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DEVELOPMENT OF SAFETY BASED RFID ATTENDANCE SYSTEM

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Abstract:
This paper presents the development of an RFID attendance system that incorporates conditional access control and safety monitoring features, we are proposing a contactless temperature measuring and attendance monitoring system because of the pandemic COVID-19. This design is developed using ESP8266 Node MCU,MLX90614 Thermal sensor, EM18 RFID Reader, and EC0141 IR Sensor module controlled by Arduino Nano 3.0. It measures the body temperature of a student with an MLX90614 Thermal sensor without any physical contact and if the temperature exceeds 100F, the student is barred from entry reducing the risk of spread to others. An EM18 RFID card reader is placed for scanning the unique RFID card at entry and exit points, each student is given an RFID card as the student ID card, and The ID number of the studentis uploaded into the ThingSpeak cloud.An IR sensor &UV light integrated sanitization system is incorporated, to help create a hygienic atmosphere in the classroom, Also a mechanism to prohibit entry of students who come late to class, thus helping avoid disturbance caused to the flow of classroom lecture is also incorporated. Theattendance can be monitored over the internet, using ThingSpeak, the details such as Entry time, ID number, No. of students entered are stored in the server and displayed onthe webpage. This system provides a comprehensive solution for managing attendance while prioritizing health and safety.

Keywords : EM18 RFID Reader , ThingSpeak ,ESP8266 NodeMCU , EC0141 IR Sensor , Arduino Nano , RFID Tags, MLX90614 Thermal sensor

1. Introduction:

The Safety-Based RFID Attendance System is an innovative application of RFID technology that focuses on ensuring safety and security in attendance management. This system utilizes RFID tags and readers to automate attendance tracking while incorporating safety measures to mitigate potential risks. By integrating safety features such as temperature sensing, access control, and real-time monitoring, the system aims to create a secure environment, especially in the context of the COVID-19 pandemic. The RFID tags, worn by individuals, enable contactless identification and attendance recording, while additional sensors can measure body temperature or detect other safety parameters. This integrated approach streamlines attendance management and enhances safety protocols, making it an effective solution for institutions and organizations seeking to prioritize safety in their attendance systems.

II. Literature survey:

This study offers a new technique to using RFID (Radio Frequency Identification) to track student attendance that is based on the Internet of Things (IoT). Educational institutions are worried about student absenteeism. Truancy can have a negative impact on a student's overall academic performance. Taking attendance the old-fashioned approach, by calling names or having individuals write their names on paper, takes a long time and is useless. One solution is an RFID-based attendance system that employs an IoT system.

"RFID-Based Attendance Management System" by H. K. Nguyen and M. T. Chew (2017):In this study, H. K. Nguyen and M. T Chew propose an automated attendance management system that can be employed at professional gatherings of different types (conferences, exhibitions, training courses, etc.) and scales (from small-to-medium seminars and workshops to large congresses and technical shows). The system is based on the application of RFID, mobile communication and IT technologies. It is capable of collecting, recording and processing data on participants of a technical gathering and their activities, attendance or different sessions, visiting different exhibition booths, etc. The system

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can also generate real-time combined detail reports on attendance, inflow and outflow of the participants during the event, their most and least preferred interests and activities, etc. This can be done for a multitude of locations and premises, and during an extended period of time [1]

"IoT based Class Attendance Monitoring System using RFID and GSM" by K. Balakrishna; B. R. Ganesh Prasad, N. D. Dhanyashree, V. Balaji& N. M. Krishna(2021):K. Balakrishna; B. R. Ganesh Prasad, N. D. Dhanyashree, V. Balaji & N. M. Krishna present a new method for student attendance monitoring using RFID and GSM communication technology based on IoT. The system utilizes an EM-19 RFID reader, RFID tags, and a GSM module for hardware implementation. With an API for instant information transmission, parents/guardians receive real-time updates on student attendance. The system also allows authorized individuals to access the attendance database remotely and securely [2]

"Radio frequency identification (RFID) based attendance system with automatic door unit" by OG Chiagozie, OG Nwaji (2012): This study focuses on the implementation of an RFID-based time-attendance management system, comprising hardware and software components. The hardware includes a motor unit and a low-frequency RFID reader (125 kHz) connected to the host computer via a serial to USB converter cable. The software involves the development of a Time-Attendance System GUI using visual basic.Net. The system enables live ID tag transactions, ID registration and deletion, attendance recording, and other essential functions. The interface is installed on the host computer to facilitate efficient time-attendance management [3]

"RFID based attendance system" by T. S. Lim, S. C Sim, M. M. Mansor (2009): T. S. Lim, S. C Sim, M. M. Mansor propose an RFID-based attendance management system tailored specifically for schools. The system employs RFID tags embedded in student ID cards and RFID readers placed in classrooms. The authors focus on system design, implementation, and integration with a web-based interface for attendance monitoring. The study evaluates the system's effectiveness and highlights its potential benefits for educational institutions. [4]

"Online attendance management system using RFID with object counter" by Ankita Agrawal and Ashish Bansal(2013):The regularity of student attendance is a concern for educational institutions worldwide, as it directly impacts academic performance. Traditional attendance methods, such as calling names or signing on paper, are time-consuming and inefficient. To address this problem, the paper proposes an RFID-based attendance system developed using C# and Microsoft Visual Studio. The system aims to overcome the issue of fake or false attendance by incorporating a special object counter for accurate head counts. By leveraging RFID technology, the proposed system offers a more efficient and reliable approach to tracking student attendance in educational institutions. [5]

III. Proposed methodology:

a)modeldiagram b)flow chart

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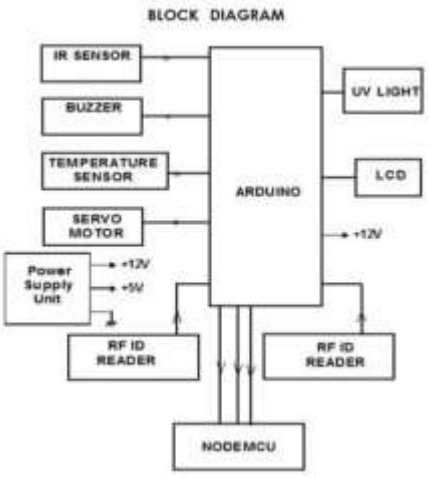

Fig1. Proposedmodeldiagram

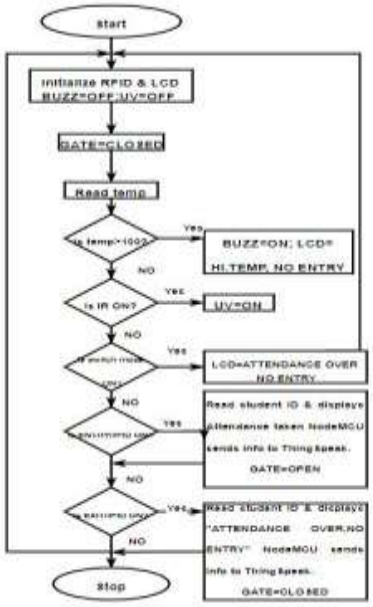

Fig2. Flow chart

- This paper presents the development of an RFID attendance system that incorporates conditional access control and hygiene monitoring features. The system utilizes various components including a thermal sensor, IR sensor, RFID readers, LCD display, voltage regulator, Arduino NANO microcontroller, Node MCU, servo motor, buzzer, and other supporting circuitry. The system aims to automate attendance management while ensuring a hygienic classroom environment.

❖ G90 Servo motor: The G90 Servo motor is a type of motor commonly used in robotics and automation applications to control precise angular motion.It gives 360-degree angular motion. It is a compact and versatile motor known for its accuracy, high torque, and wide range of motion. G90 Servo motor plays as a gateway for the entry and exit door of students, it allows students who satisfy all the conditions and place their student ID on the EM18 RFID reader.

❖ MLX90614 Thermal sensor: The MLX90614 Thermal Sensor is an advanced and non-contact temperature measurement device widely used in various applications.The MLX90614 sensor utilizes infrared technology to detect and measure the thermal radiation emitted by objects. It consists of an infrared sensor, a signal processing unit, and a digital interface, which enables seamless integration with microcontrollers or embedded systems. The sensor operates within a specified temperature range and provides accurate temperature readings with a high degree of sensitivity and resolution.It has a temperature measurement range of -70°C to +380°C (-94°F to +716°F).

❖ ESP8266 Node MCU: The ESP8266 NodeMCU is an open-source development board based on the ESP8266 Wi-Fi module. It combines the capabilities of a microcontroller and Wi-Fi connectivity, making it a popular choice for IoT (Internet of Things) projects and wireless communication applications.The NodeMCU board features an ESP8266 chip, which is a low-cost, low-power, and highly integrated Wi-Fi module. It operates at 2.4 GHz frequency and supports 802.11 b/g/n Wi-Fi standards, allowing it to connect to Wi-Fi networks and communicate with other devices over the internet.

❖ EC0141 IR Sensor: The EC0141 IR Sensor module consists of an infrared transmitter and receiver pair, often referred to as an infrared emitter and detector. The emitter emits infrared radiation, while the detector receives the reflected radiation from nearby objects. The sensor module typically includes onboard circuitry that amplifies and processes the received signal for reliable detection, the person can sanitise their hands by placing them near the IR sensor, which triggers the activation of UV light as a sanitiser.

❖ EM18 RFID Reader: The EM18 RFID Reader is a widely used RFID (Radio Frequency Identification) module that enables the reading and decoding of RFID tags. It provides a convenient and reliable solution for identifying and tracking objects or individuals using RFID technology. The EM18 RFID Reader module operates in the high-frequency (HF) range and is compatible with 125

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kHz RFID tags. It employs electromagnetic fields to communicate with RFID tags, which consist of a unique identifier and sometimes additional data. When an RFID tag is brought into proximity to the reader, the reader emits a radio signal that powers the tag and reads the information stored on it.

❖ Passive buzzer: The passive buzzer consists of a piezoelectric element that converts electrical energy into sound waves. When an alternating current is applied to the buzzer, the piezoelectric element expands and contracts rapidly, causing the diaphragm to vibrate. This vibration produces audible sound waves in the air, creating a buzzing or beeping sound.

❖ Arduino Nano 3: The Arduino Nano is a compact and versatile microcontroller board based on the ATmega328P microcontroller.At the heart of the Arduino Nano is the ATmega328P microcontroller, which is a low-power, high-performance 8-bit AVR (Advanced Virtual RISC) microcontroller. It operates at a clock frequency of 16 MHz and has 32KB of flash memory for program storage, 2KB of SRAM for data storage, and 1KB of EEPROM for non-volatile storage.

❖ 16x2 LCD:The 16x2 LCD (Liquid Crystal Display) is a widely used alphanumeric display module that provides a simple and cost-effective way to display text and basic graphics. It consists of 16 columns and 2 rows of characters, allowing for the display of up to 32 characters at a time. The LCD module utilizes a liquid crystal material that changes its light transmission properties when an electric field is applied. Each character on the display is formed by activating specific segments of the LCD, creating the desired text or symbol.

❖ ThingSpeak: ThingSpeak is an open-source Internet of Things (IoT) platform that allows users to collect, analyze, and visualize data from various sensors and devices. It provides a cloud-based infrastructure for managing and processing real-time data, making it a popular choice for IoT applications. It provides an easy-to-use web interface and APIs (Application Programming Interfaces) that enable users to connect their devices or applications to the platform. Through the use of these APIs, data can be sent to ThingSpeak from IoT devices, sensors, or other data sources, allowing for seamless integration and data management.

❖ Arduino IDE: The Arduino IDE (Integrated Development Environment) is a software platform used for programming and developing applications for Arduino boards. It provides a user-friendly interface and a set of tools that simplify the process of writing, compiling, and uploading code to Arduino microcontrollers.

❖ The LM567 Tone Decoder is an integrated circuit (IC) widely used for tone detection and decoding applications. It is specifically designed to recognize and decode specific frequencies or tones from an input signal. The LM567 operates based on phase-locked loop (PLL) technology, which allows it to accurately detect and distinguish specific frequencies.

❖ LM7805(linear voltage regulator): The LM7805 is a popular linear voltage regulator integrated circuit (IC) used to provide a stable and regulated output voltage. The LM7805 is commonly used in electronic circuits where a reliable and constant +5V power supply is required. It operates by taking in an unregulated input voltage, typically higher than +5 volts, and converting it into a regulated +5V output voltage

- During operation, the system initializes the RFID reader and LCD display, with the buzzer and UV light initially turned off, and the gate closed. As a person approaches, the thermal sensor checks their temperature, activating the buzzer and LCD displays “HI. TEMP NO ENTRY” if it exceeds 100 Fahrenheit. If it doesn’t exceed 100 Fahrenheit then the person can sanitize their hands by placing them near the IR sensor, which triggers the activation of UV light which acts as a sanitizer. While this sanitization step is mandatory, it promotes a hygienic atmosphere in the classroom.
- Next, the system determines whether the person arrives before or after the switch mode is turned off, indicating whether they are within the designated class time. If the person arrives late, the LCD displays the message "ATTENDANCE OVER, ;NO ENTRY," denying access. However, if the person arrives on time, their RFID card is read by the EM18 RFID reader, acting as their unique student ID. The LCD displays "ATTENDANCE TAKEN," and the attendance information, including the date and time, is sent to ThingSpeak via the Node MCU for recording.
- For latecomers, the EM18 RFID reader reads their RFID card, and the LCD displays "ATTENDANCE OVER; NO ENTRY," with the gate remaining closed. During exit, the person

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simply needs to place their RFID card on the EM18 RFID reader, which records and transmits the attendance information to ThingSpeak. This data can be accessed remotely by logging into the ThingSpeak account, facilitating convenient attendance management.

- The system includes additional components such as a potentiometer for variable power rating control, a servo motor for gate operation, and supporting circuitry for signal processing and management. The integration of these components provides an efficient and automated solution for attendance tracking, access control, and hygiene monitoring. Future enhancements may involve further customization and integration with advanced features to enhance system functionality and security.
- Furthermore, the system incorporates a voltage regulator connected to a transformer to adjust the input voltage for the circuit's components, ensuring their proper functioning. A 16x2 LCD display provides real-time information regarding permission or denial of entrance. A switch mode, serving as an alternative to a real-time clock, determines if a student arrived before or after the designated class time.
- To control the gate's access, an Arduino NANO microcontroller with an ATMEGA328P is utilized to orchestrate the system's operations. The code, written in Arduino IDE and uploaded to the Arduino, enables seamless coordination among the various components. Additionally, a heat sink is employed to dissipate heat and prevent circuit damage.
- The attendance data, including entrance and exit timestamps, is transmitted to the ThingSpeak cloud server via a Node MCU. This allows the information to be securely recorded and accessed from anywhere by logging into the corresponding ThingSpeak account. The system employs a servo motor to control the opening and closing of the gate. A passive buzzer, along with resistors, diodes, an LM567 Tone Decoder, capacitors, and a 547 transistor, complete the circuitry, providing necessary control and feedback mechanisms.
- The integration of the potentiometer as a variable resistor enables adjustment of the system's power rating by simply manipulating the knob. This feature allows flexibility and customization according to specific requirements.
- In summary, the developed RFID attendance system incorporates conditional access control and hygiene monitoring. It leverages a range of components and technologies to ensure accurate attendance tracking, promote hygiene practices, and provide secure data management. The system's modular design allows for scalability and potential enhancements to cater to evolving needs in educational settings.

Fig3.MLX90614Thermal sensor

Fig4.EC0141 IR sensor

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Fig5.ESP8266 Node MCU

Fig6.EM18 RFID reader RS232 module

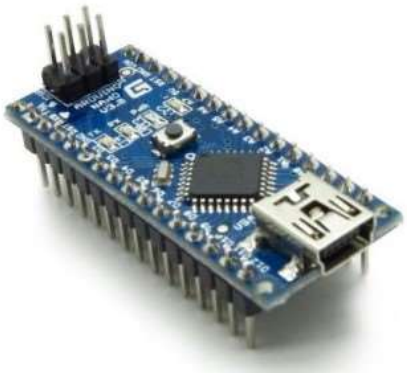

Fig 7. Arduino Nano 3.0

Fig8. RFID tag

Fig9. Passive buzzer

IV. Results and discussion:

Fig 10. If the Temperature is> 100F, the student is barred from entry.

Fig11. Attendance is taken when a student ID3 places his card on the entry RFID reader**.**

Fig12. Detection of exit when a student with ID3 places his card on the RFID reader**.**

Fig13. Activation of UV light when the IR sensor detects the student's hand

Fig 14. If the student comes late to class (i.e. switch mode is OFF), the student is barred from entry

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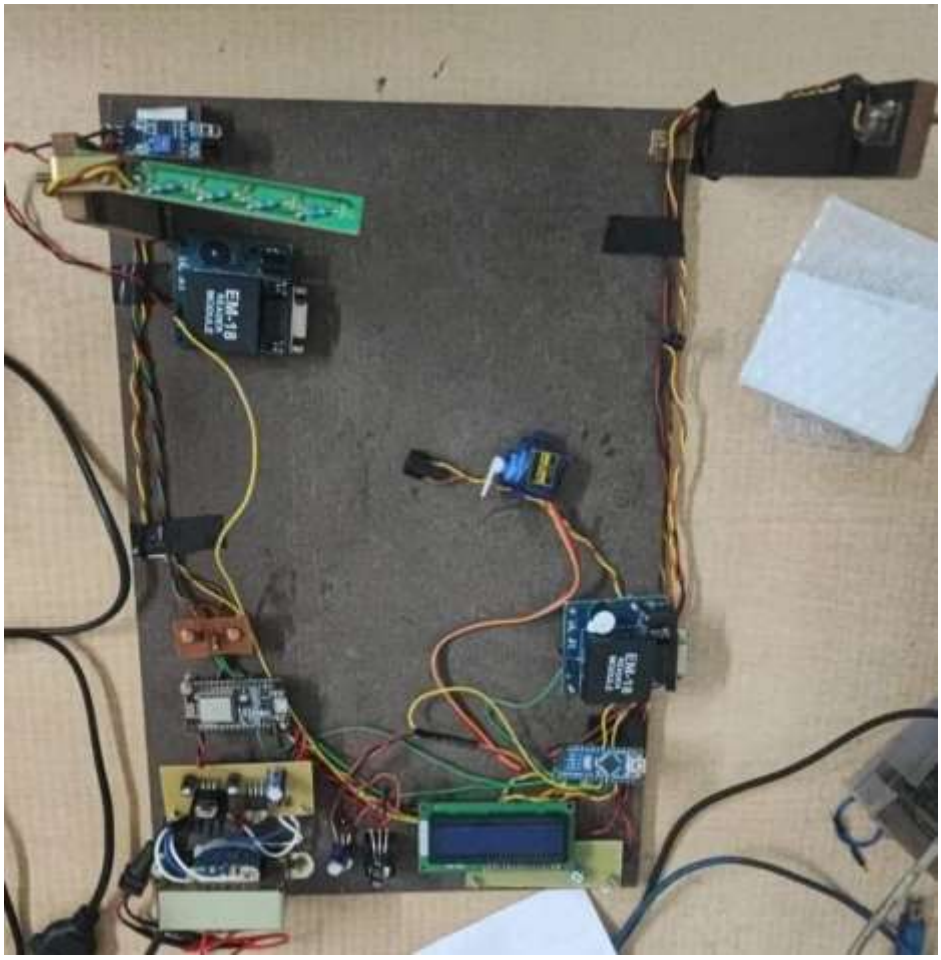

Fig15. The Final Proposed Model

Only when the student satisfies the thermal test and sanitizes his/her hand and isn't late to college, arrives when switch mode is in ON condition,his/her attendance will be taken and the information is sent to ThingSpeak cloud by NodeMCU, which can be accessed remotely from anywhere.

Charts in the private view tab:

Fig 16. Graphical representation of students with ID1 and ID2 attendances with their entry and exit times.

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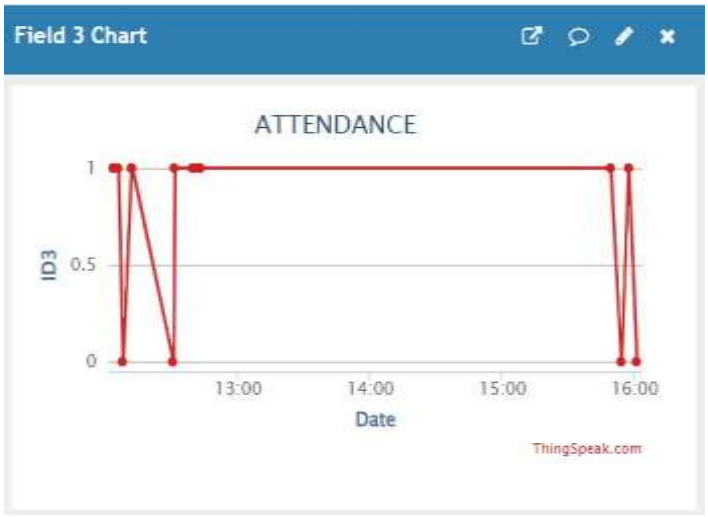

Fig 17. Graphical representation of students with ID3 and his/her entry and exit times.

Fig 18. A dark green LED indication indicates the entry

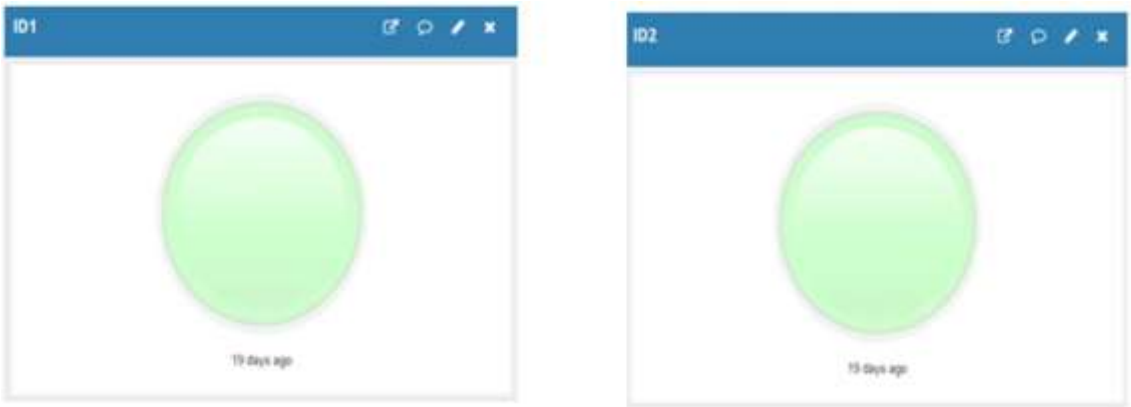

Fig 19. A light green LED indication indicates the exit

Fig 20. The figure shows the data recorded on the webpage.

Fig.18 & 19 shows that the dark green LED indication whichindicates the entry of a student and the light green indication indicates the exit of a student in ThingSpeak along with how much time prior did he/she enter or exit will also be displayed below it.

Fig.20 shows the downloadedfeed sheet from ThingSpeak which shows the time of entry and exit of a student with their respective IDs. It is an illustration of how the data will be recorded on the webpage.

V. Conclusion

In conclusion, this paper presents the development of an RFID attendance system that integrates conditional access control and safety monitoring features.The system ensures the safety of students during the COVID-19 pandemic by measuring their body temperature without physical contact and barring entry if the temperature exceeds 100F, reducing the risk of spreading the virus. Additional

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features include an RFID card reader for student identification, an integrated sanitization system using IR sensors and UV light, and a mechanism to prohibit late entry to maintain classroom lecture flow. The attendance data is stored in the ThingSpeak cloud and can be monitored over the Internet, providing a comprehensive solution for attendance management while prioritizing health and safety.

VI. Future scope

The Safety-Based RFID Attendance System holds significant potential for future advancements and expansions, some of the potential future expansions for the system are Geolocation Tracking so the system can track the location of individuals during attendance recording,Incorporating advanced security features like biometric authentication (fingerprint, facial recognition) or multi-factor authentication can bolster the system's security and can make the system more robust.These advanced security features can ensure that the attendance data is associated with the correct individuals and reduce the possibility of fraudulent attendance records.

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