Development Of an Attendance System Using Rfid Based On The Internet of Think

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ABSTRACT

The attendance system is an important component in the world of education to monitor student attendance regularly and accurately. However, manual attendance methods that are still widely used, such as recording in books, have various disadvantages such as prone to recording errors, data manipulation (absenteeism), and making the attendance recapitulation process difficult. This research aims to develop an automatic attendance system using Radio Frequency Identification (RFID) technology integrated with the Internet of Things (IoT). This system is designed so that the attendance recording process can be carried out automatically, in real-time, and directly stored in a web-based database. The system development method uses a prototyping approach, with stages of communication, quick planning, quick design, construction, and feedback from users. The hardware used includes ESP32, MFRC-522 RFID module, 16x2 LCD, buzzer, and push button. While the software is built using PHP Native, MySQL, and Arduino IDE. The system has three main modes, namely Data Add Mode, Opt-In Mode, and Opt-Out Mode. Attendance data will be sent directly to the server and can be accessed by teachers or officers through the web dashboard. The test results using the black box method show that the system is running according to the expected function. The implementation of this system has been proven to improve the efficiency and accuracy of recording student attendance, as well as reduce the administrative burden on the school. The system also has the potential to be further developed with notification features or integration into other academic.

Keywords: Attendance System; RFID; Internet of Think;

INTRODUCTION

Attendance is one of the important activities in the world of education and the world of work. At MAN 7 Jombang, the process of recording student attendance is still carried out manually using a paper attendance sheet. This method is not only time-consuming, but also prone to recording errors, negligence, and data manipulation, such as absenteeism. The recapitulation process carried out manually by the administration or homeroom teacher also adds to the workload (Gunawan. 2020).

The development of information and communication technology provides a great opportunity to overcome these problems. One of the relevant innovations is the application of the Internet of Things (IoT), which is a concept where various devices can connect to each other through the internet and exchange data automatically. In the context of attendance, Radio Frequency Identification (RFID) technology has the potential to record attendance without direct contact, simply using an RFID card or tag that is read by a sensor (Baharuddin et al. 2024).

RFID integration with IoT allows for real-time delivery of attendance data to servers or the cloud. The data can be accessed directly by teachers, administrative officers, and parents through a dashboard or application. This system improves data accuracy, minimizes manual intervention, and speeds up the reporting process (IN 2025). Similar research was conducted by (Hakim, Arnesia, and Yusup 2024) who designed an RFID and IoT-based attendance system at SMK Negeri 1 Cileungsi using ESP8266 modules and MFRC522 RFID sensors. The results show that the system is able to record attendance automatically, accurately, and efficiently, and replace the slow and error-prone manual method.

Based on this background, this study aims to develop an IoT-integrated RFID-based student attendance system at MAN 7 Jombang. This system is expected to be able to overcome the weaknesses of

manual methods, increase efficiency, and provide convenience in monitoring attendance in a modern and real-time manner.

METHOD

In this study, the method used in system development is the prototyping method. The prototyping method is one of the approaches in software development, which emphasizes the creation of an initial model (prototype) of the system to be validated by the user before it is further developed into a complete system. This method allows developers to identify flaws and make improvements before the system is fully implemented. With the use of prototypes, system development becomes easier and can lead to better solutions (Andini et al. 2023). The stages in the prototype method can be seen in the image below.
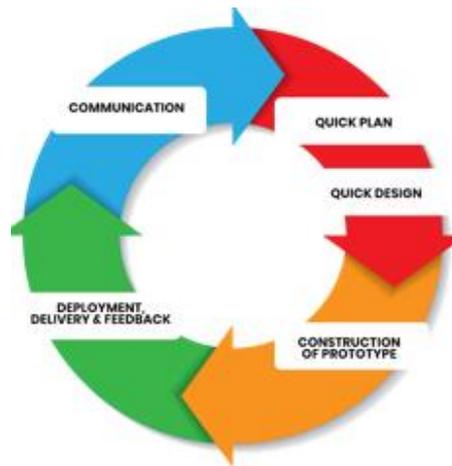
Figure 1. Prototype Method Flow

- Communication

  The problem identification step is carried out through collaboration between developers and stakeholders to understand the objectives of the system development, gather system needs, and set existing limitations (Pramudita and Setyawan 2022). This communication process includes searching for information through various references such as books, journals, and thesis. Furthermore, discussions were held to analyze the problem and formulate solutions that could provide benefits and make a positive contribution to research development.

- Quick Plan

  At the quick plan stage, a needs analysis is carried out to build a prototype that meets the expectations and needs of users. Quick Plan is an initial planning stage that is carried out to identify needs in research through an analysis process. This analysis includes the identification of needs in the input, process, and output parts, as well as the analysis of technical needs in application development, which includes hardware and software requirements (Alda 2023).

- Quick Design Modeling

  At this stage, the concept of the system begins to be designed by making an initial idea of how the system will work. This process is called Quick Design Modeling, which is creating a simple and quick initial design of the system to visualize the system's workflow. This design includes a sketch of the user interface, the flow of the attendance process.

- Prototype Construction

  After going through the analysis and design stage, the next step is to develop a prototype by realizing the design into a user interface design (Wedayasa, Putra, and Wijaya 2025). This stage is carried out to build a prototype as well as test the design of the interface that has been designed beforehand.

- Deployment, Submission and Feedback

  At this stage, the system or software that has been completed is handed over to the user for direct use. The system is operated according to its function so that users can feel the benefits of the system.

- Block Diagram

  Block diagram of the ESP32-based RFID attendance system shows the relationships between

the main components in the system. The power supply from the DC socket and the switch supplies voltage to the entire circuit. The ESP32 microcontroller serves as a control center that receives input from RFID buttons and readers, and then processes data according to the selected mode, such as recording attendance or adding new data.
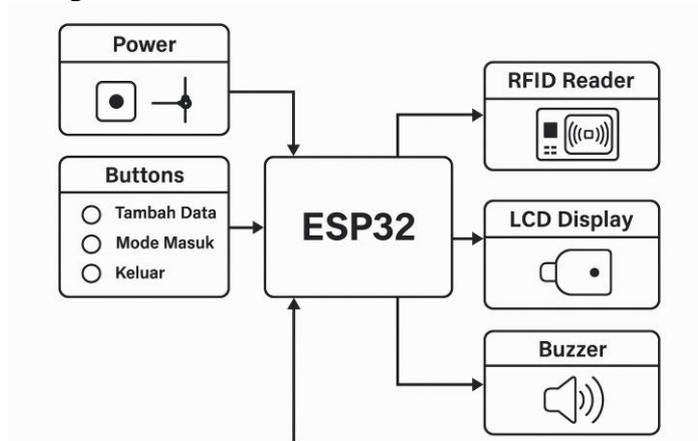

Figure 2. Block Diagram Tool

- Skema Tools

In addition, the design of the tool also includes the design of an Arduino-based tool that functions as an RFID card detector. This section shows a series of tools consisting of an Arduino microcontroller, RFID module, buzzer, and other supporting components. This series is designed to capture the RFID card data used by the student, then send it to the system as attendance data. With this design, the test can be carried out in a structured manner both in terms of software and hardware. The series of Attendance Sketches with RFID can be seen in the Figure below.
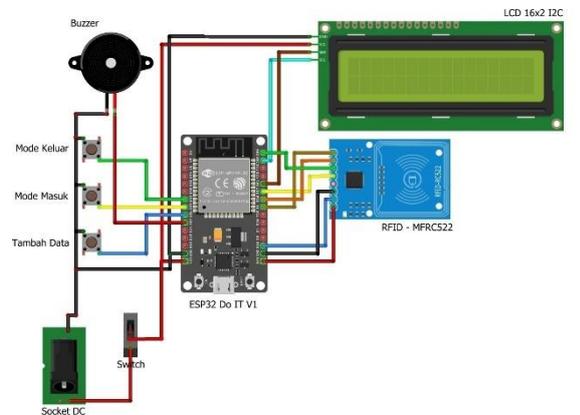
Figure 3. Skema Abscess Module With RFID

- System Flowchart

Figure 4. Attendance Flowchart with RFID

- Table Design

Table 1. Table Guru

Field Name	Data Type	Information
Yes	INT(255)	AUTO_INCREMENT
Tags	Varchar (255)	
Name	Varchar (255)	
Course	Varchar (255)	

The Teacher Table functions to store teacher data and their subjects

The entrance table functions to record student attendance with responses from RFID pasted on the reader.

Table 2. Entry Table

Field Name	Data Type	Information
Yes	INT(255)	AUTO_INCREMENT
Tags	Varchar (1000)	
Enter	Time	
Date	Date	

The exit table serves to record the attendance of students and teachers with responses from RFID when attached to the reader.

Table 3. Table Out

Field Name	Data Type	Information
Yes	INT(10)	AUTO_INCREMENT
Tags	Varchar (1000)	
Out	Time	
Date	Date	

An add table is a table for storing the addition of new tag data with students.

Table 4. Table plus

Field Name	Data Type	Information
Yes	INT(255)	AUTO_INCREMENT
Tags	Varchar(1000)	
Time	Timestamp	

- Database Design

In designing an Entity Relationship Diagram (ERD) for an RFID-based attendance system (Radio Frequency Identification), it is necessary to understand the main tables that play a role in the attendance recording process using RFID technology. The following ERD Database can be seen in the image below.
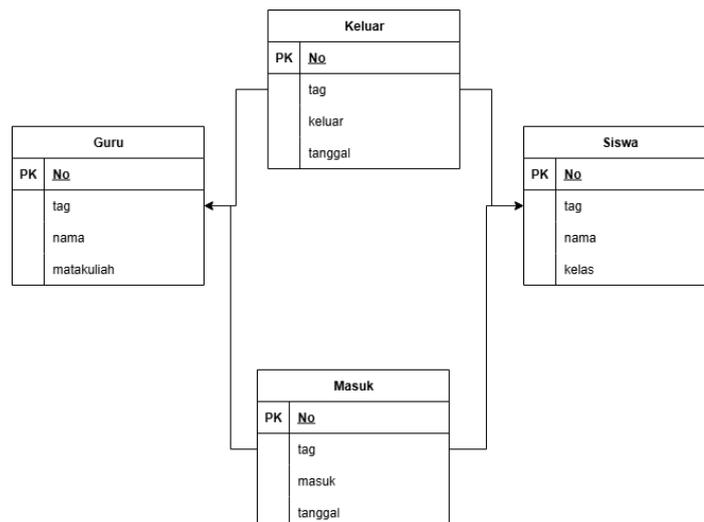
Figure 5. Database design
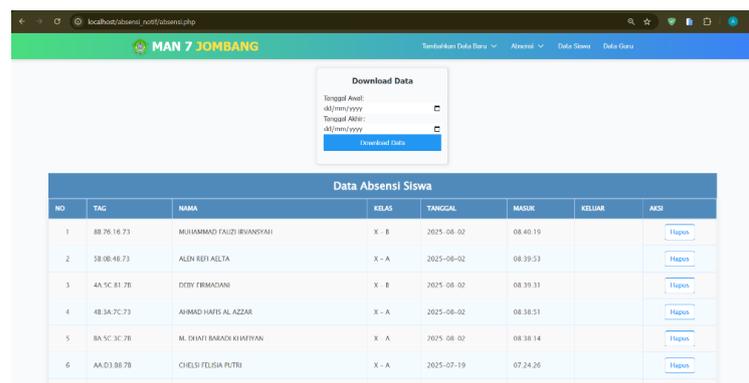
RESULT AND DISCUSSION

This research produced a student attendance system based on Radio Frequency Identification (RFID) that is integrated with the Internet of Things (IoT), able to record attendance automatically and in

real-time. The system is designed to read student identities using RFID cards or tags, transmit attendance data over a Wi-Fi connection to the server, and display it on the web dashboard instantly. With IoT integration, attendance data can be accessed by teachers, administrators, and parents anytime and anywhere, thereby increasing transparency, accuracy, and efficiency in attendance management.

Result

- Website Implementation

    On the student or teacher attendance page display, there is a table of students/teachers who have been absent from and out, the data is obtained when the student/teacher has pasted their RFID card to the reader so that the data goes directly into the database. There is also a download button which is used to download student attendance results in the form of a pdf file. The display of the student/teacher attendance page can be seen in figure 2.

Figure 6. Absence Page

    The student add page display the RFID tag data that has been added and then from the RFID tag that appears there is an add data button to add the identity data that you want to add to the RFID tag. The view of the student add page can be seen in figure 3.
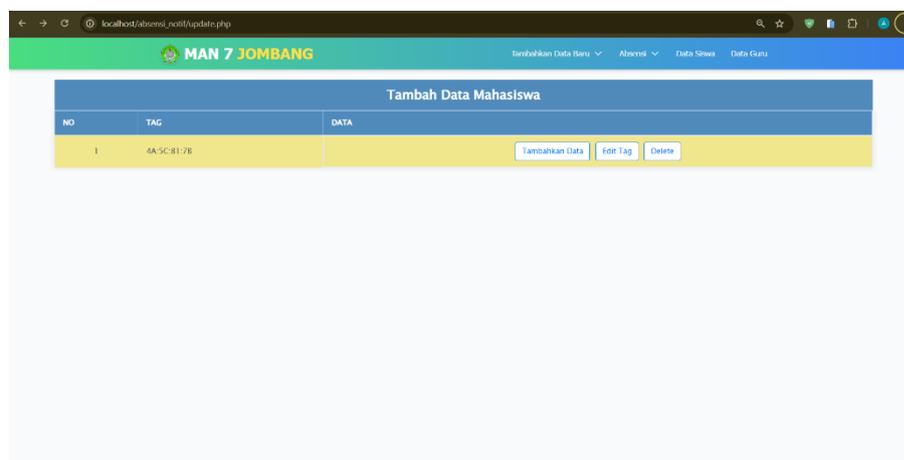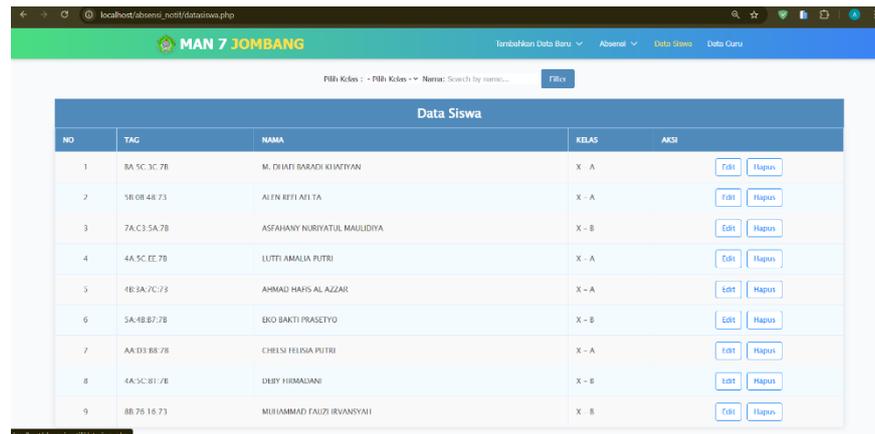

Figure 7. Add Student Page

    Finally, the display of student and teacher data pages that display student or teacher data. The display of the student or teacher data page can be seen in figure 4.

Figure 8. Student and Teacher Data Page

- Implementation of the tool

The entire device manufacturing process is carried out by integrating all the elements that have been designed into one RFID-based attendance system with ESP32. The system includes an ESP32 microcontroller as the main control unit, an RFID module MFRC522 for reading cards, three function buttons namely "Add Data", "Enter", and "Exit", a 16x2 LCD with an I2C interface to display information, a buzzer as a sound source, as well as a power source from a DC socket and switch. All elements are connected according to a pre-planned scheme, where the RFID module is connected via the SPI interface, the buttons on the input pin, the LCD via the I2C line, and the buzzer are connected to the ESP32 output pin.

Figure 9. Whole Range of Tools

The Add Data mode is used to register new RFID tags into the system. This mode is enabled when the user wants to add an unrecognized card/tag to the database.

Figure 10. Add Data Mode

Absent (Login) mode is the primary mode used to record student attendance when coming to

school.

Figure 7. Absence mode

Exit Mode is used to record the time of departure or absence of students/teachers at the end of teaching and learning activities.

Figure 11. Exit Mode.

Discussion

Testing of the RFID-based attendance system that has been developed is carried out to ensure that the system functions effectively and efficiently. The method used in this test is Black Box Testing, which is a testing method in which the tester provides various inputs without knowing the internal processes of the system. The main purpose of this method is to verify whether the system provides the output that corresponds to the predetermined needs and functions.

Tests were carried out on various aspects, including functionality, navigation between pages, interface responsiveness, access security, and integration between components in the system. In addition, this test also involves simulating multiple use scenarios to ensure that the system is capable of handling situations that may occur in real use. The results of this test are expected to be the basis for improving the system, as well as ensuring that the RFID attendance system developed truly provides an optimal user experience and is in accordance with the needs of the agency

CONCLUSIONS

From the results of the research and implementation that has been carried out, it can be concluded that the RFID-based attendance system with the support of Internet of Things (IoT) technology is as follows:

- The RFID-based attendance system created can simplify the attendance recording process without the need to write manually.

- The use of this system makes the attendance process faster and reduces the risk of data recording errors.
- Attendance data can be saved automatically and can be viewed by managers at any time easily.
- Data collection through direct observation helps researchers understand the needs of users and problems in the field.
- The test results show that the system can run well according to its functions, from reading RFID cards to recording attendance data.

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