# SPEECH RECOGNITION BASED CONTROL AND SMS SYSTEM

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Saya **SITI FARAH BINTI HUSSIN**

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Date : ……

Dedicated to my beloved family and friends

And to my PSM lecturer

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## ABSTRACT

This project can be used to run electrical appliances through voice commands. Three major parts in this project are microphone-pc connection, software interface and hardware design. Matlab was used for the software design. For the hardware design, parallel port was used as the interface between computer and hardware. For this project, user needs to set which output are desired to be 'ON'/'OFF' by using speech. When the program has been executed, the computer will analyze data that have been fixed in the program. The output from parallel port will go through resistor, transistor and diode before activating the relay via ribbon cable. Then, the e-mail notification was send to the handphone via SMS as an alert if the robberies enter house when owner are not at home.

# ABSTRAK

Projek ini mengawal sesuatu aplikasi dengan hanya menggunakan arahan suara. Terdapat tiga bahagian penting dalam projek ini iaitu sambungan antara mikrofon-komputer, pengantaramukaan perisian dan rekabentuk litar. Perisian Matlab digunakan dalam merekabentuk pengantaramukaan perisian. Untuk rekabentuk litar, *parallel port* digunakan sebagai antaramuka di antara komputer dan litar. Pengguna boleh menentukan output untuk ON/OFF. Semasa program ini beroperasi, komputer akan menganalisis data yang telah disetkan pada program tersebut. Keluaran daripada *parallel port* akan melalui perintang, transistor dan diod sebelum mengaktifkan relay melalui kabel ribbon. Akhir sekali, e-mail notification akan dihantar dalam bentuk SMS ke telefon bimbit jika pencuri memasuki rumah sewaktu tuan rumah tiada di rumah.

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# CHAPTER I

# PROJECT OVERVIEW

Although, the automatic controller is widely used in traffic controlling, industries and car handling, rarely hear that electrical appliances in the house can be controlled by using voice. Normally, all electrical appliances in a house operate via manual methods by switching on the electrical power supply sockets.

## 1.1 Introduction

This project aims at controlling electrical devices using voice and sending e-mail notification via SMS (Short Messaging Services) if the robberies happen. Although this voice control has limited range, it provides greater flexibility to user. The microphone is attached to the system as the input of the voice command. The controlled devices are connected to the computer using parallel port of computer. The software will decode the command and change the status of the parallel port. Microsoft Speech Engine 5.1 using Speech Application Program Interface (SAPI) was used to control automatically voice enables. This speech software will work in Matlab environment for controlling electrical devices.

## 1.2 Project Objective

In order for the project to success and to be implemented, the following objectives have to be achieved:

- To control the home appliances operations by using a voice command.
- To monitor whether the electrical appliances ON or OFF by using SMS (E-mail notification).
- To develop an easier appliance operation system for handicapped user.

## 1.3 Problem Statement

Nowadays, most of electrical appliances operate via manual methods by switching on the electrical power supply sockets. This technology is not practical for handicapped user. Using this simple speech command, the handicapped can control the electrical appliances easily. Besides, it also can be used as the security system if the robberies happen when the owner leaves the house.

## 1.4 Scope Of Work

To achieve the project objectives there are certain scope that must been done. The scope can be divided into several parts. The scopes are:

1) This project includes the study of reliability of the software system, which is going to be used to control voice command.

2) To make this project successful the interfacing between software and hardware need to be studied. For the hardware system, the simulation process need to be done to predetermined the result of this project.

3) After the simulation is done this project will continue with development of the hardware which process need to be plan and the component characteristic need also to be study, such as relay connection and connection between computer and hardware.

4) The way for transmitted and received the SMS need to be studied.

5) The interconnection between hardware system and software system is done based on the function.

## 1.5 Methodology

This project has been start with research of controlled the electrical devices by using voice. After that continue with developed the GUI for the software system. Then testing the SAPI and Matlab interface with microphone. Design and fabric the PCB layout hardware circuit and etching's the PCB. Attached components on PCB & complete the circuit. Finally, combined hardware and software and testing the circuit. Check and troubleshoot the circuit if the problem occurred.

## 1.6 Thesis Outline

This thesis will be divided into 5 chapters to provide the understanding of the whole project.

**Chapter 1** is introduction to the overview of this project and its objectives. It also explains the scopes of the project.

**Chapter 2** describe about the literature review that has been studied to get information to complete the project. This study is focused especially on controlled the electrical devices by using voice and the way for sending SMS.

**Chapter 3** it will cover up all the project methodology and a process of this project implementation to achieve goal. Also hardware and software technical details are explained in this part.

**Chapter 4** explains the result of this project and the operation of the circuit. In this chapter the analysis of the project also has been discussed.

**Chapter 5** explains on the future recommendation of the project for improvement matters.

# CHAPTER II

# LITERATURE REVIEW

Conducting literature review prior to undertaking research projects was critical as this will provide much needed information on the technology available and methodologies used by other research counterparts around the world on the topic. This chapter provides the summary of literature reviews on key topics related to Speech Recognition Based Control and SMS System.

## 3.1 Speech Recognition Jukebox

Speech Recognition Jukebox was used to activated a simple music player. The speech recognition system was capable of recognizing four commands and could cycle through a simple play list of three songs. The jukebox could turn itself on, begin play, move between tracks, and stop play all through user voice commands. In order to implement this design, must combine several different hardware and software elements. A small microphone was purchased and used to convert the human voice signal into a voltage signal. This alternating voltage signal was amplified by 1,000 times using three LM358 operational amplifiers. Hardware frequency filters were used to limit the frequency input and software frequency filters were used to parse the signal into different frequency regions.

The values of the signal in these different frequency regions helped to determine each individual word's unique digital 'fingerprint'. The fingerprints of important words, such as commands for the music-playing element of the design, were stored into the program. Each time a word was spoken, the fingerprint of this sample word was compared to the stored fingerprints to determine which command, if any, was spoken. Recognized commands for the system are:

| | |
|---|---|
| "ON" | Turn the music player on, play current song |
| "END" | Pause the music player |
| "SOON" | Play the next song |
| "PREV" | Play the previous song |

Table 2.1: Voice Commands Recognized by the System

### 2.1.1 Control Section

The output of the digital filters would help to formulate a digital 'fingerprint' that was unique for each word. Five samples were taken from each digital filter, thus yielding 35 total samples that would comprise the digital fingerprint of each word. The fingerprints of the dictionary words, "ON", "END", "PREV", "SOON", were stored in the software program. Whenever the user input a command to the system, this sample's digital fingerprint would be calculated and then compared to each of the dictionary words.

To compare the dictionary words with the sample, the program calculated the correlation of the two vectors. The pair with the highest absolute value correlation was chosen as a match. When an input command word was recognized as a dictionary word, the control section would set a series of flags that would update the

state machine. This state machine would change state on these flags being set and each state corresponded to a separate song being played.

### 2.1.5 Logical Structure

The logical structure of the program is quite simple. The user will speak the desired command into the microphone. The microphone will convert this audio signal into an electrical signal, which will then be filtered and amplified before being sent to the A to D converter. The program A to D samples the input, and the output of the A to D converter is run through seven digital filters. The control section uses the outputs of the seven digital filters to obtain a working fingerprint of the spoken command and compares this fingerprint with those stored fingerprints to decipher which command, if any, has been spoken. Upon recognizing a user command, a state machine within the control section will change state. Each state of this state machine corresponds to a separate song being activated. Thus, upon changing state, a different song signal will be sent to the television audio connection, enable music playback. A simple schematic of the logical structure can be found below in Figure 2.1.

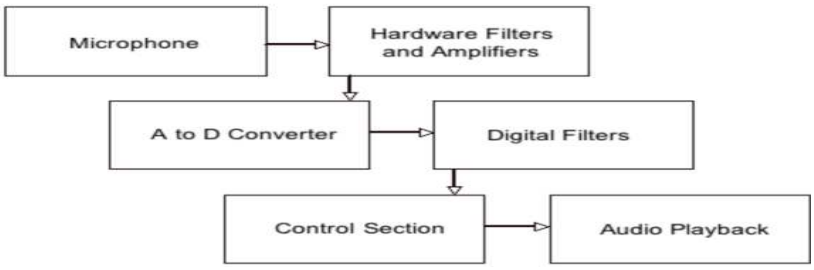


Figure 2.1: Logical Structure of Speech Recognition Jukebox

### 2.1.3 Program Design

The dataflow of the program begins with the output of the A/D converter. This value was stored in the variable *Atemp*. *Atemp* was set in the Timer/Counter 1

interrupt, which runs every 250 μs (4,000 times per second). *Atemp* was then passed to the seven digital Butterworth filters using a function called *setfilters()*, which also run in the interrupt. After the filters have been set, the program enters the *player()* function, which contains the state machine that runs the voice recognition section of the program.

The *player()* function was broken up into six states: TAKE, WAIT1, ON, END, AFTER, LAST. The TAKE state was considered to be the off state of the jukebox. When button 7 is pressed on the STK500 board, the player turns on. The user will have to press button 6 to use the voice recognition portion of the state machine. Upon this button being pressed, the state machine was in the WAIT1 state. In this state, the state machine was waiting for the user to say the word "ON." This signals was send to the state machine that the user wishes to start the player. After the user says "ON," the state machine enters the ON state and begins playing song 1.

Once in the ON state, the voice recognition state machine has four possible routes. If the user says "SOON," the state machine assumes the user wants to play the next song (song 2). If the user says "PREV," the state machine assumes the user wants to play the previous song (song 3). The user can also say "END," indicating the user wants to pause the playback of the song. Based on whether the user says "SOON", "PREV", or "END", the player state machine enters the AFTER, LAST, or END states, respectively.

In the AFTER state, the state machine plays song 2. If the user says "SOON", the state machine enters the LAST state and plays song 3. If the user says "PREV", the state machine enters the ON state and plays song 1. In the LAST state, the state machine plays song 3. If the user says "SOON", the state machine plays enters the ON state and plays song 1. If the user says "PREV", the state machine enters the AFTER state and plays song 2. If at any time button 7 is pressed, the state machine goes back to the TAKE state and the player has been turned off. A diagram of this state machine was found below (Figure 2.2).

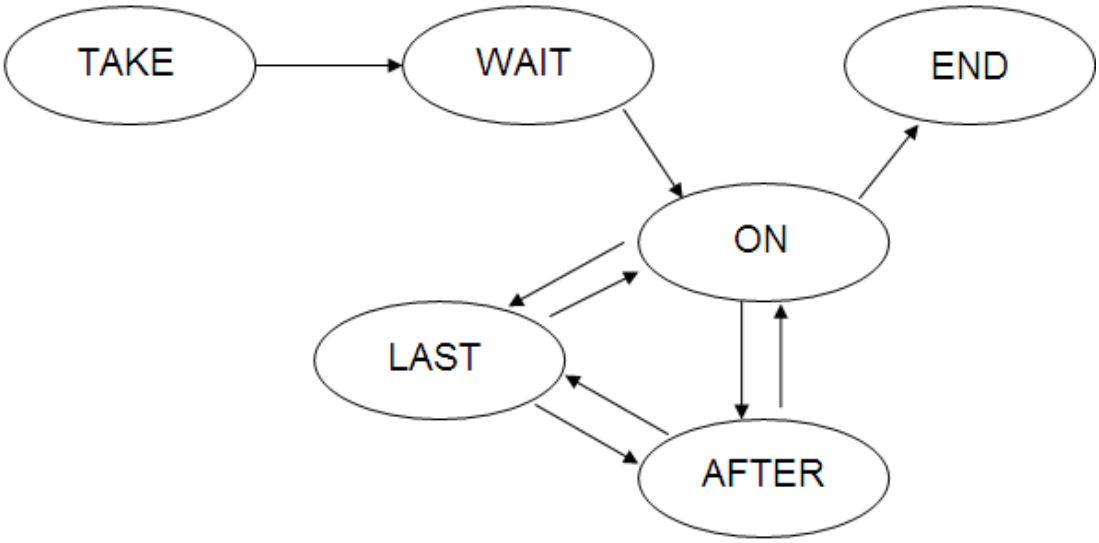


Figure 2.2: Diagram of Player State Machine

### 2.1.4 Hardware design

The human voice is comprised of numerous different frequencies emitted as a compression wave through the air. In order to perform analysis on a vocal sample, this compression wave would need to be transformed into an electrical signal using a microphone. The electrical output of the microphone was filtered and amplified several times in order to produce a clean and responsive voltage signal.

#### 2.1.4.1 Integration of Hardware Components

In order to operate properly, the ground and output connections on the microphone needed to be soldered to two pieces of wire and then connected to the white board. This output connection was connected to a high-pass filter with a 1 kΩ resistor and 1 μF capacitor, giving this filter a cutoff frequency 159 Hz. This cutoff frequency is low enough that almost all frequencies of human speech were able to pass through to the rest of the circuit. The value of this cutoff frequency was