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# Quality of Work Life and Organizational Performance: Workers' Feelings of Job Security, or Not, to the Organization's Productivity

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## ABSTRACT

*The main purpose of this research is to identify the significance of work environment towards the performance and also to study the effectiveness of the Quality of Work life in the organisation. In this research well-structured questionnaire was framed and data was collected using convenience sampling from 246 employees of the Chemical Industries in Cuddalore, and to study the significant association chi-square was used by the researcher. To find Quality of Work life of the employees of this Chemical Industries in Cuddalore can be improved by conducting some more training classes for the employees who are falling in the category of more than 3 to 4 years of experience which would boost their self-confidence and help them attain their level of satisfaction. Similarly, the organization can give some more security to the employees falling in the category of 41 and above so that they feel quite secure in the hand of organisation and they can give their high-level performance. This observation that empirical article on Quality of Work life – A Study's structured questionnaire can be applied as an Employee opinion Survey taken in once in 8 months on knowing the quality of work life. By doing this survey organisations can get to know the quality of work life of the employees and take necessary steps to improve the QWL among all the Employees. It also helps the employers to know that their employees who are working in their organisation are happily working leading to good Quality of Work life which will boost up their performance to come happily daily to their work place. In this survey, the employees how to balance between personal life and work life is to be measured and also measured how to improve their work performance.*

**Key Words: Human behaviour, Quality of work Life, Employee performance**

## INTRODUCTION:

The success of any organisation is highly dependent on how it attracts, recruits, motivates, and retains its work force. Today's organisations need to be more flexible so that they are equipped to develop their workforce and enjoy their commitment. Therefore, organisations are required to adopt a strategy to improve the employee's quality of work life to satisfy both the organisational objectives and employee needs.

Quality of work life is a process in an organisation which enables its members at all levels to participate actively and effectively in shaping organisational environment, methods and outcomes.

The current scenario is a knowledge worker and the society in which we are living has come, to be known as knowledge society. The intellectual pursuits have taken precedence over the physical efforts.

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Some knowledge workers work for more than 70 hours a week. As a result of this, their personal hobbies and interests clash with their work. Life is a bundle that contains all the stands together and hence the need to balance work life with other related issues.

One must have found out differentiate between personal life and work life and both love and work in one's life to make it healthy. Gone are the days when the priority of employees used to be for physical and material needs. With the increasing shift of the economy towards knowledge economy, the meaning and the quality of work life has undergone a sudden change.

The main objective of this research is analysis of quality work life on employee's performance. quality of work life is fast becoming an imperative issue to achieve the goals and objectives of the organization in every sector be it education, service sector, organization sector, tourism, manufacturing, etc. attrition, employees commitment, productivity etc. depend upon the dimensions of quality of work life i.e. job satisfaction, organizational commitment, reward and recognition, participative management, work life balance, proper grievances handling, welfare facilities, work environment, etc. an organization offers a better QWL then it grows the healthy working environment as well as pleased employee. high QWL can give a result in better organizational performance, effectiveness, innovativeness, etc. consequently, to contribute better life for all those peoples whom organizational members serve and with whom they deal and interact.

#### **MEANING OF QUALITY OF WORK LIFE:**

Quality of work life refers to the favourableness or unfavourableness of a job environment for the people working in an organisation. The period of scientific management which focused solely on specialization and efficiency, has undergone a revolutionary change.

Work is an integral part of everyday life, as it is our livelihood or career or business. On an average we spent twelve hours daily life and it is the one third of our entire life. Research on quality of work life is considered to be more important at the individual and organization level.

Quality of work life is considered for both the employees and organization and it is involved with job satisfaction, productivity, job involvement, job enrichment etc. The success of any organisation is highly dependent on how it attracts recruits, motivates, and retains its workforce. Today's organisation needs to be more flexible so that they are equipped to develop their workforce and enjoy their commitment.

This study is made attempts to analyses the "Quality of work life among employees". In order to improve quality of work life, various copying techniques have been suggested to upgrade the employee's attitude towards their job and the working environment in the organisation. The traditional management gave inadequate attention to human values.

#### **Major parts of quality of work life:**

- Occupational healthcare
- Suitable working time
- Appropriate salary
- Good working environment
- Welfare facilities
- Grievance handling
- Good financial benefits



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## **DEFINITION OF QUALITY OF WORK LIFE:**

The Quality of work as strategy of human resource management has assumed increasing interest and importance. Many other terms have to come to be used interchangeably with quality of work such as 'Humanisation of work' 'Quality of working life' 'Industrial democracy' and 'Participative work'.

According to Nadler and Lawler "Quality of working life is a way of thinking about people, work and organisations, its distinctive elements are,

(i) A concern about the impact of work on people as well as on organisational effectiveness (ii) The idea of participation in organisational problem solving and decision making".

According to Luthans, "The overriding purpose of quality of work life is to change the climate at work so that the human-technological interface leads to a better quality of work life".

According to Beinum, "Quality of work life is based on general approach and an organization approach. The general approach includes all those factors affecting the physical, social, economic, psychological and cultural well – being of workers, while the organizational approach refers to the redesign and operation of organisation in accordance with the value of democratic society."

According to American society of training and development, "Quality of work life is process of work organisations which enable its members at all levels to actively, participate in shaping the organisations environment, methods and outcomes. This value-based process is aimed towards meeting the twin goals of enhanced effectiveness of organisations and improved quality of life at work for employees.

According to Lloyed Suttle, "Quality of work life as the degree to which members of a particular organisation are able to satisfy important personal needs through their experiences in the organisation."

## **OBJECTIVE OF QUALITY OF WORK LIFE:**

To know about the pay and stability of employment.

To improve in various facilities to workers like salaries, benefits, and facilities.

To study about alternative work schedules including work at home, flexible working hours, staggered hours, reduced work and part-time employment.

To study about participative management, awarding the rewarding system.

To study about increase in individual productive, accountability and commitment.

To study better teamwork and communication.

To study for improving the morale of employees.

To study about reducing of organizational stress.

## **SCOPE OF QUALITY OF WORK LIFE:**

- To increase demands at work.
- To know about loss of long-term employee guarantee.
- The study helps us to know about key element of quality of work life.
- The need for enhanced work place skills.
- To know about greater competition for talent.
- To know about increased women in work force.
- To strengthen work place learning.
- To strengthen friends and family programs.

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- To provide all employees with internet access.
  - To increase investment in workplace learning.
  - To improve the effectiveness of supervisors and team leaders.
  - To improve better quality of life.
  - To create global outlook and orientation among young professionals.

### **NEED OF THE STUDY:**

The study is based that in the current scenario every organisation expects their employees to perform at their peak potential. Through monetary aspects play an important role in motivating employees, organization around the world have come to understand that there are many other aspects that contributes better employees' performance. It's aims to identify the various tangible and intangible aspects that contribute to the quality of the workplace. It is very important for an organization to create a very conducive working environment for employees. This research is needed to ensure that all employees are performing at their peak potential, free from stress and strain, and to ensure that all their needs are fully satisfied. It will be used as feedback from employees to know their current perspective of workplace and also to identify the areas of improvement for the organization.

### **OBJECTIVES OF THE STUDY:**

#### **Primary objectives:**

- To find out the quality of work life of employees in Chemical Industries in Cuddalore.
- To study the attitude of employees towards various welfare measures provided in the unit under the study.
- To find out the employee's problems and offer suitable suggestions on the basis of the findings.
- To know whether quality of work life leads to improved productivity of the organization.
- To study whether quality of work life motivates the employees to learn further for present and future roles.

#### **Secondary objectives:**

- To identify measures to overcome these drawbacks.
- To know the real situation of the employees.
- To collect employee's opinion about this matter.
- To understand the relationship between quality of work life and employee's satisfaction.
- To know the level of employee's satisfaction.
- To study about benefits of individual employees from high quality of work-life in organizations.

### **SCOPE OF THE STUDY:**

- The study helps in determining employee performance.
- The study shoelps us to analyse quality of work life and its effect in organisation productivity
- To study helws the commitment of employees in Chemical Industries in Cuddalore.
- The study helps us improvement impact on shaping employee personality.
- To study shows the commitment to the organization and the society.
- To study help we to understand the major issues involved in quality of work life in Chemical Industries in Cuddalore.
- The study hp, know about the extend workers participation involved in quality of work life.
- The study helps to analyse the satisfaction level among the Chemical Industries (Cuddalore) employees towards quality of work life.

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### **Negative point of the research**

- The study is limited to the workers of in Chemical Industries in Cuddalore. and therefore, the findings of the study cannot be extended to other areas.
- Convenient sampling has been used in the study and it has its own limitations.
- Personal bias of the respondents might have crept in while answering a few questions in the structured interview schedule.
- Results of the study may not be generalized.
- The purpose from the sample not reveals the accurate facts.
- Lack of respondent's interest in answering the questions, and also might not have revealed true information.
- The study ignores important root causes of stress because they focus on the worker and not the environment.
- The time period for carrying out the research was short as a result of which many facts have been left unexplored. Lack of time and other resources as it was not possible to conduct surveys at large level.

### **Theoretical Foundation**

Taylor (1979) more pragmatically identified the essential components of Quality of working life as; basic extrinsic job factors of wages, hours and working conditions, and the intrinsic job notions of the nature of the work itself. He suggested that relevant Quality of working life concepts may vary according to organization and employee group. Mirvis and lawler (1984) suggested that Quality of working life was associated with satisfaction with wages, hours and working conditions, describing the – basic elements of a good quality of work life as; safe work environment, equitable wages, equal employment opportunities and opportunities for advancement. Baba and Jamal (1991) listed what they described as typical indicators of Quality of working life, including: Job satisfaction, Job involvement, Work role ambiguity, Work role conflict, Work role overload, Job stress, Organizational commitment and Turn-over intentions.

Normal and Daud (2010) in their study – Investigating the relationship between Quality of work life and organizational commitment amongst employees in Malaysian firms say that the quality of work life of employee's job satisfaction and commitment. Sayeed and Sinha (1981) examined the relationship between Quality of work life dimensions, job satisfaction and performance measures on the two groups of sample work in high quality of work life and low Quality of work life organizations. The result revealed that Quality of work life dimensions are related to job satisfaction in both types of organizations. A comparison between high and low quality of work life organization further indicated systematic variation in the correlation pattern i.e., Organisation with low quality of work life tended to yield comparatively better relationship between Quality of work life dimensions and performance measures than the organization with high Quality of work life.

Singhal (1983), emphasized on the job quality of life where it is pointed out that quality of working life will be meaningful if the people working in organisation live a happy life in society. Economic, Family and Health related aspects to which employees are exposed as member of larger significant – society are significant factors that influence their quality of working life experience. He also made a point that Quality of work life is a time and situation bound concept that requires constant revisions and modifications as psycho-socio and organisational contents change over time. Kontbluh (1984) suggested that the contribution, of increased worker's participation in decision-making is appearing

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more often on labour management agenda as a strategy to increased employees Quality of work life. The reason for management interest includes need for (i) Increased profitability positive quality (ii) Improving quality of work life for the new workers who are educated and have good work ethic, but are alienated and unmotivated under current management practices and (iii) meeting foreign compensation.

Chakraborty (1986) found out that there are many organizational situations which indicate hidden realities of Quality of work life. Researchers are required to examine the Quality of work life in light of new paradigm based on study of Indian psycho-philosophy offered from a strict problem- solving point of view and may have relevance to educate predicting managers. Sinha (1986) enumerated that modern workers demand jobs that satisfy their inner needs. In the light of content and process theories of motivation, it is postulated that the popular way of determining Quality of work life is to measure the attitude that constitutes job satisfaction. Moreover, it is also suggested that the prospects of better Quality of work life in India have to take sociological, psychological and related context into account. Smith and Haims (2001) have revealed that stress arises in the process of interaction between a person and a work environment that threatens the individuals physical and psychological. Physical illness and psychological disorders increase when pressure at work increases. Stress causes problems to the muscular system and circulation thus, increasing risk of myocardial infarction which is well documented psychosomatic studies.

Hackman and Oldham (1980) highlight the constructs of quality of work life in relation to the interaction between work environment and personal needs. The work environment that is able to fill employees' personal needs is considered to provide a positive interaction effect, which will lead to an excellent quality of work life. They emphasized that the personal needs are satisfied when rewards from the organization, such as compensation, promotion, recognition and development meet their expectations. Eberle (1990) described that, the elements that are relevant to an individual's quality of work life include the task, the physical work environment, social environment within the organization, administrative system and relationship between life on and off the job.

A Stephen, D Dhanapal (2011), "Quality of Work life and its impact on Organisational Excellence in Small Scale Industrial units: Employees perceptiveness" The present study attempts to analyse the employer's perception on QWL in small scale Industrial units.

Harish K, Subashini K (2014), "Quality of Work Life in Indian Industries – A Case Study" The study includes satisfaction of worker depends on adequate provident benefits and supportive financial benefit.

**Sirgy et al. (2001) suggested that the key factors in quality of working life are**

1. Need satisfaction based on job requirements,
2. Need satisfaction based on work environment,
3. Need satisfaction based on supervisory behaviour,
4. Need satisfaction based on ancillary programmes,
5. Organisational commitment.

Muftah (2011) mentioned that Quality of Work life (QWL) was one of the key areas of human resource management that is attracting attention and research focus. It was a philosophy that considers people as the most important resources in the organization and views them as an "asset" to the organization rather than as "cost". Hence, if organizations are concerned about developing their human resources and

gaining competitive advantage in market place, it seems necessary that they attend to one of their most precious assets, namely, their human resources by employing high quality working life experience in consonance their various needs eliciting favourable job-relate reposes in return (Chsdranshu Sinha,2012)

**Research Methodology**

The main objective of this study is to investigate and identify the significance of work environment towards the performance and also to study the effectiveness of the Quality of Work life in the organization. In order to meet the stated objectives a structured questionnaire was framed and data was collected using convenience sampling from 246 employees of the Chemical Industries in Cuddalore, and to study the significant association chi-square was used by the researcher.

**ANALYSIS AND FINDINGS**

- **Null Hypothesis (Ho):** There is no association between Age and Satisfaction level of Work Environment and job Security
- **Alternate Hypothesis (H1):** There is association between Age and Satisfaction level of Work Environment and job Security

**Table No: 1 Showing the Chi- Square test for Association between Age and satisfaction on Work Environment and job Security (No. of respondents and the row percentages)**

Age	Satisfaction level of Work Environment and job Security					Total	Chi-square Value	P-Value
	Highly Satisfied	Satisfied	Neutral	Dissatisfied	Highly Dissatisfied			
< 20	28(70%)	10(25%)	12(30%)	14(35%)	16(40%)	80	40.94a	.000*
21-30	14(46.6%)	20(66.6%)	16(53.2%)	6(20%)	4(13.2%)	60		
31-40	38(88.36%)	26(60.4%)	8(18.6%)	10(23.2%)	4(9.2%)	86		
41-50	6(75%)	4(50%)	2(25%)	4(50%)	0(0%)	16		
> 50	1(50%)	0(0%)	0(0%)	1(50%)	0(0%)	4		
<b>Total</b>	88	60	38	36	24	246		

**Table :1 Figure:1**

The Table:1 analyses the relationship between Age and satisfaction of the employees Work Environment and job Security of the organisation. It is inferred that out of 246 respondents the respondents falling under the age group of < 20 and 21 – 30 and 31-40 are highly satisfied with 70%,66.6%, and 88.26% on the health and safety conditions of the organisation when compared to employees falling in the category of 41-50 and >50. The chi square value is 40.540. The calculated P value is less than 0.10%. Hence the null hypothesis is rejected at significant level of 10%, and we accept the alternative hypothesis and it says there is association between age and satisfaction of employees on Work Environment and job Security measures in the organisation, it is also clear that people who are falling in the category of less than 40 years of age are either satisfied or highly satisfied with the Work Environment and job Security of the company than the employees falling under the category of 41 and above. Hence from the table it is inferred that there is association between Age and satisfaction of Work Environment and job Security in the organisation.

- **Null Hypothesis (Ho):** There is no association between training programmes and No. of years of experience.

- **Alternate Hypothesis (H1):** There is no association between training programmes and No. of years of experience.

**Table No: 2 Showing the Chi- Square test for Association between training programmes and No of years of experience. (No. of respondents and the row percentages)**

No. of Years of experience	Satisfaction level of training programmes					Total	Chi-square Value	P-Value
	Highly Satisfied	Satisfied	Neutral	Dissatisfied	Highly Dissatisfied			
< 1yr	8(53.2%)	8(26.6)	8(53.3%)	2(13.6%)	0(0%)	30	81.88a	.000*
1-2 yrs	26(82%)	2(3.4%)	26(46.4%)	24(60.6%)	4(7%)	112		
2-3 yrs	4(16.6%)	8(33.2%)	28(116.6%)	6(25%)	2(8.2%)	48		
3 -4 yrs	12(66.6%)	8(44.4%)	6(46%)	6(33.2%)	4(22.2%)	36		
>4 yrs	8(80%)	8(80%)	0(0%)	4(40%)	0(0%)	20		
<b>Total</b>	78	30	76	52	10	246		

The Table: 2 analyses the relationship between years of experience and satisfaction of training programmes. It is inferred that out of 246 respondents 82% of the respondents with less than 2 years of experience feel that they are highly satisfied with training programmes conducted by organisation

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whereas 116.6% of the respondents falling in the category of 2-3 years' experience feels that the training programme conducted in their organisation is neutral and 22.2% of the respondents falling in the category of 3-4 years feels that they are not satisfied with the training programmes conducted in their organisation. The chi square value is 81.11.

### **Organization Reward System**

- Design and Maintenance of Group and inter group relationship
- Managerial Practice and
- Internal and external strategies for change

Improved performance leads to improved quality of work life. Moreover, result revealed that quality of work life toward workers development like training of the employees, workers union, participation in decision making variables, management should come forward to meet worker's demand that they have positive impact on firm performance. The over all, performance of an organisation depends completely on the performance of its people, in spite of the organisation's size, purpose or other characteristics. Based on the discussion of the literature review, prior studies have established the relationship between QWL and performance. Quality of work life programs should be linked with such affective outcomes such as increased job satisfaction, improved employee performance to the extent that they develop employee participation in management, and involvement and responsibility of their work. Studies have also shown that there is an association between personality and job satisfaction and that there are many different personality factors which is correlated with job satisfaction. Again, broad research has proven that job fulfilment does not occur in standoffishness, as it is dependent on organizational variables such as structure, size, pay, working conditions, motivation and leadership style, which create the organizational culture & climate in the study of the Quality of Work Life mean to develop enhance and proper utilize human resource effectively, to improve Quality and Quantity of products, productivity, services and minimize the cost of production. Per unit of output and to satisfy basic needs, self-esteem of the workers psychological needs, their participation, and conceding in job, etc.,

### **CONCLUSION**

QWL of the employees of this Chemical Industries can be improved by conducting some more training classes and provide good work environment for the employees who are falling in the category of more than 3 to 4 years of experience and >4 years of experience which would boost their self-confidence, job performance and help them attain their level of satisfaction. Similarly, the organization can give some more security (financial and non-financial, job security) to the employees falling in the category of 41 and above so that they feel quite secure in the hand of organization and they can give their supremacy performance. We must understand that half of our daily life is spent at work places and work life has become an integral part of our total life. Making work place happier has to be not only obligatory part of HR role but it is to be carried out by the HR functionaries with the same passion, spirit, enthusiasm, commitment and energy so management should make sure that all the employees working in their organization are happily working leading to good QWL which will boost up their performance to come happily daily to their work place.

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# Automatic Helmet Detection and ID card Detection for Motorcyclist

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## ABSTRACT

*Motorcycle accidents have been increasing enormously through out the countries across the years. Helmet is one of the most important equipment for the bike raiders. If a bike raider is driving without a helmet the chance occurring accidents are more. This Paper gives an explanation about motorcycles detection along with the helmets.*

**Key Words:** Machine Learning, Bike Detection, Helmet Detection.

## I. INTRODUCTION

Machine Learning is a field of Computer Science that permits computer to gain the information without being unequivocally customized. Regulated learning is a sub field of machine learning that needs the information needed to learn. Information will be Marked by the humans and also by using some framework. During Preparation procedure, calculation attempts to discover the connections between yield and the feeded input. Once, the preparation gets completed, framework can be utilized by different strategies with the help of administered learning calculations. Helmet is one of the safety precautions that need to be taken while raiding Motorcycle. In lot of situations causing of accidents are due to lack of wearing helmets for motorcyclists. In many countries helmet is the must and should equipment while raiding a motorcycle. The Government is also imposing some charges on the motorcyclists to those who are not wearing helmets. When a survey is conducted in USA, its reported in 2014 that nearly 15% of the fatally injured motorcyclists are not wearing helmets. Some countries having restrictions on the helmet types to wear and in some other countries both raider and pillion raider should be wearing the helmet. The count of accidents without helmet has gradually increased to 42% as of 2018 survey.

Keeping on the count of Motorcycles that exists in society, the intelligent traffic system has become popular, that includes bike detection, human with helmet detection and tracking. Separation of motorcycles from the image can be seen as the first step to detect the motorcyclists helmet use. The vehicle tracking needs the complete processing.

## II. LITERATURE SURVEY

**Creators:-**Stemy Simon, DivyaKumaran A.

**Paper:-** Detection of Motorcyclists without cap and fine installment utilizing open cv.

The cap is the primary security gear of motorcyclists, yet numerous drivers don't utilize it. The principle point of this undertaking is to build a programmed identification of the motorcyclist without head protector from video utilizing OpenCV library apparatuses. In the event that they are not wearing the protective cap, the tag of the cruiser is centered consequently. By utilizing Computer Vision strategy we can distinguish and perceive the tag number. We make the preparation set of various characters of various sizes.

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## EXISTING SYSTEM AND DRAWBACKS

In the Existing System, the manual Photographs of number plates are taken by the Traffic Police Department. It is an Outdated approach. Existing systems involve more number of humans which is not a good process to get high sustainability. The approaching we are following is Cost effective. The errors made by humans are more. The major limitation of the this existing system is it uses the full frame to find exactly where the helmet gets located which is very expensive and it also gets deviated with similar other products which are that of helmet.

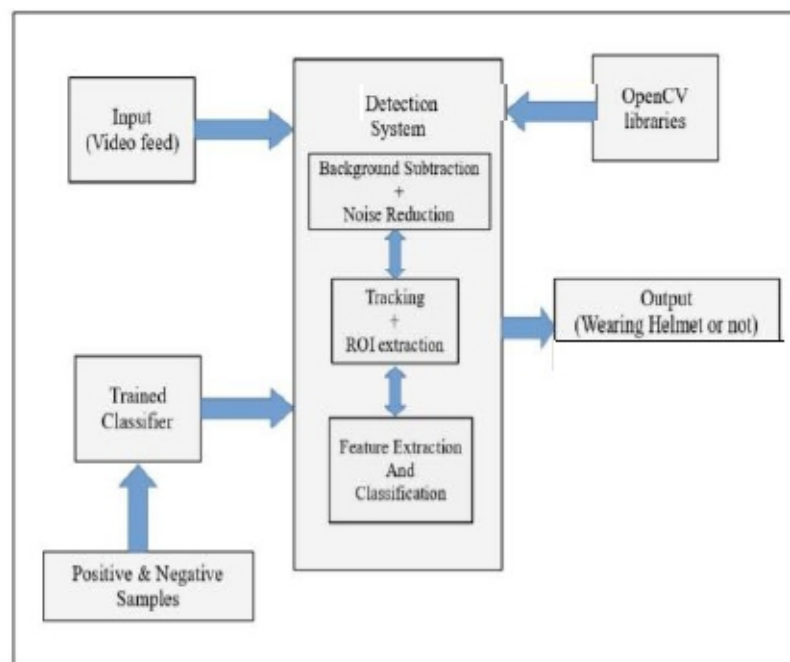
## PROPOSED SYSTEM

In the approach we proposed it initially detects the bike from the video and convert the video into images using FPS (Frames per second). The classification is further made based on algorithmic techniques. In the proposed framework, adaptive background is applied at the initial stages for subtraction to detect the moving objects. These moving objects are given as input to a CNN classifier. The fetched output is classified into two sub groups, namely man with protective helmets and without protective helmets. In the next step the images with motorcyclists are forwarded to next process by discarding the remaining objects in the given image. By this we can easily determine the person with protective caps.

Accept that the head is situated in the upper piece of the approaching pictures and subsequently find the head into top one fourth piece of pictures. The found leader of the motorcyclist is then given as contribution to second CNN which is prepared to arrange with head protector versus without-head protectors. It is accurate and time saving process. The algorithm used in this process is YOLO algorithm. YOLO is a clever convolution neural network for doing object detection in the real time environmental situations. The motorcyclists with and without helmets are placed in a separate individual folders.

## III. SYSTEM ANALYSIS

### SYSTEM ARCHITECTURE



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## SYSTEM REQUIREMENTS

### Hardware requirements:

RAM : Min 4 GB

Hard Drive : Min 100 GB

### Software requirements:

Disk Operating System : Ubuntu

IDE : Ubuntu Compiler

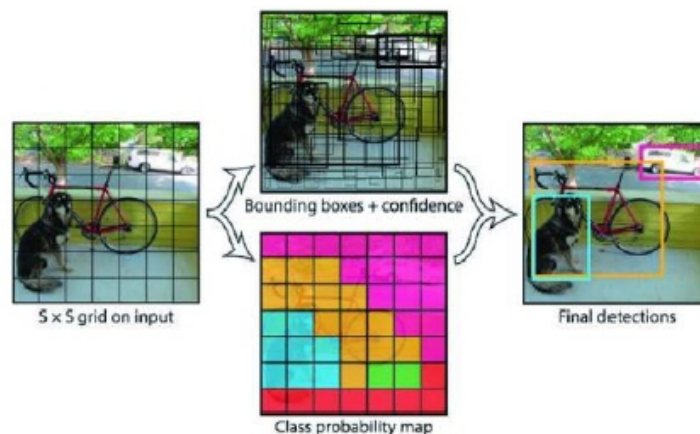
## IV. IMPLEMENTATION

### IMPLEMENTING ALGORITHM

YOLO, is the one of the quickest way to deal with locating the objects. The work that is made earlier on object detection makes the classifiers to perform on the locations. Rather, we indicate the object recognition as a irrelatable issue to bouncing boxes which are spatially isolated and the probabilities on the class can be related. A strong and vigirous neural system predicts on the jumping boxes and class probabilities of the class legitimately from full sized photograph in a single classification methodology. Since the overall pipeline of discovery is strong, it tends to be streamlined ennd-toend legitimately on identification execution. THis bound together engineering is amazingly high speeded. This high speeded based YOLO model procedures progressively at forty-five edges Per second. A small rendition of the computer, rapid YOLOalgoriyhm makes an astonishing one fifty five casings at a single instance of the time, as yet that achieves the twofold the map of other ongoing locatorsclassified by the clqassifiers.

By making use of the best frameworks of class locations, YOLO makes the mistakes confinemently , however it is defined to be the less decreqased to foresee frauddiscoveries where the data is not available to make the classification process. At last, YOLO learns extremely portraying the collecting articles in a broad way. It out plays all the remaining location techniques, including D-PM and R-CNN, by a wide remaining data while concluding up from normal photographs to fine art on the People Art Dataset present in the yolo itself.

The YOLO Detection System. It basic and clear to prepare the pictures with the algorithmic procedure of yolo. Our structurized feature resizes the whole photograph containing the information to  $448 \times 448$  sized frame, runs a Strong convolucional organize on the photograph, and limits the identification of sub sequential data by the model's certainty Principle. Classifier for that protest and evaluates the photograph at different areas of scope and scales in a test photograph.



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## V. EXPERIMENTAL RESULT



**Images of persons with and without helmet**



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## Images of persons without helmet classified by using YOLO Algorithm



**Number Plate Extraction Motorcyclist without Helmet**



**Image of Motorcyclist with Helmet**

### VI. CHALLENGES

YOLO forces the one of the strong constraints of spatial that is can contain a sinle class and able to predict only two of the boxes. This can limit the objectsthat are found near our model that can be predicted. The major constraint about object forsee is to Multiple the aspect ratios with the spatial scales that may be appeared in wide range of scales. The annotated data that is found can be categorized into ansubstancial hurdle for data. Considering an image filled with lot of background data, the data may get eliminated when classifying the background subtraction process.

### VII. CONCLUSION

We present YOLO, a model that is bound together for detecting the object location. Our Model is able to analyse the whole picture and can be constructed easily. Yolo is not similar to that of remaining classifiers , this makes the classification of the picture much easier and identification of misfortune work can be detected easily and Yolo is quickest among the classifiers for producing the output by making the execution faster. This creates a new venture for the projects that are interested in availing the faster execution, Enourmous Collection of the data and discovery in the vigerous item. The data can be analyzed vin a quicker fashion that leads to the faster execution of the vigerous amount of data and a reliable amount of data can be predicted.

### FUTURE ENHANCEMENT

The Helmet detection for Motorcyclists can be enhanced in the future in different kinds of ways such as:-

- Future work includes increasing the accuracy of detecting helmet in an video using FPS
- Number plate extraction and send a ticket to the appropriate person.

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# Developing an Android Application for Emergency Mail Sender

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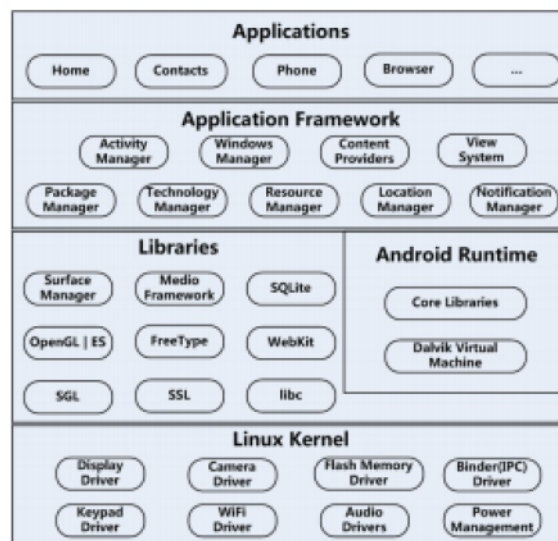
## ABSTRACT

*In not many of the organizations we don't have authorization to take mobiles to inside the workplaces. Around then in the event that we get any significant and crisis calls or messages, we don't have choice to see that data till we return to portable. Barely any occasions by not endeavoring calls/Messages for extended periods we may need to confront scarcely any issues later on. To keep away from this we are concocting an application where we can coordinate the versatile with SMTP email framework so representative/client will get the notice of email or SMS to their email customer which is introduced at his/her work stations. This application can be utilized in MNC's or association where mobiles are not permitted in the work place. Henceforth this application will be utilized to give missed calls, messages updates to the mail of individual worker. In this application we can get the approaching messages and missed call info each 5 min and we mail that data to a specific mail id.*

**Keywords:** Android system, Content Provider, SMTP, SMS;

## 1. INTRODUCTION

This paper Emergency Mail Sender helps in employers in MNC's or organization whose mobiles[1] shall not be carried in to the work place. Therefore this application can be used to give missed calls, messages updates to the mail of respective employee. Generally we can go through the messages & missed calls information in mobiles[2] only but we don't have any alternative like mail them to a desired mail id. Through this paper, we get notified by the incoming missed calls and messages[3] in very short time frequently and can get a mail about that information to a particular mail id. Architecture of android in Figure.1 shows different layers such as kernel of Linux, its Libraries, Framework of Application, Android Runtime applications [4]. Application layer is the top most layer where it is the home for so many applications like SMS Program, email client, Browser, Maps, Contacts, etc..



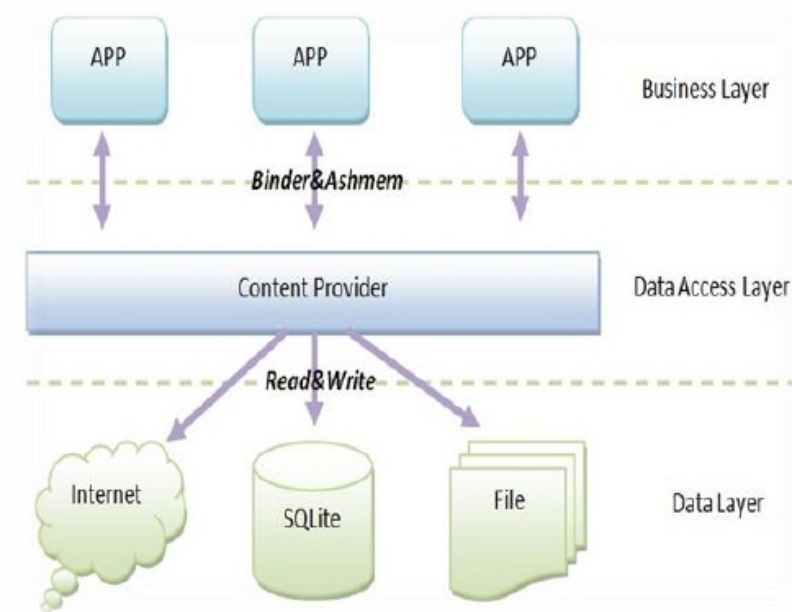
**Figure.1 Architecture of android**

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## 2. WORK FLOW

- i. To retrieve the missed call log making use of background services
- i.i Missed Call / Message Collector



**Figure.2.1 Module Diagram**

The various functionalities of app's such as missed call or unread messages[5] gets temporarily stored in the Content Provider until and unless the user get through it. Then after a certain time the information gets forwarded through internet to the specified email-id given by the user. As soon as the user goes through it, the information gets stored in the database[6] called SQLite.

- ii. Gathering the incoming messages information
- ii.i Content Providers:

A content provider provides access to a central repository of data.

**A content provider gives data in two ways:**

**a. File data:** Data which is in the form of files i.e., audio, photos, videos.

**b. Structured data:** Data which is stored in to the database, array, or similar format.

iii. Mailing the Information.

we coordinate the versatile with SMTP email framework so representative/client[7] will get the notice of email or SMS to their email customer which is introduced at his/her workstations. The Real email framework comprises of two distinct servers running on the fundamental email server machine. One is known as the SMTP Server[8] (Simple mail move convention) which handles active mail and the other is POP3 Server (Post Office Protocol) which assumes the liability of approaching mail. The SMTP server tunes in on notable port number 25, while POP3 tunes in on port 110.



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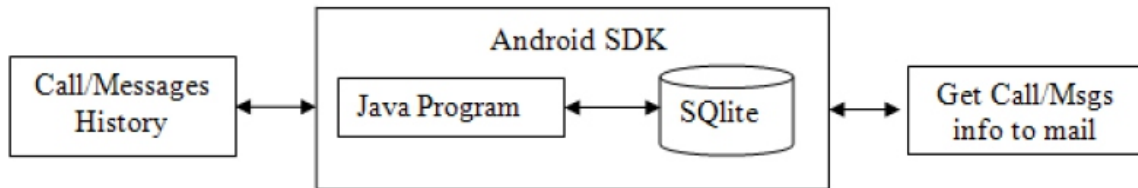
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## IV. CONFIGURATIONS SETTING MODULE

In this module, the user need to provide the input for the fields such as email-id, configuration time, from -time and to-time and should select the week days ,etc. in order to get the information alerts to the specified mail id[9].

### 3. Architecture of Emergency mail sender

Architecture diagram shows the design of the system where important functions or parts are represented by smaller partitions which are connected with lines that show the relationships between the partitions. The block diagram is very much used for a less detailed description, higher level which is aimed for more understanding of the overall concepts and less at understanding the details of implementation.



**Figure.3 Architecture for Call/Messages Forwarding**

This android app behaves like an interface between user and the mobile which actually consists of a database called as SQLite that comes along with Android SDK and SQLite doesn't need other installation. SQLite is the database that is used to store and retrieve information. Here is an application that is implemented in java and therefore all its features are portable, platform independent, data hiding etc.

## 4. METHODOLOGY

SQLite can be used in most of the SQL-92 standard for SQL but it has some drawbacks. A standalone program called sqlite3 can be used to create different databases, defines different tables within it, inserts and changes rows, runs queries and manages an SQLite database files. It is a good choice for local/client SQL storage within the rich internet application framework[10] and within the web browser.

It is different from client-server systems which manage the database, the SQLite engine is not only a standalone process with which the application program communicates. Instead, the SQLite library is connected within it and therefore becoming an integral part of the application program. The libraries can be used dynamically. The application program makes use of SQLite's functionality using simple function calls, which reduces efficiency in accessing the database as function calls within the single process that are more efficient than inter-process communication(IPC).

Well, it's been more accurate to say that it is an efficient Android application & should be fast.. That means, it must get executed as fast as possible in any of the mobile device with its limited data storage, smaller screen , computing power and constrained battery life.

As your application is developed, it may work well in your emulator, running on your dual-core development computer, but may not work properly in our mobile devices — even the most powerful mobile devices couldn't match the capabilities of a typical desktop system. Due to these reasons, efficient code should be written to make it the best possible performance on different mobile devices.

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Efficient code means to write code efficiently, avoiding programming and certain language idioms, keeping memory allocations to a minimum can make performance degradation. In object-oriented point of view, most of this work takes place on the order of actual lines of code, loops, and at the method level, so on.

The Implementation period of the framework manages the interpretation of the plan determinations into the source code. A definitive objective of the usage is to compose the source code and the inside documentation with the goal that it tends to be checked without any problem. The code and documentation ought to be written in a way that facilitates troubleshooting, testing and modifications. Framework flowcharts, test run on bundles, test yield and so on as a major aspect of the usage. An exertion was made to fulfill the accompanying objectives all together determined.

- Minimization of Hard-Coding.
- Minimizing Response Time.
- Simplicity & Clarity of the Code.

We need OS which can be LINUX, Mac and Windows XP, etc., Android SDK 1.5 or later, Java, Eclipse Ganymede IDE, Sample code is given in Table.1 which implements missed call service using java.

➤ **Miss Service.java :**

```
public class MissService extends Service {  
  
    SQLiteDatabasemydb;  
  
    String today;  
  
    DbhandlermyDbhelper;  
  
    String todaytime,fromtime,totime,t,callno,callname,emailid,dfromtime,dtotime;  
  
    intactive,crt,frt,tot;  
  
    String dayOfTheWeek,curtime,msg,ft,tt,ct;  
  
    public void onCreate() {  
  
        final Calender ca = Calender.getInstance();  
  
        intmHour = ca.get(Calender.HOUR_OF_DAY);  
  
        intmMinute = ca.get(Calender.MINUTE);  
  
        StringBuilder s1=new String Builder().append(pad(mHour)).append(":").append(pad(mMinute  
todaytime=(String )s1.toString();  
  
        super.onCreate();  
  
    }  
}
```

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## 5. RESULT

- Start Up Screen



Figure.4 Startup Screen

- This Screen informs user how to use the app. After reading this click on Start App button.

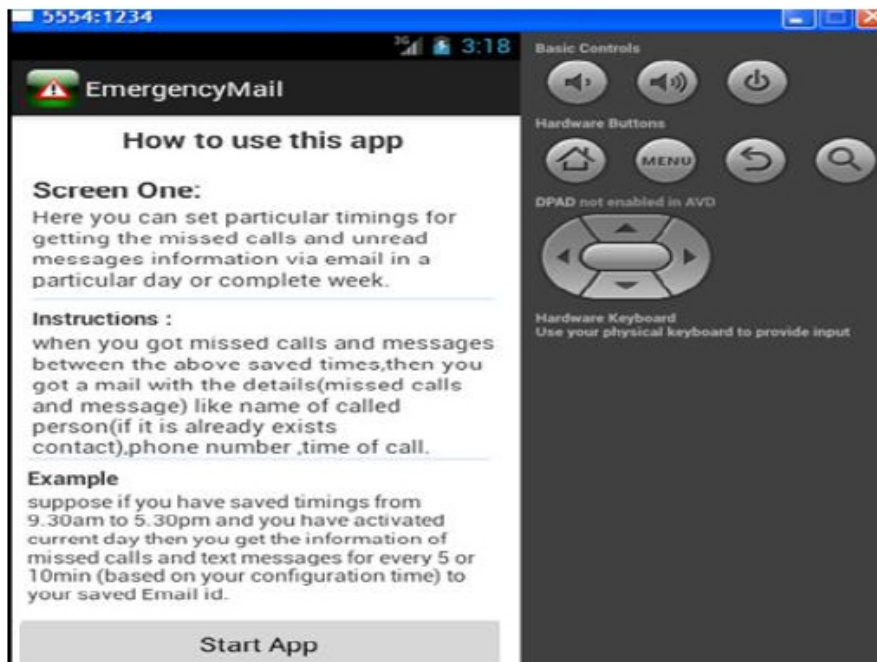
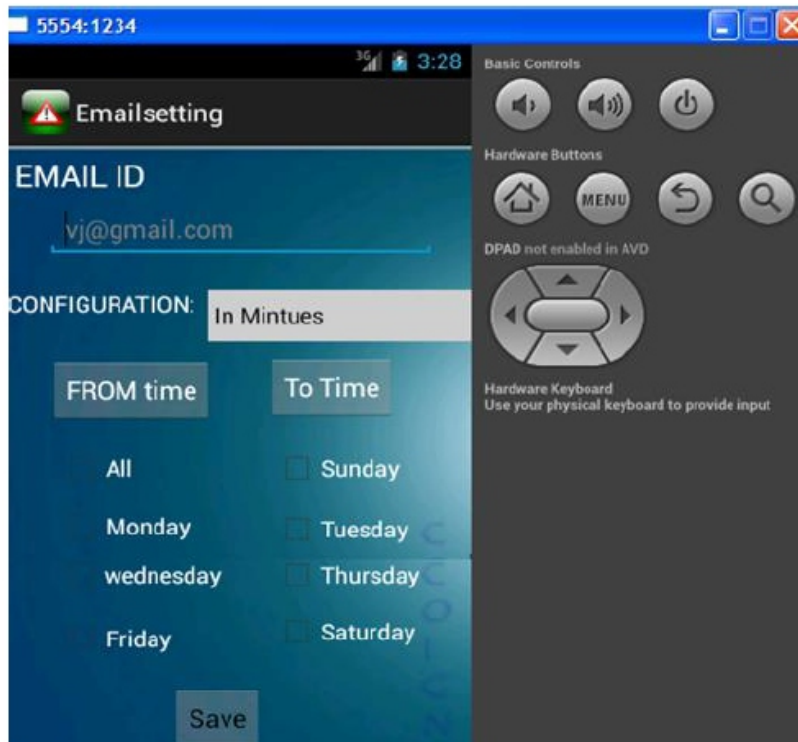


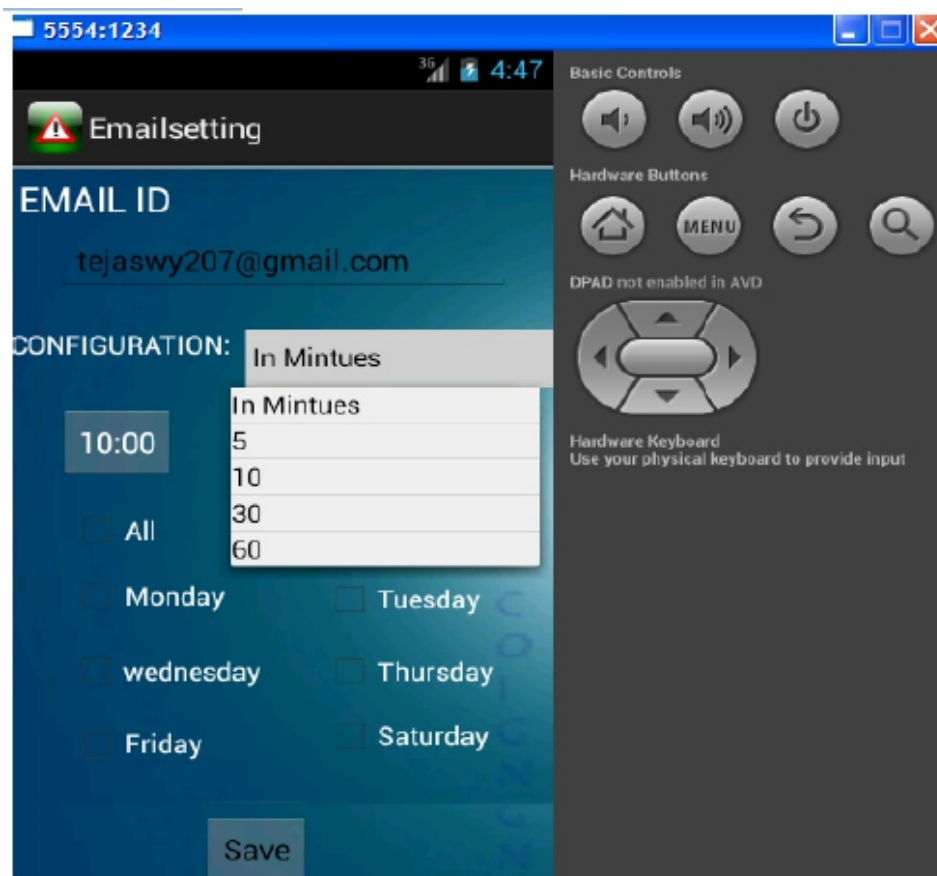
Figure.5 SCREEN 2

- Enter the details in the screen such as Gmail id of the user, from time, to time.



**Figure.6 SCREEN 3**

- Choose the Configuration (minutes) in spinner i.e., after how many minutes do you want to get alerts to the mail.



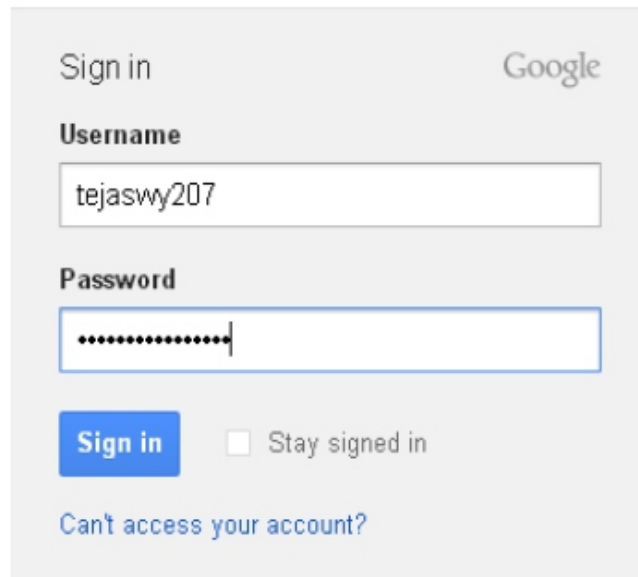
**Figure.7 Configurations Screen**

- Select the week days i.e., during which days you want to get the alerts to the mail.



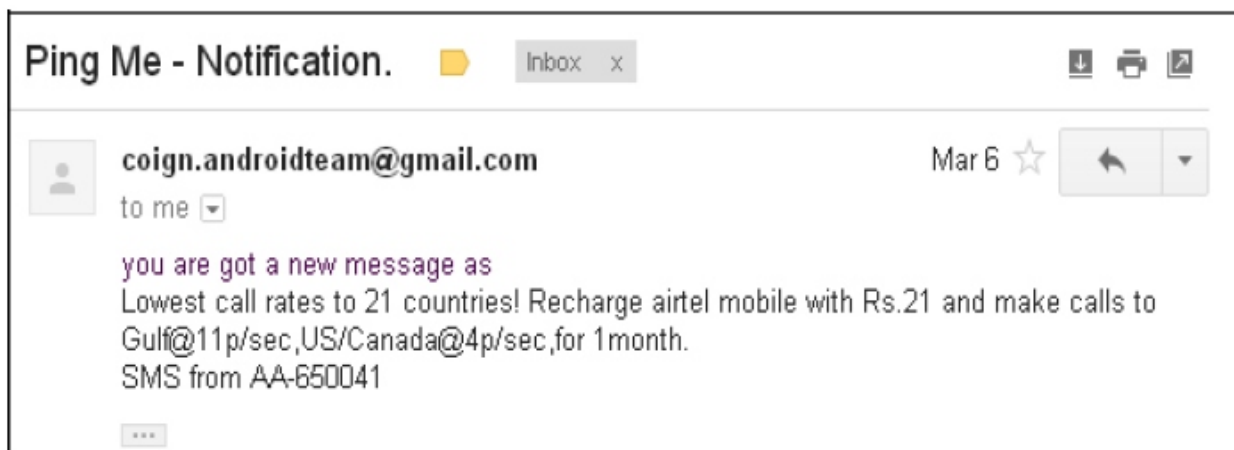
**Figure.8 SCREEN 5**

- After entering all the details click on the save button.
- Now sign in to your given mail id.



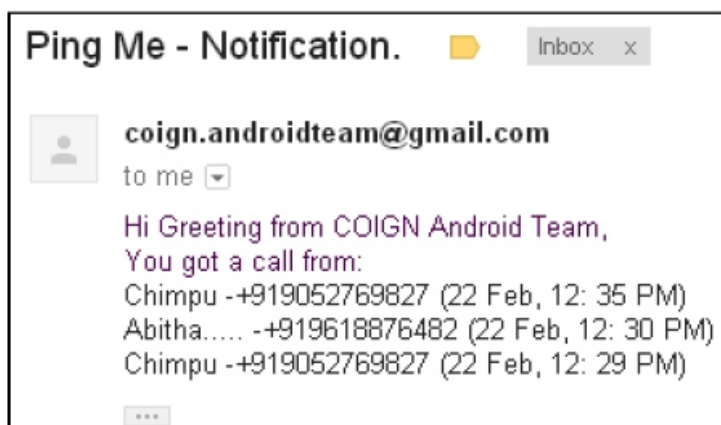
**Figure.9 SCREEN 7**

- Check your alerts.



**Figure.10 Mail Notification(SCREEN 8)**

- A missed Call alert to mail is as follows.



**Figure.11 SCREEN 9**

## 6. CONCLUSION

An Electronic mail system need to integrate SMTP email framework with our mobile devices, so that the employers or worker/clients can fetch the notifications of messages & missed calls information to their mails within their organizations. Apps can be installed in android mobiles by making use of Android Software Development Kit. It is a tool that is on top of android platforms. When compared to existing system, this is more advantageous as single mobile device is enough for the application to get deployed. one can easily retrieve required information as this is a mobile application. Users can search required books whenever user wants to without waiting for some system. Therefore, this is the application which is efficient, easy to use and convenient. User satisfaction is important factor for any developer. Therefore, this paper makes so many users satisfy.

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# An Overview of the Growth of Nationalism in the Colonial Societies of Assam

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## ABSTRACT

*Assam, the north eastern part of the British colony, has experienced the growth of nationalism due to the flames of Indian freedom movement. People started to agitate against the colonial rule because of the exploitative economic policies. The seeds of revolution were sown by the personalities like Maniram Dewan, Mohesh Chandra Baurah alias Peali Baruah, Bahadur Gaonburha, Sheikh Formud Ali, Rupahi Aideo, Lumboi Aideo, Dutiram Baruah and Madhu Mullick. The entry of the peasantry class into the revolutionary struggle has paved the way of political involvement of Assam into the larger field of freedom movement. Later on, the elements of culture and language influenced the nature of nationalism in the context of Assam. The nature of Assam agitation assumed a formal character with the formation of Assam Association and its merger with the Assam Provincial Congress Committee in the year 1921. With the inclusion of the political aspect the trend has got a new impetus in the direction of national liberation which is evidential in several incidents. Mass involvement in the process of liberation is a prominent feature of the nationalist agenda of this period.*

**Keywords:** *Exploitative, revolutionary, agitation, inclusion.*

## OBJECTIVES:

1. To study the prevailing conditions of women in the societies of Assam during colonial period.
2. To examine the process of nation-building in the societies of colonial Assam.

## RESEARCH QUESTIONS:

1. What is the condition of women in the societies of Assam during colonial era?
2. How does the process of nation-building develop in the societies of colonial Assam?

## INTRODUCTION:

For being a constituent unit of the larger territory of India that was under the colonial rule of British for a period of almost 200 years, Assam has also experienced the growth of nationalist sentiments in the native land as a result of the liberation movement staged against the British imperialist power. People of the native land fought hard to attain independence from the domination of a foreign rule or any kind of external control so that they could breathe in free air. Formation of an Assamese middle class during colonial era is influenced by the spread of western values through the medium of education. Mentioning the name of this class here is important as in the period of national struggle several members belonging to this class of Assamese population had played a crucial role in awakening as well as organizing the rest of the population in the line of a mass movement. Initially the people of Assam welcomed the British annexure as it had relieved them from the Burmese atrocities. But with the gradual exposure of colonial exploitative rule especially through economic encroachment, along with the spread of nationalist ideology across the societies, people of Assam started to agitate against the policies and actions of the British rule in their native land. The revolutionary seeds were sown by the revolt of 1857 in which

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agitation against British rule in Assam was expressed by a group of people namely Maniram Dewan, Mohesh Chandra Baurah alias Peali Baruah, Bahadur Gaonburha, Sheikh Formud Ali, Rupahi Aideo, Lumboi Aideo, Dutiram Baruah and Madhu Mullick. After the revolt of 1857 that shook the economic stability of colonial power, they introduced new economic policies in several parts of the colonial country including Assam which further generated discontentment among the natives of the land and it gradually helped in the development of nationalist sentiments and activities in Colonial Assam. The outbreak of Phulaguri uprising in the year 1861 followed by the other uprisings during 1893-94 in places like Rangia, Pati-Darrang, Nalbari, Barama, Patharughat and others have marked the entry of peasantry class in Assam into the freedom struggle. Chandana Goswami in her book Nationalism in Assam writes, "The Peasant revolts imbibed into the minds of the people the ideas of nationalism, and proved to be the dress-rehearsal for the future movement for independence." These peasantry agitations in Assam against exploitative economic policies of colonial rule had unleashed the path of its political engagement in the larger nationalist discourse of colonial India. In between these years of popular protests, some other developments were taking place in the social as well as administrative spheres of Assam which has added the elements of culture and language to the agenda of Assamese nationalism such as making of Bengali as the official language since 1837 to 1873, import of Adivasis, Bengali bureaucrats, clerks, doctors and others. To deal with such negative implications upon the issue of identity another movement on literary ground was parallelly launched by Anandaram Dhekial Phukan (1829-59), Hemchandra Baruah (1835-96), Gunabhiram Baruah (1837-94) and Anandaram Baruah (1850-91). This tradition of literary renaissance of Assam was later on carried forward by Chandrakumar Agarwala (1867-1938), Lakshminath Bezbaruah (1868-1938), Hemchandra Goswami (1872-1928), Kamalakanta Bhattacharyya (1854-1936), Satyanath Borah (1860-1925), Rajanikanta Bordoloi (1867-1939), Padmanath Gohain Baruah (1871-1946), Benudhar Rajkhowa (1872-1956), Ambikagiri Raichoudhury (1885-1967) and Sailadhar Rajkhowa (1890-1968). The political consciousness and collaboration of Assam with the rest parts for the cause of national emancipation began with the formation of Jorhat Sarbojanik Sabha in the year 1884 under the particular assistance of Jagannath Barooah. The other notable organizations of that contemporary era were the Tezpur Ryot, the Shillong Association, the Nagaon Ryot Sabha, the Upper Assam Association, the Sylhet Association and the Habiganj People's Association. These associations maintained connections with Indian National Congress by sending their delegates to the sessions of Congress namely Devicharan Baruah, Gopinath Bordoloi, Kalikanta Barkakati, Satyanath Bora, Bipin Chandra Pal, Kamini Kumar Chanda, Radhanath Changkakati, Lakshmikanta Barkakati, Ghanashyam Baruah, Harendranarayan Singh Chowdhury, Haridas Roy, Manik Chandra Barooah, Meghnath Banerjee, Durganath Roy, Bholanath Baruah, Lakshminath Bezbaruah, Hariprasad Nath, Chandrakamal Bezbaruah, Bhabani Kanta, Sundarimohan Das and Ramani Mohan Das. Due to the close association of various enlightened minds of then Assam with INC and its activities, "Assam Association" was formed in the year 1903 and its several sessions were conducted in the places of Dibrugarh(1905), Dhubri(1907), Jorhat(1914), Sibsagar(1915), Guwahati(1916), Dibrugarh(1917), Goalpara(1918) and Tezpur(1920). Since its inception till its merger with the Assam Provincial Congress Committee in the year 1921, the association took up several issues and programmes, among them the issue of Opium consumption was worth mentioning, through which it extended its support to the nationalist agenda for the liberation purpose. The nationalist zeal in then Assam addressed by this association not only influenced and encouraged a particular section of the society rather everyone who can related oneself with this very cause of liberation participated deliberately in the various activities organized by or under the banner of this association. Subsiding their initial difference on the principle of Non-cooperation which was uphold at the Calcutta Session of Indian National Congress (1920), Nabin Chandra Bordoloi and some others later on joined hands with

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Chand Sarma, Tarunram Phukon and Tapeswar Sarma to increase people's consciousness towards the principle with the help of Assam Association. As pointed out by Sagar Baruah in his book "Bharator Swadhinota Sangramat Assamor Abodan" (Assam's Contribution in India's Freedom Struggle) the session of Assam Association that took place at Tezpur in the year 1920 deserves a special mention in the direction of putting a step ahead of Assam towards adopting the principle of Non-Cooperation. With the formation of Assam Provincial Congress Committee and its various branches at the local levels across Assam a new era started in the region for the people who got a chance to encounter themselves with the policies of Indian National Congress for liberation. Arrival of Gandhi at Assam further encouraged the nationalist spirits of the people of the native land and they joined the movement with great enthusiasm by performing activities like picketing, no use of foreign goods, widespread use of khadi and other traditional ways of self-sustained economy, strikes by labour community and so on. Though the Non-cooperation movement of 1920s was ended in failure yet the people of Assam didn't lose their confidence in the principles of the movement as advocated by Mahatma Gandhi and INC and extended their support towards the anti-Simon Commission move of Congress. As noted by Sagar Baruah, Tarunram Phukon (1877-1939) in his presidential speech of the session of Assam Student Association (17-18 October, 1928) stated the formation of Simon Commission as humiliating and dishonouring for India. According to government sources, After the Lahor session of the Congress in the year 1929 which have decided to launch the Civil Disobedience movement on the demand of Swaraj or Complete Independence, dissatisfaction as well as difference of opinion arose among some of the members of Assam Provincial Congress Committee as a result of which people like Tarunram Phukon, Nabin Chandra Bordoloi, Rohini Kumar Choudhury and others debarred themselves from the activities of the Congress. The Assam Provincial Committee of Congress got a new impetus under the leadership of Bishnuram Medhi. Along with Medhi, the revolutionary spirits of the young generation of the native land namely Hemchandra Baruah, Amiyo Kumar Das, Siddhinath Sarma, Lakshidhar Bora, Kanak Chandra Sarma, Haladhar Bhuyan, Dodhiram Bhuyan and Ratneshwar Sarma who undertook several activities across Assam in support of the Civil Disobedience Movement. But unlike the nature of Civil Disobedience in other parts of undivided British India, the movement in Assam took a renewal shape of the earlier non-cooperation movement as discussed by Baruah depending on the statement of Mohamad Toibullah who urged Congress to continue their struggle largely against opium consumption, consumption of other alcohol, use of foreign goods etc. due to their inability to adopt the plan of Salt satyagrah. Amidst such circumstances, to debar the involvement of student force of Assam from the independence movement, in the face of their growing engagement in the nationalist activities throughout the early decades of twentieth century, the then Director of Public instruction, J.R. Cunningham, issued a circular known as The Cunningham Circular in the year 1930. But this seemed a mere failure and the student force expressed more enthusiasm towards the cause of freedom movement. According to government sources, till the year 1932, Police has arrested 1494 revolutionaries from Assam but as per the records of Congress almost 1700 people were arrested during the movement of 1932 which includes Chandraprabha Saikiani, Ghanachandra Goswami, Purnachandra Sarma, Hemchandra Baruah, Mahendra Mohan Choudhury, Kamalabala Kakati, Kanaklata Kakati, Laksheswari Bhuyan, Hem Kakati(Bhuyan), Puinyo Kakati, Bina Das(Hazarika), Kalpana Hazarika, Malati Koch, Hemlata Dutta, Kanaklata Dutta and others. In the year 1934 Gandhiji, after launching a new reform movement for removing untouchability from the societies and to develop the conditions of the Harijan, went to Assam when he visited Dhuburi, Rangia, Tezpur, Barpeta, Guwahati, Nagaon, Jorhat, Golaghat, Sivsagar, Dibrugarh and Tinsukia which has helped in the restoration of nationalist sentiments among the people of Assam. The period of post-Government of India Act 1935 has witnessed the electoral struggle of the leaders actively involved in the liberation movement of that time like

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Tarunram Phukon, Rohini Kumar Choudhury and Fakaruddin Ali. This period can be regarded as the dawn phase of regionalism in Assam as the political leadership of Assam under Gopinath Bordoloi focused upon the genuine problems of the region and was in favour of taking decisions for securing the interests of the people of Assam. The nationalist sentiment got its height among the people of Assam along with the other regions in the final war of country's independence during 1940s. Among the various strategies of the movement the prominent ones were picketing, self-rule through the formation of Santi Sena, Mitru Bahini, conduction of processions, boycotting government institutes and employment, 'no-tax' mission, Satyagraha and others. Sagar Baruah quoted the writings of Harendranath Baruah where he mentioned the name of Gopinath Bordoloi as the first Satyagrahi of Assam. The fire staged by Satyagraha gradually spread across all the places of Assam such as Guwahati, Tezpur, Mangaldoi, Barpeta, Goalpara, Dhubri, Nagaon, Jorhat, Sibsagar, Dibrugarh, North-Lakhimpur and others. Through this mean of Satyagraha an attempt was made to maintain the flow of popular movement set up by the national liberation struggle. The flow of nationalist sentiments among the people of Assam continues and even took a sharp turn during the mass base movement of 1942. People of Assam openly protested against the colonial government as directed by the leadership of Congress especially Mahatma Gandhi who along with several others were arrested by the British government. In order to achieve the goal of independence people of Assam came out with a larger support base who have adopted various plans of action in line with the earlier movement for national liberation. Some of these newly added plans of action are like mass based processions, hosting of national flags at several places under government control especially at the police stations, formation of santi bahini, some early initiatives for self rule, observation of independence day and others along with the earlier ones namely Satyagraha, picketing, no use of foreign goods and no tax. Apart from these non-violent means, people with revolutionary minds have formed Mirtyu Bahini and Gupta Bahini to adopt extremist measures of bombing railway stations and displacement of railway tracts, of destructing telegraph and telephone facilities to create communication troubles to colonial forces. They have also imparted trainings to the people of the land so that they could save themselves from the atrocities of foreign military force. Many lives were lost in this struggle for independence namely Kushal Kuwar, Numoli Nath, Khohuli Nath, Kanaklata, Madan Barman, Rauta Das (Kachari), Kalai Kuch, Hemram Bora, Hemram Pator, Gunaviram Bordoloi, Tilak Deka, Bhugeswari Phukononi, Thogiram Sut, Boliram Sut, Lakshminath Hazarika, Manabar Nath, Moni Kachari, Ratan Kachari, Somnath Sutia and so on. The list of martyrs depicts an all inclusive picture of nationalism in Assam, apart from the arising tendency of linguistic nationalism, during that phase of colonial rule where people of the land fought against colonial rule without any reference to the class, caste, gender and religion based discrimination. But soon this picture gets gloomy due to the emergence of crucial elements of language, religion and gender. Just before India attained independence, some elements of sectarianism have entered into the land of Assam to scratch the unity of its people so that Assam's merger with Bengal initially and later on with Pakistan would be possible. Such an attack on the identity of the Assam province was overthrown by the nationalist leaders of the Assam Provincial Committee of Congress with their strong and precise stand against the Grouping System where Assam was included with the Bengal. Thus, the nationalist agenda of Assam during the colonial period not only stood against the encroachment of the British Empire in the land but also stood firmly against any form of sectarian or separatist force that put a threat to the unique identity of the land.

#### **CONCLUDING OBSERVATION:**

From the above analysis, it is observed that the seeds of nationalist sentiment were developed in the colonial Assam primarily as an economic outrage against the exploitative policies of the colonial power.

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Active involvement of the peasantry class into the revolutionary wave has further helped in the growth of nationalism in the minds of the people of the native land. Gradually, the impression of language and culture were felt on the growth of nationalism in the context of Assam. Vibrant presence of personalities like Devicharan Baruah, Gopinath Bordoloi, Kalikanta Barkakati, Satyanath Bora, Bipin Chandra Pal, Kamini Kumar Chanda, Radhanath Changkakati, Lakshmikanta Barkakati, Ghanashyam Baruah, Harendranarayan Singh Chowdhury, Haridas Roy, Manik Chandra Barooah, Meghnath Banerjee, Durganath Roy, Bholanath Baruah, Lakshminath Bezbaruah, Hariprasad Nath, Chandrakamal Bezbaruah, Bhabani Kanta, Nabin Chandra Bordoloi, Chand Sarma, Tarunram Phukon, Tapeshwar Sarma and others have marked a great impact upon the people of Assam. Political engagement of the region with the larger discourse of nationalism took place after the formation of the Assam Association and its merger with the Assam Provincial Congress Committee in the year 1921. The student force of the region also played a vital role in the national freedom movement in spite of several restrictions imposed upon them by the ruling authority. Several joint ventures were adopted by the people of the region belonging to different categories who were bound together with the nationalist sentiments so that their prime goal of independence should be fulfilled. While discussing this issue of nationalism the contributions made by the great personalities like Gopinath Bordoloi, Tarunram Phukon, Lakshminath Bezbaruah, Anandaram Dhekial Phukan, Hemchandra Baruah, Gunabhram Baruah, Anandaram Baruah, Chandrakumar Agarwala, Hemchandra Goswami, Kamalakanta Bhattacharyya, Satyanath Borah, Rajanikanta Bordoloi, Padmanath Gohain Baruah, Benudhar Rajkhowa, Ambikagiri Raichoudhury and others are worth mentioning. Therefore, one can say that the scenario that prevailed during the colonial era in Assam has helped to curb the spread of separatist agenda in the region apart from fighting against the colonial power.

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# Precise and Robust Iris Segmentation in Specular Noisy Iris Images for Iris Biometrics

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## ABSTRACT

*Precise and Accurate segmentation of iris itself is the major challenge encountered in the process of successful implementation of iris recognition system. Number of researchers invented numerous methods to segregate the iris portion from the captured image but noises like occlusions, eyelids and specular reflections are throwing challenges in the extraction of iris part from the eye image. Most of the algorithms used in segmentation of iris are based on edge information. Here in this proposal, we are bidding an automated iterative active contour model on the database provided by CASIA- Iris-1000, for the segmentation of the iris portion. Proposed segmentation algorithm resulted 99.6% accuracy in segregating the iris on the challenging CASIA\_Iris\_1000.*

**Keywords:** *Pupil detection, Limbiac detection, Specular reflection removal, Iterative intensity threshold with circularity estimation, Distance adaptive illumination compensation inpainting technique.*

## 1. INTRODUCTION

Spread of digital technology in every sector of life made human survival a cinchy task for many transactions in communications, travelling, navigation, transport, technology, business, and commerce. But negative shade of technology accentuates the need of security in its utilization as the technological growth paved way to the unethical hacking and duplication of originals. In this scenario fake ID is the most exigent problems threatening society, creating troubles in the activities like cyber crime, terror attacks, and forgery in property documents. To avoid these malfunctions and fake IDs, automated personal identification systems using biometrics came into existence overcoming the drawbacks of traditional identification systems based on cards or passwords like. Structures like freckles, filaments, stripes, pupil controlling muscles, crypts, pigment frills, radial furrows, collarette etc. gives greater randomness and rich visible features to the iris pattern. Because of these randomly distributed microstructures, the iris pattern becomes unique and makes the pattern. Variability to a very high degree among different individuals. Ease of mathematical modeling, stability in pattern and high reliability makes iris recognition one of the popular biometrics for personal authentication and identification. An automatic segmentation algorithm to isolate the iris portion from the eye images taken from the CASIA database[2,31] is presented in this paper and compares accuracy with other prominent algorithms. The human eye is an organ with a complex system for the development of human vision and a spherical form with a radius of around 1.3 cm [1,30]. Basically, the eye structure can be broken down into three layers. 1. outer layer, consisting of multilayered cornea and limbus-connected sclera, choroid, ciliary body and iris are the 2.middle layer. The 3rd inner layer is the retina, which is light sensitive and transforms light. The apparent iris is an area of zigzag collarette between the ciliary and pupillary areas. The thickest area in the iris where the muscles of the sphincter and dilator overlap each other is Collarette. In the visible

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eye, the darkest portion is the pupil, an opening that controls the amount of light entering the retina. In brightly lit situations, when circular sphincter muscles are drawn towards the middle, the pupil is constricted and the amount of light entering the retinal region is decreased. It becomes dilatic in dimly lit conditions as radial dilator muscles pull away from the middle, dilate the pupil and try to allow full light into the retina, as shown in figure 3.

The idea of using iris for identifying human was proposed by Flom and Safer in the paper published in the year 1957. when human eye is captured by the camera most of the time it is not possible to focus the iris part only. Normally eyelids, eyebrows and some part of nose and forehead will become the part of the acquired image. When iris is the only part that can be utilized for identification purpose, other areas like eyelids and eyebrows will become unwanted data and are required to be removed. Iris recognition system is mainly composed of four divisions, image acquisition, segregation of iris, extraction of features and matching. In these modules, the success rate of iris recognition highly depends on the accuracy of segregation of iris part for the acquired image. In this way segmentation of iris region is of prime interest. In literature Daugman's integro differential operator and wilde's circular haugh transform algorithms are highly popular in extracting the iris region from the acquired image. Mean while W. Boles, B. Boashash [4,7], W. K Kong and D. Zhang [3,8], Li Ma, et.al. [5,9] also gave some of the best algorithms in the domain of iris segmentation.

For Hough transform the data requirement is very high and at the same time it takes number of iterations to find the circular regions. Since for locating pupil boundary and iris boundary the same transform is used, the requirement of computations become hazardous and results in reduction of speed in real time applications. One more disadvantage is the requirement of threshold settings. Hough transform requires threshold values to be set for edge detection which sometimes may skip the edge points resulting in failure to detect circular edges. Many of the approaches involve pre-setting edge detection thresholds that minimize the robustness of changes in image strength. S suggested an automatic threshold for binarizing and assessing the pupil center on the histogram. P. Narote and A. From S. Narote, L. M. Waghmare [6,14] on the CASSIA V1 database, where the pupil area is processed and the database was processed to remove specular reflections. Here we propose some iris segmentation algorithms from the eye image, which are responsible for determining the pupillary boundary, limbiac boundary and removing unwanted data. The different phases required for iris segmentation are shown in the flow chart shown in Figure 1.

## **2. PROPOSED SEGMENTATION APPROACH**

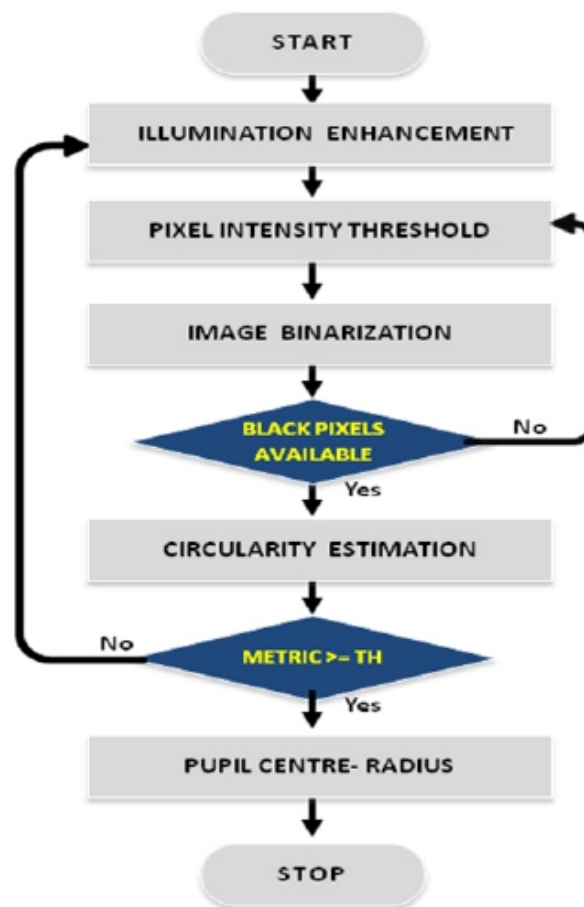
When the experiment is put on large database, sophisticated procedures may yield erroneous results if proper care is not taken. To make the system robust, the procedures and assumptions that are considered should be highly acceptable and simple to implement. In case of eye images where the pictures are captured for the men and women who were wearing contact lenses or spectacle glasses, the implementation of regular procedures may fail to give accurate results [10,11]. A non parametric fast approach algorithm is proposed for automatic segmentation of the iris from the given eye image by defining the pupil and limbus boundaries as circular or nearly circular i.e elliptical to some extent[12,13]. To extract the iris region which is lying between pupil and sclera, basically it is required to determine the pupillary and limbiac boundaries which are inner and outer borders of the iris [18,19].

Here a novel Iterative Intensity Threshold with Circularity Estimation (IITCE) procedure is proposed to mark pupillary boundary and Active Contour Weighted Post Mean Substitution (ACWPMS) method to



approximate limbiac boundary [15,20]. Inside the whole eye image pupil region will be the darkest part and the gray level of this region will be very low and hence easy to extract the region space based on gray level intensity of existing pixels rather than using complicated procedures. But when images are captured from the camera, the intensity levels will not be uniformly spread across the image and at the same time gray level values of pixels of same eye will differ from image to image as they were captured under different illumination conditions. It creates problem in defining fixed threshold in the extraction of pupil region for the entire database images. In this regard enhancing the population of dark pixels in the pupil region and getting it detected with adaptive threshold is one of the solutions to segregate the pupil. To avoid the constraints on the intensities of the images, the image is darkened in steps to increase the pupil pixel population.

LED light used to illuminate eye, to capture the image also creates problem in detecting the pupil, as it will not spread light uniformly and the focus is mainly on iris region. The illumination will diminish as it moves away from the iris region to the corners. making the corners of the image much darker when compared to the centre region of the image. These dark pixels at corners are big obstacles as noise, in the separation of the pupil region from the image. Sometimes, gray levels of pixels defining the pupil region befall to be non uniform as their intensities vary in a random way because of specular reflections of light source. This creates a need to poise the pixel intensity levels of this region to be uniform, to make up the complete shape of the pupil. Here the proposed segmentation module is divided into three sub sections are preprocessing, Pupil detection and Limbiac detection.



**Figure 1. Pupil detection algorithm as a flow chart**

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## 2.1. Preprocessing

The fundamental assignment of preprocessing is to prepare the iris image into suitable form for segmentation of iris. Current days, for various reasons, lot of people are wearing spectacles which are compiling a great deal of specular reflection into the imaging and making segmentation task even more complicated. In this stage, denoising, detection and removal of specular reflections and intensity balancing of image pixels are some of the tasks to be carried.

### 2.1.1. Specular Reflection Removal

CASIA database contains specular reflections in and around the periphery of pupil region because of the LED light illumination, which baffles the segmentation of pupil region. Painting is one of the methods used to morph these reflections with the information available from the neighborhood pixels. The main intension of the proposed approach is not to reconstruct the image information at the positions of pixels, but to substantiate and nullify the effect of this kind of noise for precise segmentation of iris. Specular reflections, which are produced by LED illumination, are nothing but bright spots in the image, scaling gray values towards the white region. Many a time pixel intensity in the specular spot may not be uniform and create problems for the accurate detection of pupil region. Simple thresholding technique can be used to detect specular reflections within the image, considering a pixel as a contributive sector of specular reflection if the intensity of the pixel is greater than some threshold limit (T). In the proposed approach, 80% of maximum value of the brightest pixel in the image is taken as threshold limit to identify the spots of specular reflections.

Since the candidate pixel values are non uniform, the pixels surrounding them may skip away from threshold conditions and remain creating trouble in detecting the pupil. So, it is evident to remove all these pixels by searching in the neighborhood of candidate pixel and nullify their effect. Sometimes the regions or spots in the image which are overexposed to light may also be considered as specular reflections erroneously. So much care is required in discrimination. Let  $I$  be the intensity of pixel  $I(x, y)$  at a location  $(x, y)$ . let  $I_{max}$  be the maximum value of the brightest pixel in the image. In the proposed approach, a mask is generated for identifying specular reflections based on thresholding limit. The threshold limit (T) is computed as 80% of  $I_{max}$  value. If the intensity value of pixel (I) is greater than threshold value (T), the pixel is considered as a specular reflection.

Once specular reflections are identified, they were put for treatment individually based on their location in the image. Primarily, the intensities of candidate pixels and their neighborhood pixels are reduced to 30% of their individual values. In the second stage, the intensity values of the candidate pixel along with its eight neighborhoods are substituted with the average value of the group of pixels defined by a square block of size  $11 \times 11$  with seed pixel at its centre. The procedure of specular removal with inpainting technique can be notified with the following steps.

- a. Notify the candidate pixels contributing for specular reflections by selecting the pixels whose intensities are less than the threshold value (T).
- b. Label the specular smudges.
- c. Remove large smudges with suitable threshold.
- d. Notify the pixel locations of candidate pixels in the input image and prepare the mask.
- e. Reduce the intensity of the candidate pixel by subtracting 70 % of its own value.
- f. Pick eight neighborhood pixels around the candidate pixel and repeat the procedure.
- g. Repeat the above procedure for all the candidate pixels of the generated mask.
- h. Replace the values of all individual pixels in the mask with mean of their neighborhood block of size  $11 \times 11$ .

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### 2.1.2. Image Intensity Balance

For the databases like Casia Iris Thousand, Casia Iris Lamp, the illumination is not evenly distributed throughout the image where the corners of the image are darker to its central region. A radial operator is proposed to balance this difference of illumination, which scans the image in circular manner from the centre of the image and increases the intensity of pixels in reasonable steps. Two parameters that are required to start the operation are Coordinates of centre of the image and Intensity quotient by which illumination to be enhanced. Computation of centre coordinates of an image can be done simply by dividing the rows and columns of the image. i.e  $x\_center = rows / 2$ ;  $y\_center = columns / 2$ . Intensity quotient by which each pixel on radial circle to be incremented is computed by dividing the difference of mean of outer region to centre region, with number of radial lines from centre to extreme boundary of image. The circular region with radius equal to half of the height of the image will be considered as inner region and the remaining area is considered as outer region.

$$I = \frac{(m_i - m_o)}{n} \quad (1)$$

Where, I Intensity quotient  $m_i$  and  $m_o$  are the average intensity values of inner and outer regions. 'n' is the number of radial lines.

#### Algorithm:

- a. Compute the centre of the image  $c(x,y)$ .
- b. Compute the intensity quotient I by using the difference of mean intensities of inner and outer regions.
- c. With  $c(x,y)$  as centre and r as radius, scan the pixels along the circular paths and enhance the pixel intensities by an amount of illumination factor.
- d. Repeat the procedure with increment in radius r, taking values from 1 to n.

### 2.1.3. Denoising

Noise is one which may affect the segmentation process a lot as it may destroy the right informative pixels in the image. So, removal of noise from the eye image is must to attain good precision in iris segmentation. For denoising, a two-dimensional adaptive median filter which identifies the impulses by calculating the difference between the standard deviation of the pixels inside the filter window with the particular candidate pixel is applied.

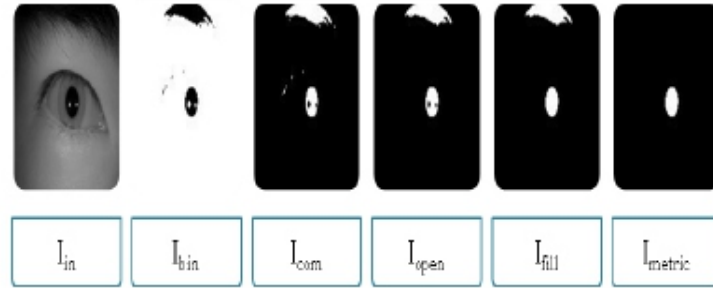
### 2.2. Pupil detection

Iterative Intensity Threshold with Circularity Estimation (IITCE) is a two-layer iterative method used to achieve fast and effective segmentation of pupil by reducing the search area along with iterative intensity thresholding and circularity estimation of dark pixel cloud of pupil.

#### Algorithm:

- a. Input the preprocessed eye image  $I_{in}$ . Rescale the image to reduce mathematical complexity and time.
- b. Measure the intensity of image based on their mean value.
- c. Binarize the image based on pixel intensity threshold.
- d. Check for the cluster of dark pixels, contributing for pupil region.
- e. If they exist sufficiently, check for circularity otherwise increase the pixel intensity threshold, in steps, put for binarization of the image and continue to find it from step 3.

If the cluster of pupil pixels was found, and if the metric for circularity is within the threshold limit, accept it as pupil else change the illumination of image and continue from step 2. Once the pupil region was defined, find the centre and radius of pupil down scaling: First image is resized to one eighth of its original size, to obtain low resolution image over which pupil is approximated and can be refined back on to high resolution images later, thus significantly increasing segmentation speed and minimizing computational mathematics. Probing of region of interest: A circular contour is framed around the iris in such a way that iris area lies within the contour space. i.e., the iris region should be within the contour space so that the search area to detect pupil will be minimized.



**Figure 2. Sequence of operations in pupil detection**

### 2.2.1. Binarization

The input image is converted into binary image with a given threshold so that the pixels whose intensities lie below the threshold will be made 0 and all the remaining pixels to 255 of gray value. After binarization the image is complimented to form  $I_{com}$ . Finding connected components: Applying some morphological operations, small noisy pixel blocks are removed to form image  $I_{open}$ . By using dilation and erosion operations on  $I_{open}$ , noise inside the components is removed and image  $I_{fill}$  is generated.

Estimation of compactness: Once the image  $I_{fill}$  is generated, the connected components in the image are labeled. Every component that is labeled will be tested for its compactness. Compactness Metric (CM) is defined to measure the circularity of the object with the equation

$$CM = \frac{4A\pi}{(P)^2} \quad (2)$$

Where, A is the area and P is the perimeter of the individual component.  $CM=1$ , defines unit metric. Unit metric defines full circularity to the object and measure towards zero defines deterioration in objects' circularity. Since not all the pupils are circular in nature, metric threshold is decreased gradually in steps for defined object in measuring its circularity and for the reasonable threshold condition the candidate pupil region is determined automatically.

### 2.2.2. Detection of pupil centre

Once the pupil region is extracted from the input image, now it is required to find the centre and radius of the pupil to define pupillary boundary. This can be computed by averaging coordinates of two end points of largest number of pixels of pupil region both in horizontal and vertical directions.

- a. Count the number of white pixels in each row and column of the detected pupil image.
- b. Determine row and column numbers, corresponding to maximum count of white pixels
- c. Find the coordinates of end pixels, corresponding to these row and columns.
- d. Intersection of lines made by joining these pixels in vertical and horizontal directions will depict the centre of pupil  $(x_c, y_c)$ .

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### Defining pupillary boundary:

Knowing the coordinates of the centre of the pupil, the radius of pupil region can be obtained as follows. Sum the pixel values of the binarized image in x and y directions to generate x-vector and y-vector

- a. Replace the nonzero values of x-vector and y-vector with 1s.
- b. Sum the x-vector and divide it by 2 to determine the radius (rp)

Once the radius (rp) of the pupil region is determined, a circle is defined around (xc, yc) with rp as radius, to segment the pupil region and at the same time defining it's boundary also.

### 2.2.3. Pupil segmentation in the presence of Glass Specular Reflection

Iris segmentation in the presence of Glass specular reflection is one of the trickiest problems for which the industry is searching for solutions. For iris segmentation or analysis, specular reflections which are produced because of light illumination adapted for capturing iris images at the time of image acquisition or from environ light reflections are big obstacles. When the images are captured from the persons wearing spectacles, the reflections from the glasses from various illuminating sources in nearby vicinity produces not only noisy bright spots on the image but also affects iris pattern gradation. If the reflection spots are concentrated around the pupil and iris regions, it becomes hazardous to segment the iris region and extract the features.

So here, Distance Adaptive Illumination Compensation Impainting Technique (DAICIT) was proposed to counter the problem mentioned above so that segmentation of pupil and iris can be carried effectively.

#### Algorithm:

- a. Binarize the image with suitable threshold to haul out the brightly illuminated regions.
- b. Supposing,  $X_k$  as the  $k^{\text{th}}$  block of the detected specular smudges in the binarized iris image, mine the largest luminous hunk  $X_1$  from the remaining with suitable morphological operations.
- c. Determine the centroid ( $x_c, y_c$ ) of the luminous hunk  $X_1$ .
- d. With the help of spatial centre of pupil ( $x_p, y_p$ ), evaluate the distance, direction and effective spread of impact of this specular hunk on the iris region. The distance  $v_{\text{mag}}$  and direction  $v_{\text{ang}}$  are estimated with magnitude and angle made by the vector framed between the centre of the pupil and centroid of the specular smudge.

$$vmag = \sqrt{(xc - xp)^2 + (yc - yp)^2} \quad (3)$$

$$vang = \tan^{-1} \left( \frac{yc - yp}{xc - xp} \right) \quad (4)$$

The effective angular spread of luminous intensity at iris region from specular hunk is determined by using the distance measure vmag with the following equations

$$\theta_{\text{clock}} = (vang - (360 - vmag) / 2) \quad (5)$$

$$\theta_{\text{anticlock}} = (vang + (360 - vmag) / 2) \quad (6)$$

$$\text{Effective Spread: } \theta_{\text{es}} = \theta_{\text{anticlock}} - \theta_{\text{clock}} \quad (7)$$

5. Now every pixel  $I_1(i, j)$  in the effective spread of iris region is interpolated by mapping it with new value  $I_{\text{new}}(i, j)$ , computed by the equation

$$I_{\text{new}}(i, j) = I_1(i, j) - (k * I_1(i, j) / D) \quad (8)$$

$I_i(i, j)$  - pixel intensity at the  $i^{\text{th}}$  row and  $j^{\text{th}}$  column of iris region.

$I_{\text{new}}(i, j)$  - denote the impainting value of  $I_i(i, j)$ .

$k$ - Scaling factor

$D$ - The distance between the individual pixels to centroid of specular smudge.

The second parameter  $(k * I_i(i, j) / D)$  reduces the original pixel intensity by some reasonable percentage to balance the intensity from the added brightness by specular hunk. This parameter is directly proportional to the intensity of the existing pixel and inversely proportional to the distance from the specular smudge. So, the percentage reduction in pixel intensity is well balanced as the spread of brightness varies with distance and the distance adapted here is independent for individual pixel.

### 2.3. Limbiac detection

After defining the pupillary boundary, it is requisite now to estimate outer limbiac boundary, for the extraction of the iris region. Unlike pupillary boundary, the detection of limbiac boundary, which separates iris from sclera, is very difficult and sensitive issue, as the transition of gray intensities from iris to sclera is very smooth. So the iris region is alienated into circular clusters around the pupil centre and the pixels of cluster are substituted with the mean of cluster pixels, to make the gray intensities distinguishable between iris and sclera. Most of the time the top and bottom areas of the iris are occluded by eyelashes and eyelids, so the limbiac boundary is estimated from the area covered between the top and the bottom edge points of pupil region along the horizontal direction. An edge detection algorithm using principle of maximum gradient difference between post mean substituted gray levels of succeeding circumferences is used to estimate the outer boundary of iris, i.e. limbiac boundary of iris. Here it is assumed that pupil and iris are circular in shape and share the same centre an integro differential operator is used for this purpose.

$$\max_{(i, xc, yc)} \left| P(r) * \int_{(r, xc, yc)} \frac{I(x, y)}{2\pi r} ds \right| \quad (9)$$

The operator behaves as circular edge detector that searches for maximum contour integral derivative with increasing radius on concentric circles successively. In execution, the contour fitting procedure is discretized, with finite sums serving for integration and finite differences between successive circles serving for derivatives. Maximum of difference of post mean substituted value is used to create maximum gray scale value at the iris-sclera boundary. Fitting contours to images using such optimization formulation, which is a standard machine vision technique is often referred to as active contour modeling. First, the mean of gray values of pixels on virtual circles are computed, by incrementing the radius in steps, from the centre of the pupil and a vector is formed with these mean values,  $m = \{ m_1, m_2, \dots, m_n \}$ . A new vector  $v_{\text{pms}} = \{ v_1, v_2, \dots, v_n \}$  is generated with the present value being replaced with the post mean values of intensities of virtual circles, using the formula

$$V_p = \frac{1}{n} \sum_{k=p}^{p+n} m_k \quad (10)$$

Or

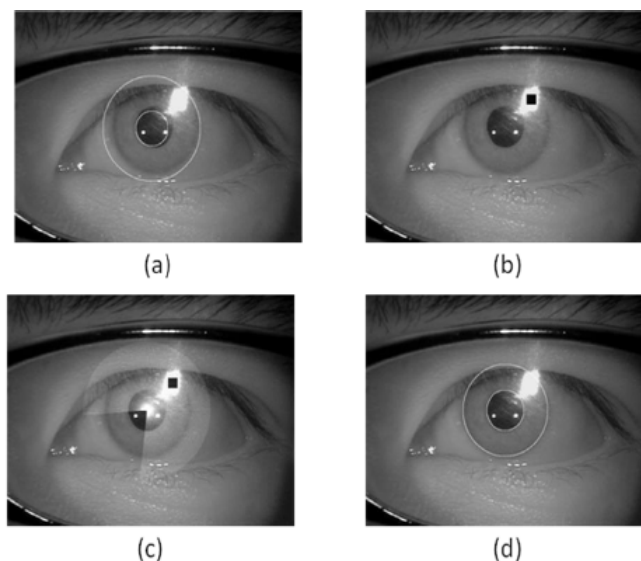
$$v_p = (m_{p+1} + m_{p+2} + m_{p+3} + \dots + m_{p+n}) / n$$

Generate weighed mean vector  $v\_wpms = \{wv_1, wv_2, \dots, wv_n\}$  that holds post mean substituted pixel intensities of the virtual circles multiplied by the weights. The weights that were accommodated were nothing but the positions of the virtual circles from the centre of pupil. The difference vector  $vd\_wpms = \{vd_1, vd_2, \dots, vd_n\}$  is adapted to create the difference between the successive circles in order to project the biggest difference at iris-sclera boundary. Position of maximum value in  $vd\_wpms$  vector, determines the radius of limbiac region. The maximum value endows the maximum blur representing the separation of iris region from sclera, and position of this maximum value represents the radius of limbiac boundary.

Since the sclera gray intensities will be higher than that of iris pixel intensities, the virtual circle at iris-sclera boundary will be bestowed with maximum value, i.e., difference of weighted post mean substitution brings maximum value of blur at transitions of boundaries between sclera and iris. This maximum value of blur above the pupillary region gives the limbiac position and the distance from the centre of the pupil to limbiac position gives the radius of outer iris region. The sweep of sequence to detect limbiac boundary are itemized with the following steps.

- a. Locate the centre  $(x_p, y_p)$  and radius  $(r_p)$  of the pupil using IITCE algorithm.
- b. Isolate horizontal strip covering pupil region.
- c. Create vector  $m = \{m_1, m_2, \dots, m_n\}$  that holds mean pixel intensities of the virtual circles fleeting around the centre of the pupil by using integro differential operator.
- d. Create vector  $v\_pms = \{v_1, v_2, \dots, v_n\}$  that holds post mean substituted pixel intensities of the virtual circles by applying PMS.
- e. Generate vector  $v\_wpms = \{wv_1, wv_2, \dots, wv_n\}$  which holds weighed PMS values.
- f. Generate difference vector  $vd\_wpms = \{vd_1, vd_2, \dots, vd_n\}$  which gives the difference between the successive values of  $v\_wpms$ .
- g. Determine the maximum value and its position in  $vd\_wpms$  vector.
- h. Position of maximum value gives the radius of limbiac boundary.

Once the inner and outer peripheries of iris are determined in the name of pupillary and limbiac boundaries, iris is extracted, by marking all the remaining pixels in the image, to gray value 255 (white) or to gray value 0 (black).



**Figure 3. (a) Iris localization without DAICIT; (b) locating centroid; (c) Defining DAICIT spread; (d) Iris localization with DAICIT.**

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Once iris is segregated and extracted from the eye image, it is carried to normalization process where, each point in the iris region is mapped to a pair of polar coordinates, forming a fixed size unwrapped rectangular iris image

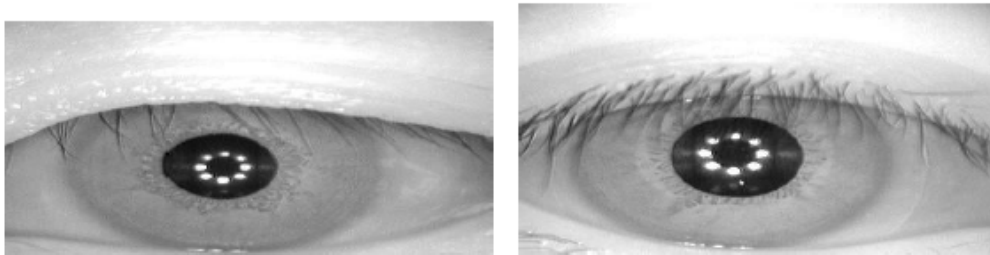
### 3. EXPERIMENTAL RESULTS

#### 3.1. Datasets

In order to promote research on long-range and large-scale iris recognition systems, CASIA released CASIA Iris Image Database V4.0 (CASIA-IrisV4), to the public domain. CASIA-IrisV4 contains a total of 54,601 iris images from more than 1,800 genuine subjects and 1,000 virtual subjects. All iris images are 8 bit gray-level JPEG files, collected under near infrared illumination or synthesized. CASIA\_IrisV4 is an extension of CASIA-IrisV3 and contains six subsets named as CASIA-IrisV3 are CASIA-Iris-Interval, CASIA-Iris-Lamp, and CASIA-Iris-Twins, CASIA-Iris-Distance, CASIA-Iris-Thousand, and CASIA-Iris-Syn. CASIA-Iris-Interval, CASIA-Iris-Lamp, and CASIA\_Iris\_Thousand databases are chosen to evaluate the performance of proposed algorithms.

##### 3.1.1. CASIA Iris Interval

High clarity iris images with resolution 320x280, were captured with close-up iris camera in indoor environment in two sessions.

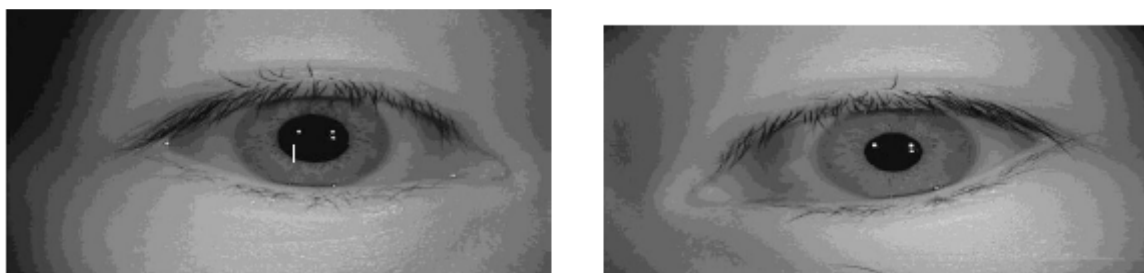


**Figure 4. CASIA-Iris-Interval**

The images are most suitable to study the texture features of iris. The database contains 2639 images of 249 subjects, breeding 395 classes.

##### 3.1.2. CASIA Iris Lamp

One of the most challenging issues in iris recognition is deformation of iris texture with dilation of pupil. Variation of illumination forces the pupil to expand or contract, in turn alters the pattern of iris and makes the recognition of individual, an issue. CASIA-Iris-Lamp produced intra class variation of iris images with dilation of pupil, which is best suited to study the problems of non linear deformation of texture due to variations in illumination.



**Figure 5. CASIA-Iris-Lamp**



Dilation of pupil was customized by turning a lamp on/off, close to the eye using a hand-held iris sensor produced by OKI. CASIA-Iris-Lamp database was fortified with 16,212 iris images of 640x480 resolution, of 411 subjects.

### 3.1.3 CASIA Iris Thousand

CASIA-Iris-Thousand is the first publicly available dataset with more than 1000 subjects containing 20000 images. To the best the database is fortified with 2000 classes, which is best suited for developing iris classification and indexing methods. The fundamental sources posing intra class variations in the database are specular reflections and eye glasses.

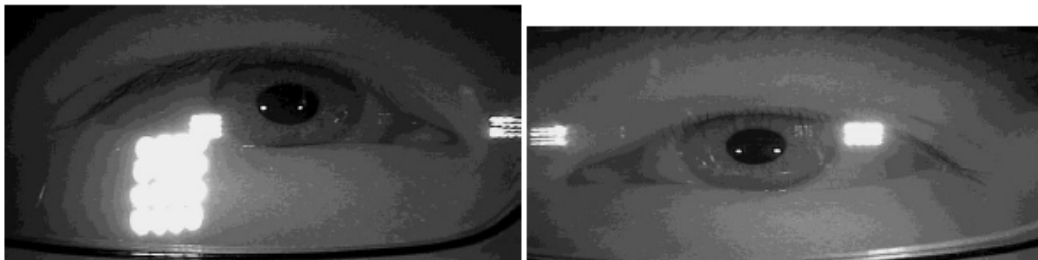


Figure 6. CASIA-Iris-Thousand

The iris images of wide range distribution of ages, with 640x480 resolution, were captured indoor with lamp on/off using Iris King IKEMB-100 camera, which is user friendly dual eye camera provided with bounding boxes in frontal LCD, to adjust the position of eye, in the acquisition of high quality iris images.

### 3.2. Performance Evaluation

The performance of the proposed algorithms for segmentation, feature extraction and recognition in identification of iris are evaluated in this section. CASIA\_Iris\_Interval, CASIA\_Iris\_Lamp, CASIA\_Iris\_Thousand database are used for this purpose.

#### 3.2.1. Evaluation of proposed segmentation model

The mislocalization percentage in segmentation and average localization time required to segment iris form the eye images are evaluated on CASIA-Iris V4 database.

Table 1. Comparison of mislocalization percentage (i) on CASIA\_IrisV4 database (ii) with other existing methods

Mislocalization Percentage – CASIA-Iris V4 - Comparison	
DATABASE	Mislocalization Percentage (%)
CASIA_Iris_Interval	0.26 %
CASIA_Iris_Lamp	0.17 %
CASIA_Iris_Thousand	0.075 %

(i)

Mislocalization Percentage – Comparison with Existing Methods.			
DATABASE	MASEK	MEHROTRA	PROPOSED
CASIA_Iris_Interval	5.23 %	0.45 %	0.26 %

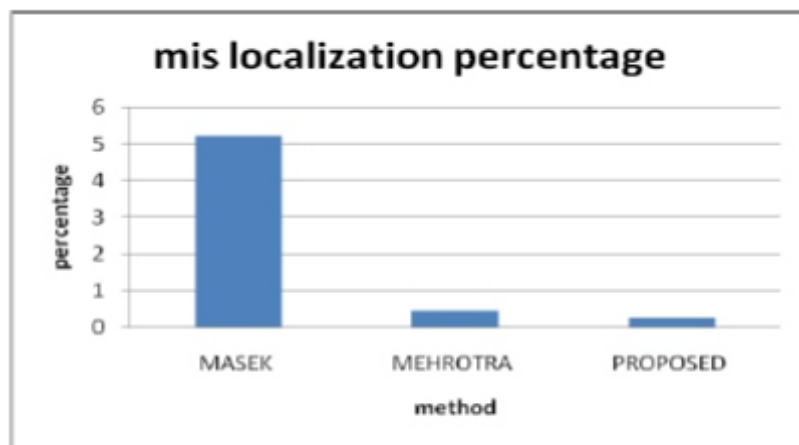
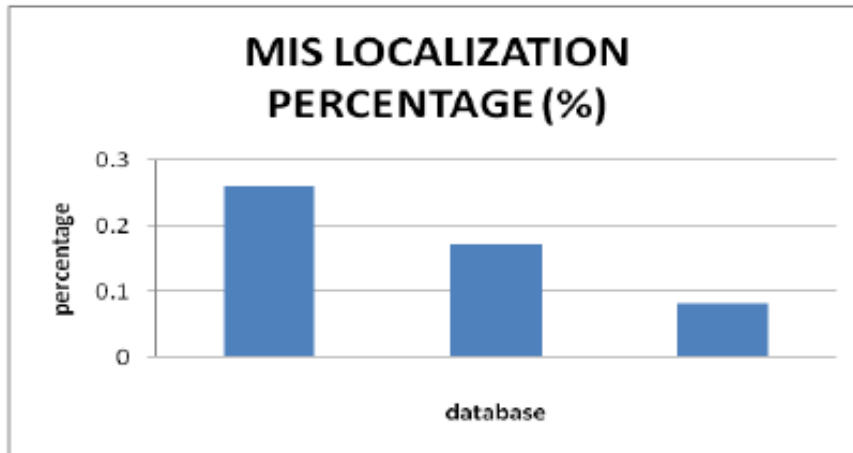


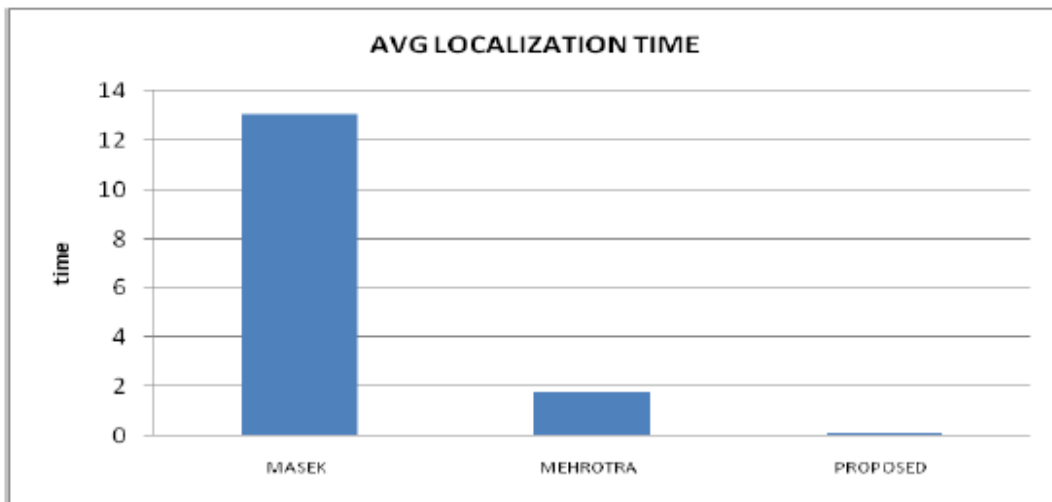
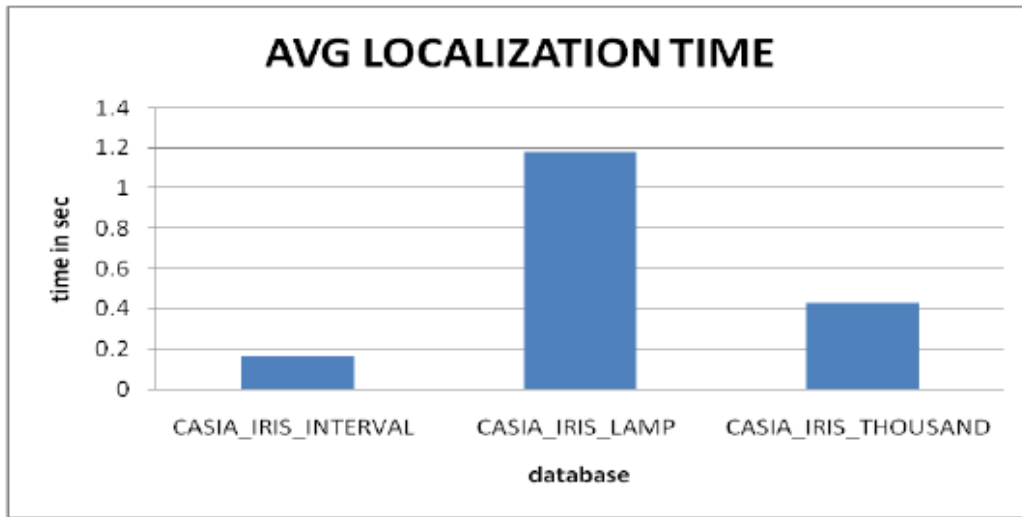
Figure 7. Graphical Representation for comparison of the mislocalization percentage (i) CASIA-IrisV4 database (ii) with existing methods

Table 2. Comparison of average localization time (i) on CASIA-IrisV4 database (ii) with existing methods

Database	Average Localization Time
CASIA-Iris-Interval	0.16 sec
CASIA-Iris-Lamp	1.18 sec
CASIA-Iris-Thousand	0.43 sec

(i)

Average Localization Time- Comparison with Existing Methods.			
DATABASE	MASEK	MEHROTRA	PROPOSED
CASIA_Iris_Interval	13.067 sec	0.396 sec	0.16 sec



**Figure 8. Graphical Representation for comparison of the average localization time (i) CASIA-IrisV4 database (ii) with existing methods**

The results tabulated in table 1 (i) and their graphical representations in figure 7 (i) compares the mislocalization percentage in segmentation of irises on cassia v4 database. The misclassification percentage in segmentation obtained by the proposed technique on Casia-Iris-Interval, Casia-Iris-Lamp and Casia-Iris-Thousand database is 0.26, 0.17 and 0.075 respectively. The results tabulated in table 2 (i) and their graphical representations in figure 8 (i) compares the average localization time of segmentation of irises on CASIA-IrisV4 database. The proposed technique segments CASIA-Iris-Interval, CASIA-Iris-Lamp and CASIA-Iris-Thousand database with time spans of 0.16 sec, 1.18 sec and 0.43 sec respectively.

The results tabulated in table 1(ii) and their graphical representations in figure 7 (ii) compares the performance of segmentation of irises with Masek's bench mark algorithm and Mehrotra's [3] approach. Masek's approach utilizes Circular Hough Transform, to localize both pupil and limbiac boundaries. It works well on localizing pupil boundary to that of limbiac boundary in most of the cases of CASIA-Iris-Interval database. Its performance in localizing iris, fails drastically on low resolution and noisy images. Table 1(ii) elucidates the improvement in mislocalization percentage of 0.26 of proposed approach over 5.23 of Masek's approach and 0.45 of Mehrotra's.

Table 2(ii) shows the average time taken by Masek's approach to segment iris from the image is approximately 13.06 seconds per image. The approach adapted by Mehrotra et al [12], utilizes a non parametric spectrum approach to localize the pupil and circular summation of intensity approach to localize limbiac boundary. The algorithm proposed by Mehrotra segments iris with in 0.396 sec which is much faster to Masek's approach. The proposed algorithm was able to segment the iris with average time of 0.16 sec which excels both the above said approaches.

As said above in introduction, Hough transform needs very large data and number of iterations in finding the circular portions of pupil as well as of iris for large range of radius values. The computations required become very expensive for high resolution images, resulting in reduced speed which is the main drawback of Masek's approach. In case of Mehrotra's approach, though the pupil segmentation approach was novel and innovative, it consumes moderate time for the required processing. Whereas the proposed iterative approach was able to overcome most of the difficulties with the support of preprocessing and weighted post mean substitution approach in the detection of iris region, and performed remarkably both in reducing mislocalization percentage as well as reducing the detection time with reasonable accuracy.

**Table 3. Segmentation performance of proposed technique on noisy images**

Database	Noisy Images	Segmented Correctly	Percentage	Avg Time
CASIA_Iris_Thousand	1000	996	99.6	4.43 sec

The tabulated results in table 3 show the proposed technique's performance on noisy images existing in Casia-Iris-Thousand database. Cassia-Iris-Thousand database contains most noisy images with specular reflection of glasses, challenging the segmentation process. The proposed algorithm is applied on selected thousand images and results are tabulated in table 3. It is found that the proposed algorithm segments the noisy database correctly to the extent of 99.6% and the average time taken per iris to be localized is 4.43 sec.

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