IMPLEMENTATION OF SMART ATTENDENCE USING RASPBERRY PI

[1]S. GAYATHRI, [2]P. SATYADEEP, [3]D. AKHILA, [4]V. RISHITHA, [5]N. SANTHOSH

[1](ASSISTANT PROFESSOR), **CSE**, J.B. INSTITUTE OF ENGINEERING & TECHNOLOGY
[2345]B.TECH SCHOLORS, **CSE, J.B. INSTITUTE OF ENGINEERING & TECHNOLOGY**

Abstract: Using face recognition technology, the "Implementation of Smart Attendance Management System Using Raspberry Pi" project tackles the urgent problem of student attendance in educational settings. The system takes pictures of the students who are there using a linked camera and uses Raspberry Pi's face detection and recognition skills to get accurate attendance. Instructors may easily keep track of student attendance and avoid interruptions by comparing these photos with recorded data. In addition to improving accuracy, this automated method reduces the possibility of proxy attendance. Its primary goal is to build an automated attendance system with the help of Raspberry Pi and OpenCV/Python modules. The solution incorporates a recognizer algorithm and works well in a variety of situations where attendance has to be tracked. Among the many advantages that might accrue from the project's effective execution are enhanced precision, less administrative burden, real-time tracking, and the introduction of features like automatic absence notifications. In conclusion, this research presents a state-of-the-art system for monitoring attendance, which is expected to be widely used in organizational and educational settings.

Keywords: Raspberry Pi, OpenCV, Attendance, LCD, Camera, Database App Are Some Index Terms

1. INTRODUCTION

Efficient attendance management is a cornerstone in today's ever-changing educational scene, where students' academic performance is of utmost importance. Nevertheless, conventional approaches of tracking students' presence in class have long been problematic, being time-consuming, prone to mistakes, and unable to provide real-time tracking. Innovative solutions to these problems are badly needed as educational institutions try to adapt to the changing demands of the digital era. Tracking students' attendance is crucial for gauging their level of involvement, participation, and, in the end, their academic performance, which greatly influences academic results. Manual roll-calling or barcode scanning, two of the most used traditional approaches of documenting attendance, are laborious and prone to errors [1]. These outmoded methods not only waste time in the classroom but also allow students to use proxies, which taints attendance records and makes schools less accountable [2]. This project presents a state-of-the-art "Facial Recognition-Based Smart Attendance System." It is a response to the urgent demand for an improved method for tracking attendance. Offering a revolutionary alternative to conventional ways of collecting attendance, this cutting-edge solution is carefully designed to fit in with educational institutions with ease. The system's stated goal is to completely revamp the current state of attendance tracking by using cutting-edge face recognition technology in conjunction with cutting-edge IT infrastructure and software [3]. We must not forget that manual attendance-taking has its limits. Although it is often

used, roll calling is inefficient since it wastes class time and opens the door to fraud and mistakes [4]. One major threat to the reliability of attendance records is proxy attendance, in which one student knowingly or unknowingly registers another's attendance without their knowledge or consent [5]. A high-tech, automated solution to these problems is the Facial Recognition-Based Smart Attendance System, which reduces human error and boosts productivity [6]. From security to marketing, and beyond, face recognition technology has brought about a golden age of efficiency and accuracy [7]. To enable the system to detect face characteristics in a multidimensional environment, image processing methods are crucial in the context of attendance management [8]. These approaches extract critical data from digital images. The Smart Attendance Management System uses face recognition to provide a more secure, accurate, and user-friendly way to track student attendance than old techniques [9]. The main objective of this project is to develop an intelligent system for managing attendance at educational institutions that needs little to no human involvement. Students will be able to easily access their attendance and academic performance data through an easy-to-use online registration platform, and the project aims to streamline the attendance recording process by implementing a secure and accurate facial recognition system. It will also eliminate opportunities for fraud. To summarize, the implementation of the Facial Recognition-Based Smart Attendance System signifies a sea change in the way schools handle attendance tracking. The project's overarching goal is to improve educational accountability, efficiency, and accuracy by using face recognition technology to radically alter the current state of attendance tracking.

2. LITERATURE SURVEY

Innovations in technology have spurred huge strides in the field of school attendance management. Many different strategies have been developed to improve the efficiency, precision, and lack of problems with conventional methods of attendance tracking, according to a thorough literature review. Facial recognition, radio frequency identification, wireless sensor networks, and fingerprint recognition are just a few of the technologies that have been the subject of studies and research efforts that have been surveyed here as they pertain to attendance management systems. Utilizing face recognition algorithms, Shreyak Sawhney et al. [1] introduce a Real-Time Smart Attendance System. Their solution shows how face recognition technology may overcome the shortcomings of traditional attendance management systems by using cloud computing and data analytics to monitor attendance in real-time. Domingo Mery et al. [3] also suggests a system for taking attendance in a crowded classroom using the camera of a smartphone, demonstrating that it is possible to use already-existing gear for this purpose. In their work, Danijel Mijic et al. [2] provide an upgraded RFID-based system for managing student attendance. As an example of how RFID technology is always improving in attendance management applications, their approach outperforms conventional RFID-based systems in terms of accuracy and efficiency. In his research, Fawaz Alassery [4] investigates the feasibility of using wireless sensor networks in a Smart Classroom to track students' attendance. This method shows how to improve classroom management and automate attendance monitoring using Internet of Things (IoT) technology. The significance of biometric identification in avoiding proxy attendance is highlighted by Omar Abdul Rhman Salim et al. [5], who suggest a class attendance management system that uses facial recognition. Their approach provides a strong answer to the problems of authenticating students and keeping track of their attendance. One example of the usefulness of biometric identification technology in time and attendance tracking is the Fingerprint-Based Attendance System that Khin San Myint et al. [6] demonstrate using Arduino. Using facial recognition and Raspberry Pi, Priya Pasumarti and Purna Sekhar [7] investigate how to implement Classroom Attendance. Automating attendance monitoring in school settings has never been easier or more affordable than with their technology. A Modern Attendance System utilizing Raspberry Pi, proposed by D. Santhi Priya and M. Uma Sankar [8], demonstrates the applicability of systems based on Raspberry Pi in varied applications, including attendance management. As a whole, the literature review shows how many different kinds of technology and approaches were used to make attendance tracking systems. Every method has its own set of benefits when it comes to efficiency, accuracy, and scalability; some

examples include RFID, fingerprint identification, and wireless sensor networks. These studies highlight the increasing significance of using modern technology to overcome the problems with old-fashioned attendance tracking and to create better, more efficient systems for managing student attendance in schools.

3. METHODOLOGY

a) Proposed Work:

The suggested system combines face recognition with radio frequency identification to track and control employee attendance. Within a certain time frame, students use RFID tags—which include integrated circuits and antennas—to record their attendance. Radio frequency identification readers enable data transfer by sending signals to tags. Every one of the three varieties of RFID tags used today has non-volatile memory: active, passive, and battery-assisted passive. At the same time, image processing is used to identify students' faces using facial recognition, which is accomplished using the OpenCV library and Python scripts. After students are identified, they scan their RFID cards at the scanner. If the scans are successful, their attendance is recorded. Using the best features of both RFID and face recognition, this solution streamlines and improves the efficiency of monitoring attendance while simultaneously increasing its accuracy and security.

b) System Architecture:

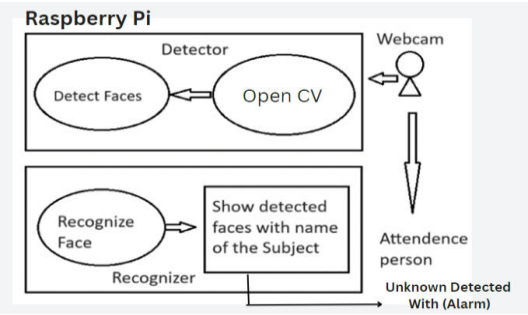

Fig 1 Proposed Architecture

The Raspberry Pi camera port is where the camera is attached. Raspberry pi takes in live video feed from the classroom camera, processes it, and then outputs a recognizable picture to the instructor. Each matched picture has its own unique RFID value. Using a comparison between the user's RFID value and the validated RFID value from the recognition, attendance is recorded in the local database along with the date and time. Every student gets an RFID card; as soon as they step foot in the classroom, they only need to scan their card, which will record their attendance along with the time and date. With their login credentials, students may access their profile.

c) Components:

i) The Registration Module, which streamlines the process of adding new students and lays the groundwork for precise attendance monitoring, allows users to take pictures of the kids and enter their names and unique identification (ID).
1) Picture Capture Module: When a user inputs a student's ID and name, the system takes several webcam photos of the student's face to help with registration data collecting.
2) Module for Data Storage: The 'TrainingImage' directory is where the captured photos are saved, while the 'StudentDetails.csv' file provides a systematic way to save student information for later use, including ID, name, and image URLs.
ii) Profile Management Module: This module provides useful features for managing registered student profiles, such as managing passwords and deleting profiles. It also enhances security and ensures that data remains intact and private. The first is the Password Management Module, which allows users to take charge of their accounts by allowing them to alter the passwords that provide them access to the system. The second module is the Profile Deletion Module, which allows users to remove photographs and information from registered student profiles. This ensures data integrity and respects privacy.
iii) The Attendance Tracking Module: Students' profiles that have been registered allow this module to automate the attendance process by employing facial recognition technology. The system uses LBPH face recognition to effortlessly capture attendance data by taking photographs of present persons and comparing them with images of enrolled students.
3) The Face Recognition Module: Our system uses LBPH face recognition to accurately monitor attendance by identifying enrolled students based

on their facial characteristics.

4) The Attendance Recording Module: Initiating the system takes webcam pictures of anybody present, compares them to photos of registered students, and records attendance data (student ID, name, date, and time) to ensure data integrity and security.

d) Raspberry Pi:

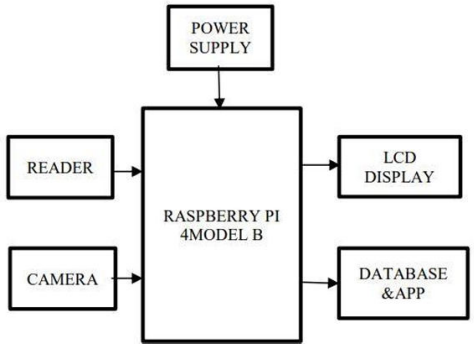

Fig 2 Raspberry Pi Block Diagram

1. Power Supply: Maintaining continuous functioning of the system is dependent on a reliable power supply. To keep the Raspberry Pi, camera, and other components powered and running reliably, you'll need a solid power source, either a regular AC adapter or a portable charger.
2. The system's central component, the Raspberry Pi 4 Model B, is a single-board computer that provides processing power and communication. The Raspberry Pi 4 Model B has more than enough power and flexibility to operate the attendance management system smoothly, thanks to its quad-core CPU, plenty of RAM, and several connectors, such as USB and HDMI.
3. Reader: RFID operation inside the system relies on the reader device. The ability to connect with RFID tags makes it easier to identify pupils while taking attendance. The reader's transceiver characteristics allow it to communicate with RFID tags, which in turn collect data. This allows for a smooth connection with the attendance monitoring module.
4. Camera: The system's face recognition feature relies heavily on the camera component. When used in conjunction with the Raspberry Pi, it takes pictures of people for use in attendance monitoring. Students can be easily and accurately identified by the camera's high resolution and clarity, allowing for dependable and effective attendance tracking in classrooms.
5. The system's visual output, allowing user interaction and feedback, is provided via the LCD (Liquid Crystal Display) screen. It may show the current system status, user input prompts, and attendance data when linked to the Raspberry Pi. The LCD screen gives users immediate feedback and improves the system's usability.
6. Database & App: The database enables easy maintenance and retrieval of data by storing student information and attendance records. Users may easily access, edit, and analyze attendance data with a specialized application running on the Raspberry Pi. Managing student information and keeping track of attendance is made easier with this integrated solution.

4. EXPERIMENTAL RESULTS

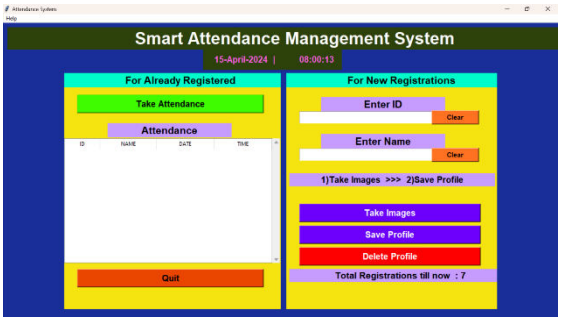

Fig 3 Graphical User Interface

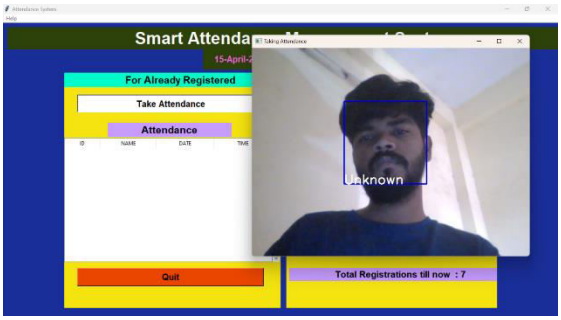

Fig 4 Detecting the Unknown Person During Attendance Monitoring

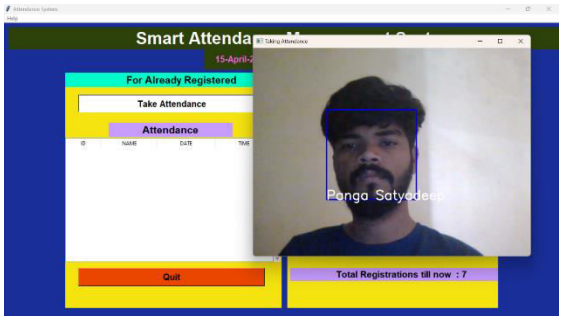

Fig 5 Detecting the Person and Capturing Attendance

Fig 6 Marked Attendance of the Person

	A	B	C	D	E	F	G
1	Id		Name		Date		Time
2							
3	'20671A0535'		Panga Satyadeep		########		13:16:26
4							
5	'20671A0533'		Santhosh		########		13:21:31
6							
7							

Fig 7 Storing the Attendance in the Excel Sheet

Fig 8 Images taken while training the model of User

5. CONCLUSION

By eliminating the need for human interaction and increasing accuracy, face recognition technology is revolutionizing attendance marking systems. This fresh method simplifies the attendance procedure by giving computers difficult jobs, which in turn saves resources. The amount of face data can be adequately accommodated by micro-SD cards, even if there is a large demand for data storage capacity. When compared to more traditional approaches, the system's excellent accuracy in facial recognition greatly improves efficiency. Improved efficiency is the result of automated attendance collection made possible by constant monitoring of entrance and departure points. We are always working to improve our face detection and recognition algorithms so they work even better. In the end, this system provides customers with more convenience by allowing them to get attendance records via email. With its user-friendly features, improved accuracy and efficiency, and the elimination of current issues, it is a major step forward in the field of attendance management systems.

6. OUTLINE FOR THE REST OF THE WORK

The use of state-of-the-art facial recognition algorithms such as OpenFace, VGGFace, or FaceNet guarantees enhanced precision and resilience. Security may be further improved with the addition of additional authentication methods like voice recognition, iris recognition, or fingerprint scanning. Making it accessible over the web facilitates distant access, and letting users alter their profiles according to their preferences facilitates personalization. Take advantage of convenient on-the-go access and personalized features with a mobile app companion. The optimization of scalability and speed guarantees smooth operation as the user base and data volume grow, while supporting many languages guarantees accessibility. These developments provide the groundwork for an improved system for tracking attendance that is more adaptable, safe, and easy to use.

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