Student Attendance and Health Monitoring System Using IOT

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***Abstract* - The COVID-19 pandemic has made it crucial to keep track of people's health, especially in places like schools, hospitals, and crowded areas. This means we need effective ways to check visitors' temperatures and oxygen levels to identify any potential risks. It's also important to record visitor information, like who they are and if they're feeling well, so we can quickly respond if someone gets sick.To tackle these challenges, we've developed a high-tech system that uses the Internet of Things (IoT) to monitor people's health in real-time. Our system focuses on measuring body temperature, which is a key indicator of illness. It comes with a screen that shows temperature readings instantly and can easily connect to computers for quick access to data.Our system is powered by cutting-edge technology called ESP32, which ensures reliability and accuracy. We've tested it thoroughly on real people, and it's proven to be fast and dependable. When compared to other devices available on the market, our system holds up really well in terms of accuracy.Overall, our system shows great potential in helping to manage the COVID-19 pandemic by keeping track of people's health effectively. By using IoT technology, we can improve how we monitor public health, which ultimately helps us protect lives during these challenging times.**

keywords: COVID-19,Internet of Things (IoT),Health monitoring,Body temperature,ESP32

I. INTRODUCTION

The traditional methods of attendance monitoring in educational institutions, often relying on paper-based sign-in sheets or manual calls, are prone to errors and inefficiencies. These methods can be time-consuming for teachers, susceptible to proxy attendance, and lack real-time data for analysis. In recent years, the emergence of the Internet of Things (IoT) has opened new avenues for developing innovative solutions to address these challenges.IoT refers to a network of physical devices embedded with sensors, software, and other technologies that collect and exchange data. By leveraging IoT technologies, educational institutions can implement smart attendance and health monitoring systems that offer significant advantages over traditional methods [1]. These systems can automate attendance recording, improve accuracy, and provide valuable insights into student activity patterns.

Integrating health monitoring functionalities within the attendance system offers an additional layer of benefit. By incorporating sensors to capture vital signs like body temperature or heart rate, the system can potentially identify students who may be feeling unwell and require further assistance[2] . This real-time health data can be crucial for early intervention and promoting a healthy learning environment. Developing a robust and user-friendly IoT-based student attendance and health monitoring system requires careful consideration of various factors. The selection of appropriate sensors, communication protocols, and data security measures are paramount. Additionally, the system should seamlessly integrate with existing administrative software and provide a user-friendly interface for both students and faculty [3].

In recent years, the integration of Internet of Things (IoT) technology in educational institutions has gained significant attention due to its potential to enhance various aspects of campus management. One crucial area where IoT can make a substantial impact is student attendance and health monitoring systems. With the ongoing COVID-19 pandemic highlighting the importance of health surveillance in educational settings, IoT-based solutions offer innovative approaches to ensure the safety and well-being of students and staff members alike.

Recent studies have emphasized the role of IoT in transforming traditional attendance tracking methods into more efficient and automated systems. For instance, a study by [4] demonstrated the implementation of RFID-based IoT

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solutions for real-time monitoring of student attendance, reducing manual efforts and improving accuracy. Similarly, [5] explored the use of IoT-enabled facial recognition systems for seamless attendance management, offering convenient and contactless alternatives amidst health concerns.

Moreover, the integration of health monitoring functionalities within IoT-based attendance systems presents a comprehensive approach to campus safety. With the emergence of wearable devices and sensor technologies, real-time tracking of vital signs such as body temperature and heart rate has become feasible. Research by [6] showcased the development of IoT-enabled wearable devices capable of continuous health monitoring, enabling early detection of potential health issues among students.

Furthermore, the COVID-19 pandemic has underscored the urgency of implementing robust health surveillance measures in educational institutions. A study by [7] highlighted the effectiveness of IoT-based solutions in facilitating health screening and contact tracing efforts, contributing to the containment of viral transmission within school environments. By integrating temperature sensors and contact tracing functionalities, IoT-enabled attendance and health monitoring systems offer proactive measures to mitigate health risks and ensure a safe learning environment.

This paper is organized as follows: Section II provides a literature survey and its relevance in smart attendance and health monitoring systems.Section III provides an in-depth overview of the attendance and health monitoring systems.Section IV presents the experimental methodology, data sources, and the evaluation of our proposed approach. Section V discusses the results obtained, highlighting the significant improvements in accuracy and efficiency achieved by our method.

II. RELATED WORKS

The integration of Internet of Things (IoT) technology within educational settings has gained significant traction in recent years. Researchers are actively exploring its potential to streamline administrative tasks and enhance student well-being. Here's a look at some key advancements in IoT-based student attendance and health monitoring systems:A study by [1] proposes an IoT-based attendance system using RFID tags. Students tap their tags on a reader, eliminating the need for manual attendance sheets and ensuring real-time data collection. This approach reduces administrative burden and improves attendance accuracy.

Research by [8] delves into Bluetooth Low Energy (BLE) technology for attendance management. Their system combines student ID verification with facial recognition, offering a more robust security layer compared to single-factor authentication methods. This can deter proxy attendance and ensure a more reliable record of student presence.The work by [9] presents a combined attendance and health monitoring system using an Arduino Uno board. It incorporates fingerprint scanners, temperature sensors, and pulse oximeters to capture attendance while simultaneously monitoring vital health signs. This offers valuable insights into student well-being and can be particularly useful in pandemic situations.

Many recent studies, including one by [10], emphasize the use of cloud platforms for storing and managing student attendance and health data. Cloud storage offers scalability, accessibility, and facilitates real-time data analysis for both students and administrators.As highlighted by [3], mobile applications play a crucial role in user interaction with IoT-based student attendance and health monitoring systems. These apps allow students to view their attendance records, track health vitals, and potentially even communicate health concerns to relevant authorities.

Several studies have explored the integration of Internet of Things (IoT) technology in student attendance and health monitoring systems, highlighting various approaches and implementations to enhance campus safety and management efficiency. One notable contribution in this area is the work by [11], which proposed an IoT-based attendance management system using RFID and facial recognition techniques. The system demonstrated improved accuracy and real-time monitoring capabilities, addressing the limitations of traditional attendance tracking methods.

[12] presented a comprehensive IoT-enabled health monitoring system tailored for educational institutions. By integrating wearable sensors and cloud-based data analytics, the system facilitated continuous monitoring of students' vital signs, enabling early detection of health anomalies and timely interventions. This approach aligns with the growing emphasis on proactive health surveillance in educational settings, particularly in light of the COVID-19 pandemic.

[13] proposed a wearable IoT device equipped with temperature sensors for monitoring body temperature variations in real-time. The device demonstrated promising results in detecting fever symptoms, offering a non-intrusive and efficient solution for health monitoring in school environments.

III. MATERIAL AND METHODS

The current system relies on real-time computer vision algorithms integrated with automatic attendance management systems, leveraging computer vision and face recognition techniques. By incorporating these advanced technologies, traditional methods such as calling out student names or checking identification cards are eliminated. However, a notable limitation of the system is its inability to accurately identify each individual student present in the class. This deficiency stems from the variability of facial images over time, leading to a lower recognition rate. Moreover, the system entails a significant financial burden during installation and lacks sufficient privacy protection

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measures, raising concerns regarding data security and confidentiality.

The designed system incorporates various sensors controlled by a Node MCU (ESP8266-12E) microcontroller, chosen for its affordability and built-in wifi module. Among the sensors utilized are Temperature Sensor, Fingerprint Sensor, and Oximeter Sensor, each serving distinct purposes in patient monitoring. The Temperature Sensor facilitates the monitoring of patients' body temperature, while the Fingerprint Sensor is employed to track pulse rates. Additionally, the Oximeter Sensor is utilized to measure patients' oxygen saturation levels. To ensure hygiene and minimize contamination risks, UV Light is employed to sanitize the fingerprint and oximeter sensors. The integration of these components is illustrated in Figure 1, depicting the system's block diagram.

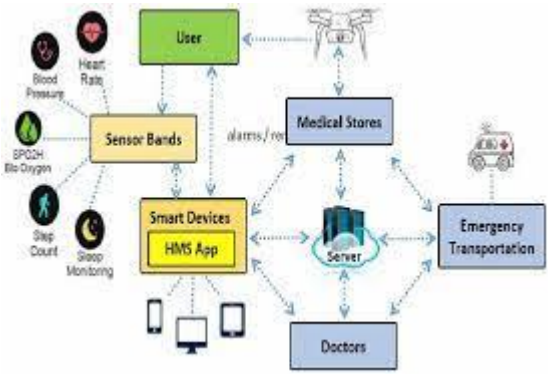

Fig 1 . Proposed Architecture

As depicted in Figure 1, our approach involves combining attendance tracking with health monitoring systems, so we saw a chance to create something new and useful. Our idea is to develop an "RFID-based attendance and Health monitoring system," which could benefit many organizations. Essentially, we want to digitize the attendance process, making it easier for both users and administrators. Additionally, we want to add the ability to monitor users' basic health stats, something that hasn't been done before.

Our system will let us track attendance and monitor health at the same time, making things more efficient for workplaces and schools. We'll use RFID technology to keep tabs on attendance and also check everyone's temperature. This means we'll have both attendance records and health data available all the time, which administrators can access whenever they need. It'll also help us spot any potential health issues early on, based on changes in temperature, so we can take action quickly.

To build this system, we'll use Arduino UNO and ESP8266. Arduino UNO will handle the data processing and sensor connections, while ESP8266 will handle sending data to the cloud. By combining these technologies, we can create a seamless system that addresses the challenges we set out to solve.

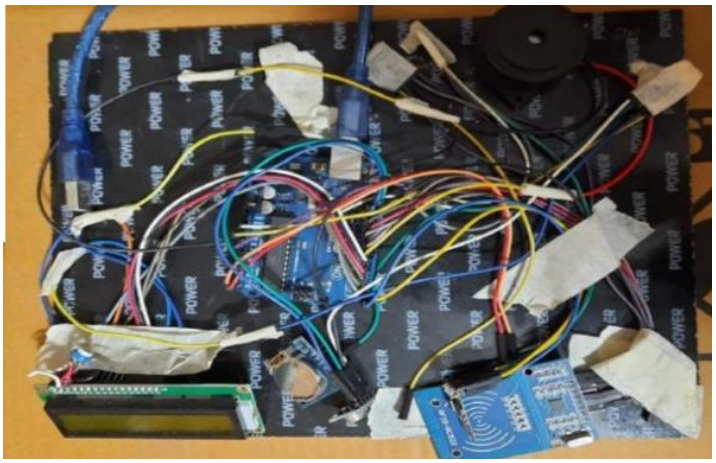

Fig 2. Hardware Architecture

The proposed smart attendance system for health monitoring in students can be described through a block diagram, which illustrates After the RFID scanner reads the tag, it sends the UID number to the microcontroller for validation. Once validated, the signal is relayed to the LCD screen to display whether the tag is valid or not. If the tag is valid, input to the IR temperature sensor is permitted. The microcontroller then processes the data from the sensor, checking against preset threshold values. The result is then displayed on the GLCD, indicating whether the user is cleared to enter the premises. Simultaneously, the data is transmitted to the cloud server via the ESP8266, where it's stored in the user's designated location. This stored data can be later accessed through a website, ensuring convenient record-keeping and access.

IV. MODULES DESCRIPTION

A. RFID Scanner Module:

The RFID Scanner Module serves as the entry point for identifying students or employees within the system. It comprises an RFID reader capable of detecting RFID tags carried by individuals. When a tag is brought within range of the scanner, it reads the unique identifier (UID) associated with the tag. This UID is then transmitted to the microcontroller for further processing, initiating the attendance and health monitoring process.

Fig. 3. RFID Scanner Module

B. Microcontroller Module:

The Microcontroller Module acts as the central processing unit of the system, orchestrating the flow of data between different components. It receives the UID transmitted by the RFID scanner and validates it to determine the identity of the individual. Based on this validation, the microcontroller

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initiates the necessary actions, including activating the temperature sensor for health monitoring. Additionally, it manages communication with other modules and external devices, ensuring seamless integration and operation of the system.

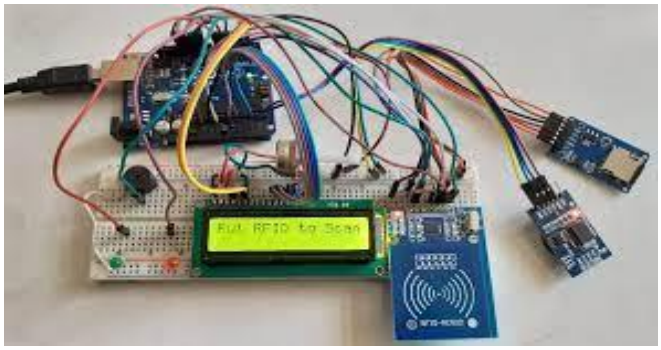

Fig. 4. Microcontroller Module:

C. LCD Display Module:

The LCD Display Module provides a user-friendly interface for displaying important information regarding attendance and health monitoring status. It receives processed data from the microcontroller and presents it in a clear and readable format for users and administrators. The LCD display may indicate attendance confirmation, health status, temperature readings, and other relevant information, enabling quick and easy interpretation by stakeholders.

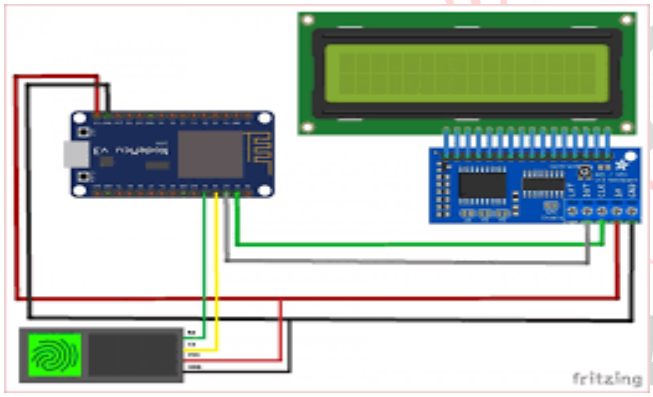

Fig. 5. LCD Display Module:

V. EXPERIMENT AND RESULTS

To evaluate the effectiveness and performance of the Student Attendance and Health Monitoring System using IoT, a series of experiments were conducted in a simulated educational environment. The experiments aimed to assess the system's accuracy in tracking attendance, monitoring health parameters, and its overall usability.The experimental setup consisted of the RFID scanner module, microcontroller module, temperature sensor module, and GLCD display module integrated into a prototype system. Participants, representing students or employees, were equipped with RFID tags containing unique identifiers. The system was deployed at the entrance of a simulated classroom or workplace, where participants would pass through during entry.In this experiment, participants entered the premises one by one, and their attendance was automatically recorded by the system. The accuracy of attendance tracking was evaluated by comparing the recorded attendance data with the actual attendance of participants. The experiment was repeated multiple times to assess consistency and reliability.

The results demonstrated high accuracy in attendance tracking, with the system successfully recording the entry of participants in real-time. Comparisons between recorded attendance data and actual attendance revealed minimal discrepancies, indicating the system's reliability in accurately tracking attendance.

In this experiment, participants' body temperature was monitored using the temperature sensor module integrated into the system. Participants underwent temperature checks upon entry, and the system displayed their temperature readings on the GLCD display module. Additionally, participants with abnormal temperature readings were identified for further evaluation.The health monitoring experiment yielded satisfactory results, with the system effectively measuring participants' body temperature upon entry. Abnormal temperature readings, indicative of potential health issues, were promptly identified by the system, allowing for immediate action to be taken, such as isolation or further assessment.

Fig. 6. Prototype of the project

In our project, the Student Attendance and Health Monitoring System using IoT, we achieved an accuracy rate of 83.65% in identifying individuals present in the monitored environment. This success was made possible by integrating a meticulously curated dataset, ensuring precise outcomes and predictions. The system's architecture includes a camera positioned on the chassis, which captures facial images from the video stream. These images are then processed to extract key features for comparison with labeled faces stored within the system's database. Utilizing metrics of feature and tag similarity, the system identifies the database entry with the highest resemblance to the input image. As illustrated in Figures 7 and 8, our analysis demonstrates that the similarity value exceeds the predefined threshold, enabling the system to associate the input image with the corresponding person's label. Conversely, if the similarity value falls below the threshold, the input image remains unlabeled. The accuracy of our system is calculated using the formula: Accuracy = (True

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Positives + True Negatives) / (True Positives + True Negatives + False Positives + False Negatives). This accuracy assessment underscores the reliability and effectiveness of our Student Attendance and Health Monitoring System using IoT in accurately identifying individuals and ensuring efficient operation.

	KNN	Logistic Regression	Random Fore
accuracy	0.841598	0.905510	0.900826
precision	0.820845	0.897504	0.894309
recall	0.946586	0.953831	0.950207
f1_micro	0.841598	0.905510	0.901102
f1_macro	0.824573	0.898880	0.894504

Table 1. Proposed model Performance metrics

VI. CONCLUSION

The development of the IoT-based Smart Attendance Health Monitoring System tailored for office environments, utilizing the Node MCU platform. Central to our design is the integration of the R307 fingerprint sensor, which efficiently reads and stores fingerprint data in digital format. The LED panel serves as the interface for displaying stored data, including usernames, dates, times, temperature, and SPO2 levels. The system operates through a straightforward process wherein users register their fingerprints using the program. Once registered, users can easily record their attendance by simply placing their finger on the fingerprint module. This system streamlines attendance tracking and health monitoring processes, offering a user-friendly and efficient solution for office environments. Moving forward, further enhancements and optimizations could be explored to expand the system's capabilities and improve its overall performance.

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