# ECO HOME MONITORING SYSTEM

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I hereby declare that I have read this thesis and in my opinion this thesis/report is sufficient in terms of scope and quality for the award of the degree of Bachelor of Computer Science
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## ABSTRACT

Smart home is known among people as a luxurious set of gadgets that affordable only for elite group residence. The increase in house breaking cases trigger the need for a smart home security system for all houses. Therefore, with the rapid changing in information and communication technology (ICT), a web base system that called Economic Home Monitoring System or Eco Home Monitoring System is developed to control electrical home appliances by using Single Board Computer (SBC). By using one module of SBC that integrated by GPIO port for controlling the sensors in the electrical home devices, can tighten up the security, saving time and money. At the same time, the Eco Home Monitoring System also integrated with home camera system and home security system, which able the user to monitoring surrounding house are thru their smart smartphone, tablets, and personal computer. This Eco Home Monitoring System is user friendly, affordable and the important thing it is secure system.

# ABSTRAK

Rumah pintar dikenali di kalangan masyarakat sebagai satu set alat mewah yang mampu dimiliki hanya untuk kediaman kumpulan elit. Peningkatan kes-kes pecah rumah menjadikan satu keperluan untuk pembangunan sistem rumah pintar untuk keselamatan semua rumah. Oleh itu, dengan perubahan pesat dalam teknologi maklumat dan komunikasi (ICT), satu sistem asas web yang dipanggil “Economic Home Monitoring System” atau “Eco Home Monitoring System” dibangunkan untuk mengawal peralatan elektrik rumah dengan menggunakan “single board computer” (SBC). Dengan menggunakan satu modul SBC yang mempunyai GPIO port untuk mengawal sensor dalam peranti elektrik di sesebuah rumah, malahan juga boleh meningkatkan tahap keselamatan serta menjimatkan masa dan wang. Pada masa yang sama, “Eco Home Monitoring System” juga bersambung dengan sistem kamera rumah dan sistem keselamatan rumah, yang mampu membantu pengguna untuk memantau persekitaran rumah melalui telefon pintar, tablet, dan komputer peribadi. Selain itu, “Eco Home Monitoring System” adalah mesra pengguna, mampu milik dan yang paling penting ia adalah satu sistem yang selamat.

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# CHAPTER 1

# INTRODUCTION

## 1.1 OVERVIEW

The terms smart home, home networking, home automation, intelligent home have been used for more decade to introduce the concept of networking devices and equipment in the house. According to the Smart Homes Association the best definition of smart home technology is the integration of technology and services through home networking for a better quality of living [1].

Other terms that are related to smart homes are changeable home, aware house, ambient intelligence and attentive house. These terms are used to emphasize that the home environment should be able to respond and modify itself continuously according to its diverse residents and their changeable needs. For instance ambient intelligence is defined as a digital environment that is sensitive, adaptive and responsive to the presence of people [2]. Ambient intelligent will encompass the home, car, clothing, work and public places.

Smart home is known amongst people as a luxurious set of gadgets affordable only for elite group residence. The needs of home automation system probably will increase as the occurrences of housebreaking may involve any group of people. Therefore, with the new rapid changing in ICT, a web base system that is Eco Home Monitoring System could be develop to control the electrical home devices for our homes.

The Eco Home Control and Monitoring System is a control system by using a web based system to control the devices in the house. User will be able to turn on and off the device using a web browser. Other than that, user also can monitor the house via camera. For the security in the house, user can turn on the magnetic door switch to give an alert and sending an email to the user. This system also integrates with a few sensors like a motion, temperature, and light sensor. This system will uses to control and monitoring the home appliance which is located anywhere and everywhere in the house.

## 1.2 PROBLEM STATEMENT

- There are no controller and monitoring system using single board computer.
- There are no integration of controlling and monitoring with security system.
- Waste money to buy remote sensor to control with each devices.
- Waste electricity and time due to if we forget to turn off the switch.

## 1.3 OBJECTIVE

The objectives of this project are:

I. To design and develop a controller and monitoring system using a single board computer.

II. To verify that a web base system that can be integrate with GPIO port for controlling home electrical appliances and sensor due to save money and time.

III. To ensure that Eco Home Monitoring System will be useable towards users.

## 1.4 SCOPE

This study focused on home automation system architecture that will be useful to Malaysian market. The target group of this Eco Home Monitoring System probably for various group of income level.

The cost is more affordable than previous system available in the market. Prototype of this study will be developing within the period of two semesters. The development will focused on one module which is the Raspberry Pi on controlling the home appliances such as the lamps, fans, gate, sensor, camera, etc.

# CHAPTER 2

# LITERATURE REVIEW

## 2.1 INTRODUCTION

The objectives of this study are to introduce the raspberry pi competency in home automation system. Home automation system being known in the market as an expensive system, so not everybody can afford these devices. However, as the rapid growth of the technology increased the popularity of home automation began in the market positively. Therefore, the study of an eco-home automation system is being introduced to develop a product that will be affordable to the middle class income level. Before we proceed the architecture of Raspberry Pi and other devices, we need to review the current literature review on the related issues of home automation system. In this chapter, a literature review in support of the study will be carried out in the following 4 areas;

2.2 Overview of home automation
2.3 The benefits of home automation
2.4 The existing system
2.5 The problems with the current systems
2.6 Comparison of technologies

The literature review covers only the most relevant aspects of home automation in order to introduce the new technology used for home automation system.

## 2.2 OVERVIEW OF HOME AUTOMATION

### 2.2.1 HOME AUTOMATION TERMINOLOGY

Home automation technologies have remained out of reach of the mainstream consumers for a long time [3]. The high cost and custom installer requirements have restricted them to high end homes. The multitude of technologies in this space has also been detrimental to the adaption rate [3]. However the rise of smartphone and tables has suddenly brought about a big shift in the landscape.

Consistently the word ‘Automation’, ‘Home Automation’, ‘Smart Home’ or ‘Intelligent Homes’ every time is mentioned gives out the impression of exaggeration, luxurious desires or as show-off for their homes, through unlikely and in wise terms this is a simplification of the basic or so common functions around the house.

In home automation terminology, ‘scenes’ refer to the linking of devices in intelligent ways based on events [3]. Simple device-based control using a mobile app opens the door. But, one also needs a central device which can perform the orchestration [3].

### 2.2.2 THE HISTORY OF HOME AUTOMATION

Home automation system is not new in the market. In fact, it has been here for many years. The home automation technology has been introduced to the world for the last 30 years. However, for us the Malaysian market is thinking that to implement the home automation system in the house is very expensive. But, if the system more affordable, more people will purchase the devices and gadgets.

Despite interest in home automation, by the end of the 1990s there was not a widespread uptake with such systems still considered the domain of hobbyists or the rich. The lack of a single, simplified, protocol and high cost of entry has put off consumers [4].

## 2.3 THE BENEFITS OF HOME AUTOMATION

With home automation, we can experience a life of convenience and security. Other than that, we have the ability to control the small appliances and lighting, again with the simple tap of finger on favorite technological device such as smartphones and tablets. Not only to make sure that the lights are off when we are gone to save electricity, it also allows to turn them on at specific times if we would like it to look like someone are at home. This also helps increase the safety and security of our home.

Unfortunately, we just cannot be everywhere at once. This means that we often miss things that happen, perhaps even in our own home. With a home automation system, we can easily see what is happening at our home. Now we can me sure no unwelcome guest arrive unbeknownst to our home [5]. Security camera increase family safety by capturing clips when detecting movement or at specific times of the day or night.

## 2.4 EXISTING SYSTEM

Home automation system plays an important role in the modern life where concerned of safety is one of the foremost thoughts right after comfort. Many of studies have been conducted to develop the products at once to promote the benefits of this home automation system. There are a two existing system of home automation has been developed using various kind of technology:-

### 2.4.1 X10


Figure 2.1: X10 Lamp Module

X10 is the standard used to control other X10 connected devices using the building's built in eletctrical system to transmit the signals [6]. Lights and devices can be plugged into X10 modules such as the ones sold by Habitek [7]. The modules are the interface between devices and the power lines which receive the commands from an X10 control devices. This can be basic device such as a remote control [8]. Delivering X10 command to the relevant X10 modules or a controller that is software based and runs on some sort of computer. An example of such software is X10 Controller [9]. It uses a graphical user interface to control X10 modules both locally on the computer and across the web. It runs as windows

service which allows command to be issued when the computer is on, but the user isn't logged on [9].

#### 2.4.1.1 HOW X10 IS USED TO SEND COMMANDS

The theory of transmitting commands to the X10 devices consists of transmitting byte codes along a power line. To connect devices to a computer we need to use a two-way interface called CM12U (this is the U.K 240v version of 110v CM11A which will see widely used in home automation in the US [10]) connect to the Computer and then to the power line.

AC (alternating current) is the current that we have in our homes in the Malaysia. AC has a "current that changes polarity or direction, respectively, over time [11]" This type of current forms a sine wave as shown in Figure 2. Commands are sent along the power lines and "transmissions are synchronized to the zero crossing point of the AC power line".

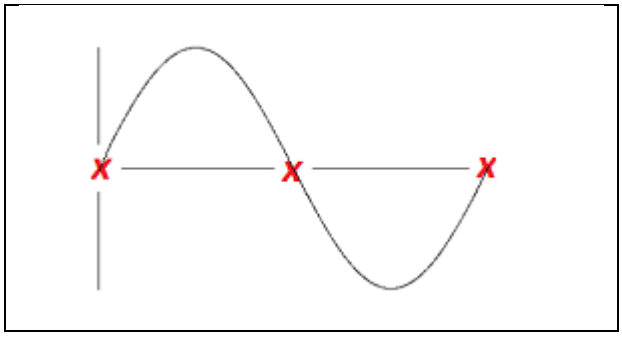

Figure 2.2: Sine Wave

The zero crossing points are when the sine curve crosses the x axes (as marked by the red crosses above). The transmitter provides a square sine wave [12].

"The rate of changing direction (from positive to negative) is called the frequency of the Alternating Current and is measured in hertz (Hz)" [13]. In the Malaysia our electricity is delivered to our homes with a frequency of 50Hz [13]. This mean that one cycle/sine wave take 1/50 seconds, which is 20 milliseconds.

X10 transmission is sent at the zero crossing point of the AC Sine Wave. The aim should be to transmit the data with a 200 microsecond threshold of the zero crossing point [12].

### 2.4.1.2 X10 DEVICE COMMANDS

X10 Device Commands consist of a bit "Start Code", followed by a "House Code" (denoted by letters A-P but transmitted in Binary), then followed by either a "Device Code" (denoted by number 1-16 but transmitted in Binary) or by a "Function Code", then followed by a "Function" bit which is tagged on to the end of the Device/Function code to let the X10 modules know whether it is an addressing command or a function command [13]

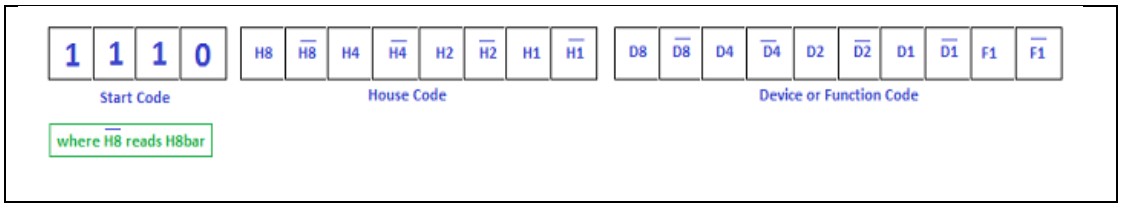


Figure 2.3: X10 Transmission Format

We first send a message consisting of the Start Code, House Code and Device Code. The next message we need to send consists of the Start Code, House Code and Function. Each message is sent in full twice, with at least three power line cycles

between each message [11].This does not apply with the dimming commands as then the message are sent continuously.

For example if we want to transmit the verbal command “turn on Device 1, in House A” we would send the following:

The house code for A is: 0110 The Device code for 1 is: 01100 The Function Code for On is: 00101

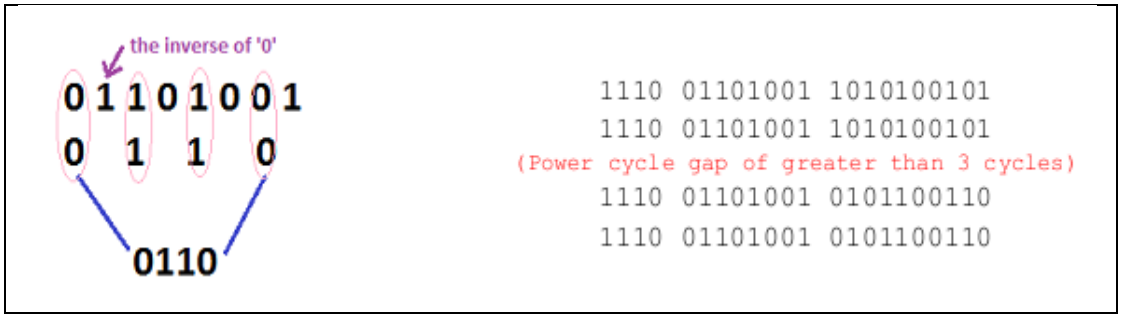


Figure 2.4: Decoding True bit and complement bit codes

### 2.4.2 INSTEON


Figure 2.5: Insteon Home Automation modules

Insteon is brand name for another alternative to X10. Insteon uses modules between each device and the power line. Each module acts as both a transmitter and a receiver, so no dedicated transmitter modules are required. Insteon technology is that it is backwards compatible with X10. People who already own X10 devices can use them in their Insteon network without the need to replace them. Developers at Insteon have looked more deeply into devices and looking at how they can control air-conditioning and heating system relatively easily, taking the home automation arguably to the next step past X10. The reason they wanted to develop this product was that they thought that there were reliability issues with X10 and wanted to improve on the X10 technology.

#### 2.4.2.1 HOW INSTEON SENDS COMMANDS

Insteon devices like X10 have to message methods, a standard and an extended message. The standard message length for Insteon is 10 byte.

| INSTEON Standard Message – 10 Bytes | | | | |
|---|---|---|---|---|
| 3 Bytes | 3 Bytes | 1 Byte | 2 Bytes | 1 Byte |
| From Address | To Address | Flags | Command 1, 2 | CRC[3] |

Table 2.1: Insteon Standard Message Structure

The Insteon messages are much larger than X10 message, they are as minimum 80bits (10 bytes) but 14 byte longer for extended messages. It does however mean that both the message and the command are stored together and sent together rather than in two separate messages as they are in X10.

## 2.5 PROBLEMS WITH THE CURRENT SYSTEM

The first clear disadvantages to some of the systems are cost. If money is not object then we can get some really great systems, but seeing as this is not the case for many people, budget is a key factor. If a product is to become successful it needs to be financial accessible to the mass market. X10 and Insteon system are not an option for a lot of people, therefore affordable plug and play and easily configurable solutions need developing, even if they do have slightly less functionality than the X10 and Insteon system.

The problem with current home automation system is that the home automation standards are extremely fragmented [11]. The problem with this is there is no universal

standard, and lots of protocols and devices are proprietary and this makes it harder for new system to be developed as quickly as we would like [12].

## 2.6 COMPARISON OF TECHNOLOGIES

Insteon and X10 are both designed to achieve very similar goals. Insteon offers a broader scope for development in the future and its mesh network topology should make the system more reliable of the two. Insteon is not currently available for sale in the Malaysia yet. Insteon prices in the US are considerably more expensive [13], but as Insteon is not sale in the Malaysia, it is hard to make a direct comparison.

## 2.7 SUMMARY

Form my research I then concluded with the main technologies that I will use in my own home automation system. I will use Raspberry Pi in my system as it is a relatively simple protocol that is ideal for developing a home automation system in the time scale I have. Python will be used as the main language for my system due to its multi-platform compatibility with Raspberry Pi.

# CHAPTER 3

# METHODOLOGY

## 3.1 INTRODUCTION

This chapter will discuss about the methodology use to complete this project. It will involve the planning, analyzing, preparation, designing, coding, testing and maintaining. The methodology that will be used is the Rapid Application Development (RAD). RAD makes the development process to be more credible one by facilitating a scope for the customer to actively provide inputs and feedback in the development process. This may also prove feasible from the point of view of a developer.

RAD is chosen for this project because RAD focused on building system rapidly in a very short amount of time and it is flexible and adaptable to change. RAD is suitable for this project because this project requires maintenance. This project will have a hardware and software. The system will communicate with the Raspberry Pi to the relay board and the sensors.

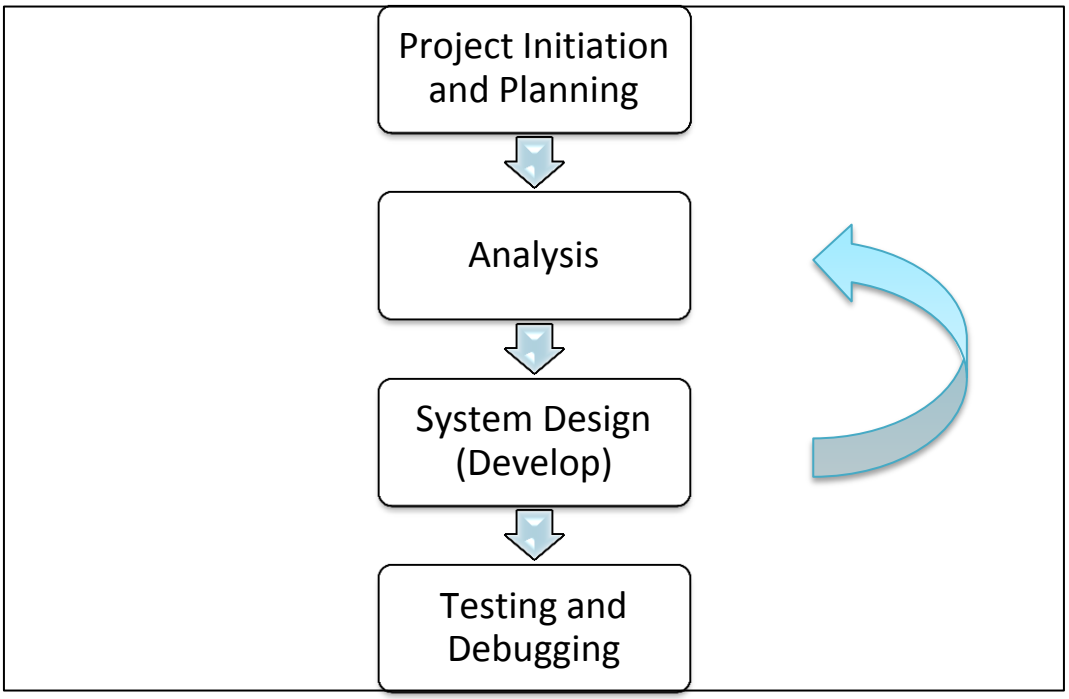


**Figure 3.1:** RAD Cycle

**Advantages of Rapid Application Development (RAD)**

- Flexible and Adaptable to change
- RAD realizes an overall reduction in project risk
- Can handle large project without problem
- Minimizes feature creep by developing in short intervals resulting in miniature software projects and releasing the product in mini-increments.
- Speed up the development by re-usability components
- Quality will be increases

## 3.2 PROJECT INITIATION AND PLANNING

In this stage of project, meeting and discussion between developer and customer is required to know how this project should be developed. The purpose of the development of this project also part of the consideration. The planning and initiation of the project will be discussed carefully to avoid misunderstanding between both parties. The meeting is between the home users and the developer. The system provider in the first place will play the role to explain and brief the developer regarding the operation of the system.

## 3.3 ANALYSIS

In this phase, the analysis has been done at home users house as a sample for the project development. This research analysis is to gather the information about the electrical design in the house. An interview has been made with the home users. Question is to collect data and specifies data requirement to know what are the requirements and weakness of current house they are faces. This is to solve the problem of monitoring and controlling electrical devices in the house. This phase also analyze the software and hardware requirement to create the system.

## 3.4 SYSTEM DESIGN

After analyzed all the part and data has been collected, the phase will concentrate on designing the system that will based on the data that have been collected and will meets the requirement. This project will be able controls and monitoring home appliances remotely via web browser. Other than that, this system also can show the temperature in the specific room in the house. User can control and monitoring the house by simply clicks on the button in the system. The concept is, this system will control the sensors or relay to do a specific job such as turn on and off the switch, lock a door, turn on the door alarm for the security in the house, view the temperature on the system if the user want to switch on or off the air conditioner, can monitor the house and capture the image from web camera

through the system, the system will log every activity when user turn on or off the switch, and also log when the sensor detect a motion if someone break the door. This system have a login features to make sure that there are security features to protect the system from unauthorized users.

Figure 3.2 will show the system design that will be implemented, it include the flow for the user. The user will be able to control and monitoring the electrical devices and view the devices status.

### 3.4.1 System Flow

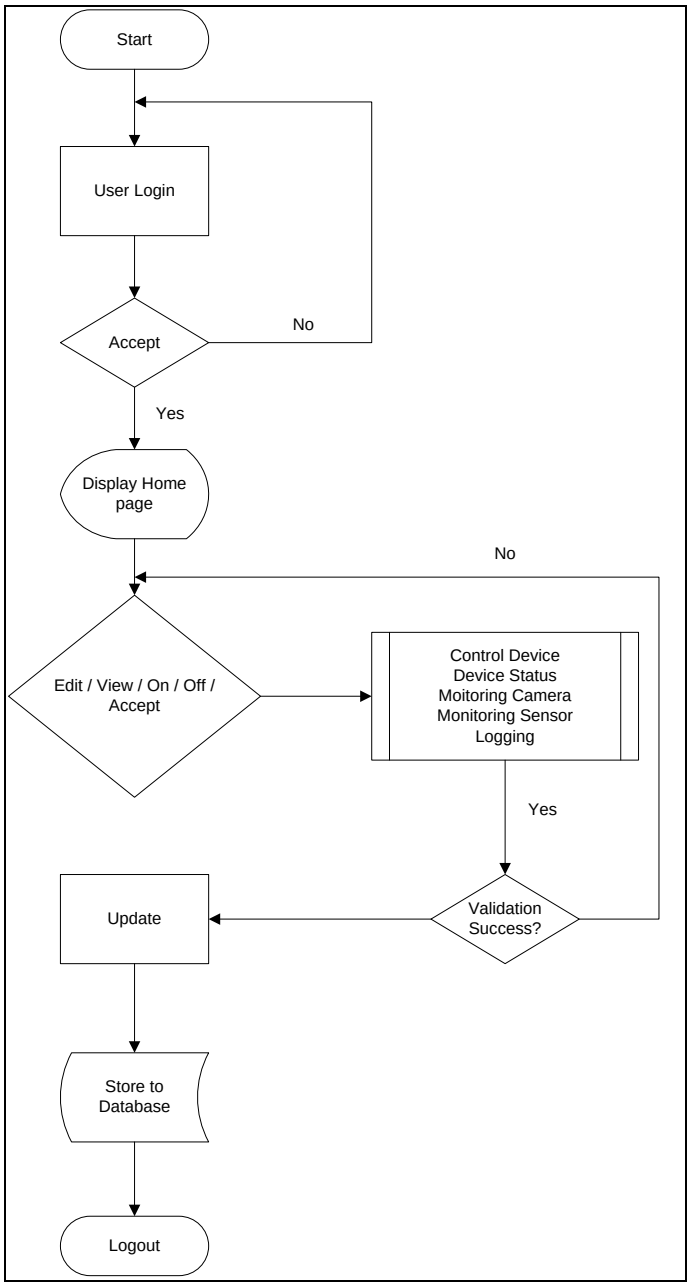


**Figure 3.2:** Flowchart

## 3.5 TESTING AND DEBUGGING

The EHMS will be tested in order to identify whether the system is in good condition and running successful or not. The system also will be tested whether the system meets the requirement or not. After the system has been tested, the debugging process will be run to find any error. The developer will make an alpha testing to make sure that this system is completely running in good condition and error free. The home users will be the tester for alpha testing.

## 3.6 DEVELOPMENT AND TOOLS

Developing the system requires appropriate software and hardware. This is to make sure the system will run as planned without any problem. Following are the requirement software and hardware for the development phase.

### 3.6.1 Hardware and Software Specification

**Table 3.1:** Hardware Specification

| **Hardware** | **Specification** | **Description** |
|---|---|---|
| Raspberry Pi | • 700Mhz Arm CPU<br>• RAM 512MB<br>• SD CARD 8GB<br>• HDMI Port<br>• 2x USB<br>• 1x 10/100 Ethernet Port<br>• GPIO port | To develop the system |
| Wifi Dongle | 150N | Connection to the router |
| Jumper wires | 30pcs of jumper wire | Connection between GPIO port to the relay board and the sensors. |
| LDR | Analog light sensor | Light sensor |
| PIR Sensor | Digital motion sensor | |
| Magnetic Door Switch | Switch | |
| Relay Board | 5v | To control the switch or any electrical devices. |
| LED | 5v | Indicator |
| Buzzer | 5v | Alarm sound |
| USB | • Connector<br>• Cable | For the connection between the hardware and the software |
| Board | • Circuit<br>• Bread | To place the electronic parts and test the electronic parts |

**Table 3.2:** Software and Purposes

| **SOFTWARE** | **PURPOSE** |
|---|---|
| Debian Linux | ▪ The platform for a system and software to run<br>▪ Will be used to develop the system |
| Apache | ▪ The server that running PHP scripts<br>▪ The platform for creating the user interfaces and programs the system. |
| MYSQL | ▪ Database |
| Microsoft Office<br>▪ Microsoft Word 2010<br>▪ Microsoft Project 2010<br>▪ Microsoft Power Point 2010<br>▪ Microsoft Visio 2010 | ▪ To prepare the documentation and proposal<br>▪ Create planning, and Gantt Chart<br>▪ To prepare the slide for the presentation<br>▪ To Design and draw chart and diagram |
| Adobe<br>▪ Reader | ▪ To read the related article with the project |
| Web Browser Mozilla Firefox | ▪ To access the internet and search related information. |
| Putty | ▪ Remote configuration |
| WinSCP | ▪ Transferring files |

### 3.6.2 RASPBERRY PI

The Raspberry PI is a single board computer developed in the United Kingdom by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools [14]. Raspberry Pi is a Linux-based, single-board computer with a 700MHZ ARM architecture CPU, 512 Mbytes of RAM, two USB ports, and 10/100 Ethernet controller. The 45-gram machine measures 85.6 x 53.98 x 17 millimeters, not including the SD card and connectors. The Raspberry Pi foundation started work in 2009 to produce an inexpensive computer that young people could use to learn programming.

The unique of Raspberry PI compare with other SBC in the market because it has a GPIO port. Raspberry PI has a 26 pins that provide GND, 3.3v, 5v, I2C, SPI, UART and plus the GPIO pins. The GPIO port on Raspberry PI is use to read a sensor and control the relays.

Raspberry PI running a Linux operating system, so the user can install a web server, database, java application and any Linux package on it [14]. Raspberry PI support many programming language to control the GPIO port for the examples is Python, C++, C#, Ruby, Java and the PHP. As a result, the Raspberry PI is a powerful single-board computer that suitable to develop a Home Automation System.

### 3.6.3 GENERAL PURPOSE INPUT/OUTPUT (GPIO)

General Purpose Input/ Output (GPIO) is a generic pin on a chip whose behavior including whether it is an input or output pin that can be controlled by the user at run time. When debugging, GPIO port usually used to input some commands, trigger interrupts for testing the embedded system [13]. The traditional GPIO ports do no gave abilities of complex signal detecting and interrupts. It is a limit to debugging complicated system.

The purposed GPIO with event-capture can provide more powerful capability of detecting of signals which pass through the GPIO ports. User can configer some registers in the purpose GPIO, and then the event-capture module of the GPIO detects signals pass through the GPIO ports, captures configured events, and then generates corresponding interrupts.

### 3.6.4 PYTHON PROGRAMMING LANGUAGE

Python was conceived in the late 1980s and its implementation was started in December 1989 by Guido van Rossum at CWI in the Netherlands as a successor to the ABC programming language capable of exception handling and interfacing with the Amoeba operating system [16]. Python is a remarkably powerful dynamic programming language that is used in a wide variety of application domains. Python is often compared to Tcl, Perl, Ruby, Scheme or Java [17].

To develop a Eco Home Automation System is easily using the python programming language. Python programming Language are suitable to make combination to other programming language such as PHP and SQL. As a result, the main programming language to develop this system is using python programming language.

### 3.6.5 HYPERTEXT MARKUP LANGUAGE (HTML)

HTML is a authoring or computer language that will allow for creation documents of website. Website that has been created can be viewed by anyone else as long they connected to the internet. It defines the structure and layout of a Web document by using a variety of tags and attributes. HTML is actually stands for HyperText Markup Language. HyperText is the method that brought user to move around the web. User need to click on the special text known as ‘hyperlinks’ in order to proceed to next page. Markup is what HTML tags do to the text inside them, it will be mark as certain type of text such as *italicized* text [18].

HTML consist a series of short codes that has been typed into a text file. HTML documents must be in text only and not in other formats. Next, saved the file as a html file and viewed through a browser such as Internet Explorer or Mozilla Firefox. The browser then reads the file and translates the text into a visible form.

### 3.6.6 HyperText Preprocessor (PHP)

PHP is a server-side scripting language for creating dynamic Web pages. Normally, the pages will be created using PHP and HTML. A PHP script is not sent directly to a client by the server but it is passed by the PHP binary which is server side installed. PHP code is interpreted and executed. The PHP code in a script can query databases, create images, read and write files and so forth.

PHP is an open source and cross platform. It has many open source libraries including core build which are readily available. Extension function is to help PHP interface with a number of systems including IRC, a number of compression formats. Besides that, there are also other extensions to let PHP generate file formats on-the-fly which will allows PHP to create Macromedia Flash movies.

The output from the PHP coding will be combined with HTML in the script and the result server will process the PHP commands and send the results to the user's web browser. Thus, user or client would not be able to know whether the web uses PHP in the scripting or not as all that can be seen is only HTML.

### 3.6.7 Javascript

JavaScript is a very simple scripting language that used in web browser to make websites more dynamic. JavaScript is use together with HTML. HTML is more or less static pages. When user loads the page, the view of the page would not be change much until user click a link which will lead to another page. By adding JavaScript code, it would allow to change the look of document completely. It could change the text, color, change the options that available in a drop down list and so forth.

JavaScript is a client-side language. All the action occurs on the client's side of things. It means that, there will be no trips or transaction to the server required for any operation. The trips to server will only slow down the process and cause increase the

processing time. Therefore, the code of JavaScript will help to reduce the process time and performed its job instantaneously. The example of the operation is request input validation. This task will speeds up the process.

### 3.6.8 Database

A database is an application that manages data and allows fast storage and also retrieval of data. Database is actually a collection of information that is organized so that it could be managed, accessed and updated easily. Database can be classified according to the types of their contents such as bibliographic, document-text, numeric and images. Digital databases are managed using database management systems which store the databases contents allowing data creation, maintenance, search and other access like mentioned earlier on.

A very basic form of database is a spreadsheet. Spreadsheet allows user to catalog information easily. However, user need database management in order to find the relationship in the data on the spreadsheet. Example of spreadsheet is Microsoft Excel. Same as Microsoft Excel tables, database consists of columns and rows. Each column contains different types of attributes and each row corresponds to a single record. Besides that, database can go beyond that. It could allow user to access information in new ways and apply the information in different formats such as Web pages.

### 3.6.9 Structured Query Language (SQL)

SQL which is stands for Structured Query Language is a computer language database. According to American National Standards Institute (ANSI), SQL is the standard language for relational database management systems (RDBMS). SQL can be divided into two classes. They are Data Manipulation Language (DML) which is use for retrieving and storing data and the other class is Data Design Language (DDL) which is for creating, altering and dropping tables [19].

Programs on the client computer allow users to manipulate data using table, columns, rows and field. This operation need the client programs send SQL statements to the server. Server then will process these statements and returns the reply to the client program. Some common relational database management systems that use SQL are Oracle, Sybase, Microsoft SQL Server, Access and so forth. Even though most of the database systems use SQL, but they also have own proprietary extensions that are usually used only in their systems. However, the common SQL statements such as 'Select', 'Insert', 'Update', 'Delete' and 'Create' can be used to accomplish almost every basic needs of database in systems.

### 3.6.10 MySQL Database

MySQL is a relational database management system (RDBMS) based on SQL. It was released in January 1998. Many Internet startups became interested in the original open source version of MySQL as an alternative to the proprietary database systems from Oracle, IBM, and Informix. MySQL runs on virtually all platforms, including Linux, Unix, and Windows. It is fully multi-threaded using kernel threads and provides application program interfaces (APIs) for many programming languages such as C, C++l, Java, PHP and Python. There are few advantages by using MySQL database:

1. Provide consistent fast performance.
2. Has high reliability.
3. Easy to use.
4. Save cost.

## 3.7 CONCLUSION

Rapid application development has been chosen for this project because RAD is the flexible and adaptable to change. This will help when this system have a constraints and update in the future. Other than that RAD is efficient in developing for small system in a very short amount of time rapidly

The Hardware and Software that have been chosen to develop this project has been listed. The requirement for hardware and software is very important because it is to make sure that this project complete within the time schedule.

# CHAPTER 4

# DESIGN AND IMPLEMENTATION PLAN

## 4.1 IMPLEMENTATION

The purpose of this chapter is to document the whole processes in the project development. In Rapid Application Development (RAD) methodology, Implementation is conducted after the Development phase. This chapter covers the implementation of the Eco Home Monitoring System. The implementation for the system is including the system coding, debugging and documenting. The coding includes the structure of coding system that is used to run the functionality in this system. The coding is able to interact with the GPIO on the Raspberry Pi to execute the function on the circuit board.

## 4.2 DATABASE CONSTRUCTION

Database is the most important things that need to be constructed during the initial stage of implementation. Database for Eco Home Monitoring System is constructing using PhpMyAdmin. PhpMyAdmin is a tool written in PHP intended to handle the administration of MySQL over the Web. The database for this system is to record a user data, control the GPIO activities and for logging an activities.

| # | Column | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| 1 | **userID** | int(11) | | | No | *None* | AUTO_INCREMENT | Change Drop More |
| 2 | **username** | varchar(28) | utf8_unicode_ci | | No | *None* | | Change Drop More |
| 3 | **password** | varchar(64) | utf8_unicode_ci | | No | *None* | | Change Drop More |

Figure 4.1: User table in MySQL

| # | Column | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| 1 | **pinID** | int(11) | | | No | *None* | AUTO_INCREMENT | Change Drop More |
| 2 | **pinNumber** | varchar(2) | utf8_unicode_ci | | No | *None* | | Change Drop More |
| 3 | **pinDirection** | varchar(3) | utf8_unicode_ci | | No | *None* | | Change Drop More |

Figure 4.2: GPIO Pin Direction table in MySQL

| # | Column | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| 1 | **logid** | int(30) | | | No | *None* | AUTO_INCREMENT | Change Drop More |
| 2 | **logdate** | date | | | No | *None* | | Change Drop More |
| 3 | **logtime** | time | | | No | *None* | | Change Drop More |
| 4 | **action** | varchar(30) | latin1_swedish_ci | | No | *None* | | Change Drop More |
| 5 | **description** | varchar(30) | latin1_swedish_ci | | No | *None* | | Change Drop More |

Figure 4.3: Logging Table in MySQL

| # | Column | Type | Collation | Attributes | Null | Default | Extra | Action |
|---|---|---|---|---|---|---|---|---|
| 1 | **alarmid** | int(11) | | | No | *None* | AUTO_INCREMENT | Change Drop More |
| 2 | **alarmdate** | varchar(200) | utf8_unicode_ci | | No | *None* | | Change Drop More |
| 3 | **alarmtime** | varchar(200) | utf8_unicode_ci | | No | *None* | | Change Drop More |
| 4 | **alarmstatus** | varchar(200) | utf8_unicode_ci | | No | *None* | | Change Drop More |

Figure 4.4: Security Logging table in MySQL

## 4.3 User Interface Construction

User Interface design is important for several reason. Basically, the intuitive of user interface is easy to use it and reduce the training costs due to the straightforward to train people to use this system. User-friendly interfaces attract more users to use it and increasing the user satisfaction with the system. PHP, HTML and CSS script language is used in develop the interface in this system.


Figure 4.5: Login Interface


Figure 4.6: Main Page (Controlling Devices) Interface


Figure 4.7: Camera (Monitoring) Interface

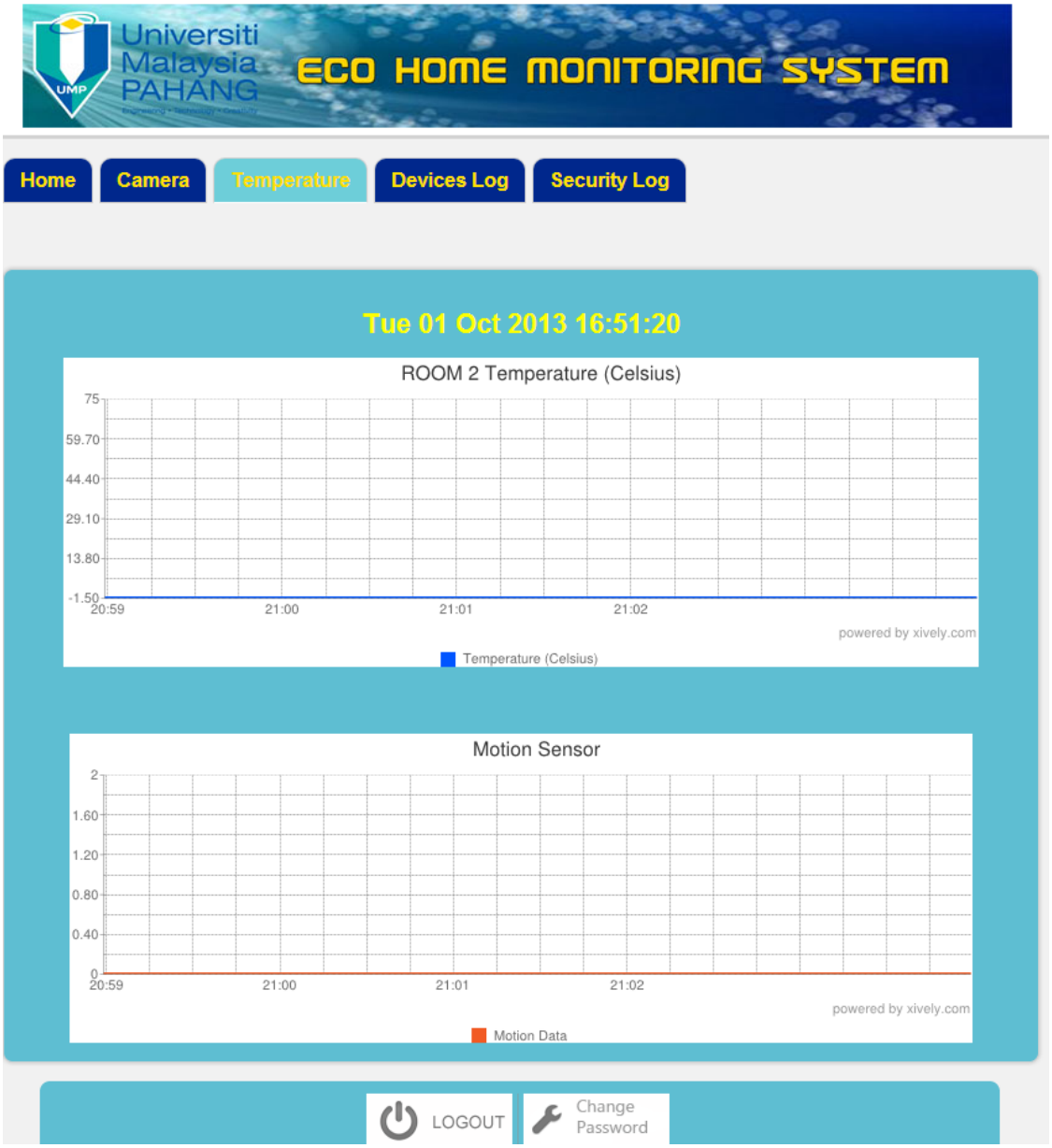


Figure 4.8: Temperature Sensor (Monitoring) Interface


Figure 4.9: Devices Logging Interface


Figure 4.10: Security Log Interface

## 4.4 PROCESS FLOW

The most important part in any project development or the implementation plan is establishing the process flow of the system. A process flow is a diagram commonly used in engineering to indicate the general flow of plant processes and equipment. The process flow displays the relationship between major function of the system. Typically, process flow diagrams of a single unit process. Without process flows, developers are not able to determine the exact result of the system and thus achieving the objectives set for the project. Based on this project there is one process flow to show how the project flows.

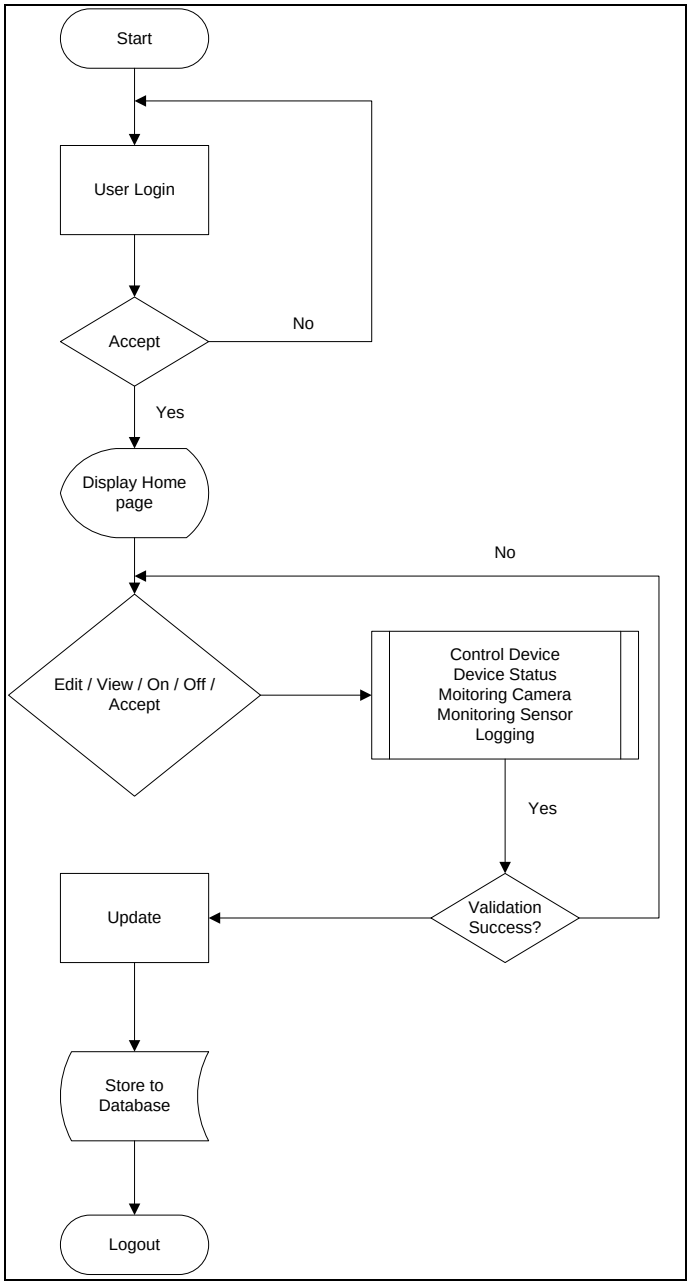


Figure 4.11: Process Flow of the system

## 4.5 CODING

```
session_start();

$MySQLUsername = "root";
$MySQLPassword = "";

$MySQLHost = "localhost";
$MySQLDB = "Ecc";

If (($MySQLUsername == "USERNAME HERE") || ($MySQLPassword == "PASSWORD HERE")){
    print 'ERROR - Please set up the script first';
    exit();
}
```

Figure 4.12: Database Connection

```
If ((isset($_POST['username'])) && (isset($_POST['password']))){
    $username = mysql_real_escape_string($_POST['username']);
    $password = mysql_real_escape_string($_POST['password']);
    $loginQuery = "SELECT UserID, password, salt FROM users WHERE username = '$username';";
    $loginResult = mysql_query($loginQuery);
    If (mysql_num_rows($loginResult) < 1){
        mysql_close();
        header('location: index.php?error=incorrectLogin');

    }
    $loginData = mysql_fetch_array($loginResult, MYSQL_ASSOC);
    $loginHash = hash('sha256', $loginData['salt'] . hash('sha256', $password));
    If ($loginHash != $loginData['password']){
        mysql_close();
        header('location: index.php?error=incorrectLogin');
    } else {
        session_regenerate_id();
        $_SESSION['username'] = "admin";
        $_SESSION['userID'] = "1";
        mysql_close();
        header('location: index.php');
    }
```

```
';<div id="page_login">

  <div id="login">
  <form name="login" action="index.php" method="post">
  <tr>
  <td>Username: </td><td><input type="text" name="username"></td>
  </tr>
  <tr>
  <td>Password: </td><td><input type="password" name="password"></td>
  </tr>
  <tr>
  <td colspan="2" align="center"><input type="submit" value="Log In"></td>
  </tr>
  </form>
  </div>
```

Figure 4.13: Login

```
$dbConnection = mysql_connect($MySQLHost, $MySQLUsername, $MySQLPassword);
mysql_select_db($MySQLDB, $dbConnection);
If (isset($_POST['action'])){
    If ($_POST['action'] == "setPassword"){
        $password1 = $_POST['password1'];
        $password2 = $_POST['password2'];
        If ($password1 != $password2){
            header('Location: index.php');
        }
        $password = mysql_real_escape_string($_POST['password1']);
        If (strlen($password) > 28){
            mysql_close();
            header('location: index.php');
        }
        $resetQuery = "SELECT username, salt FROM users WHERE username = 'admin';";
        $resetResult = mysql_query($resetQuery);
        If (mysql_num_rows($resetResult) < 1){
            mysql_close();
            header('location: index.php');
        }
        $resetData = mysql_fetch_array($resetResult, MYSQL_ASSOC);
        $resetHash = hash('sha256', $salt . hash('sha256', $password));
        $hash = hash('sha256', $password);
        function createSalt(){
            $string = md5(uniqid(rand(), true));
            return substr($string, 0, 8);
        }
        $salt = createSalt();
        $hash = hash('sha256', $salt . $hash);
        mysql_query("UPDATE users SET salt='$salt' WHERE username='admin'");
        mysql_query("UPDATE users SET password='$hash' WHERE username='admin'");
        mysql_close();
        header('location: index.php');
    }
```

```
If (isset($_GET['action'])){
    If ($_GET['action'] == "logout"){
        $_SESSION = array();
        session_destroy();
        header('Location: index.php');
    } else If ($_GET['action'] == "setPassword"){
        print '
<html xmlns="http://www.w3.org/1999/xhtml">
    <head>
    <meta http-equiv="Content-Type" content="text/html; charset=UTF-8" />
    <meta http-equiv="Content-Style-Type" content="text/css" />
    <meta name="viewport" content="width=device-width, user-scalable=no" />
    <meta name="format-detection" content="telephone=yes">
    <link rel="shortcut icon" href="images/favicon.png" />
    <link rel="stylesheet" href="css/stylea.css" type="text/css" media="screen" />
    <script src="js/jquery.min.js"></script>
    <title>Eco Home Monitoring System</title>
    </head>
    <body>
        <div id="nav">
        <span><img src="images/banner2.jpg" id="home" border="0"></span>
        </div>
 <div id="page_login">

    <div id="login">
        <form name="changePassword" action="index.php" method="post">
        <input type="hidden" name="action" value="setPassword">
        <p>Enter New Password: <input type="password" name="password1">
Confirm: <input type="password" name="password2"><input type="submit" value="submit"></p>
        </form>
    </div>
```

Figure 4.14: Change Password

```
$action = $_GET['action'];
$pin = mysql_real_escape_string($_GET['pin']);
if ($action == "turnOn"){
    $setting = "1";
    $action = "turn ON";
    $date = date("Y-m-d");
    $time = date("h:i:s");
    $query = mysql_query("SELECT pinDescription FROM pinDescription WHERE pinNumber='$pin';");
    $descRow = mysql_fetch_assoc($query);
    $description = $descRow['pinDescription'];
    mysql_query("UPDATE pinStatus SET pinStatus='$setting',date_on='$date',time_on='$time' WHERE pinNumber='$pin';");
    $query2 = "INSERT INTO pinlogging VALUES('$logid','$date','$time','$action','$description')";
    $sql = mysql_query ($query2) or die (mysql_error());
    mysql_close();
    header('Location: index.php');
} else If ($action == "turnOff"){
```

```
while ($currentGPIOCount < $totalGPIOCount){
    $pinRow = mysql_fetch_assoc($query);
    $descRow = mysql_fetch_assoc($query2);
    $pinNumber = $pinRow['pinNumber'];
    $pinStatus = $pinRow['pinStatus'];
    $pinDescription = $descRow['pinDescription'];
    $pintemp = $descRow['pintemp'];
    If ($pinStatus == "0"){
        $buttonValue = "Turn On";
        $action = "turnOn";
        $image = "off.jpg";
    } else {
        $buttonValue = "Turn Off";
        $action = "turnOff";
        $image = "on.jpg";
    }
    print '<tr bgcolor="faffbd">';
    print '<td align="center">' .
    $pinDescription . '</td><td align="center"><img src="' .
    $image . '" width="50"></td><td align="center" valign="middle"><form name="pin'
    . $pinNumber . 'edit" action="index.php" method="get"><input type="hidden"
    name="action" value="' . $action . '"><input type="hidden" name="pin" value="'
    . $pinNumber . '"><input style="cursor: pointer;" type="submit" value="'
    . $buttonValue . '"></form></td><td><form name="pin' . $pinNumber . '"
    action="index.php" method="get"><input type="hidden" name="action"
    value="edit"><input type="hidden" name="pin" value="' . $pinNumber . '">
    <input style="cursor: pointer;" type="submit" value="Edit"><td align="center">
    ' . $pintemp . '</td></form></td>';
    print '</tr>';


    $currentGPIOCount ++;
```

Figure 4.15: Control Devices

```
$action = $_GET['action'];
$pin = mysql_real_escape_string($_GET['pin']);
if ($action == "turnOn"){
    $setting = "1";
    $action = "turn ON";
    $date = date("Y-m-d");
    $time = date("h:i:s");
    $query = mysql_query("SELECT pinDescription
    FROM pinDescription WHERE pinNumber='$pin';");
    $descRow = mysql_fetch_assoc($query);
    $description = $descRow['pinDescription'];
    mysql_query("UPDATE pinStatus SET pinStatus='$setting',
    date_on='$date',time_on='$time' WHERE pinNumber='$pin';");
    $query2 = "INSERT INTO pinlogging VALUES('$logid',
    '$date','$time','$action','$description')";
    $sql = mysql_query ($query2) or die (mysql_error());
    mysql_close();
    header('Location: index.php');
} else If ($action == "turnOff"){

    $setting = "0";

    $date = date("Y-m-d");
    $time = date("h:i:s");
    $action = "turn OFF";
    $query = mysql_query("SELECT pinDescription
    FROM pinDescription WHERE pinNumber='$pin';");
    $descRow = mysql_fetch_assoc($query);
    $description = $descRow['pinDescription'];
    mysql_query("UPDATE pinStatus SET pinStatus='
    $setting',date_off='$date',time_off='$time'
    WHERE pinNumber='$pin';");
    $query2 = "INSERT INTO pinlogging VALUES('$logid',
    '$date','$time','$action','$description')";
    $sql = mysql_query ($query2) or die (mysql_error());
    mysql_close();
    header('Location: index.php');
} else IF ($action =="edit"){
    $pin = mysql_real_escape_string($_GET['pin']);
    $query = mysql_query("SELECT pinDescription
    FROM pinDescription WHERE pinNumber='$pin';");
    $descRow = mysql_fetch_assoc($query);
    $description = $descRow['pinDescription'];
```

Figure 4.16: Devices Control Logging

```
mysql_select_db(gpio);
$per_page = 10;
$pages_query = mysql_query("SELECT COUNT(logid) FROM pinlogging");
$pages = ceil(mysql_result($pages_query,0)/$per_page);
if(!isset($_GET['page']))
{
    header("location: logging.php?page=1");

}
else
{
    $page = $_GET['page'];
}
$start = (($page-1)*$per_page);

$query = mysql_query("SELECT * FROM pinlogging ORDER BY logid DESC LIMIT $start,$per_page");
        WHILE($rows = mysql_fetch_array($query))
        {
         $logid = $rows['logid'];
            $date = $rows['logdate'];
            $time = $rows['logtime'];
            $action = $rows['action'];
         $description = $rows['description'];

  print'

    <td style="padding: 5px;" valign="top">';
        print'' .$date. ' <br>
      </td>
    <td style="padding: 5px;" valign="top">
    ' .$time. '<br>
</td>

                    <td style="padding: 5px;" valign="top">

                    ' .$action. '<br>

                    </td>
```

Figure 4.17: Show Devices Control Logging

```
<center><iframe src="http://192.168.43.2:8083/?action=stream"
width="320" height="320" frameborder="0" scrolling="no"></iframe>
</center>
<center><h1><a href="http://192.168.43.2:8083/?action=snapshot"
 target="_blank"><font color="red">Capture Image</font></a></h1>
 </center>
```

Figure 4.18: Monitor Live Camera

```
if (isset($_POST['startlightsensor']))
    {
        exec('sudo /etc/init.d/lightsensor start');
    }
if (isset($_POST['stoplightsensor']))
    {
        exec('sudo /etc/init.d/lightsensor stop');
    }
if (isset($_POST['startdooralarm']))
    {
        exec('sudo /etc/init.d/dooralarm start');
    }
if (isset($_POST['stopdooralarm']))
    {
        exec('sudo /etc/init.d/dooralarm stop');
    }

print'  ';
<center>
<div id="page3"><br> <h1>Sensor Control<h1><center>
<br> <form method="post">


    <p> <button name="startlightsensor">Start</button>
    <button name="stoplightsensor">Stop</button></p>
    <p> <button name="startdooralarm">Start</button>
    <button name="stopdooralarm">Stop</button></p>
```

Figure: 4.19: Sensor Control

```
mysql_select_db(gpio);
$per_page = 10;
$pages_query = mysql_query("SELECT COUNT(alarmid) FROM pinalarm");
$pages = ceil(mysql_result($pages_query,0)/$per_page);
if(!isset($_GET['page']))
{
    header("location: securitylog.php?page=1");

}
else
{
    $page = $_GET['page'];
}
$start = (($page-1)*$per_page);

$query1 = mysql_query("SELECT * FROM pinalarm ORDER BY alarmid DESC LIMIT $start,$per_page" );

        WHILE($rows = mysql_fetch_assoc($query1))
        {
         $alarmid = $rows['alarmid'];
            $alarmdate = $rows['alarmdate'];
            $alarmtime = $rows['alarmtime'];
            $alarmstatus = $rows['alarmstatus'];

  print'

    <td style="padding: 5px;" valign="top">';
        print'' .$alarmdate. '
    <br>
        </td>
    <td style="padding: 5px;" valign="top">
    ' .$alarmtime. '
    <br>
    </td>
    <td style="padding: 5px;" valign="top">
    <font color=yellow>' .$alarmstatus. '</font>
    <br>
    </td>
    <td style="padding: 5px;" valign="top">
    <a href="deletesecuritylog.php?alarmid=' . $alarmid .
    '"onclick="return confirm("Are you sure you want to delete?")">[Delete]</a>
    <br>
    </td>
</tr>
```

Figure 4.20: Show Security Logging

```
import time
import datetime
import RPi.GPIO as io
import os
import MySQLdb
conn = MySQLdb.connect('localhost','root','','Eco');


io.setmode(io.BCM)
pir_pin = 8
door_pin = 14
io.setup(22, io.OUT)
io.setup(pir_pin, io.IN)
io.setup(door_pin, io.IN, pull_up_down=io.PUD_UP)

while True:
    cursor = conn.cursor();
    today = datetime.date.today()
    masa = time.strftime('%H:%M:%S')
    if io.input(pir_pin):
        print("PIR ALARM!")
        print today
        print masa
        cursor.execute("INSERT INTO pinalarm
        (alarmdate, alarmtime, alarmstatus)
        VALUES (%s, %s, %s)", (today, masa,
        'motion detected!!'))

    if io.input(door_pin):
        print("DOOR ALARM!")
        res1 = say("intruder")
        cursor.execute("INSERT INTO pinalarm
        (alarmdate, alarmtime, alarmstatus)
        VALUES (%s, %s, %s)", (today, masa,'Door is open!'))
    io.output(22, True)

    else:
    io.output(22, False)

    time.sleep(1)
    conn.commit()
io.cleanup()
```

Figure 4.21: Door Alarm (Python)

```
import RPi.GPIO as GPIO
import time
import os

DEBUG = 1
GPIO.setmode(GPIO.BCM)
GPIO.setup(27, GPIO.OUT)


def RCtime (RCpin):
    reading = 0
    GPIO.setup(RCpin, GPIO.OUT)
    GPIO.output(RCpin, GPIO.LOW)
    time.sleep(.5)

    GPIO.setup(RCpin, GPIO.IN)

    while (GPIO.input(RCpin) == GPIO.LOW):

        reading += 1

    return reading

while True:
    if RCtime(15) > 1000:
        GPIO.output(27, True)
    if RCtime(15) < 500:
        GPIO.output(27, False)

GPIO.cleanup()
```

Figure 4.22: Light Sensor (Python)

```
#!/usr/bin/env python
import time
from time import sleep;
import os
import RPi.GPIO as GPIO
import eeml
import MySQLdb
import datetime
from datetime import timedelta
GPIO.setmode(GPIO.BCM)
conn = MySQLdb.connect('localhost','root','','Eco');

DEBUG = 1
LOGGER = 1

def readadc(adcnum, clockpin, mosipin, misopin, cspin):
        if ((adcnum > 7) or (adcnum < 0)):
                return -1
        GPIO.output(cspin, True)

        GPIO.output(clockpin, False)
        GPIO.output(cspin, False)

        commandout = adcnum
        commandout |= 0x18
        commandout <<= 3
        for i in range(5):
                if (commandout & 0x80):
                        GPIO.output(mosipin, True)
                else:
                        GPIO.output(mosipin, False)
                commandout <<= 1
                GPIO.output(clockpin, True)
                GPIO.output(clockpin, False)

        adcout = 0

        for i in range(12):
                GPIO.output(clockpin, True)
                GPIO.output(clockpin, False)
                adcout <<= 1
                if (GPIO.input(misopin)):
                        adcout |= 0x1

        GPIO.output(cspin, True)
```

```
SPICLK = 18
SPIMISO = 23
SPIMOSI = 24
SPICS = 25

GPIO.setup(SPIMOSI, GPIO.OUT)
GPIO.setup(SPIMISO, GPIO.IN)
GPIO.setup(SPICLK, GPIO.OUT)
GPIO.setup(SPICS, GPIO.OUT)
pirPin = 8
motionCount = 0
GPIO.setup(pirPin, GPIO.IN)

API_KEY = 'cfA-bP_HD1HrV1Nn1qU4Ihn075-SAKxDWE9xdlVWdms2Yz0g'
FEED = 120883

API_URL = '/v2/feeds/{feednum}.xml' .format(feednum = FEED)

adcnum = 0
adcnum1 = 1
while True:


        cursor = conn.cursor();
        read_adc0 = readadc(adcnum, SPICLK, SPIMOSI, SPIMISO, SPICS)
        analog_hum_value = readadc(adcnum1, SPICLK, SPIMOSI, SPIMISO, SPICS)

        millivolts = read_adc0 * ( 3300.0 / 1024.0)
        temp_C = (((millivolts) / 10.00)-1.50)
        humidity = ((analog_hum_value * 12) /4) - 1.5
        temp_F = ( temp_C * 9.0 / 5.0 ) + 32

        millivolts = "%d" % millivolts
        analog_hum_value = "%d" % analog_hum_value

        temp_C = "%.1f" % temp_C
        temp_F = "%.1f" % temp_F
        humidity = "%.1f" % humidity

        motionCount+=GPIO.input(pirPin)
        motiondata = motionCount

        if DEBUG:

                cursor.execute("UPDATE pinDescription SET pintemp=%s WHERE pinID='%s' " % (temp_C, 3))
                print "analog_hum_value:\t", analog_hum_value
                print "temp_C:\t\t", temp_C
                print "humidity:\t\t", humidity
                print motiondata
                motionCount = 0
```

```
if LOGGER:

        pac = eeml.Pachube(API_URL, API_KEY)
        pac.update([eeml.Data(0, temp_C, unit=eeml.Celsius())])
        pac.update([eeml.Data(1, temp_F, unit=eeml.Fahrenheit())])
        pac.update(eeml.Data(2, humidity, tags=('Humidity',)))
        pac.update(eeml.Data(3, motiondata, tags=('Motion',)))
        pac.put()
time.sleep(1)
```

Figure 4.23: Read Temperature (Python)

## 4.6 TESTING

During the development process, testing is a part of methodology and keep going do during this development process. Testing by each part or module is the way to keep and avoiding system error during development.

## 4.7 CONCLUSION

In this implementation chapter, shows how the system that has been develop in the PSM II. Database of the system is the first step that has been created before starting the development process. The database of this system is use MySQL in MyPHP admin in MySQL server in Raspberry Pi. After done create database, interface has been develop by using PHP, HTML and CSS. After interface design is complete, Engine of the system that is PHP will operate in the interface to run the system smoothly. The Python script is the engine that operates with MySQL to execute the operation of devices and sensors.

# CHAPTER 5

# RESULTS AND DISCUSSION

## 5.1 INTRODUCTION

In this chapter, it describes the achievement of the project objectives based on the result of the system. Detail about the outcome, assumption and further research about this system also discussed in this chapter.

## 5.2 EXPECTED RESULT

The expected result from the project and development of this system are described as below:

i. The web systems run successful without any error and have capability to give result towards user.
ii. Users are able to use the web system based on following the system flow.
iii. All of the data information will be easier to handle and managed by using this system.

## 5.3 RESULTS OF THE SYSTEM

After the web system have been finished developed, it needs to be analyzed from the form of the pages so that it meets the objectives. The Eco Home Monitoring System have met the all the objectives of this project.

When the user starts using the system, there will be a login form that ask user to login first before user can use the systems. The login interfaces is important for this system

from unauthorized users for trying to controls the home appliances and monitor the house. The username and password is already set by developer in the database. Only authorized user can use the system.


Figure 5.1: Login Interface

After user have successfully log in, the home page of the system will appear for user to start controlling the devices. User can edit the devices names if have any changes. User also can monitor the temperature value where the sensors are installed. Every activity that user do the system will logging the information to the database.


Figure 5.2: Controlling Devices Interface

The systems have logging interface for user to monitor a sensor activity which is a motion sensor, and magnetic switch. When the users turn on the sensors, the system will log into the database if got any input from the sensors. The python script was running background on Raspberry Pi to control the sensor and pushing the data into database.


Figure 5.3: Security Logging Interface

This system also has sensors controls to control the light automatically and door sensor for security in the house. If someone opens the door without stopping the door sensor function, the alarm will trigger. This system also shows the status of the sensor is running or not to make the user easy to know the sensor is start or not.


Figure 5.4: Sensor Controls

## 5.4 SYSTEM CONSTRAINS

This systems have a several constrains but does not affect the main modules of the system. Raspberry pi need expended micro controller to controls more than fifteen input and output devices. This means user can only control for the main devices that they usually used.

### 5.4.1 NETWORK CONNECTION

This priority of this system must have a network communication to communicate between the user and the Raspberry pi to control the controller board. The internet connection gives user to access and control the system anywhere but when internet is down this system can only access locally by Local Area Network (LANs). Both of this connection are not operates well, this system cannot be access.

### 5.4.2 LIMITED HOME DEVICES CONTROLLER

The Raspberry Pi has 16 GPIO port to control input and output. So the Raspberry Pi has maximum number of input and output port. User need to plan how many devices they want to controls because Raspberry Pi can expand their input and output port by using expanded micro controller.

### 5.4.3 PRECISE SENSOR DETECTION

The motion sensor will detect any movement surround the house even all small activity such as animals and birds. It's also sensitive with the changes of lights and shadow. By using LM35 for temperature sensor, the result is not accurate compare to thermocouple.

## 5.5 ADVANTAGE OF ECO HOME MONITORING SYSTEM

There are several advantages of this application:

i. This system can control electrical devices such as lights, gate, fan, and sensor through the web system.
ii. User can monitor the house by camera via web system.
iii. The system will log sensor activity into the system database.
iv. User can access this system everywhere and anywhere.

## 5.6 FUTURE ENHANCEMENT OF ECO HOME MONITORING SYSTEM

There is several future enhancements can be implemented to this systems:

i. SMS notification when alarm is triggered.
ii. Near Field Communication (NFC) technology for security to access door house.
iii. Automatic control air conditioning speed and temperature.
iv. Systems will detect when devices is faulty.
v. Can estimate electrical usage.

# CHAPTER 6

# CONCLUSION

## 6.1 INTRODUCTION

In conclusion part, it will generally explain what had been proposed so far, including developer's hopes and opinions on this project and also the contribution that can be done after the project is finished.

Eco Home Monitoring Systems is a web base application system s to control and monitoring using a Raspberry Pi. This system helps user to control home appliances and also integrated with home camera system and home security system. This system can control home devices such as lights, fan, gate, sensors and also monitor the house. This Eco Home Monitoring System is user friendly, affordable and the important thing it is secure system. This system also can access by using any PCs, laptops, smartphone and tablet because this system is web based platform.

## 6.2 SUMMARY OF LITERATURE REVIEW

Literature review is an necessary flow that helps the developers to gives the idea in developing a project. In developing the Eco Home Monitoring System, lots of researches have been explored to get as many information as possible. The information that related to the project is collected and discussed in details. The existing systems are being analyzed and compared to get the advantages and flaws.

## 6.3 SUMMARY OF METHODOLOGY

This system used Rapid Application Development (RAD) methodology because Rad is suitable for project in a short period of time and it also lower cost. There is several phase in this development which is Project Initiation and Planning, Analysis, System Design, and Testing and Debugging.

This system is planned to be developed using text editor only by using Notepad++ and Linux common text editor which is “nano” for developing python script to interact with the GPIO port on Raspberry Pi. PHP, HTML and CSS for interface design and programming as it provides in System Design phase. These projects also use MySQL as database.

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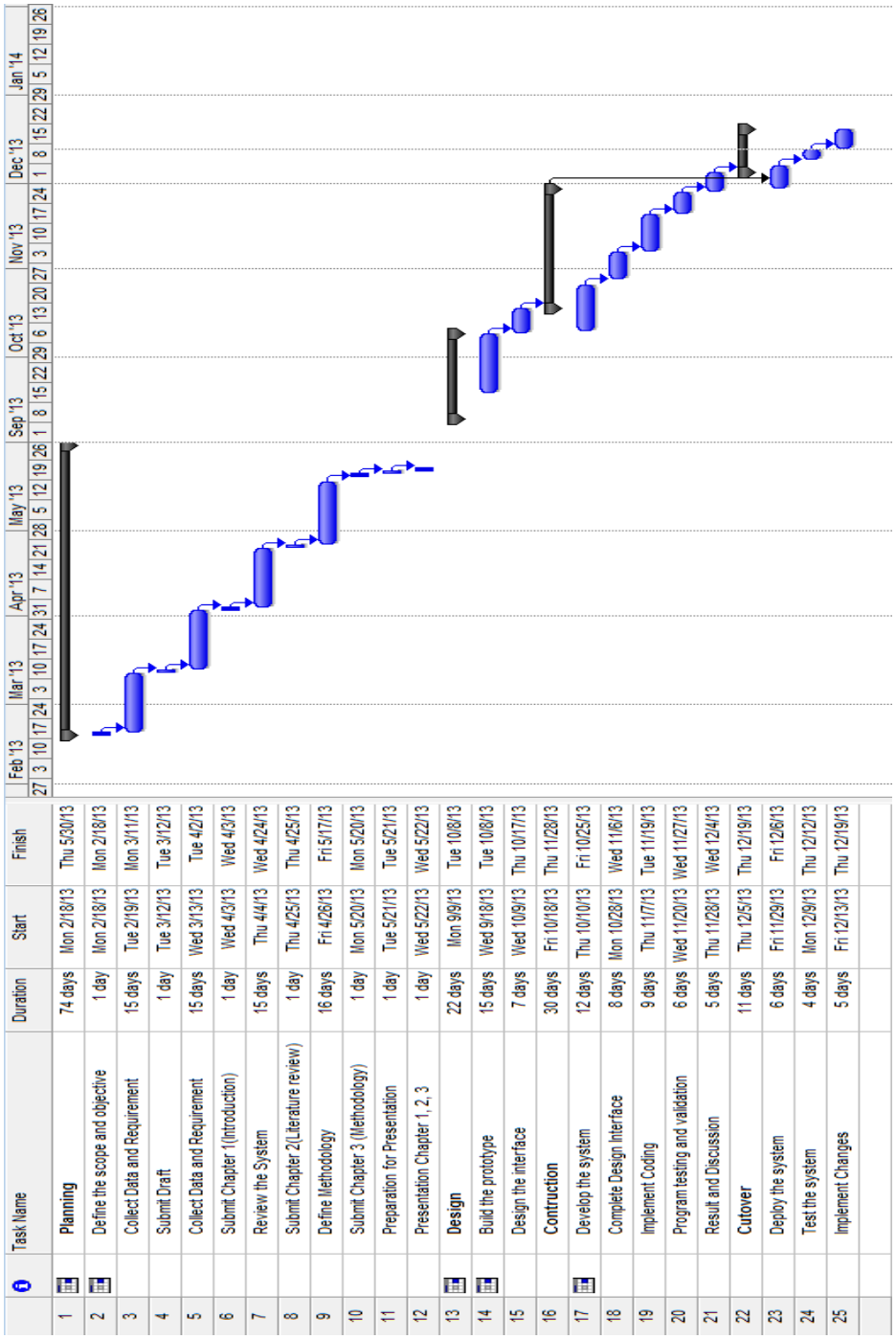
# APPENDIX A

## Gantt chart



| | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | Planning | 74 days | Mon 2/18/13 | Thu 5/30/13 |
| 2 | Define the scope and objective | 1 day | Mon 2/18/13 | Mon 2/18/13 |
| 3 | Collect Data and Requirement | 15 days | Tue 2/19/13 | Mon 3/11/13 |
| 4 | Submit Draft | 1 day | Tue 3/12/13 | Tue 3/12/13 |
| 5 | Collect Data and Requirement | 15 days | Wed 3/13/13 | Tue 4/2/13 |
| 6 | Submit Chapter 1(Introduction) | 1 day | Wed 4/3/13 | Wed 4/3/13 |
| 7 | Review the System | 15 days | Thu 4/4/13 | Wed 4/24/13 |
| 8 | Submit Chapter 2(Literature review) | 1 day | Thu 4/25/13 | Thu 4/25/13 |
| 9 | Define Methodology | 16 days | Fri 4/26/13 | Fri 5/17/13 |
| 10 | Submit Chapter 3 (Methodology) | 1 day | Mon 5/20/13 | Mon 5/20/13 |
| 11 | Preparation for Presentation | 1 day | Tue 5/21/13 | Tue 5/21/13 |
| 12 | Presentation Chapter 1, 2, 3 | 1 day | Wed 5/22/13 | Wed 5/22/13 |
| 13 | Design | 22 days | Mon 9/9/13 | Tue 10/8/13 |
| 14 | Build the prototype | 15 days | Wed 9/18/13 | Tue 10/8/13 |
| 15 | Design the interface | 7 days | Wed 10/9/13 | Thu 10/17/13 |
| 16 | Contruction | 30 days | Fri 10/18/13 | Thu 11/28/13 |
| 17 | Develop the system | 12 days | Thu 10/10/13 | Fri 10/25/13 |
| 18 | Complete Design Interface | 8 days | Mon 10/28/13 | Wed 11/6/13 |
| 19 | Implement Coding | 9 days | Thu 11/7/13 | Tue 11/19/13 |
| 20 | Program testing and validation | 6 days | Wed 11/20/13 | Wed 11/27/13 |
| 21 | Result and Discussion | 5 days | Thu 11/28/13 | Wed 12/4/13 |
| 22 | Cutover | 11 days | Thu 12/5/13 | Thu 12/19/13 |
| 23 | Deploy the system | 6 days | Fri 11/29/13 | Fri 12/6/13 |
| 24 | Test the system | 4 days | Mon 12/9/13 | Thu 12/12/13 |
| 25 | Implement Changes | 5 days | Fri 12/13/13 | Thu 12/19/13 |

**Gantt chart**

**APPENDIX B**

**Turn it in result**

ORIGINALITY REPORT

| 15 % | 14 % | 2 % | 4 % |
|---|---|---|---|
| SIMILARITY INDEX | INTERNET SOURCES | PUBLICATIONS | STUDENT PAPERS |

PRIMARY SOURCES

| | | |
|---|---|---|
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| 3 | peswiki.com<br>*Internet Source* | 2% |
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| 5 | Submitted to Universiti Malaysia Perlis<br>*Student Paper* | 1% |
| 6 | www.kobore.net<br>*Internet Source* | 1% |