"I hereby declare that I have read through this report entitle "*Develop A Graphical User Interface For Home Lighting System Using Android SDK*" and found that it has comply the partial fulfillment for awarding the degree of Bachelor of Electrical Engineering (Control, Instrumentation and Automation)"

Signature   : ……………………………………………………..

Supervisor's Name   :   MR. AHMAD FAIRUZ BIN MUHAMMAD AMIN

Date   : 24th JUNE 2015

DEVELOP A GRAPHICAL USER INTERFACE FOR HOME LIGHTING SYSTEM USING ANDROID SDK

SITI NORSUHAILA BT MOHAMED YUSOFF

A report submitted in partial fulfillment of the requirements for the degree of

Bachelor of Electrical Engineering (Control, Instrumentation and Automation) with Honours

Faculty of Electrical Engineering
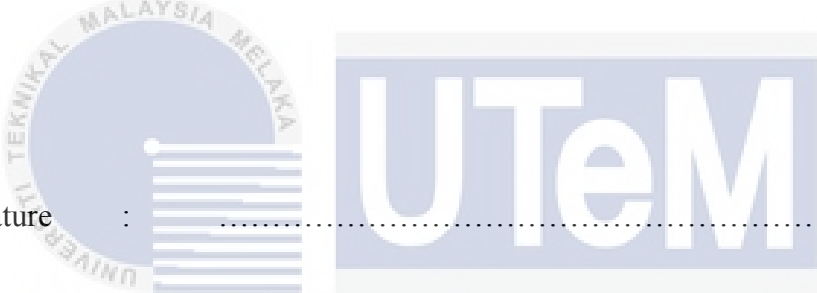
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2015

I declare that this report entitle *"Develop A Graphical User Interface For Home Lighting System Using Android SDK"* is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature   :   ………………………………………….

Name   :   SITI NORSUHAILA BT MOHAMED YUSOFF

Date   :   24th JUNE 2015

To my beloved parents and family

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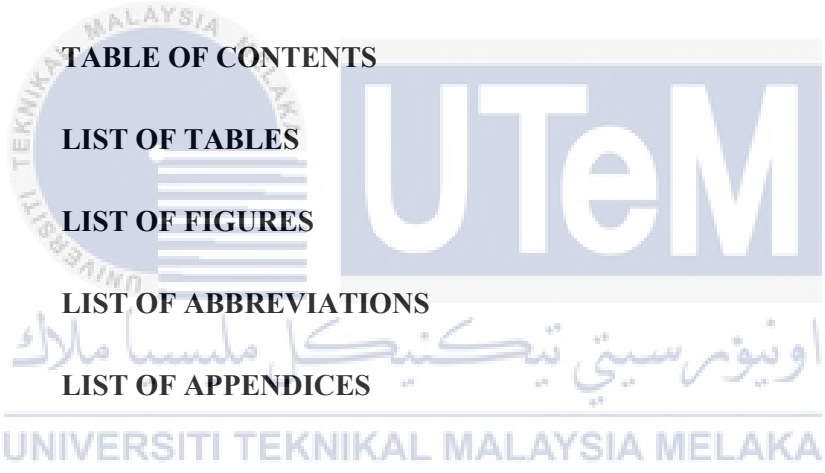
ABSTRACT

The purpose of this project is to create an android application system which works to control home automation systems such as fans, lights, air conditioners and other devices in the house. Automation system is one of the best systems which can save time and provide energy efficiency. It also can reduce human energy. Today, Smartphone are becoming the most popular phones among the community especially teenagers. Look into the matter, the concept of this project is deeply compatible with the current world situation. Android has a complete software package and it is the most popular because of the technology. This project design for home automation system using Android SDK (System Development Kit). This project will be focusing on controlling home lighting system using the android application. The flow of this project is when the switches on the android Smartphone is pressed, the data will be send to the arduino board using router. It presents a design for automation system that can controls lighting system at home using a Smartphone. At last of this project, it will achieve the stated objectives which is to control home lighting system using android application and also to improve the home lighting system using android application for energy saving. Besides, it cause use to facilitate handicapped people, patient's poeple and an elder people who are not able to control home devices manually. Hopefully that this project will give a little contribution to the community, in particular to reduce wastage of electricity and help their users.

ABSTRAK

Tujuan projek ini adalah untuk mewujudkan satu sistem aplikasi android yang berfungsi untuk mengawal sistem automasi rumah seperti kipas, lampu, penghawa dingin dan alat-alat lain di dalam rumah. Sistem automasi adalah salah satu sistem yang terbaik yang boleh menjimatkan masa dan memberikan kecekapan tenaga. Ia juga dapat mengurangkan tenaga manusia. Hari ini, telefon pintar menjadi telefon yang paling popular di kalangan masyarakat terutama remaja. Melihat kepada perkara tersebut, konsep projek ini adalah sangat bersesuaian dengan keadaan semasa dunia. Android mempunyai pakej perisian yang lengkap dan ia adalah yang paling popular kerana teknologinya. Reka bentuk projek untuk sistem automasi rumah menggunakan Android SDK (System Development Kit). Projek ini akan memberi tumpuan kepada kawalan sistem pencahayaan rumah menggunakan aplikasi android. Aliran projek ini ialah apabila suis pada telefon android ditekan, ia akan menghantar data kepada papan arduino melalui router. Ia menunjukkan satu reka bentuk untuk sistem automasi yang dapat mengawal sistem pencahayaan di rumah dengan menggunakan telefon pintar. Di akhir projek ini, ia akan mencapai tujuan yang dinyatakan iaitu untuk mengawal sistem pencahayaan rumah menggunakan aplikasi android dan juga untuk meningkatkan sistem pencahayaan rumah menggunakan aplikasi android untuk penjimatan tenaga. Selain itu, ia juga bagi memudahkan mereka yang kurang upaya, orang sakit dan golongan tua yang tidak mampu untuk mengawal peralatan rumah secara manual. Diharapkan agar projek ini dapat memberikan sedikit manfaat kepada masyarakat, khususnya untuk mengurangkan pembaziran tenaga elektrik dan membantu semua pengguna.

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LIST OF ABBREVIATIONS

HAS   -   Home Automation System

HLS   -   Home Lighting System

GUI   -   Graphical User Interface

ADK   -   Accesorry Development Kit

SDK   -   Software Development Kit

WSN   -   Wireless Sensor Network

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CHAPTER 1

INTRODUCTION

1.0   Overview

This section will give a brief introduction about the project. A few explanations about Home Lighting System (HLS) will be considered to acknowledge the performance to control system. The research background, problem statement, objectives, scope of work, and expected project outcome are explained in this chapter.

1.1   Introduction

Lighting system is an important thing that used by human to help us move or do something in the dark place. It must be have in any places including houses, offices, factories, playgrounds, roads or public places. Although the main purpose of lighting system is to provide a good lighting, it also serves to increase the attractiveness of a place and will enhance the safety.

Before lighting system was introduced, users need to control every appliance in the home manually to the purpose of electrical energy cost savings. Nowadays, the cost of the lighting system wastage can be avoided or reduce by applying the lighting system at home.

There are many types of lighting which is developed by following the latest technology. Each of the type has a different function or has its own specialty depends on the place that user need to apply it. For example, there are differences between the light that installed in the toilet with the light in an entertainment room. Figure 1.1 shows type of lighting system that normally used.
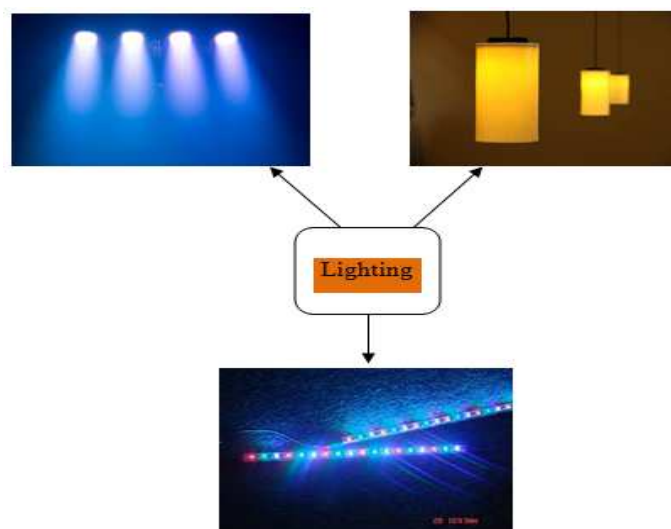
Figure 1.1: Type of lighting system

1.2   Research Background

Home automation is an interconnected device's that can be controlled automatically. Home automation includes many appliances such as light control, air conditioning, heating, ventilation, locks, security and home entertainment. Apart from to control straight forward function such as to turn on and off the lamps, the system also provides other functions such as energy efficiency, provide better facilities and comfort. It's also known as "Intelligent Home" or "Smart Home" [7].

HLS was designed to be user friendly and provides an appropriate level of light for users. A home lighting system can reduce human efforts, provides energy saving, manage time efficiency and also will help the users who are far away from the switches. It also will be help handicapped people, patient people and old aged people who are not able to control home appliances physically. This system is suitable for effectively reducing power consumption by the appropriate use of natural light and energy conservation.

Nowadays, Smartphone was become an exciting technology because it has a larger storage capacity, functioning like entertainment and communication methods. Android is a mobile operating system (OS) designed with touch screen mobile device. Android has a complete software package consists of an operating system, middleware and key application layer. This technology brought an easier way of life to many people around the world.

This system will produce a programming code to control the hardware which is shown in a simulation system. There are several different of popular wireless connection used like Bluetooth, GSM, ZIGBEE and WIFI. Each of this connection has their own specification and applications. For this system, a wireless network will be the ways to control the home devices by develop a graphical user interface (GUI). The wireless sensor network (WSN) technology can be a better solution to control application and function of the system automation. This system also can reduce the implementation costs compared to ordinary wired networking.

1.3 Home Lighting System (HLS)

HLS is an application of the technology that has been designed to assist human in controlling the switches of electrical devices. This application has been develop regarding to the ability of human to control the switches in their house especially for them who live in a big house. This application was designed to be user friendly and provides an appropriate level of light for users.

By having this HLS application, it can help human in term of reducing their efforts. It also can provide energy saving which are all people can take the responsibility to turn OFF the switch by using their Smartphone. Besides that, it will help users to manage time efficiency especially if they are very busy with their work. It also can help handicapped people patient people and old aged people who are not able to control home devices.

Figure 1.2: Example of home lighting system

Figure 1.2 above shows the example of home lighting system. Based on observation, there are many positive feedbacks that given by the customers who are using

the HLS application. Other than to help the users to enjoy their easy life, it indirectly will be a burner spirit to the inventors to produce a better product.

1.4   Motivation

The main motivation to develop this project is to facilitate handicapped person, elder age people and also patient who has a difficulties in their daily life compared to other healthy people. For example, person who sits on wheelchair can't press the device's switch manually. If we are not going to propose the solution for them, they maybe will let the waste of electrical energy while waiting for other people to come and help them. Other than that, it also can help disable users to access the home device's switch physically from far area.

Figure 1.3: Handicapped person and elder aged people

Figure 1.3 shows the handicapped person and elder aged people who are not able to control home automation system physically. Besides that, safety issues are a priority in this project because many criminal cases happened in a dark places. Lighting system is one of the crucial and important thing in daily life. For sure users can't do their work in a dark situation which is without a lamp.

However, dark place is the best place for the thugs to do their illegal activities such as theft, robbery and more. Therefore, the lighting system will help to reduce these activities. Users can turn ON the lights in any part of the house immediately for the purpose of frightening villain before contacting the authorities. At the same time, criminals are likely to be surprised that the lamp was lights suddenly. With the help of technology,

related project can be developing in order to overcome their difficulties. The system can allow the user to control many devices.

1.5   Problem Statements

There are several problem statements as listed below:

   i.   Users are not able to access the home devices physically from a far distance.
  ii.   Handicapped and elder age people not able to control home devices manually.
 iii.   Waste electrical energy will be happened if left it always ON without using it.
  iv.   Patients cannot control the home devices manually when they are not feeling well.

1.6   Objectives

Following are the objectives on this project, which are:

   i.   To design a graphical user interface to control home lighting system by using android application via SDK.
  ii.   To facilitate the users and assist handicapped people, elder age people and also patients who are not able to control home devices manually.
 iii.   To improve home lighting system using android application for energy saving.

1.7   Scopes

The scopes on this project stated as below:

   i.   Use Eclipse software to develop Android application for Smartphone.
  ii.   Control home devices remotely via android application.
 iii.   Control devices at anytime and anywhere when users are not able to access them physically.
  iv.   Using android application to control home lighting system through wireless router.

1.8   Report Outlines

The report outlines are as listed below:

Chapter 1   is a brief introduction regarding the application of HLS in daily life. The motivation, problem statements, objectives and scopes of the project are clearly states in report.

Chapter 2   is an explanation about HLS which consists of discussion of several papers about HLS and HAS approach. Other than that, the discussion on the wireless connection also stated in this chapter.

Chapter 3   is about the methodology of the whole project. In this chapter, the process of transferring data was explained. The software development also stated in this chapter.

Chapter 4   States the result and discussion which consists of design and execution of the project. Results are divided into GUI development, Emulator display and android application on Smartphone.

Chapter 5   consists of conclusion of the overall work and recommendation for future works.

CHAPTER 2

LITERATURE REVIEW

2.0   Overview

This chapter will discuss about the research on the revolution of the HLS such as the field of study and the types of wireless connection which has been implemented in HLS. In order to develop a graphical user interface for HLS, the method of communication within users and home devices also has been researched.

2.1   Introduction

There are various types of wireless connection that have been developed in communication between HLS with the users which is GSM, WIFI, ZIGBEE and Bluetooth. One of the famous connections that often implement is by using Bluetooth technology. Regarding to this connection, it can link a digital devices within a range of 10m to 100m with up to 3Mbps's speed at frequency of 2.4GHz. But, it also is depending on the Bluetooth devices itself.

2.2   Theory and Basic Principle

Automation was used for much equipment such as machinery, switching in telephone network, processes in factories and other applications with minimal human intervention. It is a mechanism which depends on machines to execute manual functions. It can reduce the numbers of labor and operator by doing an observation for machine operations and provide a troubleshooting.

Automation systems will reduce the need of an operator by using sensory programs. So, the machine can carry out a task from the beginning until finish without needed a human assistance. Today, automation becomes one of the most important roles in human life. There are many advantages of automation such as to saves labor, materials and energy. Besides that, it also important to improve quality, precision and accuracy.

2.3   Review of Previous Related Work

A few things that will be discussed in this part are about Home Automation System (HAS), Android, Android SDK and Android ADK and Types of Wireless Connection.

2.3.1   Home Automation System (HAS)

Wireless technology becomes most popular technology in the worldwide because the users no need to use any wire on their devices in order to access the internet. Nowadays, home automation is one of the main applications who are using the wireless technology. There are a few things that must be consider and take an action when designing a HAS. First of all, the system should be scalable so that new devices can integrate into it easily. It should provide a user-friendly interface on the host side, so that the devices can be easily setup, monitored and controlled [13].

HAS is an automation of the home, housework or household activity [1]. The concept of HAS has been around for a long time ago but it becomes practical since the early of 20th Century following the widespread introduction of electricity into the home. It allows us to control home devices like air conditioning, door, light, fan and other systems. Besides that, it also used for home security and emergency system. The advantage of this system is to provide energy efficiency, comfort, time saving, improve convenience and reduce human effort. HAS using a Smartphone and tablet's technology to control any home devices.

Figure 2.1: Home automation system

Figure 2.1 shows the example of HAS that can be used by users. It show that there are many type of HAS include light control, HVAC control, door control, window control and more. The popularity of HAS has been increasing rapidly due to much higher affordability through Smartphone and tablet connectivity. The popularization of home automation also has been closely with the concept of "Internet of Things". The system can consist of control or close depending on the connection type that has been used.

This system should be cost effective in order to justify its application in home automation [13]. So that, the other person will be attract with this technology. The HAS are controlled by the home server, which operates accordingly to the user commands receives from mobile phone via internet [15]. The users only need to press any button (that represent to the state devices) that they want to control. That button will be appearing in graphical user interface at their Smartphone.

HAS design also been developed for certain situation which for those who are needs more attention such as old age person, handicapped person and sick patients [17]. A good system of HAS is easy to use, give an energy efficiency and can help user to monitor home devices.

2.3.2 Android

In May 2011, Google held its annual developer conference to present its newest technologies. Google has placed the focus on two major themes which are Chrome and Android. On that day, Google has announced that Google's first standard for Android

devices to communicate with external hardware. The Android open Accessory Standard and the Accessory Development Kit (ADK) will be the key for communicating with hardware and building external accessories for Android device.

The rapid growth in mobile communication system in present era is changing people's life and work style [15]. Users can do everything by using their Smartphone such as downloading and running any application. Today, everything is on their fingertip which is users can get any news or info easily by using their Smartphone. Android is a software stack for mobile devices that includes an operating system, middleware and key application. Android boasts array of connectivity option includes Bluetooth, Wi-Fi, and wireless data over a cellular connection. It provides access in an extensive range of useful that can be used to build rich applications [10].

Figure 2.2: Types of android Smartphone

Figure 2.2 shows there are so many type of android Smartphone that has been develop since it was been a most famous Smartphone. Android is designed for touch screen mobile devices such as Smartphone and tablet computers [1]. For this home automation we are targeting to use android system since it has big market and open sources. Android SDK provide the tools to start developing android applications by using Java programming language [1]. The remote control based on Android phone will be a mainstream way. Users can easily control the home appliances anywhere and anytime when they login into the control interface.

Android can utilize cameras, touch screens, GPS, accelerometers, magnetometers, accelerated 2D bit blits and accelerated 3D graphic [4]. Android also support connectivity technologies like a Bluetooth, GSM, UMTS, CDMA and Wi-Fi. Other than that, Android device acts as a client in the home automation system. Mobile devices are ideal in

providing a user interface in such a system, due to their portability and their wide range of capabilities [3].

Android will ship with a set of core applications including an email client, browser, maps, contacts, calendar, SMS program and others. These all applications are written using the Java programming language [4]. So, developers can use Java to develop their applications. Android includes a set of C/C++ libraries used by various components of the Android system [4].

A central feature of Android is one application that can make use of element of other applications [4]. The system should be able to start an application process when it is required. Android applications have four components like activity, services, broadcast receivers and content provider. An activity is the basic part of an application. An application maybe consists of one or more activity.

A service does not have a visual interface, but runs in the background for a period of time [4]. An example of a service is playing background music. A broadcast receiver is a component that receives an action request and takes response. Broadcast receiver does not display a user interface but they may start an activity by response from the action they receive. Next, a content provider makes a specific set of the application's data available to other application. The data can be stored in the file system, SQLite database, or in another way of storing [4].

This Mobile System has many advantages such as an open platform where anyone can use it. This will make Android system has more developers. Besides that, Android is an open source and free so everyone can develop this applications on it and put it into the Android Market. Second, it has wide selection of hardware. Therefore, the different hardware manufacturers can use a different type of hardware to make a phone on the same platform. So, it will give more choices to the customers [4]. Look at this situation, Android must be the most popular mobile Operating System in the future.

Nowadays, most android Smartphone and some android tablets that use a 2.x release and android 3.0 was a tablet-oriented release but does not officially run on mobile phones [2]. There are many types of android's version that are come from nickname of sweets or desert. It includes Frozen Yogurt ("Froyo") (2.2), Ginger Bread (2.3), Honeycomb (3.0), Ice Cream Sandwich (4.0), Jelly Bean (4.1), KitKat (4.4) and Lollipop (5.0). The latest android version is Lollipop (5.0). Android application will be written in

Java language. It has many software that can be use to create an android application such as Eclipse, Android Studio, MIT App Inventor 2, Xamarin and other software.

2.3.3   Android SDK and Android ADK

Android SDK stands for Software Development Kit. The Android SDK provides all necessary tools to develop Android application (API) like a debugger, compiler and a device emulator, as well as its own virtual machine (emulator) to run the Android programs. The Android SDK provides tools for code compilation and packaging data into an archive file with '.apk' extension called as an Android package [2]. The '.apk' file is used by Android devices to install the application. Android's application framework allows the creation of extremely feature rich and novel applications by using a set of reusable components [2].

Android ADK stands for Accessory Development Kit [1]. Android accessory is a physical accessory that can be attached to Android device [1]. The Android Open Accessory Development Kit is a reference implementation of an Android open accessory, based on the Arduino open source electronics prototyping platform [1]. The Arduino ADK is a microcontroller board based on the ATmega2560 [1].

2.3.4   Types of Wireless Connection

There are a few types of wireless connection that has been implementing by the other researchers. For example, they use Bluetooth and Wireless Sensor Network (WSN).

2.3.4.1 Bluetooth

Bluetooth is a mainly used for data exchange within two phone's user. It is one of the important technologies for home automation system (HAS). This technology shows it advantage by integrating it with Smartphone. It changed the technique of transferring digital devices that use before which is from wired digital device into wireless device. A

host Bluetooth device has a capability of communicating within up to seven Bluetooth modules at one time through one link [6].

Bluetooth is a wireless connection that used for transfer data from one device to another device within a fixed distance. An Android phone sends its command to customers Bluetooth-enable devices via embedded Bluetooth module [6]. The phone used as a host controller to communicate with Bluetooth module. These connections are a secure as they come and offer no risk of intrusion or theft of data. It is because the devices who want to connect with another device should ask the permission first from the owner before any data can be transferred in or out.

2.3.4.2 Wireless Sensor Network (WSN)

A wireless sensor network technology is a new approach to develop home device's control. This technology provides a wireless solution to control an application and functionality of the system. In the previous research shown that this WSN was decrease about 10% less than ordinary wired networking. Wireless technologies not only apply in real implementation but now it has been develop for educational purposes [8].

Wireless communication was used to transfer any data or information between two or more device that is not connected physically from each other. There are many types of portable applications, including two-way radios, cellular telephones, personal digital assistants (PDAs) and wireless networking. An example of applications for radio wireless technology includes GPS units, satellite television, radio receivers, wireless computer mouse, garage door openers, keyboards and headsets, headphones, cordless telephones and broadcast television. The most common use of wireless networking is to connect users who travel from one location to another location.

Wireless is commonly used in the telecommunications industry that refer to the telecommunications systems like radio transmitters and receivers which is use some form of energy to transfer any information without using the wire. Information was transferred in this manner over both short and long distances.

Wi-Fi, is a local area wireless technology that allows an electronic devices to send and receive data. Wi-Fi works on radio wave technology, which the data passed through and convert into electromagnetic signal that sent using the antenna. The router received

and decoded this signal at the receiving end. Wi-Fi's technology allows an electronic device to exchange data or connect using microwaves in 2.4 GHz and 5 GHz band [10].

2.3.5 Graphical User Interface (GUI)

GUI application was developed by using Visual Basics.NET (VB.NET). Users were able to customize the application to include a command button by using the GUI. GUI provide a command button ON or OFF for a users. A GUI is a type of interface that allows users to interact with electrical devices at home through that icon shown in the Smartphone [8].

A GUI used as a combination of technologies and home devices to provide a platform that the users can interact with. It was designed to suit Android Smartphone's application. It is a simple platform and more compacts for user to control the home devices. Android application will control home devices by connecting it to the server [11].

Today, the most familiar GUI interfaces are Apple Computer's Macintosh and Microsoft Corporation's Windows operating systems. The advantages of the GUI are it can be user-friendly and speed up the user's work. Besides that, it can be more attractive to non-technical people. In general, it looks more professional (but this does not mean it is always the best solution).

2.3.6 Summary from the Previous Research

In 2013, Deepali Javale, Mohd.Mohsin, Shreerang Nandanwar and Mayur Shingate [1] were designed the home automation system and security system using Android ADK. That design is based on a standalone embedded system board Android ADK at home. This system will be function by connecting the home devices to the ADK which is the communication will be happen between ADK and Android Smartphone or tablet. They also presented the design and implementation of automation system which is can be control by Android Smartphone or tablet. Table 2.1 shows the important information that has been discussed by the writers.

Table 2.1: Important information of home automation and
security system using Android ADK

Title	Objective	Summary
Home Automation and Security System Using Android ADK	To help handicapped and old aged people to control home appliance and alert them in critical situations.	They would like to develop an authentication to the system for authorized person to access home appliances.

In 2014, Sachin Kishor Khadke [2] were designed the remote appliance control system based on the android Smartphone. By using this application, users can control the appliances anytime and anywhere. It also can make their house more automated and intelligent. Table 2.2 shows the important information of home appliances control system based on Android Smartphone

Table 2.2: Important information of home appliances
control system based on Android Smartphone

Title	Objective	Summary
Home Appliances Control System Based On Android Smartphone	To overcome the difficulties of disabled people like deaf people and Alzheimer diseased people and to support them.	By designing the control interface on Android Smartphone, users can control home devices easily compared by using PC. Advantages: i) easy to carry ii) low cost ii) smallest size compared to PC

In 2011, Chao Wang, Wei Duan, Jianzhang Ma and Chenhui Wang [4] were doing their research about Android system architecture and application programming. Start from 21th century, personal computing becomes more personal and computer becomes more

accessible at anywhere and anytime. Table 2.3 shows the important information of the research of Android system architecture and application programming.

Table 2.3: Important information of the research of Android system architecture and application programming

Title	Objective	Summary
The research of Android System Architecture and application programming.	Research all things about Android system and application.	Android is a software stack for mobile devices. Android SDK provide the tools and APIs necessary to begin developing application on the Android platform. Advantages: i) open platform ii) wide selection of hardware iii) advantage in cloud computing

In 2010, Wan Norsyafizan W.Muhamad, Mohamad Yusof Mat Zain, Norfishah Wahab, Noor Hafizah Abdul Aziz and Rosmalini Abd Kadir [5] were doing their research about the energy management in a building and design of the energy efficient lighting system. Table 2.4 shows the important information of energy efficient lighting system design for building

Table 2.4: Important information of energy efficient lighting system design for building

Title	Objective	Summary
Energy Efficient Lighting System Design for Building	To determine the minimum required lamps in a specific place without reducing the quality of lighting	This project is important to reduce the highest amount of electricity usage and decide the ideal lighting condition for a certain room. The ideal value of lamps and

		luminaries are depends on room's size, dimension and illuminance level.

In 2013, Ming Yan and Hao Shi [6] were designed a Bluetooth-based Smartphone application. A Bluetooth device is able to communicate with up to seven Bluetooth modules in one time and can interact with other user in a range within eight meters. Table 2.5 shows the important information of smart living using Bluetooth-based android Smartphone.

Table 2.5: Important information of smart living using
Bluetooth-based android Smartphone

Title	Objective	Summary
SMART LIVING USING BLUETOOTH-BASED ANDROID SMARTPHONE	To realize the home lighting control system using Bluetooth technology	Android Smartphone can be a platform to design Bluetooth-based application. Function that was provided: i) device registration ii) lighting status monitoring iii) lighting control iv) diagnostic utility

In 2013, D.NARESH, B.CHAKRADHAR and S.KRISHNAVENI [7] were designed the home automation and security system using ARM7 LPC2148. Table 2.6 shows the Important information of Bluetooth based home automation and security system using ARM9.

Table 2.6: Important information of Bluetooth based home automation
and security system using ARM9

Title	Objective	Summary
Bluetooth Based Home Automation and Security System Using ARM9	To help handicapped and old aged people who will enable to control home	This low cost system was designed to improve the standard living at home. A

	appliance, alert them in critical situation, reduce human efforts, energy saving and time efficiency.	low voltage activating switches is use to replace current electrical switches because to give a safety protection to users.

In 2014, Dhawade Pooja J, Lathkar Y.V and Date Purushottam B. [10] were designed a Smart Home System for mobile phones using Android to enable Wi-Fi which is interfaced with AVR microcontroller which control home appliances. Android provides access to a wide range of useful libraries and tools that can be used to build applications. An AVR Microcontroller is a controller device of the whole system and it acts according to switch connected home appliances. Table 2.7 shows the important information of smart home using android application.

Table 2.7: Important information of smart home using Android application

Title	Objective	Summary
SMART HOME USING ANDROID APPLICATION	To propose a new technology using mobile phone to control home appliances.	They are present a new design which is the system can operate in distinct way whether by using Smartphone or press the button physically.

In 2013, Ridza Azri Ramlee, Daphne Tang Hui Zyen, Mohd Azlishah Othman, Mohd Muzafar Ismail, Hamzah Asyrani Sulaiman, Mohamad Harris Misran and Maizatul Alice Meor [11] were created a smart home system to allow user's control home appliances from a certain distance. Table 2.8 shows the important information of mobile phone controlling home appliances.

Table 2.8: Important information of mobile phone
controlling home appliances

Title	Objective	Summary
Mobile Phone Controlling Home Appliances	To ease user's control home appliances and to improve their lifestyle.	Android device is a controller platform to control home appliances by connecting to the main server. Two way communications between GUI and microcontroller was accomplished.

In 2010, Mohd Helmy Abd Wahab, Norzilawati Abdullah, Ayob Johari and Herdawatie Abdul Kadir [12] were developed a smart home system control by using GSM. It receives a SMS from user's mobile phone and the controller will automatically reacts for that such as to switch ON or switch OFF the home appliances. Table 2.9 shows the important information of GSM based electrical control system for smart home application.

Table 2.9: Important information of GSM based electrical
control system for smart Home application

Title	Objective	Summary
GSM Based Electrical Control System for Smart Home Application	To reduce electricity wastage. To design a circuit that can control switch automatically using MPLAB software.	SMS technology has been choosing as a medium communication because it gives an extensive coverage in a low cost. This system is suitable for users when they are away from their house.

2.4   Conclusions

As a conclusion, many researchers on the HAS field were done by previous researcher. Researches about this system are still ongoing for improving the HLS and to give a good performance in real life. Every selected wireless connection such as Bluetooth, ZIGBEE, WIFI and also GSM has their own advantages compared to others. There are many aspects need to be improved such as in term of currently growth technology, users living area (town or village), type of users (normal person, handicapped person, patient people) and follow the suitable budget of users (low, medium, high).

CHAPTER 3

METHODOLOGY

3.0 Overview

In this section, it will discuss about the methodology of the project which is about all the process involved from the beginning of the project until getting the result and also analysis of the performance. It is includes the flowchart of the whole project, software development, explanation about the related system, project Gantt chart and key milestones.

3.1 Project Flow chart

The flow chart for overall project is shown in Figure 3.1. The flow chart consists of two stages which are Stage 1 for FYP 1 and Stage 2 for FYP 2. In FYP 1, the part of project is including the research about the project and investigated the previous related work that has been done by other researchers. The aim is to get an early exposure about the project that will be carried out and make a comparison between a few of project which have been carried out by previous researchers. Besides that, the work that has been done also about the collecting data which related to this project and searching the suitable software that going to be use. From the study, the information obtained has helped in the process of conducting research for this project. From the first observation, there are a few software that related to do this project including Eclipse, Android Studio, MIT App Inventor 2 and Xamarin.

In FYP 2, the project has started with do some research and study about shortlisted software that maybe can be use. After reviewing and doing a comparison regarding a few aspects involve between all the software, the Eclipse's software was chosen to be use in this project. The next step is developing a graphical user interface by using Eclipse's

software and writing a program. Last but not least, it was continued by testing the program to make sure that the application was run successfully. After the application was successful, the last part in this process is writing a full report. All the result that has been got will be explained in Chapter 4.
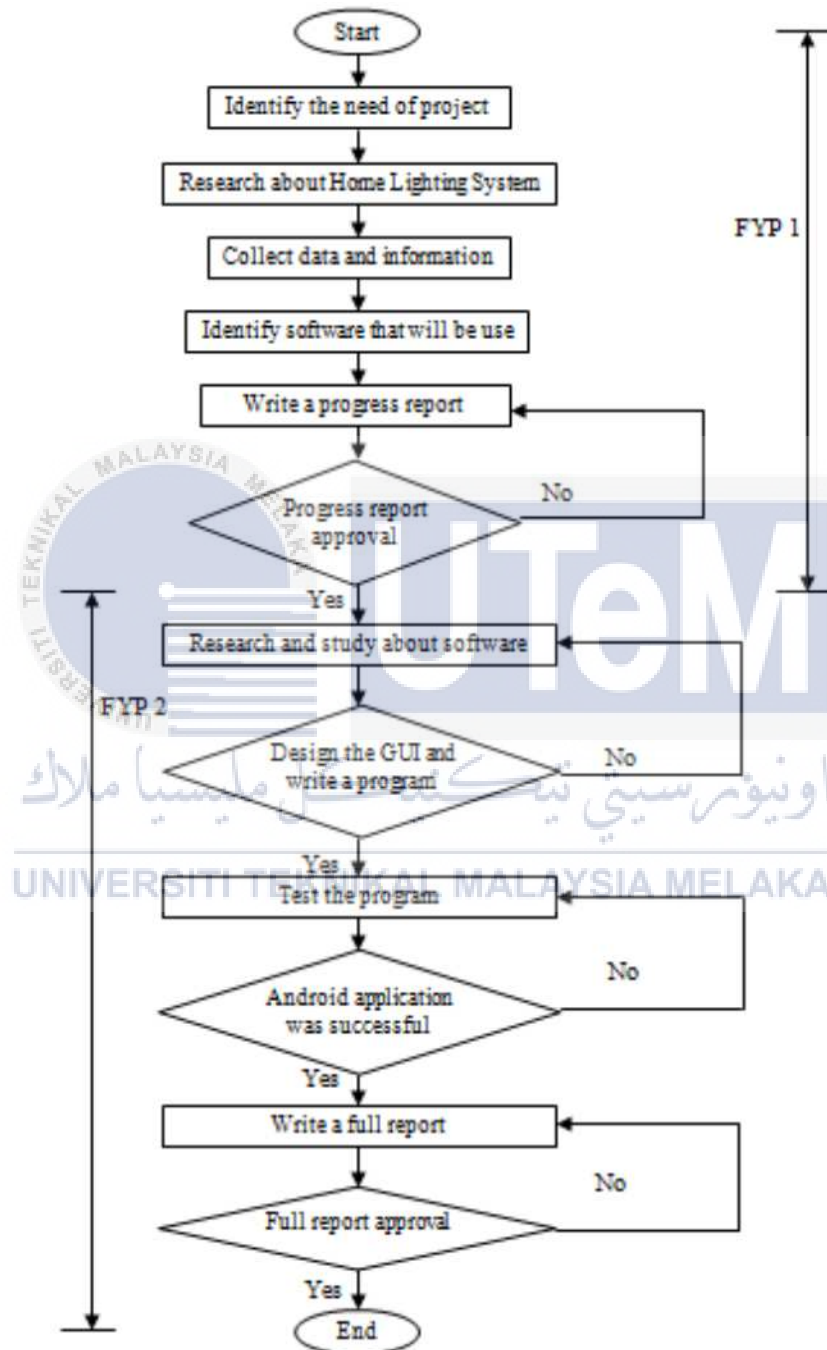

Figure 3.1: Project workflow

3.2   Principles of the Methods or Technique Used In Previous Work

From the related work that has been done before, there are a few principles of the method that has been used. It includes Bluetooth, ZIGBEE, WIFI and also GSM. Every method has their own advantages and disadvantages and also the specification.

The most popular wireless connection that has been chosen is Bluetooth because it has a suitable capability. Bluetooth with a globally available frequency of 2400Hz is able to provide connectivity up to 100 meters at speed up to 3Mbps depending on the Bluetooth device class [7]. Among the advantages of Bluetooth is it does not require a clear line of sight between the synced devices.

That means the devices no need to be facing each other while the data transfer. Besides that, this technology not uses any cable or wires and the maximum range is about 100 meters. Lastly, this technology is free of charge. However, this technology also have disadvantage which is when there are a few mobile devices in the same room, it will possibly attempting the same operation.

Next, among the popular wireless connection that has being chosen is ZIGBEE. It is because ZIGBEE is an energy efficient protocol, using the least amount of power in transmitting and receiving data [3]. Compared to Wi-Fi and Bluetooth has the lowest bandwidth, so that it suitable for small messages. Besides that, ZIGBEE bid low power consumption, which is can overcome the network changes, reduce implementation cost, and cover household area. Security and data integrity are the keys to ZIGBEE technology [9].

ZIGBEE use the security framework to specify the security services such as Access control, Data encryption, Frame integrity and Data detection. The advantages of ZIGBEE are all ZIGBEE compliant appliances compatibly operate in the same network. ZIGBEE also able to manage home devices network remotely and not depending on Infrared devices. However, it also has the disadvantages such as the cost for replacement with ZIGBEE compliant a bit pricey. ZIGBEE compliant manufacturers a bit slow to make an appearance on the market.

Last but not least, Global System for Mobile communication (GSM) is a cellular technology used for transmitting data. The purpose of using SMS is to provide an extensive coverage with a minimum cost. Most of the people turn on the light for the whole day when they are away from home. So, it will waste the electrical energy. Thus this

project is proposed to develop a system is to facilitate the home owner to optimize usage of electricity [14]. There are a few advantages for GSM wireless such as worldwide roaming, security, reasonable device and extensive spectrums obtainable. However, the GSM also have the disadvantages which are released and missed calls, safety issue and competence.

Lastly, Wi-Fi is also the most popular wireless connection that was used in the market. Wireless technology communications not only apply in the real implementation but now it has been develop for the educational purpose [8]. It is allows an electronic device to exchange and collect the data from others. One of the advantages of Wi-Fi is the flexibility that it was offered. Everyone can connect to the wireless network and will get the benefit. Wi-Fi also has low cost implementation because it has no network wiring. Next, it has an efficiency which is all people can do their activities by using the Wi-Fi. Like other wireless technology, Wi-Fi also has their disadvantage which is about security. It is because this open network will attract hackers who are broadcasting their own network id.

3.3 Detail Discussion on the Selected Technique Used

In terms of operating frequency Wi-Fi, Bluetooth and ZIGBEE use the 2.4GHz band. The selected technique to be use in this project is Wi-Fi. This is because Wi-Fi has become a necessity for every Smartphone users nowadays. With Wi-Fi, it can facilitate Smartphone users to get more accurate current information about an event that occurred. In addition, they can also communicate with others despite the extent of the distance between them through social media, either virtual (Facebook, Twitter, Instagram, Weechat, WhatsApp) or a video call like Skype, Tango, Facebook messenger.

Therefore, it will be easier for Smartphone users to use the android app to control their home automation system. This allows them to leave the house without worrying about the safety of the home. To allow this application to be used, they just need to always activate Wi-Fi at their home and make sure their Smartphone has the Internet while to use this application. Apart from that, it also provides benefits to the disabled and the elder people. This is because of their current circumstances may not allow for them to activate the switch manually.

3.4   Android Software Development Kit (SDK)

The android development resource was setup on computer which is setup the Android SDK and Eclipse first. Eclipse is an IDE (Integrated Development Environment) for Java. Eclipse provides an environment joint with the ADT (Android Development Tools) plug in, that we can use to build, design, code and run Android application.

Before that, there are a few requirements need to achieve in order to setup this software. First of all, the computer must have memory at least 6GB to 8GB RAM. Besides that, for operating system requirements, users should be able to run the Android development tools. It is good if use Windows XP, vista or Windows 7. For all three Windows versions, the Android tools support 32-bit edition plus 64-bit editions of vista and Windows 7.

On Mac, the official tools on OS X versions from 10.5.8 (x86) can use for develop Android. But for Linux, Android tools are supported for Ubuntu from version 8.04 and from 2.7 on the GNU C Library. It need to be able to run 32-bit applications if run a 64-bit Linux installation.

The Java Development Kit (JDK) version 6 needs to be installed from Oracle on computer to develop Android applications. Java SE 6 was chosen and the most recent update of the Java SE Development Kit was selected. The license agreement must be accepted and the proper download for operating system will be selected.

Next, the ADT Bundle will be downloading. The ADT Bundle simplifies into a single download the setup process for Android development. It is contains of Android Software Development Kit (SDK), Android Developer Tools (ADT) plug in, Eclipse Integrated Development Kit (IDE) and various platform tools.

After the download process is complete, the folder must be unzip and placed in the chosen location. "Eclipse" was run by double-clicking the executable "eclipse" file. During the setup process, a location for workspace can be chosen or let Eclipse to create it. This is the place where the files of the Android project will be saved. On the first run, Eclipse will display some option for getting started including creating a new project.

Android SDK Manager needs to be run to see the available contents. When the data is loaded the installed package can be seen. The updates available and what other platform components are available and should to install it. The minimum required SDK and target

SDK need to be installed according to Android version that we set on page "New Android application".
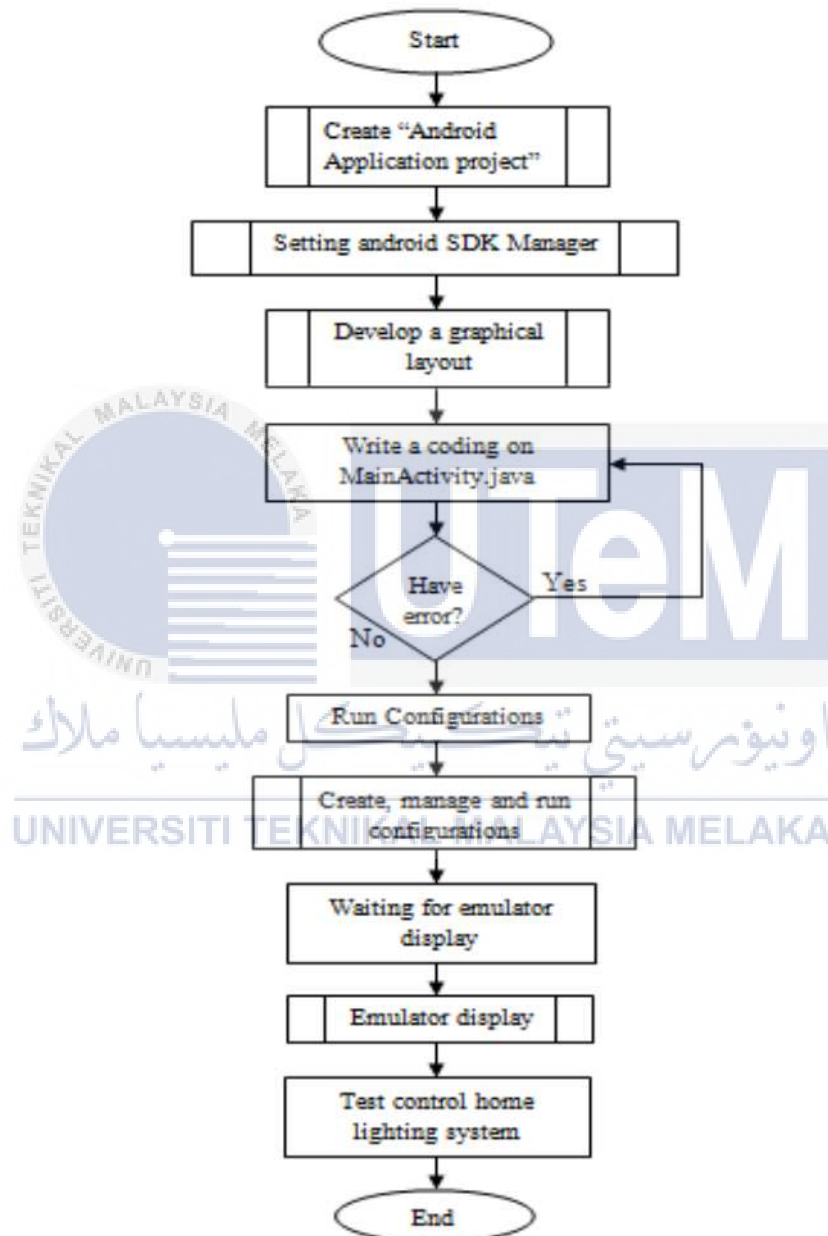
3.4.1 Process of developing an android Application

Figure 3.2: Process of developing an android application

Figure 3.2 shows the overal process of developing an android application. To start with the design, the steps below must followed to make sure that the developing process is success. First of all, an "Android application project" must be created (All the step involved will be described in detail later). After that, android SDK Manager must be setting first to make sure that the right package was chosen (All the step involved will be described in detail later). Next, a graphical layout will be developed (All the step involved will be described in detail later). It was continue by write a coding on MainActivity.java when graphical layout was completed.

If there is no error in coding, the process can be proceeding with run configuration. But if it has an error, turnaround to a coding and make a correction until there is no error. Now, create, manage and run configuration file will be create. (All the step involved will be described in detail later). After that, we will wait for an emulator launch. It will take a few minutes before emulator launch and after that emulator will display the menu like a menu displayed in the Smartphone's screen. (All the step involved will be described in detail later). After all the process was successful, the application will be test to the home lighting system.
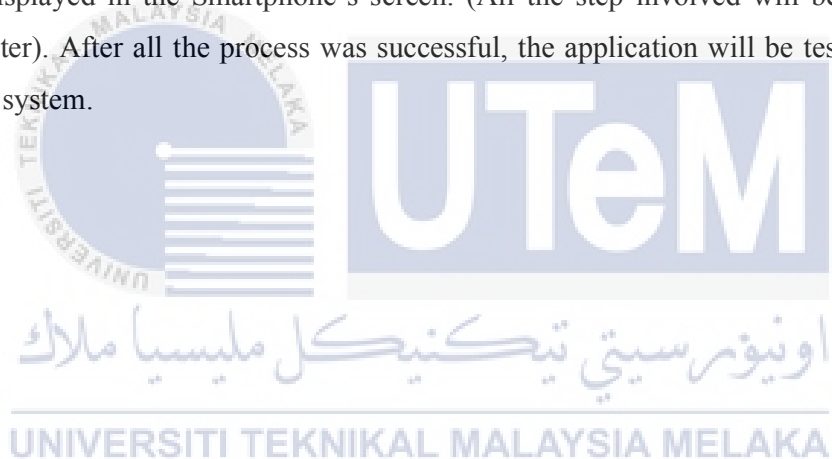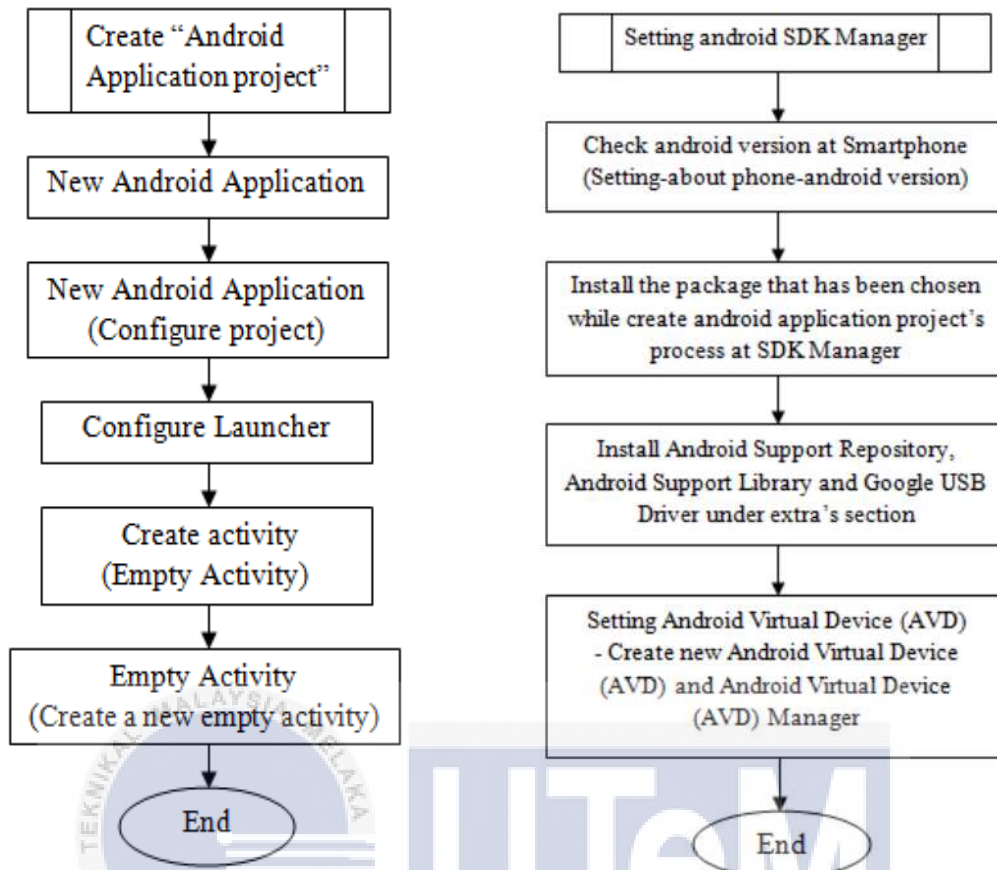
Figure 3.2 (a): Process while creating an Android application

Figure 3.2 (b): Process while setting Android SDK Manager

Figure 3.2 (a) shows the detail process while creating an Android application. When a new Android application project wants to create, "New Android application" must be chosen first. Then, an application name will be created. The minimum required SDK, target SDK, compile with the selected SDK and the theme must be chosen. Then, the button "Next" was clicked to go to the next stage which is new Android application to configure project. Button "Next" was clicked until the page create activity is got. Type of activity was chosen and button "Next" was clicked again. The activity name and the layout name that was appeared can be selected or can change it into other name. Then, button "Finish" was clicked.

Next, move to another step which is how to setting the android SDK manager as shown in Figure 3.2 (b). Before start the setting process, the Android version at Smartphone need to be identified. The way how to know the android version is by open the setting on the Smartphone, click the file name "about phone". Then scroll until the android

version such as (4.4.2-with API 19) was found. Then the package that has been chosen to use was installed at the Android SDK manager's setting. In addition, the package of android support repository, android support library and Google USB driver under extra's section was installed. This is used to support android application project. After that, the Android Virtual Device was setup and the android virtual device was created in order to get the desired display emulator.
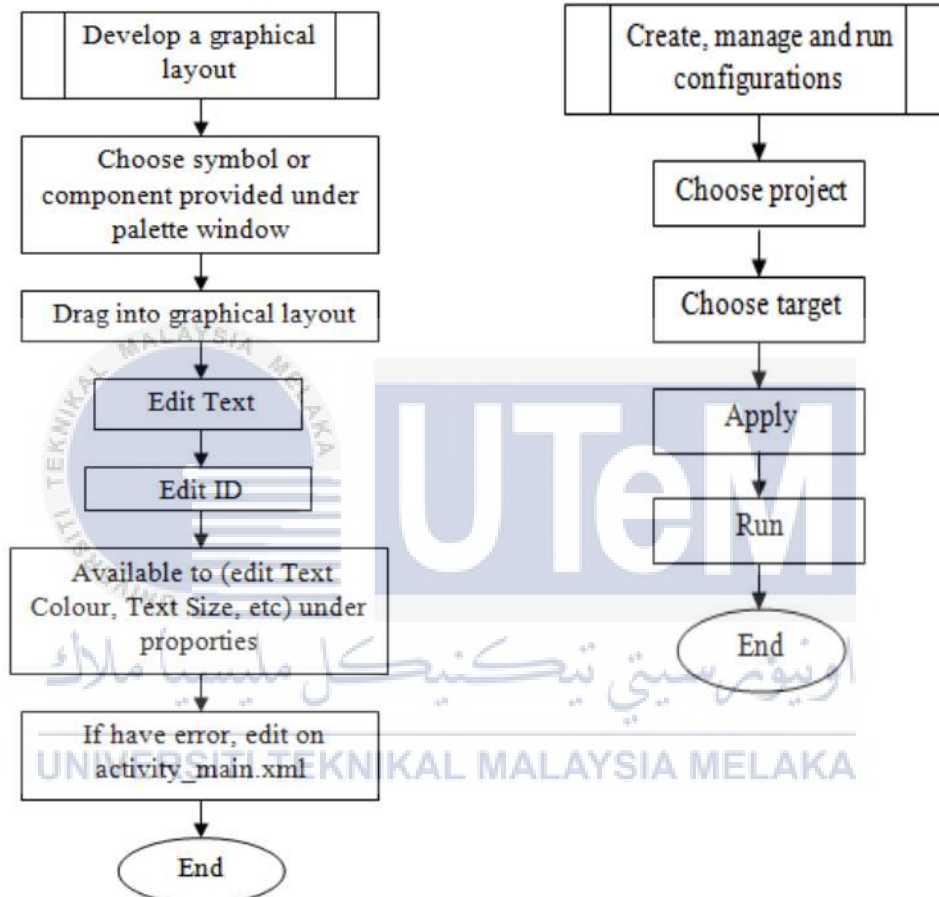
Figure 3.2 (c): Process while developing a graphical layout

Figure 3.2 (d): Process while create, manage and run configuration

After the setting of android SDK manager and android virtual device manager was done, the process was proceed with develop a graphical layout. On the left side of graphical layout, there is a palette window with a few sections of symbol and component such as Form Widgets, Text Fields, Layouts that can help user to create the graphical layout. The symbol or text that wants to use will be chosen and was drag into the graphical

layout. That component can be placed anywhere. After that, the component must be edit by edit text and edit id. Edit text means that the text of component can be change to another name. For example, if the component was drag from text view, it will appear as text view into the graphical layout. But, the name can be changed to another name such as username. While the edit id means that the name can be fixed by write the short form of the component. For example, if the component was drag from text view, the short name of component should be like tv_username. After that, the font size of text or whatever related can be edited by change it at the properties on the right side of graphical layout. If there is an error, it can be fixed on the activity_main.xml form.

If the coding has no error, the program can be run and the emulator will be display. Figure 3.2 (d) shows the process to run the program. Firstly, a run configuration was chosen under the run program. Then, the required form must be filled in the file create, manage and run configuration. The correct android virtual device should be chosen and the button "apply" will be clicked. After that, the program will be run. The emulator will be display the result in a few minute.
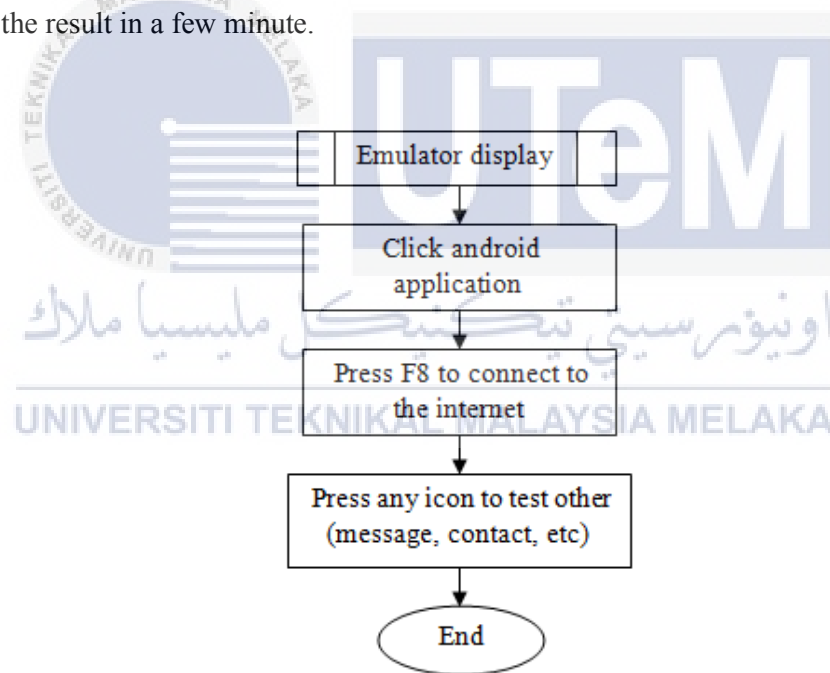
Figure 3.2(e): Process while emulator display the result

Figure 3.2 (e) shows the process while emulator displays the result. After the emulator displayed, the unlock icon should be swap and the application that has been designed will be displayed in the menu. The button f8 on the keyboard will be pressed to make sure that the emulator will get the wireless connection. After that any button can be

click to test the function of emulator such as message, contact and more. Figure 3.3 shows the example of message display when the icon message was pressed.
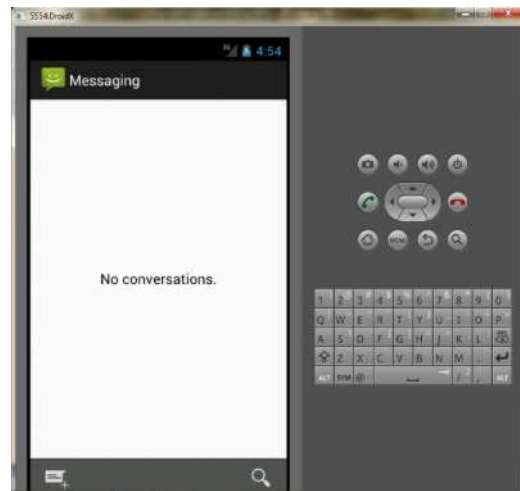
Figure 3.3: The example of message display

3.5 Software Development

This project is to develop an Android Application. Using this application, users can activate the home devices anytime and anywhere they are. When the users open the home lighting system's application in their Android Smartphone, they can choose what they want to select either to ON or to OFF the lamp switch which is appear in the Smartphone's screen.

There are three important things that involve in creating a project which is software, system and hardware. The software means a coding for Android application that will be create by using Eclipse's software. This system only can be used if there is an internet connection in that area. The GUI can be open by using Android application and only can be used for those who have an android Smartphone. Lastly, this project using Arduino Uno and Router to connect with the hardware.

3.6   System Specification

The Figure 3.4 shows the process of information transfers that is run for each application. It consists of three parts, namely the control environment, home environment and equipment or hardware. Remote environment is the first step which is represented by Android Smartphone or tablet's user. This system will be working when the users connect the tablet or Android Smartphone with internet. Internet is a global system of interconnected computer network that use a standard International Protocol suit (IP).

Then, it will be going to the next stage which is home environment. There are two main things in this stage which is Router (installed with open Wrt) and Arduino server. The program of Android application that was created by using Eclipse software will be send to router when user press a button in their Android application. Router is a networking device that forwards data packets between computer networks. It is connected to two or more data lines from different networks. The router reads the address information in the packet when a data packet comes in on one of the lines to determine its ultimate destination. Routers perform the "traffic directing" functions on the Internet. After that, Arduino board will process the data that was received from router.

Lastly, it will be going to the last stage which is hardware. When user press button ON for Fan, the fan will be spin. If user press button OFF for fan, the fan will be stop. Next, when user press button ON for lamp 1, the lamp 1 will be light. If user presses OFF for lamp 1, the lamp 1 will be off. Same goes will be happen to lamp 2.
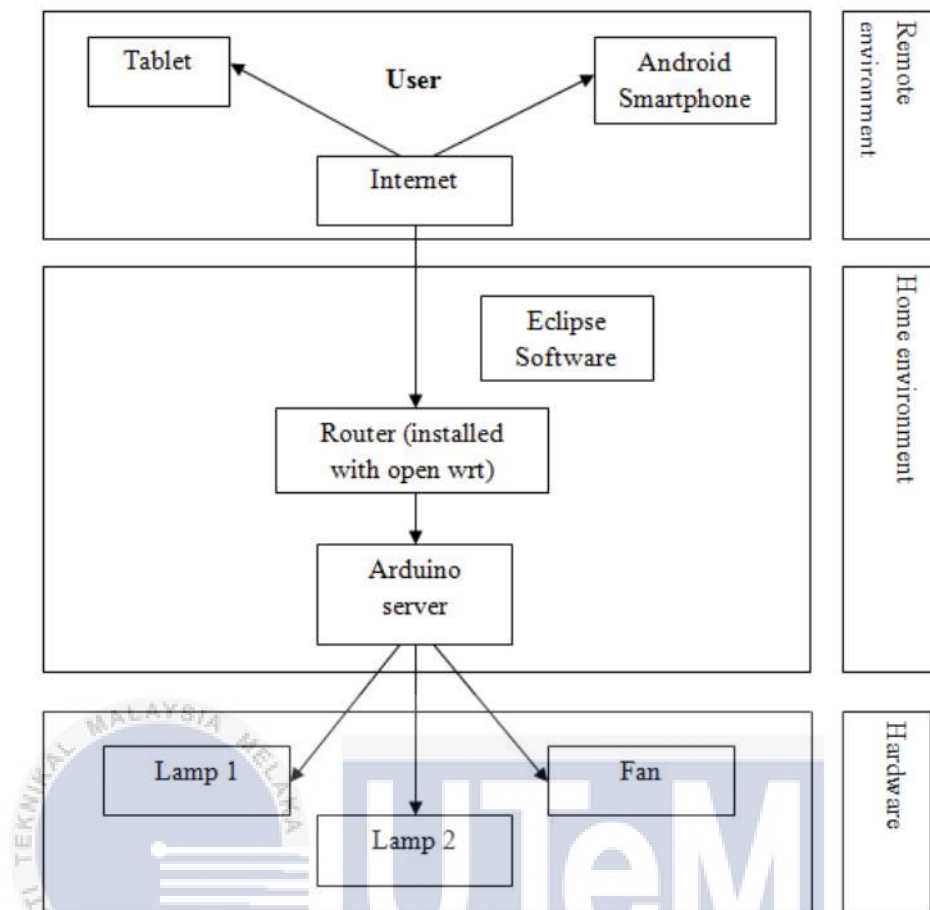
Figure 3.4: The process of sending data

3.7   Connection between Android Applications with Wi-Fi

Figure 3.5 shows that the Wi-Fi Module and Android Smartphone connection's flow chart, which show the process that will be happen before user can transferring the data from their Android application. First of all, user must check the Wi-Fi connection of Android Smartphone (Wi-Fi is ON or OFF). If Wi-Fi on Android application is ON, then search the applicable Wi-Fi. It is because of this Android application can only work if it is connected to a Wi-Fi which is has the same IP address as written in the program.

But if Wi-Fi connection is OFF, user has to turn ON the Wi-Fi of Android application and search the applicable Wi-Fi. Then Android Smartphone will search for the surrounding Wi-Fi. After that if the Wi-Fi is in the range, the Android Smartphone will be connected with that Wi-Fi. If not, user must make sure that the Wi-Fi is in the range first.

Now, the Android application will ready to send the instruction to control the home devices. Lastly, the home devices will function in accordance with the instructions given by Android application.
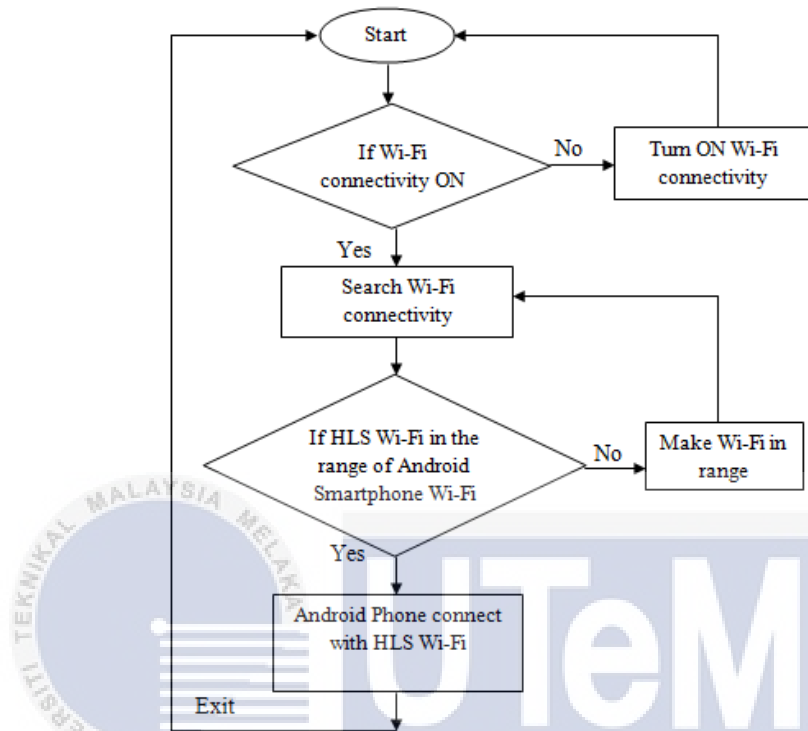
Figure 3.5: Flowchart for Wi-Fi Module and android Smartphone

3.8   Project Gantt chart and Key Milestones

Table 3.1: Project Gantt chart

Title	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Research and study about software	■	■	■	■						
Design GUI and develop a program		■	■	■	■	■	■	■		
Test a program						■	■	■		
Write a full report					■	■	■	■	■	
Presentation										■

Table 3.1 above shows the project Gantt chart of the overall task that was done and will be doing after this. Until now, the stage has been done is test a program. For stage write a full report, it is still ongoing process. It will be done until this report is finish and will be submit to the supervisor and the panel for evaluation process. The last stage is presentation which is will be held on 9th of June 2015. After finish the presentation process, the overall process of this project will be consider done.
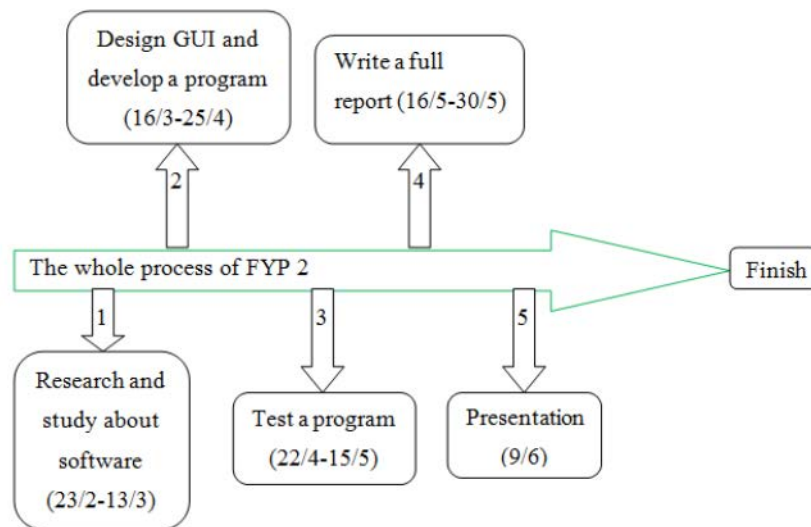
Figure 3.6: Key Milestones of the Project

The Figure 3.6 shows the key milestones of doing this project. It shows there are five stages in doing this project. It was started on 23rd of February 2015 and will be end on 9th of June 2015 which is the day of presentation.

CHAPTER 4

RESULTS AND DISCUSSIONS

4.0   Overview

In this chapter, there are a few important things that must be analyzed to make sure that the expected result will be getting in the end of the project. The way how to develop a GUI must be known first because this is the first step that should be done in this project. The next task that has been done is transferring the data to the android Smartphone. The android application is considered success if the home lighting system can be controlled using the android application.

4.1   Requirement of Android Interface Development

There are a few requirements that we must to have in order to develop this program such as the computer must have the memory with at least 6GB to 8GB RAM to support the Android application software like eclipse. If the RAM is below than that, it will give some effect while developing this program. For example, the process of developing this application will be quite slow and the process of emulator display will take a long time.

For operating system requirements, users should be able to run the Android development tools. It is good if we are using Windows XP, vista or Windows 7. For all three Windows versions, the Android tools support 32-bit edition but for vista and Windows 7, it also available to use a 64-bit editions.

4.2   Graphical User Interface (GUI) Development

4.2.1   Create a Graphical Layout
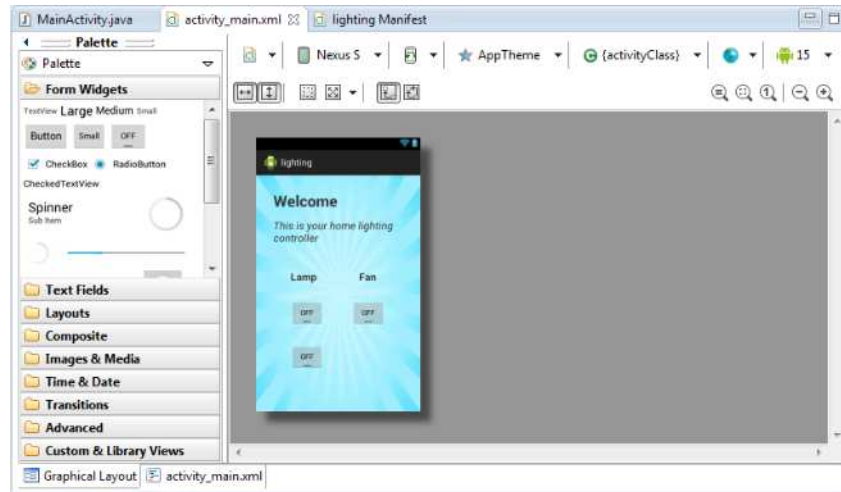
Figure 4.1: Graphical layout using Eclipse's software

Figure 4.1 above shows that this is a graphical layout of developing a GUI by using Eclipse software. After create the new file of an Android application project, the graphical layout will be displayed automatically. After that, the layout can be develop by choosing the related symbol that was provided under the palette window.

There are a few section that can be choosed like Form Widgets, Text Fields, Layouts, Composite and more. Each section contains of different components which can be used to create a user interface. For example, if we want to write a text or button, go to Form Widget's section and choose the suitable form then drag it into the layout. The text or button can be placed anywhere that we like to.

The next step is, we must edit the text or button by click on that text or button that was choosen or go to the activity_main.xml's section that was placed next to the Graphical Layout. All the specification or details about the components that has been installed into the layout will be appear in the activity_main.xml's section. We can check or edit the details as mush as we want to improve the application.

4.2.2 Write a Coding For Application

This coding (`<uses-permission android:name="android.permission.INTERNET" />`) must be add into the program to make sure that the application can be connect to the internet.

After the graphical layout was created, the above coding must be add into the program to make sure that the application can be connected to the internet. If not, the application cannot detect the available surrounding internet. If this is happened, the application cannot be used to control the home lighting system.

The table 4.1 below shows that the comparison between the original program with the program with the additional coding. The original program cannot connect to the internet because it not have the coding that mention to connect to the internet.

Table 4.1: Comparison between the original program and the program with the additional coding

Original program	Program with the additional coding

``xml
<uses-sdk
    android:minSdkVersion="15"
  android:targetSdkVersion="19" />
 	
    <application
    android:allowBackup="true"
 	
android:icon="@drawable/ic_launcher"
 	
android:label="@string/app_name"
 	
android:theme="@style/AppTheme" >
``
	``xml
	<uses-sdk
	    android:minSdkVersion="15"
	  android:targetSdkVersion="19" />
	
	<uses-permission
	android:name="android.permission.IN
	TERNET" />
	
	    <application
	    android:allowBackup="true"
	
	android:icon="@drawable/ic_launcher
	"
	android:label="@string/app_name"
	
	android:theme="@style/AppTheme" >
	``

4.2.3   Coding data from Android

```php
<?php
require_once ("php_serial.class.php"); // include the php serial class
      $data=(int)$_POST["message"]; // get the message from the phone
      $serial = new phpSerial();// create a serial object
      // specify where you want to send the data to (where the arduino is connected in the
usb ports)
      $serial->deviceSet("/dev/ttyACM0");
      $serial->confBaudRate(9600);// the transfer data rate of your arduino
      $serial->deviceOpen();// start the communication
      $serial->sendMessage($data); // send message to arduino
      $serial->deviceClose();// close the serial connection
?>
```

Figure 4.2: The data from Android

Figure 4.2 above shows the data that is come from Android. For example, if the button light ON is pressed (consider as 3), the message will be get from the phone. Serial object will be created for php serial which is the data will be send to the the usb ports from arduino. The transfer data rate of arduino will be count. Then, the communication will be start. After that, the message will be send to arduino. Lastly, the serial connection will be closed.

4.3   Emulator Display

Figure 4.3 shows that the display on emulator surface after the project was run. The display appear on emulator is look like a real Smartphone which is it will give a same function like a real Smartphone out there. Users can click any icon on the emulator surface by using the curser to check that the emulator can work like a loafer or not.

Figure 4.4 shows the menu that available on emulator like the menu that shown in a real phone. It also show the Android application that has been created using Eclipse's software. In this figure, we can see that it has four Android application that has been done

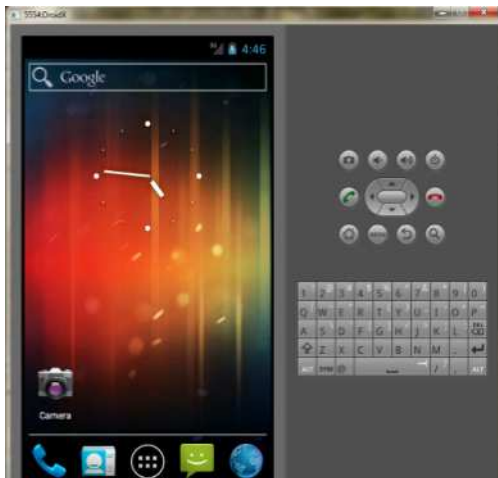and stored in this application which is graphical_1, HomeControl, Lighting and LoginScreen.

Figure 4.3: The display on emulator   Figure 4.4: Main menu on emulator
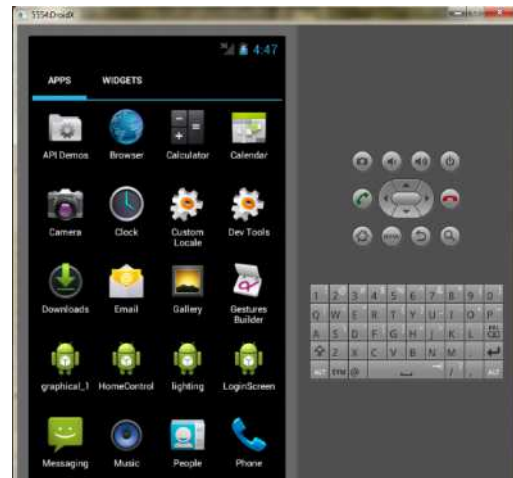
Figure 4.5 shows the lighting application on emulator. It is same with the graphical layout that was created on the Eclipse's software.
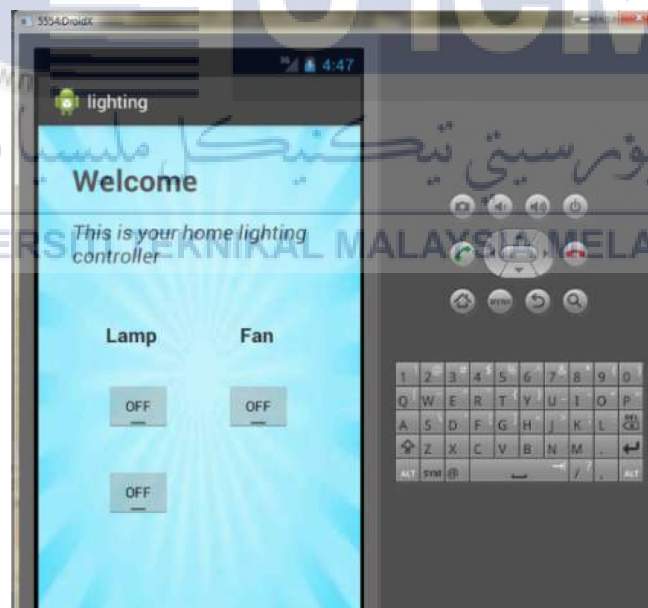
Figure 4.5: Lighting application on emulator

4.4   Android Application on Android Smartphone

Figure 4.6 shows the graphical user interface that display on the Android Smartphone. This is also same with the graphical layout on the software and on the emulator. Users can use this application to control their home lighting system by pressing the displayed button. Figure 4.6 (a) show that all switches is on OFF condition and Figure 4.6 (b) show that all switches is on ON condition. Users can choose any button to press whether to switch ON or switch OFF. When users press button ON, lamp or fan will be ON and when users press OFF, lamp or fan will be OFF.

(a)   (b)
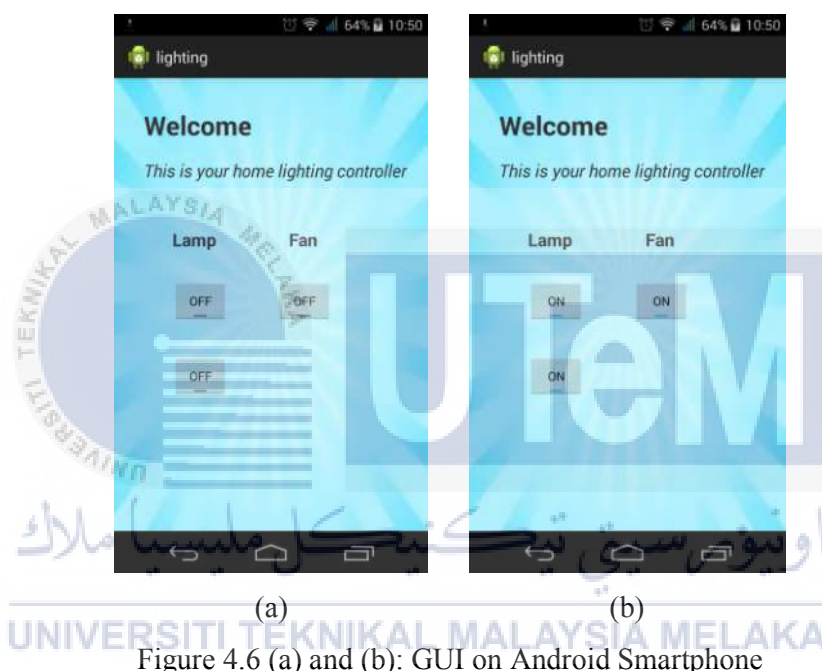
Figure 4.6 (a) and (b): GUI on Android Smartphone

Figure 4.7 shows the devices that has been control by using Android application. The distance between users and home devices can be as far as possible depends on the Wi-Fi connection. For example, if the Wi-Fi connection can detect a distance of 1 metre, home devices can be control about this range. But if the Wi-Fi connection only can detect the connection below 1 metre, so users cannot control the home devices more than this distance. Users must be in the Wi-Fi connection's range if they want to control the home devices. The accurancy of home devices funtion after pressing the button also depends on the Wi-Fi connection whether home devices will be funtion on the spot or it has a little bit delay.
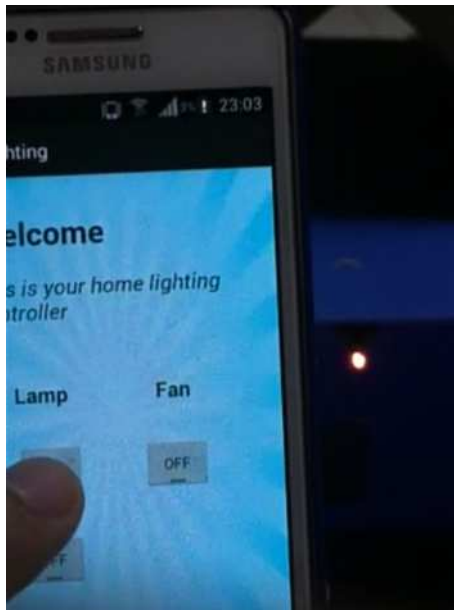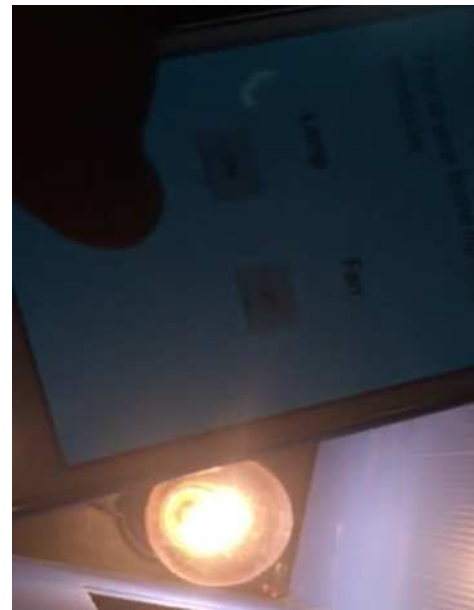
Lamp 1   Lamp 2

Fan

Figure 4.7: Control devices

First figure shows the lamp 1 was bright when user press the button ON on the Smartphone while the second figure shows the same situation was happened when user press button ON for lamp 2. The last figure shows the fan was spinned when the ON button was pressed by user. All the devices will be OFF when user pressing the OFF button.

4.5   Comparison Between Communication Technology

Table 4.2 shows the comparison between Wi-Fi (IEEE 802.11a/b/g) with other wireless communication technology such as ZigBee (IEEE 802.15.4) and Bluetooth (IEEE 802.15.1). Refer to the table, we know that Wi-Fi connection has a biggest range compared to Zigbee and Bluetooth which is each range only around 10-100 metre and 10 metre.

For operating frequency, all of them have a same frequency which is 2.4.GHz. But for Wi-Fi, it also have a frequency with 5GHz. Besides that, in order to prevent channel interface, ZigBee and WiFi use a dynamic frequency selection mechanisms whereas Bluetooth use an adaptive frequency hopping.

In terms of power consumption, ZigBee is an energy efficient protocol because it use a smallest amount of power in process of transmitting and receiving data which is around 30mA. Bluetooh module also operate within the same range amount of power consumption as ZigBee which is around 60mA. But in this criteria, Wi-Fi use the largest amount of power consumption for receiving and transmitting data which is about 230mA.

Despite Wi-Fi have a largest power consumption level, it also has a largest bandwitdh which offers it a very low ratio of energy/transferred MB [3]. In this criteria, ZigBee has a lowest bandwidth that making it adeal for a small messages while Bluetooth has a medium bandwidth.

This comparison will give a better information for users. By referring to this comparison, users can make a decision and choose the better communication technology that they would like to use and apply it in their house or office.

Table 4.2: Wireless communication technology [3]

Wireless connection / Criteria	ZigBee IEEE 802.15.4	Wi-Fi IEEE 802.11a/b/g	Bluetooth IEEE 802.15.1
Bandwidth	250 Kbps	54 Mbps	1 Mbps
Range	10-100 metre	50-100 metre	10 metre
Topology	ad-hoc, star or mesh	Point to access point	ad-hoc, small networks
Frequency	868 MHz (Eurpoe) 900-928 MHz (NA) 2.4 GHz (world)	2.4 and 5 GHz	2.4 GHz
Coexistence	dynamic freq. selection	dynamic freq. selection	adaptive freq. hopping
Power	25mA TX, 27mA RX, standby 3µA	219mA TX, 217mA RX, standby 20mA	57mA TX, 47mA RX, standby 0.2mA
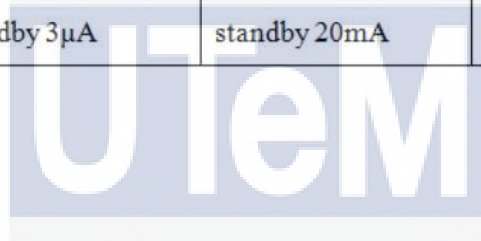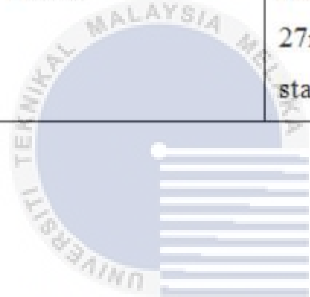
CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.0   Overview

This division will be concluding overall the project done after the result and the outcome of a response performance has been analyzed. The conclusions were presented clearly.

5.1   Conclusions

Home lighting system based on Android Smartphone can be designed by developing the graphical user interface for Android application. It is a combination among Android's user, network transmission and Wi-Fi to form a complete system and make sure that the whole system will works smoothly. Android Smartphone's have many advantages such as a human interface, easy to carry and also suitable for all ages. By improving the control function follow the schedule, Android Smartphone allows us to use it anywhere and anytime without any problem.

5.2   Recommendation and Future Work

Based on the result stated in the early chapter, further development of this project can be doing by integrating it to the internet to monitor home devices while users not in home's area. The home devices can be connected with controller by using web interface. By using this kind of way, users can always keep an eye on their home although they are far from their house. Besides that, users also can make a double checking on their home

devices to make sure the conditions of the switches are safe. This is important to confirm that they leave their house in a good condition.

Besides that, for a future work, it may be can be added a security system for this application which is known as a login interface. This security system will be preventing from the unknown person who has a bad purpose to the users.

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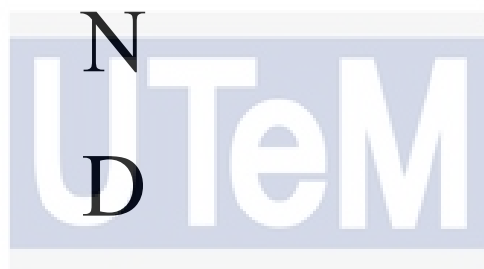
X

A

CODING

activity_main.xml

```xml
<RelativeLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:background="@drawable/default_10"
    tools:context="${relativePackage}.${activityClass}" >

    <TextView
        android:id="@+id/textView1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignParentLeft="true"
        android:layout_alignParentTop="true"
        android:layout_marginLeft="34dp"
        android:layout_marginTop="34dp"
        android:text="@string/welcome_fix"
        android:textSize="30sp"
        android:textStyle="bold" />

    <ToggleButton
        android:id="@+id/toggleButton2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignLeft="@+id/toggleButton1"
        android:layout_below="@+id/toggleButton1"
        android:layout_marginTop="38dp"
        android:text="@string/togglebutton_fix" />

    <TextView
        android:id="@+id/textView3"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_above="@+id/toggleButton1"
        android:layout_marginLeft="42dp"
        android:layout_toRightOf="@+id/textView1"
        android:text="@string/fan_fix"
        android:textSize="20sp"
        android:textStyle="bold" />

    <ToggleButton
        android:id="@+id/toggleButton3"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignBottom="@+id/toggleButton1"
```

```xml
        android:layout_marginLeft="28dp"
        android:layout_toRightOf="@+id/textView1"
        android:text="@string/togglebutton_fix"
        android:textStyle="normal" />

    <TextView
        android:id="@+id/textView4"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignLeft="@+id/textView1"
        android:layout_below="@+id/textView1"
        android:layout_marginTop="18dp"
        android:text="@string/this_is_your_home_lighting_controller_fix"
        android:textSize="20sp"
        android:textStyle="normal|italic" />

    <TextView
        android:id="@+id/textView2"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignLeft="@+id/textView4"
        android:layout_below="@+id/textView4"
        android:layout_marginLeft="33dp"
        android:layout_marginTop="52dp"
        android:text="@string/lamp_fix"
        android:textSize="20sp"
        android:textStyle="bold" />

    <ToggleButton
        android:id="@+id/toggleButton1"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:layout_alignLeft="@+id/textView2"
        android:layout_below="@+id/textView2"
        android:layout_marginTop="33dp"
        android:text="@string/togglebutton_fix"
        android:textStyle="normal" />

</RelativeLayout>
```

MainActivity.java

```java
package com.myexample.lighting;

import java.util.ArrayList;
import java.util.List;
import java.io.IOException;

import org.apache.http.NameValuePair;
import org.apache.http.client.ClientProtocolException;
import org.apache.http.client.HttpClient;
import org.apache.http.client.entity.UrlEncodedFormEntity;
import org.apache.http.client.methods.HttpPost;
import org.apache.http.impl.client.DefaultHttpClient;
import org.apache.http.message.BasicNameValuePair;

import android.app.Activity;
import android.os.Bundle;
//import android.util.Log;
import android.view.Menu;
import android.view.View;
import android.widget.CompoundButton;
import android.widget.ToggleButton;

/**
 * @author Prabu
 *
 */

public class MainActivity extends Activity {
    private ToggleButton button1;
    private ToggleButton button2;
    private ToggleButton button3;

    @Override
    protected void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.activity_main);

        button1 = (ToggleButton) findViewById(R.id.toggleButton1);
        button2 = (ToggleButton) findViewById(R.id.toggleButton2);
        button3 = (ToggleButton) findViewById(R.id.toggleButton3);
    }

    /**
     * Click event of the togglebutton1 is declared in the layout xml file itself.
     * @param view
     */
    public void onToggleClicked(View view) {
        final HttpClient httpclient = new DefaultHttpClient();
        // put the address to your server and receiver file here
        final HttpPost httppost = new
HttpPost("http://192.168.3.1:81/php/ToggleLed.php");
```

```java
            //HttpPost httppost1 = new
HttpPost("http://192.168.3.1:81/php/testscript.php");

            button1.setOnCheckedChangeListener(new
CompoundButton.OnCheckedChangeListener() {
                public void onCheckedChanged(CompoundButton buttonView, boolean
isChecked) {
                    if (isChecked) {
                        //String str = "101";
                        try {
                            List<NameValuePair> nameValuePairs = new
ArrayList<NameValuePair>(2);
                            // we wont be receiving the parameter ID in
your server, but it is here to show you how you can send more data
                            //nameValuePairs.add(new
BasicNameValuePair("id", "12345"));
                            // message is the parameter we are receiving,
it has the value of 1 which is the value that will be sent from your server to your
Arduino board
                            nameValuePairs.add(new
BasicNameValuePair("message", "3"));
                            httppost.setEntity(new
UrlEncodedFormEntity(nameValuePairs));
                            httpclient.execute(httppost); // send the
parameter to the server
                        }
                        catch (ClientProtocolException e) {
                            // TODO Auto-generated catch block
                        }
                        catch (IOException e) {
                            // TODO Auto-generated catch block
                        }
                    } else {
                        // String str = "000";
                        try {
                            List<NameValuePair> nameValuePairs = new
ArrayList<NameValuePair>(2);
                            // we wont be receiving the parameter ID in your
server, but it is here to show you how you can send more data
                            //nameValuePairs.add(new BasicNameValuePair("id",
"12345"));
                            // message is the parameter we are receiving, it
has the value of 1 which is the value that will be sent from your server to your
Arduino board
                            nameValuePairs.add(new
BasicNameValuePair("message", "4"));
                            httppost.setEntity(new
UrlEncodedFormEntity(nameValuePairs));
                            httpclient.execute(httppost); // send the parameter
to the server
                        }
                        catch (ClientProtocolException e) {
                            // TODO Auto-generated catch block
                        }
                        catch (IOException e) {
```

```java
                            // TODO Auto-generated catch block
                        }
                    }
                }
            });

            button2.setOnCheckedChangeListener(new
CompoundButton.OnCheckedChangeListener() {
                public void onCheckedChanged(CompoundButton buttonView, boolean
isChecked) {
                    if (isChecked) {
                        //String str = "101";
                        try {
                            List<NameValuePair> nameValuePairs = new
ArrayList<NameValuePair>(2);
                                // we wont be receiving the parameter ID in your
server, but it is here to show you how you can send more data
                                //nameValuePairs.add(new BasicNameValuePair("id",
"12345"));
                                // message is the parameter we are receiving, it has
the value of 1 which is the value that will be sent from your server to your Arduino
board
                                nameValuePairs.add(new BasicNameValuePair("message",
"5"));
                                httppost.setEntity(new
UrlEncodedFormEntity(nameValuePairs));
                                httpclient.execute(httppost); // send the parameter
to the server
                        }
                        catch (ClientProtocolException e) {
                            // TODO Auto-generated catch block
                        }
                        catch (IOException e) {
                            // TODO Auto-generated catch block
                        }
                    } else {
                        // String str = "000";
                        try {
                            List<NameValuePair> nameValuePairs = new
ArrayList<NameValuePair>(2);
                                // we wont be receiving the parameter ID in your server,
but it is here to show you how you can send more data
                                //nameValuePairs.add(new BasicNameValuePair("id",
"12345"));
                                // message is the parameter we are receiving, it has the
value of 1 which is the value that will be sent from your server to your Arduino
board
                                nameValuePairs.add(new BasicNameValuePair("message",
"6"));
                                httppost.setEntity(new
UrlEncodedFormEntity(nameValuePairs));
                                httpclient.execute(httppost); // send the parameter to
the server
                        }
                        catch (ClientProtocolException e) {
```

```java
                            // TODO Auto-generated catch block
                        }
                    catch (IOException e) {
                            // TODO Auto-generated catch block
                        }
                    }
                }
        });

        button3.setOnCheckedChangeListener(new
CompoundButton.OnCheckedChangeListener() {
                public void onCheckedChanged(CompoundButton buttonView, boolean
isChecked) {
                    if (isChecked) {
                        //String str = "101";
                        try {
                                List<NameValuePair> nameValuePairs = new
ArrayList<NameValuePair>(2);
                                // we wont be receiving the parameter ID in your
server, but it is here to show you how you can send more data
                                //nameValuePairs.add(new BasicNameValuePair("id",
"12345"));
                                // message is the parameter we are receiving, it has
the value of 1 which is the value that will be sent from your server to your Arduino
board
                                nameValuePairs.add(new BasicNameValuePair("message",
"7"));
                                httppost.setEntity(new
UrlEncodedFormEntity(nameValuePairs));
                                httpclient.execute(httppost); // send the parameter
to the server
                        }
                    catch (ClientProtocolException e) {
                                // TODO Auto-generated catch block
                        }
                    catch (IOException e) {
                                // TODO Auto-generated catch block
                        }
                    } else {
                        // String str = "000";
                        try {
                                List<NameValuePair> nameValuePairs = new
ArrayList<NameValuePair>(2);
                                // we wont be receiving the parameter ID in your server,
but it is here to show you how you can send more data
                                //nameValuePairs.add(new BasicNameValuePair("id",
"12345"));
                                // message is the parameter we are receiving, it has the
value of 1 which is the value that will be sent from your server to your Arduino
board
                                nameValuePairs.add(new BasicNameValuePair("message",
"8"));
                                httppost.setEntity(new
UrlEncodedFormEntity(nameValuePairs));
```

```java
                        httpclient.execute(httppost); // send the parameter to
the server
                        }
                catch (ClientProtocolException e) {
                        // TODO Auto-generated catch block
                        }
                catch (IOException e) {
                        // TODO Auto-generated catch block
                        }
                }
            }
        });
    }

    @Override
    public boolean onCreateOptionsMenu(Menu menu) {
     // Inflate the menu; this adds items to the action bar if it is present.
    // getMenuInflater().inflate(R.menu.activity_main, menu);
     return true;
    }
}
```

AndroidManifest.xml

```xml
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="com.myexample.lighting"
    android:versionCode="1"
    android:versionName="1.0" >

    <uses-sdk
        android:minSdkVersion="15"
        android:targetSdkVersion="19" />
    <uses-permission android:name="android.permission.INTERNET" />

    <application
        android:allowBackup="true"
        android:icon="@drawable/ic_launcher"
        android:label="@string/app_name"
        android:theme="@style/AppTheme" >
        <activity
            android:name=".MainActivity"
            android:label="@string/app_name" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />

                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
        </activity>
    </application>

</manifest>
```