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"Attendance Entry Using Face Recognition And Rfid"

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Abstract: In modern educational and organizational environments, accurate and efficient attendance tracking is critical for performance monitoring and security. This project presents a dual-mode attendance entry system that integrates face recognition technology with RFID (Radio-Frequency Identification) to enhance both security and reliability. The system captures and verifies facial features using a camera and facial recognition algorithms, while also validating identity through RFID tags assigned to individuals. By combining these two methods, the system reduces the chances of proxy attendance and improves automation in attendance logging. The proposed solution is scalable, user-friendly, and ensures high accuracy, making it suitable for institutions seeking to modernize their attendance procedures.

Index terms- Face Recognition, RFID, Raspberry Pi, Attendance System, , Computer Vision, Embedded System, Python, OpenCV, Automation, Real-time Processing, IoT-based Attendance.

I. INTRODUCTION

In today's fast-paced and technology-driven world, automation plays a vital role in enhancing efficiency and reliability across various sectors. One such area that demands improvement is the traditional method of attendance tracking in schools, colleges, and workplaces. Manual attendance systems are often time-consuming, error-prone, and vulnerable to manipulation such as proxy attendance. To address these limitations, the integration of modern technologies like face recognition and RFID offers a promising solution.

This project aims to develop a smart attendance entry system using Raspberry Pi, combining face recognition with RFID technology for dual-factor authentication. The Raspberry Pi, a compact and cost-effective computing device, serves as the central controller for processing facial data and reading RFID inputs. Face recognition ensures biometric verification, while RFID adds an extra layer of identity confirmation.

The system captures the user's face using a connected camera module and processes it using OpenCV and machine learning algorithms. Simultaneously, an RFID tag, uniquely assigned to each user, is scanned for identity matching. If both credentials match, attendance is marked automatically and stored in a database.

This hybrid model not only increases the accuracy of attendance recording but also reduces the possibility of fraudulent entries. The use of a Raspberry Pi enables a portable, energy-efficient, and affordable solution. The project holds potential for real-time applications in educational institutions, corporate offices, and other secured environments.

By leveraging facial recognition and RFID on a Raspberry Pi platform, this system brings together the benefits of biometric security and IoT-based automation. It aims to modernize the conventional attendance system, ensuring reliability, scalability, and ease of use in a real-world environment.

II. Problem Statement

Traditional attendance systems, whether based on manual entry or simple RFID cards, suffer from several limitations such as inefficiency, human error, and vulnerability to fraudulent practices like proxy attendance. Manual attendance takes considerable time, especially in large institutions, and requires continuous monitoring. RFID-only systems, while faster, can still be misused if cards are swapped or shared among users. Similarly, face recognition systems alone may struggle with accuracy in varying lighting conditions or may be fooled with photos or videos in the absence of additional verification. These issues create a need for a more secure, automated, and reliable attendance system.

Current solutions often lack the integration of multiple authentication methods, and high-end biometric systems tend to be expensive and inaccessible for smaller organizations or educational institutions. Therefore, there is a clear demand for a low-cost, intelligent solution that ensures secure and accurate attendance tracking. This project addresses these challenges by developing an attendance entry system that combines face recognition with RFID technology using a Raspberry Pi. The aim is to create a compact, energy-efficient, and affordable system that minimizes manual intervention while maximizing reliability and security

III. PROPOSED SYSTEM

The proposed system, **Smart-Attend-Pi**, is a smart and easy-to-use attendance device that uses both **face recognition** and **RFID** for accurate and secure attendance tracking. It works on a **Raspberry Pi**, which reads the user's face through a **camera** and scans their **RFID card**. If both match, the system records the attendance in a **database** and can also upload it to the **cloud** for online access. This makes attendance faster, contactless, and more reliable. Supported by several modular components, as illustrated in Figure 1.

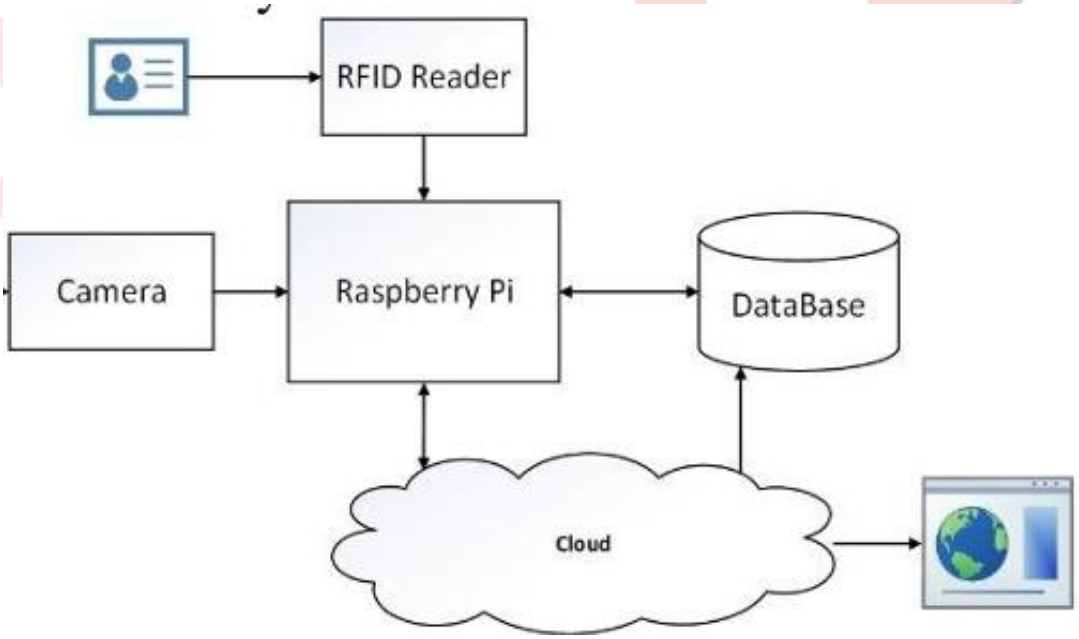

Figure 1: Proposed Block Diagram

IV. System Components

- **RASPBERRY Pi:**
  It has exceptional increase in processor speed, memory capacity, and multimedia performance with good connectivity.
  Its key features include a quad-core processor, dual-display support , hardware video decode, RAM support up to 8GB, 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet and USB 3.0. C.

Fig 2:Raspberry Pi

- **RFID Reader:**
  An RFID (Radio Frequency Identification) reader is a device used to read the data stored in RFID tags through radio waves.
  The reader emits electromagnetic signals via an antenna, which are then received by the RFID tag. The tag responds by sending back its stored data, such as an ID number,
  to the reader.
  These readers consist of key components such as antennas, receivers, processors, and interfaces for communication with other systems.

Fig 3:RFID Reader

- **Web Camera:**
  a digital camera designed for use with computers, typically for capturing live video or still images.
  Webcams connect to a computer via USB or wirelessly and are integrated into many laptops, smartphones, and tablets, though external webcams can also be attached for enhanced
  video quality.
  The primary function of a webcam is to transmit real-time video over the internet, making them essential tools for remote work, online education, and social communication.

Fig 4:Web Camera

V. Working Modules

The attendance system uses two methods to accurately identify individuals. First, an RFID reader scans a unique card or tag held by the person, providing quick identification. Second, a camera captures the person's face, and face recognition technology compares it to stored images to verify their identity. By combining RFID scanning and face recognition, the system ensures both convenience and security. This dual verification reduces errors and prevents unauthorized entries. The Raspberry Pi acts as the central controller, processing data from both devices and logging attendance automatically. Together, these technologies create a reliable and efficient attendance system that simplifies record-keeping and improves accuracy in various settings such as schools and workplaces.

VI. Result

Fig5: Snapshot of Attendance System

The implemented attendance system successfully combines face recognition and RFID verification to provide a secure and efficient method of recording attendance. During testing, the system accurately detected and recognized registered faces using the camera module and verified RFID tags with minimal delay. Only when both the face and RFID matched the stored data, the attendance was recorded and stored in the database. The system also uploaded the records to the cloud, making them accessible through a web interface. This dual authentication method significantly reduced the chances of proxy attendance and ensured higher reliability. Overall, the system demonstrated fast processing, high accuracy, and user-friendly operation in real-time scenarios.

VII. Observations

- **Accuracy of Identification**
  Observe how reliably the system recognizes individuals using both RFID tags and facial recognition. Check for false positives or negatives in face matching and RFID reading.
- **Response Time**
  Measure the time taken from scanning the RFID tag and capturing the face to logging the attendance. A fast response improves user experience and reduces queues.
- **Environmental Factors**
  Note the effect of lighting conditions, camera angle, and background noise on face recognition performance, and how well the RFID reader detects tags under different positioning.
- **User Convenience**
  Evaluate how easy and comfortable it is for users to scan their RFID tags and have their faces recognized without multiple attempts or complicated steps.
- **Data Logging and Security**
  Check the accuracy and completeness of attendance records stored on the Raspberry Pi and observe how securely personal data (face images and RFID info) is handled and protected.

VIII. Merits

1.Enhanced Security

The dual-layer authentication using RFID and facial recognition significantly reduces the risk of unauthorized access and proxy attendance.

2.Real-time Monitoring

The system provides instant updates on attendance status, allowing administrators to track and manage entries as they happen.

3.Automated Record Keeping

Attendance data is automatically logged and organized digitally, eliminating manual errors and simplifying data management.

4.Contactless Verification

The use of RFID and face recognition enables a fully touch-free attendance process, promoting hygiene and user safety.

5.Speed and Efficiency

The system verifies identity within seconds, ensuring a fast and seamless flow of users even during peak times.

IX. Conclusion

The integration of RFID and Face Recognition technologies in student attendance monitoring provides an innovative and efficient solution to the limitations of traditional attendance systems. By combining contactless identification through RFID with biometric face verification, the system ensures high accuracy, reduces the risk of proxy attendance, and automates the entire attendance process.

This project successfully demonstrates how hardware components like RFID readers and cameras can be effectively combined with powerful software tools such as Python, OpenCV, and Flask to create a secure, scalable, and user-friendly system. The web-based interface offers real-time monitoring, seamless data access, and report generation for administrators, making the system suitable for modern educational environments.

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