

# VOICE RECOGNITION HOME AUTOMATION SYSTEM

CHOY MENG ONN

UNIVERSITI TEKNOLOGI MALAYSIA

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# VOICE RECOGNITION HOME AUTOMATION SYSTEM

CHOY MENG ONN

A report submitted in partial fulfilment of the  
requirements for the award of the degree of  
Bachelor of Engineering (Electrical-Electronics)

Faculty of Electrical Engineering  
Universiti Teknologi Malaysia

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*To my beloved father and mother  
Choy Wai Kiong and How Geok Chin  
and also my siblings  
Choy Meng Tuck and Choy Meng Soon*

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*Choy Meng Onn, Kuala Lumpur*

## **ABSTRACT**

Voice is used in this project for the controlling switches. Reason for choosing voice is because it is easily being reproduced by human. Besides that, usage of voice gives a control system that can be effective and convenient to be used. The application of this system involve modifying the switching system from the traditional way which is physical contact with the switch to a safer way where the usage of voice to replace all the physical contact. This project involve a simple switching system that used the transistor along with relay to do all the connecting of the power to the devices, a voice recognition system that consists of voice recognition chip HM2007, and the PIC18F8722 microcontroller to build up the system. The HM2007 serves as the ear that will listen and interpret the command by the given while the PIC18F8722 serve as the brain of the system that will coordinate the correct output with the input command given. This project able to recognition the command trained by the user and successfully to execute the correct output. This project is a small scale design which consists of 8 commands that will used to control three different switches. The command is able to individually switch on and switch off each of the switch. Besides that, the command also able to switch on all and off all the switch at the same time.



## **ABSTRAK**

Suara digunakan dalam projek adalah bertujuan untuk mengawal suis. Suara dipilih sebagai medium kawalan adalah kerana ia mudah dihasilkan oleh manusia. Selain itu, penggunaan suara akan menghasilkan suatu sistem yang efektif dan mudah digunakan. Aplikasi sistem ini merangkumi pengubahsuaian cara mengaktifkan suis secara tradisional iaitu melalui sentuhan kepada suatu cara yang lebih selamat iaitu menggunakan suara untuk menggantikan sentuhan. Projek ini mengandungi satu sistem pensuisan yang mudah iaitu menggunakan transistor dan geganti untuk melakukan penyambungan bekalan tenaga, satu sistem pengenalan suara yang mengandungi IC Chip HM2007, dan PIC18F8722 mikropengawal untuk membina sistem ini. IC Chip HM2007 berfungsi sebagai telinga untuk mendengar dan mentafsir arahan yang diberikan sementara PIC18F8722 berfungsi sebagai otak kepada sistem yang akan mengkoordinasikan keluaran yang betul dengan masukan yang diberikan. Projek ini berupaya untuk mengenal arahan yang dilatih oleh pengguna dan berjaya melaksanakan keluaran yang betul. Projek ini merupakan rekaan skala kecil yang mengandungi 8 arahan yang digunakan untuk mengawal tiga suis yang berasingan. Arahan-arahan ini berupaya untuk mengawal setiap suis secara berasingan untuk buka dan tutup suis. Selain itu, arahan-arahan tersebut juga berupaya untuk membuka dan menutup kesemua suis pada masa yang sama.

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## LIST OF ABBREVIATIONS

UTM	-	Universiti Teknologi Malaysia
UNITEN	-	Universiti Tenaga Nasional
ADC	-	Analog Digital Converter
BCD	-	Binary Code to Decimal
CMOS	-	Complementary metaloxidesemiconductor
GLCD	-	Graphic Liquid Crystal Display
LED	-	Light Emitting Diode
LCD	-	Liquid Crystal Display
PCB	-	Printed Circuit Board
SRAM	-	Static Random Access Memory
RAM	-	Random Access Memory

## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 Background**

Home automated system is characterized by the ability of the system to perform tasks to initiate or control appliance or devices in home. Nowadays, the appliance that available in the market is getting increase as days passed. Thus, the controlling of such devices is getting more and more attention. From long time ago mostly the controlling is done manually such as walking to the switch and switching it on. But as time passed the arrival or remote control that give the user alternative way to control such appliance without the need for the user to walk to the appliance.

From the above, there are some more advancement in the controlling method that been on research. The advancement mention is using of the voice to act as the controlling medium to initiate or to control the appliance. Taking example such as a security door is only can be activated with the voice of the authorized personal only if then the door will be unlocked. In this project, the voice is also used as the medium to perform the controlling of the electrical appliance in home. The same concept applies in this project compare to the security door where the different is the electrical appliance controlled.

#### **1.2 Objective of Project**

The main objective of this project is to design a voice recognition home automation system. This project will enable the user to control the electrical appliance in home using their voice as the medium that will control the power system. This project also aim to allow not only the user that have train the system with their voice to



control the system but it extend to the other user who also can use the system without do the training process again.

Besides that, this system provides user a better safety against any current leakage, because by using voice direct contact with the power source is reduced compare to the usage of conventional switch.

### **1.3 Scope of Project**

In order to achieve the objective of this project, there are several scope had been identified. The scope of this project includes the designing of a voice recognition circuit for the voice recognition purpose. Follow by the designing of the microcontroller board using PIC18F8722 as the hardware that control the whole project by serving as interface for the voice recognition board with the electrical appliance. Next, a C programming is to be design and coded to enable the microcontroller to be able to function properly as desired.

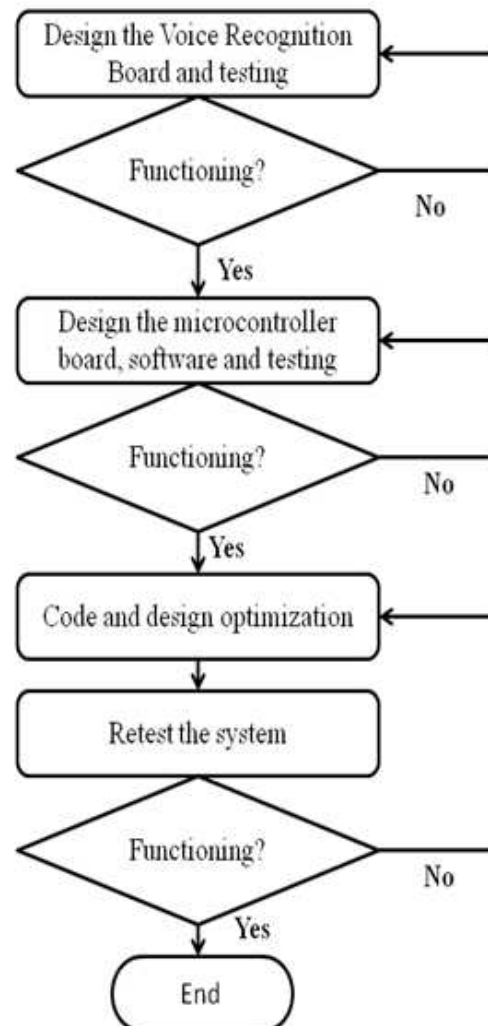
### **1.4 Outlined of Thesis**

This thesis consists of five chapters. In the first chapter, it discuss about the objective, scope of project and summary of the work. In second chapter, the discussion is more focused on the literature review. In this chapter, the discussion will be mainly on the projects that have been done that is almost similar to this project of voice recognition home automation system.

In third chapter, the discussion is mainly on the methodology of the hardware and the software implementation in this project. While for chapter four, the result and discussion is presented here. Last but not least the chapter five, the conclusion of this project is discussed along with the future work.

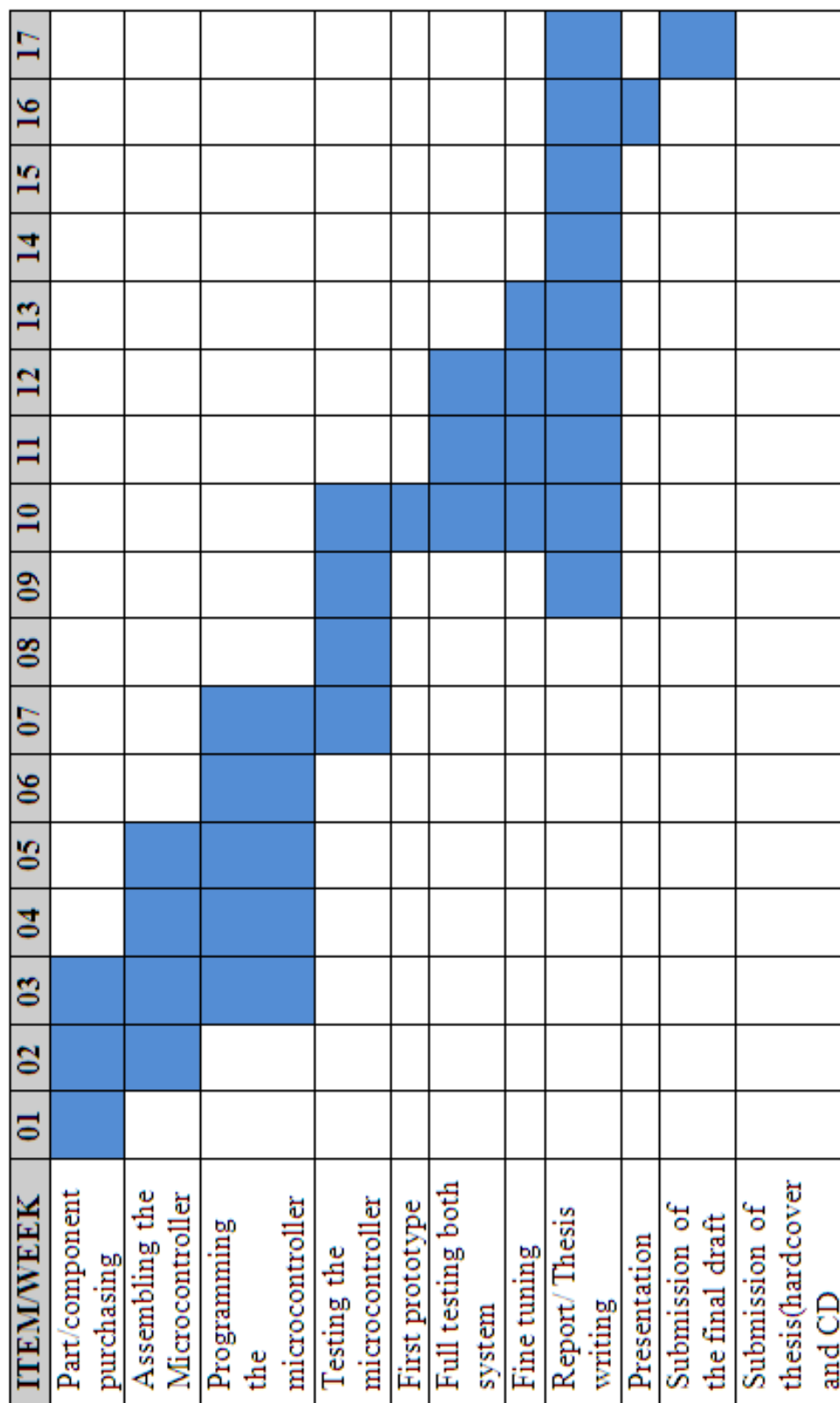
## 1.5 Summary of work

This project is summarized to the flow chart below for all the necessary implementation and optimization of the project. Figure 1.1 shows the flow chart.



**Figure 1.1:** The Flow chart of the implementation of the project.





**Figure 1.3:** Ghant Chart sem II.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter included the background study regarding the voice recognition concept and several similar projects that applies the theory of voice and sound. It also discussed briefly about the HM2007 the voice recognition chip and microcontroller.

#### **2.2 Voice Recognition concept**

This concept is more alike a comparison of between the source and the data stored in memory (the voice that stored during the training process). The way of this concept function is when a user speaks out some command, with then the voice is captured through microphone as the input devices. Once the voice is captured, the usage of a decoding system that will convert the analog (voice) to digital (binary signal). Later, the input voice is compared with the data stored in the memory early before the testing. The output of the comparison is the voice matched with any of the command trained and certain signal is produce as the input for the controlling system.

#### **2.3 Past project**

There are a few projects done locally by other student and researcher in Malaysia regarding on the voice related research.

First of it will be the automated home lighting system, by a degree student of UTM. In this projects, the usage of clap(s) as the source of input or command to control

the lighting system in home. This project offers the ability to control the lighting in term of the intensity or brightness with corresponding to the light intensity in a room due to environment. From this project, it can be concluded that the usage of sound is proof to be a way of controlling the electrical appliance [1]. But the application will be limited to one electrical appliance.

Follow by another research by a master student of UTM. While for this project the voice is apply as a way to control the wheel chair movement. In this project, a wheel chair is modified by equipping it with the motor system that will read the command given by the user to control it speed and movement direction [2]. This project is successful due to the usage of the HM2007 voice recognition chip. From this project, it can be concluded that the usage of the voice is capable to be one of the method to control electrical devices provided a suitable system is used.

The third project is done by a degree student of UNITEN. In this project, voice is used as secondary security measure to access to a restricted area. The overview of this project is to create a system that required the user to key in a series of password and later be verifying with the voice of the user if only both match then the security door will be unlocked [3]. From this project, voice is having a very high potential to be develop as one of the key component of a security related system. The main reason is voice is a unique for each and every person. Thus, by putting in the voice as one of the criteria to access a system will make the system more safety and secure.

## **2.4 Outcome of this project**

From all above of the discussion on the previous project that have been done by other student. In this project, the application of the concept and theory used in the above project is applied. Thus this lead to a project that have the capability to produce a system that have both the security and also the application of voice as the controlling method for controlling the electrical appliance or devices in home.

In this system, voice is used as the primary input to the system. This is because voice is available for each and every user by doing so the system offers a wide range of the controlling to the user. On the other hand, when considering in the view of the security this advantages will lead to the weakness of the project. The weakness is no matter who is the user either the owner of the house or visitors have the capability to

control all the system. Thus, in order to enhance the security only the owner or the resident of the house has to train the system with the unique voice.

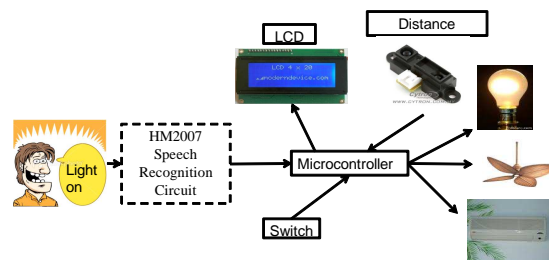
By using all the above way the system is able to function as it was designed for which is to enable the usage of the voice to control the electrical appliance and devices in home. Besides offering the owner the security effect due to only authorized personal is able to controlling the electrical appliance in home.

## CHAPTER 3

### METHODOLOGY

#### 3.1 Introduction

In this project, the microcontroller PIC18F8722 will be used as the controller and interfaces between the input voice command with the electrical appliances that be controlled by this system. Block diagram of the system is show in Figure 3.1.



**Figure 3.1:** Block diagram of the voice recognition home automation system.

From the block diagram, the controlling input is from the voice command given by the user. This voice is then being decoded by the HM2007 speech recognition circuit. In microcontroller, it receives the signal from the HM2007 speech recognition circuit. From this signal, an output signal will be sent out to the correspondent electrical appliance to activate it. Besides that, the existence of the other component such as LCD is used to display the current executed command and also the current room temperature, the temperature sensor is used to measure the temperature in the room which the data will be used to trigger the change of the fan speed, and last but not least the distance sensor is used to identify with only the present of human is then the circuit of HM2007 will be activate.



## 3.2 Hardware implementation

In this section will discuss on the hardware used in the implementation of this system that include the HM2007 IC chip, memory, microcontroller, distance sensor, LCD, and the relay for interfaces

### 3.2.1 HM2007 Voice Recognition Chip

Figure 3.2 below show the HM2007 that will be used in this design. This chip is a single CMOS voice recognition LSI circuit with on-chip analog front end, voice analysis, recognition process and system control functions. This product comes with 2 different packages the DIP and PLCC. The DIP package is used in this project.



**Figure 3.2:** The HM2007 voice recognition IC Chip.

Besides that, this chip have the ability to capture up to 40 word that have the length of 0.92 seconds and up to 20 word with the length of 1.92 seconds. In this project the word length chooses is the long word which is the 1.92 seconds. This chip required a 5v single power supply to enable all the function within it.

This chip also has a rather short response time which is less than 300 milliseconds. This chip has a set of 7 inputs for the keypad that mainly used for the training purposes which located at the pin 4,5,6,8,9,10 and 11. This enables the chip to store the word train to the system. Next is the pin of SA0 to SA12 is the external memory address bus. Then the pin of D0 to D7 is the external memory data bus. Last is the RDY pin at the pin number 7 that will serve as the indicator of the chip where it will be exert high signal if the chip is busy and it is an active-low output [4].



**Figure 3.3:** Pin layout of the HM2007 Dip package.

### 3.2.2 Memory

In order for the speech recognition circuit to have the ability to store the voice command trained to the system, an external memory is used to complete and fulfill this requirement. In this project, the memory used is a CMOS static RAM 64 K (8K X 8-bits) memory. By using this memory, the system is capable to store up to 40 isolated words.

The model of the memory used in this project is DS1225AB 64k Nonvolatile SRAM by MAXIM Dallas Semiconductor. This memory have 13 memory address bus which is A0 to A12 and 8 memory data bus which is DQ0 to DQ7. Have a fast read and write time as fast as 70ns. The data retention is about 3volts but there is some other feature of this memory which is it have a write protect at 4.5volts that mean that if the Vcc is falls below this value the process of the RAM will not enable the write process and the memory will only provide a full function condition when the external power is greater than 4.75 volts

NC	1	28	VCC
A12	2	27	$\overline{WE}$
A7	3	26	NC
A6	4	25	A8
A5	5	24	A9
A4	6	23	A11
A3	7	22	$\overline{OE}$
A2	8	21	A10
A1	9	20	$\overline{CE}$
A0	10	19	DQ7
DQ0	11	18	DQ6
DQ1	12	17	DQ5
DQ2	13	16	DQ4
GND	14	15	DQ3

**Figure 3.4:** Pin layout of DS1225AB.

### 3.2.3 Microcontroller

In this project, besides the main component HM2007 IC chip the microcontroller PIC18F8722 a product from microchip is also the essential component to ensure that this project function as desired. Figure 3.5 below show the microcontroller.



**Figure 3.5:** The microcontroller PIC18F8722.

This component play a major role in controlling the whole system as it serve as





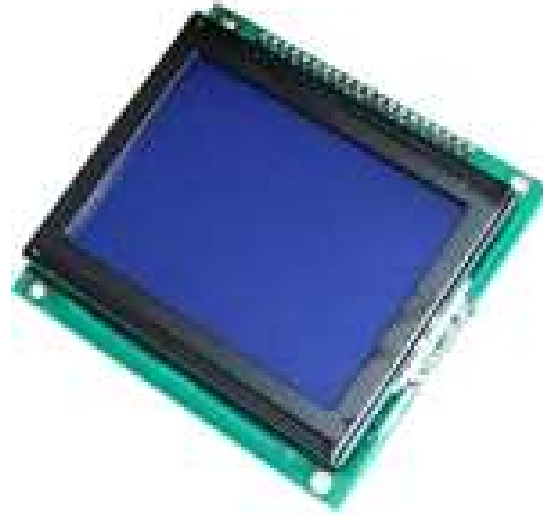
**Figure 3.7:** Distance sensor.

ability to detect object at the most of 30cm away from the sensor and the minimum distance is 4 cm. It required a 5 volts power to operate and the output voltage range from 0.2volts (at 30 cm distance) to about 3.1 volts (at 4 cm distance).

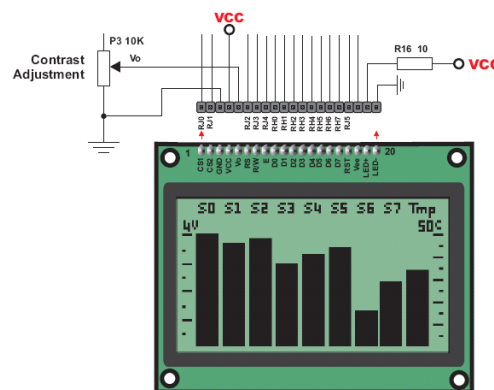
### 3.2.5 Graphic Liquid Crystal Display (GLCD)

In this project, the LCD is mainly function for the display of the current command executed to ensure that the user knows what command and which devices is currently in active mode. This will help to ease the user to monitor and a better controlling on the system.

The choice of the GLCD used here is the 128 X 64 GLCD. Figure 3.8, show the GLCD used in the project. This GLCD is control by a series of 20 pin which include 8 of the pin serves as the data input and another 6 pin is used for controlling purposes. Besides that, 2 of the pin are used for the purpose of controlling the contrast of the display through a variable resistance. The connection is as show in the figure 3.9 below.



**Figure 3.8:** GLCD 128 X 64.

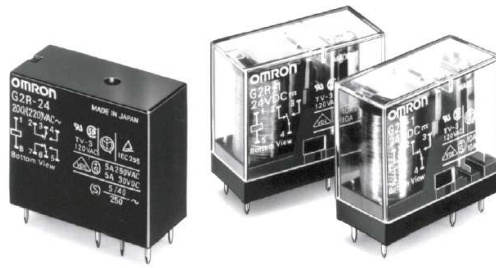


**Figure 3.9:** The connection of the GLCD.

### 3.2.6 Relay

In this project, the primary interface between the systems with the electrical appliance is the relay. The relay is actually a switch alike component just the different is the way of triggering is through the magnetic field that will change the contact and thus activating a switch.

The relay that used in this project is the OMRON G2R-1-E 5DC. This model of relay is selected for a few reasons. First of it is the required triggering voltage which is 5 volts and this power sources is easy to be acquire by using a simple 7805 regulator IC Chip. Second is the contacts voltage that permitted by this model which is 240volts, and it fit just nice to the system as this system serves as the switching system that will replace a switch which traditionally used to connect the 240 volts power supply from



**Figure 3.10:** The relay.

power supply.

### 3.2.7 Keypad

A standard keypad is used for the purpose of training the system with the correct configuration of the command with respect to the switch that will be control.



**Figure 3.11:** The keypad.

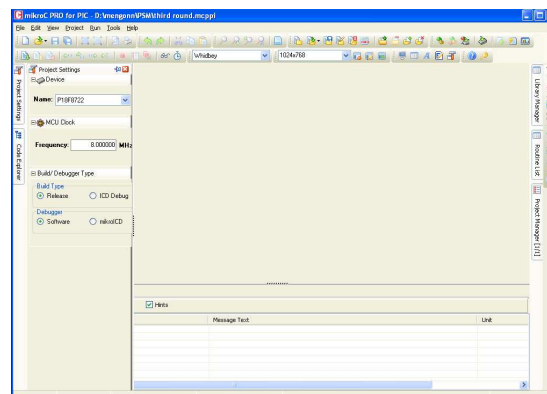
## 3.3 Software Implementation

In this project the software that will be used is the mikroElektronika which is software that used to program the microcontroller. By using this software, the programming processor the microcontroller will be much easier.

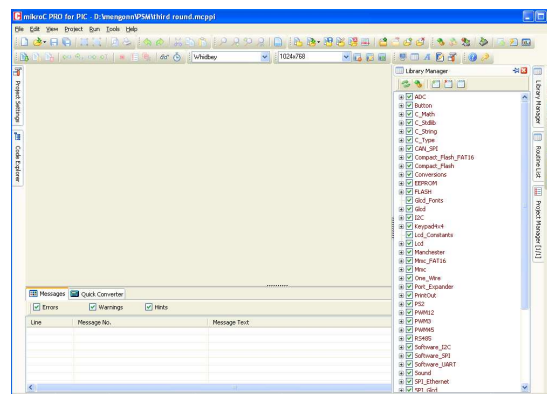
### 3.3.1 MicroC PRO

MicroC PRO is a product from the mikroelektronika that is famous in developing the program for the microcontroller. This product offers the user the usage of the C++ language for the program usage. This is indeed an ease to the user to do the program. Besides that this program also offers the conversion to the hex code that will be used in the programming. This mean that the user can have both output file that first the file that used the C++ program will ease the debugging process where it is involve a better and easier to understand language compare to the assembly language unless that user is a master or expert in using the assembly language. Second advantage is the hex file that will be produced at the same time when the program in C++ is compiled. Whereby, this hex file is the ones that will be used to program the microcontroller. [6, 7, 8]

The following figures are showing the interactive user interface that will ease and enhance the user programming ability.

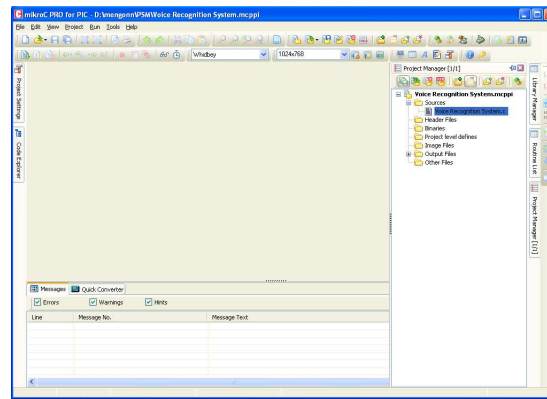


**Figure 3.12:** The project setting.



**Figure 3.13:** The library manager.





**Figure 3.14:** The Project Manager.

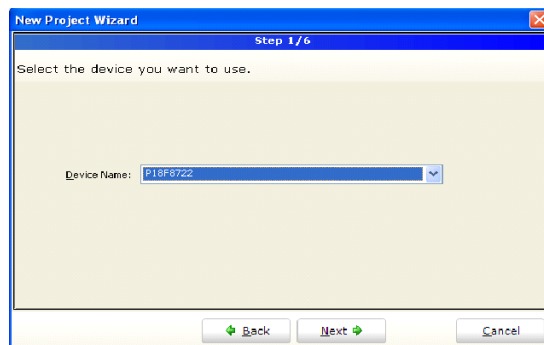
In Figure 3.12, this tab allows the user to change or modify the type of the microcontroller used or the one that the user wishes to program. Besides that this also allow user to change the frequency that will be used to implement this design. This is a very important parameter as it will determine the speed of the program running.

While in Figure 3.13 and Figure 3.14 show the library manager and the project manager. In this library manager it has a variation of the library that is predefined in this software. By having such library it enables the user to focus more on the programming part and reduce the workload of defining the entire necessary variable and most of the functions. While for the project manager, this tab is an extended version of managing the project especially on the adding file to a project and removing. This tab allow user to remove and add any file that the user wish to test build it compare to another method which is physically copy and paste the file in a related folder.

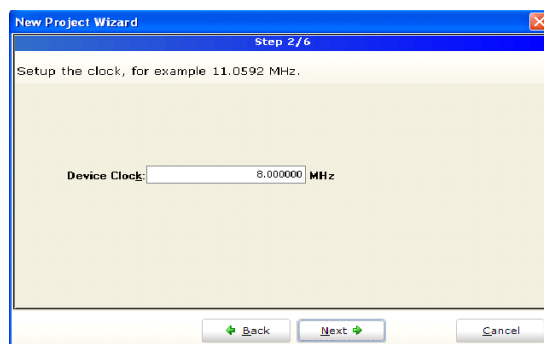
For all the above, another feature of this software is it enable the usage of wizard for setting up a project. Figures below show the new project wizard.



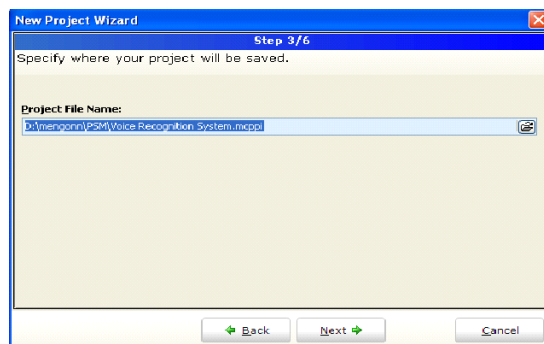
**Figure 3.15:** The starting page of the new project wizard.



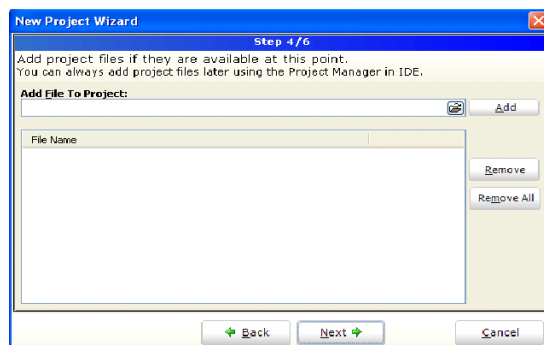
**Figure 3.16:** Selecting the microcontroller model.



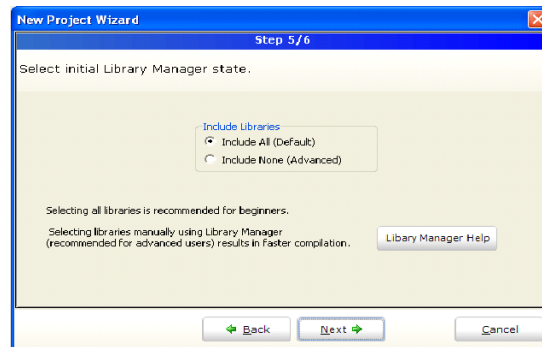
**Figure 3.17:** Setting the frequency of used in the program.



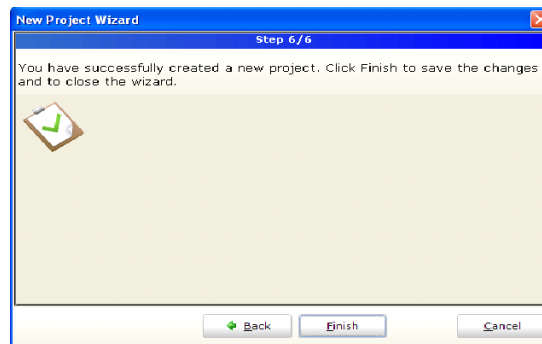
**Figure 3.18:** Opening the project location.



**Figure 3.19:** File adding option.



**Figure 3.20:** Library inclusive options.



**Figure 3.21:** Done creating a new project.

Through this wizard, user can precisely know which model of microcontroller that he or she wanted to use, setting the frequency of the system, determine the location of the file that will be save, adding initial file to the project and lastly is the setting of the library that will be available in the project.

### 3.3.2 C and C++ Programming language

The programming language used in this project is the C and C++ programming language. This language is easy to be used and it is compatible with the MicroC PRO which is a compiler.

The advantages of using C and C++ programming languages are:

- It is general purpose programming languages that provide code effectively, elements of structured programming and have a vast set of operators.

- It is very convenient and effective programming solution for a wide variety of software task
- More easy to write a program using this language compare to assembly language which result the reduction of time and cost.

## **CHAPTER 4**

### **RESULT AND DISCUSSION**

#### **4.1 Introduction**

This chapter will discuss on the results and findings of this project. Besides that, in this chapter the insight of the system is discussed thoroughly especially on the way to use the system.

#### **4.2 Insight of the system**

##### **4.2.1 Overview of the system**

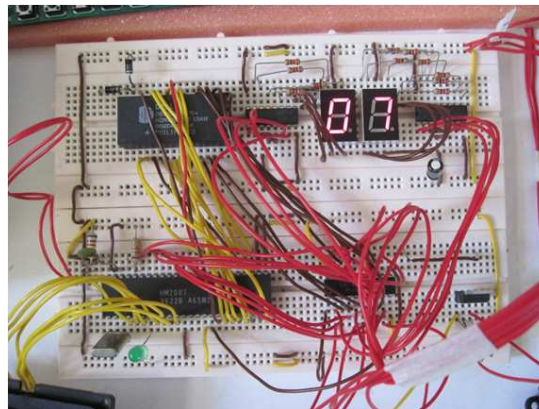


**Figure 4.1:** Voice Recognition Systems.

Figure 4.1 show the whole of the system that been compacted into a container for the ease of installation and storage purposed. it is consisted of a voice recognition board, microcontroller board, and relay with switching system.

From the system develop, it manage to function as desire and it comply to the objective of this project which is to develop a system that enable the user to use speech to control the electrical devices that the used wanted. In a more precise word, this system enables the user to control the switching on and off of the power supply where the electrical devices connected to the adapter provided.

#### 4.2.2 The Voice Recognition system



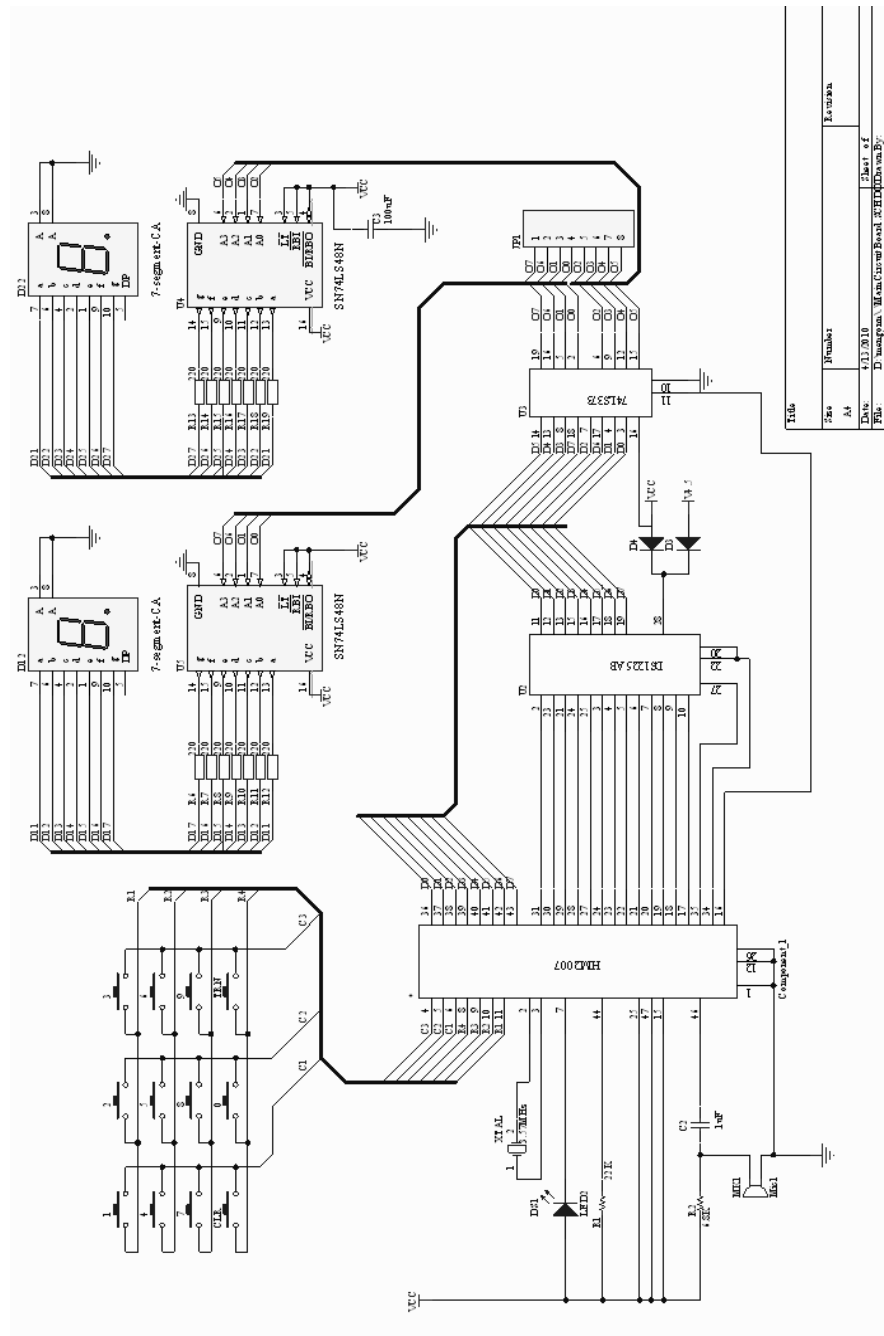
**Figure 4.2:** The voice recognition circuit.

Figure 4.2 above showed, the primary circuit for the project, in this circuit it consist the voice recognition chip HM2007, a 8kX8 SRAM memory, 7 segment display, and other supportive component such as tri-state latch SN74LS373 and BCD to seven-segment decoder 7448.

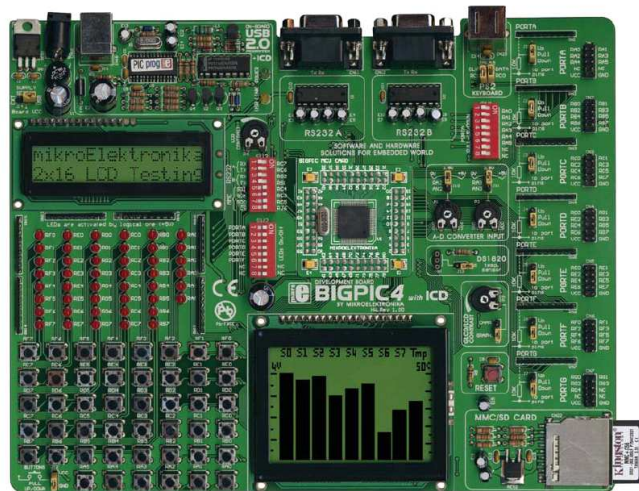
Figure 4.3 showed the circuit of the voice recognition board. This circuit functions as in the order show in below:

1. First voice or speech is received through the microphone.
2. The voice or speech will be converter in to digital signal which will be passed to the memory data bus.
3. Follow by a comparison process which will counter check with the word stored before.
4. If the word is matched then HM2007 will send out the latches enable signal along with the correct output that been trained earlier.

5. After that the 7-segment will display the number same as the word that have been trained for the particular words



**Figure 4.3:** The connection the HM2007 Voice recognition board .



**Figure 4.4:** The BIGPIC4 Development Board.

### 4.2.3 The Microcontroller

This project used a development board BIGPIC4 by mikroElektronika. This board is chosen because of the various of supportive element is available in it such as the GLCD, LCD and multiple port that is ready to be connected for the testing purposes. Besides that, this development board comes with 46 LED that each of it corresponded to an input or output pin. This will enable the double confirming of the input signal that sends by the voice recognition board.

The GLCD is used to display the introduction notes, also the current status of all switch and update the changes of the status from time to time. In addition, this development have an on board programmer that can be used directly to program the microcontroller through the use of the USB-blastor cable. This will ensure that the microcontroller to be programmed properly.

### 4.2.4 How to use this system

The usage of this system is separate into two major parts. First of all the training process:

1. A training process has to take place by keying the desired number from 01 to 20 follow by the # button. This action will cause the LED to light up.



2. Once the LED is lit up, users are required to speak the word that they want to train to the microphone attached.
3. The LED will blink indicating the training process is done. Repeat step 1 to 3 for other switch.
4. Just in case once wish to change to another word for a number that already trained, the user will need to perform step 1 to 3 again with the new word that wish to be used as the command.

The system is ready to be use once the training process is completed. All the user has to do is to be at a place where the distance sensor can detect and give the command. Then the rest of the work will be done by the microcontroller system.

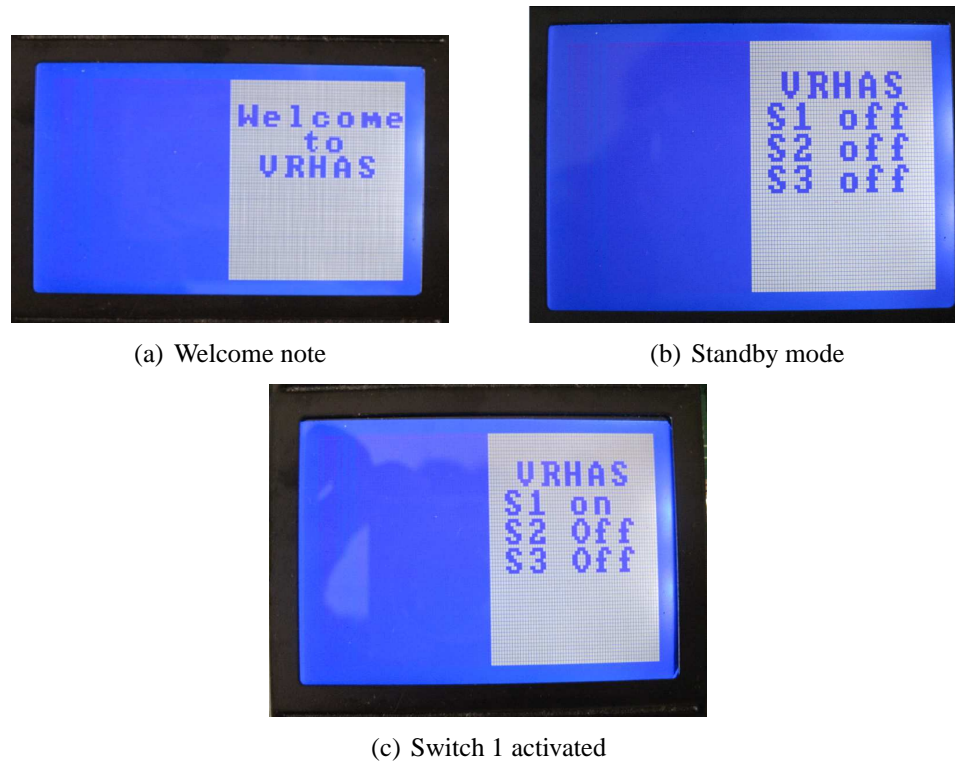
The system is set or program to be able to execute the following command as in the table 4.1.

**Table 4.1:** The configuration of the command

Number used to store	Command Execution
01	Switch on S1
02	Switch off S1
03	Switch on S2
04	Switch off S2
05	Switch on S3
06	Switch off S3
07	Switch off all
08	Switch on all

#### 4.2.5 Result

Figure 4.5(a) show the initial display of the GLCD which is interpreted as introduction note. Follow by the Figure 4.5(b) showing the initial status of each switch. Next Figure 4.5(c) shows that one of the switches is switched on when the command of the 01 is given out. By examine the figure 4.5(b) and 4.5(c), it shows that the voice recognition system has produced the desired output.



**Figure 4.5:** The Display of the GLCD.

#### 4.2.6 Discussion

Since this system is related to the voice or the speech by the user that will use to control this system, thus there is some issue that arises when using this system. The problems are the pronunciation of the user when doing the training process, pronunciation when using the system, the repetition of the same word used to train the system with different number and lastly the length of the word used.

For the pronunciation matter, the system takes it at a quite high level of sensitivity. The main reason is when a word is trained into the system, the HM2007 IC chip will perform ADC. Which later convert the word into a series of data with correspondent to the time. So when the user wishes to use the system, thus he or she must produce the word with the correct pronunciation as in the training process.

While for the problem of the repetition of word used to train 2 different numbers, it will create an issue of common output value for both of the number trained. This issue will cause the system to enable to perform it duties perfectly as when the user use the word that trained it will either display one of the number which mean there is a probability of executing wrong command.

Lastly the problem on the length of the word trained. This system has 2 different modes that can be choose of for the length of the word which is 0.92 seconds and 1.92 seconds. Thus, if user used word that too long then the system will face some issue in converting the word to digital signal. Therefore the usage of the word, do need to be consider before do the training.

## **CHAPTER 5**

### **CONCLUSION AND RECOMMENDATION**

#### **5.1 Conclusion**

This project discussed the development of the voice recognition home automation system which can be used to replace the old and conventional way to switch on the power of an electrical device. This system consists of a voice recognition circuit that builds up using the HM2007, a microcontroller circuit that used PIC18F8722 and a set of relay.

The voice recognition home automation system has been successfully developed and through this project I have gained much experience especially in the field of applying the technique of troubleshooting an electrical circuit and also in programming the microcontroller. This project is a very simple project compare to any of those who are already in the industry and commercialized but yet I hope that this project can be research on further to create a better design that can be applied to a larger scale of controlling. Besides that, I also hope that this project can be jumping stone for the application as one of the smart home necessity.

Besides the achieving of the main objective, by using this system, it can help reduce any occurrence of getting shock due to the failure of the switch and it offer a more safety way to turn on the switch. Moreover if this system is fully equipped in a house it can reduce the addition of the wall switch and what left is only the plug point for user to plug in their devices only.

## **5.2 Future Work**

There are a few recommendations for further on this project:

1. A designing of a complete PCB will be able to put the whole system on to one single board to save the space.
2. A better and deeper research on type of distance sensor and detection system so that each of the command given is carried out properly
3. Research on the way to collecting the command such as using an additional system that can capture the voice command clearly to create a more stable controlling system.
4. Design and planning on location where this system should be placed in a house.

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## **APPENDIX A**

### **PROGRAM IN MICROCONTROLLER PIC18F8722 FOR THE VOICE RECOGNITION HOME AUTOMATION SYSTEM**

```
=====
; File name : Voice Recognition System.c
; Project : Voice Recognition Home Automation System
; Programmer : CHOY MENG ONN
; Date : 31/3/2010
; Supervisor : Dr Fauzan Khairi Bin Che Harun
=====
```

```
// This is declaration of variable used
char *someText1;
char *someText2;
char *someText3;
int state;
int plug1;
int plug2;
int plug3;
// Glcd module connections
char GLCD_DataPort at PORTH;
sbit GLCD_CS1 at LATJ0_bit;
sbit GLCD_CS2 at LATJ1_bit;
sbit GLCD_RS at LATJ2_bit;
sbit GLCD_RW at LATJ3_bit;
sbit GLCD_EN at LATJ4_bit;
sbit GLCD_RST at LATJ5_bit;
```

```

sbit GLCD_CS1_Direction at TRISJ0_bit;
sbit GLCD_CS2_Direction at TRISJ1_bit;
sbit GLCD_RS_Direction at TRISJ2_bit;
sbit GLCD_RW_Direction at TRISJ3_bit;
sbit GLCD_EN_Direction at TRISJ4_bit;
sbit GLCD_RST_Direction at TRISJ5_bit;
// End Glcd module connections
void delay1S(){
// 0.5 seconds delay function
    Delay_ms(500);
}
void delay2S(){
// 2.0 seconds delay function
    Delay_ms(2000);
}

void main() {
ADCON1|=0x0F;
CMCON  |= 7;
TRISD = 0xff;           // port D as input
TRISA = 0x1f;           // port A as analog input
TRISE = 0x00;           // port E as output
PORTE =0;

    Glcd_Init();           // Initialize GLCD
    Glcd_Fill(0xFF);       // Clear GLCD
    // Setting the Font
    Glcd_Set_Font(Character8x7, 8, 7, 32);

    Glcd_Write_Text("Welcome ", 67, 1, 2);
    Glcd_Write_Text("to", 90, 2, 2);
    Glcd_Write_Text("VRHAS", 75, 3, 2);
    delay2S();
    Glcd_Fill(0xFF);       // Clear GLCD
    someText1="off";       // Initialize the display
    someText2="off";       // Initialize the display
    someText3="off";       // Initialize the display
while(1){

```



```

Glcd_Write_Text("VRHAS", 75, 1, 2);
delay1S();
Glcd_Write_Text("S1", 70, 2, 2);
Glcd_Write_Text(someText1, 95, 2, 2);
Glcd_Write_Text("S2", 70, 3, 2);
Glcd_Write_Text(someText2, 95, 3, 2);
Glcd_Write_Text("S3", 70, 4, 2);
Glcd_Write_Text(someText3, 95, 4, 2);
delay1S();
// Distance sensor input
while (PORTA.F1==0) {}
// user input command
if (PORTD==0X01)      state=1;
else if (PORTD==0X02) state=2;
else if (PORTD==0X03) state=3;
else if (PORTD==0x04) state=4;
else if (PORTD==0x05) state=5;
else if (PORTD==0x06) state=6;
else if (PORTD==0x07) state=7;
else if (PORTD==0x08) state=8;

Glcd_Fill(0xFF); // Fill GLCD
Glcd_Set_Font(Character8x7, 8, 7, 32); // Change font

switch (state) {
case 0:
    break;
case 1:plug1= 1; // setting output
    someText1= "on"; //update display
    break;
case 2:plug1= 0; // setting output
    someText1= "Off"; //update display
    break;
case 3:plug2=1; // setting output
    someText2= "On"; //update display
    break;
case 4:plug2=0; // setting output
    someText2= "Off"; //update display

```

