

DESIGN AND IMPLEMENTATION PARALLEL PORT-BASED DATA
ACQUISITION SYSTEM

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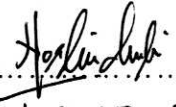
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To my beloved Family and Friends, I love you all. To my Supervisor, Thank you so much.

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ABSTRACT

Nowadays, computers became essential communication between human and equipments. All communications now are using computers. Much computer-oriented equipment is invented. Each of the equipment has their own communication protocol such as Parallel Port, Serial Port, USB and wireless. Each of the communication protocol has their advantages and disadvantages. So, Parallel Port-Based Data Acquisition System is created as final year project in order to examine the ability of the communication protocol can be widely used. The objective of this project is to realize communication between hardware and software by using parallel port. Besides that, it helps student to gain knowledge about parallel port protocol deeply so that the protocol could be upgraded. Lot of reviews and researches has been done to realize it. A lot of simple experiments have been done as reference. Scope of the project covered useful of PIC as controller and vb2005 as programming language to develop data acquisition system.

ABSTRAK

Dalam era yang serba moden ini, komputer menjadi alat penghubung utama di antara manusia dan perkakasan. Semua urusan kini menggunakan komputer. Jadi, komputer menjadi satu keperluan wajib. Pelbagai peralatan berorientasikan komputer dicipta. Dan setiap peralatan itu mempunyai satu atau lebih komunikasi yang digunakan. Pelbagai media penghantaran digunakan untuk komunikasi. Antaranya ialah parallel port, serial port, usb dan wireless. Setiap protokol komunikasi ini mempunyai kelebihan dan kekurangan masing-masing. Oleh itu, “Parallel Port-Based Data Acquisition System” dicipta sebagai projek sarjana muda untuk mengkaji sejauh mana protokol ini dapat digunakan dan kekangan-kekangan yang dihadapi. Objektif projek ini adalah untuk membolehkan perkakasan dan perisian dihubungkan dan dilaksanakan supaya data dapat dibaca oleh komputer dari perkakasan luar. Selain itu, ia juga memberi pengetahuan yang amat dalam kepada pelajar supaya protokol ini dapat ditingkatkan penggunaannya. Banyak kajian dibuat untuk merealisasikannya. Antaranya dengan membuat ujikaji –ujikaji mudah sebagai rujukan. Skop projek ini meliputi perkakasan yang menggunakan PIC sebagai pengawal dan perisian yang menggunakan VB2005 sebagai bahasa aturcara.

TABLE OF CONTENTS

CHAPTER	SUBJECT	PAGE
	TITLE	i
	SUPERVISOR VERIFICATION	ii
	DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENTS	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF TABLE	xii
	LIST OF FIGURE	xiii
	LIST OF ABBREVIATION	xiv
	LIST OF APPENDICES	xv
I	INTRODUCTION	
	1.0 Overview	1
	1.1 Objective	2
	1.2 Problem Statement	2
	1.3 Scope of Work	3
	1.4 Methodology	5
	1.5 Structure of Report	5
II	LITERATURE REVIEW	
	2.0 Literature Review	7

2.1	Controller	8
2.1.1	PIC Developed as Peripheral Controller	8
2.1.2	PIC Small Computer	8
2.2	PIC16F877A	9
2.2.1	Basic PIC16F877A	10
2.2.2	Analog at PIC16F877A	11
2.3	How to Program ADC into PIC	13
2.4	Introduction to Parallel Port	14
2.4.1	Pin Assignment	15
2.4.2	Parallel Port Register	16
2.5	Port Types	17
2.5.1	Original (SPP)	17
2.5.2	PS/2-type (Simple Bidirectional)	18
2.5.3	EPP	18
2.5.4	ECP	18
2.5.5	Multi-mode Ports	19
2.5.6	Bidirectional	19
2.6	Port Addresses	20
2.6.1	Inputs	21
2.6.2	Problem and Solution	22
2.7	Inpout32.dll	23
2.7.1	Kernel Mode Driver Hwinterface.sys	24
2.7.2	DLL Inpout32	25
2.8	Reading and Writing Data to Parallel Port Pins	25
2.9	LCD	27

III METHODOLOGY

3.0	Methodology	29
3.1	Literature Review	30
3.2	Review of PC Programming in General, Including Parallel-port Programming	31
3.3	Review of PIC Programming, including	

	the use of Internal ADC, LCD interfacing and Timer/Interrupt Programming	31
3.4	Realization of a Simple PC-Based Parallel-Port Testing Device	32
3.4.1	Download Inpout32.dll	33
3.4.2	Module	33
3.4.3	Form	33
	3.4.3.1 Write and Read Data Using Data Register	33
	3.4.3.2 Read Data From External Device Using Status Register	34
3.5	Realization of a Simple PIC-Based Voltage Measurement and Display Device	35
3.5.1	PIC-Based Voltage Measurement Circuit	35
	3.5.1.1 PIC-Based Data Acquisition Board	36
3.5.2	PIC Programming	37
	3.5.2.1 Flowchart	37
	3.5.2.2 Source Code	38
3.6	Addition of Timer/Interrupt Programming to Control Measurement Interval	39
3.7	Realization of a Simple PC Program to Accept Data via Parallel Port and Display Them	40
	3.7.1 Flow Chart	41
	3.7.2 Source Code	41
3.8	Addition of Features to PC Software	43
3.9	System Integration	45
3.10	Testing and Troubleshooting	45

IV

RESULT AND DISCUSSION

4.0	Result	46
4.1	PIC-Based Data Acquisition Board (DAB)	47
	4.1.1 Analog Input	47

4.1.2	Analog to Digital	48
4.1.3	LCD	49
4.2	PC-Based Data Acquisition Software (DAS)	50
4.3	Parallel-Port Based Data Acquisition System	52

V CONCLUSION AND SUGGESTION

5.0	Conclusion	54
5.1	Suggestion	55

REFERENCES 56

APPENDICES 58

LIST OF TABLE

NO	TITLE	PAGE
Table 2.1	Pin Assignment	16
Table 2.2	Port Addresses	20
Table 2.3	LCD's Pin Configurations	27
Table 3.1	The A/D Conversion Time per Bit	40

LIST OF FIGURE

NO	TITLE	PAGE
Figure 2.1	PIC	8
Figure 2.2	Architecture of PIC	9
Figure 2.3	Basic PIC16F877A	11
Figure 2.4	ADC Input Voltage	12
Figure 2.5	DB-25 Male	14
Figure 2.6	Pin Assignment	15
Figure 2.7	DLL	24
Figure 2.8	LCD's Pin Configuration	28
Figure 3.1	PC-Based Parallel Port Testing Device Circuit Diagram	32
Figure 3.2	Source Code Module in VB6	33
Figure 3.3	Source Code Main Form to Write and Read Data	34
Figure 3.5	GUI for Reading Data	35
Figure 3.6	LCD Connection Circuit Diagram	36
Figure 3.7	Address of Parallel Port	42
Figure 3.8	GUI before Executed	44
Figure 3.9	Status port Result	44
Figure 4.1	Basic Block Diagram	47
Figure 4.2	Analog Input	48
Figure 4.3	Project's Main Circuit	49
Figure 4.4	Result of ADC	50
Figure 4.5	Parallel Port Male and Female	51
Figure 4.6	GUI of Data Acquisition System	52
Figure 4.7	Hardware of Parallel Port Based Data Acquisition System	53
Figure 4.8	Implementation of Parallel-Port Based Data Acquisition System	53

LIST OF ABBREVIATIONS

ADC	-	Analog to Digital Converter
CPU	-	Central Processing Unit
DAB	-	Data Acquisition Board
DAS	-	Data Acquisition Software
DMA	-	Direct Memory Access
ECP	-	Extended Parallel Port
EPP	-	Enhanced Parallel Port
GUI	-	Graphic User Interface
PIC	-	Programmable Interface Controller
PC	-	Personal Computer
SPP	-	Standard Parallel Port
VB6	-	Visual Basic 6.0
VB 2005	-	Visual Basic 2005

LIST OF APPENDICES

NO	TITLE	PAGE
A	TUTORIAL PARALLEL PORT WITH VB 2005	59

CHAPTER I

INTRODUCTION

1.0 Overview

Nowadays, all technology is a computer-based. Computers are used as monitoring device as well as data storage. Those data being display are more precise with less error on it. In order to send data to the computer, one communication protocol is used. The communication protocol will be used based on how fast the data might be displayed. This is one of the very important things when buying hardware. User will buy the fastest communication technology between pc and hardware. There are 3 types of protocol widely use nowadays. They are serial communication, parallel communication and USB communication. In order to communicate, cable is used to connect between PIC and PC.

From that, parallel-port-based data acquisition system is designed and implemented as a project to shows how parallel port works when communicating with pc. Many hobbyist and engineer prefer to use serial port compared to the parallel port. But actually, implement parallel port is easier. Parallel port could be directly connected to the hardware without any adapter. If so, it just used to multiplexed and latched. Research before widely used in MS-DOS. This is because

window 95/98 can access I/O. But this project is implemented in Window XP environment to take advantages of the extended capabilities of a modern PC to take care of all data manipulation (store, calculation, display) tasks.

1.1 Objective

The objective of this project is to realize a basic parallel-port-based data acquisition system. The hardware that is to be developed will measure data at a fixed interval and send them to a PC. On the PC side, a program will receive the measured data, store them, and display them as text or graph. The hardware will limit itself to measuring voltage levels, but the final product can be adapted to suit many applications, such as temperature monitoring, water level monitoring, etc. Besides that objectives of the project are:

1. To master relevant aspects of PC and PIC programming.

This project encourages student to gain knowledge until master of relevant aspects of PC and PIC programming. Student must know needs of PC in term of sending and writing data and how to communicate with other device.

2. To master the parallel-port protocol.

Designing this project also encourages student to find information about parallel port protocol as much as they can until they master on it.

1.2 Problem Statement

In order to communicate using parallel port protocol in Window XP there were several problems occurred when accessing input data from external device. Writing programs to talk with parallel port was easy in old DOS days and in Win95/98 too. Inportb and outportb or `_inp()` or `_Outp` functions could be used in the programming without an problem if the program is run on DOS or WIN95/98. But

entering to the new era of NT clone operating systems like WIN NT4, WIN2000, and WINXP, all this simplicity goes away. Being interested in Parallel port interfacing and programming in writing a program that can talk to parallel port successfully in NT based operating systems experienced the problems. When a program which is written using the conventional software functions like Inporb, outportb, _inp() or _Outp on a WINNT or WIN2000 system is ran, an error message is shown.

The other problem that had been faced is parallel port mode. In order to read input from data lines at parallel port, parallel port mode has to change into bidirectional. This means data lines are changed into input mode and it can be as data input instead of output in default.

1.3 Scope of Work

This project is divided into 2 parts: PC programming and PIC programming.

1. The PC programming side involved:

- i) Parallel-port-based communication
 - Parallel-port is used as medium to communicate between PIC and PC. In order to use the parallel port, configuration pins of parallel port and its program must be known so that the parallel-port recognized by the PC.
- ii) Data storage
 - The PC is programmed so that the value accessed from parallel port could be store into PC.
- iii) Text-based and graphical (optional) display of measured value
 - The PC is also programmed to display value in text-based.

2. The PIC programming side involved:

The overall information about PIC being used is studied referred to the datasheet. The important parts that highlighted are:

- i) Internal ADC
 - ADC is programmed into PIC so that PIC could measure input analog value then it is converted into digital value.

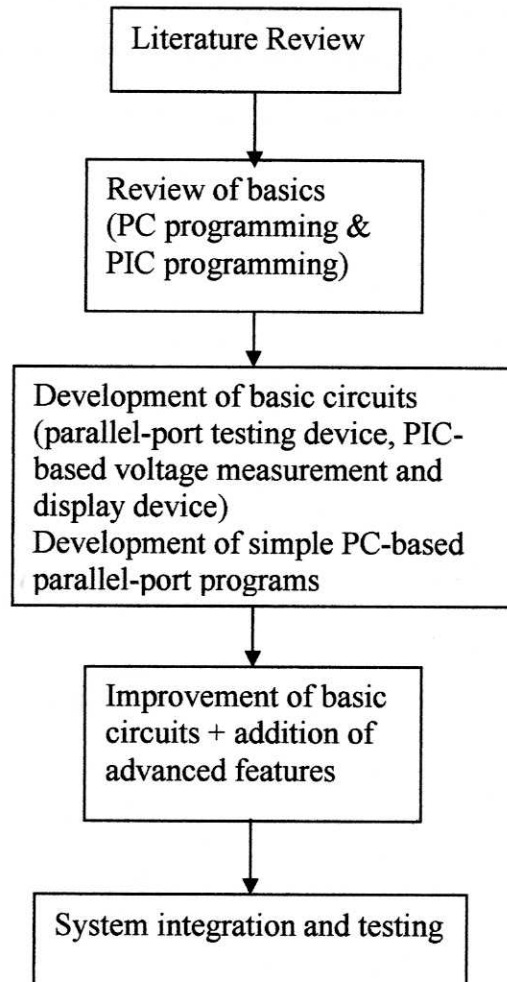
- ii) LCD display
 - PIC is also programmed in order to display measured value at LCD.

- iii) Timer/interrupt programming
 - The PIC is programmed in order to read input value at desired time interval.

- iv) Parallel-port communication
 - Output and input pin at PIC is recognized so the output and input signal from that pin can access parallel port.

1.4 Methodology

Below is the flowchart of the methodology that has been referred.



1.5 Structure of report

Generally, this report contained 5 main chapters. Those are Introduction, Literature Reviews, Methodology, Result & Discussion and Conclusion. In Chapter I – Introduction, briefly explained overview of the whole projects that is introduced the project and why it must be implemented into real world, the objectives of project, problem faced when running the hardware that is problem statement, scope of work done when developing the project and method that has been used. All theories that are taken and referred from articles, journal, books related to the project are

explained detail in Chapter II. Methods that have been used in order to achieve purpose of the project are explained in detail in Chapter III. Including also in this chapter explanation about hardware that has been built and programming source code with appropriate comments. Chapter IV is Result & Discussion that explained the output and the operation of the project with end user pictures. Conclusion then is included in Chapter V which contained suggestion, strengths and weaknesses of the project. Chapters are separated in sequence in order to give easier view for readers.

CHAPTER II

LITERATURE REVIEW

2.0 Literature review

In order to develop this project, some reviews and researches are made from articles, journal, and Lab sheet from other university, reference books and also forum. All sources are used to compare and to familiarize with various ways to develop the project.

“IF YOU STEAL FROM ONE AUTHOR, IT’S PLAGIARISM; IF YOU STEAL FROM MANY, IT’S RESEARCH”

(Wilson Mizner, 1876 – 1933)

One structure of work that shows connection between technical aspect of project and theory is implemented.

2.1 Controller

From perspective of controller, choosing suitable microcontroller is important in order to control the device that has been made. Microcontroller that has been chosen must be programmable and erasable. For that purpose, *Peripheral Interface Controller (PIC)* is chosen as microcontroller. Reviews about PIC are referred from some book about PIC. Some article and journal are also downloaded from the Internet and IEEE Xplore websites as references. Discussions are made among expertise in the related forum. Below are theories about PIC adapted and compiled from resources mentioned above.

2.1.1 The PIC was developed as a peripheral controller



Figure 2.1: PIC

PIC is the IC that has been developed years ago to control peripheral devices, alleviating the load from the main CPU. Compared to a human being, the brain is the main CPU and the PIC is equivalent to the autonomic nervous system.

2.1.2 The PIC is the small computer

The PIC, like the CPU, has calculation functions and memory, and is controlled by the software. However, the throughput and the memory capacity are low. Depending on the kind of PIC, the maximum clock operating frequency is about 20 MHz and the memory capacity (to write the program) is about 1K to 4K words.

The speed has been determined by clock frequency at which a program is read and an instruction is executed. The throughput cannot be judged with the clock frequency alone. It changes with the processor architecture. However within the