IoT-BASED ATTENDANCE MONITORING SYSTEM FOR CHILDCARE CENTERS USING RFID AND MOBILE APPLICATION

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ABSTRACT: Childcare centers often face significant challenges in ensuring the safety and security of children, particularly in monitoring attendance effectively. Traditional methods such as paper registers or manual check-ins are prone to errors, leading to inaccuracies in attendance records. These inaccuracies not only affect operational efficiency but also expose children to serious safety risks. This paper presents an IoT-based attendance monitoring system for childcare centers by integrating RFID technology with a mobile application and real-time database system to replace traditional methods. The primary objective is to enhance the efficiency and accuracy of attendance tracking while ensuring the safety and security of children. The system utilizes RFID tags assigned to each child and RFID readers strategically placed at entry points. When a child enters or exits the childcare center, their attendance is automatically recorded and updated in real-time on a centralized database. A mobile application allows parents to receive notifications instantly. The system uses RFID technology with a Wi-Fi-based microcontroller (ESP8266) and Blynk application. By developing and implementing a robust IoT-based solution, this system aims to reduce risks associated with manual attendance tracking methods while enhancing child safety and improving operational workflows, reducing administrative burdens and time, and ultimately preventing unwanted incidents.

KEYWORDS: *IoT; RFID; Attendance Monitoring; Childcare Centers; Mobile Application.*

1.0 INTRODUCTION

The rapid growth in Internet of Things (IoT) technology has brought new and innovative solutions across various fields such as education, healthcare, agriculture, manufacturing, and many more. IoT in childcare centers can improve the way attendance is monitored and children are cared for, leading to better safety and operational efficiency.[1] Radio Frequency Identification (RFID) technology has been widely adopted in various sectors, including supply chain management, where it has proven effective in tracking and identifying items. Similarly, the application of RFID in academic institutions for student attendance monitoring has been explored, as it offers a more automated and efficient solution compared to traditional methods. [2] This paper presents the design and implementation of an IoT-based attendance monitoring system for childcare centers, using RFID technology and a mobile application to replace traditional methods while adding the safety and security of children.

Traditional attendance monitoring systems in childcare centers often rely on manual methods, such as paper registers, which are susceptible to errors and inefficiencies. [3] These methods not only consume valuable staff time but also present challenges in maintaining accurate attendance records and ensuring the safety of children. Moreover, existing automated systems may lack integration with mobile platforms, limiting real-time data recording and no notification for parents and guardians. To address these issues, there is a need for an advanced IoT-based attendance monitoring system utilizing RFID technology and a mobile application. By integrating RFID readers with IoT devices such as ESP8266, this system automates attendance recording by allowing parent to tap their children's RFID tags for instant and accurate data capture, eliminating manual errors and enhancing real-time accessibility of attendance records. [4]

This research project aims to develop a comprehensive solution that improves operational workflows in childcare centers and enhances overall child safety and parental satisfaction. The RFID tags are uniquely assigned to each child, and as they tap the tags during entering or leaving the premises, their attendance is automatically recorded, and notification sent. Parents will receive notification immediately on their mobile phone when the RFID tags are detected by the system. The system will offer a reliable and precise means of tracking children's daily attendance records in addition to monitoring their arrival and departure as well as reducing parents' worries because they receive notifications on their respective devices on their children's attendance.

2.0 METHODOLOGY

This project consists of 3 main phases: system and architecture design, hardware/software implementation, and testing and deployment. In the first phase, information and requirements from stakeholders, including selected childcare center owner, staff, and parents gathered. After gathering all the information needed, the overall architecture of the system has been designed including the hardware. In this project, RFID readers RC522 and tags, and ESP8266 Wi-Fi module have been chosen as the primary parts. [5] LCD display and LED are also needed to complete the system hardware. Software components such as mobile applications, coding writing software and database platform have also been selected at this stage.

The diagram in Figure 1 shows how an RFID tag interacts with an RFID reader, which then communicates with an ESP8266 Wi-Fi module. The Wi-Fi module is connected to various outputs, including an LED and LCD display, a database system, and a mobile notification system.

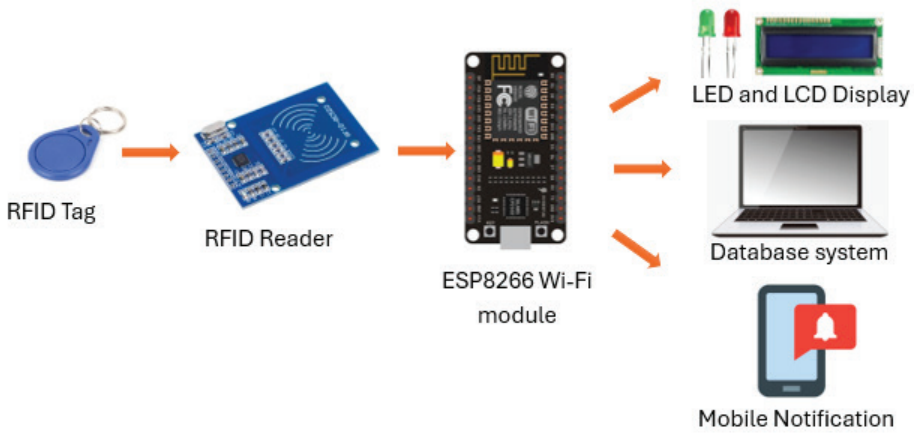


Figure 1: A block diagram of hardware component connection

A flowchart was also developed during this stage to visualize the system's operation and data flow as shown in Figure 2. The RFID tag reader will recognize the tags tapped on it and will display on LCD. If it is recognized, the LCD shows the name and status, green LED turn on, notification send to parents and data recorded, else LCD display "Not Recognize", and red LED will turn on.

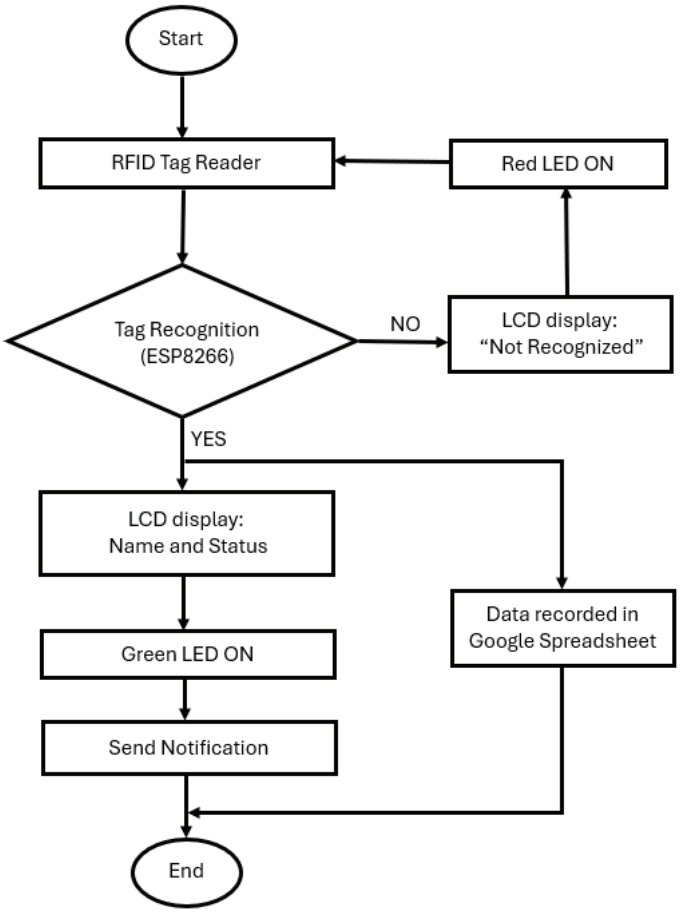


Figure 2: A flowchart of the system's operation

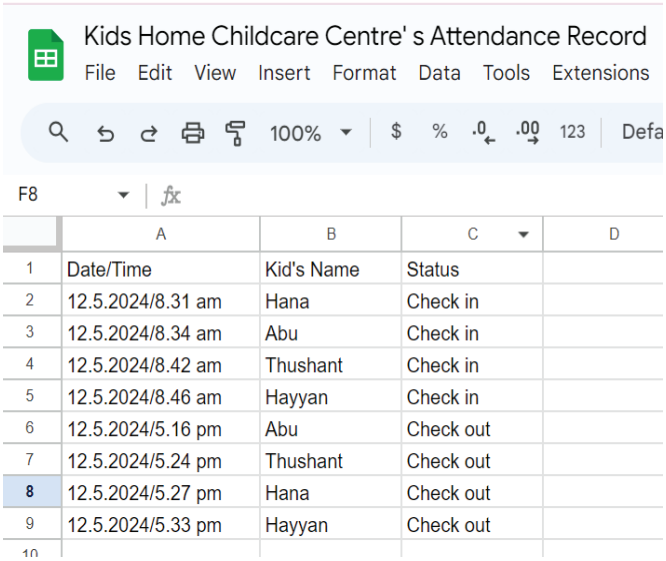
During the hardware/software development phase, the RFID reader was connected to the ESP8266 along with all other components to build the prototype. The software was also integrated by creating code using the Arduino IDE. The Blynk Application has been selected as the platform to send notifications to parents and childcare center administrators. This application was chosen because of its compatibility and user-friendly interface. Google Spreadsheet was used to collect and store attendance data from RFID readers.

In the last phase, testing and troubleshooting was conducted followed by the deployment of the prototype. The system has been deployed in a selected childcare center for a pilot phase. The system's performance monitored, and data gathered to see the impact on attendance recording in the database and operational efficiency of the childcare center.

3.0 RESULT AND DISCUSSION

The system was successfully tested and was functioning as expected. Each time a tag is tapped on the RFID reader, the LCD screen displays the child's name and status, as shown in Figure 3. Simultaneously, related data including the date, the child's name, check-in time, and check-out time is recorded in a Google Sheet. Figure 4 shows a sample of the stored data.

Figure 3: LCD screen displays upon check in



Kids Home Childcare Centre' s Attendance Record

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	A	B	C	D
1	Date/Time	Kid's Name	Status	
2	12.5.2024/8.31 am	Hana	Check in	
3	12.5.2024/8.34 am	Abu	Check in	
4	12.5.2024/8.42 am	Thushant	Check in	
5	12.5.2024/8.46 am	Hayyan	Check in	
6	12.5.2024/5.16 pm	Abu	Check out	
7	12.5.2024/5.24 pm	Thushant	Check out	
8	12.5.2024/5.27 pm	Hana	Check out	
9	12.5.2024/5.33 pm	Hayyan	Check out	

Figure 4: Sample of data stored in Googlesheet

Notifications will be sent to parents' and guardians' mobile phones using the Blynk platform, which serves as the mobile application for alerting parents and guardians when children check in and out of the childcare center. These notifications play a crucial role in ensuring children's safety by reminding parents if they are not sending their children to childcare center when no notification is received. Figure 5 shows a sample of notification received by parents.

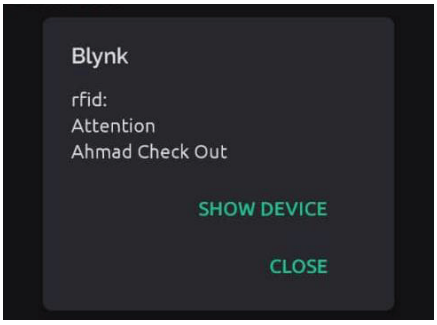

Figure 5: Sample of notification received on mobile phone

4.0 CONCLUSION

The implementation of an IoT-based attendance monitoring system for childcare centers using RFID technology and a mobile application has proven to be highly effective in improving the efficiency, accuracy, and reliability of attendance tracking and children's safety. Beyond providing user satisfaction, this system has the potential to transform the attendance monitoring process, offering a secure and reliable solution for childcare center management. Additional features, such as biometric integration, and absentee alerts, can further enhance the system's capabilities.

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