Home Lighting Control Based on Time Scheduling using Crontab

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ABSTRACT

Access control system in smart home concept is a support system that affects especially on controlling the electronic devices. Along with advances in technology, the conventional access control system was developed into an electronic-based access control system. A conventional access control system such as manual electric switches is now beginning to be developed with an electric switch that can be controlled wirelessly from the web. Raspberry pi 2 model B is one of the minicomputers which can be used in an automatic access control system. By using GPIO (General Purpose Input Output) on Raspberry Pi, can be created by a wireless access control system, safe and effective. The purpose of this study is designing a prototype relay control system wirelessly model that can be accessed through the web, the result indicates the possibility of relay control to be remote. Crontab scheduling functions on the controller's relay are used, then the device can function based on a predetermined schedule, it is very helpful to turn on and off electrical devices home remotely. The form of a username and password authentication will be used to protect the system from being accessed by anyone. In the final phase of research, the system is evaluated at day and night using Crontab function. Meanwhile, the response time of the relay is within 1-2 seconds range.

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1. Introduction

The relay is a switch which is operated electrically and consisted of two main parts namely electromagnets (coils) and mechanical. The relay uses electromagnetic principles to drive the switch contacts so that the electric current is small (low power) can deliver a higher voltage electricity [1]. Figure 1 shows the relay.

Points Relay Contact consists of 2 types:

1. Normally Close (NC): initial condition before activated will always be in a close position (closed).

2. Normally Open (NO): initial condition before activated will always be in open position.

Figure 1. Relay

From the previous research that has been done by D. Prihatmoko is designing web server which is used as a server to control lamp usage. This design is in the form of software design using PHP programming language, C Programming Language, and database. The result of this research is a web server that can be used to control and monitor home electronic devices by using Rasberry Pi [2] or who have applied to the Arduino [3].

This study discusses control through the Personal Computer (PC) using Visual Basic is used in many applications, especially in the field of electronic goods control, when the lights on then the status of the lights is ON and when the lights off then the status of lights is OFF. Simulation of lighting controller is performed by a computer using windows operating system with a Visual Basic programming language. This simulation has 2 modes of control that is automatic mode and manual mode [4].

2. Discussion

The system to be used in this research is from designing, software and hardware. In general, the block of this relay control system is applied to 4 lamps this can be seen in Figure 2.
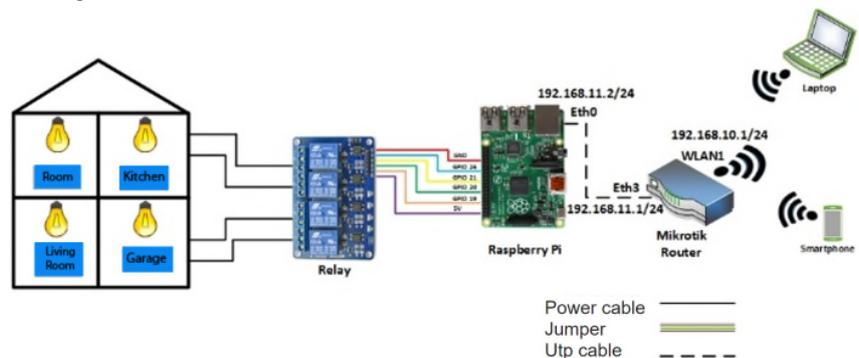

Figure 2 Block Diagram of Relay Control System (applied for four lamps)

From Figure 2 it is explained that the Mini PC Raspberry Pi as the main control of the system and as the server. Apache web server is installed as a means to support system controlled through the website, and GPIO serves to control the work of the system.

The system circuit in Figure 2 shows that the system controls the 4 loads shown by the relay. Using wiring pi and PHP programs, the program outputs through GPIO 19,20,21,26 as a trigger for the relay, while the 5V voltage of GPIO is used as a grounded trigger derived from the Raspberry pi GPIO.

System load of 4 lamps 15 watts 220V AC, through 4 relays that control each load. The output of the program is "1" and "0". If the output of the program is a value of "0", the 5V voltage is connected and the relay coil trigger, causing magnetism and pulling the relay pin contact so that the 220V voltage is connected, and the lamp turns on. If the output of the program is a value of "1", then the 5V voltage of the GPIO will be disconnected, so that no relay current is spooled, the magnetism of the relay is lost and the relay pin contact is disconnected, the 220V voltage is disconnected and the lamp off.

The system is controlled through a web page in the form of 8 buttons. There are 4 buttons ON and 4 buttons OFF, where if the relay is in condition ON, then button "enable". And if the relay is OFF, then OFF button is disabled. [4], [5].

Crontab is the application daemon (running behind the scenes) that is used to run the scheduled task at a time in the Linux operating system. Each user on a system that has a Crontab file, allows the file to perform an action and according to the specified time [6], [7], [8], [9].
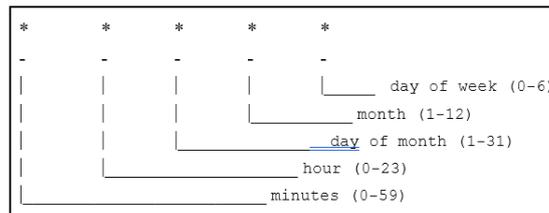
```
*       *       *       *       *
-       -       -       -       -
|       |       |       |       |_____  day of week (0-6)
|       |       |       |_____          month (1-12)
|       |       |_____                  day of month (1-31)
|       |_____                          hour (0-23)
|_____                                  minutes (0-59)
```

Figure 3 Design of Crontab

Figure 3 shows the design of Crontab to set the date of time beginning from minutes to day of week or month. The Crontab command is shown in Figure 4.

```
import RPi.GPIO as GPIO                    import RPi.GPIO as GPIO
GPIO.setwarnings(False)                    GPIO.setwarnings(False)
GPIO.setmode(GPIO.BCM)                     GPIO.setmode(GPIO.BCM)
GPIO.setup(19, GPIO.OUT)                   GPIO.setup(19, GPIO.OUT)
GPIO.setup(20, GPIO.OUT)                   GPIO.setup(20, GPIO.OUT)
GPIO.setup(21, GPIO.OUT)                   GPIO.setup(21, GPIO.OUT)
GPIO.setup(26, GPIO.OUT)                   GPIO.setup(26, GPIO.OUT)


GPIO.output(19, GPIO.HIGH)                 GPIO.output(19, GPIO.LOW)
GPIO.output(20, GPIO.HIGH)                 GPIO.output(20, GPIO.LOW)
GPIO.output(21, GPIO.HIGH)                 GPIO.output(21, GPIO.LOW)
GPIO.output(26, GPIO.HIGH)                 GPIO.output(26, GPIO.LOW)
print "LED IS OFF"                         print "LED IS ON"

# For more information see the manual pages of crontab(5) and cron(8)
#
# m h  dom mon dow   command


00 18 * * * python /home/pi/on.py
00 06 * * * python /home/pi/off.py
```

Figure 4 Scheduling Script

Then create a scheduling function with a Crontab

```
# Crontab -e
```

3. Results

System testing is a process or activity undertaken to assess the main system designed to corresponding the expected. This test is also a step in the next system development process. There is also an explanation of each test as follows:
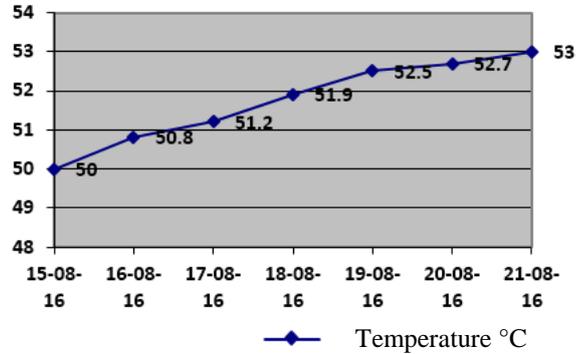
1. Raspberry Pi Resistance Testing

Figure 5 Graph of Raspberry Pi Temperature

From Figure 5, the results indicate that within 7 days the raspberry pi temperature the rise only 3 °C without any constraints like a sudden restart.

2. Measurement and Testing of Web Server Delay Packages

For testing this delay, use software Wireshark 1.6.4. Testing is done in E2 lab of applied science faculty using the wireless network. Measurements made starting from the client to call Raspberry Pi address on the client browser by taking one of the data packages. The results of the capture of Wireshark software can be seen here:
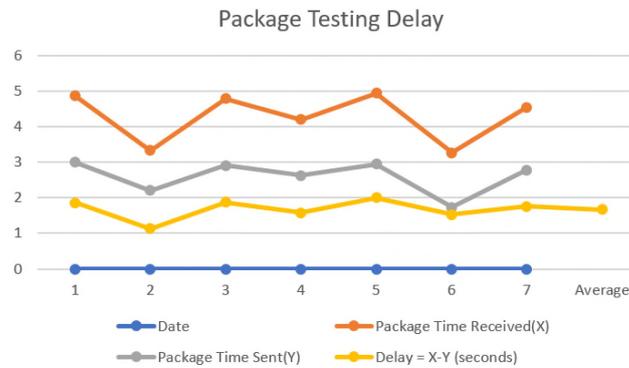

Figure 6 Package Testing Delay

Figure 6 shows the average delay for sending 1 packet on the Raspberry Pi server is 1.675300 seconds. The delay value is not absolute from the calculated result, because many factors influence the network condition when sending the data packet.

3. Functional Web Server Testing

Testing functionality is done on the web server to know all the menu functions found on the web server menu. Testing is done for seven days and obtained the same result that is successful.

4. Testing Relay Function and Electronic Equipment Response

The output of the control on the web will be forwarded to a series of relays that have been connected to some electronic devices, electronic devices here are 4 pieces of 15 Watt lamps. For the test system, the lights are controlled on

the web in the ON state then the light will light up as well as the off state. Testing is done for seven days for the four lights.

5. Scheduling Function Testing
    a. Figure 7 shows the Crontab script performs scheduling test based at 06:00 AM will automatically turn off the lights.
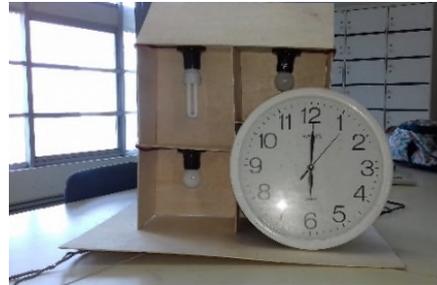

Figure 7. Lights Off

    b. Figure 8 shows the Crontab script performs scheduling test based at 06:00 PM will automatically turn on the lights.
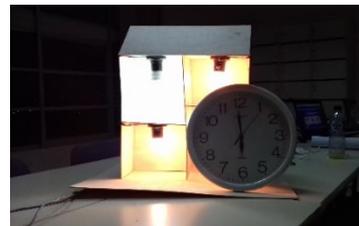

Figure 8. Lights On

6. Testing Based on Distance And Different Room
    Table 1 shows the results of distance and signals interference test that were performed and conducted in Faculty of Applied Science. Vistumbler v10.6.4. is used in this experiment.

Table 1 Testing Based on Distance and Different Room

No	Direction	Distance	Obstacle	Signal Result	Control Result
1	North	1 m	No Obstacles	Excellent	Success
		5 m	No Obstacles	Excellent	Success
		10 m	With Wall Obstacles	Good	Success
		20 m	With Wall Obstacles	Good	Success
		30 m	With Wall Obstacles	Fair	Success
		40 m	With Wall Obstacles	Fair	Success
		50 m	With Wall Obstacles	Poor	Failed
2	West	1 m	No Obstacles	Excellent	Success
		5 m	No Obstacles	Excellent	Success
		10 m	No Obstacles	Good	Success
		20 m	With Wall Obstacles	Good	Success
		30 m	With Wall Obstacles	Fair	Success
		40 m	With Wall Obstacles	Fair	Success
		50 m	With Wall Obstacles	Poor	Failed
3	South	1 m	No Obstacles	Excellent	Success
		5 m	No Obstacles	Excellent	Success

No	Direction	Distance	Obstacle	Signal Result	Control Result
		10 m	With Pillar Obstacles	Good	Success
		20 m	With Pillar Obstacles	Good	Success
		30 m	With Wall Obstacles	Fair	Success
		40 m	With Wall Obstacles	Fair	Success
		50 m	With Wall Obstacles	Poor	Failed
4	East	1 m	No Obstacles	Excellent	Success
		5 m	No Obstacles	Excellent	Success
		10 m	No Obstacles	Good	Success
		20 m	With Wall Obstacles	Good	Success
		30 m	With Wall Obstacles	Fair	Success
		40 m	With Wall Obstacles	Fair	Success
		50 m	With Wall Obstacles	Poor	Failed

Capability Signal Description:
- Excellent: -57 to -10 dBm (75 - 100%)
- Good: -75 to -58 dBm (40 - 74%)
- Fair: -85 to -76 dBm (20 - 39%)
- Poor: -95 to -86 dBm (0 - 19%)

4. Conclusions

This paper successfully presented an alternative method for scheduling using Crontab and web-based relay control. Based on the research results obtained the following conclusions.

1. The System can run using Web Server and control 4 lamps based on relay control in the form of house model.
2. On testing the relay function and response time, testing is done twice and the relay works well. Either light on or off on each lamp. With the average response time obtained to turn on and turn off the light is 1-2 seconds.
3. On Crontab scheduling, testing is done and successfully.

Bibliography

[1]   G. Depari, "Teknik Digital Teori Dan Aplikasi." Bandung: Nuansa Aulia, 2011.
[2]   D. Prihatmoko, "Pemanfaatan Raspberry Pi Sebagai Server Web Untuk Penjadwalan Kontrol Lampu Jarak Jauh," *J. Infotel*, Vol. 9, 2017.
[3]   D. Prihatmoko and B. B. Wahono, "Sistem Penjadwalan Kontrol Lampu Berbasis Web Menggunakan Arduino," *J. Inform. Dan Komputasi*, Vol. 10, No. 2, Pp. 120–126, 2017.
[4]   S. Supatmi, "Simulasi Pengontrolan Lampu Gedung Menggunakan Visual Basic," In *Seminar Nasional Informatika (Semnasif)*, 2015, Vol. 1, No. 1.
[5]   A. Ahmadi, "Kendali Penerangan Rumah Jarak Jauh Menggunakan Short Message Service (SMS)," *J. Neutrino J. Fis. Dan Apl.*, 2012.
[6]   L. Reznick, "Using Cron and Crontab," *Sys Admin*, Vol. 2, No. 4, Pp. 29–32, 1993.
[7]   D. Guo, Z. Zhao, And X. Wang, "Design and Implementation of Time Management of Scheduled Tasks Based on Cron [J]," *Mod. Electron. Tech.*, Vol. 14, P. 19, 2011.
[8]   R. Peters, "Cron," *Expert Shell Scripting*, Pp. 81–85, 2009.
[9]   J. N. Johnson and P. F. Dubois, "Issue Tracking," *Comput. Sci. Eng.*, Vol. 5, No. 6, Pp. 71–77, 2003.