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MULTI-FACTOR AUTHENTICATION FOR CARDLESS TRANSACTIONS

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Abstract: The main objective of this project is to design a secure ATM system using multi-factor authentication system. The use of ATM machines is increasing day by day but fraud is also increasing rapidly. ATMs play an important role in bank transactions, but with increasing fraud, people are scared to use ATM systems. This innovative system eliminates the need for physical cards and enhances security through face recognition technology. The user initiates the transaction by entering the account number, activating the camera for facial recognition and the face will be captured and stored in database. If the individual is authorized using convolutional neural network, the transaction proceeds seamlessly. For elderly users, relationships such as daughters or sons can be registered, and their facial images are stored in a secure database. When nominee attempts a transaction, the system recognizes the database for successful facial recognition, facilitates the limited withdrawal amount. This not only adds a layer of personalized security but also accommodates the needs of older individuals who may find traditional ATM transactions challenging. Furthermore, the system leverages notification technology to enhance security. Transaction, including the amount withdrawn and nominee face are communicated to the user's registered device. This ensures that users receive real-time alerts about transactions, providing the security and transparency.

Index Terms *- Multi-factor authentication, cardless transactions, facial recognition, Deep Convolutional Neural Network.*

I. INTRODUCTION

The proposed project aims to revolutionize ATM security by integrating cardless transactions with advanced facial recognition technology, specifically utilizing Deep Convolutional Neural Networks (DCNNs). This innovative model seeks to combat the growing threats of card skimming and PIN theft, which have plagued traditional ATM systems. By eliminating the need for physical cards and PINs, the model enhances security through secure authentication protocols and encrypted communications, significantly reducing the risk of fraud. Users benefit from increased convenience as they no longer have to carry physical cards or remember PINs. The adoption of facial recognition powered by DCNNs ensures precise authentication, marking a

significant advancement in ATM security. Encrypted communications further safeguard sensitive data during transactions, bolstering the resilience of banking systems against cyber threats. This shift not only addresses current vulnerabilities but also simplifies the banking experience, offering a robust solution to evolving security challenges. Overall, the integration of cardless transactions and facial recognition technology represents a pivotal step forward in securing financial transactions in the digital age, signaling a transformative shift in ATM security practices.

II. RELATED WORK

[1] This project introduces the Secure Cardless Transaction System, which eliminates the need for ATM PIN and physical cards to enhance cash withdrawal security. It proposes the use of User-Generated One Time Password (OTP) to combat card-related frauds, offering a more robust and secure environment for digital payments. By leveraging technological advancements, this system aims to mitigate risks associated with cybercrime in ATM transactions, ensuring safer and more convenient transactions for users.

[2] This paper introduces a customer-aware surveillance system for ATM transactions, integrating an IP Camera to capture user facial images. Using Unified Modeling Language (UML), it enables real-time transmission of images to account owners' mobile devices for remote certification, enhancing security by detecting suspicious activities and providing customer-level visibility. Through this approach, online monitoring and immediate alerts for potential security violations are facilitated, improving ATM banking security.

[3] This paper proposes a biometric-based ATM authentication system using fingerprint and facial recognition, replacing traditional ATM cards and PINs. Additionally, it incorporates a one-time password (OTP) for enhanced security and user convenience. The system employs real-time verification of biometric data and automatically blocks fraudulent access attempts, capturing and transmitting the perpetrator's image for further investigation.

[4] It emphasizes the urgent need for enhanced security measures in ATM banking systems due to the growing threat of hacking and fraud. It highlights the importance of multiple layers of security, including biometric identification and authentication systems, to protect against various security risks. Specifically, the integration of facial recognition and QR code verification offers advanced security features to safeguard financial transactions and mitigate the risks associated with traditional authentication methods.

[5] This research paper proposes an advanced authentication system utilizing face recognition alongside PIN verification for accessing user accounts, surpassing the security of traditional methods. By employing a CNN model for face recognition, the system ensures high accuracy and security. It effectively distinguishes between real and fake user traits, enhancing transaction security and mitigating risks associated with ATM card theft and other security vulnerabilities.

[6] This study investigates the factors driving the preference for cardless cash technology over traditional debit cards at ATMs, utilizing a predictive analytics approach on survey data from 521 Indian bank customers. Findings indicate that customers prioritize the usefulness of cardless cash over perceived ease of use, trust, or security. The research contributes insights into enhancing cash access methods, reducing ATM interactions, and promoting adoption of innovative banking technologies.

[7] This paper introduces a location-based mutual authentication scheme for cardless ATMs, enhancing both security and usability without additional hardware. It analyzes security and usability issues and compares the proposed scheme with existing systems through simulation, demonstrating superior security and comparable usability. The findings suggest the proposed system offers enhanced security without compromising user experience.

III. OBJECTIVE

The primary objective of implementing multifactor authentication for cardless transactions in ATMs is to enhance security and mitigate risks associated with unauthorized access and fraudulent activities. This is achieved through three layers of authentication: Account Number verification, Facial Recognition, and a unique Verification Link. By combining these factors, the system fortifies protection against unauthorized transactions and fraudulent practices such as card skimming and identity theft. Advanced biometric technologies, especially Facial Recognition, are integrated to streamline authentication processes. The system accommodates elderly users by enabling registration of familiar relationships, enhancing security and comfort. It serves as a deterrent to theft and criminal activities through a comprehensive security framework. Designed to address potential threats and vulnerabilities associated with ATM transactions, it prioritizes a Seamless Transaction Experience. User-friendly features are included to ensure heightened security doesn't compromise ease and efficiency.

IV. RESEARCH METHODOLOGY

4.1. DATA COLLECTION

To begin face training, users voluntarily enroll in the facial recognition system by providing consent. During enrollment, multiple facial images are captured from different angles under various lighting conditions. It's essential to ensure diverse samples to account for potential variations in facial appearance.

4.2. IMAGE PREPROCESSING

Preprocessing enhances facial image quality for recognition by converting to RGB for comprehensive color analysis, applying noise filtration like Gaussian blur and median filtering to remove disturbances, and binarization for contrast enhancement. Adaptive methods like Otsu's find optimal thresholds, aiding in segmenting facial regions from backgrounds for improved accuracy.

4.3. SEGMENTATION

Face segmentation involves isolating the facial region within an image. Steps include detecting faces, extracting a region of interest, and using techniques like color-based, texture-based, or edge-based segmentation to separate the face from the background. Refinement and validation ensure accurate results, essential for tasks like facial recognition and analysis.

4.4. FEATURE EXTRACTION

Feature extraction using Convolutional Neural Networks (CNNs) involves passing an image through several layers of convolutional, pooling, and activation functions to extract hierarchical features. These features capture patterns and characteristics from the input image, progressively learning more abstract representations.

CNNs are widely used in computer vision tasks due to their ability to automatically learn discriminative features directly from raw data. After feature extraction, these features can be fed into a classifier for tasks like image classification, object detection, or facial recognition.

4.5. CLASSIFICATION

For face recognition, Convolutional Neural Networks (CNNs) are trained on labeled facial images paired with the corresponding names of account holders and their nominees. The CNN learns discriminative features to associate with names during training. After training, the model accurately classifies new facial images into account holder and nominee categories, enabling secure access control based on recognized faces. Continuous monitoring and refinement maintain model accuracy and adaptability to variations like facial expressions and lighting conditions.

4.6. VALIDATION AND TESTING

The trained facial recognition model undergoes validation and testing to ensure its performance and accuracy. Validation assesses the model's performance on a separate dataset, refining parameters and optimizing metrics like accuracy, precision, and recall. Extensive testing uses diverse facial images to simulate real-world scenarios, ensuring reliability across varied conditions like lighting, facial expressions, and occlusions.

4.7. ARCHITECTURE

The figure shown below represents the Solution Architecture that we made use of in our Project. Multifactor authentication (MFA) for cardless transactions involves using multiple layers of security measures to verify the identity of a user before allowing them to conduct a transaction without the need for a physical card. This approach enhances security by requiring users to provide more than one form of authentication, making it harder for unauthorized individuals to access accounts or make fraudulent transactions. Implementing face recognition for cardless transactions at ATMs involves integrating facial biometric technology into the existing ATM infrastructure.

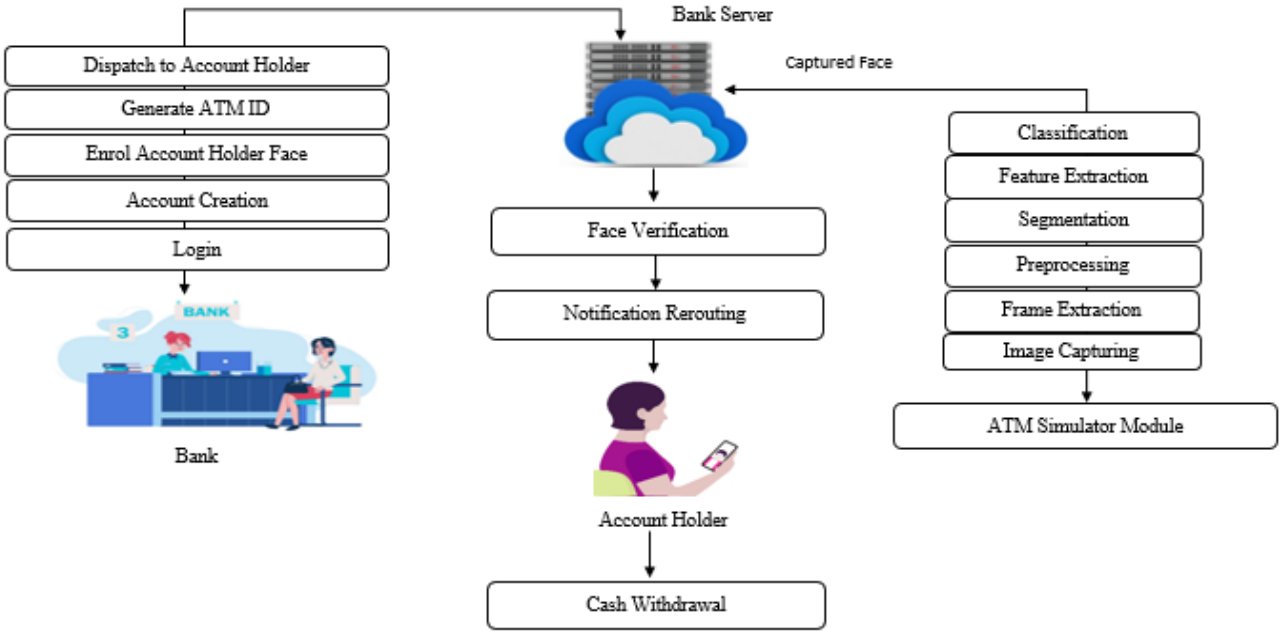

Fig.1 Architecture

V. RESULT

The proposed Multi-Factor Authentication (MFA) system for ATM security combines Account Number verification, Facial Recognition, and a Verification Link, significantly bolstering security against unauthorized access. Facial Recognition, a key biometric technology, enhances security by analyzing unique facial features, streamlining authentication, and improving user experience. The system accommodates elderly users by allowing registration of familiar relationships, enhancing security and comfort. By providing a familiar and secure ATM experience, it acts as a deterrent to theft and criminal activities, establishing a robust security framework. Account Number verification ensures only authorized users with valid details can transact, preventing unauthorized access to sensitive information and reducing risks like identity theft and card skimming.

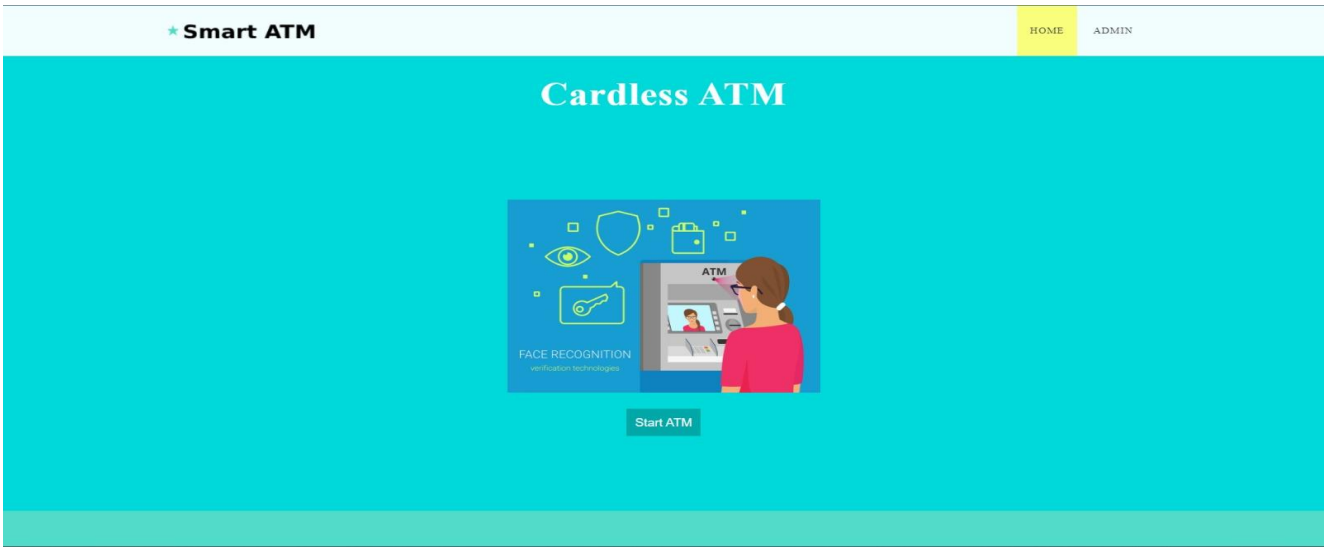

Fig.2 ATM Simulator

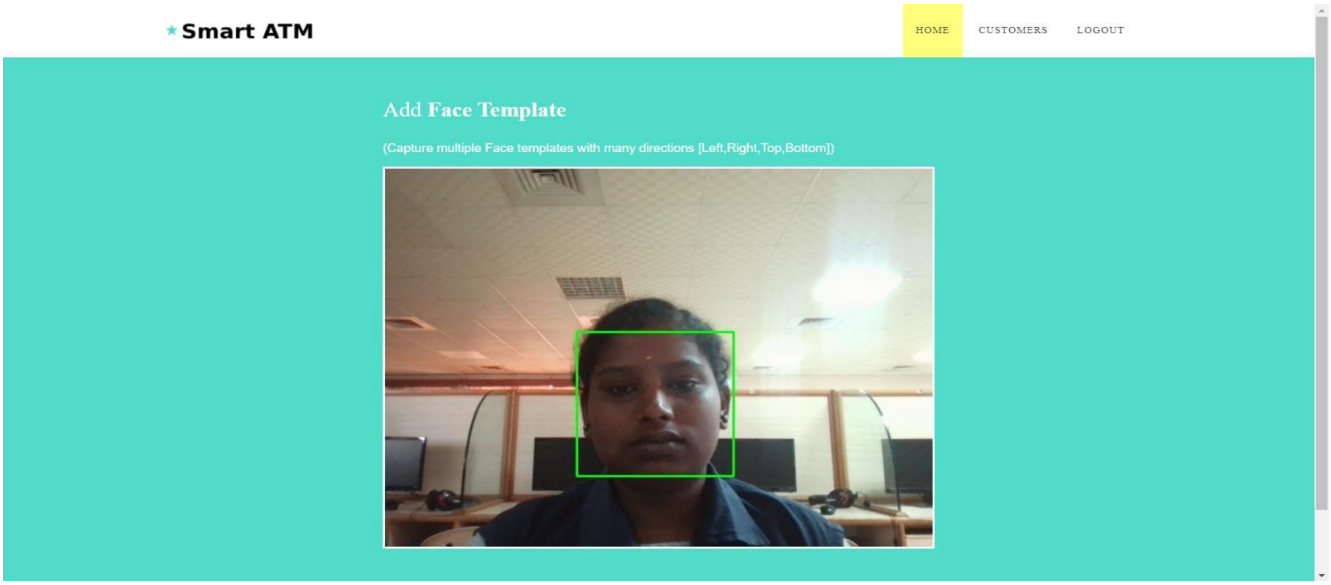

Fig.3 Face Capturing

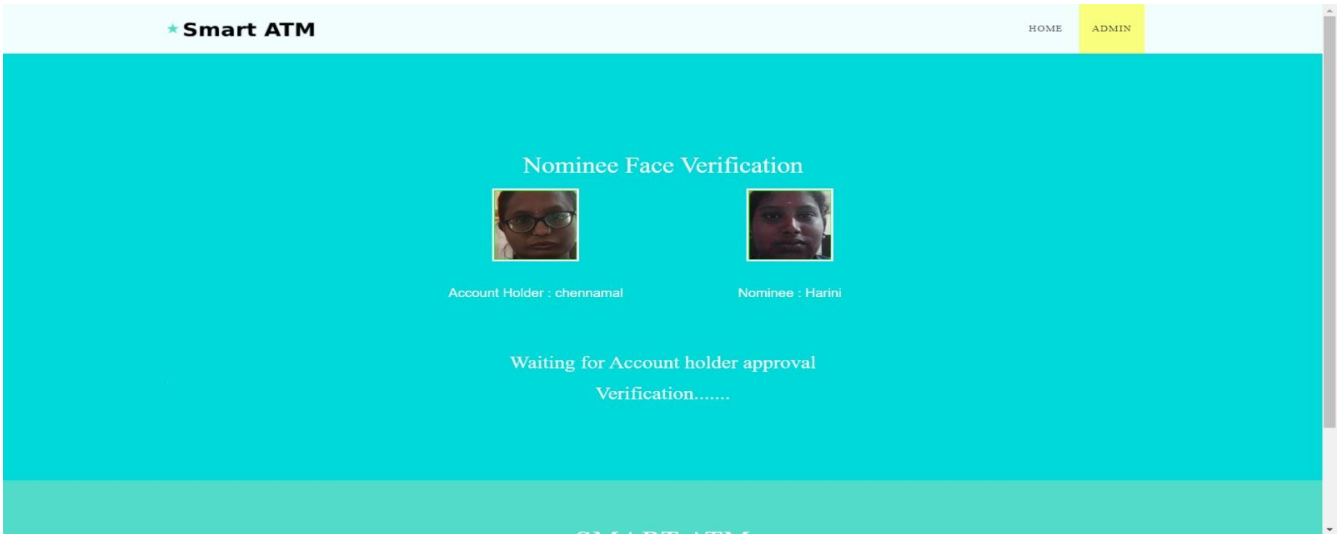

Fig.4 Nominee Verification

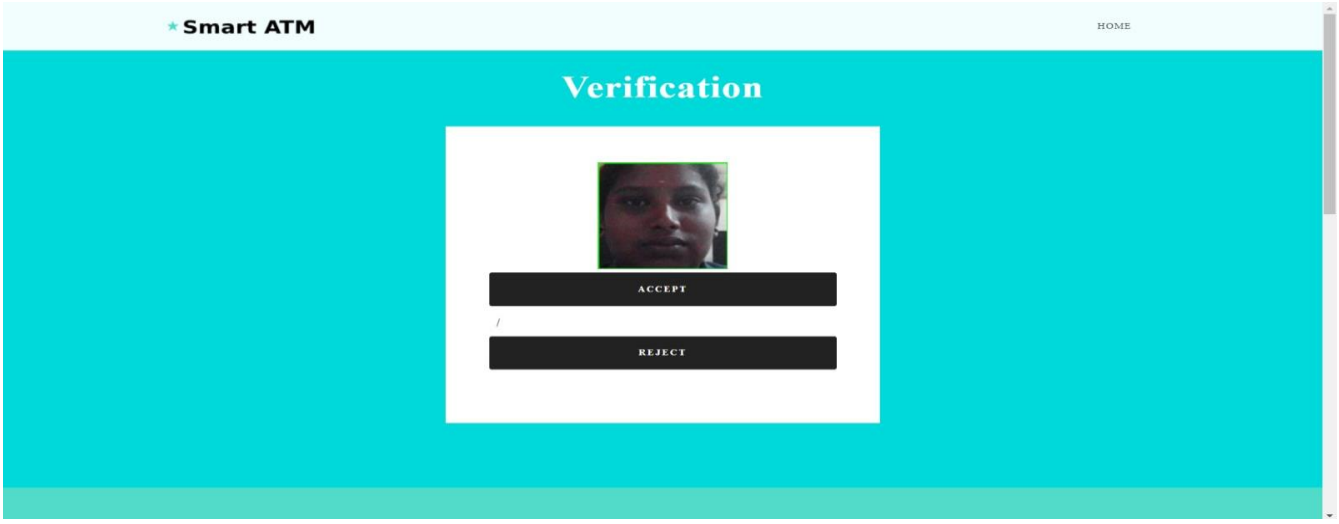

Fig.5 Notification

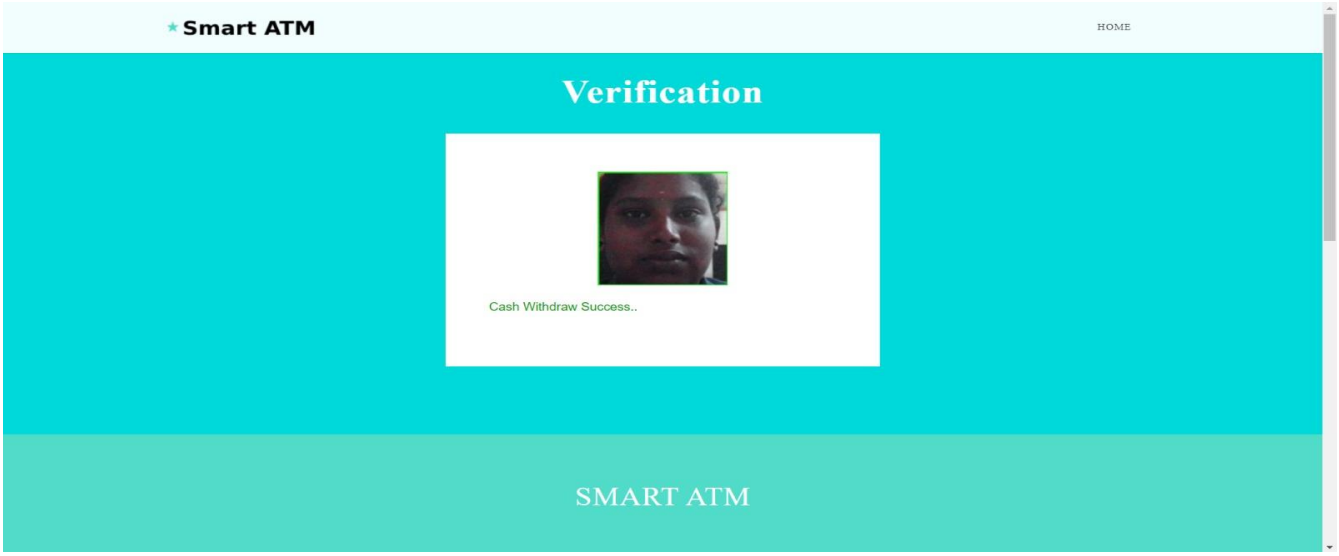

Fig.6 Cash Withdrawal

VI. CONCLUSION

In conclusion, our project introduces an innovative ATM security model leveraging cardless transactions and facial recognition technology. By integrating multi-factor authentication methods, including account number verification and facial recognition powered by a Deep Convolutional Neural Network (DCNN), we have significantly fortified ATM security while ensuring user convenience. The inclusion of a unique Face Verification Link further enhances security measures against unauthorized access attempts. Our research demonstrates the feasibility and effectiveness of our proposed system in mitigating security risks associated with traditional ATM usage. With a focus on proactive security measures and user experience, our project offers a promising solution to combat ATM-related frauds and elevate banking security standards.

VII. FUTURE ENHANCEMANT

Future enhancements for our project entail refining facial recognition algorithms for accuracy, integrating blockchain technology for heightened security, and expanding scalability to cover a broader spectrum of banking services. Collaboration with cybersecurity experts and regulators will ensure alignment with industry standards, while ongoing research will drive innovation in ATM security.

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