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This report is submitted in partial fulfillment of the requirement for the award of Bachelor of Electronic Engineering (Industrial Electronics) With Honours

Faculty of Electronic and Computer Engineering
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Voice Recognition For Security System

Sesi Pengajian : 2007/2008

Saya Mohd Hasrul Ariff Bin Saidin

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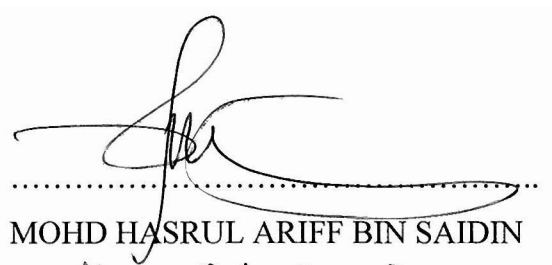
VOICE RECOGNITION FOR SECURITY SYSTEM

"I hereby declare that this report is the result of my own work except for quotes as cited in the references."

Signature : 

Author : MOHD HASRUL ARIFF BIN SAIDIN

Date : 16 MAY 2008

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Supervisor's Name : PUAN FAUZIYAH BINTI SALEHUDDIN

Date : 16 may 2008

Special dedicated to my beloved parents, family, lecturers, friends, who had strongly encouraged and supported me in my entire journey of learning.

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I have completed my thesis which is a partial fulfillment of requirements for the degree of Bachelor in Electronic Engineering (Industrial Electronic).

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ABSTRACT

The aim of this project is to design the voice recognition system for security by using the PIC microcontroller as the heart of the circuit. This instrument is capable of detect command or password the holder. The main objective of this project is to develop and research about the voice recognition system that all mankind use for the better life. Besides that, I also must know the range of human voice and this part need to be research. This project is a combination of a simple electronic circuit, PIC controller and LCD display. The simple electronic will function as input to the PIC microcontroller and to be the LCD will be connected to the PIC for better interface. The PIC microcontroller will be compared computed and displays the output result on the LCD display. The output result which displayed on the LCD was displayed with the password correct or wrong from the user. To complete this project, the programming for PIC microcontroller is writing by using the C language.

ABSTRAK

Tujuan utama projek ini adalah untuk menghasilkan dan merekacipta suatu sistem yang dipanggil Sistem Keselamatan dengan menggunakan pengenalan suara dan dikawal sepenuhnya oleh unit kawalan mikro sebagai nadi sistem. Objective utama projek ini adalah untuk membangunkan dan menyelidik berkenaan pengenalan suara bagi mewujudkan keselesaan dan kemantapan hidup bagi semua penggunanya. Selain itu, sy juga perlu tahu berkenaan dengan jarak suara manusia dengan melakukan sedikit menyelidikan agar segara yang mengelirukan dapat ditafsirkan. Projek ini merupakan satu percantuman atau kombinasi tiga elemen asas iaitu litar electronic, mengawaskan PLC dan LCD sebagai bahan penyampaian. Sistem ini akan berfungsi jika sebarang kata kata yang diberikan dari pemegang kata kunci adalah betul dan jika salah kata kunci system akan menolak sebarang kemungkinan yang akan terjadi. Sistem ini diperkemaskn lagi dengan ada nya paparan monitor bagi memudahkan pengguna yang menggunakannya.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 Project introduction

This function of voice recognition security system is to have a system that will only unlock upon recognizing a voice from password spoken by the administrator or password holder. Firstly, the voice recognition algorithm must be look to understand the implementation. Then prepared the microphone circuit before proceeded to start sampling and generate the digital data for the voice.

In addition, the analysis of the voice is made using the correlation and the regression method to compare the voiceprint of different words. These techniques provide stronger ability to recognize the same word. Training procedure is also used to reduce the random changes due to one word is spoken different times. The training procedure can get more accurate frequency spectrum for one word. The experimental results demonstrate high accuracy for this real time voice recognition system.

1.2 Project objectives

The objectives of this project are:

i) To understand and able to obtain soft skill such as C language, Multisim and Matlab

ii) To design the voice recognition security system function

iii) To perform standard signal by using the speech processing toolbox in the C language

1.3 Problem statement

The voice recognition security system have been develop, comprised of a speech recognition system that activated or unlock upon the security. The voice recognition system was capable of recognizing the password holder. In order to implement this design, several different hardware and software element such as C language or Matlab has been combined to get the result. A small microphone was purchased and used to convert the human voice signal into a voltage signal. For information, speech technology offers some tangible advantages over alternative option if it to be successful in any given application. Potential advantages include:

- Cost savings may be obtained by automating services or making human more efficient
- Safety may be increased by using an additional modality for communication
- Effectiveness may be improved for example in terms of speed and quality of the output or in term of ease with which a goal can be archived.

1.4 Project scope

The scope of this project is mainly about the voice recognition for security system by using the identification codes. The circuit is designed to detect the speech from the password holder and open when the password was correct. The circuit will be controlled by one microcontroller that is PIC microcontroller. By using PIC, it can be programming using C language or assembly language.

1.5 Report structure

This thesis consists of five chapters. The following is the outline of this project "Voice Recognition for Security System"

Chapter 1 will represent the brief overview about the project. This chapter contains introduction, objectives problem statement and scope of the project.

Chapter 2 will discuss about the research and information about the project. Every facts and information that found through journals or other references will be mentioned in this chapter. Besides that, the techniques from the literature review will be also discussed in Chapter 2. All these techniques and information will be research and compared to get the method for finding the archives of this project.

Chapter 3 is canvassed about the project methodology used in this project such as speech spectrum analysis, hardware design, filter design, program design and analysis about the fingerprint. All these methodologies will be described detail in this chapter.

Chapter 4 will represent the project findings such as results and analysis of the voice recognition and voice spectrum. The result will presented by tables, graphs and figures. Discussion also will be write for analyze the results.

Chapter 5 is the last chapter. This chapter will mention about the conclusion and the problem that faced to archive this target of the project.

CHAPTER 2

BACKGROUND OF THE STUDY

2.0 Introduction

Voice recognition security system has 3 essential elements such as for hardware that is for the microphone circuit, MCU or DAQ card and LCD interface to the better user. The MCU or DAQ card will be interface and recognize between computer, LCD and the microphone circuit when the password from the holder and open the lock if the password is correct [14].

What we need to know in this project is how to calculate the frequency to sample speech based on the Nyquist Rate Theorem. Secondly, we also need to know how to calculate filter cutoff frequency to build the high and low pass RC filter for human speech. Thirdly, we need to know how to calculate the gain of differential op-amp. We had to learn about Chebychev filters to determine the cutoff frequencies to build the digital filters for human voice. As for the analysis part of the speech, we need to know how to calculate Euclidean, correlation and simple linear regression. Lastly, we need to know how the Fourier Transform works, because we need to understand and analyze the outputs of the digital filters [14].

The structure is very simple. The microphone circuit goes to the ADC of the MCU. The digitized sampling of the word is passed through the digital filters (flash programmed onto the MCU). The analysis is done on the MCU as well. Once that is done, the LCD which is connected to the MCU displays if the word spoken matches the password or not.

2.1 Hardware Descriptions

2.1.1 Microphone

A microphone sometimes referred to as a mike or mic is an acoustic-to-electric transducer or sensor that converts sound into an electrical signal. Microphones are used in many applications such as telephones, tape recorders, hearing aids, motion picture production, live and recorded audio engineering, in radio and television broadcasting and in computers for recording voice, VoIP, and for non-acoustic purposes such as ultrasonic checking.

In a condenser microphone, also known as a capacitor microphone, the diaphragm acts as one plate of a capacitor, and the vibrations produce changes in the distance between the plates. There are two methods of extracting an audio output from the transducer thus formed. They are known as DC biased and RF (or HF) condenser microphones [17].

2.1.2 Microcontroller Unit (MCU)

Microcontroller (also known as MCU) is a computer-on-a-chip. It is a type of microprocessor emphasizing high integration, low power consumption, self-sufficiency and cost-effectiveness, in contrast to a general-purpose microprocessor. In addition to

the usual arithmetic and logic elements of a general purpose microprocessor, the microcontroller typically integrates additional elements such as read-write memory for data storage, read-only memory, such as flash for code storage, EEPROM for permanent data storage, peripheral devices, and input/output interfaces. At clock speeds of as little as a few MHz or even lower, microcontrollers often operate at very low speed compared to modern day microprocessors, but this is adequate for typical applications.

They consume relatively little power (milliwatts), and will generally have the ability to sleep while waiting for an interesting peripheral event such as a button press to wake them up again to do something. Power consumption while sleeping may be just nanowatts, making them ideal for low power and long lasting battery applications. Microcontrollers are frequently used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines, appliances, power tools, and toys. By reducing the size, cost, and power consumption compared to a design using a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to electronically control many more processes [12].

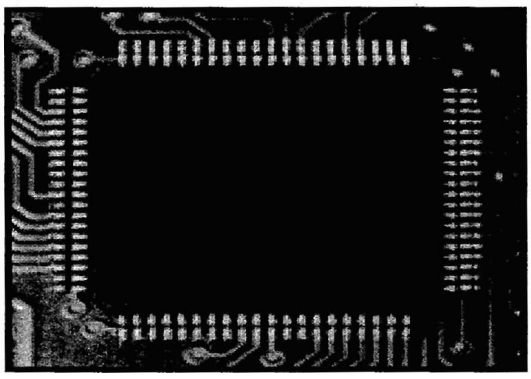

Figure 2.1: A PIC 18F8720 microcontroller in an 80-pin TQFP package [1].

2.1.3 Atmega32 (Single-board computer)

ATmega32/644 is a small Single-board computer (SBC) based on the Atmel ATmega32 or Atmel ATmega644 AVR processor (20 MHz). It was designed trough a cooperation between Ulrich Radig, Holger Buss and Thomas Scherer with the initial intent to remotely control a coffee machine via the internet. The ECB_ATmega32/644 supports up to 2048 bytes RAM. It uses a specially designed embedded operating system and measures 85mm x 77 mm [3].

Although quite similar to the ECB_AT91, the ECB_ATmega32/644 has distinctive features and far less computing power. This allowed this design of being built DIY with a bare minimum of parts and for a far lower price. Also, it is capable of operating at bare minimum energy consumption (less than 100mA). Besides this, it is still powerful enough to be used as a web server and to perform web-based remote control, and webcam-monitoring. However, due to the limited computing power, web server-capability is limited (restricted to 1000 page views per second) and the device is mainly targeted for low intensity use.

Table 2.1: Features of ATMEGA32L

20 MHz AVR processor (Atmel ATmega32/644)
32 kB of Serial Flash
2048 bytes of RAM
1 wire-interface (Dallas)
e-mail, web server and NTP-time functionality
SD-memory card interface (no slot)
webcam-slot
<100 mA power consumption
Seven I/O digital-out channels, and 3 analogue digital-in channels

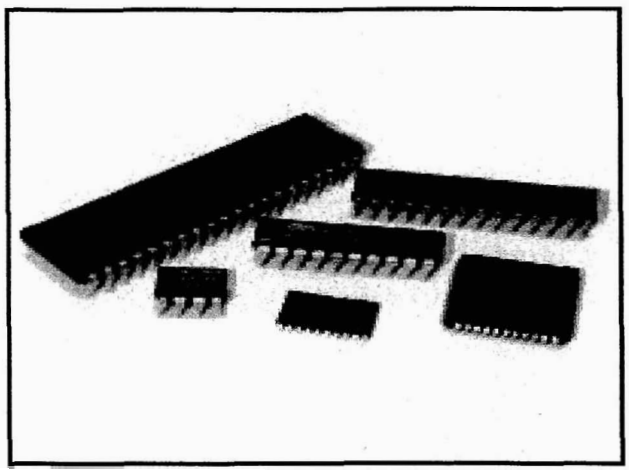

Figure 2.2: Examples Atmege32 [3]

2.14 The DevBoard-M32 Controller

The DevBoard-M32 Controller is a versatile, easy-to-use, general-purpose controller using the popular Atmel ATMega32 microcontroller. The board includes no more than is absolutely necessary for a basic controller, thus keeping the cost and board size to a minimum. All of the individual pins have been brought out to standard. One spaced headers to accommodate interfacing to almost any kind of circuitry. It is designed for use in applications ranging from robotics to industrial controller applications. The following features make M32 very versatile [16].

Table 2.2: Devboard –M32 Features

Operates over a wide range of supply voltage: 7 to 15 Volts
On-Board Power Distribution Bus
On-Board Reset Switch
Standard ISP Connector for "In-System-Programming"
On-Board Power Indicator LED
On-Board Regulation for the Microcontroller
Separate On-Board Regulation for the Power Distribution Bus
Two On-Board TWI* Connectors

On-Board TWI Pull-up Resistors
Optional Ceramic Resonator Connection for Accurate Clock Frequency up to 16 MHz
User-Selectable TWI Clock and Data Lines

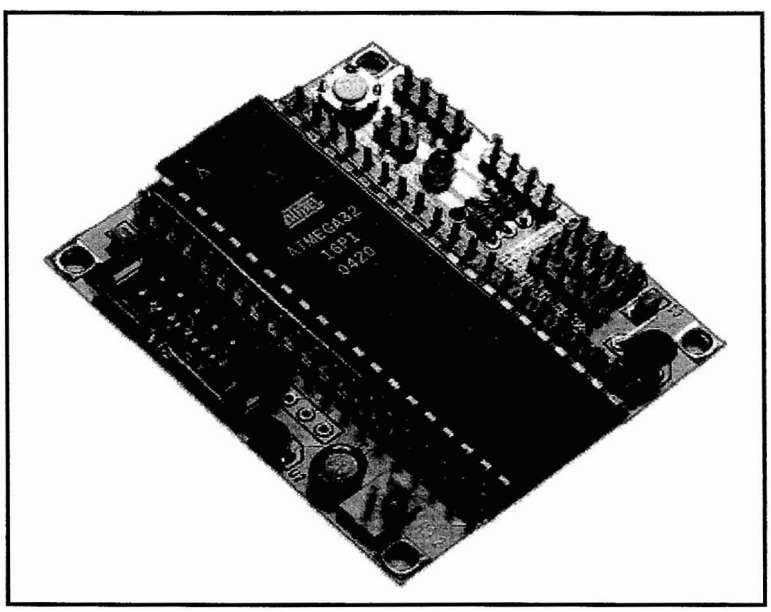

Figure 2.3: Devboard-M32 circuit [16]

2.1.5 The LCD

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. It is often utilized in battery-powered electronic devices because it uses very small amounts of electric power. The LCD need to used is the small monochrome, alphanumeric type which display alphabetical, numerical and symbolic characters from the standard ASCII character set. This type can also display low resolution graphics but these example is the simple one [5].

Figure 2.4: Example LCD interface [5]

2.1.6 Printed circuit board

A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, or traces, etched from copper sheets laminated onto a non-conductive substrate. Alternative names are printed wiring board (PWB), and etched wiring board. A PCB populated with electronic components is a printed circuit assembly (PCA), also known as a printed circuit board assembly (PCBA).

PCBs are rugged, inexpensive, and can be highly reliable. They require much more layout effort and higher initial cost than either wire-wrapped or point-to-point constructed circuits, but are much cheaper and faster for high-volume production. Much of the electronics industry's PCB design, assembly, and quality control needs are set by standards that are published by the IPC organization. The steps how to have the good PCB are patterning (etching), lamination, drilling, exposed conductor plating and coating, solder resist, screen printing, test, populating, printed circuit assembly, protection and packaging [7].

2.2 Software Developement

2.2.1 Multisim 2001

Multisim 2001 is a complete system design tool that offers a large component database, schematic entry, full analog/digital SPICE simulation, VHDL/Verilog HDL design entry/simulation, FPGA/CPLD synthesis, RF capabilities, Postprocessing features and seamless transfer to PCB layout packages such as Ultiboard, also from Electronics Workbench. It offers a single, easy-to-use graphical interface for all your design needs. Multisim 2001 provides all the advanced functionality you need to take designs from specification to production and because the program tightly integrates schematic capture, simulation, Printed Circuit Board (PCB) layout and programmable logic.

Multisim 2001 supports every step of the overall circuit design process, which typically includes the following phases:

1) Entering the design (using schematic capture, behavioral language formats or other methods) into the software tool being used.
2) Verifying that the behavior of the circuit matches expectations. This step is performed using simulation, and analysis.
3) Modifying the circuit design if the behavior does meet expectations, and returning to step 2 as often as necessary.

Depending on how the circuit is to be physically implemented, passing the design through the appropriate process. For example, if it is to be placed on a PCB, the next step is to use a PCB layout program such as Electronics Workbench's Ultiboard product. If it is to be placed on a programmable logic device (PLD, CPLD, FPGA, etc.), the next step is to use a synthesis tool such as that available from Electronics Workbench.