Elasticity		
4	Derive from	Young's Modulus...	
5	Young's Modulus	7E+10	Pa
6	Poisson's Ratio	0.33	
7	Bulk Modulus	6.8627E+10	Pa
8	Shear Modulus	2.6316E+10	Pa
9	Bilinear Isotropic Hardening		
10	Yield Strength	3.24E+08	Pa
11	Tangent Modulus	6.7028E+08	Pa

5. FINITE ELEMENT ANALYSIS

File generated in Catia is imported in Ansys software in igs format. Carbon fibre 395 material properties such as density, young's modulus, poisons ratio, bulk modulus, shear modulus, tangent modulus, yield strength, ultimate strength are missing in Ansys material library so it is necessary to create custom material properties for Carbon fibre 395 in material library. Meshing is done using Ansys Mechanical APDL with element size for bumper are 5mm. For this element size node and element counts are 15129 and 34015 respectively. The boundary conditions are applied for analysis. Bumper travels to positive Y axis towards wall with velocity of 108 kmph, displacement is set as 0mm in z direction. The Explicit simulation is carried out for better convergence of the problem for deflection and stresses.

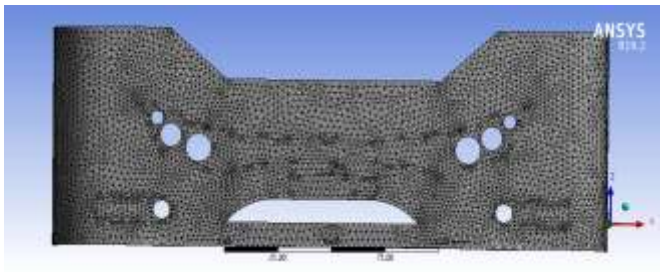

Fig -3: Meshing of CAD model

5.1 Total deformation

Total deformation obtained from analysis is 4.292 mm. This shows the total deformation is within acceptable value.

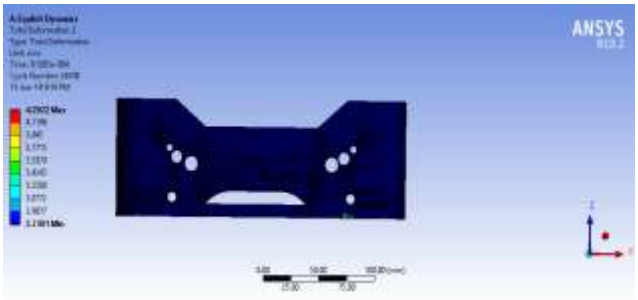

Fig -4: Deformation of Bumper

5.2 Equivalent Elastic Strain

Equivalent Elastic Strain is 2.0979. This value shows the ratio of change in dimension with original dimension. From the results we can say that bumper is not too thin.

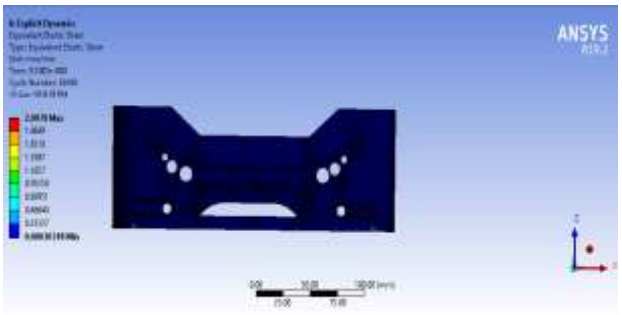

Fig -5: Elastic Strain of Bumper

5.3 Equivalent Elastic Strain

Fig.6 shows equivalent stress generated on component. Maximum stresses occur at the Bumper is 13474 MPa. In this simulation no single tearing evidence found at neck while checking animated simulation video.

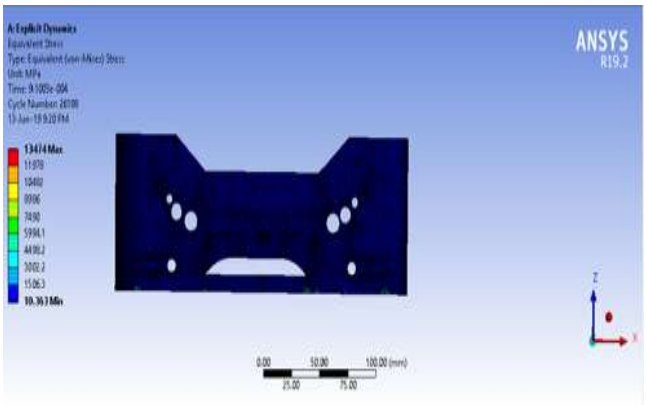

Fig -6: Equivalent Stress of Bumper

6. RESULTS

Below table shows the strain stress and resultant Bumper generated as particular deformation value.

Table -2: Result Table

Total Deformation (mm)	Equivalent Elastic Strain x10^{-3}	Equivalent Stress (MPa)
0.40958	0.0001191	207.021
0.6832	0.0005075	211.7084
0.8190	0.0008007	235.06
1.0921	0.001323	391.89
1.2322	0.002067	611.86
1.3801	0.002067	871.18
1.5359	0.002746	1189.7
1.69	0.0030295	1246.5
1.8328	0.002214	1463.5
1.9486	0.00197	1143.8
2.0819	0.5032	4613.6
2.9439	0.4790	6149.4
3.736	1.9639	10225
4.2415	2.1236	11896
4.2922	2.0979	13474

From this value for better understanding about behavior of stress and strain with respective to deformation graphs are plotted as below.

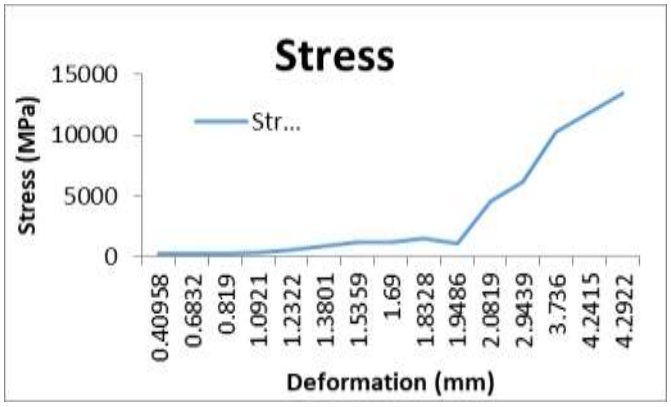

Chart -1: Stress analysis with change in deformation

Above graph shows the relationship between the changes in deformation with change in stress value. As deformation increases stress also increases. The behavior of this graph is non- linear.

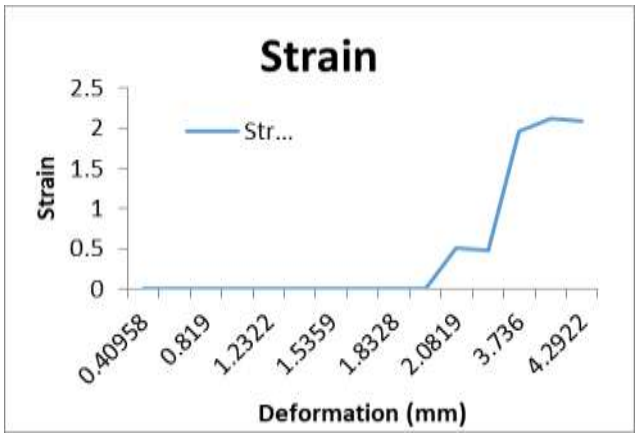

Chart -2: Strain analysis with change in deformation

This graph shows the relationship with change in deformation with change in strain value. As deformation increases strain also increase. The behavior of this graph is non- linear. From the previous research or analysis on vehicle bumper, basically they focus on the design and crashworthiness optimization. However, for this analysis just focusing on the stress analysis on vehicle bumper by applying various loads and materials on the static condition only. In the real situation, there is much point that points that bumper mounting to the car which make it stronger or can absorb more energy during the impact. For the simulation, wall taken as fixed member and the bumper is the moving member. The total bumper part is taken in consideration for test.

7. CONCLUSIONS

From the above results it is clearly indicative that use of composite material is very advantageous than metals, due to following reasons:

Decrease is system weight, improves an automotive's fuel efficiency. Carbon Fiber 395 displacements is less than simple carbon steel, so using carbon fiber makes the system more compact and efficient.

Nowadays, composite materials such as TPO, polypropylene used in bumpers are connected to the fenders because of this the displacement is greater and the ability to handle stress is lower than that of Carbon Fiber 395.

Bumpers produced of Carbon Fiber395 do not need any additional attachments that can be connected straight to the chassis of the vehicle that can enhance their ability. The carbon fiber 395 is therefore the best material for the production of bumper.

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Optimization of Hand Brake Lever using FEA & Experimental Stress Analysis Technique

S. D. Sasane
Mechanical Department (Automotive Engineering)
Sinhgad College of Engineering
Pune, Maharashtra

D. H. Burande
Mechanical Department
NBN Sinhgad School of Engineering
Pune, Maharashtra

***Abstract*— Hand brake levers are widely used in all automotive, which acts as a linkage between occupant and brake mechanism. Existing design seems to be overdesigned. Solid modelling of same is done using CATIA V5 software. Finite element analysis is used to apply cantilever load. Topology Optimization solver is used to perform topology optimization. Existing design is then machined as per topological optimization results and tested using strain gauge technique at tensile loading using UTM machine. Comparative analysis is done with FEA and Experimental results.**

***Keywords*— Hand Brake, UTM, CATIA, Optimization**

I. INTRODUCTION

In the system of road vehicles, the parking brake, also known as the hand brake, emergency brake or e-brake, is used to keep the vehicle stationary and in many cases an emergency stop is also performed. Parking brakes operation system on older vehicles often consist of a cable connected to two wheel brakes at one end and the other end to a pulling mechanism which is operated with the driver's hand or foot. The mechanism may be a hand-operated lever, at floor level beside the driver, or a straight pull handle located near the steering column, or a (foot-operated) pedal located beside the drivers leg. In most automobiles the parking brake system process operates only on the rear wheels, which have reduced traction while braking. Some cars have the parking brake on the front wheels, such as most Citroens manufactured since the end of the Second World War and early models Saab 900. The most common use process system for a parking brake is to keep a vehicle motionless when it is parked. The parking system brake has a ratchet or other locking mechanism that will keep it engaged until manually released. On vehicles with automatic transmissions process system, this is usually used in concert with a parking pawl in the transmission. A recent variation is the electric parking brake. First installed in the 2001 BMW 7 Series (E65), electric parking brakes have since appeared in a number of vehicles. Two variations process system are available: In the more-traditional "cable-pulling" type, an electric motor simply pulls the parking brake cable on the push or pull of a button rather In the cabin, as a mechanical pedal or handle. A more complex unit (first seen on the 2003 Audi A8) uses a computer-controlled motor attached to each of the two rear brake calipers referred to as the Motor on Caliper(MoC) system. Hand brake levers are cantilever structure used for transferring motion from occupant to brake mechanism. Existing design needs to be investigated for mass optimization, hence reducing overall cost of brake levers. The objectives of this project is to achieve topology optimized model for hand brake lever using FEA and experimental stress analysis technique. To draw 3 D model using CATIA and to analyse hand brake using ANSYS. To validate the results.

Amit B. Maske et al. [1] The parking brake won't work without pulling or pushing the lever. We humans also often forget to use parking brakes because of negligence or in emergency conditions. This may result in vehicle rolling in the parking area in the event of slopes and collision with other vehicles. Sometimes parking brakes are used as an emergency brake to stop the vehicle when the service brake fails. This project offers a new design of the parking brake system with simple and low-cost features. This paper examines the design, analysis and manufacture of new car parking braking systems. This new parking brake system, also known as the by-wire brake, replaces the conventional parking brake handle with an electronic switch. This is done by replacing conventional connections with electric motor units. High-performance DC motors and gear reduction directly generate the braking force by applying the parking brake [2]. M.R. Mansor et al. Because of the recent trend and increasing awareness of sustainable product design, natural fiber materials are gaining popularity to replace synthetic based fiber in composite formulation, particularly for structural and semi-structural applications in automotive applications. The Analytical Hierarchy Process (AHP) method was used in this paper to select the most suitable natural fiber to be hybridized with glass fiber reinforced polymer composites for the design of the parking brake component of a passenger vehicle center lever lever. Thirteen candidates were selected and analyzed for the hybridization process to determine their overall scores in three main performance indices in accordance with the specifications of the component product design. Using the AHP method, the kenaf bast fiber yields the highest scores and was chosen as the best candidate material for formulating the hybrid polymer composites for the construction of automotive components. Sensitivity analysis has also been carried out and results show that kenaf bast fiber has emerged as the best candidate material in two out of three simulated scenarios, further validating the results obtained by the AHP method. Chunyan Wang et. al. [3] This paper discusses the consistency strategy of braking sense from two aspects of multi-objective optimization and control of compensation. Under multiple targets and multiple constraints, an optimized method of braking force allocation is explored to find the optimal distribution ratios of front and rear axles as well as Hydraulic braking and regenerative braking. The braking sense

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consistency controller is further designed to make up the braking force difference and keep the rate of change in the braking force unchanged. Daogao Wei et. Al. [4] This study sets up a dynamic model of a new two-layer brake system to explore the vibration and noise reduction mechanism of a brake pad with a new structure. The model is used to analyze the effects of double-layer pad parameters on the brake system's stability characteristics and stick-slip vibration.

II. METHODOLOGY

CAD model of existing Hand break lever is done using CATIA software. The meshing of CAD model is carried out using Hypermesh software. Loading and boundary conditions are applied for the analysis of Stress- starin results. For topology optimization of hand break lever, Optistruct solver is used. With the help UTM, stress analysis of optimized mode is carried out. Comparative analysis of FEA and experimental results is done.

III. CAD MODELLING

Computer-aided design (CAD) is the use of computer systems (or workstations) to aid in the creation, modification, analysis, or optimization of a design. CAD software is used to increase the productivity of the designer, improve the quality of design, improve communications through documentation, and to create a database for manufacturing. CAD output is often in the form of electronic files for print, machining, or other manufacturing operations. The term CADD (for Computer Aided Design and Drafting) is also used. For modelling of Hand Break Lever CATIA software is used.

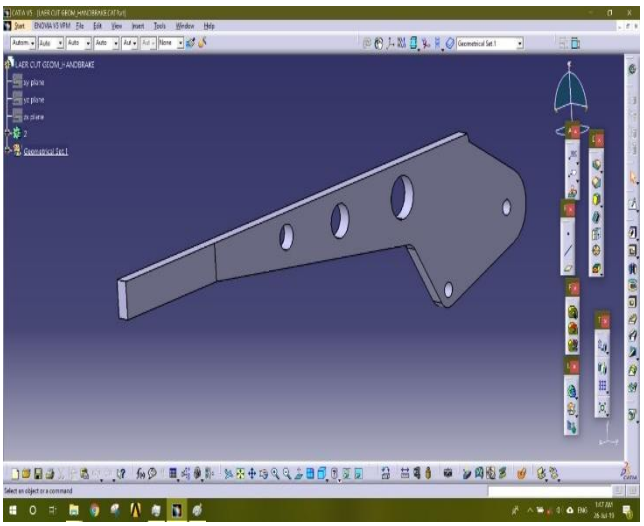

Fig. 1 CAD model

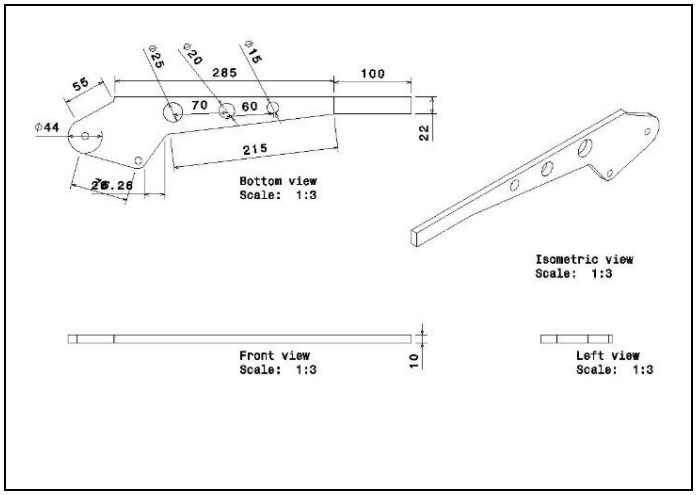

Fig. 2 Drafting of CAD Model

2. Finite Element Analysis:

MESHING

ANSYS Meshing is a general-purpose, intelligent, automated high-performance product. It produces the most appropriate mesh for accurate, efficient Multiphysics solutions. A mesh well suited for a specific analysis can be generated with a single mouse click for all parts in a model. Full controls over the options used to generate the mesh are available for the expert user who wants to fine-tune it. The power of parallel processing is automatically used to reduce the time you have to wait for mesh generation.

The solid tetrahedron elements are used to generate the meshing of the Hand Brake lever. The node population count is 20751 and element population count is 12387.

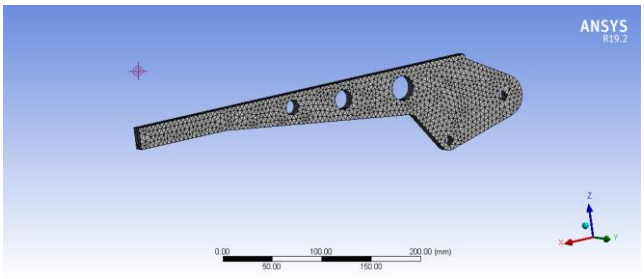

Fig. 3 Meshing of CAD Model

Properties of Outline Row 3: ACRYLIC

	A	B	C
1	Property	Value	Unit
2	Material Field Variables	Table	
3	Density	1.18	g cm^-3
4	Isotropic Elasticity		
5	Derive from	Young's Modulu...	
6	Young's Modulus	2760	MPa
7	Poisson's Ratio	0.37	
8	Bulk Modulus	3538.5	MPa
9	Shear Modulus	1007.3	MPa

Fig.4 Properties of Acrylic

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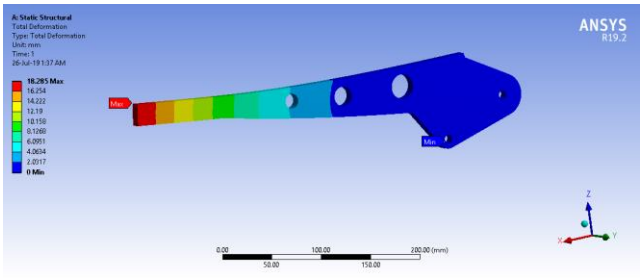

Fig. 5 Results Obtained

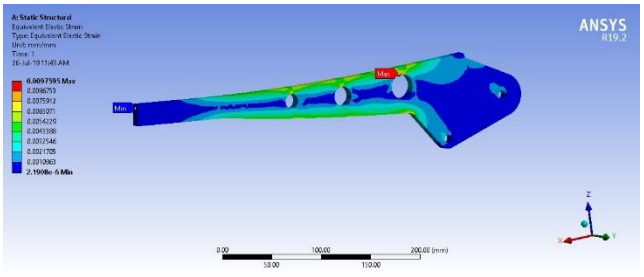

Fig. 6 Maximum Principle Strain

IV. RESULTS AND DISCUSSIONS

By assigning material properties to hand brake lever static structural analysis is carried out. From this analysis deformation and maximum principle strain are obtained 18.25mm and 0.0097 respectively.

V. EXPERIMENTAL SETUP

A universal testing machine (UTM), also known as a universal tester, materials testing machine or materials test frame, is used to test the tensile strength and compressive strength of materials. An earlier name for a tensile testing machine is a tensometer. The "universal" part of the name reflects that it can perform many standard tensile and compression tests on materials, components, and structures (in other words, that it is versatile). The set-up and usage are detailed in a test method, often published by a standards organization. This specifies the sample preparation, fixturing, gauge length (the length which is under study or observation), analysis, etc.

The specimen is placed in the machine between the grips and an extensometer if required can automatically record the change in gauge length during the test. If an extensometer is not fitted, the machine itself can record the displacement between its cross heads on which the specimen is held. However, this method not only records the change in length of the specimen but also all other extending/elastic components of the testing machine and its drive systems including any slipping of the specimen in the grips.

Once the machine is started it begins to apply an increasing load on specimen. Throughout the tests the control system and its associated software record the load and extension or compression of the specimen.

Fig. 7 Experimental Setup

VI. CONCLUSION

It is seen that with use of computer aided design and FEA the results can be obtained very close to the actual testing results which saves our time and cost for the production. It also allows us to get different methods to optimize the product within less time with best results. The optimization done using acrylic material shows the results obtained for the hand break lever are maximum principle strain after the analysis 975microstrain and that for the testing maximum principle strain value is 897.56microstrain. These results obtained from both the methods are useful to validate the work as they are very close to each other with the variation of 8%. As compared to the previous use of material for hand break lever the acrylic shows better results with less mass and good strength for the hand breaks and can be used for the mechanism after actual implementing the hand break and testing it in the real time scenario.

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Design and Experimental Analysis of Magnetic Climbing Robot

Mansi S. Chabukswar[1], Ravikant K. Nanwatkar[2], Aparna M. Bagde[3]
[1]*UG Student, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Pune, India*
[2]*Assistant Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Pune, India*
[3]*Assistant Professor, Dept. of Computer Engg., Universal College of Engineering and Research, Pune, India*

***Abstract*: Many industrial applications, specifically piping industrials faces performance evaluation issues of working condition. This Project work basically focused on integration of robotics and magnetic applications with permanent magnetic tracks to facilitate cleaning inspection issues of pressure vessels. This work includes an experimental evaluation of robot assembly system with wall climbing robot and permanent magnetic adhesion mechanism for inspecting pipes and duct system. Conceptual design of proposed system considering all working parameters is done by suitable CAD modeler (CATIA). Hardware includes many sensors and Arduino controller to facilitate smooth automation. Arduino programming is studied in this work for experimental evaluation of robotics system.**

***Keywords*: Robot, pressure vessels, CATIA, Arduino, Sensors.**

1. Introduction

Pressure vessel inspection was identified by the industry as a key challenge in maximizing economic return. The robot, incorporating advanced inspection technologies, will help increase production up-time, reduce costs and improve efficiency. Work is going on to develop a new robot crawler equipped with 3D laser scanning and non-destructive testing technology. Recently, crawlers are used only when there is clear line-of-sight for the operator. Ideas are focused on predicting, preventing, detecting and repairing corrosion under insulation. Presently, magnetic climbing robots are implemented to facilitate the investigation, maintenance and building tasks due to new locomotion types and adhesion principles. One of the main aspects is safety, which considers the ability of robots to inspect dangerous constructions of human beings to perform the requested tasks, climbing robots as all other technical systems have to accomplish several fulfillments which depend on the area of application. Required inspection parameters can be implemented for practically all climbing robots in the range of investigation and support. This technique for magnetic inspection robots includes electromagnets and permanent magnets, which are placed on the surface or held at a specific distance. This project work can be useful for metallic (ferromagnetic) components and related applications as it can produce high adhesion forces on specific surface area.

A. Problem Statement

It was observed that to inspect the vessel was difficult for humans, so it was a required a system which can inspect the internal part of the vessel which was impossible due to hazardous gases and risky situations. So, magnetic climbing robot was designed for that purpose.

B. Objective

1. Development of robot climbing using locomotive mechanism.
2. Automatic controlling of Robot using Arduino controller.
3. Magnetic based Climbing Operation of robot.
4. Temperature sensing using LM 35 sensor.
5. Provide Real time image using Camera.
6. Detection of smoke level and gases like LPG, Butane, propane using gas sensor.

C. Methodology

First we will do the analysis and research on robot then designing of new robot with more reliability and lesser weight. Then prototype creation and testing of wall climbing robot is to be done. And after which the manufacturing of final prototype with optimization will done. Power for actuation of robot is transmitted from electric motor to the gearbox which is connected through robotic arm. When robotic arm is actuated, robot is moved to the intended direction with the help of adhesion mechanism by virtue of permanent magnetism.

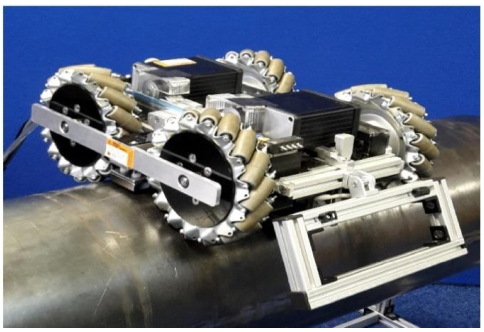


Fig. 1. Pipe inspection robot

2. Literature review

Laboratoiredes Sciences du Numerique de Nantes LS2N, Ecole Centrale de Nantes (2018): In this paper the mechanical and control design of a magnetic tracked mobile robot is presented. The robot is designed to move on vertical steel ship hulls and to be able to carry 100 kg payload, including its own weight. The mechanical components are presented and the sizing of the magnetic tracks is detailed. All computation is embedded in order to reduce time delays between processes and to keep the robot functional even in case of signal loss with the ground station. The main sensor of the robot is a 2D laser scanner that gives information on the hull surface and is used for several tasks. This work focuses on the welding task and exposes the control algorithm that allows the robot to follow a straight line for the welding process. [1]

Ravindra Singh Bisht (2018): This paper presented experimental excremental studies on permanent magnet based wheel mechanism for safe navigation of climbing robot on ferrous wall surface structures. Three types of wheel mechanism are manufactured and compared for their working performance experimentally for climbing robot locomotion trials. The Wheel 1 mechanism with MS hub is very compact, simple in design with easy assemble/dissemble features, and having less manufacturing cost. Wheel 1 design is further improved by developing Wheel 2 and Wheel 3 versions by changing hub materials from mild steel to aluminum. These Wheels mechanisms are light in weight and more powerful to achieve maximum adhesion force that is 210N and 251N with and without rubber grip, respectively, at only 200g Wheel weight has compared to previously reported permanent magnetic adhesion mechanism. Thus, more payload carrying capacity climbing robot can be developed using these developed mechanisms for field trials of climbing robot. A comprehensive experimental study on the influence of rubber grip thickness, air gap, wheel tilt angle and test surface thickness variation on adhesion force of these developed. The influence of both static and kinetic coefficient of friction (COF) for vertical surface of locomotion of climbing robot has also been investigated. These developed wheel mechanisms have been further demonstrated using a four-wheel differential drive prototype climbing robot for safe navigation testing force on a 2D frame plane wall structure and a next on 3D frame wall structure. It is found from the laboratory trials that based on these wheel mechanisms, the climbing robot can safely navigate remotely on even surface for these chosen structure. [2]

Uppu Ramachandraiah (2017): The large numbers of research are carried out in the field of wall climbing robots. These wall climbing robots are utilized for variety of applications including hazardous operations. The wall climbing robots must be capable of manoeuvring in different wall surfaces without sacrificing its mobility. For such capabilities, wall climbing robots should be enabling with proper adhesion
n such as suction based absorption technology. In this
e modeling and experimental analysis of suction pressure generated inside the suction chamber with different chamber contours is analyzed. In this study, a novel bottom restrictor is included at the bottom of the design suction chamber. The suction motor, suction chamber with different contours and bottom restrictor is modeled using 3D package. The impact on the adhesion efficiency of the climbing robot with the design bottom restrictor is experimentally evaluated and tested on non-plastered brick walls. [3]

Bing Li, Kenshin Ushiroda, Ling Yang, Qiang Song (2017): The impact echo (IE) acoustics inspection method is a non-destructive evolution technique, which has been widely applied to detect the defects, the structural deterioration level, and thickness of plate like concrete structures. This paper presented the novel climbing robot, namely Rise rover, to perform automated signal collection from concrete structures with IE signal analyzing base on machine learning techniques. Rise rover is our new generation robot and it has a novel and enhances absorption system to support heavy load, and crawler like suction cups to maintain high mobility performance while crossing small grooves. The design enables a seamless transition between ground and wall. This paper applies the fast Fourier transform and wavelet transform for feature detection from collection IE signals. A distance metric learning base support vector machine approach is newly proposed to automatically classify the IE signals. With the visual inertial odometry of the robot, the detected flaws of inspection area on the concrete plates are visualized in 2D\3D. Field test on a concrete bridge deck demonstrate the efficiency of the proposed robot system in automatic health condition assessment for concrete structures. [4]

Yanwei Liu (2016): In this paper the design and experiment of a Bioinspired wall-climbing robot with spiny arrays is studied. Inspired by the Sericaorientalis Motschulsky's tarsal system, a spiny structure is designed, and the robot's foot which has two grippers using the structure is designed. An inchworm-like gait is employed and its trajectory is planned. The robot's foot as well as the whole prototype is fabricated and tested. It is verified that the foot has remarkable adhesive ability and the robot can scale vertical and inverted rough surfaces including the ceiling. [5]

MD Omar Faruq Howlader (2015): Wall climbing robot can provide easier accessibility to tall structure for non- destructive testing (NDT) and improve working environments of human operators. However, existing adhesion mechanism for climbing robots for vortex, electromagnet etc. At development stage an offer no feasible adhesion mechanism. As a result, few practical products have been developed for reinforce concrete surface. Though wall climbing robots have been researched for many years. This paper proposes a novel magnetic adhesion mechanism for wall climbing robot for reinforce concrete surface. Mechanical design parameters such as distance between magnets, the yoke thickness, and magnet arrangements have been investigated by finite element analysis (FEA). The adhesion module can be attached under the chassis of a

prototype robot. The magnetic flux can penetrate maximum concrete cover of 30mm and attain adhesion force of 121.26N. The prototype provides high force to weight ratio compare to other reported permanent magnet base robotic system both experiment and simulation results prove that the magnetic adhesion mechanism can generate efficient adhesion force for the climbing robot to operate on vertical reinforce concrete structures. [6]

Riad Hossain Faisal, Nafiz Ahmed Chisty (2018): This paper work deals with the design and implementation of a wireless controlled motor vehicle with the ability to move in both vertical and horizontal plane. Aerodynamic techniques have been used to hold the vehicle in any inclined vertical plane. The paper work covers both electrical and mechanical portions. The mechanical portion has been designed using Solid works and 3D studio MAX while the electrical parts have been designed and simulated using Proteus VSM tool. [7]

Mohamed G. Alkalla (2015): In this paper author discussed about proposing and designing a new climbing robot to explore the interiors of industrial vessels and enable a human outside the vessels to implement required regular inspection tasks efficiently. There are two main adhesion systems in the literature: magnetic and air suction systems. The magnetic system climbs surfaces made of ferromagnetic materials only, while air suction system cannot handle irregular surfaces due to possible seals damage. Opposite to previous climbing robots, the proposed robot here can climb and navigate vessels made from different materials besides handling possible irregular surfaces during inspection. Its main task is visual inspection of welds and any critical spots inside these vessels. The novelty of this robot comes from utilizing a hybrid actuation system. This hybrid actuation system consists of upturned propellers fixed on mobile robot and motorized wheels of the mobile robot. The pressure generated from the upturned propellers increase the friction force between the wheels of the mobile robot and the wall. The wheels' motors generate the required torque either to fix the robot in any position or to move it to any place. Since the motion of the robot comes mainly from the motorized wheel, the stability of the system during navigation is guaranteed. Size and topology optimizations are carried out to achieve optimum design of the proposed robot. Simulation results of the designed robot using ADAMS software prove its feasibility. [8]

International Journal of Scientific & Engineering Research, Volume 5, Issue 7, and July-2014: The project aims in designing a pipe climbing Robot which is operated using computer wirelessly from a remote location wirelessly using ZigBee modules. The advent of new high-speed technology and the growing computer Capacity provide realistic opportunity for new robot controls and realization of new methods of control theory. This technical improvement together with the need for high performance robots created faster, more accurate intelligent robots using new robots control devices, rs and advanced control algorithms. [9]

Ke Wang (2013) in this paper authors discussed about 'How to develop practical robots with high artificial intelligence to replace the traditional manual method of on-site inspection of glass- curtain-walls needs to be solved urgently. Therefore, a double-cavity climbing robot that can automatically conduct safety inspection of glass-curtain-wall is researched and presented in this paper. The robot includes adsorption module based on the principle of negative pressure adsorption, servo-drive system to control traveling distance, vibration testing device and safety device. The mechanical structure and its optimization are described in detail, which is followed by a presentation of the robot control system. Finally the wall-climbing and vibration testing experiments are conducted on glass-curtain-wall, and effectiveness of the design is approved. [10]

Mahmoud Tavakoli (2013): This paper introduces omni climber, a new climbing robot with high manoeuvrability for inspection of ferromagnetic flat and convex human made structure. In addition to manoeuvrability, adaptability to various structures with different curvatures and materials are address. The conceptual and detail design of omni climbers are presented and two prototype of the robot are introduced. Several laboratory and field test are reported. And the results are discussed. [11]

Kristin Fondah, Markus Eich, Johannes Wollenber, Frank Kirchner, (2012): Currently, the inspection of sea-going vessels was performed manually. Ship surveyors did a visual inspection in some cases they also use cameras and non-destructive testing methods. Prior to a ship surveying process, a lot of scaffolding has to be provided in order to make every spot accessible for the surveyor. In this work a robotic system was presented, which was able to access many areas of a cargo hold of a ship and perform visual inspection without any scaffolding. The paper also described how the position of the acquired data is estimated with an optical 3D tracking unit and how critical points on the hull can be marked via a remote controlled marker device. Furthermore, first results of onboard tests with the system are provided. To make a use of the marking unit in a real world environment, it was needed to be equipped with a more suitable varnish for metallic surfaces. This varnish must not clog the outlet of the spray container and has to be suitable for multiple if not all surfaces in a ship. The transmission problems of the video images were to be prevented, as other repairs cannot be put to a hold during the inspections. Therefore, a new video transmission was later integrated into the robot with a 5.8 GHz submission rate and 2.5 times stronger signal. The transmission remains to be tested onboard a ship but the noise ratio inside the lab decreased drastically with this setup. [12]

Weiguang Dong, Hongguang Wang, Aihua Liu (2011): In this paper the novel wall climbing robot mechanism designed for anti- hijacking task is presented. This mechanism consists of a negative pressure adhesion module, a vacuum suction module and planetary gear train. The design of biped-wheel hybrid locomotion mechanism, with the advantages of wheel

robots and legged robots, allows the robot to move fast and crossover obstacle easily. This design qualifies the robot for the motion of moving straight, turning in plane and crossing between inclined surfaces. Then the kinematics equations are derived and the locomotion modes are analyzed. Many experiments have been implemented and the results prove that the robot such characteristics as rapid speeds, excellent transition ability between inclined surfaces and curved surface adapt ability. Therefore, this novel wall climbing mechanism could be used for the application of inspection, surveillance and reconnaissance. [13]

A. Albagul, A. Asseni, O. Khalifa (2011): A wall climbing robot is a robot with the capability of climbing vertical surfaces. This paper describes the design and fabrication of a quadruped climbing robot. We are required to design and create a wall climbing robot which uses suction as means of sticking to the wall. The robot will be controlled using basic stamps and the movement of its legs will generated by two servomotors. Each servomotor will control legs which are located on the left and right side of the robot. The leg rotations mimic stepping motions through the use of a slider and a crank. The suction force will be supplied by two vacuum pumps that will turn on intermittently. The main body of the robot will carry all the components except for the compressor thus making it mobile. Currently robot is only design for linear movement. However, plans to incorporate maneuverability and other functions can be implemented after the first stage of the development achieves success. [14]

Surachai Panaich (2010): The problem of a wall climbing robot is holding on the wall. This is challenge for researchers. There are many factors, which effect in holding, all forces, robot movement and mechanical design. This study proposes movement step design for wall climbing robot. In design the robot use pneumatic system as main unit to move on the wall. The robot can move in four directions, forward, backward, left and right. They analyzed force acting with the wall that the wall should have only slope from 0 degree (parallel with the ground) to 90degree (vertical line). At equilibrium condition, we express all forces in equilibrium by sum all forces that equal zero. For further work they proposed to choose parameter to improve the climbing efficiency that the robot can climb much slope. For the first way, to change the wall material to increase μs and for the second way, also to improve vacuum force by means of increasing pneumatic system efficiency. [15]

3. Design and CAD modelling

A. Power Calculations:

$$\text{Power} = \frac{2\times\pi\times N\times T}{60} = \frac{2\times\pi\times 10\times 10}{60} = 10.47\text{W}$$

$$Gear Ratio = \frac{N1}{N2} = \frac{23}{23} = 1$$

gear 1 = Power of gear 2 (N1 = N2)

$$\therefore \frac{2\times\pi\times N1\times T1}{60} = \frac{2\times\pi\times N2\times T2}{60}$$

$$\frac{2\times\pi\times 10\times 10}{60} = \frac{2\times\pi\times 10\times T2}{60}$$

T2 = 10 N.m

Load carrying capacity = 10 kg (Including self weight)

Actual load carrying capacity = Total load carrying capacity - Self weight = 10 - 1 = 9 kg

Displacement of Robot in one direction of rotor:

As robotic arm rotates so displacement = Diameter of circle traced by arm = 2r = 2*80 = 160 mm

Power required for travelling 160 mm of one rotation

$$P = \frac{2\times\pi\times N\times T}{60} = \frac{2\times\pi\times 1\times 10}{60} = 1.04W$$

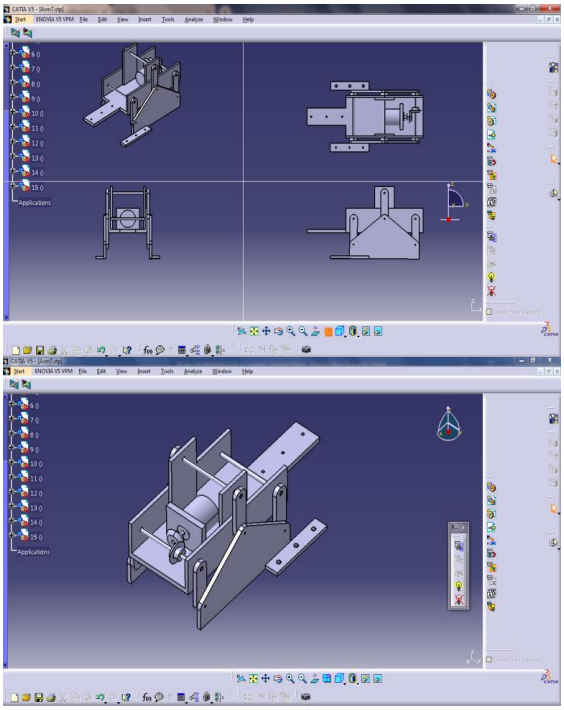


Fig. 2. CAD Model of proposed set up

B. Robot Design

Robot design determines the inherent capabilities of a robot. Robot design requires making trades among many factors, such as functional capability and complexity, weight and strength of mechanical parts, weight and power of actuators, cost and performance of sensors, and so on. It is a complicated process that has not a single optimal solution. The high-level guideline that we used throughout our work is to achieve the functions needed for free-climbing with the simplest possible design.

C. Kinematic design

The kinematic design of Capuchin required us to consider several important issues, in particular: number of limbs, number of degrees of freedom (DOFs) in each limb and body, distribution of these DOFs over the robot structure, and detailed

specification of each link of the limbs and body. After resolving these issues, our work focused on the detailed design of each part. During the initial phase of the process, we loosely used the body structure of humans and animals that are good at climbing as a source of inspiration. We then ran more formal and quantitative simulations to evaluate key capabilities, like workspace reach ability.

D. Working Principle

Each of the 4 cranks is connected with the slider part and sucking cup. Only 2 legs will generate motion of the slider crank mechanism while 2 legs remain fixed at a certain position. The numbers of DOF are the number of components of motion that are required in order to generate the motion. The formula of DOF of any planar mechanism through number of moving links (n), number and types of joints (f1 and f2) can be expressed as:

$$F = 3*n – 2*f1 – f2$$

Where, f1 is the number of one DOF joint and f2 is the number of two DOF joint. The DOF for the slider-crank mechanism of the robot leg can be calculated.

No. of links = 3
No. of one DOF = 4 (3 joints and 1 slider)
F = 3*3 – 2*4 – 0 = 1

4. Experimental set-up

A. Hardware

Types of Sensors used

Infrared Sensor	**Features**
	• 5V DC Operating voltage • I/O pins are 5V and 3.3V compliant • Range: Up to 20cm • Adjustable sensing range • Built-in Ambient Light Sensor • 20mA supply current • Mounting hole
LM35 Temperature Sensor	
	• Calibrated directly in degree Celsius (centigrade) • Linear at 10.0 mV/℃ scale factor. • 0.5℃ accuracy guarantee-able (at 25℃) • Rated for full -55℃ to a 150℃ range, Suitable for remote application. • Low cost due to wafer-level trimming • Operates from 4-30V.
Gas Sensor (MQ6)	
	• High sensitivity to LPG, iso-butane, propane. • Small sensitivity to alcohol, smoke. • Detection Range: 100 – 10,000 ppm iso-butane, propane. • Fast response time: <10s • Simple drive circuit. • Heater voltage: 5V.

B. Electronic components

Arduino UNO

Features:

- Microcontroller: ATmega328P.
- Operating voltage: 5V
- Input voltage: 7-12V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog input pin: 6.
- DC Current: 40-50 mA.
- Flash memory: 32KB.
- SRAM: 2KB
- EEPROM: 1KB
- Clock speed: 16 MHz

ESP8266- WIFI Module:

	• Low cost, compact and powerful Wi-Fi Module • Power supply: +3.3V only. • Current consumption: 100mA. • I/O Voltage: 3.6V (max). • I/O source current: 12mA • 512KB Flash memory • Can be used as station or access point or both combined • Support serial communication • Can be programmed using Arduino IDE or AT-command or Lua Script • The WI-FI range is up to 100 metres.

L293D Motor Driver board:

	• L293D motor driver IC. • Male burg sticks connectors for supply, ground and input connection • Screw terminal connectors for easy motor connection • On Board LM7805 Voltage Regulator.

Geared Motor:

	• 10RPM 12V DC motor with metal gearbox and gears. • 18000 RPM base motor • 6mm Dia shaft with M3 thread hole • Gearbox diameter 37mm. • Motor Diameter 28.5mm • Length 63mm without shaft • Shaft length 30mm • 180gm weight • 120kgcm Torque • No-load current = 800mA, Load current = up to 7.5A.

OV7670 Camera Module:

- High sensitivity for Low-light operation
- Low operating voltage for embedded portable apps
- Lens shading correction.
- Flicker (50/60Hz) Auto-detection
- De-noise level auto adjusts
- Image quality controls including color saturation, hue, gamma, sharpness (edge enhancement), anti-blooming

C. Software

We have used IDE (Integrated development environment) software to program Arduino and it provides comprehensive facilities to computer program for software development. An IDE normally consists of at least or source code editor, build automation tools, and a debugger.

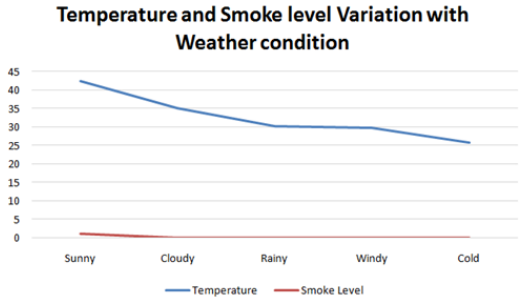
Arduino programs

```
#include<SoftwareSerial.h>
#define DEBUG true
SoftwareSerial esp8266(2,3);
const int lm35_pin = A1;  /* LM35 O/P pin */
int smokeA0 = A0;
int sensorThres = 400;
void setup()
{
Serial.begin(9600);    ///////For Serial monitor
esp8266.begin(115200); ///////ESP Baud rate
pinMode(11,OUTPUT);     /////used if connecting a LED to pin 11
digitalWrite(11,LOW);
pinMode(7,INPUT);
pinMode(13,OUTPUT);
pinMode(8,OUTPUT);
pinMode(9,OUTPUT);
pinMode(smokeA0, INPUT);
pinMode(lm35_pin, INPUT);
digitalWrite(13,HIGH);
sendData("AT+RST\r\n",2000,DEBUG); // reset module
sendData("AT+CWMODE=2\r\n",1000,DEBUG);          // configure as access point
sendData("AT+CIFSR\r\n",1000,DEBUG); // get ip address
sendData("AT+CIPMUX=1\r\n",1000,DEBUG);          // configure for multiple connections
sendData("AT+CIPSERVER=1,80\r\n",1000,DEBUG);    // turn on server on port 80
}
float sensetemp() ///////function to sense temperature.
 {
int val = analogRead(A1);
float mv = ( val/1024.0)*5000;
float celcius = mv/10;
        :elcius);
int connectionId;
void loop()
{
 int analogSensor = analogRead(smokeA0);
int  percentValue = ((analogSensor-110)/(1023-110))*100;
digitalWrite(8,LOW);
digitalWrite(9,HIGH);
 if(digitalRead(7)==0)
{
digitalWrite(13,LOW);
digitalWrite(8,LOW);
digitalWrite(9,LOW);
delay(2000);
digitalWrite(8,HIGH);
digitalWrite(9,LOW);
delay(5000);
  }
 else{
digitalWrite(13,HIGH);
}
 if(esp8266.available())
 {
if(esp8266.find("+IPD,"))
 {
delay(300);
connectionId = esp8266.read()-48;
if(esp8266.find("pin="))
  {
Serial.println("recieving data from web browser");
  int pinNumber = (esp8266.read()-48)*10;
pinNumber += (esp8266.read()-48);
digitalWrite(pinNumber, !digitalRead(pinNumber));
   }
Else
 {
  String webpage = "<h1>Duct Inspection Robot</h1>";
espsend(webpage);
 }
  if(sensetemp() != 0)
   {
String add1="<h4>Temperature=</h4>";
String two =  String(sensetemp(), 3);
 add1+= two;
add1+="&#x2103";   /////////Hex code for degree celcius
 String add2="<h6>Smoke Level<h6>";
String three = String(percentValue, 3);
add2+= three;
 if(digitalRead(7)==0)
{
digitalWrite(13,LOW);
//int object =1;
 String add3="<h8>Object Detected<h8>";
//String four=(object,3);
//add3+=four;
```

```
   espsend(add3);
    }
   espsend(add2);
   espsend(add1);
    if (analogSensor>sensorThres){
   String add4="<h8>Smoke Level is High<h8>";
   }
    }
   else
    {
   String c="sensor is not conneted";
   espsend(c);
    }
    String closeCommand = "AT+CIPCLOSE=";
///////////////close the socket connection////esp command
   closeCommand+=connectionId; // append connection id
   closeCommand+="\r\n";
   sendData(closeCommand,3000,DEBUG);
      }
    }
   }
   void espsend(String d)
    {
   String cipSend = " AT+CIPSEND=";
   cipSend += connectionId;
   cipSend += ",";
   cipSend +=d.length();
   cipSend +="\r\n";
   sendData(cipSend,1000,DEBUG
   sendData(d,1000,DEBUG);
    }
   //gets the data from esp and displays in serial monitor//////////
   String sendData(String command, const int timeout, boolean
debug)
   {
   String response = "";
   esp8266.print(command);
   long int time = millis();
   while( (time+timeout) >millis())
   {
    while(esp8266.available())
    char c = esp8266.read(); // read the next character.
    response+=c;
    }
    }
     if(debug
     {
   Serial.print(response); //displays the esp response messages
in arduino Serial monito
     }
    return response;
     }
```

5. Result

S. No.	Weather Condition	Temp. (°C)	Smoke Level
1	Sunny	42.446	Medium
2	Cloudy	35.156	Low
3	Rainy	30.267	Low
4	Windy	29.842	Low
5	Cold	25.785	Low



6. Conclusion and Future scope

A. *Conclusion*

- We developed a climbing robot using locomotive mechanism of four bar chain which gives a forward and backward movement.
- The motion of the robot was controlled by Arduino controller which has ATmega328P microcontroller that allows the logical operations to be performed.
- The climbing operations of the Robot has been permanent magnetic based which provide adhesive force to stick on vertical surface.
- Various sensors such as LM 35, IR sensor, MQ6 gas sensor, are used to provide the information regarding various characteristics.
- Hardware and software are integrated in such a way to provide imaging-based automatic inspection and analysis for such applications as automatic inspection, and robot guidance.

B. *Future Scope*

- The wall climbing robot is one kind of the special mobile robots. Because the workspace of this kind of robots is often on the vertical plane, not only does the wall climbing robot need to have the same locomotion mechanism as mobile robots.
- It also needs the special adhesion mechanism to support it to absorb on the vertical walls. Therefore, it is more challenging to develop a wall climbing robot that a mobile robot.
- To increase operation efficiency and protect human's health and safety in hazardous tasks makes the wall climbing robot very attractive.
- The climbing robot is widely applied in different industrial departments, such as the inspection and

maintenance of storage tanks in nuclear power plants and petrochemical enterprises, ship hull welding and cleaning, rescue robots for firefighting, the cleaning of high-rise buildings, etc.

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A Study on Perception of Job Seekers about Digital Marketing Tools Used for Recruitment Process

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A Study on Perception of Job Seekers about Digital Marketing Tools Used for Recruitment Process

Dr. Nilesh Balvant Anute
Assistant Professor
NBN Sinhgad School of Management Studies
Pune, Maharashtra, India

Prof. Smeeta Kabadi
Assistant Professor
NBN Sinhgad School of Management Studies
Pune, Maharashtra, India

Dr. Devyani Ingale
Assistant Professor
NBN Sinhgad School of Management Studies
Pune, Maharashtra, India

Abstract

Today's job seekers have high expectations from the recruiters. Development in technology have simplified as well as complicated talent acquisition process. The use of social media by recruiters created lots of opportunities for job seekers. It is an additional source of information for both recruiters and job seekers. In the beginning social media tools were used for connecting with people but later on it has taken a professional look. Social media tools are now working as a marketing tool for recruiters.

The objective of this research paper is to study the perception of employees about the use of digital marketing tools by organizations for recruitment process. The researcher has used descriptive research design and non-probability convenience sampling method for this study. Survey methodis used to collect the data from 260 respondents by using well-structuredquestionnaire. This research will help various organizations to know awareness and usage of digital marketing tools by the candidates to search new jobs. And this will help organizations to use effectively digital marketing tools for the recruitment process.

Keywords: Digital Marketing, Social Networking, Recruitment, Awareness, Usage, Satisfaction.

Introduction

The process of generating a pool of qualified candidates for a specific job is called as recruitment. It is the first stage in the process of hiring candidates.Recruitment process is cost effective and it also helps for employer branding. It creates wider pool of candidates and

helps to identify quality candidates.Advertisements, paper applications and CVs, or face-to-face networking, phone calls are the traditional ways of recruitment. But now a days most of the organizations have started using internet and especially social media sites for recruitment process. Organizations have understood the need of changing with technology and hence they have adopted various digital media tools as per their suitability. This change is necessary for every organization to make recruitment process more effective. These new approaches have given good scope for both recruiters and job seekers. This change from traditional to digital media was not simple it requires more strategic decisions for effective recruitment process.

Having an online presence is a crucial element in the job search. Facebook, Twitter and LinkedIn are the popular job search tools. Social networking sites also helps recruiters to know truthfulness of job aspirants. LinkedIn is a huge business-related professional network and the most important for job search. Linkden users creates professional connections which helps them to find a suitable job.Linkden is mostly used to recruit technical and senior staff.As per opinion of Davison, Maraist and Bing (2011), different social networking sites have different characteristics, Linkden is widely used as professional networking site whereas Facebook is used to build up social connections and twitter is used for social as well as personal opinion platform on various issues. The candidates who are looking for jobs with the help of internet have additional advantages than those who are searching it with traditional media. (Rooy et al., 2003 in Searle, 2006).

The most popular and engaged social networking site is Facebook. It also helps to grow candidate pool, by offering a unique opportunity to recruiters through advertisement targeted to Facebook users by keyword, education, location, and age. Job seekers interests, hobbies, education, and activities are available on Facebook.Recruiters also leverage recruiting on Twitter. Hashtag on Twitter allow businesses to go beyond their followers. Google+ is one of the fastest social media platforms. It provides organizationsanextensive channel to recruit, source, and search. Users add individuals they wish to engage by categorizing them into circles, which they create. As compared to other social media tools you tube is not that much popular for recruitment but at some extent it is also used by very few organizations as one of the tools of recruitment process. It is used for specific targeted market where recruiters send video messages to job seekers.

Recruitment through internet is cost effective and it also saves time. E recruitment attracts suitable job seekers and that's why most of the organizations started using internet for the recruitment process. (Freeman & Autor, 2002). The use of digital media by recruiters is based

on their company size, policies, objectives and budget.The use of digital marketing tools varies as per industry also such as banking, insurance, IT, FMCG etc.

Literature Review

Broughton, Foley et. Al. (2013) , in their research paper "The use of social media in the recruitment process" they have given some recommendations like potential issues of social media must be considered by organizations, they can use social networking sites to verify candidate's information, using social media sites for wider recruitment strategy, providing training and information on social networking sites to the job seekers etc.

Archana L, Nivya V G, Thankam S M (2014), in their research paper "Recruitment through social media area: Human resource", observed that social media helps organizations in their recruitment process by increasing the visible talent pool. As social media sites are available 24*7 it helps recruiters and employers to interact all the time.

Sujeet Kumar, Ashish Gupta (2014), in the research paper entitled "A Study on Recruitment and Selection Process" the researcher identified that, to improve organizational effectiveness, it is necessary to design strategic recruitment and selection process. When it comes to recruitment process organizations should focus on long term objectives rather than short term. There is also need of enhancing skills of recruiters and talent acquisition must be smoothly.

Pooja Khanna (2014), in the research paper entitled "Recruitment and Selection: A need of the hour for organizational success" the researcher suggested that organizations need to do proper planning of recruitment and selection policies for the successful implementation of recruitment and selection process. They concluded that as the growth and success of organization depends on employees it is necessary to identify qualified and suitable candidates for the position and for that recruitment and selection process must be effective.

Research questions

The present research paper is focusing on the below mentioned research questions;

- Which digital marketing tools are used by recruiters for recruitment?
- Which digital marketing tools are referred by job seekers while searching jobs?
- What is the pattern of referring digital marketing tools of job seekers to find new jobs?
- What are the benefits of various digital marketing tools for recruiters and job seekers?

Research Methodology

Objectives of the study

- To study the various digital marketing tools used by recruiters for the recruitment process.
- To study the awareness of various digital marketing tools among the job seekers while searching jobs.
- To study the usage of various digital marketing tools among the job seekers while searching jobs.
- To study the satisfaction level of job seekers from various digital marketing tools.

Scope of the study

The present research study deals with perception of job seekers about their awareness, usage,usage pattern and satisfaction levelaboutdigital marketing toolswhile searching jobs. The researcher has selected only five digital marketing tools for the present study; Linkden, Facebook, Twitter, Instagram, You tube based on their popularity for recruitment process. The perception of job seekers of freshers as well as experienced candidates is considered in this study. The respondents are only from Pune city and those who are using digital media for searching the new jobs.

The researcher has selected candidates who have basic qualification either BE or MBA those who are looking for corporate jobs. The candidates who are looking for government jobs and also those who are other than these professions are not included in this study.

The researcher has considered three major managerial levels, lower management (BE/MBA freshers), middle management (Managers, Area Managers, General Managers etc), top management (Vice President, Director, Chairman etc).

Sampling Method

The researcher has selected non-probability convenience sampling method for selecting 260 respondents as sample size.

Methods of Data collection

Primary data is collected using the well-structured questionnaire and secondary data is collected from various sources like Internet, Books, Magazines, and Articles etc. For primary

data the researcher has visited BE and MBA freshers as well as respondents with work experience in Pune city.

Method of analysis and statistical tools

The researcher has arranged all the collected primary data in master chart andthen analysedit with the help of IBM Statistical Package for the Social Sciences (SPSS)-20.

Reliability and Validity

The researcher has carried out reliability test using SPSS 20. The Cronbach's Alpha observed is 0.845, which is more than 0.700, so the questionnaire is considered to be reliable. The researcher has used content validity and acknowledged the questionnaire is valid.

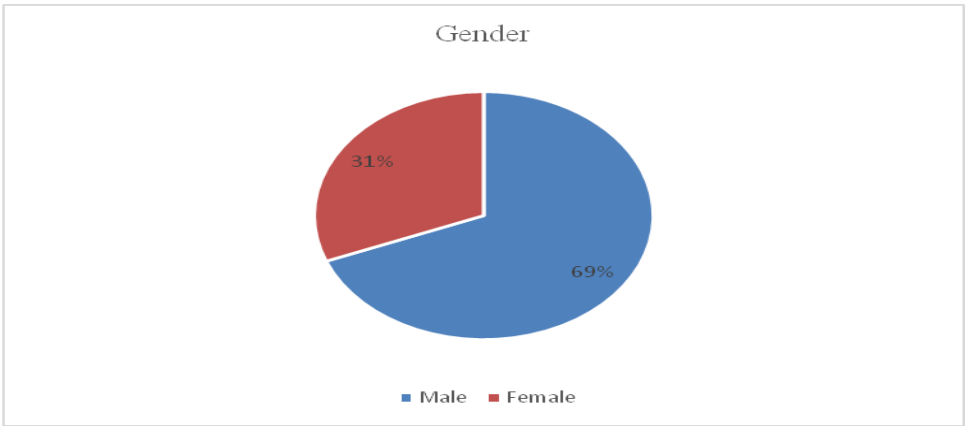
Research Design

Table No.1 Research Design

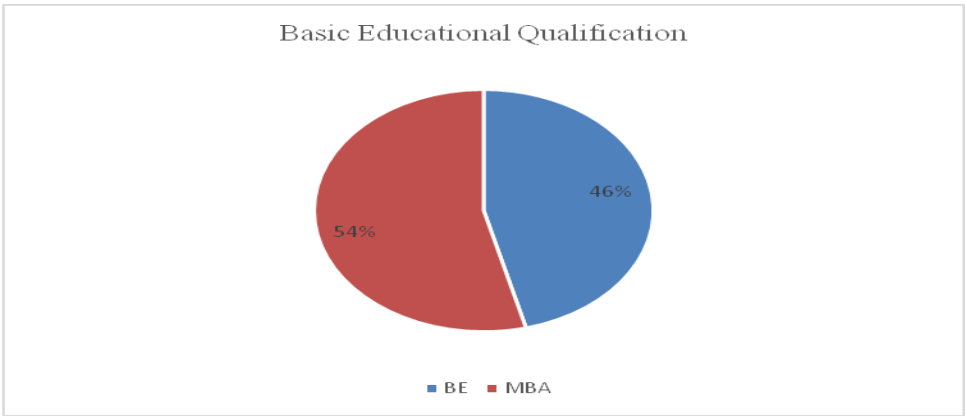
Type of Research Design	Descriptive Research Design
Population	Candidates in Pune city who are having basic qualification as BE/MBA
Sampling Technique	Non-Probability Convenience Sampling
Sampling Area	Pune City
Sample Size	260
Primary Data	Well-structured questionnaire
Secondary Data	Research papers, Articles, Books, Journals etc.
Data Analysis	MS-Excel, IBM SPSS-20

Data Analysis

Graph No. 1 Gender of the Respondents



Graph No. 2 Basic Educational Qualification of the Respondents



Graph No.3 Managerial Levels of the Respondents

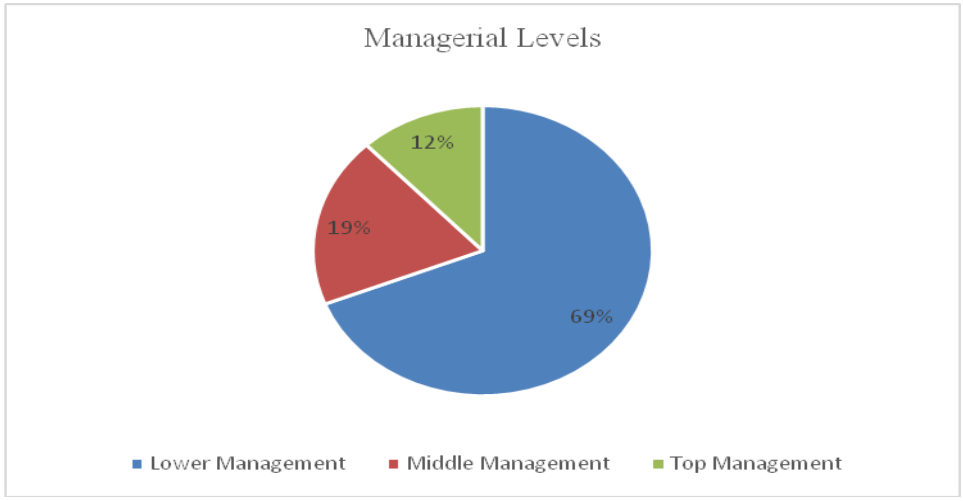


Table No.2 Awareness about selected digital marketing tools for recruitment amongst job seekers

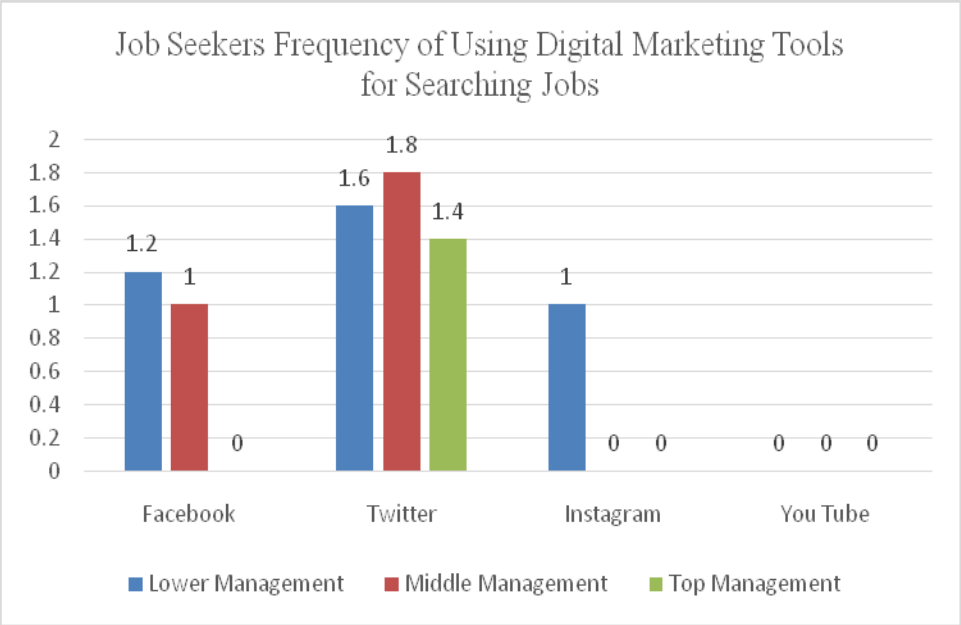
	Facebook	Twitter	Instagram	You Tube
Lower Management	76	96	14	4
Middle Management	16	24	4	6
Top Management	6	12	2	0

Table No.3 Usage of selected digital marketing tools for searching jobs by the respondents

	Facebook	Twitter	Instagram	You Tube
Lower Management	10	80	2	0
Middle Management	2	18	0	0
Top Management	0	8	0	0

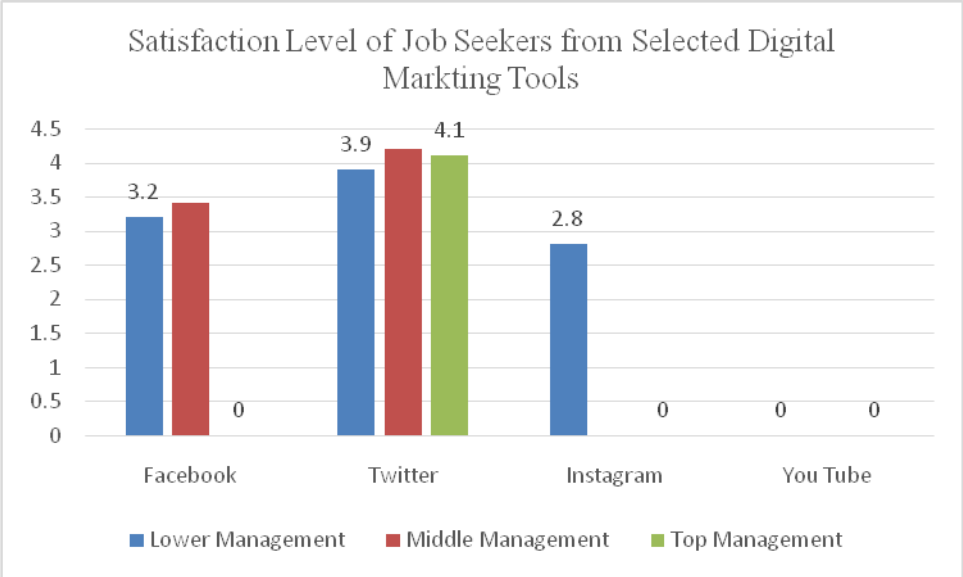
Graph No. 4 Job Seekers Frequency of Using Digital Marketing Tools for Searching Jobs

Measurement Scale: 1 -Rarely, 2- Sometimes 3- Frequently, (0-Not Applicable)



Graph No. 5 Satisfaction Level of Job Seekers about Selected Digital Marketing Tools

Measurement Scale: 1- Strongly Dissatisfied, 2-Dissatisfied, 3-Neutral, 4-Satisfied, 5-Strongly Satisfied, (0-Not Applicable)



Findings

- From the total respondents 69 % (180) are male while 31% (80) are female.
- 46% (120) respondents have their basic qualification as BE and 54% (140) respondents have their basic qualification MBA.
- When it comes to managerial levels 69% (180) respondents belongs to lower management, 19% (50) belongs to middle management and 12% (30) belongs to top management.
- Job seekers who are working in lower management, middle management and top management level departments are more aware about Linkden as a tool for searching new jobs, and usage of Linkden is also high in all respondents of these managerial levels.
- The usage pattern for searching jobs is higher for Linkden and Twitter in all managerial levels.
- The satisfaction level about selected digital marketing tools while searching new jobs at all managerial levels is higher about Linkdenand closely followed by Twitter.
- The awareness, usage, usage pattern, and satisfaction level about Instagram and You Tube as a medium for recruitment is negligible and at some cases nil.

Conclusion

From the research study we can say that Linkden and Twitter are the most popular digital marketing tools for job seekers when searching new jobs. So recruiters need to focus more on these two social networking sites. As Facebook is most powerful social network, recruiters can give more emphasis on it to attract job seekers attention on this social networking site. It is observed that the role of Instagram in recruitment process is negligible even though as it is becoming powerful social networking tool its importance in recruitment process special for BE/MBA freshers may increase in coming days, so recruiters have to keep eyes on this. You tube is used in some foreign countries as a tool for recruitment but India its importance is very negligible and that's why job seekers in present study not preferred this social networking tool.

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