



**Faculty of Electrical and Electronic Engineering Technology**



**DEVELOPMENT OF AN IOT BASED VOICE COMMAND FOR HOME  
CONTROL SYSTEM USING ANDROID APPLICATION**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**MOHD NASHRUL IKRAM BIN AHMAD GHAZALI**

**Bachelor of Computer Engineering Technology (Computer Systems) with Honours**

**2022**

**DEVELOPMENT OF AN IOT BASED VOICE COMMAND FOR HOME  
CONTROL SYSTEM USING ANDROID APPLICATION**

**MOHD NASHRUL IKRAM BIN AHMAD GHAZALI**

**A project report submitted  
in partial fulfillment of the requirements for the degree of Bachelor of Computer  
Engineering Technology (Computer Systems) with Honours**



اونيورسيتي تېكنيكل مليسيا ملاك  
**Faculty of Electrical and Electronic Engineering Technology**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**2022**

## DECLARATION

I declare that this project report entitled “DEVELOPMENT OF AN IOT BASED VOICE COMMAND FOR HOME CONTROL SYSTEM USING ANDROID APPLICATION” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature

: **Nashrul**

Student Name

: MOHD NASHRUL IKRAM B AHMAD GHAZALI

Date

: 27 JANUARI 2023



## APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours

Signature

:



**NURLIYANA BINTI ABD MUTALIB**

PENSYARAH  
Jabatan Teknologi Kejuruteraan Elektronik Dan Komputer  
Fakulti Teknologi Kejuruteraan Elektrik Dan Elektronik  
Universiti Teknikal Malaysia Melaka

Supervisor Name

:

PN.NURLIYANA BINTI ABD MUTALIB

Date

:

22/2/2023

Signature

:

Co-Supervisor

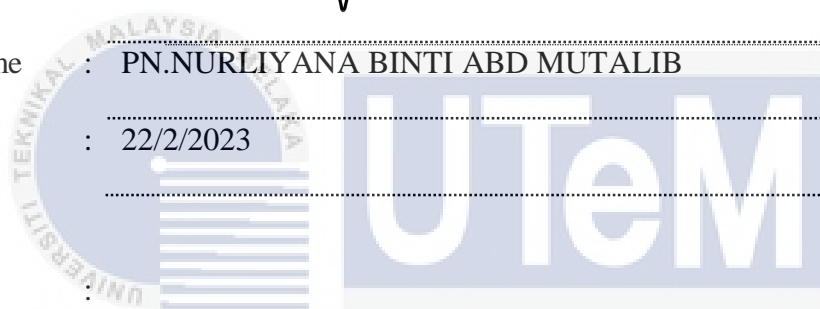
:

Name (if any)

:

Date

:



## ABSTRACT

Since technology advances on a daily basis, voice recognition systems have become a popular trend in home automation in today's culture. A voice recognition system for home automation can be cheap and simple to set up. A voice recognition system is a physical device that recognises the speaker's voice and can control itself. This voice recognition system's main goal is to make it easier for normal, disabled, and elderly people to handle and operate household equipment. Furthermore, it was designed for customers seeking luxury and sophisticated home automation. The goal of IoT Based Voice Command for Home Control System Using Android Application is to assist people with disabilities like vision impairment, physical disability, and blindness who are unable to perform daily tasks like turning on and off electrical devices without assistance. This system is also ideal for businesses, factories, offices, and institutes with a large amount of equipment, such as fans, air conditioners, lights, door locks, and windows. It would be difficult to operate all of the appliances, especially if there are many of them, so having a system that allows you to run any item simply by saying a command is beneficial. Non-technical users will find the device easy to transport, install, configure, run, and maintain. The process of connecting various electrical equipment in a home is referred to as "home automation." This article discusses how the system controls the electrical appliances of the house by using a user interface device and speech recognition technology by using a microcontroller device via a Bluetooth module to control the on/off of devices such as lights, fans, and door lock.

## ***ABSTRAK***

Sejak teknologi berkembang setiap hari, sistem pengecaman suara telah menjadi trend popular dalam automasi rumah dalam budaya hari ini. Sistem pengecaman suara untuk automasi rumah boleh menjadi murah dan mudah untuk disediakan. Sistem pengecaman suara ialah peranti fizikal yang mengecam suara pembesar suara dan boleh mengawal dirinya sendiri. Matlamat utama sistem pengecaman suara ini adalah untuk memudahkan orang normal, orang kurang upaya dan warga emas mengendalikan dan mengendalikan peralatan rumah. Tambahan pula, ia direka untuk pelanggan yang mencari kemewahan dan automasi rumah yang canggih. Matlamat Perintah Suara Berasaskan IoT untuk Sistem Kawalan Rumah Menggunakan Aplikasi Android adalah untuk membantu orang kurang upaya seperti cacat penglihatan, kecacatan fizikal dan buta yang tidak dapat melakukan tugas harian seperti menghidupkan dan mematikan peranti elektrik tanpa bantuan. Sistem ini juga sesuai untuk perniagaan, kilang, pejabat dan institut yang mempunyai sejumlah besar peralatan, seperti kipas, penghawa dingin, lampu, kunci pintu dan tingkap. Sukar untuk mengendalikan semua peralatan, terutamanya jika terdapat banyak daripadanya, jadi mempunyai sistem yang membolehkan anda menjalankan sebarang item hanya dengan mengatakan arahan adalah berfaedah. Pengguna bukan teknikal akan mendapati peranti mudah untuk diangkut, dipasang, dikonfigurasi, dijalankan dan diselenggara. Proses penyambungan pelbagai peralatan elektrik di rumah dirujuk sebagai "automasi rumah." Artikel ini membincangkan cara sistem mengawal peralatan elektrik rumah dengan menggunakan peranti antara muka pengguna dan teknologi pengecaman pertuturan dengan menggunakan peranti mikropengawal melalui modul Bluetooth untuk mengawal hidup/mati peranti seperti lampu, kipas dan kunci pintu.

## TABLE OF CONTENTS

	<b>PAGE</b>
<b>DECLARATION</b>	
<b>APPROVAL</b>	
 <b>ABSTRACT</b>	<b>i</b>
<b>ABSTRAK</b>	<b>ii</b>
<b>TABLE OF CONTENTS</b>	<b>iii</b>
<b>LIST OF TABLES</b>	<b>v</b>
<b>LIST OF FIGURES</b>	<b>vii</b>
 <b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Background	1
1.2 Problem Statement	2
1.3 Project Objective	2
1.4 Scope of Project	3
 <b>CHAPTER 2 LITERATURE REVIEW</b>	<b>4</b>
2.1 Introduction	4
2.2 Voice Command and Arduino Based Automatic Home Control	4
2.3 Method of Automatic Control Based on Voice Commands and Arduino	7
2.4 Concept of Voice Recognition	8
2.4.1 How Voice Recognition Work	9
2.4.2 A Voice Recognition Advantages and Disadvantages	10
2.5 Internet of Things(IoT)	10
2.6 Arduino	17
2.6.1 Type of Arduino	17
2.6.1.1 Arduino UNO	17
2.6.1.2 Lilypad Arduino	18
2.6.1.3 Arduino MEGA	19
2.6.1.4 Arduino Leonardo	20
2.6.1.5 Arduino Red Board	20
2.6.1.6 Arduino Shield	21
2.7 Previous Related Project	22
2.7.1 Intelligent Voice Controlled Home Automation	22
2.7.2 Voice Recognition Based Home Automation System	24
2.7.3 Voice Controlled Smart Home System	25
2.7.4 Voice Controlled Robot Vehicle using Arduino	27
2.7.5 Voice Controlled Smart Home Automation System	28
2.8 Comparison of Previous Related Projects	29
2.9 Summary	34

<b>CHAPTER 3</b>	<b>METHODOLOGY</b>	<b>35</b>
3.1	Introduction	35
3.2	Parameters	35
3.3	Project Flowchart	36
	3.3.1 Project Implementation Flowchart	36
	3.3.2 Project Development Flowchart	38
3.4	Hardware Specification	39
	3.4.1 Arduino Uno	39
	3.4.2 Bluetooth module HC-05	40
	3.4.3 Breadboard	41
	3.4.4 LED	41
	3.4.5 Fan	42
	3.4.6 Servo Motor	43
3.5	Software Specification	44
	3.5.1 Arduino IDE	44
3.6	Mobile Application	45
	3.6.1 AMR_Voice	45
3.7	Block Diagram	48
3.7	Summary	48
<b>CHAPTER 4</b>	<b>RESULTS AND DISCUSSIONS</b>	<b>49</b>
4.1	Introduction	49
4.2	Software Development	49
4.3	Hardware Development	50
4.4	Prototype Development	51
4.5	Project Integration	52
4.6	Data Analysis	55
	4.6.1 The connection between mobile phone and HC05	56
	4.6.2 The accuracy of word receiver of mobile phone	58
	4.6.3 The distance between user's voice and mobile phone	63
	4.6.4 Maximum and minimum voltage used	64
4.7	Summary	65
<b>CHAPTER 5</b>	<b>CONCLUSION AND RECOMMENDATIONS</b>	<b>66</b>
5.1	Conclusion	66
5.2	Future Work and Recommendation	67
<b>REFERENCES</b>		<b>68</b>
<b>APPENDICES</b>		<b>70</b>



## LIST OF TABLES

<b>TABLE PAGE</b>	<b>TITLE</b>	
Table 2.1	Fundamental Technologies of Automatic Control Based on Voice Commands and Arduino	5
Table 2.2	Structure of IoT	11
Table 2.3	Comparison Table of Previous Projects	30
Table 3.1	HC-05 Pinout Configuration	40
Table 2.3	Comparison Table of Previous Projects	30
Table 3.1	HC-05 Pinout Configuration	40
Table 4.1	Testing the connection distance between the phone and HC05	56
Table 4.2	The same word sounding using this project	59
Table 4.3	The works of the output	61
Table 4.4	The distance between user's voice and mobile phone	63
Table 4.5	Maximum and minum voltage used	64

## LIST OF FIGURES

FIGURE PAGE	TITLE	
Figure 2.1	Block Diagram of Literature Research Steps	8
Figure 2.2	How Voice Recognition Work	9
Figure 2.3	Internet of Things (IoT) Infographic	16
Figure 2.4	Arduino Uno	18
Figure 2.5	Lilypad Arduino	19
Figure 2.6	Arduino Mega	19
Figure 2.7	Arduino Leonardo	20
Figure 2.8	Arduino Red Board	21
Figure 2.9	Arduino Shield	21
Figure 2.10	Block Diagram of The Project	23
Figure 2.11	Block Diagram of their Project	25
Figure 2.12	Block Diagram for Voice Controlled Smart Home System	26
Figure 2.13	Connection of Project	28
Figure 2.14	Block Diagram Voice Controlled Smart Home Automation System	29
Figure 3.1	Flowchart of the Project Implementation	36
Figure 3.2	Flowchart of the Project	38
Figure 3.3	Arduino Uno	39
Figure 3.4	Bluetooth Module HC-05	40
Figure 3.5	Breadboard	41
Figure 3.6	LED	41
Figure 3.7	Cooling Fan	42
Figure 3.8	Car Central Locking System	43

Figure 3.9	Arduino IDE Icon	44
Figure 3.10	Interface of Arduino IDE	45
Figure 3.11	Icon for AMR Voice	45
Figure 3.12	Home Interface for AMR Voice	46
Figure 3.13	Interface for Input Voice	46
Figure 3.14	Setting for AMR Voice	47
Figure 3.15	Credits of AMR Voice	47
Figure 3.16	Block Diagram of the Project	48
Figure 4.1	The app and HC05 connected	50
Figure 4.2	The connected hardware	50
Figure 4.3	Prototype Development	51
Figure 4.4	BT Voice Control on Playstore	52
Figure 4.5	Bluetooth Setting on mobile phone	53
Figure 4.6	BT Voice Control is connected to HC05	53
Figure 4.7	LED/Lamp	54
Figure 4.8	Fan	54
Figure 4.9	Door lock	55
Figure 4.11	The distance between mobile phone and HC05	56
Figure 4.12	The correct words that captured	57
Figure 4.13	The wrong words that captured	59
Figure 4.14	The distance between voice and mobile phone	62

## CHAPTER 1

### INTRODUCTION

#### 1.1 Background

Nowadays communication technology is advancing. It's now very simple to use voice recognition to input text, verify spelling, and dictate messages. The microphone icon on most on-screen keyboards allows users to easily switch from typing to voice recognition.

Speech recognition are used to control electrical appliances in the voice controlled smart home automation system. The system employs a Bluetooth module to communicate data in order to manage the operation of electrical loads. Any device with Bluetooth capability, such as a smartphone, can send an input signal to Bluetooth. Smart home automation is very advantageous to persons who are disabled or elderly. To operate the appliance or electrical loads, the user only needs to issue a voice command; the system eliminates the problem of switching on/off electrical appliances. The system is designed so that the user can control all of the appliances simultaneously or individually. Some software is developed for operating the system built-in microphone implemented in a device such as Android phone are used to send the user's voice command. The Arduino Uno receives input from the user devices and sends the signal to the appropriate relay to turn on and off electrical appliances connected to the system, such as lighting, fans, and air door lock units.

The benefits of using voice as a communication channel are numerous. To begin with, we would eliminate or greatly reduce the need for operating technology training. Second, service simplification would result in a greater acceptance of current technology, allowing persons with a variety of disabilities to use the technology. Android app was chose as the user front end partly because the app allows us to integrate advanced technology and because of its extensive usage in the mobile sector.

## **1.2 Problem Statement**

The aim of this project is for people with various disabilities such as vision impairment, physical handicap and blindness who are unable to move excessively and to do daily activities such as turning on and off electrical device without the assistance of another person. Besides, this system is ideal for industries, factories, offices, and institutes with a significant number of equipment, such as fans, air conditioners, lights, door locks, and windows. It would be tough to operate all of the appliances, especially if they are numerous, thus a system that allows you to run any item simply by speaking a command is beneficial. So, keeping the situation in mind, we decided to create an intelligent system to assist these disabled people. After the project is completed, the purpose is to provide specific assistance to disabled people.

## **1.3 Project Objective**

The main focus of this project is to design and construct a voice recognition system for turning electrical devices on and off. The project's objective are as follows:

- To study and understand the properties of voice recognition

- To develop an iot based voice command for home control system using android application

#### **1.4 Scope of Project**

The scope of this project focuses mainly on using microcontroller and Arduino to communicate with Bluetooth module and smartphone application which is AMR\_Voice application to get the user voice and command. The presence of Bluetooth module is to connect the smartphone application with the microcontroller and Arduino to get the voice from user. The electrical device such as light, fan and door lock will turn on and off based on the user command. Moreover, the range between user voice command and the electrical devices has limitation. Last but not least, this project is dedicated for people with various disabilities such as vision impairment, physical handicap and blindness. The performance of the project is analyzed by observing between the function of the voice command and the electrical devices.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter discusses the crucial features and information discovered by various studies and research from prior project. As a result, the topic starts with an exploration of voice recognition concepts. It is critical to conduct study on these ideas because they are the project's main objective. Furthermore, because this project involves voice technologies as well as microcontrollers and Arduino, it is important to understand the underlying ideas in order to have a comprehensive understanding of the scope. In conclusion, this section ends with a comparison of prior relevant projects and the type of implementation that will be suitable for the project.

#### 2.2 Voice Commands and Arduino Based Automatic Home Control

Automatic Control Based on Voice Commands and Arduino is an integrated system provides the easiest home automation system that can be controlled using voice recognition system [1]. For controlling appliances, toys, tools, computers, and robotics, speech recognition is becoming the preferred way. Voice-controlled equipment, such as computers, televisions, lighting systems, and security systems, become easier to operate, improving the efficiency and effectiveness of working with them, because of the rapid advancement of technology, it is now possible to control electronic equipment using a number of control methods, including controlling electronic devices automatically via sensors or remotely. This technological innovation, users of electronic gadgets no longer have to struggle with controlling their equipment. Sound-

based control is a commonly utilized method of control nowadays. Operating a smart house, such as turning off or on lights, opening or closing doors, and manipulating the robot, is similar to controlling a smartphone to run software put on it. Its offers a security system that uses an individual's characteristic pattern, voice control is in high demand.

Table 2.1: Fundamental Technologies of Automatic Control Based on Voice Commands and Arduino

Technology	Type of Fundamental	Function of Fundamental
Internet of Things (IoT)	Microcontroller	A microcomputer that is compressed into a single integrated circuit. It has been improved in order to control electronic gadgets. On a single printed circuit board, this compact gadget contains memory, input-output pins, and a microcontroller. This device is typically employed in industrial settings, where it is integrated with other devices to give control and interface. Microcontrollers such as the Raspberry Pi and Arduino are examples.
	Microsensor	A little instrument that can measure a variety of things. As a result, several of these gadgets work at the nanoscale. For example, sensors that detect heart rate and output data in digital format. Data that was



		previous inaccessible, such as blood oxygen levels, can now be measured and evaluated.
	Easy VR	EasyVR 3 Plus is a multi-purpose speech recognition module that may be used in practically any application to add diverse, powerful, and cost-effective speech recognition features. The EasyVR 3 Plus module works with any host that has a 3.3V–5V UART interface, such as PIC and Arduino boards.
	Voice Recognition	Voice Recognition is an interdisciplinary branch of computer science and computational linguistics that develops approaches and technologies that allow computers to recognise and translate spoken language into text, with the main advantage being searchability.
	Arduino	Arduino is a corporation, initiative, and user community that designs and manufactures single-

		board microcontrollers and microcontroller kits for making digital devices using open-source hardware and software.
--	--	---

### 2.3 Method of Automatic Control Based on Voice Commands and Arduino

The study was a literature review based on the findings of published works, such as research findings. In library research, literature searches were used not only as the initial stage in constructing a research framework (research design), but also to gather research data from library sources [1]. The data was gathered through a review of books and publications on controlling with voice commands and Arduino. The data analysis technique utilised was to summarise data and information in simple phrases in order to find answers to the difficulties investigated, which were related to numerous research on controlling using voice commands and Arduino.

There were three steps involved in doing literature research. The initial step was to decide on the research's title, the literature sources to be used, the amount of literature to be employed, and so on. Furthermore, the literature search was done in accordance with the topic under consideration. Finally, a content analysis of easyvr 3.0 is performed.

Easyvr 3.0 is a voice module that is simple to use and works with nearly all programmes. At a voltage of 3.3v- 5v, Easy vr 3.0 can be used with any uart (universal asynchronous receiver-transmitter).

For low impedance sound, this module audio output interface can be connected to an 8ohm speaker or to an external amplifier. Furthermore, it can be connected to high impedance loads such as headphones, given that the power output is in accordance with the literature that has been obtained and how the relationship between the literature obtained was carried out. Figure 1 shows a block schematic of the procedures involved in conducting literature research.

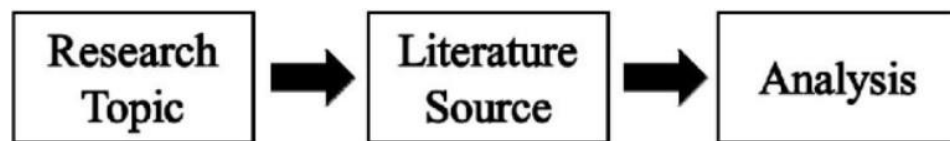


Figure 2.1 Block Diagram of Literature Research Steps [1]

This study's literature review was carried out by examining 25 journals published between 2014 and 2020 that discussed Using Arduino and voice commands to control [1]. Journal Assessments are made by paying attention to the details. Based on the similarities and differences in each journal using vocal commands to control an electrical gadget to be commanded, a verbal command in the form of the hardware for voice recognition or speech recognition used, the tests conducted, the results of the tests, and the system functioning and the factors that are influenced by the system [1].

## 2.4 Concept of Voice Recognition

The ability of a machine or program to receive and interpret dictation or to recognize and execute spoken commands is known as voice or speaker recognition. With the advent of AI and smart assistants like Amazon's Alexa, Apple's Series and Microsoft's Cortana, voice recognition has gained popularity and usage [2].

The voice recognition system allows users to interact with the technology simply by talking to it, enabling hands -free requests, reminders and other simple tasks.

### 2.4.1 How Voice Recognition Work

Audio must be transformed into digital signals by voice recognition software on the computer, that is what we call the process of analog to digital conversion [2]. Computers should have a digital database of syllables, as well as a rapid way to contrast this data to signals or parse signals. When an app is started, the speech ornamentation is delivered on the hard disk and filled into memory. Recorded ornamentation compared with A/D encoder output, the process called pattern recognition.

In operation, the amount of effectual vocabulary of a voice recognition program is exactly in proportion to the RAM space of a computer. When contrast to observing a hard drive for multiple matches, voice recognition programs manage many times quicker if an absolute vocabulary can be put into RAM. Processing speed is also dominant because it consequences how fast a computer finds a RAM match [3].

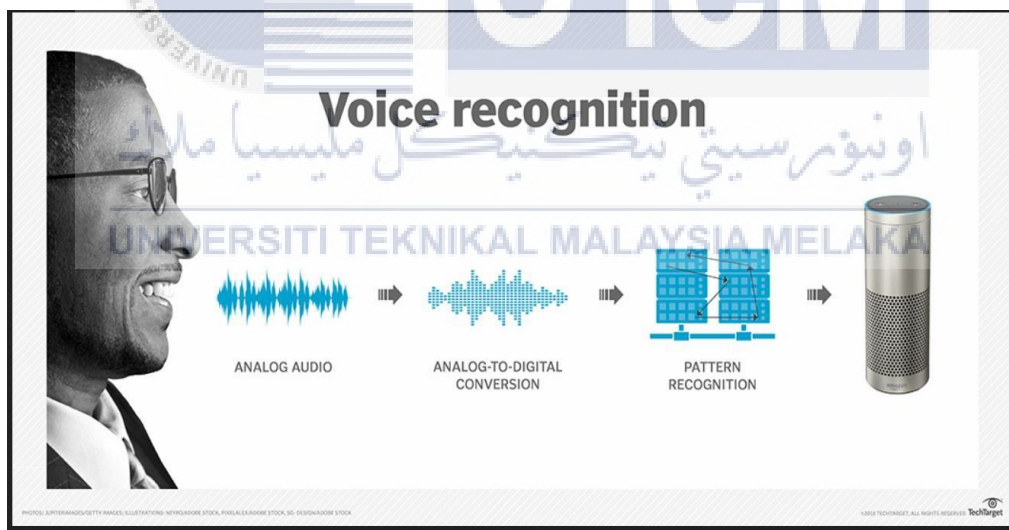


Figure 2.2: How voice recognition work [3].

Even speech recognition system began on PCs, it has open out to smartphone and maid products in both the business and end user sectors. The admiration of smartphones allows voice recognition technology to be intermix into users' pockets, while home appliances like Google Home pushing the voice system space into the

bedroom and master living room. Many end user devices that previously did not have any smart potential have gained a layer of technology thanks to voice recognition and an ever -expanding number of internet sensors [3].

#### **2.4.2 Voice Recognition Advantages and Disadvantages**

By using voice directly to Google Home, Amazon Alexa or their other voice recognition system, end-users can carry-out a variety of piece of work. Voice recognition system can quickly change your speech work to written text using expert systems and advanced algorithms [3].

While the precision of the voice recognition system and program ameliorate, it all made inaccuracy. Untrue inputs can be fabricated by background noise, which can be bypass by using the system in a quiet room. There is also the problem of near words sounding unalike and having different meanings, such as red and read. This problem may one day be resolve by storing contextual data [3]. However, the increase of RAM and a the faster of processor can be accessed now in personal computers will be needed.

#### **2.5 Internet of Things (IoT)**

According to Big Data Insight, Kevin Ashton, a member of the team that identified RFID tags to use as a communication channel to connect objects to the Internet [4], coined the term Internet of Things. The word was first introduced in 1999 [5], and it has since grown fast in a variety of industries all around the world. Kevin Ashton has also stated that, in comparison to what the Internet has accomplished for the world, the Internet of Things has the potential to achieve even greater advancements [5]. In addition, characterize IoT as a network made up of physical, technological, and wide socioeconomic settings. The structures are listed in table 2.2 below.

Table 2.2: Structures of IOT [6]

Characterize of IoT	Structure of IoT	Explanation
Physical	Environment	The environment is a place where humans and other entities interact. For example, in hotel rooms, RFID readers are embedded in the lights and fans.
	Person/Individual	The Internet of Things can be accessed by anybody with a wireless device or who can handle and operate a wireless object, such as a smartphone or laptop (IoT).
	Device/Object	Cars and packages are real objects that can connect to

		the internet via any wireless device.
Technological	Networking	Wireless networks are widely used to connect devices and share information
	Hardware	Home automation, cellphones, and RFID tags are examples of wireless devices that connect humans and objects to the Internet of Things for communication across a wireless medium.
	Software	End-user IoT applications that are designed to help people.

	Integrated Platforms	The platform is cloud-based. as a result of which software, and hardware operating networks flawlessly together
	Standards	IoT design and internal operations are guided by technical and operational guidelines.
	Data	IoT device data streams can be captured and analysed in real time, allowing for enhanced decision-making.



Socioeconomic Environment	Environment	<p>Entrepreneurs who put their technology abilities to good use have a desire to learn and develop themselves, and your contribution helps to advance the Internet of Things. They are more inclined to employ IoT for business development and intrapreneurship.</p>
	Customers	<p>People who are being targeted by smart devices.</p> <p>Consider an IoT security system that keeps an eye out for theft or burglary.</p>
	Legislative Organizations	<p>Regulatory bodies that enforce IoT rules and regulations. RFID, for</p>

		example, must follow the standards of the Federal Communication Commission (FCC) for near-field communication.
	Associated Industries	Industry groups could influence the development of IoT technologies and applications. Their goal is to create guidelines for autoidentification technologies like barcodes.

Internet of Things (IoT) is defined by K. Shafique, B. A. Khawaja, F. Sabir, S. Qazi, and M. Mustaqim as "intelligent devices and sensors that are addressable specifically based on their communication protocols, independent and adaptable with essential security" [7]. It has also divided IoT into three categories:

- i. Thing oriented: a vision that gives attention to representation, storage and organization of information.
- ii. Knowledge oriented: a vision that gives attention to representation, storage and organization of information.
- iii. Internet oriented: a vision that gives attention to the connectivity between devices.

The Internet of Things (IoT) opens up new economic opportunities by allowing businesses to develop new business approaches and models to utilise the concept. Researchers and investigators from a variety of backgrounds will be able to engage in discussions regarding IoT, in addition to novel research opportunities. As a result, the Internet of Things spans engineering, science, business, and humanities. The Internet of Things also makes the world a smarter place by allowing everyone to have access to everything in less time and with less energy.



Figure 2.3: Internet of Things (IoT) Infographic [4].

In a word, the Internet of Things consists of many types of hardware and software that are connected to the Internet in order to fulfil their specific function. It is critical to design a project with good planning to meet the project's objectives by addressing the problems that will be faced.

## **2.6 Arduino**

The Arduino was design for students of electronics to employ in their projects. The Arduino boards are free open-source hardware, and let users to design their own projects based on what they needs. Microcontrollers, connectors, LEDs, and other components are included in this electrical device. The Arduino UNO, Red Board, LilyPad Arduino, Arduino Mega, and Arduino Leonardo are all examples of Arduino that available on the shop. Different Arduino boards have different range in terms of specs, functionality, and applications, and are utilised in a variety of electrical projects.

### **2.6.1 Type of Arduino**

#### **2.6.1.1 Arduino UNO**

In all of Arduino boards, the evolution of the Arduino UNO board is considered latest. This board has a lot of attributes that make it easy for the user to use in project. In all Arduino boards, the Arduino UNO uses the Atmega16U2, which assist to magnify the transfer rate and provide big memory. SCL and SDA pins are comprised on the Arduino UNO near the RESET pin [8].

Arduino UNO board has 14 digital i/o pins, with 6 PWM pins, 6 analogue input pins, a USB port, a reset button, and 1 power connection. The Arduino UNO board can be link to a computer using USB port and receive current from the computer power. Its has a 32kb memory that is used to load the data [8]. The Arduino UNO also has similarity with others and can be used in concurrence with other Arduino boards.



Figure 2.4: Arduino Uno [8]

### 2.6.1.2 Lilypad Arduino

The Lilypad Arduino is a board that is signify to work with apparel and e-textile systems. This board has a globe-shaped design that bring-down snagging and allows for easy connection to another devices. The Atmega328 and Arduino bootloader are used in this board [9]. This board carry a very few outside device and making the design straightforward.

The board need a power-supply of 2V to 5V and has overload holes for easy link to other devices. This board is frequently used to dominance various devices like motors, lights, and switches [9]. Because this board is make use in the textile industry, their components can be washed, such as the sensor board, input board, and output board.

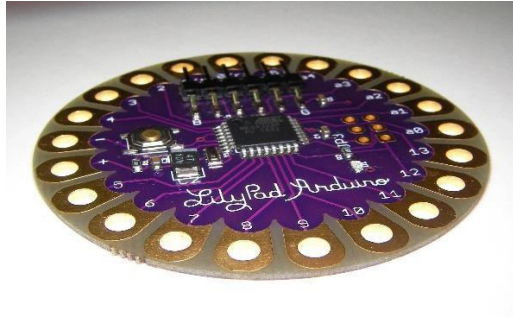


Figure 2.5: Lilypad Arduino [9]

### 2.6.1.3 Arduino MEGA

This boards are called microcontrollers because they employ the Atmega2560. It has 54 i/o pins, with 14 pins for PWM output, 4 pins for hardware connection, and 16 pins for analogue. 1 USB connection, an ICSP header, a power connection, and one REST pin also included on the board [9].

There are 2 more pins that obey as a 16 MHz crystal oscillator. The board also characterize a 256KB flash memory, which is used to load the data. The Arduino Mega board may be link to a computer system through USB connection, and the power can be provide to the board via a battery [9]. Because the board is provide with a many pins, it is suitable for project that need a large number of pins.



Figure 2.6: Arduino Mega [9]

#### 2.6.1.4 Arduino Leonardo

This Arduino is a microcontroller that use Atmega32u4. It has a combine of 20 digital i/o pins, with 7 pins dedicated to PWM and 12 pins devoted to analogue inputs. 1 USB connection, a power connection and a RESET button are incorporate on the board [9]. There are 2 more pins that set-off as a 16 MHz crystal oscillator.

The Arduino Leonardo board could linked to a computer using USB cable, and it can be electrified by AC to DC connection or battery. A USB connection on the Arduino Leonardo's microcontroller remove the need for a unrelated CPU. The board can be utilized as a mouse or keyboard for computer system because it has no extra USB linked [9]. The Arduino Leonardo is the cheapie Arduino board when weigh up to other Arduino boards



Figure 2.7: Arduino Leonardo [9]

#### 2.6.1.5 Arduino Red Board

The Arduino Red board is variety of Arduino board that is arrange using a small USB and the software called Arduino IDE. This board is suitable using Windows 8 and no need any interchange to the safety settings in order to use it. The FTDI and USB connection on the Red board are make-used to link to other devices [9]. The red board's design is so s that straightforward and be simply combine into other projects. The only

must-have is that the red board be linked in and the suitable choice be selected, and the software may be transmitted in no time. The barrel jack can be used to authority the Arduino Red board's USB cable [9].



Figure 2.8: Arduino Red Board [9].

#### 2.6.1.6 Arduino Shield

Arduino shields are boards that are pre-made and utilized to link to other Arduino boards. The Arduino shield is put on top of Arduino boards and upgrade the board's size to link to the internet, control motors, and display LCDs, as well as support in wireless system [10]. There are various types of shields to choose from. Wireless Shields, Ethernet Shields, Proto Shields, and GSM Shields are all included. This helps to improve the Arduino boards' interoperability.

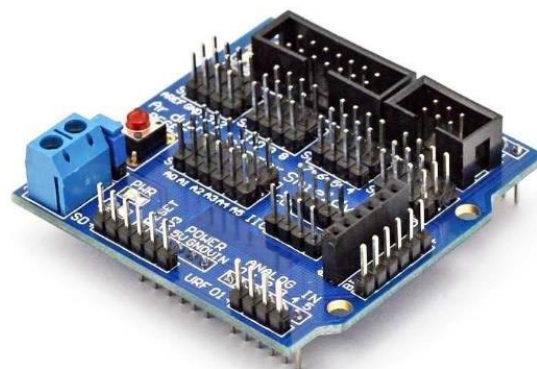


Figure 2.9: Arduino Shield [10].



## **2.7 Previous Related Project**

The study of past relevant projects that are primarily focused on voice recognition and Arduino is vital to have a good understanding of the project so that fundamental bits of knowledge are learned to achieve the project's objectives. The smart home voice recognition is part of this IoT project. As a result, this part will analyse five past projects that use a similar strategy and have a similar goal to fulfil the main goal of this project.

### **2.7.1 Intelligent Voice Controlled Home Automation**

The crucial well-being of any automated system is that it lessen people employment, attempt, time, and mistakes created by people mistake. Smart phones have suit a be-in-need for everyone on the world as a consequence of the development of present-day technology [11]. The title of the project is Intelligent Voice Controlled Home Automation System. The premier target of technology has exist to grow-up systematic and decrease effort.

The project are using Arduino Uno, HC-05 Bluetooth Module and Home Automation. The Arduino Uno has 14 digital i/o pins, 6 analog inputs, a USB linked, a power connection, an ICSP and a RESET button [11]. The Arduino circuit take action as an interface between the software part and the hardware component of this project. Then, The Bluetooth module used to authorize, transfer and get the signal. It get the text from the Android smartphone and transfer it to the serial port of the Arduino board. The Bluetooth module used is HC-05. The voice which is an integral attribute of Android phones is utilized to build an app that the end-user can make-go to automate the devices in his house.

They construct their project on a breadboard using the part designated above. The switch board must be link to the microcontroller with the Bluetooth module. Then, on the Android phone, must start the Android-based-application "Auto\_Home." It can straight the microcontroller to switch on or off an device using the app. The microcontroller transmit a signal to the relay board after getting the instruct from the Bluetooth module [11].

The application start by searching for a Bluetooth device. It starts the voice recognizer if it is accessible. The voice is peruse and the audio sign is change to a string. It bring-out a value for each devices, which is then proceed on to the microcontroller. The serial port is utilized by the microcontroller. It dechiper the input utility after get the data and transfer a signal to the parallel port, which operate the relay circuit [11].

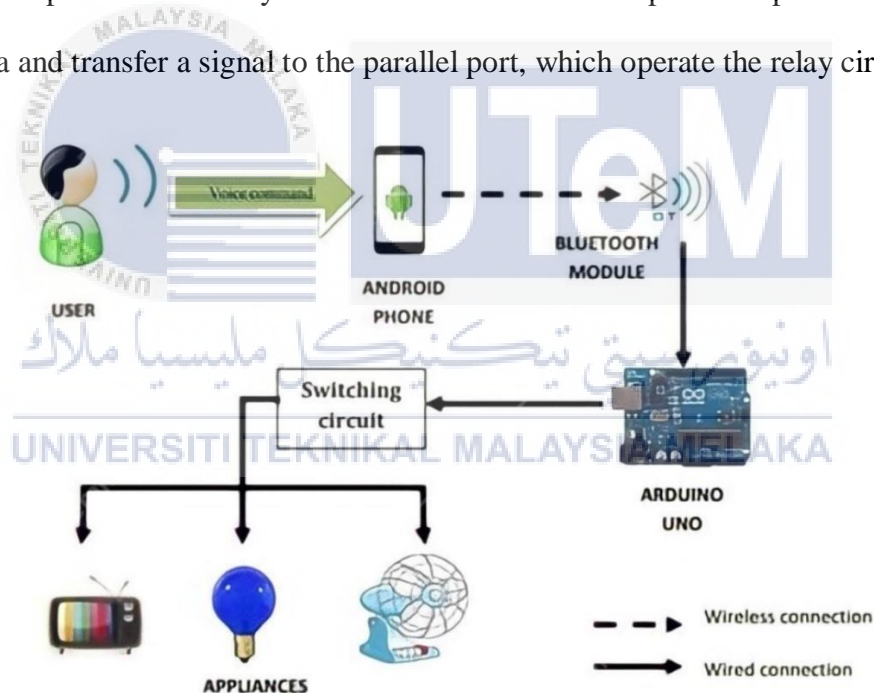


Figure 2.10: Block Diagram of The Project [11].

### 2.7.2 Voice Recognition Based Home Automation System

In this project [12], the foremost plan for the system is everything from lights to gas burners to a garage door may be in charge by a middle panel in the home, wireless gadget, application, or even voice instruct. The authors have apply voice recognition system to receive the instruct to move the componet. Basically, this project used HC-05 Bluetooth Module to link the smartphone to receive the voice from person to give the command. Arduino Uno is the head microcontroller in this system to operate the arriving commands and the home appliances.

To utilize the project, link the Bluetooth to the application. Then, click the mic image and hand the instruct. When HC-05 Receive the instruct, it will transfer it to the Arduino. Finally, the Arduino instrument the task using relay switches. In the Arduino, link the Bluetooth to the app. Then, tap ON/OFF for specific device. Finally, the application will be-in-touch the particular command to the HC-05 and the Arduino will operate and carry out the instruct.

Finally, Voice Recognition Based Home Automation System is a significant aid as the bodily challenge person get a little more individualistic by being allow to commute their beds without the need for helps [12]. The limitation were speech recognition in rowdy environments, voice recognition module training and the module's response time or latency.

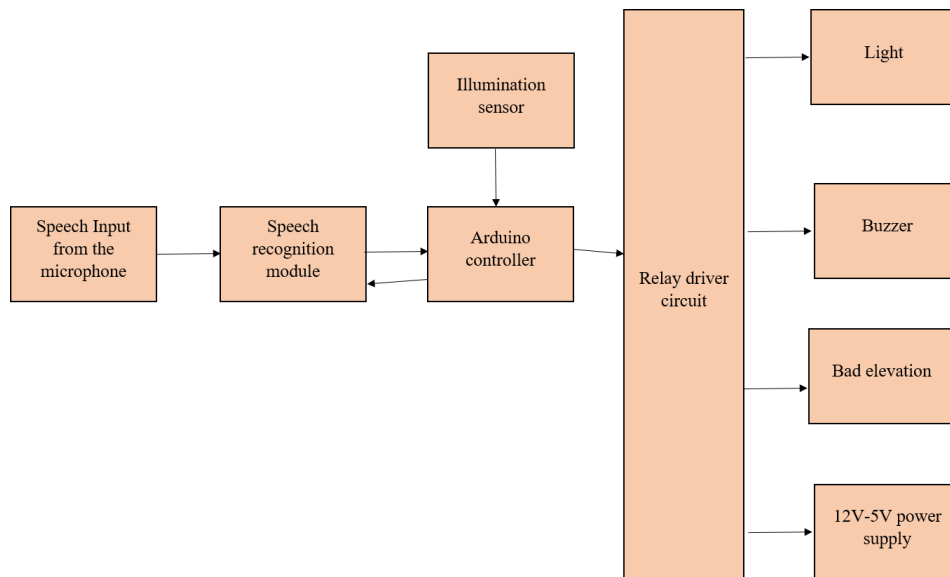


Figure 2.11: Block Diagram of their Project[12].

### 2.7.3 Voice Controlled Smart Home System

According to the author [13], offer persons with special needs with a system that can respond to voice instructions and regulate the on/off status of electrical items throughout the house, such as lighting, fans, and televisions. Its promises the cheap devices, easy to use and easy to configure for the user to use the system. The project is integrated system that provides an easy-to-use home automation system that can be fully controlled with voice commands for elderly and disabled individuals.

The project used two microcontrollers, wireless communication is set up by two ZigBee chips [13]. One is connected to the first ATmega328, which is used as a transmitter, while the other is connected to the second ATmega328, which is used as a receiver. The ATmega328 was chosen for the transmitter because it is the most compatible with Easy VR 2.0 and has an inbuilt microphone that can receive and store voice signals from the user. The human voice is recorded using a microphone. It matches the voice that was previously captured in Easy VR 2.0. If it matches, ZigBee sends the relevant character. The voice recognition unit in this case is Easy VR 2.0. The

Speech Recognition System is made up of the Easy VR 2.0 speech recognition module and the Atmega328. It's a programmable voice recognition circuit that's simple to use [13]. You can programme the circuit to recognise the words (or vocal utterances) you wish it to recognise. It allows you to try out various aspects of voice recognition technology.

In the conclusion, the project is target for elderly person and disabled person. The advantage of the project is, it can give instruction all over the home device using the existing of electrical wires built-in the walls of the home.

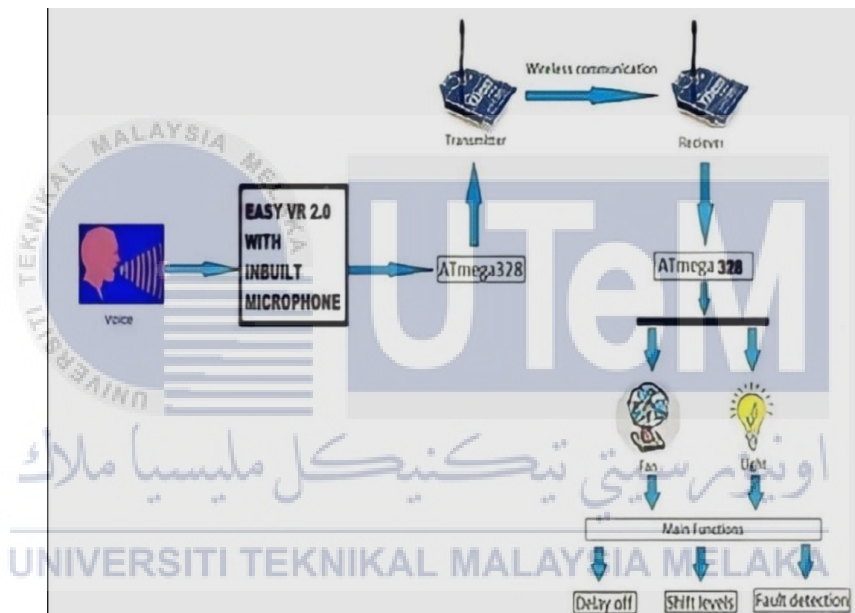


Figure 2.12: Block Diagram for Voice Controlled Smart Home System [13].

#### 2.7.4 Voice Controlled Robot Vehicle using Arduino

The authors [14] of the project, that are design to controlled robot vehicle using voice recognition system. In this project, Android app with a microcontroller is utilized for the need of labour. The link between the app and the robotic device is connected with Bluetooth technology.

This labour put-forward a robotic transport to observe or monitor their move given intructions from the people. Its used undercarriage as inner framework, a gear motor to substitute the vision of flow current in path of motor regularly, Arduino Uno as a microcontroller and L298D Motor Driver to receive TTL logic quantity and drive derivable load. Its also use HC-05 Module to link the smart as a microphone to get the instructions from person.

The smartphone's microphone is used to acknowledge human command. Using the Android OS and AI software, this voice is operate and transmit into English words [14]. Speech recognition is a integrative work of computational linguistics that traverse speak and technology that let the computers to acknowledge and interpret spoken language into word [14].

In conclusion, the project got some advantages such as, it has the potential to become a real-world vehicle for transportation, The robotic vehicle can be utilised in places where humans find it impossible to reach but where human voice can be heard, such as a small pipeline, a fire, or a severely poisonous environment [14]. It also can be used in conjunction with wheelchairs to aid impaired people. Next, the project can be used to transport and store tiny items. Finally, in military place , it can be uses as camera surveillance of an enemy camp.

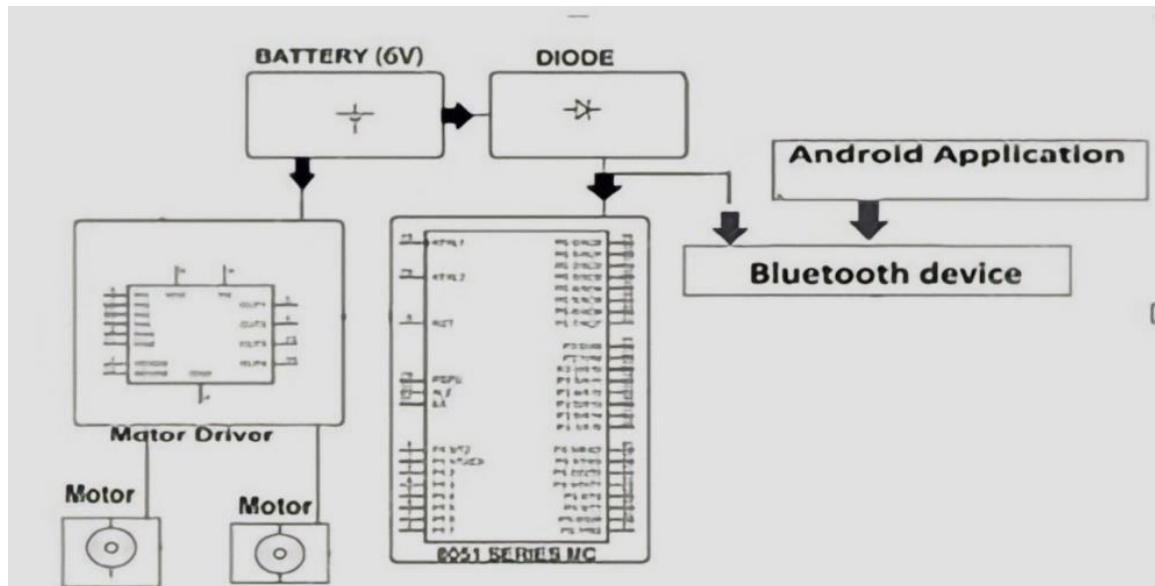


Figure 2.13: Connection of the project [14].

### 2.7.5 Voice Controlled Smart Home Automation System

In the project, the authors has made a project about voice controlled to control electrical appliances using voice commands [15].

Its use Bluetooth module to transfer data for running the work of electrical load. Bluetooth may get the input sign from any Bluetooth-accessible device, such as a smartphone. Smart home automation is very benefit to people who are disabled or elderly. Because the end-user only has to problem a voice to process the devices, the system resolved the issues of changing on/off electrical devices. The system is build such that the user can on/off all of the devices at once or individually [15].

A software developed for be in charge the system, a internal microphone, and a voice recognition system put in appliances such as Samsung's Bixby are utilized to transfer the voice instructions. In Arduino Uno recieve input from the end-user appliances and transfer the signal to the relay for on/off electrical devices connected to

the system, such as lights, fans, and air conditioner devices [15]. This work aim on the design a speech recognition-based voice control system.

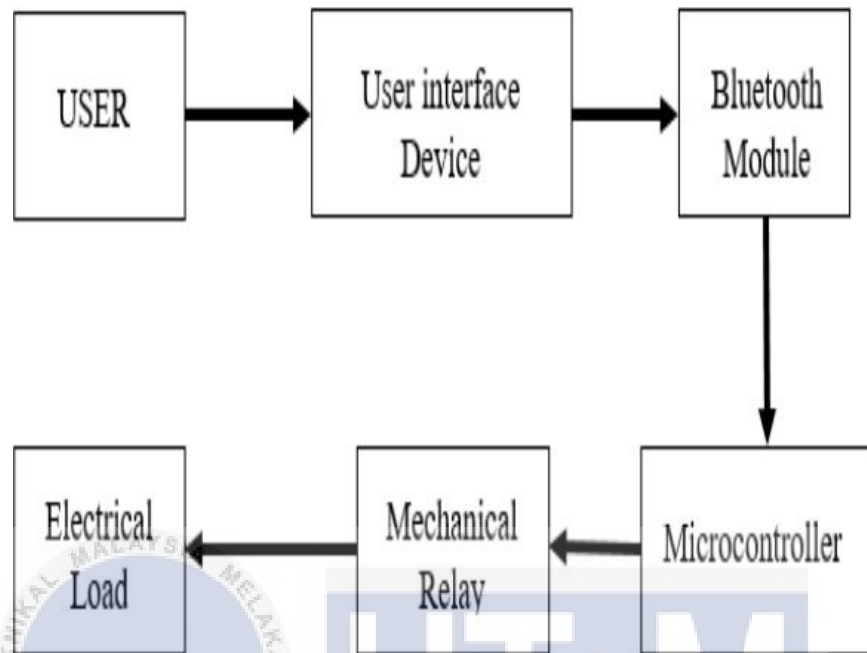


Figure 2.14: Block Diagram for Voice Controlled Smart Home Automation System[15]

## 2.8 Comparison of Previous Related Projects

Based on the past research projects that have been addressed, certain variations in terms of the methods utilised can be discussed and compared. As a result, the table below offers a comparison of the study publications in terms of methodology, benefits, and drawbacks.



Table 2.3: Comparison Table of Previous Related Projects

No.	Reference	Method	Advantage	Disadvantage
1.	[11]	<p>This project used Arduino Uno as their microcontroller to collect data from another devices. HC-05 module used allows to transmit and receive signal and forward to microcontroller. Android phone is utilized to build an app so the user can process to automate the devices in his home.</p>	<p>-Decrease the need of training for operating technology</p> <p>-The simplification of services would entail a wider adoption of existing technology and would help people with varied disabilities access the same technology.</p>	<p>-Error and misinterpretation of words.</p> <p>-For disabilities (mute) person cannot use the project</p>

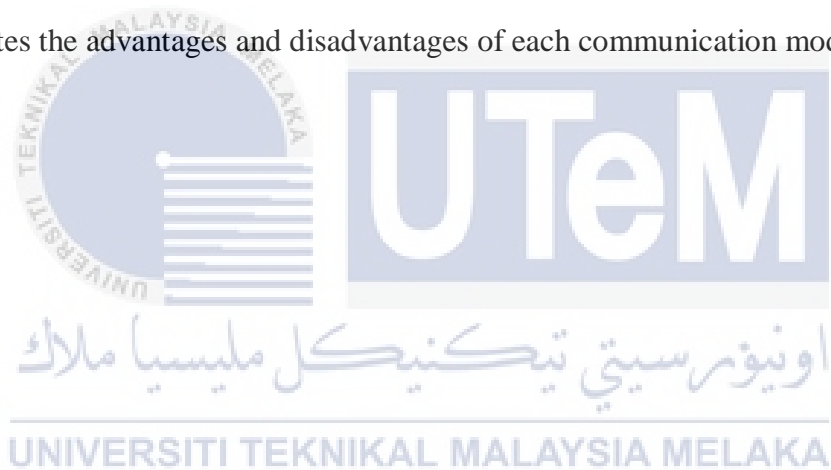
2.	[12]	<p>The project is used voice recognition system to get the command to move the device. HC-05 is used to connect the android phone to get the voice from user. Arduino Uno is the microcontroller for this project to process the incoming commands. The project focus on adjusting the bed on their own without assistance from anyone.</p>	<p>- To make a home automation system specifically for the paraplegic people.</p> <p>-To adjust a bed indifferent position using voice commands without anyone help</p>	<p>- The bed move slowly and sometime not stop even already command to stop.</p> <p>-Time cost and productivity</p>
3.	[13]	<p>The project used two microcontrollers, wireless communication is set up by two ZigBee chips. One is connected to the first</p>	<p>-It can give instructions over the home without</p>	<p>-Its has limit of when the user give the commands</p>

		<p>ATmega328, which is used as a transmitter, while the other is connected to the second ATmega328, which is used as a receiver. The Speech Recognition System is made up of the Easy VR 2.0 speech recognition module and the Atmega328.</p>	<p>using electrical wire</p>	<p>-Sometime the device get misunderstand of word that user give</p>
4.	[14]	<p>The focus of the project is to move the robotic vehicle using voice controlled. Arduino Uno is used as a microcontroller and L298D Motor Driver to receive standard TTL logic. HC-05 Module to connect an android mobile phone as a</p>	<p>-It can be used into a real vehicle such as send customer food.</p> <p>-It can integrated with wheelchairs for assisting disabled persons.</p>	<p>-Speaking is loud and invites noise to others.</p> <p>-It doesn't keep privacy it does not suit a crowded environment.</p>

		microphone to give commands from users.		
5.	[15]	<p>The project use Bluetooth module to transmit data for controlling functioning of electrical load. In this system a Arduino Uno recive input from the people device and transfer a signal to the relay for on/off electrical devices connected to the system.</p>	<p>-This technology solves inefficiencies and reduces wasted time.</p> <p>-Voice commands are a long-away more systematic system than type message.</p>	<p>- Worth to examine is its restriction of range.</p> <p>- If you are non-American people, it will hard to detect the language</p>

## 2.9 Summary

Overall, after reading and observing the previous linked projects, it is clear that the classic microcontroller has various shortcomings when compared to the Arduino Uno and HC-05 Bluetooth module, which are advancements over the old technology. Due to its practical requirements, it is safe to assume that Arduino technology is the best and most understandable notion that can be implemented in this project. The Development of an IoT Based Voice Command for Home Control System Using Android Application is aided by the research on voice recognition system base project. As a result, the employment of Bluetooth networks in previous connected projects illustrates the advantages and disadvantages of each communication mode.



## CHAPTER 3

### METHODOLOGY

#### 3.1 Introduction

This chapter discuss the research of methodology used to build the project and fulfil the objectives. To maintain the project's flow, detailed research on the employed hardware was developed to obtain a better understanding of how to handle it and the appropriate model to use for this project. This chapter is also important for gaining a broad understanding of the project flowchart. The process flow is described in great detail, and the hardware specs will be detailed after that. Last but not least, a schematic showing the project's link is shown and briefly explained in this chapter.

#### 3.2 Parameters

The purpose of the project is to develop an IoT-based voice command for a home control system that uses an Android app. This final year project's flowchart tasks are shown to ensure that each task is handled seriously and performed in detail. A flowchart is also prepared to show the process of the procedures that are carried out in this project. Essentially, Arduino serves as the project's brain. The Arduino Uno is the type of Arduino utilised in this project. HC-05 is also used to connect android applications in mobile phones over a short-range wireless connection in order to exchange files. It operates on the 2.45GHz band. Then, based on the user's command, LEDs, fans, and door locks will turn on and off. The Arduino IDE software is used in

this project to compile and upload the coding to the hardware and Proteus software is used to build the operating project virtually.

### 3.3 Project Flowchart

#### 3.3.1 Project Implementation Flowchart

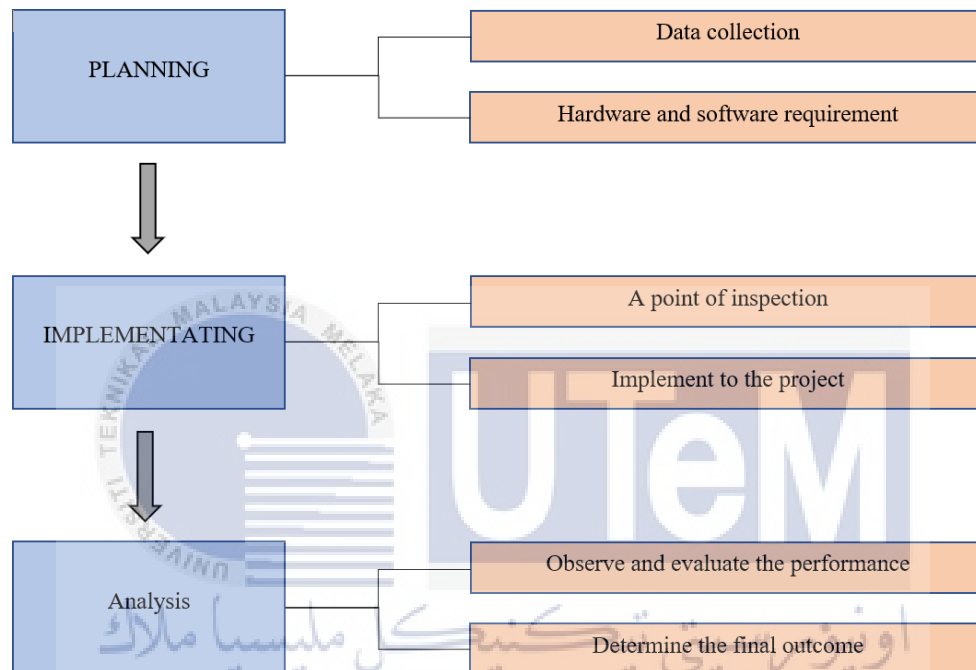
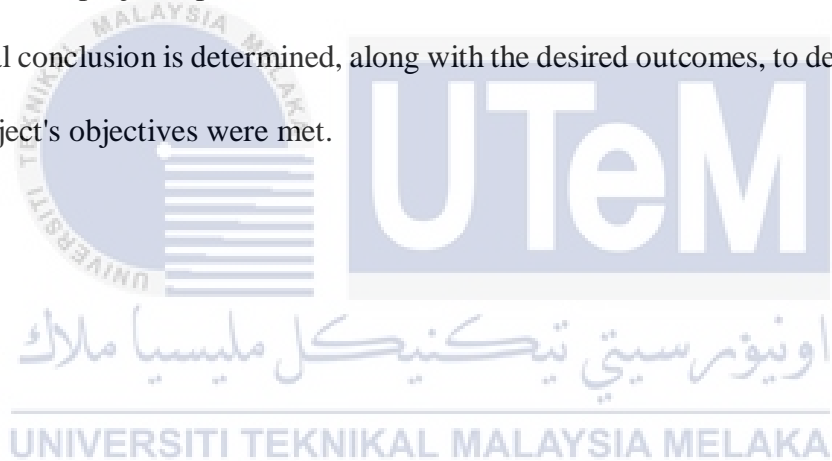


Figure 3.1 Flowchart of project implementation

Referring to the figure 3.1, this project's implementation flowchart. This section will describe the theory portion of the project, which is important to ensure the project is completed utilising information. The project implementation process has been separated into three stages: planning, implementation, and analysis. To begin, an observation is made using sources from the literature review. The study literature review objectives aid in the development of the problem statement, objectives, and methods for this project. Then, by looking at previous projects, you can figure out what gear and software you'll need for this project.

The data collection from the literature reviews is the second step in the project execution process. The circuit and programme code are designed in this phase in order to inspect the predicted consequences. The circuit design was done with Proteus 8 software, and the coding was done with Arduino IDE. When the constructed circuit and code give positive results, the project will be implemented.

The data analysis is the final step in this flowchart. The data analysis technique is separated into two parts: observing and analysing the project's performance, and determining the ultimate output. The project's performance is determined by observing and evaluating the built circuit and coding. Various outcomes and analyses are collected to assess the project's performance based on the observation of the outcome. Finally, the final conclusion is determined, along with the desired outcomes, to demonstrate that the project's objectives were met.





### 3.3.2 Project Development Flowchart

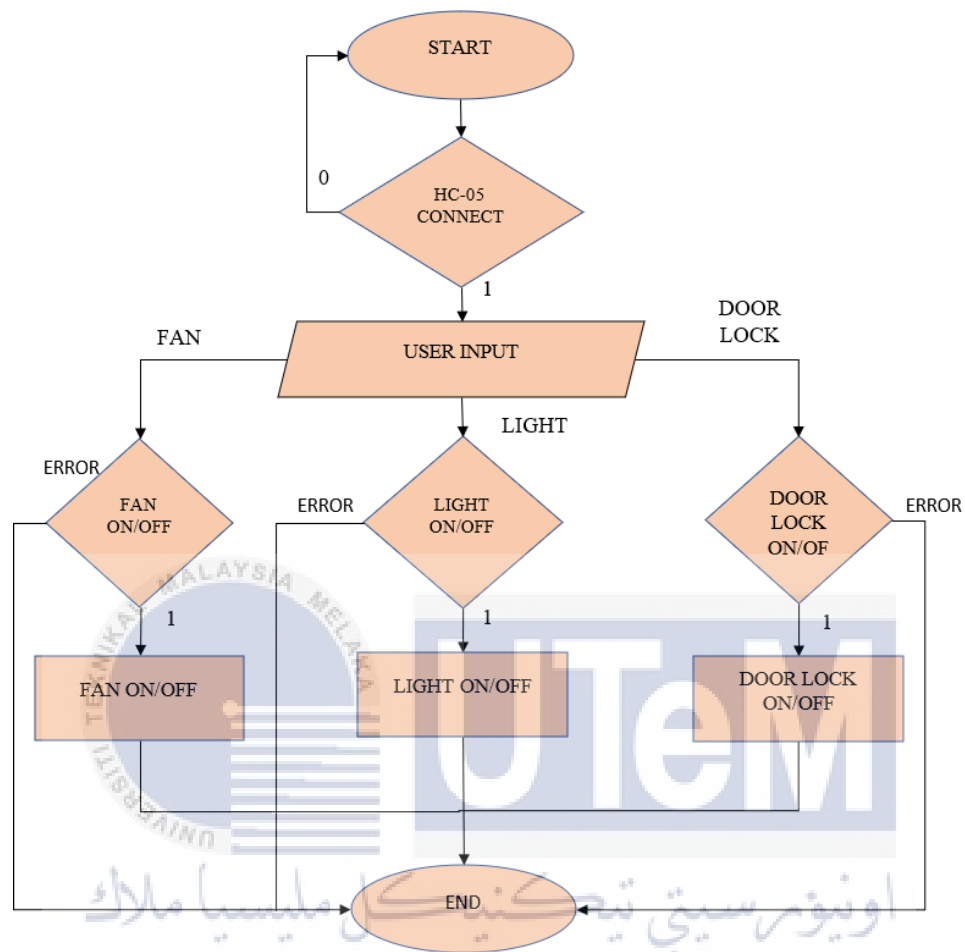


Figure 3.2 Flowchart of the Project

### 3.4 Hardware Specification

#### 3.4.1 Arduino Uno



Figure 3.3 Arduino Uno

Arduino Uno has a lot of features. It makes the user easy to use in their project. The Atmega16U2 microprocessor was built in Arduino UNO, which is to boost the rate of transfer and provide bigger memory. Arduino UNO no need any other devices such as a joystick, mouse, keyboard. Arduino UNO have SCL and SDA pins located near the RESET pin.

Arduino UNO has 14 digital i/o pins, 6 PWM pins, 6 analogue input pins, a USB port, reset button, and 1 power port. The Arduino UNO board can connect to a computer system through USB port and program in the computer. To store the data, Arduino Uno has a 32-KB flash memory.

### 3.4.2 Bluetooth Module HC-05



Figure 3.4 Bluetooth module HC-05

The HC-05 is Bluetooth module which can connected the phone using wireless functionality to use in the project.

Table 3.1 HC-05 Pinout Configuration

Pin No.	Pin Name	Description
1	Enable	To change the Data Mode (low) and AT mode (high). The default data is Data Mode (low)
2	VCC	The power of the module, its is +5V
3	Ground	To connect the pin to the ground
4	TX Transmitter	Transmits Data. It will run out by this pin that everything it received
5	RX Receiver	Receive Data. Its will be program via Bluetooth that serial data give to this pin
6	State	To inspect either Bluetooth working properly or not
7	LED	To specify the modules; <ul style="list-style-type: none"><li>• If 2 seconds blink once: It in Command Mode</li><li>• Blink repeatedly: Wait to connect to Data Mode</li><li>• If 1 second blink twice: It in Data Mode</li></ul>
8	Button	Change mode to Data or Command Mode

### 3.4.3 Breadboard

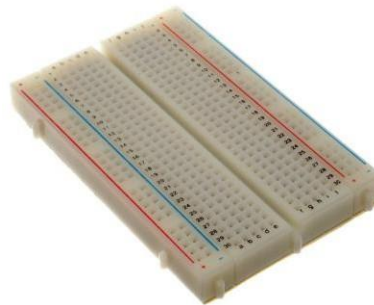


Figure 3.5 Breadboard

Before finalising any circuit design, a breadboard is used to quickly build and test circuits. Holes on the breadboard allow circuit components to be inserted. The breadboard has metal strips that run underneath it and connect the holes on the top of the board. It is worth noting that the top and bottom rows of holes are joined horizontally, whereas the other holes are joined vertically.

### 3.4.4 LED



Figure 3.6 Light Emitting Diode (LED)

Light Emitting Diode (LED) is a semiconductor, it works like a bulb, that will throw out light when it has current flow. LED have 2 pins one is cathode and another is anode. Cathode is negative pin while anode is positive pin. Its important to put the pin right direction, if not the LED will not work.

### 3.4.5 Fan



Figure 3.7 Cooling Fan

Cooling fan with two wire, because it have dual speed mode which is 3.3V and 5V direct current. Its is suitable for project that use fan as electrical device. This project use fan as output, so its suitable to put this cooling fan to this project. Below are some specifications of the cooling fan;

- 3V to 5V operating volt
- Black colour
- Dimension: 30mm x 30mm x 8mm

### 3.4.6 Servo Motor



Figure 3.8 Servo Motor

This servo motor is work as a door lock in this project. Servo motor can make 360-degree continuous rotation servo but can be programmed what user needs such as 90-degree, 180-degree or others. In this project, its only use 90-degree and back to 0-degree. Servo motor voltage-rated is 5VDC and their RPM is 130.

### 3.5 Software Specification

#### 3.5.1 Arduino IDE



Figure 3.9 Arduino IDE icon

Arduino IDE is open source software that's mostly used to write code for Arduino board. Compiling the code is far too simple. Even a novice with no technical understanding might get complacent while learning. It runs on the platform of Java, which contains built-in commands and functions that are required for debugging and generating code in the environment. It may be used on OS such as iOS, Windows, and others. Arduino is programmed and receives information in the form of code. The code will be transferred and uploaded to the board. The IDE consists of two components: an compiler and a editor. The former is used to develop the appropriate code, after which it is compiled and loaded into an Arduino module. The Arduino IDE software icon is seen in Figure 3.9. The Arduino IDE software interface is shown in picture 3.10 below.



Figure 3.10 Interface of Arduino IDE

### 3.6 Mobile Application

#### 3.6.1 AMR\_Voice



Figure 3.11 Icon for AMR\_Voice

AMR\_Voice is open source android application. Its use mobile phone to receive voice recognition system to send the command to the Arduino board. Before it want to



use, it must connect to Bluetooth module first. The app sends in the recognized voice as a string for such as if you say 'Hi' the android phone will return a string \*Hi # to your bluetooth module, start and stop bits indicated of \*and#.



Figure 3.12 Home interface for AMR Voice

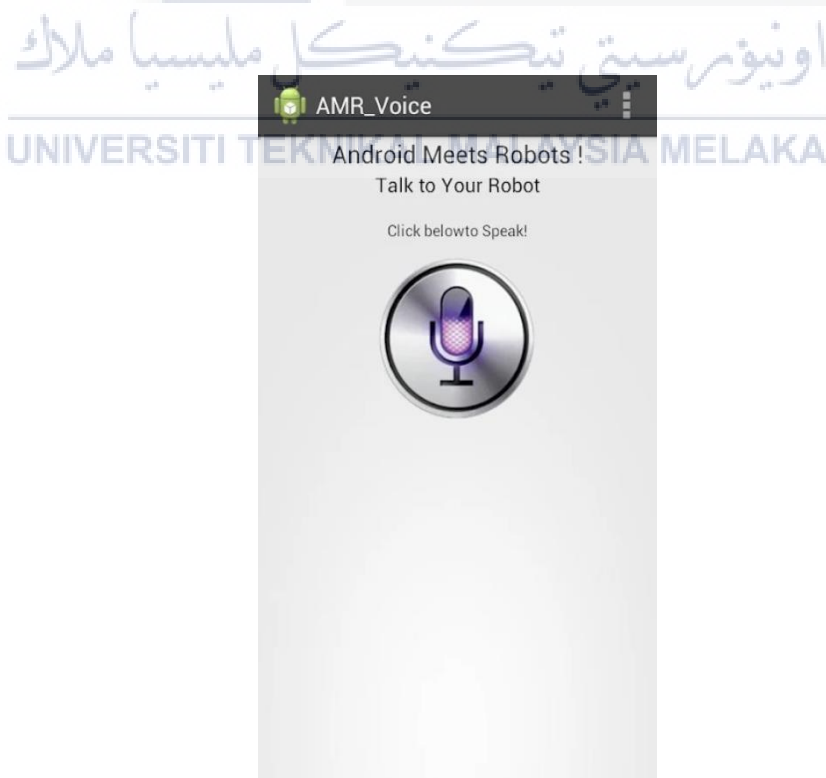


Figure 3.13 Interface for Input Voice

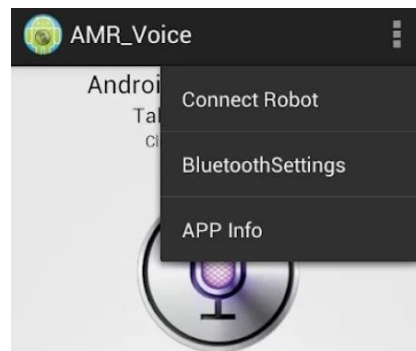


Figure 3.14 Setting for AMR\_Voice

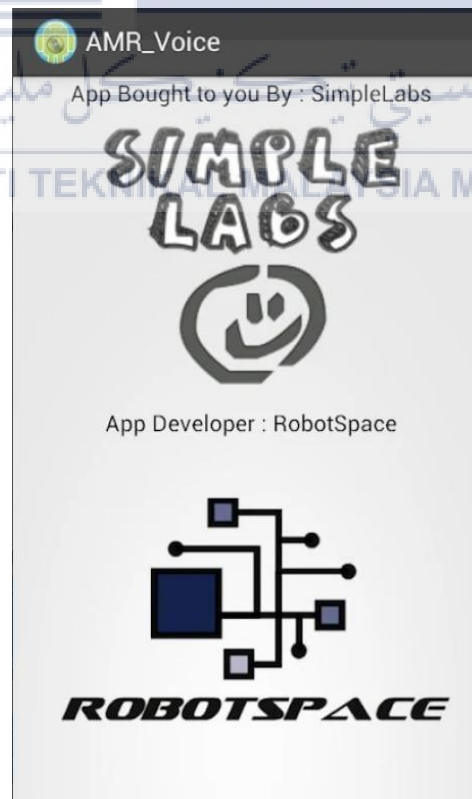


Figure 3.15 Credit of AMR\_Voice

### 3.7 Block Diagram

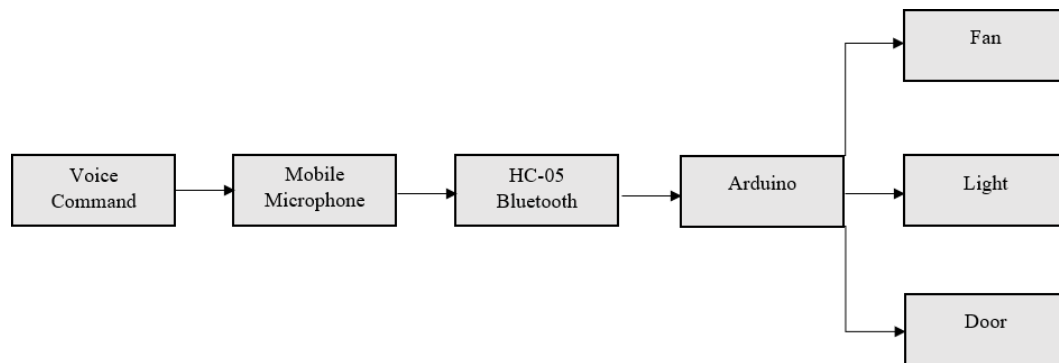


Figure 3.16 Block Diagram of the Project

Figure 3.16 show that my project block diagram. For the first, voice is need to send the data to mobile microphone, the mobile phone should connect to HC-05 Bluetooth modules, then data send to the Arduino for the executing. Whether fan, light, door or all the electronics devices will turn on based on user commands.

### 3.8 Summary

In conclusion, this chapter are focused on the key component of developing the project and how exactly the hardware will work. Furthermore, this chapter highlight the project flow and how I will conduct the project until it finished. During this semester, I almost finish making the simulation part of the my project and programmed the Arduino using Arduino IDE but lacking in the code in Arduino IDE and the electronic devices not funtion properly. In next semester, I will continue to programmed the code and do again the simulation until it finished.

## CHAPTER 4

### RESULTS AND DISCUSSIONS

#### 4.1 Introduction

This chapter will concentrate on the entire project's outcomes and discussion. All project test results from simulation prior to data finalisation, operational circumstances, and data analysis are provided. The final outcomes of these reviews and evaluations serve as a guideline for determining if the project aim has been met.

#### 4.2 Software Development

BT Voice Control application is used to receive voice from user to give command to the Arduino. First and foremost, BT Voice Control application is an app which need to be installed by the user in his/her phone. It enables user to integrate with devices and receive voice. Once the Bluetooth of the phone is connected to the HC05, the data is collected and immediately sent it to BT Voice Control. This application will receive the voice from user. BT Voice Control application will be installed at the android play store. Moreover, this application is offline application it does not need WiFi connection to use. Figure 4.1 shows that the BT Voice Control is connected to the HC05.

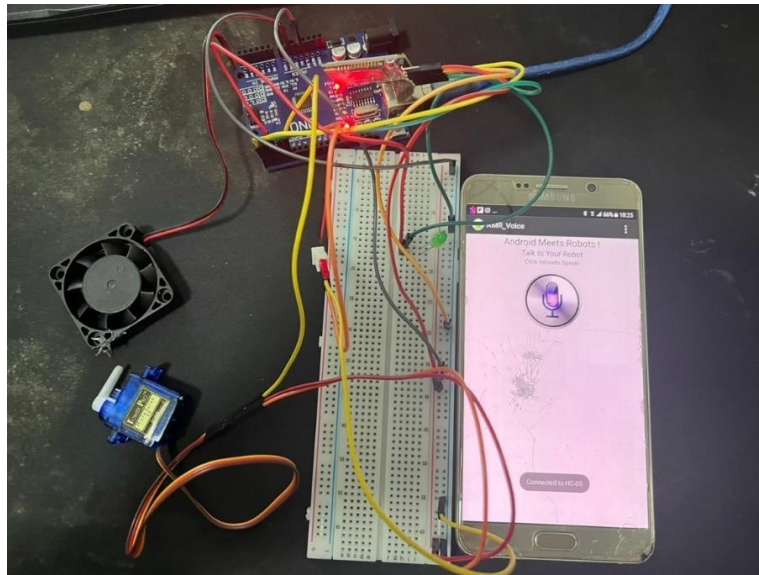


Figure 4.1 The app and HC05 connected

### 4.3 Hardware Development

The hardware used in this project are Arduino Uno, HC05, LED, Fan, Servo Motor. The hardware configuration is shown in Figure 4.2.

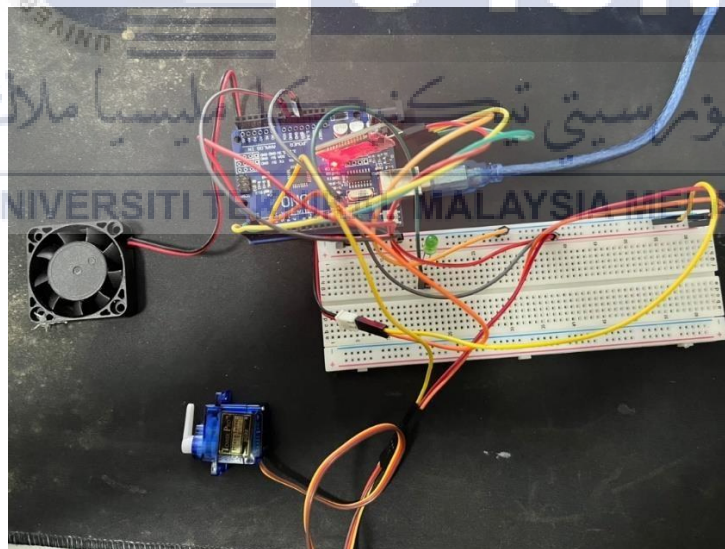


Figure 4.2 The connected hardware

Mainly, there are two hardware of this project which is Arduino and HC05 Bluetooth Module. For Arduino uno, its is used to program what the user needs. for example, if the user wants to open the light, the user should give the voice "LED on",

if the fan, "Fan on", and the door "Lock door". But the user can also switch on or switch off them all at once by giving a voice signal "Switch on" or "Switch on". Next, for HC05, it is used to connect between the user's mobile phone and the Arduino. HC05 must be connected using Bluetooth on the user's mobile phone. If not connected, the user cannot give voice command to this project.

#### 4.4 Prototype Development

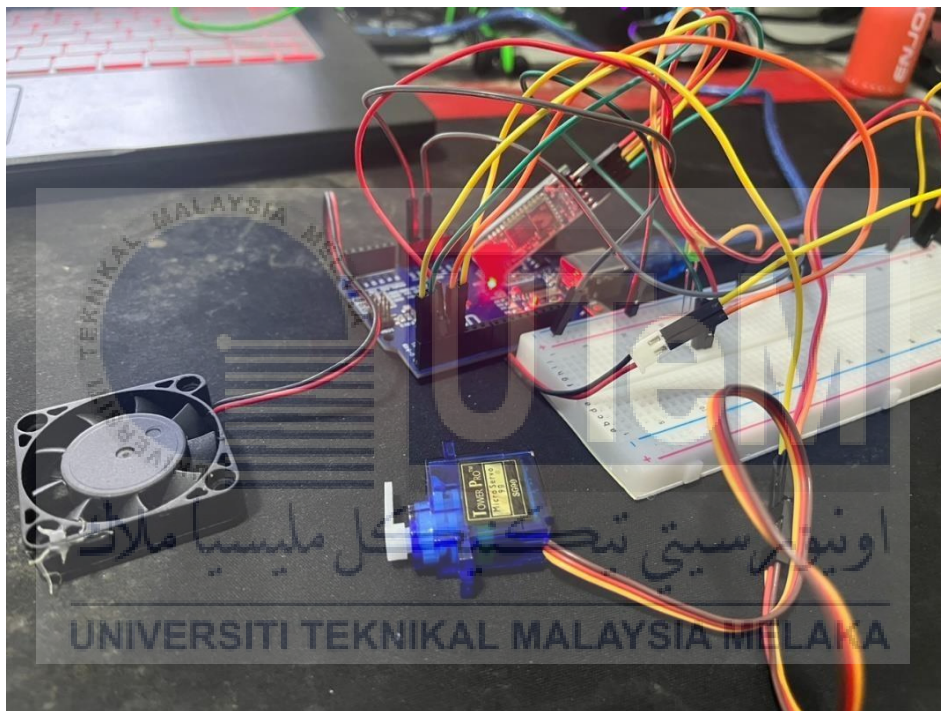


Figure 4.3 Prototype Development

Figure 4.3 shows the prototype model for the Development Of An Iot Based Voice Command For Home Control System Using Android Application. The mobile phone should be connected to the HC05 Bluetooth module before it is used. After the mobile phone is connected to the HC05, user can give voice command to the project. we use three outputs, which are LED, Fan and Servo motor.



## 4.5 Project Integration

Development Of An Iot Based Voice Command For Home Control System Using Android Application is designed to make user easier. This project is able to run continuously as long as Bluetooth is connected to user's mobile phone. The workflow of this project is stated in this section.

First, the user needs to install the BT Voice Control application (refer figure 4.4) on the play store (Android phone) at their mobile phone. This is an open sources application. Anyone who uses an android phone can install it on their phone.



Figure 4.4 BT Voice Control on play store

After that, the user should go to Settings, then find Bluetooth settings (figure4.5) and open Bluetooth on the user's phone. Next, the user should open the BT Voice Control application and search for the name HC05 and click on that. Now, the phone and HC05 are already connected (figure 4.6).

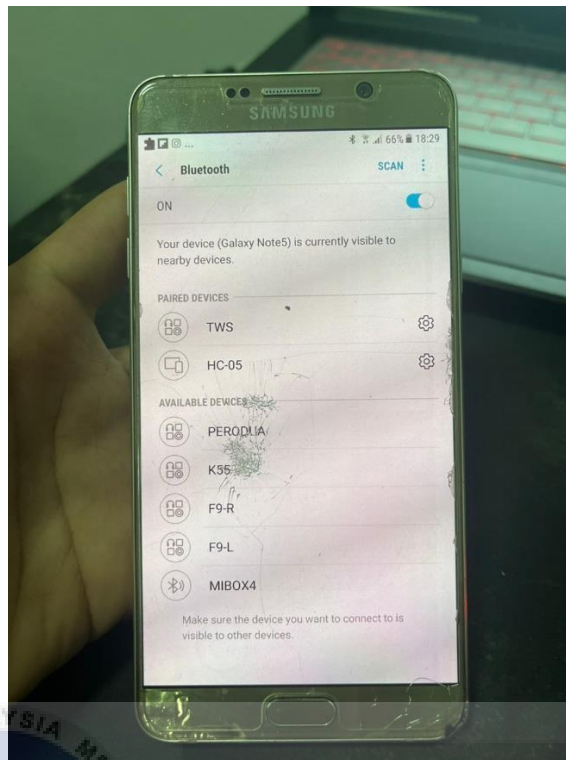


Figure 4.5 Bluetooth Setting on mobile phone

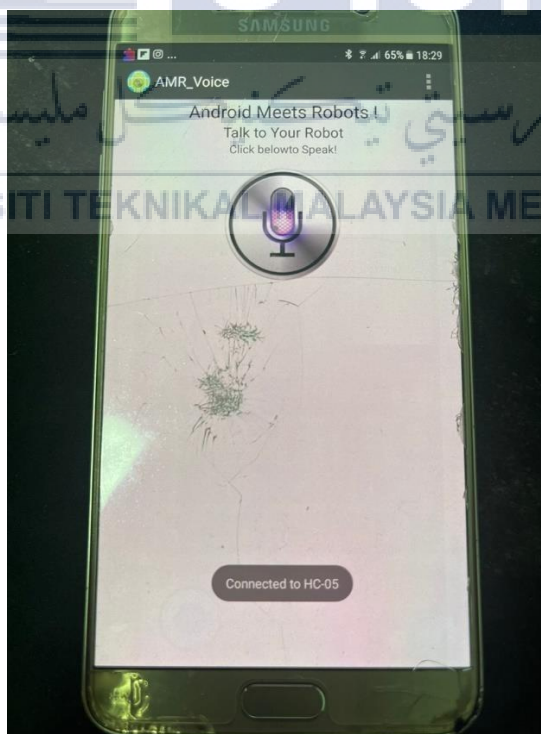


Figure 4.6 BT Voice Control is connected to HC05



Finally, the user can give voice commands for the home hardware that the user wants. Such as, LED, fan or door lock.

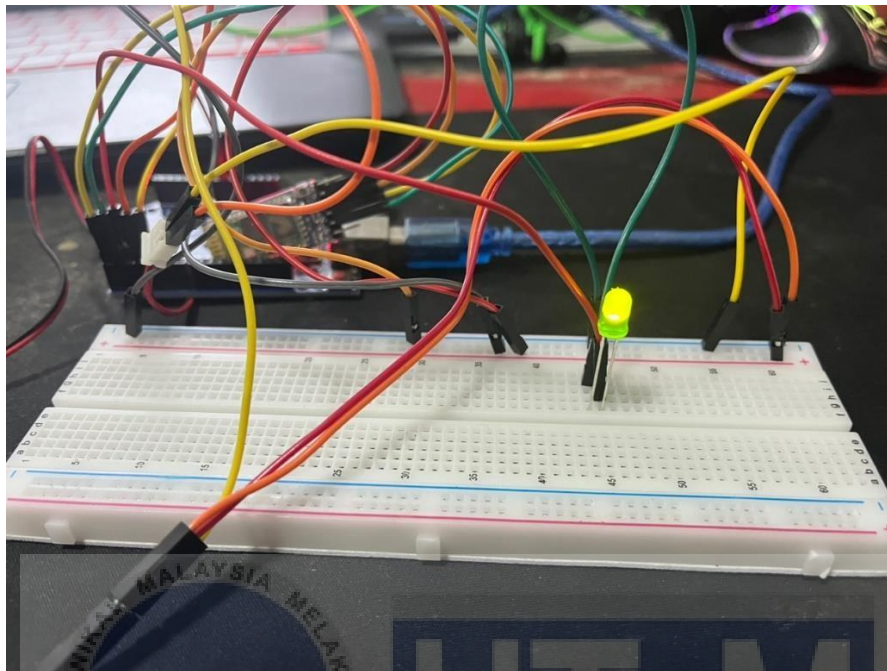


Figure 4.7 LED / lamp

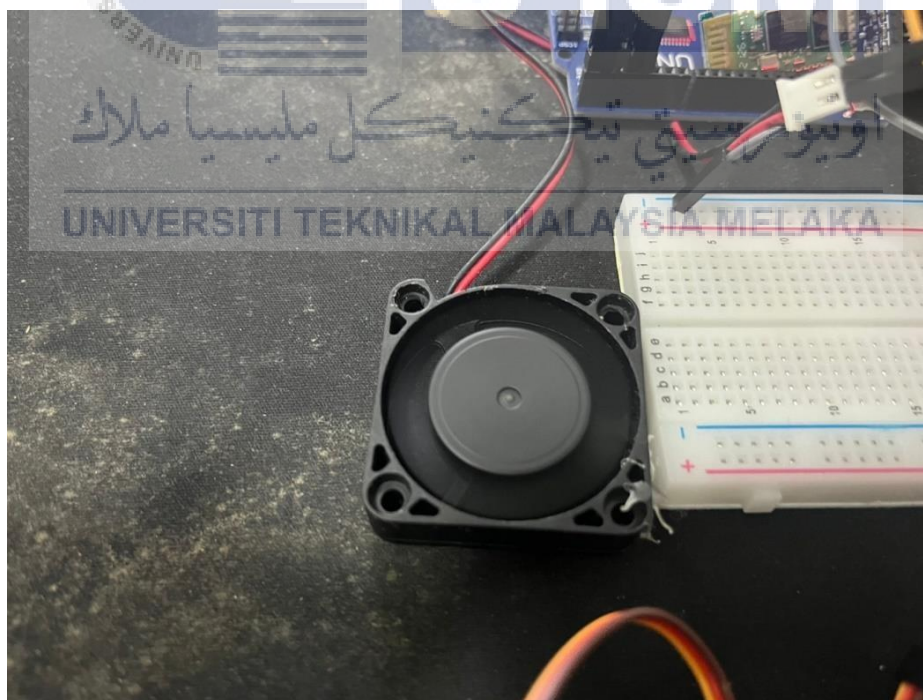


Figure 4.8 Fan

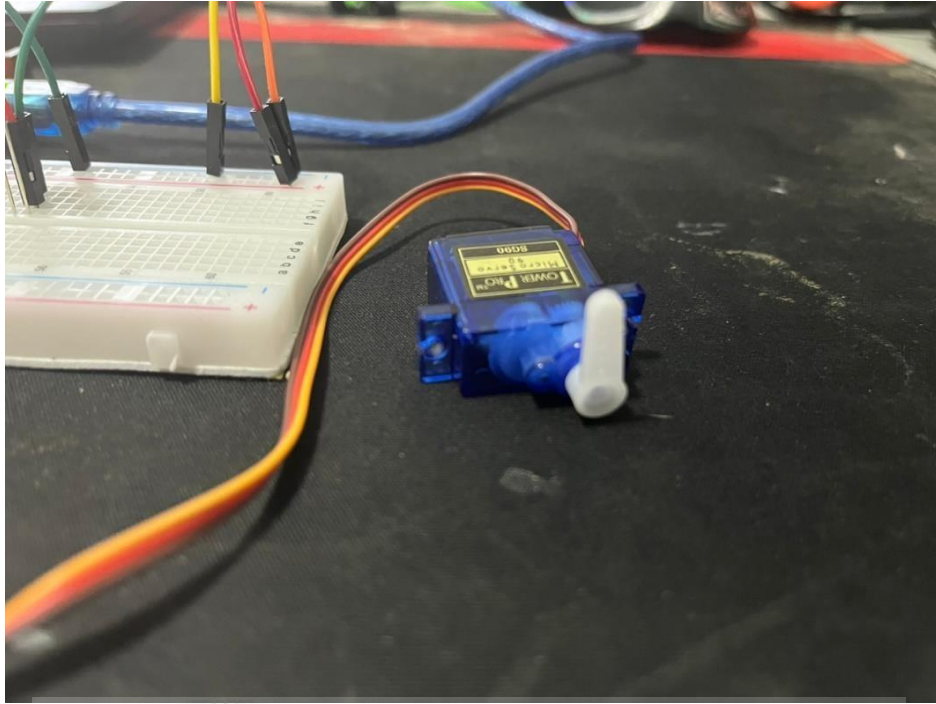


Figure 4.9 Door Lock

Figure 4.7, figure 4.8, figure 4.9 shows that the home appliances are working well after the user give their command to switch on. The LED burns brightly, the fan spins fast and the servo motor moves successfully.

#### 4.6 Data Analysis

The human voice communicates in both the temporal and frequency domains. In recorded waveforms, only time-domain information is freely accessible. For frequency-domain information to be available, a transformation is necessary. In the presented system, the FFT algorithm is used. To maintain time-domain information, the whole waveform is divided into several smaller windows using a rectangle window technique. A rectangular window function is the simplest, but also the fastest. It permits the use of fast memory copy routines rather than the slower every value weighting. Its also has a defect where if the human voice is used to give commands, the voice will be disturbed by the noise of the environment.

#### 4.6.1 The connection between mobile phone and HC05

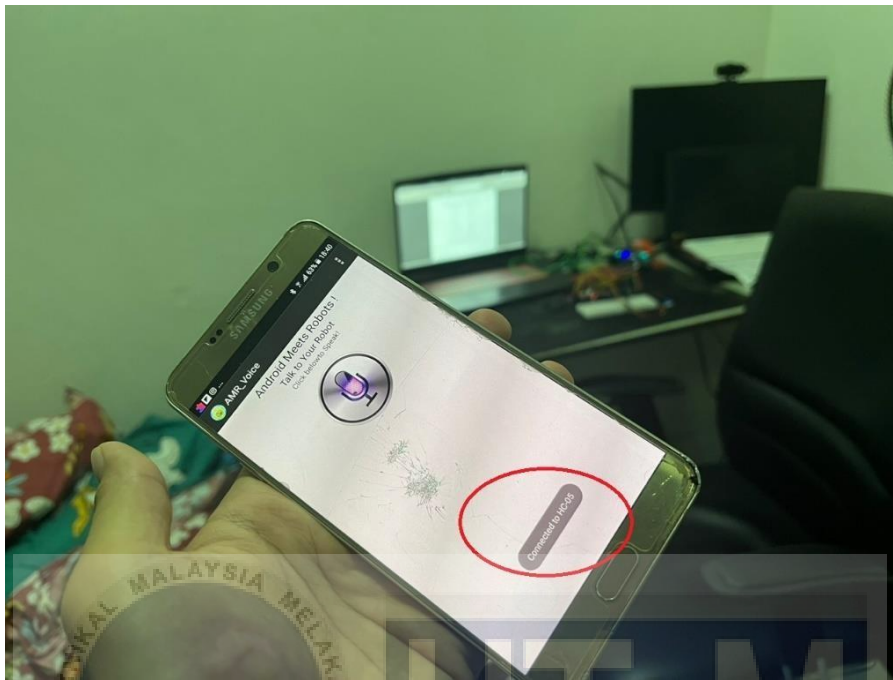


Figure 4.11 The distance between mobile phone and HC05 (2 meters)

Figure 4.11 shows that. The phone already connected to the HC05 Bluetooth module. "Connected HC05" will be display on the screen if the phone connect to the Bluetooth module.

Testing the distance between the mobile phone and HC05.

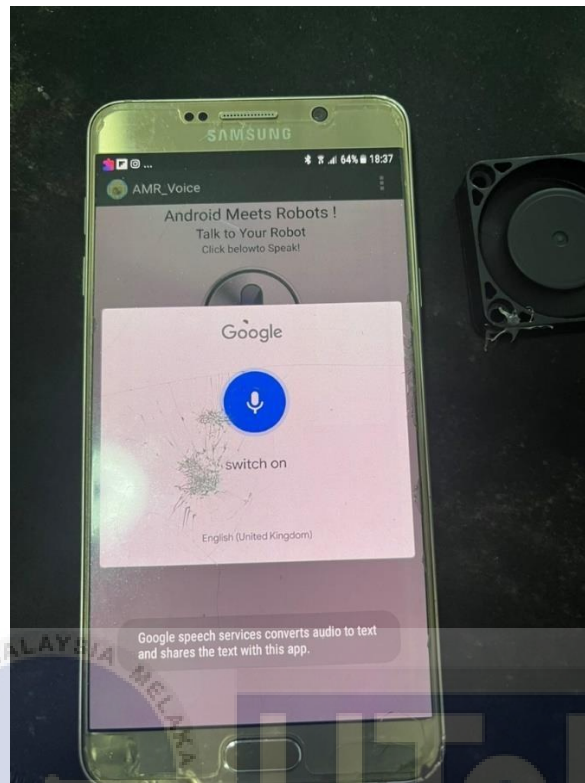
Table 4.1 Testing the connection distance between the phone and the HC05 Bluetooth

Module		
Distance Discover (m)	Connected?	Coverage
1 meter	✓	Stable
2 meters	✓	Stable

3 meters	✓	Stable
4 meters	✓	Stable
5 meters	✓	Stable
6 meters	✓	Stable
7 meters	✓	Stable
8 meters	✓	Connected but unstable
9 meters	✓	Connected but unstable
10 meters	✗	Not Connected
11 meters	✗	Not Connected
12 meters	✗	Not Connected

For the conclusion, the best distance to discover is 5meters because the connection is connected and the coverage is stable.

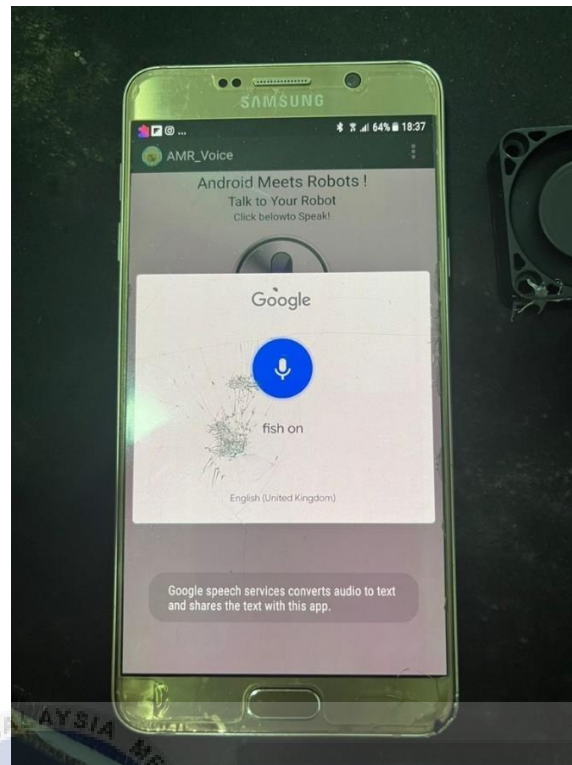
#### 4.6.2 The accuracy of word receiver of mobile phone



4.12 The correct words that captured ('switch on')

Figure 4.12 shows that, the user give command where the user say 'switch on', and the captured word is 'switch on'. So, the correct word is captured what user said.





#### 4.13 The wrong words that captured ('fish on')

Figure 4.13 shows that, the user give command where the user say 'switch on', and the captured word is 'fish on'. So, the wrong word is captured what user said.

Table 4.2 The same word sounding using this project

Word that is used in the project	Same sounding words
'All'	'Fall' 'Hall' 'Wall' 'Brawl' 'Scrawl' 'Bawl'
'On'	'Upon' 'Non'

	'Con'  'Hon'  'Won'  'Phone'
'Off'	'Boff'  'Golf'  'Auf'  'Hof'  'Morph'
'Switch'	'Swish'  'Speech' 'Rich' 'Which' 'Snitch'
'Turn'	'Then'  'Terns' 'Thurn' 'Than' 'Burn'
'Fan'	'Fend'  'Flan'  'Span'  'Pan'
'Door'	'Dore'  'Dorr'

	'For' 'Thor' 'Core'
'Lock'	'Clock' 'Locke' 'Chalk' 'Blok' 'Fork'

There is a few words that same sounding like the project. Whatever wrong word be captured from the command, the home appliances will not working well.

From 20 times the experiment of using words in this project, there were only a few times where the phone could not capture the voice used by the user.

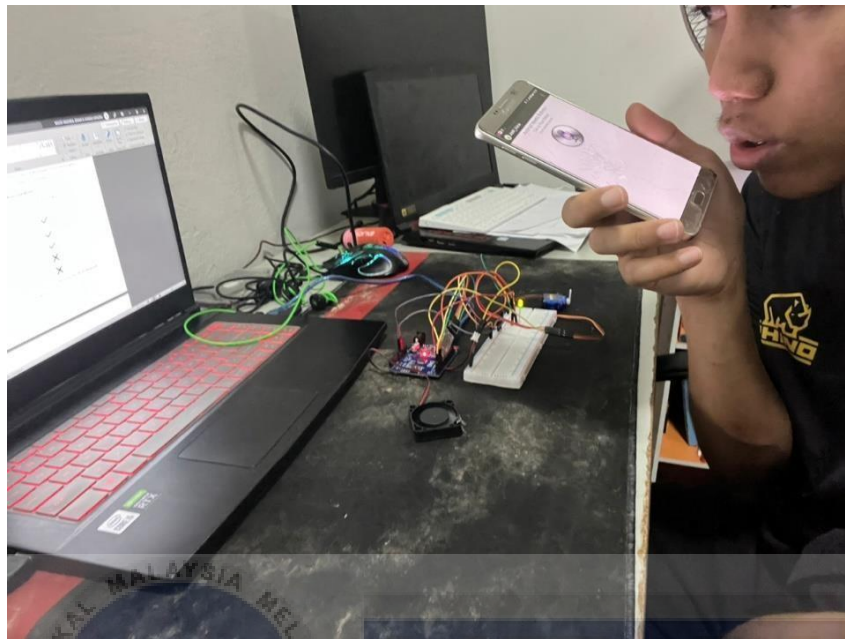
Table 4.3 The works of the output

Trial	User say..	Voice Captured	LED	Fan	Door
1 <sup>st</sup>	'All on'	'All on'	✓	✓	✓
2 <sup>nd</sup>	'All on'	'Balloon'	✗	✗	✗
3 <sup>rd</sup>	'All on'	'All on'	✓	✓	✓
4 <sup>th</sup>	'Turn on'	'Turn on'	✓	✓	✓
5 <sup>th</sup>	'Turn on'	'Turn on'	✓	✓	✓
6 <sup>th</sup>	'Turn on'	'Turn on'	✓	✓	✓



7 <sup>th</sup>	'LED on'	'LED on'	✓	✓	✓
8 <sup>th</sup>	'LED on'	'LED on'	✓	✓	✓
9 <sup>th</sup>	'LED on'	'LED on'	✓	✓	✓
10 <sup>th</sup>	'LED off'	'LED off'	✓	✓	✓
11 <sup>th</sup>	'LED off'	'LED off'	✓	✓	✓
12 <sup>th</sup>	'LED off'	'LED off'	✓	✓	✓
13 <sup>th</sup>	'Fan on'	'Fan on'	✓	✓	✓
14 <sup>th</sup>	'Fan on'	'Fan on'	✓	✓	✓
15 <sup>th</sup>	'Fan on'	'Fan on'	✓	✓	✓
16 <sup>th</sup>	'Fan off'	'Fan off'	✗	✗	✗
17 <sup>th</sup>	'Fan off'	'Fan off'	✗	✗	✗
18 <sup>th</sup>	'Fan off'	'Fan off'	✓	✓	✓
19 <sup>th</sup>	'Door Lock'	'Door Lock'	✓	✓	✓
20 <sup>th</sup>	'Unlock'	'Unlock'	✗	✗	✗
		Accurate Voice Captured = 16 $(16 / 20) \times 100\%$ $= 80\%$			

#### 4.6.3 The distance between user's voice and mobile phone



4.14 The distance between voice and mobile phone (5 meters)

Figure 4.13 shows that, the user give command to the mobile phone. The distance between user's voice and mobile phone recorded in the table below.

Table 4.4 The distance between user's voice and mobile phone

Distance Discover (m)	Captured?
1 meter	✓
2 meters	✓
3 meters	✓
4 meters	✓
5 meters	✓
6 meters	✓
7 meters	✗

8 meters	✓
9 meters	✓
10 meters	✓

It depends how the environment are and other external noises, but if the environment is relatively quiet, the voice will be easily captured by the mobile phone.

#### 4.6.4 Maximum and minimum voltage used for home appliances

Table 4.5 Maximum and minimum voltage used

Component	Maximum Voltage	Minimum Voltage	If over voltage used
Supercell Battery	8.5V	6.5V	The battery will dry
LED	3.3V	1.8V	The led will be burn
Fan	5.0V	3.5V	The fan will be broken
Servo Motor	7.2V	4.0V	Any higher voltage will be damaged the servo motor

All the components used have maximum and minimum voltage. This project only needs a little bit voltage to turn on household appliances.

#### 4.7 Summary

This chapter explain abouts project test results from simulation prior to data finalization, operational circumstances, and data analysis. Besides that, its cover connection distance between the phone and the HC05 Bluetooth Module, same word sounding using this project, distance between user's voice and mobile phone and maximum and minimum voltage used for home appliances. The results is recorded for future use.



## CHAPTER 5

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Conclusion

Home appliances is important nowadays and our future. Therefore we need to use home appliances in parallel with today's technology. Development Of An Iot Based Voice Command For Home Control System Using Android Application has been produced to further facilitate a person's movement and balance the technology nowadays. The objectives of this project are achieved as the as the mention in Chapter1. The development of this project are able to conduct some research of the voice recognition of their characteristics and their functioning. The data received on the BT Voice application then send to the output were developed successfully with the transmission medium of Arduino. Thus, the output of this project which is LED, Fan and Servo Motor are functioning well.

For the conclusion, I learned many things in this project, especially in the field of hardware. I do a lot of research on hardware, such as arduino uno, arduino lilypad, servo motor, 5V fans and HC-05 bluetooth module. In addition, I can also learn the objective speech recognition system and its pros and cons.

## 5.2 Future Work and Recommendation

Although the development of this project is performing well, there are still room for improvement. No system in this world works perfect, there are definitely flaws including this project. Here are some point to do some future works and their recommendation;

- i. Develop their own mobile application to have easy, functional access to information and processes that they need in real-time and are optimized for hands on interaction.
- ii. Upgrade Bluetooth module to increase the distance of the connection of Bluetooth.
- iii. Add more home appliances or output in the project such as curtain mover, cloth hanger or suspension, a large umbrella to cover from rain and others that can move by using voice command.
- iv. Adding button to switch on and switch off if the voice cant captured of user's command.
- v. Put emergency buzzer if the home appliances are not working well or something happen to home appliances.

## REFERENCES

- [1] A. N. Azhiimah, K. Khotimah, M. S. Sumbawati, and A. B. Santosa, "Automatic Control Based on Voice Commands and Arduino," 2020.
- [2] S. M. Lee, Y. K. Cho, and D. L. Olson, "Voice recognition: An examination of an evolving technology and its use in organizations," *Computers and Operations Research*, vol. 14, no. 6, pp. 457–464, 1987, doi: 10.1016/0305-0548(87)90042-6.
- [3] Jesse Scardina, (2018,January). *voice recognition (speaker recognition)*. How voice recognition works. Retrieved From "https://www.techtarget.com/searchcustomerexperience/definition/voice-recognition-speaker-recognition"
- [4] K. Shafique, B. A. Khawaja, F. Sabir, S. Qazi, and M. Mustaqim, "Internet of things (IoT) for next-generation smart systems: A review of current challenges, future trends and prospects for emerging 5G-IoT Scenarios," *IEEE Access*, vol. 8. Institute of Electrical and Electronics Engineers Inc., pp. 23022–23040, 2020. doi: 10.1109/ACCESS.2020.2970118.
- [5] Jim Donaldson, (2016, October 11). *RFID Started The Internet of Things Movement... Now It's Set to Lead It*. Coming Up Next For IoT. Retrieved from "https://www.mojix.com/rfid-internet-of-things-movement/"
- [6] V. Krotov, "The Internet of Things and new business opportunities," *Business Horizons*, vol. 60, no. 6, pp. 831–841, Nov. 2017, doi: 10.1016/j.bushor.2017.07.009.
- [7] Z. Hassan, H. Arafat Ali, M. M. Badawy, Z. H. Ali, and H. A. Ali, "Recent Research Directions Article in International Journal of Computer Applications · October," 2015. [Online]. Available: <https://www.researchgate.net/publication/320532203>
- [8] B.Dahlan, "SISTEM KONTROL PENERANGAN MENGGUNAKAN ARDUINO UNO PADA UNIVERSITAS ICHSAN GORONTALO," Dis, 2017

- [9] M. Verma, "IJESRT INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY WORKING, OPERATION AND TYPES OF ARDUINO MICROCONTROLLER," © *International Journal of Engineering Sciences & Research Technology*, doi: 10.5281/zenodo.805403.
- [10] Rajguru Electronics, "L293D Based Arduino Motor Shield, Wiring and Installation the DC Motor to the l293D Shield" May,2015
- [11] S. Sen, S. Chakrabarty, R. Toshniwal, and A. Bhaumik, "Design of an Intelligent Voice Controlled Home Automation System," *International Journal of Computer Applications*, vol. 121, no. 15, pp. 39–42, Jul. 2015, doi: 10.5120/21619-4904.
- [12] H. Kamdar, R. Karkera, A. Khanna, P. Kulkarni, and S. Agrawal, "A Review on Home Automation Using Voice Recognition," *International Research Journal of Engineering and Technology*, vol. 9001, p. 1795, 2008, [Online]. Available: [www.irjet.net](http://www.irjet.net)
- [13] A. Surve, R. Kankal, L. Chile, S. Nayak, and P. Us, "VOICE CONTROLLED SMART HOME SYSTEM," 2015.
- [14] M. Saravanan, B. Selvababu, A. Jayan, A. Anand, and A. Raj, "Arduino based voice controlled robot vehicle," in *IOP Conference Series: Materials Science and Engineering*, Dec. 2020, vol. 993, no. 1. doi: 10.1088/1757-899X/993/1/012125.
- [15] S. Pal, A. Chauhan, and S. K. Gupta, "Voice controlled smart home automation system," *International Journal of Recent Technology and Engineering*, vol. 8, no. 3, pp. 4092–4093, Sep. 2019, doi: 10.35940/ijrte.C5460.098319.



## APPENDICES

```
#include <Servo.h>
```

```
Servo servo;  
String voice;  
int LED =2;  
int FAN = 3;  
int DOOR = 4;  
int angle = 90;
```

```
void LedOn(){  
    digitalWrite (LED, HIGH);  
}  
void LedOff(){  
    digitalWrite (LED, LOW);  
}
```

```
void FanOn(){  
    digitalWrite (FAN, HIGH);  
}  
void FanOff(){  
    digitalWrite (FAN, LOW);  
}
```

```
void DoorOn(){  
    servo.write(0);  
}  
void DoorOff(){  
    servo.write(90);  
}
```

```
void allon() {  
    LedOn();  
    FanOn();  
    DoorOn();  
}
```

```
void alloff() {  
    LedOff();  
    FanOff();  
    DoorOff();  
}
```

```
void setup() {  
    servo.attach(4);  
    servo.write(angle);  
}
```



```

Serial.begin(9600);
pinMode(LED, OUTPUT);
pinMode(DOOR, OUTPUT);
pinMode(FAN, OUTPUT);

}

void loop() {
while(Serial.available()) {
delay(10);
char c=Serial.read();
if(c=='#')
{break; }
voice += c;
}

if (voice.length() > 0) {
Serial.println(voice);
Serial.println(voice.length());
if (voice == "*all on" || voice == "*turn on" || voice == "*on" || voice == "*then on" ||
voice == "*switch on")
{
allon() ;
Serial.println("All");
}
else if (voice == "*off" || voice=="*turn off" || voice == "*off" || voice == "*switch off" )
{
alloff() ;
Serial.println("Off");
}

else if(voice == "*led" || voice == "*led on" || voice == "*LED on"){
LedOn();
Serial.println("LED On");
}
else if(voice == "*LED off" || voice == "*led off"){
LedOff();
Serial.println("LED Off");
}

else if(voice == "*fan" || voice == "*fan on" || voice == "*fanon" ){
FanOn();
Serial.println("fan On");
}
else if( voice == "*fan off" ){
FanOff();
Serial.println("fan Off");
}
}

```

```

else if(voice == "*door" || voice == "*door on" || voice == "*door lock" || voice ==
"*lock"){
DoorOn();
Serial.println("door On");
}
else if(voice == "*door off" || voice == "*door unlock" || voice == "*unlock"){
DoorOff();
Serial.println("door Off");
}

voice="";
}
}

```

