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Design for A Remote Smart Home Monitor Using the Internet of Things (IoT)

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ABSTRACT

Designing a Remote Smart Home Monitor Based on the Internet of Things (IoT) using the NodeMCU ESP32 microcontroller as a wifi network provider and also utilizing Firebase Technology as a data storage medium. This remote smart home monitor with the Internet of Things concept is safe because only people who have certain access can control home appliances such as turning on lights, fans, opening doors, filling water in the bath, preventing theft, in Remote Smart Home Monitors also uses CCTV cameras that utilize special applications, with the selection of these communication technologies efficiently and also saving power in controlling and monitoring from smart home remotely via smartphones. Test results control data can function properly when the switch control is activated then the lights, fans, doors will automatically turn on. Test results PIR sensor can detect movement or when the door is open and the buzzer will sound sending information on the android application. Test results, the ultrasonic sensor can work when the sensor reads the water distance >15 cm then the pump will work to fill the water and when the sensor distance reads the distance <2 cm then the pump will stop to fill the water.

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1. INTRODUCTION

Technological developments have become an important part of various needs in various fields, For example, the State Electricity Company (PLN) industry. All power tools are devices that require electrical energy to operate. The use of electrical energy today is not very effextive, because many household electronic devices use electrical energy and its use is very excessive. Excessive use of electrical energy causes electricity scarcity. As for the need to turn on and off the switch, which is directly connected to electrical appliances. From time to time, there are some electrical devices that are known to be alive when not in use. This may be because the user neglected to turn off the electrical equipment[1]. If you have a large number of electrical appliances in your home, turning them off and on manually can be very ineffective and inconvenient. The use of electrical energy from these tools is also inefficient (waste of electrical energy)[2]. And also an electrical accident can occur due to direct contact with an electric switch. About 78% of the causes of fires are electricity, either due to household appliances, the use of non-standard electrical cables[3].

With the development of the Industrial Age 4.0 which allows remote control of all devices, the level of mobile phone usage in society has become very high. The built system is convenient for application because anyone can control the electrical equipment with a smartphone. In addition to

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saving time, saving electrical energy, and easy to control electrical equipment, there is no direct connection to operate the equipment, thereby reducing the possibility of electrical accidents[4].

In Wahyuni Kurniasih's article (2020), using a Raspberry Pi microcontroller with a camera as a home monitoring system and various sensing sensors such as magnets, PIR Sensor, solenoid, etc. like auto lock. Home security. If the sensor detects something in the house, the owner will immediately receive a notification sent from the database to the smartphone application, and the owner record photos and videos installed in the house to record the house[5].

Technological developments are carried out to be more efficient and practical as well as to support human needs for saving electrical energy in our lives. One of them is the household sector, to help improve security and provide user comfort because some household appliances are controlled automatically. Internet of Things (IoT) can be described as everyday object communication where devices are shared automatically[6]. It allows you to form new connections over the internet between things and people, and between things themselves. This is the background of this research to design a remote smart home monitor that uses NodeMCU ESP32 as a command that operates on a real time database concept[7,8,9,10]. The establishment of a smart home monitoring system based on the Internet of Things concept is expected to be beneficial in terms of efficiency, power saving, and home security value.

2. RESEARCH METHOD

This device's design includes an overall schematic that serves as a framework for the stages of this study. The diagram's design is its most crucial component since it might reveal the steps that must be taken to complete this design. such that the overall shape of the research phases diagram will result in a functional system. Explaining the concept, designing the concept of a hardware block diagram (hardware), designing the concept of a software block diagram (software), and creating a flowchart to monitor the smart home are the stages of the study that will be done.

2.1. Equipment Design

This device's design includes an overall schematic that serves as a framework for the stages of this study. The diagram's shape is its most crucial component since it might reveal the steps that must be taken to complete this design. such that the overall shape of the research phases diagram will result in a functional system. Explaining the concept, designing the concept of a hardware block diagram (hardware), designing the concept of a software block diagram (software), and creating a flowchart to monitor the smart home are the stages of the study that will be done.

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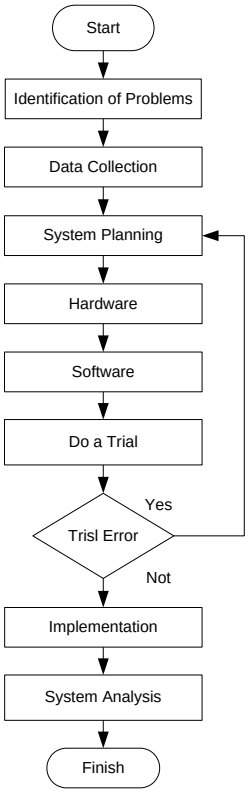

Figure 1. Concept explanation flowchart

In the flowchart Starting with problem identification, data collection, and system design, there is hardware and software. A system test is performed once all procedures have been completed. Implementation should proceed if successful. Execute analysis, come to conclusions, and finish.

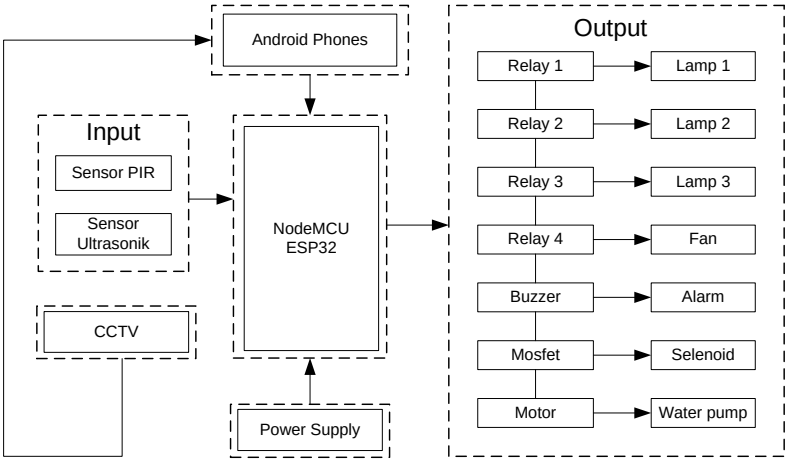

Figure 2. Hardware block diagram concept

The NodeMCU ESP32 microcontroller is used in the hardware block diagram for wifi and may also be utilized for serial communication. Power supply has the ability to rectify mains voltage and modify voltage to usage. The results of this remote smartphone's smart home technology (Android).

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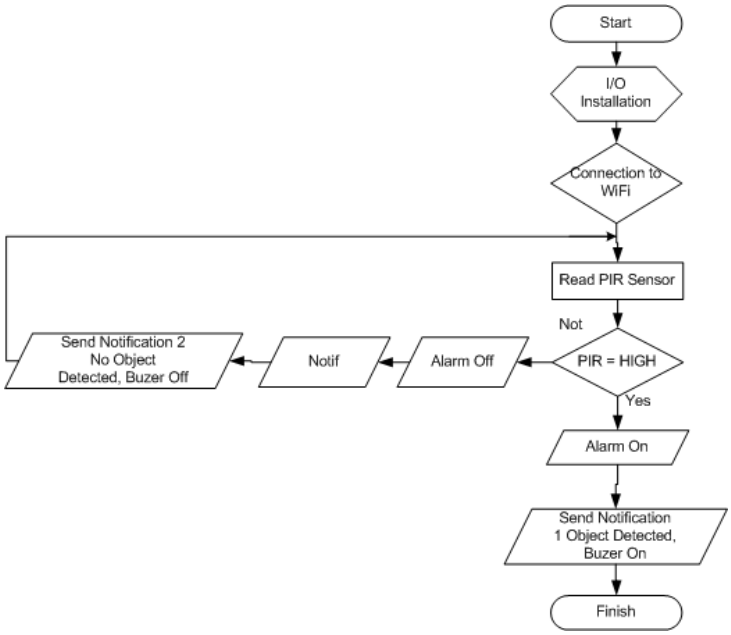

Figure 3. Includes the flow for reading PIR sensor data

The presence of a human may be determined using the flowchart interpretation of the PIR sensor data above. Making commands on the Arduino IDE while utilizing the NodeMCU as a microcontroller allows for the PIR sensor to be activated and allows for the transmission of commands. Following upload and I/O installation, the previously developed software is linked through wifi. The PIR Sensor will read the automatically generated data when all orders have been fulfilled.

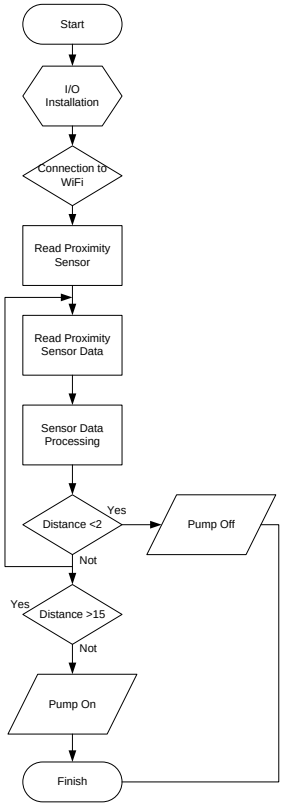

Figure 4. Data reading using distance sensor flowchart

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When the water distance is less than 2 cm and greater than 15 cm for water filling, the flowchart of reading the distance sensor data above may be used to detect the water distance. Making commands on the Arduino IDE using the NodeMCU as a microcontroller in order to transmit commands in order to enable the proximity sensor The previously created software is then uploaded, performing I/O installation, and linked over wifi. When the distance is less than 2 cm and greater than 15 cm, the proximity sensor will automatically fill the water once all orders have been carried out.

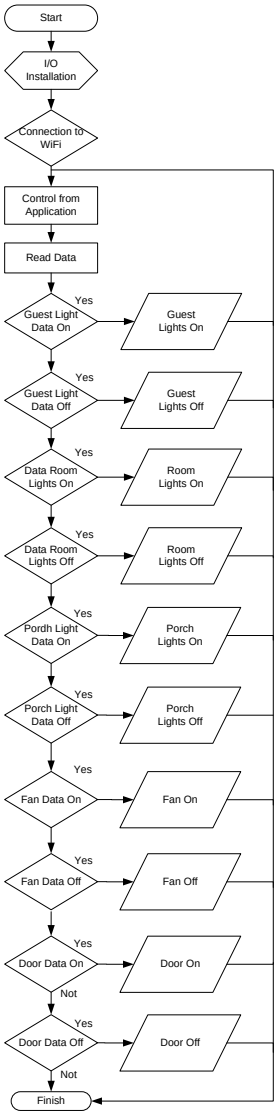

Figure 5. Read control data flowchart

In the flowchart reading the control data above, it is possible to control lights, fans, and doors in order to make use of the data, namely by creating commands on the Arduino IDE and utilizing the NodeMCU as a microcontroller to transmit orders. The previously created application will then react to the automated relay switch-on and perform the I/O installation before connecting via wifi. The control data output will also turn on automatically at this point. The data control output will automatically switch on after all commands have been performed.

2.2. The Operation of Remote Smart Home Monitors

The functional smart house remote smart home system uses a real-time Firebase based on the internet of things and works with NodeMCU, relay, lamp, MOSFET, selenoid, DC motor, buzer, PIR sensor, and proximity sensor. Then, a laptop that is already linked to the internet is connected to all of

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these gadgets. Then, control data, PIR sensor data, and proximity sensor data from the smart home will be shown on the remote monitor smart home.

3. RESULTS AND DISCUSSION

3.1. RESULTS

This remote smart home monitor was created using an Android IoT smart home application and a Ptorotype. The Internet of Things (IoT) application for smart homes uses real-time Firebase technology to remotely monitor control data, PIR sensor data, and proximity sensor data. The prototype's and the smart home application's look is as follows:

1. The Smart Home IoT

Serie of prototypes with the use of real-time Firebase technology based on the Internet of Things, this Smart Home IoT prototype is intended to provide a remote smart home monitoring system.

Figure 6. Shows the Smart Home IoT prototype home's display

This is the Smart Home IoT prototype home in Figure 6.

Figure 7. Shows the Smart Home IoT prototype home's display

Figure 7. The Smart Home IoT prototype house's visible portion is this.

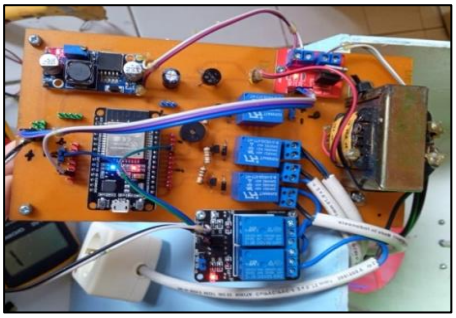

Figure 8. Shows many IoT prototypes for smart homes

Figure 8 shows a collection of Smart Home IoT prototype homes where a variety of parts have been assembled and connected in accordance with the blog's flow diagram.

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2. The Smart Home IoT Monitor App

As a monitor that shows control data, PIR sensor data, and proximity sensor data, the Smart Home IoT monitor application may be accessed on Android devices.

Figure 9. Display on the splash screen

Before accessing the login page for the Smart Home IoT monitor application, this splash screen display serves as the application's primary screen.

Figure 10. Display for Smart Home Log in

For accessing the main page of the Smart Home IoT application, this Smart Home Log in view is a display that includes a Username and Password.

Figure 11. Display for Smart Home Control in

There are control buttons for things like doors, fans, and lighting on this Smart Home control display. The item will automatically turn on or off when the button is pressed.

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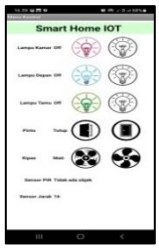
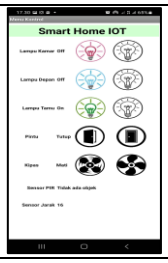
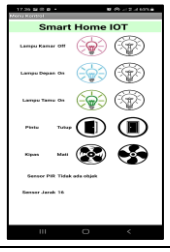
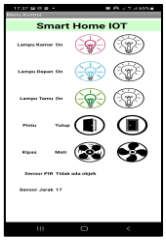
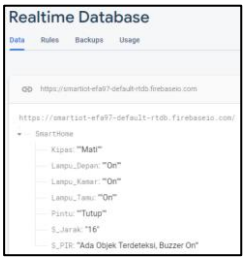
3.2. Testing

Table 1. Shows the testing results for IoT applications and monitors for smart homes

No.	The commands that are activated	Application Display	Connection	Reading Real-Time Database
1.	Room Lights – Off Headlights – Off Guest Lights – Off Doors – Close Fan – Off PIR Sensor – No Proximity Sensor Object – 16			
2.	Room Lights – Off Headlights – Off Guest Lights – On Doors – Close Fan – Off PIR Sensor – No Proximity Sensor Object – 16			
3.	Room Lights – Off Headlights – On Guest Lights – On Doors – Close Fan – Off PIR Sensor – No Proximity Sensor Object – 16			
4.	Room Lights – On Headlights – On Guest Lights – On Doors – Close Fan – Off PIR Sensor – No Proximity Sensor Object – 16			
5.	Room Lights – On Headlights – On Guest Lights – On Doors – Open Fan – Off PIR Sensor – no Proximity Sensor Object – 16			
6.	Room Lights – On Headlights – On Guest Lights – On Doors – Close Fan – Off PIR Sensor – Object detected by Proximity Sensor – 16			

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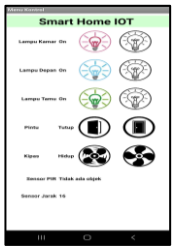
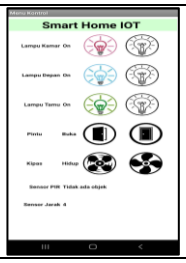
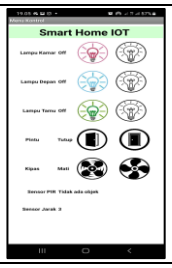
7.	Room Lights – On Headlights – On Guest Lights – On Doors – Close Fan – On PIR Sensor – No Proximity Sensor Object – 16			
8.	Room Lights – On Headlights – On Guest Lights – On Doors – Open Fan – On PIR Sensor – No Proximity Sensor Object – 4			
9.	Room Lights – On Headlights – On Guest Lights – On Doors – Open Fan – On PIR Sensor – Object detected by Proximity Sensor – 3			
10.	Room Lights – Off Headlights – Off Guest Lights – Off Doors – Close Fan – Off PIR Sensor – No Proximity Sensor Object – 3			

The status of the lights, fans, doors, PIR sensor data, and distance sensor data received on the smart home application are shown in Table 1 as the outcomes of the orders given. Where there are proximity sensors, on/off door fans, PIR sensor readings, and light monitor commands. The Smart Home application's status screen displays the outcomes of the supplied instruction.

3.3. Discussion

The target of this tool's design is to make it simpler for consumers to understand how to handle IoT data from Smart Homes as a system that can save energy and offer information through Android applications. The Arduino IDE is used as the command program that you wish to run by the Smart Home IoT Monitor tool's work system. The created software is then uploaded to the NodeMCU ESP32 as a microcontroller, after which it is connected via real-time technology to a firebase that is based on the Internet of Things. The results of the remote smart home monitor can then be seen on an Android device using an application. The Smart Home monitor's results will be shown together with control data, PIR sensor data, and proximity sensor data.

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4. CONCLUSION

The Smart Home application can support with real-time technology monitoring of remote smart homes using only Android, according with results of building tools and apps for remote smart home monitoring. The improvements made throughout the development of this Smart Home application can making features more appealing and usable on a variety of platforms in additions to Android.

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