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DESIGN WEB-BASED ELECTRICAL CONTROL SYSTEM USING RASPBERRY PI

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Abstract-- The use of current website technology can be applied as a control and monitoring system, which is used to control electrical devices, so that the user can only control the PC or smartphone that has been connected to Wi-Fi or the Internet. In this case the control uses the Raspberry Pi Mini PC which has several advantages such as low power and is relatively easy when connected with a web server compared to a microcontroller. By utilizing the Raspberry Pi Mini PC as a web server, it can replace PC functions in general. The results in this study are the Electric Control System that has been made capable of controlling 4 AC voltage electronics as well as 4 relays with each relay capable of bearing a maximum load of 2200 watts using a power supply on the Raspberry Pi which has a minimum of 0.7 amperes and Control of electrical load can be done within a distance of 0 meters - 15 meters from the wireless router

Keywords: Web-design; Electrical control; Raspberry pi

I. INTRODUCTION

In the current era of globalization, technology greatly helps human activities to be easier and more efficient. Electronic equipment technology is one of the technologies that will certainly help humans in doing various things, especially in controlling various electrical devices.

The use of current website technology can be applied as control and monitoring, which is used to control electrical devices, so that the user can only control the PC or smartphone that has been connected with Wi-Fi or the Internet. In this case the control uses the Raspberry Pi which has several advantages such as low power and is relatively easy when connected with a web server compared to a microcontroller. By utilizing Raspberry Pi Mini PC as a web server, it can replace PC functions in general [1], [2], [3]. Some studies have utilized the Raspberry Pi Mini PC, [4], [5].

II. METHOD

A. Proposed System

The control system proposed in this study is shown in Figure 1. This control system uses logic 0 and logic 1 output from the Raspberry Pi GPIO pin it controls via a web server. Control of electronic devices is done by users of PCs or smartphones that have been connected to Wi-Fi. Users are connected to a web server, which can then be selected on the web page "ON" or

"OFF". After pressing the button on the web server, the web server will send data to the Raspberry Pi that has been connected to Wi-Fi.

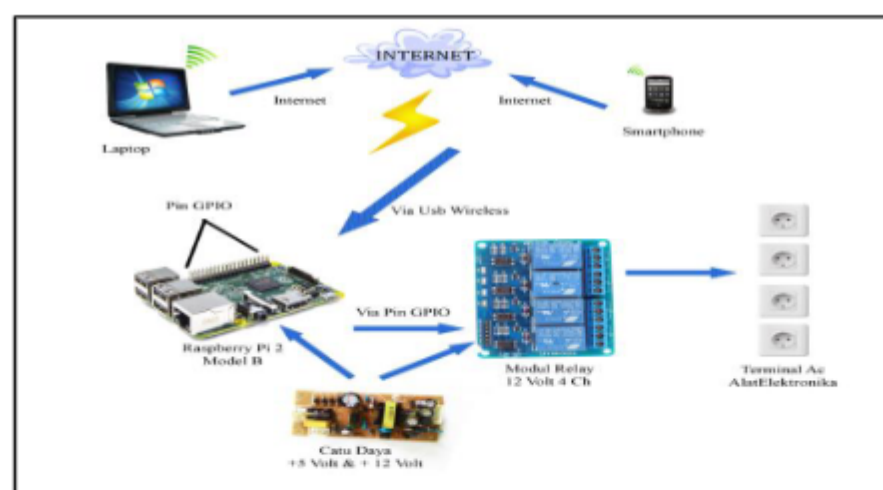


Fig. 1. Control system schema

B. Flowchart system

Figure 2 shows that the first client to do is configure an IP address, PC or similar device according to the local network. After the configured IP address client connects the client device to the local network via wireless.

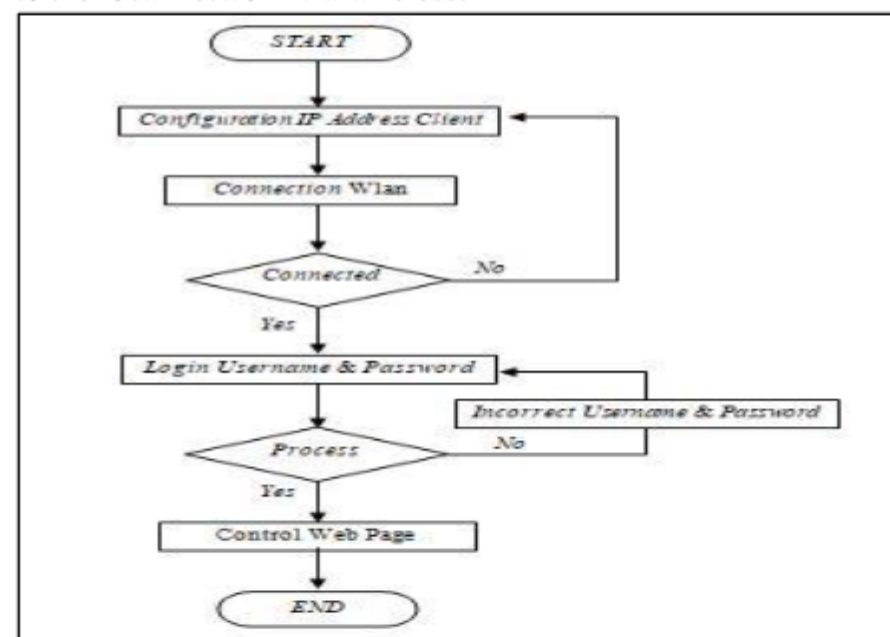


Fig. 2. Control system access flowchart

If it cannot connect to the local network, there may be an error in configuring the IP address, repeat the configuration steps. after connecting to the local network, open a web browser, then open the electric control system web page. On the web page to enter the electrical control system first fill in the username and password, if the login is successful then enter the main menu of

the control system web page. The electrical control system is only limited to relay status via the button, the relay function is on and off only.

C. Control system program flowchart

Figure 3 shows that in the initial stage of the control system program, initialization of the GPIO pin is used. After that, reading each relay status depends on the GPIO pin used. To find out the relay status through a web page that is represented by the status button of each relay.

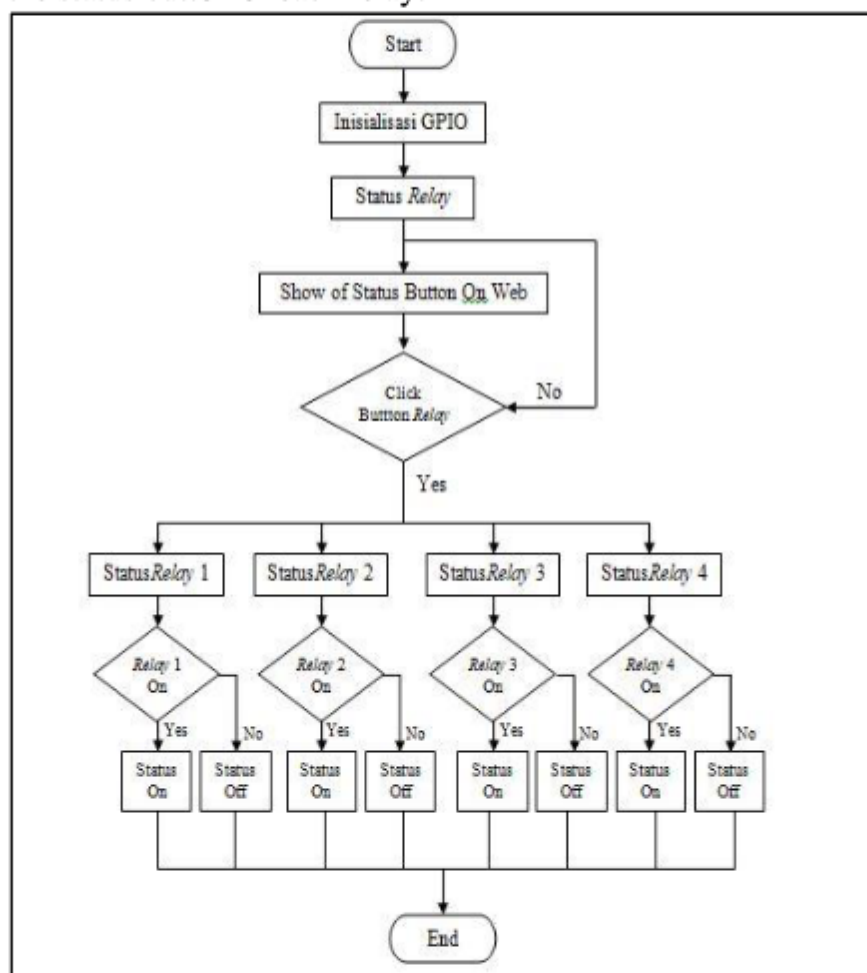


Fig. 3. Control system program flowchart

The client can input actions via the button on the web page. there are 4 buttons representing 4 relays. input action on if you want to turn on and input the action off if you want to turn off the relay. And if you don't want to do an action, or just check the status, the client can immediately exit by closing the web page.

III. RESULT AND DISCUSSION

The implementation phase of this system is the preparation of the Raspberry Pi 2 model B. It includes steps to assemble system equipment including power supply, relay, raspberry pi, and electrical load terminals into 1 part. Next step is to install OS Raspbian Jessie Lite on the MicroSD card, step network IP address settings, install Python steps, code control system programs, step install Apache as a web server, Chromium web browser for displaying systems through the website.

A. Stringing System Equipment

The power supply used is the DVD regulator circuit because it is simpler and safer for the resources of the system to be built. The power supply circuit used has a 5 volt output to connect to

the Raspberry Pi module and 12 volts for relay circuits are shown in Figure 4.



Fig. 4. Power suplay circuit with output 12 volt and 5 volt

In the design of the electrical load control system limits the number of loads to be controlled by 4 electronic equipment. It means using 4 pieces of relay. But in this system design, 8 channel relays are used to anticipate if there is a problematic relay circuit shown in Figure 5.

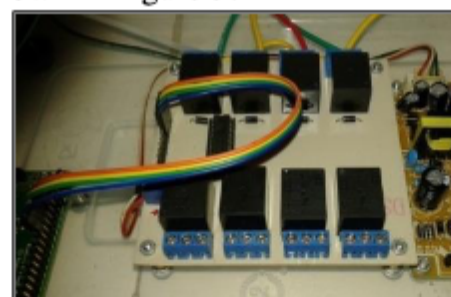


Fig. 5. Relay circuit 8 Ch 12 volt

The Raspberry Pi used is the Raspberry Pi 2 Model B 1Gb. GPIO pins used on raspberry pi include GPIO 7, 11, 27 and 22 shown in Figure 6.



Fig. 6. Module rapsberry Pi 2 model B

The system design output uses 4 AC terminals so that all electrical equipment to be controlled is shown in Figure 7.



Fig. 7. AC terminal

B. Testing

In this test we performed with 2 stages, namely, First using the Test from a Web Browser on the Laptop Client and Second using the Testing from a Web Browser on an Android Mobile Client.

In the first test, the test is carried out using the Laptop Client. Tests carried out are how far the client laptop can control the system. These test results are shown in Table I.

TABLE I
Result of client laptop testing

No.	Distance (Meter)	Control Capability	Description
1	1	Good	Good Connection
2	5	Good	Good Connection
3	10	Good	Good Connection
4	20	Good	Good Connection
5	30	Good	Good Connection
6	40	Not Good	Slow Connection
7	50	Not Good	Lost Connection

Based on Table 1, testing the distance control by using the laptop above, that electronic devices can work at a considerable distance, which is in the range of 30 meters and is located in 1 adjacent building area. However, not only does the distance that determines the performance of the tool run well or not. Given that Wi-Fi has the nature of LOS (Line Of Sight), or in other words that the nature of the waves used Wi-Fi is microtic waves that have a straight propagating nature, so the signals emitted by Wi-Fi will be received maximally if there are no obstacles which inhibits it.

In the second test, Testing on the Android Mobile Client. Testing of a Web Browser on an Android Mobile Client. Testing is done is how far the Android Mobile client can control the system. The test results are shown in Table II.

TABLE II
Result of client laptop testing

No.	Distance (Meter)	Control Capability	Description
1	1	Good	Good Connection
2	5	Good	Good Connection
3	10	Good	Good Connection
4	20	Good	Good Connection
5	30	Not Good	Slow Connection
6	40	Not Good	Slow Connection
7	50	Not Good	Lost Connection

Based on Table II, the test results, it can be seen that there is a difference between testing using a laptop with testing using Android mobile. Testing using a laptop has a greater control distance compared to using an Android phone. This happens because laptops have Wi-Fi adapters with better specifications compared to Wi-Fi adapters that are on Android phones. Then,

Wi-Fi adapters that are on Android phones also have less power when compared to Wi-Fi adapters available on Laptops.

IV. CONCLUSION

The Electric Control System that has been made is able to control 4 AC voltage electronic devices at the same time by 4 relays with each relay capable of bearing a maximum load of 2200 watts using a power supply on the Raspberry Pi which has a minimum of 0.7 amperes and Control will have performance more leverage if controlled via a PC / Laptop compared to using an Android mobile.

V. ACKNOWLEDGMENT

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