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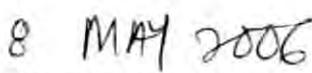

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Date   : 8 MAY 2006

SPEECH RECOGNITION MOTOR AND LIGHT DIMMER CONTROLLED

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MAY 2006

"I admitted that this is my own works except for sentences or phase that I have stated its sources".

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Without you all, I am nothing… Thank you all.

ABSTRACT

In the near future, speech recognition will become the method of choice for controlling appliances, toys, tools, computers and robotics electronics bases. There is a huge commercial market just waiting for this technology to mature. To control and command an appliance (computer, VCR, TV security system, etc.) by speaking to it, will make it easier to use, while increasing the efficiency and effectiveness of working with that device. Speech recognition motor and light dimmer controlled is a project where the user just needs to give the command by using the voice to control the dc motor and light dimmer. This project have two main parts, it is speech-recognition circuit with speech-recognition interface circuit, and the output circuit (dc motor and light dimmer circuit). This project can be applied to our life everyday. For example we can apply this project to control the fan and lamp in the house. So that we can switch ON and OFF the fan and lamp easily, no need to move to the switch to turn ON or turn OFF the fan and lamp.

ABSTRAK

Pada masa akan datang, sistem pengecaman arahan suara akan menjadi satu kaedah pilihan bagi mengawal peralatan, permainan, komputer dan robot yang berasaskan elektronik. Pasaran yang besar sedang menanti untuk perkembangan teknologi ini. Mengawal dan memberi arahan perlatan seperti komputer, televisyen, system keselamatan dan berbagai-bagai lagi peralatan elektronik dengan hanya bersuara akan menjadikannya lebih mudah untuk digunakan di samping meningkatkan kecekapan dan menjadikannya lebih efektif dengan menggunakan peralatan itu. Pengecaman suara terkawal motor dan kecerahan lampu adalah satu projek di mana pengguna hanya perlu memberi arahan suara untuk mengawal motor arus terus dan tahap kecerahan lampu. Projek ini terdiri daripada dua bahagian yang utama, iaitu litar pengecam suara dengan litar antaramukanya dan litar keluaranya iaitu litar motor arus terus dan litar pengawal kecerahan lampu. Projek ini boleh diaplikasikan dalam kehidupan kita seharian. Sebagai contoh, kita boleh mengaplikasikannya untuk mengawal kipas dan lampu di rumah. Dengan itu kita dapat hidup dan matikannya dengan mudah tanpa perlu bergerak untuk memetik suis untuk menghidupkan kipas dan lampu.

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LIST OF ABBREVATIONS

AC   Alternating Current

ASR   Automatic Speech Recognition

BCD   Binary Code Decimal

CMOS   Complementary Metal-Oxide Semiconductor

CPU   Central Processor Unit

DC   Direct Current

DSP   Digital Signal Processor

ECU   Environmental Control Unit

LED   Light Emitter Diode

LSI   Large Scale Integration

MOSFET   Metal-Oxide-Semiconductor Field-Effect Transistor

NSP   Native Signal Processing

PC   Personal Computer

PWM   Pulse Width Modulation

RAM   Random Access Memory

SR   Speech Recognition

SRAM   Static Random Access Memory

SRC   Speech Recognition System

PCB   Printed Circuit Board

VACS   Voice Activated Control System

VCR   Video Cassette Recorders

APPENDIX LIST

CHAPTER I

INTRODUCTION

Speech recognition system (SRC) or automatic speech recognition (ASR) is the process of converting an acoustic signal, captured by a microphone or a telephone, to a set of words. The recognized words can be the final results, as for applications such as commands & control, data entry, and document preparation. They can also serve as the input to further linguistic processing in order to achieve speech understanding.

1.1 Brief History of Speech Recognition System

Technology continually amazes society with the improvements and capabilities that computer systems exceed annually. When it seems the top of the line speech recognition (SR) program has been put on the market another company is in the process of developing a more sophisticated product. In fact, today, we can buy a computer with SR capabilities built into the hard drive. Don't be mistaken though, SR is not a new entity. It first evolved over 30 years ago. This continued growth in technology opened the doors to various applications of SR. Not only is SR a popular medium for use by professionals in the working world, it is also an exceptional tool for people with disabilities.

Four main areas of interest have received attention by professionals working with individuals with disabilities. The first area researched was use of SR systems by people having physical disabilities but no speech impairment. Investigation in a second area expanded to include use of SR by individuals with impaired speech. SR was viewed to have the potential to make hard to understand speech more easily recognizable. The third area explored was use of SR for drill practice. The last and most recent area studied by researchers is use of SR by students with learning disabilities as an aid to improve the effectiveness of written comprehension.

In 1972, dictation and word processing systems were combined to formulate the first SR system. Speech recognition systems were first used by severely disabled individuals with normal speech. The first voice activated wheelchair with an environmental control unit (ECU) was developed in the late 1970s at Rehabilitation Medicine in New York. In 1977, the Voice Activated Control System (VACS) was developed. The VACS is composed of a microphone, hardware preprocessor and feature extractor, minicomputer, electronic display, a Teletype and relay interface. Currently, most speech recognition systems available today are programs that use personal computers equipped with a sound card.

1.2 Three Major Markets for Speech Recognition

The different types of technologies used in speech recognition are aimed at three broad classes of applications. Each class has different price, performance, and feature sets.

1.2.1 Office

Many voice systems intended for office applications are offered as enhancements to the basic desktop PC. Most of these are based on speaker-independent technology and use headsets or desktop microphones. Some products require add-in boards with special digital signal processing chips; others use the chips available on sound cards; still others use software-only techniques that employ the host CPU for the speech algorithms. This approach is guaranteed to become more popular and more practical as the processing power of desktop computers continues its evolution, as Pentium and PowerPC chips replace older architectures. The resultant differences include speed of speech recognition and vocabulary size. Voice recognition is also used in many devices to aid the physically handicapped: keyboard and mouse replacements for data entry, wheelchair and appliance control, etc. Office products are also available as dedicated hardware and software systems for customers in dentistry, mammography, radiology, pathology, legal, and other identified niches. These solutions are often sold as automated dictation systems.

1.2.2 Industrial

Industrial applications usually represent a different design center for the technology; devices must work in rugged, often noisy environments; they must be accurate to avoid early operator frustration; and they must easy to use, since the voice operator is always busy doing something else, such as driving a forklift, or working a shipping/receiving line. Industrial voice products are usually also portable. Some use radios to send data to host PCs or mainframe computers. Horsepower requirements also impact design for portability. Hence, for many industrial applications where workers require portable, battery -powered voice terminals, speaker dependent technology is a better choice. Speaker dependent speech requires less CPU power, is suitable for continuous speech, and easily accommodates job-specific vocabulary.

1.2.3 Telephony

Voice recognition over the telephone is a major application of the technology. ASR can be used where the caller does not have a touch-tone phone, still very common outside the U.S., or for car-phone services, where hands-free, eyes-free operation has important benefits, or for applications where the vocabulary doesn't map well onto the limited sixteen-pad touch-tone phone. (How would you order a blue button-down oxford-cloth dress shirt in size 15 1/2 x 34 using a touch-pad?.

The reduced bandwidth of a telephone line, the poor quality of many telephone microphones, line problems such as echo, static, and background noise combine to create a far more difficult environment for telephone-based speech recognition than is typical of office or even industrial environments. Many of these factors (such as line

quality and microphone quality) are usually outside the control of the speech system designer so the system must be designed to handle the worst cases. Hence many over-the-telephone voice recognition systems seem to be much more limited than those intended for office and industrial use. The problem of cellular telephone voice recognition is even more demanding. All telephone products employ high horsepower electronics and are typically shared over multiple phone lines.

1.3   Introduction of the Project

Speech recognition motor and light dimmer controller is a project where the user just needs to give the command by using the voice to control the dc motor and light dimmer. This project have two main parts, it is speech-recognition circuit with speech-recognition interface circuit, and the output circuit (dc motor and light dimmer circuit).

This project can be applied to our life everyday. For example we can apply this project to control the fan and lamp in the house. So that we can switch ON and OFF the fan and lamp easily, no need to move to the switch to turn ON or turn OFF the fan and lamp. Beside that, this system is user friendly. User can easily to set up the command for the output. This become a popular medium for use by professionals in the working world, it is also an exceptional tool for people with disabilities. Main target of this project are for people having physical disabilities but no speech impairment. Thus, this can give a big benefit to them. In this project, I were used HM2007 as the engine or heart of the system. The detail of the HM2007 I was briefly explains in Chapter 2.

1.4 Why Using Speech Recognition System?

Today most of the tools and appliances are using the automatic system. One of the method that become famous to control the appliances, tools, toys, computer, and robotics are by using speech recognition system. This technology will become a huge commercial market in the near future.

To control and command an appliance (computer, VCR, TV security system, etc.) by speaking to it, will make it easier to use, while increasing the efficiency and effectiveness of working with that device. At the most basic level, speech recognition allows the user to perform parallel tasks, (i.e. hands and eyes are busy elsewhere) while continuing to work with the computer or appliance.

This circuit is a stand-alone trainable speech recognition circuit that may be interfaced to control just about anything electrical, such as; appliances, robots, test instruments, VCR's TV's, etc. The circuit is trained (programmed) to recognize the words you want it to recognize. The unit can be trained in any language and even non-languages such as grunts, birdcalls and whistles. The entire speech recognition circuit is available as a kit (SR-07) or may be hardwired together in accordance with the schematic.

This circuit allows us to experiment with many facets speech recognition technology. The heart of the circuit is the HM2007 speech recognition integrated circuit. This chip provides the options of recognizing either forty .96 second words or twenty 1.92 second words. A jumper on the main circuit board selects either the .96 second word length (40 word vocabulary) or the 1.92 second word length (20 word vocabulary). I typically use the 1.92 second option because I found the recognition to be more accurate.

The HM2007 stores the "trained" word patterns used for recognition in external memory. For memory, the circuit uses an on board 8K X 8 static RAM. The main board has a coin battery holder that provides backup power to the static ram when the main circuit is turned off. This keeps all the trained words safely stored in memory (SRAM) so the circuit does not have to be retrained every time it is turned on. A fresh coin battery provides years of memory protection.

1.5   Project Objective

- To design a speech-recognition system that can control the motor and light dimmer by using the voice command.
- To analysis and evaluate the speech recognition circuit that already has and make a research to create the new tools from the technology of speech-recognition.
- To analysis the DC motor and light dimmer circuit and interface it with speech recognition circuit to create a new tool.
- To interfaces the speech recognition circuit with motor and light dimmer circuit.

1.6   Problem Statement

Currently, most speech recognition systems available today are programs that use personal computers equipped with a sound card. These memory-resident programs operate continuously in the background of the computers operating system (Windows, OS/2, etc.), allowing the speech recognition program to be used with other programs like

Word or Excel. There is a noticeable slow-down in the operation and function of the computer when the memory resident voice recognition program is enabled. The memory resident programs add to the processing overhead of the computer's CPU.

From a commercial aspect, the disadvantage in this approach is the necessity of a computer. While these speech programs are impressive, it is not economically viable for manufacturers to add full blown computer systems to control a washing machine or VCR.

1.6.1 High cost

The increasing use electronics and electronic commerce in our day-to-day lives, the cost of the electronics tool also becomes high. Because of this I have to create a tool that has a function same with already tools but the cost are low. For example, most speech recognition systems available today are programs that use personal computers equipped with a sound card, so it is so expensive. From a commercial aspect, the disadvantage in this approach is the necessity of a computer. It is not economically to control a motor or light dimmer via main computer systems. But in this project I just used an integrated circuit HM 2007 as speech recognition circuit. So that, the cost for this project can be decreased.

1.6.2   Complex system design

Currently, most speech recognition systems available today are programs that use personal computers equipped with a sound card. These memory-resident programs operate continuously in the background of the computers operating system (Windows, OS/2, etc.), allowing the speech recognition program to be used with other programs like Word or Excel. There is a noticeable slow-down in the operation and function of the computer when the memory resident voice recognition program is enabled. The memory resident programs add to the processing overhead of the computer's CPU. While these speech programs are impressive, it is not economically or practically for a main computer system to control a DC motor and light dimmer. So for this project I just used HM 2007 as speech recognition. HM 2007 circuit is a stand-alone trainable speech recognition circuit that may be interfaced to control just about anything electrical, such as; appliances, robots, test instruments, VCR's TV's, etc. The circuit is trained (programmed) to recognize the words that we want it to recognize. So, it becomes easier to design.

1.6.3   Not Portable

Because it is a stand-alone trainable speech recognition circuit, it's a portable tool too. Compare with computer speech recognition it become more effectively and practically to control the tool that are portable.

1.7   Scope of Works

1.   Study about speech-recognition circuit (SRC)
  - How SRC work, the SRC control system and the interface with motor and light dimmer circuit.
2.   Analysis of SRC (breadboard) and software simulation for dc motor and light dimmer circuit.
  - Multisim
  - Breadboard testing
  - Component
3.   Design the project circuit on PCB-construct on PCB
  - Eagle Software

This project consists of three phases. Firstly, I have to study about speech-recognition circuit (SRC). I must know how it work, especially the IC HM2007. IC HM2007 is like a central processing unit (CPU), it is a single chip CMOS voice recognition LSI circuit with the on-chip analog front end, voice analysis, recognition process and system control functions. Then we have to know how to interface the SRC circuit with output circuit (motor and light dimmer circuit).

Second phase are, make analysis for SRC circuit, and software simulation for the output circuit using the MultiSim Software and getting the component to make the testing on the bread board for Speech Recognition Circuit and the output circuit. After all components are already the project component we constructed on the bread board to test the project functionality before proceed on the PCB. If the projects are success on the bread board, then we go through to proceed on the PCB circuit.

Thirdly, I design the project circuit on the PCB using Eagle Software. Then all the components were constructing on the PCB circuit. The complete constructing circuit project must be tested. If the functionality is succeeding, then the finishing will be doing.

1.8   Report Overview

This report consist 5 chapters. Chapter 1 is introduction to the Automatic Speech Recognition (ASR) system. In this chapter I will discuss overall about the intro of ASR and introduction of the project. In the chapter 2, I will discuss the detail about project and the circuit theory. This chapter will be explaining how to train the SRC and interface it with output. In the Chapter 3, I will discuss about the project methodology and the project progress that I used in this project. In the Chapter 4, Discussion will discuss about the features in SR system and this speech recognition project. For this I was divided in two, first is general discussion, it is about global in speech recognition system, and the second one is project discussion. In the Chapter V, it is about the suggestion and future works and also the conclusion of the project.