

LIGHT CONTROLLER AND HOME SENSING

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Abstract

This research is the utilization of internet of things to assist between people and their home through the internet. This research is called as Light Controller and Home Sensing. People could control and monitor their house although they are far away from their home. Light Controller and Home Sensing will discuss how people could control, monitor, and report their home such as control the light, monitor the temperature and humidity, and report if there is fire or not.

Keywords : light controller, arduino, home sensing, automatic control, energy saving, Internet

1. Introduction

The development of technology would convey information between people. One of this technology which is used to convey the information is Internet. Internet is a part of technology that is increasing very fast. People can access internet easily and quickly. People in different country could get connected easily. Not like 10 years ago, people hard to find internet. Now to access internet, not only use computer or laptop but people can easily get internet access with their phone. The cost that people spent to access internet is not expensive as 10 years ago. Time to time, the cost is cheaper than before. Internet provides a lot of information which people can take, such as, news, knowledge, tutorial, etc.

Internet becomes the most popular in computer world. Because of that Kevin Ashton proposed "Internet of Things". Internet of things is virtual represented of many things that around us to an internet structure. Until now, not many people use this term (Internet of Things). Only certain institution use this terms. This term is implemented by ponsel provider. Ponsel provider uses this term for monitoring the condition of "Base Transceiver Station" (BTS), like monitor the temperature, voltage, current, etc. Another example, Internet of Things is important for monitoring the server. The temperature of the server must be monitored periodically. The scope of internet of things is very wide and has many variation. This research is one of internet of things. This research is a kind of web base application

that can control the light and monitor the temperature, humidity, and fire status. This research will be named "Light Controller and Home Sensing".

Lately, there are many burglaries happen in houses. One factor of this action happens is the owners of the houses leave their houses. Not only that, the lighting of those houses is dark because of the light is off. Especially when day of celebration at end of fasting month comes, they leave their home to go back to their own village. They leave their homes not for a short time, usually they leave for a week or more. The thief thinks that if the lighting of the houses is off, it means that there is no people inside. This condition is susceptible from burglaries.

It needs controller to control the lighting of the house although the owner of the houses are far away from their houses and monitor the house by this research "Light Controller and Home Sensing".

Arduino will support light controller and home sensing. Arduino is an open source electronics prototyping platform based on flexible hardware and software. The arduino is a simple yet sophisticated device which is based on Atmel's ATmega microcontrollers. The arduino software is supported by Windows, Macintosh OSX and Linux operating systems despite the fact that most microcontrollers are limited to Windows operating system. The software language is based on AVR C programming language and can be expanded through C++ libraries. There are various types of arduino

microcontroller board available in the market including the arduino kits and arduino shields. [1]

To connect to the network, Arduino needs an Ethernet shield. In this case, the Ethernet shield that will be used is Arduino Ethernet Shield. It is based on the Wiznet W5100 ethernet chip (datasheet). The Wiznet W5100 provides a network (IP) stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. Use the Ethernet library to write sketches which connect to the internet using the shield. The ethernet shield connects to an Arduino board using long wire-wrap headers which extend through the shield. This keeps the pin layout intact and allows another shield to be stacked on top [3].

This technology will facilitate people in daily life. This technology could be accessed everywhere as long there is internet connection. Not only access via notebook/PC, this technology could be accessed via smartphone.

There are existing application which is related to Light Controller and Some sensing. Light Controller and Home Sensing has same function with these related works, but having different in feature. These are two existing works: MiCasa Lite [4] and Lutron.

MiCasa Lite is a Light controller application which works under IOS. For the hardware MiCasa is supported by SmartLinc Device. This application is used to control some lights in at home, while UPB Home Automation runs in Android platform [5]. The function is the same with Lights Controller and Home Sensing. This application is used to turn on or off light in the house. There are 10 buttons to control 4 lights. There are feature All On and All Off.

Purpose to be achieved in making this research, among others:

- To create light controller to switch on/off the Light.
- To give information about the temperature of the house.
- To give information if there is fire or not.

2. Methodology

In order to develop the application, the methodology that is used is Rapid Application Development (RAD). "*Rapid application development (RAD) is a software development methodology, which involves iterative development and the construction of prototypes.*" This is accomplished by focusing on streamlining the build process, called the "development cycle." The RAD system is split into four separate phases: Requirements Planning, User Design, Construction and Implementation [2].

3. Discussions

Light controller is used for control the Light of the house through the internet. It is web application that allow user to on/off the Light. There is some additional feature. Light controller has ability to monitor temperature and humidity of the house.

Arduino will support Light Controller. The role of Arduino is as microcontroller. Arduino is programmed via computer application based on Arduino1.0.5 visual programming language.

Light controller is developed by using C, PHP, HTML, CSS and some Javascript. These are the features of this research:

- Controlling 2 lights, by this feature, user could turn on/off the light of his/her house through the website. User also could get report of the history of when and which Light that user turn off/on the Light. This report could be exported to the excel file.
- Monitoring temperature and humidity, this feature user get report of temperature and humidity of his/her house. There are some charts to compare temperature and humidity of the house in different time. The report could be exported in excel file and user could download it.
- Detecting fire, Light Controller and Home Sensing will remind user if there is fire or not in user's house. There is SMS Gateway feature to report if there is fire in user's house so user could be anticipate before the fire bigger.

Light controller is developed on Notepad++ and Arduino 1.0.5 in a computer running Windows OS. The hardware specification of this computer are 1.8 GHz Intel Core i3 3217U and 4GB RAM running in Windows 8.0. Light Controller will run on any devices that supports internet connection.

Beside a computer, the development of Light controller another things such as microcontroller, Ethernet Shield, router, modem 3G, Temperature and Humidity Sensor, and Fire Detector:

- For the microcontroller of Light Controller and Home Sensing is Arduino Uno. Arduino Uno is a microcontroller board based on the ATmega328.
- Ethernet Shield, without Ethernet Shield, Arduino could not connect to the internet. Ethernet Shield is an external board to connect Arduino to the internet.
- TP-Link 3G Wireless-N Router (TL-MR3020), the function of this hardware is used to connect 3G Modem to Arduino.
- 3G Modem, without this modem, router could not connect to the internet. This modem also important thing in Light Controller and Home Sensing.
- For the Temperature and Humidity Sensor, Light Controller and Home Sensing uses DHT11.
- Fire Detector, Fire Detector is a board to detect fire and send it to Arduino.

Table 3.1 Specification of DHT11

Measurement Range	Humidity Accuracy	Temperature Accuracy	Package
20-90%RH 0-50° C	±5%RH	±2° C	4 Pin Single Row

Figure 3.1 shows the use case of Home Controller and Home Sensing. Use-Case Diagram is a diagram that defines the functionality of a system and explains the whole system from user point of view. The elements in the use-case diagram termed as actors and use cases. For this system, there are 11 use-cases, which are: Login, Light Controller, Monitor Temperature and Humidity, Show Chart, Monitor Fire, SMS Notification Fire, Forgot Password, Send Temperature and Humidity, and Response.

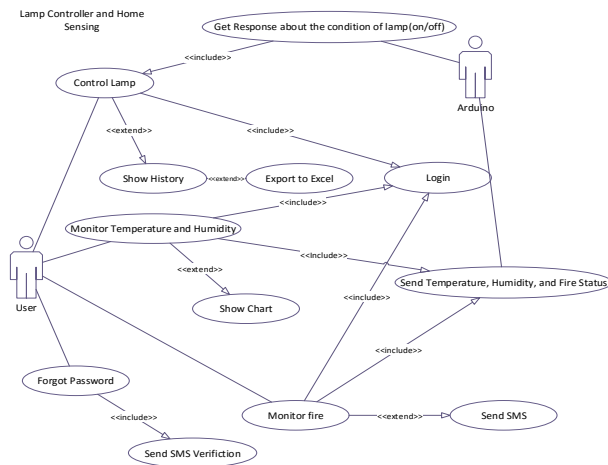


Figure 3.1 Use-Case Diagram for Light Controller and Home Sensing

To fulfill the goal and objectives, the hardware component specification must be fit and capable. Therefore, several components is needed to make the Light Controller and Home Sensing. List of Light Controller and Home Sensing components is listed in Table 3.2.

In this research, it needs an electrical circuit design. The main electrical circuit is showed in Figure 3.2 There are Arduino, breadboard, DHT 11, Fire Detector and two LEDs.

Arduino is set to be a web client. In this method, Arduino call PHP file in the server to receive or send the data. In this research, the temperature, humidity, and fire value stores to the database. Without php file, Arduino could not store the data directly to the database. PHP file is a translator between the Arduino and the database. That is why php file is needed. Arduino uses HTTP GET

request to send the value of the sensors to the database using PHP file.

For the light controller, Arduino is also set as web client. The step to control the light are first, PHP file reads the light status from the database and shows the light status. Then Arduino calls that PHP file with HTTP GET request. The Arduino get the light status from that PHP file. After Arduino gets the light status, Arduino execute whether on or off.

Table 3.2. Component

No	Hardware/Component	Amount (items)	Information
1	Arduino UNO	1	Microcontroller for Light Controller and Home Sensing.
2	Ethernet Shield	1	Ethernet Card for supporting Arduino to connect to the network.
3	Light	2	
4	DHT11	1	Temperature and Humidity Sensor.
5	Fire Detector	1	Sensor to detect fire.
6	Wires	-	All wires are used for connecting all electrical components.
7	BreadBoard	1	For testing an electrical circuit.
8	Router	1	For connecting 3G modem to Ethernet card.
9	3G Modem	1	For connecting to internet connection.
10	LAN Cable	1	For connecting router and ethernet card.

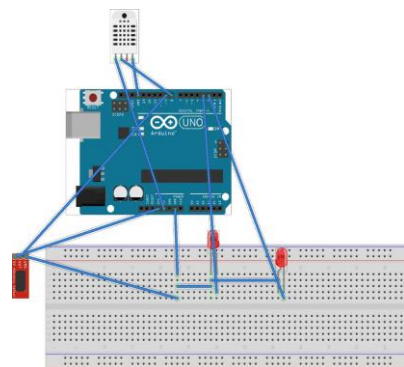


Figure 3.2. Electrical circuit design

Database is needed for this research. There are several table in this database such as user, light, log, and temp. In user table contains the detail of user information. In light table contains the light status. In the log table contains the transaction history of turn/off light. In the

temp table contains the value of all sensoring such as temperature, humidity, and fire status.

Arduino will post the sensors value and check the light status every +/- 20 seconds. Arduino is set as web client. Arduino calls PHP file in server which named status.php. For Ethernet shield, the libraries which is used are SPI.h and Ethernet.h. For the DHT 11, the library which is used is DHT.h. DHT 11 is controlled in pin 8. Light 1 is controlled in pin 2. Light 2 is controlled in pin 3. Fire detector is controlled in pin 9.

The homepage contains the main function of this research, there are lights controller, monitor temperature and humidity, and monitor fire status. There are three part of homepage. First is Arduino's Connection Status, second is Light Controller, and third is Home Sensing.

Auto Refresh

The homepage is set to automaticly refresh every 30 seconds.

Arduino's Connection Status

Arduino insert the sensors value to the database every +/-20 seconds. From that data, this system could know the connection of Arduino. If the different between the last record in temp table and now is bigger than +/-20 seconds, it means that Arduino has not good connection. If smaller than +/-20 seconds, it means that Arduino has good connection.

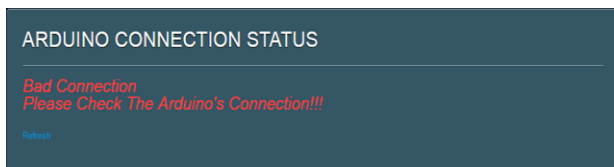


Figure 3.3. Bad Connection Status Interface

Light Controller

In this part, there are two switch to on/off the light. That switch is made by checkbox that is modified to become a switch. There is a button to open popup windows to show the history of trun on/off transaction. The swich condition is based on the database. If the status of light in the database is on, the switch also will be on. If the status of light in the database is on, the switch also will be off.



Figure 3.4. Light Controller Part

PHP File To Update Light Status

To update light status, there are two PHP file. That PHP file is saved in editstatus.php and editstatus2.php. In the first PHP file hadles the first light. The second handles second light.

Show History

In the end of this part, there is button to show the history. It will show the popup window to show the history.

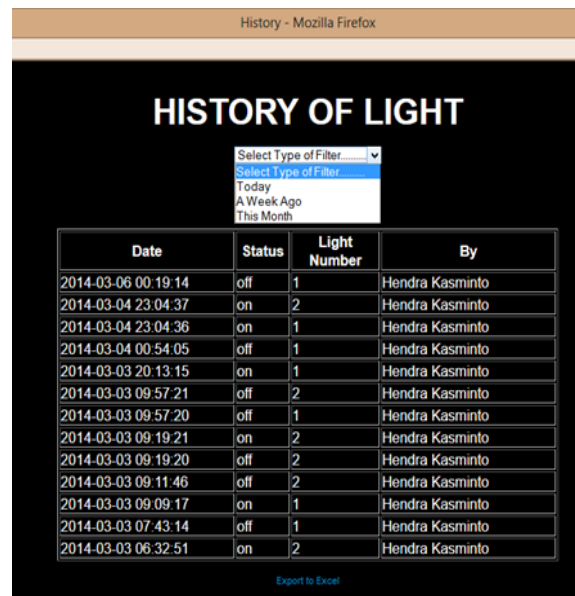


Figure 3.5. Popup Window Lamp History

Home Sensing

In this part contains all sensoring values that is recorded in database. In the begining there is a last record in the database (date, temperature, and humidity). In the middle there is today's average of temperature and humidity. Next there is a fire status from the last record in the database. In the end there is button to show the chart of temperature and humidity.



Figure 3.6. Home Sensing Part

4. Conclusions

All objectives of Light Controller and Home Sensing has successfully achieved which are:

1. Control lights through the internet.
2. Monitor the temperature and humidity.
3. Giving notification if there is fire.

References

- [1] Arduino. Introduction to Arduino [online] URL: <https://www.arduino.cc/en/Guide/Introduction>. Accessed: 24 August 2016.
- [2] Aries, Benjamin. RAD Life Cycle Model, Retrieved November 15, 2013, from ehow.com: http://www.ehow.co.uk/how-does_5272396_rad-life-cycle-model.html.
- [3] DHT11. From URL: <http://www.droboticsonline.com/arduinoBoardUno>, Retrieved on December 3rd, 2013
- [4] MiCasa Lite. From URL: <http://cybernetnews/control-light-with-your-iphone>, Retrieved on January 20th, 2014
- [5] UPB Home Automation. From URL: <http://homecontrols.com/Home-Controller-Android-App>, Retrieved on January 20th, 2014