INTERACTIVE ROBOT USING SPEECH RECOGNITION SYSTEM

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FYP 2
FINAL REPORT

INTERACTIVE ROBOT USING SPEECH RECOGNITION SYSTEM

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INTERACTIVE ROBOT USING SPEECH RECOGNITION SYSTEM

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A report submitted submitted in partial fulfillment of requirements for the degree of Bachelor in Electrical Engineering (Mechatronics)

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA (UTeM)

2009

I declare that this report entitle Interactive Robot using speech recognition system is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature 

Name : Radin Md Firdaus bin Radin Mohd Ali

Date

Dedicated to my beloved parents,
Radin Mohd Ali bin Radin Sumadi & Rohani binti Abdul Wahid,
my siblings and friends
for their support and love.

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Alhamdulillah, praise be to Allah, the Cherisher and Sustainer of world, most Gracious, most Merciful Lord.

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ABSTRACT

With the development in engineering and technology field, voice or speech recognition has been invented and applied in this modern world such as automatic telephone operation and digit voice controlled. Currently, this latest technology has been applied in the embedded system in such ways to make the possibility of human robot interaction (HRI). The most common and old style in robot or machine operation is by using buttons which this method is called as voice user interface (VUI). This is because all command is made by pressing keys/buttons or by responding verbally to the interface. Somehow, most of the available robots or machines in the market only using buttons as their main interface rather than using voice or speech recognition interface. Thus, the big potential of speech recognition interface is seen powerful in transferring the amount of information and of its natural way in communication between humans. There is high probability in future; an interactive robot can be a teacher for toddlers in early stage of learning and also as a therapy for autism in this world. Basically, this "Interactive Robot" project which using the speech recognition system consists of two parts, hardware development and software development. Implementation and works of this project are summarized into a flow chart to see the overall progression of the project. This Interactive Mobile Robot is not only reply back what is being asked, but it also can do some simple mechanism such as moving forward, moving backward, turning left, and turning right. Thus this Interactive Mobile Robot is developed using the speech database which being stored in the random access memory (RAM) inside the integrated voice chip microprocessor. The success of speech recognition is when the recorded databases are matching between the spoken speech and the bookmark databases recorded in the voice chip microprocessor. Therefore the hardware component is developed by using voice chip microprocessor, PIC 16F877A microcontroller, and a hardware model robot. Then the actions or output at the Mobile Robot is determined by the software develop in the PIC 16F877A and also in the voice chip microprocessor. Last but not least this Interactive Mobile Robot is able to communicate interactively with the user and do action as been command.

ABSTRAK

Dengan perkembangan dalam bidang kejuruteraan dan teknologi, pengecaman suara dan percakapan telah dicipta dan diaplikasikan di dalam dunia moden kini seperti operasi telefon dan juga kawalan digit menggunakan suara. Dewasa ini, teknologi terkini ini telah diaplikasikan di dalam sistem yang kecil dalam pelagai cara untuk membolehkan interaksi antara manusia dan robot. Cara paling biasa yang digunakan pada robot dan operasi mesin adalh dengan menggunakan hubungan capaian suara (VUI). Ini adalah kerana semua arahan dibuat denagn menggunakan butang atau secara lisan. Akan tetapi, kebanyakan produk yang terdapat di pasaran adalah menggunakan butang semata-mata daripada kaedah lisa. Justeru potensi yang besar dilihat pada kaedah capaian suara kerana kuasanya dalam memindahkan jumlah data yang banyak dan ia adalah kaedah yang semulajadi untuk berkomunikasi. Jadi ia berpotensi besar di masa akan datang, robot interaktif boleh menjadi guru kepada kanak-kanak sebagai pelajaran awal dan juga terapi kepada golongan autism. Secara asasnya, projek ini terbahagi kepada dua bahagian iaitu "hardware" dan juga "software". Pembahagian kerja dalam projek in telah dirumuskan di dalam carta alir untuk mengetahui perkembangan projek. Robot Interaktif ini bukan sahaja boleh membalas semula soalan yang diajukan tetapi juga boleh bergerak ke hadapn, belakang, kiri, dan kanan seperti yang diarahkan. Justeru robot ini dibangunkan dengan menggunakan "RAM" di dalam mikropemproses. Kejayaan projek ini adalah apabila percakapan seseorang adalah sama dengan rangakaidan data di dalam mikropemproses. Output atau keluaran ia adalah menggunakan software yang diprogramkan di menggunakan PIC 16F877A dan mikropemproses chip. Akhir sekali, Robot Interaktif ini bukan sahaja boleh berinteraksi secara interaktif tetapi juga boleh membuat mekanisme seperti yang diarahkan.

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CHAPTER 1

INTRODUCTION

1.1 Background

Speech recognition system has become popular when the idea of developing the human and robot interaction (HRI) as a reality these days. The success of other user interfaces such as graphical user interface (GUI), web user interface (WUI), and many more has invented the idea to develop the speech based interface which being called speech user interface (SUI). Thus in this project, the Interactive Mobile Robot will be developed to communicate interactively with the user and the user are freely to command the robot to do movement as being programmed in the software.

The increasing of mobile robot product either for simple task function or more complicated task has become new phenomena in the humanoid robot. Somehow, most of this mobile robots application is using the manual and old style via the button or switch to be operated. Thus, the button interface is still need us to operate them just like a machine instead of speaks naturally as a human or in human interaction. Scientists and engineers have seen this technology as a big potential to be implemented into machines for disabilities people ease in doing work. Furthermore, this method is more users friendly because it only needs speech command in order to give instructions to the machines or robot.

Finally, this project is developed as an effort to make the communication between human and robot become possible. In addition, it will become more interactive and interesting because a robot can communicate and understands what is being spoken to them. Therefore, people will slowly accept this human and robot interaction (HRI) which can create a normal view in human life [9].

1.2 Problems Statement

There are three problems statement being carried out in this project:

1. Most of the machines and humanoid or intelligent robots available in the market need us to operate manually by pressing button or keypad and therefore there is the need of using speech recognition. Thus this old style method might be burden dyslexic and disabilities people to make data entry instead of speech recognition which can recheck the data being entered or using fully verbal command.
2. The available robots in the market specifically programmed doing a single task without giving feed back (using speech interaction). In this way, the completeness or perfection of the work done by the machine robot is not known as there are no verifications from the robots itself.
3. Some parents are busy with their work until there are no time allocations to educate their toddlers, thus this interactive robot can teach simple words and would help the toddlers to speak earlier than the other toddlers.

1.3 Objectives of project

There are three objectives that hoped be achieved in this project:

1. To develop an interactive robot which is able to interact in 2 way communication (accept orders & do actions or reply back using speech). This is due to speech recognition system concept by processing the input signal and outputting by doing actions or speech words sound.
2. To build up a natural behavior network system in order robots are capable to verify the completeness of the task using speech. Verifications from the machine robot are important as if there are failures or problems while doing the task and thus human will be alerted on this problem.
3. To invent a robot that can communicate intelligently for teaching purpose in future such as toddlers and autism or special disabilities people. Some of parents are busy with their load of works until there are no time allocations to educate their toddlers or children, thus this interactive or talking robot might help educate by playing with them. It is also seen can be a therapy for autism as the robot will excite their thinking by talking to them.

1.4 Scope of Project

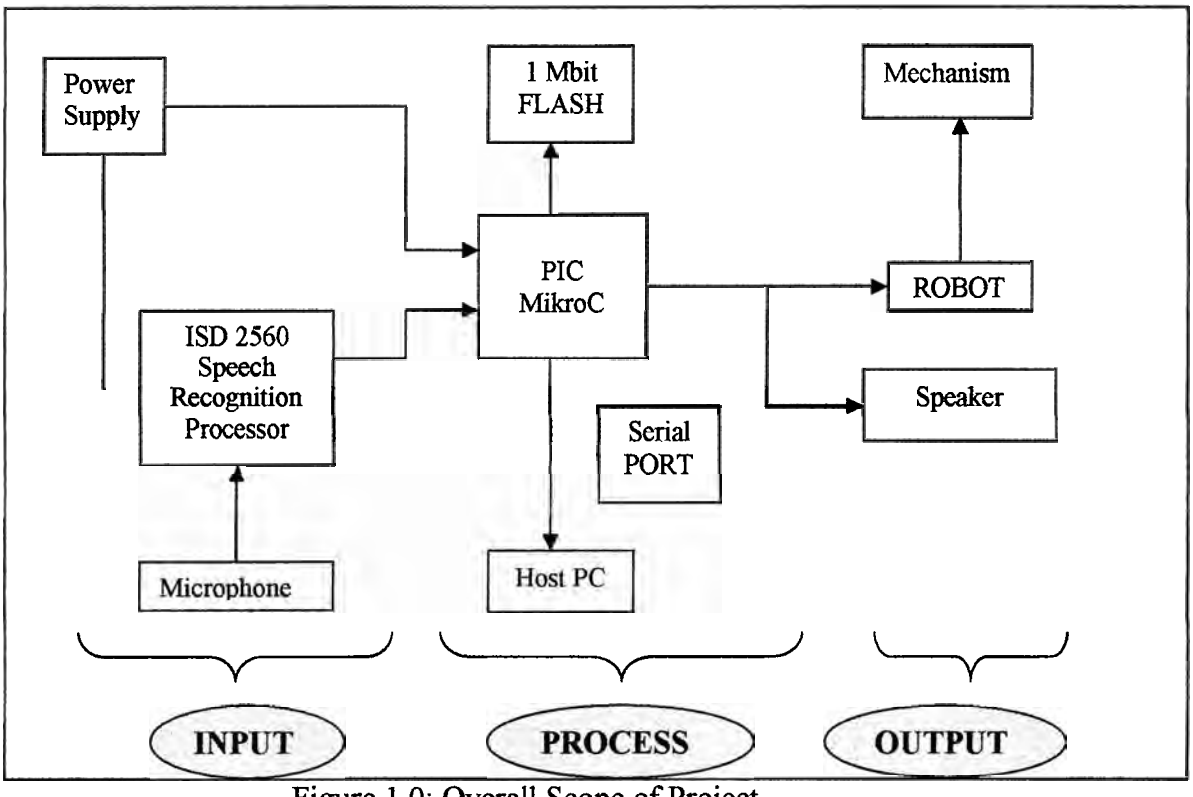

Figure 1.0: Overall Scope of Project

The Figure 1.0 above shows the Overall Scope of Project which being covered in this Interactive Mobile Robot project using the speech recognition system. The input part consists of power supply, microphone as a main input signal, and also the storage voice data in the ISD 2590 (speech recognition processor). First of all, voices data are recorded in the speech recognition processor, ISD 2590 as command inputs to the system. Then, the input signal from the ISD 2590 is then being interfaced with the PIC 16F877A Microcontroller to process the input signal data via the serial port host PC by synchronizing the signal wave voice. Thus the output data will be transformed in term of voices and gestures which has been programmed in the PIC 16F877A when there are any voices command input. In addition, the serial port host PC can show the input voice signal in words via the HyperTerminal once an input voice is given before it is processed to give outputs.

1.5 Outline of Progress Report

This progress report consists of five chapters. The first chapter of this progress is discussing the basic thing of this project like background, problems statement, objectives, and also the scope. This chapter will review on the objectives that is hoped can be achieved from the statement of the problems. Then the second chapter will be starting with the theory and literature review that has been research and studied that has been done so far. In this chapter also, it discusses the use and the theory of hardware and software components. The theory is more on the comparison of the available hardware components available in the market and which of them the best to be used. Next in Chapter 3, the methodology of this project will be discussed and explained which consists of two major part; software development and software development. In Chapter 4, the current or preliminary result is being discussed and explained as well as the expected result which the result being expected at the end of this project. Finally in Chapter 5, discussion, suggestion, and conclusion is being reviewed in this chapter. All problems occurred during the progression in completing the project is discussed in the discussion part. Then in suggestion and conclusion part, improvement for future project being suggested and the result of working on this project is concluded.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Generally, a literature review is a summary body of the beginning research which it is being aim to review the critical points of the whole body. It is done as to convey related knowledge and established ideas on a topic and also the strengths and weaknesses of the research project. In this project, literature review has been conducted in order to obtain the information on the current technology available and the methodology being used by other researchers on the same topic or field all around the world. Basically, this chapter provides the summary of literature reviews key points related to the speech recognition system.

2.2 Speech Recognition System

Recently, there are two main types application of speech recognition system available in the market which are PC Based System and Embedded System or being called "stand alone system" which not interfacing with the PC (personal computer). As this technology grows rapidly, there are several of products for the PC Based System and also the Embedded System which come out with various features and characters [7]. This part will discuss about history, methodology, available products exist in the market, specifications, and its functions for both systems but in this project, it will be focused more on the embedded system speech recognition.

2.2.1 History and Methodology of Speech Recognition System Technology

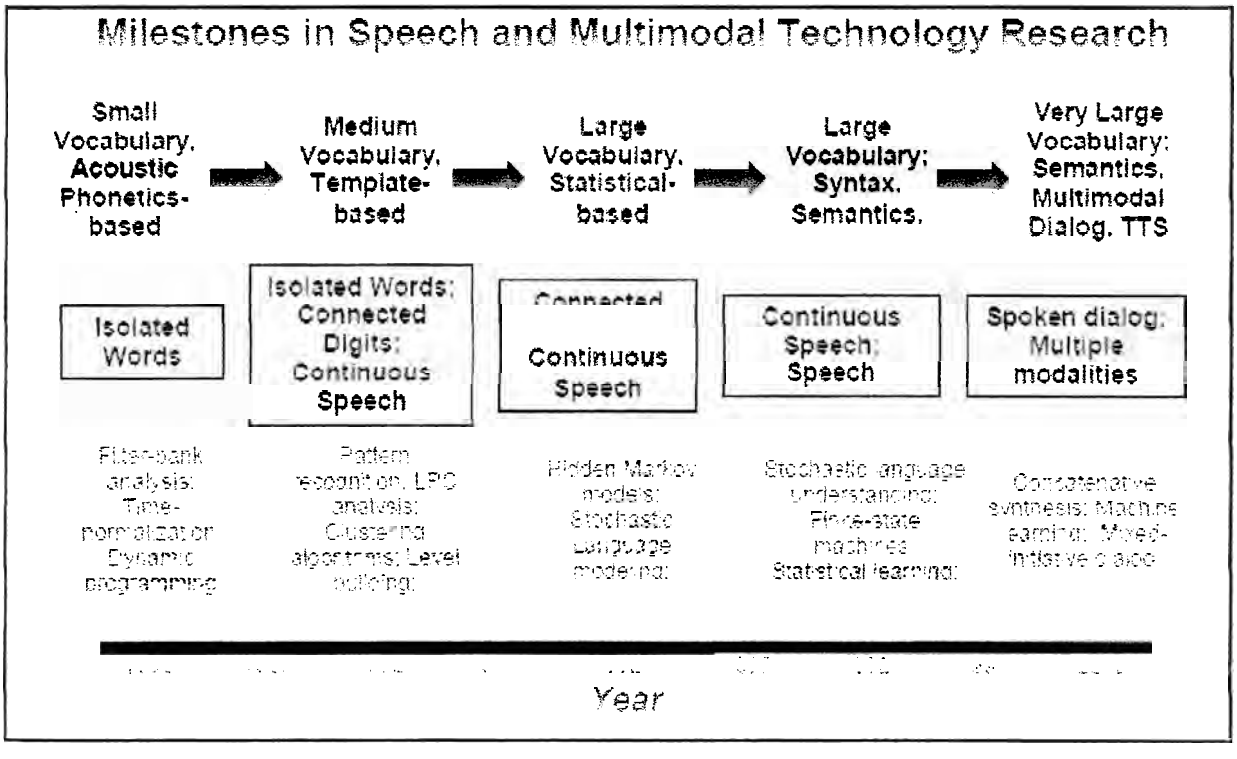

Figure 2.0: Speech Recognition Milestone