SAVITRIBAI PHULE PUNE UNIVERSITY

A PRELIMINARY PROJECT REPORT ON

BE PROJECT TITLE

SUBMITTED TOWARDS THE
PARTIAL FULFILLMENT OF THE REQUIREMENTS OF

BACHELOR OF ENGINEERING (Computer Engineering)

BY

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DEPARTMENT OF COMPUTER ENGINEERING

CERTIFICATE

This is to certify that the Project Entitled

Face Recognition and Description

Submitted by

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is a bonafide work carried out by Students under the supervision of Prof.Shilpa Pimpalkar and it is submitted towards the partial fulfillment of the requirement of Bachelor of Engineering (Computer Engineering) Project.

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Abstract

Humans have spatial as well as temporal memory. Our visual sensors perceive the data and transmit it over neurons so that we could remember it. Although what we perceive has some memory bound and happen to obliterate over time. We often distinguish a person by his/her features. As our glance projects to human face,we separate people by genders,eyes,expressions,facial muscles etc.A system,thus,can be implemented to recognize people from one another.The image sent to the system is human face and hence driven through series of tests consisting threshold calculation,histogram plotting,error introduction.The Proposed System increases the efficiency to get the information of a human face whose record is already available.The image then compared with the one stored in database and hence described upon the suitable match.Such system with an inclination towards higher accuracy may yeild great opportunities in the field of criminal detection,airport security system,face recognition vaults,attendance system.

Acknowledgments

It gives us great pleasure in presenting the preliminary project report on ***'Face Recognition And Description'****.*

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

I am also grateful to ***Prof. S.N.Zaware****, Head of Computer Engineering Department, AISSMS'S IOIT for her indispensable support, suggestions.*

In the end our special thanks to ***adherent*** *for providing various resources such as laboratory with all needed software platforms, continuous Internet connection, for Our Project.*

Aditya Kulkarni
Sushant Belsare
Sarang Kulkarni
(B.E. Computer Engg.)

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1.2 PROJECT OPTION

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1.3 INTERNAL GUIDE

Prof.Shilpa pimpalkar

1.4 SPONSORSHIP AND EXTERNAL GUIDE

No

1.5 TECHNICAL KEYWORDS (AS PER ACM KEYWORDS)

1. I.Computing Methodology
    (a) I.4 IMAGE PROCESSING AND COMPUTER VISION
        i. I.4.8 Scene Analysis
            A. Color
            B. Depth Cues
            C. Object Recognition
            D. Photometry
            E. Range Data
            F. Shape

1.6 PROBLEM STATEMENT

Formulation of a system for recognition of human face and retrieval of its equivalent description when provided an image as input.

1.7 ABSTRACT

- Humans have spatial as well as temporal memory. Our visual sensors perceive the data and transmit it over neurons so that we could remember it. Although what we perceive has some memory bound and happen to obliterate over time. We often distinguish a person by his/her features. As our glance projects to human face,we separate people by genders,eyes,expressions,facial muscles etc.A system,thus,can be implemented to recognize people from one another.The image sent to the system is human face and hence driven through series of tests consisting threshold calculation,histogram plotting,error introduction.The Proposed System increases the efficiency to get the information of a human face whose record is already available.The image then compared with the one stored in database and hence described upon the suitable match.Such system with an inclination towards higher accuracy may yield great opportunities in the field of criminal detection,airport security system,face recognition vaults,attendance system.

1.8 GOALS AND OBJECTIVES

- To propose a system for efficient recognition of human face and portraying its description for validation.
- To distinguish between different facial patterns with a designed system.

1.9 RELEVANT MATHEMATICS ASSOCIATED WITH THE PROJECT

System Description:

- Input: Image
- Output: Description
- Distributed Environment
- Functions : Input(),LoadStore(),Compute(),Describe()

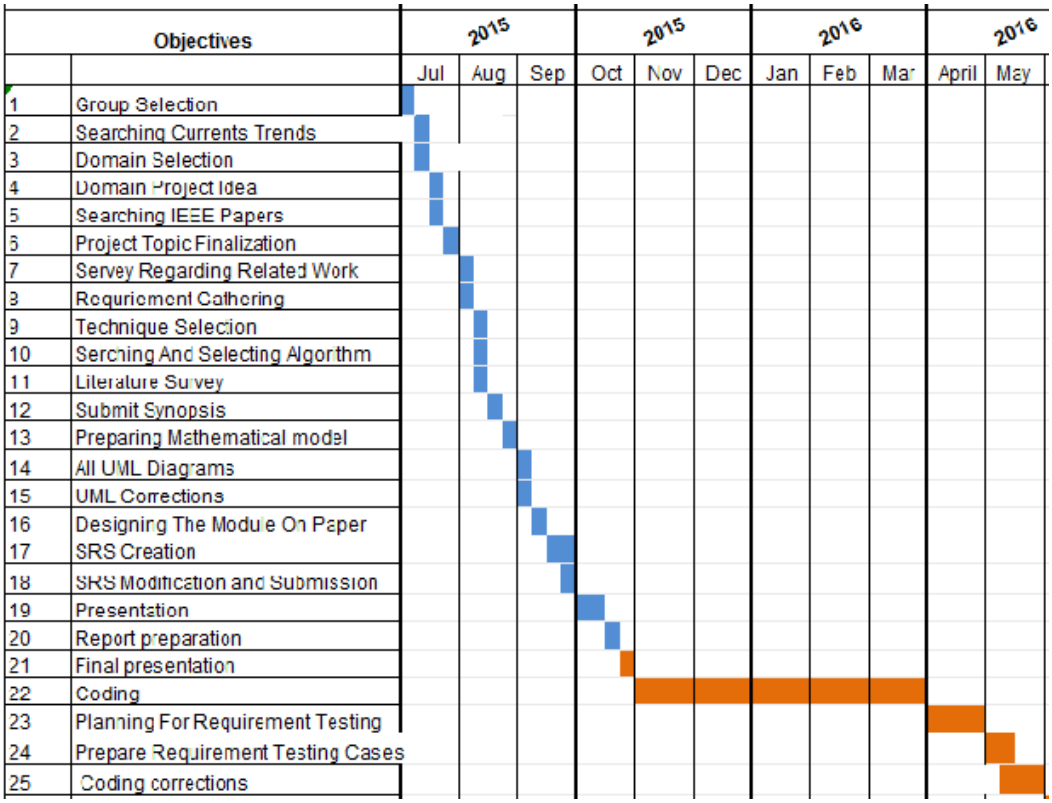
- Success Conditions: Image Recognition and equivalent description
- Failure Conditions: Invalid identification of Image

1.10 REVIEW OF CONFERENCE/JOURNAL PAPERS SUPPORTING PROJECT IDEA

Sr No	IEEE Paper Name	Advantages	Disadvantages
1	A Complementary Study for the Evaluation of Face Recognition Technology By Taketo Horiuchi,Takuro Hada(2013)	Complementary experiments by confirming whether the recognition accuracy is influenced by four factors, • A change over the years (15 year aging) • An angle of photo taking • A change of expressions (smiling and laughing) • Wearing accessories (cap, sunglasses, beard and mustache).	The results of the experiments were no more than the evaluation with good condition while neglecting other conditions such as low resolution camera
2	The Development Trend of Evaluating Face-Recognition Technology By Caixia Liu(2014)	Whether FERET, FRVT, FRGC of American, or CAS- PEAL (2004), Gallery (2008) of China, all made an indelible contribution to the rapid development of visible light face- recognition technology.	FERET, FRVT, FRGC of American, or CAS- PEAL (2004), Gallery (2008) of China, all preferred to testing face-recognition algorithm relatively, and their test environments were mostly in natural light.
3	Automatic Face Recognition System by Combining Four Individual Algorithms By Manzoor Ahmad Lone,S. M. Zakariya and Rashid Ali(2011)	In the multi-algorithmic approach, we combine PCA, DCT, Correlation and PIFS techniques in a pair of two, three and all to obtain combinations face recognition system namely PCA-DCT, PCA-DCT-Corr and PCA-DCT-Corr-PIFS. These combinations based systems provide better results than the corresponding individual algorithms.	This approach is implemented against ORL (Olivetti Research Laboratory) database consisting 400 face images taken from 40 people, 10 images per person against dark homogeneous background.
4	Feature Extraction and Classification by Machine Learning Methods for Biometric Recognition of Face and Iris By Miloš Oravec(2014)	Introduction of machine learning by MLP wherein m<p and m is number of hidden neurons, p is number of input-output neurons. Using this machine learning for feature extraction and classification of data for face recognition.	Dimensionality of the feature space is the same as that of data space but when the transform is not chosen appropriately, the dimensionality of the feature space will remain unchanged.
5	Face Recognition using Subspaces Techniques By G. Prabhu Teja,S.Ravi(2012)	The approach is primarily to reduce the error rates by using preprocessing techniques and recognizing using subspace methods in which False	Difference of Gaussian filter does not support the complete removal of darkness instead removing local shading

		Acceptance Rate (FAR) and False Rejection Rate (FRR) will compute to find error rates (ERR).	
6	Markovian Mixture Face Recognition with Discriminative Face Alignment By Ming Zhao,Tat Seng-Chua(2008)	Mixture of top-down as well as bottom up approach to incorporate class-specific knowledge.	Discriminative face alignment model for each person increases space complexity.
7	Face Recognition Using Principal Component Analysis and Self Organizing Maps By Dian Retno Anggraini(2014)	Self-Organizing Maps, is an unsupervised learning neural network. It is used to classify patterns of image feature extraction by Principal Component Analysis method. Accuracy obtained after implementation is better.	Results are not satisfactory when computed against CNNL database.

1.11 PLAN OF PROJECT EXECUTION



CHAPTER 2

TECHNICAL KEYWORDS

2.1 AREA OF PROJECT

Image Processing

2.2 TECHNICAL KEYWORDS

1. I.Computing Methodology
    (a) I.4 IMAGE PROCESSING AND COMPUTER VISION
        i. I.4.8 Scene Analysis
            A. Color
            B. Depth Cues
            C. Object Recognition
            D. Photometry
            E. Range Data
            F. Shape

CHAPTER 3

INTRODUCTION

3.1 PROJECT IDEA

- Having taken image as input to the proposed system and considering it to be a human face,the image is then driven through computational unit where its comparison is made with the trained image,upon finding the suitable match,the information equivalent to image is described.

3.2 MOTIVATION OF THE PROJECT

- Considering a scenario wherein a manual face validation is done,it is likely to take longer time.Instead,an efficient system with higher precision may reduce the face validation time.

3.3 LITERATURE SURVEY

Sr No	IEEE Paper Name	Advantages	Disadvantages
1	A Complementary Study for the Evaluation of Face Recognition Technology By Taketo Horiuchi,Takuro Hada(2013)	Complementary experiments by confirming whether the recognition accuracy is influenced by four factors, • A change over the years (15 year aging) • An angle of photo taking • A change of expressions (smiling and laughing) • Wearing accessories (cap, sunglasses, beard and mustache).	The results of the experiments were no more than the evaluation with good condition while neglecting other conditions such as low resolution camera
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CHAPTER 4

PROBLEM DEFINITION AND SCOPE

4.1 PROBLEM STATEMENT

Formulation of a system for recognition of human face and retrival of its equivalent description when provided an image as input.

4.1.1 Goals and objectives

Goal and Objectives:

- To propose a system for efficient recognition of human face and portraying its description for validation.
- To distinguish between different facial patterns with a designed system.

4.1.2 Statement of scope

- The proposed system contains input as an image.Given the image to system,it must be of nothing but human face.The image validation is done according to the images stored in database.The dependancy can be drawn between the computational unit(where the recognition is done) and database(where images are stored).The output of the matched image is description equivalent to it.The output of the unidentified image is,connotation from user.
- The implementation of system is solely based on input as human face.Any input other than human face,is prone to failure.

4.2 SOFTWARE CONTEXT

- It can be used in crime investigation.
- Airport security system.
- Attendance system.

4.3 MAJOR CONSTRAINTS

- In order to provide input, user must sign up first.
- User should not provide partial or incomplete face image.

4.4 METHODOLOGIES OF PROBLEM SOLVING AND EFFICIENCY ISSUES

- Given the input as human face image,if the image is recognized then the description equivalent to image is retrieved.
- Given the input as human face image,if the image is unrecognized then user connotation is asked equivalent to image.

4.5 SCENARIO IN WHICH MULTI-CORE, EMBEDDED AND DISTRIBUTED COMPUTING USED

- Distributed Environment: It is used in the system for taking input from user.
- Multicore: Multiple images are compared on different cores.

4.6 OUTCOME

- Given the input as human face image,if the image is recognized then the description equivalent to image must be retrieved.

4.7 APPLICATIONS

- Surveillance System
- Airport System
- Attendace System

4.8 HARDWARE RESOURCES REQUIRED

Sr. No.	Parameter	Minimum Requirement	Justification
1	CPU Speed	2 GHz	Remark Required
2	RAM	3 GB	Remark Required

Table 4.1: Hardware Requirements

4.9 SOFTWARE RESOURCES REQUIRED

Platform :

1. Operating System: Linux(Fedora/Android)
2. IDE: Netbeans,eclipse
3. Programming Language: java

CHAPTER 5

PROJECT PLAN

5.1 PROJECT ESTIMATES

Use Waterfall model and associated streams derived from assignments 1,2, 3, 4 and 5(Annex A and B) for estimation.

5.1.1 Reconciled Estimates

5.1.1.1 Cost Estimate

Not applicable.

5.1.1.2 Time Estimates

Please refer planner.

5.1.2 Project Resources

- People: Aditya Kulkarni , Sushant Belsare , Sarang Kulkarni
- Hardware: RAM (min. 4Gb), CPU(at least 2 cores) , Motherboard , other peripheral devices
- Software : Eclipse IDE , Net beans IDE, Database
- Language: Java
- Tool: openCV

5.2 RISK MANAGEMENT W.R.T. NP HARD ANALYSIS

This section discusses Project risks and the approach to managing them.

- Problem can be reduced to Np-Complete, Given a problem of face recognition denoted as x, is NP-Complete when, a non-deterministic problem y having decision d for comparison of faces and suggesting reduction as if in the form of problem x such that, There is an algorithm A,
  For all inputs m,
  if $y(m)=YES$ then $x(m)=YES$
  if $y(m)=NO$ then $x(m)=NO$

5.2.1 Risk Identification

- Risk is a probability or threat of damage, loss or any other negative occurrences that is caused by external or internal vulnerabilities. Risk management is the first process that takes place in risk management. Risk identification is the process of determining what hazards or risk exist or are anticipated , their characteristics , remoteness in time , duration period , and possible outcomes. The objectives of project risk management are to increase the likelihood and impact of positive events, and decrease the likelihood and impact of negative events in the project.

- The earlier the risk can be identified, the earlier the plan can be made to mitigate the effects of the potential risks. Identifying the risk is an iterative process, and the entire project team should be involved from the beginning of the project. Comprehensive and good risk identification will produce a good project results.

5.2.2 Risk Analysis

The risks for the Project can be analyzed within the constraints of time and quality

ID	Risk Description	Probability	Impact		
			Schedule	Quality	Overall
1	The development team is unfamiliar with the environment being used	Medium	Low	Medium	Medium
2	Unauthorized user	Low	Low	High	Medium
3	Image not found in database	Medium	Low	Medium	Medium

Table 5.1: Risk Table

5.2.3 Overview of Risk Mitigation, Monitoring, Management

Following are the details for each risk.

Probability	Value	Description
High	Probability of occurrence is	$> 75\%$
Medium	Probability of occurrence is	$26 - 75\%$
Low	Probability of occurrence is	$< 25\%$

Table 5.2: Risk Probability definitions [8]

Impact	Value	Description
Very high	$> 10\%$	Schedule impact or Unacceptable quality
High	$5 - 10\%$	Schedule impact or Some parts of the project have low quality
Medium	$< 5\%$	Schedule impact or Barely noticeable degradation in quality Low Impact on schedule or Quality can be incorporated

Table 5.3: Risk Impact definitions [8]

Risk ID	1
Risk Description	The development team is unfamiliar with the environment being used
Category	Development Environment.
Source	Software requirement Specification document.
Probability	Medium
Impact	Medium
Response	Mitigate
Strategy	Reading and learning all the related documents
Risk Status	Identified

5.3 PROJECT SCHEDULE

5.3.1 Project task set

Major Tasks in the Project stages are:

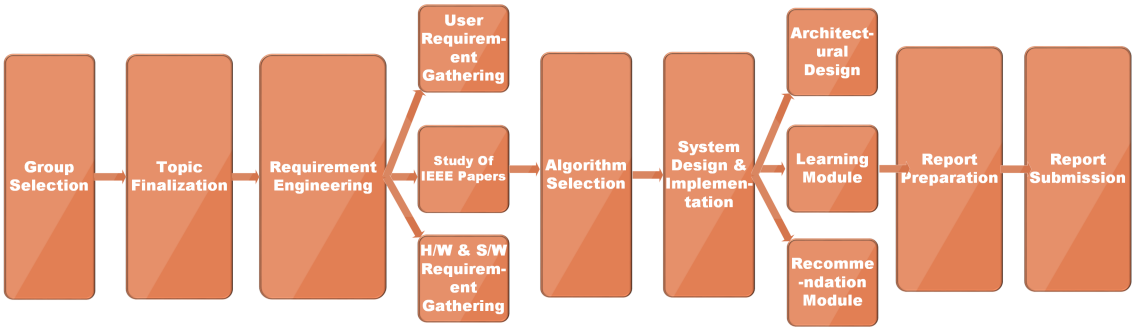
- Defining the problem statement.
- Research on project topic.

Risk ID	2
Risk Description	Unauthorized user
Category	Coding and Designing
Source	Software Design Specification documentation review.
Probability	Low
Impact	Medium
Response	Mitigate
Strategy	Designing software that will provide access to authorized person
Risk Status	Identified

Risk ID	3
Risk Description	Image not found in database
Category	Coding and Designing
Source	Software Design Specification documentation review.
Probability	Medium
Impact	Medium
Response	Accept
Strategy	Administrator will add image and its description to the database
Risk Status	Identified

- Studying topic related IEEE papers.
- Requirement gathering
- Design and modeling of project.
- Implementation of various modules.
- Testing
- Final Evaluation.

5.3.2 Task network



5.4 TEAM ORGANIZATION

The manner in which staff is organized and the mechanisms for reporting are noted.

5.4.1 Team structure

Sr.No.	Name	Role
1	Aditya Kulkarni	Developer
2	Sushant Belsare	Designer
3	Sarang Kulkarni	Project Manager

Table 5.4: Team structure

5.4.2 Management reporting and communication

Mechanisms for progress reporting and inter/intra team communication are identified as per assessment sheet and lab time table.

CHAPTER 6

SOFTWARE REQUIREMENT SPECIFICATION (SRS IS TO BE PREPARED USING RELEVANT MATHEMATICS DERIVED AND SOFTWARE ENGG. INDICATORS IN ANNEX A AND B)

6.1 INTRODUCTION

6.1.1 Purpose and Scope of Document

- The purpose of Face Recognition And Description (FRAD) is to detect human face and retrieve its description from huge database. In this document we consider few scenarios so that the accuracy of FRAD will be achieved.
- Face Recognition And Description may yield the great opportunities in the field of criminal detection, airport security system and attendance system.

6.1.2 Overview of responsibilities of Developer

Following list of task defines the responsibility of developer:

- Reviewing the current system
- Presenting the ideas for system improvements
- Working closely with analysts, designer.
- Testing the product in controlled manner.

6.2 USAGE SCENARIO

This section provides various usage scenarios for the system to be developed.

6.2.1 User profiles

- User: User is a one who gives image as an input to the proposed system and receives the description of an image as output.
- Administrator: Administrator takes the corrective action on those images which are not found in database. If the image is not found in database administrator will train the image and store it in database. He will also take description from user and map it with the image.

Sr No.	Use Case	Description	Actors
1	Input image	User gives image as an input	User
2	Description of an image	Case denotes that the input image is present in database	User
3	Description of unmatched image	Image is not recognized by System	User
4	Update database	Adding the new image and its description in database	Administrator,User

Table 6.1: Use Cases

6.2.2 Use-cases

6.2.3 Use Case View

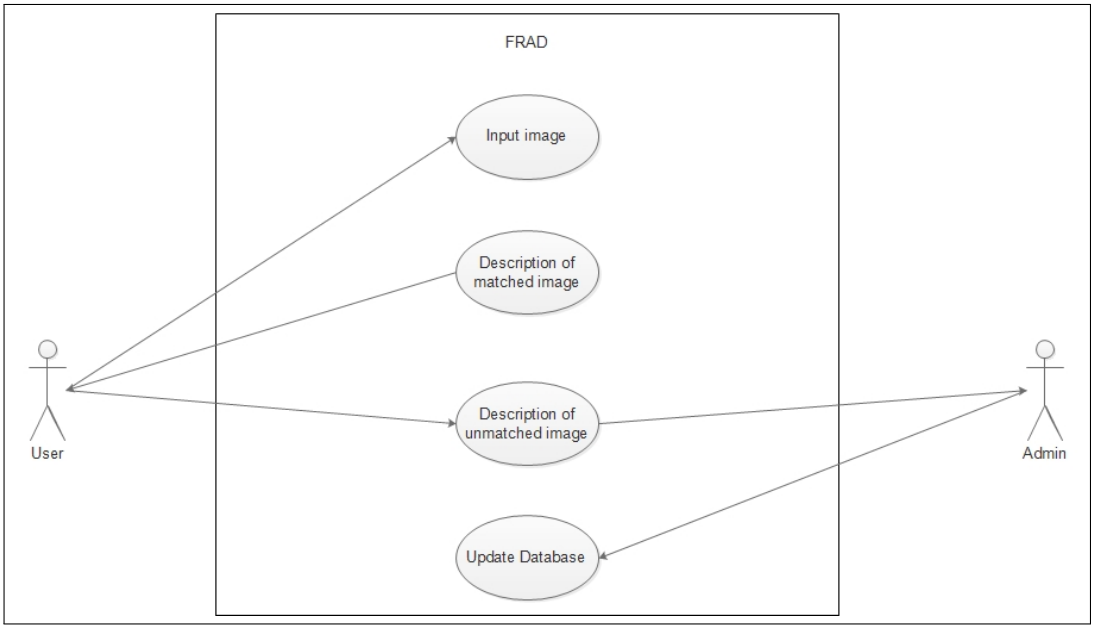
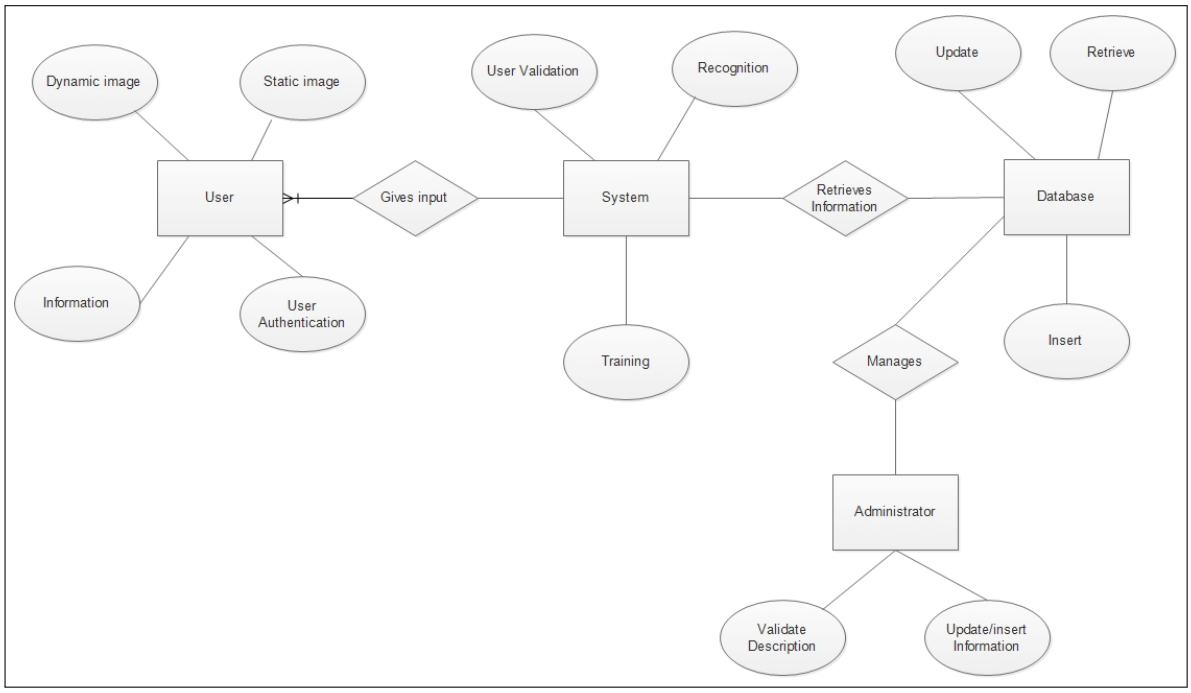


Figure 6.1: Use case diagram

6.3 DATA MODEL AND DESCRIPTION

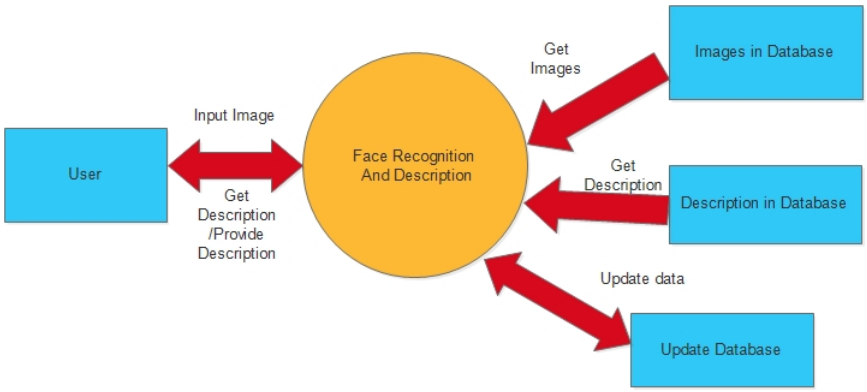
6.3.1 Data objects and Relationships



6.4 FUNCTIONAL MODEL AND DESCRIPTION

6.4.1 Data Flow Diagram

6.4.1.1 Level 0 Data Flow Diagram



6.4.2 Activity Diagram:

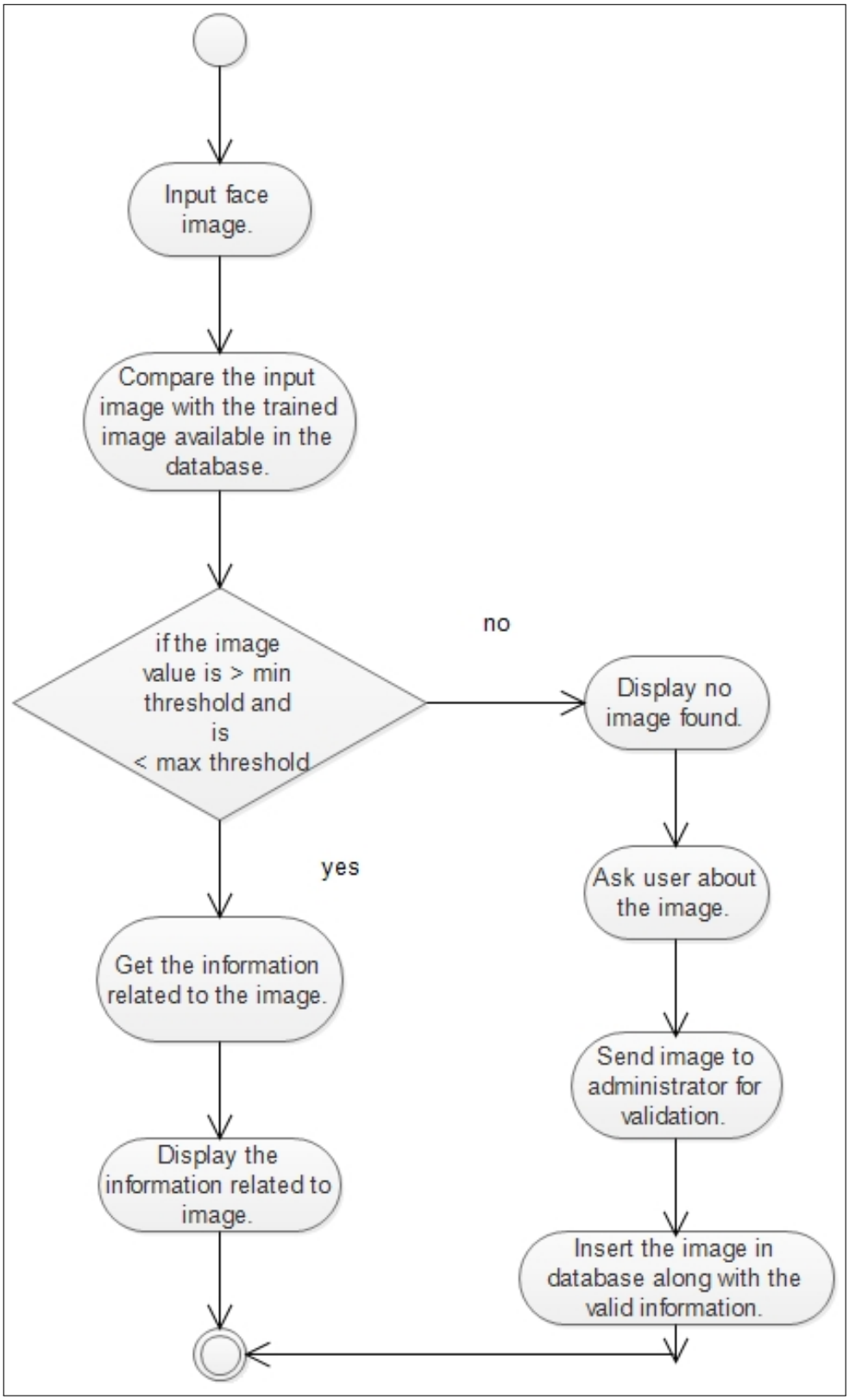


Figure 6.2: Activity diagram

6.4.3 Non Functional Requirements:

- System should always find the description of an image.
- System should support admin in troubleshooting problems.

6.4.4 State Diagram:

State Transition Diagram

Fig.6.3 example shows the state transition diagram of Cloud SDK. The states are represented in ovals and state of system gets changed when certain events occur. The transitions from one state to the other are represented by arrows. The Figure shows important states and events that occur while creating new project.

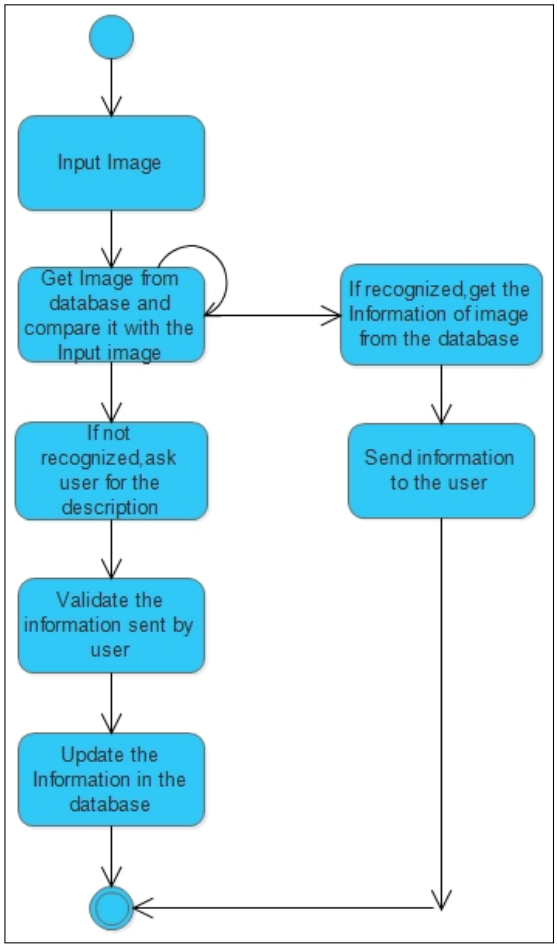


Figure 6.3: State transition diagram

6.4.5 Design Constraints

- Input should be human face.
- Client and Server should establish connection.
- Need for validation by administrator.

6.4.6 Software Interface Description

- Software interface should be user friendly.
- Software interface should be modular.

CHAPTER 7

DETAILED DESIGN DOCUMENT USING APPENDIX A AND B

7.1 INTRODUCTION

This document specifies the design that is used to solve the problem of Product.

7.2 ARCHITECTURAL DESIGN

A description of the program architecture is presented. Subsystem design or Block diagram,Package Diagram,Deployment diagram with description is to be presented.

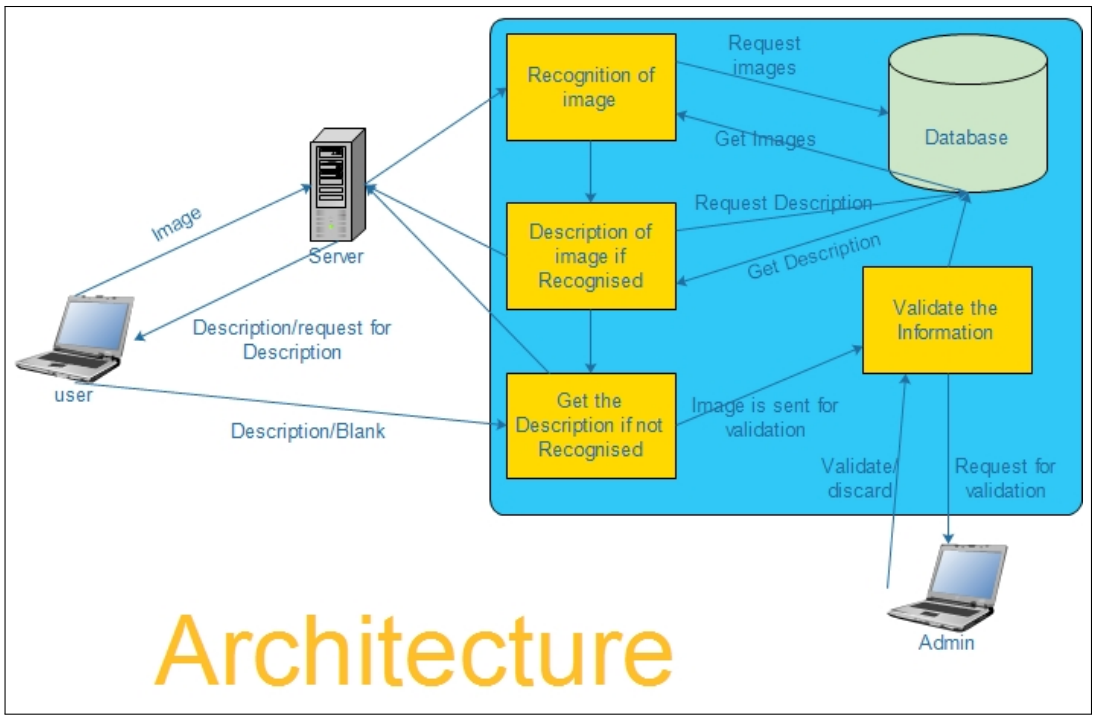


Figure 7.1: Architecture diagram

- **Recognition of Image:**In this phase the image is compared with the existing images in the database.
- **Description of image if recognize:**This phase will return the related information of the Image which is there in the Database.
- **Get the description if not recognized:**This phase will ask the user for the description if the image is not recognized.
- **Validate the information:**In this phase the information provided by the user for a particular image is cross verified and is validated by the administrator.

- **Database:**It stores the image and image related information.

7.3 DATA DESIGN (USING APPENDICES A AND B)

A description of all data structures including internal, global, and temporary data structures, database design (tables), file formats.

7.3.1 Internal software data structure

Data structures that are passed among components the software are described.

7.3.2 Global data structure

Data structured that are available to major portions of the architecture are described.

7.3.3 Temporary data structure

Files created for interim use are described.

7.3.4 Database description

Database(s) / Files created/used as part of the application is(are) described.

7.4 COMPOENT DESIGN

Class diagrams, Interaction Diagrams, Algorithms. Description of each component description required.

7.4.1 Class Diagram

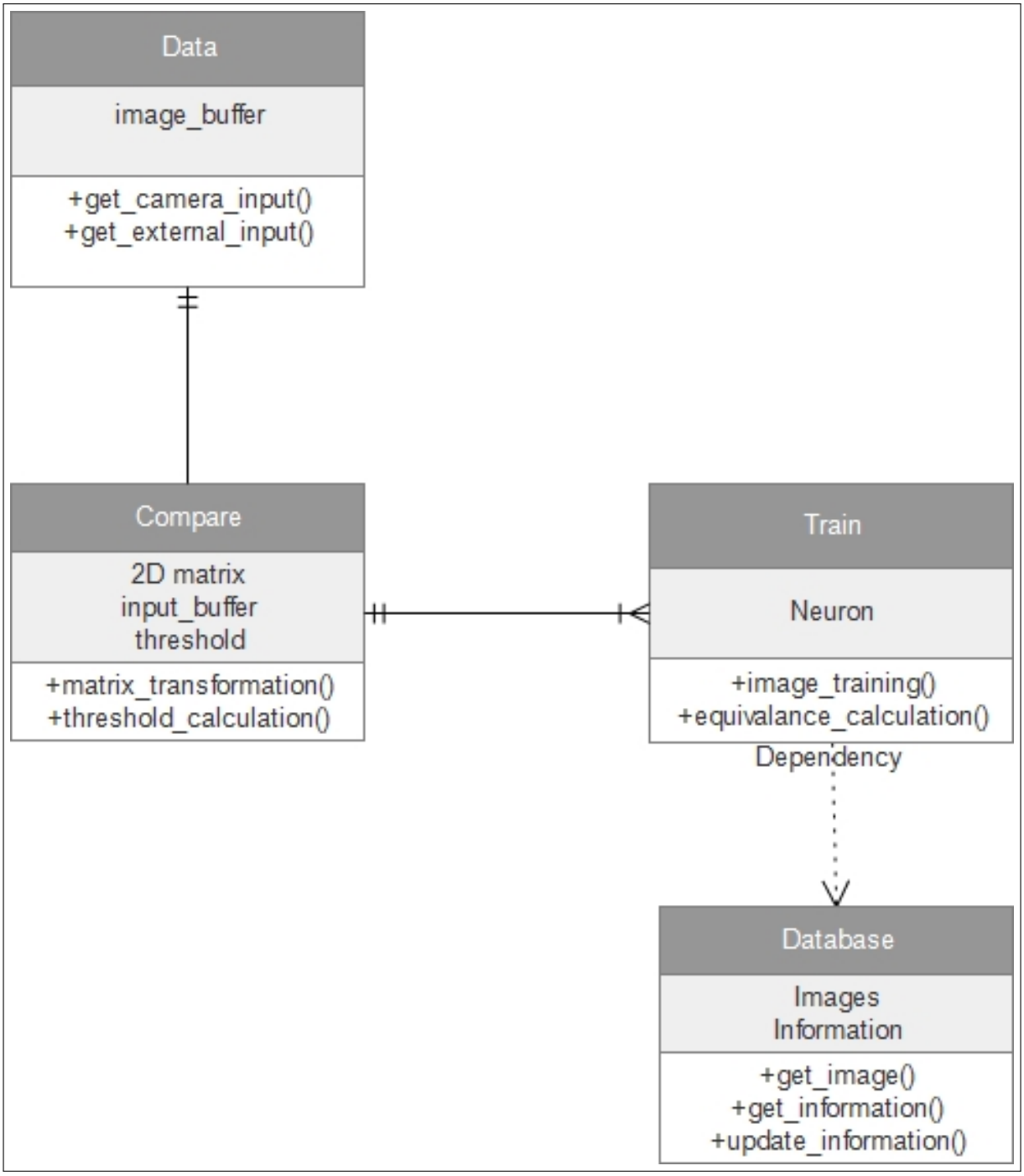


Figure 7.2: Class Diagram

CHAPTER 8

SUMMARY AND CONCLUSION

1. Summary

   - The image is formed by 32bit pixel values which is then divided into 8bits of R,G,B and intensity.These pixel values constitute a matrix which depicts a picture.
   - Face recognition system is constructed for recognition of human faces and their equivalent information.
   - The pixel values of input image are compared with the image existing in database and hence upon finding the equivalence,the information is retrieved.
   - Multi-layer perceptrons works in a structure wherein the number of pixels are segmented according to layers and existence of hidden layers compares multiple state sequences.

2. Conclusion

   - The face recognition and description system takes input as human face and upon suitable match portrays its description.
   - Human facial expressions changes upon behaviour. There always exist randomness in human behaviour from one person to another.
   - Human facial expressions therefore need catagorization such as smiling face,sad face,angry face.
   - Identification of face must not confine itself to expressionless faces but invest explorative face recognition upon different behaviour.

CHAPTER 9

REFERENCES

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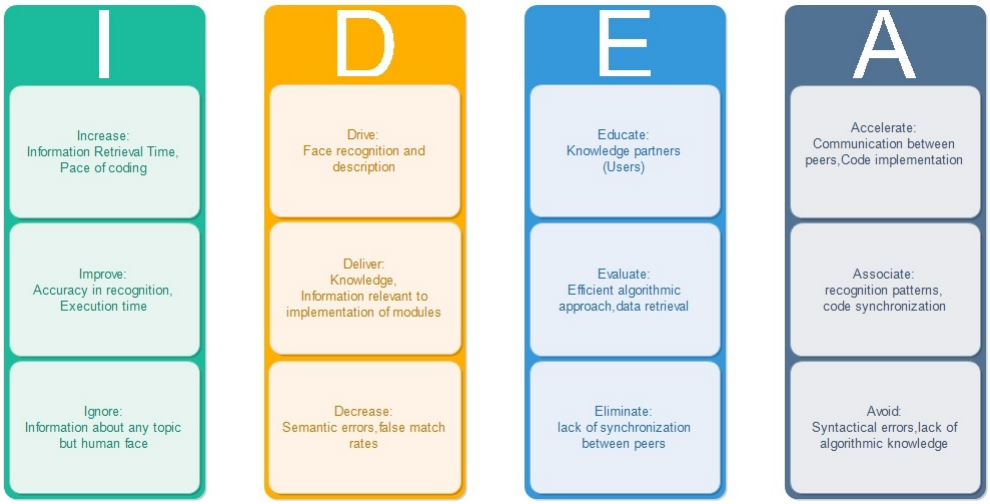
ANNEXURE A

LABORATORY ASSIGNMENTS ON PROJECT ANALYSIS OF ALGORITHMIC DESIGN

- To develop the problem under consideration and justify feasibilty using concepts of knowledge canvas and IDEA Matrix.



- Problem can be reduced to Np-Complete, Given a problem of face recognition denoted as x, is NP-Complete when, a non-deterministic problem y having decision d for comparison of faces and suggesting reduction as if in the form of problem x such that, There is an algorithm A,

  For all inputs m,

  if $y(m)=YES$ then $x(m)=YES$

  if $y(m)=NO$ then $x(m)=NO$

ANNEXURE B

LABORATORY ASSIGNMENTS ON PROJECT QUALITY AND RELIABILITY TESTING OF PROJECT DESIGN

- We are using divide and conquer strategy and parallel processing for implementation.

B.1 WHITE BOX TESTING

White box testing is a testing technique, that examines the program structure and derives test data from the program logic/code. The other names of glass box testing are clear box testing, open box testing, logic driven testing or path driven testing or structural testing.

B.1.1 White box testing techniques

- Statement Coverage - This technique is aimed at exercising all programming statements with minimal tests.
- Branch Coverage - This technique is running a series of tests to ensure that all branches are tested at least once.
- Path Coverage - This technique corresponds to testing all possible paths which means that each statement and branch is covered.

B.1.2 Function Dependency graph

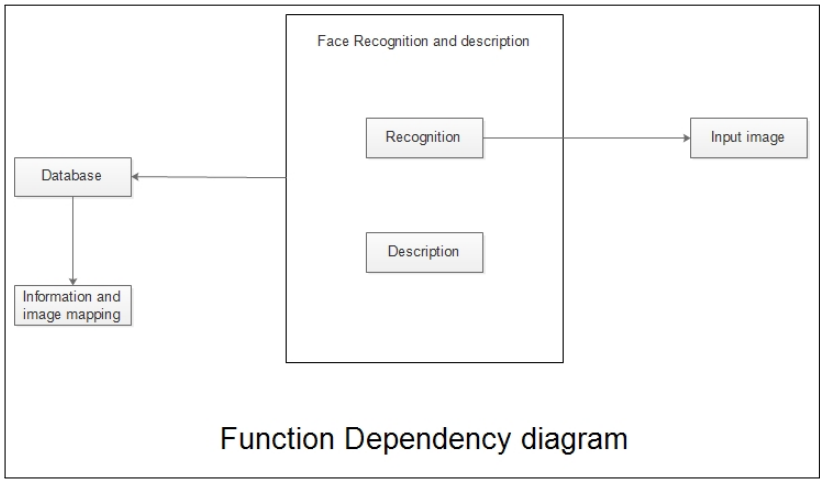
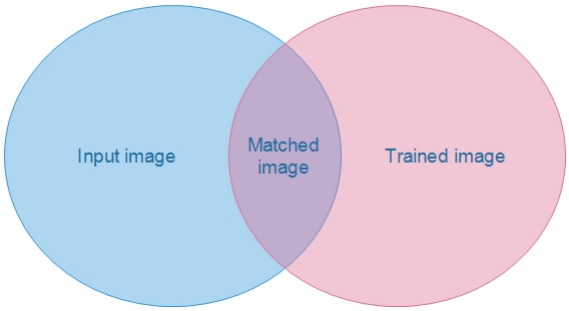


Figure B.1: Functional Dependency Graph

Black box testing-Test Cases

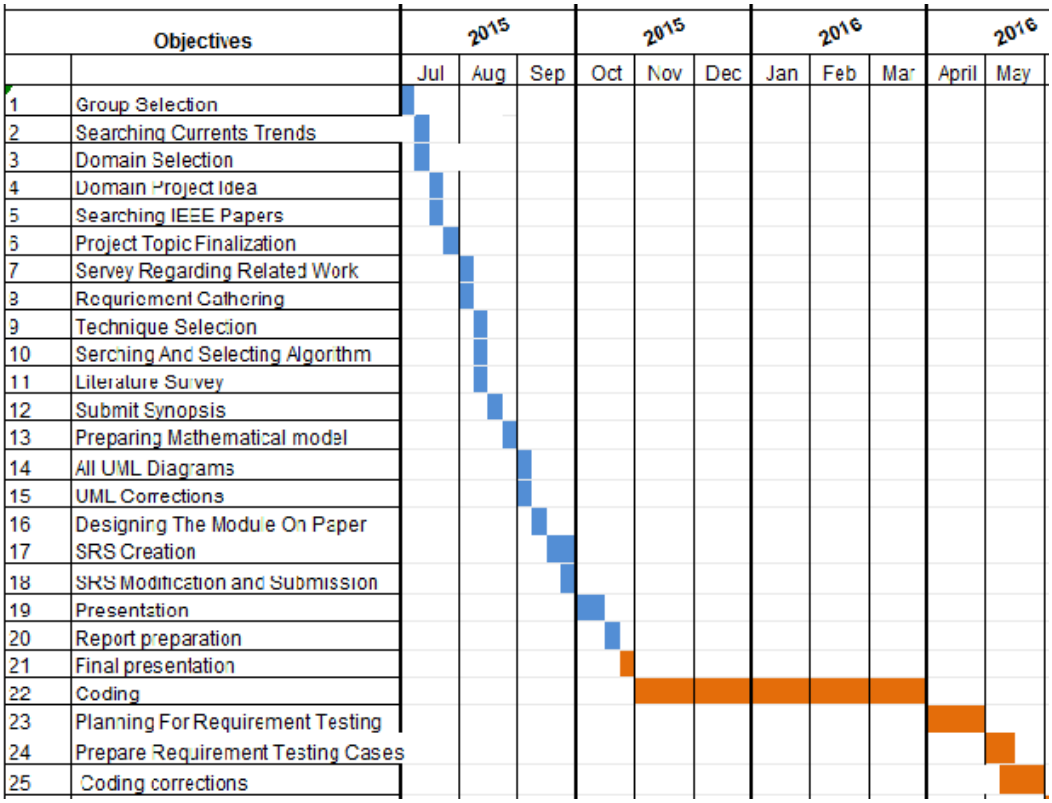
Test case Description	Test Input	Expected Result	Actual result	Test Status (pass/fail)	Corrective Action
Equivalence testing	Image stored in database	Description of image	Description of image	Pass	No
	Image not stored in database	Image not found	Image not found	Pass	Ask user for description
Boundary conditions	Blurred image	Description of image	Image not found	Fail	NO
	Partial Image	Description of image	Image not found	Fail	Ask user for next image
Comparison Testing	Same image given multiple times	Description of image	Description of image	Pass	NO
Orthogonal Array testing	Small but relatively large input images	Corresponding output for each input	Corresponding output	Pass	NO

B.2 VENN DIAGRAM



ANNEXURE C

PROJECT PLANNER

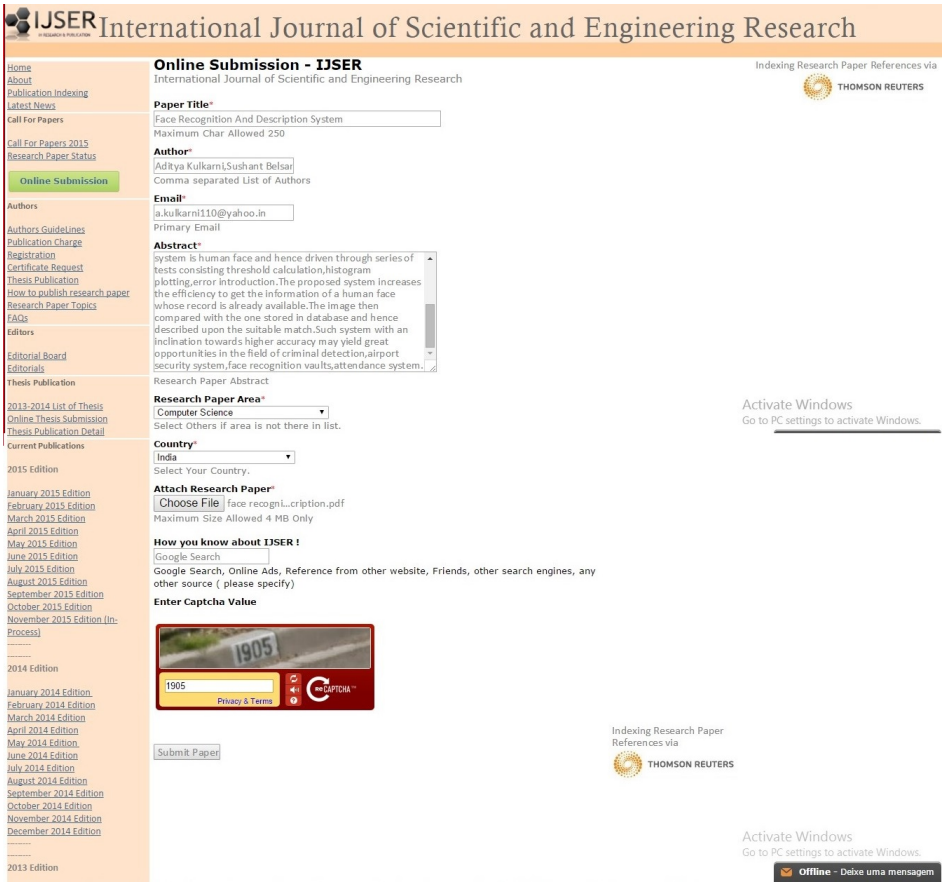

Objectives
2015
2015
2016
2016
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
April
May
1 Group Selection
2 Searching Currents Trends
3 Domain Selection
4 Domain Project Idea
5 Searching IEEE Papers
6 Project Topic Finalization
7 Servey Regarding Related Work
8 Requriement Cathering
9 Technique Selection
10 Serching And Selecting Algorithm
11 Literature Survey
12 Submit Synopsis
13 Preparing Mathematical model
14 All UML Diagrams
15 UML Corrections
16 Designing The Module On Paper
17 SRS Creation
18 SRS Modification and Submission
19 Presentation
20 Report preparation
21 Final presentation
22 Coding
23 Planning For Requirement Testing
24 Prepare Requirement Testing Cases
25 Coding corrections

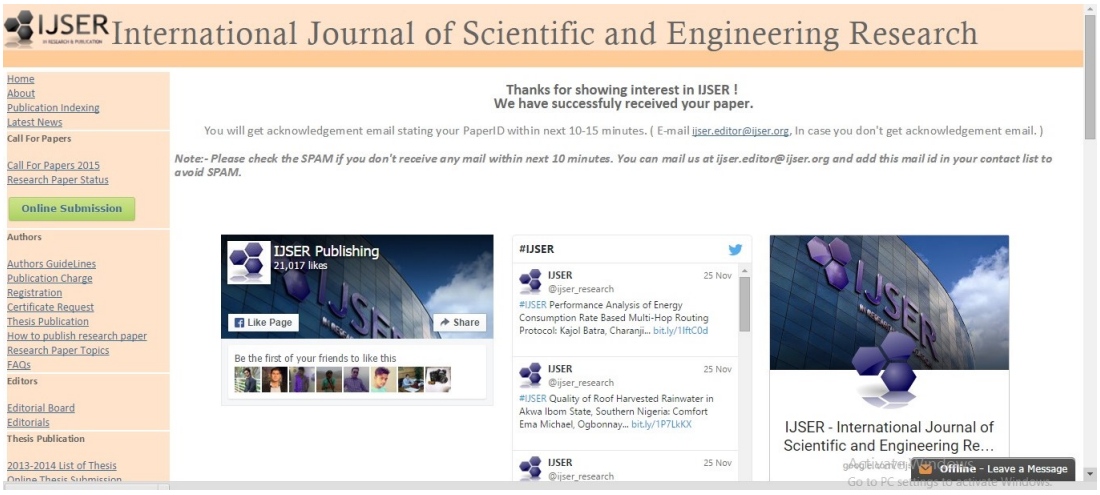
ANNEXURE D

REVIEWERS COMMENTS OF PAPER SUBMITTED

1. Paper Title: Face Recognition And Description

2. Name of the Conference/Journal where paper submitted : IJSER

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ANNEXURE E

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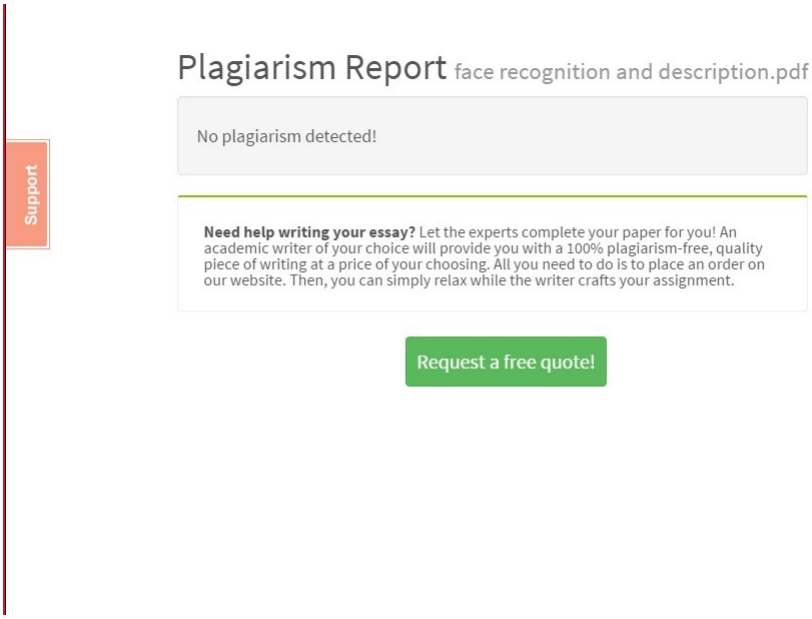
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