



KOLEJ UNIVERSITI TEKNIKAL KEBANGSAAN MALAYSIA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENYERAHAN LAPORAN AKHIR PROJECT
PROJECT FINAL REPORT SUBMISSION FORM

A. Butir-butir Pelajar
Student's Details

Name Pelajar : NORLIZAH BINTI MAT ISA
Student's Name
Tajuk Projek : TEMPERATURE MONITORING SYSTEM
Project Title

Name Penyelia : EN. ZAHRIADHA BIN ZAKARIA
Supervisor's Name

No. Kad Pengenalan : 7 9 0 5 2 0 0 4 5 2 1 0
Identification Card No.

Semester : 2 0 4 0 5
Semester

No. Matrik Pelajar : B 0 2 0 2 1 0 1 3 9
Matrix No. Student

Kursus : BENE
Course

(Tandatangan)
Signature

Tarikh
Date

31/03/05

Untuk Kegunaan Pejabat Sahaja
For Office's Use Only

Saya akui bahawa telah menerima:
I hereby acknowledge that received:

- (i) SATU salinan Laporan Akhir Projek berjilid
One copy of Project Final Report
- (ii) SATU salinan cakera padat yang mengandungi Laporan Digital PSM
One copy of compact disc containing PSM Digital Report
- (iii) Hasil projek pelajar
Student's project
- (iv) Baki komponen yang tidak digunakan dalam projek
Extra components that not used in project

daripada pelajar di atas.
from the student above.

(Tandatangan)
Signature

ZAHRIADHA BIN ZAKARIA


Nama : Pensyarah
Name : **Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer**
Kolej Universiti Teknikal Kebangsaan Malaysia

Tarikh
Date

31/03/2005

Karung Berkunci 1200
 Ayer Keroh, 75450 Melaka. (Sila isi dalam dua salinan)

"I declare that I have read this report and in my opinion, it is suitable in term of scope and quality for the purpose of awarding a Bachelor Degree in Electronic Engineering (Industrial Electronic)"

Signature : 
Supervisor : En. Zahriladha Bin Zakaria
Date : 31/03/2005

TEMPERATURE MONITORING SYSTEM

NORLIZAH BINTI MAT ISA


This Report Is Submitted In Partial Fulfillment Of Requirements For The Bachelor
Degree of Electronic Engineering (Industrial Engineering)

Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Kolej Universiti Teknikal Kebangsaan Malaysia

March 2005

DECLARATION

“Hereby, I declare that this report entitled, Temperature Monitoring System is a result of my own research idea except for works that have been cited clearly in the references.”

Signature : 

Name : Norlizah Binti Mat Isa

Date : 31/03/05

Dedicated to my beloved family especially my mother and father and also to my friends.

ACKNOWLEDGEMENTS

I would like thank all of the peoples which are involved directly or indirectly to make sure this project become a reality. Special thanks to my supervisor Mr. Zahriladha bin Zakaria who is shares his time and give full attention to make sure my project is done successfully. I also would like to thank the contributions of my colleagues at Kolej Universiti Teknikal Kebangsaan Malaysia (KUTKM), who are contributed to this project. Without their support, this project may have not come to fruition. The continued support through all phases of this project by the Faculty of Electronic and Computer Engineering and Prof. Abdul Hamid bin Hamidon as a faculty dean, was invaluable for the completion of this work. I also would like to express my appreciation to my parents and family, whose give fully support for the whole project. There are other thank; namely those with whom I did not have the pleasure of interacting personally, but whose contributions are extremely valuable, nevertheless.

ABSTRACT

The title of this project is Temperature Monitoring System which is used computer and seven-segment display to monitor the actual temperature data. Monitoring data using the computer need a software which can be used to interface the data from sensor to the system. Therefore, the knowledge in designing and using Visual Basic programming language is needed besides the knowledge in electronic circuit to realize this project. This project is separated into three parts. The first part includes designing and developing the software for data acquisition and analysis. The program will be writing using Visual Basic programming language. The output (data temperature) is analyzed and recorded into table and graph manner. Finally, it can be monitored through the computer. Parallel port connection is used to make an interfacing between electronic circuit and computer which is enabled the system to acquire data from the sensor. The second part of this project is developing the temperature monitoring circuit. This circuit used the seven-segment as a temperature monitor to display the temperature reading from sensor. For this part, it is needed to understand about the characteristic of the component used and also the connection between electronic components to make the circuit well functions. The final part of this project is joining the circuit to the computer using parallel port connection to complete the Temperature Monitoring System. The advantages of this project are low-cost, rapidly analyze the result and display through computer, high-speed input/output port, easy to implement, possibility to edit data, monitoring using seven-segment display and high-level languages. This project can be applied for many applications such as in power plant requirement to monitor the lube oil temperature, air inlet temperature, turbine compartment temperature and others. This project also can be applied in biotechnology industry to monitor the greenhouse temperature, sample plant temperature etc.

ABSTRAK

Tajuk projek ini adalah Sistem pemantauan suhu yang menggunakan komputer dan paparan tujuh bahagian untuk memaparkan bacaan suhu sebenar. Paparan data menggunakan komputer memerlukan satu perisian tau program yang boleh digunakan untuk mengantaramukakan data dari pengesan suhu kepada sistem. Oleh itu, pengetahuan dalam merekabentuk dan menggunakan bahasa pengaturcaraan Visual Basic diperlukan selain daripada pengetahuan berkenaan elektronik. Projek ini terbahagia kepada tiga bahagian. Bahagian pertama meliputi rekabentuk dan pembinaan perisian yang diperlukan untuk merekodkan data dengan menggunakan bahasa pengaturcaraan Visual Basic. Data suhu akan dianalisa dan direkodkan ke dalam bentuk graf dan jadual dan dipaparkan pada komputer. Liang selari digunakan untuk mengantaramukan litar elektronik dengan komputer. Bahagian kedua melibatkan pembangunan litar elektronik yang menggunakan paparan tujuh bahagian. Kemahiran yang diperlukan adalah yang berkaitan dengan ciri-ciri dan pemasangan komponen. Bahagian terakhir projek ini adalah penyambungan antara litar elektronik kepada komputer untuk melengkapkan Sistem Pemantauan Suhu. Projek ini berkebolehan untuk menganalisa dan memaparkan pada komputer dengan kerap, kos yang rendah, liang masukan dan keluaran yang berkelajuan tinggi, mudah untuk digunakan dan juga menyediakan paparan pada tujuh bahagian. Ia boleh digunakan untuk memaparkan bacaan suhu-suhu yang penting di dalam industri bioteknologi seperti memaparkan suhu rumah hijau, sampel suhu tumbuhan yang diuji dan sebagainya.

CONTENTS

NO.	TITLE	PAGE
	PROJECT TITLE	i
	DECLARATION	ii
	DEDICATION	iii
	ACKNOWLEDGEMENTS	iv
	ABSTRACT	v
	ABSTRAK	vi
	CONTENTS	vii
	LIST OF TABLES	xi
	LIST OF FIGURES	xii
	LIST OF ABBREVIATIONS	xiv
	LIST OF APPENDICES	xv
I	INTRODUCTION	1
	1.0 BACKGROUND	1
	1.1 PROJECT OBJECTIVES AND SCOPE OF WORK	2
	1.1.1 Project Objectives	2
	1.1.2 Scope of Work	3
	1.2 PROBLEM STATEMENTS	3
	1.3 PROJECT METHODOLOGY	4
	1.3.1 Workflow Description	6
II	LITERATURE REVIEW	8
	2.1 OVERVIEW	8

2.2	THERMAVIEWER PRODUCTS	9
2.3	BARNANT TEMPERATURE MONITORING SYSTEM	12
2.4	TEMPTRAX MODEL F RS232 PORT THERMOMETER	13
2.5	SMARTEK SYSTEM	15
2.6	TEMPERATURE MONITORING SYSTEM	16
III	HARDWARE DEVELOPMENT	17
3.0	OVERVIEW	17
3.1	BLOCK DIAGRAM	18
3.1.1	Temperature sensor	18
3.1.2	Desirable characteristics	19
3.2	SILICON TEMPERATURE SENSOR (KTY 10)	21
3.3	AMPLIFIER	25
3.4	ULN2003A	27
3.5	SEVEN-SEGMENT DISPLAY	28
3.6	PARALLEL PORT	30
3.6.1	Advantages of Parallel port	34
3.6.2	Parallel versus serial transmission	34
IV	APPLICATION OF PROGRAM DEVELOPMENT TOOLS	36
4.0	VISUAL BASIC 6.0	36
4.1	VISUAL BASIC'S 6.0 FEATURES	37
4.1.1	Simple	37
4.1.2	Integrated Development Environment (IDE)	38
4.1.3	Speed	38
4.1.4	Assemble Components in Any Language	38
4.1.5	Web Page Development	38
4.1.6	Easier to learn	39
4.1.7	Easier to Debug	39

4.1.8	Create Program More Quickly and Accurately	40
4.1.9	Include Many New Controls	41
4.2	PROCEDURAL, OBJECT ORIENTED AND EVENT DRIVEN	41
4.2.1	Object Model	41
4.2.2	Writing Visual Basic Projects	42
4.2.2.1	The Three-Step Process	42
4.3	MICROSOFT EXCEL	44
4.3.1	Powerful in Analysis	44
4.3.2	E-mail Data without Leaving Excel	44
4.3.3	Share data Online	45
4.3.4	Collaborate with others	45
4.4	PIC MICROCONTROLLER	46
4.4.1	Overview	46
4.4.2	Peripheral Interface Controller (PIC)	47
4.4.2.1	PIC 16C54	47
4.4.2.2	Architectural Overview	48
V	OBSERVATION AND RESULT	51
5.0	OPERATION	51
5.1	PIC OPERATION	54
5.2	TEST AND CALIBRATION	57
5.2.1	Preparation	57
5.2.2	Testing	59
5.2.3	Calibration	60
5.2.4	Results	60
5.2.5	Program screen	64
5.2.6	Program Flow Chart	66
VI	DISCUSSION AND CONCLUSION	68
6.0	DISCUSSION	68
6.1	CONCLUSION	69

REFERENCES	70
APPENDICES	72

LIST OF TABLES

NO.	DESCRIPTIONS	PAGE
3.1	Pin connections to form numbers 0 to F	29
3.2	Addressing for parallel port	32
3.3	Pin Assignments of the D-Type 25 pin parallel port connector	33
3.4	Parallel versus serial port system	35
4.1	Pinout description of PIC 16C54	50
5.1	Results when set the minimum temperature	61
5.2	Results when set the maximum temperature	62

LIST OF FIGURES

NO.	DESCRIPTIONS	PAGE
1.1	Project workflow	5
2.1	ThermaViewer product	9
2.2	ThermaViewer LCD display	10
2.3	(a) Temperature data on computer	11
	(b) Temp/RH data on computer	11
	(c) Printed chart	11
2.4	Benchtop thermometer	12
2.5	Wall-mount thermometer	13
2.6	TempTrax product	14
2.7	TMS-2 SmarTek System	15
3.1	Block diagram for Temperature Monitoring System	18
3.2	Silicon Temperature Sensor in TO-92 modified packaging	21
3.3	Schematic drawing for TO-92 modified packaging	22
3.4	Resistance R_T versus temperature T_A	23
3.5	Resistance R_T versus temperature T_A	24
3.6	The linearity of thermistors and silicon temperature sensors	25

3.7	Pinout of the CA3160E BiMOS operational amplifier	26
3.8	Block diagram of CA3160E operational amplifier	26
3.9	Top view of ULN2003A package	27
3.10	The logic diagram for ULN2003A package	27
3.11	Seven-segment display	28
3.12	25-way female D-Type connector	31
4.1	Pins diagram of PIC 16C54	48
4.2	PIC 16C5X series block diagram	49
5.1	Schematic diagram	53
5.2	PIC operation flow chart	55&56
5.3	Sensor connections	58
5.4	Twisted wires	58
5.5	Shrinking tube to cover the copper wire	58
5.6	Voltage measured across R2 and R7 versus temperature (for minimum temperature setting)	61
5.7	Voltage measured across R2 and R7 versus temperature (for maximum temperature setting)	62
5.8	Hardware assembly	63
5.9	Complete project with casing assembly	63
5.10	Connections of project while doing testing	64
5.11	GUI for Temperature Monitoring System	65
5.12	GUI when running the program	66
5.13	Visual Basic program flow chart	67

LIST OF ABBREVIATIONS

PIC	-	Peripheral Interface Controller
IDE	-	Integrated Development Environment
LAN	-	Local Area Network
AM	-	Amplitude Modulation
FM	-	Frequency Modulation
EPP	-	Enhanced Parallel Port
ECP	-	Enhanced Capabilities Mode
SPP	-	Standard Parallel Port
PC	-	Personal Computer

LIST OF APPENDICES

NO.	DESCRIPTIONS	PAGE
A	Source Code For Form 1	74
B	Source Code For Module	81
C	Datasheet KTY 10-7	82
D	Datasheet ULN2003A	89
E	Datasheet CA3160	93
F	Datasheet PIC 16C54	96
G	List Of Components Used	104

CHAPTER I

INTRODUCTION

1.0 BACKGROUND

Electronic systems are like the humans body. This is because their temperature needs to be measured at regular intervals. However, measurement alone is usually insufficient. The temperature reading must be interpreted properly and processed so that, the appropriate actions can be taken to counteract the unwanted temperature change.

There are an abundance of applications where temperature must be monitored and controlled including personal computers, automobiles, medical equipment, biotechnology laboratory etc. Therefore, Temperature Monitoring System is developed to solve some problems within all these. This is because, this project can be used to monitor the temperature reading by using two methods which is using seven-segment display and through computer monitoring.

This project is divided into two major parts; hardware and software. Hardware parts including the electronic circuit while the software part including the program which is writing using the Visual Basic 6.0 programming language. These two parts will be combined by using parallel port interfacing connection to make a complete system. This report will divided into seven chapters which is introduction, literature review,

project methodology, application of program development tools, hardware development, observation and result, and discussion and conclusion.

1.1 PROJECT OBJECTIVES AND SCOPE OF WORK

This chapter will discuss about the objectives of the project, scope of work which is including in this project, problem statements, and a brief about the methodology of doing this project.

1.1.1 Project Objectives

The objectives of this project is to develop the Temperature Monitoring System which is able to sense the temperature by using silicon temperature sensor (KTY-10) or semiconductor temperature sensor and monitor the output through the seven-segment display. The data also will be interfaced to the computer using parallel port connection to monitor the temperature data which is analyzed through a software developed using the Visual Basic programming language.

1.1.2 Scope of Work

There are many kinds of method that can be used to develop this system but for this project, the scopes of work are describes as follow:

- i) Design and develop an electronic circuit to sense the temperature. The output of this circuit can be monitored using seven-segment display.
- ii) Using the Visual Basic programming language to develop software to interface data from the output of PIC microcontroller to the computer by using parallel port connection.
- iii) Using Microsoft Excel spreadsheet as the database to record the temperature data from electronic circuit (hardware).
- iv) Record and plot the data into real-time graph.

1.2 PROBLEM STATEMENTS

As we know, there are many kinds of methods that can be used to measure temperature. The past few years ago, temperature is measured using a traditional method such as the thermometer application which is required low-cost. This method is popular because it is simple and easy to implement but there are many disadvantages by using this method. The temperature reading is not very accurate. This is because the people whose get the data may cause reading error (parallax). By using this method, it is also difficult to analyze the data because the data maybe recorded into the piece of paper which is difficult to transfer it into graph for analyzing. This method also limited to some applications. For example, if the

thermometer is placed in the hot or hazardous environment such as in the latex industries or power plant, it is not suitable for people to get the data manually.

Nowadays, there are many ways to measure the temperature such as by using digital thermometer, temperature sensor, temperature recorders and so on. The conventional method becomes not as popular as before. This is because, the modern method used more accurate, have a wide range of applications, easy to implement and also use the latest technology. Even though there are many advantages of this method, but it is quite expensive and required high-cost to develop. This is because it is required many systems which is combined to make one complete system.

Therefore, software applications become more popular to overcome this problem. In addition, it is a solution for temperature monitoring, recording and alerting system. Since there are many industries implement the temperature measurement system such as in power plant requirement, PETRONAS, biotechnology industries, and even in server room applications, therefore this project is developed to fulfill this requirement. This project also developed to overcome such problems occurred when using conventional and modern method. This is because it's required low-cost but the application is quite similar to the modern technology. So, it can reduce development cost for industries. It is also can rapidly analyze the result and display through computer and seven segment display. In addition, it is a combination between conventional and modern technology.

1.3 PROJECT METHODOLOGY

For this project, there are some procedures and methods will be used to produce a complete Temperature Monitoring System. The project workflow is described as follows:

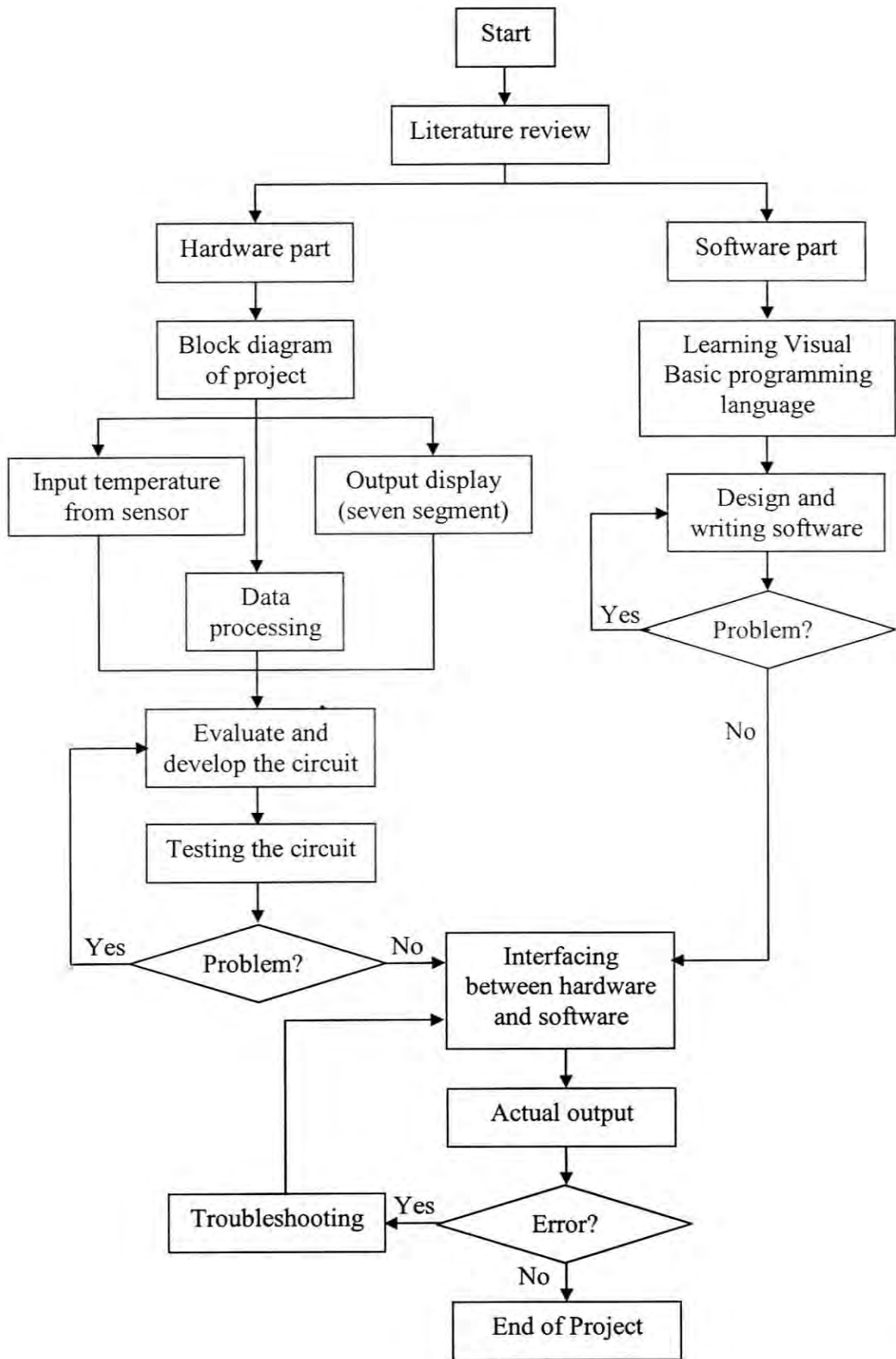


Figure 1.1: Project workflow.

1.3.1 Workflow Description

The project is started with literature review about the same project before. This project is divided into two major parts; hardware and software. In the hardware part, the circuit is grouped into the block diagram which contains input from sensor, data processing and output display to seven-segment.

Input is get from the Silicon Temperature Sensor and will be processed into PIC microcontroller (16C54). The output of this PIC will be as the input to the IC of high-voltage high-current Darlington transistor arrays (ULN2003A). This is to increase the voltage output from PIC to drive the seven-segment display. Seven-segment will display the temperature data measurement.

Then, continue with the project development. The completed electronic circuit is tested and calibrated to make sure whether it well functions or not. If there is an error, the circuit should be troubleshoot and solve the problems. The hardware part is now ready to interface with the software part.

For the second part; software, Visual Basic 6.0 programming language is learned before any designing and program development can be done. After that, the program required is planned and designed into the Visual Basic form. The program then is simulated to check whether there is an error or not with the program code. If there is an error, it is supposedly to identify and solve for the error. Testing is done until the program is completely functioned. Now, the software part is ready for interfacing.

The final part of this project is to make the interfacing between hardware and software part. This is used parallel port (DB25 way) as the interfacing medium. The connection between hardware and software will be tested. This is to confirm the interfacing circuit functions as per requirement. If there is an error occurs while testing the circuit, this is should be troubleshoot and solve as soon as possible and doing the testing again. Finally, if there is no error occurs during the interfacing, the

system is just complete and ready for any application which it can support. The project is ending.