



# Development of an Absence System using IoT Technology Based on Radio Frequency Identification (RFID)

Nur Aini Hutagalung

Faculty of Computer Science, Prabumulih University  
[ainihutagalung8@gmail.com](mailto:ainihutagalung8@gmail.com)

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## Abstract

SMK Negeri 1 Rambang Niru has implemented an online attendance system, but it still faces challenges related to reliability, accuracy, and efficiency, as the system is not based on Internet of Things (IoT) technology. This research aims to develop an automated attendance system utilizing IoT technology based on Radio Frequency Identification (RFID) to improve the effectiveness and efficiency of attendance tracking. The system uses RFID tags assigned to teachers and administrative staff, which are scanned by an RFID reader connected to a microcontroller. Once detected, the attendance data is immediately transmitted to a centralized server via an IoT communication module. The approach involves integrating RFID hardware with IoT infrastructure, as well as developing software for database management and user interface. The system was tested in the SMK Negeri 1 Rambang Niru work environment to evaluate scanning accuracy, response time, and data consistency. The results show that the RFID-based attendance system provides high reliability, fast data processing, and minimizes errors. This implementation demonstrates the potential to replace the existing online attendance system, enhancing data integrity and providing an efficient solution in modern workplace environments.

**Keywords:** Attendance System, Internet of Things (IoT), Radio Frequency Identification (RFID).

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## 1. Introduction

Attendance is a crucial aspect of human resource management in every institution, both government and private. In today's digital era, the need for more efficient, accurate, and real-time attendance systems is increasing, along with the increasing demand for productivity and transparency of teacher and administrative staff attendance data. One rapidly developing technology with significant potential to improve the quality of attendance systems is the Internet of Things (IoT) combined with Radio Frequency Identification (RFID).

SMK Negeri 1 Rambang Niru currently uses an application to record the attendance of teachers and administrative staff. However, the system does not yet utilize IoT technology, so it still has several limitations, such as reliance on manual or semi-digital input, potential fraud, and delays in the reporting and data analysis process. The absence of automation technology in this attendance system can impact low operational efficiency and suboptimal oversight of discipline.

Given these conditions, an innovative attendance system is needed that not only automatically records attendance but also integrates with an IoT network, allowing for real-time and more accurate access to attendance data. RFID, as an automatic identification technology, offers a fast, secure, and touch-free solution, making it ideal for modern attendance systems.

The development of an attendance system using RFID-based IoT technology is expected to provide an effective solution to existing problems. This system not only improves the efficiency of attendance recording but also minimizes the potential for misuse and supports direct monitoring and evaluation by school management. Furthermore, the system's implementation also supports digital transformation efforts and improves organizational governance, leading to greater transparency and accountability.

Thus, research and development of this attendance system is a rational and relevant urgency in addressing the challenges faced by SMK Negeri 1 Rambang Niru and other institutions in building a more modern, effective, and adaptive attendance system to technological developments. With the development of this system, it is hoped that there will be significant improvements in the efficiency, security, and reliability of the attendance system, as well as supporting digital transformation within the SMK Negeri 1 Rambang Niru environment.

## 2. Research Methods

This study uses a quantitative approach to assess the effectiveness of an attendance system developed using Internet of Things (IoT) technology based on Radio Frequency Identification (RFID) at SMK Negeri 1 Rambang Niru. The main focus of this study is to measure improvements in efficiency, accuracy, and speed of attendance recording compared to the previous conventional attendance system.

Quantitative data was collected through direct observation of system usage by teachers and administrative staff, as well as by measuring attendance processing times and data recording error rates. The data obtained were analyzed using descriptive statistics and comparative tests, such as paired sample t-tests, to identify significant differences between the old and new systems. This approach provides an objective picture of the impact of the new system implementation on attendance performance in the workplace.

The project plan includes the design, construction, and testing of an IoT-based attendance system with RFID. The system will be developed using a microcontroller (such as an ESP32), an RFID module, and a web-based or mobile application to display and summarize attendance data in real time.

The activity stages consist of:

1. Literature review and analysis of attendance system requirements.
2. System architecture design and selection of hardware and software components.
3. Prototype creation of an IoT-based RFID attendance system.
4. Live system testing in the work environment.
5. Data collection on system effectiveness and efficiency.

The scope of this research is limited to the development and implementation of an attendance system using IoT-based RFID technology on a small to medium scale, with a focus on the process of automatically recording, storing, and reporting attendance data. The research subjects are teachers and administrative staff at SMK Negeri 1 Rambang Niru.

The materials and tools used in this research are:

1. Hardware: ESP32 microcontroller, RC522 RFID module, RFID cards/tags, jumper cables, and a breadboard.
2. Software: Arduino IDE, Firebase/Thingspeak/MQTT Broker (for IoT communication), and a web/mobile-based attendance application platform.
3. Network: Wi-Fi connection for IoT integration.

This research was conducted in the environment of SMK Negeri 1 Rambang Niru, especially among teachers and TU staff. In this study, data was collected using several methods, namely:

### 1. Direct Observation

The researcher conducted direct observations of the attendance process carried out by teachers and administrative staff using the new system. This observation aimed to determine how the system actually works in the field, including the RFID scanning process, system response, and potential challenges.

### 2. Employee Data Request

Employee data required for the study included name, position, and Student ID Number (NIP). This data was used as a reference in analyzing attendance results.

### 3. Limited Interviews

The researcher conducted brief interviews with several teachers and administrative staff who use the attendance system. The goal was to gather information regarding user experiences, challenges, and suggestions for system improvements.

The data obtained will be analyzed quantitatively using descriptive statistics and comparative tests (such as paired-sample t-tests) to determine differences in effectiveness between the old and new systems. Additionally, qualitative data from interviews and questionnaires will be analyzed to assess user acceptance of the system.

## 3. Results and Discussion

This section presents the results of the development and testing of an attendance system using Radio Frequency Identification (RFID)-based IoT technology at SMK Negeri 1 Rambang Niru. These test results demonstrate the system's performance, speed of attendance recording, and effectiveness compared to previous attendance methods.

The attendance system was developed using an ESP32 microcontroller connected to an RC522 RFID module. Each employee is given an RFID card, which they use to record attendance by tapping it on an RFID reader. Attendance data is automatically sent to a cloud-based database (Firebase) and can be viewed in real time through the app.

**Table 1:** Hardware Specifications

No	Hardware	Quantity
1	PN532 NFC RFID Module	1
2	ESP32	1
3	Buzzer 5v	1
4	Kabel Jumper	1
5	BreadBoard	1

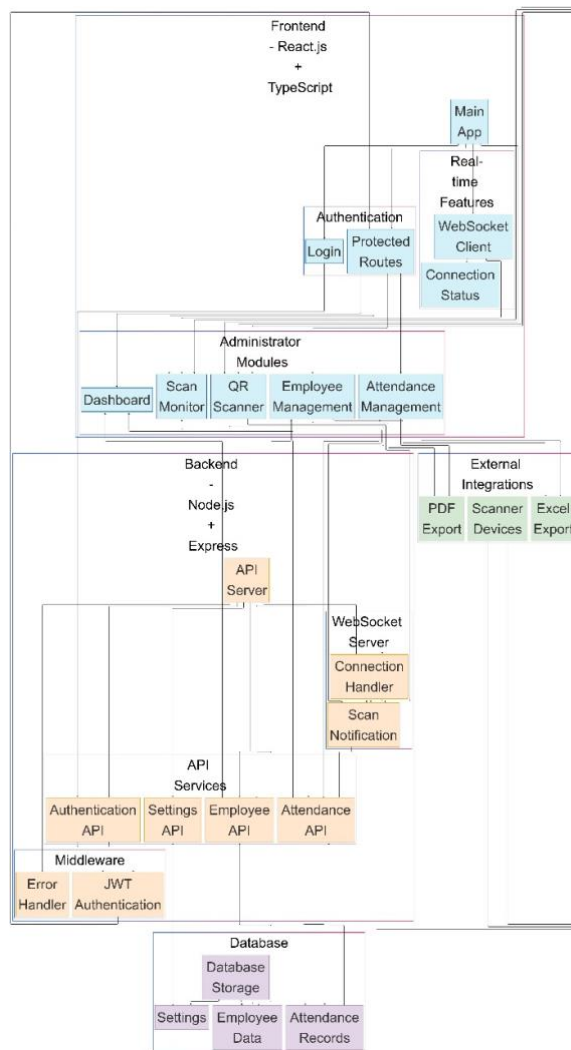
**Table 2:** Software Specifications

No	Perangkat Lunak	Quantity
1	Node Js	1
2	Bun	1
3	Docker	1
4	VS Code	1

**Table 3:** Attendance Recapitulation

Employee	Check In	Check Out
Bader Halim	10:45:56	15:46:02
Rinti Awalia	10:45:50	15:46:27
Aidil Mastari	10:45:33	15:46:32
Heni Susanti	10:45:29	15:46:09

This attendance system is built using RFID technology connected to an ESP32 microcontroller and communicated wirelessly with a cloud database. The following figure shows the general architecture of the implemented system.



**Fig.1:** IoT and RFID Based Attendance System Architecture

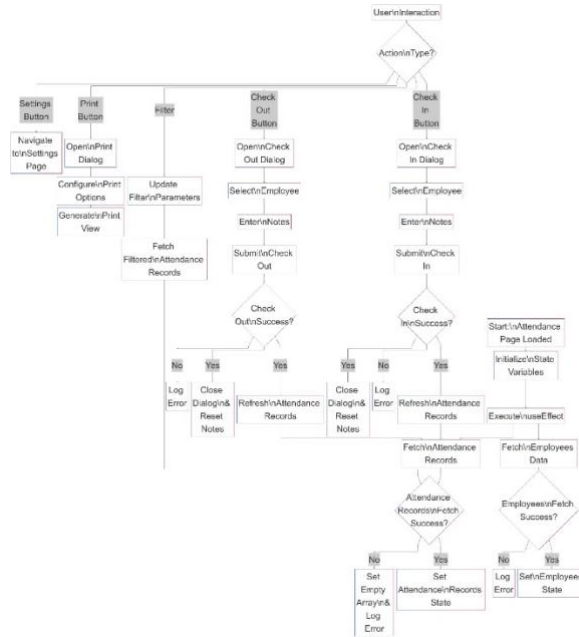


Fig. 2: Workflow Diagram

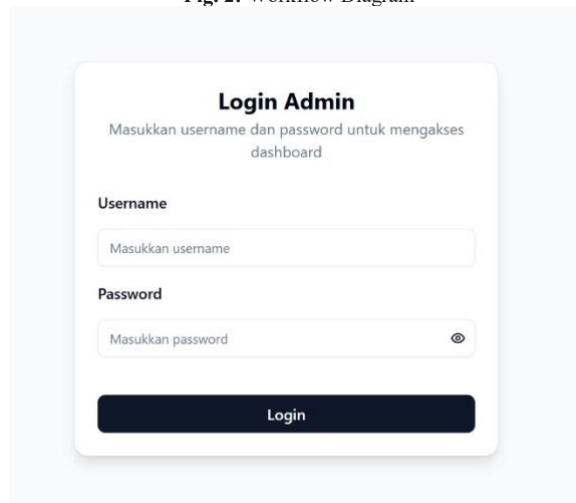


Fig. 3: Admin Login Page View

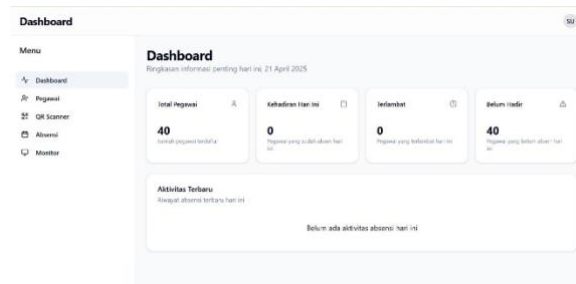


Fig. 4: Dashboard Page View

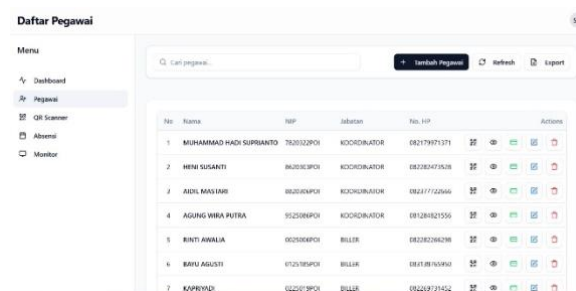


Fig. 5: Personnel Page View

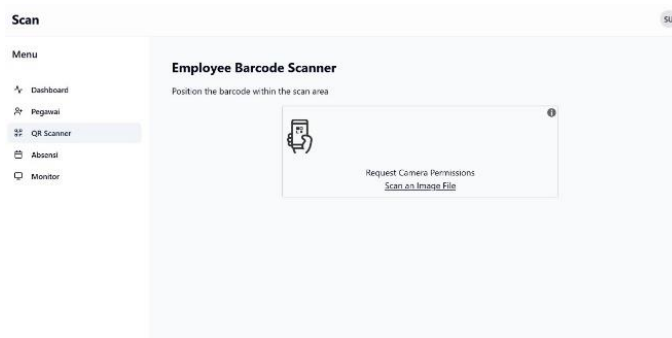


Fig. 6: QR Scanner Page View

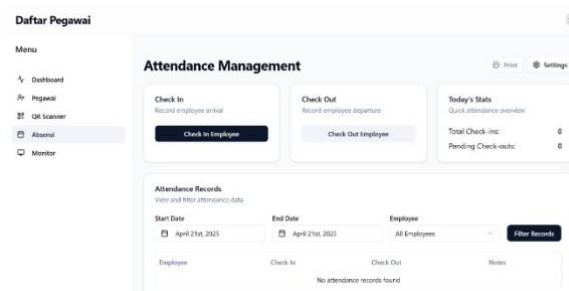


Fig. 7: Attendance Page View

Attendance Records  
View and filter attendance data

Start Date: April 21st, 2025 | End Date: April 21st, 2025 | Employee: All Employees | Filter Records

Employee	Check In	Check Out	Notes
BADER HALIM (7225038POI)	10:45:56	10:46:02	-
RINTI ANALLIA (0025006POI)	10:45:50	10:46:27	-
AIDIL MASTARI (8820306POI)	10:45:33	10:46:32	-
HENI SUSANTI (8620303POI)	10:45:29	10:46:09	-
MUHAMMAD HADI SUPRIANTO (7820322POI)	10:45:24	10:45:45	-

Fig. 8: Monitor Page View

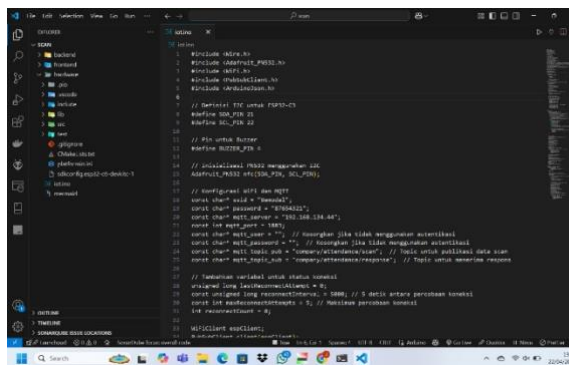


Fig. 9: Code Line Section on the Attendance Tool

Time efficiency in the attendance process is calculated to compare the old method (manual attendance via an app) with the new system (RFID). The time efficiency formula used is:

$$Efisiensi = \frac{Waktu Lama - Waktu Baru}{Waktu Lama} \times 100\% \quad (1)$$

It is known that the previous attendance time was 5 minutes and the RFID system requires 1 minute:

$$Efisiensi = \left(\frac{5-1}{5}\right) \times 100\% = 80\% \quad (2)$$

From the test results, the system demonstrated reliability in:

1. Detects attendance quickly and automatically.
2. Sends data in real time to a cloud database.
3. Minimizes human error, which often occurs in manual attendance systems.

This system also increases the efficiency of attendance recording by 80% as calculated in Equation (2), and accelerates data recapitulation for administrative purposes. This research is consistent with a previous study by Baiq Andriksa et al. (2023), which stated that the integration of RFID and IoT technology can increase a company's operational efficiency by more than 70%.

## 4. Conclusion

This research has successfully designed and developed an Internet of Things (IoT)-based attendance system utilizing Radio Frequency Identification (RFID) technology as a modern solution to improve the quality of attendance at SMK Negeri 1 Rambang Niru. This system is able to automate the attendance recording process by minimizing the potential for human error and increasing the efficiency and transparency of employee attendance data.

Through experimental methods, implementation results demonstrated that the RFID attendance system integrated with a microcontroller and cloud database is capable of operating in real time and accurately. Key components, such as the RFID reader, ESP32, and attendance dashboard application, functioned as designed, with recorded attendance data directly accessible to administrators and authorized users.

The system developed has also proven to facilitate attendance monitoring and can be further developed for integration with broader employee information systems. Thus, the use of RFID-based IoT technology has positively impacted the effectiveness and efficiency of conventional attendance systems, which were previously limited to manual or semi-digital systems.

## References

- [1] Desra Triyunsari, Billi Mahardika, Tata Sutrabri, "Pengembangan Sistem Informasi Perpustakaan dengan Menggunakan Internet of Things Menggunakan Perangkat Radio Frequency Identification pada SMA Negeri 9 Palembang," *Jurnal Sistem Informasi dan Teknologi*, vol. 5, No.1 (2023).
- [2] Baiq Andriska Candra Permana, Muhammad Djameluddin, Suhro W Saputra, "Penerapan Sistem Absensi Siswa Menggunakan Teknologi Internet of Things", *Jurnal Informatika dan Teknologi*, vol. 6 No. 1, Januari 2023.
- [3] Kamus Besar Bahasa Indonesia. <https://kbbi.web.id/absensi>.
- [4] Muhammad Dimas Prasetya Himawan, Joushua Lian Aldora Djuk, Riski Dava Prayogi, "Sistem Presensi Mahasiswa Berbasis IoT Menggunakan Rfid dan Esp8266 pada Database Server," *Journal Of Smart System (JSS)*, vol. 4 No. 1 Juli 2024.
- [5] Siagian, Sondang P. (2023). "Manajemen Sumber Daya Manusia". Jakarta: Bumi Aksara.
- [6] Susanto, F., Komang Prasiani, N., & Darmawan, P. (2022). Implementasi Internet of Things Dalam Kehidupan Sehari-Hari. *Jurnal IMAGINE*, 2(1), 2776–9836. <https://jurnal.std-bali.ac.id/index.php/imagine>.