

# Home Automation Control System Using Arduino

Mustaffa bin Ibrahim  
Faculty of Electrical Engineering  
Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia.  
mustaffa\_ibrahim57@yahoo.com

**Abstract** -Energy saving is an important issue in the times of increasing energy prices. Products and services provided by the information and communication technology (ICT) can support energy efficiency and emissions reductions. A home automation control system is a system equipped with technology that could observe the residents and provide proactive services. With the availability of inexpensive low-power sensors, radios, and embedded processors, this home automation control system are typically equipped with a large amount of networked sensors which collaboratively process and make deductions from the acquired data on the state of the home as well as the activities and behaviors of its residents. This system use long distance control system that can control the system via internet and webpage. In this project, the sensors that are temperature sensor and light sensor played a major role to receive input data and transfer it to the controller of the control system. The programming language used for developing the software to the microcontroller is Arduino. Using this project, it helps the user to save highly cost bill. In the same time, it is an energy saving since less energy is used.

**Keywords** – Automation home, Adruino, sensor temperature and light, LED, fan, web page, internet, energy saving.

## I. INTRODUCTION

Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, and other systems, to provide improved convenience, comfort, energy efficiency and security [1]. Home Automation Control System is a controller that enables the end users to switch electrical appliances such as lights, fan or air conditioning ON and OFF while they are away. Using Home Automation Control System they user can switch OFF all lights and air-conditioning from far away from home such as office via internet through webpage. Moreover, using this Home Automation Control System, the user can switch ON back the lights and the air-conditioning before they get back from work.

One of the benefits of this system is, the users would be able to check whether their home is in dark, bright, hot or cold even they are not there. Ambient light sensor is designed to detect the brightness of the light density while temperature sensor is a precision integrated-circuit temperature sensor, whose output voltage is linearly proportional to the Celsius temperature. A program was developed in an Arduino board that enables the data to be sent to users via internet. Then the

webpage was used to show the house condition. This will allow them to monitor their home while they are away.

## II. METHODOLOGY

The overall process in ensuring the success of this project is summarized in Figure 1. Generally, in this project it involved the development of both hardware and software designs. The developed system was tested and the output data were analyzed. The following sections describe the detail explanation on the development of hardware and software designs for Home Automation Control System.

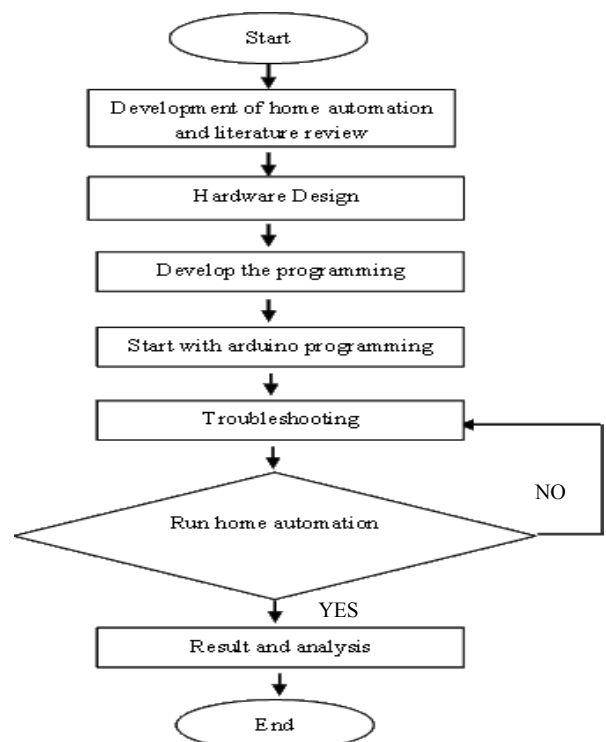


Figure 1: Overview of the project (Flowchart)

Home automation and literature review was gain by several knowledge which through the internet, books, journal, magazine and papers. The hardware was design by CATIA. The house was plugged with motor and LED. The circuit design was designed by Express PCB and programming was programmed using Arduino. The developed system was subjected to troubleshooting process. The data were then collected and analyzed.

### A. Hardware system design

The hardware used in this system is mostly the used items that have been modified to reduce cost. Also, the hardware is chosen based on the theories and its availability to interface with the other components. The software is used to program and simulate.

In this project the circuitry for the electronic parts and the connection to Arduino board were designed. Arduino Wifi Shield was place above the Arduino board. The light sensor and temperature sensor were placed directly to the Arduino board to act as the input. For the output such as LED and fan were placed on PCB board as well as the relay. The system was designed to operate in four conditions which are cold, hot, bright and dark. The block diagram of the hardware system design is shown in Fig. 2.

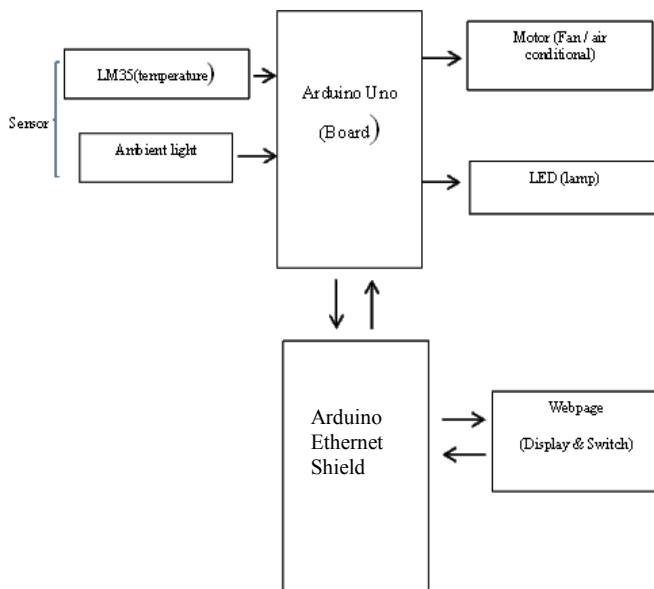


Figure 2: Block diagram of the home automation

The sensors will sense the environment and capture it in analogue data. The analogue data will be converted to digital input data bit that will be sent to microcontroller Arduino board. The Arduino will process the data and send them to Ethernet Shield. From the Ethernet Shield, the data will be sent through internet to the webpage. The data that the sensors collected will be displayed on the webpage. From the webpage, where the switch ON/OFF are displayed, the users can click the switch on the webpage. From the webpage, the input will be sending back through internet and sent it back to Ethernet Shield. From the Ethernet Shield, it sends the data to Arduino for process. From Arduino board, it sends the command from the input to switch on or off the output that is the fan and the lights. The schematic diagram shown in Fig. 3 summarized the overall process involved in this Home Automation Control System.

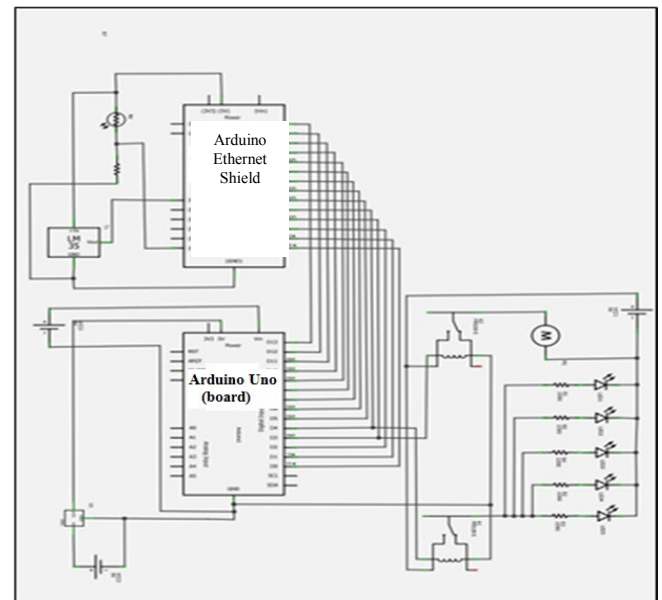


Figure 3: Schematic diagram of the home automation

Fig. 4 shows an example of webpage for Home Automation Control System. A webpage is a document or information resource that is suitable for the World Wide Web and can be accessed through a web browser and displayed on a monitor or mobile device. This information is usually in HTML or XHTML format and may provide navigation to other web pages via hypertext links. Web pages may be retrieved from a local computer or from a remote web server. The web server may restrict access only to a private network

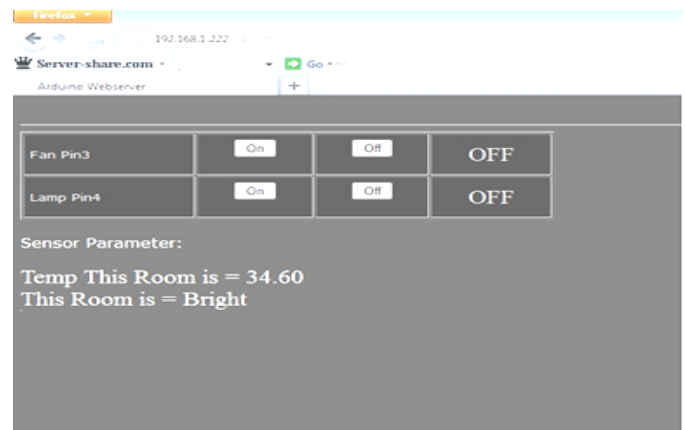


Figure 4: webpage

### B. Software system

The Arduino Uno was used in home automation control system. Arduino is an open source software using input/output board to upload and easy to write code. Pin mode (A0) and (A1) on the Arduino board were selected to act as temperature sensor and light sensor while output LED was connected to pin mode (4), (5) and (6) and fan pin mode (3). The sensors will sense the environment and capture it in analogue data.

The analogue data will be converted to digital data in the form of 8-byte input data bit that will be sent to microcontroller Arduino board.

The flow chart of software development for the automation home control system is shown in Figure 5. As shown in Figure 5, the software was designed based on four conditions: bright, dark, hot and cold.

From the data sheet, light sensor read the value from table below.

Value	Condition
<800	Dark
>800	Bright

Table 1: Light sensor table

Temperature sensor read value from formula also.

$$\text{Temperature} = (5.0 * \text{temp} * 50)/1023;$$

$$\text{temp} = \text{analogRead}(\text{sensorPin0})$$

In this project assume that condition of house show in table below.

Degree celcius	Condition
> 27	Hot
< 27	Cold

Table 2: Temperature table

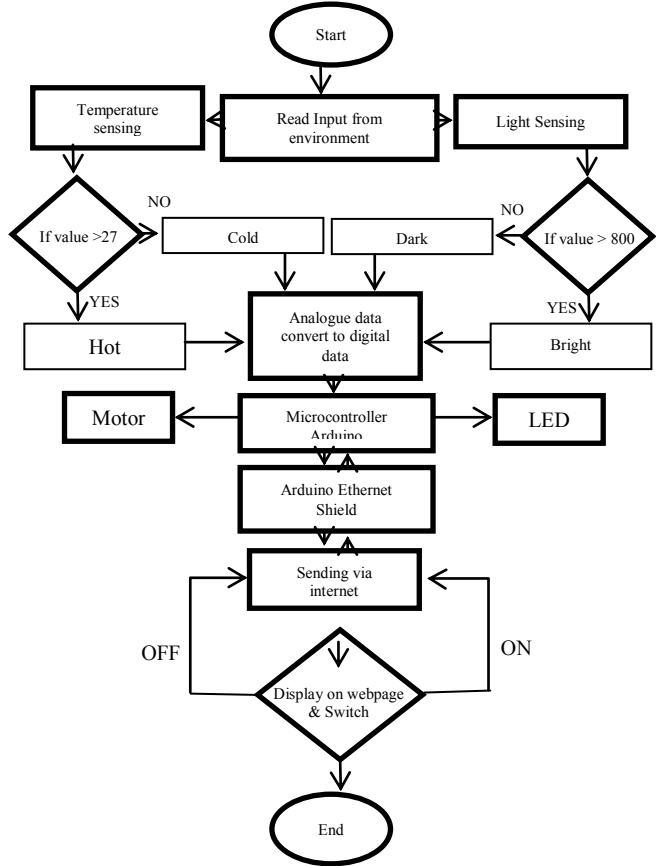


Figure 5: Flow chart of the operation of Home Automation Control System

The Arduino Ethernet Shield allows an Arduino board to connect to the internet using the Ethernet library. The shield must be assigned a MAC address and a fixed IP address using the Ethernet begins function. Original modem was set IP address with default 192.168.1.1. Arduino Ethernet shield was set IP address 192.168.1.222. Static IP address was used to configure with modem.

The source code of Home automation shown in Figure 6 below.

```

mustaffa_home_automation | Arduino 1.0
File Edit Sketch Tools Help

mustaffa_home_automation
*/

#include <SPI.h> // hardware library
#include <Ethernet.h> //for ethernet shield

byte mac[] = { 0x54, 0x55, 0x58, 0x10, 0x00, 0x24 }; // entspricht einer MAC von 84.85.88.16.0.36
byte ip[] = { 192, 168, 1, 222 }; // IP-Address for arduino
byte gateway[] = { 192, 168, 1, 1 }; // Gateway server address
byte subnet[] = { 255, 255, 255, 0 }; // server subnet

Server server(80);

int Pin3 = 3; // fan
int Pin4 = 4; // led1
int Pin5 = 5; // led2
int Pin6 = 6; // led3
int sensorPin0 = A0; // temp sensor
int sensorPin1 = A1; // light sensor
float temp = 0;
float tempC = 0;
float light = 0;

String readString = String(100); // string for fetching data from address
boolean Pin3ON = false; // Status flag
boolean Pin4ON = false;
boolean Pin5ON = false;
boolean Pin6ON = false;
  
```

Figure 6:Arduino IDE

### III. RESULTS AND DISCUSSION

The Home Automation Control System worked as we wanted it to be. The system is successfully running using the web page. Through the web page, the users are able to monitor the condition inside of his/her house whether the light/fan is on. If it is so then the user are able to turn it off remotely.

Figure 7 shows the condition of the house when the user check the fan and the lights. From the web page, the user are able to know that the fan and lamp are ON or OFF, the temperature and the brightness of light.



Figure 7 :Initial Condition of “The Model House”

Figure 8a show the serial monitor on the Arduino for bright, temperature is 31.89, fan and LED are OFF. As mentioned previously in the methodology session, the sensor temperature and light will detect the input.

```
GET / HTTP/1.1
Temperature = 31.89
Bright
GET /favicon.ico HTTP/1.1
Temperature = 31.89
Bright
GET /?3=Off HTTP/1.1
Pin 3 LOW
Pin 4 LOW
Pin 5 LOW
Pin 6 LOW
```

Figure 8a: initial condition

When the user switch ON the fan, serial monitor will display like figure 8b.

```
GET / HTTP/1.1
Temperature = 31.89
Bright
GET /favicon.ico HTTP/1.1
Temperature = 31.89
Bright
GET /?3=On HTTP/1.1
Pin 3 HIGH
Temperature = 32.26
Bright
GET /
```

Figure 8b: Fan switch ON

When the user switch ON the LED, serial monitor will display like figure 8c.

```
GET /?4=On HTTP/1.1
Pin 4 HIGH
Temperature = 32.62
Bright
GET /favicon.ico HTTP/1.1
Temperature = 32.62
Bright
```

Figure 8b: LED switch ON

When the user switch OFF the LED and fan, then the temperature cold and brightness is dark serial monitor will display like figure 8d

```
GET /?4=Off HTTP/1.1
Pin 3 LOW
Pin 4 LOW
Pin 5 LOW
Pin 6 LOW
Temperature = 25.22
Dark
GET /favicon.ico HTTP/1.1
Temperature = 25.51
Dark
```

Figure 8b: Fan & LED switch OFF, cold and dark

When the user switch OFF the LED and fan, then the temperature cold and brightness is bright serial monitor will display like figure 8d

```
GET / HTTP/1.1
Temperature = 25.51
Bright
GET /favicon.ico HTTP/1.1
Temperature = 25.22
Bright
Pin 3 LOW
Pin 4 LOW
Pin 5 LOW
Pin 6 LOW
```

Figure 8b: Fan & LED switch OFF, cold and dark

## V. CONCLUSION

From the experiment, all objectives in this project are successfully fulfilled and this Home Automation Control System Using Arduino is working properly when the sensors sense the surrounding and give the reading at the webpage. Using the Arduino IDE is much easier to program and easy to understand. Besides that, using Arduino Uno board help a lot in this project where it is easy to use and is not complicated as PIC.

Using the theoretical and practical approach to solve the given task is quite troublesome. From the research that been done, the requirement to fulfil the project had been done. This project was focussing on literature review about how to construct the circuit. When identified customer needs, student can make a survey what does customer wants from the home control system, therefore the first target specification of the project can be applied. The analysis that gets it from the survey, the concept of generation can be processes and can make the selection from the concept generation using screening method. From this project, the student is able to create a product that is useful and practical to be applied in a electronic industry.

## VI. RECOMMENDATION

The preeminent recommendation for this project is the enhancement that can be made on the predicament proclamation that was mentioned on the earlier chapter which described as follows:

For future development, we should use our own server where it is more secure for customer rather using the world server.

Analogue input from Arduino, can add other features rather than temperature and light sensor. We can collect data from sensor to sense humidity, vibration, motion.

From the Arduino itself, we can control 14 outputs to control many things in our house.

## ACKNOWLEDGMENT

The authors would like to acknowledge Miss Raudah Binti Abu Bakar supervise during development of Home Automation Control System Using Arduino and the Faculty of Electrical Engineering, Universiti Teknologi MARA (UiTM) on the facilities provided during the project.

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