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Electricity Switch Using Internet Of Things (Iot)

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ABSTRACT
The problem of a fixed power switch or is only in a controlled device, has its own problems. The problem is if you forget to turn off, or cannot turn off because there are certain activities that cannot be abandoned. The basic of these problems, it is necessary to present a solution. The solution in question is an electric switch that can be controlled remotely and can be controlled with a variety of devices. This discovery presents a solution to the problem of a fixed electric switch. By utilizing qualified communication network, integrated with web technology as a user interface and a device that can be used to control devices through the internet network, the node MCU is integrated with a relay. The test results show that the electric switch which is controlled remotely by a web page running well and is constant. This finding is given the name internet of things (IoT) electricity switch.
Keywords: Switch, Electricity, Internet of Things, Web, Node MCU.

1. INTRODUCTION

The development of telecommunications equipment today makes it one of the primary human needs. A person's level of dependence on communication technology is very high, even creating anxiety if it is not with the telecommunications device [3]. It encourages human habits to be with telecommunications equipment anywhere and in any activity [7]. But on the other hand, the growth of someone's forgetfulness caused by the use of communication devices is currently increasing ("Matikan Listrik 1 Jam Saat Earth Hour, Masyarakat Hemat Rp 249 Juta - Bisnis Liputan6.com," 2018). Especially for things that can be ignored. Like forgetting to buy necessities at home, forgetting to turn off the lights in the garden/yard, forget to turn off the bathroom lights, and other things that are still negligible. One of the things that people often forget is turning off the lights when it is daytime. Especially workers, often leave the porch lights, or the lights in the house alive, for reasons of forgetting to turn off.

Besides the reason to forget, often leaving the lights in the house and other electrical equipment alive is because of manipulating the state of the house for those who observe the house. As if the lights are alive some assume that there are occupants in them. The next

reason is that it left the house for a long time, then turned on the light so it wouldn't dark at night. The various reasons and needs of the people who created that electricity and other electrical equipment were turned on were not because they were needed, but because of their inability to control them when they were not at home. For the problem of the need for electrical control devices and electrical equipment at home remotely, the authors formulated a remote control technology that uses Node MCU and relay node components and integrate them with web and network technology. The remote control in question is multifunctional control. The intended multifunction is portable (can be attached to various electrical devices). It can be used with 1 (one) device or with several devices. This remote electrical control is named "Internet of Things (IoT) Electricity Switch". Called IoT because the relay device is connected to the internet, and it can be controlled via the network. This article discusses in depth the development of electrical switch systems that use the internet of things (IoT). In-depth development that will be explained covers the stages of development, testing, to the benefits and uses. The novelty of this research is a switch device that is controlled using web pages. The processing devices used by the node MCU. The node MCU is directly connected to the relay and the relay is connected to the electricity that will be flowed and controlled.

2. LITERATURE REVIEW

Electrical control systems and equipment from a distance are actually already many. But all have advantages and disadvantages for each. As for what is used as a literature review in this discovery are some of the results of research that has been done by the inventor himself and other researchers. One of the studies used as literature in this study is a study conducted by [15] about the Real-time Monitoring System which is implemented in monitoring river water. Monitoring can be displayed on a web page after the sensor readings are sent to a data tabulation center via a mobile general service (GSM) network. The device used to be able to send SMS messages is GSM Shield. The concept adopted is the concept of censorship with web pages. Displayed on the web page is the result of reading the pH sensor, turbidity sensor, and also the ultrasonic sensor. Whereas in this study what is displayed is a button connected to a device that is a relay.

The next literature examined is the result of research conducted by [2]. Research that discusses the application of the internet of things (IoT) for light control using web-based Arduino. Arduino is integrated with the ESP8266 wifi module as an Arduino mega 2560 connection to the internet network. The ESP8266 wifi module and Arduino mega 2560 connectivity aim to display buttons on web pages and connect to relays. The thing adopted from the results of this study is the Arduino concept of being connected to the Internet using a WiFi module. But in the research conducted by the author is a wifi module using node MCU.

The next research results used in this study as literature are studies that discuss the design of home automation based on node MCU. Node MCU is integrated with web technology as control of residential equipment. This control can work well for controlling the motor used to move the gate of the house. Another device that is controlled is the fan. In Addition to the motor that is controlled also controlled by a relay that is used to refrigerate the switches at home. Was adopted from this study is the conceptual framework of electrical control and its equipment [18]. The design was adopted to find an electrical control system and electrical equipment that is appropriate to use and has an easy-to-use and environmentally friendly element.

Indeed, a device can be controlled remotely for now (Bhardwaj, Khanna, Sharma, & Chhabra, 2019). Communication technology through an internet network that can be done anywhere (Salhaoui et al., 2019). The birth of the concept of internet of things (IoT) led to the birth of various internet devices [16]. Electronic components that are currently developing also contribute to the development of internet-based devices. The remote control lights studied become one of the references applied in this research article [9]. The node MCU configuration technique as a relay generator becomes the switch thing adopted in this study. Although in this study using blynk as an introduction, where blynk is applied to mobile applications. The next concept adopted is the security concept that uses a system of logging in with a user name and password. The innovation in the research written by the author is to add captcha as an addition to user authentication.

Communication protocols from relays, nodes MCU, to web pages and vice versa use the Message Queuing Telemetry Transport (MQTT) protocol. The telemetry communication concept used was adopted from the results of the study [6]. Where in the study found one protocol that can accommodate sensors and nodes using MQTT. Cloud-type storage implemented on various server storage platforms also accommodates the use of the MQTT protocol, making it easier to implement. MQTT is indeed an easy-to-use data protocol for subscribed message models. Besided, MQTT can be connected to remote areas because of its lightweight data format that is easily accessible and stable ("IoT Standards & Protocols Guide | 2019 Comparisons on Network, Wireless Comms, Security, Industrial," 2019). Thus, some things that are referred to from various research results are the concept of introducing censorship to the web. Full control of devices using web pages and through an internet network. The component used is the relay whose process control system uses the node MCU. Internet of things testing system scenario. Use of the MQTT protocol in relay communications, nodes MCU and web pages.

3. METHOD

This research was conducted in several stages, these stages as shown in Figure 1 below.

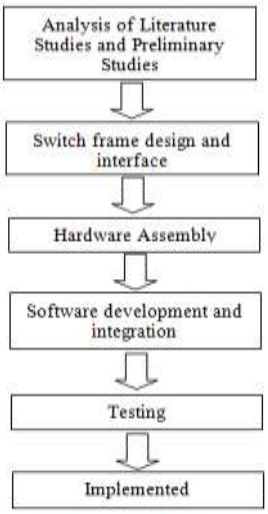

Figure 1. Research stages

As in Figure 1 above it shows that the stage of this research starts from reviewing some literature, and departs from several studies on the level of electricity control needs remotely. The literature studied is like the literature that has been described in the literature review. The study included confirming the problem of the level of electric power usage, especially from home groups, which showed that the largest electricity users were sourced from home consumers. Referring to the results of a survey published in a media ("Konsumsi listrik kuartal-I 2019 capai 78,18 TWh, terbanyak dari rumah tangg," 2019). Also, the reason for the wasteful use of electricity is excessive use of electricity (not as needed). Therefore we need a new method in providing encouragement to save energy. After conducting a literature study and preliminary study, the next step is to design the framework and interface, which is sourced from the framework design needs for remote electrical control. This framework includes determining component specification activities, as well as determining the costs required to carry out the production stages. After that the component assembly is done, then the software coding, and testing. The final stage after testing is implementation, which is product packaging on a production scale. Equipment needed to conduct this research to achieve research objectives and prove research questions, as shown in table 1.

Table 1. The tools

Number	Tools	Specifications	Quantity
1	Solder	40 Watt	1
2	Screwdriver	+-	1
3	Pliers	Cutter	1
4	Electric Drill	60 Watt	1
5	Drill bit	1mm, 10mm, 20mm	1

The tools needed in table 1, are the tools used at each stage in this study, except at the literature study stage. This research also requires several materials used to find answers to this research and its objectives. The materials needed are as shown in table 2 below.

Table 2. The materials

Number	Materials	Specifications	Quantity
1	Node MCU ESP 8266 MOD	ISM 2.4G.Hz., PA+25dBm, 802.11b/g/n	1
2	Relay module	10 A 250 VAC, 15 A 125 VAC, 5VDC	2
3	Power Supply	1 A 5VDC	1
4	Jumper cable with slot/socket	Red, white, and black shield color	1 Meter
5	Shield cable	Contains 3 cables one shield	2 Meter
6	Solder Tin	Roll	1
7	Plastic Box	Black (15 cm x 10 cm)	1
8	Light bulb	10 Watt	2

4. RESULTS AND DISCUSSION

4.1 Design Systems

The results of the component framework design and its construction as shown in Figure 1. There is a node MCU connected to a connector that is packaged in a PCB board that has been designed for the circuit layout. The node MCU is connected to a relay module that acts as a trigger for the electrical switch to be controlled.

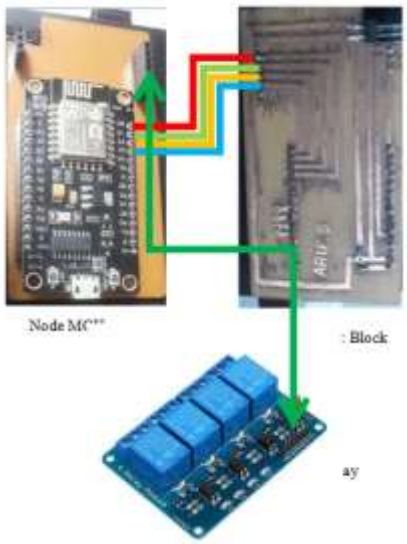

Figure 1. IoT electrical switch design framework

Figure 2 shows that the D0-D3 port of the node MCU is connected to the module relay port. Relay module that will function as a switch. While the function of the node MCU in this study is as a processor and connecting the relay and node MCU to web pages using an internet network with the MQTT data communication protocol.

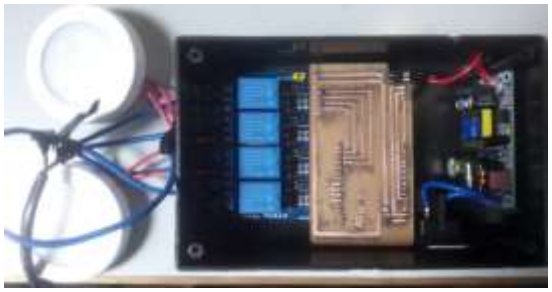

Figure 2. Integration of all components in the package

The result of the integration of all components as shown in Figure 3 above has also been integrated with the software. The coded software consists of two codes, namely the code that is coded on the node MCU and which is coded in the user interface software.
The user interface has been coded in the form of a web page as shown in Figure 4 below.

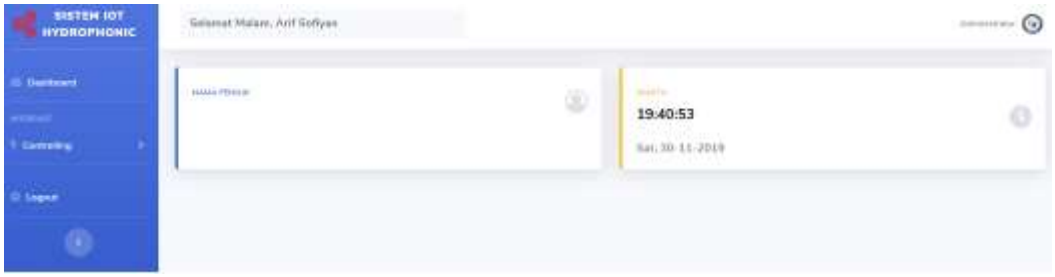

Figure 3. Graphical User Interface Display of the main web page

The code used on the node MCU as a processor and as a control switch, like the following code.

```
#include <ESP8266WiFi.h>
#include <PubSubClient.h>
const char* ssid = "your SSID name";
const char* password =  "password your SSID";
const char* mqttServer = "MQTT Server name";
const int mqttPort =  14815;//port number
const char* mqttUser = "your MQTT User name";
const char* mqttPassword = "your MQTT password";
WiFiClient espClient;
PubSubClient client(espClient);
char msg[50];
void setup() {
    pinMode(D0, OUTPUT);//pin of node MCU
```

```
   pinMode(D1, OUTPUT); //pin of node MCU
   pinMode(D2, OUTPUT); //pin of node MCU
   pinMode(D3, OUTPUT); //pin of node MCU
  Serial.begin(115200);
WiFi.begin(ssid, password);
while (WiFi.status() != WL_CONNECTED) {
   delay(500);
Serial.println("Connecting to WiFi..");
 }
 Serial.println("Connected to the WiFi network");
 client.setServer(mqttServer, mqttPort);
 client.setCallback(callback);
 while (!client.connected()) {
   Serial.println("Connecting to MQTT...");
 if (client.connect("ESP8266Client", mqttUser, mqttPassword )) {
     Serial.println("connected");
 } else {
     Serial.print("failed with state ");
 Serial.println(client.state());
     delay(2000);
   }}
   {
     digitalWrite(D0, HIGH);
     Serial.println("Turning on lamp1");
   }
   else{
     digitalWrite(D0, LOW);
     Serial.println("Turning off lamp1");
   }
 }
 if (strcmp(topic,"esp/saklar2")==0){
   if((char)payload[0] == '1')
   {
     digitalWrite(D1, HIGH);
     Serial.println("Turning on lamp2");
   }
   else{
     digitalWrite(D1, LOW);
     Serial.println("Turning off lamp2");
   }
 }if (strcmp(topic,"esp/saklar3")==0){
   if((char)payload[0] == '1')
   {
     digitalWrite(D2, HIGH);
     Serial.println("Turning on lamp3");
   }
   else{
     digitalWrite(D2, LOW);
     Serial.println("Turning off lamp3");
   }
 }if (strcmp(topic,"esp/saklar4")==0){
   if((char)payload[0] == '1')
   {
     digitalWrite(D3, HIGH);
     Serial.println("Turning on lamp4");
```

```
          }
          else{
            digitalWrite(D3, LOW);
            Serial.println("Turning off lamp4");
          }
        }
      }
```

The logic of the code above actually uses 4 (four) bulbs, but at the time of implementation, it was tentative or referred to needs. However, the node MCU has a pin limit that is used (Fernandez, Vidal, & Valera, 2019), which is a maximum of 4 (four)(Dahoud & Fezari, 2018). The code above also contains the declaration of the node MCU library, and the node MCU connection and logging in on the wifi or SSID system. Logging in to the MQTT protocol is also declared in the code. While the code for the MQTT connection with the node MCU on the web page integration is like the following javascript code.

```
function onConnect() {
      // Once a connection has been made, make a subscription and send a message.
      console.log("onConnect");
      client.subscribe("esp/test");
      message = new Paho.MQTT.Message("Hallo Saklar 1");
      message.destinationName = "esp/test";
      client.send(message);
    }
    function ledState(state) {
      if (state == 1) {
        message = new Paho.MQTT.Message("1");
      }
      if (state == 0) {
        message = new Paho.MQTT.Message("0");
      }
      message.destinationName = "esp/saklar";
      client.send(message);
    }

    function doFail(e) {
      console.log(e);
    }
```

The code was adopted from the results of the study (Kashyap, Sharma, & Gupta, 2018). It uses javascript connection code to connect the node MCU with various devices that are controlled through an internet network with a web page interface.

4.2 Testing

The testing of the internet of things (IoT) electrical switch system refers to the scenario arranged as shown in table 3 below.

Table 3. Test scenario and response

Number	Menu Names on Web Pages	Testing Scenarios	System Response
1	*Log in*	1. Enter the correct user name and password and enter the correct captcha.	log in success
		2. Enter the wrong user name and password and enter the correct captcha.	Log in failure
		3. Enter the correct user name and wrong password and enter the correct captcha.	Log in failure
		4. Enter the correct user name and correct password and enter the wrong captcha.	Log in failure
2	Switch 1, 2, etc.	1. The button that says "ON" is clicked.	Light on
		2. The button labeled "OFF" is clicked.	Light off
3	*Log out*	The button that says "Logout" is clicked	The Button that view "Logout" is clicked Button labeled "Logout" is clicked.
4	Exit confirmation on the Log out menu	*The button "cancel" is clicked*	Log out failure.
		The button "log out" is clicked	Log out success.

Referring to the test scenario, it was found that the system successfully functions as an electrical switch. But what is not defined in testing is response time. Where the response time on testing the IoT switch system is ignored because the whole test has a real-time response. While the security of the system that uses the user name and password is adopted from research (Siboni et al., 2019). It's just that in this study captcha was applied because the results of the study (Most, Ble, Rge, In, & Ber, 2019) suggested that some web users use robots. Thus, it is important to add a robot user confirmation facility or not. The facility is named captcha. Another perspective from the results of research conducted by (Alexa, 2017) states a safer web control system, it is better to use the identification of the accessing device, namely captcha.

5. CONCLUSIONS

The conclusion of this research is a web and network technology that is configured with node MCU devices, and Relay can be used as an electrical switch technology that can control switches and electrical equipment remotely. When developing this invention, it is better to be tested in terms of reliability, such as if the node MCU device is alive for a long

duration. Because of the testing carried out at this invention, it has not yet reviewed the durability of the devices used.

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