



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF AC POWER CONTROL USING
SMARTPHONE VIA BLUETOOTH**

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

By

LIEW FU HUA

B071310522

FACULTY OF ENGINEERING TECHNOLOGY

2016

DEVELOPMENT OF AC POWER CONTROL USING SMARTPHONE VIA BLUETOOTH



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2016

DECLARATION

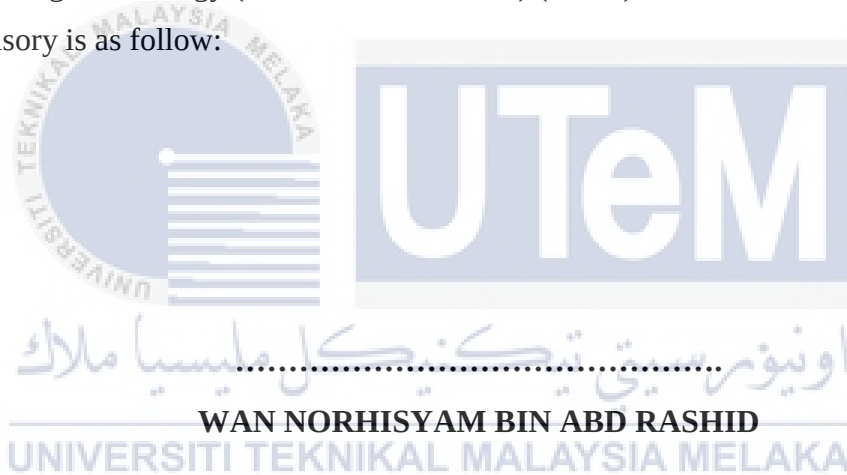
I hereby, declared this report entitled “Development of AC Power Control Using Smartphone Via Bluetooth” is the results of my own research except as cited in reference.



Signature :
Author's 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 Degree of Electronics Engineering Technology (Industrial Electronics) (Hons.). The member of the supervisory is as follow:



ABSTRACT

Nowadays, AC power control has becoming a common issue relates to the energy efficiency. The drop in efficiency mostly because of electrical energy consumed by the electrical devices. AC power control can be controlled by adjusting the desired level of output power of the electrical device. The present technology is able to feedback the ambient light intensity to adjust the require output power deliver to the light by using sensors. Although the present technology is mostly designed with self-controlled system, but are these devices really can give the desired output power to achieve the higher efficiency. Hence, the solution to solve this issue is to control the electrical appliances with Bluetooth signal. The electrical appliance is control manually by using Bluetooth device. Furthermore, disabilities they need this device to control the desired output power. The development of AC power control using smartphone via Bluetooth is designed with the microcontroller to adjust the servo motor and the motor is attached to the potentiometer which can adjust the output voltage deviate from 240V to the load. The servo motor as the mechanical way to control the potentiometer is because the motor and the electronics components could not withstand as much 240V from the source. Therefore, the output voltage to the load is able to control at voltage range of 0V - 240V. The servo motor will only rotate when the Bluetooth signal from smartphone is sent to the Bluetooth device which connected to the PIC microcontroller. The software for the smartphone to control the Bluetooth signal is designed by the MIT Apps Inventor (Android-based only).

ABSTRAK

Kini, kawalan kuasa AC telah menjadikan isu biasa yang berkaitan dengan kecekapan tenaga. Kejatuhan dalam kecekapan kebanyakan disebabkan oleh tenaga elektrik yang digunakan dalam alatan elektrik. Kawalan kuasa AC boleh dikawalkan dengan melaraskan kuasa keluaran alatan elektrik pada tahap kemahuan. Teknologi terkini adalah membolehkan intensiti cahaya ambien sebagai maklum balas untuk melaraskan kuasa keluaran yang dikehendaki dan digunakan sebagai tenaga cahaya dengan menggunakan sensor. Walaupun teknologi terkini kebanyakan dicipta dengan sistem ubahsuai sendiri, tetapi sejauh manakah alatan ini betul boleh memberikan kuasa keluaran yang dimahukan untuk mencapai kecekapan yang lebih optimum. Jadi, solusi untuk menangani masalah ini adalah mengawal alatan elektrik dengan menggunakan isyarat Bluetooth. Alatan elektrik adalah dikawal secara manual dengan aplikasi Bluetooth. Di samping itu, orang kurang upaya perlukan alat ini untuk mengawal kuasa keluaran yang dimahukan kepada mereka. 'Pembangunan kawalan kuasa AC mengguna telefon pintar melalui Bluetooth' adalah dicipta dengan mikro-pengawal untuk melaras motor servo dan motor itu adalah digabungkan dengan potentiometer dimana ia boleh melaras voltan keluaran simpang dari 240V kepada beban. Motor servo sebagai cara mekanikal untuk mengawal potentiometer adalah disebabkan motor dan komponen elektronik tidak boleh tahan voltan 240V. Oleh itu, motor akan pusing bila isyarat Bluetooth dari telefon pintar kepada alat Bluetooth dimana telah disambung dengan mikro-pengawal. Perisian untuk dikawal dalam telefon pintar adalah dicipta dengan MIT Apps Inventor (asas Adroid sahaja).

DEDICATION

To my beloved parents this thesis is dedicated to them,

For their endless love, support and encouragement.



ACKNOWLEDGEMENT

First and foremost, I have to thank my parents for their love and support throughout my life. Thank you both for giving me strength to reach for the stars and chase my dreams. My sisters, aunties and cousins deserve my wholehearted thanks as well. I would like to sincerely thank my supervisor, Encik Wan Norhisyam Bin Rashid, for his guidance and support throughout this study, and especially for his confidence in me.

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To all my friends, thank you for your understanding and encouragement in my many moments of crisis. Your friendship makes my life a wonderful experience. I cannot list all the names here, but you are always on my mind.

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Chapter 1 – Introduction



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1.1 Background

The AC power control is technology to use device to control the output voltage delivers to the load to achieve higher efficiency. In this technology, we can control the desired output power more precisely other than using the old-school discrete control (e.g ceiling fan). The power control is able to control the output from 0% - 100% and precision is up to sensitivity of 1%.

Ying-Wen Bai and Yi-Te Ku (2008) have described in recent years the energy crisis has become one problem which the whole world must face. The home power consumptions are the largest part of energy consumption in the world. In particular, the electricity consumption of lamps in a typical domestic house is a factor which can't be neglected. The desired light intensity of differ to many place due to its ambient. Sometimes it is sufficient light source from outside, and thus light does not necessary to be always on. Also, some users are not turn off the light if it is not necessary. These could be the major problem on energy wasting. Therefore, an advance power management of light control in a home is launched in order to save energy.

Chia-Hung Lien, Ying-Wen Bai, and Ming-Bo Lin, Member, IEEE (2007) they have mentioned that due the large scale increase in electric home appliance the electricity consumption tends to grow with proportion rate. Home power management is necessity to lower down energy consumption and reduce emission carbon dioxide. To design home power management, electric home appliances are networked with control and monitoring capabilities and home networks need to be installed. The home networks have been proposed and developed in order to access the networks.

Sherif Matta and Syed Masud Mahmud (2009) have mentioned about over decades, as number of electrical appliance and domestic home increase drastically, the waste of energy is gradually hard to control due to inefficient power control. In addition, it is not user friendly to rely on the users to manually adjust the power level to save energy. In this era, so much of sensors had been developed such as motion sensors and light sensors (photodiode). These technology provides the us to more convenient to detect the presence of human or the intensity of the ambient light.

Chin-Pao Hung, Kai-Chih Chang, You-Cheng Lai and Fu-Tsai Shieh (2014) have described Networking is the indispensable requirement of intelligent living technology. The home networking able to let us exchange data between electrical appliance and achieved the desired objective. For instance, power device can be monitor and control on or off by using remote power saving operation.

Annan Zhu, Peijie Lin, Shuying Cheng (2012) have explained that the development of technology is improved as the human gradually seek for high quality of life, people are preferred automated, convenient and smart home control systems. The PC is commonly used as the remote control for most home electrical appliance systems, However, there are some limitation in the PC monitor control such as its size, that inconvenience to carry, high cost and limited range of monitoring. The design in terminal based on cellphone is a good to instead the PC. The Android based smartphone are developed popular in our society. So, the power remote control based on Android smartphone will become a trend. After logged into the control interface, users can easily control the lights, TVs and air conditionings.

1.2 Problem Statement

The energy efficiency is become the most challenging problem nowadays. The most waste of energy comes from the inefficient use of the electrical energy consumed by electrical devices (lamps or Fans). For the modern control, it is still a great capacity of improvement to control the desired electrical usage. Modern control such as the speed of the fan is designed in discrete control. Discrete control is not the ideal way to control electrical devices. Discrete control sometimes not user friendly just like the air conditioner wind speed in automobile and hardly to achieve the desired level as user wanted. For some reason, the power control has becoming more difficult to disabled person. If we can design a device which can be control by finger tips on our smartphone, it could make their lives convenient.

1.3 Objectives

- i) To design android apps to control Bluetooth enabled electrical device.
- ii) Efficiently control any ac power appliance at a very specific level.
- iii) Study suitability of Bluetooth device to control ac power.

1.4 Scopes

- i) The connected device only suitable for lights and fans.
- ii) Study Bluetooth range only in a closed room.
- iii) Smartphone focus on android operating system using MIT Apps Inventor.

1.5 Thesis Organization

The 5 chapters will be covered in this report to describe the process of the thesis research. The first chapter will be an introduction which include the background of this project, problem statement, objectives, project scope and expected outcome of this project.

Also, chapter 2 Literature Review will be discussed the related theory about the project. Besides, this chapter will demonstrate the related methods developed by the past researcher and contrasting the specifications of each method to see which part of the past projects can be modified to improve the development of this project.

In chapter 3 Methodology will discussed about the process flow of this projects. Furthermore, the implementation of the projects using simulation software such as Proteus 8.3 Professional, Multisims 13 and VSPE (Virtual Serial Port Emulator) will be explained. The results from the simulation will be attached in this chapter for to convenience know the power consumptions etc.

Besides, chapter 4 Discussion will be explained the details about hardware part of the project. The hardware physical quantities of the project will be measured and compared with the simulation one. Also, the deviation from the physical output and theoretical one will be explained in this chapter.

Last but not least, the last chapter will be summarise the project report from the beginning to the conclusion. The recommendations of the projects are also stated in this report.



Chapter 2 – Literature Review

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2.1 Introduction of Literature Review

In this chapter, I will discuss about related theory to the project. From this chapter, I started to define the related equipment and example of Power control via Bluetooth signal transfer. This chapter will include the transformer, principle of voltage divider(potentiometer), Microcontroller(PIC) and Bluetooth circuit to control motor.

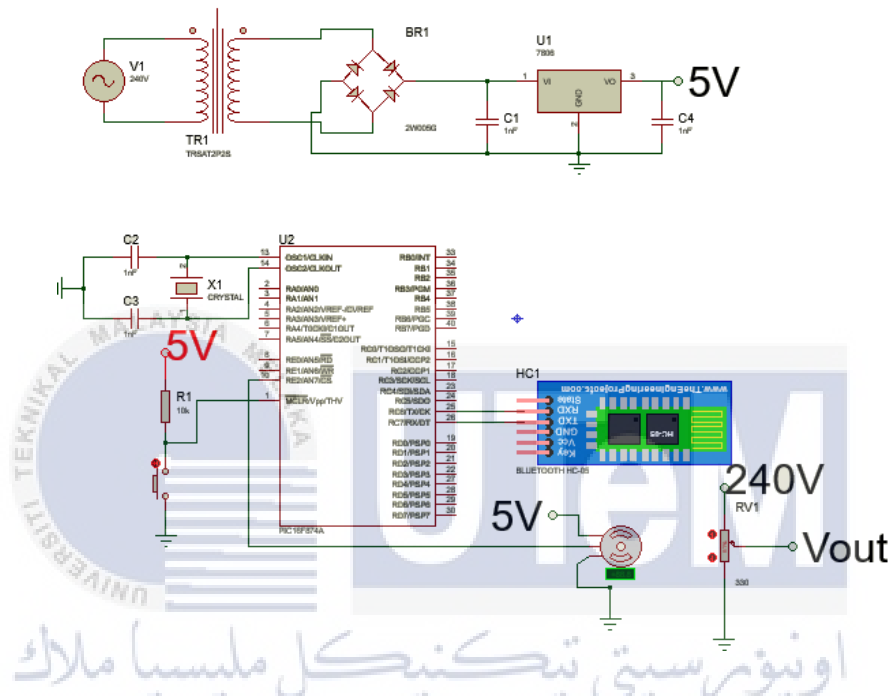


Figure 2.1.1: Expected circuit for AC Power Control Using Smartphone Via Bluetooth

As shown in the figure 2.1, the circuit divided into 2 parts. First part the voltage is transform and step down to a suitable level for the microcontroller to function as Bluetooth signal receiver and the motor controller. Furthermore, the servomotor act as a mechanical actuator to control the position of the potentiometer in the second part. Practically, our house electrical appliances are supply and support by 240 V of voltage. The second part of the circuit controls the desired output by the servo motor.

After we build the Bluetooth control apps in smartphone (android based), we can communication from our smartphone to the PIC controller and command the servo motor to move desired position and hence the output AC voltage will achieved. The output AC voltage level will be shown in the LCD display in the device as percentage value.

2.2 Demonstration of others Power Control Design

2.2.1: Method 1 - An Intelligent Light Control System for Power Saving by Sherif Matta and Syed Masud Mahmud (2009)

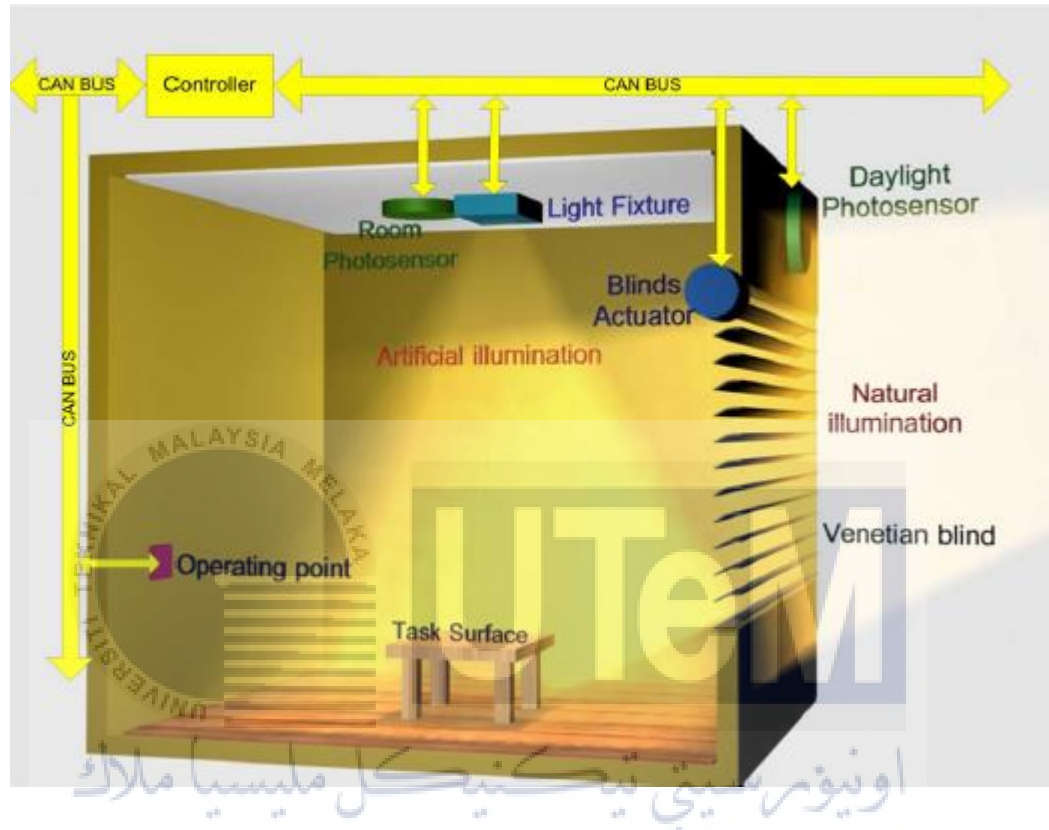


Figure 2.2.1.1: System components and physical connectivity

A) System Components:

Controlled Area Network bus, photosensors, AC/DC light bulb, servo motor, microcontroller

B) System Operation

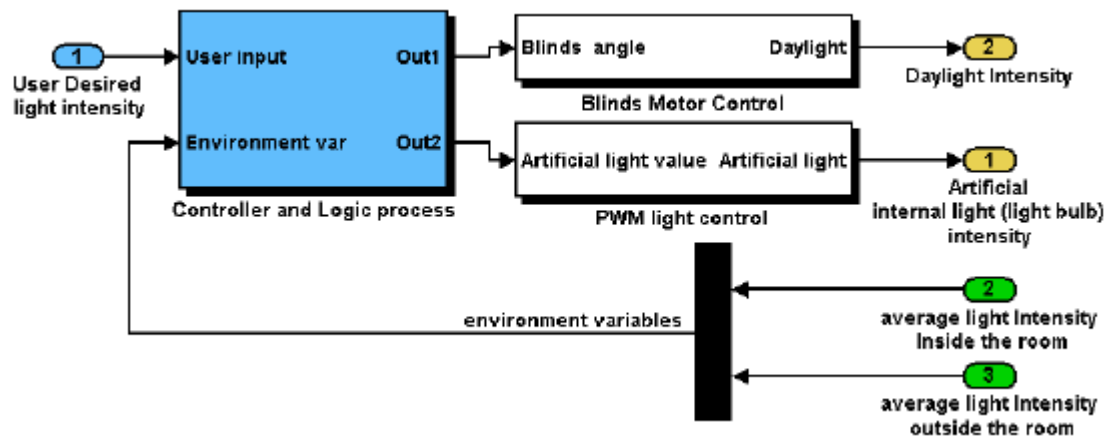


Figure 2.2.1.2: System Control Loop

The CAN Bus is to impart all segments. The estimation of room and sunlight brightening will utilize photosensors. The room photosensor ought not be set in way that it coordinate light from light sources and in the meantime it gets light from the errand surface. Average area for the room photosensor is the roof over the assignment surface. Both room or light photograph sensor can be a gathering of photosensors and by taking the normal among the whole gathering better exact readings can be acquired. The venetian blinds actuators are utilized to control the blinds edge to pass sunshine or to piece it. The light force required is balanced by means of the working point unit. The inside light source can be a DC or AC lights. DC lights are typically controlled by means of PWM signs to convey a particular measure of force without squandering any vitality in detached resistors. Air conditioning lights are controlled by means of thyristors to cut a part of the AC wave and consequently convey the predefined measure of vitality required for the fancied brightening. The fundamental controller speaks with alternate parts through the CAN transport.

The controller and logic handle pieces are dependable to gather all the approaching environment factors including light power outside the room (sunlight), light force inside the room (light) lastly the client input. The controller will handle every one of the sources of info and will be capable to give the best answer for light up the stay with the minimum conceivable power utilization. For instance, if the client needs to expand the room

enlightenment, the controller will first check how much light can be gotten from the sunlight. On the off chance that it is sufficient notwithstanding for little commitment, the controller will begin to open the venetian blinds to bring a part of the sunlight inside. In the event that the sunshine commitment is insufficient to fulfill the client necessities, the controller will incompletely utilize the fake (light) as a collaborator source to fulfill the sought light level. The controller will go about as the basic leadership piece. In addition, the controller will handle all CAN messages. Venetian blinds engine control piece is mindful to change the venetian visually impaired edge; it contains a controller and an engine driver enhancer to supply energy to the engine.

2.2.2: Method 2- Remote-Controllable Power Outlet System for Home Power Management by Chia-Hung Lien, Ying-Wen Bai, and Ming-Bo Lin (2007)

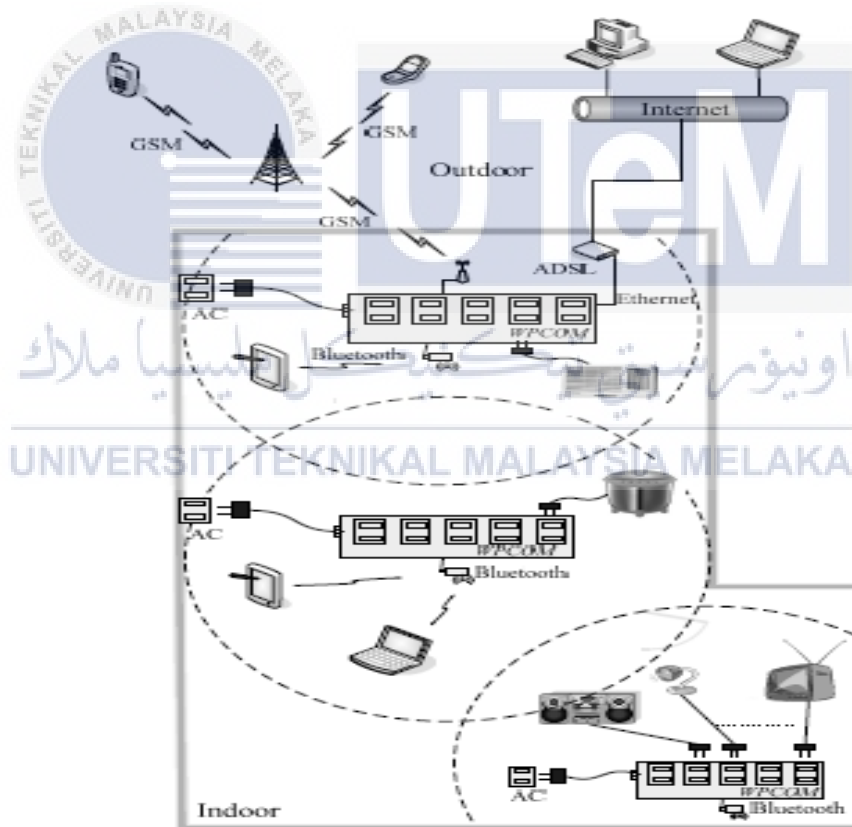


Figure 2.2.2.1: Remote-controllable power outlet system.

A) System Components:

Bluetooth module, Ethernet module, Microcontroller, GSM module and SD Card module.

B) System Operation

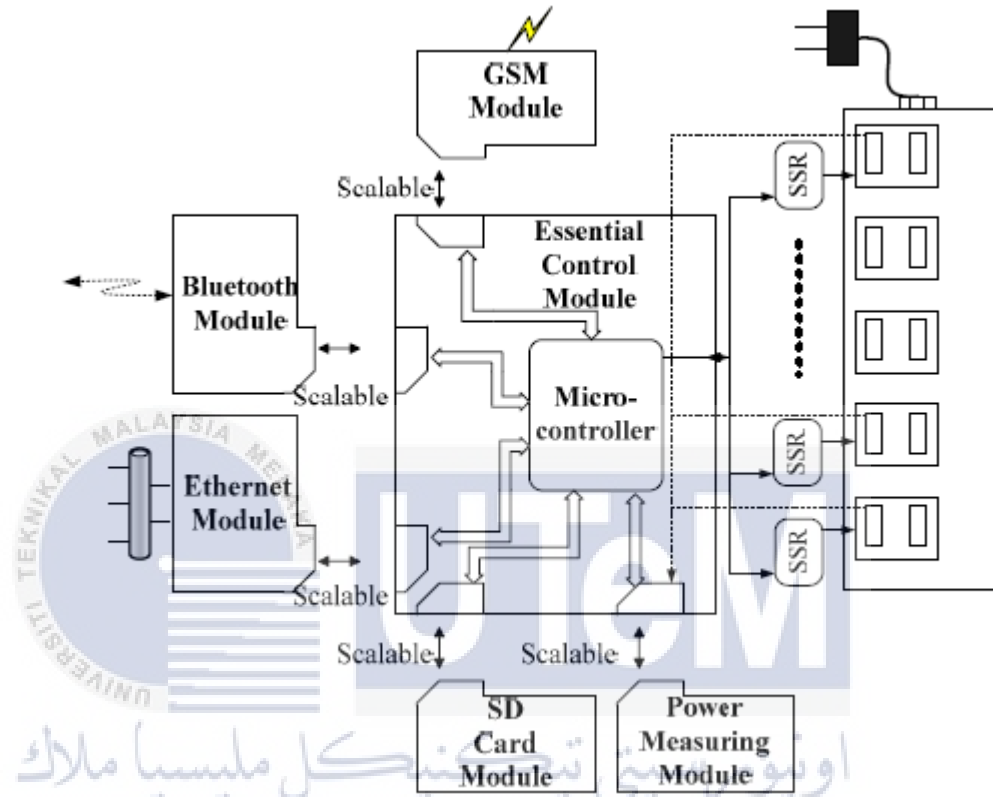


Figure 2.2.2.2: The complete block of the WPCOM.

An AC electrical plug comprising line one end and couple of attachments outlet on other. The WPCOM associated with an AC electrical plug is comprised of numerous AC control attachments, an Essential Control Module, a Bluetooth Module, a GSM Module, an Ethernet Module, a SD Card Module and a Power Measuring Module. The total piece of the WPCOM is appeared in Fig. 2.2.2.2.

The utilization of Solid State Relays (SSR) to switch every attachment are connect to electric home machine. SSR have been used to supplant mechanical transfers as a result of their many points of interest, including scaled down design, disposal of contact skip, low-vitality utilization, diminished electrical clamor, similarity with advanced hardware and rapid exchanging execution. Besides, SSR gives separation between an exchanged

2.2.3: Method 3 - Power Remote Monitoring and Control Platform Development Using MiWi Wireless Networking Protocol by Chin-Pao Hung, Kai-Chih Chang, You-Cheng Lai and Fu-Tsai Shieh (2014)



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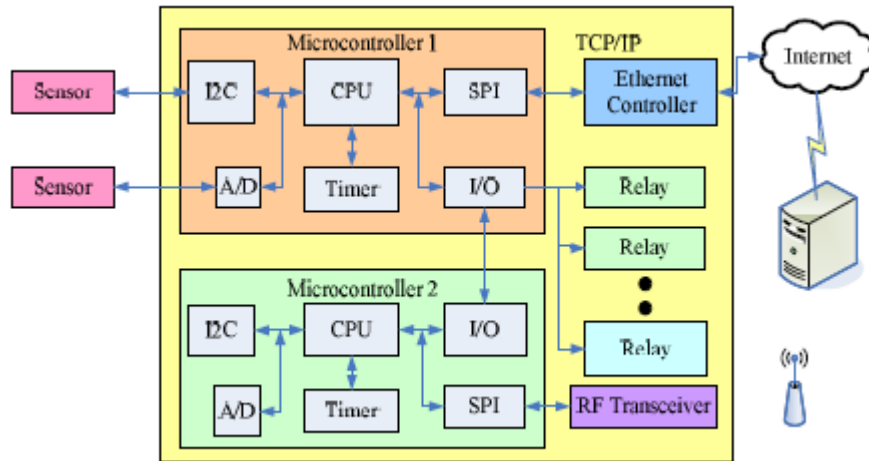


Figure 2.2.3.2: Functional block diagram of central control module of power remote controller

As appeared of Fig. 2.2.3.2, the shaded yellow range is the capacity square chart of focal control module. It predominantly contains microcontroller 1, microcontroller 2, Ethernet controller, and RF handset. Microcontroller 1, for example, actualized in PIC24FJ128GA010, is the control piece and interfacing with the web organize by means of Ethernet controller. Microcontroller 1 is installed with a site which shows a working interface about the power gadgets. Authorized client can login the site utilizing any system gadget at any system space. The control bit distinguishes the data change of the site and changes the data as control summons to microcontroller 2. Microcontroller 2 gets the control orders and communicates the control charge by means of RF handset utilizing MiWi convention. Microcontroller 2, for example, executed in PIC18F4620, offers the calculation stacking of microcontroller 2 to enhance the framework steadiness. RF handset is executed in MRF24j40MA, which incorporated has PHY and MAC addresses and effortlessly associates with microcontroller by SPI interface.

The power control unit for the most part contains a microcontroller, RF handset, and hand-off circuit which control the power plug on or off. As portrayed above, microcontroller is actualized in PIC18F4620 chip and RF handset in MRF24J40MA. Microcontroller gets the control charge and turns the hand-off on/off or reactions the hand-off states to focal control module relying upon the summon substance.

MiWi remote conventions is created by Microchip Technology that utilizes little, low-control computerized radios in view of the IEEE 802.15.4 standard for remote individual zone networks (WPANs). Uniquely suited for low information transmission rates and short separation, cost-compelled systems. Contrasting with Zigbee remote conventions, MiWi appears to be basic and effective. For example, the stack space prerequisite is just 3K-17K and not exactly the necessity of Zigbee 40K-100K under the PIC microcontroller engineering. It means MiWi is appropriate for cost-touchy applications with restricted memory. Figure 5 demonstrates the system topology for MiWi convention. It bolsters up to 8 Coordinator-able hubs, including the individual range systems (PAN) Coordinator that begins the system. It likewise bolsters directing up to 4 bounces from end-gadget to end-gadget, or 2 jumps from PAN Coordinator to any end-gadget. For improving the steering structure, a Coordinator can just join the PAN Coordinator and not able to join another Coordinator. Once the Coordinator can't achieve the PAN Coordinator, or there are as of now 8 Coordinators in the system, the Coordinator will turn into an end-gadget consequently. In this work, the focal control module assumes the PAN Coordinator part and various power control modules are the end-gadgets. In light of RF module incorporation with an interesting PHY and MAC usefulness in a solitary chip, the PAN Coordinator can communicate the summons to the sought end-gadget taking after the locations organize.

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Method 4: Automatic Room Light Intensity Detection and Control Using a Microprocessor and Light Sensors by Ying-Wen Bai and Yi-Te Ku

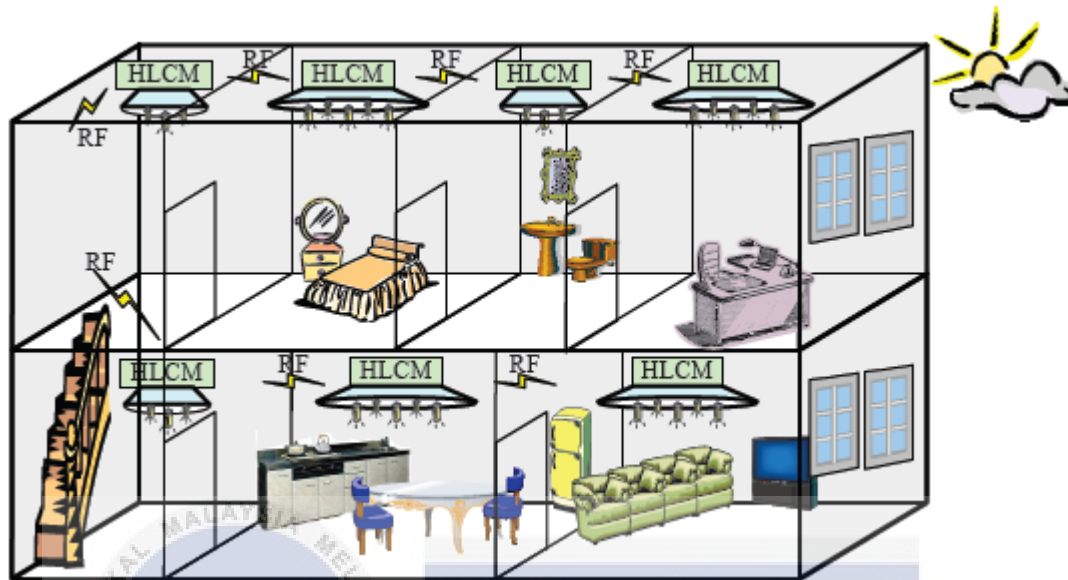


Figure 2.2.4.1: Room light intensity detection and control architecture

A) System Component:

Light Sensor, Pyroelectric Infrared Sensor and microcontroller

B) System Operation

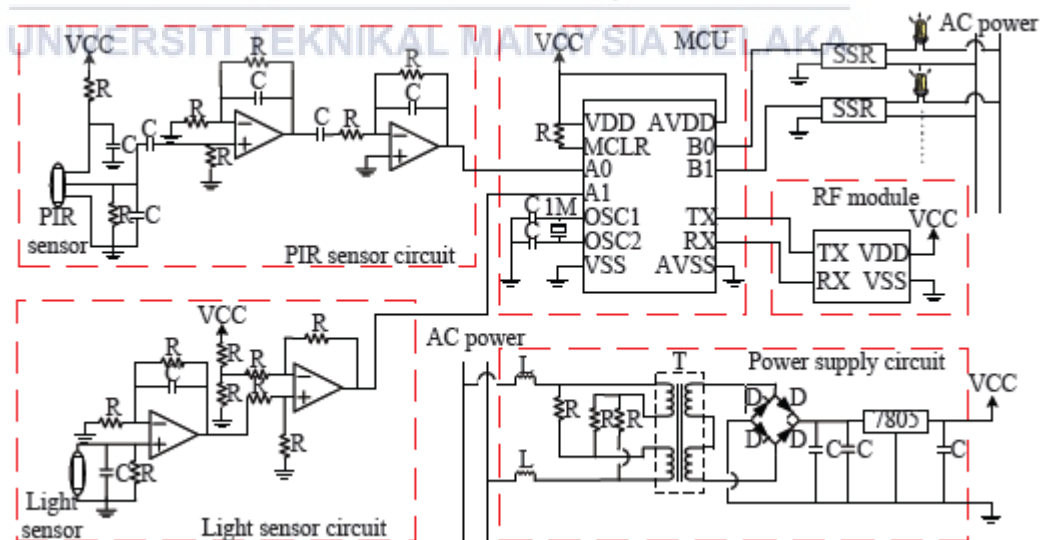


Figure 2.2.4.2: The circuit diagram of the HLCM.

The HLCM appeared in Fig. 2.2.4.1 is made up from the PIR sensor circuit, the RF module, low-control MCU and the light sensor circuit. The DC control supply from AC energy to each segment additionally provided. We utilize the PIR sensor circuit to recognize participation of somebody. On the off chance that a human body is recognized in the discovery region, the PIR sensor gets the deviation of the temperature gathered by the infrared vitality radiated to the environment, and if essential delivers the varieties of electric changes by method for a pyroelectric impact. As the electric charges are not very many and troublesome detected by the sensor, we utilize the high-impedance FET to get the flag. Since the yield adequacy of the sensors we measure, about the level of mV, is not sufficiently expansive for a MCU, we utilize intensifier to intensify the yield flag to the DAQ framework. with an adequate amount of two-phase high-pick up enhancers. Unless, if the pick up is high, slightest commotions are intensified at the same time and meddle truly with the yield flag. In this way, in our plan we have balanced the estimation of both the capacitance and the resistance so as to intensify the detected flag and as well as to lessen any clamor coming about because of the temperature varieties.

The RF module is designed to connect to the MCU in certain specific, and the communications to be made in the HLCMs. The modulation of the RF communication is FSK, and the working frequency of FM modulator is at 2.4 GHz and at speed of 2 MKbps. The benefits of using RF communication are the unnecessary of extra connection wires and the costing is low. The SSR is used to switch each light. SSRs have been applied to replace mechanical relays because of those many advantages, like miniaturized in configuration size, little or no contact bounce, low energy consumption, decreased electrical noise, compatibility with digital circuitry and high-speed switching performance. These SSR also provide isolation between a control circuit and a switched circuit.

The RF module is intended to associate with the MCU in certain particular, and the correspondences to be made in the HLCMs. The balance of the RF correspondence is FSK, and the working recurrence of FM modulator is at 2.4 GHz and at speed of 2 MKbps. The advantages of utilizing RF correspondence are the unnecessary of additional association wires and the costing is low. The SSR is utilized to switch every light. SSRs have been connected to supplant mechanical transfers on account of those many points of

interest, as scaled down in setup size, practically no contact skip, low vitality utilization, diminished electrical commotion, similarity with computerized hardware and fast exchanging execution. These SSR additionally give detachment between a control circuit and an exchanged circuit.

Method 5: Design and Realization of Home Appliances Control System Based on The Android Smartphone by Annan Zhu, Peijie Lin, Shuying Cheng(2012)

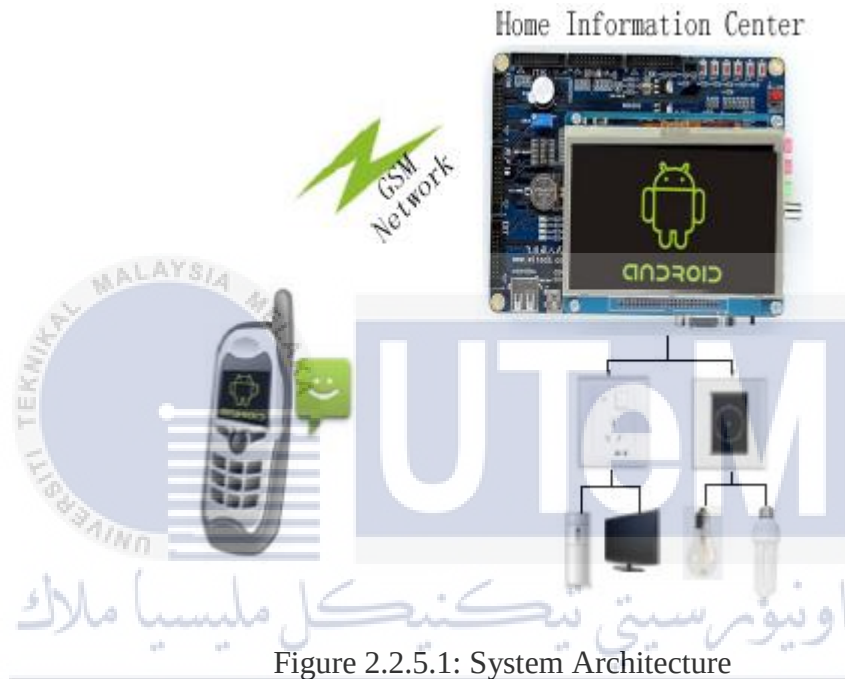


Figure 2.2.5.1: System Architecture

A) System Components:

Smartphone, Bluetooth, Microcontroller

B) System Operation

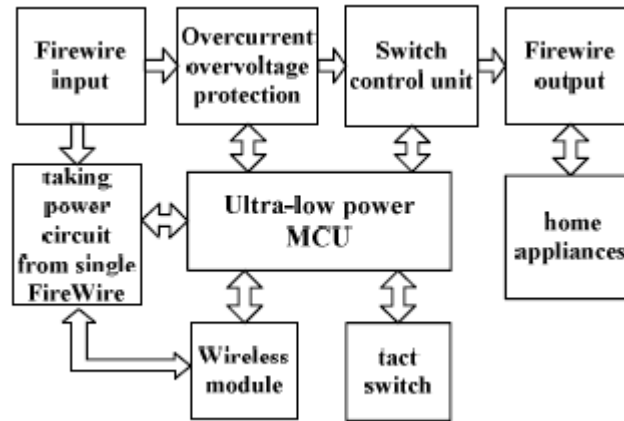


Figure 2.2.5.2: Wireless switch structure

The plan depends on Terminal on Androids cell phone, which contains GUI configuration, message order sending occasion and client administration. In the wake of entering the lighting control interface, clients send preset orders just by squeezing the suitable catch or the light picture. The client administration incorporates login, client data stockpiling, client enlistment, and its security. The client enlistment is to make a true blue client, and give him the proper get to authorizations. The present charge and the client ID will be sent to the data focus. After that, the client ID must be enrolled in the home data focus, so that the inside can recognize it precisely. Once the client uncovers his data or loses wireless, he needs to cross out the substantial ID in the home data focus to keep unlawful clients from getting to apparatuses, going for enhancing the framework security. Since the client name and secret key are straightforward information sorts, client data can be put away by the SharedPreferences class, which stores private primitive information in key-esteem sets. To store and read client data, the accompanying strides ought to be performed:

- a) Use the method `getSharedPreferences()` to get a `SharedPreferences` object for application.
- b) Call `edit()` to get a `SharedPreferences.Editor`.
- c) Add values with methods such as `putBoolean()` and `putString()`.

d) Commit the new values with commit().

e) Use SharedPreferences methods such as getBoolean() and getString() to read it.

Method	Author	Title	Description
1	Sherif Matta and Syed Masud Mahmud	An Intelligent Light Control System for Power Saving	-Servo motor actuate -Sensor feedback control light intensity of light
2	Chia-Hung Lien, Ying-Wen Bai, and Ming-Bo Lin	Remote-Controllable Power Outlet System for Home Power Management	-Control using both Bluetooth and Internet -Switch socket outlet
3	Chin-Pao Hung, Kai-Chih Chang, You-Cheng Lai and Fu-Tsai Shieh	Power Remote Monitoring and Control Platform Development Using MiWi Wireless Networking Protocol	-MiWi wireless network control -Control Switch Socket outlet using internet
4	Ying-Wen Bai and Yi-Te Ku	Automatic Room Light Intensity Detection and Control Using a Microprocessor and Light Sensors	-Human detection -Light Control using light sensors

5	Annan Zhu, Peijie Lin, Shuying Cheng	Design and Realization of Home Appliances Control System Based on The Android Smartphone	-Bluetooth control socket -Identification profile -Android Software Development
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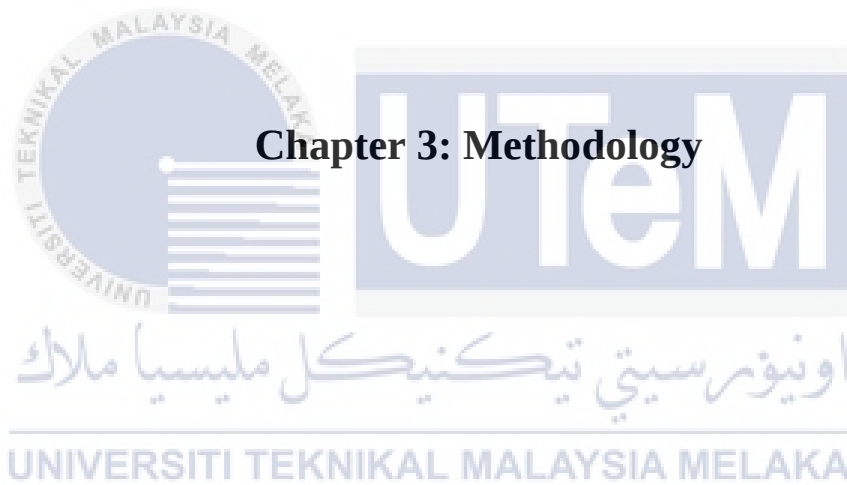
Table 2.2.1: Summary of Author, Design Title and their Description

2.3: Comparison of other Method

Design	Method 1	Method 2	Method 3	Method 4	Method 5	Method 6 (My Design)
Indoor Control Device	Sensors only	Bluetooth and LAN	MiWi Wireless Protocol	Sensors only	Bluetooth Smartphone	Bluetooth Smartphone
Setup	Medium	Difficult	Difficult	Easy	Easy	Easy
Power Control	Light only	ON/OFF	ON/OFF	Light only	ON/OFF	Lights and Fans
Server	N/A	LAN	Internet	N/A	N/A	N/A

Table 2.3.1: Comparison of other Method with my Design

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3.1 Methodology

This venture required to concentrate the Bluetooth gadget electrical circuit. The fundamental working standard of the Bluetooth is to comprehend for the accessibility of flag recurrence to work the circuit accurately.

The control run or the Bluetooth is expected to consider keeping in mind the end goal to work the gadgets inside range and less power misfortune as warmth.

The circuit required learning about how to recover motion from cell phone and turn the flag to microcontroller to control the yield voltage. Other than that, the calculation for the servo engine to turn at certain edge is should be study as well.

The control the gadget by cell phone, we need to assemble programming by utilizing MIT Apps Inventor and learn about the protest arranged programming dialect.

3.2 Expected Result

- i) The availability range for controlling the Bluetooth devices
- ii) The control for lights and fans using smartphone Bluetooth device
- iii) Understand the working principle of Bluetooth device with microcontroller
- iv) The algorithm for turning the servo motor at certain angle

3.3 Backgrounds

3.3.1 Bluetooth

Trading information over short separations (utilizing short-wavelength UHF radio waves in the electromagnetic range ISM band from 2.4 to 2.485 GHz) is the capacity of a Bluetooth which is remote innovation from settled and cell phones. This gadget is produced by telecom seller Ericsson in 1994, it was at first planned as a remote other option to RS-232 information terminal. The Bluetooth can associate numerous gadgets and tackled the synchronization issues.

The Bluetooth was named after the "short-interface" term and started in 1989 by Dr. Nils Rydbeck CTO at Ericsson Mobile in Lund and Dr. Johan Ullman. As per two innovations by Johan Ullman – SE 8902098-6 and SE 9202239 was purposed to create remote headsets. Nils Rydbeck entrusted Tord Wingren, Jaap Haartsen and Sven Mattisson in the Bluetooth advancement. They were worked for Ericsson In Lund Sweden and the recurrence jumping spread range innovation as a base of the particular.

Bluetooth Special Interest Group (SIG) has more than 25,000 part skill in the zones of media transmission, registering, and organizing. The IEEE institutionalized IEEE 802.15.1 has no more drawn out in the standard. Singular qualifying gadgets have permit for the innovation organize licenses apply to it.

3.3.2 PIC Microcontroller

These days, the use of microcontroller is profoundly associated with the remote control. In 1971, the main microchip 4-bit Intel 4004 was discharged, with the more capable chip and Intel 8008. Be that as it may, the outside chip is required for both processors so as to execute a raising aggregate framework, working framework, and making it conceivable to monetarily modernize apparatuses.

Single-chip TMS 1000 created by Intel with PC framework which enhanced for control applications. Intel 8048 consolidated RAM and ROM on a similar chip and it would discover its way into more than one billion PC consoles, and other generally applications. The microcontroller was a standout amongst the best in the organization's history said Intel's President, Luke J. Valenter. This item likewise extended the division's financial plan more than 25%.

The EEPROM memory which permitted microcontrollers (Microchip PIC16x84) to be electrically eradicated rapidly without a costly bundle concerning EPROM, and implicit Programming was presented in 1993 (This innovation is still earlier in this time, only the prior era EEPROM was less savvy and powerless, and not reasonable for ease creation with microcontrollers). The main microcontroller that utilizing Flash memory was presented by Atmel at the year end of 1993. This gadget contain the unique sort of EEPROM.

3.3.3 Software Development Tool on PIC

Editor is an application program that keeps running on a PC or workstation to permit a "comprehensible" record to be made or changed. The proofreader can likewise be utilized for surveying information situated as a part of records. Throughout the years, for standard altering necessities I simply utilize the standard Microsoft Windows Wordpad, Notepad, and Word Editors. The editorial manager in Microchip's MPLAB IDE utilizes

the standard Microsoft altering traditions and takes into account simple altering of PIC microcontroller source code documents.

The PIC Microcontroller has been around sufficiently long for there to be various dialect to browse. The low-end and mid-go PIC microcontroller structures are not appropriate for executing compilers in light of the fact that the restricted program stack, the failure to push and pop information, and the constrained enroll space all counteract customary compiler code plans to be utilized to make compilers for them.

Pertinence over the entire PIC microcontroller line is another thought when taking a gander at various dialects. The dialects that you pick ought to create code for every one of the gadgets in the PIC Microcontroller lineup. This is an imperative concern since you might put your application on a PIC16F84 for advancement and troubleshooting, however your definitive application may utilize a PIC16F54. Utilizing a compiler competent pf creating code implies that new code doesn't need to be composed when porting capacities to different individuals from the PIC microcontroller family.

An imperative element is a compiler that can be utilized "locally" with MPLAB IDE, which is excessively sat that code can be composed in MPLAB IDE and accumulated with investigating abilities straightforwardly inside the IDE to permit you to take full favorable position of the instrument. Some early compilers composed for PIC microcontrollers did not have the abilities to connect to MPLAB IDE and the absence of capacity was extremely perceptible.



Figure 3.3.3: Create Project Wizard in MPLAB IDE

3.3.4 Programming PIC Microcontrollers

The programming interface and associations, which are currently known as ICSP (In-circuit serial writing computer programs), are very basic and can be actualized effectively with standard PC interfaces. Alongside permitting others to create software engineers for their parts, Microchip was distant from everyone else likewise one of the principal producers to join electrically erasable programmable read-just memory (EEPROM, and in addition Flash memory which is identified with EEPROM) for program memory that does not require windowed earthenware bundles, and UV erasers to eradicate the chips so new projects can be stacked into them. This procedure settled on the PIC microcontroller the decision of many individuals getting into microcontrollers surprisingly.

The reason for constructing agents and compilers is to change over application source code into an information configuration that can be utilized by a software engineer to stack the application into a PIC microcontroller. The most well known arrangement is the Intel 8-bit hex record design. At the point when an application is fabricated, a hex document is produced. It might appear to be superfluous to clarify this, however the record is alluded to as a "hex" document since that is the name filename expansion.

The PIC microcontroller's ICSP capacity gives a noteworthy favorable position to engineers and producers. The ICSP elements of the PIC microcontroller consider the utilization of straightforward software engineers. This component permits you to program PIC MCUs after they have been amassed into the application circuit, which dispenses with one assembling step or kills the requirement for purchasing particular attachments and taking care of hardware for various gadgets. The ICSP interface has likewise been improved for various chips to permit troubleshooting pf the application while it is in circuit. In circuit serial writing computer programs is one of the three reasons why the PIC microcontroller is well known as it seems to be.

Vpp (RESET)	1
Vdd (+Voltage)	11, 32
Vss (Ground)	12,31

Date	40
Clock	39

Table 3.3.4: Pin Selectors for 40-Pin PCI Microcontroller Devices

3.3.5 Bluetooth Programming Concept

The fundamental of Bluetooth writing computer programs are neither various nor troublesome. All through whatever is left of this part, they will be contrasted with those of Internet programming. In spite of the fact that Bluetooth was outlined from the beginning, apparently free of the Ethernet and TCP/IP conventions, it is very sensible to consider Bluetooth programming in the same was as Internet programming. Both fall under the general rubric of system programming, and have similar standards of one gadget imparting and trading information with another gadget. Bluetooth and web programming offer such a great amount in like manner that understanding one makes it much less demanding to comprehend the other.

TCP/IP writing computer programs is developed, omnipresent, has a lot of cases, and its examination with Bluetooth reinforces the peruser's comprehension of both subjects. The greatest distinction, as said prior, is that Bluetooth concentrates on physically proximate gadgets, while Internet programming couldn't care less about separation by any stretch of the imagination. This distinction will extraordinarily influence how two gadgets at first locate each other and building up beginning association. After that, everything is essentially the same.

The genuine procedure of set up an association relies on upon whether the gadget being referred to is setting up an active or an approaching association. Generally, this is the distinction between which gadget sends the main information parcel to start correspondences and which gadget gets that bundle. We'll regularly allude to these as the customer and server, individually.

3.3.6 Servo Motor

Servo motor are rotatory actuator that permit exact control of rakish or direct position. The engines match with encoder to give speed and position criticism. The easiest servomotors can just identify the adjustments in position through the flag distinguish from potentiometer. This sort servomotor is not usually utilized as a part of mechanical zone. The servomotor is outlined with the perpetual magnet DC engine, to diminish the creation cost.

The plan for a standard mechanical part is a branch of force hardware, typically in light of a three-stage MOSFET H-connect. Likewise, the basic revolution for servomotors is just from 0 degree to 180 degrees. The control method used to alter the ON Time and OFF Time of the servomotor to decide the relating edge of revolution.



Figure 3.3.6: Servomotor

3.3.7 MIT App Inventor

This App Inventor is open-source web application initially gave by google and now kept up by Massachusetts Institute of Technology(MIT). This App Inventor permit client to make programming application for Android working framework regardless of the possibility that the client has low information about the programming.



Figure 3.3.7: Classic Block design menu in MIT App Inventor

Open Blocks is appropriated by the Massachusetts Institute of Technology's Scheller Teacher Education Program (STEP) and is gotten from ace's theory inquire about by Ricarose Roque. Teacher Eric Klopfer and Daniel Wendel of the Scheller Program bolstered the dispersion of Open Blocks under a MIT License. Open Blocks visual writing computer programs is firmly identified with StarLogo TNG, a venture of STEP, and Scratch, a venture of the MIT Media Lab's Lifelong Kindergarten Group. Application Inventor 2 supplanted Open Blocks with Blockly, a piece editorial manager that keeps running inside the program.

3.4: Related theory

The rheostat work as a voltage divider which can control the percentage of the output voltage.

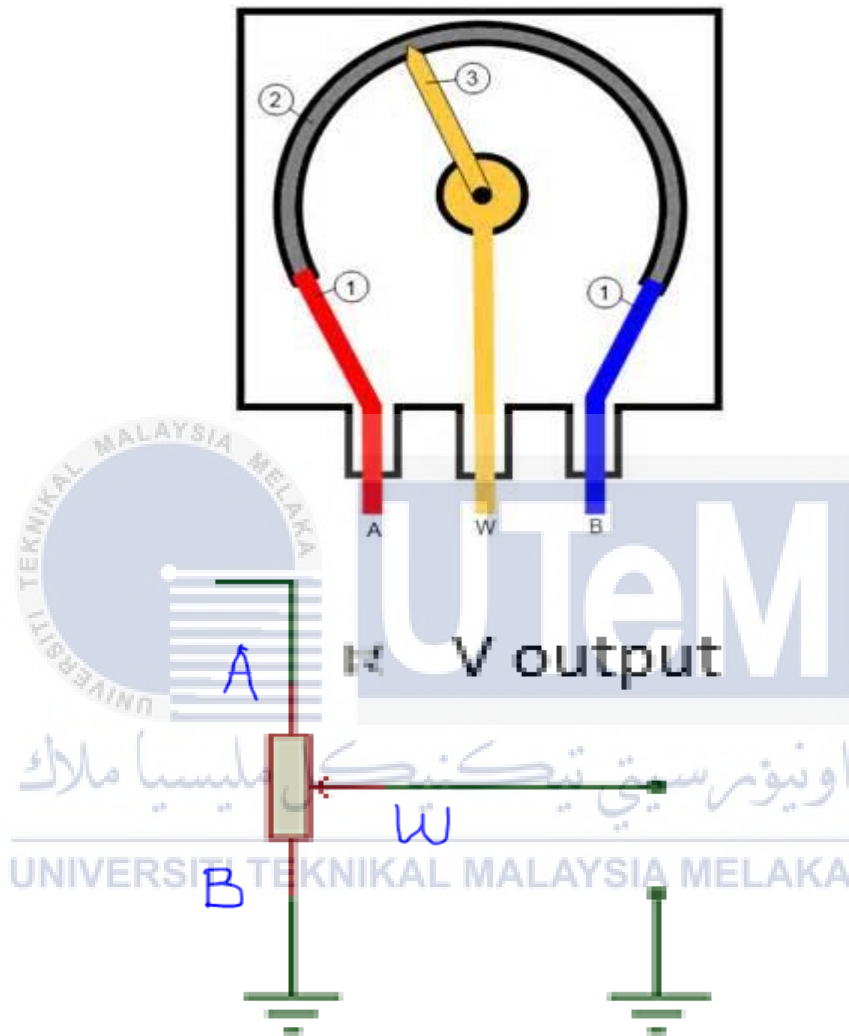


Figure 3.4.1: Circular rheostat and Potentiometer

As we can see, when the middle pointer is point fully at left, the output voltage will be 100%. Also, when the pointer is point fully at right, the output voltage will be at 0%.

Output Voltage:

$$V_{out} = \frac{R_{BW}}{R_{BW} + R_{AW}} \times 240V = \frac{l_{AW}}{l_{AB}} \times 240V$$

Output Percentage:

$$V_{out} \% = \frac{l_{AW}}{l_{AB}} \times 100\%$$

3.5 Circuit Design

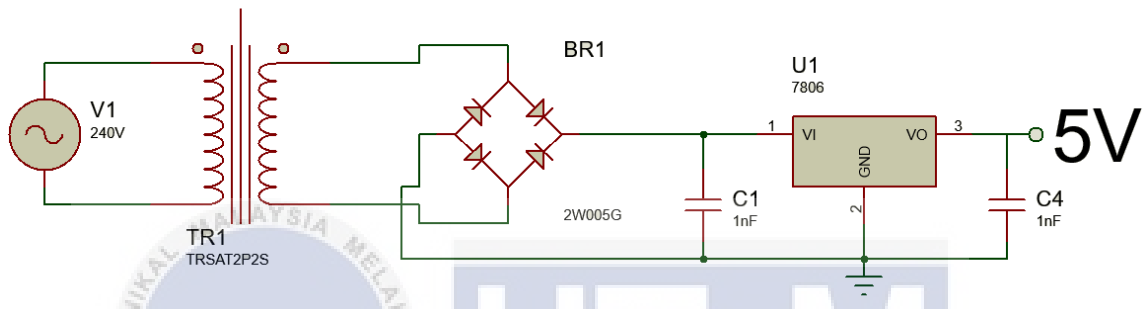


Figure 3.5.1: 5V DC supply from AC transformer and Rectifier

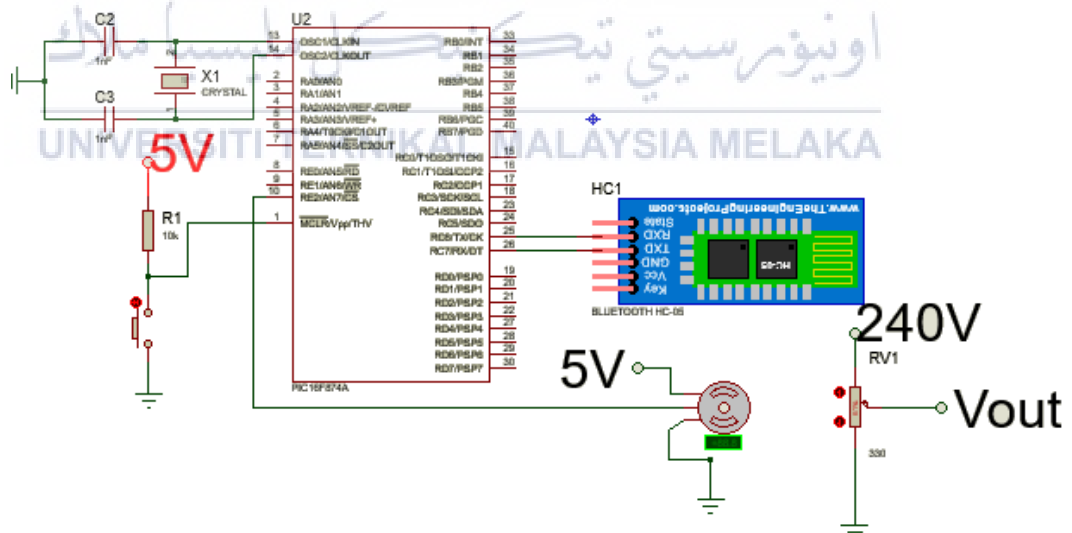


Figure 3.5.2: The Main circuit of PIC and Bluetooth

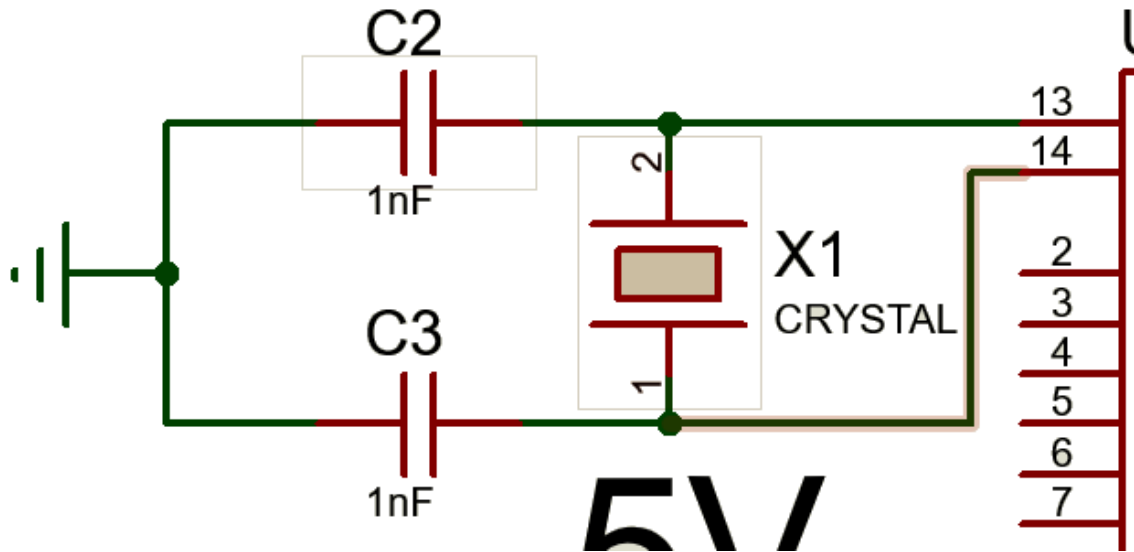


Figure 3.5.3: Clock Circuit

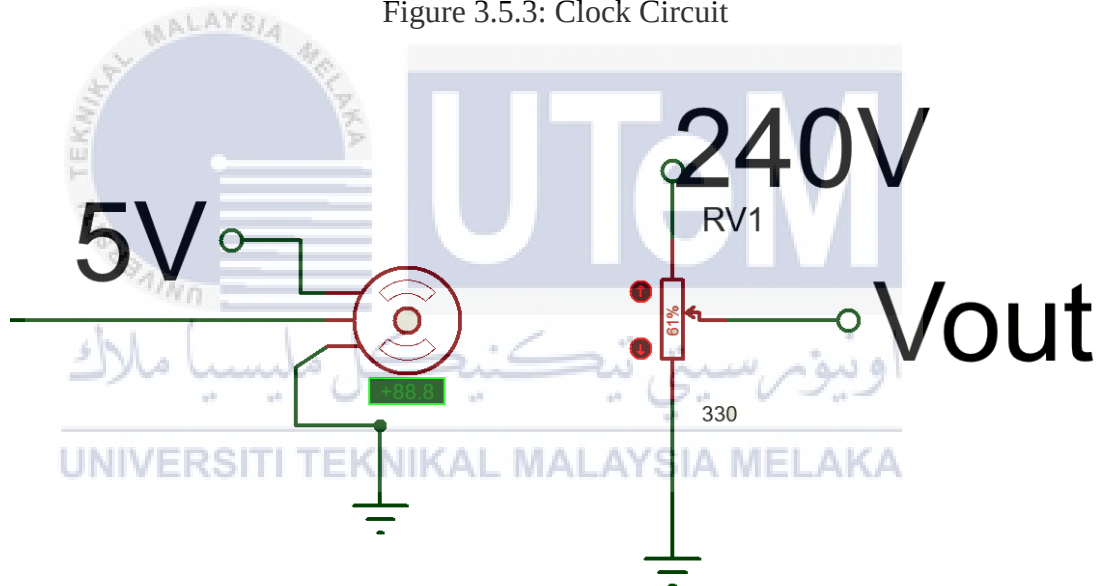
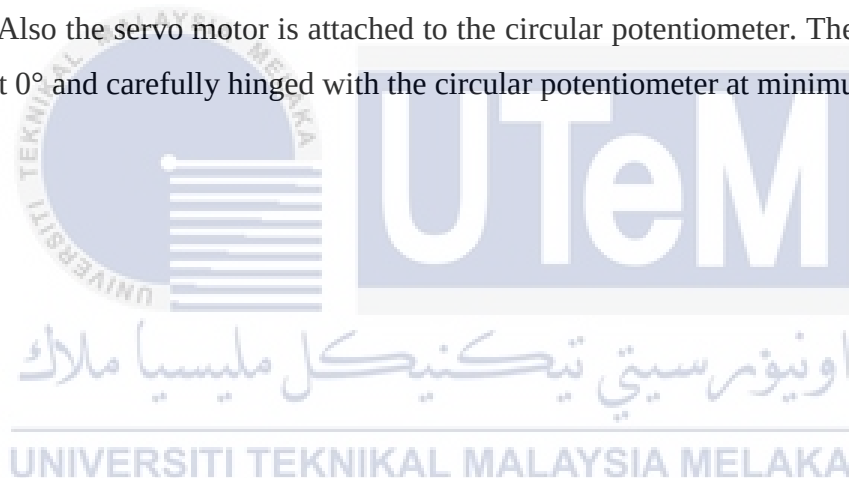


Figure 3.5.4: Servo Motor and the Controlled Output Voltage

As shown in fig 3.5.1, the 5V DC voltage is generated from the 240V AC house supply and further step down by transformer with primary to secondary ratio of 27. After that the stepped down AC voltage will proceed to full-bridge rectifier and C1 to generate smoothed unregulated 9V DC. Lastly, the unregulated 9V DC will regulated by the 5V DC regulator. Hence we can get 5V DC through the method above and use by electronics components.

The fig 3.5.3 demonstrated is the clock circuit of the PIC. The primary employment of a clock flag is to trigger occasions in an advanced circuit; it acts much as an escapement in a mechanical timepiece, driving the operation of riggings, ratchets and levers. Check beats in a PC, for instance, cause the CPU to progress to the following stride in a program and include two numbers. Clock signs are timing beats, they oversee the speed at which things happen in computerized circuits. For instance, numerous PC specialists help the execution of their PCs via painstakingly expanding the clock flag's recurrence. A clock circuit utilizes a quartz precious stone as a period base, giving a steady and solid wellspring of timing heartbeats. This accuracy is essential, as a meandering clock speed may bring about a PC to run too quick, prompting to glitches.

Fig 3.5.4 shown the servo motor received signal and then turn to the corresponding angle. Also the servo motor is attached to the circular potentiometer. The servo motor is fixed at 0° and carefully hinged with the circular potentiometer at minimum position.



3.6 System Flowchart

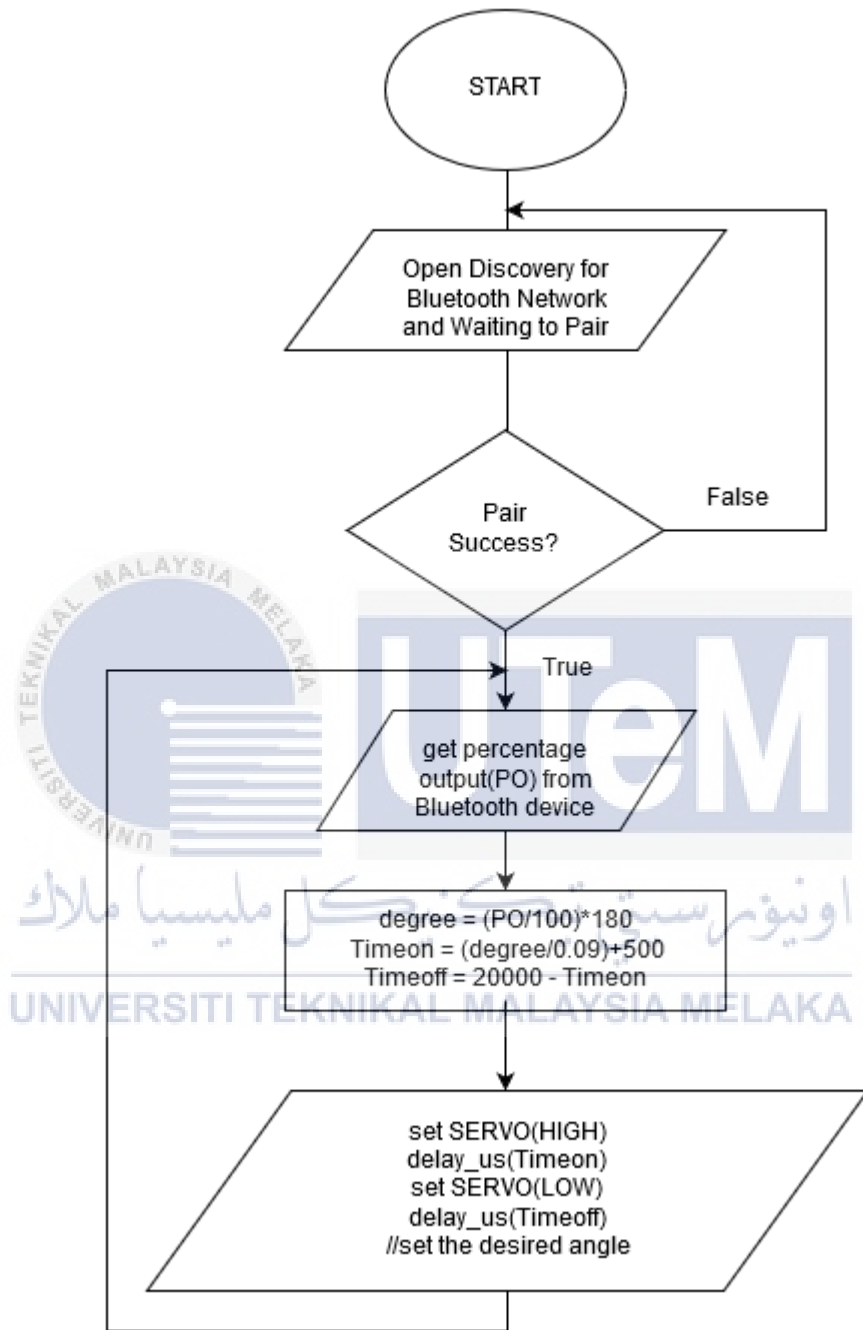


Figure 3.6.1: System Flowchart of Bluetooth Control Device

As shown in fig 3.6.1, in the Bluetooth attached to the PIC is ready open discovery to let outside Bluetooth device to pair. After the outside Bluetooth device is successfully connected to the PIC attached Bluetooth, The PIC and the Bluetooth will start to received percentage output(PO) from the smartphone via Bluetooth signal.

The angle for the servo to be turn is then calculated by, $\text{degree} = (\text{PO}/100) * 180$ (since the Servo motor is only available from 0° to 180°). The minimum signal for servo time delay to ON is $500\mu\text{s}$ and maximum at $2500\mu\text{s}$. The on time for servo motor is calculated by, $\text{Timeon} = (\text{degree}/0.09) + 500$. Hence the Timeoff for servo motor to turn off is $\text{Timeoff} = 20000 - \text{Timeon}$.

After the parameters are calculated, then the PIC will set the `delay_us(Timeon)` and `delay_us(Timeoff)` with the C command “`output_high(SERVO)`” and “`output_low(Servo)`” respectively.



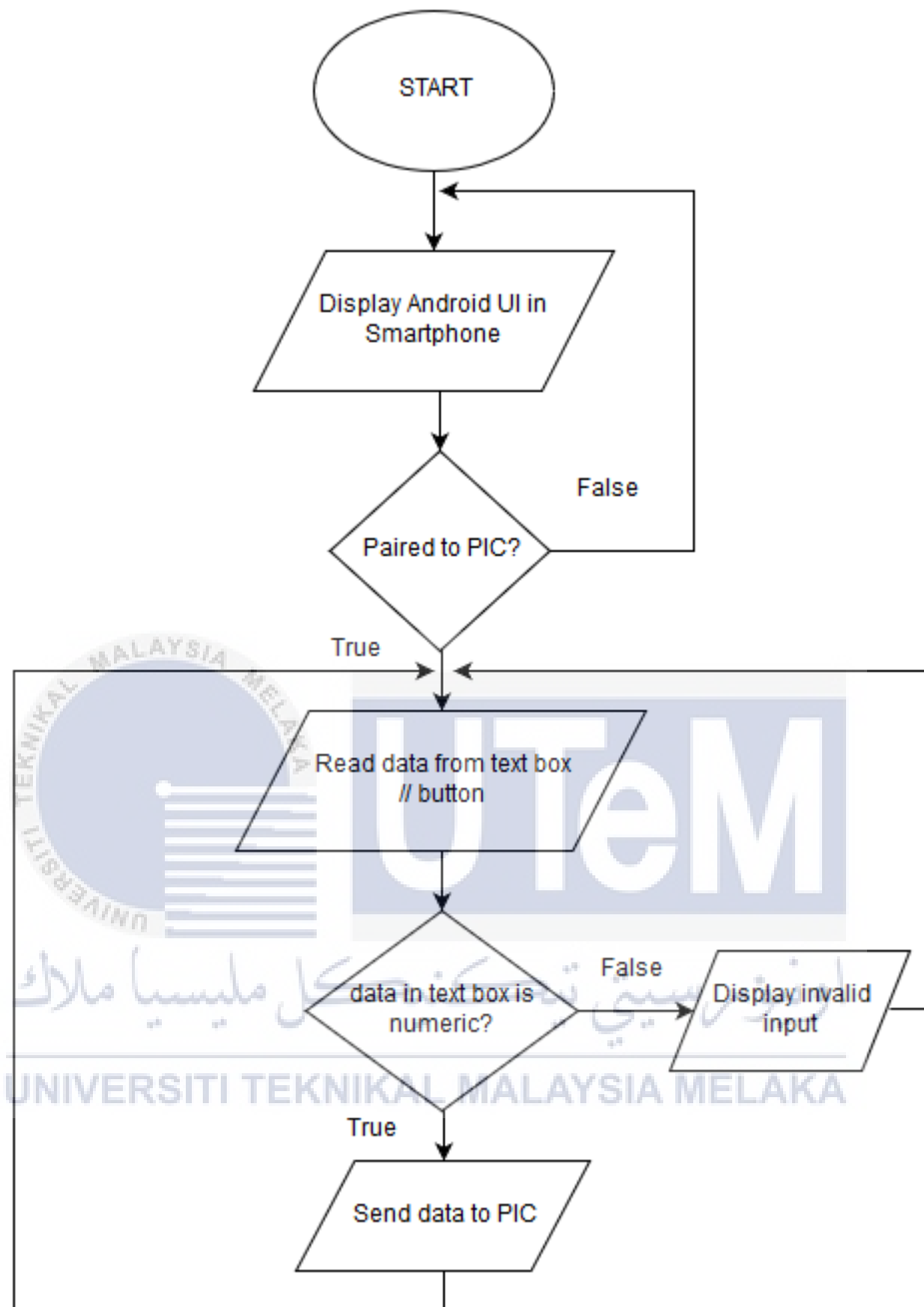


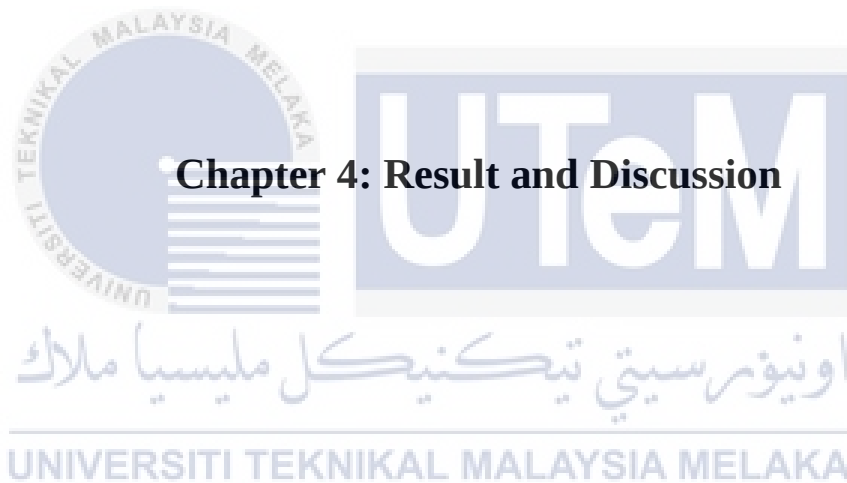
Figure 3.6.2: Flowchart of Android Apps User Interface

As shown in fig 3.6.2 the Android Apps is to be design in this flow. The Apps is first display the user interface in the smartphone. Then the Apps will ask for permission to pair the Bluetooth device in the PIC. After the Bluetooth is connected successfully to the PIC, it will read the data we either key in from the text box or the buttons. Before the data is send to PIC, the Apps will check whether input data is a numerical data. If the input data from the text box is other than numeric, an ‘invalid input’ message will be displayed in the smartphone. If the input data is validated, then it will convert to character and send it to PIC.

Degree of Servo Motor/°	Output AC voltage/V
0	0.00
20	26.67
40	53.33
60	80.00
80	106.67
100	133.33
120	160.00
140	186.67
160	213.33
180	240.00

Table 3.6.1: The relationship between the servo motor angle and output AC voltage

The table 3.6.1 shown that the angle of servo motor is directly proportional to the output AC voltage.



4.1 Introduction

In this chapter will detail explain about the outcomes for the Development of AC Power Control Using Smartphone Via Bluetooth. Moreover, the signals from the smartphone send to the microcontroller and how the Bluetooth device pair will be further discussed in this chapter. Lastly, a survey to test the device market demand is also covered at the end of this chapter.

4.2 Discussion

In the software development part, I used MIT App Inventor to develop the program. First, we need to sign-in to google account in the MIT Apps Inventor homepage. After that we choose 'create new project' and the front panel will be displayed as below.



Figure 4.2.1: Front Panel of MIT Apps Inventor

In the front panel we inserted horizontal arrangement in order to let box component to be filled. Also, I inserted a listpicker which allow me to choose the Bluetooth device that I need to pair. The text for the blocks we can edit as we want. In the program, we need 2 button which control the servo move $\pm 10\%$ for every single press. After we have complete constructed the user interface for the android apps, we may proceed to the block digram.

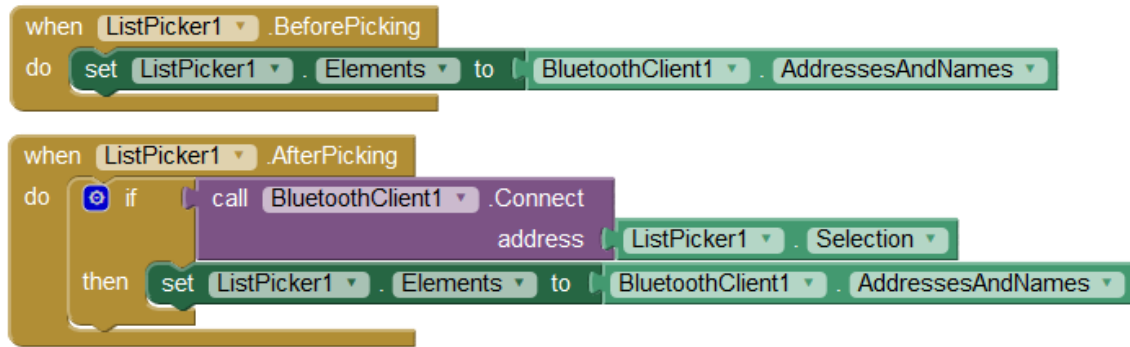


Figure 4.2.2: Block Diagram (1)

These block are to define the address and the name of the Bluetooth devices when we pressed the listpicker which allow us to select the Bluetooth device.

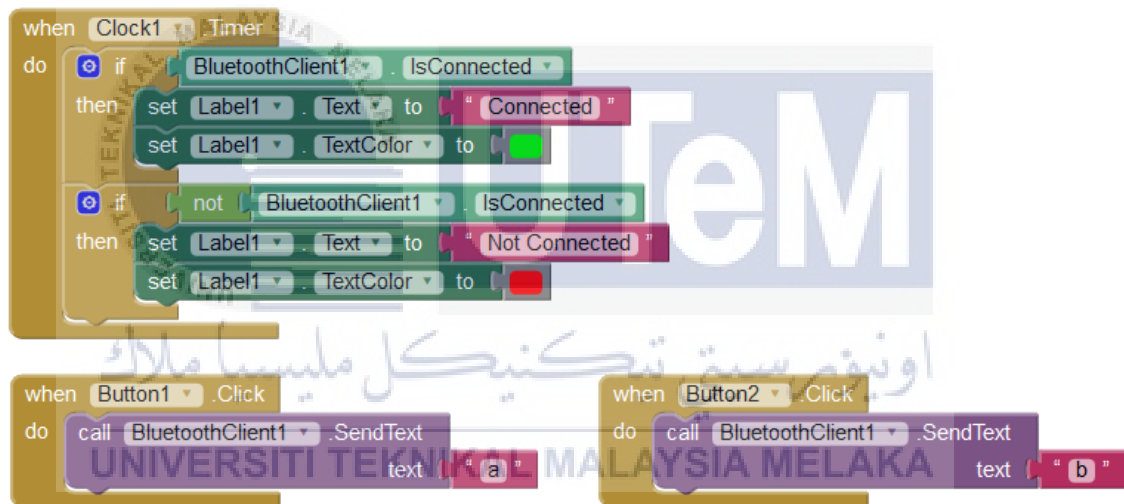


Figure 4.2.3: Block Diagram (2)

The clock block is to determine whether the Bluetooth device pair successfully. Hence we use IF-ELSE block to display the text and change the text color. The command in this apps is when press the 'minus' button the app will send character 'a' via Bluetooth. Same goes to 'plus' button, when pressed 'b' will be send out.

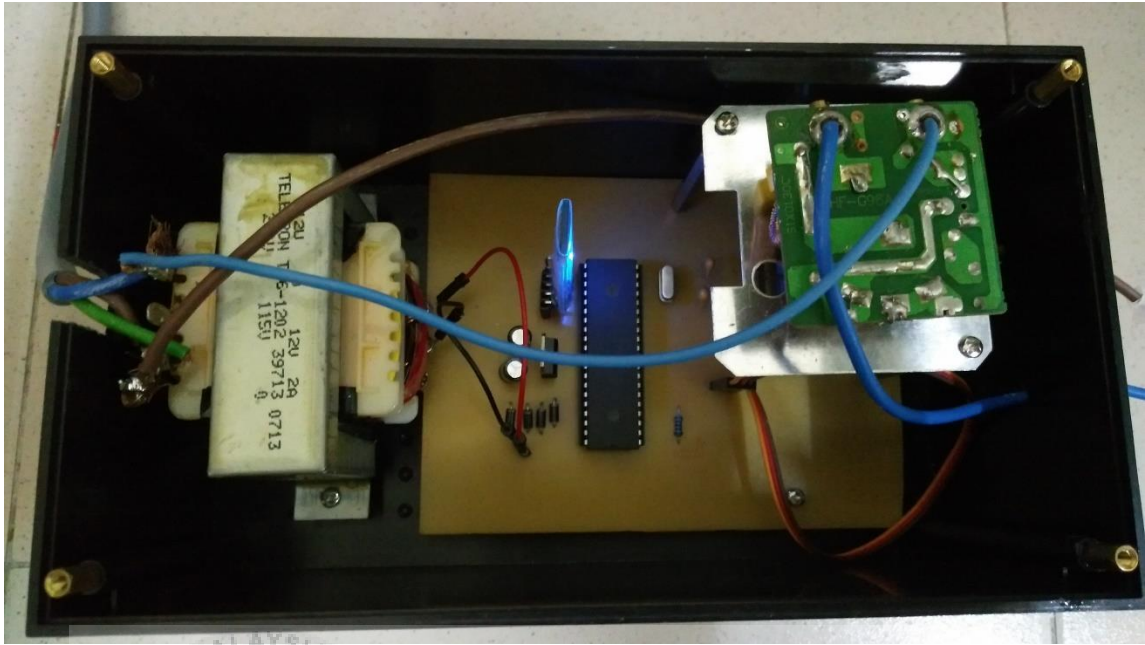


Figure 4.2.3: Hardware Prototype of the Circuit

As we can see in the figure 4.2.3, the components are installed inside a black box. From the left side, it is the transformer which step down 240V AC to 12V AC. The stepped down AC voltage 12V is then connector using male-male connector to the PCB. In the front of the PCB we have full wave rectifier, smoother capacitor, voltage regulator, Bluetooth module, servo motor and clock oscillator. The full wave rectifier, smoother capacitor and voltage regulator work as power electronics system which supply constant 5V DC to the board. The female sockets for the 4-pins and 40-pins are installed on the PCB to convenient user to detach the Bluetooth and coding the PIC.

The modified light dimmer is installed on the servo motor. The rotor for the servo motor is attached on the potentiometer in the light dimmer. It acts like a mechanical way to adjust the output voltage level.

The “Life” wire is soldered from the transformer and inserted into the IN of the light dimmer. The OUT of the light dimmer is to connect with the “life” wire of the electrical appliance. I used driller to make holes for the insertion of “Life” and “Neutral” wire.

```

#include <16F877A.h>
#include <stdlib.h>
#fuses HS,NOWDT,NOPROTECT,NOLVP
#use delay (clock=8MHz)
#define RS232_TX_PIN PIN_C6
#define RS232_RX_PIN PIN_C7
#use RS232 (baud=9600,xmit=PIN_C6,rcv=PIN_C7, bits=8, PARITY=N, STOP=1)
#define SERVO PIN_E2

void main()
{
    unsigned long timeon, timeoff;
    int degree=0;
    unsigned char data;
    set_tris_e(0x00);
    output_e(0x00);

    while(1)
    {
        data=fgetc();

        if(data=='a')
        {degree+=10;}
        else if(data=='b')
        {degree-=10;}

        timeon = 10.31* degree + 544;
        timeoff = 20000-timeon;

        output_high(SERVO);
        delay_us(timeon);
        output_low(SERVO);
        delay_us(timeoff);
    }
}

```

Figure 4.2.4: Code of the PIC

In the program we need to first declare the fuses and library that required in our program. For instance, I used PIC16F877A, hence the library for this particular PIC is declared. Then `#include<stdlib.h>` is required when we use the fuction `getc()`, `fgets()` or `getchar()`.

The default baud rate for the Bluetooth device is 9600 and we use RS232 fuse to declare the parameters. In the program, I used `fgetc()` due to its accuracy. The program will determine whether the PIC has received character 'a' or 'b'.

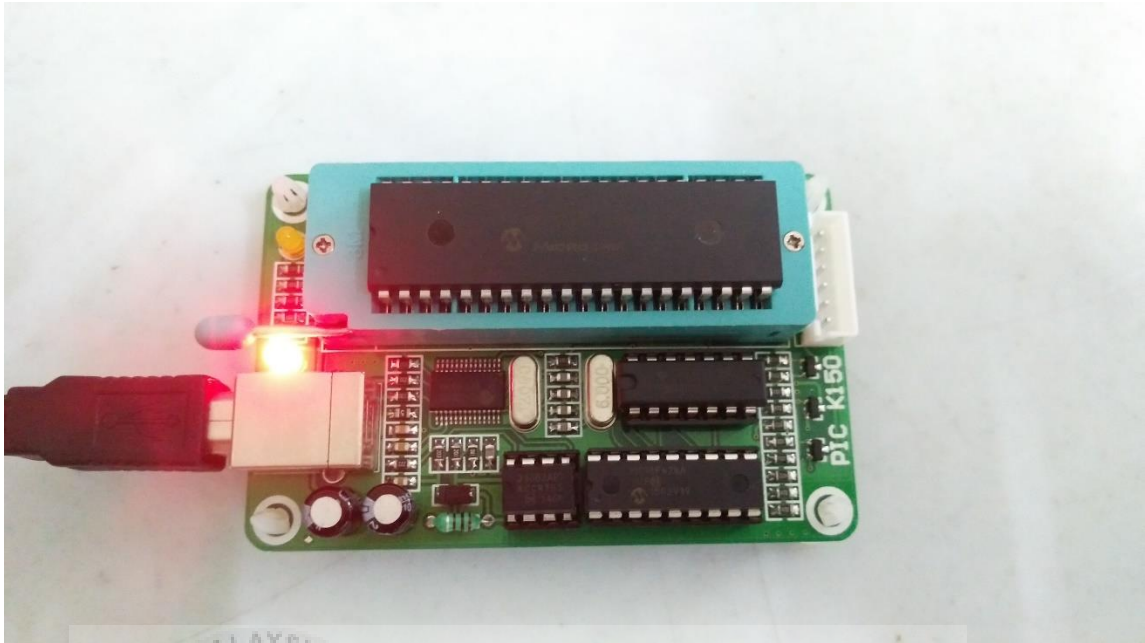


Figure 4.2.5: K150 Programmer

After we done the coding part, we need to transfer the code from PC to PIC by using this K150 Programmer. I connected this device by plugging the USB cable for each ends. We need to install the driver in order to make this device work properly. After the setup is done, we run the microbrn.exe as figure 4.2.6 shown.

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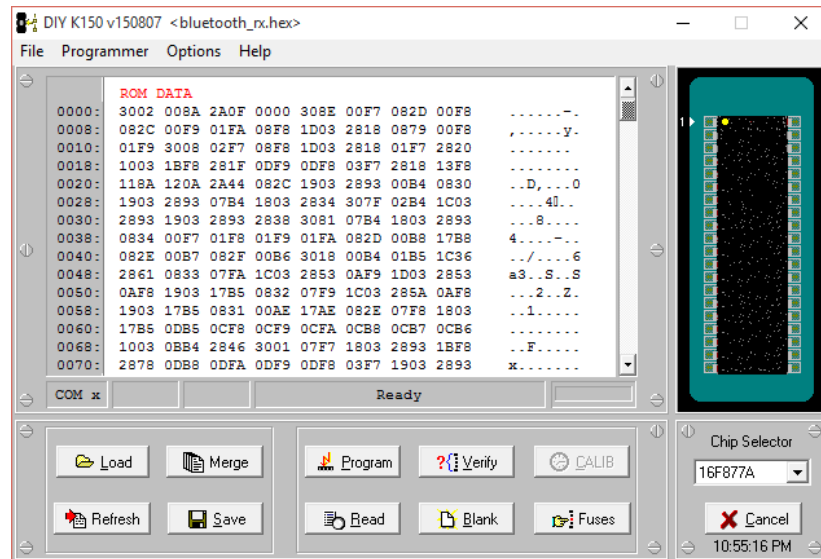


Figure 4.2.6: Microbrn.exe layout

We need to select the COM port at the Device Manager in our PC, and define the COM port number. After we know the port number, in the Microbrn.exe we use the corresponding COM port to communicate in between PC and K150 Programmer. As we done the coding part, the HEX file will be generated and then we load it at the Microbrn and make sure the PIC is already inserted to the K150 Programmer. After everything is ready, we can transfer the HEX file (PIC codes) to the PIC by pressing the “Program” button in the Microbrn. After the code is done burning to the PIC, a yellow led will lighted up in the K150 Programmer.

4.3 Analysis Results

4.3.1 Tested Outcome

The outcome is tested by using Cross Wind Detection for Direction and Speed Monitoring System. The construction for the testing is as below.



Figure 4.3.1.1: Hardware testing using Windspeed detection

The test for the hardware is constructed as figure 4.3.1 shown. I used a fan which its socket is dismantled and its “life” and “neutral” is connected with my hardware. The Windspeed Detection is only a monitoring device to read the windspeed which correspond to output power of the fan. After I power on my device, the Bluetooth in the black box is ready to pair.

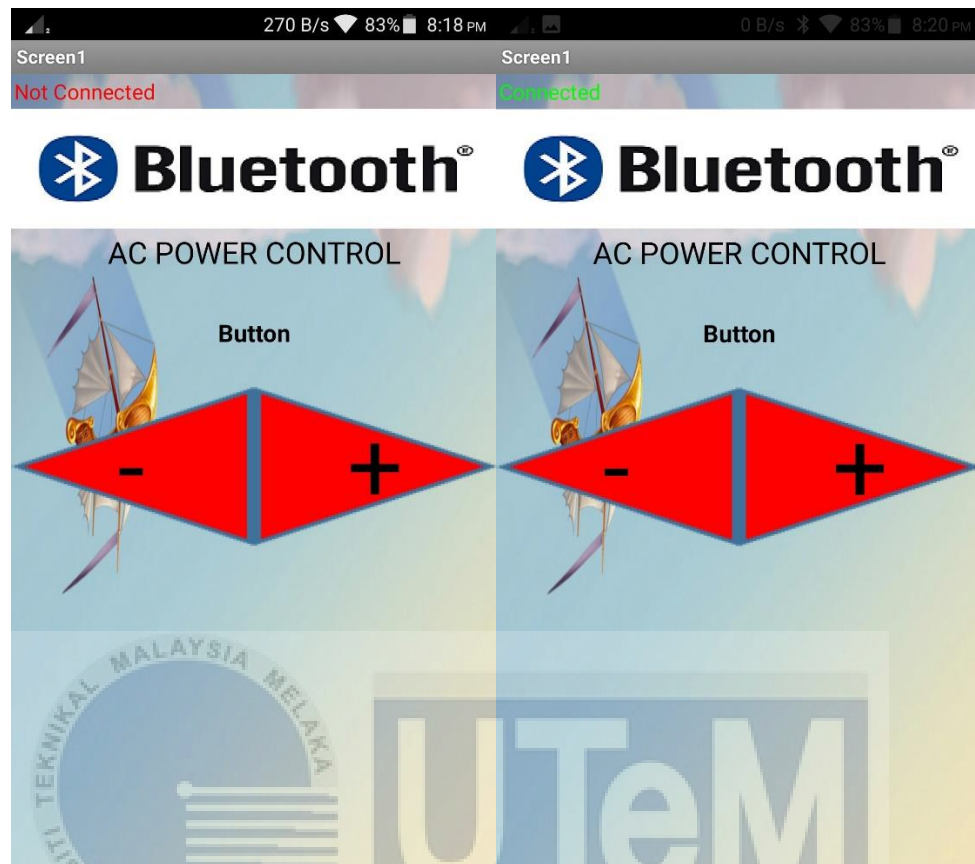


Figure 4.3.1.2: Smartphone GUI when Bluetooth is Not Connected, and Connected

In the GUI, we need to press the “listpicker” which is the “Bluetooth” logo in the GUI in order to connect to Bluetooth devices. After click the listpicker, a list of Bluetooth devices which are ready to pair will show up as figure below.



Figure 4.3.1.3: Bluetooth Devices ready to pair, HC-05

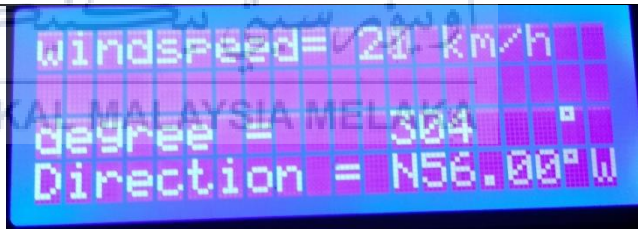
Times of '+' button pressed	Result
0	 0 km/h
1	 4 km/h
2	 10 km/h
3	 21 km/h

Table 4.3.1.1: Results for Windspeed Test of Fan

4.3.2 Product Market Demand Test

In this section, the product market demand test for the Development of Ac Power Control Using Smartphone Via Bluetooth will be discussed. How useful of the device can tell by conducting a general market survey to all different age groups and genders.

The survey is conducted as in google form or face to face interview. The age group is categorized as 19-25, 26-40, 41-60, and above 60. Each of this age group require 50 respondents to answer this survey. This survey consists of 5 questions as mentioned below.

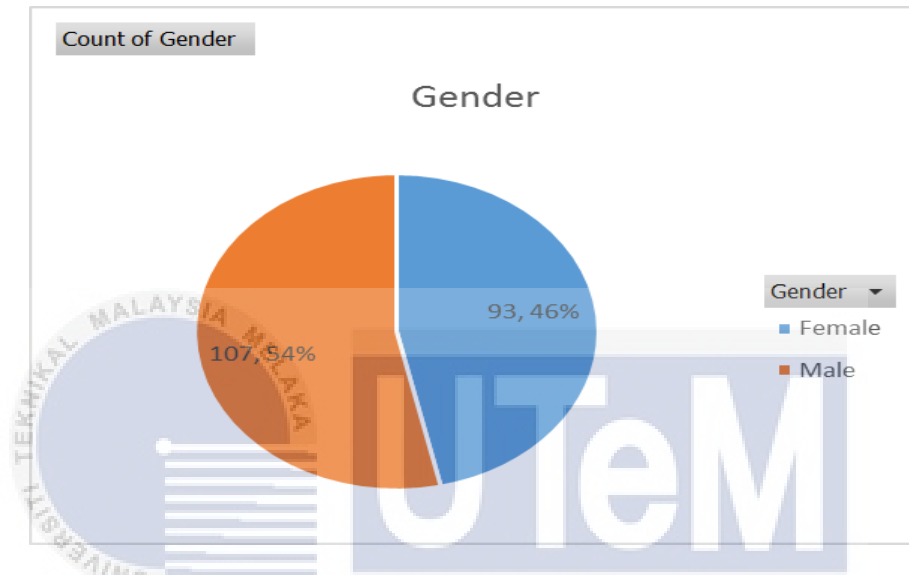


Figure 4.3.2.1: Respondents Gender Ratio

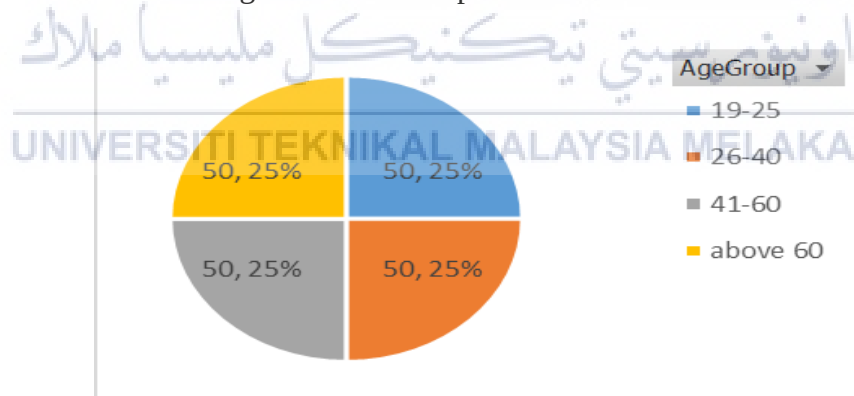


Figure 4.3.2.2: Respondents Age Group Ratio

As we can see in the pie chart, the respondents are 107(54%) male and 93(46%) female. The number of respondents between male and female shown not much difference.

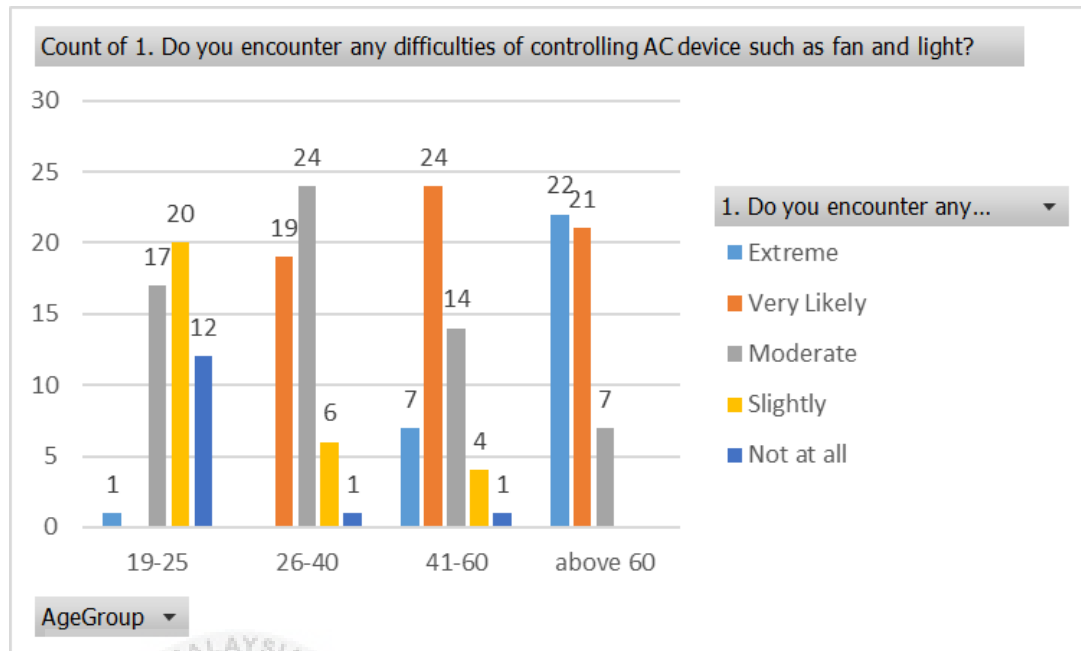


Figure 4.3.2.3: Bar Chart for Question 1

	Extreme	Very Likely	Moderate	Slightly	Not at all	Grand Total
19-25	1	17	20	12	1	50
26-40	19	24	6	1	1	50
41-60	7	24	14	4	1	50
above 60	22	21	7	0	0	50
Grand Total	30	64	62	30	14	200

Table 4.3.2.1: Response for Question 1

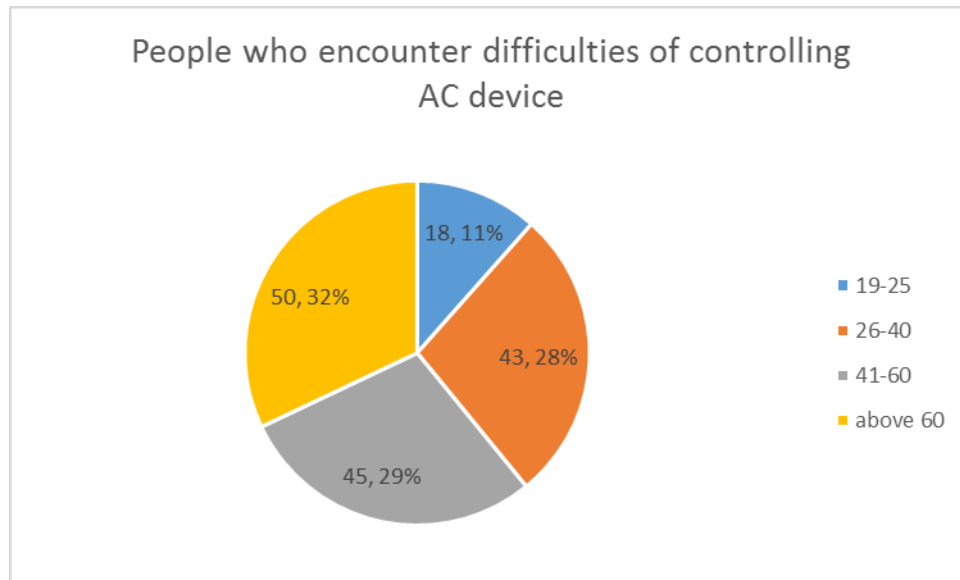


Figure 4.3.2.4: People who answered positive answer for Question 1

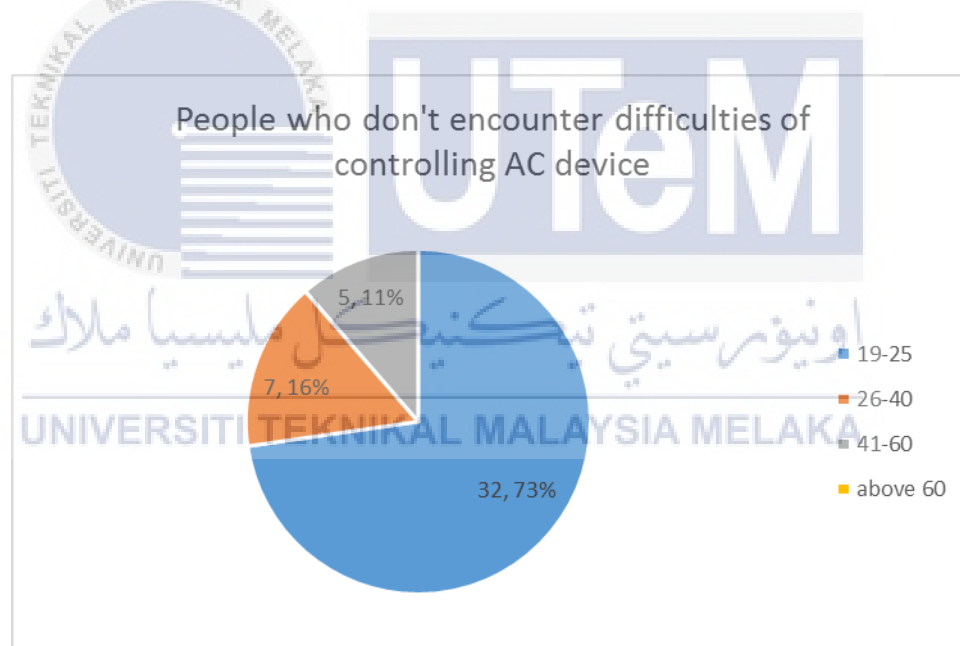


Figure 4.3.2.5: People who answered negative answer for Question 1

The bar graph in the figure 4.3.2.3 shows the distribution of the answer for the 4 age group of people. The age group that most encounter with the difficulties of controlling AC device such as fan and light is the group above age of 60.

For the graph in Figure 4.3.2.4, it shows how many of them are positively encounter with the difficulties of controlling AC device. I grouped the data of “Extreme”, “Very Likely” and “Moderate” as positive data. From that we can see the most encounter difficulties of controlling AC device is from the age group above 60 years old. The age group of 19-25 is encounter the least difficulties when controlling AC device among the all age group. The difference of people who encounter the difficulties when controlling AC device between age group of 19-25 and above 60 is 32 (64%). The significant difference of this two group exists is because elderly feels not really convenient to control the controller which fixed at certain location.

For the graph in Figure 4.3.2.5, it shows how many of them are negatively encounter with the difficulties of controlling AC device. I grouped the data of “Slightly” and “Not at All” as negative data. From that we can see the most not encounter difficulties of controlling AC device is from the age group 19-25. The difference of people who not encounter the difficulties when controlling AC device between age group of 19-25 and above 60 is 32 (73%). The significant difference of this two group exists is because youngster feel it is not difficult to control the controller which fixed at certain location.

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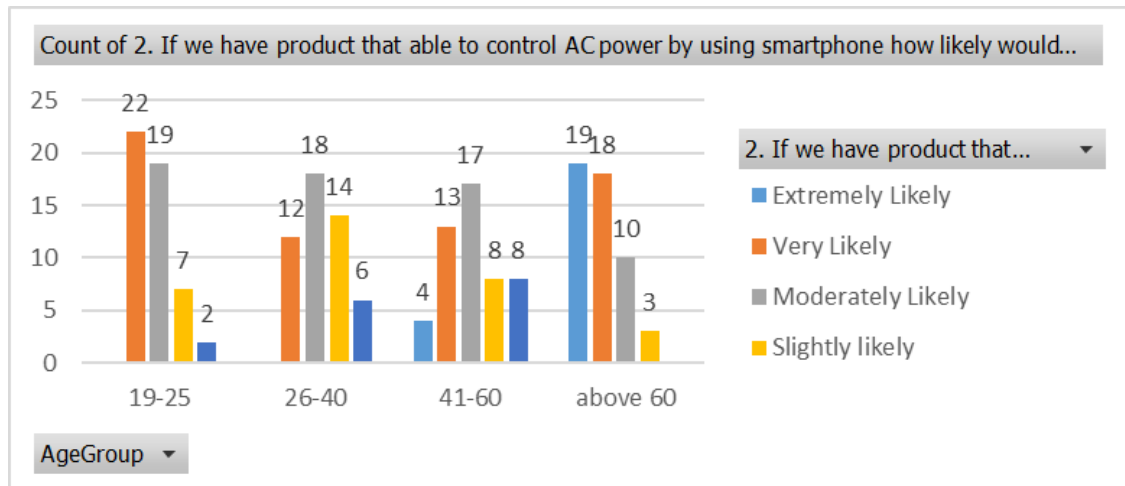


Figure 4.3.2.6: Bar Chart for Question 2

	Extremely Likely	Very Likely	Moderately Likely	Slightly likely	Not at all likely	Grand Total
19-25	2	22	19	7	2	50
26-40	6	12	18	14	6	50
41-60	8	4	13	17	8	50
above 60	19	18	10	3	3	50
Grand Total	23	65	64	32	16	200

Table 4.3.2.2: Response for Question 2

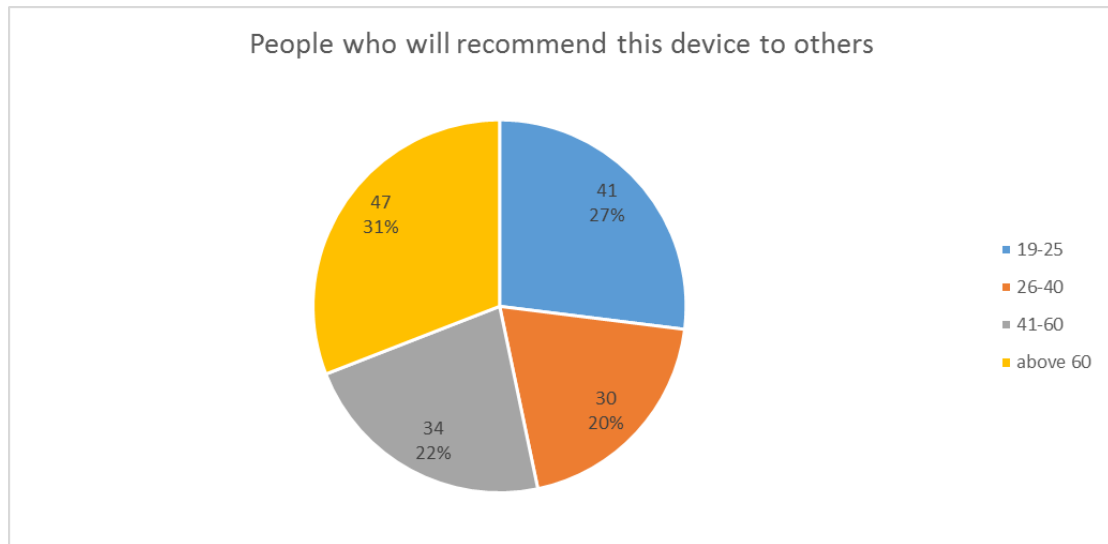


Figure 4.3.2.7: People who answered positive answer for Question 2

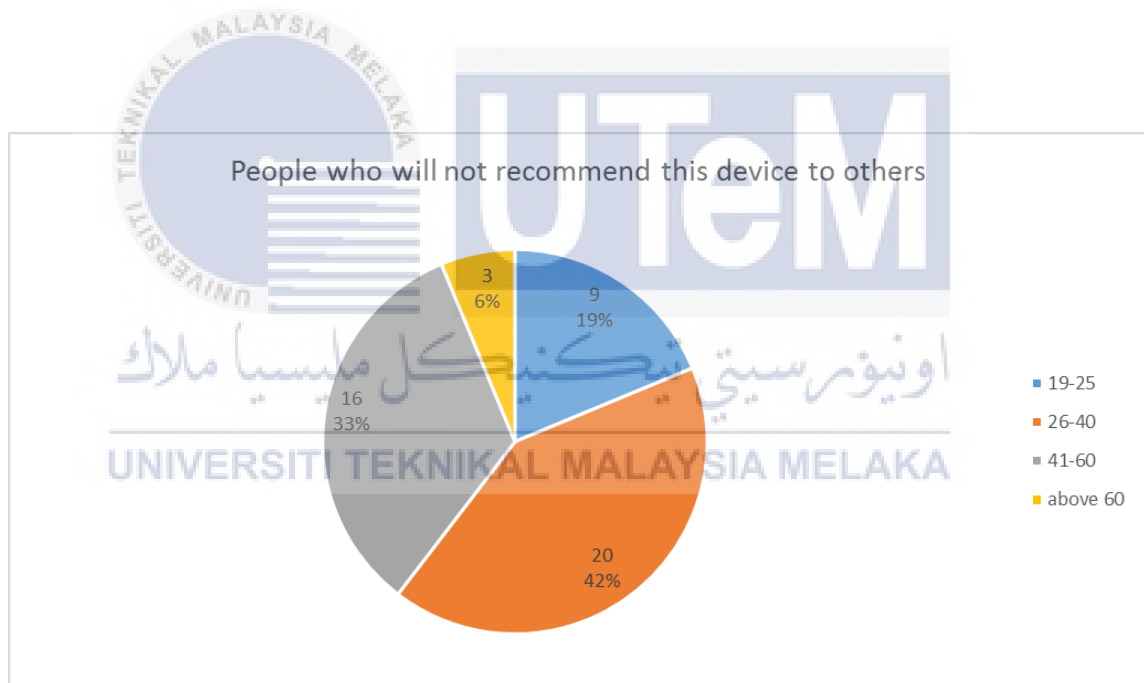


Figure 4.3.2.8: People who answered negative answer for Question 2

The figure 4.3.2.6 shows the response distribution for question 2. This question is to how they respond if the product capable to control AC device such as fan and light, would they recommend others to buy it? As we can see from the bar chart, as the age increase number of user tend to buy this product will also increase.

As we can see from figure 4.3.2.7, it shows how many of them is positively will recommend to other when this product is available. I grouped the result of “Extremely Likely”, “Very Likely” and “Moderate Likely” as positive result. From that we can see the most enthusiast to recommend to others when the product that capable to control AC device is available is the group above age of 60. The largest group support this product is group of above 60 which weight 31%. The second largest age group that support this product is the group from 19-25 which weight 27%. It is essential product for the age group above 60 and they believe this product will make their life easier. The youngster group from age of 19-25 will support this product because most of them there are elderly in their family. They hope this product could help elderly too.

For the graph in Figure 4.2.6.8, it shows how many of them are negatively will not recommend the product even the product is capable to control any AC device. I grouped the result of “Slightly Likely” and “Not at All” as negative result. From there we can know the most disagree that they will recommend to other about this product availability is from the group of 26-40 which weighted 42% among other group. There is only 3% from the group of above 60 is not recommend to others about this product. The difference from the highest group and lowest group is 39%. This difference is due to the group from 26-40 usually they are too busy with their work and don’t even feel interested about this product that can control AC device.

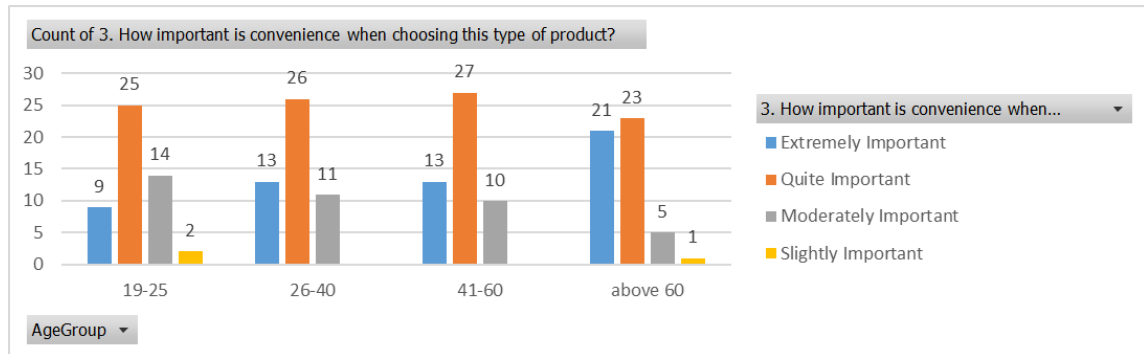


Figure 4.3.2.9: Bar Chart for Question 3

	Extremely Important	Quite Important	Moderately Important	Slightly Important	Grand Total
19-25	9	25	14	2	50
26-40	13	26	11	0	50
41-60	13	27	10	0	50
above 60	21	23	5	1	50
Grand Total	56	101	40	3	200

Table 4.3.2.3: Response for Question 3

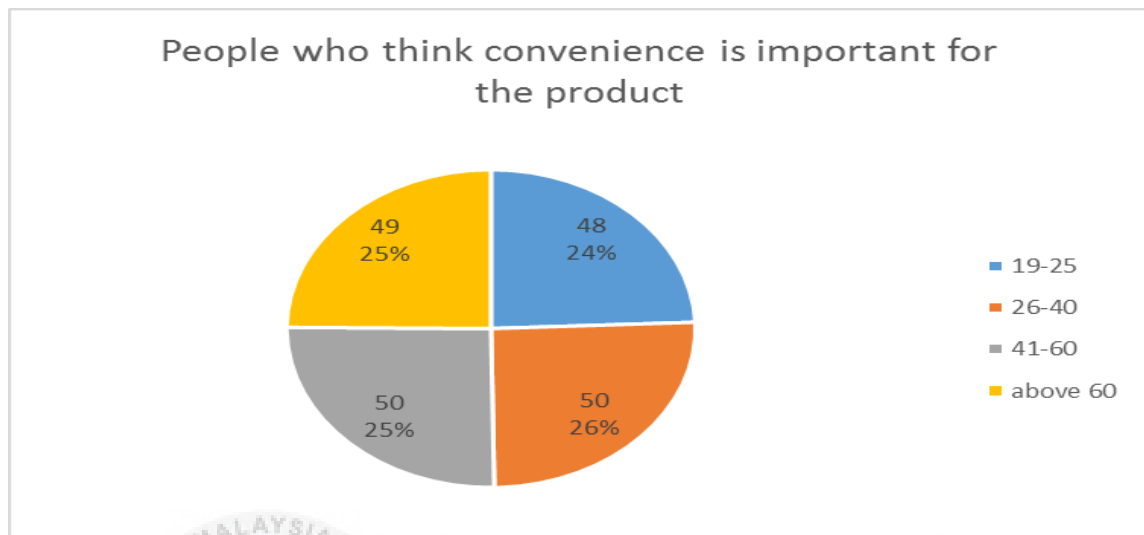


Figure 4.3.2.10: People who answered positive answer for Question 3

The bar graph in the Figure 4.3.2.9 shows the distribution of the answer for question 3. The Figure 4.3.2.10 shows how many of them are positively think that convenience is important when choosing this type of product. I grouped the data of “Extremely Important”, “Quite Important” and “Moderately Important” as positive data. From that we can see there are not much difference among these 4 age group. This is because the all group might think convenience is very important when choosing this product and they don’t buy a product if it is not convenience. If we look at the Table 4.3.2.3, there are only 3 people say that slightly important.

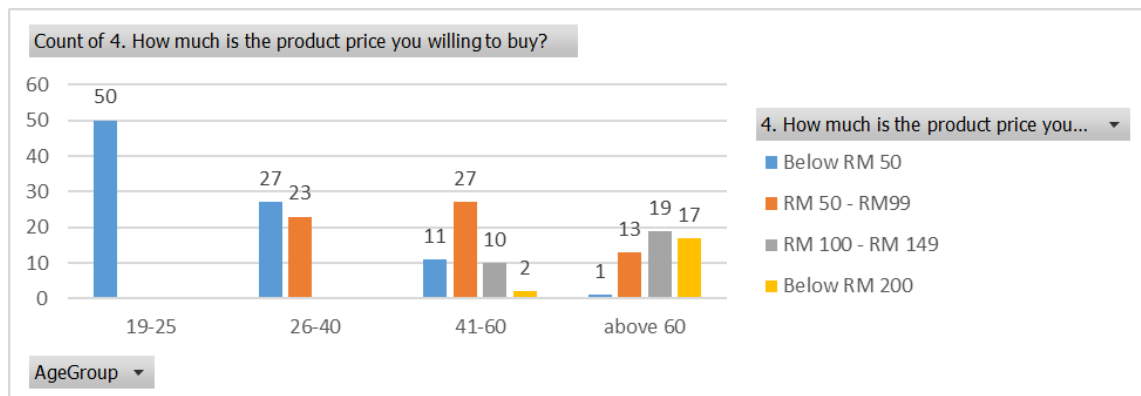


Figure 4.3.2.11: Bar Chart for Question 4

	Below RM 50	RM 50 - RM 99	RM 100 - RM 149	Below RM 200	Grand Total
19-25	50				50
26-40	27	23			50
41-60	11	27	10	2	50
above 60	1	13	19	17	50
Grand Total	89	63	29	19	200

Table 4.3.2.4: Response for Question 4

The bar graph in the Figure 4.3.2.11 shows the distribution of the answer for the question 4. Question 4 is about how much price they willing to buy the product that able to control AC device with Bluetooth. Also, as we can see in the Table 4.3.2.4, in the group of 19-25 all of them willing to buy the product only if the product price is below RM50. For the group above 60, 13 of them willing to buy the product is the product price is in between RM50-99. 19 of them willing to buy the product if the price is between RM100-149. 17 out of 50 from group above 60 say they willing to buy the product is the price is below RM200.

For elders, price below RM200 is ok to them if the product really can change their life easier. The convenient product that changed their life is priceless.

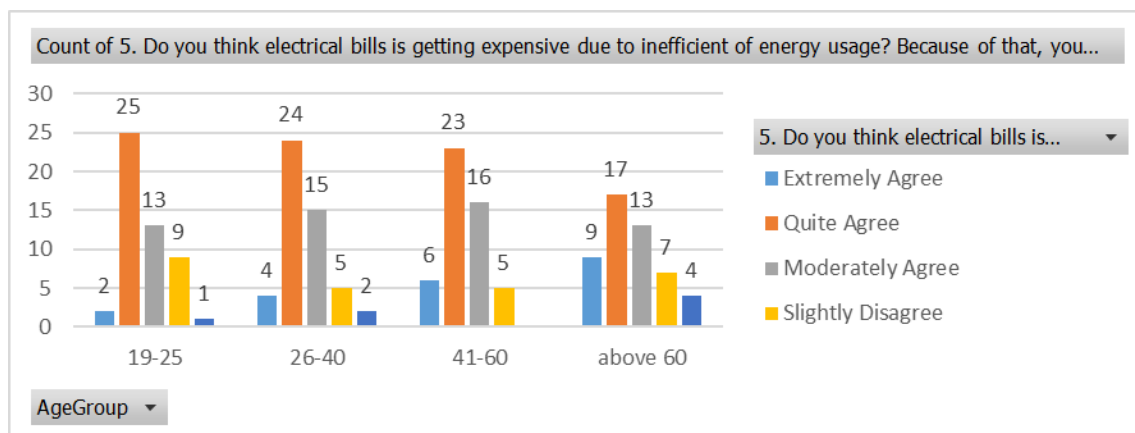


Figure 4.3.2.12: Bar Chart for Question 5

	Extremely Agree	Quite Agree	Moderately Agree	Slightly Disagree	Very Disagree	Grand Total
19-25	2	25	13	9	1	50
26-40	4	24	15	5	2	50
41-60	6	23	16	5		50
above 60	9	17	13	7	4	50
Grand Total	21	89	57	26	7	200

Table 4.3.2.5: Response for Question 5

People who think they need this device to reduce the electrical wastage

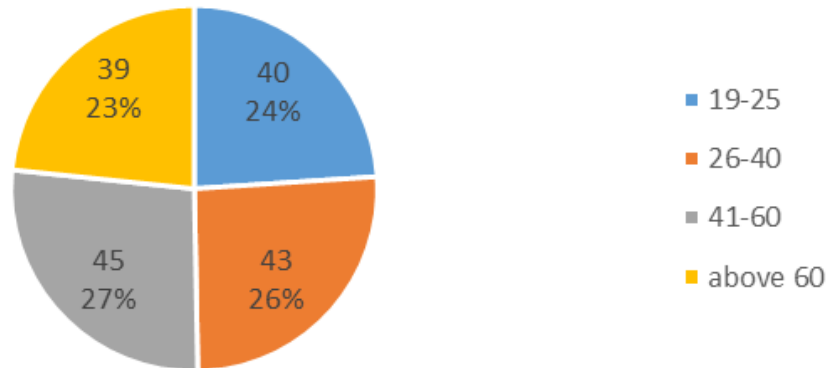


Figure 4.3.2.13: People who answered positive answer for Question 5

People who think they dont need this device to reduce the electrical wastage

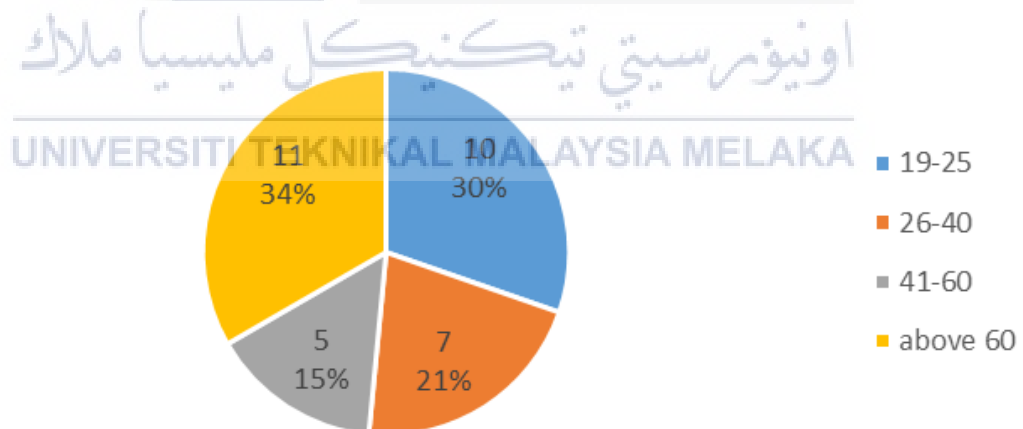
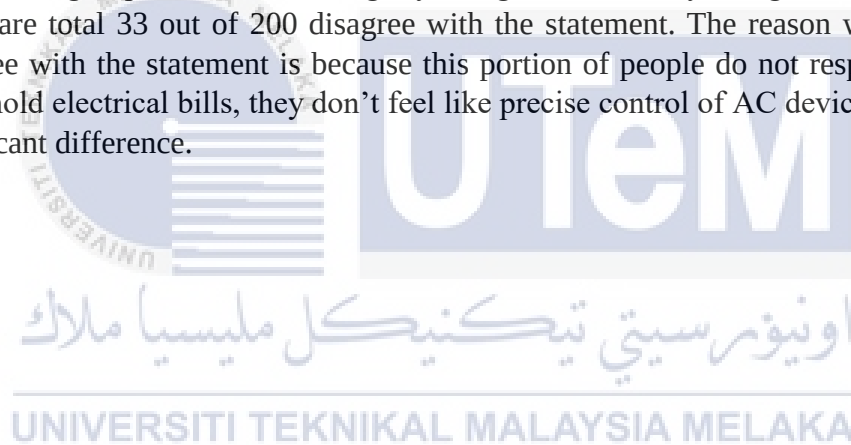


Figure 4.3.2.14: People who answered negative answer for Question 5

The bar graph in Figure 4.3.2.12 shows the distribution of the answer for the question 5. Question 5 is to test how they react with the statement of electrical bills is getting expensive due to inefficiency of the energy used and because of that they need a device to help them reduce the electrical wastage hence the bills cheaper.

From the chart in Figure 4.3.2.13, it shows how many of them are positively agree with the statement. I grouped the data “Extremely Agree”, “Very Agree” and “Moderately Agree” as positive data. From that we can see the most agree with the statement is from the age group 41-60 which is 27%. For the second most agree with statement is from the age group 26-40 which is 26%. The reason why the age group of 41-60 and 26-40 being the highest among 4 groups is because most of them already became household and the electrical bills is direct effect to their monthly expenses. They hope this device can help them reduce the monthly electrical bills.

The Figure 4.3.2.14, it shows how many of them are negatively disagree with the statement. I grouped the data of “Slightly Disagree” and “Very Disagree” as negative data. There are total 33 out of 200 disagree with the statement. The reason why this people disagree with the statement is because this portion of people do not responsible for the household electrical bills, they don’t feel like precise control of AC device can make any significant difference.





5.1 Introduction

This project has achieved the objectives where the Development of AC Power Control Using Smartphone via Bluetooth has built. A specific control technique is mentioned in the projects paper. Furthermore, there will be few suggestions for future work were given so that this product can be improved to more sustainable.

5.2 Conclusion

In a nutshell, the objectives of this project has achieved where the Development of AC Power Control Using Smartphone via Bluetooth is able to control Bluetooth enabled electrical device using android apps. The demerits of this projects are the Bluetooth Connectivity will easily disconnect and the servo motor cannot rotate any angle we wanted i.e. it only can rotate from 0 – 180 degrees. The Bluetooth signal might get disrupt and cause to disconnect by the transformer inside the black box. The disruption can cause the Apps in the smartphone cannot control the AC device smoothly. The suitability for Bluetooth home appliance as a remote controller is a wise invent. The Bluetooth signal can send through a distance 10 meter of in empty. The effective range for the Bluetooth signal transmission will reduce as the obstruction set in the room.

Besides, I learnt how to design apps using MIT Apps Inventor. The user interface in MIT Apps Inventor is very friendly to use. The UI ease understand of layout arrangement and its items is easy to find. This will easy for user to design program without tedious coding.

5.3 Recommendation

There will be some improvement can be made until this product more sustainable. The improvement can be focus on the accuracy of the controlling technique and the sustainability which the Bluetooth signal not to disconnected easily. The reinforcement can be applied to this system are:

- A. Use encoder geared servo motor to make more precise control of angle instead of current project that only rotates 180 degrees.
- B. To study the interference of the electrical device that might cause the Bluetooth signal disruption, and figure the measurements to minimized the interference.
- C. To study the method of controlling the Housing uses Fluorescence Lamp.
- D. Design more user friendly apps by in Android based and iOS based.
- E. To minimize the cost of the product by using smaller transformer and AC potentiometer.



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