



Prototype Control of Lighting Equipment Using Web-Based Arduino Microcontroller

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ABSTRACT

Control of lighting equipment still uses the conventional way, namely by turning it on and off via a manual switch with the presence of light equipment control. It makes it easy for users to monitor or control lights anytime and anywhere with a note that the light equipment control will be applied using a WEB-based arduino microcontroller. From that background. remote control system, makes it easier for users to control and monitor room lights that are quite far away by conducting 4 stages of research (i) System Performance Analysis and Requirements Analysis (ii) Hardware Design Design, Schematic Design, Database Design, WEB Design, Topology Network (iii) Hardware Implementation and Software Implementation (iv) Testing. The results of this study are in the form of a control and monitoring system using a predetermined use with a system using the WEB. When the light is on, it will appear on the WEB which will become a printable report.

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1. Introduction

The lamp was originally created by Thomas Alfa Edison, a type of incandescent lamp, which is still very simple. There are more and more types of lamps used in everyday life. There are three types of lamps that are currently widely used by the community. First, incandescent lamps that produce light by heating incandescent fibers or filaments so that the temperature emitted by these lamps is relatively high. The filament is a fine metal wire that has resistance to passing currents. Inside the electric filament is converted into a hot and luminous incandescent lamp containing a gas with twisted coiled fibers, the gas that is usually used is argon gas. Second, fluorescent lamps use the principle of a fluorescent mineral fluorescent process where the mineral material is exposed to ultraviolet light and then reacts with the gas in the lamp, which produces ultraviolet light. The ultraviolet light then reacts with the phosphor, which is a mineral mixture that coats the inside of the bulb. Third, the LED (Light Emitting Diode) lamp is a semiconductor that can emit monochromatic light. Inside the LED, there are a number of chemicals that will emit light if the electrons pass through it. By changing these chemicals, we can change the wavelength of the light emitted. [1]

The NCC laboratory is located in the informatics engineering faculty of Ibn Khaldun University, Bogor (UIKA). is a higher education institution located in the city of Bogor which currently uses a switch that has a deficiency to turn off and turn on the NCC laboratory lights. who and must approach the switch in the NCC laboratory room to turn on or turn off the room lights and often forget to turn off the light after using the NCC laboratory room.

The use of a computer system will make performance in terms of time more effective. Media that can be used in increasing work efficiency is the internet. The internet provides various functions and facilities that can be used as a medium of information and communication that can be utilized from the connection. This internet is able to access electronic equipment such as room lights which can be operated online through the website so that it can make it easier for users to monitor or control lights. anytime and anywhere provided that the location where remote control technology will be applied has an adequate internet network. Remote control system, makes it easier for users to control room lights that are located quite far away. The purpose of this final project is a prototype of lighting equipment control using a WEB-based Arduino microcontroller. The formulations of the problems in this study are: (1) How to design and implement a lamp control prototype using a WEB-based Arduino microcontroller? , (2) What are the results of testing a prototype control of lighting equipment using a WEB-based Arduino microcontroller? The objectives of this research are (1) To be able to design and implement a prototype of lighting equipment control using a WEB-based Arduino microcontroller. (2) Obtain a test result of a lamp equipment control prototype using a WEB-based Arduino microcontroller.



2. Research Method

This research method is a framework for carrying out an action or a frame of mind to formulate an idea that is directed and related to the aims and objectives. The method used in this study is shown in Figure 1.

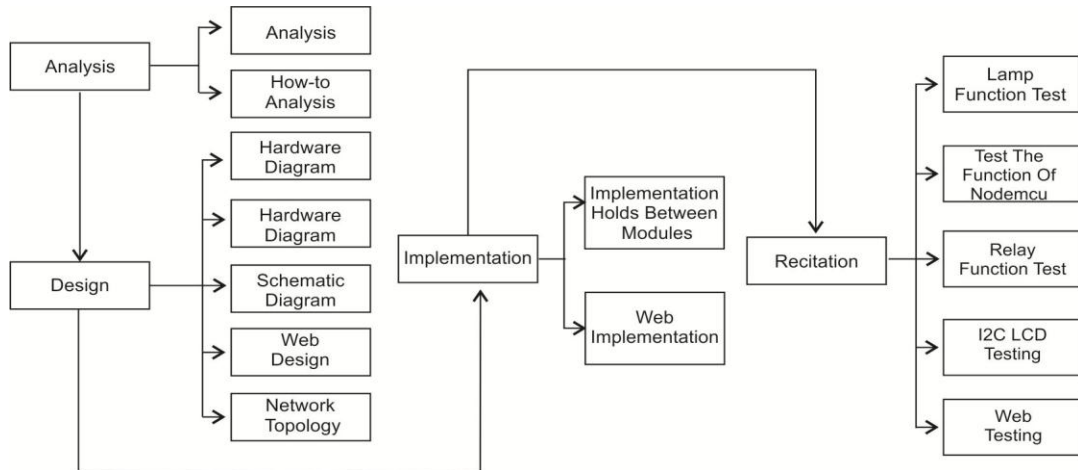


Fig 1. Research Method

3. Result

3.1 Analysis

In the process of analyzing how it works, it will explain how the system works in this research. The following image describes the analysis of how this system works:

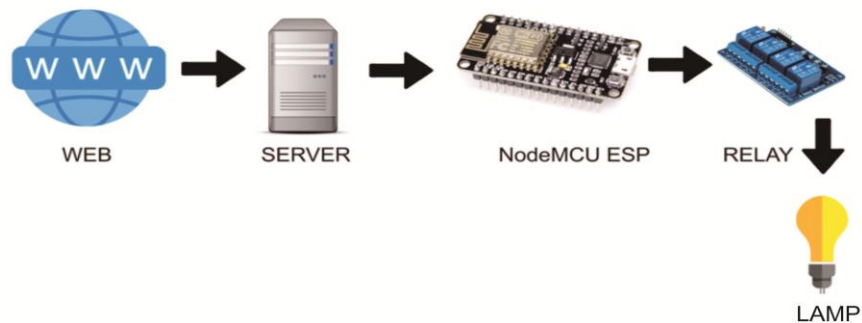


Fig 2. analyzing how it works

Figure 2 explains how the system works in this study starting from the WEB which has access rights to control lighting equipment which will give commands to the database connected to NodeMCU ESP 8366 giving commands to Relays that turn the lights on or off.

3.2 Design

A. Schematic Diagram

At this stage several schematic diagrams related to research are carried out, starting from the whole system schematic diagram of the NodeMCU EPS8266 schematic diagram with the following relays are some of the systematic stages in this research:

a) Whole system schematic diagram.

The devices used in the schematic diagram of the whole system are as shown in table 1 and in Figure 3 shows the circuit is divided into 2 stages, namely (1) NodeMCU ESP8266 schematic diagram circuit and stage relay (2) NodeMCU ESP8266 schematic diagram circuit with overall.

Table 1
Overall System Schematic Diagram

No	Device	Function
1	NodeMCU ESP8266	To process data and to connect to a web server via a WiFi network.
2	Relay	To receive commands from On / Off from NodeMCU ESP8266.
3	Jumper Cable	To connect NodeMCU EPS 266 with a relay.
4	LCD I2C 16x2	To display the output of the process
5	Power Cable	To connect a relay with AC current.

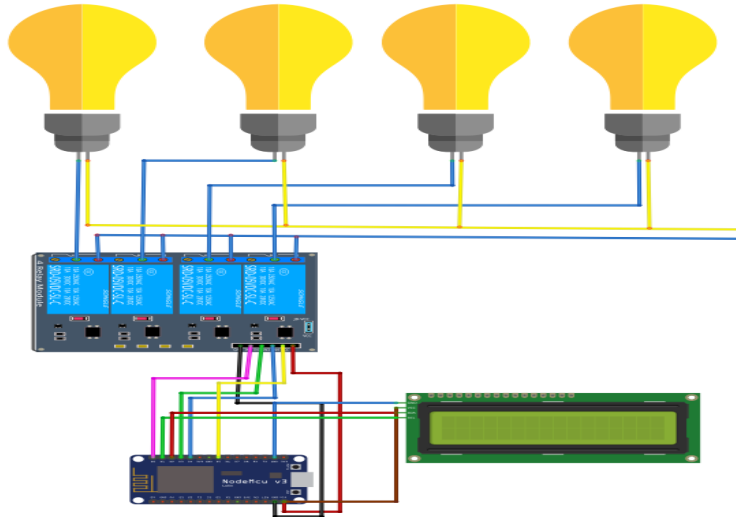


Fig 3. Overall System Schematic Diagram

b) NodeMCU and Relay Schematic diagram.

Figure 4 shows 7 outputs that are connected to each other at NodeMCU. The output pins used for the relay are D0, D1, D2, D3, G and 3V consisting of pins VV = VVC, pin D0 = in1, pin D1 = in2, pin D2 = in3, pin D3 = in4, pin G = GND and pin 3V = 3.3V.

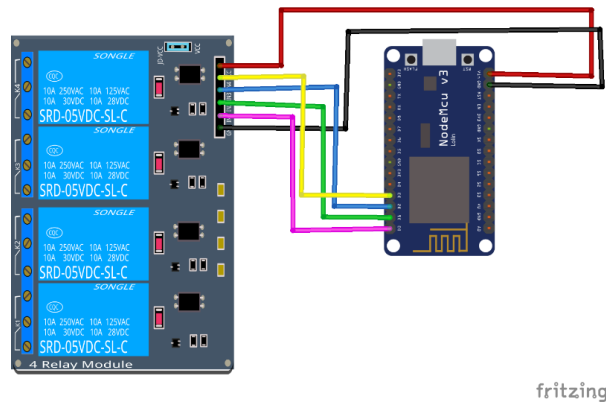


Fig 4. NodeMCU and Relay Schematic diagram.

c) NodeMCU ESP8266 circuit diagram with LCD

In Figure 5, the I2C LCD component has 4 pins, namely the SDA LCD pin to the SDA Arduino pin, the LCD SCL pin to the ESP8266 NodeMCU SCL pin, the 5V LCD pin to the Arduino 5V pin, and the LCD GND pin to the Arduino GND pin.

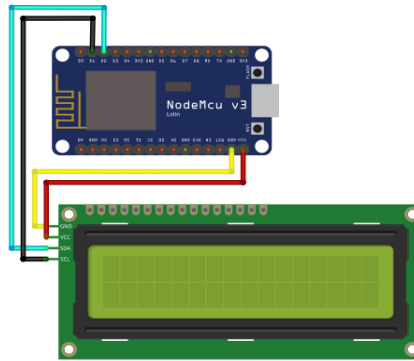


Fig 5. NodeMCU ESP8266 circuit diagram with LCD

B. Network Topology

The network topology in Figure 6 shows that the ESP8266 NodeMCU is connected to the router via a WiFi connection or Access Point, a series of NCC laboratory lighting equipment control devices in accordance with the programming instructions that have been made.

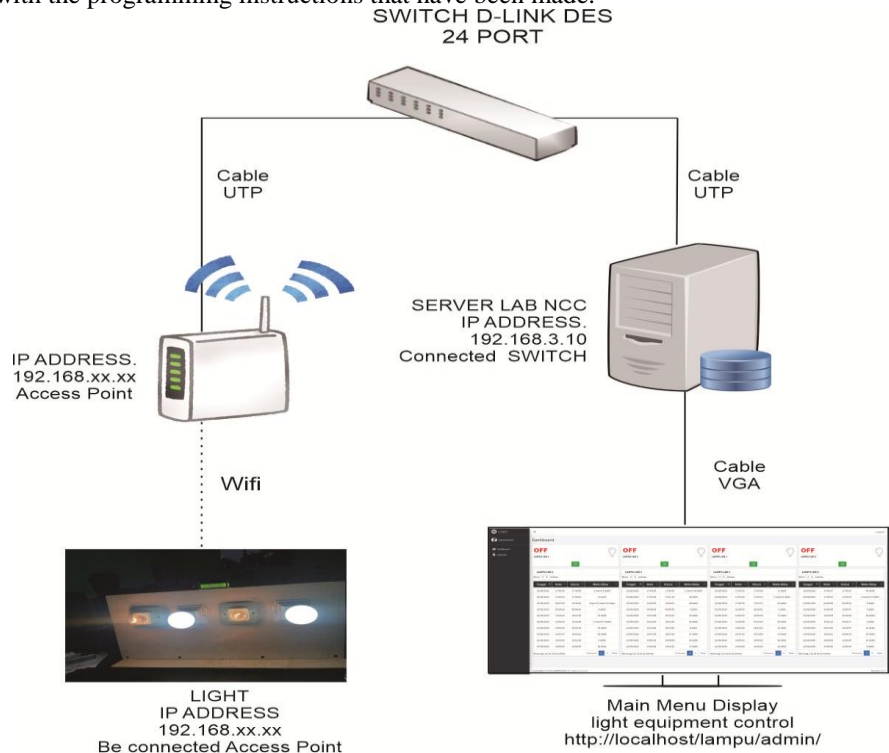


Fig 6. Network Topology

3.3 Implementation

The following are the stages of implementing the components that will be carried out. The component implementation process is done by connecting between modules using jumper cables to NodeMCU ESP8266 and declaring their pin numbers.

A. Relay

The implementation stage of the tool taken is connecting the relay with NodeMCU EPS8266. Order for NodeMCU EPS8266. The process of planting the source code is carried out using the Arduino IDE software which can be downloaded for free on the official Arduino website.

The next process is to connect the NodeMCU EPS8266 with the relay using a female to female jumper cable, connect the cable with the pin on the ESP8266 NodeMCU according to what has been previously determined, connect the lan side of the jumper cable to the relay. The source code for the Arduino IDE program is as follows:

```

// led1

Serial.print("connecting to ");
Serial.println(host);

if(!client.connect(host, httpPort)) {
  Serial.println("connection failed");
  //return;
}
// We now create a URI for the request
url = "/lampu/perintah/bacaperintah";
Serial.print("Requesting URL: ");
Serial.println(url);
// This will send the request to the server
client.print(String("GET ") + url + " HTTP/1.1\r\n" +
              "Host: " + host + "\r\n" +
              "Connection: close\r\n\r\n");
timeout = millis();
while (client.available() == 0) {
  if (millis() - timeout > 5000) {
    Serial.println(">>> Client Timeout !");
    client.stop();
    return;
  }
}
// Read all the lines of the reply from server and print them to Serial
while(client.available()){

```

Fig 7. Source Code Relay

B. NodeMCU ESP8266

NodeMCU ESP8266 can connect to the server as well as access the WEB via localhost, then NodeMCU ESP8266 is assigned the destination server address with IP address 192.168.xx.xxx to find out the process of connecting NodeMCU ESP8266 with the Web server page, it can be seen in the following source code.

```

if (client.connect(host, httpPort)) {
  client.print("GET /absensi/write_data.php?");
  client.print("rfid=");
  client.print(data);
  client.println(" HTTP/1.1");
  client.println("Host: 192.168.3.100");
  client.println("Connection: close");
  client.println();
  client.println();
  client.stop();
}
else {Serial.println("--> connection failed\n");
}
|

```

Fig 8. NodeMCU ESP8266

3.4 Testing

Black box testing is carried out on the admin page, with the aim that the admin page is made as expected and valid. The following is the test table from the admin page.

Table 1
Testing Black Box

NO	Test Name	TEST CASE	Test Result	Test Result	Conclusion
1	Led light 1 Until Led light 4 is ON or lit	Click the ON Button	Led light status 1 to Led 4 turns ON And the database changes to 1	According to expectations	Valid
2	Led light 1 Until the Led 4 lights are OFF or OFF	Click the OFF button	Led light status 1 to Led light 4 changes to OFF And the database changes to 0	According to expectations	Valid
3	Monitoring LED lights 1 to 4 when ON	Date Start Done And Life Time Date	The system will run to create a report. And time will run	According to expectations	Valid
4	Monitoring LED lights 1 to 4 when OFF	Date Start Done And Life Time	The system will stop when the user turns off the light And make a report lit	According to expectations	Valid

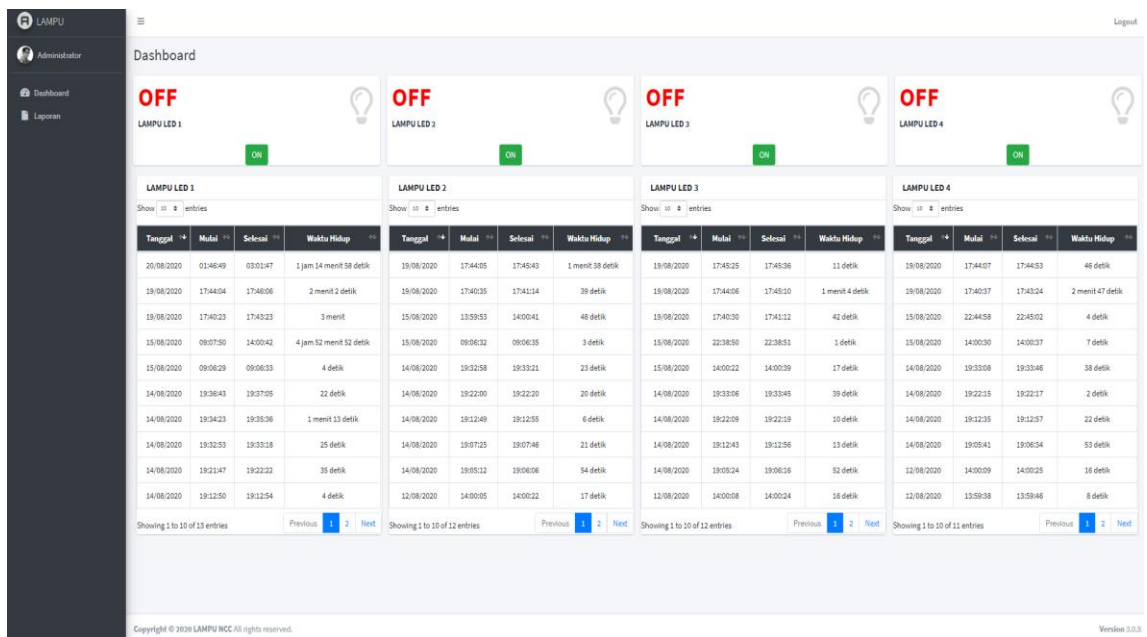


Fig 9. Control Testing

In Figure 9 is a control test for lighting equipment consisting of 4 lamps that can be operated via the WEB which will provide a report on lamp usage on the start, finish and life time of the lamp.

4. Conclusion

Based on the research conducted, until the process of making a lamp control prototype in the NCC laboratory in the previous chapter, the following conclusions can be drawn: (1) By designing and implementing a lamp equipment control prototype using a WEB-based arduino microcontroller connecting all modules including Relay, LCD and NodeMCU ESP8266. In testing this system device can already be connected to the database and can send data 0 = OFF, 1 = ON, date and time of light. (2) From all WEB tests using a Black Box which consists of 2 tests including testing the login page and testing the admin page, the appropriate results are obtained.

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