UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ANDROID BASED ELECTRICAL HOUSING APPLIANCES CONTROLLING SYSTEM

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree of Electronics Engineering Technology (Telecommunications)(Hons.)

by

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A thesis submitted in fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology.

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DECLARATION

I hereby, declared this report entitled “Android Based Electrical Housing Appliances Controlling System” is the results of my own research except as cited in references.

Signature : .....

Name : .....

Date : .....

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunication) (Hons.). The member of the supervisory is as follow:

…….

(Project Supervisory)

ABSTRAK

Kajian ini dilakukan bagi membantu warga emas dan kurang upaya untuk mengawal suis lampu dan kipas di rumah secara jarak jauh. Projek ini dijayakan dengan bantuan aplikasi android yang telah diintegrasikan bersama suis lampu san kipas tersebut.Kebelakangan ini, banyak aplikasi telah dicipta bagi membantu orang kurang upaya dan warga emas seperti aplikasi *Vlingo Virtual Assistant, Text to Speech tools* dan pelbagai lagi aplikasi lain. Projek ini dikuasakan oleh Android. Pembanggunan android kini tidak hanya terhad kepada penggunaan di dalam telefon pintar sahaja malah ia juga boleh digunaakan bersama perkasasan elektronik lain. Bagi membina prototaip ini, aplikasi yang akan dicipta menggunakan pengkodan dalam perisian Java Eclipse dan Android SDK.Dari applikasi ini, para pengguna akan dapat menghubungkan aplikasi tersebut di dalam telefon pintar mereka melalui bluetooth yang bersambung dengan IOIO *board*. Konsep projek ini akan memudahkan pengguna mengawal suis lampu dan kipas mereka melalui pembanggunan android.

ABSTRACT

This study was designed to help elderly and disable people to control the light and fan ON and OFF switching in their home remotely. This was made possible by the development of android application that has been integrated with the light and fan switch circuit. There had been a lot of applications created to help the disable people such as Vlingo Virtual Assistant and Text to Speech tools. In this project, the system will be powered by Android. The development of android now is not limited to only in smart phone application but instead, it can be use for many electronic hardware. To develop the prototype, the application which is the user interface is created. The application is develop using Android SDK and Java Eclipse coding. From the application, the user will connect their smart phone android application through Bluetooth connection to the Bluetooth dongle that is connected to the IOIO board. The concept of this project is to make a less sophisticated remote lighting and fan switching system together with the development of android.

DEDICATION

The hardship on executing this project is dedicated to my beloved parents, family, my supervisor, and my best friends for the support and indulgence of easing till the completion of this project.

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I would like to express my greatest gratitude to Mr Mohd Fauzi Bin Abd Rahman from thr Faculty of Engineering Technology as my supervisor of this project, for his advices, dedication, efforts and tremendous support. From him, i have learned a lot about all the skills needed when working on a project and writing a report.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

PIC	-	Programmable Interface Controller
ISM	-	Industrial, Scientific and Medical Radio Band
SDK	-	System Development Kit
IDE	-	Integrated Development Environment
USB	-	Universal Serial Bus
OS	-	Operating system
AC	-	Alternating current
DC	-	Direct Current
m	-	meter
cm	-	centimeter
dB	-	power ratio in decible
dBm	-	measured power ratio references to one miliwatt
Mbps	-	Megabits per second
Hz	-	Hertz (unit for frequency)
kHz	-	Hertz in kilo

CHAPTER 1
INTRODUCTION

1.1 Project Overview

Numbers of smart phones users are increasing day by day. From the Harvard Business Review on 2013(Anonymous, 2013), data shows that almost 68% of consumers‟ use happens at home Most of the smart phones consumers are among android user. The product or technology created to assist disable and elderly people were widely created these days. Product such as Vlingo Virtual Assistant which could help disables people to navigate their android device by voice command or Text to Speech application. This will allow users to listen to the text they had received in the android device. But, most of the applications created only limited to the in android devices used only. Thus, for this project, an android application that is able to control home electrical appliances will be created. The user can control their household electrical appliances such as fan and lamp wirelessly. Users may be able to turn ON and OFF the fan and light through the mobile application created for this project. The application will be created using Eclipse software where the coding will be written in Java. This project is made up by both hardware and software. To allow this to happen, the IOIO board is used to allow the android application to connect with the circuit. These connections are capable to be wirelessly via Bluetooth connection. By implementing the android function into electrical appliances control, this system is aimed to help disabled people when turning on/off the electrical appliances remotely.

1.2 Problem Statement

There has been a lot of advance android application created to assist disable and elderly people. Applications such as text to speech were created to help the disable people to read the text messages received in their smart phones by converting the text into a speech so that the disable people can hear the message. Through the studies, there is lack of application that could help the disabilities to perform simple daily activities. Most of the applications created only focus on in smart phone use only. Other than that, in this innovative era, people demand for creations that are able to help them in performing daily activities. Thus, this project will become one of the project can help people for their convenience. In this project, an application that could help people to control their home light and fan ON/OFF switch will be created. This project is also "disable friendly", which means it is suitable for the use of the disable people and also anyone including the elderly. The connectivity is wireless. The user can control this switch by only using the Bluetooth connection. No data or WiFi connection is needed.

1.3 Objective of Study

The objectives of the project are;

1. To investigate on the development of android application and the performance of IOIO board.
2. To design an android application and fan and light switching circuit to be connected to IOIO board.
3. To test and evaluate the prototype of the connection between the android application and the light and fan switch

1.4 Project Work Scope

The work scope of the project is listed out to make sure that the project is not going off course and achieve the objectives. In this project we are creating a system that could control light and fan switch using android application. The scopes of the project are not limited only on software development but also hardware. Bluetooth connection will become the connector between the hardware and software. In this project, the main focus is on Android development and not Apple iOS. The work scopes are listed out as follows:

1.4.1 Android Application

The android application will be created using Eclipse software. The coding for the software will be created using Java, Eclipse and Android SDK. The android application will become the user interface in the project. The user may be able to control the lighting and fan system ON and OFF from this application.

1.4.2 Bluetooth Connection

From the application, Curt and Layton (2000) defines that a Bluetooth connection is required to allow the connection between the android devices to the hardware. Meanwhile, according to the studies done by Kondology (2011), a Bluetooth connection works over 2.4 KHz frequency up to the range of 100m with 1Mbps speed depending on Bluetooth design class, thus providing a safe and efficient solution for light and fan control system.

1.4.3 Bluetooth Dongle

A Bluetooth dongle is a device used to allow Bluetooth connection between PIC and the smart phones. According to Kondology (2011), the Bluetooth dongle has a built in antenna that allows which could allows it to operate up 100m with a frequency of 2.4GHz ISM band with a data transfer rate up to 3 Mbps. As Kondology (2011) state that a Bluetooth dongle is small in size and easy to fit in the most crowded USB port. In this project, we are going to use a standard 10m-30m range Bluetooth dongle. A class 2 Bluetooth radio with transfer rate up to 3Mbps.

1.4.5 IOIO Board

The IOIO board is a device that allows android smart phones to be connected to the hardware. It is only 2.7x1.2” in size. The IOIO and compatible to all android version 2.1 and above. This IOIO board is Bluetooth compatible. The Bluetooth dongle will be attached to the IOIO board and will allow the Bluetooth connection. This system will be installed indoors such as and living rooms and bedrooms.

1.4.6 Fan and Light

In this project we are going to create a prototype. We are using one standard light bulb and one case fan. The light bulb and the fan will be connected to the power supply. An AC to DC converter will be used in order to allow the IOIO board to support the hardware.

1.4.7 Indoor Installation

This project works on Bluetooth connectivity which only allows connection between 10m to 30m in range. Other than that, the IOIO board is also small in size, thus, it is suitable to be installed indoors only. The best place to install this system is in bedrooms or living rooms.

1.5 Report Outline

In this part, the overview of the overall thesis will be explained by chapter.

Chapter 1:
The first chapter gives a brief introduction and idea of the project. It focuses on the overview of the project, list of objectives, explanations on the problem statement, work scope and finally the project significant.

Chapter 2:
The background of the project is discussed in this chapter along with the methods, concepts, and theory that were used in this project. The concept of the research and how it is related to the theory is also discussed in this chapter.

Chapter 3:
Chapter 3 is the methodology section. In the methodology chapter, it contains the schedule or steps that are needed to be completed in order to achieve the objective of the project. This chapter explains the procedures taken in completing this project. The detail of the project development is also explained in this chapter.

Chapter 4:
Chapter four obtains the discussion on the result. All the simulation, data collection and analysis that were obtained from the project will be discussed in detail. The

result was compared with the objectives in order to state the conclusion of the project.

Chapter 5:

In this chapter the conclusion that had been made will be listed out. This followed by some recommendation on how to improve the performance of the project based on the desired result.

1.6 Project Significant / Summary

This project started due to problem faced by the disable people to turn ON/OFF the fan or light switch. People who are physically impaired had to face this problem in their daily routine. From this project, the application created will become the user interface for the disable people to control the fan and light switch. Less movement s required for them to perform this activity. This project will be implemented indoors such as bedrooms and living rooms. In the future, this project can also be installed widely in other places such as hospital ward or nursing homes for the elderly.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

There is many types of projects that had been created or upgraded these days to help the disable people. It will become the backbone of this project. The studies and research that had been done before will be the reference in the flow of this project. Many theory and studies that had been made to create a suitable project in assisting the disable. Although the literature covers a wide range of theories, this review will focus on 6 main elements that will emerge repeatedly throughout the report. These themes are: smart phone as a controlling device in the project, Android as the operating system, Wireless switch, Bluetooth connections as a wireless media, Bluetooth adapter as the device that allows Bluetooth connections, Java Eclipse and Android SDK in creating the application, IOIO board as the connector between hardware and software, finally the AC to DC converter circuit. Although the literature presents these themes in a variety of contexts, this paper will primarily focus on their application and function to help creating this project.

2.2 Smart Phone as Controlling Device

In this project, smart phone will become the user interface. It will be used in turning ON/OFF the light and fan switch. The user will be able to control the switch remotely and no cable connection is needed between the device and switch is needed. By using smart phone, the user interface is not complex and easy to be navigated. With the help of the touch screen functions and a clear display, it will make it easier for the disable people to navigate through the system. Hwang (2012), states thath Smart phones gives the opportunity to the developers to create new applications for the advance smart phone usage. According to a study made by Nichols and Mayers (2013), smart phone are the best in providing interface because they are common, able to communicate and have the capability to connect with appliances in a wide range. In this project, a framework will be created to allow the user to interact with the appliances. It will include a two-way communication protocol between the appliances and the user. The smart phone will become the personal universal controller system in this project.

2.3 Android as the Operating System

According to a research done by Asokan (2013), early in the year 2013 the most popular mobile operating system is Android system. This has been concrete with the studies done by Paul and Kumar (2012), that is Android is the most selling mobile OS compared to Windows iOS or Mac OS devices, Android offers an open source licenses which has encouraged applications developers to create projects with many new features for advance android users. According to Tennisson (2013), other features that Android holds is, components of the structure is based on Linux and open source, it has a lot of built in services, supports automatic management of application life cycle, high quality graphics and finally it is applicable for wide range of usage including hardware integration. With all of the extra features that Android holds, it has made Android the most popular operating system for users that prefers a low cost and easy to customized for smart phones and tablets. Ham and Park (2014),

states that by using android, the developers are free to utilize the open source code to produce application software with less development effort to design and produce new embedded device as well.

According to studies by Liu and Yu (2011), the android operating system is based on Linux V2.6 kernel. It is build up from multiple layers. The first layer is the Applications layer. Ko and Os (2013), also states that this layer contains the android applications which were written using Java. This layer is also the controller for the applications that operates. The controller works in Java together with the Android Runtime and Application Framework.

The next layer is the Application Framework. This layer allows the user to access to the hardware function such as, setting the alarm, displaying messages to running the background services. One application is allowed to get access to the data from other applications (sync). According to Lui and Yu (2011), the notification manager situated in this layer allows applications to display alerts in the notification bar.

The third layer is the Libraries. This layer contains the program of the applications and many other components needed by the android system. Liu and Yu (2011), also states that, the program is important to create support to the application framework. To optimize the libraries and Java virtual machine, there is the Android Runtime. It enables the application to be compatible with the android platform.

The final layer is the Linux kernel. This layer provides the base of the service and acts as the divider between the hardware and the software stack. The security, memory management, process management, network stack, and driver model are made possible from this layer,(Liu & Yu 2011),(Ko & Os 2013).The overall stage and level for the system is shown in figure 2.1. According to Ma et al. (2014), each layer in the framework lowers encapsulation, while providing call interface to the upper layer. The overall layer is represented in Figure 2.1.

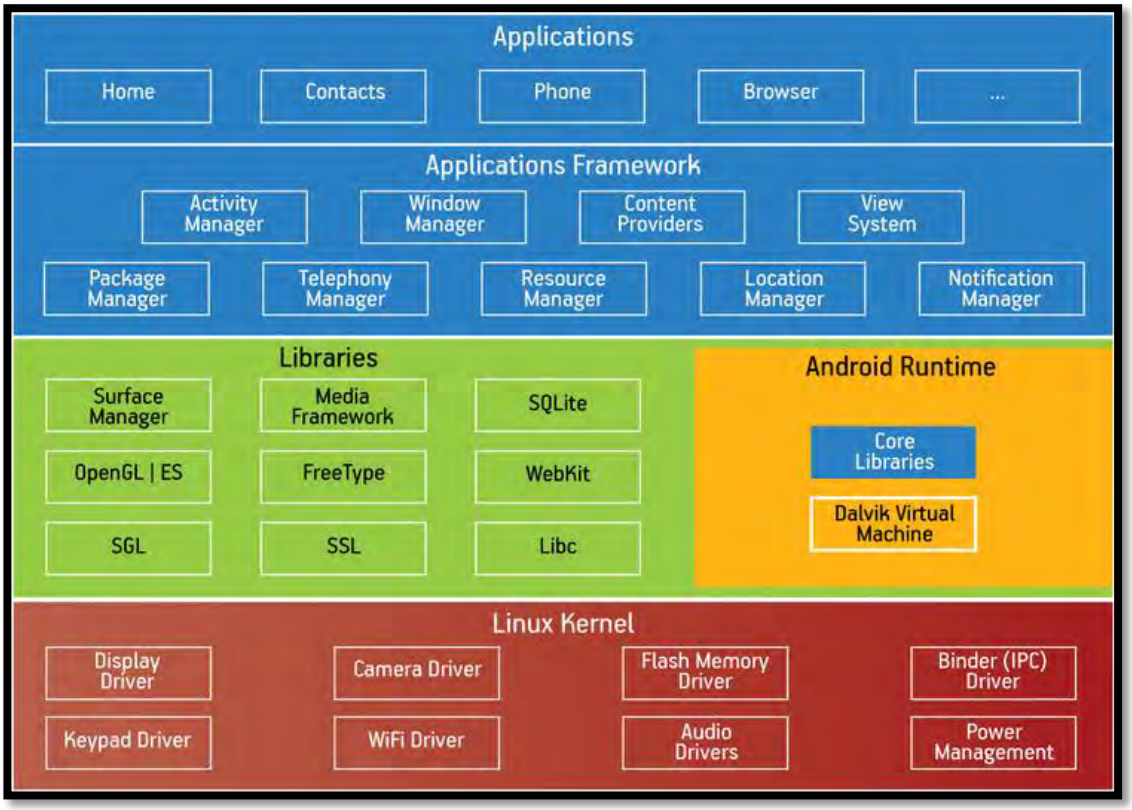

Figure 2.1 : Android system [Google]

2.4 Wireless switch

Conventional switches are commonly used everywhere. These mechanical switches are easy to use. According to Ramlee (2013), direct contact between the user and the switch is needed in order to allow it to work. Due to this action a few accidents have occurred where the user are electrocuted when turning the switches with wet hands. Thus, this have arise the idea of having a wireless switching system. Yan and Shi (2013), defines that by using a wireless switch, it will replace the cable for the switching system to create a point to point connection. Thus, it provide convenient for the user to control their switching system. According to Robles and Kim (2010), with the wireless switching system the appliances will react as output device of the project and the smart phone will become the input device.

2.5 Bluetooth Connection as a Wireless Media

Minar and Tarique (2012), defines that bluetooth is a combination of the hardware and software technology where the hardware part is the radio chip and software is the main control and security protocols. Meanwhile according to Singh et al (2011), Bluetooth promotes low power consumption and it is also potentially low cost which makes it an attractive solution for mobile user to choose when in busy network. This connection is available in all Android smart phones. The Bluetooth connection can be done wirelessly and low cost. According to Panth and Javani (2011), Bluetooth are unlike infrared connections, the connections are possible even when the devices are not directly in line of sight of each other. Panth and Javani (2011) also state that Standard Bluetooth connection has the speed of 1Mbps with the frequency of 2.4GHz within the range of 100m. The speed of the Bluetooth connection can reach up to 3Mbps according to the Bluetooth class .Bluetooth works in two different networking levels. According to Curt and Layton (2000), the first level is the physical level where the Bluetooth is a radio-frequency standard. The next level is the protocol level. In this level the parties must agree when the data is sent according to the number of bits were sent at a time and making sure that the data sent is the same as the data received. Users need to pass security offered by Bluetooth when transferring data. The user needs to establish “trusted devices” in order to transfer data. Any device that wanted to communicate needs permission from all parties involved. For the device that the user is familiar, the user can change the setting to “always allow”. By doing this action parties does not need to request for authentication every time when making Bluetooth connections to the system. As stated by Panth and Javani (2011), Bluetooth connections are wireless and covers a good range for indoor connectivity. This has made it a good medium in transferring data for light and fan controlling.