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Implementation of the Internet of Things using Blynk platform for smart home

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ABSTRACT

This research develops an Internet of Things (IoT)-based Smart Home system using the Blynk platform and the ESP32 microcontroller. The system is designed to facilitate remote control of household electronic devices through a smartphone application, thereby optimizing energy use and enhancing efficiency. In its implementation, the ESP32 serves as the main connector of electronic devices to the internet, while relays are used to control the power of devices like lights. This system not only increases user convenience but also reduces the risk of household accidents caused by devices left on unintentionally. The research results show that users can monitor and control device status in real time, potentially lowering monthly electricity costs. This system is considered suitable for application in smart homes, providing easy, efficient, and safe remote control.

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1. INTRODUCTION

Rapid technological advances in the modern era have driven the demand for innovative solutions that can disrupt daily activities and improve the comfort of human life. One significant development in this field is the integration of the Internet of Things (IoT) into the home environment, known as Smart Home technology [1]-[3]. This innovation allows household devices to be monitored and controlled remotely via internet connectivity, thereby addressing issues such as energy efficiency and user safety. For example, by utilizing IoT, users can check whether they have turned off devices such as lights and air conditioners, even when they are outside the home, thereby preventing unnecessary energy consumption and potential hazards [4]-[7]. Traditional home appliances, such as lighting, usually require manual operation, which can be inefficient amidst increasingly fast-paced lifestyles. Therefore, many users want a more practical and time-saving solution to manage home devices [8]-[18]. IoT-based Smart Homes meet this need by allowing users to control devices via smartphones, whether at home or away. In addition, this system can help reduce energy waste due to devices that are forgotten to be turned off, thereby reducing electricity costs and supporting a sustainable lifestyle.

Despite its great potential, implementing a Smart Home system still faces challenges, especially in terms of device compatibility and connectivity. Existing systems, such as those using Arduino boards, often require additional modules to support Wi-Fi connectivity, which can complicate the installation process. The ESP32 microcontroller, with its built-in Wi-Fi and Bluetooth capabilities, provides an optimal solution for IoT integration without the need for external modules. Additionally, platforms such as Blynk facilitate real-time monitoring and control, making the system more accessible and user-friendly [19],[20].

This study aims to design and develop a Smart Home system that uses the ESP32 microcontroller and the Blynk platform to control household devices remotely, with a focus on lighting devices. This system allows users to operate devices via smartphones, improving comfort, security, and energy efficiency. The results of this study are expected to contribute to the practical application of IoT in the home environment, as well as demonstrate the feasibility and benefits of Smart Home technology for a more efficient, safe, and user-friendly living environment.

2. METHOD

This study aims to design and implement an IoT-based smart home system integrated with the Blynk application using the ESP32 microcontroller as a control center. The methodology used includes several stages, namely hardware system design and software development. The block diagram is a visual representation of the system workflow designed in this study. This diagram is used to illustrate how the various components in the smart home system are connected and interact with each other. In this system, the ESP32 microcontroller acts as a control center that manages input from sensors and controls output devices through internet connectivity. By using a block diagram, data flow and work processes can be visualized more clearly, facilitating understanding of the function and integration of each component in the overall system. Figure 1 shows the proposes smart home in this paper.

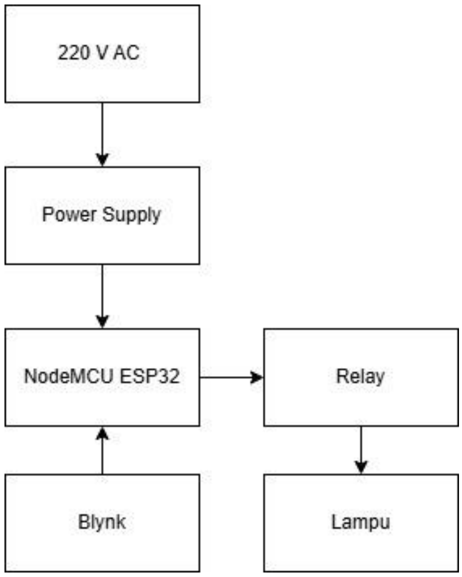


Figure 1. Diagram block of the proposed smart home

Based on Figure 1, the block diagram consists of several components that have their respective functions, namely: 1) Internet Function: Communication media that connects all IoT components. Role: Allows devices and applications to communicate with each other without distance limitations. 2) ESP32 Function: The main microcontroller that controls the entire system. Role: Connects devices to the internet and receives commands from the Blynk application. 3) Relay Function: An electronic switch used to turn on or off electrical devices. Role: Controls electric current to devices such as lamps based on commands from the ESP32. 4) LED lights Function: As a lighting device that is controlled in the system. Role: Can be turned on or off via the application.

The working principle of the tool begins by turning on the system, where the ESP32 is turned on and connected to WiFi, while the Blynk application is ready to receive commands. After that, the device processes the commands received by the ESP32. If the command is related to turning the device on or off, the ESP32 will send a signal to activate the relay. The device control process is then carried out with a relay connected to an electrical device, such as a lamp, which will be activated or deactivated according to instructions from the ESP32, so that the lamp turns on or off based on the command received. This system also allows remote control, where users can monitor the status of the device, for example whether the lamp is on or off, through the Blynk application. The application sends device status data to the Blynk server, which is then forwarded to the ESP32. In addition, users can provide additional commands through the Blynk application to control the device, which will be processed by the ESP32.

Hardware Design aims to simplify the process and reduce the risk of errors, so that it can produce optimal hardware according to needs. Through this stage, hardware design and direct testing of the system are carried out, to ensure whether the device works according to the initial design or not. This hardware design includes the design of IoT-based smart home devices and their electronic circuits which can be seen in Figure 2.

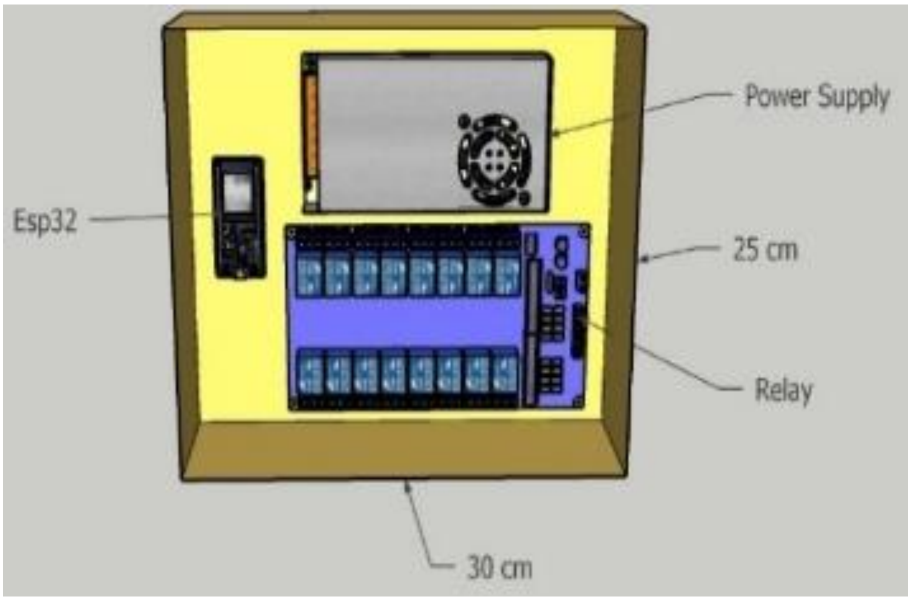


Figure 2. 3D design of the lighting system for the house

Figure 3 is a design of a schematic circuit of a lighting system tool in a house, in the design it can be seen that the components on the panel box contain a control circuit for the lighting system in the house. The device is controlled using a relay connected to an electrical device, such as a lamp, which will be turned on or off based on instructions from the ESP32. This allows the lamp to turn on or off according to the command received. This system also supports remote control, so users can monitor the status of the device, for example whether the lamp is on or off, through the Blynk application. The application sends device status data to the Blynk server, which is then forwarded to the ESP32. In addition, users can send additional commands through the Blynk application to control the device, which will be processed by the ESP32.

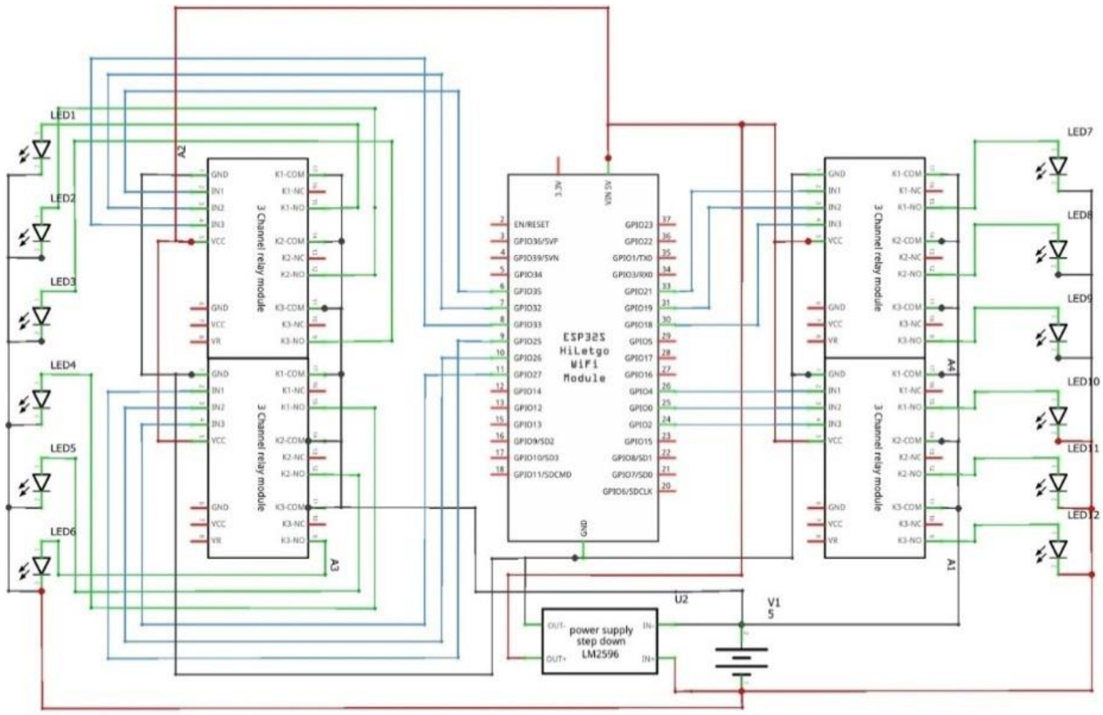


Figure 3. Schematic of the lighting system circuit

Flowchart or flow diagram is a chart that directs the flow logically in a system procedure or program. To explain the stages of problem solving, flowcharts use certain symbols that are easy to understand, easy to use, and standard. Figure 4 shows the flowchart of the proposed smart home.

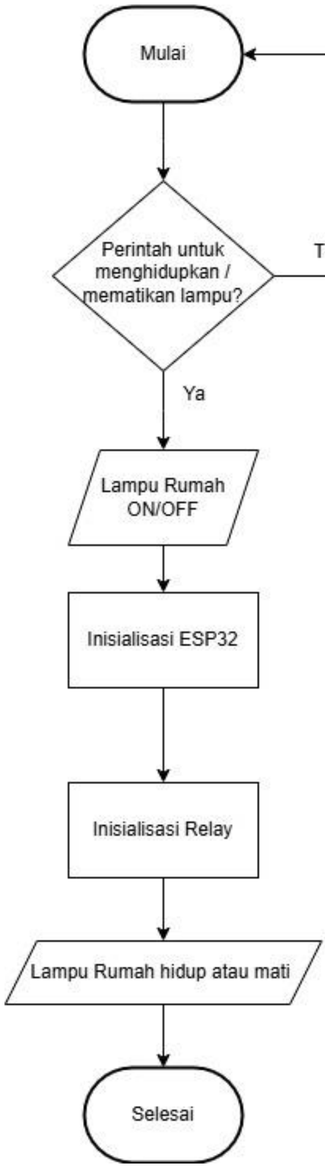
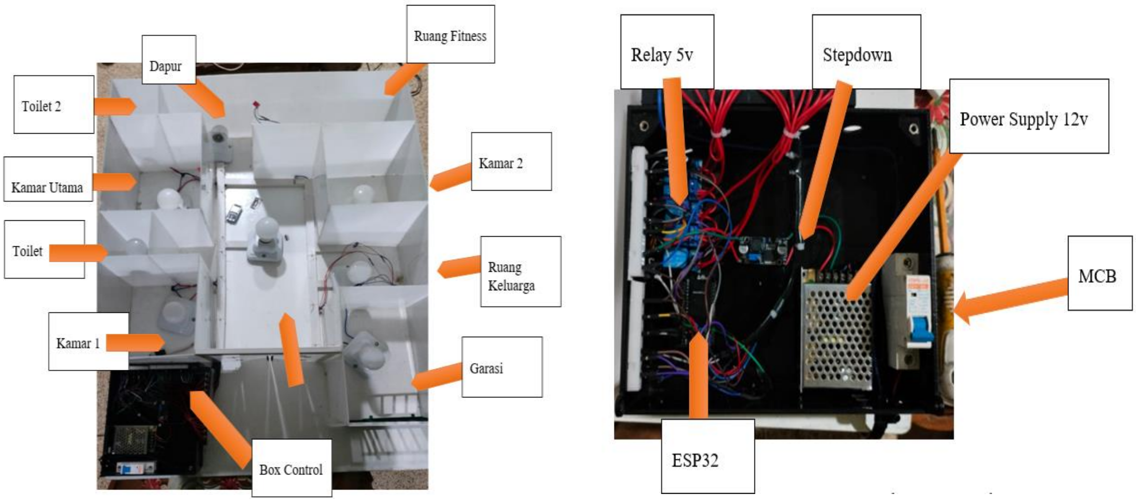


Figure 4. Program flowchart

3. RESULTS AND DISCUSSION

The results of the tool testing are used to determine how the device works and analyze the level of reliability, weaknesses and limitations of the functional specifications of the system that has been created. In addition, this test is also carried out for conditioning so that this tool can function optimally. Software testing is carried out to ensure that the application can be connected to the microcontroller. The first step taken is to connect the smartphone to the microcontroller. After the device is connected to a power source, the ESP32 microcontroller will automatically connect to the internet via the existing WiFi module. To be able to connect to the internet, this process requires an SSID and password that have been programmed into the device. The ESP32 cannot connect to a WiFi network with a different SSID and password.

The creation of an IoT implementation using the blynk platform goes through several stages of creation. Starting with preparing the materials and tools used. Such as preparing the control panel box and assembling the ESP32 mainboard. The purpose of making the control panel box is to place the input and output components or as a container for this tool system so that it can facilitate and adjust the system in its use. The design of the IoT implementation using the blynk platform can be seen in Figure 5.



(a) (b)

Figure 5. Results of tool design. a) Overall, b) Tool components

Hardware testing is done by checking various functions of indicator devices, such as Power supply, Relay, Touch sensor, lights and Microcontroller. This testing is done by observing the indicators in various conditions to detect errors that may be present in the smarthome installation circuit. The test results can be seen in Table 1

Table 1. Hardware test results

No	Components Tested	Status	Connection Time (Sec)	Information
1	ESP32	Connected	< 2	Stable Connection
2	TTP223 Touch Sensor	Connected	< 2	Succeed
7	Website (PC)	Connected	< 2	Succeed
8	Blynk App (Smartphone)	Connected	< 2	Succeed

Based on the results of testing on the hardware as a whole, it can be seen that all components are well connected and able to operate as expected. The connection with each sensor and the Blynk application shows a fast and stable response time, allowing the system to display data in real-time without interruption. This test is carried out by checking various functions of the indicator device, including relays, TTP223 touch sensors and lights. Testing is carried out when the smarthome prototype is operated. This test is carried out by running various functions of existing components including relays, touch sensors, lights and Blynk software. The results obtained can be seen in Table 2.

Table 2. Overall tool test results

No.	Load	Relay	TTP223 Touch Switch	Blynk Switch	Information
1	Room 1 and Toilet Lights	ON	ON	ON	Light ON
		OFF	OFF	OFF	Light OFF
2	Master Bedroom and Toilet 2 Lights	ON	ON	ON	Light ON
		OFF	OFF	OFF	Light OFF
3	Kitchen and Fitness Room Lighting	ON	ON	ON	Light ON
		OFF	OFF	OFF	Light OFF
4	Bedroom 2 and Living Room Lights	ON	ON	ON	Light ON
		OFF	OFF	OFF	Light OFF
5	Living Room and Garage Lights	ON	ON	ON	Light ON
		OFF	OFF	OFF	Light OFF

4. CONCLUSION

Based on the design and testing results, this final project develops a Smart Home system based on the Internet of Things (IoT) using the Blynk platform and ESP32 microcontroller. This system aims to improve efficiency and convenience in controlling electronic devices at home, especially lights and air conditioners, through applications that can be accessed remotely.

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