DESIGN AND IMPLEMENTATION ON PROTOTYPE OF WEB BASED HOME MONITORING AND LAMPS CONTROLLING BASED ON ARDUINO SYSTEM

SCIENTIFIC PAPER

Arranged as One of Requirement to Finish The Educational (S1) at Department of Electrical Engineering Faculty of Engineering
Universitas Muhammadiyah Surakarta

Submitted by:

Ilham Nur Zakaria

D 400 112 006

DEPARTMENT OF ELECTRICAL FACULTY ENGINEERING

UNIVERSITAS MUHAMMADIYAH SURAKARTA

2015

APPROVAL PAGE

Final Project the title is **"DESIGN AND IMPLEMENTATION ON PROTOTYPE OF WEB BASED HOME MONITORING AND LAMPS CONTROLLING BASED ON ARDUINO SYSTEM"**

created by:

Name : **Ilham Nur Zakaria**

NIM : **D400 112 006**

Arranged as one of requirement to finish the educational (S1) at Department of Electrical Engineering Faculty of Engineering Universitas Muhammadiyah Surakarta

.

It has been approved and authorized on:

Day : Friday

Date : 24 July 2015

Approving,

Supervisor I	Supervisor II
(Dr, Ir. Bana Handaga, MT)	**(Dedi Ary Prasetya, ST)**

DESIGN AND IMPLEMENTATION ON PROTOTYPE OF WEB BASED HOME MONITORING AND LAMPS CONTROLLING BASED ON ARDUINO SYSTEM

Ilham Nur Zakaria
Department of Electrical Faculty Engineering
Universitas Muhammadiyah Surakarta
Email : ilhamnurzakaria@gmail.com

ABSTRACTS

Smart Home is a technology that makes the house be smart and automatic. Typically, these technologies have automated systems for lighting, control, security and many other functions. Smart Home System is designed and made by utilizing WLAN network based on the Arduino microcontroller. Ethernet shield is able to connect Arduino to the network via TCP / IP communication. This system is capable of home monitoring and lamps controlling. There are three sensors used to monitor home includes two PIR and a LM35 temperature sensor. PIR sensors are used to detect of motion. A LM35 temperature sensor is used to monitor temperature in room. The home monitoring and lamps controlling are displayed on a web page by laptop and smartphone.

Key words : Arduino Uno, WLAN, Ethernet Shield, PIR sensors, LM35 temperature sensor

1. PRELIMINARY

The house is a place where people live to take refuge from the influence of the circumstances surrounding nature such as rain, sun, etc. It is also a place to rest after work or performs activities during the day. Every ones would need a place to stay and spend time with their family, which is why the house became the basic human needs. Security has become main problem in home to save the home, people inside and other stuffs when they are inside or outside the home.

The concept of Smart Home is more popular today but still rarely used in Indonesia. Smart Home is a technology that makes the house into a smart and automatic. Typically, this technology has both automation and manual systems to control lighting, security and many other facilities. This system integrates an electronic control with just a button connected to the telecommunication system. There are several concepts of communication systems within the Smart Home such as Global System for Mobile Communication (GSM), microwaves, infrared (IR), radio frequency (RF), Bluetooth, Power line communication (PLC), Platform, Wi-Fi and WLAN.

Based on background above, in this final project design and

implementation on prototype of web based home monitoring and lamps controlling based on arduino system.

2. THE RESEARCH METHOD

The system was designed by having several blocks, includes: input/output block, Microcontroller, networking block, web page block and manual switch block. The whole system can be seen in Figure 1. Detailed explanations of each block are as follows.

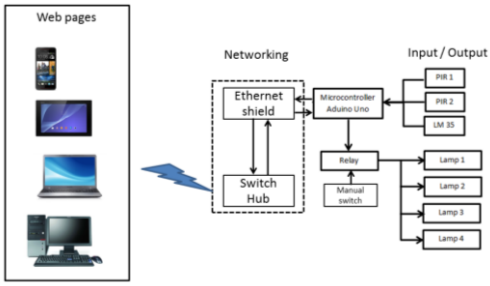

Figure 1. Block Diagram

a. Input/output

The inputs are two PIR sensors and LM35 temperature sensor. They are used to home monitoring. The PIR sensors are used to detect the presence of motion. And a LM35 temperature sensor is functioning temperature monitoring.

The outputs are four relay. They are used to lamps controlling. The output is the result of the reading button on a web page that is used to turn on and turn off the lamps.

b. Microcontroller

The second block is a microcontroller system that serves as the center of all systems and regulates all activities of the input/output system. The system used in this paper is Arduino. Arduino is a system that uses ATMega 328 as its microcontroller. All devices form input/output and networking block are connected to this.

c. Networking block

The third is network block that consists of an Ethernet shield part and Switch Hub device. An Ethernet Shield serves as a link between the arduino to the computer using TCP / IP connection. Switch hub is devices used to share IP address in WLAN. So, the web page is able opened in other PC and smart phone.

d. Web pages

A web page display is used for home monitoring and control lights. Web pages can be accessed by any device that supports HTML5 such as smartphones, tablets, and laptop or PC.

e. Manual switch

The manual switch is a hardware that used to turn on or turn off lamp without although web pages. It will be an alternative to control the lights when the LAN or WLAN is not connected.

Design of the system is divided into two parts, that is hardware and software design.

A. Hardware Design

This research uses the arduino board UNO R3 as the main control. Three sensors are connected to the main control includes are temperature sensor and two PIR sensors. The connection uses Ethernet shield and UTP cable.

a. Ethernet Shield

Arduino ethernet shield is an extension board of arduino. The Arduino Ethernet Shield allows an Arduino board to connect to the internet. It is based on the Wiznet W5100 ethernet chip. The Wiznet

W5100 provides a network (IP) stack capable of both TCP and UDP. The Ethernet Shield has a standard RJ-45 connection, with an integrated line transformer and Power over Ethernet enabled. There is an onboard micro-SD card slot, which can be used to store files for serving over the network.

b. Schematic Temperature Sensor

Temperature sensor is used to read temperature value to be entered into arduino analog pin (ADC). The input voltage of temperature sensor is 4 – 30 volts. It has a drain current of less than 60 µ A. Figure 2 shown temperature sensor entered into arduino analog pin (A0).

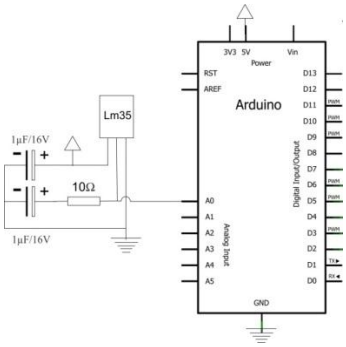

Figure 2. Schematic temperature sensor.

c. PIR sensors

PIR sensors are sensor to detect a movement with wave infrared signal. It has operating Voltage 4.7 - 10 Volt and Current standby (no load) 300 µA. The schematic of PIR sensor is shown in Figure 3

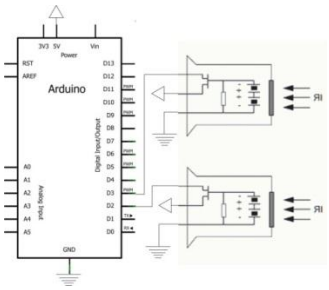

Figure 3. Schematic of PIR sensors.

d. Manual Switch

The manual switch is a hardware that used to turn on or turn off lamp without although web pages. It will be an alternative to control the lights when the LAN or WLAN is not connected. The circuit uses OR series with using two diode. It has input voltage 5 Volt. The schematic of manual switch is shown in Figure 4.

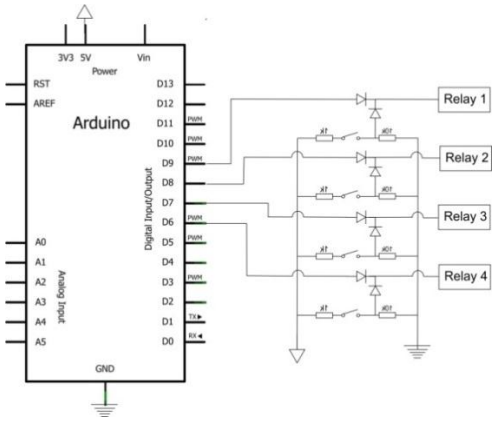

Figure 4. Manual switch schematic.

B. Software Design

Arduino compiler version 1.6.0 used to make the program as well as compiling scripts into machine language program so that the program can be read and executed by ATMEGA328 chip that contained on Arduino board. Arduino compiler also can be uploading the program. Arduino programming language is a high level programming language that is relatively easy to use. As well as the Arduino compiler software is compatible for Windows XP operating system, Windows Seven, and Windows 8.

a. The Arduino Program

The first step on the programming process is making the flowchart. Flowchart can simplify the programming process. Flowchart

program on arduino can be seen in Figure 5.

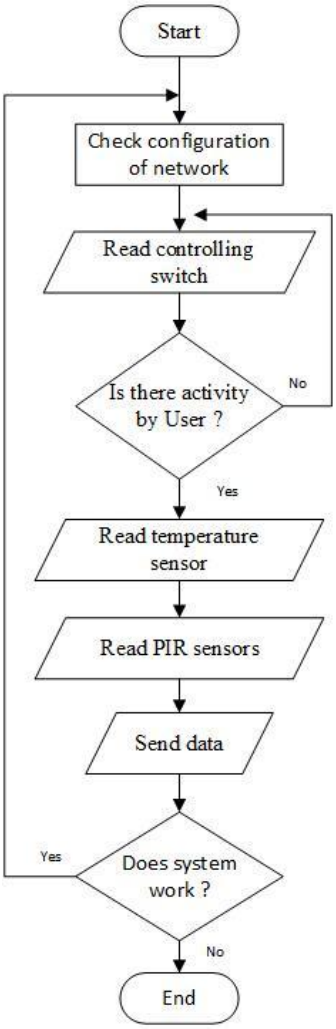

Figure 5. Flowchart of arduino program

The main program is to this system using processing program than compiled to upload in the arduino. Check configuration is first step on arduino program. It has function to connect arduino and web pages via TCP/IP communications. Then next step is reading controlling switch, temperature and PIR sensors. When there are activities by user than arduino will send data to the web page.

C. Web page program

The programming language used for the manufacture of the web page is html and javascript. Web programming is written using notepad ++. Javascript and html files will be placed on SD card. The computer server contained WAMP application that functions as an offline server. Figure 6 shows the algorithm of web page programming.

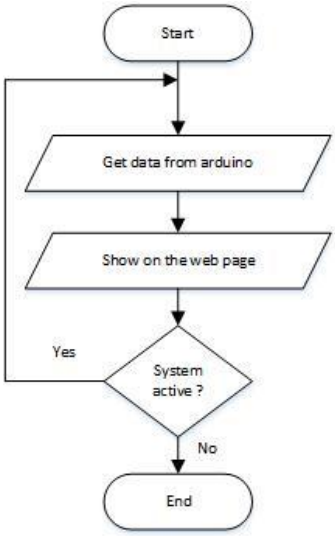

Figure 6. Flowchart of Web Page

3. THE RESULT

A. Result and analysis web page

Web pages are used to home monitoring and lamps controlling. The figure of web page can be shown in figure 7.

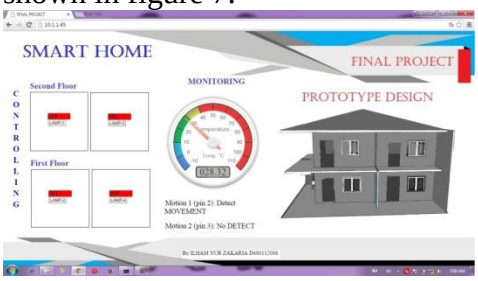

Figure 7. The web page display

Web page has 3 parts main, there are:

1. The first parts, there is lamps controlling. It has function to

control lamps though button in the web page.

2. The Second part is home monitoring. In this part, show condition in the room by sensors. Web page can display temperature in room and movement when people getting in the rooms.
3. The last parts, it's just showing design of prototype.

B. Result and Analysis of Prototype

Result of prototype is a small house that made by woods. The size of prototype is 46 cm x 89 cm x 60 cm. It consists of second flour and has four rooms main. Each room sized 30 cm x 30 cm. More ever, on the prototype is placed a devices and four lamps that connected in parallel with input AC 220 volt and current 2 Ampare. The figure of prototype can be seen in figure 8.

Figure 8. The front display of prototype

The prototype has four rooms main, as follow:

1. Room 1 is located on second flour and consist only one lamp.
2. Room 2 is located on first flour. It consist one lamp and a PIR sensor.
3. Room 3 is located on second flours. It consist a lamp and a temperature sensor.
4. Room 4 is located on first flour. It consist a lamp and a PIR sensor.

C. Testing of Ethernet shield

Testing Ethernet shield is done with connecting devices to computer though LAN connector, with configuration local network. As connector uses twisted pair cable cross type. And then done diagnostic "PING" to test communication network and test quality transmission.

Diagnostic program "PING" works using protocol ICMP. While protocol ICMP needs protocol IP to carry that to aim address. Protocol ICMP is applied o ICMP echo process. Each request from computer (PC) has to be replied by devices.

Writer does testing using a Laptop with IP address 10.1.1.1 and devices will be tested with IP address 10.1.1.45. Testing is done with command "PING" though dos prompt that aimed to IP address (10.1.1.45). The command "PING" with standard data 32 bytes and executed by "PING 10.1.1.45". The figure can be seen in figure 9

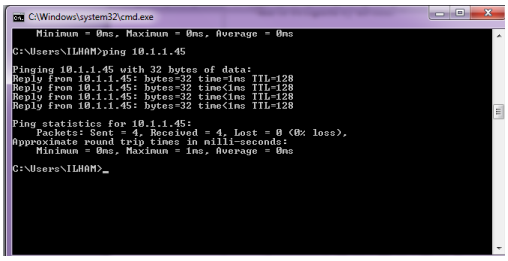

Figure 9. The result diagnostic PING (success)

In the figure 9. Testing Ethernet shield is success. It can be seen when there is replying from IP address. But when there is no replying from IP address than will display information in the figure 10.

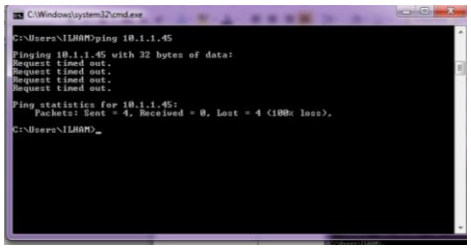

Figure 10. The result diagnostic PING (failed)

In the figure 4.6 show Ethernet shield Testing is failed. There are three causes of the failure of this experiment, among others:

a. The first micro SD is not installed.
b. Second, UTP cable between the Ethernet shield, switch hub and a server is not installed.
c. Third, Switch Hub off or not connected with adaptor.

This failure will cause an IP address can't be called by the arduino and can't display the web page. So, controlling and monitoring lamp switch rooms can't be done via the web page. But controlling lamp switch can still be done with the manual switch.

D. Testing result of the overall system

This testing was conducted to know the work of the whole tool and web page. Testing is done using a PC or Laptop (server) and a smartphone. From the test results can be seen in Figure 11 and 12

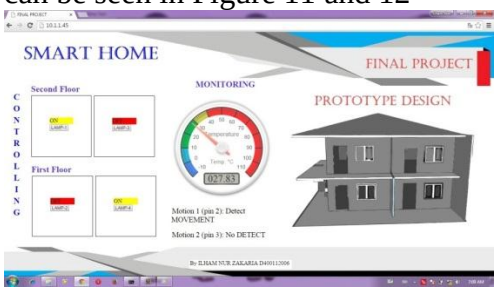

Figure 11. Testing result the overall system on Laptop display

In figure 11 shows Testing of the overall system is working properly. It can be seen all of sensors and buttons working properly.

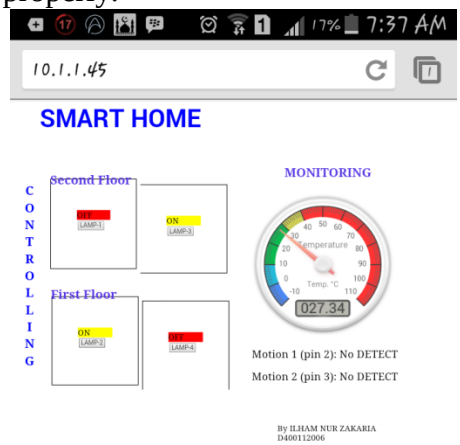

Figure 12. Testing result the overall system on smartphone display

In figure 12 shows Testing of the overall system is working properly. It can be seen all of sensors and buttons working properly. But the result of Testing on the smartphone display is not the same as the display on the laptop (server) or can't show background, because the smartphone is not installed Wamp server application.

No	Test	Function	Procedure	Result
1	Button1	Lamp controlling	Lamp will active depend on button	OK
2	Button1	Lamp controlling	Lamp will active depend on button	OK
3	Button1	Lamp controlling	Lamp will active depend on button	OK
4	Button1	Lamp controlling	Lamp will active depend on button	OK
5	PIR1	Detect of motion	Detect movement	OK
6	PIR1	Detect of motion	Detect movement	OK
7	LM35	Temperature room	35°C	OK

4. CONCLUSION

Based on final project on design and implementation on prototype of web based home monitoring and lamps controlling based on arduino system, the author can take the following conclusion:

a. Helping users turn on and turn off the lights when the position away from the light switch. Especially house that has two floors making it more effective.
b. When the LAN connection is disconnected, the monitoring system will be stopped. And when reconnected, the monitoring system will run without refreshing the web page.
c. Manual switch will be an alternative to control the lights when the WLAN is not connected.
d. This device can not know the right information about whether the lamps turn on or not.
e. When users turn on the lights using a button on a web page, the user can not switch off using the manual switch and turn on the lights. When users use the manual switch, the user can not switch off using the buttons on web pages.

5. BIBLIOGRAPHY

Arduino.cc. Arduino Uno. http://arduino.cc/en/Main/arduinoBoardUno

Ardiansyah A, Dani A W. (2012) "Design of Small Smart Home System Based" on Arduino. Jakarta : EECCIS

Hartika Ruri Z, (2013) " sistem keamanan ruangan menggunakan sensor *passive infra red* (pir) dilengkapi kontrol penerangan pada ruangan berbasis mikrokontroler atmega8535 dan real time clock ds1307". Jurnal Teknologi Informatika & Pendidikan ISSN : 2086 – 4981 Vol. 6 No. 1 Maret 2013

Hyunju Munn, et al. (2014). "Network based Mobility Management for Smart Homes through Proxy Mobile IP", International Journal of Smart Home Vol. 8, No. 6 (2014), pp. 225-230

Khaharudin Rizki. 2012. "Pengertian rumah fungsi dan syarat" Tersedia : http://rizkikhaharudinakbar.blogspot.com/2012/11/pengertian-rumah-fungsi-dan-syarat.html [21 November 2012]

Pahlanop, Boni (2011). Lapanporo1, Prototipe Sistem TelemetriBerbasis Sensor Suhu dan Sensor Asap untuk Pemantau Kebakaran Lahan". POSITRON, Vol. I, No. 1, Hal. 43-49.. ISSN : 2301-4970

Startingelectronics.org. "Two Gauge Arduino Web Server" avaible: https://startingelectronics.org/tutorials/arduino/two-gauge-arduino-web-server/ [30 July 2014]