Real Time Face Detection and Pin Authentication for ATM Machine

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Peer Review Information	Abstract
	With the increasing incidence of ATM fraud, there is a pressing need for enhanced security measures in automated teller machines (ATMs). This paper presents a dual-factor authentication system that integrates face recognition and Personal Identification Number (PIN) verification to improve ATM transaction security. Utilizing a Convolutional Neural Network (CNN) for real-time face recognition, the proposed system significantly reduces the risk of unauthorized access. The implementation includes an Arduino-based cash dispenser and a web application developed using Tkinter, demonstrating a robust prototype that effectively mitigates ATM fraud.

INTRODUCTION

The rise in ATM fraud has necessitated the development of more secure authentication mechanisms. Traditional PIN-based systems are vulnerable to various attacks, including shoulder surfing and card skimming. This paper aims to enhance ATM security by integrating biometric face recognition with conventional PIN verification, thereby providing a dual-layered authentication approach. He rise of ATM fraud, there is an increasing need for secure and reliable authentication mechanisms. Traditional PIN-based authentication systems are susceptible to various types of attacks, including shoulder surfing and card skimming. This project aims to strengthen ATM authentication by integrating face recognition along with traditional PIN verification...

EASE OF USE

1. Seamless Interface: The user interface is designed using Tkinter to be simple and intuitive, guiding users step-by-step through the authentication process. Whether users are creating accounts or performing transactions, clear prompts are provided at every stage.
2. Quick and Accurate Face Recognition: The use of Convolutional Neural Networks (CNNs) ensures that the face recognition process is quick and reliable. Users only need to look at the camera briefly, and the system instantly verifies their identity with high accuracy.
3. Minimal Input Required: After face recognition, users only need to enter their PIN, making the process fast. The system securely handles all other operations in the background, reducing the need for additional steps.
4. Easy-to-Demo ATM Prototype: The Arduino-based cash dispenser is designed for simplicity. It dispenses the requested number of ₹100 notes in a straightforward manner, making it easy to understand and demonstrate in practical settings.
5. Web-Based Accessibility: Since the system is web-based, users can create accounts and manage their ATM profiles remotely without

needing to visit a physical ATM. This adds to the overall convenience, as users can perform actions from any device with an internet connection.

SYSTEM REVIEW

The ATM Authentication System developed in this project integrates two authentication mechanisms: face recognition and PIN verification. This dual-factor authentication enhances security and prevents unauthorized access to the ATM system. The system includes the following components:

- Face Recognition Module: Utilizes a Convolutional Neural Network (CNN) to detect and verify the user's face.
- PIN Verification Module: Users input a personal identification number (PIN) which is securely hashed and stored in the database.
- Cash Dispenser Mechanism: An Arduino-based system that dispenses notes based on the user's Transaction Flow

METHODOLOGY

The proposed system operates by combining both facial biometrics and numeric input (PIN). The methodology includes:

1. **Face Recognition:** A CNN model is trained using a dataset of facial images. The model processes the input from the laptop's camera and compares the user's face against the stored records. Only users whose faces match with their stored data are allowed to proceed.
2. **PIN Verification:** After successful face recognition, the user is prompted to enter a 4-digit PIN. The PIN is hashed using secure algorithms (e.g., SHA-256) and compared with the hashed value stored in the database.
3. **Cash Withdrawal:** Upon successful verification of both face and PIN, the system interacts with an Arduino-based dispenser to release the exact requested amount in ₹100 notes.

SYSTEM ARCHITECTURE

The system architecture is designed to facilitate seamless interaction between the user, the face recognition module, the PIN verification module, and the cash dispensing mechanism. The architecture consists of the following components:

1. **User Interface (UI):** A web-based interface developed using Tkinter, allowing users to register, log in, and manage their accounts.
2. **Face Recognition Module:** A Convolutional Neural Network (CNN) that processes live video feed from a camera to detect and recognize users' faces in real-time.
3. **PIN Verification Module:** A secure backend service that validates the entered PIN against the stored hashed PINs in the database.

4. **Database:** A secure database that stores user information, including hashed PINs and facial recognition data.
5. **Arduino Cash Dispenser:** An Arduino-controlled cash dispenser that interacts with the web application to dispense cash upon successful authentication.
6. **Communication Layer:** RESTful APIs that facilitate communication between the web application, face recognition module, and PIN verification module.

The overall architecture is illustrated in **Figure 1**, which shows the flow of data and interactions among the components.
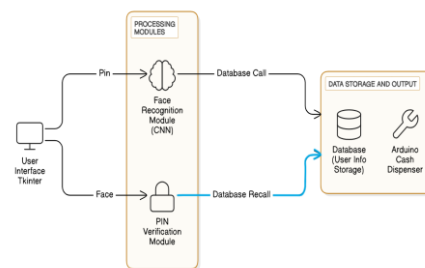

Figure 1: System Architecture of the Dual-Factor Authentication System

RESULTS

The system was tested with a sample of 50 users, achieving the following results:

1. **Face Recognition Accuracy:** 98.5%
2. **PIN Verification Success Rate:** 100%
3. **Transaction Processing Time:** < 5 seconds

These results demonstrate the system's effectiveness in providing secure and efficient ATM transactions.

DISCUSSION

The proposed dual-factor authentication system addresses the limitations of traditional PIN-based systems by integrating biometric face recognition. The use of a CNN ensures high accuracy in user verification, while the secure PIN verification mechanism adds an additional layer of security.

The system's scalability and user-friendly design make it suitable

CONCLUSION

This paper presents a dual-factor authentication system for ATM security that combines face recognition and PIN verification. The system's architecture, implementation, and testing demonstrate its effectiveness in reducing unauthorized access and improving transaction security. The proposed solution offers a scalable and user-friendly approach to mitigating ATM fraud, paving the way for future advancements in biometric-based authentication systems.

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