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Internet Based Control of Room Lights Using Wemos D1

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ABSTRACT

The Internet of Things (IoT) has made things easier and cheaper because all devices are connected to the internet. Electronic equipment at home can be monitored and controlled remotely via internet so that it can be effective, easy, and automatic. This study builds lights as part of a smarthome that is used for lighting automatically using IoT. This study uses lamp automation method using equipment including the Wemos D1, LDR sensor, LCD, relay, and two lamps which are controlled using the Blynk application. This research has succeeded in building a remote home light monitoring system based on IoT in real time. The test has been carried out 24 times with 100% success. The house is no longer dark when the light intensity is low because the lights will automatically turn on, while if the light intensity is high, the lights will automatically turn off.

1. Introduction

In this era of rapidly advancing science and technology, it is possible for people to do everything with an automated system to assist humans in completing and assisting with daily activities [1]. Activities that require human power to do something or control can be done automatically and the process becomes easier [2]. This reason has encouraged a lot of research to create automatic systems that can help humans, including those related to houses that require monitoring and control even though the owner is not at home [3]. Humans who are lazy or forgetful, so they need the help of smart devices that make everything at home completely automatic [4]. Many activities are carried out at home including turning off or turning on the house lights [5].

This research focuses on monitoring Internet of Things (IoT)-based lights to monitor, turn off and turn on house lights using a smartphone from anywhere and anytime [6]. IoT is a concept that aims to take advantage of a continuously connected internet connection such as sending and receiving data, remote control, electronic goods or equipment that is connected in a local or global network [7]. This IoT-based lamp monitoring can be controlled via a smartphone as long as it is connected to the internet network [8]. Commands are received and processed by Wemos D1 which receives data from the LDR sensor to measure light intensity to then be executed and the light intensity can be seen in real time from the LCD and the Blynk application [9-12]. IoT uses a module that is directly installed on Wemos D1, namely ESP8266 to receive and send data wirelessly and a smartphone to monitor lights in real time [13-16].

2. Method

2.1. Research Tools and Materials

This research required several supporting components, namely tools and materials in the form of hardware and software. The research tools used are as follows:

1. PC/Laptop with the Arduino IDE application as a tool for tool programming.
2. Cellphones are used to control and monitor lights.

The materials used for the research are as follows:

1. Blynk application for monitoring light intensity.
2. The USB cable is used to connect the smartphone and computer/laptop.
3. Wemos D1 is used to connect light intensity data to a smartphone.
4. The LDR sensor is used to measure the intensity of light.
5. The lamp is used to get the electric voltage.
6. A plug is used to connect electrical or electronic equipment.
7. Jumper wires are used for connecting electrical circuits.
8. Bread Board is used to make electronic circuits.

2.2. Hardware Design

Before the hardware design is carried out, system block diagrams and system wiring diagrams are first made which are useful tools for describing the flow of hardware system design. The tool system block diagram is shown in Fig. 1.

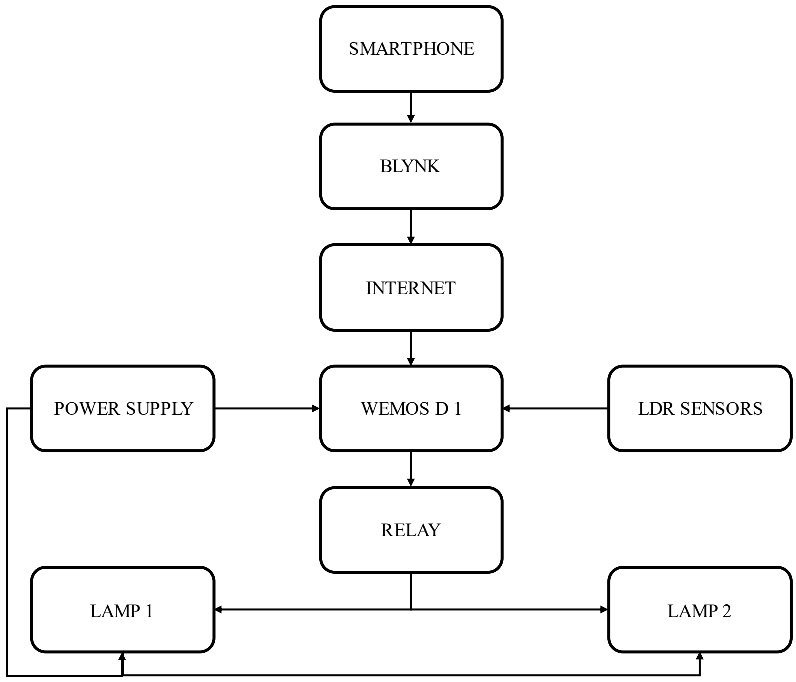

Fig. 1. Flowchart of beam package separation system

The system is used to monitor in real time against automatic lights and can be monitored (wireless) remotely [17]. Smartphones are used to monitor light intensity using the Blynk application which is connected directly to Wemos D1 via the internet network [18-19]. Wemos D1 gets light intensity data from the LDR sensor. After getting the data, Wemos D1 will process automatically whether the lights will turn off or on according to the limits set in the program. After getting the data, Wemos D1 will send instructions to the relay to execute the command or input given to turn on or turn off the lights.

Fig. 2 is a hardware prototype design that is made using two lamps connected directly to the power supply to turn them on. The lamp is connected to a relay to connect and disconnect electric current in the circuit and protect other components from overvoltage or short circuit. The LDR sensor is used to read the intensity of light processed by Wemos D1 which can then be monitored directly with the LDC and smartphone via the Blynk application [20].

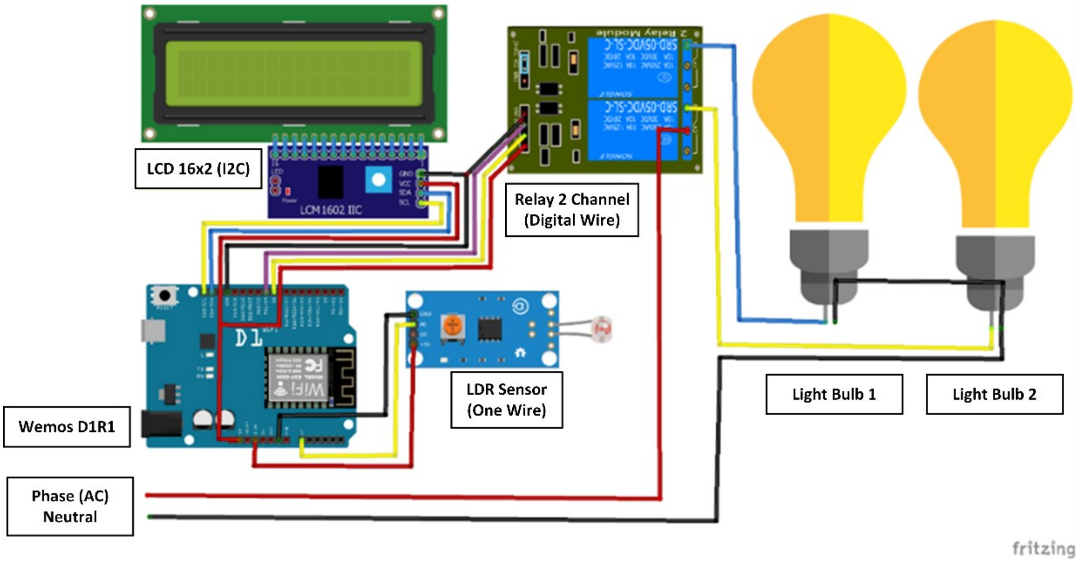

Fig. 2. Hardware system design wiring diagram

2.3. Software Design

Creating a program that will be downloaded to the Wemos D1 board using the Arduino IDE software. The display of the Arduino IDE software is shown in Fig. 3.

```
#define BLYNK_PRINT Serial
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

// Dapetin tokennya di email kamu
char auth[] = "xxxxx";

// id dan password internet kamu
char ssid[] = "xxxxxx";
char pass[] = "xxxxxx";

void setup()
{
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
}

void loop()
{
  Blynk.run();
}
```

Fig. 3. Display of the Arduino IDE

Information is conveyed by Wemos D1 about the state of the existing light intensity. “Serial. begin();” used to set the speed of program delivery from the PC to Wemos D1 Mini. If you want to connect Wemos D1 with "WiFi.begin(ssid, password);", then Wemos D1 will connect to the Access Point and enter the token into the char auth() section in the Blynk application so that it can connect to a smartphone.

2.4. Flowchart

The flowchart or program work flow tool can be seen in Fig. 4. The flowchart in Fig. 4 is another form of the block diagram in Fig. 3. The flowchart illustrates how the tool system works. First of all, the LDR sensor reads the light intensity which will be processed on Wemos D1 which is connected directly to the home wifi. If it is connected, the LDR sensor displays the sensor value output on the LCD. If the LDR sensor value is greater than 25000, the output is bright and lights 1-2 will turn off. If the LDR sensor reads greater than 1000-25000 then the output on the LCD is cloudy but lights 1-2 are still off. If the sensor conditions are 0-1000 then the output on the LCD is dark and lights 1-2 light up automatically. If processing turns on the light with the Blynk application, if light switch 1 and light switch 2 are turned on, the value of the LDR sensor appears in the Blink application. If it is turned off, the lamp returns to read the LDR sensor as processing the light is off or on.

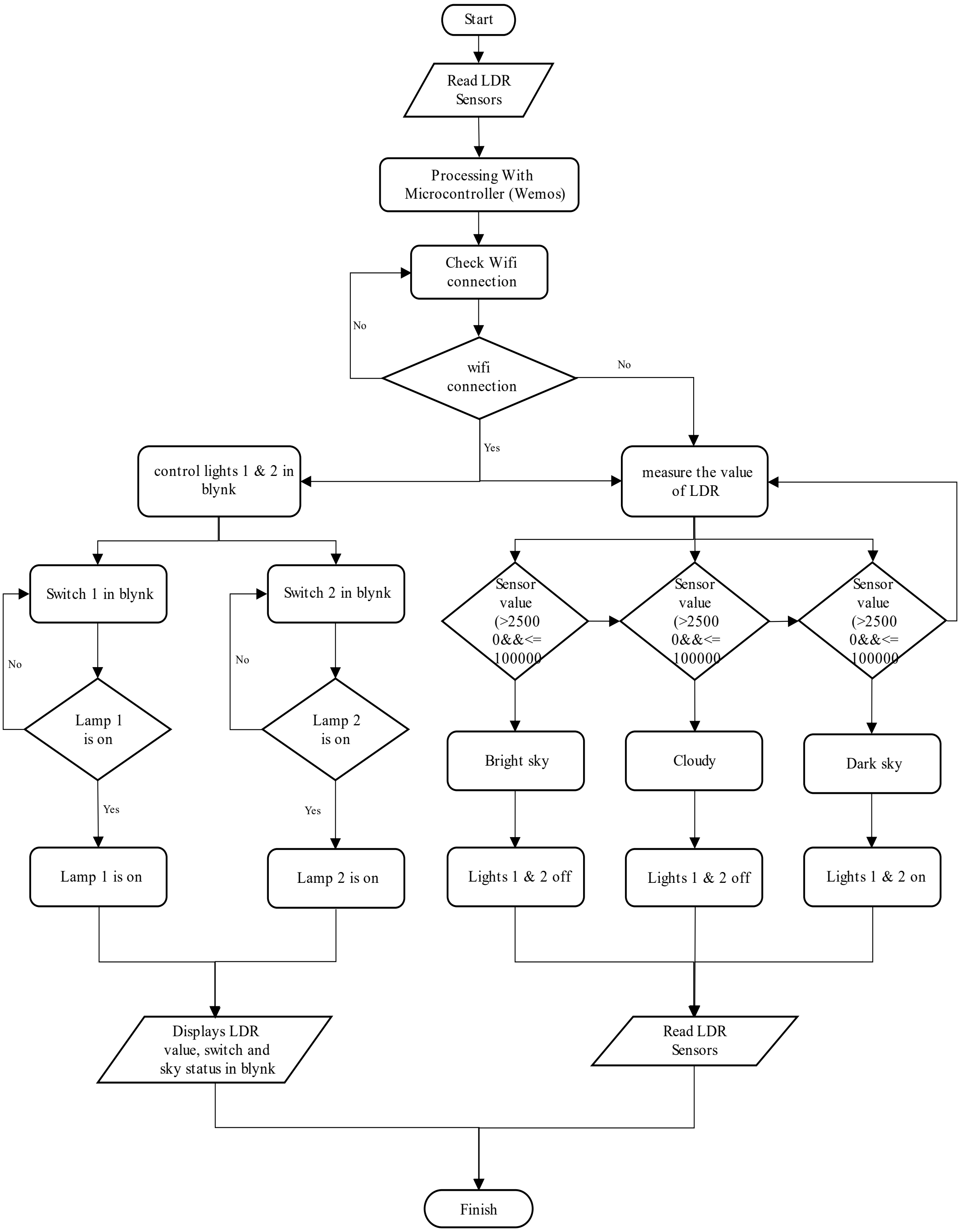

Fig. 4. System flowchart

3. Results and Discussion

Testing of this automatic light monitoring system is carried out at home by utilizing the intensity of sunlight as input to obtain the value from the LDR sensor.

3.1. Tool Physical Form

The overall circuit in hardware form is shown in Fig. 5. The LCD display on the side of the box displays light intensity and weather conditions. Then there is an LDR sensor which is useful for receiving the incoming light intensity.

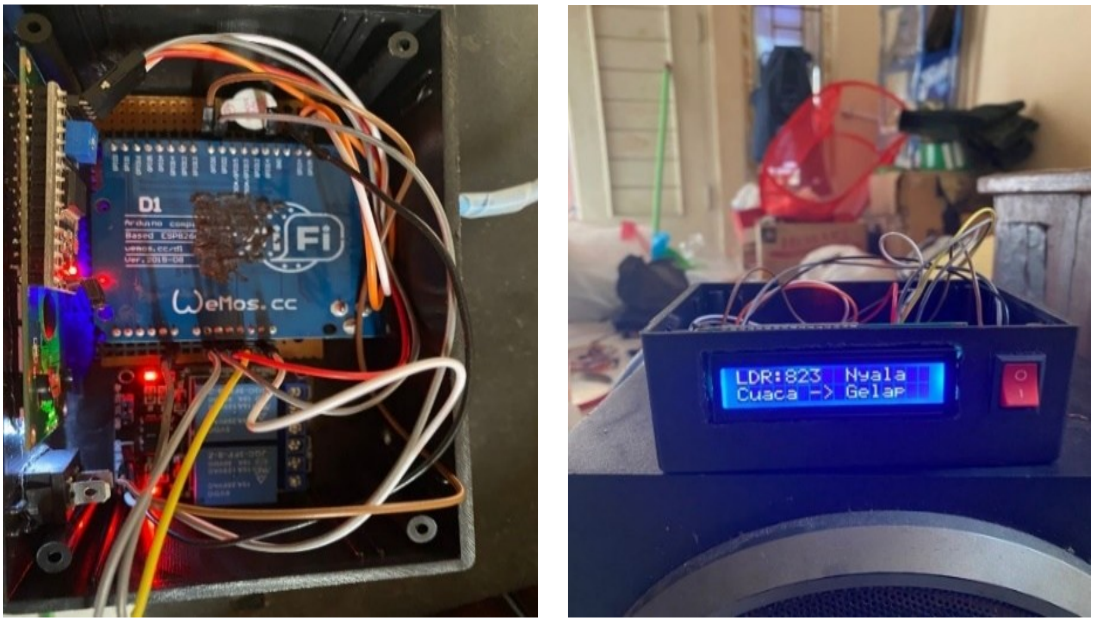

Fig. 5. Physical Form of the Tool

The components and sensors used in the tool include Wemos D1, LCD, I2C, relay, and LDR sensor. Testing the LDR sensor which directly detects the intensity of sunlight in open spaces. Data is taken every 1 hour for 24 hours. The data results from the LDR sensor can be seen in Table 1.

Table 1. LDR sensor reading results

No	Time	LDR Light Intensity	No	Time	LDR Light Intensity
1	00:00:00	0	13	12:00:00	37466
2	01:00:00	0	14	13:00:00	55724
3	02:00:00	0	15	14:00:00	9300
4	03:00:00	0	16	15:00:00	4729
5	04:00:00	0	17	16:00:00	3102
6	05:00:00	0	18	17:00:00	1209
7	06:00:00	1029	19	18:00:00	78
8	07:00:00	2154	20	19:00:00	0
9	08:00:00	14202	21	20:00:00	0
10	09:00:00	19203	22	21:00:00	0
11	10:00:00	8540	23	22:00:00	0
12	11:00:00	28129	24	23:00:00	0

Table 1 shows the results of the LDR sensor. The data is taken from 00:00:00 to 23:00:00 WIB. Retrieval of this data requires 23 hours and data is taken once an hour. In the dark the data on the LDR sensor is smaller and vice versa. The brighter the light intensity, the greater the data obtained.

3.2. Tool Performance Testing

The system has been designed and then tested. After testing each component part, the last part that is carried out is to carry out a complete simulation of the tool. The test was carried out for 23 hours starting from 00:00:00-23:00:00 and the results obtained were light intensity values, errors, relay conditions, and lamp conditions. The results of the test data can be seen in Table 2.

Table 2. Test Results for the LDR sensor system

No	Time	LDR reading	Lux meter reading	Error (%)	Relay	Lamp
1	00:00:00	0	0	0	High	On
2	01:00:00	0	0	0	High	On
3	02:00:00	0	0	0	High	On
4	03:00:00	0	0	0	High	On
5	04:00:00	0	0	0	High	On
6	05:00:00	0	0	0	High	On
7	06:00:00	1029	1287	0.2000	Low	Off
8	07:00:00	2154	2012	0.0700	Low	Off
9	08:00:00	14202	13736	0.0300	Low	Off
10	09:00:00	19203	18203	0.0540	Low	Off
11	10:00:00	8540	8434	0.0120	Low	Off
12	11:00:00	28129	27090	0.0380	Low	Off
13	12:00:00	37466	34874	0.0740	Low	Off
14	13:00:00	55724	51340	0.0800	Low	Off
15	14:00:00	9300	8527	0.0900	Low	Off
16	15:00:00	4729	4520	0.0460	Low	Off
17	16:00:00	3102	3110	0.0025	Low	Off
18	17:00:00	1209	1029	0.1749	Low	Off
19	18:00:00	78	19	3.105	High	On
20	19:00:00	0	0	0	High	On
21	20:00:00	0	0	0	High	On
22	21:00:00	0	0	0	High	On
23	22:00:00	0	0	0	High	On
24	23:00:00	0	0	0	High	On

Table 2 is the result of the LDR sensor test data against the comparison measuring instrument, namely the Luxmeter. The table explains that the light intensity used at any time is not the same and can change. The brighter the light intensity, the greater the data value obtained. the darker the light intensity, the smaller the value. From the results of the light intensity measurement, it can be seen that the light intensity readings using the Luxmeter are smaller than the LDR sensor readings. This is because the LDR sensor does not have a focus on light intensity like a luxmeter. Next is to calibrate the LDR sensor data with data from the Luxmeter. Calibration is done with the aim of knowing the error on the LDR sensor. The LDR sensor calibration error value can be calculated using equation (1) and (2).

$$Difference = |Reference\ Value - Sensor\ Value| \tag{1}$$

$$Error\ percentage = \frac{|Difference|}{|Reference\ Value|} \times 100\% \tag{2}$$

The data obtained from the measurement results shows that the average error is 0.16569%. The sensor will detect bright and dark light or day and night. If there is light intensity or during the day then the lights turn off. Vice versa, if the light intensity on the LDR sensor reads dark, the light turns on automatically and can be monitored directly with a smartphone.

4. Conclusion

The prototype hardware for this lamp monitoring tool has been successfully made using several components and circuits, including the main circuit such as using Wemos D1, LDR sensor, and LCD, connecting materials such as jumper cables, relays, cardboard for prototype tools and power supply to activate and deactivate the device. The software used to program this tool is the Arduino IDE and the C programming language which has been simplified by the Arduino IDE. Based on the tests that have been carried out at the time of data collection to read sensor input data then send it to the LCD which is then displayed. The working process of this tool during research uses sensors to detect incoming light and has been running well. The light sensor takes the intensity of the light which will later be displayed on the smartphone and LCD.

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