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Smart Home Wireless System

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Abstract: The purpose of this project is to produce a Smart Home Wireless System prototype that has the advantage of maintaining home security by provided the facilities such as turning on and off the lights without having to use the switch and know the lighting conditions. This project has two essential parts to ensure this prototype is complete, namely software and hardware. For the hardware part, this prototype project uses Node MCU ESP8266, relays, LDR sensor, and LED bulb where all the hardware will be connected to the central processing unit known as Arduino. The use of an LDR sensor as a light detector is to know the lamp's condition is in good condition or not. The relay is also used to allow and turn off the electric current connected to the LED lights available on the circuit of this project according to the instructions process from the Arduino Uno as a microcontroller.
Furthermore, Node MCU ESP8266 is a component to connect between project devices and smartphones using Wi-Fi wireless technology. This prototype's software is Arduino Ide for the construction of command for Arduino Uno and Node MCU ESP8266. Blynk application is to construction for the user interface available on smartphones. Users who are outside the home or work area will get info from their smartphone in real-time.

Keywords: Arduino Uno, Arduino IDE, Microcontroller, Wi-Fi, LED, Node MCU ESP8266, LDR Sensor, Relay

1. Introduction

In today's digital era, technology helps people's daily work become more comfortable and easier to see with the development of IoT that can be fully applied to all sectors such as factories, public services, and others because, without it, human beings need to make full use of energy [1]. IoT is one platform that gives comfort to human beings in today's digital world [2].

Today's technology brings many visible benefits such as provide a smart home and can save users' time and money and reduce the use of heat and energy by turning off appliances automatically when not in use with the help of smart applications that can control the hardware at home remotely such as closing the smart garage door and locking the smart door when leaving the house [3].

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Also of human beings causes the consumption of electricity to increase from year to year. Although various parties have taken steps to reduce electricity consumption, especially at home, the move has not received a public response. The effect will be that the country will have to spend too much funds to cover the cost to cover large electricity consumption [4]. Eventually, the government must bear a lot of debt due to excessive electricity consumption.

So, smart thermostats and smart bulbs can reduce energy consumption by lowering utility costs by 10.00 % to 25.00 % from time to time with the implementation of the advantages of using home automation systems [3].

1.2 Problem statement.

In this era, human busyness in daily life causes some essential aspects of care, use of electricity in the home are often neglected. This can be further proven when using electricity in Malaysia from 1974 until the year 2000 increases over the Philippines, Thailand, and Indonesia [5]. Furthermore, about 20.70 % of electricity consumption in Malaysia from the residential sector [6]. In ASEAN countries, Malaysia is an Asian country with an increase in the average percentage of electricity consumption throughout the year [7]. A survey of 348 samples in Malaysia found that the average electricity consumption for residential is 345 kWh per month and is expected to increase due to lifestyle changes, economic improvement, and increased homeownership [6].

Although in today's market, various devices can facilitate consumers in saving electricity consumption and maintaining the home environment, but most manufacturers manufacture devices that do not meet the needs of consumers by focusing only on the sale price of devices at high costs and the use of unfriendly device systems which ultimately the use of the device could not be sold to the public.

1.3 Project Objective

1. Develop a system to monitor and control lighting at home remotely.
2. Analyze the practicability of the developed system.
3. Build a system to optimize the consumption of electricity in the home.

1.4 Project Scope

1. Using Arduino and Node MCU with built-in ESP8266 as a microcontroller for the system.
2. Implementation IoT uses the Blynk application to send and receive signal from Node MCU to control and monitor the home lightings remotely.

2. Methodology

2.1 Block diagram of the system.

The Smart Home Wireless System project is designed to produce output to control the light whether it is on or off and to know the lamp's condition in a damaged condition. This prototype consists of several key components that will work together in the Arduino Uno, LDR module, ESP 8266, and LED system.

Figure 1 shows the block diagram for the Smart Home Wireless System project. Using the Blynk application on a personal phone is a user interface for this project that facilitates users in controlling the lights and knowing the lights' condition to be connected with the MCU Node with the Wi-Fi connection set. For component Node MCU ESP 8266 type ESP-01 module by Ai-Thinker with ESP8266EX SoC, this small model allows the microcontroller to connect to the Wi-Fi network can make TCP / IP connection easily using Hayes type command. The LDR Module uses to know and detect the lamp's condition by detecting the LED's light and sending the information to the microcontroller. Arduino Uno uses microcontrollers and functions to process data received and transmitted from Node MCU, relay, and LDR Module.

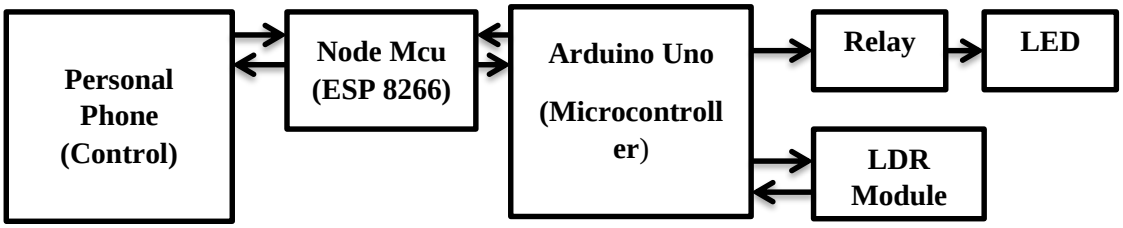

Figure 1: Block Diagram of Smart Home Wireless System project

2.3 System algorithm

The project flow chart in Figure 2 shows how this project works according to the settings we have set and as a guide to do the coding settings that will be made on the Smart Home Wireless System project

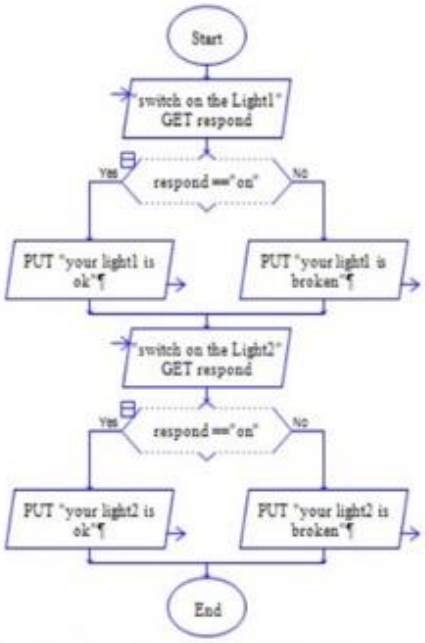

Figure 2: Flowchart of project

2.4 Project development

In this section, the results of the study findings help in the selection of software and hardware that will be developed on this project and will be described in detail:

I. Hardware development.
II. Software development.

2.4.1 Hardware development

a. Arduino Uno (control the light and sensor).
b. Node MCU ESP8266 ESP-01 module (provide the connection between smartphone and Arduino Uno).
c. LDR sensor module (detect light).
d. Relay module (as switches to open or close the circuit of light).
e. Male to female Arduino breadboard DuPont jumper wires (connect between electronic components).
f. Dc step-down power module (step down the voltage light source).
g. Led bulb 12W (lamps).

The Arduino Uno used in this project controls and processes the instructions for lights and sensors. Its small size and the use of not many pins make the Arduino Uno an option. Also, Node MCU ESP8266 type ESP-01 shown in Figure 3 is easy to maintain and able to connect between smartphones and devices using only Wi-Fi. The LDR sensor module used in this project has the ability to adjust the efficiency in detecting light compared to ordinary LDR. Figure 4 shows the light-dependent resistor sensor module.

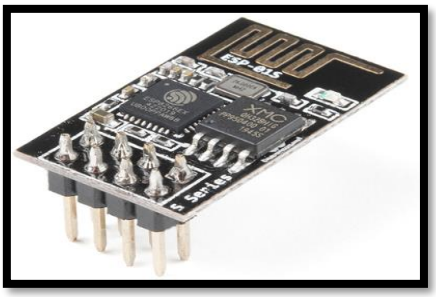

Figure 3: Node MCU ESP8266 type ESP-01 module

Figure 4: Light-dependent resistor sensor module

2.4.2 Software development.

a. Arduino IDE (develop coding for Arduino Uno and Node MCU ESP8266).
b. Blynk application (develop user interface).

2.5 Circuit Assembly

This model's design begins by using the Protester 8 Professional as a simulation for the circuit shown in Figure 5.

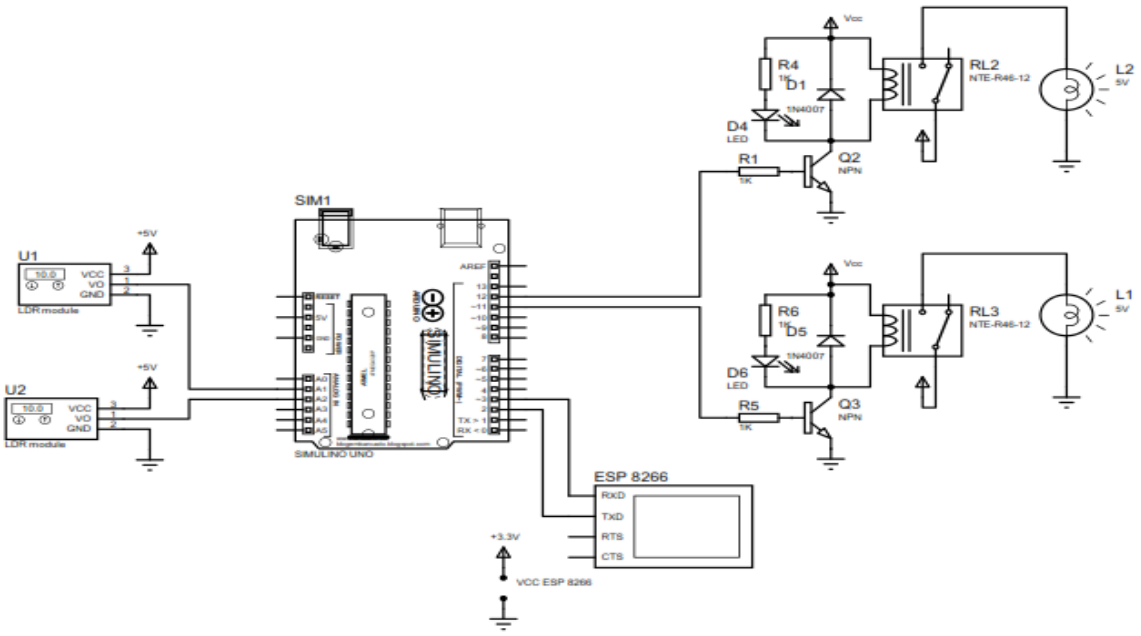

Figure 5: Complete sketching circuit for Smart Home Wireless System project

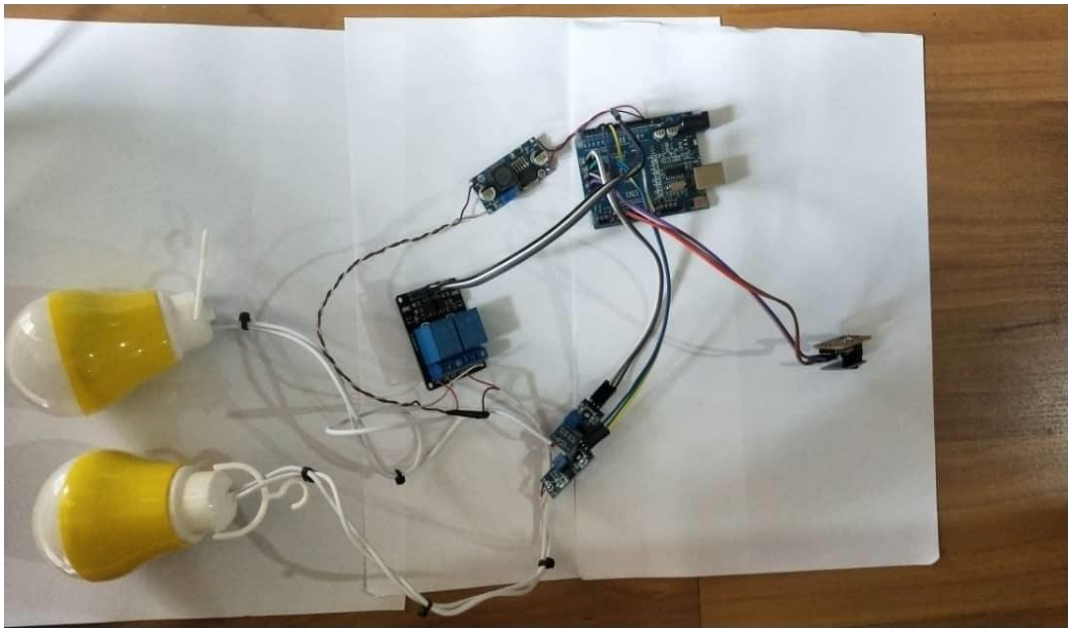

Figure 6: Full circuit assembly of Smart Home Wireless System project

3. Results and Discussion

This section will show how the Smart home wireless system operates. There are two situations where the first situation is a good lighting condition, and the second situation is where the lighting condition is damaged.

- Situation 1: Blub in good condition
  - When Button Lamp 1 and Button Lamp 2 are pressed, the light will turn on, and the gauge shows a reading from 1023 to 29 and means the lamp is in good condition that shows in Figure 7 and Figure 8.

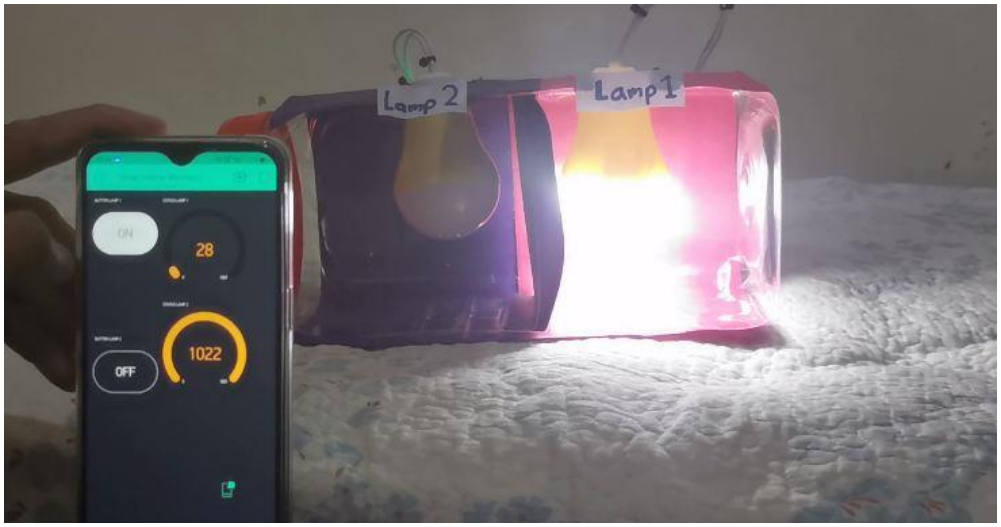

Figure 7: Status Lamp 1 on when Button Lamp 1 press blubs was light on

Figure 8: Status Lamp 2 on when Button Lamp 2 press blubs was light on

In this condition, the reading changes from 1023 to 28, and the value displayed on the gauge shows the light rate of the lamp detected by the LDR sensor, which shows the good lamp condition as shown in Figure 7 and Figure 8.

- Situation 2: Blub in damaged condition.
  - When Button Lamp 1 and Button Lamp 2 are pressed, the light will turn on, and the gauge shows a reading of 1023 (unchanged value) and means the lamp is in damaged condition, and that shows in Figure 9 and Figure 10.

Figure 9: Status Lamp 1 on when Button Lamp 1 press but blub was light off

Figure 10: Status Lamp 2 on when Button Lamp 2 press but blub was light off

In this condition, the unchanged reading (unchanged value) displayed on the gauge shows the LDR sensor's lamp flame rate, indicating the lamp's condition is faulty or not lit, as shown in Figure 9 and Figure 10.

3.2 Data Analysis

The data obtained in Table 1 resulting from LDR sensor detection is displayed on the Blynk application as a measuring stick to determine the lamp's condition, whether in good condition or damaged. The gauge widget used on the Blynk application is to display data in real-time [8].

Table 1: Collection data from the result of Smart Home Wireless System

No	Status Button lamp 1 and 2	Value in gauge show	Condition of lamp 1and 2
1	OFF	1023	OFF
2	ON	28	GOOD
3	ON	1023	DAMAGE

4. Conclusion

In conclusion, all three project objectives were successfully achieved at the end of the project. Some components can be learned from this project, such as using C ++ language works with Arduino UNO and Node MCU ESP8266, including Arduino IDE software to build a coding that will control the device and connect the device with a smartphone properly. Besides, the knowledge of IoT implementation in the use of Blynk applications adds to wireless communication knowledge by learning how Blynk applications can control a device by connecting using Node MCU ESP8266 which uses Wi-Fi technology is widely used today.

The data measured and transmitted wirelessly to the surface system in real-time for monitoring shows the monitoring system's ability to use Arduino Uno and Node MCU ESP8266 and Blynk applications to communicate successfully and produce the data referred to in Blynk applications is accurate and authentic. From there, users can use the technology used in the Home Wireless System project to quickly know the lamp's condition at house easily and save energy by just using a smartphone.

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