Multi-Account Embedded ATM Card with Face Recognition Security System

Ranjitha R S
Department of Electronics and Communication Engineering
NIE Institute of Technology, Mysuru-570018

Kowshik
Department of Electronics and Communication Engineering
NIE Institute of Technology, Mysuru-570018

Sheetal Rao M S
Department of Electronics and Communication Engineering
NIE Institute of Technology, Mysuru-570018

Vignesh S K
Department of Electronics and Communication Engineering
NIE Institute of Technology, Mysuru-570018

Nitesh K A
Assistant Professor
Department of Electronics and Communication Engineering
NIE Institute of Technology, Mysuru-570018

***Abstract*----The growth in the electronic transactions has resulted in a greater demand for fast and accurate user identification and authentication. An automated teller machine (ATM) or cash machine is an electronic device that allows a bank's customers to make cash withdrawals and check their account balances without the need of human intervention. There is a limitation in transaction for the bank customers in using the ATM of some other bank due to the crossing the limit of transaction for which they have to pay the extra transaction fees. However, the ATM fraud has recently become more widespread. The idea behind this universal ATM card is that the customers can use a single ATM card to operate different bank accounts instead of having individual card for each bank accounts. The technology behind the product of the service is that adding all the user bank accounts to a universal ATM card. Considering the advances in biometrics, Artificial Intelligence, Internet of Things and other technologies, this next-generation ATM is adopted with face recognition for identity verification of the bank customer. There is an essential need to provide high security for each transaction carried out by individual customers. Features like face recognition and One-Time Password (OTP) are used for the enhancement of security of accounts and privacy of the users. This project proposes the amalgamation of Face Recognition System and OTP in the identity verification process and user authentication engaged in ATMs to enhance the security of the system and helps in better way to encounter the misuse of the ATM at remote locations.**

Keywords---Face Recognition, 2-factor API, Raspberry pi 3 Model B, Radio Frequency Identification (RFID) module, Viola-jones Algorithm.

I. INTRODUCTION

The rise of technology in India has brought into force many types of equipment that aim at more customer satisfaction. ATM is one such machine which made money transaction easy for customers of the bank.Automated Teller Machine is introduced in the year 1959 for encouraging self-service in retail banking. Firstly, ATM was made to transact for the particular bank customers but later on the ATMs are connected to interbank network, so that it enables people to deposit, withdraw and transfer amount from the ATM machines not belonging to that particular bank so that anyone can access any banks ATM machine to carry out their transactions. ATMs rely on authorization of a financial transaction by the card issuer or other authorizing institution via the communication network. This is often performed through an ISO 8583 messaging system. Many bank charges ATM usage fees from the customers for the transactions. ATM has both advantages and disadvantages. An article explores and discusses the risk management and different controls of ATM. To reduce the risk of fraudulent activity, several controls can be integrated into the ATM processing environment. However, the controls should not be considered a cure-all [1].

In a paper, an overview of face recognition research activities at the interACT Research Centrefor development of a fast and robust face recognition algorithm and fully automatic face recognition systems that can be deployed for real-life smart interaction applications[2].The UART mode of communication was used to scan the data base of the card holder and it automatically generates the message to a register mobile number through a GSM module. The RFID card reader is used as to identify particular users [3]. A solution that exploits a systematic set of actions to detect the skimming devices attached to the ATM machine by utilizing existing surveillance camera technology to read the images and find out if any additional items have been attached to the machine [4].Vibration Detection Sensor and GSM modules are usedfor continuous detection of vibration and a message is passed to the nearby police stations [5]. A microcontroller-based prototype of ATM cashbox access system using fingerprint sensor module is implemented using 8-bit PIC16F877A microcontroller developed by Microchip Technology and necessary software is written in Embedded 'C' and the system is tested [6].

Financial users especially utilize ATM's for physical transactions like cash withdrawal or cash deposit. However, just like any other system, ATM's are also suffering from numerous issues caused by users. Among these problems, card and/or cash forgetting (CCF) is a common issue.At present every customer has an individual ATM card for each and every bank in which he/she maintains account. So, handling the cards, their passwords play a major role here.

To overcome these difficulties, more than one bank account of the user is embedded in a single ATM smart card, so that the user can swipe the card and can select the bank from which he/she is interested to carry out transaction. In the proposed system Face Detection module analyses the picture taken by the ATM camera, recognizes if a person's face is pictured and determines whether it is covered or not.If for some reason, the face of the ATM user is not detected or covered with anything at the start of a transaction, the OTP is sent to the registered mobile number using 2factor API. Hence tis process is most secure and accurate.

II. METHODOLOGY

OpenCV was designed for computational efficiency and with a strong focus on real-time applications. So, it's perfect for real-time face recognition using a camera. To create a complete project on Face Recognition for ATM security, we must work on 3 very distinct phases-- Face Detection and Data Gathering, Train the Recognizer, Face Recognition. The process of detecting the human face in an image and representing the location of it is called Face detection.Face detection system is fundamental portion of the face recognition system. Higher the detection rate of face detection better is the efficiency of recognition system. This system can be applied for searching an individual in a set of databases, collecting the information about the persons identification based on ones stored database.A facial recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source.Face recognition starts with a picture, attempting to find a person in the image. This can be accomplished using several methods including movement, skin tones, or blurred human shapes.The most common way to detect a face, is using the "Haar Cascade classifier". Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. In the proposed system, a dataset is created, a group of photos in gray with the portion that was used for face detecting are stored for each id. Facial samples are stored in a directory called 'Dataset'. On this second phase,all user data are taken from dataset and the OpenCV Recognizer is trained. This is done directly by a specific OpenCV function. The fresh face on camera is captured and if this person had his face captured and trained before,recognizer will make a "prediction" returning its id and an index, shown how confident the recognizer is with this match [12][13].

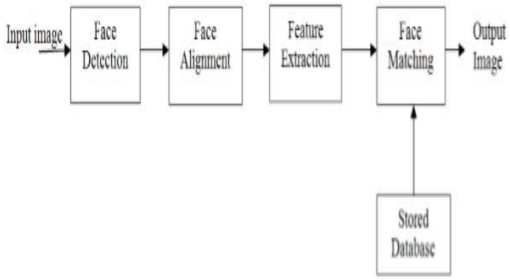

Figure 1: Face Recognition System

The Raspberry Pi 3 Model B is the latest version of the Raspberry Pi computer. The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The Pi isn't like your typical machine, in its cheapest form it doesn't have a case, and is simply a credit-card sized electronic board of the type you might find inside a PC or laptop but much smaller. 12V adapter will be used for power supply of the raspberry pi. Raspberry Pi is connected to PC/ Laptop to view the output of the proposed system, an HD-webcam is used for capturing the facial images for face detection and face recognition system. USB RFID reader is used for detecting the RFID card which is used as ATM card. Face recognition finds its application in a variety of fields such as homeland security, criminal identification, human-computer interaction, privacy security, etc. The face recognition feature inhibits access of account through stolen or fake cards. The card itself is not enough to access account as it requires the person as well for the transaction to proceed. Eigenface based method is used for the face recognition. However, the drawback of using eigenface based method is that it can sometimes be spoofed by the means of fake masks or photos of an account holder. To overcome this problem 2D face recognition methods can be used. However, its computation cost is high and requires large storage space which makes it very difficult to store information about a large number of users and 2D masks can also be used to spoof the 2D facial recognition-based model. 2D printing is mostly used for such attacks. These drawbacks can be easily overcome by using One-Time passwords (OTP). OTP ensures that the user is authentic by sending the randomly generated 6-digit code to the registered mobile number of the corresponding account holder.

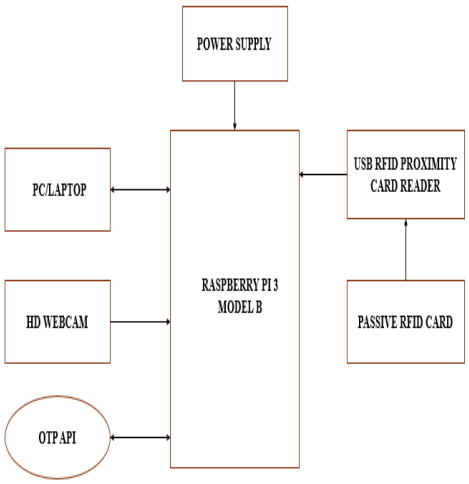

Figure 2: Propose system for

III.ALGORITHM OF THE PROPOSED SYSTEM

First, the user will swipe the ATM card. A live image is captured automatically through a webcam installed on the ATM, which is compared with the images stored in the database. Database holds information about a user's account details, images of his/her face and a mobile number which will improve security to a large extent. If it matches, it will ask to enter the password and then cash, the transaction will be processed. Otherwise an OTP will be sent to the corresponding registered mobile number. This randomly generated code has to be entered by the user in the text stage. If the user correctly enters the OTP, the transaction can proceed. Therefore, the combination of face recognition algorithm and an OTP drastically reduces the chances of fraud plus frees a user from an extra burden of remembering complex passwords.

FLOWCHART:

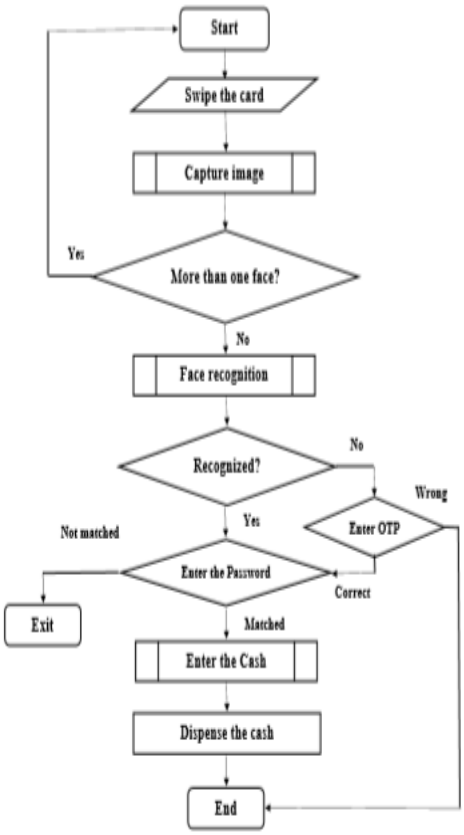

Figure 3: Flowchart of the proposed system

IV. SOFTWARE SPECIFICATION

1. Open CV: OpenCV abbreviated as open source computer vision library which consists of more than 2500 computer vision algorithms, documentation and vision applications developed by Intel and managing by Willow Garage. OpenCV is freely available for both commercial and noncommercial applications. Its algorithms are available for many machine learning problems and they are used to detect and tracking of an object, extraction of 3D model objects and classification of persons action in videos etc. OpenCV has its own predefined function for analysis of image data and applying mathematical as well as matrix operations on them.
2. Python: Python is the high-level and powerful programming language. Python's effective syntax and simple tying makes it as popular language for developing many application platforms. It is also one of the three official programming languages used by Google for its development of most application. Python is free and open source product. The syntax of python is clear and easily readable. Elegant development in python coding leads to produce direct result. Python is highly portable language and it is written in ANSI C (portable).The packages and modules in pythonlibrary are reusable.Python is not a scripting language, but is object-oriented language.
3. Raspbian buster:Raspbian is a Debian-based computer operating system for Raspberry Pi. There are several versions of Raspbian including Raspbian Buster and

Raspbian Stretch. The Raspbian Buster released as the successor of Raspbian Stretch which was the default Raspberry Pi operating system for almost 2 years, is compatible with all the models of Raspberry Pi. Buster is based on the latest version of Debian Linux 10, with Linux kernel version 4.19, and 8.3 GCC compiler. The Raspbian Buster is released before the official Debian release date for Debian Buster.

4. VNC Viewer: Virtual Network Computing (VNC) is a graphical desktop-sharing system that uses Remote Frame Buffer protocol (RFB) to remotely control another computer. Through this software Raspberry pi is programmed using laptop.

V. RESULT

The experiment was conducted for the proposed system. Raspberry pi was powered with 12V power supply. An RFID reader and a Web CAM are connected to Raspberry pi through USB ports. Different cases are tested and result is recorded.

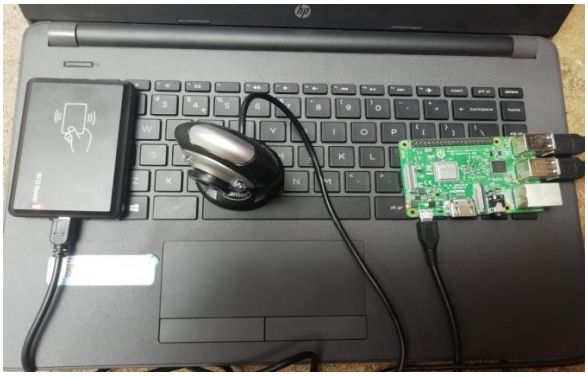

Figure 4: Experimental Setup

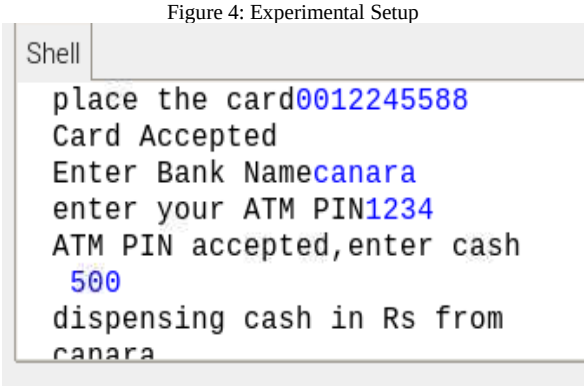

Figure 5: Result when face is recognised

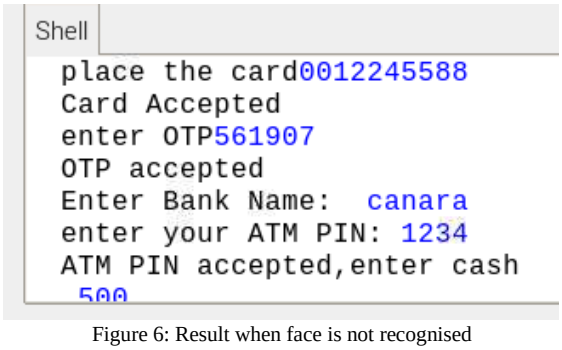

Figure 6: Result when face is not recognised

Figure 7: OTP sent to the registered number

First, the faces of the customer are captured and will be stored in the dataset. These captured pictures are used to train the system. After training the system is able to recognize the trained person's face. If the customer runs the program firstly the system asks to place the card, after reading the card number the camera captures the face of the customer and compare the captured face with set of faces in the database. If the face is recognized then the system asks the person to enter the PIN and enter the bank name and cash the customer required to withdraw (figure5). But if the camera fails to recognize the face of the customer, the processor requests the API to send the OTP to the registered mobile number and confirms the processor weather the entered OTP is correct or wrong. Once the OTP is verified, the customer can continue with the transaction(figure6).

VI.CONCLUSION

As a result, ATM model which provides security by using Facial verification software adding up facial recognition systems to the identity confirmation process used in ATMs can reduce forced transactions to a great extent. Using a 2d technology for identification is strong and it is further fortified when another is used at authentication level. The model shows the qualitative analysis of algorithms used based on the metrics of existing algorithms. According to the statistics PCA based face recognition is very accurate, requires less computation time and less storage space as trainee images are stored in the form of their projections on a reduced basis. Facial verification software is at present up to the task of provided that important match rates for use in ATM transactions. Adding up facial recognition systems to the identity confirmation process used in ATMs can reduce forged transactions to a great extent. To avoid atm robberies and provide security for atm, to secure such a complex system will be even more difficult than design it. And now people just begin to discuss some issues of ATM security. It will provide some experience for us to implement security services in ATM network.

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