IoT Based Class Monitoring System with Smart Attendance

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ABSTRACT: - An innovative IoT-based solution for classroom monitoring with intelligent attendance management incorporating face recognition and bar code technologies. The system aims to optimize classroom supervision and attendance tracking by leveraging IoT devices and sensors. Through the integration of facial recognition and bar code scanning, the system offers efficient and accurate attendance recording.

Real-time monitoring of classroom activities and environmental conditions is facilitated, providing educators with valuable insights into student engagement and behavior. The implementation of this system is expected to enhance classroom management practices, streamline attendance procedures, and foster a conducive learning environment.

Keywords: Attendance system, Face recognition, Internet of things,Raspberrypi., Bar code .

1. INTRODUCTION:

Attendance tracking for students is a significant task in classrooms, but manual methods often consume considerable time. The market offers biometric attendance solutions as an alternative. Our proposed solution addresses this issue by automating attendance through face recognition. Faces serve as the primary identification for individuals. Our project outlines a method for real-time face detection and recognition, utilizing the computational power of the Raspberry Pi 5B model and an efficient algorithm developed within an open-source image processing framework. This project extends beyond classroom settings, offering applications wherever face recognition authentication is needed, leveraging features such as Barcode and Face recognition. Our motivation is to develop a versatile, low-cost, and mobile system that replaces time-consuming traditional methods like calling out names or signing papers.

The system aims for reliability and widespread implementation, combining deep learning and Raspberry Pi technology for practical use rather than just proof of concept. Currently, attendance records are manually stored, and reports are generated at the end of sessions, avoiding interruption of staff duties. Face recognition is employed to streamline student attendance. Our Smart Attendance using Real-Time Face Recognition (SMART-FR) system allows for individual student identification, enhancing accuracy, efficiency, and reliability through advanced algorithms. Integrating attendance data with video streaming services enables the presentation of absentees' recorded time slots during classroom lectures.

Automatic attendance in classrooms is crucial, prompting our proposal for a "Face Recognition and Barcode-based Smart Attendance System Using IoT."

This system optimizes attendance management, utilizing facial identification to save time and prevent proxy attendance. Raspberry Pi, Python, and OpenCV form the foundational requirements for this system, which aims to replace manual processes with automation, storing data online for easy record maintenance. Face recognition, a biometric software, mathematically maps facial features and utilizes deep learning techniques to verify identities, enhancing efficiency and reducing physical contact with objects. Automated attendance systems based on machine learning algorithms offer time-saving benefits and accurate record-keeping, addressing the limitations of manual methods prevalent in traditional classroom attendance processes.

2. PROBLEM STATEMENT:

Traditional methods of classroom monitoring and attendance tracking are often labor-intensive, time-consuming, and prone to errors. Manual attendance processes can be inefficient and may lead to inaccuracies, while conventional monitoring techniques lack real-time insights into classroom activities and student participation. Additionally, the use of physical attendance registers and paper-based systems can be cumbersome to manage and maintain.

To overcome these challenges, there is a need for a modernized solution that integrates advanced technologies such as IoT, face recognition, and bar code scanning into the classroom environment. This system should provide automated attendance management, accurate tracking of student participation, and real-time monitoring of classroom dynamics. By leveraging IoT sensors and devices, along with facial recognition and bar code scanner technologies, the system aims to streamline attendance procedures, enhance classroom supervision, and improve overall learning outcomes.

The problem statement thus revolves around the inefficiencies and limitations of traditional classroom management and attendance tracking methods, highlighting the necessity for a more innovative and automated solution to address these challenges effectively.

3. OBJECTIVE:

Automated Attendance Management implement a robust attendance tracking mechanism that eliminates the need for manual recording and reduces the likelihood of errors and

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inaccuracies. Real-time Monitoring enable educators and administrators to monitor classroom activities and student participation in real-time, facilitating timely intervention and engagement.

Enhanced Security utilize face recognition technology to ensure accurate identification of students and personnel, thereby enhancing security within the classroom environment. Data Insights generate comprehensive reports and analytics based on attendance records and classroom data, providing valuable insights for educational planning and decision-making.

IoT-based classroom monitoring system aims to enhance efficiency, accuracy, and transparency in classroom management, ultimately creating a more conducive learning environment for both educators and students.

4. SCOPE:

Nearly all educational institutions necessitate student attendance records, yet manually managing them proves cumbersome and time-consuming. Thus, automating attendance through facial recognition proves highly advantageous. This not only alleviates the burden of manual upkeep but also curtails potential attendance tampering by students, promising time efficiency. Future prospects include capturing detailed student images and employing cloud technology for storage, with potential application in fraud detection in ATM machines. Additionally, the system holds promise for electoral use, facilitating voter identification via facial recognition. The ultimate aim is to establish a universally applicable attendance system, adaptable for use in schools, colleges, and various corporate settings, streamlining attendance management universally.

5. COMPONENTS OF MODEL

1.Raspberry pi 5
Specifications:
- 2.4GHz quad-core, 64-bit Arm Cortex-A76 CPU, with 512KB L2 caches and a 2MB shared L3 cache
- LPDDR4X-4267 SDRAM (4GB and 8GB SKUs available at launch)
- Micro SD card slot with support for high-speed SDR104 mode
- 2 × USB 3.0 ports, supporting simultaneous 5Gbps operation
- 2 × USB 2.0 ports)
- 5V/5A DC power (PD enabled)
- Raspberry Pi standard 40-pin header
- Real-Time Clock (RTC), powered by an external battery
- On-board power button

2.WEB Camera :
1080p FULL HD USB Camera with Microphone, Web Cam USB Camera, Computer HD Streaming Webcam for PC Desktop & Laptop w/Mic, Wide Angle Lens & Large Sensor for Superior Low Light

3. Bar Code Scanner :
The scanner captures and translates the bar code into numbers and letters. The data is then sent to a computer and analyzed by a software application.
Specification: Input voltage 4.5 to 5.5 VDC, Dimension 6.0 in. H x 2.5 in. W x 3.3 in. D,Supported host interface USB, RS232, Keyboard Wedge, TGCS (IBM) 46XX over RS485

4.Liquid Crystal Display (LCD):
A 20x4 LCD means it can display 20 characters per line and there are 4 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers namely, Command and Data.
Specification:5x8 dots includes cursor,+5V power supply (Also available for +3V),Negative voltage optional for +3Vpower supply,1/16 duty cycle Interface: 6800 (ST7066 IC), option SPI/I2C (RW1063 IC)

5.Connecting probes :
A probe is a device that convey a signal. A connecting probe is physical device used to connect electronic test equipment to a device under test.
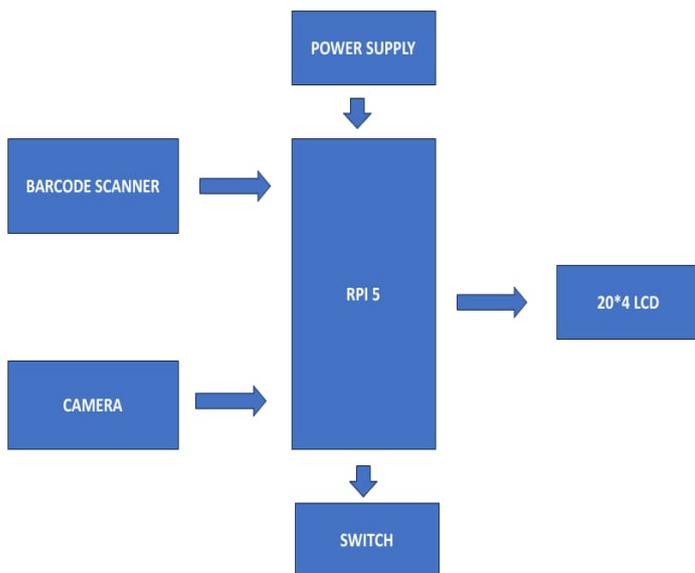
6.Power Supply (5V , 3A) :
power supply adapter rated as Input AC Voltage 100v-240v, Stabilized DC Output with Low Ripples &Interference ,Short Circuit & Overload Protection, High Efficiency & Low Energy Consumption

6. BLOCK DIAGRAM

7.WORKING

1. Data Collection from IoT Devices:
IoT sensors placed in the classroom continuously collect data on environmental conditions such as temperature, humidity, noise levels, and occupancy.
This data is transmitted to the data processing unit, which may be a microcontroller or a single-board computer like Raspberry Pi.

2. Facial Recognition for Attendance Tracking:
Cameras installed in the classroom capture images of students and staff entering the room.
The facial recognition algorithm processes these images to identify individuals by matching their facial features with stored templates.

Upon successful recognition, the system records attendance for the identified individuals.

3. Barcode Scanning for Attendance Verification:
Barcode scanners located at entry points scan student and staff IDs as they enter the classroom.
The barcode scanner decodes the barcode information, which typically contains unique identification data.
This information is processed by the data processing unit to verify attendance and associate the scanned IDs with the corresponding individuals.

4. Data Processing and Storage:
The data processing unit receives information from IoT devices, facial recognition system, and barcode scanner.
It processes this data, performs attendance tracking, and stores attendance records in a database or cloud storage.
Attendance records may include timestamps, student/staff IDs, and other relevant information.

5. Cloud Integration and Remote Access:
Attendance records and other data may be synchronized with cloud services for remote access and backup.
Administrators, educators, and authorized personnel can access attendance records, monitor classroom activities, and generate reports through a web-based or mobile application.

6. Security and Privacy Considerations:
The system incorporates security features such as encryption, authentication, and access control to protect sensitive data and prevent unauthorized access.
Privacy concerns related to facial recognition and barcode scanning are addressed through compliance with relevant regulations and best practices.

7. Power Supply and Backup:
The system relies on a stable power supply to ensure uninterrupted operation.
Backup power sources such as batteries or uninterruptible power supplies (UPS) may be employed to maintain operation during power outages.

7. ADVANTAGES

1. Time Efficiency for Your Workforce
The foremost and most impactful advantage is time efficiency, as renowned individuals often assert, "time saved equals money saved.". This time could have been utilized for productive work. Such inefficiencies can be eradicated by adopting a facial recognition attendance system, enabling employees to focus on their tasks promptly without time wastage.

2. Enhanced Efficiency and Capability
Daily student attendance tracking is a pivotal practice in any institution. Nonetheless, manual attendance management is both time-consuming and prone to human errors. By implementing an automated attendance management system utilizing facial recognition, precise timekeeping is ensured, thereby minimizing costly errors.

3. Streamlined Time Tracking

The process of entry and exit monitoring can be fully automated through facial recognition attendance systems. Utilizing the system's advanced analytics, faces can be detected and identified without human intervention or physical verification.

4. Simplified Record Management

Handling an individual's daily activities, entry, and exit times can be challenging. Managing such tasks for hundreds of individuals is even more daunting. Imagine being tasked with retrieving an employee's attendance details from the previous month. It would entail considerable time and effort to navigate through records.

8. LITERATURE REVIEW

1. S. Rajkumar al. /International Journal of Pharmacy & Technology In this paper, Face Recognition-based Lecture Attendance System, the system marks attendance using face recognition by taking pictures of the whole class. It will be difficult to estimate the attendance accurately using individual results of the face recognition system as the face detection rate is usually low.

2. Paras Jain UG Student, Computer Science Department, Arya Institute of Engineering & Technology, Jaipur, Rajasthan, India

3. A Counterpart Approach to Attendance and Feedback System using Machine Learning Techniques: In this paper, the idea of two technologies namely Student Attendance and Feedback system has been implemented with a machine learning approach. This system automatically detects the performance and maintains the student's records like attendance and their feedback on the subjects like Science, English, etc. Therefore, the attendance of the student can be made available by recognizing the face-recognizing, attendance details and detail about the marks of the student is obtained as feedback.

4. Automated Attendance System Using Face Recognition: Automated Attendance System sing Face Recognition proposes that the system is bas on face detection and recognition algorithms, which are used to automatically detects the student's face when he/she enters the class and the system is capable to marks the attendance by recognizing him. Viola-Jones Algorithm has been used for face detection which detects human faces using cascade classifier, PCA algorithm for feature selection, and SVM for classification. When it is compared to traditional attendance marking this system saves tiune and also helps to monitor the students.

9. CONCLUSION

In summary, the Smart Attendance System incorporating Barcode Scanner and Facial Recognition presents a resilient approach to precise, streamlined, and protected attendance monitoring across diverse sectors and contexts. By amalgamating various biometric methods and capitalizing on technological advancements, this initiative tackles the limitations associated with conventional attendance monitoring techniques, while offering numerous advantages to users and institutions alike.

By amalgamating barcode scanning and facial recognition technologies, the system guarantees dependable authentication of individuals' identities, thereby diminishing the likelihood of inaccuracies, fraudulent activities, and unauthorized entry. The user-friendly interface and instantaneous feedback mechanisms amplify user satisfaction and simplify the attendance recording procedure, ultimately economizing time and resources for administrators and personnel.

10. REFERENCE

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7. Ruian Liu Mimi Zhang Shengtao Ma, "Design of Face Detection and Tracking System", 2010 IEEE 3rd International Congress on Image and Signal Processing.

8. Automated attendance management system based on face recognition algorithms Computational Intelligence and Computing Research ICCIC), 2013 IEEE International Conference.