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Automatic Bell Using Esp8266 and Telegram Method as a Reminder for Laboratory Time at the AMIKOM Purwokerto University Assistant Forum

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Abstract

The purpose of this research is to create an automatic bell system that uses an ESP8266 microcontroller integrated with Telegram as a reminder for practical sessions at the Amikom Purwokerto University Assistant Forum. This system is necessary because assistants need to balance laboratory responsibilities and academic activities. Using an Internet of Things-based approach, this system combines NodeMCU ESP8266, DS3231 Real-Time Clock (RTC) module, buzzer, and Telegram Bot notification service. The research process includes identifying needs, reviewing literature, designing the system, implementing, and testing. The bell operates automatically according to the schedule stored in the RTC, while the Telegram bot sends reminders 15 minutes before the practicum begins. Test results show that the bell consistently activates at the right time without delay, and that Telegram notifications are sent according to the configured schedule. These results indicate that the proposed system can meet the functional requirements for accuracy, reliability, and effective communication. Potential for further development in this system includes integration with an automatic attendance feature.

Keywords: *ESP8266, IoT, Real Time Clock, Telegram*

1. Introduction

A Bells are sound-producing instruments that serve as important codes, reminders, and communication aids [1] . Some reviewed publications state that as technology advances, manual bells are becoming less frequently used because they are considered less efficient and often cause common problems, including forgetting to press the button at the designated time [2] [3] [4]. At the assistant forum at Amikom University Purwokerto, time discipline is very important. Assistants are informed in advance about upcoming practicum sessions so they can prepare well, be on time, and develop better work habits. Because forum members are also still registered as active students in addition to their responsibilities as lab assistants.

The application of the Internet of Things (IoT) with an automated bell system is a relevant and innovative solution in this regard. IoT's ability to connect digital systems with physical objects via the internet has enabled it to dominate a number of industries. Although there are other options, IoT offers a beneficial alternative for developing interconnected and intelligent systems [5]. The ESP8266 is one of the tools frequently used in Internet of Things (IoT) applications for real-time data transmission and reception [6]. By connecting to the Wi-Fi network, it allows for the integration of the automatic bell system with a Telegram-based notification system, which sends practical time notifications directly to the Telegram accounts of the practical assistants. Thus, assistants can be informed quickly and accurately when the practical session is about to begin.

2. Literary Studies

2.1. Arduino IDE

The Arduino IDE is a programming environment that must be programmed. This software helps researchers develop Java-based programming sketches, which are used to edit, create, upload, and write specific programs. In addition, Arduino Uno also includes a C/C++ library that facilitates input and output operations [7]**.** In this study, Arduino was used as a medium to encode commands and program logic so that the ESP module could be integrated with the Telegram application. Using Arduino IDE, researchers wrote and uploaded programs that functioned as a link between the hardware and the Telegram platform, enabling ESP to send and receive data automatically via the internet.

2.2. Telegram

Telegram is an application for sending messages, not only text, but also images, videos, and audio [8]. In the context of the Internet of Things (IoT), Telegram has the advantage of supporting Application Programming Interfaces (API) that allow users to freely develop bots [9].These advantages enable Telegram to be integrated with IoT devices, including this automatic doorbell.

2.3. NodeMCU ESP8266

NodeMCU is an electronic board based on the ESP8266 chip that has the ability to perform microcontroller functions and connect to the internet via Wi-Fi. NodeMCU ESP8266 can be programmed with the Arduino IDE compiler because it has many input/output pins, making it suitable for IoT projects [10].

2.4. Real Time Clock (RTC)

A Real Time Clock (RTC) is an electronic clock in the form of a chip that can accurately calculate time from seconds to years and maintain or store time data in real time. Because this clock works in real time, its output can be stored or sent to other devices via an interface system [11].

2.5. Buzzer

A buzzer is an electronic component that operates on electromagnetic principles, converting electrical current into sound. It is generally divided into two types: active buzzers, which produce sound without additional circuits, and passive buzzers, which require a frequency signal from a microcontroller to produce sound [12]. The buzzer serves as the main actuator that sounds when the practical session time arrives.

2.6. Jumper

Jumper cables are used to connect one electronic component to another when creating prototypes [11]. This cable comes in several types, distinguished by the shape of the connector ends: male to male, male to female, and female to female. Male cables have metal pins that can be directly plugged into a breadboard or female port on a module, while female cables have connector sockets that receive the pins.

2.7. USB

USB (Universal Serial Bus) cables are the most commonly used cables in modern electronic devices today, due to their standard design that can be used on many electronic devices such as printers, scanners, keyboards and all devices that have USB cables [13]. In this project, a USB cable is used to connect the ESP8266 module to a laptop during the program upload and power supply processes. The USB cable also functions as a serial communication line between the ESP8266 and the laptop for debugging monitoring.

3. Research Methods

The research methodology in this case study involves an IoT system prototype. The objective of this research is to develop an ESP8266-based automatic bell system integrated with Telegram to provide notifications regarding practical sessions at the Amikom Purwokerto University Assistants Forum. The following steps are included in this research:

Fig. 1: Research Flow

The figure shows the flow of the research method for this automatic bell system, starting from the identification of the need for a more effective time reminder system, because teaching assistants also have to divide their time between lectures and assisting, so they often need very precise notifications and reminders. Once the needs were clear, a literature study was conducted on the hardware and software that cloud be applied. At the design stage, a workflow was developed for a system that cloud read the time, send Telegram notifications, and trigger an automatic bell. Implementation was then carried out by combining the planned hardware and software. After the system was up and running, testing was conducted to assess the accuracy of the system in reminding students of their lab times.

3.1. Diagram Block

This bloc diagram explains the flow of input and output, processes for an ESP8266-based automatic bell integrated with Telegram:

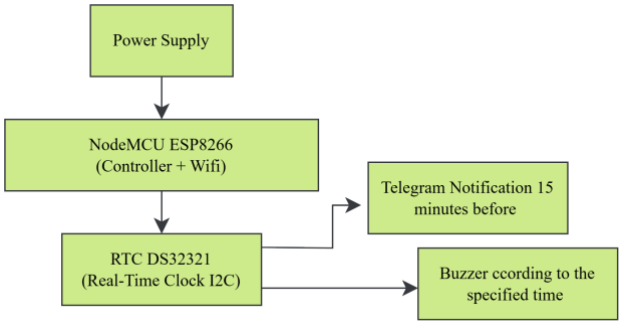

Fig. 2: Block Diagram

The NodeMCU ESP8266, DS3231 RTC module, buzzer, and Telegram notification system are combined in the design of this device. The RTC module and NodeMCU receive their main power supply from the power source. NodeMCU periodically receives accurate real-time data provided by the DS3231 RTC module via an I2C connection. NodeMCU tracks the user-defined alarm schedule and continuously checks the schedule against the current time from the RTC and automatically uses the Telegram bot to send notification messages to Telegram via a WiFi connection when the time on the RTC indicates that the alarm will sound in 30 minutes. NodeMCU activates the buzzer as an audible signal right on time. Overall, the system flow begins with the RTC reading the time, followed by NodeMCU's logic processing, sending a Telegram message thirty minutes before the alarm sounds, and finally activating the buzzer at the specified time.

3.2. Schematic

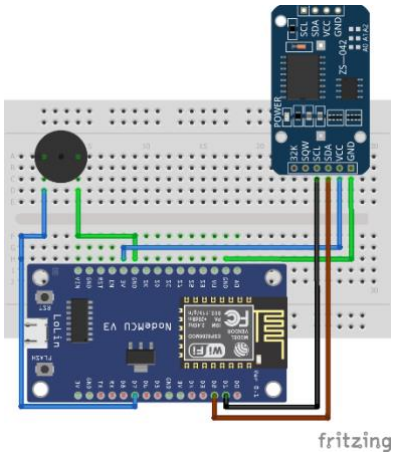

Fig. 3: Schematic

The image above shows a schematic diagram of an IoT-based automatic bell that illustrates the relationship between components, resulting in a real-time scheduling solution from Telegram and an innovative bell.

Table 1: Schematic Diagram of Tools

Components	Pin	Pin to NodeMCU ESP8266
Buzzer	(+)	D7
Buzzer	(-)	GND
RTC Module	SCL	D1
RTC Module	SDA	D2
RTC Module	VCC	3V
RTC Module	GND	GND

4. Result and Discussion

4.1. Implementation

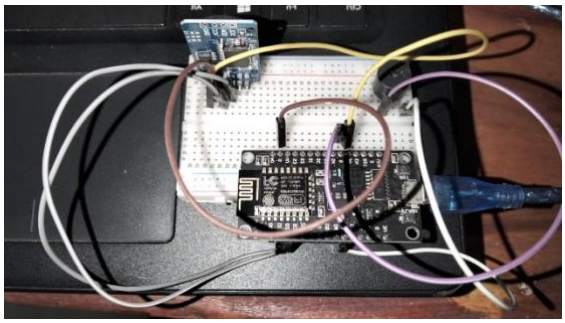

Fig. 4: Harware Implementation

4.2. Testing

Our testing of the ESP8266-based automatic bell system integrated with the RTC DS1307 and Telegram application showed according to the schedule that had been inputted. The microcontroller used RTC time data to store and read the practical time that had been inputted through the Telegram bot application. During testing, the bell was always active at the minute and hour specified in the schedule, without any delays or sounds that did not match the input schedule. This shows that the system was successfully designed so that the bell sounds according to the input time.

Fig. 5 : Telegram Notification

In addition, testing of integration with the Telegram application also showed good and successful results. Before the practical session began, the system successfully sent reminder notifications via the Telegram bot. The notifications appeared exactly 30 minutes before the practical session began, as previously inputted, and were sent automatically without requiring additional interaction from the user. This shows that the microcontroller and Telegram bot can communicate well with each other and that the notification delivery logis is working properly.

5. Conclusion

All The results of research and testing show that the Telegram-based automatic bell system using ESP8266, RTC DS1307 dan Telegram application has successfully achieved the objectives set out in the introduction. The system has the ability to automatically ring the bell at the time entered by the user. Additionally, before the practical session begins, the system can send reminder notifications. This demonstrates the alignment between the research expectations and the implementation results in terms of the accuracy of the bell sound timing and how the notification system functions effectively using Telegram as the Communication medium.

The system is not only successful, but also shows considerable potential for further development. Development could include adding a Telegram-based attendance system feature. This would allow users to check in directly via a Telegram bot, and attendance data could be automatically recorded without the need for manual processing. It is hoped that further development will improve operational efficiency while providing greater added value for future implementation.

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