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Cardless ATM System

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Abstract: *Banks provide ATM cards to customer to avail the services like cash withdrawal, PIN change, balance inquiry etc. But physical cards have some problems. It can be stolen, skimmed, cloned, hijacked, damaged or expired. Due to this problem, we need to think an alternate way to provide better security. Many researchers are thinking about cardless transaction through ATM Automated Teller Machine (ATM) transactions are found safe, reliable, and inevitable these days for fulfilling our financial commitments. Traditional approach for using ATM mandates involvement of Debit card. But however, people do experience times when their account lacks balance amount or they forget to carry card and struggle to complete transaction. We know that parallel to ATM usage, mobile phones' 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 debit card which can be referred to as card less cash withdrawal. Face detection and OTP is used for authentication of user. This along with Face detection comprises two levels of security. When Face and OTP are matched then customer's account will open in ATM machine.*

Keywords: Face Detection, ATM Machine, OTP, Cardless Transaction, Debit Card, Credit Card, Financial, Withdraw, Cash, Security, Face Recognition, etc

I. INTRODUCTION

In today's world to secure personal data is a big problem for the common man. Leaked personal data means losing all money within a minute and this type of fraud in India is increasing rapidly. In India, bank accounts and the use of ATMs are increasing rapidly, but fraud is also increasing in this system. So, we are designing a system to improve the security of the ATM system. This system is very secure and not costly. There is only one additional step to give a live photo in the registration process. For security, people can use a face that has been unique, easy, safe, and accurate for identification. In this system, we can also give an advantage to the customer to give access to an ATM to relatives without any hesitation. For these we can add an OTP step in ATM for the guest user and OTP will send on account holder's mobile number. Facial recognition is a way of identifying or confirming an individual's identity using their face. Facial recognition systems can be used to identify people in photos, videos, or in real-time. Facial recognition is a category of biometric security. Other forms of biometric software include voice recognition, fingerprint recognition, and eye retina or iris recognition. The technology is mostly used for security and law enforcement, though there is increasing interest in other areas of use.

II. RELATED WORK

In recent years, cash withdrawal through ATM cards has seen an increase in the number of card related frauds; cardcloning, shoulder surfing, fake keyboard, skimming etc. being a few of them.
To combat these problems, Khushboo Yadav et al [1] proposed a Secure Card less Transaction System- a method which would eliminate the usage of ATM PIN and physical cards altogether and hence provide a secure environment for cash withdrawal. The concept of User-Generated One Time Password (OTP) has been introduced in this project. With all these modification in existing systems, the robustness of the machines will increase.
Md. Al Imran et al [2] analysed their protocol and found some flaws on this. This protocol doesn't specify what if it isoff us transaction. Besides, customers get different categories of services, but this protocol cannot determine whichcustomer will get which category of services. That is why, inspired by this protocol we have proposed a modified

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model for getting same transaction facilities as exists which uses BPIN that will determine the bank identity (B) and a random Personal Identification Number (PIN) and One Time Password for authentication of the customer instead of biometric fingerprint because of major disadvantage of biometric authentication. And obviously it will use no card for accomplishing the transaction.

"OTP Based Cardless Transaction using ATM" [3] proposed a secure, robust, and flexible biometric authentication system which combines two methods that use a Biometric and a proximity sensor. To increase the security level in ATM transaction this proposal integrates a biometric fingerprint technique along with a shuffling keypad method. Here the card is replaced wit h the fingerprint, which is registered during the opening of a bank account and PIN number is entered in a shuffling keypad. To avoid the shoulder-surfing attacks with or without concealed cameras in PIN entry, this approach uses a shuffling keypad which uses a proximity sensor to shuffle the keypad during the PIN entry. The system is tested with multiple users and has obtained 100% accuracy. This system avoids the misuse of electronic cards and supports a secure transaction.

An automated teller machine (ATM) is an electronic telecommunications device that helps customers of banking departments in transactions and transfer of money in their accounts. The customer enters their unique personal identification number (PIN), i.e., stored in the chip of the card. Due to an increase in the installation of ATM and the number of ATM cardholders, the number of cases of fraudulence has also increased radically. The advancement in technology has resulted in an increase in various skimming activities. So, developments are incorporated in the existing systems to make it more secure, convenient, and reliable. The employed secured system must have high speed and must be durable.

The design presented in [4] is unique because of biometric scanners such as Iris scanner and the two-way check with fingerprint scanner makes it more reliable. The iris scanner being the primary security check lets the system access the further steps for transaction. Fingerprint scanner embedded in the ATM card acts as the secondary security check for the system. The transaction procedure is successful only if the input data by the card holder matches with the database. It consumes less energy that makes it suitable for use. The suggested modified system is pragmatic more over economical when correlating to the alternative existing classification and affirmation processes of ATMs.

Nowadays iris recognition is getting more popular in terms of security. Iris pattern is more stable with ages, uniqueness,and acceptability. Because of its high reliability and good rates of recognition, iris recognition is therefore used forhighly secure locations. With the arrival of ATM banking has become much easier and it has also become moreaccessible. The product (ATM) it is manifold due tothe highly increasing risk of intelligent criminals. Due to which thebanking services are in danger and not secure. This situation is getting progressed as huge progress is made in biometricrecognition techniques like fingerprint and iris scanning. Customers password can be encrypted using selective articlepoints. Therefore, a system is needed which is moresecure and provides safe transactions and also help from variousfrauds. System described in [5] is more secure and fast and helps to provide better facilities.

In paper [6], Mahansaria,Divyans; Roy, Uttam Kumar 2019 International Carnahan Conference on Security Technology (ICCST) – "Secure Authentication for ATM transactions using NFC technology". The objective of this research is to consider smart phone in Near-Field Communication (NFC) Card Emulation mode as an alternative to ATM cards.

In Embedded Systems[7], Kale Priyanka Hemant; Jajulwar, 2019 9th International Conference on Emerging Trends in Engineering and Technology – "Design of Embedded Based Dual Identification ATM Card Security System". In this paper, two options are included like One Time Password (OTP) and Fingerprint detection for a successful transaction.

3-Level Authenticationsystem [8], VelasiriDwarakamayi Amareswari1, Gopi Manoj Vuyyuru2, International Journal of Advanced Research in Computer and Communication Engineering, "Card less ATM Using 3-Level Authentication System". In this paper, it is proposed that a use of a 3-level authentication system for withdrawing cash without cards by using combination of various authentication techniques.

In paper [9], D.Arun Kumar, B.Iniyan, M.Ahamed Askar, A.Ajay, R.Ambika, 2019 5th International Conference on Advanced Computing and Communications , "Face Recognition System Based new generation ATM machine". This paper presents a biometric based framework by achieving face acknowledgement calculations successfully.

Mobile Banking [10], Nischal Bansal, Nepali Singla, 2016 International Conference on Computational Techniques in Information and Communication Technologies, "Cash Withdrawal from ATM machine using Mobile Banking". This research paper proposes enhanced feature of mobile banking which increases security and speeds up withdrawal.

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III. PROPOSED METHODOLOGY

Here is a proposed methodology for implementing a cardless ATM system:

1. Requirements gathering: The first step is to gather requirements from stakeholders, including customers, bank management, and technical teams. This should include identifying the features and functionalities that the cardless ATM system should provide.
2. Design: Based on the requirements, the design of the cardless ATM system should be developed. This should include the technical architecture, data flow, and user interface design.
3. Authentication: Authentication is a critical component of a cardless ATM system. Several authentication mechanisms can be used, including biometric authentication, two-factor authentication, and secure identification codes. The authentication mechanism should be chosen based on the system requirements and the level of security desired.
4. Encryption: Encryption is necessary to protect user data and prevent unauthorized access. All data transmitted between the user's device and the ATM must be encrypted to ensure confidentiality and integrity.
5. Fraud detection: Effective fraud detection mechanisms are critical to identify and prevent fraudulent transactions. This can include real-time monitoring of transactions, machine learning algorithms, and other security measures.
6. Testing: The cardless ATM system should be thoroughly tested to ensure that it meets the requirements and is functioning correctly. This should include both functional and non-functional testing.
7. Deployment: Once the testing is complete, the cardless ATM system can be deployed. This should be done in a phased manner to minimize the impact on users.
8. Maintenance: Maintenance is an essential component of any system. The cardless ATM system should be monitored and maintained regularly to ensure that it continues to function correctly and meet the evolving needs of users.

3.1 Advantages of Proposed System

The proposed cardless ATM system offers several advantages, including:

1. Increased Security: Cardless ATM systems offer enhanced security compared to traditional ATM systems. The use of biometric authentication and encryption makes it difficult for fraudsters to steal user data and conduct fraudulent transactions.
2. Convenience: Cardless ATM systems offer greater convenience to users as they no longer need to carry a physical card with them. This reduces the risk of lost or stolen cards, and eliminates the need to remember PINs or carry cash.
3. Accessibility: Cardless ATM systems can be accessed from anywhere using a mobile device, making them more accessible to users who may not have access to traditional banking services.
4. Cost Savings: Cardless ATM systems can reduce costs for banks as they no longer need to produce physical cards or maintain physical ATMs. This can result in significant cost savings over time.
5. Improved User Experience: The use of mobile devices and biometric authentication makes the user experience more seamless and user-friendly. Users can quickly and easily conduct transactions without having to navigate complex menus or enter PINs.

3.2 Architecture

Multi-banking

This is the list of all the banks that the user has registered at. The user will be allowed to choose one particular bank from the list and gains access to it.

Prototype ATM Application

This is the sample application developed to demonstrate how the security measures will be accomplished using the MFA application. This is the application that allows the ATM operations. The ultimate target for the users after the registration and the login process is this prototype application. When the users try to perform those operations in this

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portal, the portal redirects them to the MFA application which guides the users to complete the multiple phases of authentication before getting the access to the prototype.

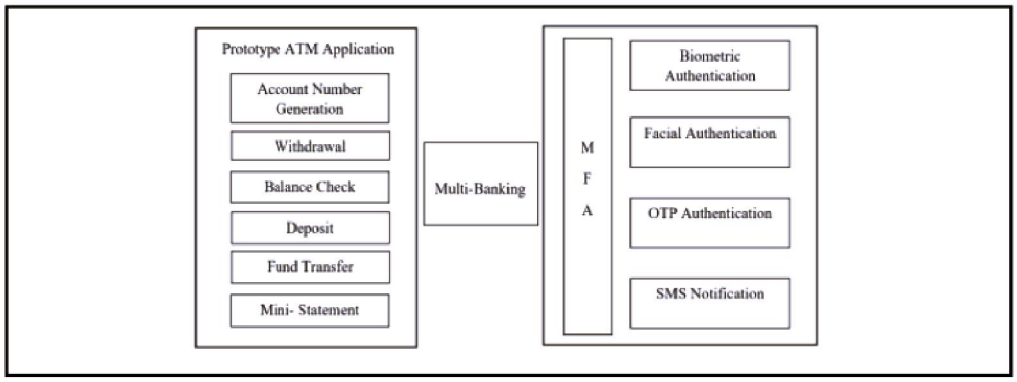

Fig 1. System Architecture

The user can perform different ATM services like:

- Withdraw
- Deposit
- Balance Check
- Generate Account Number
- Fast Cash

IV. IMPLEMENTATION

The implementation of a cardless ATM system involves several steps, including:

1. System Design: The first step in implementing a cardless ATM system is to design the system architecture, including the mobile application, application server, ATM controller, biometric authentication system, encryption, cloud services, APIs, and database. This involves defining the functional and technical requirements, selecting the appropriate technologies and tools, and creating a detailed implementation plan.
2. Development: The next step is to develop the software components of the cardless ATM system, including the mobile application, application server, ATM controller software, and database. This involves writing code, integrating third-party libraries and APIs, and testing the software components to ensure they work as intended.
3. Hardware Integration: The next step is to integrate the software components with the hardware components of the cardless ATM system, including the ATM controller hardware and biometric authentication devices. This involves configuring the hardware components, connecting them to the software components, and testing the integration to ensure it works as intended.
4. Testing: The next step is to conduct comprehensive testing of the cardless ATM system to ensure it meets the functional and technical requirements. This involves testing the system's performance, security, reliability, and usability, and identifying and fixing any issues or bugs that arise.
5. Deployment: The next step is to deploy the cardless ATM system to production environments. This involves installing the hardware components at ATM locations, configuring the software components, and ensuring the system is fully operational.
6. Maintenance and Support: The final step is to provide ongoing maintenance and support for the cardless ATM system. This involves monitoring the system's performance, identifying and fixing any issues that arise, and providing technical support to users as needed.

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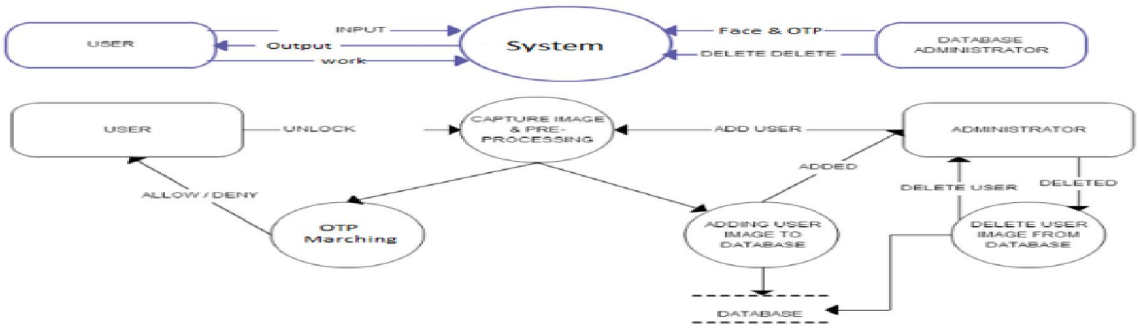

Fig 2. DFD Diagram

4.1 Algorithms

The cardless ATM system uses two main algorithms for face recognition and OTP generation.

1. Face Recognition Algorithm: The face recognition algorithm is used to verify the identity of the user before allowing access to the ATM transaction. The algorithm works by analysing the user's facial features, such as the distance between the eyes, nose, and mouth, and comparing them to the facial features in the user's profile. The algorithm uses deep learning techniques to improve the accuracy of the facial recognition process, and it can also detect and prevent spoofing attacks.
2. OTP Generation Algorithm: The OTP generation algorithm is used to generate a one-time password (OTP) for the user to use during the transaction. The OTP is sent to the user's mobile phone, which they then enter into the ATM to complete the transaction. The OTP generation algorithm uses a combination of cryptographic and random number generation techniques to ensure the OTP is unique and secure. The algorithm can also adjust the length and complexity of the OTP based on the transaction type and user preferences.

V. RESULTS AND DISCUSSION

5.1 Simulation Results

The system consists of both software and hardware components. The overall coding in the system is done with Python programming language [12]. Raspbian stretches a computer operating system for working of Raspberry Pi. The system contains PCB design, circuit design and simulation in the circuit wizard. The connections of components are shown in the circuit diagram (Fig. 2). The PIN can be entered from the 4x4 keypad. The 4x4 keypad is connected to the Raspberry Pi through the PINs 11, 13, 15, 19, 21, 23, 27 (11 for row1, 13 for row2, 15 for row3, and 19 for row4, 21 for column1, 23 for column2, 27 for column3) and it is mainly used for typing the password and selecting the options etc. The 16x2 LCD Display is connected to the GPIO (General Purpose Input/output) pins 7, 8, 25, 24, 23, 18 (7 for Register Select, 8 for Enable, 25 for Data pin 4, 24 for Data pin 5, 23 for Data pin 6, 18 for Data pin 7) of Raspberry Pi for different display purposes like showing various options like Enter. The Amount, Main Menu, Code accepted, Wrong Password etc.

5.2 Intermediate Results

The working result of the project is explained with the images shown below. Images of the whole project and the results obtained are mentioned. The software and hardware components of the system are shown. The hardware components are Raspberry Pi B+ model, 16x2 LCD Display, 4x4 Keypad, GSM Module, TTL Module, Web Camera, RFID Reader and RFID Card and Power Supply. Each component is connected to one another as shown in the schematic diagram. The software part of the system consists of the Python programming. In this system python 3 language is used to run the main program code.

Following are the steps involved required to complete the authentication process:

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Fig 3. Login Page

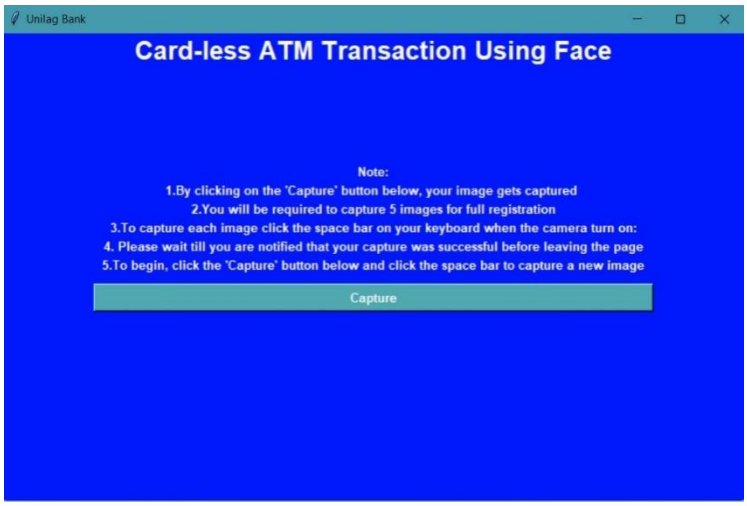

Fig 4. Capture Face ID

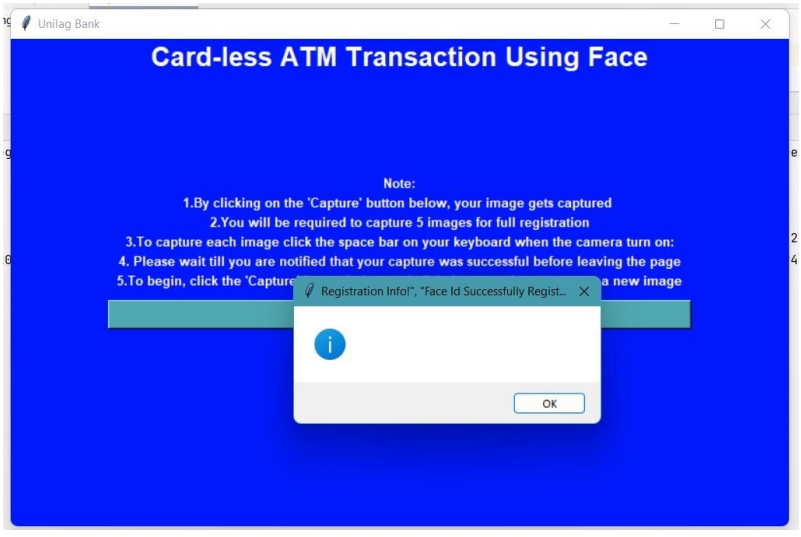

Fig 5. Registration of Face ID

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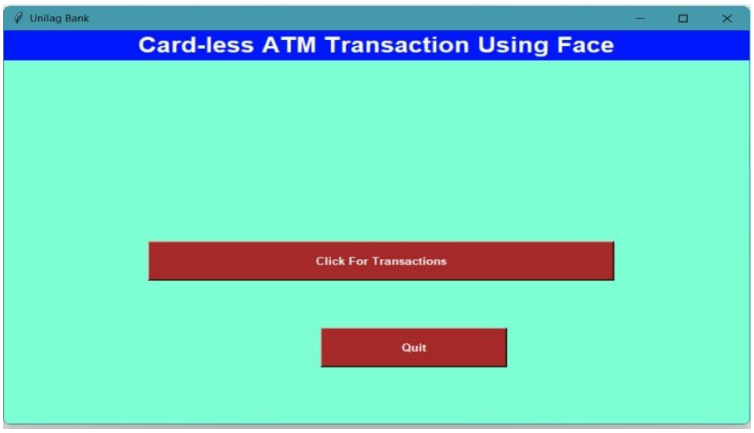

Fig 6. Main Page

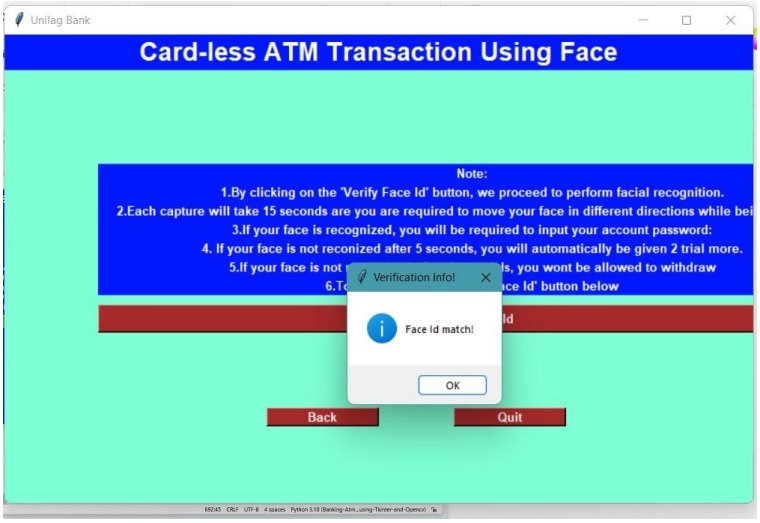

Fig 7. Matching Face ID

Fig 8. Proceed To Transactions

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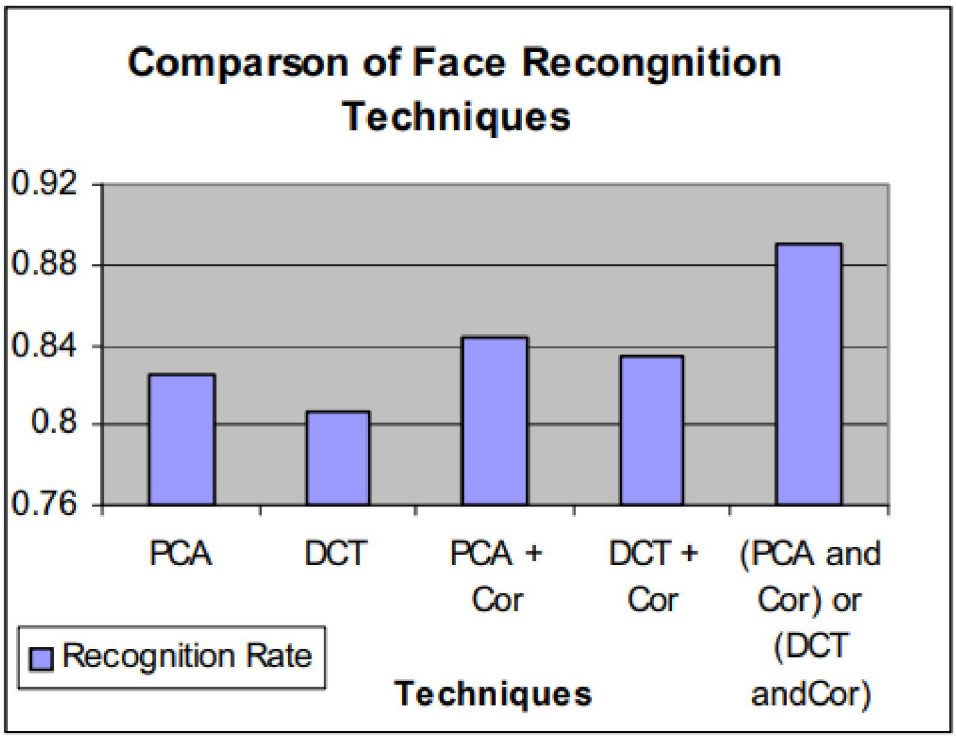

Fig 9.Recognition rate of various face recognition techniques tried.

DISCRETE COSINE TRANSFORM (DCT)

Discrete Cosine Transform (DCT) is the technique used here for converting spatial components into frequency component.

PRINCIPAL COMPONENT ANALYSIS ALGORITHM (PCA)

Principal component analysis (PCA) is a technique used to find underlying correlations that exist in a (potentially very large) set of variables.

The recognition rate, measured as the ratio of successful attempts (cases where the best match is the correct match) to the total attempts, was analysed offline for the various approaches.

VI. CONCLUSION

The adoption of the ATM as an electronic banking channel has positively impacted the banking industry worldwide because it is very effective and convenient for bank customers. The advent of ATM fraud has however been a menace for many banks all over the world and many banks now aim to eradicate fraud costs to the bank. The proposed system can provide a practical and workable solution that addresses the requirements of the regulatory authority of the banks.

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