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VIRTUAL KEYBOARD AND MOUSE TO ACCESS THE ATM

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Abstract- In an emerging reality world, we introduce an innovative approach to ATM interactions by integrating advanced technologies such as facial recognition and hand gesture recognition. This system aims to reduce physical touchpoints, enhancing both safety and security— especially crucial during and after health crises like COVID-19. The process begins with facial recognition, where the user's identity is verified using the Haar Cascade algorithm. Once the face is matched successfully, the user is prompted to enter a unique password, not through a traditional keypad, but via hand gestures. This is made possible using Media Pipe, which detects and interprets hand movements to recognize numbers or signs corresponding to a secure password. To further improve the interface, we introduce a virtual keyboard and mouse system that allows users to interact with the ATM screen without touching it. The virtual mouse is controlled by tracking the user's index finger, enabling pointer movement and click actions based on specific gestures like pinching or tapping. Similarly, the virtual keyboard is displayed on the screen, allowing users to hover their finger over virtual keys to input PINs or transaction details. This method not only improves safety and reduces the spread of germs but also creates a futuristic and user-friendly ATM experience. By combining biometrics with gesture-based input, this solution represents a significant step forward in secure, contactless banking technology[1]

Keywords: hand gesture, face recognition, virtual keyboard, virtual mouse, cordless withdraw.

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1. INTRODUCTION

Traditional ATMs require users to make physical contact by inserting a card, entering a PIN, and pressing buttons, which can be both inconvenient and a security risk due to potential theft or card skimming. To overcome these challenges, a new generation of ATMs is being introduced that leverages facial recognition and hand gesture technology, allowing users to perform transactions without touching the machine. This contactless approach not only enhances convenience but also improves hygiene and safety. Accessibility is also being reimagined—while many ATMs include Braille markings to help blind users identify keys, virtual ATMs go further by offering audio-guided instructions that clearly walk users through each step of the transaction process[2]. The graphical user interface (GUI) is designed for ease of use, featuring intuitive icons, responsive navigation, and customizable display settings for a more inclusive banking experience. These modern ATMs support a range of standard services, such as balance inquiries, fund transfers, and transaction history checks. With the integration of artificial intelligence, they can also learn user preferences and provide personalized assistance, making banking more efficient, secure, and accessible for everyone.

2. RELATED WORK

The existing system primarily revolves around a gesture-controlled mouse, where users can manipulate the cursor on a computer screen through hand gestures. However, the current setup lacks comprehensive interaction capabilities with a virtual keyboard, limiting its functionality for tasks that require textual input or extensive navigation. Moreover, the system does not encompass the domain of ATM transactions and experiences, missing the crucial elements of facial recognition for user identification and secure hand gesture-based authorization. In essence, the existing system focuses on basic cursor control through gestures but falls short in providing a holistic touchless solution for secure and convenient ATM transactions. as technology continues to evolve, the need for more intelligent, secure, and user-friendly systems becomes increasingly important, particularly in sensitive environments like banking[4]. The current gesture-controlled setup, while innovative, is still in its infancy and lacks the capability to handle real-world applications that demand higher levels of interaction and security. For instance, without facial recognition or gesture-based authentication, the system cannot ensure that the individual performing actions is the legitimate user, leaving it vulnerable to misuse. Moreover, the absence of voice feedback and multi-modal input makes it less accessible for people with disabilities, especially those with visual impairments. Slower than physical keypads and visually impaired users[3].

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3. PROPOSED SYSTEM

Virtual Mouse Handling: Allows users to interact with the ATM using hand gestures instead of touch[4].
This system ensures a secure, touchless, and efficient ATM experience using facial recognition and hand gestures.

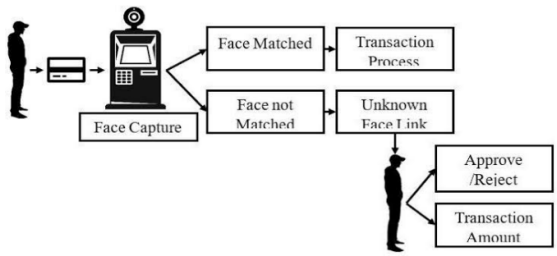
- Web Camera Frame: Captures the user's face for verification.
- Face Match: Compares the captured face with stored data.
- Haar Cascade Algorithm: A face detection algorithm used to verify the user's identity.
- Virtual Keyboard Monitor: Displays a keyboard for entering login credentials.
- Login PIN & Password: Users enter their secure PIN/password for authentication.
- Debit and Balance Enquiries: After authentication, users can check their balance and make transactions.
- Check Balance and Debit Amount: The system processes requests like checking balance or withdrawing money.

4. CASE DEFINE ADMIN MODULE

Modules in "Touchless ATM Using Facial Recognition and Hand Gestures"
MODULES LIST:

- Face matching
- HAAR cascade algorithm
- Virtual mouse handling
- Virtual keyboard handling
- ATM functionalities like debit and balance checking.

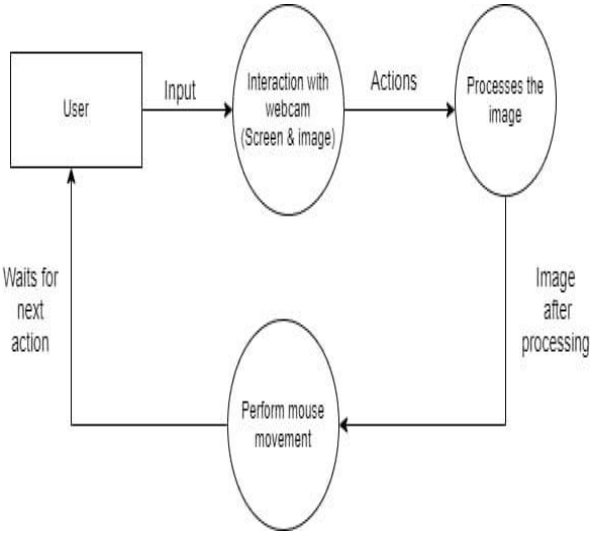
4.1 FACE MATCHING.



The Face Matching module in the "Touchless ATM Using Facial Recognition and Hand Gestures" system plays a crucial role in user authentication. It uses the HAAR Cascade classifier for detecting faces and extracting key facial features from the live camera feed. Once a face is detected, a unique facial template is generated and matched against the stored database to identify the user. If a match is successful, the system grants access to ATM functionalities. This module also supports user enrolment, allowing new users to register their facial data securely. For enhanced security, users may be prompted to enter a password after facial recognition [5] By combining biometric verification with an additional layer of authentication, the Face Matching module ensures a secure and reliable user experience in a completely touchless manner.

4.2 HAAR CASCADING ALGORITHM.

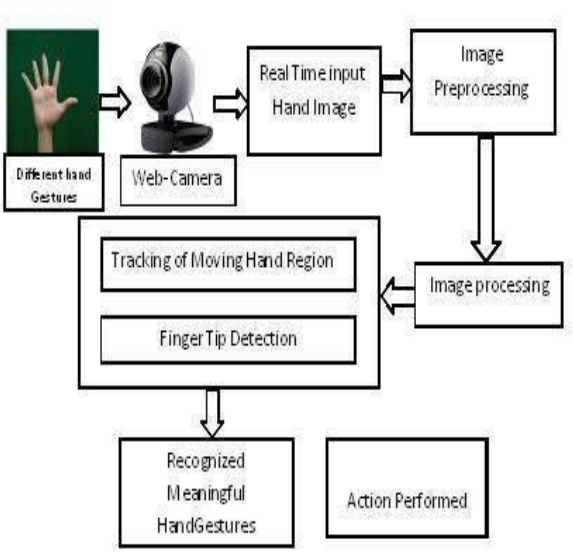
the Haar Cascade algorithm plays a crucial role in the Face Matching module. It is a machine learning-based object detection method used to identify features in images, specifically trained to detect human faces by recognizing patterns in areas such as the eyes, nose, and mouth. The algorithm relies on Haar-like features and organizes them into a cascade of classifiers, where each stage progressively filters out non-face regions, allowing for fast and efficient detection.[6] In our system, the Haar Cascade ensures quick and reliable face detection, which is essential for enabling a smooth and secure user authentication process. Its real-time performance capabilities make it ideal for applications like our touchless ATM, where speed and accuracy are key.



4.3 VIRTUAL MOUSE HANDLING.

virtual mouse handling is implemented to enable users to interact with the ATM interface without any physical contact. This is achieved using the MediaPipe library, which provides advanced hand gesture recognition capabilities[3] Media Pipe's hand tracking module detects and analyse key landmarks of the hand, such as the fingers and palm, allowing the system to interpret various

gestures in real-time. These gestures are then mapped to corresponding mouse events—for example, a swipe gesture may move the cursor, while a pinch gesture can simulate a click. This touchless interaction method allows users to navigate menus, select options, and complete transactions using only hand movements, thereby improving user convenience and promoting a more hygienic ATM experience.. Instead of physical movement, virtual mice simulate cursor actions through alternative input methods like touch, eye-tracking, joystick navigation, or gesture-based controls Developers must ensure that applications correctly interpret these virtual inputs, maintaining smooth navigation, precise selection, and responsive interaction.[6] This often requires customized event handling, adapting UI components to respond to simulated hover, click, or drag events. Proper virtual mouse handling is essential for accessibility, enabling users with physical limitations to interact with digital interfaces efficiently. It also plays a key role in remote desktop applications, VR environments, and other platforms where traditional pointer devices are replaced with virtual controls. Ensuring seamless virtual mouse support contributes to a more inclusive, versatile, and user-friendly experience.



4.4 VIRTUAL KEYBOARD HANDLING.

The virtual keyboard handling module plays a vital role in enabling secure and touchless interactions for ATM users. Utilizing hand gesture recognition through the Media Pipe library, this module presents a dynamic on-screen keyboard that allows users to enter their passwords without physical contact[7]. It interprets hand movements in real-time and maps them to specific virtual key presses, ensuring a secure and user-friendly method for input. This touchless approach not only improves the overall user experience but also addresses hygiene concerns by eliminating the need to touch a traditional keyboard. By offering a secure and convenient alternative for password entry, the virtual keyboard handling module contributes to the project's goal of delivering a sophisticated, hygienic, and user-centric ATM system. Handling virtual keyboards is a crucial aspect of modern application development, particularly for mobile and touch-based interfaces. When a virtual keyboard appears, it often overlaps part of the user interface, potentially hiding important elements such as input fields or buttons. To ensure a smooth user experience, developers must implement responsive designs that adjust layout dynamically when the keyboard is displayed or hidden. This includes listening for keyboard events, resizing or repositioning views, and maintaining input focus.

V. EXPERIMENTAL RESULTS

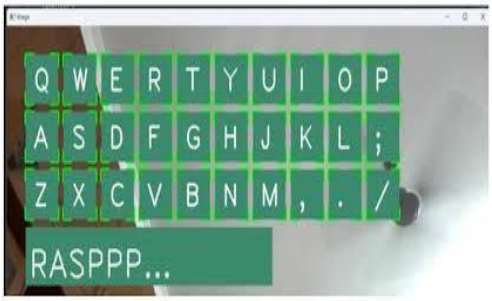


Fig 2: Virtual Keyboard

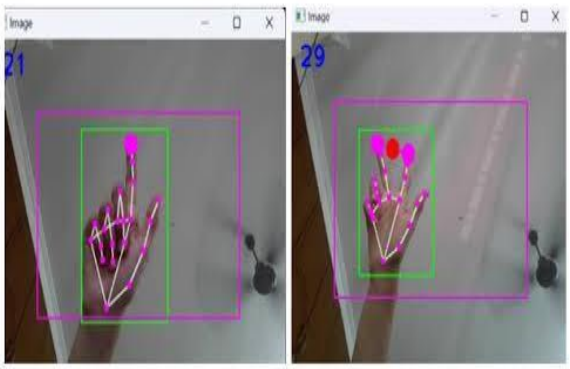


Fig 3: Virtual Mouse detects Finger up and Distance between them

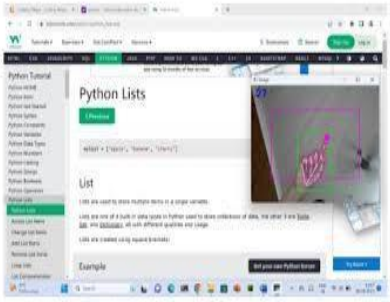


Fig 4: Virtual Mouse operating real-time websites

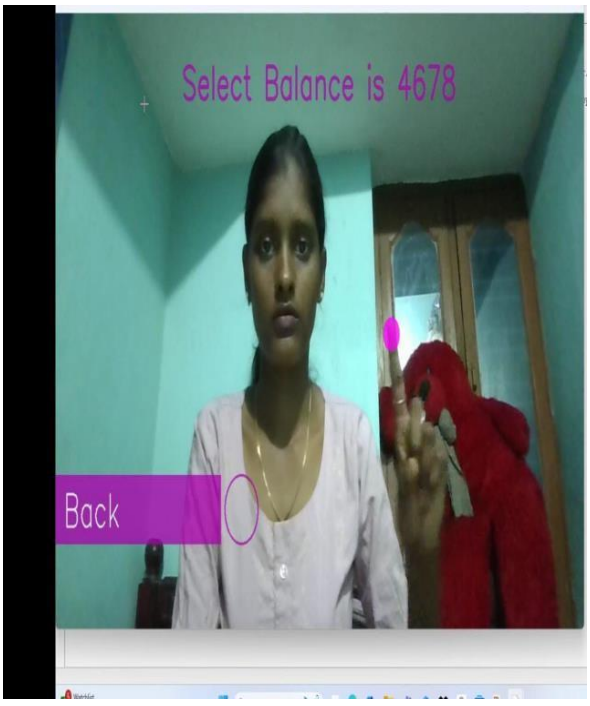
4.5 ATM FUNCTIONALITIES LIKE DEBIT AND BALANCE CHECKING.

ATMs offer a range of essential banking functionalities that allow customers to perform transactions without visiting a bank branch. One of the primary features is cash withdrawal, where users can debit money from their accounts using a debit or ATM card and PIN authentication. Another key functionality is balance inquiry, which lets users check the current balance of their account displayed on-screen or printed as a receipt[5]. ATMs also support mini statements, showing recent transaction history for quick account reviews. Additional services may include fund transfers between linked accounts, PIN change options, and mobile recharge or bill payments. Many modern ATMs also accept cash and check deposits, enhancing self- service banking convenience. These functionalities are designed to offer fast, secure, and 24/7 access to basic financial services, making banking more accessible to the general public.

5. EXPERIMENTAL RESULT

once the user is identified, a hand gesture such as pointing or moving a finger is used to select the "Match" button displayed on the screen. This gesture-based control enables completely contactless interaction, enhancing hygiene and accessibility. The system uses real-time camera input to detect the user's face and track hand movements, ensuring a smooth and intuitive login process. The clear visual cues and simple interface design contribute to a user-friendly experience, demonstrating the feasibility and effectiveness of touchless ATM technology.

In this stage of the "Touchless ATM" interface, the user interacts with a virtual numeric keypad to enter their PIN securely using hand gestures.



6. CONCLUSION

The "Touchless ATM" project presents a modern solution to traditional ATM interactions by eliminating the need for physical contact. Through the integration of facial recognition technology, the system ensures secure and accurate user authentication, reducing the risk of fraud and unauthorized access. Additionally, the implementation of hand gesture controls allows users to perform transactions without touching the ATM surface, thereby promoting better hygiene—an important consideration in public spaces, especially post-pandemic. The interface is designed to be user-friendly and intuitive, making it accessible to people of all ages and technical backgrounds. This combination of advanced technologies not only enhances the overall security and cleanliness of ATM usage but also adds a layer of convenience and efficiency. By prioritizing user safety, simplicity, and innovation, the Touchless ATM system represents a significant step forward in the evolution of banking services.

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