

A PROJECT REPORT ON

**CARD-LESS ATM USING TWO TIER
AUTHENTICATION (FACE
RECOGNITION AND OTP)**

**SUBMITTED TO THE SAVITRIBAI PHULE PUNE UNIVERSITY, PUNE
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CERTIFICATE

This is to certify that the Project report entitled

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

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ABSTRACT

Automated Teller Machine (ATM) transactions are found safe, reliable and inevitable lately for fulfilling our financial commitments. Traditional approach for using ATMs mandates involvement in revolving credit. The recent version of the ATM (Automated Teller Machine) system uses an ATM card and Personnel Identification Number(PIN) for authentication and validation. Due to various risk factors this ATM system is prone to many security issues such as ATM card theft, skimming done by identity thieves to capture important information, Lebanese loop etc. So we have proposed a new system that uses face recognition authentication (not ATM cards) and One Time Password(OTP) verification for accessing user accounts along with PIN, all these features make the new system more secure and reliable than the existing system. Here the face recognition is done by the Convolution Neural Network(CNN) model of Machine Learning for Image processing.

We all know that, parallel to ATM usage, mobile phone's usage has also been an inevitable trend. Establishing a connection between these e-gadgets has ignited a simple and effective approach to withdraw cash without the involvement of revolving credit which can be mentioned as card less cash withdrawal. Face recognition and OTP is used for user authentication. The OTP in conjunction with Face detection comprises two levels of security.

Keywords: ATM, OTP, CNN, Machine Learning, Image processing

Contents

List of Abbreviations	i
List of Figures	iii
List of Tables	iv
1 INTRODUCTION	1
1.1 Overview	2
1.2 Motivation	2
1.3 Problem Definition and Objectives	2
1.4 Project Scope and Limitations	3
1.4.1 Project Scope	3
1.4.2 Limitations	3

2	LITERATURE SURVEY	4
3	SOFTWARE REQUIREMENT SPECIFICATIONS	8
3.1	Assumptions and Dependencies	9
3.2	Functional Requirements	9
3.2.1	Image Preprocessing	9
3.2.2	Segmentation and Analysis	9
3.2.3	Feature Extraction	9
3.2.4	Image Classification	10
3.2.5	Post Processing	10
3.3	External Interface Requirements	11
3.3.1	User Interfaces	11
3.3.2	Communication Interfaces	11
3.4	Nonfunctional Requirements	11
3.4.1	Performance Requirements	11
3.4.2	Security Requirements	12
3.4.3	Software Quality Attributes	12

CONTENTS

CONTENTS

3.5	System Requirements	12
3.5.1	Database Requirements	12
3.5.2	Software Requirements	12
3.5.3	Hardware Requirements	13
3.6	Analysis Models: SDLC Model to be applied	14
3.6.1	Advantages of Incremental model	15
4	SYSTEM DESIGN	16
4.1	System Architecture	17
4.2	Mathematical Model	18
4.3	Data Flow Diagrams	20
4.4	Entity Relationship Diagrams	22
4.5	Use Case Diagram	23
4.6	Class Diagram	24
4.7	Sequence Diagram	25
4.8	Activity Diagram	26
5	PROJECT PLAN	27

CONTENTS

CONTENTS

5.1	Project Estimate	28
5.1.1	Reconciled Estimates	28
5.1.2	Project Resources	28
5.2	Risk Management	28
5.2.1	Risk Identification	29
5.2.2	Risk Analysis	29
5.2.3	Overview of Risk Mitigation, Monitoring, Management . . .	30
5.3	Project Schedule	30
5.3.1	Project Task Set	30
5.3.2	Task Network	31
5.3.3	Timeline Chart	32
5.4	Team Organization	32
5.4.1	Team Structure	33
5.4.2	Management reporting and communication	33
6	PROJECT IMPLEMENTATION	34
6.1	Overview of Project Modules	35

CONTENTS

CONTENTS

6.2	Tools and Technologies Used	35
6.3	Algorithm Details	36
6.3.1	Algorithm	36
7	SOFTWARE TESTING	37
7.1	Goal of Testing	38
7.2	Types of Testing	38
7.3	Test cases and Test Results	39
8	RESULTS	40
8.1	Outcomes and Screenshots	41
9	OTHER SPECIFICATIONS	49
9.1	Advantages	50
10	CONCLUSIONS	51
10.1	Conclusions	52
10.2	Future Work	52
10.3	Applications	52

CONTENTS

Appendix A

Appendix B

Appendix C Plagiarism Report

11 REFERENCES

CONTENTS

53

55

57

59

List of Abbreviations

ATM - Automated Teller Machine
PIN - Personnel Identification Number
OTP - One Time Password
CNN - Convolutional Neural Network
AOM - Active Orientation Models
AAM - Active Appearance Models
BPIN - Bank Identity
FRT - Facial Recognition Technology
SMS - Short Message Service
DLT - Distributed Ledger Technology
API - Application Program Interface
HOG - Histogram of Oriented Gradients
SVM - Support Vector Machine
GUI - Graphical User Interface

List of Figures

3.1	Incremental model	14
4.1	System Architecture	17
4.2	Mapping Diagram	18
4.3	Data Flow Diagram Level 0	20
4.4	Data Flow Diagram Level 1	21
4.5	Entity Relationship Diagram	22
4.6	Use Case Diagram	23
4.7	Class Diagram	24
4.8	Sequence Diagram	25
4.9	Activity Diagram	26
5.1	Task Network	31

LIST OF FIGURES

LIST OF FIGURES

5.2	Timeline Chart	32
8.1	User Registration Page	41
8.2	User Face Detection	42
8.3	ATM Home Page	43
8.4	PIN and OTP Verification	44
8.5	Transaction Choice Page	45
8.6	Multi-Bank Withdrawl Page	46
8.7	Account Balance Page	47
8.8	Backend-Database	48
C.1	Plagiarism Report	58

List of Tables

7.1	Test Cases & Test Results	39
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CHAPTER 1

INTRODUCTION

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

1.1 Overview

The manual banking services are all based on paperwork in which the customer walks into the bank for withdrawal of money and doing other transactions, it is time consuming and lacks efficiency. The ATM is designed to replace the manual banking transaction. But the rising issues in cyber security world related to ATM cards has raised a concern in customers mind while using the ATM services. Problems including lost or stolen card, card skimming and pin capturing, damage card, etc. has made to think whether to use ATM services or go with traditional manual banking.

So to address this problem we have planned to make a secure system for ATM transactions namely Cardless ATM using Two-tier Authentication that will be using Face Detection and OTP to access the ATM system.

1.2 Motivation

The recent versions of ATMs use pin based security. During the course of the transaction, We input the pin number which is encrypted on the client side and the data we input is decrypted on the server side. When this comparison gets satisfied, we can carry out the transaction. As the technology is evolving, the crackers can easily retrieve this data and hence there is increase in the number of frauds. The data is made available on the cloud, so that the transaction time can be reduced. When the data is available on the cloud, this data can be easily retrieved for fraudulent activity, which is the biggest drawback. Hence the only way to secure the datum is to replace the computer generated numbers with the biometric security.

1.3 Problem Definition and Objectives

To design deep learning based Card-less ATM using two tier protection (OTP and face recognition).

1.4 Project Scope and Limitations

1.4.1 Project Scope

The basic aim of this research work is to design and develop a card less ATM. If that can be achieved and implemented, it could lead to the following objectives.

1. Enhance and ease the use of ATM by banking customers.
2. ATM fraud and criminal activities can be reduced or eliminate completely.
3. It can eliminate financial burden and pressure placed on customers for issuance and maintenances of ATM card.
4. It will also reduce stress emanated from complaints related to ATM cards at the bank staff and customers.

1.4.2 Limitations

- If there are some network issues then the user may receive the OTP at a later time.

CHAPTER 2

LITERATURE SURVEY

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

S.N. Firme, Sahil Garat, Sumit Sonawane, Hrishikesh Datir, Nilesh Dusane [1] proposed a two dimensional security level with OTP verification alongside face recognition to access the ATM. For any transaction the ATM requires client verification. At present the client makes use of smart-cards which are vulnerable to threats like copying or imitated with precision. The authors in this paper has provided a solution to deal with the pull back money by setting up association between e-device, without the inclusion of charge cards which can be imply to card less money withdrawal. The two dimensional verification system has a Biometric authentication facility setup on a cloud (Saas) with end to end encryption. For verification of a user face detection is used along side a OTP is send to the user. After coordination of both face detection and OTP user can access their record in ATM.

There exist various databases of facial images which to a limited extent justifies the advances in research for the task of face alignment. These databases show-case large discrepancies in resolution, quality of image, identity, head pose, facial expression, lighting conditions and partial blocking. The main idea behind the proposed tool is to take advantage of the generalization qualities of Active Orientation Models(AOM)'s rather than using Active Appearance Models(AAM)'s by building a model using annotated images with various poses and expressions and generate the annotations on images with different poses and expressions [2].

The ATM and Mobile Banking [3] combined together increases security by adding new feature and reduce the time of withdrawal money. There is no change required to the existing system but some addition required, which makes no impact on existing system. This research will increase the speed of cash withdrawal almost 3 times fast. It will also have positive impact on the customer's satisfaction, if proper functioning is ensured by the banks.

ATM card users have problems [4] such as card cloning, card expiring, card skimming, card damaging, cost of issuance and maintenance and accessing customer account by third parties. The motive of this project is to give a freedom to the user by changing the card to Biometric security system to access the bank account using AES algorithm.

The traditional & conventional ATM authentication schemes available are mostly cryptographic based and this gives room to lots of vulnerabilities & improvisation. This technique provides high output entropy keys and also locks original biometric data such that it is impossible to recover the biometric data even when the stored information in the system is open to an attacker [5].

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

As the threats related to ATM cards are increasing, the researchers are interested in developing new technology for ATM access authentication. In 2019 some researchers proposed OTP based Cardless Transaction using ATM [6]. The proposed methodology is that, all the standard ATM transaction will be carried out by doing verification using a Personnel Identification Number(PIN) and Bank Identity (BPIN) and One Time Password (OTP). This method has more security than a biometric fingerprint and using an ATM card.

In several Biometric scan technologies: finger-scan, facial-scan and retinal-scan and others are discussed [7]. Facial technology is a relatively new entrant to the biometric field and offers significant promise. One of the continuing challenges for the security is to reduce the fraud and security issues. Here we are proposing card less security architecture for ATM using facial technology. Our proposed system provides unique authentication technique to improve security of ATM machine over present system.

In today's society, Technology Advancement have made life easier by providing us with higher levels of knowledge and innovation through the invention of different devices. However, each and every technological innovation hubs the potential of hidden threats to its users [8]. One of the major threat is theft of private or personal data, information, assets and properties. As digital data become more and more prevalent, users try to secure their information and keep it secret with highly encrypted passwords and ID cards. However, taking advantage of security flaws in ID cards result in cards being duplicated or counterfeited and being misused, the misuse of these security measures are also on the rise. This increasing battle with cyber security has led to the birth of biometric security systems which increases security with unique biometrics.

There are many privacy risks due to security breaches of biometric templates [9]. We have proposed a hierarchical bloom filter based identification system for large-scale biometric systems that reduces storage requirements while providing rapid handling of queries and template security. The challenge of incorporating a hash-based bloom filter by introducing a mathematical framework with noisy biometric data that is adaptive to characteristics of biometric database. The proposed architecture is implemented using a face database containing 25,000 facial templates and achieves 92.05 percent reduction in storage size with 99.82 percent reduction in average query time without sacrificing accuracy of result.

Facial Recognition Technology (FRT) [10] addresses several complimentary needs of identifying and verifying an individual's identity and emerged as a solution. The biometric system requirements are fulfilled by FRT, which tries to

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

recognize the status of an individual person by using features distinctive from the body and different functionalities that are more and more familiar with the operation of visual surveillance. It highlights the limitations of the technology and the problematic, potentials of the technology. The report also identifies the sub-tasks that the FRT seems to be ready to deploy, the areas with specified obstacles, and how to overcome them by the developments of future technology and operating procedures of sound. The report also addresses specific issues that appear to interact with technology. The report's research are further broken down into different genres to understand further the performance, operation, policy concerns, evaluation, and political and moral operations.

ATM's and Credit cards are used with the end goal of cash exchanges which assumes a fundamental job in the nature of currency exchange [11]. There are some issues of existing validation plan, for example, secret key and PIN number caused the spillage of data put away in ATM card which lead to the lost of cash in ledger and private databases and creates a mental pressure in customers. To conquer this inaccuracy of theft in cash exchanges, we have proposed the thought of utilizing fingerprints of clients as secret phrase , which also includes conventional PIN number. After approved confirmation, the user will have the option to continue for exchange else after three progressive wrong inputs, the ATM card will be obstructed for 24 hours and a message will be sent to the registered versatile number.

CHAPTER 3

SOFTWARE REQUIREMENT SPECIFICATIONS

3.1 Assumptions and Dependencies

Assume Bank server and Database

3.2 Functional Requirements

3.2.1 Image Preprocessing

Image Preprocessing is the term for image operations at the lowest level of abstraction. The image information content is not increased by these operations, but they can be reduced if the information measure is an entropy. An image data might be suppressed with undesired distortion, to improve these images is the aim of image Preprocessing. Enhancement of the some image feature may help for further processing and analysis task. Redundancy is used in image Preprocessing. The Real image corresponding Neighboring pixels have the same or similar brightness value. The distorted pixel from the image, can have average value of the neighboring pixels restored.

3.2.2 Segmentation and Analysis

The partition of an image into meaningful regions concerning a particular application is done in our system. The segmentation is based on the analysis of observations taken from an image such as grey level, color, texture, depth, or motion. Identification of objects in a scene for object-based measurements such as size and shape.

3.2.3 Feature Extraction

The process in which relevant features within an image are detected and represented for further processing is called Feature extraction.

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

Marking the transition from pictorial to non-pictorial data representation, feature extraction is a necessary step in Computer vision and image processing. The resulting representation can be used as an input to several pattern recognition and classification techniques such as labeling, classification, or to recognize the semantic contents of the image or its objects.

3.2.4 Image Classification

Image classification helps to classify images with the help of data we extracted from other images. Categorizing all the digital image pixels into several classes is the main aim of the classification process. Identifying and portraying the image to get the data i.e. grey values and feature extraction for the future classification of the images by creating more classes is the main objective of the image classification, which can be used to create a signature file.

Image classification is training the computer and making it to classify the given image into the specified classes by certain image properties and training set we used to train.

3.2.5 Post Processing

In post processing the knowledge extracted from the prior step could be processed further. We can simply and evaluate the extracted knowledge. It can further be visualized and be documented for the end user. Various techniques can be used for the same. The processed knowledge can be interpreted to incorporate in the system.

3.3 External Interface Requirements

3.3.1 User Interfaces

- Screen: Either a touch enabled screen or a normal display screen for user interaction.
- Keypad: A keypad for the user to interact and input PIN and OTP.

3.3.2 Communication Interfaces

- Fast2SMS: A Bulk SMS service provider. Fast2SMS simple platform helps to send promotional, marketing, OTP, multimedia & alerts SMS. SMS Gateway API. Its Bulk SMS API which works with PHP, JAVA, C#, C, Python, Ruby, Javascript, NodeJS, etc. Secure, robust and easy to integrate APIs to send DLT Approved SMS, Promotional SMS, Service Implicit SMS, Service Explicit SMS via REST API. Fast2SMS expects for the API Key to be included in all API requests to the server in a header for POST requests & in query parameters for GET requests.

3.4 Nonfunctional Requirements

3.4.1 Performance Requirements

- The performance of the system lies in the way it is handled. Every user must be given proper guidance regarding how to use the system. The other factor which affects the performance is the absence of any of the suggested requirements.

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

3.4.2 Security Requirements

- The software doesn't require any kind of sensitive information. The software adheres the specific standard and maintains the privacy of user.

3.4.3 Software Quality Attributes

- Portability- The software should be completely portable to all the operating platforms/systems.
- Reliability - The software should operate in all lighting conditions. Irrespective of the brightness level of the user's monitor, the program should always detect the image.
- Usability - This software should always be easy to use for all the types of users with minimal instructions.

3.5 System Requirements

3.5.1 Database Requirements

MySQL server or phpMyAdmin open-source software tool of XAMMP used to store user data. phpMyAdmin supports various type of operations on MariaDB and MySQL. The main purpose of phpMyAdmin is to handle the administration of MySQL over the web.

3.5.2 Software Requirements

- Desktop application: Tkinter is the standard GUI library for Python. Python provides the standard library Tkinter for creating the graphical user interface for desktop based applications. Python when combined with Tkinter

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit.

- Python Libraries used for face recognition:
 1. OpenCV is a Python open-source library, which is used for computer vision in Artificial intelligence, Machine Learning, face recognition, etc. OpenCV is created to implement various operations including recognising and detecting faces, analysing human tasks in videos, identifying objects, recording camera movements, tracking moving objects, and combining images to create a high-resolution image for the accurate scene.
 2. Dlib is a powerful library having a wide adoption in image processing community similar to OpenCV. Researchers mostly use its face detection and alignment module. Beyond this, dlib offers a strong out-of-the-box face recognition module as well. Even though it is written in c++, it has a python interface as well.
 3. Numpy is a general-purpose array-processing package. It provides a high-performance multidimensional array object, and tools for working with these arrays. It is the fundamental package for scientific computing with Python. Besides its obvious scientific uses, Numpy can also be used as an efficient multi-dimensional container of generic data.
- Standard IDE: Python-IDLE (Integrated Development and Learning Environment) is an integrated development environment (IDE) for Python. IDLE can be used to execute a single statement just like Python Shell and also to create, modify, and execute Python scripts. IDLE provides a fully-featured text editor to create Python script that includes features like syntax highlighting, autocompletion, and smart indent. It also has a debugger with stepping and breakpoints features.

3.5.3 Hardware Requirements

- Camera: High resolution camera of minimum 1280 x 720 pixel quality required to capture user image
- ATM machine: The ATM machine consists of the following hardware :
 - A Display Screen : Used for user interactions
 - A Cash Dispenser Slot : To dispense money

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

- A Keypad : To take inputs from the user
- A Receipt Printer : To print the transaction receipt

3.6 Analysis Models: SDLC Model to be applied

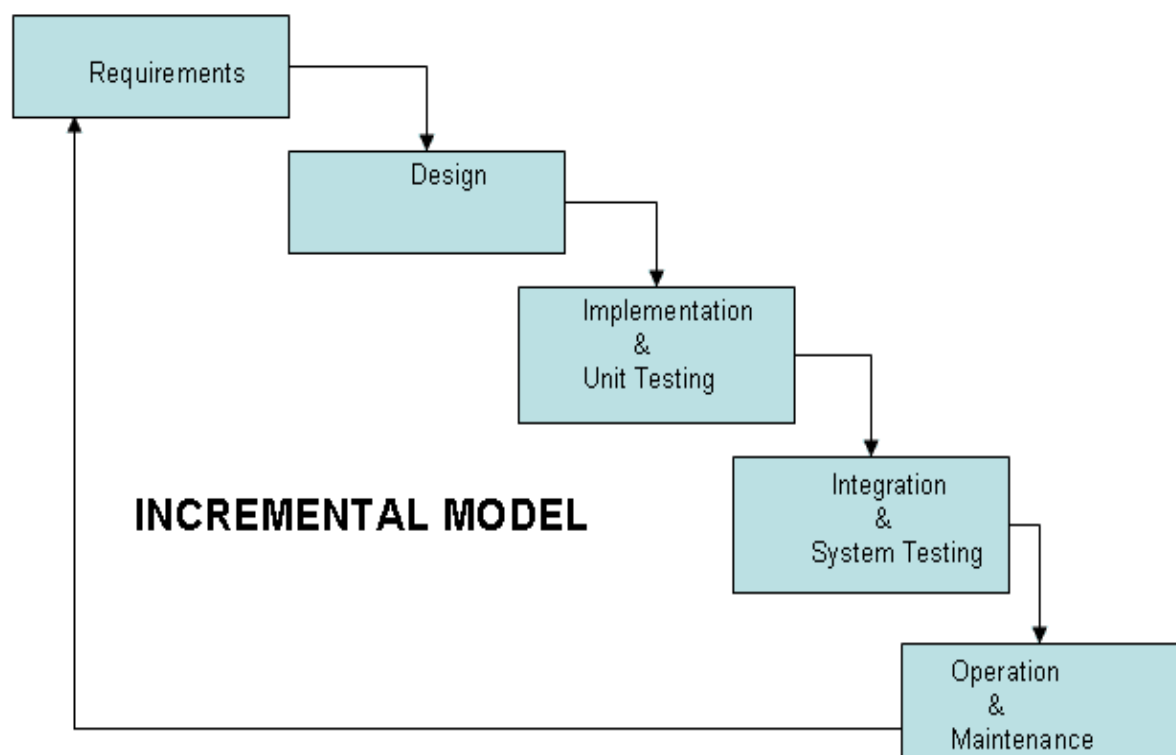


Figure 3.1: Incremental model

- A Incremental approach has been chosen for the implementation of the project(Figure 3.1 is representation of Incremental model).
- In Incremental Model software development requirements are divided into multiple modules of the software development cycle. In this model, each module goes through the requirements, design, implementation and testing phases. Every further release of the module adds function to the previous release. The process continues until the complete system achieved.

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

- Various phases can be listed as:
 1. Requirement analysis: In this phase product analysis expertise identifies the requirements. To develop the software under the incremental model, this phase performs an important role.
 2. Design & Development: In this phase the design of the system functionality and the development method are completed. Modules to be included are also designed.
 3. Testing: In the incremental model, the testing phase checks the performance of each existing function as well as additional functionality. In the testing phase, the various methods are used to test the behavior of each task.
 4. Implementation: Implementation phase includes the coding phase of the development. It involves the final coding and tests the functionality in the testing phase. After completion of this phase, working product is upgraded up to the final system product.
- This model is used to introduce flexibility.

3.6.1 Advantages of Incremental model

- This model is easy to test and debug.
- Incremental model lowers initial delivery cost.
- By the use of Incremental model customer can respond to each build.
- model is more flexible – less costly to change scope and requirements.

CHAPTER 4

SYSTEM DESIGN

4.1 System Architecture

After analyzing the problem faced by people in the existing technology, we have come up with this project to solve the problem of complexity and provide easiest way to secure the ATM transaction.

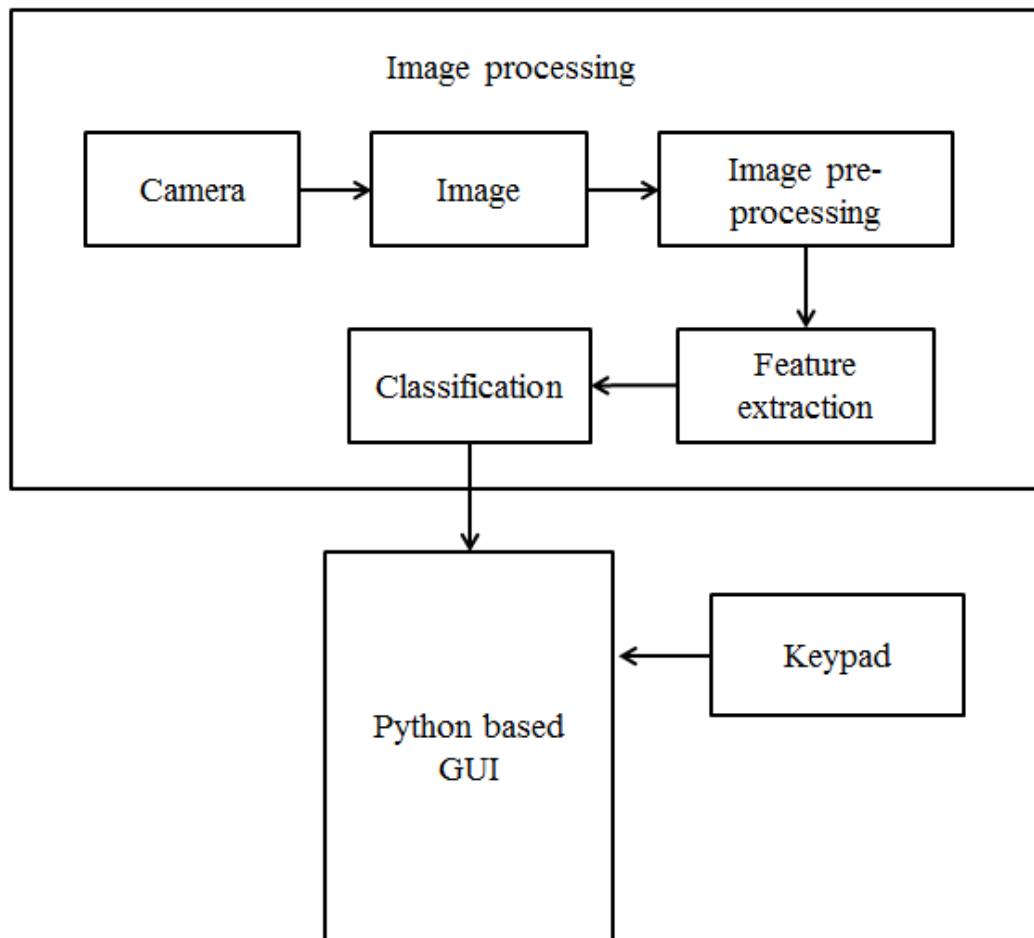


Figure 4.1: System Architecture

System Architecture of proposed system is as shown in figure above. The user authentication will be done using laptop/PC camera. Whenever a person enters in ATM, camera will capture the user's image and displaying all information about him. Graphical User Interface (GUI) is developed for user and system interactions. An Camera, which along with face recognition comprises two levels of security. When face and OTP are matched then customer's account will open in ATM machine. User name, debited money, authentication status etc, will be displayed using GUI.

4.2 Mathematical Model

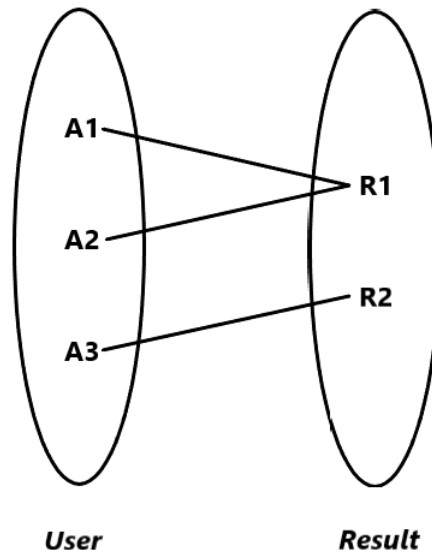


Figure 4.2: Mapping Diagram

Where,

A1: OTP

A2: Captured and Browse image

R1: Resultant output provided by system (Authorisation successful)

A3: Wrong or incorrect data submitted.

R2: ATM authorisation Failed

Set Theory:

$S = \{s, e, X, Y, \Phi\}$

Where,

s = Start of the program.

- Registration
- Login
- Capture and Browse Image
- Processing
- Feature Extraction

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

- Classification
- Final Result

e = End of the program.

Resultant output provided by the input data.

X = Input of the program.

Input should be Captured image and OTP.

Y = Output of the program.

As per the credential provided by user, transaction is allowed or rejected

$X, Y \in U$

Let U be the Set of System.

$U = \{\text{Admin, TD1, TD2, C}\}$

Where, Admin, TD1, TD2, C are the elements of the set.

Admin= Admin of System.

TD1= Test Data

TD2= Train Data

C= CNN Algorithm

Space Complexity:

The space complexity of an algorithm is the maximum amount of space used at any one time, ignoring the space used by the input to the algorithm.

Time Complexity:

Check No. of records available in the dataset= n

If ($n > 1$) then retrieving of information from database can be time consuming. So due to face recognition the time complexity of this algorithm is $O(n)$.

Φ = Failures and Success conditions.

Failures:

1. Huge database can lead to more time consumption to get the information.
2. Hardware failure.
3. Software failure.

Success:

1. Search the required information which is available in Database.
2. User gets result very fast according to their needs.

Above mathematical model is NP-Complete.

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4.3 Data Flow Diagrams

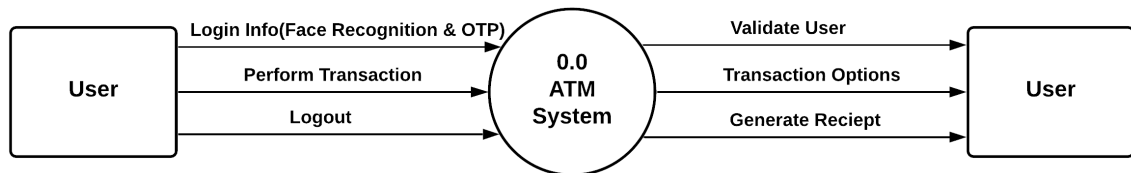


Figure 4.3: Data Flow Diagram Level 0

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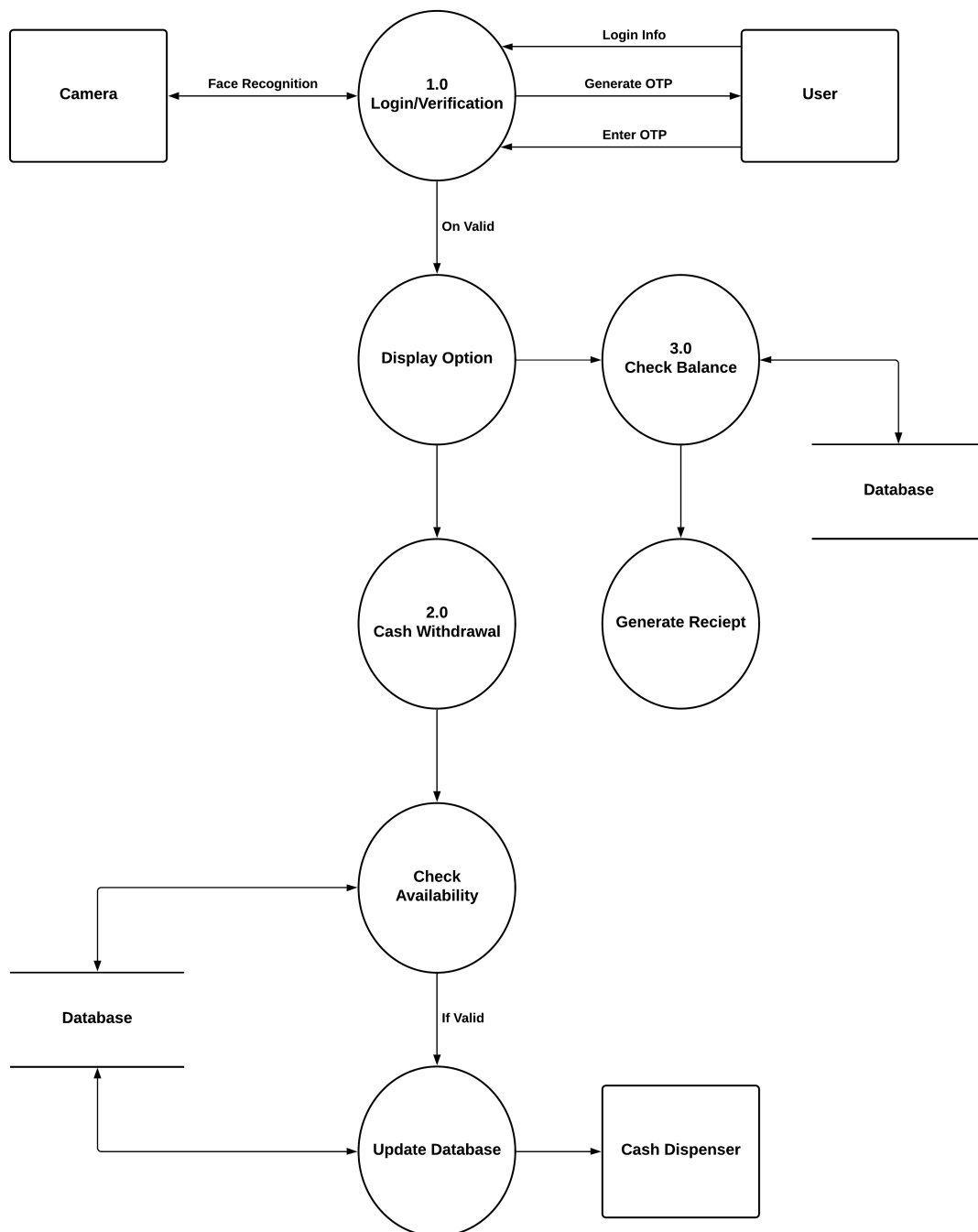


Figure 4.4: Data Flow Diagram Level 1

4.4 Entity Relationship Diagrams

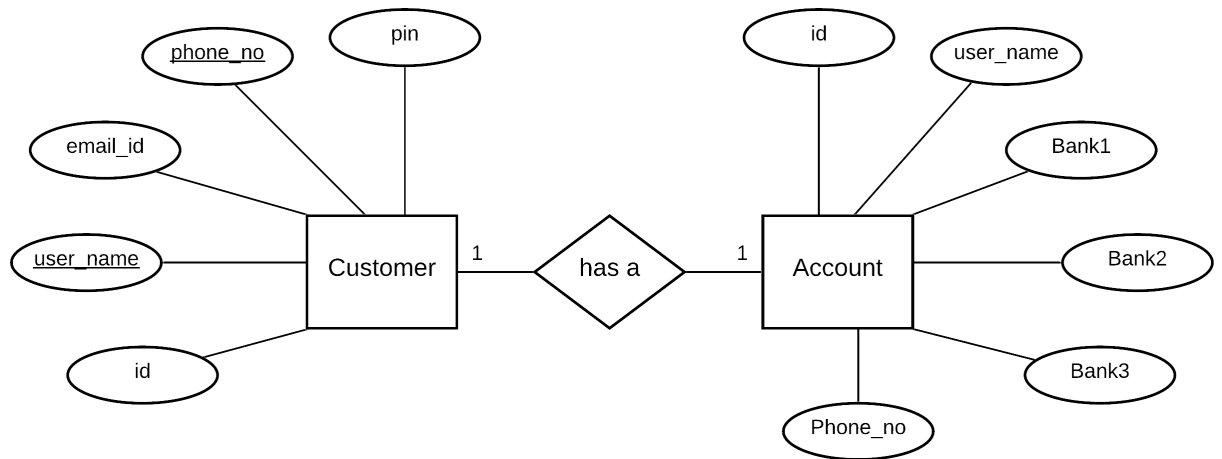


Figure 4.5: Entity Relationship Diagram

4.5 Use Case Diagram

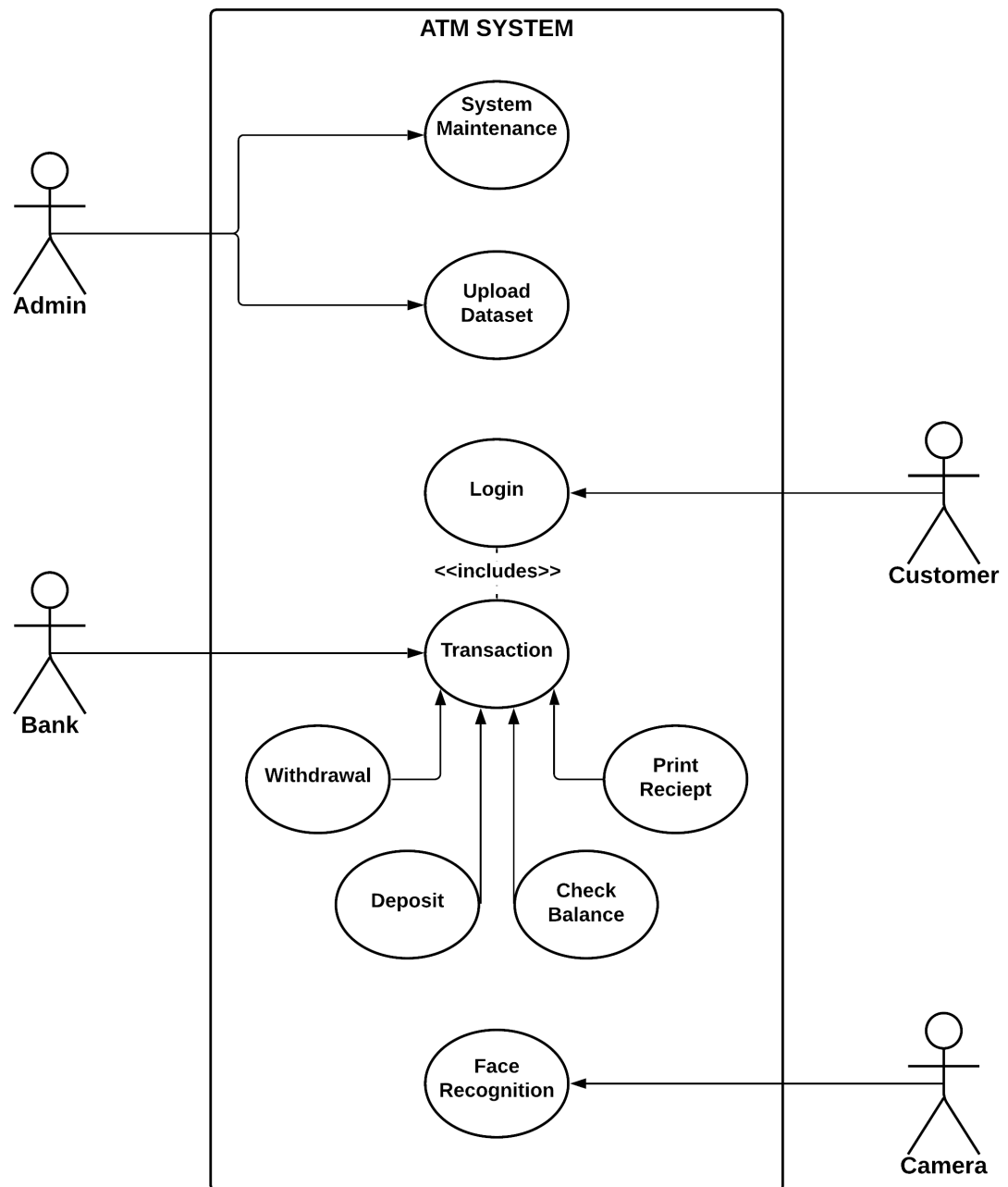


Figure 4.6: Use Case Diagram

4.6 Class Diagram

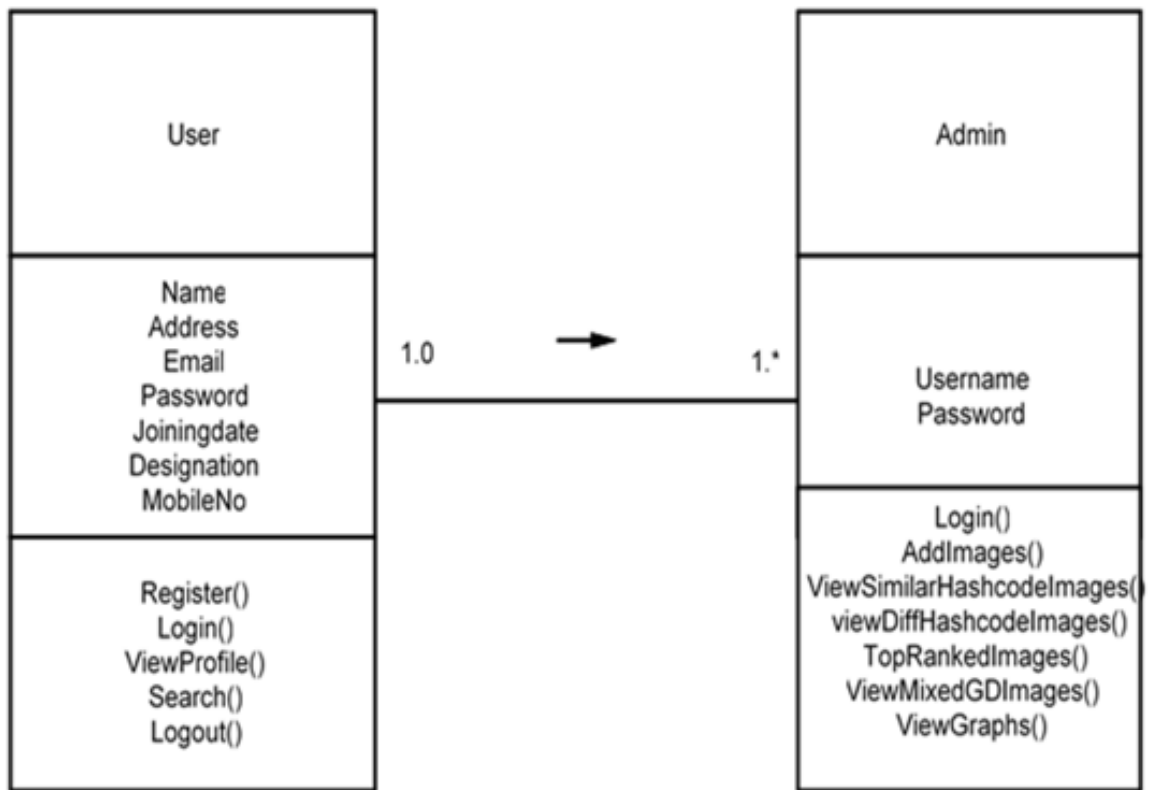


Figure 4.7: Class Diagram

4.7 Sequence Diagram

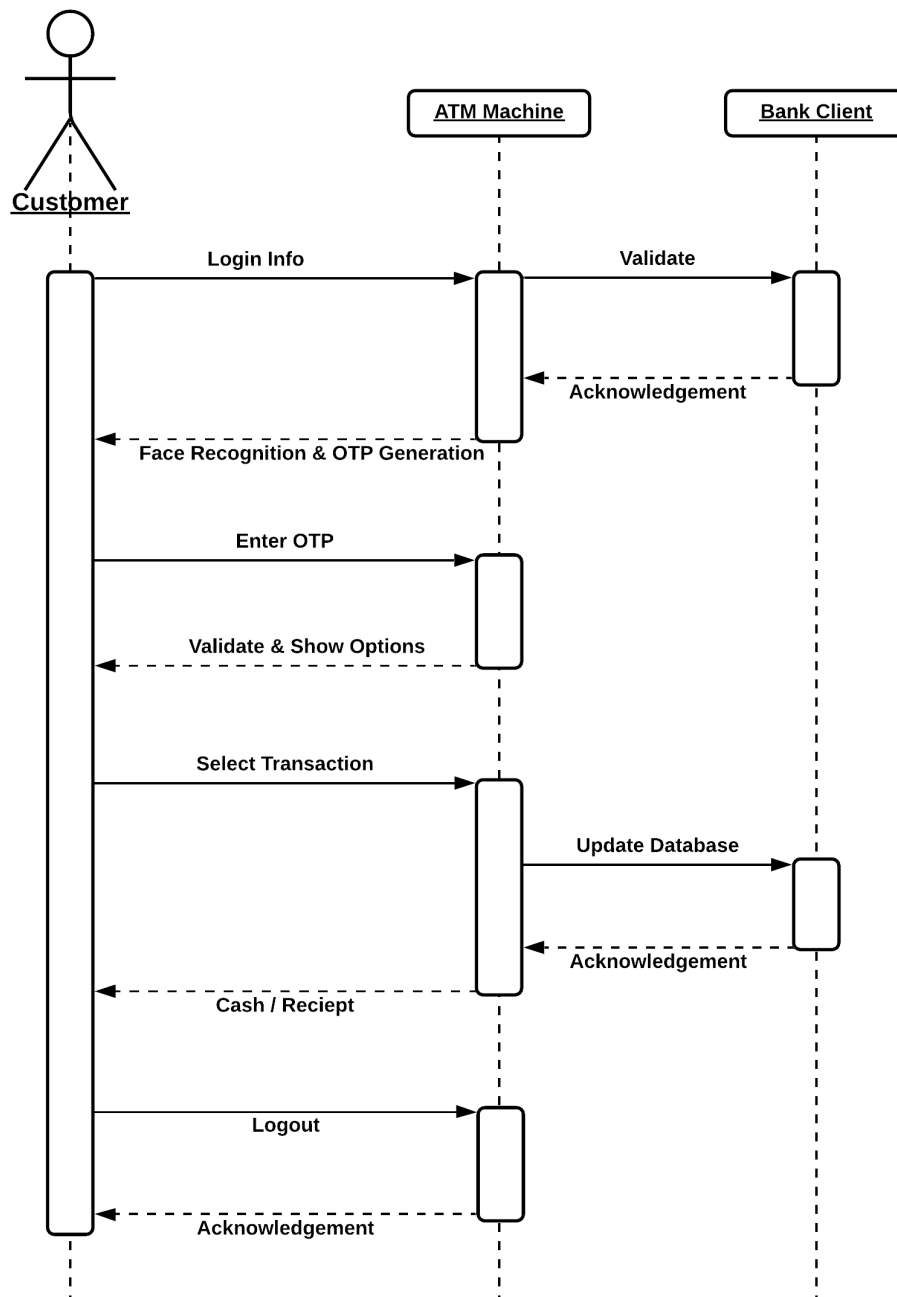


Figure 4.8: Sequence Diagram

4.8 Activity Diagram

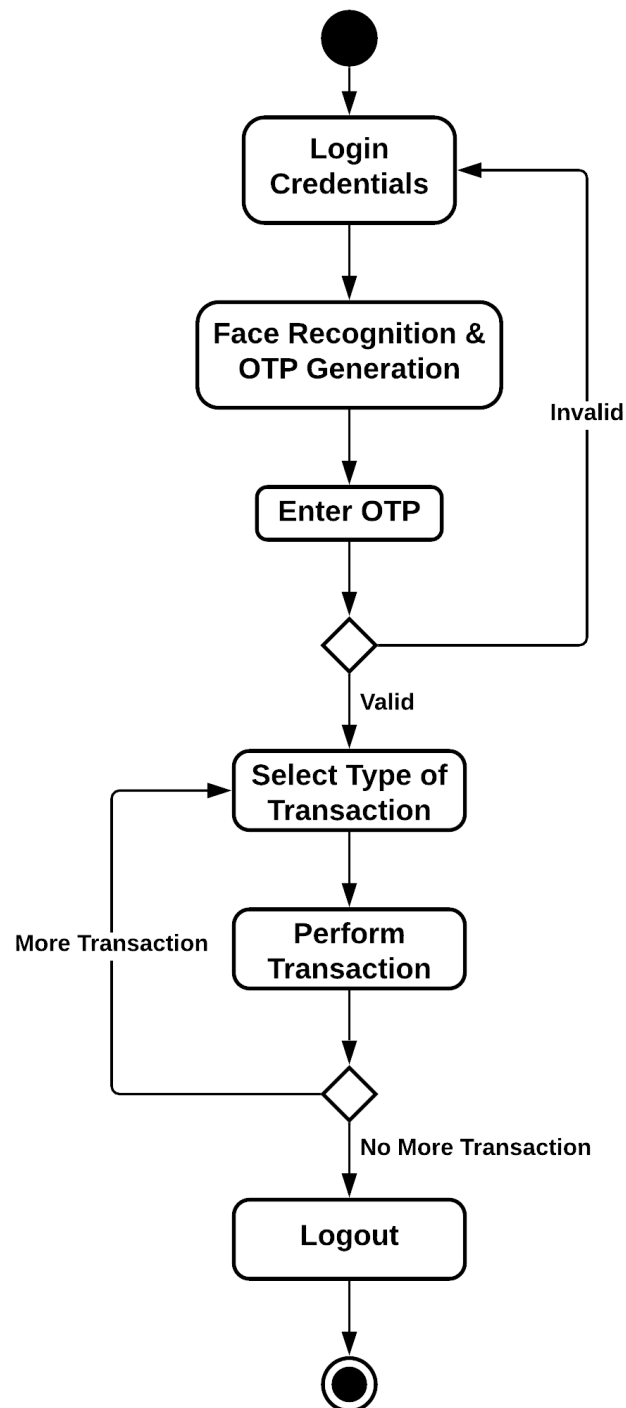


Figure 4.9: Activity Diagram

CHAPTER 5

PROJECT PLAN

5.1 Project Estimate

Project Estimating is a critical part of project planning, involving a quantitative estimate of project costs, resources or duration. One conundrum in estimating, especially for public-sector projects, is that bidders sometimes make overly optimistic estimates in order to win the business.

5.1.1 Reconciled Estimates

A reconciliation is an independent cost estimate that the end user can compare against the contractor's cost estimate, mitigating budget shortfalls and correcting identified deficiencies. Reconciliations can help ensure that differences between the two estimates are appropriate and reasonably expected.

5.1.2 Project Resources

- Team of 4 people
- Camera usage along with laptop
- OS - Windows/Ubuntu
- Third Party SMS tool - Fast2SMS
- Memory sharing - 8GB RAM
- Standard IDE: Python IDLE

5.2 Risk Management

Risk Management Risk Analysis and Management is a key project management practice to ensure that the least number of surprises occur while your project is underway. While we can never predict the future with certainty, we can apply a simple and streamlined risk management process to predict the uncertainties in the projects and minimize the occurrence or impact of these uncertainties. This improves the chance of successful project completion and reduces the consequences of those risks.

5.2.1 Risk Identification

- Risk ID=1
Risk Category - Technical
Risk Description - Schedule delay to be expected if the inputs are not clear
- Risk ID=2
Risk Category - Hardware
Risk Description - Webcam/Camera should be working properly
- Risk ID=3
Risk Category - Runtime
Risk Description - Time, cost and scope deviation to be expected if requirements will not be final at project kick-off
- Risk ID=4
Risk Category - External
Risk Description - OTP can be delayed due to range issues or telecom network issues

5.2.2 Risk Analysis

- Risk ID=1 ,Risk ID=3
Project Impact - Nothing can be executed well if inputs are not clear
Likelihood - Possibility of this risk is low
Impact - Extent of this risk's impact on the project is significant
- Risk ID=2
Project Impact - Face will not be detected if camera not working
Likelihood - Possibility of this risk is low
Impact - Extent of this risk's impact on the project is severe
- Risk ID=4
Project Impact - 2-way authentication won't be possible without OTP
Likelihood - Possibility of this risk is low
Impact - Extent of this risk's impact on the project is significant

5.2.3 Overview of Risk Mitigation, Monitoring, Management

- Risk ID=1 ,Risk ID=3
Probability - Low
Response - Mitigate the task
- Risk ID=2
Probability - Low
Response - Solve the camera issue asap
- Risk ID=4
Probability - Low
Response - Inform the network and wait to get it resolved

5.3 Project Schedule

5.3.1 Project Task Set

Major Tasks in the Project stages are:

- Task 1: June-August 2020 : Getting acquainted with the required domain knowledge and building on ideas to develop the Machine Learning models, Facial detection and literature survey.
- Task 2: September 2020 : Getting started with Machine Learning algorithms, Facial detection algorithms and Optimization Algorithms.
- Task 3: October-Mid-December 2020: Implementation of Algorithms and Data collection as well as Preprocessing.
- Task 4: Mid-December to January 2021 : Selection of one algorithm based on various parameters.
- Task 5: February-May 2021 : Creating a Graphical User Interface for end users in actual Market Place.

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5.3.2 Task Network

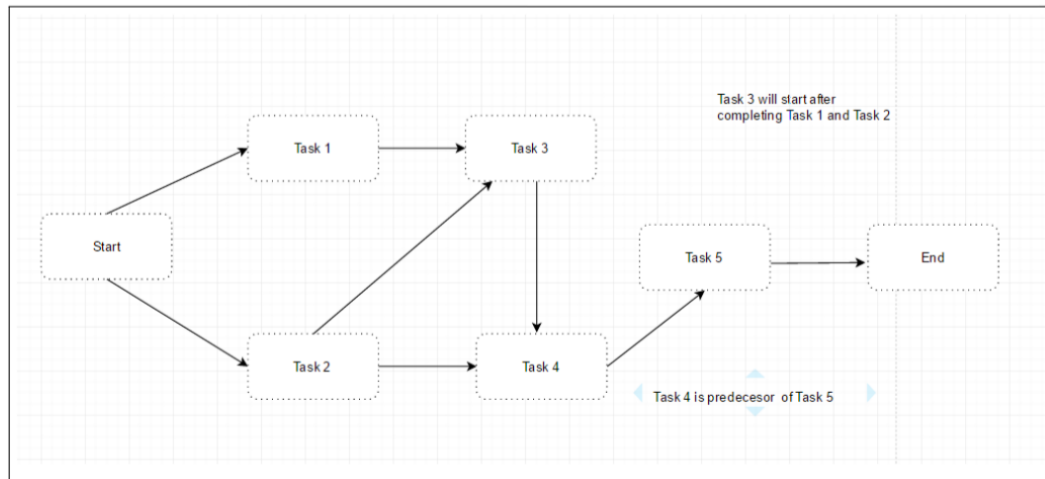


Figure 5.1: Task Network

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5.3.3 Timeline Chart

Schedule-Month	Week	Date	Project Activity
August	1st week	4/08/20	Project Topic Selection
August	3rd week	22/08/20	Synopsis Submission
September	2nd week	09/09/20	Presentation on Project Ideas
September	3rd week	21/09/20	Submission of Literature survey
September	4th week	28/09/20	Internal Review I
October	1st week	03/10/20	Review Remark sheet submission
October	2nd week	7/10/20	Design of Model
October	3rd week	15/10/20	Internal Review II
October	3rd week	20/10/20	Review Remark sheet submission
October	4th week	28/10/20	Report Preparation and Submission
January	3rd Week	23/01/21	High level Design Document
February	1st week	04/02/21	Project workstation selection, setup installation
March	1st week	03/03/21	Implementation of Functions
March	3rd week	25/03/21	Internal Review III
March	4th week	30/03/21	Review Remark sheet submission
April	1st week	01/04/21	Implementation of advanced features
April	2nd week	10/04/21	Test Tool selection and testing use cases
April	4th week	29/04/21	Project Demonstration and Review IV
May	1st week	05/05/21	Review Remark sheet submission
May	4th week	25/05/21	Final Report Submission

Figure 5.2: Timeline Chart

5.4 Team Organization

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

1. E-mails and Text messages were the medium of reporting, maintaining updates and communication.
2. Updates regarding the improvement of project are given to the guides via

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whatsapp messages. Once or twice a month a meet is held with internal guide regarding updates.

3. Weekly four days and 3-4 hours each day are given to project.

5.4.1 Team Structure

The team structure for the project is identified. Roles are defined as follows:

1. Rajendra Gavit: Developer and Documentation
2. Rudra Bhadane: Developer and Documentation
3. Nikhil Jain: Developer and Documentation
4. Ankita Pawar: Developer and Documentation

5.4.2 Management reporting and communication

- Team is always in contact with the mentors via mails and messages.
- Team members collaborate online on E-mails along with working together to improve efficiency. Also chat group and mails are used for communication.

CHAPTER 6

PROJECT IMPLEMENTATION

6.1 Overview of Project Modules

- User Registration Module :

The User Registration Module allows user to register them selves for accessing the ATM services. This module asks user to enter some basic information about them like username, phone number, email address, pin and store the details in the Database. The fields on the Registration module has some validation checks as per constraints specified and the user needs to enter the information according to the constraints. After successful validation of user information the data is forwarded to the database and camera opens for user's face detection. For face detection dlib library, OpenCV library are used and for Database connectivity MySQL connector is deployed and the whole module is implemented in python. The dlib library provides pre-trained facial landmark detector based on CNN algorithm and OpenCV has Deep Learning based face detector and recognizer.

- ATM Module :

The ATM module allows user to access the banking facilities in traditional ways but the user authentication is in different way. This module uses Two-Layer Authentication to grant access to the user and for this face detection and OTP verification is implemented. For face detection face_recognition library is used which is built using dlib a state of art face recognition based on Deep Learning and for OTP authentication random number is generated using random number generator and this number is forwarded on user registered phone number. For sending the OTP number Fast2SMS API is used.

6.2 Tools and Technologies Used

The project implementation is done using Python language and different modules are built using libraries and API. Those libraries and API are as follows :

- DLIB : Dlib is tool for creating complex software in C++ also known as modern C++ toolkit containing machine learning algorithms for solving real world problem. The feature of dlib is that it can be used in any application as it is open source. The dlib library provides pre-trained facial landmark detector based on CNN, histogram of oriented gradients (HOG), linear SVM. Dlib is used to estimate the location of 68 coordinates (x,y) that map the facial points on a person's face.
- face_recognition : This library is built using dlib state of art face recognition based on deep learning. This library is used in python for various applications like manipulating facial features in an image, Real time face recognition.

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

- OpenCV : OpenCV is a computer vision and machine learning software open source library. It is an image and video processing library used for analysing image and video, like facial detection, optical character recognition and a whole lot more.
- Fast2SMS API : Fast2SMS is a bulk sms service provider in india. This API is used for sending OTP to user after successful face recognition for authentication purpose in our project.

6.3 Algorithm Details

6.3.1 Algorithm

- Start
 1. Image Acquisition(Face Detection)
 2. Preprocessing (Image transformation)
 3. Feature Extraction (To extract 128-d feature vector)
 4. Recognition and Classification using Test and Training image Dataset
 5. OTP Generation and Authentication
- Stop

CHAPTER 7

SOFTWARE TESTING

7.1 Goal of Testing

1. To identify the bugs in the system as early as possible.
2. Preventing the bugs from occurring in the project and the product.
3. To check whether the user requirements are met or not.
4. To measure the quality of the product.

7.2 Types of Testing

- Unit testing : Unit testing is carried out to test individual units or components of software and the purpose is to validate if each unit of software performs as expected. During the coding phase project individual units were tested against predefined test suit. We created a test suit for each individual unit and that test cases were carried out using manual testing. For example validating user with incorrect OTP, Registration form validation, etc. For all senarios Positive and Negative test cases were considered.
- Integration Testing : The individually tested modules are combined as one module and tested as a group. Integration testing was conducted to evaluate the system with specified functional requirements. For this testing Test Suit with both Positive and Negative test cases was designed and tested manually.
- System Testing : System Testing validates the complete and fully integrated software product. The purpose of system testing was to evaluate end to end system specification. It consists of Black Box testing that involves the external workings of the software from the user's perspective and White Box testing that test internal working of code.

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7.3 Test cases and Test Results

Test Cases Description	Positive/Negative	Expected Result	Test Result
The User Name must contain only Alphabets and length 5 to 15 ex. ViratKohli	Positive	Accepted by the system	Pass
Invalid user name ex.Virat12	Negative	Error message	Pass
The phone number must be 10 digit	Positive	Accepted by the system	Pass
The PIN number should be numerical and length of 4 digits ex.9890	Positive	Accepted by the system	Pass
Invalid phone number ex. 1234567890 or +91 08763976412	Negative	Error message	Pass
Face detection - Camera opens after valid data entry	Positive	Accepted by the system	Pass
Face Detection - hands on face or face not visible properly	Negative	Show count of face found 0	Pass
Face detection result is store in the database	Positive	Show count of face found 1	Pass
Database Constraints	Positive	Updation on parent table reflects on child table	Pass
Face recognition - The face from Database is mapped with the users face from camera interface	Positive	Username and id is displayed	Pass
OTP verification - on successful face recognition OTP is send on valid phone number	Positive	Validate the OTP	Pass
PIN verification - user need to enter the PIN registered simultaneously with OTP	Positive	Display ATM options	Pass
Invalid Data - enter valid OTP and invalid pin or vice versa	Negative	Error message	Pass

Table 7.1: Test Cases & Test Results

CHAPTER 8

RESULTS

8.1 Outcomes and Screenshots

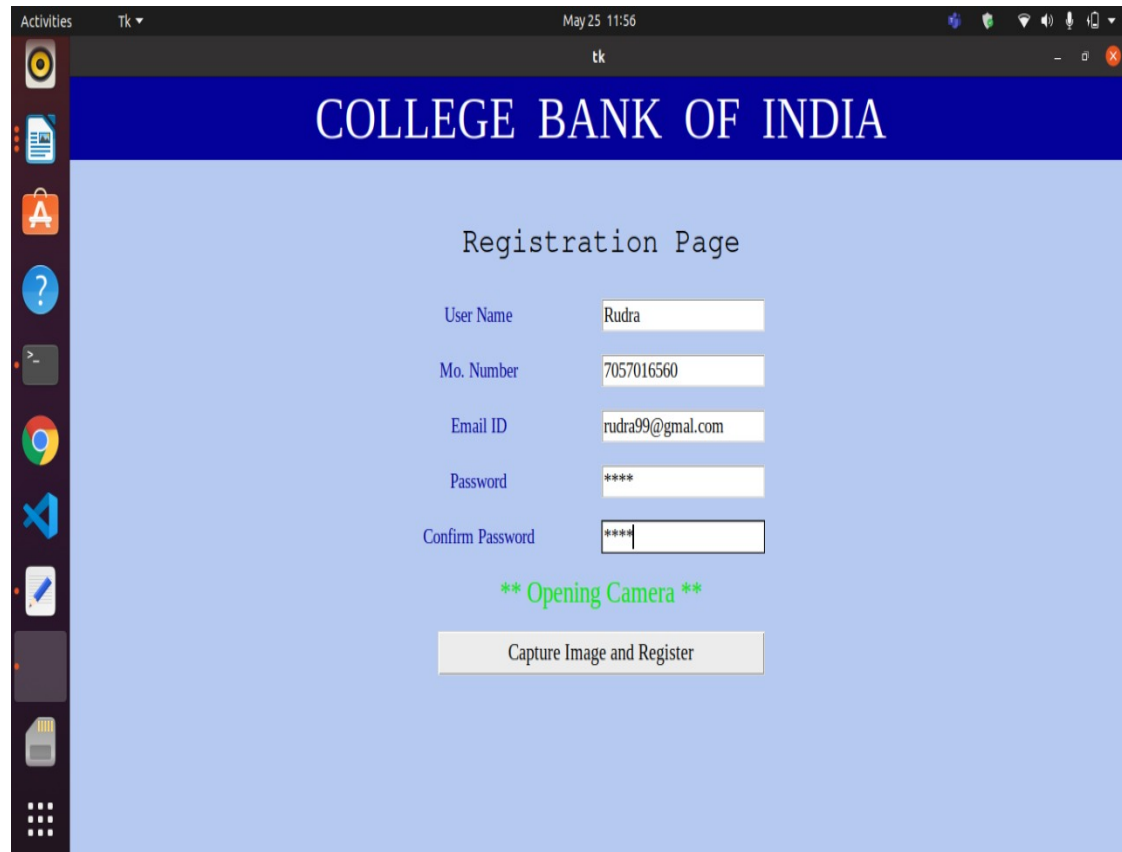


Figure 8.1: User Registration Page

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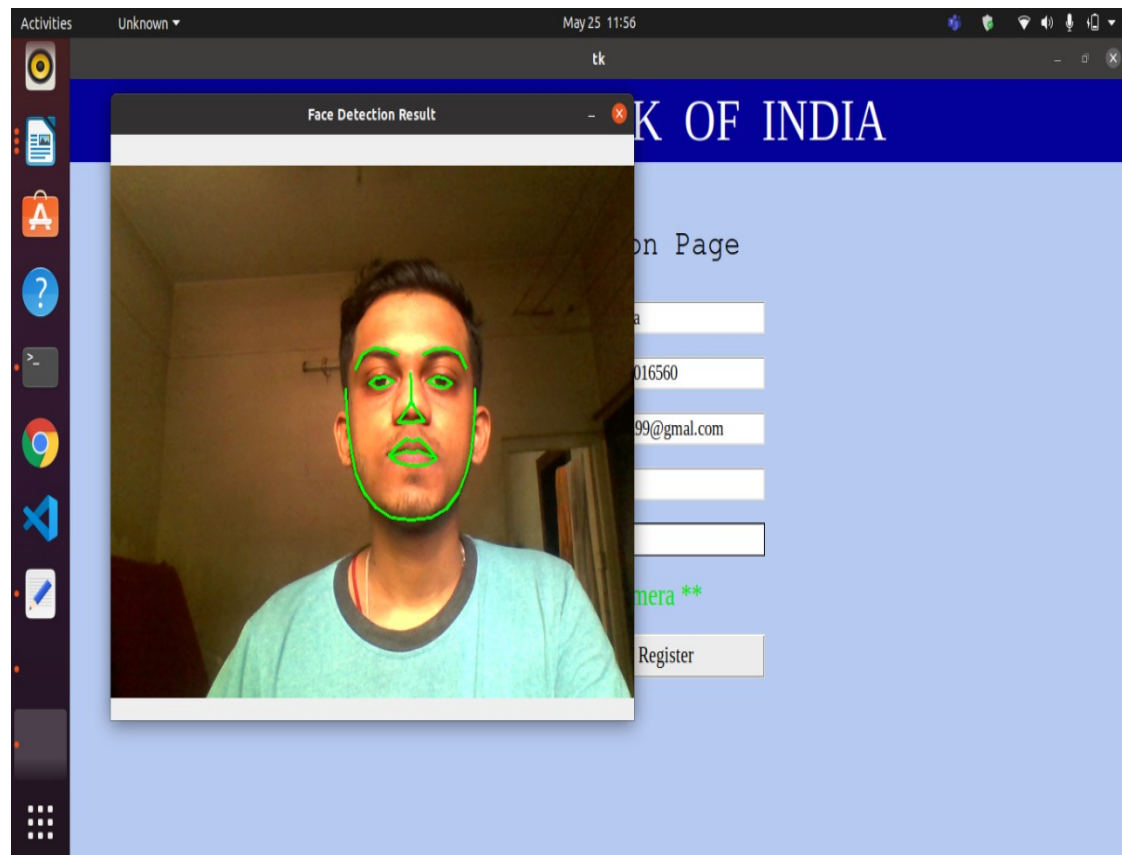


Figure 8.2: User Face Detection

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

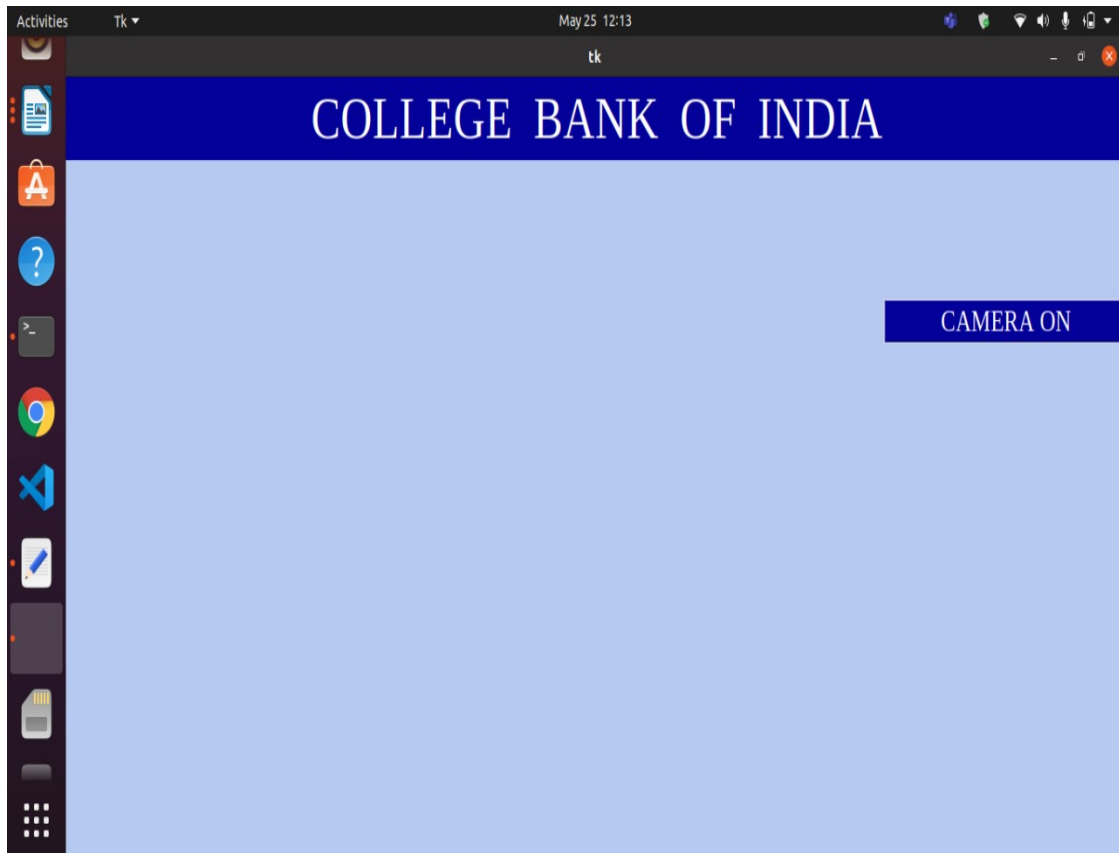


Figure 8.3: ATM Home Page

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)



Figure 8.4: PIN and OTP Verification

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

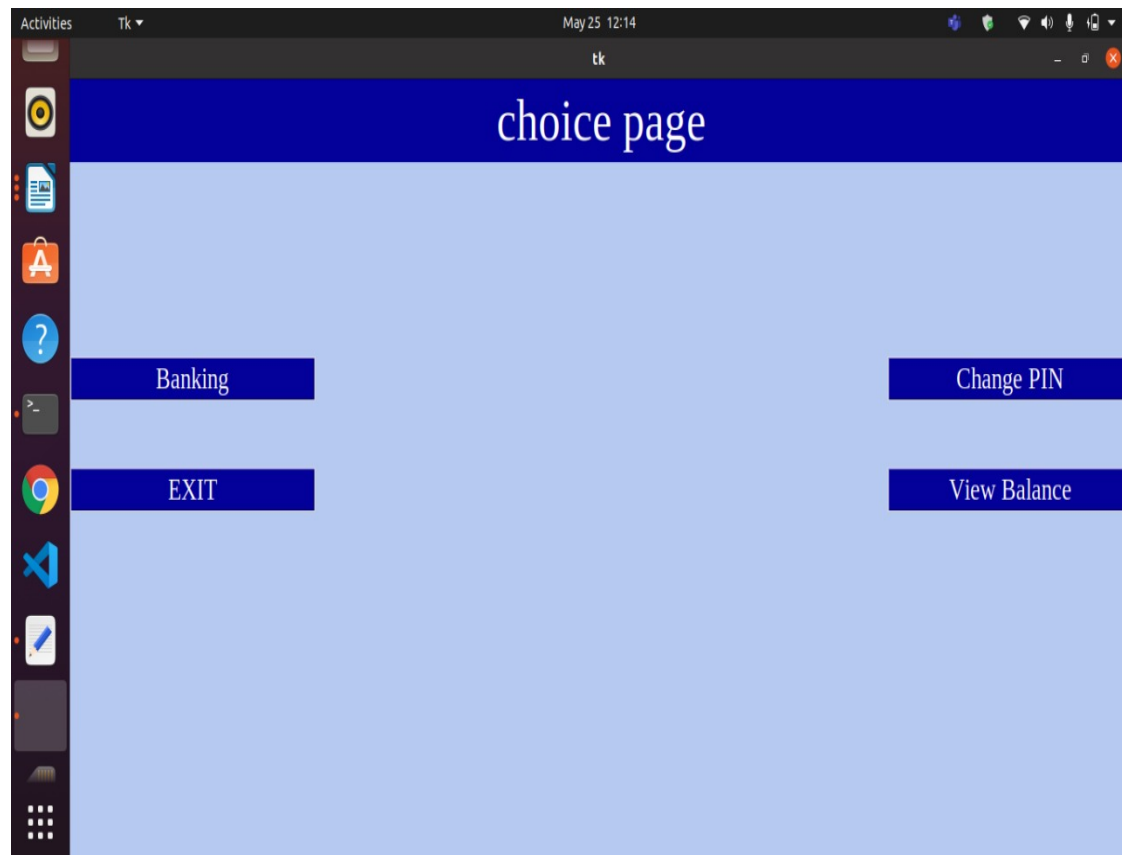
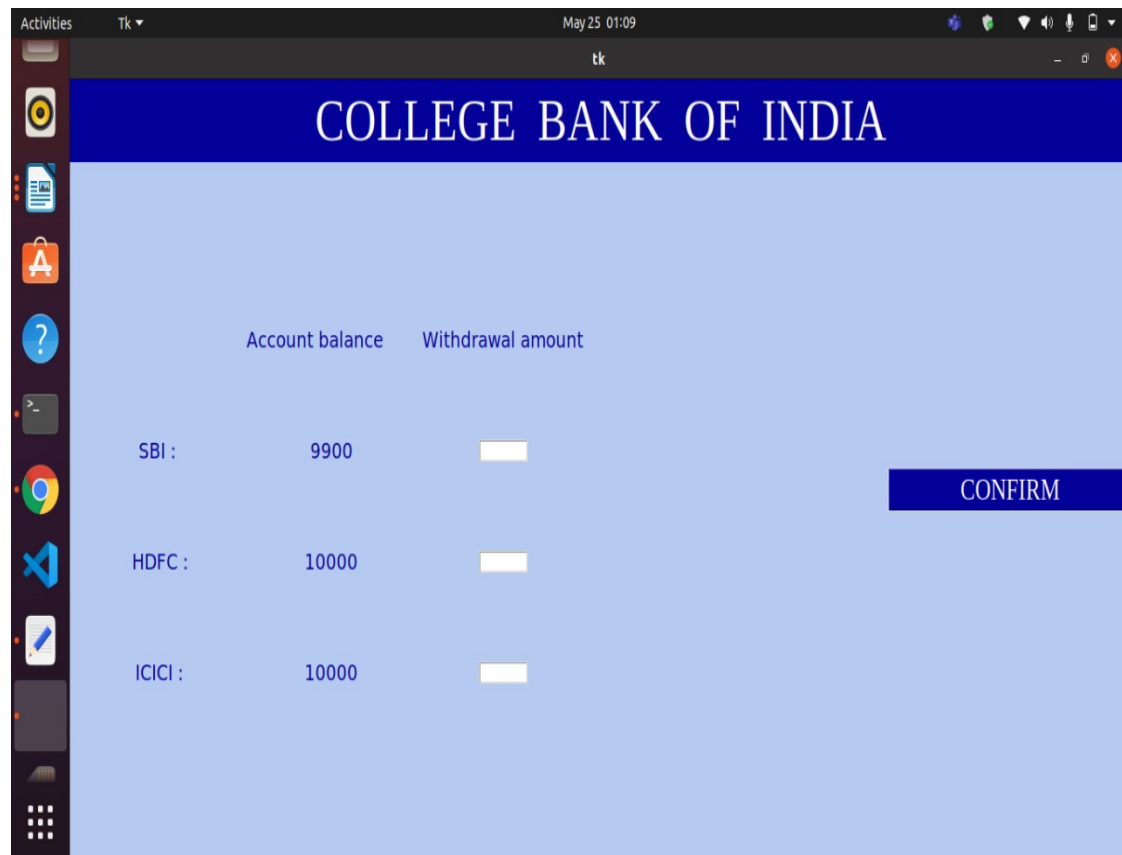


Figure 8.5: Transaction Choice Page

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)



	Account balance	Withdrawal amount
SBI :	9900	<input type="text"/>
HDFC :	10000	<input type="text"/>
ICICI :	10000	<input type="text"/>

CONFIRM

Figure 8.6: Multi-Bank Withdrawl Page

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

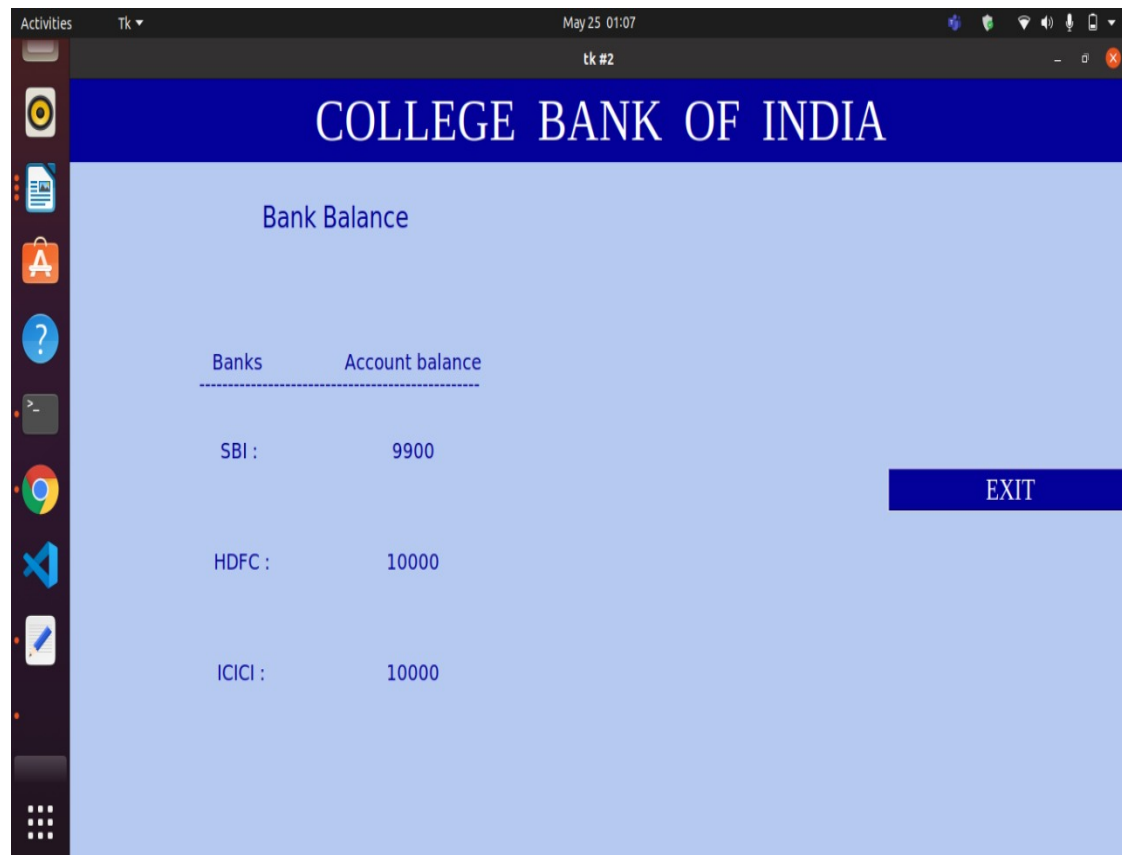
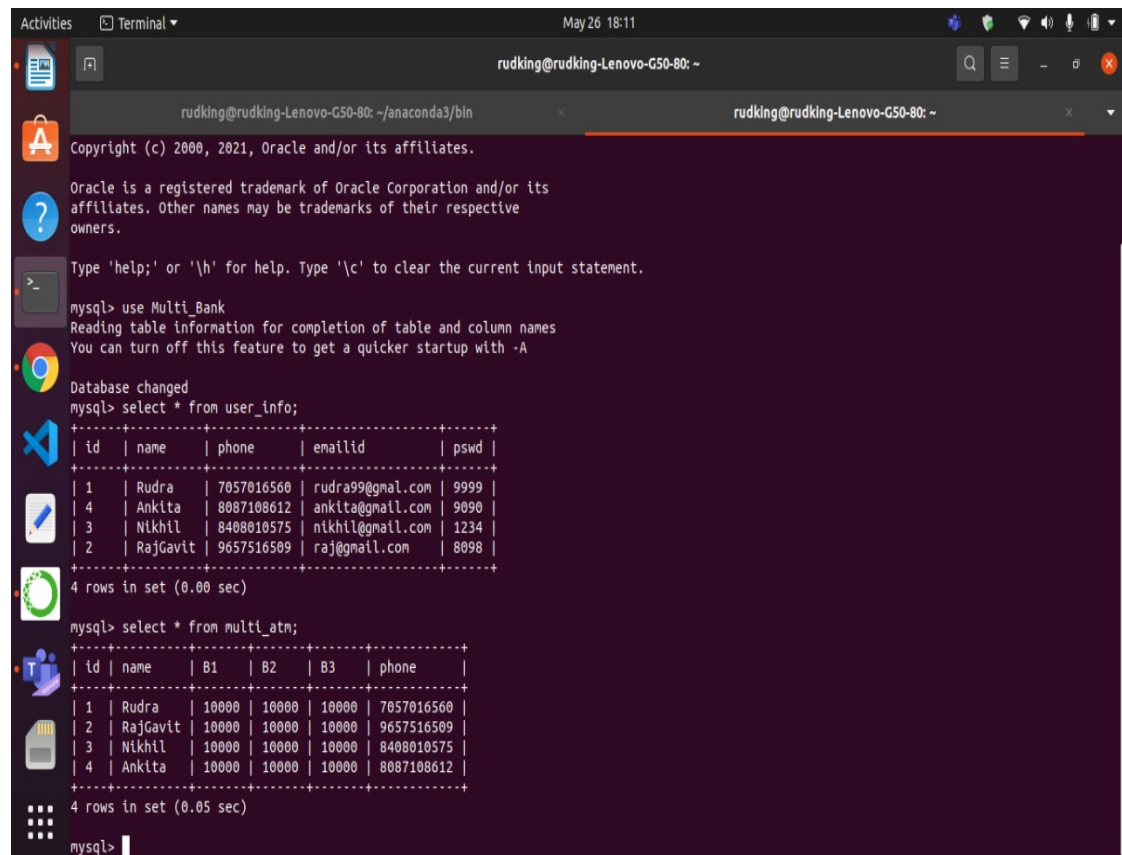


Figure 8.7: Account Balance Page

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)



```
rudking@rudking-Lenovo-G50-80: ~  
Copyright (c) 2000, 2021, Oracle and/or its affiliates.  
Oracle is a registered trademark of Oracle Corporation and/or its  
affiliates. Other names may be trademarks of their respective  
owners.  
Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.  
mysql> use Multi_Bank  
Reading table information for completion of table and column names  
You can turn off this feature to get a quicker startup with -A  
Database changed  
mysql> select * from user_info;  
+-----+-----+-----+-----+-----+  
| id | name | phone | emailid | pswd |  
+-----+-----+-----+-----+-----+  
| 1 | Rudra | 7057016560 | rudra99@gmail.com | 9999 |  
| 4 | Ankita | 8087108612 | ankita@gmail.com | 9090 |  
| 3 | Nikhl | 8408010575 | nikhl@gmail.com | 1234 |  
| 2 | RajGavit | 9657516509 | raj@gmail.com | 8098 |  
+-----+-----+-----+-----+-----+  
4 rows in set (0.00 sec)  
mysql> select * from multi_atm;  
+-----+-----+-----+-----+-----+  
| id | name | B1 | B2 | B3 | phone |  
+-----+-----+-----+-----+-----+  
| 1 | Rudra | 10000 | 10000 | 10000 | 7057016560 |  
| 2 | RajGavit | 10000 | 10000 | 10000 | 9657516509 |  
| 3 | Nikhil | 10000 | 10000 | 10000 | 8408010575 |  
| 4 | Ankita | 10000 | 10000 | 10000 | 8087108612 |  
+-----+-----+-----+-----+-----+  
4 rows in set (0.05 sec)  
mysql>
```

Figure 8.8: Backend-Database

CHAPTER 9

OTHER SPECIFICATIONS

9.1 Advantages

- Face recognition and One Time Password will prove to be more secure than ATM card.
- Face recognition will enhance the security as one cannot hack the technology.
- With faster processing the process of cash withdrawal will also speedup.
- User can make transaction using OTP anywhere and at any time he need not have to carry ATM card as he/she will be carrying mobile all the time.

CHAPTER 10

CONCLUSIONS

10.1 Conclusions

The adoption of the ATM as an electronic banking channel has positively impacted the banking system worldwide because it's very effective and convenient for bank customers. The advent of ATM fraud has however been a menace for several banks everywhere on the planet and lots of banks now aim to eradicate the fraud costs to the bank. The proposed system can provide a practical and workable solution that addresses the wants of the regulatory agency of the banks. The adopted technology of the proposed system the face detection authentication technique is also cheaper to deploy because it utilizes the components of the existing system. The model also can provide for top withdrawal limits to cater for the stress of a cash-focused customer base demands. In general, it'll positively impact the banking system and therefore the society by reducing the rising levels of crimes that are related to ATM transactions.

10.2 Future Work

In the proposed idea, authentication is done by Face detection and OTP is sent to user, which will be entered in the ATM system, In the future scope the OTP sent to user's mobile can be scanned using OCR technique using the system camera.

10.3 Applications

- ATM machine
- Home security system
- Electronic voting machine

APPENDIX A

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

Problem statement feasibility assessment using, satisfiability analysis and NP-Hard, NP-Complete or P-type using modern algebra and relevant mathematical models. The feasibility of the project is defined by the following :

Classification is an NP-Hard type problem because there's clearly a polynomial time algorithm to verify correct solutions.

Mathematics used:

Set Theory:

$S = \{s, e, X, Y, \Phi\}$

Where,

s = Start of the program.

- Registration
- Login
- Capture and Browse Image
- Processing
- Feature Extraction
- Classification
- Final Result

e = End of the program.

Resultant output provided by the input data.

X = Input of the program.

Input should be Captured Image and OTP.

Y = Output of the program.

As per the credential provided by the user, transaction is either allowed or rejected

$X, Y \in U$

Let U be the Set of System.

$U = \{\text{Admin, TD1, TD2, C}\}$

Where, Admin, TD1, TD2, C are the elements of the set.

Admin = Admin of System.

TD1 = Data for Testing

TD2 = Data for Training

C = CNN Algorithm

APPENDIX B

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)

Presently no paper publication. Current status of paper is finalised and prepared a paper. Identifying of journal and submission is in process.

APPENDIX C
PLAGIARISM REPORT

CARD-LESS ATM USING TWO TIER AUTHENTICATION (FACE RECOGNITION AND OTP)



Document Information

Analyzed document	Group id 15 (Project Report stage 2).pdf (D107777257)
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SA	Pune Institute of Computer Technology / newreport1.pdf Document newreport1.pdf (D77359835) Submitted by: arbuchade@pict.edu Receiver: arbuchade.pict@analysis.urkund.com	 1
W	URL: http://www.jmest.org/wp-content/uploads/JMESTN42351785.pdf Fetched: 11/28/2020 4:22:20 AM	 1
SA	Pune Institute of Computer Technology / Location_Recommendation Dhanashree munde.pdf Document Location_Recommendation Dhanashree munde.pdf (D74352351) Submitted by: hpchanne@pict.edu	 3

Figure C.1: Plagiarism Report

CHAPTER 11

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