Secure UPI Transaction System using Face Authentication

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***Abstract*—In today's digital world, UPI transactions are widely used for online payments. Most UPI systems use a PIN for authentication, but PINs can be stolen or misused. To improve security, this project proposes a Secure UPI Transaction System using Face Authentication. The main aim of this project is to replace the traditional PIN-based verification method with face recognition technology. The system is developed as a web-based application using Python. It uses OpenCV and a live camera to scan and detect the user's face during a transaction. The captured face is compared with the stored face data of the registered user for authentication and verification. If the face matches successfully, the transaction is approved. If it does not match, the transaction is rejected. This method increases banking security and reduces the risk of fraud. The system focuses on providing accurate face detection and fast verification to ensure smooth and secure UPI transactions. Overall, the proposed system enhances digital payment security by using biometric face authentication instead of a PIN, making online transactions safer and more reliable.**

***Index Terms*—UPI Security, Face Authentication, Face Recognition, OpenCV, Python Web Application, Biometric Verification, Banking Security, Digital Payment Security, Fraud Prevention, Python, Automation, etc.**

I. INTRODUCTION

In today's digital era, online payment systems like UPI have become very popular and are widely used for daily transactions. People use UPI for money transfers, bill payments, shopping, and many other services. Most UPI applications use a PIN-based authentication system to verify the user before completing a transaction. Although PIN systems are easy to use, they are not fully secure. PIN numbers can be guessed, stolen, or shared unknowingly, which may lead to fraud and unauthorized transactions. Therefore, there is a need for a more secure and reliable authentication method for UPI transactions. Biometric authentication is one of the most secure methods for user verification. Face recognition technology is widely used in smartphones, banking systems, and security applications because it provides strong identity verification. In this project, we propose a Secure UPI Transaction System using Face Authentication. Instead of entering a PIN, the user's face will be scanned using a live camera. The system will detect and recognize the face using OpenCV and compare it with the stored registered face data for authentication.

The project is developed as a web-based application using Python. When a user initiates a UPI transaction, the system activates the camera and captures the live face image. The captured image is processed and verified with the stored database. If the face matches successfully, the transaction is approved; otherwise, it is rejected. This method increases banking security, reduces fraud risks, and ensures safe digital transactions with high accuracy and reliability.

II. PROBLEM STATEMENT

Traditional UPI transaction systems depend mainly on PIN-based authentication, which can be easily stolen, guessed, or misused, leading to security risks and financial fraud. There is a need to develop a more secure authentication system that can accurately verify the real user during a transaction. Therefore, this project aims to design and develop a secure UPI transaction system using face authentication with Python and OpenCV, where the user's identity is

verified through live face detection instead of a PIN to improve banking security and reduce unauthorized access.

III. PROPOSED SYSTEM

The proposed system is a Secure UPI Transaction System using Face Authentication developed as a web-based application using Python. The main goal of this system is to improve the security of UPI transactions by replacing the traditional PIN- based verification method with face recognition technology.
In this system, each user must first register their face in the system. The facial data is captured using a live camera and stored securely in the database. When the user wants to perform a UPI transaction, instead of entering a PIN, the system activates the camera and scans the user's face in real time. The captured face image is processed using OpenCV and face recognition algorithms. The system compares the live face image with the stored face data of the registered user. If the face matches successfully, the transaction is approved and processed. If the face does not match, the transaction is rejected, and access is denied. This ensures that only the authorized user can complete the transaction. The system improves security, reduces fraud risk, and provides a safer digital payment experience.

Main features of the proposed system include:

- Face registration and storage
- Live face detection using camera
- Face recognition and verification
- Secure transaction approval process
- Web-based user interface
- High accuracy authentication
- Fraud prevention and enhanced banking security.

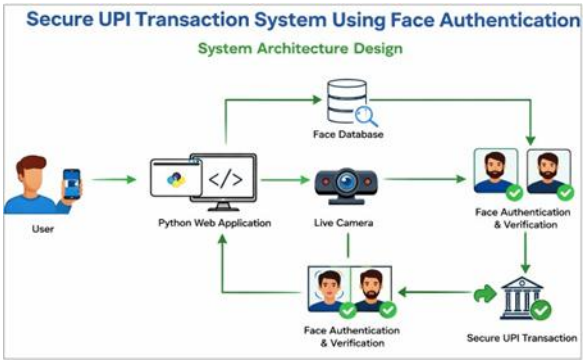

Fig.1: System Architecture Design

IV. METHODOLOGY

The methodology of this project is divided into several steps:

1. User Registration

First, the user registers in the system by providing basic details and capturing their face image using a live camera. The system extracts facial features using OpenCV and
stores the encoded face data securely in the database.

2. Face Detection

When a user initiates a UPI transaction, the system activates the camera and captures a live image. OpenCV is used to detect the face from the captured frame.

3. Face Recognition and Verification

The detected face is converted into feature vectors and compared with the stored face data of the registered user. The system calculates similarity between the two faces.

- If similarity is high → Authentication
successful
- If similarity is low → Authentication
Failed

4. Transaction Processing

After successful face verification, the system allows the UPI transaction to proceed. If verification fails, the system blocks the transaction and may display an error message.

5. Security Measures

To improve accuracy and security, the system may include:

- Multiple face sample storage
- Real-time face detection (to prevent photo spoofing)
- Encrypted database storage
- Error handling and retry attempts

6. Testing and Accuracy Check

The system is tested under different lighting conditions and user positions to ensure good performance and high accuracy. The response time and authentication speed are also measured.
The system replaces PIN-based authentication with face-based biometric verification. It captures the user's live face, verifies identity using OpenCV, and

then approves or rejects the transaction. This method increases banking security and provides a secure and user-friendly digital payment system.

V. RESULT ANALYSIS

After developing and testing the Secure UPI Transaction System using Face Authentication, the results show that the system works successfully and securely. The face detection and recognition module correctly identified registered users in most test cases. The system was tested under different lighting conditions and different face angles to check accuracy and performance.

The results show that:

- The system successfully captured live face images using the camera.
- OpenCV accurately detected and recognized the user's face.
- Transactions were approved only when the face matched the registered data.
- Unauthorized users were denied access when the face did not match.
- The response time for face verification was fast and suitable for real time transactions.

Compared to traditional PIN based systems, the proposed system provides better security because it reduces the risk of PIN theft, guessing, or misuse. The overall performance of the system proves that face authentication can be effectively used for secure UPI transactions with good accuracy and reliability.

VI. CONCLUSION

In this paper, we successfully discuss about project work of a Secure UPI Transaction System using Face Authentication. The system replaces the traditional PIN-based verification method with biometric face recognition technology. By using Python and OpenCV, we implemented live face detection and verification for secure transaction processing.

The system enhances banking security by ensuring that only the authorized user can complete a UPI transaction. It reduces fraud risk and provides a safer digital payment method. The project demonstrates that face authentication is a reliable and efficient solution for improving security in online financial transactions.

The project can be further improved in the following ways:

- Implement advanced deep learning models to increase face recognition accuracy.
- Add anti-spoofing techniques to prevent photo or video-based attacks.
- Integrate multi-factor authentication (Face + OTP) for higher security.
- Develop a mobile application version of the system.
- Improve performance under low-light conditions.
- Connect the system with real banking APIs for real-world implementation.
- Use cloud storage and encryption for stronger data security.

In the future, this system can be integrated into real banking and UPI applications to provide safer and more advanced digital payment security.

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