



Sinhgad Institutes

Sinhgad Technical Education Society's

NBN SINHGAD TECHNICAL INSTITUTES CAMPUS

Approved by AICTE, New Delhi, Recognized by
Government of Maharashtra & Affiliated to
University of Pune (ID No. -
PU/PN/Engg/432/2012)

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

INDEX

Number of papers published per teacher in the Journals notified on
UGC website and in other journals during the year 2018

Sr. No.	Title of paper	Page No.
1	Overview of Iris Recognition with Ubiris.V2	1
2	Identification of Robust ROI (Region of Interest)	5
3	Critical Analysis of Selected Digital Channels with Special Reference to Sports and Physical Education Programs and Movies	12
4	Recommender System with Aspect Category and its Rating with the Help of User Reviews	15
5	Automatic Quality Assessment of Echocardiograms Using Convolutional Neural Networks: Feasibility on the Apical Four-chamber View	26
6	RIO: An AI based Virtual Assistant	49
7	Design And Manufacturing Of Washing And Cleaning Unit For Connecting Rod	55
8	Enhancement of Engine Efficiency by using Air pre heater System	58
9	Correlation Of Test Data With Analysis Of Turbocharger Hot Bolted Joint	63
10	Durability Analysis And Optimization Of An Automobile Lower Suspension Arm Using FEA And Experiment Technique	70
11	Auxiliary drive wheel Vehicle Parking mechanism (Fifth Wheel car parking Mechanism)	79
12	Reliability Cost/Worth Analysis of Distribution System with Wind Generation as Alternate Supply using Monte Carlo Simulation	90

Overview of Iris Recognition with Ubiris.V2

Suvarna Pansambal¹, Swati Shirke², Aruna Pavate³, Divya Kumawat⁴

^{1,3,4}(Department Of Computer Engineering, Atharva College Of Engineering, University Of Mumbai, India)

²(Department Computer Engineering, NBN Sinhgad School Of Engg, Savitribai Phule Pune University, India)

Abstract : Automated Human Identification At-A-Distance, Using Completely Self Regulating Iris Segmentation, Is Extremely Challenging As Well As Wide Range Of Private Citizens And Forensics Applications. Iris Pictures Obtained At-A-Remove Utilizing Unmistakable And Infrared Imaging Are Frequently Uproarious And Experience The Ill Effects Of Dissimilar Otherworldly Changes To A Great Extent Coming About Because Of Dispersing, Albedo And Phantom Absorbance Selectivity. Hence Further Research Endeavors Are Required To Create Highlight Extraction Procedures Which Are More Tolerant To Light Changes And Commotion. We Show The Iris Rendering Issue As 2-D Gabor Coding Arrangement In Light Of Computationally Proficient Which Is Comprehended By Generally Considered Arched Improvement Approach/System. The Iris Acknowledgment And Check Execution For The Remotely Gained Iris Pictures Are Additionally Assessed Utilizing Gauge 1-D Log-Gabor Channel And Monogenic Log-Gabor Channel Based Approach. The Test Comes About Are Accounted For On The Publically Accessible UBIRIS V2, Separate Databases. The Accomplished Test Comes About On At-A-Remove Databases Are Exceptionally Encouraging And Affirm The Convenience Of The Approach.

For Iris Recognition From Visible Illumination Face Images Acquired In Less Constrained Imaging Environment. The Developed Approach Attempts To Extract Orientation Specific Data From The Randomly Distributed Iris Texture Feature, Which Are Commonly Observed In Visible Illumination In Iris Images. The Iris Recognition And Verification Performance For The Distantly Acquired Iris Images Are Also Evaluated Using Baseline 2- D Log-Gabor Filter And Monogenic Log-Gabor Filter Based Approach And For Improving The Result Of Paper We Can Use Euclidean Distance Instead Of Hamming Distance

Keywords - Canny Edge Detection, Ubiris.V2, Iris Recognition, 2- D Log-Gabor Filter, Monogenic Log-Gabor Filter

I. INTRODUCTION

The Human Identification And Authentication Purpose Iris Recognition Is The Best Biometrics System. Iris Segmentation Plays An Important Role In An Accurate Iris Recognition System. In Less Constrained Environments Where Iris Images Are Captured At-A-Distance And On-The-Move, Iris Segmentation Becomes Much More Difficult Due To The Effects Of Significant Variation Of Eye Position And Size, Eyebrows, Eyelashes, Glasses And Contact Lenses, And Hair, Together With Illumination Changes And Varying Focus Condition. We Can Use Accurate Iris Segmentation In Very Noisy Images. The Terms Canny Edge Detection, Ubiris.V2, Iris Recognition, 2- D Log-Gabor Filter Are Explained As Follows:

1. Canny Edge Detection:- Circular Hough Transform Is Employed To Deduce The Radius And Centre Co-Ordinates Of Pupil And Iris Region.
2. Ubiris.V2: In This Images Were Actually Captured On Non-Constrained Conditions (At-A-Distance, On-The-Move And On The Visible Wavelength), With Corresponding More Realistic Noise Factors
3. Iris Recognition: The IRIS Recognition Is A Biometric Method Used To Identify An Individual. Biometrics Offers Greater Security And Convenience Than Traditional Identity Authentication Systems (Based On Passwords) Since Biometrics Characteristics Are Inherently Associated With A Particular Individual Making Them Insusceptible To Being Stolen, Forgotten, Lost Or Attached
4. Log- 2dgabor Filters: The Iris Images Generally Contain Broader Iris Regions Surrounding The Eye, And Hence The Eye Position And Size May Vary Significantly. In Addition, The Effects Of Illumination Changes And Poor Focus, As Well As Eyebrows, Eyelashes. Iris Recognition Process Consists Of First Segmentation Then Normalization Process Then Iris Code Generation Then Comparison.

II. MOTIVATION

As A Kind Of Pattern Recognition To Classify The Iris Correctly By Comparing The Similarity Between Irises, Two Major Works Are: (1) To Find The Appropriate Features To Represent Iris Properly; And (2) To Classify Iris Patterns Based On The Features. A Popular Representation In The Former Iris Recognition Algorithms. For Iris Recognition We Use Grey-Level Co-Occurrence Histogram And An Improved Hough Transform .Then Approximate Centre Of Pupil Is Detected And Centre Of Pupil Is Located. After Detecting Inner Boundary Of Iris Predefined Percentage Of Iris Position Is Extracted. A Segmentation Approach Is Presented That Exploits

Various Techniques And Different Image Information .Segmented Iris Is Converted Into Rectangular Format. For Identifying Classifier Gabber Filter Is Used For Improving Accuracy Of The System.

III. IRIS RECOGNITION PROCESS

1. Localization:

In Order To Determine The Iris Inner Boundary, The Location Of The Pupil Center Is Required. First The Gray Levels Histogram For The Eye Image Is Plotted And Analyzed. Then, A Threshold Value T Is Determined As The Intensity Value Associated With The First Important Peak Within Histogram.

2. Iris Normalization:

In Order To Compensate For The Differences In The Located Iris Regions Due To Different Iris Sizes And To Improve The Precision Of Matching, Iris Normalization Is Necessary.

3. Segmentation:

Segmentation Consists Of Eye Detection, Limbic And Then Pupillary Boundary Localization, Followed By Upper And Lower Eyelid Detection. For Given An Eye Image, Algorithm, Uses Co-Occurrence Histogram And An Improved Hough Transform To Localize The Threshold, The Result Is Considered To Be Accurate And Proceed To Locate The Upper And Lower Eyelids With Algorithm

4. Feature Extraction: Feature Extraction Is Very Important Part In Recognition Systems. The Required Texture Patterns Are Extracted From The Entire Iris Image.

A Typical Iris Recognition System Generally Consists Of The Following Basic Modules:

1. Image Acquisition, Iris Location, And Pre-Processing,
2. Iris Texture Feature Extraction
3. Iris Matching For Recognition Or Verification.

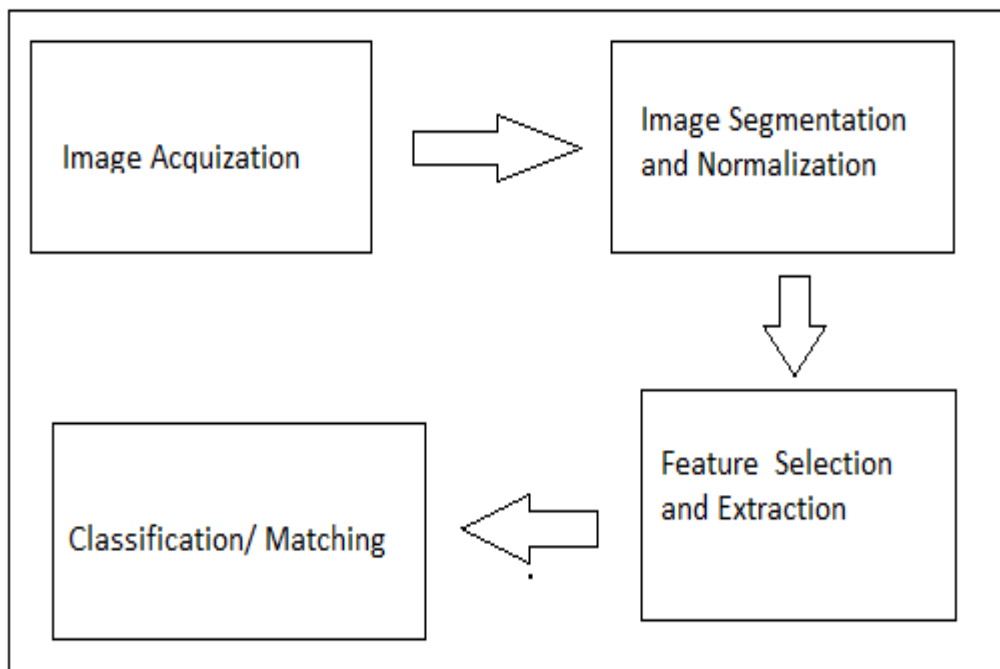


Fig 1: "Iris Recognition Process"

5. Canny Edge Detection:

There Are Many Methods For Edge Detection, But One Of The Most Optimal Edge Detection Methods Is Canny Edge Detection. It Receives A Gray Scale Image And Outputs A Binary Map Correspondent To The Identified Edges. It Starts By A Blur Operation Followed By The Construction Of A Gradient Map For Each Image Pixel. A Non-Maximal Suppression Stage Sets The Value Of 0 To All The Pixels Of The Gradient Map That Have Neighbours With Higher Gradient Values. Further, The Hysteresis Process Uses Two Predefined Values To Classify Some Pixels As Edge Or Non-Edge. Finally, Edges Are Recursively Extended To Those Pixels That Are Neighbours Of Other Edges And With Gradient Amplitude Higher Than A Lower Threshold.

A. The Upper And Lower Eyelids:

In Eye Detection Algorithm, Clip The Original Image To Get The Coarse Eye Region. The Original Image Is Used As The Coarse Eye Region. Image Segmentation Based Edge Detection To Get An Edge Map Eye Fitting With An Elliptical Hough Transform To Get A Fine Eye Region. Improved Circular Hough Transform To Locate The Boundary Output...

In Algorithm For Localizing The Limbic And Pupillary Boundaries Using The Improved Hough Transform The Eye Detection Algorithm Determines The Coarse Eye Location And Correspondingly Clips A Region. An Ellipse Is Obtained Via The Hough Transform On The Edge Map And A Fine Eye Region Can Be Obtained.

A. Iris Codes Using Modified Log-2dgabor Filters:

The Iris Images Generally Contain Broader Iris Regions Surrounding The Eye, And Hence The Eye Position And Size May Vary Significantly. In Addition, The Effects Of Illumination Changes And Poor Focus, As Well As Eyebrows, Eyelashes. Iris Recognition Process Consists Of First Segmentation Then Normalization Process Then Iris Code Generation Then Comparison. First Color Images Are Converted Into Gray Then Gray Are Converted Into Binary .Then Left And Right Eye Position Is Detected .Then Detect Approximate Centre Of Pupil. Then Detect Inner Boundary Of Iris. From Inner Boundary Extract Pre-Defined Percentage Of Iris Recognition Convert Segmented Iris Into Rectangular Format .Then Segmentation And Pre-Position Is Done. In All These Algorithms, The Method Using Complex 2D Gabor Filters Is Applied In Practical Systems. Gabor Filters Are Used For Obtaining Localized Frequency Information. They Offer The Best Simultaneous Localization Of Spatial And Frequency Information. However They Have Two Main Limitations. The Maximum Bandwidth Of A Gabor Filter Is Limited To Approximately One Octave And Gabor Filters Are Not Optimal If One Is Seeking Broad Spectral Information With Maximal Spatial Localization.

6. Matching :

In General, The Matching Metric Gives A Measure Of Similarity Between Two Iris Templates. This Metric Should Give One Range Of Values When Comparing Templates Generated From The Same Eye, Known As Intra-Class Comparisons, And Another Range Of Values When Comparing Templates Created From Different Irises, Known As Extra-Class Comparisons. These Two Cases Should Give Distinct And Separate Values, So That A Decision Have Made With High Confidence As To Whether Two Templates Are From The Same Iris, Or From Two Different Irises.

- **Training**

It Is The Process Of Registering Iris Images In The Database. The Purpose Of Training Is To Construct Database Of Eligible Iris Images Which Is Used In Recognition Phase. In These Template Of Iris Images Is Created And Stored In Database. This Phase Goes Through Only First Step Of Iris Recognition I.E. Feature Extraction, In Which It Finds Trained Iris And Stores In Database

- **Recognition/ Testing**

In This Module, Test Image Is Given As An Input And Recognition Decision Is Made. It Also Performs Feature Extraction On Test Image. It Uses Extracted Features I.E. Train Irises By Feature Extraction Module For Reconstruction Of An Image. Thus, This Module Compares Test I.E. Unknown Image With Images In Database I.E. Known Images And Gives Recognition Result.

- **Feature Extraction**

This Module Accepts The Each Image And Extracts The Features Of Iris From Image. For Extracting Features It Uses Principal Component Analysis (PCA) Method. Extracted Features Are Called As Eigen Irises. Vector Of Eigen Irises Are Calculated And Stored In Database. The Convolution Of The Resized Segmented Iris With 2D Gabor Will Give An Image.

- **Feature Selection**

In This, Extracted Features Are Selected For Recognition. Extracted Features Are Stored As A Feature Vector In Hough Matrix For Each Image And Then It Is Used For Recognition.

- **Classification**

For Classification Euclidean Distance Is Used. The Distance Is Calculated And The Sample Having Minimum Distance Is Fetch And The Recognition Result Is Given.

5. Iris Database

Publicly And Freely Available Iris Databases UBIRIS.V2 Is New Approach For Recognition. Images Database Is Trained And Stored In Template. A Large Number Of Experiments Were Conducted On This Database And Reported In The Literature, Although The Realism Of Its Noise Factors Received Some Criticisms. This Was A Major Motivation For The Development Of A New Version Of The Database (UBIRIS.V2.)

IV. CONCLUSION

Iris Recognition With UBIRIS.V2 Is Easy Technique. UBIRIS.V2 Is Iris Dataset Which Is Freely Available To Researchers For The Research. In This Paper We Have Studied How To Capture, Perform Segmentation And Normalization On Image And How To Extract The Features And Match The Templates.

REFERENCES

- [1] Iona Climent, Juan Diego Blanco, Roberto A. Hexcel, "Approximate String Matching For Iris Recognition By Means Of Boosted Gabor Wavelet", IEEE Trans On Systems. 2010 23rd SIBGRAPI
- [2] Park, R. R. Jillela, A. Ross, And A. K. Jain, "Particular Biometrics In The Visible Spectrum," IEEE Trans. Info. Forensics & Security, Vol. 6, Pp. 96–106, 2011.
- [3] Ajay Kumar, Tak-Shing, Chun-Wei Tan "Human Identification From At-A-Distance IRIS Images Using Sparse Representation Of Local Iris Features. IEEE-2012.
- [4] R.M. Farouk¹ R. Kumar² K.A.Riad¹, "Iris Matching Using Multi-Dimensional Artificial Neural Network", Department Of Mathematics, Faculty Of Science, Zigzag University, Egypt The Institution Of Engineering And Technology 2011.
- [5] Fadi N, "Improved Neural Network-Based Recognition Of Irises With Sector And Block Partitioning", International Conference On Innovations In Information Technology 2011.
- [6] Shirke Swati D. Shirke Suvarna D. Gupta Deepak, "Iris Recognition", International Journal Of Computer Applications (IJCA), 2012.
- [7] Shirke Swati, Suvarna Pansambal, Enhancement Of Iris Recognition Using Gabor Over FFBPANN", Computing For Sustainable Global Development (Indiacom), 2015 2nd International Conference On 11-13th March 2015.

Identification of Robust ROI (Region of Interest)

¹Shwetambari Kharabe, ²C. Nalini

¹Phd Scholar, Department of CSE, BIHER, Chennai

²Professor, Department of CSE, Bharath Institute of Higher Education and Research, Chennai

¹srkharabe16@gmail.com, ²drnalinihidambaram@gmail.com

Abstract

The finger vein authentication technique plays a lively job for personal identification and verification. In recent era, this technique is gaining popularity, as it provides a high security and convenience approach for personal authentication. In this paper we focused on the literature survey on various steps which are involved in the process of finger vein identification and authentication and extraction of Region of Interest (ROI). ROI extraction is a crucial step in an automatic finger view recognition system. The motive of this paper is to identify ROI. The projected method performs accurate finger region segmentation and correct calculated orientation can support each other to produce higher accuracy.

1. Introduction

Analysis and review being done on various techniques applied for finger vein recognition system by eminent personalities. A brief analysis of each method was carried out to identify its own merits and limitation. The literature survey serves as stare of the art tool to develop an efficient method which can be used as authentication tool based on finger vein. The survey helps to gather novel ideas from the existing methods such as capturing of finer image without noise, enhancing the image captured segmentation technique and matching process.

Robust ROI localization is crucial for a finger vein identification system. It directly results in whether the interest regions from

the same finger vein images have high match. To a large extent, the performance of the finger vein identification system will be determining by the robustness of the ROI localization method. Unfortunately, most of the investigations have focused on finger vein extraction [15-18], finger vein image enhancement, novel finger vein feature representation methods [19-23], and multimodal recognition systems that combine the finger veins with other biometrics [24,25]. Little research has been devoted to finger interest region exploitation. Furthermore, most of the currently utilized finger vein ROI localization methods are, in practice, sensitive to finger position variation. To solve the problem, Finger vein ROI localization and vein ridge enhancement method have been proposed by Yang et al. The finger structure and optic knowledge are combined to localize the ROI. This works well for most finger vein images, but the method fails for some images since the influence of image orientation is ignored, although the influence of image orientation has been alleviated with a considerable imaging device.

2. Literature Survey

2.1 Literature Survey on Finger Vein Data Acquisition:

David Mulyono et. al proposes an ideology for finger vein image off-line and online acquisition. The images which are acquired during the course of real time is called On-line images. Images which are acquired from already existing source such as database, historical information, etc are

called as Off-line images[2]. By using equipment like Web Camera or any device so designed using light transmission technology are the distinct methods for capturing on-line images. Light reflection and transmission are the two prominent methods used for acquiring on-line images and the prominent difference between the two is the location where in the near infrared light is positioned. In the case of light reflection method, the pattern of finger vein is acquired based on near infrared light reflection from palmer surface but in the method of light transmission the same is placed in finger palmer side and finger vein pattern is captured by the reflected light from finger palmer surface. Whereas in light transmission method, the light is placed in dorsal side of the finger which penetrates to capture finger vein pattern. While comparing between light reflection and transmission methods, the later one can acquire vein images with high contrast, and most of the devices apply this methodology [6, 7].

2.2 Literature Survey on Finger Vein Pre-processing

In finger vein based biometric systems, various pre-processing task are to be performed – retrieving information regarding edges, enhancement of contrast and brightness, noise removal, sharpening of images, etc. in order to enhance the quality of image captured. These pre-processes helps to improve image quality, which can be used as an input during later stage of process for obtaining more relevant information and authentication tool. Indeed, if the quality of the image is better, then better accuracy can be gained which helps to improve upon the authenticity of the biometric system. Primarily the pre-processing activity involves segmentation of finger vein images and alignment [8-11], denoising of images, detection of Region of

Interest (ROI), normalization of image size, and image enhancement.

2.3 Literature Survey on finger Vein segmentation:

Fernando C. Monteiro [12,13] proposed a novel method for segmenting finger vein image based on edge information which can be obtained by watershed of morphological algorithm and spectral method. By implementing pre-processing step of initially reducing the noise by using bilateral filter and subsequently preliminary segmentation is performed for region merging as well region similarity. Finally by using Multi-class Normalised Cut Method is instigated for graph based region grouping. This method is computation complexity even though out performed over other methods.

R. V. Patil [14] prerogative that better result can be provided by K-means image segmentation, if the estimation of cluster numbers are measure accurately. The process of edge detection is considered as major phenomenon for estimating the cluster numbers accurately. To detect the edges and find cluster, phase congruency was proposed by the author. The clusters are made and identified based on Threshold and Euclidean distance computation and to find the segmentation of the image K-means is used. Results obtained based on experiments on nine different images proves that the identification of clusters based on the proposed method was accurate and optimal.

2.4 Literature Survey on finger Vein Extraction:

In order to extract finger vein patterns from non-uniform images, by a robust system, the method proposed should consider to track dark lines presents in an image repeatedly. Based on the quantum of times, wherein the tracking lines pass through the points, the extracting process is defined. A few literatures published by eminent

personalities, describing the process and modalities for extracting finger vein images are discussed in this work[2].

N. Miura, A. Nagasaka, and T. Miyatake [1, 15] proposed a new method for future extraction based on repeated line tracking technique. This method adopts the pattern of extraction by applying the concept of number of times the tracking lines pass through the points[15]. This method helps to identify local dark lines, which starts at various positions for line tracking and the same is executed by moving along with the lines by pixel by pixel.. During this process if a dark line is not detectable, then start a new tracking operation from another position until all the dark lines present in an image is identified. This process is carried out repeatedly, by executing local line tracking operations and based on this operations the location of the lines overlap and the finger veins pattern are statistically obtained. Even though we can track noises also by applying this method, but is emphasized to a smaller degree than the dark lines. This proposed method helps to improve the robustness of line extraction technique and to reduce the tracking operation quantity. This method also helps to reduce the computational cost with respect to spatial reduction of the pattern as compared to other traditional methods.

M..Subramani [20] offered a new technology for extracting pattern from finer vein images in consideration with directional information of the same using Radon Transform and Principle Component Analysis (PCA) method [16]. The requisite features of the vein images are extracted by applying Radon projections in different orientation for each projection. The computation of image intensity vector at a specified angle is done by using this algorithm based on specified angle of oriented radian line. The project matrix is constructed based computation using this

algorithm, from the individual projection. In order to compose a feature vector, the PCA analysis is performed on the projection matrix for calculating singular values and arranging them in descending order. Thus computed feature vector will be helpful in defining the finger vein image distinctively.

2.5 Literature Survey on finger vein image Classification and matching:

Classification and Matching process is one of the important stage in finger vein identification[2]. This process measures the similarity or dissimilarity among the real time input finger vein images and historical images previously stored in the database. This is the process which is performed immediately once the finger vein features are extracted [17-19]. Once this process completed, then the next stage is minutiae matching which involves three stages:

- (a) Minutiae Pairing
- (b) False Removing
- (c) Score Calculating and template matching.

Literature survey is carried on based on the papers published by various authors on their contribution towards these process are evaluated and submitted in this thesis work.

Fei Liu et al proposed a new method for minutiae pairing which is called Singular Value Decomposition (SVM) [20]. The process of False Removing is performed based on Local Extensive Binary Pattern (LEBP) by applying the local characteristics which are rich in nature for minutiae representation. LEBP is the combination of Local Directional and Local Multilayer binary pattern. For image classification Support Vector Machine (SVM) is widely used for image classification and matching.

3. Proposed Methodology

The hierarchical verification finger-vein recognition system includes feature point based matching and Image Quality Assessment (IQA) done with hierarchical verification to provide rigorous identification. The proposed feature point based matching, is introduced in the following paragraphs and be divided into two parts: Image normalization, RROI extraction[3]. The corresponding feature point matching processing flow chart is shown in Fig.1

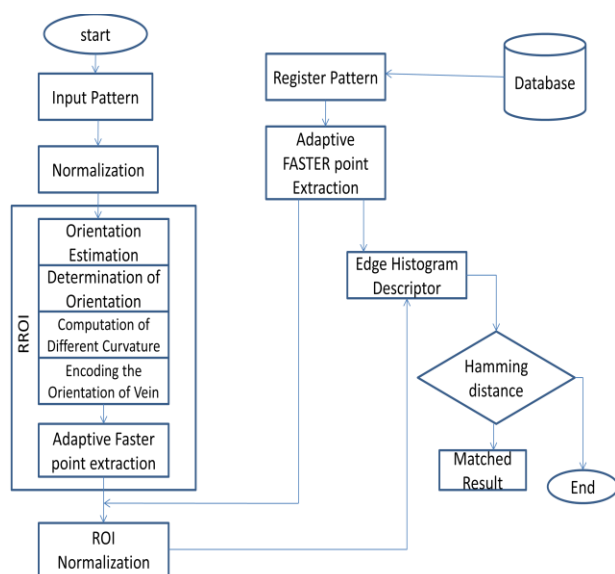


Fig. 1. Flow chart

A. The Image Normalization

The proportion of the vein area varies mostly at different time. And for the convenience in further study, the dimension size normalization is done in this paper. The vein image shall be defined as 64×96 . That is to say the image zooming will be done. For the difference of acquisition time, light intensity and the personal palm thickness,

the image gray scale distribution will be with high difference. If the image difference is great, the difficulty of image processing and matching will be increased. So the image must be normalized. All of the images must be converted to the standard image of the same mean and variance. For dispelling the illumination effect, a method of gray scale normalization has been adopted[3].

$$p(i, j) = (p(i, j) - G_1) / (G_2 - G_1) \times 255 \dots\dots(1)$$

where $p(i, j)$ is the gray scale value of original image; $p(i, j)$ is the gray scale value after conversion; G_1 is the minimum gray scale of original image; G_2 is the maximum gray scale of original image. Figure 2 shows the vein pattern image. Some of the finger veins are influenced from different factors like translation, orientation, scattering, scale, rotation, finger pressure, uneven illumination and collection posture.

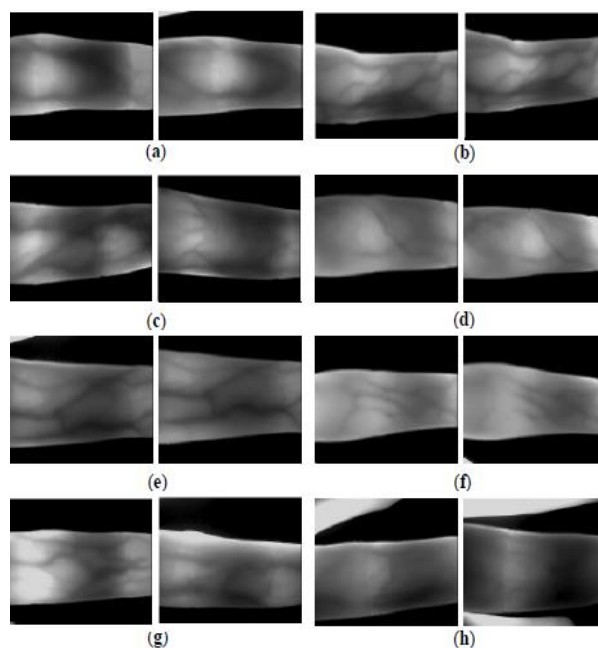


Fig.2. Influences from different factors on the finger vein images. (a) translation;(b) orientation; (c) scattering; (d) scale; (e)

rotation; (f) finger pressure; (g) uneven illumination; and (h) collection posture.

B. Robust Region of Interest Extraction of Finger-Vein Shape Feature

Suppose if F is a finger-vein image, and $F(x, y)$ is the gray value of pixel (x, y) , a cross-sectional profile of point (x, y) in any direction is denoted by $P(z)$ [3]. Its curvature is computed as follows:

$$K(z) = \frac{|P''(z)|}{\{1+P'(z)^2\}^{3/2}} \quad \dots\dots(2)$$

where $P''(z) = d^2P/dz^2$ and $P'(z) = dP/dz$.

Therefore, the maximum difference curvature can be defined as:

$$D_{max} = \max_{0 \leq \theta \leq \pi} \Delta K_{\theta} \quad \dots\dots(3)$$

$$\text{where } \Delta K_{\theta} = \begin{cases} K_{\theta}(z) - K_{\theta+\pi/2}(z) & \text{if } \theta \leq \pi/2 \\ K_{\theta}(z) - K_{\theta-\pi/2}(z) & \text{if } \theta > \pi/2 \end{cases} \quad (0 < \theta \leq \pi), \text{ and } K_{\theta}(z)$$

θ represents the curvatures in the direction and the direction perpendicular to θ . The enhancement vein image is obtained after computing maximum difference curvature of all pixels[3]. Then the vein pattern is binarized using a threshold. It is worthwhile to highlight several aspects of the proposed method here:

1. For the vein regions, the curvature is large in ridge direction and small in the direction perpendicular to the ridge direction. Therefore, D_{max} is large.

2. For the flat regions, the curvatures in all directions are small, so the maximum differences D_{max} are small.

3. For the isolated noise and irregular shading, the curvature in all directions is large, but D_{max} is still small.

According to the analysis above, the vein region can be distinguished from other regions effectively, so robust vein patterns can be obtained by the difference curvature method.

Conclusion

This paper presents the fundamental principles, various segmentation procedures and feature extraction techniques and performance evaluation metrics adopted in the course of finger vein identification. Exploring the proposed works in the field of vein based identification principle, literatures and commercial utilization experiences, different Finger-vein Feature Extraction. In this paper, we proposed a finger vein RROI extraction with the influences coming from image translation, orientation, scattering, complicated background, collection posture, and uneven illumination. To detect the ROI as large and effective finger region as possible, an extended ROI detection method is employed. The block image truncated from the processed image is projected to detect the reference line. This can abate the variations of uneven illumination and finger structure.

References

[1] N. Miura, A. Nagasaka and T. Miyatake, Extraction of finger-vein patterns using maximum curvature points in image profiles, IEICE Trans. Inf. & Syst. Vol.90, no.D(8),pp. 1185-1194, 2007.

- [2] Shwetambari Kharabe, C. Nalini, "Survey on Finger-Vein Segmentation and Authentication", *International Journal of Engineering & Technology*, 7(1.2) (2018), 9-14.
- [3] Shwetambari Kharabe, C. Nalini, "Robust ROI Localization Based Finger Vein Authentication Using Adaptive Thresholding Extraction with Deep Learning Technique", *Jour of Adv Research in Dynamical & Control Systems*, Vol. 10, 07-Special Issue, 2018.
- [4] Xin Ma , Xiaojun Jing, Hai Huang, Yuanhao Cui, Junsheng Mu "Palm vein recognition scheme based on an adaptive Gabor filter", January 2017
- [5] Jun Wang, Guoqing Wang "Quality-specific hand vein recognition system", January 2017
- Edward Rosten, Reid Porter, and Tom Drummond "Faster and Better: A Machine Learning Approach to Corner Detection", January 2010
- [6] Chih-Hsien Hsia, Jing-Ming Guo ,Chong-Sheng Wu "Finger-vein recognition based on parametric-oriented corrections", December 2016
- [7] D. Huang, R. Zhang, Y. Yin, Y. Wang, and Y. Wang, "Local feature approach to dorsal hand vein recognition by centroid-based circular key-point grid and fine-grained matching" , February 2017
- [8] A. Gayathri, A.Srinivasan, "An efficient algorithm for image denoising using NLM and DBUTM estimation", *TENCON 2014-2014 IEEE Region 10 Conference*, pg.no 1-6, 2014.
- [9] A.Gayathri, A.Srinivasan, "Wavelet Based Self Adaptive Dictionary Algorithm for Image Denoising", *Advances in Natural and Applied Science* 9(9). 7-17, 2015.
- [10] A.Gayathri, "Photometrical and Geometrical similar patch based image denoising using Wavelet Decomposition", *Journal of Medical and Bioengineering* 4, 47-53, 2015.
- [11] A.Gayathri and V.Nandhini, "HVS based Enhanced Medical Image Fusion", *Computational Intelligence and Information Technology*, 250, 870-872, 2011.
- [12] F. C. Monteiro and A. Campilho, "Watershed framework to region-based image segmentation," in *Proc. International Conference on Pattern Recognition, ICPR 19th*, pp. 1-4, 2008.
- [13] M. Hameed, M. Sharif, M. Raza, S. W. Haider, and M. Iqbal, "Framework for the comparison of classifiers for medical image segmentation with transform and moment based features," *Research Journal of Recent Sciences*, vol. 2277, p. 2502, 2012.
- [14] R. Patil and K. Jondhale, "Edge based technique to estimate number of clusters in k-means colour image segmentation," in *Proc. 3rd IEEE International Conference on Computer Science and Information Technology (ICCSIT)*, pp. 117-121, 2010.
- [15]. N. Miura, A. Nagasaka, and T. Miyatake, "Feature extraction of finger vein patterns based on repeated line tracking and its application to personal identification", *Machine Vision Application*, vol. 15, no.4, pp.194-203, 2004.
- [16] M.Subramani, "Highly secure and reliable user identification based on finger vein patterns" *Double Blind Peer Reviewed International Research Journal*, 11, 2011.
- [17] Jian-Da Wu, Chiung-Tsiung Liu "Finger Vein Pattern Identification using SVM and Neural Network Technique" *Elsevier, Expert Systems with Applications* 38(2011) 14284-14289.
- [18] Pandillapalli Gowtham, Ch.sindhu, C.Sudheer Kumar, Ch.ChandraSekar "Identification of Finger Images using

Score-Level Fusion” International Journal of Engineering Science Invention, Volume 2 Issue 2, February 2013.

[19] Cheng-Bo Yu, Hua-Feng Qin, Lian Zhang, Yan-Zhe Cui “Finger Vein Image Recognition Combining Modified Hausdorff Distance with Minutiae Feature Matching” J. Biomedical Science and Engineering, 2009.

[20] D. Mulyono and S.-J. Hong, “A study of finger-vein biometric for personal identification,” in Proc. IEEE Int. Symp. Biometrics Secur. Technol., Apr. 2008, pp. 1–8.

[21] E. C. Lee and K. R. Park, “Restoration method of skin scattering blurred vein image for finger-vein recognition,” IET Electron. Lett., vol. 45, no. 21, pp. 1074–1076, 2009.

[22] D. Wang, J. Li, and G. Memik, “User identification based on fingervein patterns for consumer electronics devices,” IEEE Trans. Consum. Electron., vol. 56, no. 2, pp. 799–804, May 2010.

[23] N. Miura, A. Nagasaka, and T. Miyatake, “Feature extraction of fingervein patterns based on repeated line tracking and its application to personal identification,” Mach. Vis. Appl., vol. 15, no. 4, pp. 194–203, 2004.

[24] J. Peng, N. Wang, A. A. A. El-Latif, Q. Li, and X. Niu, “Finger-vein verification using Gabor filter and SIFT feature matching,” in Proc. IEEE Int. Conf. Intell. Inf. Hiding Multimedia Signal Process., Jul. 2012, pp. 45–48.

[25] H. G. Kim, E. J. Lee, G. J. Yoon, S. D. Yang, E. C. Lee, and S. M. Yoon, “Illumination normalization for SIFT based finger vein authentication,” in Proc. Int. Symp. Vis. Comput., 2012, pp. 21–30.

[26] Kono, M.; Ueki, H.; Umemura, S. Near-infrared finger vein patterns for

personal identification. Appl. Opt. 2002, 41, 7429-7436.

Critical Analysis of Selected Digital Channels with Special Reference to Sports and Physical Education Programs and Movies

Prof. Nilesh Anute^{1*} Dr. Devyani Ingale²

¹ Assistant Professor, Sinhgad Group of Institutes, Pune

² Associate Professor, Sinhgad Group of Institutes, Pune

Abstract – This research paper is aimed to analyze selected top digital channels with special reference to movies and programs related to sports and physical education. The researcher has collected the data from 125 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 sports shows and movies.

-----X-----

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. Movies on sports also running successfully on digital channels in India.

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 and shows 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.

OBJECTIVES

1. To study the awareness and usage about selected digital channels broadcasting Indian movies and shows related to sports and physical education.
2. To study the perception about selected digital channels broadcasting Indian films and shows related to sports and physical education.

SCOPE OF THE STUDY

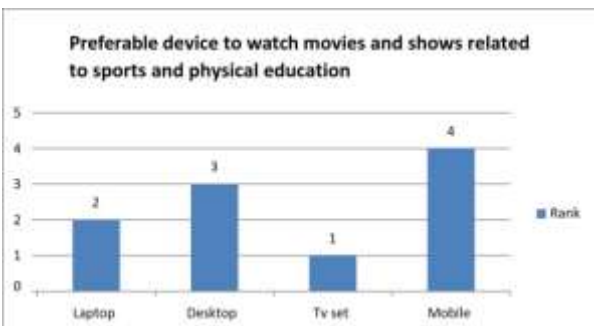
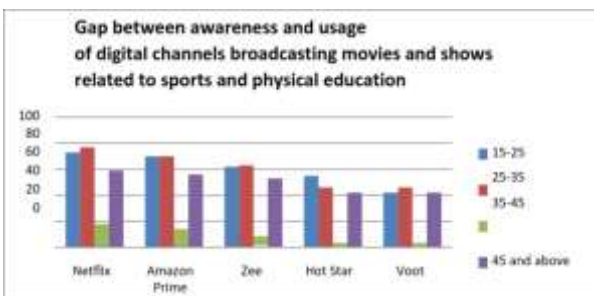
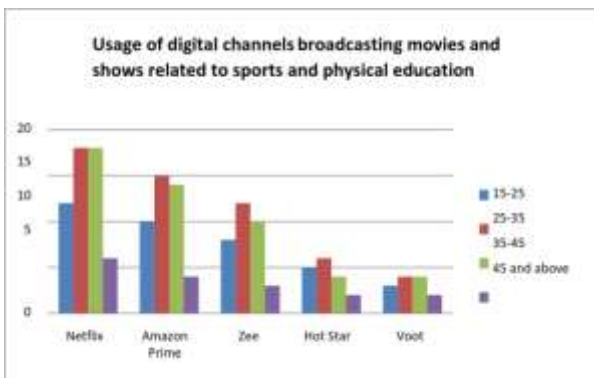
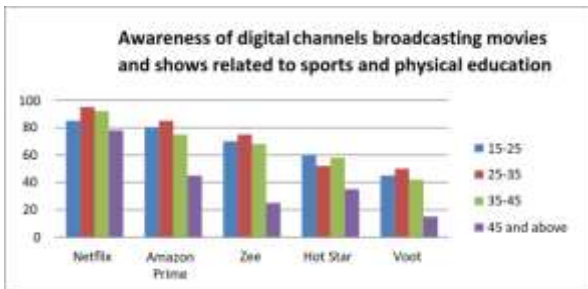
The scope of the study is limited to selected top five digital channels broadcasting Indian films. (Netflix, Amazon Prime Video, hotstar, Zee, Voot).

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

RESEARCH METHODOLOGY

Type of Research Design	Descriptive Research Design
Sampling Technique	Non Probability Convenience Sampling
Sampling Area	Pune City
Sample Size	125
Primary Data	Well-structured questionnaire
Secondary Data	Research papers, Articles, Books, Journals etc.

TABULATION & DATA ANALYSIS



FINDINGS

- Netflix has high awareness amongst all age groups as compared to other digital channels broadcasting movies and shows related to sports and physical education
- Awareness of digital channels broadcasting movies and shows related to sports and physical education 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 movies and shows related to sports and physical education
- Usage of digital channels broadcasting movies and shows related to sports and physical education 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.
- Respondents have given first rank to Tv sets to watch movies and shows related to sports and physical education on digital channels.

BIBLIOGRAPHY

Research Papers

Nigel Culkin & Keith Randle (2003), "Digital Cinema: Opportunities and Challenges", Film Industry Research Group, University of Hertfordshire [UK], DOI: 10.1177/135485650300900407.

Nilanjana Sensarkar (2007), "The potential impact of digital rights management on the Indian entertainment industry", Journal of International Trade Law and Policy, ISSN: 1477-0024.

Gautam Mandal, Fabio Diroma, Prof Rekha Jain (2017), "Netflix: An In- Depth Study of their Proactive & Adaptive Strategies to Drive Growth and Deal with Issues of Net-Neutrality & Digital Equity", IRA International Journal of Management & Social Sciences ISSN 2455-2267; Vol.08, Issue 02.

Books

Rampal M. K. and Gupta S.L. (2005), "Services Marketing Concepts, Applications and Cases", Galgotia Publishing Company, New Delhi, Third Edition

Kotler Philip and Armstrong Gary (2005), "Principles of Marketing", Prentice Hall of India Pvt. Ltd., New Delhi, Eleventh Edition

Ms. D. Lavanya (2014), "A Study on Factors Influencing Purchase Behavior of Skin Care Products Among Working Women in Madurai" Volume : 3 | Issue : 5 | May 2014 ISSN - 2250-1991.

Websites

www.researchgate.net

www.academia.edu

www.wikipedia.com

www.slideshare.com

Corresponding Author

Prof. Nilesh Anute*

Assistant Professor, Sinhgad Group of Institutes, Pune

Recommender System with Aspect Category and its Rating with the Help of User Reviews

Anuja Mehetre, Shruti Shrivastava, Sulochana, Arati Shinde, Priti Joverkar

Sinhgad Technical Education Society NBN Sinhgad School of Engineering.

Abstract:

Today's world is all about performing tasks on the internet. If we want purchase something goes to online order it and purchases that. These things happen online only. While purchasing online, we are worried about quality of product as well as we cannot check the product in hands. So, most of system provides facility to give reviews that can be useful to end user. End user views the reviews of product given by other users and decides about pros and cons. Based on previous theory, the process of computationally retrieving and grouping opinions into categories expressed in a piece of text, especially in order to determine whether the writer's attitude towards a particular topic, product, etc. is positive, negative, or neutral. So, in this paper we are working on the sentiment analysis of that particular review and gives proper recommendation to end user. We are working on the supervised and unsupervised methodology for aspect and its category identification. This system uses the real-time dataset of the review of the product.

Keywords: *Sentiment analysis, supervised and unsupervised techniques, spreading activation.*

Introduction

Nowadays if we want to purchase something, we go online and search for products and look for their reviews. A user has to go through each

and every review for getting information regarding each and every aspect of product. Some of these reviews contains large amount of text and detailed information about product and its aspects. A user may have to go through all of these reviews for help in decision making. Some of these products can have large amount of reviews and can contain information about its aspects in the form of large texts corpuses. A user might get irritated while reading all of these reviews and learn about the product. To avoid this, a system is needed that can analyze these reviews and detect the sentiments from these reviews for every aspect. Existing approaches fails to cover the fact if two reviews are mentioning same aspect with two different words. Existing systems considers those as two different aspects. Also, the aspect wise information is not preserved by these systems as they rely mostly on rating that is provided by different users for showing the quality or overall rating. The paper proposes a system that can use this information from reviews to evaluate the quality of these products' aspects. Also, the proposed system categorizes these aspects so that problem with different words for same aspects can be resolved. These aspects are identified using supervised and unsupervised techniques. Then these identified aspects are categorized in categories. The sentiments or opinions user provided for particular aspect is assigned to category of that aspect. Using natural language processing techniques, the opinions are rated in the scale of 1 to 5. These ratings are used to evaluate the quality of the products. These ratings can also be used to compare the products based on their features. Along with this, the proposed system consists of an admin panel which can identify overall flaws in specific brands' products and has a facility to send a mail to concerned brand.

Problem Definition:

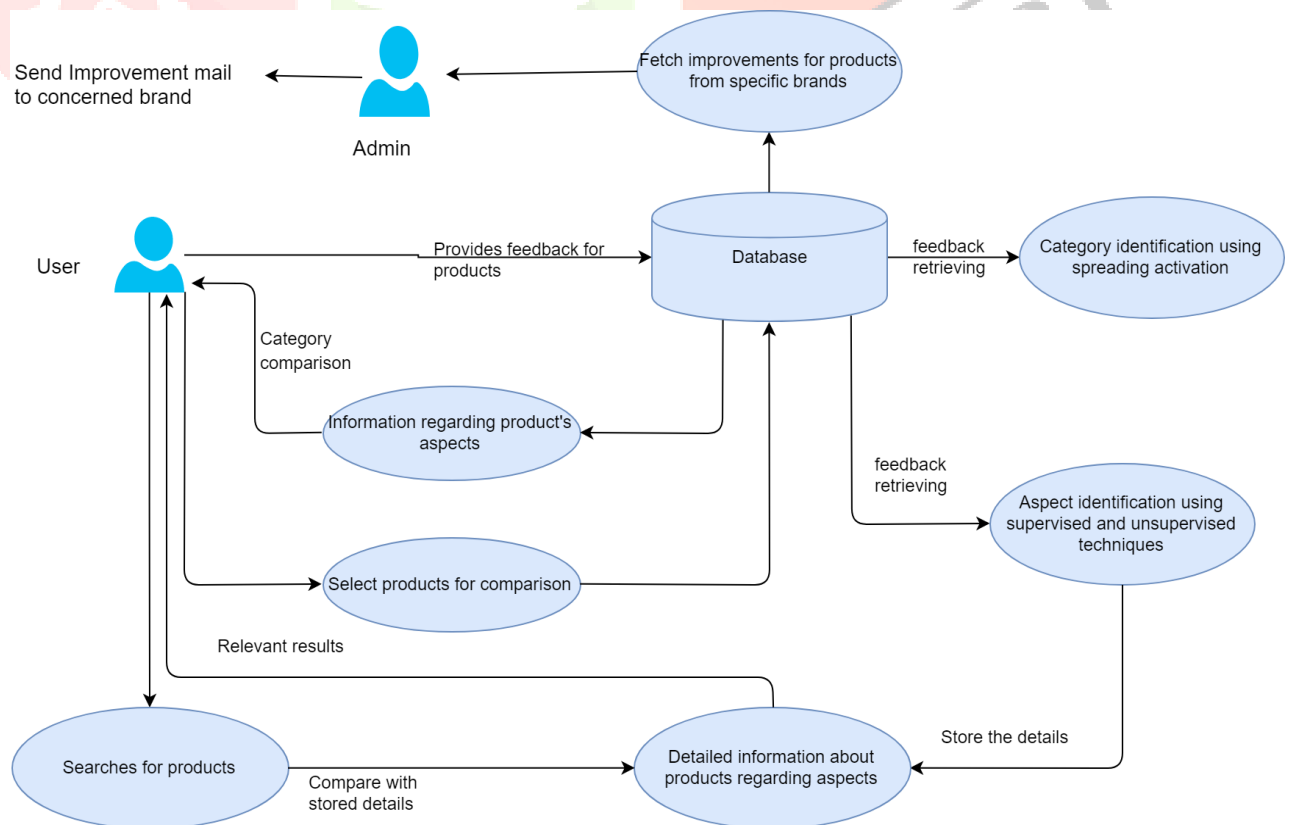
The existing systems face challenges to show quantitative experimental results regarding their work. There's another approach developed which clusters the aspect/opinions and then use these cluster to evaluate the aspects. But these

approaches consider adjectives only as the opinion and can fail to cover every opinion or sentiment.

Objectives

- To develop a system that can identify aspects accurately from given text corpus.
- To develop a system that can provide aspect wise results in the order of quality of aspects when searched in order to achieve satisfying results.
- To develop a system that can compare features of products with the help of user reviews.
- To develop a recommender system which recommends the products based on user’s interests.
- A system that can identify overall improvements in products of specific brands.

SYSTEM ARCHITECTURE

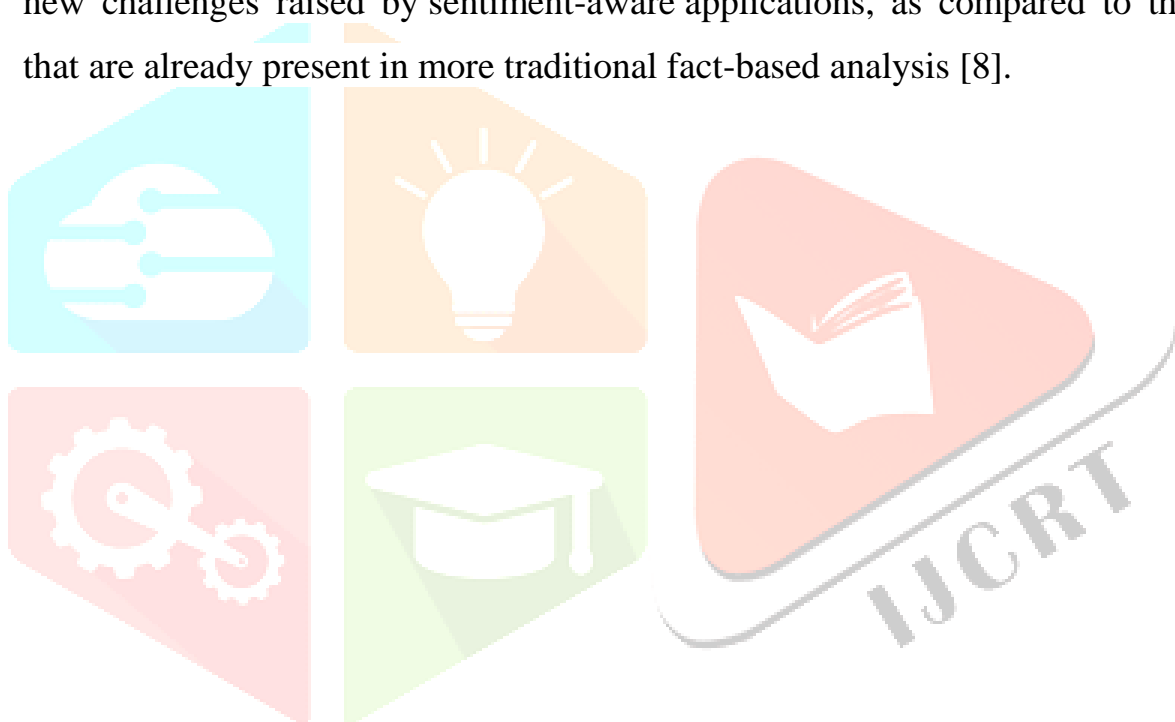


In this system, a user can be a consumer who registers and logs into e-commerce application. A user can provide feedback for products that are for sell on this e-commerce based application. These feedbacks will be taken in the form of text corpus. User can provide information regarding aspects of this product. These provided feedbacks are then passed to supervised and unsupervised methods for aspect identification. Supervised methods are those methods which have information regarding aspects in advance. Unsupervised method on the other hand doesn't have any information in advance. Supervised methods can be fast in terms of performance where unsupervised methods are useful in identifying newly arrived aspects. Since, both methods have their advantages over each other; we are using combination of both supervised and unsupervised method for better performance of the system. These identified aspects are then categorized into categories using spreading activation algorithm. Categorization helps in resolving the issue of two different words referring to the same aspect. These identified aspects and their categories are then passed for its sentiment analysis. So, sentiments for these aspects are assigned to their categories instead of aspects itself. This avoids problem of duplication of aspects and provides proper evaluation of aspects. These reviews are used for rating the aspect categories in scale of 1 to 5 where 1 being the lowest rating and 5 being the highest rating. Once aspect category and their opinions are found, a matrix is constructed for evaluation of the given product or service. These ratings provided to every feature can also be used for evaluation of overall rating for that product. So, as we can see, the system evaluates and stores information about aspects of products using reviews that user has provided. This information can be used for recommender system for recommending products with good quality for particular aspect.

Related Works

In this paper calculating sentiment of words that are inserted by the user, this happen because of the supervised and un unsupervised method. For that consider the background analysis of some techniques. Data come from one

large social networking site, to find the natural language that are comes from words of mouth [1]. A graph-based semi supervised learning algorithm to address the sentiment-analysis task of rating inference and their experiments showed that considering unlabeled reviews in the learning process can improve rating inference performance [9]. A positive sentiment score indicates a greater overall association with positive sentiment, whereas a negative score indicates a greater association with negative sentiment [11]. This survey covers methods that can be used to directly enable opinion-based system that are used to seek information. Our focus is on methods that seek to address the new challenges raised by sentiment-aware applications, as compared to those that are already present in more traditional fact-based analysis [8].



DELIMITATION OF THE STUDY

1. More training data is needed to process with the help of unsupervised technique.
2. Complexity of construction of influence matrix increases along with increase in number of reviews.

DESIGN OF THE STUDY

Proposed Algorithm:

Input: Aspect category set (C) along with its aspects

Input: Set of Reviews (R)

Output: Rating set for every category in category set.

map $\leftarrow \emptyset$

foreach Category $c \in C$

totalRatingCount $\leftarrow 0$

reviewCount $\leftarrow 0$

foreach Review $r \in R$

foreach Sentence $s \in r$

Aspect $a = \text{identifyAspect}(s)$

if ($a \in c$)

rating $\leftarrow \text{extractSentiment}(s)$

totalRatingCount $\leftarrow \text{totalRatingCount} + \text{rating}$

reviewCount++

end if

```
categoryRating←totalRatingCount/reviewCount
```

```
map←(c,categoryRating)
```

```
end foreach
```

```
end foreach
```

```
end foreach
```

```
return map
```

SAMPLE OF THE STUDY

The paper is based on system that deals with reviews that are provided by various users. These reviews are considered in textual format. These reviews can talk about various aspects/ features of given product and the system extracts those features/aspects along with their opinion/sentiment. These sentiments are further turned into ratings with the help of natural language processing techniques. These ratings are later on used to evaluate the quality of every feature that has been talked/ discussed in reviews.

TOOLS USED

Software Requirement:

- Operating System : windows 8 and above.
- Application Server : Tomcat 8.0 or above
- Language : Java
- Front End : HTML, JSP
- Database : MySQL

Hardware Requirement:

The hardware design of the system includes designing the hardware units and the interface between those units.

- Processor - Pentium –III
- RAM - 1 GB (min)
- Hard Disk - 20 GB

STATISTICAL TECHNIQUE USED

We have used Stanford NLP API for sentiment analysis as well as aspect identification. Also, to identify categories of an identified aspect, we have used combination of both supervised and unsupervised techniques

Experiment Result:

We developed an e-commerce web application where user can register/ login, view products, view reviews of products, post reviews of products which will be used to evaluate the quality of the product later. Experimental results show that, the system is able to identify the aspects and their categories along with the sentiments of those aspect categories accurately.

Future scope:

The system identifies the aspects and its categories from textual data. Also, it is able to identify the sentiments for respective aspect and its category. In future work, we plan to include images as well in reviews. Along with that, we plan to reduce the dependency on seed sets of aspect category identification.

Acknowledgment:

It gives us great pleasure in presenting the preliminary project report on ‘Recommender System with Aspect Category and its Rating with the Help of User Reviews’.

I would like to take this opportunity to thank my internal guide Prof. Mrs. Priti Jorevekar for giving me all the help and guidance I needed I am really grateful to them for their kind support. Their valuable suggestions were very helpful.

I am also grateful to Prof Mrs. Shwetabmbhari Chiwhane, Head of Computer Engineering Department, Sinhgad Technical Education Society NBN Sinhgad School of Engineering, Pune. for his indispensable support and suggestions.

In the end our special thanks to Prof Mrs. Priti Jorevekar for providing various resources such as laboratory with all needed software platforms,

Anuja Mehetre

Sulochana

Shruti Shrivastava

Arati Shinde

(Sinhgad Technical Education Society
NBN Sinhgad School of Engineering)

Conclusion:

In this system we have presented two methods for detecting aspect categories which is useful for online review summarization. The first, unsupervised method uses spreading activation over a graph built from word co-occurrence data, enabling the use of both direct and indirect relations between words. This results in every word having an activation value for each category

that represents how likely it is to imply that category. While other approaches need labelled training data to operate, this method works without labelled data.

Reference:

- [1] P. F. Bone, "Word-of-mouth effects on short-term and long-term product judgments," *J. Bus. Res.*, vol. 32, no. 3, pp. 213–223, 1995.
- [2] R. Feldman, "Techniques and applications for sentiment analysis," *Commun. ACM*, vol. 56, no. 4, pp. 82–89, 2013.
- [3] S. Sen and D. Lerman, "Why are you telling me this? An examination into negative consumer reviews on the Web," *J. Interact. Marketing*, vol. 21, no. 4, pp. 76–94, 2007.
- [4] B. Bickart and R. M. Shindler, "Internet forums as influential sources of consumer information," *J. Consum. Res.*, vol. 15, no. 3, pp. 31–40, 2001.
- [5] D. Smith, S. Menon, and K. Sivakumar, "Online peer and editorial recommendations, trust, and choice in virtual markets," *J. Interact. Marketing*, vol. 19, no. 3, pp. 15–37, 2005.
- [6] M. Trusov, R. E. Bucklin, and K. Pauwels, "Effects of word-of-mouth versus traditional marketing: Findings from an Internet social networking site," *J. Marketing*, vol. 73, no. 5, pp. 90–102, 2009.
- [7] M. T. Adjei, S. M. Noble, and C. H. Noble, "The influence of C2C communications in online brand communities on customer purchase behavior," *J. Acad. Marketing Sci.*, vol. 38, no. 5, pp. 634–653, 2010.
- [8] B. Pang and L. Lee, "Opinion mining and sentiment analysis," *Found. Trends Inf. Retrieval*, vol. 2, nos. 1–2, pp. 1–135, 2008.

[9] C.-L. Liu, W.-H. Hsaio, C.-H. Lee, G.-C. Lu, and E. Jou, “Movie rating and review summarization in mobile environment,” *IEEE Trans. Syst., Man, Cybern. C, Appl. Rev.*, vol. 42, no. 3, pp. 397–407, May 2012.

[10] M. Pontiki et al., “SemEval-2014 Task 4: Aspect based sentiment analysis,” in *Proc. 8th Int. Workshop Semantic Eval. (SemEval)*, Dublin, Ireland, 2014, pp. 27–35.



Automatic Quality Assessment of Echocardiograms Using Convolutional Neural Networks: Feasibility on the Apical Four-chamber View

Karan Qasba, Bhavesh Prajpat, Alka Chavan, Prof Rahul Samant
NBN SSOE Pune

Abstract

Neural network has been evolving day by day with many features. The core of the neural network lies in the interaction between the neurons in the hidden layer. The neurons interact with each other by considering the weights between them. This results in the output of the system. There are many applications in which neural network can be practiced. This paper proposes Convolutional Neural Networks in medical science. It focuses on echocardiography. The term echocardiography means that the internal structure of a patient's heart is studied through the images. The ultrasound waves create these images. The abnormalities in these images are found through echo.

The motive of this work is to decrease the overhead of the cardiologist. This approach will result in pointing the abnormality in the heart. Since, cardiologist and less experienced surgeons may take a while to figure out the defect or may miss the defect in the heart. This approach considers the view of apical four-chamber (A4C) which considers 4 chambers of heart. This is a powerful approach which can detect even a little defect in heart which human eye tends to ignore.

Keywords: Convolutional neural network, Deep learning, Quality assessment, Apical four-chamber, Echocardiography.

Introduction

Data mining has been gaining number of eye consideration in the past decades. Data mining has proved to be very effective in many fields. This paper focuses on a very popular field i.e. healthcare field where data mining has served many applications. One of the applications in healthcare field is predicting the disease through some parameters which will be useful in decision making before diagnosis. This can save a good amount of life since the decision to be taken for diagnosis should be fast. But what if the decision is incorrect and contain some error?

This kind of false decision for diagnosis can take a life out of a person. To avoid such kind of risk it is need to make a system which can be reliable and in which the doctor can easily trust. This paper has focused on echocardiography where the decision is to detect the defect in the four chambers of heart quick and this paper proposes Convolutional Neural Network.

The accuracy of estimations of chamber volumes, function and ejection fraction in 2D echo views, such as the A4C view, depends on the quality of the acquired cine. To assist the sonographer in acquiring optimal views, several research groups have made notable efforts in producing real time feedback to the operator regarding image quality. A set of studies have attempted to detect shadows and aperture blockage in echo images. Several groups have proposed content-based cardiac interview classification techniques using machine learning and statistical approaches as well as low-level features. However, intra-view quality analysis of echo is a much more challenging problem, as there is relatively higher correlation between the visual content of the different echo images that need scoring. System framework incorporates a regression model, based on hierarchical features extracted automatically from echo images, which relates images to a quality score determined by an expert cardiologist.

HEART disease is the main cause of premature death worldwide. 2D echocardiography (echo) is a non-invasive, low-cost, portable, and accessible imaging technology that allows diagnosis of various cardiac conditions, risk stratification, and prognostication with minimal risk. Echo provides an excellent assessment of structure and function.

Echocardiography can be performed with several different techniques, among which transthoracic echocardiography (TTE) is the most common. In TTE, images are obtained from different probe positions, which can be grouped into four main categories, i.e. parasternal, apical, subcostal and suprasternal.

The motive of this work is to decrease the overhead of the cardiologist. This approach will result in pointing the abnormality in the heart using Convolutional Neural Network. Since, cardiologist and less experienced surgeons may take a while to figure out the defect or may miss the defect in the heart. This approach considers the view of apical four-chamber (A4C) which considers 4 chambers of heart. This is a powerful approach which can detect even a little defect in heart which human eye tends to ignore.

System design:

Class diagram

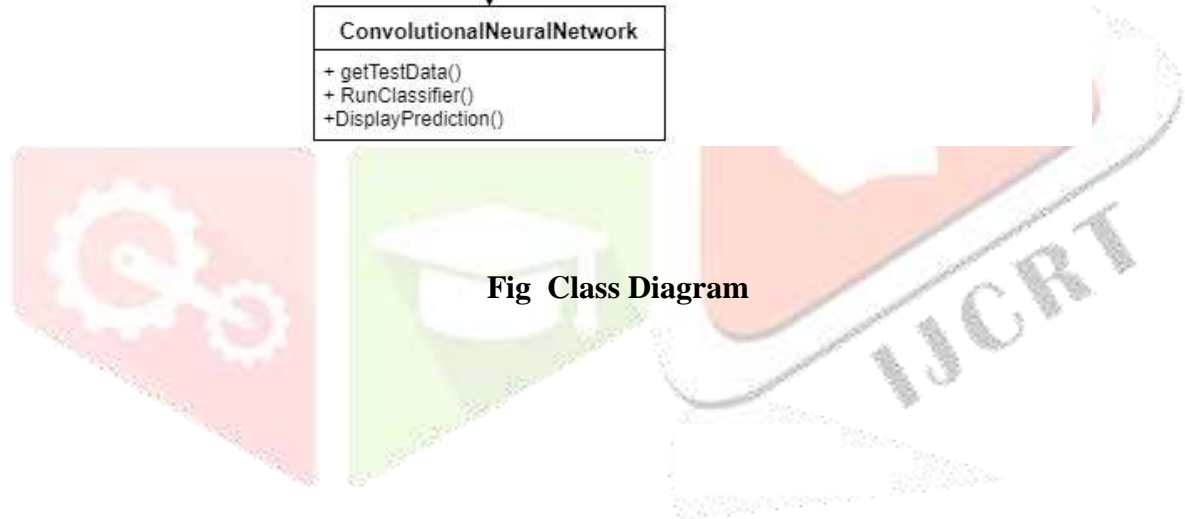
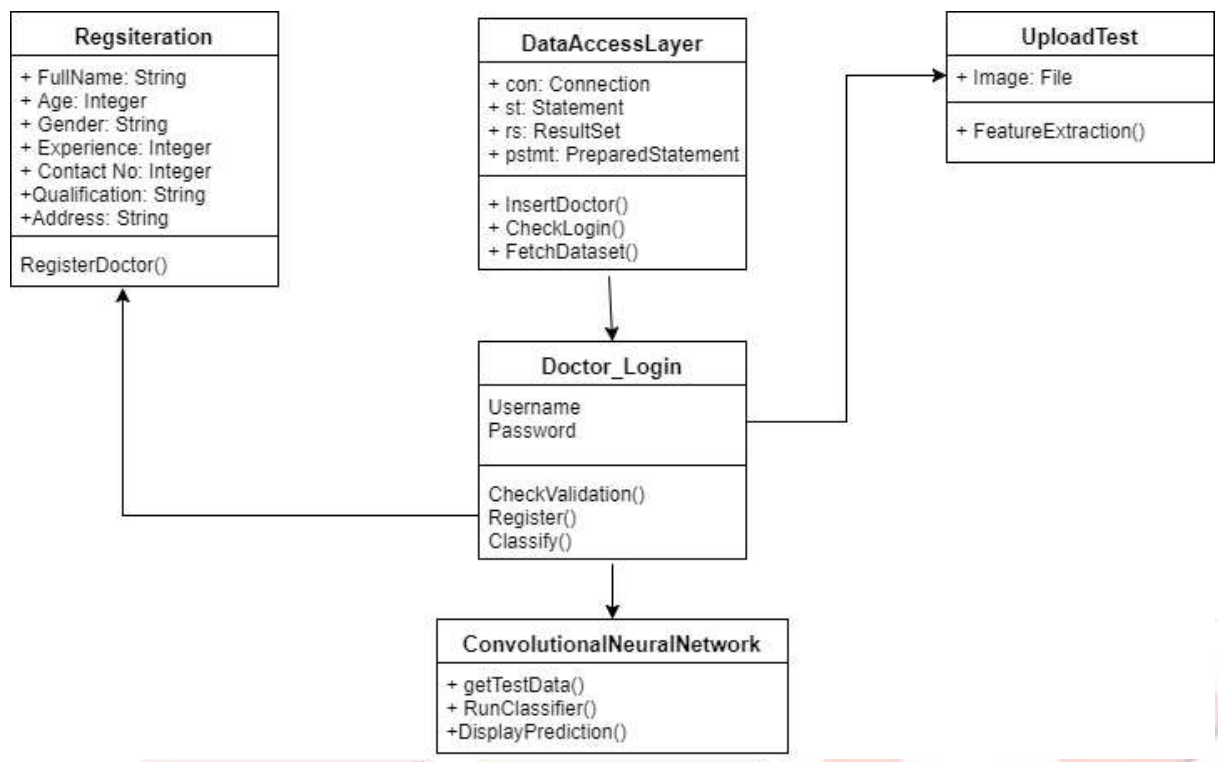


Fig Class Diagram

Sequence diagram:-

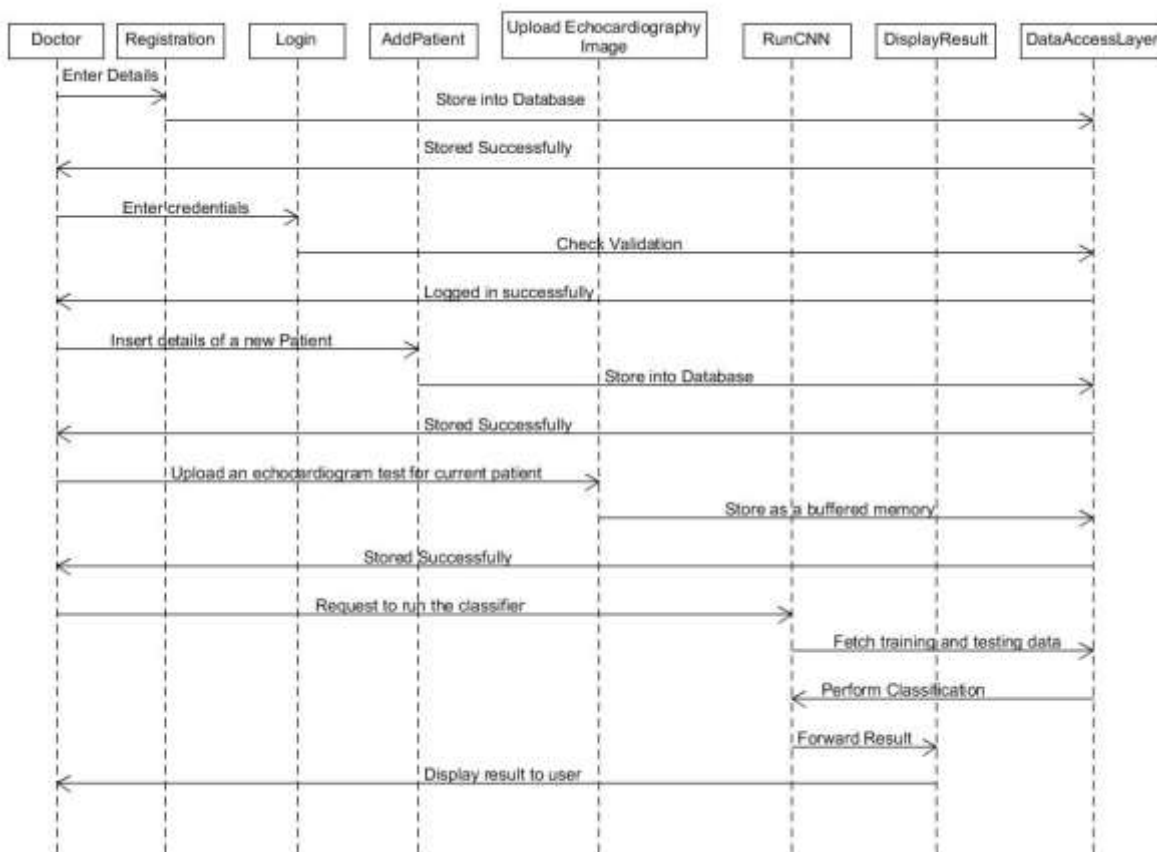


Fig :Sequence Diagram

Activity diagram:

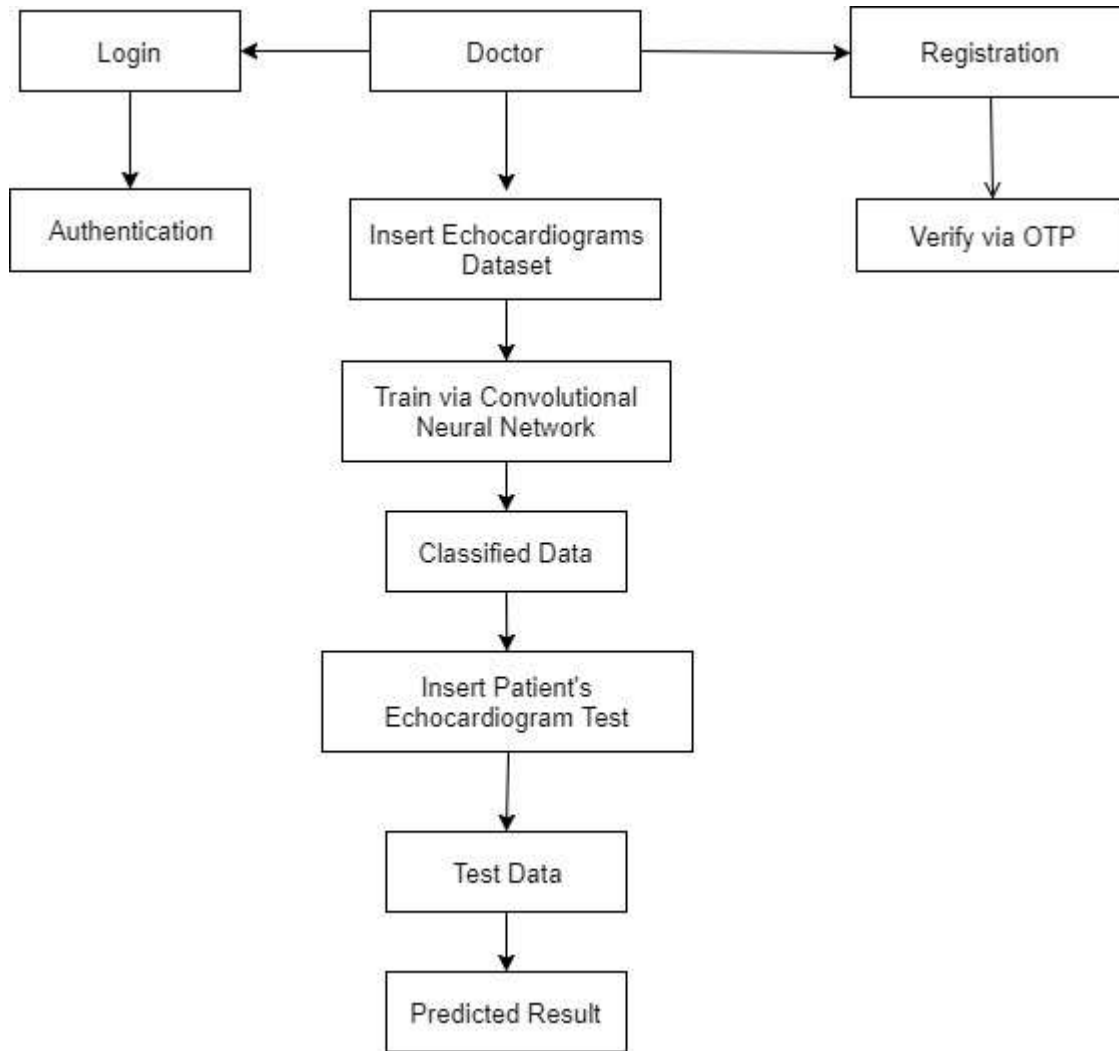


Fig : Activity Diagram



Use Case diagram:

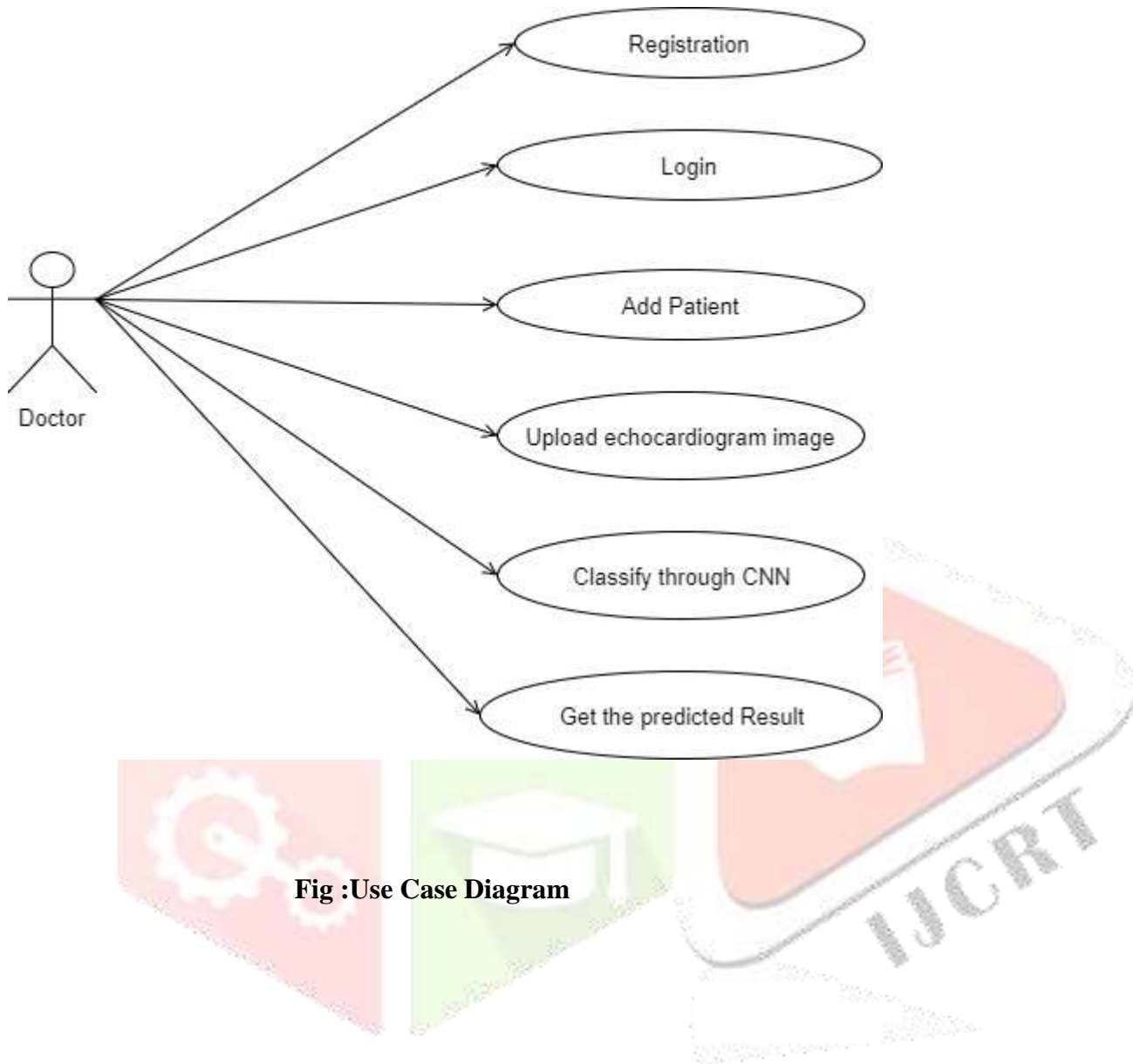


Fig :Use Case Diagram

3.2.5 Object diagram:

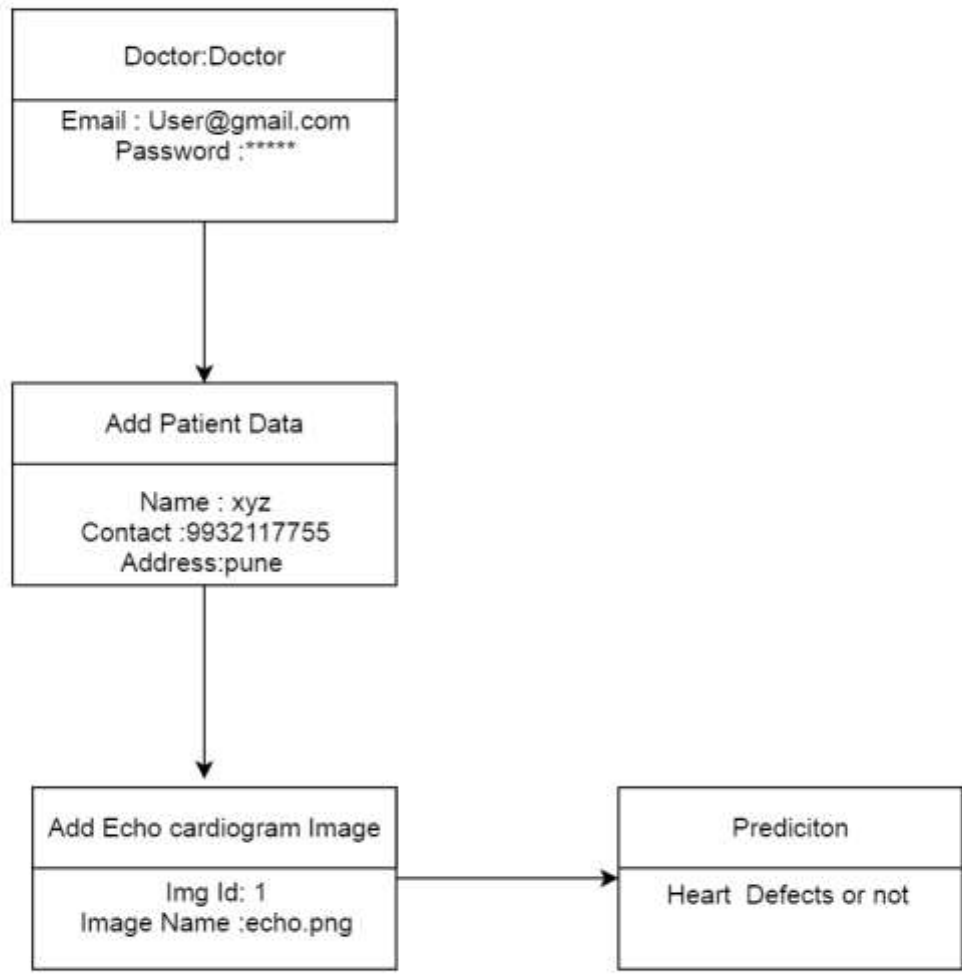


Fig: Object Diagram

Component diagram:

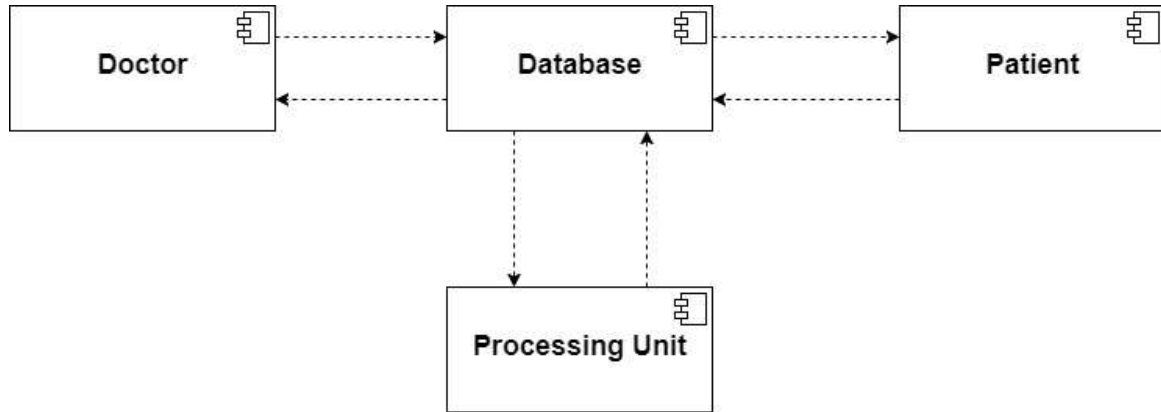
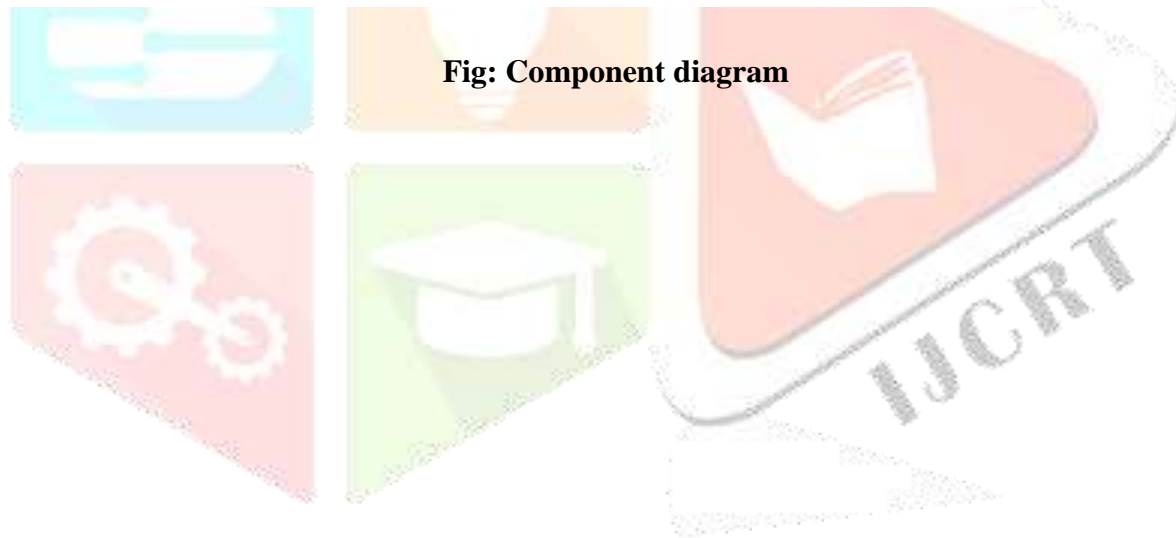


Fig: Component diagram



Deployment diagram:

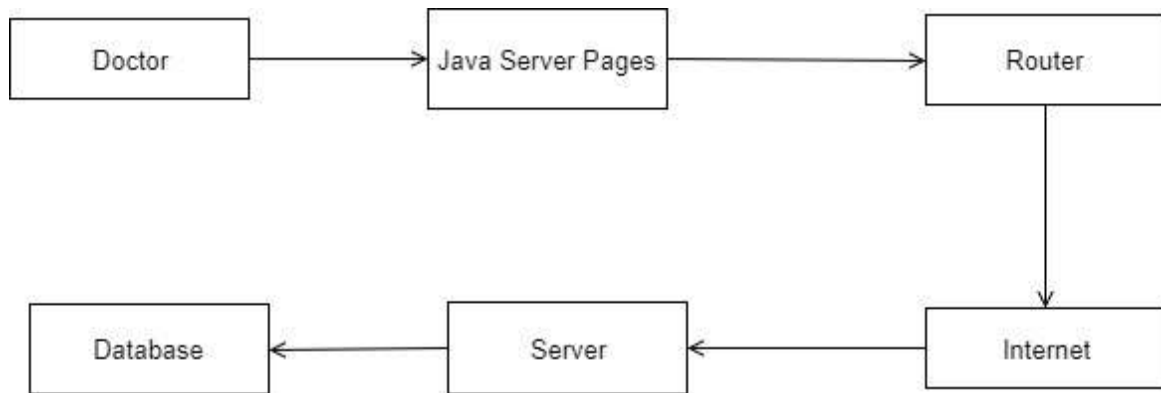
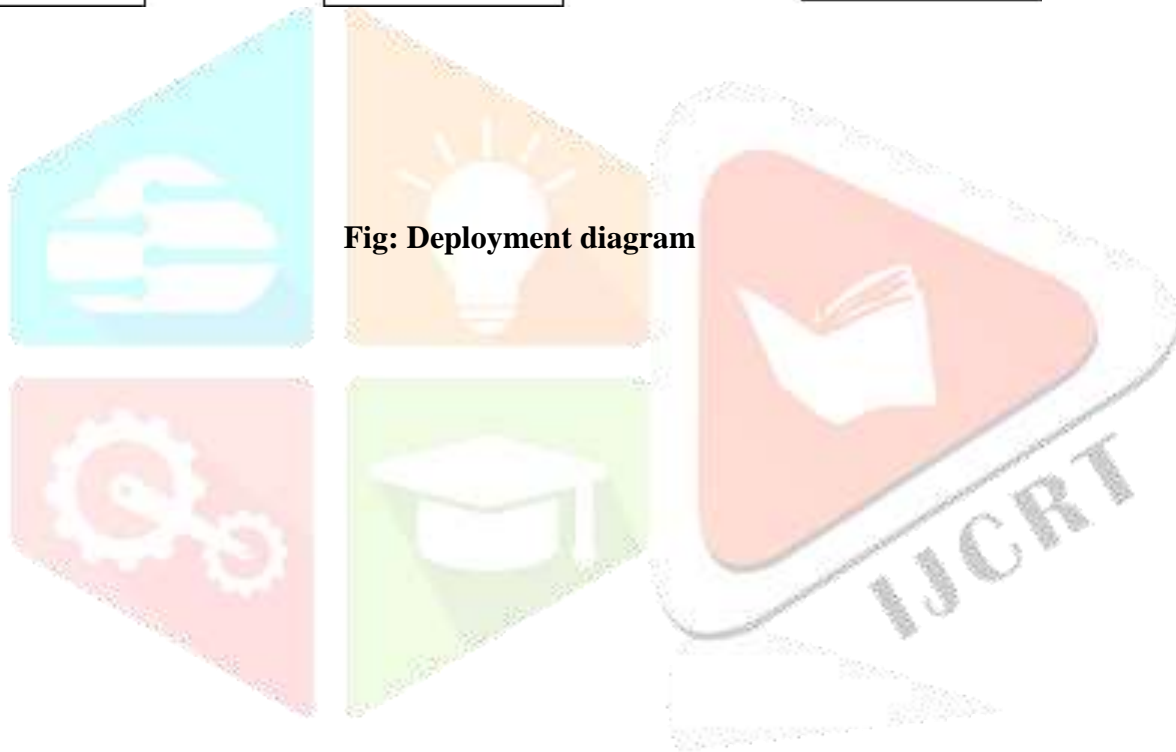


Fig: Deployment diagram



DFD 0 diagram:

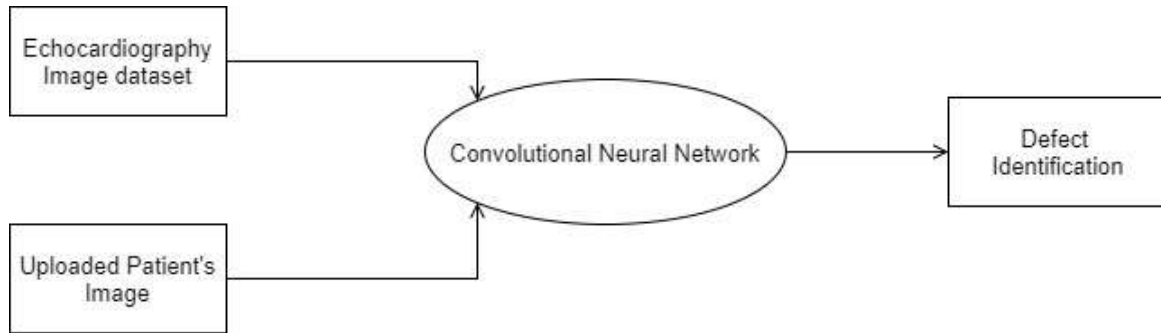
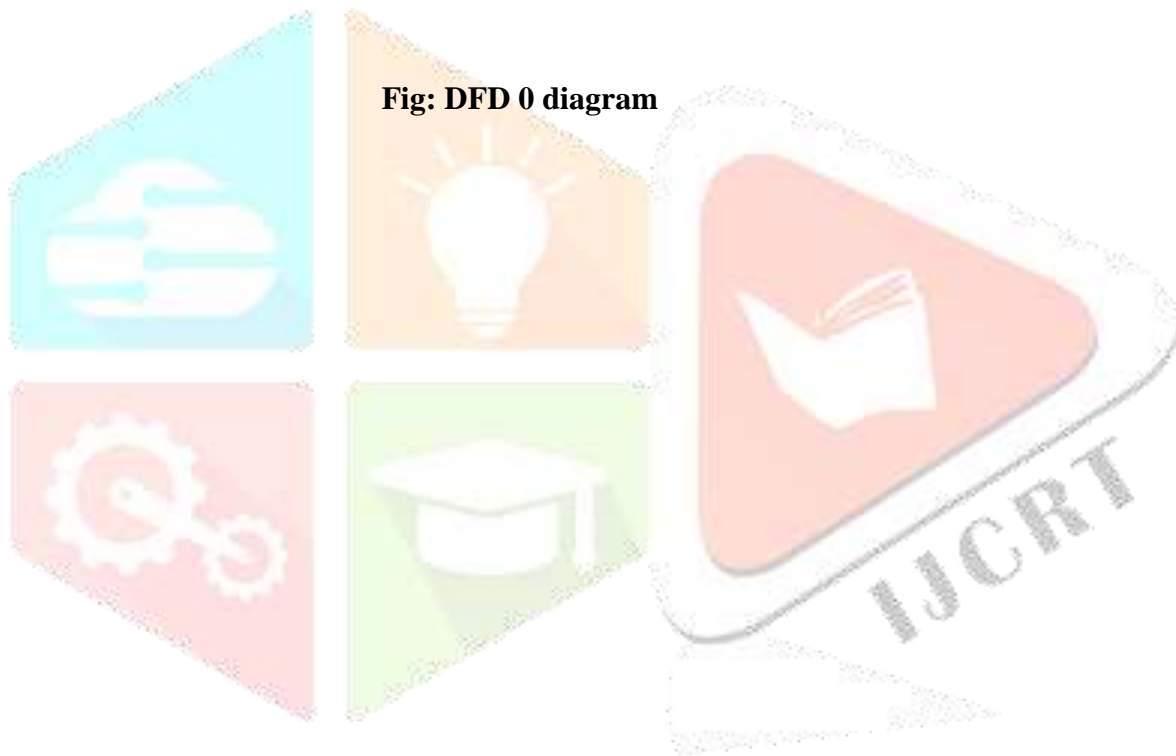


Fig: DFD 0 diagram



DFD 1 diagram:

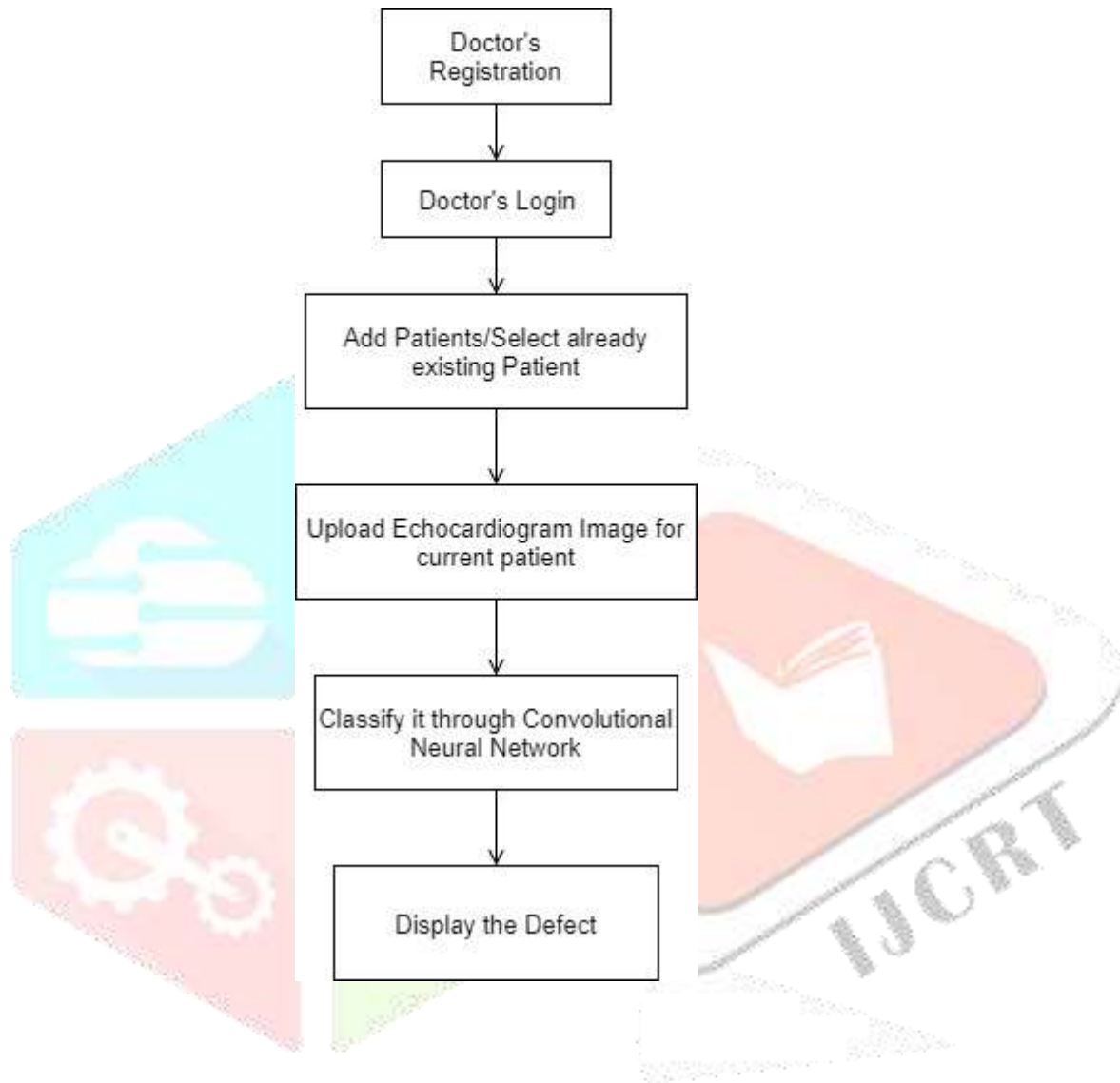


Fig: DFD 1 diagram

Related Works

[1] lasse løvstakken and fredrik orderud have proposed, a method for the visualization of the effective aperture of phased-array transducers is described. Reverberations from obstructing structures close to the transducer aperture may also cause problems for the proposed method.

[2] h. park1, s. k. zhou have proposed a fully automatic system for cardiac view classification of echocardiogram.[2] *Pierrick Coupé, Pierre Hellier, Charles Kervrann, and Christian Barillot* have an adaptation of the nonlocal (NL)-means for speckle reduction in ultrasound (US) images. The automatic tuning of the OBNLM filter and on the influence study on post processing tasks such as image registration or image segmentation is needed.

[3]*Xavier Glorot Antoine Bordes Yoshua Bengio* have proposed a technique, that shows rectifying neurons are an even better model of biological neurons. Problem could arise due to the unbounded behaviour of the activations in a network of rectifier units.

[4] *Fei Wang2, David Beymer* have proposed system for automatic view classification that exploits cues from both cardiac structure and motion in echocardiogram videos.

[5] *Pierrick Coupé, Pierre Hellier, Charles Kervrann, and Christian Barillot* have an adaptation of the nonlocal (NL)-means for speckle reduction in ultrasound (US) images. Originally developed for additive white Gaussian noise. The automatic tuning of the OBNLM filter and on the influence study on post processing tasks such as image registration or image segmentation is needed.

[6] *Sten Roar Snare , Hans Torp, Fredrik Orderud, Bjorn Olav Haugen* have proposed a novel method for assisting no expert users in capturing the apical 4-chamber view in echocardiography has been presented. there are some challenges remaining, in particular with respect to detection of oblique views, the results suggest that use of a real-time scan assistant may improve the results when no experts are acquiring apical 4-chamber echocardiographic views.

[7] *Roberto M. Lang, MD, FASE, FESC, Luigi P. Badano, MD, PhD, FESC, Victor MorAvi, PhD, FASE* proposed a technique to updated normal values for all four cardiac chambers . One may have presumed that since the convolutional layers don't have a lot of parameters, over fitting is not a problem and therefore dropout would not have much effect.

HYPOTHESES

- 1- We are developing a system that helps a user to predict the heart disease as per the category.
- 2- User will add patient details into the system such as personal details of patient.
- 3- Convolutional Neural Network is used to classify the images. CNN algorithm provides increased accuracy in the predication.
- 4- This approach considers the view of apical four-chamber (A4C) which considers 4 chambers of heart. This is a powerful approach which can detect even a little defect in heart which human eye tends to ignore.

System Architecture

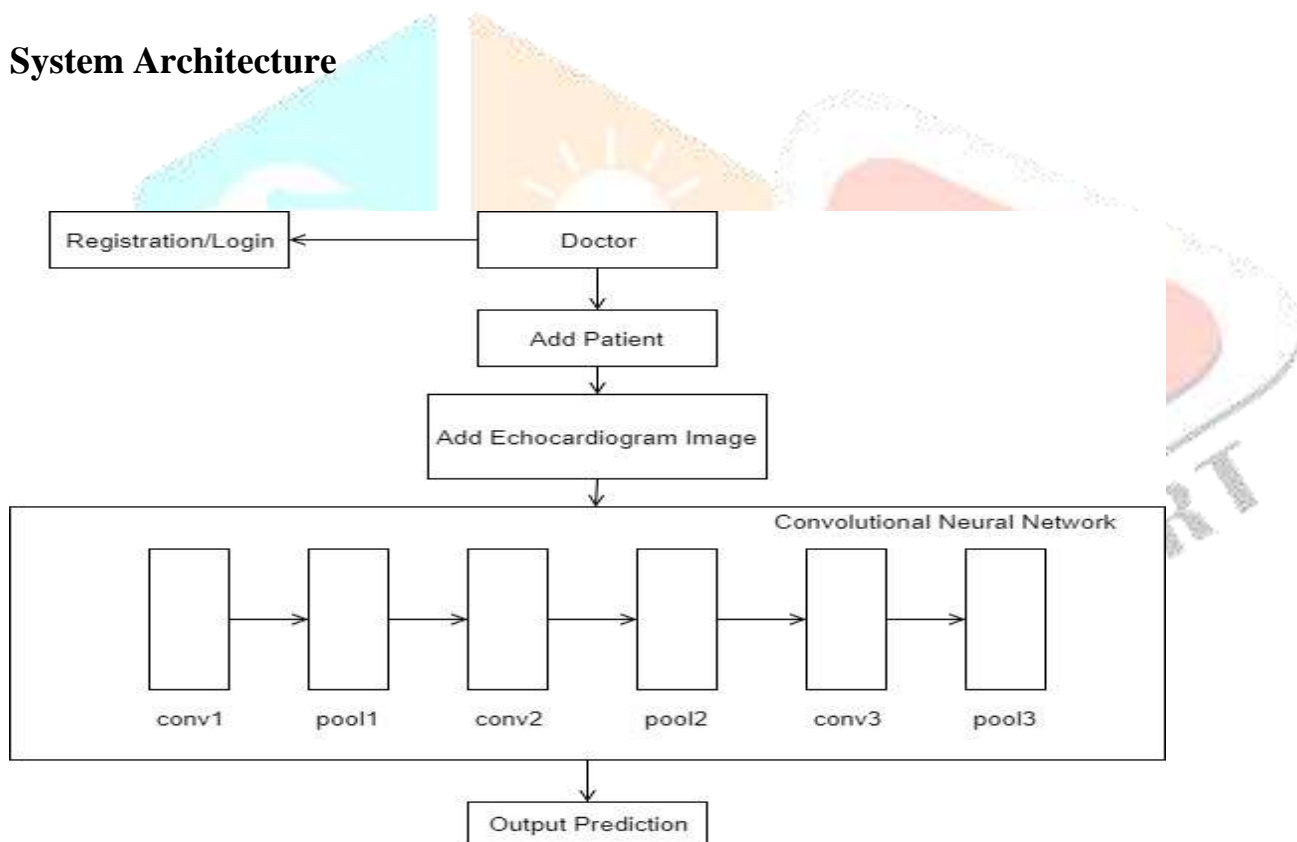


Fig: System Architecture

As shown in the above Architecture,

First user will register with the system by providing details like First name, last name, mobile number, service provider, mail id, and password. after that user will receive the Opt on his mail id .

If user enters correct OPT then user will get registered with the system. and users details will be get stored into the database

After registration user can login into the system with valid mail id and password.

User will upload the ecg image of heart .after uploading image , pass image to the CNN classifier .CNN classifier recognize the images and predict the disease .

Then user can logout from the System.

DESIGN OF THE STUDY

Implementation phase focus over system design objectives. Software implementation is the process of designing, writing, testing, debugging / troubleshooting, and maintaining the source code of computer programs.

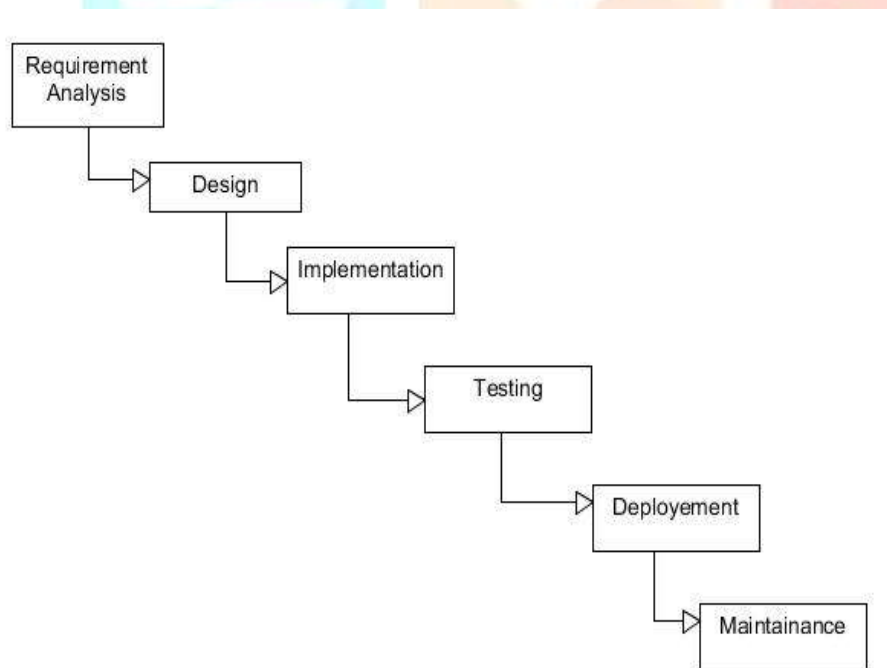


Fig : Software Development Process

Implementation of system is divided into 5 main modules. with the help of Register and Login module user will register and login into the system. User will store patients' details into the system. Upload ECG module is used

to store ECG image of the patient into the database. After that user will fetch image id to pass image to the classifiers. Then we will get the final result.

SAMPLE OF THE STUDY

TOOLS UDED

Software Requirement:

- Operating System : windows 10
- Application Server : Tomcat 8.0
- Language : Java
- Front End : HTML, JSP
- Database : MySQL

Hardware Requirement: The hardware design of the system includes designing the hardware units and the interface between those units.

- Processor - Pentium –IV
- RAM - 1 GB (min)
- Hard Disk - 20 GB

STATISTICAL TECHNIQUE USED

We have developed Login and Registration which manages the user profiles. User adds the patient details such as personal details and ECG image. User stores the image into the database and then sends it to the classifier for predication. After that classification process starts. System uses CNN classifier to predict the disease. Classifiers predict the disease as per the category.

Propose approach provides framework for automatic quality assessment of echo data. CNN classifier locates the defect in the four chambers of heart, like Left Ventricle (LV), Right Ventricle (RV), Left Atrium (LA) and Right Atrium (RA). After that suggestions or recommendation will be provided in the form of medicines to the patients as per the respective disease that occurs in part.

ALGORITHM

Convolutional Neural Network Layer

In this research CNN algorithm is used to detect the disease from given ECG image. System has used three layers of the CNN these are Convolutional Layer, Pooling Layer and fully connected layer. Here, convolutional layer and pooling layer, both layer work together. First it represents the image into three dimension vector space then applies filters to convert that image into 2 dimensions. Again fully connected layer applies the filters to recognize the image. After training the system when we pass the image to test it, As per the specified categories it classifies the image and detect the disease accurately. After disease detection system suggests the medicine on the detected disease.

The Conv layer is the core building block of a Convolutional Network that does most of the computational heavy lifting. To summarize, the Conv Layer:

Accepts a volume of size $W_1 \times H_1 \times D_1$

Requires four hyperparameters:

Number of filters K ,

their spatial extent F ,

the stride S ,

the amount of zero padding P .

Produces a volume of size $W_2 \times H_2 \times D_2$ where:

$$W_2 = (W_1 - F + 2P) / S + 1$$

$$H_2 = (H_1 - F + 2P) / S + 1 \text{ (i.e. width and height are computed equally by symmetry)}$$

$$D_2 = K$$

With parameter sharing, it introduces $F \cdot F \cdot D_1$ weights per filter, for a total of $(F \cdot F \cdot D_1) \cdot K$ weights and K biases.

In the output volume, the d-th depth slice (of size $W_2 \times H_2$) is the result of performing a valid convolution of the dd-th filter over the input volume with a stride of S, and then offset by dd-th bias.

$$a_{i,jk}^l = \sum_{m=-\infty}^{\infty} \sum_{n=-\infty}^{\infty} w_{i,mn}^l a_{(j+m)(k+n)}^{l-1}$$

<i>Notations</i>	<i>Description</i>
a_i^l	output feature map of kernel.
w_i^l	s the Weight matrix.
a^{l-1}	Represents the input feature-map of the layer.

Pooling Layer:

Its function is to progressively reduce the spatial size of the representation to reduce the number of parameters and computation in the network, and hence to also control overfitting.

More generally, the pooling layer:

Accepts a volume of size $W_1 \times H_1 \times D_1$

Requires two hyperparameters:

their spatial extent F,

the stride S,

Produces a volume of size $W_2 \times H_2 \times D_2$ where:

$$W_2 = (W_1 - F) / S + 1$$

$$H_2 = (H_1 - F) / S + 1$$

$$D_2 = D_1$$

Introduces zero parameters since it computes a fixed function of the input

Note that it is not common to use zero-padding for Pooling layers

It is worth noting that there are only two commonly seen variations of the max pooling layer found in practice: A pooling layer with $F=3$, $S=2$ (also called overlapping pooling), and more commonly $F=2$, $S=2$. Pooling sizes with larger receptive fields are too destructive.

Fully connected layer

Output of pooling layer is the input of fully connected layer .fully connected layer takes the output of polling layer and applies filter to recognizes the object.

$$f_{fci}^l(a^{l-1}) = \sum_{j=1}^n w_{ij}^l a_j^{l-1} + b_i^l,$$

<i>Notations</i>	<i>Description</i>
f_{fci}^l	Fully Connected.
a^{l-1}	Represents the input feature-map of the layer.
w_i^l	Is the Weight matrix.
a_i^l	Output feature map of kernel.
b_i^l	Bias value.

OUR APPROACH

This paper proposes a framework incorporates a regression model, based on hierarchical features extracted automatically from echo images, which relates images to a quality score determined by an expert cardiologist. This paper has demonstrated the feasibility of proposed approach on the A4C echo view. Deep Neural Network

is proposed to extract the feature, recognize the images and classify it. Echo Images are used to train and test the model. Trained network is able to assess the quality of an echo image in real time. Fully automatic system is proposed to cardiac view classification of echocardiogram. Since the design of the proposed architecture does not include any a priori assumptions on the A4C view, this approach could be extensible to other standard echo views.

To improve the quality of echocardiograms, this paper has implemented Computational Neural Network to detect the disease from given ECG image. System has used three layers of the CNN these are Convolutional Layer, Pooling Layer and fully connected layer. CNN algorithm first extracts the features from the images then it generates the patterns and finally it classifies the images.

Here, convolutional layer and pooling layer, both layer work together. First it represents the image into three dimension vector space then applies filters to convert that image into 2 dimensions. Again fully connected layer applies the filters to recognize the image. After training the system when we pass the image to test it, as per the specified categories it classifies the image and detects the disease accurately. After disease detection system suggests the medicine on the detected disease.

Experiment Result:

Data mining supports many different techniques for knowledge discovery and prediction such as classification, clustering, sequential pattern mining, association rule mining and analysis. Data mining is extensively used in business analysis, strategic decision making, financial forecasting, future sales prediction etc.

Our proposed model implements Computational Neural Network for analyzing the abnormality in a heart showed in echocardiogram in Apical Four Chambers (A4C).

In this research, we have collected echo image dataset from the hospital . These echo images were acquired mostly by echo-technicians, with a small contribution from cardiology trainees and trainee technicians, during routine cardiac exams. In an echo acquisition, the heart is imaged from at least seven standard (parasternal long and short axes, apical 2-, 3-, and 4-chamber, subcostal, and suprasternal) and atypical imaging views for which the sonographer places a transducer on the patient's chest to obtain ultrasound frame stacks (cine clips) in a specific order from each of the standard echo views.

The designed DCNN (Deep convolutional neural network) was trained on the training data and was evaluated on the test set against expert cardiologist's manual scores. The performances of the trained models were evaluated as the mean absolute error

(MAE) between the predicted AES and the expert's manual echo scores (MES).

The designed model was trained three times on the training data and was evaluated on the test set against expert cardiologist's manual scores. The performances of the trained models were evaluated as the mean absolute error (MAE) between the predicted AES and the expert's manual echo scores (MES).

Table I presents the performance of the three trained models for each quality-level as well as the overall accuracy of each model.

TABLE I

THE PERFORMANCE OF THE THREE TRAINED MODELS ON EACH QUALITY-LEVEL AND IN TOTAL. ALTHOUGH THEIR PERFORMANCES IN EACH QUALITY-LEVEL SLIGHTLY VARIES, THEIR OVERALL ACCURACIES MATCH.

Model	Mean Absolute Error (MAE)						
	0	1	2	3	4	5	Total
model1	0.63	0.77	0.84	0.78	0.58	0.85	0.72
model2							0.72
model3	0.68	0.85	0.87	0.78	0.59	0.86	0.72
	0.69	0.84	0.85	0.77	0.58	0.87	
Average	0.67	0.81	0.83	0.77	0.58		0.71

model	0.86
-------	------

Future scope:

Future steps include covering other standard echo views and extending the framework to respond to the cardiac cycle (echo cine) as a whole, rather than a single frame.

Acknowledgment: (optional)

It gives us great pleasure in presenting the preliminary project report on ‘’.

I would like to take this opportunity to thank my internal guide Prof. -----for giving me all the help and guidance I needed I am really grateful to them for their kind support. Their valuable suggestions were very helpful.

I am also grateful to Prof. -, college name, for his indispensable support and suggestions.

In the end our special thanks to Prof. ----for providing various resources such as laboratory with all needed software platforms,

Student name

Student name

Student name

(B.E. Computer Engineering).

Conclusion:

Proposed approach provides framework for automatic quality assessment of echo data using deep neural network model. The goal of proposed technique is to improve echo by reducing observer variability in data acquisition using a real-time feedback mechanism that helps the operator to read just the probe and acquire an optimal echo.

Reference:

- [1] L. Løvstakken, F. Orderud, and H. Torp, “Real-time indication of acoustic window for phased-array transducers in ultrasound imaging,” Proceedings of IEEE Ultrasonics Symposium, pp. 1549–1552, 2007.
- [2] Automatic cardiac view classification of echocardiogram,” Proceedings of the IEEE International Conference on Computer Vision, pp. 0–7, 2007.
- [3] X. Glorot, A. Bordes, and Y. Bengio, “Deep Sparse Rectifier Neural Networks,” Aistats, vol. 15, pp. 315–323, 2011.
- [4] H. Wu, D. M. Bowers, T. T. Huynh, and R. Souvenir, “Echocardiogram view classification using low-level features,” pp. 752–755, April 2013.
- [5] P. Coupé, P. Hellier, C. Kervrann, and C. Barillot, “Nonlocal means based speckle filtering for ultrasound images,” IEEE Transactions on Image Processing, vol. 18, no. 10, pp. 2221–2229, 2009.
- [6] V. Nair and G. E. Hinton, “Rectified Linear Units Improve Restricted Boltzmann Machines,” 27th International Conference on Machine Learning, pp. 807–814, 2010.
- [7] S. R. Snare, H. Torp, F. Orderud, and B. O. Haugen, “Real-time scan assistant for echocardiography,” IEEE Trans. Ultrasonics, Ferroelectrics, and Frequency Control, vol. 59, no. 3, pp. 583–589, 2012.
- [8] N. Srivastava, G. Hinton, A. Krizhevsky, I. Sutskever, and R. Salakhutdinov, “Dropout: A simple way to prevent neural networks from overfitting,” Journal of Machine Learning Research, vol. 15, pp. 1929–1958, 2014.

[9] G. N. Balaji, T. S. Subashini, and N. Chidambaram, “Automatic classification of cardiac views in echocardiogram using histogram and statistical features,” *Procedia Computer Science*, vol. 46, no. Ict 2014, pp. 1569– 1576, 2015.

[10] R. M. Lang et al., “Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging,” *Journal of the American Society of Echocardiography*, vol. 28, no. 1, pp. 1–39, aug 2016.



RIO: An AI based Virtual Assistant

Samruddhi S. Sawant

Department of Information
Technology
NBN Sinhgad Technical Institute
Campus
Pune, India

Abhinav A. Bapat

Department of Information
Technology
NBN Sinhgad Technical Institute
Campus
Pune, India

Komal K. Sheth

Department of Information
Technology
NBN Sinhgad Technical Institute
Campus
Pune, India

Swapnadip B. Kumbhar

Department of Information Technology
NBN Sinhgad Technical Institute Campus
Pune, India

Rahul M. Samant

Professor
Department of Information Technology
NBN Sinhgad Technical Institute Campus
Pune, India

ABSTRACT

In this world of corporate companies, a lot of importance is being given to Human Resources. Human Capital Management (HCM) is an approach of Human Resource Management that connotes to viewing of employees as assets that can be invested in and managed to maximize business value. In this paper, we build a chatbot to manage all the functions of HRM namely -- core HR, Talent Management and Workforce management. A chatbot is a service, powered by rules and sometimes artificial intelligence that you interact with via chat interface. The service could be any number things, ranging from functional to fun, and it could live in any major chat product. The chatbot deployed in this project will be tailor-made according to the company. Some aspects will be handling FAQ's, getting notice periods according to designation etc.

Keywords

HCM, NLP, Microsoft bot framework.

1. INTRODUCTION

Organizations have realized that their real assets are the human capital available to them. The output achieved from them can make or break a company. A large amount of resources are dedicated to acquire them, train them and get maximum output from them. This has led to the development of the domain Human Capital Management (HCM). HCM generally deals with a few key features such as recruitment, onboarding, training (or at least training support and tracking) and performance management. The best HCM software can be seamlessly integrated with other HR software solutions and even third party applications like social media, accounting or payroll outsourcing. Increasingly, HCM software vendors are starting to offer features that were typically offered with HRIS and HRMS solutions, like time and attendance tracking. We intend to provide a solution for this domain by creating a chatbot. Chatbot's are taking the tech world by storm [14]. This technology — which helps humans converse with computers in their native language via a computer interface — is gaining popularity in a variety of scenarios, especially customer service. Most of the businesses first heard about chatbot between the years 2015 and 2016. A survey conducted by Mind Bowser [16] found out that industries like E-commerce (90%), Insurance (80%), Healthcare (75%), Hospitality (57%), and Recruitment (30%) would be

benefitted by such virtual assistants. The rise of messaging apps, the explosion of the app ecosystem, advancements in artificial intelligence (AI) and cognitive technologies, a fascination with conversational user interfaces and a wider reach of automation are all driving the chatbot trend. A chatbot can be deployed over various platforms namely Facebook messenger, Slack, Skype, Kik, etc. The most preferred platform among businesses seems to be Facebook messenger (92%). There are around 80% of businesses that would like to host their chatbot on their own website. It is recommended creating chatbots that specialize in specific tasks, provide recommendations to users and excel at helping users complete those tasks. Effective chatbots will demonstrate an understanding of user needs [18] and complement these needs with quick access buttons and images that depict the options available. By incorporating these visual aids, chatbot can reduce the time and effort spent on interacting with the chatbot, resulting in a quality user experience.

2. HISTORY

1. German scientist Joseph Weizenbaum developed ELIZA in 1966 considered as the first chatbot. It behaved like a therapist by rephrasing the statements of user and posing them back as questions. Mimicked human conversation by matching use prompts to scripted responses-it was able, at least for a time, to pass the Turing artificial intelligence test [3], [10].
2. Psychiatrist Kenneth Colby developed PARRY in 1972 attempted to simulate a person with paranoid schizophrenia. Parry was described as an Eliza with an attitude. It used a combination of assumptions, attributions and 'emotional responses' [3].
3. British programmer Rolo Carpenter developed JABBERWACKY in 1982. It was mostly used entertainment purposes. It attempted to move from text based to voice based [3].
4. Dr. Wallace developed ALICE (Artificial Linguistic Internet Computer Entity) an open source natural language AI based chatbot to form responses to queries. It forms responses based on some pattern matching. The basic unit of AIML is category. Each

category consists of an input or question, an output or an answer and an optional context. The questions are called pattern. The answer is called the template. The two types of optional context are called “that” and “topic”. The pattern matching while working with AIML consists only words, spaces and wildcard symbols _ and * [3].

5. In 2006 IBM came up with WATSON that used natural language processing and machine learning to reveal insights from large amounts of data. It was originally developed to compete in Jeopardy which it won in 2011 against two former winners. Watson uses IBM’s deepQA software and Apache’s UIMA framework [3].
6. In 2011 Apple came up with the popular Siri that used Automatic Speech Recognition that converted human voice commands to text. Siri played the role of a personal assistant. It used NLP to convert the converted text to parse text and then analyzed it to give out answers. When Siri recognized that the human has asked a question but it does not have an adequate answer to the question, it directed the query to WolframAlpha that performed general search operations [3].
7. In 2014, Microsoft released CORTANA for Windows 10. It was Microsoft’s version of a personal assistant. Cortana gets its NLP capabilities from Tellme Networks and are coupled with a Semantic search database called Satori [3].
8. In 2015, Amazon released ALEXA. Alexa could stream podcasts, play audio books. It could also control smart devices using itself as a home automation hub. Alexa uses Amazon’s own Amazon Comprehend for its natural language processing capabilities [3].
9. In 2016 Microsoft launched TAY based on Python, Java and Node.js but had to be taken down 16 hours into its launch because the chatbot started posting inflammatory content through its twitter handle and caused an uproar leaving Microsoft red faced [3].
10. In 2017 HDFC bank launched EVA, a chatbot that could get customers quick access to the bank’s product details, fees and charges for various product details, application processes etc. EVA has served over 350,000 unique customers and has addressed over 2.7 million customer queries successfully. EVA uses NLP and AI like every modern chatbot.

3. LITERATURE SURVEY

We start with a paper that talk’s about the basic design and implementation of a chatbot. However it failed to perform complex activities and queries [1], [11].

Next up a paper that compared the very first chatbot ELIZA and ALICE where the researcher ruled that it was easier to make bots using ALICE because of it was implemented using rule based pattern matching [2].

Next step was a study of different types of models of a chatbot from an article that compared them [13].

A chatbot is applicable in different domains. A few examples would be

Education domain - A virtual assistant is implemented for

college students, solving college related queries. However the author suggested that neural networks could be a future implementation of the system and data encryption and data compression could be used to secure data [8].

Business domain - A chatbot could answer FAQs using Artificial Intelligence Markup Language (AIML) and Latent Semantic Analysis (LSA). The system would automatically route to LSA block if AIML failed to provide answer to a particular user query. Chappie [7] a semi-automatic chatbot converses with the user and finds out his intent. On learning the intent of the user it could transfer the user to associated expert. It achieved 65-67% accuracy using Naïve Bayes Classifier, SVM. Future scope was that Chappie could be scaled to handle the entire conversation.

Banking domain - A banking assistant that carries out banking tasks efficiently and in no time. This chatbot was built on the techniques of AIML and NLP but it failed to provide 3 tier architecture and its implementation on web services to support multiple clients [5], [6].

NLP is the basic technique on which a chatbot works. An article by J. Crawford spoke about what NLP is, why we need it and its basic implementation [12].

We reviewed how a chatbot was answering questions like how will AI powered customer service help customer support agents? How a chatbot assistant can help a business? How to design a conversation that could influence a person? What can be the cons of implementing a chatbot in HR domain? We’ve reviewed this from an article in chatbot magazine.

4. PROPOSED WORK

A survey was under taken at the HR Tech Conference and Expo [17] of more than 350 attendees. The following were the survey results:

Any information regarding leaves, company policies are made available when the employees demanded anytime, anywhere said 99% of the respondents.

47% said that they would prefer to get information from such virtual assistant.

In the end 92% of the respondents agreed that the future Chabot’s will be significant to help employees find information they need instantly.

The idea behind this chatbot is that it will give out information to a particular employee on a wide range of topics directly without having to consult the HR personally each time. It will focus on particular requirements of the company. Primary functionalities will include handling FAQ’s, getting notice period according to the designation of that particular employee. The same survey also helped in understanding the most common employee’s query like paid time off, open enrollment, maternity leave, leave of absence, etc. The following figure depicts the queries that the employees found comfortable asking a chatbot.

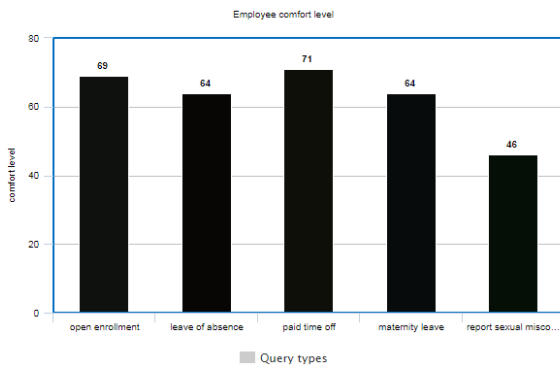


Fig.1 Common Employee Queries

Suppose an employee needs to talk to another employee on the intercom then it will provide an extension list. It will review an employee's performance by taking feedback from other employees and complete the appraisal cycle. Also employee can update his major life events. In short, most of the HR's work will be digitized and easy to access.

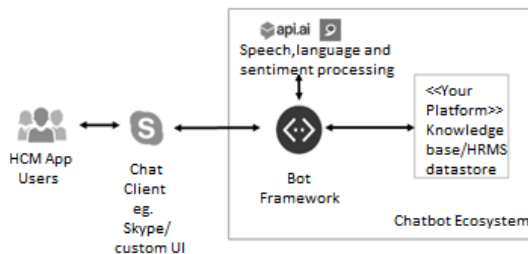


Fig 2: Architecture of Chatbot

4.1 HCM App Users

The users of this application are the employees of the company where this chatbot will be deployed.

4.2 Chat client

The user interface can be deployed over existing platform or a custom UI. Our UI will be a custom UI, in accordance with

the company's specification.

4.3 Chatbot Ecosystem

A chatbot ecosystem is built on two major components-

1. HRMS Database
2. Technology Used

4.3.1 HRMS Database

A typical HRMS database will consist of the entire information of an employee. The database is huge. It contains information in every field. The database will have information on name, address, email-id, phone no, region, country, job title, salary, department name, joining date, extension list, notice period in accordance of a job title etc.

4.3.2 Technology Used

Technologies used in our project are

1. Bot framework
2. Node.js
3. Microsoft LUIS

4.3.2.1 Bot Framework

Microsoft bot framework consists of Bot builder, bot Connector, and bot directory. It also has an emulator where we can test the working of the bot. Bot builder SDKs for Node.js, .Net are available to build the bot. If we want our bot to be more interactive, we can incorporate Microsoft cognitive services such as Language Understanding Intelligence Service. In Microsoft bot framework, the role of bot connector is very important. The responsibility of bot connector is to connect with the different channels some of which are Facebook, Skype, Slack, Web Chat etc. Once the bot is built, next job is to publish and deploy the bot to the Microsoft azure cloud platform. For that, it is mandatory to create the azure bot service in the azure cloud platform. Using the azure bot service, the bot is deployed to the cloud [15]. Mind Bowser survey [16] showed that 41% of businesses prefer Microsoft Bot Framework as a bot building platform.

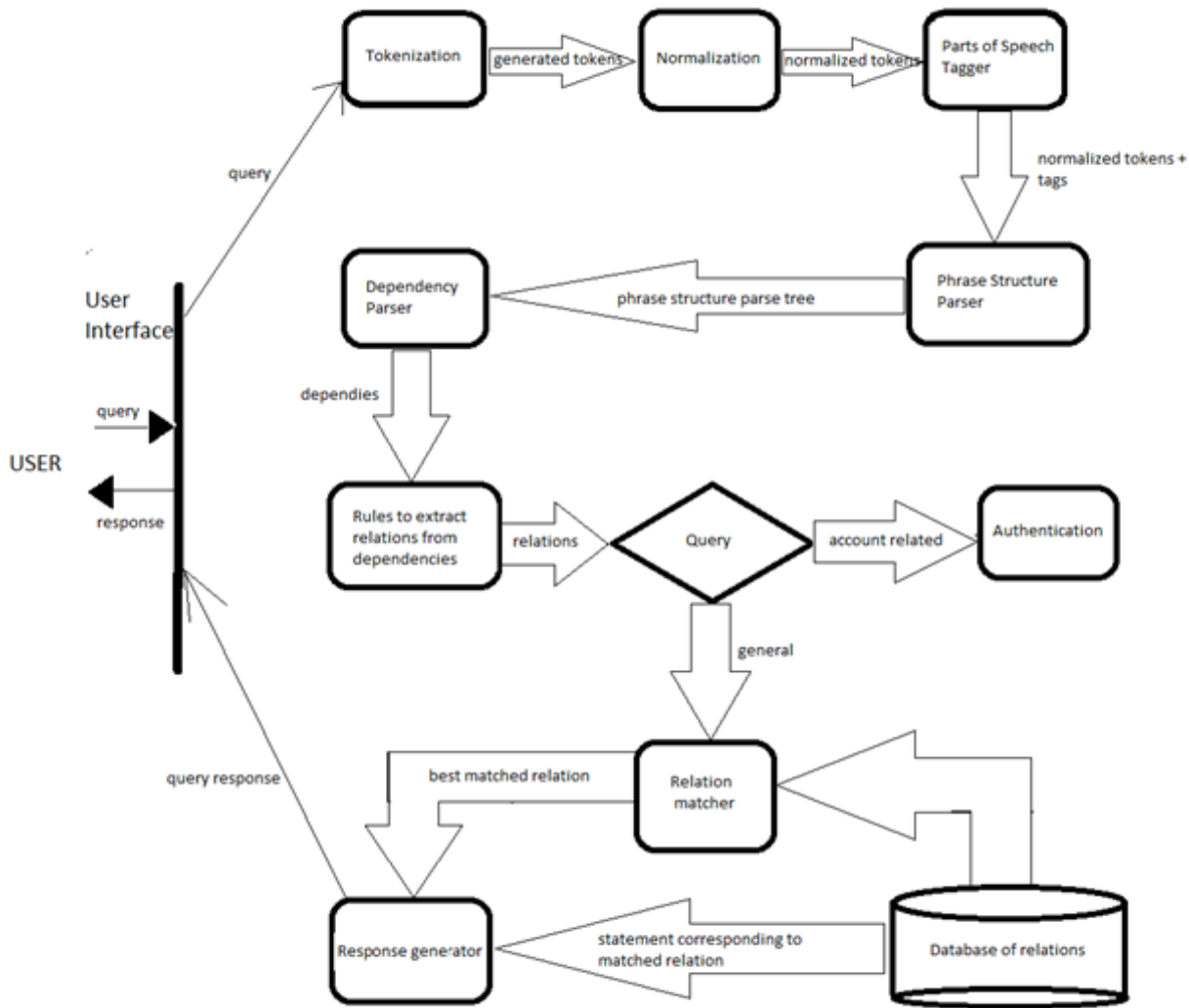


Fig 3. NLP Architecture

4.3.2.2 Node.js

Node.js is used to build and run a web application that uses JavaScript as its main language. It also has a built in web server and plug-ins that allow you to mold your application the way you want it to. Node.js allows language reuse that is, it requires you to learn only JavaScript on both client and server side. Node.js is lightweight. It allows a single thread per client request. It is the very foundation of non-blocking I/O a main feature of Node.js. It provides to object databases like Mongo DB. The advantage of JavaScript is that it's been around for a long time. So most editors and IDE's support it. Another advantage is that it can be hosted anywhere. Several web servers and cloud-based hosting providers support hosting of Node.js web applications out-of-the-box. Some examples would be Google, Microsoft Azure, and Amazon (AWS) etc. [9]

4.3.2.3 Microsoft LUIS

LUIS is what helps your application understand what you're saying when you say it in your own language. Thus LUIS allows developers to create an application that can understand what the user is saying in his natural language. It also allows the application to gather meaning from it. Basically LUIS allows a user program to enter a query in his natural language

and get a response from the application. LUIS uses entities and intents. Applications are usually content related and centered on a topic that is domain specific. It allows the use of pre-built models from Cortana and Bing. Models deployment to a HTTP endpoint is very easy and it returns JavaScript Object Notation. Programmatic REST API's are available which helps the developer in automation of the application development process. LUIS offers free plans and is available in a number of languages like English, French, Italian, German, Spanish, Portuguese, Japanese, Brazilian, Chinese and Korean. A major component of LUIS is Natural Language Processing or NLP. The basic architecture of NLP can be drawn as shown in Figure 3. The basic functioning of NLP can be summarized in the following way. The user will type in his query, in his natural language. A friendly user interface will accept this query and pass it on to the tokenizer. The tokenizer converts the query into tokens by using delimiters like commas or semicolons. The output of the tokenizer is given to a normalizer which will do pre-processing. It includes spell check, expanding acronyms and abbreviations. These normalized tokens are tagged, giving it some meaningful labels. The labeled output is given to a Phase Structure Parser which checks whether language follows a pre- defined syntax. This can be difficult. Thus some rules

will be used and using probability we can find the best parse of the sentence. The grammar must be of the type Probabilistic Context Free Grammar. Thus parse tree will be generated. This is further given to a dependency parser which will convert the Phase Structure rules into dependencies. Stanford's dependency parser is preferred. The output of this parser will give us the dependencies between the words of the sentence. These dependencies are then used to extract some relations. This helps understand the context of the statements. The query is then authenticated. For e.g., in a banking assistant, it will check whether a user is allowed to access the details of his account. If it gets the go ahead then the relations are matched with existing relations in the database. The relations have a set of associated statements. The statements of the best matched relations are given to the response generator which gives it as query response to the user interface. The UI displays the statements as outputs to the clients query.

5. RESULTS

In this paper we have implemented a chatbot by the name RIO that carries out HR functionalities namely

5.1 Getting the Extension list

When an employee wants to contact another employee, he can simply ask the chatbot for the extension number of said employee, by typing his name. In companies having 1000s of employees working at one location this is especially useful since the employee have to ask around for the said employee's extension number.

5.2 Getting Notice period

Getting Notice period according to the employee's designation. Every company has different rules for notice periods. They're usually more stringent at fresher level and are relaxed up the order. The chatbot will tell the employee how much of a notice period he must serve.

5.3 Finding the appraisal cycle

All employees get an appraisal every year. The percentage depends on his performance through the year. The factors can be molded according to the policy and the user can know what percentage of appraisal he can get.

5.4 Inserting/Updating life events

Most companies have policies that will look after their employees. Along with that with that there are always security concerns. So most companies will demand complete information from their employees, so that it can be accessed whenever needed. Common life event can be getting married, divorces etc.

5.5 Handling FAQs

The most common task the HR has to accomplish will be answering questions that the employees have about company policy. In most cases, these questions are very common or in some cases, an employee might find it awkward to approach the HR. He can simply ask the chatbot for the answer. If the chatbot has no answer, the chatbot will send the query to HR.

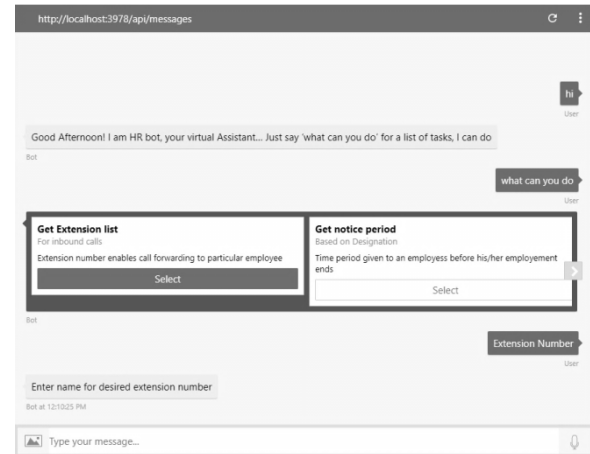


Fig 4: The Bot Laying Out the Users Options

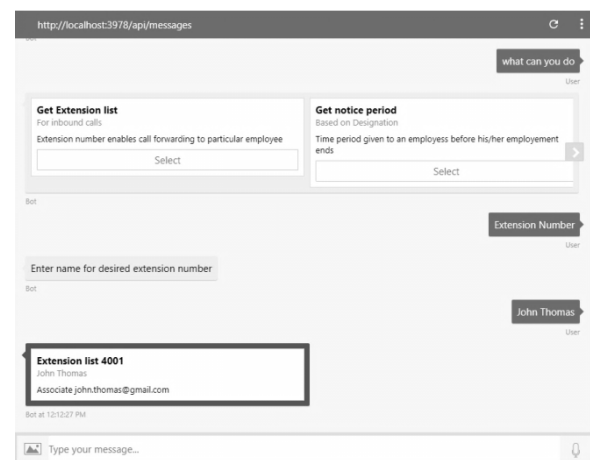


Fig 5. Getting extension no. after entering the required name

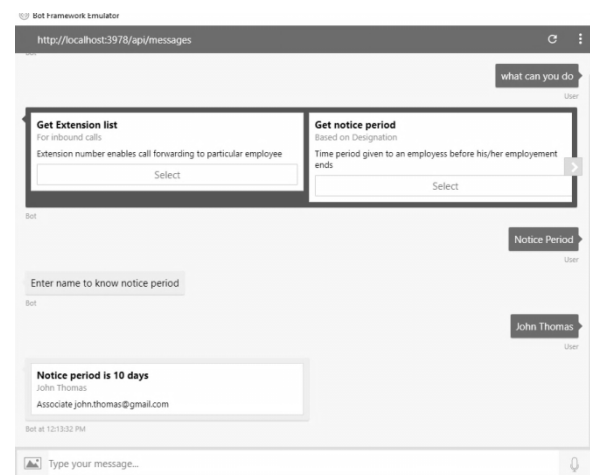


Fig 6. Getting the notice period you must see out

6. CONCLUSION

As of 2016 Facebook messenger had 33,000 chatbot. That number is now up to a 100,000. It is evident that chatbot are future. Chatbots help in answering queries at any time and any place. Thus HR leaders are beginning to pioneer the use of AI into HR. A recent survey of 350 HR leaders found that 92% leaders believe that the future of an enhanced service lies in Chatbot. The HR department has to deal with numerous queries on a daily basis. Chatbot can answer most of those

queries. There lies the problem. Even a highly trained chatbot can fail to answer a query that is extremely unique query. So the chatbot will have to refer it to the HR personnel. But that'll be a unique case. The pros outweigh the cons. This chatbot can help the company save millions. Even though the chatbot will not render the human obsolete, but a significant amount of work load will come down for the HR. He can focus on the important parts thus improving his more output.

7. FUTURE SCOPE

A chatbot can be made friendlier by making it multi-lingual, e.g. Hinglish (Hindi + English). This can be done using a combination Natural Language Understanding and Natural Language Generation. NLU is a technique that helps in converting unstructured inputs into structured form. NLG helps in enhancing the quality of response. Conversational Interface (CI) a new approach to enhance the user experience by addition of UI elements like message menus, images, buttons etc. A chatbot can be made friendlier by incorporating voice recognition. We have used a text based in this chatbot because according to consumer surveys most people prefer a text based chatbot.

8. ACKNOWLEDGEMENT

This research was supported by Harbinger Systems. We thank Jino Thomas (Software Engineer) and Sameer Nair (Software Engineer) for assistance with Node js, Microsoft Bot Framework. We thank our college professors from NBN Sinhgad College of Engineering who provided insight and expertise that greatly assisted the research.

9. REFERENCES

- [1] M. Dahiya," A Tool of Conversation: Chatbot", International Journal of Computer Sciences and Engineering E-ISSN: 2347-2693, Volume-5, Issue-5, May 2017.
- [2] V. Sharma, M. Goyal, D. Malik, "An Intelligent Behaviour Shown by Chatbot System", International Journal of New Technology and Research (IJNTR) ISSN: 2454-4116, Volume-3, Issue-4, April 2017.
- [3] A. Deshpande, A. Shahane, D. Gadre, M. Deshpande, Prof. Dr. P. M. Joshi, "A Survey of various chatbot implementation technique", International Journal of Computer Engineering and Applications ISSN 2321-3469, Volume XI, Special Issue, May 17.
- [4] A. Patil, K. Marimuthu, N. Rao A, R. Niranchana, "Comparative study of cloud platforms to develop a Chatbot", International Journal of Engineering & Technology, Volume-6, Issue-3, 2017.
- [5] K. B. Shah, M. S. Shetty, D. P. Shah, R. Pamnani, "Approaches towards Building a Banking Assistant", International Journal of Computer Applications (0975 – 8887), Volume 166 – No.11, May 2017.
- [6] Thomas N T, "An E-business Chatbot using AIML and LSA", Intl. Conference on Advances in Computing,

Communications and Informatics (ICACCI), Sept. 2016.

- [7] B. Behera, "Chappie-A Semi-automatic Intelligent Chatbot".
- [8] V.Y. Shetty, N.U. Polekar, S.U. Das, S. Pansambal, "Artificially Intelligent College Oriented Virtual Assistant", International Journal of Technical Research and Applications e-ISSN: 2320-8163, Volume-4, Issue-2, April 2016.
- [9] S. Tilkov, S. Vinoski, "Node.js: Using JavaScript to Build High-Performance Network Programs", IEEE Computer Society, 2010.
- [10] J. Weizenbaum, "Computational Linguistics", Communications of the ACM, Volume 9, January 1966.
- [11] M. Schlicht, "The Complete Beginner's Guide To Chatbots – Chatbots Magazine," Chatbots Magazine, 20-Apr-2016. [Online]. Available: <https://chatbotsmagazine.com/the-complete-beginner-s-guide-to-chatbots-8280b7b906ca>. [Accessed: 06-Mar-2018].
- [12] J. Crawford, "Understanding the Need for NLP in Your Chatbot – Chatbots Magazine," Chatbots Magazine, 15-Feb-2018. [Online]. Available: <https://chatbotsmagazine.com/understanding-the-need-for-nlp-in-your-chatbot-78ef2651de84>. [Accessed: 06-Mar-2018].
- [13] Pavel Surmenok. [Online]. Available: <http://pavel.surmenok.com/2016/09/11/chatbot-architecture/>. [Accessed: 06-Mar-2018].
- [14] "Artificial Intelligence – Chatbots Magazine," Chatbots Magazine. [Online]. Available: <https://chatbotsmagazine.com/tagged/artificial-intelligence>. [Accessed: 06-Mar-2018].
- [15] RobStand, "Bot Service Documentation - Tutorials, API Reference - Bot Service," Tutorials, API Reference - Bot Service | Microsoft Docs. [Online]. Available: <https://docs.microsoft.com/en-us/bot-framework/>. [Accessed: 06-Mar-2018].
- [16] D.Robinson, A.Ghodake, P.Smith, G.Miller, W.Sims, G.Martin, "Chatbot Survey 2017-Current state of Chatbots and their outlook in 2017" Chatbots Journal [Online]. Available: <http://mindbrowser.com/chatbot-market-survey-2017/>. [Accessed: 06-Mar-2018].
- [17] D.R.Bharadwaj, "Chatbots and the Future of Employees Experience" ServiceNow [Online]. Available: <https://servicematters.servicenow.com/2017/11/09/chatbots-and-the-future-of-employee-experience/>. [Accessed: 06-Mar-2018].
- [18] A. R. Gadiyar, "The Chatbot Imperative: Intelligence, Personalization and Utilitarian Design", Jan-2017. [Pdf], pp.2-9. Available at: <http://www.cognizant.com> [Accessed: 06-Mar-2018].



RESEARCH ARTICLE

DESIGN AND MANUFACTURING OF WASHING AND CLEANING UNIT FOR CONNECTING ROD

¹Akash Orum, ^{1,*}Niraj Kunkulol, ¹Surabhi Naidu, ¹Neeraja Prabhudesai, ¹Arun S. Thakare and ²Mr. Balasaheb Pawar

¹Mechanical Department, NBSSOE, Pune, India

²Manufacturing Department, Cummins India Ltd, Pune, India

ARTICLE INFO

Article History:

Received 28th January, 2018

Received in revised form

14th February, 2018

Accepted 10th March, 2018

Published online 30th April, 2018

Key words:

Connecting Rod, Impurities, Washing, Cleaning.

ABSTRACT

Every component adds up to the machine's performance. For effective working of a machine, every component needs to have proper dimensions and without any kind of impurities on it. The main objective of this work is to design and manufacture washing and cleaning unit. Whenever a manufacturing process takes place, it includes contact with oil, coolant and some amount of burr will accumulate on the surface of the component. These things are not acceptable when the component goes for further operations. To minimize the errors due to the presence of these impurities, a machine is designed and manufactured to clean the connecting rod with the help of water and air nozzles. Pneumatic cylinders are used to achieve smooth and noise free operation.

Copyright © 2018, Akash Orum et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Citation: Akash Orum, Niraj Kunkulol, Surabhi Naidu, Neeraja Prabhudesai, Arun S. Thakare and Mr. Balasaheb Pawar, 2018. "Design and manufacturing of washing and cleaning unit for connecting rod". *International Journal of Current Research*, 10, (04), 68015-68017.

INTRODUCTION

Connecting rod plays a vital role in the performance of an engine. It connects the piston with the crankshaft of the engine. Thus, imperfections in it will affect the engine's performance (Anusha Chintada, 2016). For a metal piece to transform into connecting rod, it needs to go through many manufacturing processes viz. forging, boring, facing, chamfering, honing, finishing etc. Whenever a manufacturing process takes place, a lot of heat is generated due to friction between the metal and the tool. To overcome this heat during the manufacturing process oil or coolant is generally used. But, because of this the burr sticks to the surface. This affects further manufacturing processes. So, to overcome this difficulty the machine is designed and manufactured.

Washing and cleaning unit

The washing and cleaning unit is designed and manufactured for cleaning the impurities on connecting rod. The main function this unit is to remove oil and burrs stuck on the connecting rod. The machine is fully automated. The important component of this machine includes Pneumatic Cylinder (for door and rest pad operations), Nozzles

(for water and air spray), Gripper Assembly (to hold the connecting rod) and Additive (Polyclean MT). Washing and cleaning unit is shown in Figure 1.

Working

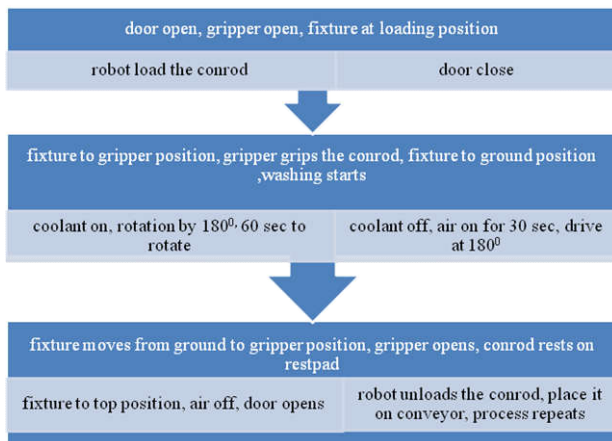
Rest pad works at three positions viz. top, middle and bottom. Initially the robotic arm keeps the connecting rod on the rest pad in the unit where the rest pad is at its top position. Once the connecting rod is placed sensor senses the position of connecting rod and the door closes. Now, the actual washing and cleaning cycle starts wherein at the middle position, gripper holds the connecting rod placed on the rest pad for washing and cleaning. After gripping the connecting rod rest pad moves to the bottom position. Now the mixture of water and additive is sprayed by the nozzles on the connecting rod. The gripper flips the connecting rod by 180 degree. Again the mixture of water and additive is sprayed to wash the other face of connecting rod.

After removing the impurities on the connecting rod the excess water on the connecting rod are removed using air nozzles. Then the rest pad again returns to its middle position and gripper releases the connecting rod. Now the rest pad moves to its top position and sensor senses the position of connecting rod and the door opens. Here, the cycle is completed and for the next connecting rod same procedure is repeated.

*Corresponding author: Niraj Kunkulol,
Mechanical Department, NBSSOE, Pune, India.



Figure 1. Washing and Cleaning Unit



Components of unit

Pneumatic cylinder: It is primarily used to control the movement of door and provides reciprocating motion to the rest pad in desired time interval (Jun Lia *et al.*, 2013). Schematic diagram of pneumatic cylinder shown in Figure 2.



Figure 2. Pneumatic Cylinder

Flat Jet Spray Nozzle: Flat jet spray nozzles are designed for high pressure washing application. Their specially designed inner profile allows for even jet distribution, which results in effective and uniform cleaning action over the surface being processed (John Durkee, 2009). It is ideal for Degreasing and Rinsing in industrial washing machine. Jet spray nozzle is shown in Figure 3.



Figure 3. Flat Jet Spray Nozzle

Straight Jet Spray Nozzle: Straight jet spray nozzle provides with optimized flow and maximum jet power concentrated energy (Tao Zhang *et al.*, ?). It gives away a narrow, concentrated stream jet with high impact force. A high efficiency and economical performance is obtained and is suitable for high pressure cleaning application shown in Figure 4.



Specifications of the machine

- The system is fully automated.
- Water and additive mixture to ensure proper removal of oil on connecting rod.
- Additive- Polyclean Mt 218, Flow rate- 32 LPM at pressure 2-5 bar.
- Nozzles used are –Straight Jet and Flat Jet.
- Sensors used are- Photoelectric and Proximity.
- Photoelectric sensors are used to make sure the connecting is placed or not.
- Proximity sensors are used to sense the position of connecting rod.

Calculations for Pneumatic Cylinder

Factors considered for selection of the pneumatic cylinder

- Force on it (weight of the material mounted)
- Factor of safety = 4
- Operating pressure $P = 4\text{bar}$
- Bore diameter d (to be calculated)
- Available bore diameter i.e. $d = 32, 40, 50, 63, 80, 100, 125$ The mass of components to be lifted for cylinder 1 are calculated using CATIA software which is shown in Table 1.

Table 1. Mass of Components for Cylinder 1 (200 mm)

Components	Mass (Kg)
Brackets	8.33
Shaft	10.80
Locator	0.5192
Side Butting Pad	0.264
Spacer	0.988
Cover 1	1.08
Adapter	0.793
Rest Pad	0.377
Cover 2	1.102

From Table 1 total mass to be lifted is

$$8.33+10.80+0.5192+0.264+0.988+1.08 + 0.793 + 0.377 + 1.102 = 24.2532 \text{ kg}$$

$$\text{Force } F = 237.924 \text{ N}$$

Now we have,

$$A = F / P$$

$$\pi d^2 / 4 = 951.6955 / 400$$

$$d = 55 \text{ mm}$$

Therefore calculated bore diameter for cylinder 1 is 55 mm. As per the design catalog of SMC cylinder the available diameter is 63mm. Hence the final diameter which is selected for cylinder 1 is 63mm. The mass of components to be lifted for cylinder 1 are calculated using CATIA software which is shown in Table 2.

Table 2. Mass of Components for Cylinder 2 (250 mm)

Components	Mass (Kg)
Cover	29.211
Adapter	0.793

From Table 2 total mass to be lifted is

Total mass to be lifted is:

$$29.211 + 0.793 = 30.004\text{kg}$$

$$\text{Force } F = 294.34 \text{ N}$$

Now we have,

$$A = F / P$$

$$\pi d^2 / 4 = 1177.357 / 400$$

$$d = 61.12 \text{ mm}$$

Therefore calculated bore diameter for cylinder 1 is 61.12 mm. As per the design catalog of SMC cylinder the available diameter is 63mm. Hence the final diameter which is selected for cylinder 1 is 63mm.

Application and Future Scope**The applications of washing and cleaning unit for connecting rod are as follows**

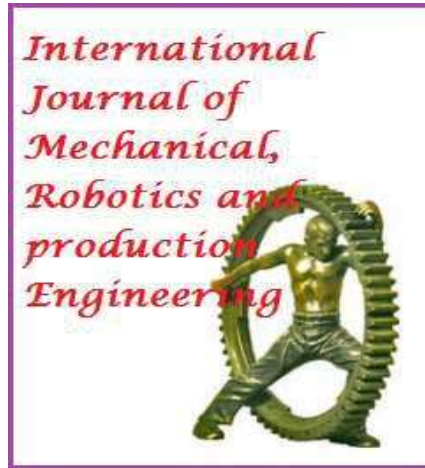
- It is used to clean the connecting rod for quality improvement.
- It is used on a robotic line as it is fully automatic.
- Can be used for multiple application by changing the fixtures.
- Changes can be done in the time cycle and also the number of nozzles can be increased or decreased as per requirement.
- The gripper assembly can be changed as per the component to be washed.

Conclusion**From the study of cleaning unit following conclusions are made**

- The use of air and water nozzle resulted in 100% cleaning of connecting rod.
- The solution of water and Polyclean MT has led to effective cleaning of connecting rod.
- The use of Pneumatic Cylinder has helped in reduction of noise and it also keeps the working area oil free.
- Pneumatic cylinder helps to reduce process time.
- The machine being fully automatic, it is compatible with the robotic line.

REFERENCES

- Anusha Chintada, 2016. "A Study on Process Capability on Connecting Rod in Assembly Line" Volume 8, Number 1
- John Durkee, 2009. "Spray Nozzles play a critical role in Cleaning Machine" Volume 107, Issue 6.
- Jun Lia, Kenji Kawashima, T oshinori Fujitab and Toshiharu Kagawa, 2013. "Control Design of Pneumatic Cylinder" 4
- Tao Zhang, Bo Dong, Xiao hong Chen, Zhonghua Qiu, Rui Jiang and Weizhong Li, "Spray characteristics of pressure-swirl nozzles at different nozzle diameters"



Enhancement of Engine Efficiency by using Airpreheater System

Prof. P. D. Gharge¹, Sumit S. Pawar², Mahesh B. Pawar³, Rakeshkumar Chaudhary⁴, Yesh A. Pathak⁵,
¹Asst. Prof. Department of Mechanical Engineering, ^{2,3,4,5} Student Department of Mechanical Engineering
N. B. N. Sinhgad School Of Engineering, Vadgaon, Pune, Maharashtra, India-411041

Abstract—In an IC Engine the complete combustion of fuel generates energy as heat in which is some energy is converted in the form of mechanical work. And the remaining is wasted to atmosphere through exhaust. That is only 30 to 40% of heat energy is in the form of work remaining 60-70% as waste heat, this causes the engine efficiency only 20 to 30%. This heat is treated as waste heat. The recovery of this heat depends on the exhaust gas temperature and its economics involved. If some amount of this heat is recovered considerable amount of fuel will be saved, some of the examples would be preheating of combustion air, or pre-heating boiler feed water or process water and space heating. The present study describes the experimental analysis of a CI engine by incorporating an air to air heat exchanger that is air preheater for preheating of air from exhaust gas from the engine and before supplying it to the inlet of the cylinder of CI engine. The preheated air at the engine intake manifold results in performance of engine and on emission control. The exhaust gas passed through the preheater increases the temperature at inlet. Higher the inlet air temperature increases brake thermal efficiency, decreases the specific fuel consumption, reduces emissions and also reduces the lower ignition delay. Due to preheating of inlet air uniform combustion takes place causes to reduce engine noise.

Keywords—Air preheater, Fuel consumption reduction, waste heat recovery.

I. INTRODUCTION

The output of the engine exhaust gas is given to the input of the ignition system, so that the proper ignition is occurred. In this case, the efficiency of the engine is also increased. The exhaust gas is given to the heating chamber as shown in figure. The exhaust hot air is used to pre-heat the input air into the ignition system. So far this type of system has not been introduced in two wheelers. So this may be very useful to two wheelers without any complication and maintenance. But the air pre-heater design depends on the exhaust pipe fitted to the particular two wheeler engine. The design is simple, cheap and does not give any trouble to the engine. So far the vehicle which is used for this project has covered a distance of more than 500kms, without any complications.

The concept of increasing the fuel efficiency of a petrol engine in this project, is to pre-heat the intake air which is flowing through the carburetor. The humidity in the atmospheric air affects the petrol vaporization in the carburetor. Therefore, by pre-heating the inlet air to the carburetor for a considerable amount, the vaporization can be ease and in turn complete combustion is achieved. Moreover by reducing the

water vapor to the engine, the steam formation in the engine can be reduced pitting of the engine cylinder, piston and exhaust pipe.

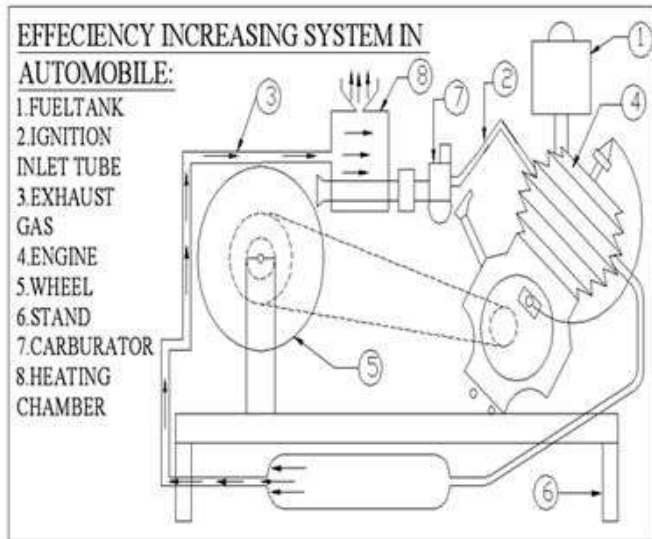


Fig. 1 Setup

The pre-heating of inlet air to the engine can be achieved by fixing a heat exchanger inside the exhaust pipe. The atmospheric air is sucked through the heat exchanger to the carburetor. The air which is flowing through the heat exchanger gets heated by the engine exhaust gas. This reduces the water vapor in the inlet air and the temperature of the air is raised. The temperature raise causes complete combustion in the engine and it is also more suitable for warming up the engine in cold conditions. In particular, this article describes the combustion air preheaters used in large boilers found in thermal power stations producing electric power from e.g. fossil fuels, biomass or waste. The purpose of the air preheater is to recover the heat from the boiler flue gas which increases the thermal efficiency of the boiler by reducing the useful heat lost in the flue gas. As a consequence, the flue gases are also conveyed to the flue gas stack (or chimney) at a lower temperature, allowing simplified design of the conveyance system and the flue gas stack. It also allows control over the temperature of gases leaving the stack (to meet emissions regulations).

II. LITERATURE SURVEY

J. manivel, L. manimaran, P. satheshkumar 2017 [1] they have detailed methods for improving the gross efficiency of the air pre heater and economizer by the solution minimizing heat losses during the process. Considerable increase in efficiency is achieved by improving the above parts on the design aspect.

Even though it is importing these improvements in the generality boiler it would be highly appropriate if it is considered in the design of newly constructed boiler. In this work, energy analysis of a coal based thermal power plant is done by using the design data from 210 MW thermal power plants. Performance and analysis of air pre heater and economizer, in the air pre heater segment, notched flat profiles are replaced by double undulated profiles, and single seal are replaced by double seals, so heat loss in the air pre heater will be minimized. Economizer is achieved by increasing the diameter of coils in the economizer so that additional heat from flue gas can be observed from the economizer. Hence the performance of air pre heater will increase. The main advantage of this proposed method is that, the heat transfer rate in the boiler will be increased.

N Santhisree, P Sudheer Kumar, S Ashok, B Srikanth 2017 [2] they present study reveals that the high potential thermal energy of exhaust gases can be recovered and utilized by preheating of fuel & intake air in order to improve the performance of the engine and also act as a concept for conservation of fuel. In a nut shell the advantages of preheating are listed below.

- The break specific fuel consumption is decreased with increase in fuel inlet temperature.
- Preheating reduces the ignition delay their by improving cold start of engine in cold conditions, also shorter ignition delay leads to higher in-cylinder pressure.
- Rise in the inlet temperature will improve combustion process (complete combustion) and due to this torque, brake power and the efficiency of the engine improved.
- Due to better evaporation and shorter ignition delay engine produces low noise and vibration.
- Preheating of air subsequently reduces the exhaust emissions. HC and CO emission will decrease with increase in the inlet temperature.
- Utilizing the waste heat reduces the amount of greenhouse gases.

Heat energy is recovered from the exhaust gases, which causes lower heat addition, thus improving engine thermal efficiency.

Pratik Khomane, ShubhamKhivansara, HrishikeshKhairnar, SiddharthKatkar, Prof.R.R. Yenare 2017 [3] the attempt has been made in this research to use preheating of exhaust gas is given to input of ignition in two/four stroke engine to increase the efficiency. Our foremost

aim of selecting this research is to increase efficiency. It is also beneficial with regard to economic considerations and engine efficiency. A method and system for preheating internal combustion engine fuel to an optimum temperature before introducing the fuel into carburetion system. The two wheeler engine is an internal combustion engine. It is a device, which converts the thermal heat energy from the exhaust and converts it to air preheat. Also the atmospheric air is fixed over the silencer for intake the hot air to the carburetor. The concept of increasing the fuel efficiency of a petrol engine in this research is to pre-heat the intake air which is flowing through the carburetor. The humidity in the atmospheric air effects the petrol vaporization in the carburetor. Therefore, by pre-heating the inlet air to the carburetor for a considerable amount, the vaporization can be easier and in turn complete combustion is achieved.

R.Vishal 2016 [4] the experimental results obtained show that there is an increase in mileage and therefore, the thermal efficiency of the IC engine. Although this increase only corresponds to around 2-3 %, it can be increased a little further by using other techniques like variable valve timing, charge exchange work etc. The improvement in efficiency of the engines of today may very well be one of the first steps towards further developments and revolutions in the field of energy management which may go from effective management of fossil fuels to the full-time usage of renewable resources leading us to a cleaner and greener future.

A. Rameshbabu, K. Arunkumar 2016 [5] in this paper, we introduce a new presentation of inlet air preheater model. The new definition of efficiency constraint enables us to find good efficiency criteria instead of using iterative search method, with respect to conventional engine. With the new IAP representation, we can also easily integrate the efficiency criteria with an extra useful heat energy dissipated term. Experimental results on an order of efficiency properties of engine setup with IAP is greater than efficiency properties of without IAP. In addition, the efficiency difference were not highly significant

III. PROBLEM STATEMENT

In the Current System some amount of the energy is waste due to the Air Heating. Here silencer removes the exhaust hot air so the average of the vehicle is not getting good. Here we fabricate the model of fuel efficiency increasing system by using air preheated system. The two wheeler engine is an internal combustion engine. It is a device, which converts the thermal heat energy from exhaust and converts it to air preheat.

IV. OBJECTIVES

In automobile engines significant amount of heat is released to the environment. For example, As much as 35% of the thermal energy generated from combustion in an automotive engine is lost to the environment through exhaust gas and other losses. The amount of such loss, recoverable at least partly or greatly depends on the engine load. Among various advanced concepts, Exhaust Energy Recovery for Internal Combustion (IC) engines has been proved to not just bring measurable advantages for improving fuel consumption but also increase engine power output (power density) or downsizing, further reducing CO₂ and other harmful exhaust emissions correspondingly

Which was predicted that if the heat contained in the exhaust gases were converted to electric power, 10% reduction of fuel consumption can be achieved.

- Reduction in secondary energy consumption and equipment sizes gives additional benefits in the form of reduction.
- Reduction in equipment sizes: Waste heat recovery reduces the fuel consumption, which leads to reduction in the flue gas produced.
- Reduction of exhaust gases and protects the environment and controls the global warming, ozone depletion layer etc.

V. INITIAL CONCEPT

The concept of increasing the fuel efficiency of a petrol engine in this project, is to pre-heat the intake air which is flowing through the carburetor. The humidity in the atmospheric air affects the petrol vaporization in the carburetor. Therefore, by pre-heating the inlet air to the carburetor for a considerable amount, the vaporization can be ease and in turn complete combustion is achieved. Moreover by reducing the water vapor to the engine, the steam formation in the engine can be reduced pitting of the engine cylinder, piston and exhaust pipe. The pre-heating of inlet air to the engine can be achieved by fixing a heat exchanger inside the exhaust pipe. The atmospheric air is sucked through the heat exchanger to the carburetor. The air which is flowing though the heat exchanger gets heated by the engine exhaust gas. This reduces the water vapor in the inlet air and the temperature of the air is raised. The temperature raise causes complete combustion in the engine and it is also more suitable for warming up the engine in cold conditions.

VI. Working principle

The heat exchanger is located in the engine exhaust pipe. The exhaust pipe consists of a muffler and stay plates etc. The heat exchanger is made up of 18 SWG M.S. plate. The inner tube

is inserted tightly on the muffler tube. A spiral baffle plate arrangement is made in between the two concentric tubes so as to make a spiral path to the incoming air. So that the heat transfer to the air can be increased. Moreover the air is flowing in counter direction to the exhaust gas; thereby effective heat transfer can be achieved. The heat exchanger inlet is fitted with a pre-filter. The outlet is connected to a by-pass mechanism through a hose pipe. The by-pass mechanism is connected to the carburetor intake. The temperature of the air entering to the carburetor can be maintained constant for a particular degree centigrade. When the temperature of air is increased above the predetermined value the thermal relay opens the butterfly valve (4- wheeler Application) and allows the atmospheric air to mix with the heater air from the heat exchanger. So the hot air is diluted with atmospheric air and reducing the temperature.

Suction stroke:

When the piston moves from TDC to BDC, (i.e., suction stroke) Vacuum is created which opens the intake valve. Due to the creation of vacuum, air is drawn from atmosphere and hydrogen gas from the electrolysis kit. Both the air and gas passes to the pre-heater, which is preheated and increases temperature by the external flow of exhaust gases. Now, the pre-heated air and H₂ gas is passes to the carburetor in which the air+H₂gas+petrol gets mixed in required proportions. Then the mixture is drawn into the cylinder up to the piston reaches BDC. At the end of suction stroke the inlet valve gets closed.

Compression Stroke:

Now the piston moves from BDC to TDC, in which the air and hydrogen gas and the petrol mixture get compressed, which results in increase in temperature. At the end of compression stroke the piston reaches TDC at the time Power stroke will starts by igniting the mixture through spark plug. During this stroke both the valves are in closed condition .

Power Stroke:

Thus the ignited mixture produces high power which pushes the piston downwards at high pressure from TDC to BDC. During this period the mixture gets burned completely as much as higher compared to other 4stroke Petrol engines due to, "Pre-heated air and Hydrogen gas". Then the power obtained in the cylinder is transmitted to drive wheel through connecting rod, crankshaft and flywheel. Thus there is no timing delay in burning of mixture which results in decreasing of "Knocking".

Exhaust Stroke:

During this stroke the piston moves from BDC to TDC by opening the exhaust valve. The upward movement of this stroke blows out the burned gases outside the cylinder. When the piston reaches TDC exhaust valve closes and inlet valve gets opened and suction stroke starts. After the exhaust stroke the exhaust hot gases passing into the heat exchanger through silencer. Then heat transfer takes place to the atmospheric air in heat exchanger then hot air is supplied to the engine through carburetor and due to this air fuel mixture burn efficiently which gives maximum efficiency.

VII. DESIGN OF AIR PREHETER

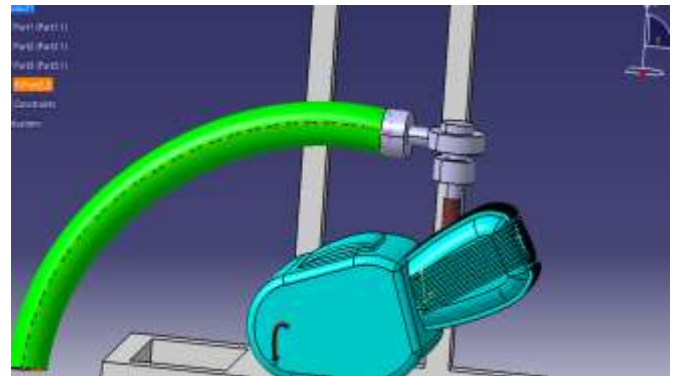


Fig 1 CATIA Model

VIII.FABRICATION WORK



Fig 2 engine



Fig 3 preheater mechanism



Fig 4 exhaust system



Fig 5 Actual model

IX. CONCLUSION

This project is an attempt to reduce our dependency on foreign oil and reduce the tail pipe emission from automobiles and this was an attempt to design and implement this new technology that will drive us into the future. Use of production pre heating will reduce smog-forming pollutants over the current national average. The first hybrid on the market will cut emissions of global-warming pollutants by a third to a half and later modes may cut emissions by even more. The preheating of charge is beneficial in many ways. It is expected to increase power output of the engine by 11-15% due to the extreme homogeneity of the air-fuel mixture present in the cylinder during power stroke. This leads to maximum utilization of the specific heat of the fuel (C.V.=42000KJ/Kg) which results in an improved the thermal efficiency of the engine.

X. FUTURE SCOPE

The energy recovery system is basically a device which utilizes the waste energy or it utilized the temperature of the gases. The energy recovery system has got wide range of the application in the future it can be a transient test methodology to measure the humidity and the temperature. The energy wheel is the transient system which enables to use the waste energy from the engines which enters the atmosphere at the high temperature. The energy recovery system is device which can directly connected to the outlet of exhaust gas. Energy recovery systems are the system which can be used in the device like boilers, superheated, gas duct system. The energy recovery system is the device which consume minimum energy does it help to the recovery energy at the minimum price.

XI. REFERENCES

- [1] J. manivel, L. manimaran, P. satheeshkumar, 'Performance Analysis of Air Preheater in 210mw Thermal Power Station', IJARIT, Volume 3, Issue 2, 2017.
- [2] N. santhisree, P. sudheer kumar, S. ashok, B. srikanth, 'Exhaust Gas Heat Recovery using Air Preheater for CI engine', IJMET, volume 8, issue 5, may 2017.
- [3] Pratik Khomane, Shubham Khivansara, Hrishikesh Khairnar, 'Exhaust Emission Reduction in Two-Wheeler by Pre Heating Method', ICIIME, Volume 5, Issue 6, June 2017.
- [4] R.Vishal, 'Enhancing the Efficiency of an IC Engine Using the Concept of Preheating', IJRET, May 2016.
- [5] A. Rameshbabu, K. Arunkumar, 'Increase Engine Efficiency by Using Inlet Air Preheating Method through Exhaust Gas Temperature with Convective Mode of Heat Transfer', IJSER, April 2015.

CORRELATION OF TEST DATA WITH ANALYSIS OF TURBOCHARGER HOT BOLTED JOINT

Smita S Abhang¹, Assistant Prof. Y.C. Jadhav ², Prof. S. M. Jadhav ³

¹P G Student, Department of Mechanical Engineering, N.B.N Sinhgad School of Engineering Ambegaon (Bk), Pune-41, India

² Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering Ambegaon (Bk), Pune-41, India

³ Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering Ambegaon (Bk), Pune-41, India

Abstract - This project study variation of standard parameters which used in analysis of joint for checking the variation of it along with its effect on the stress and contact pressure to correlate the analysis with test results accurately. The model contains turbine housing, bearing housing, clam plate, heat shield, compressor cover and bolt. The modeling and simulation software used are CREO and ANSYS. In existing analysis procedure there are some standard values but in this project it will change to lower and higher side and observe its effects on the result and find best combination. This will help industry to match the results with test data and reduce time as well. The parameters are mesh, coefficient of friction, preload and coefficient of thermal expansion.

Key Words: Finite element analysis, thermal analysis, structural analysis, bolted joint, mesh, coefficient of friction, Bending test, combine loading.

1. INTRODUCTION

Turbocharger is the mechanical device which increases density of air entering into the combustion chamber of IC engine with compressor which is driven by a turbine driven by exhaust gas of same IC engine. Turbocharging increases quantity of air entering into the combustion chamber which promotes lean combustion, this further result into better performance and lower exhaust emissions. From last few years many researchers made effort to improve the power output of an engine and to reduce exhaust gases by making some changes in conventional turbocharger and installing some additional accessories like turbocharger and intercooler. Due to increase in the demand of fuel efficient engines with more power and minimum emissions more research will take place in this field. Basically two types of joints are using in turbocharger industry, V-band joint and bolted joint. The joint used between turbine housing and bearing housing is bolted joint.

There were types of loading applied on this joint –thermal load, bending load and torsional load. Preload is applied to clamp the joint components which generate clamping force between joint. The joint members and bolts both behave like stiff springs, one being compressed and the other stretched as suggested in Fig. 1

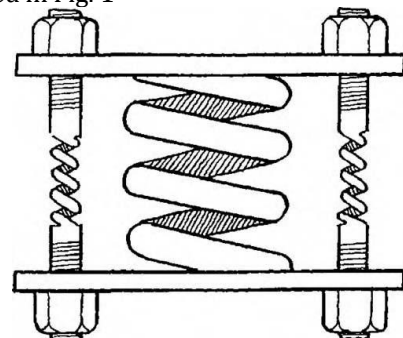


Fig.1 Bolt and joint members

$$\text{Preload} = \text{Torque} / (\text{Nut factor} * \text{dia. of shank})$$

Turbine housing contains exhaust gas so the temperature of the components nearby is high. So thermal stresses will induced in the joint components. Bending and torsional load is generated due to boost loading, the loading due to attached accessory to the joint components.

2. METHODOLOGY

Finite element model of turbine housing to bearing housing bolted joint is prepared in ANSYS work bench. All solid metal parts are modelled using tetrahedron and wedge elements SOLID187, contact and target elements by CONTA174 and TARGE170 and pretension elements by PREST179. The contact established within joint has been carried out by standard procedure. Bonded as well as frictional contacts are used for the joint analysis. Coupled thermal structural analysis of turbine housing to bearing housing bolted joint assembly has been done in ANSYS workbench to determine the stresses induced in critical area that is fillet in this

analysis. Bending test was conducted on the “A” frame and customer end test was conducted on “B” frame of turbo and aim of this analysis is to correlate that test along with examine the effect of various parameters on the stresses induced. In case of “A” frame bending load is the reason behind failure. The test is bending limit validation test. The behaviour of any component or assembly can be predicted in advance through simulation. Experimentation is one of way to predict the behaviour in advance before field use, but since it involves time, cost, complex set up and prototype or actual model, therefore experimental test is not recommended every time. Simulation is the one of the best method to predict behaviour of structure and to understand stresses induced stresses in advance to have more confidence in model before going for test. Hence to check strength of joint also at high temperature, thermal structural coupled analysis of joint assembly was performed.

3. THEORETICAL BACKGROUND

A computerized process helpful for analysis of structure can be defined as finite element [FE] analysis. To evaluate stresses due to structural along with thermal FE analysis can be used. Since the joint components are subjected to higher temperatures, thermal stresses will developed in the components of the joint. Simultaneously since the joint assembly is subjected to various external loads –thermal load and bending load structural stresses will get developed within the joint components.

Thermal analysis:

Matematically thermal analysis in Ansys can be done as follow. In this analysis only heat flow due to conduction is considered.

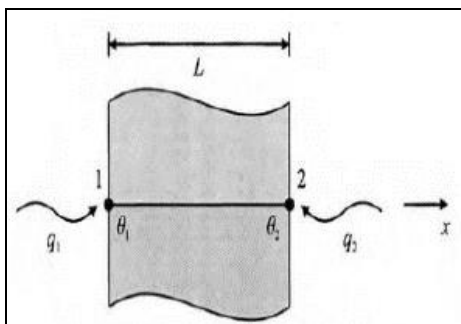


Fig. 2 : One Dimensional Heat flow.

This heat flow by conduction and convection

Where K= thermal conductivity,

By combining both conduction and convection the final equation can be written in matrix form as;

$$[K] [T] = [F]$$

Where [K] =global stiffness matrix. This can be obtained by assembling stiffness matrix of each element.

[T]= Temperature of that node.

[F]= Boundary condition.

This matrix form of equation can be used in FEM to solve problem. In summery if [K] and [F] can be formed, and then temperature distribution can be determined by any matrix solver procedure. These are basic question of FEA.

A. Structural Analysis:

For structural analysis we are using output of thermal analysis i.e. node wise temperature. This temperature can be applied as body force on component. But in case of structural analysis temperature data for each node is available. So we applied each node temperature as body force and allow it to expand. Mathematical equation for calculating thermal stress is

...where α =thermal expansion and ΔT = temperature difference, ν =poisons ratio.

In FEM this can be written as in matrix form such as

$$[\sigma] = [K] [T]$$

[K] =matrix called as global stiffness matrix. Equation shows matrix for one element. Global matrix can be calculated by assembling all elements stiffness matrix. These are basic question of FEA.

Material properties:

Table 1: Material properties of joint component.

Component	Material	Density (Kg/m ³)	Poisson's ratio
Bearing housing	Grey cast iron	7050	0.26
Turbine housing	S.G. cast iron	7100	0.3
Bolt	B16 alloy steel	7850	0.3
Clamp plate	Stainless steel	9000	0.28
Heat shield	Stainless steel	9000	0.28
Compressor cover	Aluminum	2890	0.34

4. SIMULATION WORK

Analysis objective is to perform coupled thermal structural analysis to evaluate stresses on critical area that is fillet of the joint component.

A. A frame

In the analysis for "A" frame assembly is not available so I assembly has been carried out in CREO and then import it to ANSYS workbench. Geometry clean-up has been done in design modular and pre-processing of the proposed structure has been done in mechanical window of ANSYS workbench. Number of nodes of joint assembly is around 15 lac. For "A" frame. Meshed model of the bolted joint assembly has been shown in following fig. 3.

In finite element modelling of the bolted joint assembly the elements are used as per table 1.

Table 2: Elements used in analysis

Sr. No.	Component's name	Element's Type
1.	All solid parts	SOLID 187
2.	Contact Element	CONTA174
3.	Target Element	TARGE170
4.	Pretension	PREST179

CAD model of bolted joint assembly is shown in following fig. 3.

Analysis summary: For this finite element model of bolted joint assembly first steady state thermal analysis is carried out then structural analysis.

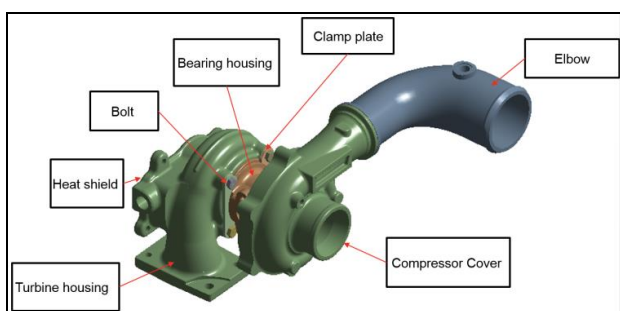


Fig. 3: CAD model of bolted joint assembly of "A" frame

For design of experiment four parameters are selected, which are preload, coefficient of friction, coefficient of thermal expansion and mesh. There are some standard values for the parameter, these values varied as per given table no. 2 to lower and higher side for 3 parameters.

Table 3: Parameters for the Design of experiment

Sr. No.	Parameter	Lower limit	As per standard	Higher limit
1	Mesh	2X	X elements at	3X

			critical area	
2	Preload	30% less	As per Std.	30% more
3	Coefficient of friction	50% less	As per Std.	50% more
4	Coefficient of thermal expansion of bolt	10% less	As per Std.	10% more

Thermal boundary condition

After meshing the next step is to apply the boundary conditions. The boundary conditions are applied as per standard procedure. In this, the heat transfer coefficient and temperatures are given as thermal boundary condition for the below mentioned areas.

1) Structural boundary condition:

After meshing the next step is to apply the boundary conditions. Selecting the proper boundary condition has an important role in structural analysis. For a static analysis, the turbine inlet flange is fixed same as test condition. For the loading, there are two external forces acting on the joint components. Hydraulic force is applied at the elbow face to achieve bending moment of the "Y" N-m and the thermal load which generate due to high temperature.

2) Analysis approach -

Load step 1 - bolt preload

Load step 2 - bolt preload + thermal load

Load step 3 - bolt preload + thermal load + bending load.

The assembly is fixed at the turbine housing flange and the structural boundary conditions have been applied at the compressor end elbow.

B. "B" Frame

In the analysis for "B" frame assembly is available so it imported to ANSYS workbench. Geometry clean-up has been done in design modular and pre-processing of the proposed structure has been done in mechanical window of ANSYS workbench shown as fig.4. No. of nodes of joint assembly is around 16 lac. for "B" frame. Fine mesh is applied at the critical area. Parameter study has been carried out as per the "A" frame.

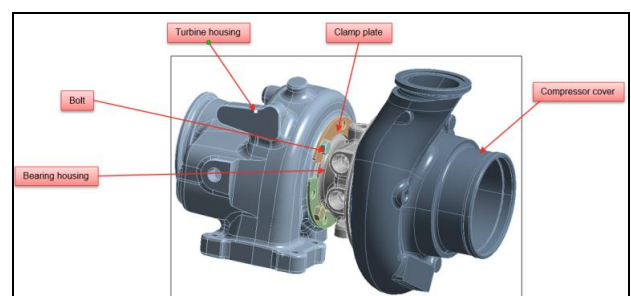


Fig. 4: CAD model of bolted joint assembly of "B" frame

Thermal boundary condition

The boundary conditions are applied as per standard procedure. In this, the heat transfer coefficient and temperatures are given as thermal boundary condition for the below mentioned areas.

3) Structural boundary condition:

4) Analysis approach –

Load step 1 – Bolt preload

Load step 2 – Bolt preload + Thermal load

Load step 3 – Bolt preload + Thermal load + bending load+ Rotational torque.

The assembly is fixed at the turbine housing flange and the structural boundary conditions have been applied at the compressor outlet.

5. RESULTS AND DISCUSSION

Thermal results:

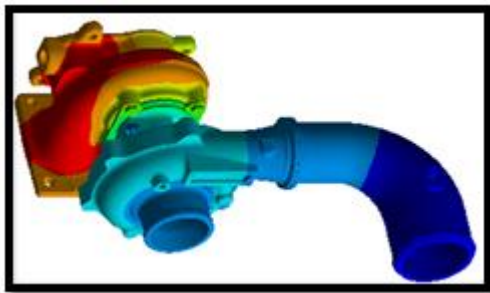


Fig.7: Results of thermal analysis for “A” frame

Exhaust gas has been entering into the turbine inlet and atmospheric air enters into the compressor inlet so the temperature flows from turbine housing to the compressor cover and elbow. The temperature at the components in actual test is correlated with simulation results.

Table 4: Result of steady state thermal analysis

Sr. No.	Component	Maximum temperature (°C)	Minimum temperature (°C)
1	Bearing housing	57	20
2	Turbine housing	100	57
3	Bolt	79	56
4	Heat shield	65	34

5	Compressor cover	35	25
6	Clamp plate	74	46
7	Elbow	22	14



Fig.8: Results of structural analysis for load step 1

The bearing housing made by brittle cast iron so maximum principle stresses theory is used. Out of all loading the bending load is dominant. Stresses are low in bolt preload case 11.15, in second load step two – 26.3, and third load step – 100. All results are scaled as per company policy.

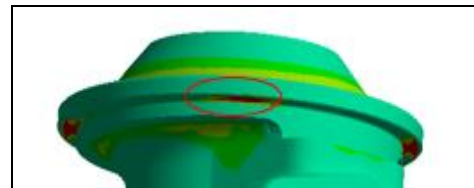


Fig.9: Results of structural analysis for load step 2

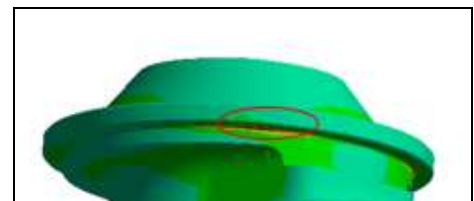


Fig.10: Results of structural analysis for load step 3

Table 5: Result of static structural analysis

Sr. No.	Load Step	Maximum Principal Stresses (MPa)	Maximum Total deformation (mm)
1	LS1	5	0.22848
2	LS2	26	1.4894
3	LS3	75	3.6393

DOE is carried out on this joint assembly.

Table 6: Stress results by varying preload values

	Load step	% change	Test Model	% change
1	LS1	18	5	27
2	LS2	16	26	16
3	LS3	6	75	7

Due to preload variation % change in stress is maximum 27% and minimum 2 %.

Table 7: Stress results by varying coefficient of thermal expansion values

	Load step	% change	Test Model	% change
1	LS1	0	5	0
2	LS2	0	26	0
3	LS3	0	75	2

There is no effect of variation of coefficient of thermal expansion.

Table 8: Stress results by varying coefficient of friction.

	Load step	% change	Test Model	% change
1	LS1	18	5	9
2	LS2	0	26	2
3	LS3	1	75	2

There is effect of coefficient of friction but not in the case of combine loading.

Table 9: Stress results by varying mesh.

	Load step	Test Model	% change	% change
1	LS1	5	4	4
2	LS2	26	0	0
3	LS3	75	0.4	0.4

Mesh with X elements at the fillet gives the accurate results within less time

Thermal results of "B" frame:

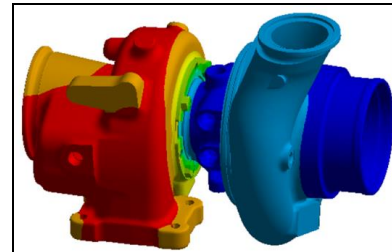


Fig.11: Results of thermal analysis for "B" frame

The temperature at the components in actual test is correlated with simulation results.

Table 10: Result of steady state thermal analysis

Sr. No.	Component	Maximum temperature (scaled values)	Minimum temperature (scaled values)
1	Bearing housing	53	15
2	Turbine housing	100	55
3	Bolt	75	50
4	Heat shield	83	35
5	Compressor cover	30	13
6	Clamp plate	74	42

As turbine exposed to hot gas and compressor cover to atmospheric condition, the temperature gradient generated. The temperature at the components in actual test is correlated with simulation results. The maximum temperature archived at the turbine end.

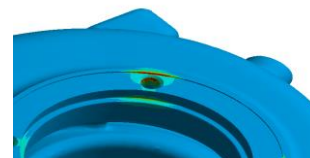


Fig.12: Results of structural analysis of load step 1 for "B" frame

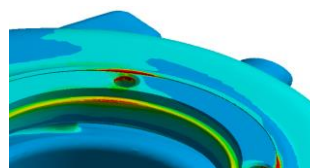


Fig.13: Results of structural analysis of load step 2 for "B" frame

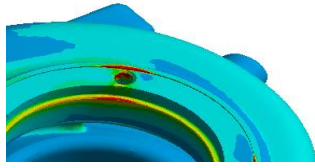


Fig.14: Results of structural analysis of load step 3 for “B” frame

The material of the turbine housing is ductile cast iron so equivalent von-Mises stress is used. From the results in table 11, it is clearly seen that the preload is more dominant in the analysis. So the focus of this DOE is the effect parameters on LS1.

Table 11: Result of static structural analysis for “B” frame

Sr. No.	Load Step	Von Mises Stresses (scaled values)	Maximum Total deformation (scaled values)
1	LS1	125	0.26
2	LS2	93	1.63
3	LS3	80	1.67

DOE has been carried out.

Table 12: Stress results by varying preload values

Load step	% change	Test Model	% change
1	30	125	34
2	20	93	27
3	25	80	29

Due to preload variation % change in stress is maximum 34% and minimum 20 %.

Table 13: Stress results by varying coefficient of thermal expansion values

Load step	% change	Test Model	% change
1	0	125	0
2	14	93	12
3	15	80	15

Due to coefficient of thermal expansion variation % change in stress is maximum 15% and minimum 12 %.

Table 14: Stress results by varying coefficient of friction.

Load step	% change	Test Model	% change
1	1	125	0
2	2	93	0.2
3	3	80	2

There is no effect of variation of coefficient friction.

Table 15: Stress results by varying mesh.

Load step	Test Model	% change	% change
1	125	0.5	2
2	93	0.5	1
3	80	0.3	0.05

Mesh with X elements at the fillet gives the accurate results within less time.

6. EXPERIMENTAL VALIDATION



Fig.15: Test set up

Test Procedure

The temperature of the component has been raised to reference temperature.

Then cyclic loading is applied to the assembly through force, till failure is achieved.

Instruments

1. Fixture
2. Data logger
3. Cyclic force generator
4. thermocouples

Experimental Results:

In this assembly of joint the bearing housing prior failed and reason behind it is bending load. The crack is generated at the bearing housing fillet which is below flange. After design modification it passes the test.

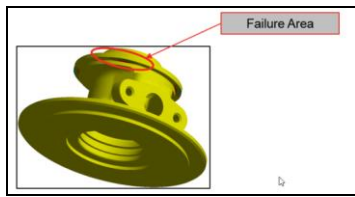


Fig. 16: failure of bearing housing.

7.CONCLUSION

The correlation between “A” frame model for bending test simulation and experimentation shows a good agreement. From the correlation it is observed that finite element model and experimentation test are matched, thus it can be concluded that failure of bearing housing is adequately captured in analysis.

Stresses on bearing housing fillet should be taken on tetrahedron element below inflation layer, which are realistic and show correlation with the test failure using Haigh diagram.

In case of “A” frame the preload have max impact but this preload load case is not the reason for failure. The bending load with combine loading is dominant in this analysis. This parameter has significant impact because the critical location is very close to the bolt.

Coefficient of thermal expansion doesn't have any impact on this analysis it is concluded as if there is no temperature dependent data of the material where stress will be plotted then do not run for variation of this parameter.

Coefficient of friction has no impact for both of cases.

From Mesh study it is concluded that the “X” elements at the fillet gives better result when mesh is either bearing housing fillet or turbine housing fillet.

Similarly for “B” frame the failure is on same location as shown in highly stress area that is fillet of turbine housing at bolt no. 3.

In this “B” frame analysis again bolt preload have more impact reason same as “A” frame the location of stress is near to the bolt along with this preload is dominant in this analysis.

The second important parameter is coefficient of friction. It has significant impact on the analysis result for “B: frame size.

REFERENCES

- [1]Z.S. Lad, Nikhil S. Mane, H.M. Dange “Review on Turbo charging Of IC Engines” International Journal of Engineering Sciences & Research Technology, 2015, 327-331.
- [2] li K. A. Khudhir, Mahesh C. Aggarwal, Michael Sirak and Michael J. Panza,” A Theoretical and Computational

Analysis Of The Bolted Joint – A Sensitivity Study Of Temperature Effect On The Turbocharger Inlet Bolted Joint In Locomotive Engines” ASME 2014 Gas Turbine India Conference GTINDIA2014 December, New Delhi, India, 2014, 1-8.

- [3] Muhammad Abidand Saad Hussain, “Relaxation behaviour of gasketed joints during assembly using finite element analysis” Ghulam Ishaq Khan Institute of Engineering Sciences and Technology, 31-433.
- [4] Sanjib Goswami,” A Finite Element Investigation on Progressive Failure Analysis of Composite Bolted Joints under Thermal Environment” German Aerospace Center, Institute of Structures and Design, Pfaffenwauldring, D-70569 Stuttgart, Germany, 2005, 161-171.
- [5] Nomesk Kumar, P.V.G. Brahamanandam and B.V. Papa Rao, “3-D Finite Element Analysis of Bolted Flange Joint of Pressure Vessel” MIT International Journal of Mechanical Engineering Vol. 1, No. 1, ISSN No. 2230 – 7699, Jan 2011, 35-40.
- [6] W. Brown, “Recent Advancement in PVP Bolted Joint Technology” 14th International Conference on Pressure vessel technology, Australia, 2015, 158-167.
- [7] Lreman, Tomas; Nyman, Tonny; Hellbom, Kurt “On design methods for bolted joints in composite aircraft structure” Composite Structures (ISSN 0263-8223), vol. 25, no. 1-4, 1993, 567-578.
- [8] Hehui Wang , Yan Zhang, “Creep Analysis of Combined Bolted Flange Joints under High Temperature” international journal of Applied Mechanics & Materials, Issue 624, 2014, 187-192.
- [9] W.BrownT.-Y.Lim, “Factors Affecting Nut Factors for PVP Bolted Joint Assembly”14th International Conference on Pressure vessel technology, Australia, 2015, 168-175.
- [10] Dattatraya Parle, Amol Patil and Anirudha Ambulgekar, “Evaluation of Stress Concentration Factor using ANSYS” Pune, India,2011, 35-38.

Durability Analysis and optimization of an Automobile Lower Suspension Arm Using FEA and Experiment Technique

Abhishek Mukund Puranik¹, Prof. V.M. Bansode², Prof. Sainand N. Jadhav³, Asst. Prof. Y.C. Jadhav⁴

¹PG Student, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune-41, India

²Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune-41, India

³Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune-41, India

⁴Professor, Department of Mechanical Engineering, NBN Sinhgad School of Engineering, Ambegaon (Bk), Pune-41, India

Abstract - This paper deals with finite element analysis for optimization of lower suspension arm of 4W suspension system. The main function of the lower suspension arm is to manage the motion of the wheels & keep it relative to the body of the vehicle. The control arms hold the wheels to go up and down when hitting bumps. This paper describes the analysis of lower suspension arm to determine its stress behavior during its operation and scope for permissible topology optimization. The main objective is to have robust optimized less stressed lower suspension arm system. The optimization of lower suspension arm system is directly related to its strength or stiffness to withstand imposed force on the vehicle created by the road. Hence, Durability analyses and optimization is done in iterations, through Finite element method and computer aided engineering software's it is possible to come out with new final optimized design of lower suspension arm. The new design again is tested for initial loading conditions and responses of suspension system are confirmed for safe and fatigue life. Thereafter, best fitting optimized model is fabricated according to the new design of suspension system. Fabricated model is tested considering initial loading conditions using suitable experimental setup like universal testing machine, Fatigue testing machine and validated with FEA results.

Key Words: Lower Suspension Arm, Optimization Technique, Durability Analysis

1. INTRODUCTION

Introduction about lower suspension arm

The performance of a vehicle is judged by driving comfort and safety, and both are provided by the suspension system. The suspension system is designed to carry the weight of vehicle and transmits all the forces between vehicle body and road. From a design point of view, there are two main types of disturbances on a vehicle namely the road and load disturbances. Therefore, the suspension system design is method of establishing compromise between these two

disturbances. The Wishbone lower arm is a type of independent suspension used in motor vehicles. The general function of control arms is to keep the wheels of a motor vehicle on ground when the road conditions are not smooth. The control arm suspension consists of two arms, upper arm and lower arm. Based on the model and purpose of the vehicle, the upper and lower control arms have different structures. If we compare both the suspension arm, lower suspension arm is better shock absorber and upper suspension arm because of its position and load bearing capacities in the automotive industry. Independent suspension system gives the best rides, which permit the wheels to move independently of each other.



Figure 1: Automobile Lower Suspension Arm

There are various types of the suspensions like wishbone or double wishbone suspensions and Suspension arm is one of the main components in these suspension systems. Suspension arm joins the wheel hub to the vehicle frame allowing for a full range of motion while maintaining proper suspension alignment. The main causes of the failure of the lower suspension arm are uneven tire wear, suspension noise

or misalignment, steering wheel shimmy or vibrations. Most of the cases the failures are catastrophic in nature. Therefore, the structural integrity of the suspension arm is crucial from design point of view both in static and dynamic conditions. Finite element method gives the exact visualisation for these kinds of failures. Therefore, FEM analysis of the stress distributions around typical failure initiation sites are necessary. Therefore, in this study, static analysis and fatigue analysis of lower suspension arm needs to be carry out for light commercial vehicle using FEM.

Literature Survey

Miss. P. B. Patil and Prof. M. V. Kharade[1] in their research "Finite Element Analysis and Experimental Validation of Lower Control Arm" have analyze the lower suspension arm by FEA and experimental technique. The paper is referred for loading conditions & boundary conditions for the FEA of lower suspension arm

Dattatray Kothawale and Dr. Y. R. Kharde[2] in their work "Analysis of Lower Control Arm in Front Suspension System Using F.E.A. Approach" have used FEA for analysis of lower suspension arm considering al, the dynamic forces such as road bump, cornering, braking, accelerating, etc. The paper is referred to decide the dynamic forces acting on lower suspension arm the

Bhushan S. Chakor and Y.B.Choudhary[3] in their paper "Analysis and optimization of upper control arm of suspension system" analyze and optimize upper suspension arm using FEA and experimental technique. This paper is mainly referred for the methodology followed to carry out the study

Thomas D. Gillespie [4] in his book "Fundamentals of Vehicle Dynamics" have explained the study of vehicle dynamics. The book is referred to calculate the dynamic forces which are considered in FEA technique

Pratik S. Awati and Prof. L.M.Judulkar[5] in their research "Modal and Stress Analysis of Lower Wishbone Arm Along With Topology" aims to complete FEM analysis of a suspension link for bending vibrations, pitching, bouncing and combined mode dynamic analysis for deformation and stresses

Y. Nadota and V. Denierb[6] in their paper "Fatigue failure of suspension arm: experimental analysis and multiaxial criterion" have developed an experimental device to study fatigue phenomena for nodular cast iron automotive suspension arms. On the base of a detailed fracture analysis, it is shown that the major parameter influencing fatigue failure of casting components are casting defects.

M. M. Rahman, M. M. Noor, K. Kadirgama¹, Rosli A. Bakar and M.R.M. Rejab[7] in their work "finite element modeling, analysis and fatigue life prediction of lower suspension arm" explores the finite element modeling, analysis and fatigue life prediction of lower suspension arm using the strain-life approach. Aluminum alloys are selected as a suspension arm material. The structural model of the suspension arm was utilizing the Solid works

N.A. Kadhim¹, S. Abdullah, A.K. Ariffin and S.M. Beden[8] in their resear "Fatigue Failure Behaviour Study of Automotive Lower Suspension Arm" have studied fatigue life of automotive lower suspension arm under variable amplitude loadings. In simulation, the geometry of a sedan car lower suspension arm has been used

D. Taylor, P. Bologna and K. BelKnani[9] in their work "Prediction of fatigue failure location on a component using a critical distance method" have done the prediction of fatigue failure from notches and other stress concentrators is complicated by factors relating to the local notch geometry and stress field

Ashish Powar, Hrishikesh Joshi, Sanket Khuley and D.P. Yesane[10] in their paper, "Analysis and Topological Optimization of Motorcycle Swing-Arm" have stated that life cycles above $1e5$ can be considered as infinite life cycles.

Problem Identification

During the car crash accidents, when the car is damaged from front side, it was seen that the lower suspension arm is the strongest and is just slightly damaged. Therefore, it can be said that the lower suspension arm carries over strength. From this observation the material optimization team from Tata Motors found the scope to optimize lower suspension arm. This optimization aims to reduce the unnecessary over strength of the arm. This work intended to design, modeling and analysis of car lower suspension arm to study and analysis of lower suspension arm to determine its stress behavior during its operation and scope for permissible topology optimization.

Objectives

The main objectives of this study to determine critical locations of stress and strain distributions of the lower suspension arm and to remove excess material from stress free region. The paper aims to complete Finite Element Analysis of the lower suspension arm which consist the analysis for stress, deformation and optimization.

Therefore, the existing model is to be analyzed by using FEA for fatigue life cycle. Also, the optimized final iteration design is to be checked for the fatigue life cycles. The values of life cycles of both the designed are to be compared. Finally, the final iteration of optimized design is to be fabricated. The fabricated model is to be checked for fatigue life cycles to validate the FEA results experimentally.

2.METHODOLOGY.

Since the study contains optimization of lower suspension arm, the methodology includes FEA as well as experimental analysis of the optimized design of lower suspension arm. This study has followed the below methodology to achieve required results.

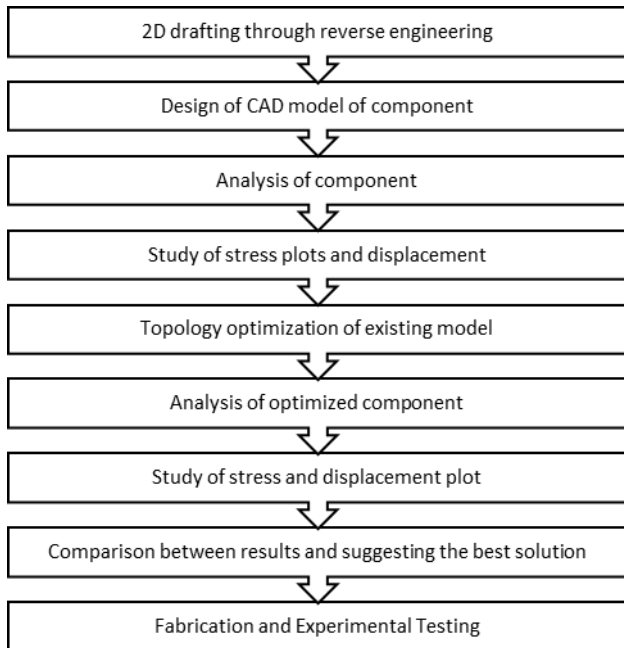


Figure 2 Methodology for implementation

3.FINITE ELEMENT ANALYSIS OF EXISTING LOWER SUSPENSION ARM

Reverse Engineering of existing lower Suspension Arm

Existing lower suspension arm was reverse engineered to prepare the CAD mode. Blue light scanning method is used for reverse engineering.



Figure 3 Lower suspension arm during blue light scanning
Points generated from blue light scanning is transferred to CatiaV5. Model is created using surfaces. The model looks as below in CatiaV5



Figure 4: Suspension arm in CATIA V5

Analytical force calculations

If we consider a moving vehicle, there are two major forces acting on the suspension arm. One is load due to road bump and other is braking load. These are the two cases which are majorly affects to the design of a lower suspension arm. Therefore, for the finite element analysis, we consider the load by these two cases.

Assumptions made during calculations:

1. 50:50 weight ratio is considered as standard assumption for ideal case
2. Average speed of car and bump height is considered
3. Suspensions is considered as a rigid component, that's why excluding damping effect.

Calculation of load

Loads on Transverse link:

- Road bump case
- Braking case

Car wheel designation: Indica

Kerb vehicle weight (GVW) = 995 kg

Therefore, weight on front side = 497 kg

(Assumption at ideal 50:50 weight ratio)

Weight on one side of wheel = $497/2 = 248.5$ kg

Road bump case:

Let, Speed of vehicle = 14km/hr (3.8m/s)

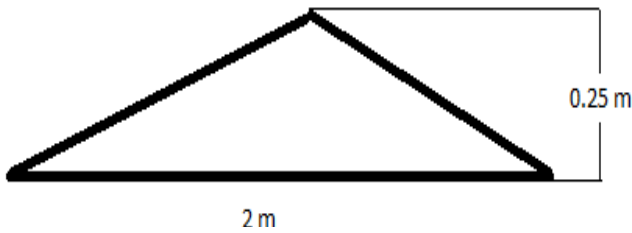


Figure 5: Road Bump

$$U = \frac{x}{t}$$

$$t = \frac{1}{3.8} = 0.25 \text{ m/sec}$$

$$U_{\text{vertical}} = \frac{x_{\text{vertical}}}{\text{time}} = \frac{0.25}{0.25} = 1 \text{ m/s}$$

$$A_{\text{vertical}} = \frac{U_{\text{vertical}}}{\text{time}} = 4 \text{ m/sec}^2$$

Wheel acceleration force (inertia force) = mass X acceleration

$$= 248.4 \times 4$$

$$\approx 1000 \text{ N}$$

Braking case:

Vehicle de accelerates (i.e braking) at a constant 0.5 G

$$\text{Braking force} = \text{mass} \times \text{acceleration} \times 0.5 \text{ G} \quad (5)$$

$$= 248.4 \times 9.81 \times 0.5$$

$$\approx 1250 \text{ N}$$

Finite element analysis

Meshed Model: Following figure shows the meshed model of lower suspension arm. The meshing is done using Hypermesh 14. Number of nodes and elements formed after meshing are 9217 and 35848 respectively.

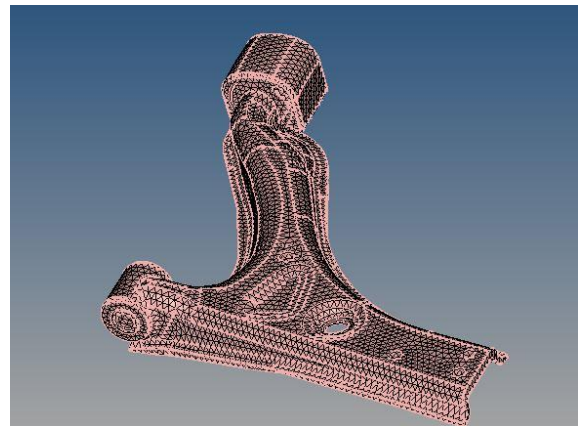


Figure 6: Meshed model of a lower suspension arm

Loading and Boundary Condition: Rigid are being formulated for the ease of application of boundary conditions. The rigid are concentrated on an independent node on which the forces are to be applied. The boundary conditions include braking and bump loads. The constraints are put on the mounting areas arresting all degrees of freedom as shown. In the below figure, two pivots shown by red colour are considered as mounting area. The direction and values of forces are shown in below figure.

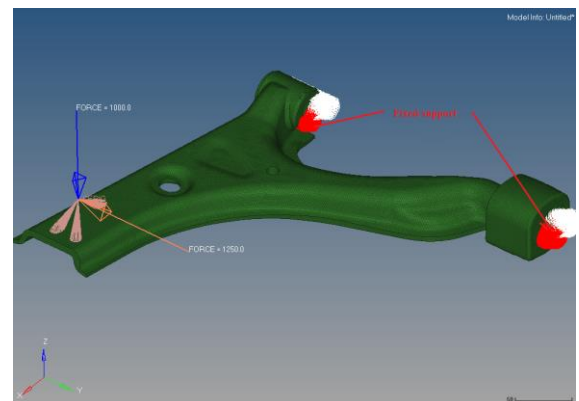


Figure 7: Constraint at the mounting location & Force applied

Table 1: Material properties of lower suspension arm

Property	Value
Young's Modulus, E	210 GPa
Poisson's Ratio, ν	0.29
Density, ρ	7850 kg/m ³

Static Analysis Results

The reversed CAD model is analysed for static stresses and deformations using ANSYS 15.0. Results of the analysis are shown in the below figures.

a. Deformation for existing design:

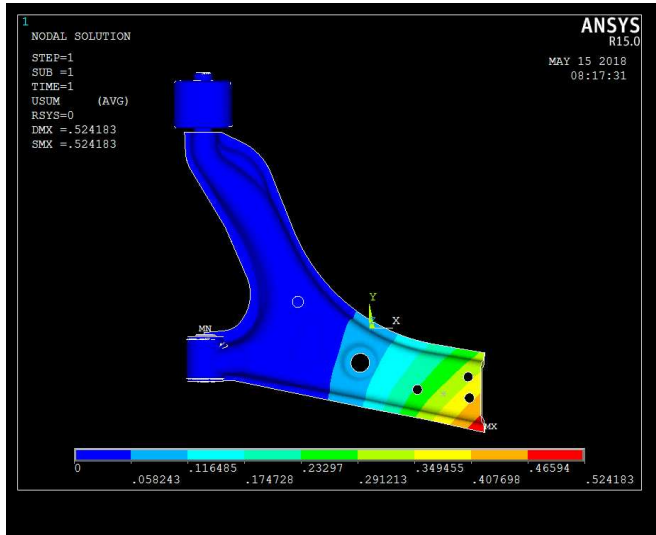


Figure 8: Displacement result for Existing Design

From above plot the maximum displacement value for existing design of lower suspension arm is 0.524 mm

b. Von Mises stress for existing design:

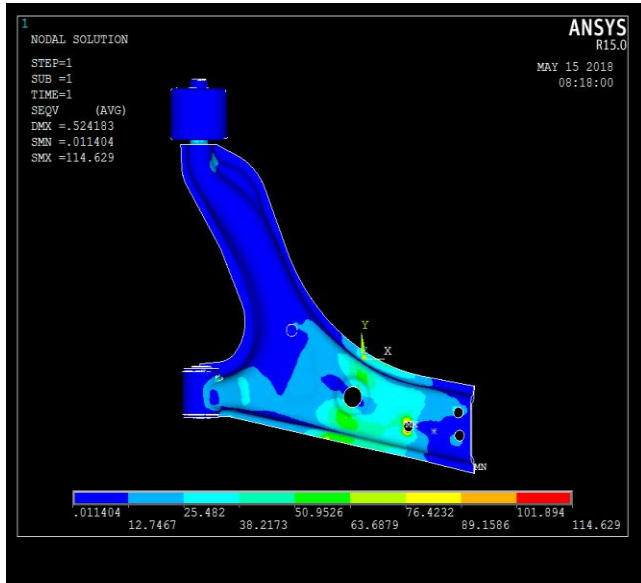


Figure 9: Von Mises stress for existing design

From above plot the maximum stress value for existing design lower control arm is 114.629 MPa which is less than yield strength; hence the design for lower suspension arm is safe.

Fatigue Life analysis for existing design

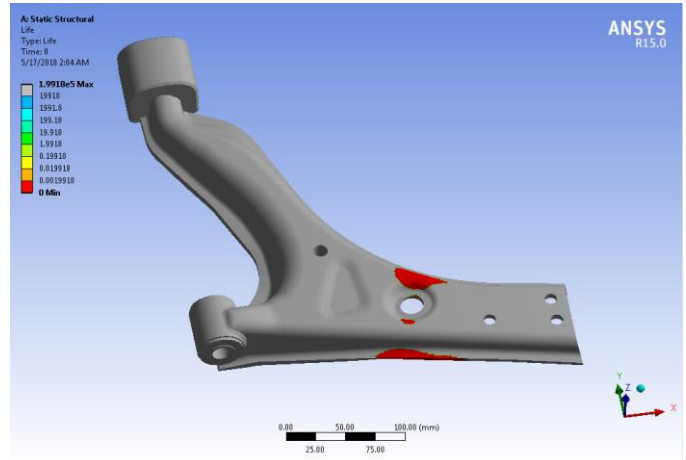


Figure 10: Fatigue life of Existing Design

From finite element analysis for fatigue, the no. of life cycles for existing design is 1,99,180 cycles. Therefore, the optimized design should have the no. of life cycles nearer to 199180 cycles.

Life of Existing Design: 1,99,180 cycles

4.OPTIMIZATION OF EXISTING MODEL

Topology optimization: Topology optimization is an optimization process in which it gives the optimum material layout according to the design space and loading case.

The weight reduction is done using Topology optimization by meeting the strength, safety factor targets. And the corresponding weight reduction is analysed.

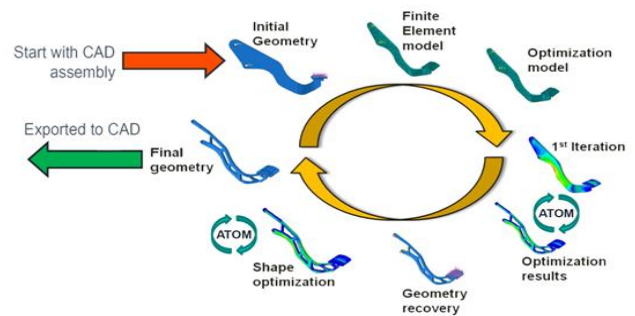


Figure 11: Loop of topology optimization

Topology optimization of existing Lower Suspension Arm:

After observing FEA results of existing Lower Suspension Arm and above discussed optimization techniques we can go for topology optimization to reduce weight, material and cost.

Iteration 1

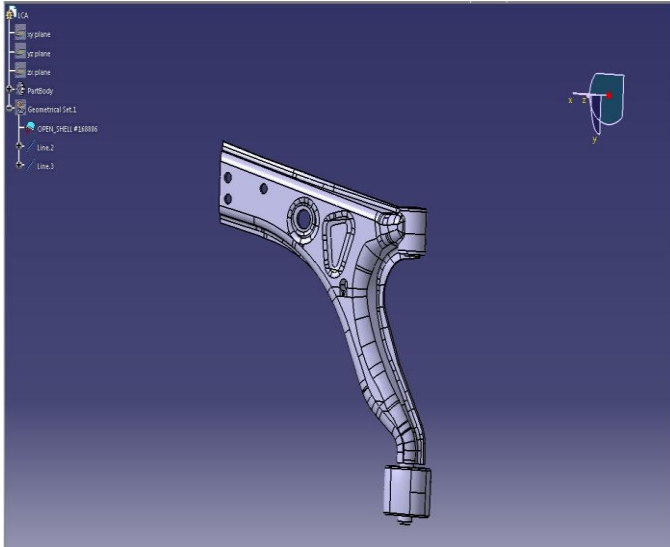


Figure 12: Optimized CAD model - Iteration-1

Fig: Optimized CAD model Iteration-1

From FEA results, the deformation is 0.549 mm, which is very low. Also, the stress induced is 119.56 MPa, which is well below the critical limit; hence the Lower Suspension Arm is safe in optimization Iteration-1. Therefore, for more weight reduction, the design is further optimized in Iteration 2.

Iteration 2

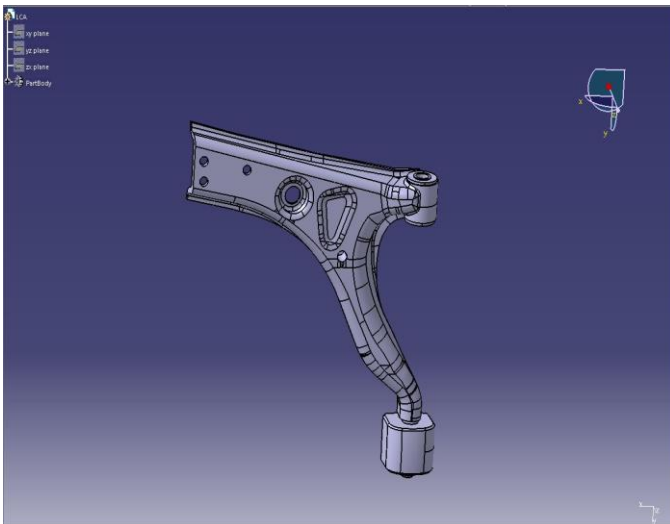


Figure 13: Optimized CAD model - Iteration-2

From FEA results, the deformation is 0.574 mm, which is very low. Also, the stress induced is 124.50 MPa, which is well below the critical limit; hence the Lower Suspension Arm is safe in optimization Iteration-2. Therefore, for more weight reduction, the design is further optimized in Iteration 3.

Iteration 3

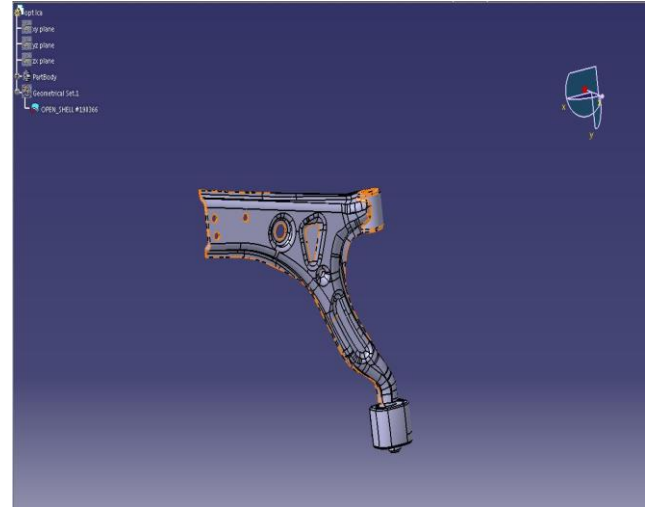


Figure 14: Optimized CAD model - Iteration-3

From FEA results, the deformation is 0.543 mm, which is very low. Also, the stress induced is 136.035 MPa. Since the factor of safety considering this stress is about 1.5, we consider this as the final iteration of optimization. Hence, further optimization is not possible since, it may result in very low factor of safety.

5.FINITE ELEMENT ANALYSIS OF OPTIMIZED MODEL

As mentioned above, the Iteration 3 gives the optimum stress value and deformation, Iteration 3 of optimized design is selected.

Results for Stress and Deflection of Lower Suspension Arm Iteration-3:

Static Analysis Results for Optimized design:

Result for Deflection for optimized design:

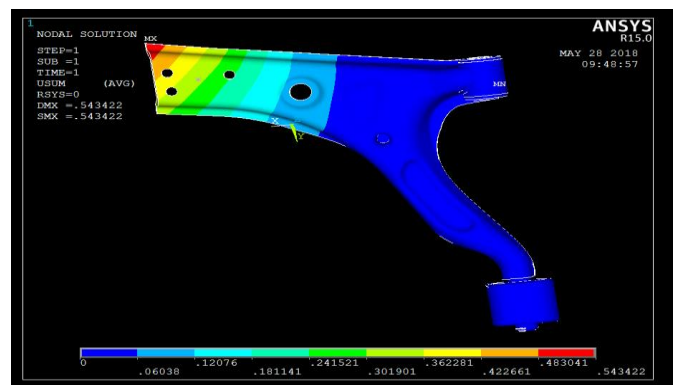


Figure 15: Displacement result for Iteration 3

From fig., the deformation of final iteration of optimized model is 0.543 mm the maximum deformation of optimized design and existing design are not varying by considerable amount.

a. Result of Stress for optimized design:

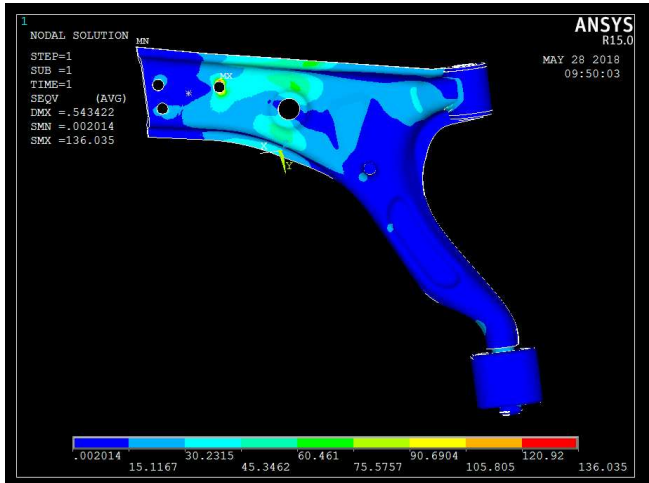


Figure 16: Von-mises stress for Iteration 3

As the stress induced is 136.035 MPa, which is well below the critical limit but amount of deformation is increasing gradually. Hence, keeping factor of safety in view Iteration-3 Lower Suspension Arm is considered final and safe optimization model

Results and discussions

Compression of structural analysis results

Table 2: Comparison of structural analysis

Material	Existing	Optimized Iteration-1	Optimize d Iteration-2	Optimized Iteration-3
Deformation (mm)	0.524 mm	0.549 mm	0.574 mm	0.543
Stress (Mpa)	114.62M pa	119.56 Mpa	124.50 Mpa	136.03 Mpa
weight	6.97 Kg	6.75Kg (3% weight reduction)	6.66 Kg (4.4% weight reduction)	6.31 Kg (9.4% weight reduction)

Fatigue Life analysis for optimized design

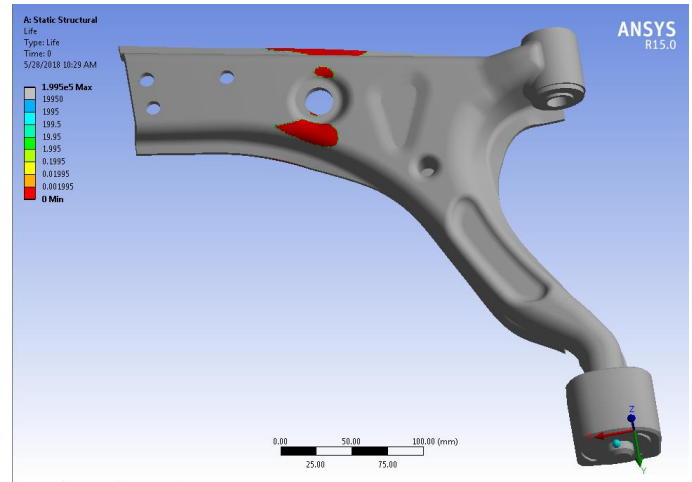


Figure 17: Fatigue life of Iteration 3

From finite element analysis for fatigue, the no. of life cycles for iteration 3 are 199090 cycles. The no. of cycles of optimized specimen and existing design are almost same. Therefore, it can be said that the optimized design is satisfying FEA results.

Life of optimized design: 1,99,090cycles

Comparison of Fatigue life:

Table 3: Comparison of Fatigue life

Fatigue Life	Maximum (cycles)
Existing steel Model	199180
Optimized 6 mm slot model (Iteration 3)	199090

6.EXPERIMENTAL ANALYSIS OF OPTIMIZED LOWER SUSPENSION ARM

Manufacturing of optimized design of lower suspension arm

In fabrication existing lower suspension arm is considered and machined according to final topology optimization suggested through finite element analysis. Machining process involves markings in existing lower suspension arm according to new design drawings followed by cutting, grinding, welding and finishing processes. Finally machined optimized model is considered for further testing process.



Figure 18: Final machined optimized model

Experimental Validation of optimized

For the experimental validation of optimized lower suspension arm, we have used Instron Actuator. Road bump load of 1000N is applied vertically on the arm and Braking load of 1250N is applied horizontally on arm. Both the loads are applied on wheel hub side connection of lower suspension arm. The certificate and the result of the experimental validation is provided in below image.

Report No.: ACDR/RPL/0318/549 Page 2 of 2 Date: 17.05.2018

Customer's Name: ABHISHEK PURANIK
Service Requirements: Fatigue Test

Test Results:

1. **Equipment Make** : Instron Structural Testing System (Country: Germany)
2. **Test Equipment used:** Instron Actuator 25KN (AC/MC/059)
3. **Controller** : 8800 Instron Make

Test Setup Photo:

Sr. No.	Sample Name	Test Description	Test Condition	Test Results
1	Lower Suspension Arm	Fatigue Test	Frequency: 28 Hz Load: V: 1000 N H: 1250 N No. of cycles: 100000 times	There was no functional deformation visible up to completion of 100080 cycles

Test Report Compiled By: TEJAS PATIL, MANAGER
Test Report Verified & Approved by: S. V. SHETE, CONSULTANT

Figure 19: Certificate of fatigue testing results of optimized model

In fatigue testing optimized Lower Suspension Arm is subjected to repeated loading case and ran for stipulated cycles and with respective frequency. In fatigue analyses if a component successfully completes one lakh cycles the component is considered as having infinite life. From the above testing the component is ran for one lakh cycles in one

hour with frequency of 28 Hz and component was stable and safe even after one lakh cycles and passed fatigue life

7.RESULTS AND DISCUSSION

When the above loads are applied on the specimen, there was no crack initiation till cycle 100080. And we always consider that above 1 lakh cycle the component under loading condition is considered as infinite number of cycle.

The difference between weight of existing and optimize lower control arm along with the fatigue life cycle of existing and optimized designed is as shown below table. Below table shows the comparison and results from FEA and Experimental techniques.

Table 4: Results and discussions

Component	Weight	Analysis method	Fatigue Life
Existing Component	6.97 Kg	FEA Results	199180
Optimized Designed Component	6.31 Kg (9.4% weight reduction)	FEA Results	199090
		Experimental Testing Results	100080 (Infinite)

8.Conclusions

- The reversed CAD modeling and analysis for static and fatigue life cycle of existing lower suspension arm showed possibility of optimization as the stresses and displacement induced were well within the prescribed limits.
- Therefore, topology optimization is carried out of the existing lower suspension arm at less stress concentrated area. As per the FEA analysis the lower suspension arm is being optimized by iterative method and thus optimizing the weight of the component.
- The final iteration of topology optimization shows 0.543mm of maximum displacement and 136.03MPa of maximum stress which is having 1.54 FOS.
- The total weight reduction in final iteration of optimization is 9.4% of the total lower suspension arm weight.
- The optimized model is then fabricated and validated for fatigue life testing by experimental method

REFERENCES

1. Miss. P. B. Patil and Prof. M. V. Kharade "Finite Element Analysis and Experimental Validation of Lower Control Arm" 2016 IJEDR | Volume 4, Issue 2 | ISSN: 2321-9939
2. Dattatray Kothawale and Dr. Y. R. Kharde "Analysis of Lower Control Arm in Front Suspension System Using F.E.A. Approach" International Journal of Engineering Research and Development e-ISSN: 2278-067X, p-ISSN: 2278-800X, Volume 5, Issue 12 (February 2013), PP. 18-23
3. Bhushan S. Chakor and Y.B.Choudhary "Analysis and optimization of upper control arm of suspension system" International Journal For Technological Research In Engineering Volume 5, Issue 1, September-2017 ISSN (Online): 2347 - 4718
4. Thomas D. Gillespie "Fundamentals of Vehicle Dynamics" Published by Society of Automotive Engineers, Inc
5. Pratik S. Awati, Prof. L.M.Judulkar, "Modal and Stress Analysis of Lower Wishbone Arm Along With Topology", International Journal of Application or Innovation in Engineering & Management (IJAIEEM) Volume 3, Issue 5, May 2014 ISSN 2319 - 4847
6. Y. Nadota, V. Denierb, "Fatigue failure of suspension arm: experimental analysis and multiaxial criterion", Elsevier, Engineering Failure Analysis 11 (2004) 485-499
7. M. M. Rahman¹, M. M. Noor¹, K. Kadirgama¹, Rosli A. Bakar¹, M.R.M. Rejab, "finite element modeling, analysis and fatigue life prediction of lower suspension arm, Malaysian Technical Universities Conference on Engineering and Technology June 20-22, 2009
8. N.A. Kadhim¹, S. Abdullah², A.K. Ariffin and S.M. Beden, "Fatigue Failure Behaviour Study of Automotive Lower Suspension Arm", Key Engineering Materials Vols. 462-463 (2011) pp 796-800
9. D. Taylor a, P. Bologna b, K. BelKnani b, "Prediction of fatigue failure location on a component using a critical distance method", Elsevier, International Journal of Fatigue 22 (2000) 735-742
10. Ashish Powar, Hrishikesh Joshi, Sanket Khuley and D.P. Yesane "Analysis and Topological Optimization of Motorcycle Swing-Arm" International Journal of Current Engineering and Technology E-ISSN 2277 - 4106, P-ISSN 2347 - 5161

AUXILIARY DRIVE WHEEL VEHICLE PARKING MECHANISM (FIFTH WHEEL CAR PARKING MECHANISM)

Mr. Paresh G. Chaudhary¹, Mr. Sanket R. Avhad ²,
Mr. Omkar P. Dharpale², Mr. Ganesh R. Dhumal ²

Mr. Akshay R. Dhende²,

¹Assistant Professor, ²UG Student,

Department of Mechanical Engineering

NBSSOE, Ambegoan

Pune, India

chaudharyparesh12@gmail.com,

avhadsanket4@gmail.com,

omkardharpale6334@gmail.com,

ganeshdhumal306@gmail.com,

akshaydhende04@gmail.com.

May 28, 2018

Abstract

In earlier methods of parking, the driver would taken to be more time as well as alert while parking in compact spaces avoid hitting of the vehicle during the movement of vehicle. The parking is a big problem in the big cities due to congestion of roads and traffic regulation and if it is a unskilled driver it will be a big problem to the other drivers also maximum time is needed for parking. Therefore to avoid these inconveniences, a concept of parking is developed for taking least time for parking and

aim of this system is to fold the auxiliary wheel for better space adaptability also placed in boot space. This parking can be done using an additional wheel (an Auxiliary Drive Wheel) most probably this will be a Stepney wheel. Initially, when the driver finds a slot for parking, he pushes the button and the DC motor actuate the movement of rack and pinion. Rack and pinion will applied force on the one side of triangular hub and due to the pivot point the triangular hub move in angular moment and other side of triangle will lift auxiliary wheel. This will land the auxiliary wheel on the road and slightly lifts the rear side of the vehicle. A rack and pinion and triangular hub set up is used to control an Auxiliary drive wheel to land and lift. The model enables the driver to park the vehicle between two vehicles, where the space is limited.

Keywords:Auxiliary Drive Wheel, DC Motor, Triangular hub, Rack and Pinion, Stepney wheel.

1 INTRODUCTION

Roads that facilitate parallel parking have an additional lane or an outsized shoulder for put cars. it's also used whenever parking facilities aren't accessible typically in giant metropolitan areas wherever there's a high density of vehicles and few (or restricted) accommodations like multi- keep automobile parks. Some jurisdictions have eliminated individual spots permitting shorter vehicles to use less area. Parallel parking could be a methodology of parking a vehicle in-line with different put vehicles. Parallel parking needs at first driving slightly past the automobile parking space, parallel to the put vehicle before of that area, keeping a secure distance, and so followed by reversing into that area. later position adjustment could need the utilization of forward and reverse gears. Parallel parking is taken into account to be one in every of the toughest skills for brand new drivers to be told. Parallel parking enables the driver to park a vehicle in a smaller space than would be true of forward parking. Driving forward into a parking space on the side of a road is typically not possible unless two successive parking spaces are empty. Reversing into the spot via the parallel parking technique allows one to take

advantage of a single empty space not much longer than the car. New drivers learn to use reference points to align themselves in relation to the car in front of the space, to determine the proper angle for backing, and to determine when to turn the steering wheel while backing. They may find it easier to briefly stop at each reference point and turn for the next step. Two major types of parallel parking technique differ in whether they will use two or three positions of the steering wheel while backing. A skilled driver may be able to parallel park successfully by backing with the steering wheel turned all the way to the left and then immediately cranking the wheel all the way to the right at a critical point. For beginning drivers, those with larger cars or bad sight lines, this may risk collision with either the car in front of or behind the parking space, or it could also result in the car being parked too far away from the curb. Such drivers may find it easier to include an intermediate step, where after having achieved the ideal angle for backing up they back up with the wheels straight until the rear end of the car is far enough back to allow them to make their final reverse turn. While steering wheel positions in between full-right, straight, and full-left are possible to use, beginners may be able to gauge their progress more effectively by turning the wheel all the way to the right or left.

2 LITERATURE REVIEW

In 1950s, The Walker had developed a parallel wheel parking system for automobiles and trucks and he developed in his conception in an exceedingly Saab sedan car conjointly developed his self -parking conception in ford beach waggon. conjointly in 1970s of these ideas of automobiles modifying by that tire may be fitted underneath chassis and hidden underneath the car, motivated once the method begin for parking in slots. every of this method got to set at very cheap of every automobile. This mechanism was fitted underneath the chassis that with facilitate of rack and pinion or with the assistance of centrally fitted worm and gear wheel. The Packard Cavalier developed the conception that is totally different from Walkers parking conception. The Packard used the additional tire for the parking and this

originated was used move the automobile in circular arrangement. this idea applied to the automobile with none changes within the entities or in structure of automobile.

Janhvi Nimble et.al. had developed bound ideas for parking in huge cities or busy cities, notably facing the traffic problems, was tough within the car park. Parking drawback had huge issue to face traffic network and in life quality. completely different ideas were developed for progress in automatic or simple parking for vehicles. final aim of her analysis was to develop glorious, user friendly automatic automotive parking that reduces personnel, traffic congestions and secure parking slots in restricted space. the standard parking systems were like structure, automaton automotive parking systems, automatic structure automotive parking systems etc. had been used on an oversized scale. however these systems have a serious disadvantage of enormous area consumption that is with success eliminated with the assistance of parallel automotive parking mechanism. varied ways were used for development of autonomous and intelligent parking systems. Study of those systems needs a trifle or a lot of human interference for the functioning. sensible Parking system planned a mechanical model which incorporates image process facility. With the assistance of carry cars were put at multiple levels. To captured the amount plate and hold on in info for comparison to avoid unofficial automotive entry image process was used. the most benefits of this systems were area optimization, value effectiveness and security.[1]

D. Gorinevsky et.al. had performed the implementation of a parking control system to support an automatic parking system mode in activate in cars. By using development in the parking concept technique without using the manpower for controlling the parking of cars. They invented controller for controlling of parking. They came to conclusion of the calculation and designing, containing parking problem analysis, problem. Two general cases of backward parking considered in this work are emulated using the proposed controller. The controller design gave high efficiency and proves that the prototype system can be invented for a typical passenger car. They had proven that automatic parking well as simply solving the parking problem with the help of controller, but with huge complex cases of car

parking as well. The car parking problem results proved that and gets exact confirmation of solution to the automatic parking control problem. Automatic parking can be invented for the solving parking problem.[2]

Sawankumar G. Narone et.al. had focused on car manufacturing related with the ease of Car Parking System. This system had developed to reduce the use of large land space for the parking which was creating problem in big busy cities. Various types of parking systems are gathering all over the world namely automatic car parking, rotary car parking, autonomous car parking, parallel parking, fifth wheel parking. The present problem of parking is target to invent automatic prototype model which can solve the original issue face by big cars for parking in parking area. The chain, sprocket, rack and pinion, worm and worm gear mechanism is get link and form mechanism. This whole prototype model is work and rotates by a D.C motor or stepper motor. When the car street or road or parking slots the car is ready for the parking and the vehicle become park. When the button will pressed by the operator, sprocket starts the rotating and the vehicle become park taken less space as well, so they were using this concept to build the technology of automatic parking to where it is needed.[3]

Amin Kianpishah et.al. had explained about increased used of cars with increasing population and its adverse effects on surroundings of vehicle mass production, but large space for the parking places and lands are required. Hence they had developed the concept for vehicle parking system defines as the smart parking system(SPS) is invented for taken as less time and less space as well. The new concept had been developed by using the ultrasonic sensors to identifying the either space for car parking or to less space for park. Various concepts have been developed but as compared to other techniques smart parking is the best technology. The smart parking was containing the various process space detection, parking space, image processing, viewing of less space for parking, indicating the correct direction, and payment facilities and different types of parking spaces through the use of specific controlling unit. They had been described automatic parking system from car enter in parallel parking slots the controller detecting the vacant spaces on road side or street. The

system containing the image processing to display the car motion to park in slots with help of sensors or LED.[4]

Mayur S. Raipure et.al. had described about development in the parking system through the automobile industry ,particularly in the four wheelers. Also they were explained the main purpose to wheel move in circular motion (90 degree). Four wheeler or any vehicle can be park in any direction with getting from planned and regulated movement as compared to the other larger vehicles. The ability to move along any direction irrespective of the orientation of the vehicle makes it an attractive option in dynamic environment. They used some system for certain movements in which can be seen in car. Here they had described on the prototype model which can easily movement in all directions on the street. They had discussed about motion and movement about the car system which implement in actual vehicle. They said that the advancement in the parking problem is very important .The improvement in the automobile industry especially in the four wheeler is tough challenge for us.[5]

Apurva Medhekar et.al. had recent search on major problem facing against the car parking in congested or small spaces. Large scale infrastructure companies like Whor, Tal manufacturing ltd, Claus, Pari parking solutions, Dae Duck engineering, etc. developing concept for the parking implemented in the car. The car can be rotated in 3600 with safety of car. This system was much efficient for parking in circular or lateral direction in the less space utilization or other energy available sources. This system concept has contained the conveyor belt, controller system, solar panels. With all the combination of parking types are the unique one from all other parking system which invented for the ease of parking, less spacing required, with minimum cost and manipulate. As compared to other parking system multilevel circular parking system becoming efficient than other for less consuming space as well as safety.[6]

3 MECHANISM

This mechanism is utilizing rack and pinion system, triangular pivot and chain drive for exploit. The rack and pinion mechanism

can initiate the method of motion transfer and transfer it to triangular pivot and it leads to movement of fifth wheel with the assistance of chain and sprockets in conjunction with electrical motor if required. This invention relates typically to vehicles. a lot of significantly, the current invention issues with maneuverability of vehicles in restricted areas. a automatically retractile assembly for article of furniture in vehicles that, once motivated, causes associate auxiliary wheel to exerting a rubbing force and park in restricted areas like parking slots. Aim for development of a system to show the vehicle base frame at zero to 360angle. DC motor used for driving Vehicle model. Chain and sprocket or DC motor arrangement can transfer the ability from motor to vehicle axel. At the rear side we are going to provide auxiliary drive wheel on perpendicular plane of four wheels. Triangular pivot principal (as shown in the fig.2) used for folding of an auxiliary drive wheel. As shown in fig.2 rack and pinion will applied force on the one side of triangular hub. Due to the pivot point on the top of the triangle, other side of triangle will lift the fifth wheel. For the actuation of rack DC motor will provided at the pinion. Hence whenever needed operated must have unfold the fifth wheel axel by liner actuator (Rack and Pinion). In the normal drive the vehicle will travel with the normal four wheels whereas during the parallel parking the fifth wheel comes to action and the remaining two rear wheels will be not in contact with the ground.

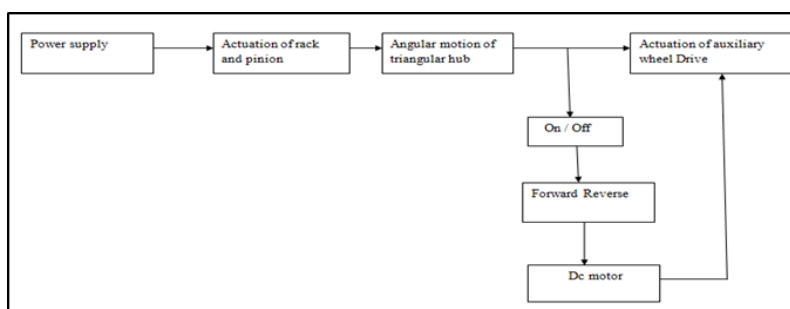


Figure 1: Flow of the System

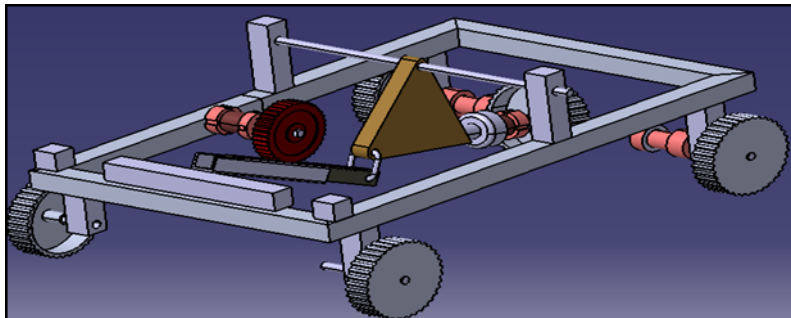


Figure 2: 3D view of the system

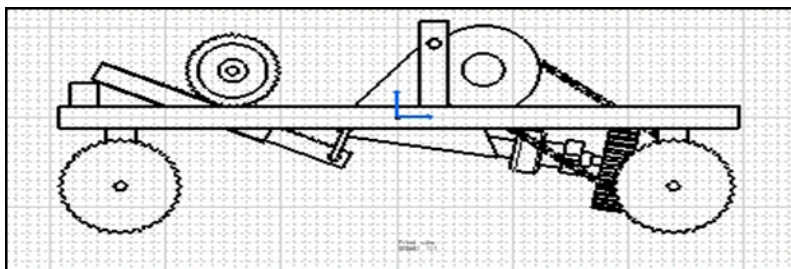


Figure 3: 2D view of the system

4 ANALYTICAL RESULT

The purpose of the FEA is to check the design for failure before manufacturing stage. This helps to eliminate the defects in the design and reduced the cost and also helpful aesthetically and ergonomically. Design engineers always go with this analysis and also easy for representation.

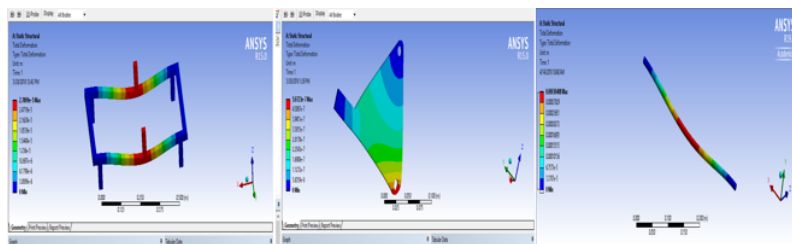


Figure 4: Total Deformation of Chassis, Shaft Triangular pivot

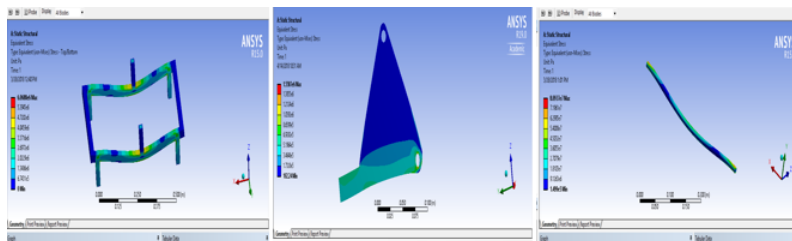


Figure 5: Von- Mises stress of Chassis, Shaft Triangular pivot

5 ADVANTAGES

- To obtain better parking in narrow space and at multiplexes.
- To obtain 0 to 360 degree turning with zero turning radius.
- Resolve Traffic Problems.
- Vehicle parking and driving in city conditions with heavy traffic in tight spaces.

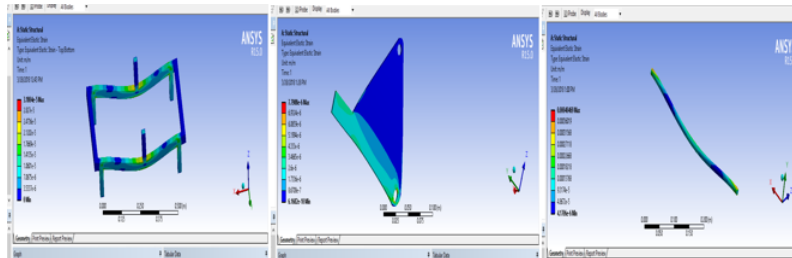


Figure 6: Equivalent strain analysis of Chassis, Shaft Triangular pivot

- This type of car can be taken through traffic jam.
- Saving of Time.

6 FUTURE SCOPE

- Aim for development of a system to useful in the automotive sector.
- Four bar mechanism will be implementing for working of fifth wheel, our aim is to fold the fifth wheel axel for better space adaptability.
- Hence whenever needed operated must have unfold the fifth wheel axel by actuating rack and pinion.
- Arrange conventional steering system at front side.

7 CONCLUSION

A vehicle featuring low cost and user friendly steering mechanism for Auxiliary wheel has been introduced. This paper focused on a steering mechanism which offers feasible solutions to a number of current maneuvering limitations. A prototype for the proposed approach was developed by introducing separate mechanism for normal steering purpose and 360 degree steering purpose. This prototype was found

to be able to be maneuvered very easily in tight spaces, also making 360° steering possible.

References

- [1] Jahnvi Nimble Et. Al., “Automatic Smart Car Parking System”, International Journal of Advances in Electronics and Computer Science, ISSN: 2393-2835 Volume-3, Issue-3, Mar.-2016, PP-49-51.
- [2] D.Gorinevsky Et. Al., “Control of Automated Car Parking using Neural Network Architecture”, IEEE Transaction on Control Systems Technology, vol. 4, NO. 1, 1996, PP-51-56.
- [3] Sawankumar G. Narone Et. Al., “Vertical Car Parking A Prototype”, International Journal of Emerging Technology and Advanced Engineering, ISSN:-2250-2459, Volume 5, Issue 4, 2015, PP-199-203.
- [4] Amin Kianpisheh Et. Al., “Smart Parking System (SPS) Architecture Using Ultrasonic Detector” International Journal of Software Engineering and Its Applications Vol. 6, No. 3, July 2012, ISSN-1812- 5638, PP-51-58.
- [5] Mayur S. Raipure Et. Al., “90 Degree Turning Wheels of Car for Transverse Parking”, International Journal for Scientific Research & Development, Vol. 3, Issue 01, 2015 ,ISSN (online): 2321-0613, PP-1161-1163.
- [6] Apurva Medhekar Et. Al., “Expandable Modern Automatic Car Parking System” ,International Journal of Engineering Trends and Technology (IJETT) Volume 34, 2016, PP-93-99.
- [7] Jaishnu Moudgil Et. Al., “360 degrees Rotating Vehicle to Overcome the Problem of Parking Space”, IJRMET Vol. 5, Issue 2, May - Oct 2015, ISSN: 2249-5762 (Online), PP-16-19.
- [8] Sudip Kachhia Et. Al., “Design Of 3600 Degree Rotating Car”, IJARIE-ISSN (O)-23954396, Vol-2 Issue-5, 2016, PP-523-527.

University "Politehnica"
Timișoara Romania
Faculty of Electrical and Power
Engineering

JOURNAL

OF ELECTRICAL ENGINEERING




"Politehnica" Publishing House
ISSN 1582-4594

No 3

(<http://www.jee.ro/index.php/jee/issue/view/56>)

Published Jul 6, 2018

 Download

 Statistic


Vol 18 No 3 (2018): Volume 18 / 2018 (<http://www.jee.ro/index.php/jee/issue/view/56>)

 Nisha Dagade

NBSSOE, Pune

 Rahul Dagade

MMCOE, Pune

 Nishant Godha

Reliance Energy

Abstract

A Monte Carlo simulation approach is used in this paper to evaluate the impact of intermittent wind generation on reliability evaluation of distribution system. Taking into account the fluctuating nature of wind speed, the random failures of generating units and recognized dependencies, wind speed model, wind turbine generator output model and load model are established. 2-parameter Weibull probability distribution is used to simulate hourly wind speeds values and the output of the wind farm. A specific Monte Carlo simulation procedure is described and a test system from the Roy Billinton Test System (RBTS) is used to illustrate the method.

[Info \(http://www.jee.ro/index.php/jee/ino\)](http://www.jee.ro/index.php/jee/ino)

[Current Issue \(http://www.jee.ro/index.php/jee/issue/current\)](http://www.jee.ro/index.php/jee/issue/current)

[Archives \(http://www.jee.ro/index.php/jee/issue/archive\)](http://www.jee.ro/index.php/jee/issue/archive)

[Hard copy \(http://www.jee.ro/index.php/jee/hard_copy\)](http://www.jee.ro/index.php/jee/hard_copy)

[Electricity Historical Letters \(http://www.jee.ro/index.php/jee/electricity-historical-letters\)](http://www.jee.ro/index.php/jee/electricity-historical-letters)

[New Books \(http://www.jee.ro/index.php/jee/books\)](http://www.jee.ro/index.php/jee/books)

[Editorial Team \(http://www.jee.ro/index.php/jee/about/editorialTeam\)](http://www.jee.ro/index.php/jee/about/editorialTeam)

Partners (<http://www.jee.ro/index.php/jee/partners>)

Contact (<http://www.jee.ro/index.php/jee/about/contact>)

Search (<http://www.jee.ro/index.php/jee/search/search>)

(/)

(<https://www.beespeed.ro/>)



(<http://editurapolitehnica.upt.ro/>)



Universitatea
Politehnica
Timisoara

(<http://upt.ro/>)