SMART ATTENDANCE MONITORING SYSTEM USING RFID AND IR SENSORS

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ABSTRACT

Measuring the strength is crucial in educational institutions to ensure appropriate resource allocation and maintain a conducive learning environment. This research presents a novel solution for measuring class strength using Arduino Uno and IR sensors. The device utilizes IR sensors placed at the entry and exit points of the classroom to detect and count individuals entering or leaving. The measured data is processed and displayed using an Arduino Uno microcontroller. The results demonstrate the effectiveness and reliability of the proposed automated attendance system. The results indicate accurate real-time monitoring of teacher entry and exit. Challenges faced during implementation include ensuring the accuracy and reliability of the RFID system and integrating the system with Google Sheets. Future scope includes integration with other educational platforms and the implementation of predictive analytics for classroom management. This system offers a significant advancement in classroom management technology, with applications for educational institutions worldwide. Throughout the development and implementation phases, the project achieved its primary objectives of automating attendance tracking, improving accuracy, and delivering real-time feedback.

Keywords :-*IR Sensor, RFID Module, Wi-Fi Module, Arduino Uno, Liquid Crystal Display.*

1. INTRODUCTION

For educational establishments toeffectively manage resources and offer a proper learning environment, an accurate assessment of class size is essential. Though it can be laborious, prone to mistakes, and interfere with the learning process, manual counting has been used historically. Thus, an automated, non- intrusive method for precisely measuring class strength is required. To tackle thisproblem, we present a research project thatuses an Arduino Uno and infrared sensors to create a class strength measuring device [1]. Due to human mistake, deliberate manipulation, or the sheer logistical difficulty of supervising big groups, traditional pen-and-paper or spreadsheet- based attendance systems are prone to errors. Using Infrared (IR) sensors and the adaptable Arduino Uno microcontroller is a calculated move that combines processing power. This project aims to provide a reliable, efficient, and technologically advanced solution to automate attendance tracking, ensuring not only accuracy butalso real-time feedback for enhanced user experience [2]. To enhance the overall userexperience, the system will offer immediate confirmation of attendance through real-time feedback mechanisms. The integrationof an LCD display will provide visual confirmation, while a buzzer will offer audible feedback. This real-time feedback not only serves as a confirmation for the individuals registering their attendance but also facilitates quick corrections in case of any discrepancies.

2. LITERATURE REVIEW

Previous studies have explored various methods for measuring class strength or occupancy in educational settings. These methods include video- based systems, motion sensors, and RFID- based solutions [3]. However, these approaches have limitations such as high costs, privacy concerns, or limited accuracy. Arduino-based

solutions have gained popularity due to their affordability, versatility, and ease of use [4]. Additionally, IR sensors have been widely used for proximity sensing in various applications. However, there is limited research specifically focused on using Arduino Uno and IR sensors for class strength measurement. Kulkarni et al. (2017) proposed an RFID-based system for monitoring students' entry and exit in school buses. The system aimed to enhance the security and safety of students during transportation. By using RFID technology, the system accurately tracked the boarding and alighting of students, providing real- time information to school authorities and parents [5]. Although existing literature primarily focuses on RFID systems for student attendance management, the principles can be adapted to the proposed Real-Time RFID Based Entry/Exit Monitoring System for classroom environments. By extending these principles, the proposed system aims to monitor the real-time entry and exit of teachers into the classroom. The integration of RFID technology with an existing bidirectional counting device will enhance the accuracy and efficiency of monitoring [6]. Li et al. (2019) developed an RFID- based attendance management system for universities. The system automatically records students' attendance by reading RFID tags embedded in their student ID cards. Results showed a significant reduction in time spent on attendance taking and an increase in accuracy compared to traditional manual methods [7].

3. METHODOLOGY

The Smart Attendance Monitoring System Using RFID and IR Sensors consists of two IR sensors placed collinearly at the entry door of classroom within certain distance. These sensors have programmed in such a way that if an individual first passes through sensor_1 and then passes through sensor_2, it will take as +1 else if the reverse is done it will take as - 1(outgoing). The Arduino Uno microcontroller processes the sensor data and updates the class strength count accordingly. The system employs a simple algorithm to differentiate between incoming and outgoing individuals based on the sequence of sensor activations. A display mechanism, such as an LED display, is integrated to showcase the real- time class strength count. There is a RFID module (RC522) connected with ESP8266 Module, when teachers are entering to the classroom, they must scan their RFID card once their entry is taken successfully the buzzer will be activated to confirm their entry. This data will be updated in the google sheet immediately which includes teacher name, entry time & date.

4. SYSTEM DESIGN AND IMPLEMENTATION

The hardware components required for the class strength measuring device include an Arduino Uno board, two IR sensors, connecting wires, and a display module. The IR sensors are positioned facing each other, creating a detection zone at the entrance. The sensors are connected to the Arduino Uno board, which is programmed to read the sensor inputs and update the class strength count accordingly. The display module is connected to the Arduino Uno to provide real-time output to the users.
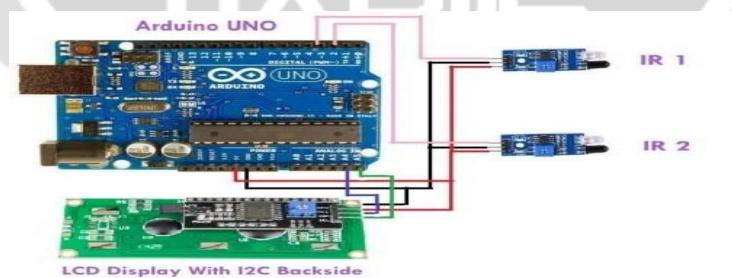

Fig 1 Sensor Calibration Diagram

The RFID module (RC522) is connected with ESP8266 module to determine the teacher availability. This module is updating the results in a Google sheet. A buzzer is connected to ensure successful activation of RFID module.
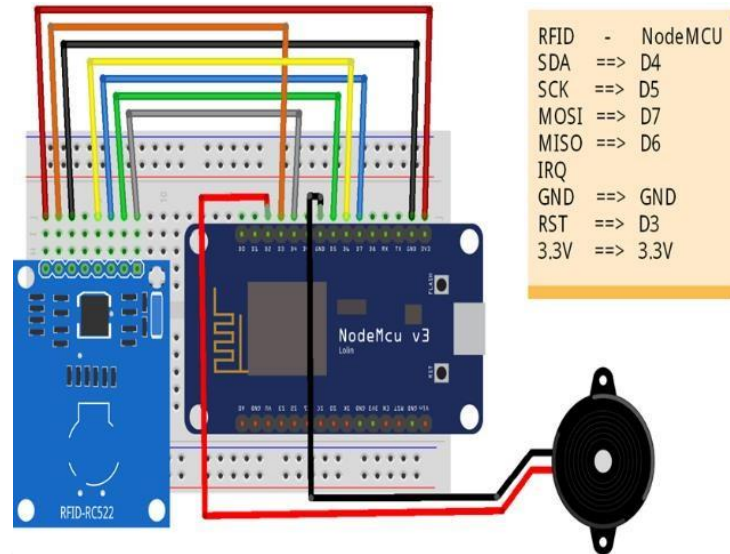
Fig -2 RFID Calibration Diagram

5. RESULT ANALYSIS AND DISCUSSION

To evaluate the performance of the class strength measuring device, experiments were conducted in a real classroom environment. The device accurately detected individuals entering and exiting the classroom, providing a reliable class strength count. The system demonstrated a high level of accuracy, with minimal false positives or negatives. Statistical analysis of the collected data revealed a significant reduction in counting errors compared to manual methods. The proposed class strength measuring device using Arduino Uno and IR sensors offers several advantages over traditional manual counting and other existing methods. It provides a non- intrusive solution that is cost-effective, easy to deploy, and accurate in measuring class strength. The device can be integrated seamlessly into existing educational environments without disrupting the learning process. However, challenges such as sensor calibration and environmental factors may influence the accuracy of the measurements, warranting further investigation and optimization.

Fig-3 Proposed Model

Fig-4 Real Time Feedback Analysis

When we implement the device in a classroom, we observe the Real-time feedback in the LCD display. we calculated the observed value with actual value and found device is working with 100% accuracy as our original value is equals with the LCD display value. The integration of real-time feedback mechanisms, including the LCD display and buzzer, contributes to an enhanced user experience. Immediate visual and audible confirmation of attendance registration not only boosts user satisfaction but also facilitates quick corrections in case of discrepancies.

Table 1 Accuracy Measurement of RFID Module

	A	B	C
1	**DATE**	**TIME**	**NAME**
2	4/19/2024	23:44:15	Monalisa_Samal
3	4/19/2024	23:44:24	Priyajit_Dash
4	4/20/2024	0:03:52	Priyajit_Dash
5	4/20/2024	0:11:44	Priyajit_Dash
6	4/20/2024	0:11:50	Priyajit_Dash
7	4/20/2024	3:02:39	Priyajit_Dash
8	4/20/2024	3:11:31	Monalisa_Samal
9	4/20/2024	3:11:40	Priyajit_Dash
10	4/20/2024	11:31:40	Priyajit_Dash
11	4/20/2024	11:32:21	Priyajit_Dash
12	4/20/2024	11:32:32	Monalisa_Samal
13	4/20/2024	11:53:26	Priyajit_Dash
14	4/20/2024	11:57:14	Priyajit_Dash
15	4/20/2024	11:57:29	Monalisa_Samal

We observed the class room entry by each teacher while activating the RFID module by RFID card. All the entries are successfully updated in the Google sheet along with the date and exact time of entry. We compare the actual time and entry of individual teacher with the Google sheet data and measure the accuracy. We got the device is 100% accurate in updating the time and date along with teacher name.

6. CONCLUSION

This research presented a novel automated attendance system using Arduino Uno and IR sensors. The device offers an automated, accurate, and non- intrusive solution for measuring class strength in educational institutions. The results of the experiments demonstrate. The system's accuracy is a significant highlight, as it eliminates human error and provides reliable attendance data. The IR sensors are designed to detect even small movements, minimizing the chances of false readings. This ensures that attendance records are as precise as possible, benefiting both students and administrators. The project lays the groundwork for future enhancements, such as biometric integration, cloud compatibility, and advanced analytics. These avenues represent opportunities to further refine and expand the system's capabilities, ensuring its relevance in dynamic and evolving educational and professional landscapes. The Automatic Attendance System has the potential to make a substantial impact on attendance management practices. Its benefits extend beyond efficiency gains to encompass improved resource allocation, enhanced data analytics, and a foundation for future technological integrations.

7. REFERENCES

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