

PORTABLE WATER LEVEL INDICATOR

MUHAMMAD SYAFIQ BIN YUSUF

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

Fakulti Kejuruteraan Elektronik dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka

June 2013



UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN KOMPUTER

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : PORTABLE WATER LEVEL INDICATOR
Sesi Pengajian : 2012 / 2013

Saya MUHAMMAD SYAFIQ BIN YUSUF
(HURUF BESAR)

mengaku membenarkan Laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan () :

SULIT*

*(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD**

***(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:

(TANDATANGAN PENULIS)

Alamat Tetap: LB 16 KAMPUNG PARIT BANGAS
SERI MEDAN 83400
BATU PAHAT
JOHOR

(COP DAN TANDATANGAN PENYELIA)
Engr. Siti Fatimah Binti Sulaiman
Pensyarah

Fakulti Kejuruteraan Elektronik Dan Kejuruteraan Komputer
Universiti Teknikal Malaysia Melaka (UTeM)
Hang Tuah Jaya
76100 Durian Tunggal, Melaka

Tarikh: 23 MEI 2013

Tarikh: 23 MEI 2013

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

Signature :

Author : Muhammad Syafiq Bin Yusuf

Date : May 23, 2013

“I hereby declare that I have read this report and in my opinion this report is sufficient in terms of the scope and quality for the award of Bachelor Degree of Electronic Engineering (Industrial Electronic)”

Signature :

Supervisor's Name : Engr. Siti Fatimah Binti Sulaiman

Date : May 23, 2013

Dedicated to my parents, my siblings and also my colleagues and friends who have been supporting me all the time.

ACKNOWLEDGEMENT

It's grateful to Allah S.W.T because with His blessing, I am able solve my problems. I am also thankful for my parent for their support, help, and guidance through all this long process.

I would like to acknowledge and thank my project supervisor, Engr. Siti Fatimah binti Sulaiman. She has supervised her student's very excellent. I am indebted to her. Without her help and support, this thesis would not have been presented here.

ABSTRACT

One of the most common natural disasters that hit our country is flood. Many lives have perished in this hazardous natural disaster. Early precaution and safety measures can be taken if in anyway the people can be warn about the incoming flood. Most of those who died in these floods did not aware about the water accumulating outside their house and when they finally realize about the situation, it was too late for them to do anything. The purpose of this study is to develop “A Portable Water Level Indicator” that can be used at home to detect the level of water outside the house and the level of the river depth. Extensive simulations using software were performed and the solution to the flood problem is proposed. Evaluation is based on i) the needs of the user, ii) the cost of production, iii) the portability of the alarm, and iv) the types of output that can be used to warn the user about the flood. Research done on the water level indicator shows that a portable type is more convenient for the users rather than a permanent placed water level indicator because the users can know about the status of the level of water from anywhere inside the house. It was found that basic features for a water level indicator such as sensors, buzzer, Light Emitting Diode (LED), and Liquid Crystal Display (LCD). This method show a significant improvement in safety, reliability and user friendliness of the alarm compared to the other alternative methods. The findings also suggest that the water alarm should be easy to maintain, easy to use, and the most importantly can warn the users.

ABSTRAK

Salah satu bencana alam yang sering kali melanda negara kita ialah banjir. Banyak nyawa dan harta benda yang terkorban dalam bencana alam yang dahsyat ini. Langkah-langkah keselamatan dan berjaga-jaga boleh diambil agar para penduduk dapat mengetahui keadaan semasa ketika berlakunya banjir. Kebanyakan daripada mereka yang terkorban dalam musibah ini adalah disebabkan oleh ketidaksedaran mereka mengenai bencana yang akan melanda ini dan apabila mereka menyedari keadaan ini, ianya sudah terlambat. Tujuan kajian ini adalah untuk menghasilkan sebuah “Pengukur Air Mudah Alih” yang boleh digunakan untuk mengukur ketinggian air di luar kawasan rumah dan paras kedalaman sungai semasa berlakunya banjir. Kajian mendalam menggunakan perisian komputer telah dilakukan dan langkah penyelesaian untuk masalah banjir ini telah dicadangkan. Kajian yang dilakukan adalah berdasarkan i) keperluan pengguna, ii) kos penghasilan projek, iii) kemudahan alihan projek, dan iv) jenis penggera yang digunakan untuk memberi amaran kepada pengguna. Kajian yang telah dijalankan menunjukkan penggera air mudah alih adalah lebih sesuai untuk kegunaan orang ramai berbanding dengan penggera air yang tetap. Keperluan asas sebuah penggera air seperti Paparan Kristal Cecair (LCD), Diod Pemancar Cahaya (LED), pengera, dan pengesan air dengan penggunaan bateri adalah langkah terbaik dalam penghasilan projek ini. Kaedah ini menunjukkan penambahbaikan dari segi keselamatan dan ianya lebih mudah digunakan berbanding dengan kaedah lain.

TABLE OF CONTENTS

CHAPTER	TITLE	PAGE
	PROJECT TITLE	i
	DECLARATION	ii
	SUPERVISOR'S DECLARATION	iii
	DEDICATION	iv
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF FIGURES	xi
	LIST OF TABLES	xiii
	LIST OF ABBREVIATIONS	xiv
	LIST OF APPENDICES	xv
I	INTRODUCTION	
	1.1 PROJECT BACKGROUND	1
	1.2 PROBLEM STATEMENT	2
	1.3 PROJECT OBJECTIVE	2
	1.4 SCOPE OF PROJECT	3
	1.5 METHODOLOGY	4
	1.6 THESIS OUTLINE	4

II LITERATURE REVIEW

2.1	VOLTAGE REGULATOR	6
2.2	POWER SUPPLY CIRCUIT	7
2.3	SENSING OF WATER	8
2.4	TRANSMISSION AND RECEPTION	9
2.5	PIC MICROCONTROLLER	11
2.6	CRYSTAL OSCILLATOR	12
2.7	LIGHT EMITTING DIODE (LED)	13
2.8	BUZZER	14
2.9	RELAY	15
2.10	DIODE	15
2.11	CAPACITOR	16
2.12	PROJECT OUTPUT	17
2.13	OVERALL OPERATION	19

III METHODOLOGY

3.1	INTRODUCTION	20
3.2	FLOW CHART FOR PROJECT DEVELOPMENT	21
3.3	FLOW CHART FOR HARDWARE DEVELOPMENT	23
3.4	FLOW CHART FOR SOFTWARE DEVELOPMENT	25
3.5	PIC16F877A	26
3.6	WIRELESS SYSTEM MODULE	28
3.7	PROJECT SCHEDULE	29

IV	RESULT AND DISCUSSION	
4.1	CIRCUIT CONSTRUCTION	30
4.2	CONSTRUCT THE PRINTED CIRCUIT BOARD (PCB) USING PROTEUS	32
4.2.1	Circuit PIC16F877A	32
4.2.2	Circuit Transmitter	34
4.2.3	Circuit Receiver	35
4.3	BUILD THE PRINTED CIRCUIT BOARD (PCB)	36
4.3.1	Printing The Circuit Layout	36
4.3.2	Expose	36
4.3.3	Develop	37
4.3.4	Etching	37
4.3.5	Drilling	38
4.4	RESULT	38
V	CONCLUSION AND RECOMMENDATION	
5.1	CONCLUSION	42
5.2	RECOMMENDATION	43
	REFERENCES	44
	APPENDICES	45

LIST OF FIGURES

NO.	TITLE	PAGE
1.1	Block diagram for Portable Water Level Indicator	3
2.1	IC LM7805	7
2.2	Power supply circuit	7
2.3	Conductor and insulators	9
2.4	Radio Frequency module	10
2.5	PIC microcontroller pin	11
2.6	PIC16F877A	12
2.7	Crystal Oscillator	13
2.8	Light Emitting Diode (LED)	14
2.9	Buzzer	14
2.10	Relay	15
2.11	Diode	16
2.12	Type of capacitor	16
3.1	Flow chart for project development	21
3.2	Flow chart for water sensor operation	23
3.3	Flow chart for output operation	24
3.4	Programming flow chart	25
3.5	Block diagram of PIC16F877A	26
3.6	Wireless system module	28
3.7	Gantt chart of project planning	29

4.1	Transmitter circuit on breadboard	31
4.2	Receiver circuit on breadboard	31
4.3	PIC microcontroller circuit on ISIS	32
4.4	PIC microcontroller circuit on ARES	33
4.5	PIC microcontroller circuit PCB layout	33
4.6	Transmitter circuit on ARES	34
4.7	Transmitter circuit PCB layout	34
4.8	Receiver circuit on ARES	35
4.9	Receiver circuit on PCB layout	35
4.10	Transmitter and receiver circuit printing layout	36
4.11	Ultra Violet machine	36
4.12	Develop machine	37
4.13	Etching machine	37
4.14	Drilling activity	38
4.15	Transmitter PCB view from top	39
4.16	Receiver PCB view from top	39
4.17	Circuit PIC microcontroller view from top	40
4.18	Portable water level indicator front view	40

LIST OF TABLES

NO.	TITLE	PAGE
2.1	Function each components in power supply circuit	8
2.2	List output project consist	17
2.3	Standard LCD character table	18
3.1	PIC16F877A pin assignment	27
4.1	Stage of output condition	41

LIST OF ABBREVIATIONS

PIC	-	Programmable Integrated Circuit
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
RF	-	Radio Frequency
TX	-	Transmitter
RX	-	Receiver
AM	-	Amplitude Modulation
FM	-	Frequency Modulation
A/D	-	Analog to Digital Converter
WTD	-	Watchdog Timer
DC	-	Direct Current
PCB	-	Printed Circuit Board
IC	-	Integrated Circuit

LIST OF APPENDICES

NO.	TITLE	PAGE
A	PIC Microcontroller Pin	45
B	HT12 Encoder Pin	46
C	HT12 Decoder Pin	47
D	Pin Radio Frequency Module	48
E	Coding Code using CCS C-Compiler	49

CHAPTER I

INTRODUCTION

This chapter consists of background study, objective, problem statement, scope of project, and methodology.

1.1 Project Background

Our country has two kinds of seasons. There are drought season and rainy season [1][2]. The rainy season might destroy human lives and things that are valuable to us. It happens when the water level increase to the danger level under controlled.

Flood is the most frequent that occur in our country, Malaysia. Often, we heard about flood from television, newspaper, radio and many more where this disaster causes a lot of damage in term of property and life. This loss can be reduced and avoided if the first move was made before it happened. There are many factors that causing the flood. The factors can be divided into two categories, natural phenomena and human activities [3].

The natural phenomena such as heavy rainfall are the main factor that causing flood. The human factor is also the major problem that contributing flood. The human factor that caused the flood situation comes from uncontrolled development, effect of urbanization, inadequate drainage infrastructure, obstruction in the river by solid waste and garbage and development of flood plains [4][5]. Most of the victim of flood did not realize when the flood happened because the flood is unexpected phenomena if the public do not alert with the current situation of surroundings and weather.

1.2 Problem Statement

Flood in Malaysia are regular natural disaster which happen nearly every year during the monsoon season. Most floods that occur are a natural result of cyclical monsoon during the tropical wet seasons that are characteristic by heavy and regular rainfall. That is the major cause of flooding in Malaysia. Other than that, this flood problem is probability occur to residents whose lives at flooding area [6].

In fact, it is become dangerous to whole resident in the area especially to children and sometime cause death. Besides, it will cause big detriment such as assets destroyed, maintenance cost for electrical equipment and so on. It is also contribute traffic jam for closing the main road where the flood reached at high level. Hence, to avoid this problem, one project namely “Portable Water Level Indicator” will detect level of water (flood), thus preventing the water level to be more serious.

1.3 Project Objective

The main objective for this project is to develop a low-cost portable water level indicator using PIC microcontroller with LCD output, buzzer and LED indicators for water level.

The aim of the portable water level indicator is to sense the accumulating water outside the house and the river depth. At the same time, the alarm will alert the user about the water level by using LCD and LED indicators. A buzzer will sound when the water level reaches a critical level determined by the user.

The height of water that will be displayed by the LCD can be changed accordingly to the user's need. The LED indicators will light up one by one according to the level of the water that is accumulating outside the house. Figure 1.1 shows the block diagram of portable water level indicator.

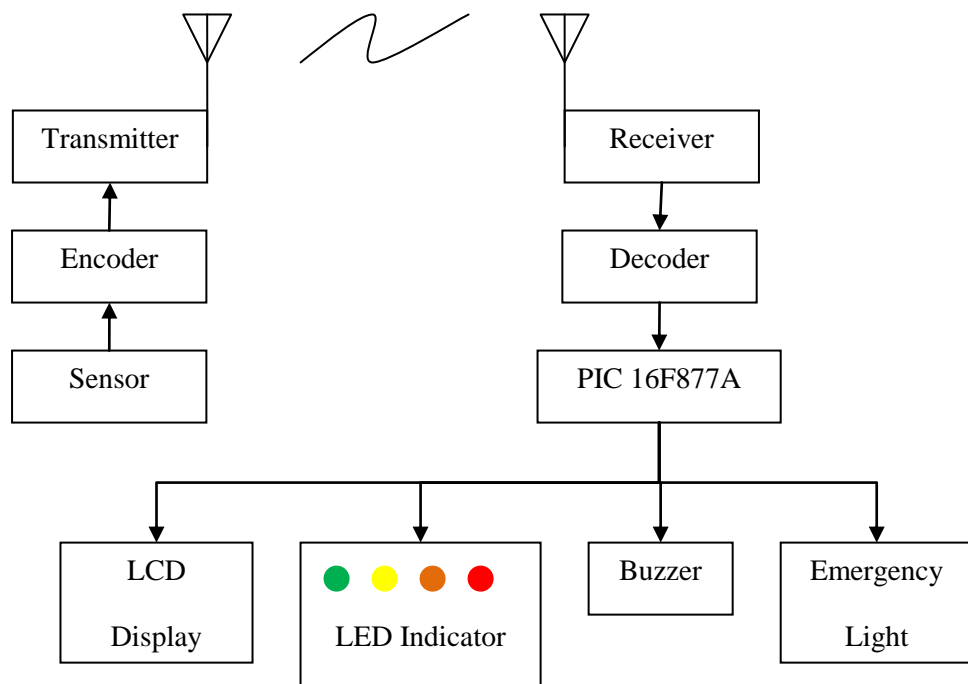


Figure 1.1: Block Diagram for Portable Water Level Indicator

1.4 Scope of Project

The scope of this chapter has been identified and it way divided into three parts which are:

- i) Transmission of signal
Relate the used of Radio Frequency (RF) to the sensor, LCD, LED, buzzer, and emergency lights.
- ii) Program code
Design a program code using Programmable Integrated Circuit (PIC) microcontroller that will control the whole system's operation.
- iii) Hardware and software
Design and test circuit using PROTEUS and compile coding using C-programmer.

1.5 Methodology

There are several methods to achieve the objectives. Firstly, literature research the RF communication and PIC microcontroller. Secondly, understand the function of each component to be used in the production, type of material use and improvement of this project. Lastly, collect the information based on the simulation of the designed circuit using PROTEUS and MULTISIM software.

1.6 Thesis Outline

The first chapter for this report is introduction. In introduction, it will have a few of sub-topics, which are background study, objective, problem statement, scope of project, and methodology. In project background it will roughly story about flood detector and application from this chapter. In the problem statement sub-topic it will be explained what was the problems found in this flood disaster will be explained. After that, the purpose of this project will be explained more clearly in objective part. In order to achieve the objective of this project some scope of work has been determined and described clearly in sub chapter of scope of work.

Second chapter for this report is literature review. This chapter is divided into a few of sub chapter that will explain everything related to the flood detector, radio frequency and also previous work or design from other researchers. The basic concept and the principle of this metamaterial part will be show in this chapter.

Next chapter is methodology part. This part will explain about some of the guidelines for this project and also clearly mentioned steps that should be taken for this project. It show the step to achieve the main objective in this report.

The fourth chapter is the result and discussion. This part will cover about the results obtained for this project, and also discuss the results obtained. The result will be simulated using MULTISIM and PROTEUS software.

The last chapter for this report is conclusion. In this part, the achievement of project objectives will be concluded. Some recommendation will be shown in this chapter and for future improvement.

CHAPTER II

LITERATURE REVIEW

In this chapter, the overview of several fields that is involved in this report will be discussed. Design and building a portable water level indicator requires high knowledge of the input volatage supply to circuit a portable water sensor; water sensing ability, communication protocols, alarm output and others. This chapter discusses elaborately the system designs as they have been implemented in the final system design.

2.1 Voltage Regulator

In this project, all components used 5V Direct Current (DC). Therefore, in order to supply this voltage to the components, we need a regulator circuit to step down the voltage source like 9V alkaline battery to 5V DC. Since the regulator Integrated Circuit (IC) is cheap and easily available, the regulator IC 7805 is used in this project. The Figure 2.1 shows the IC LM7805.

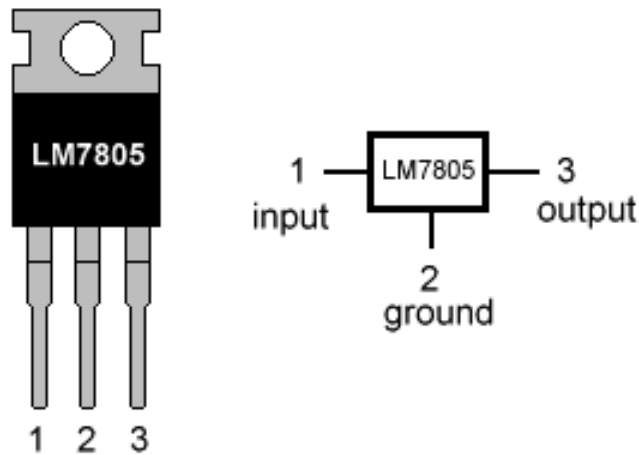


Figure 2.1: IC LM7805

2.2 Power Supply Circuit

Power supply circuit is the most importance circuit to make sure the overall component can be function. In this project, voltage source come from the 9V battery, LM7805 (1A maximum) will regulate the given voltage to 5V for supplying power to the PIC 16F877A, diode UF4001 is used in this circuit to protect the circuit if the connection for voltage source in wrong polarity. The capacitors are used to stabilize the voltage input and output of the LM7805. Figure 2.2 shows the power supply circuit and description for each components in power supply is shown in Table 2.1.

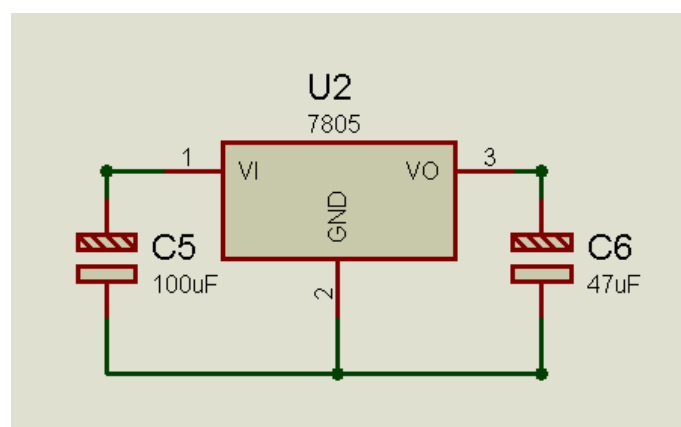


Figure 2.2: Power Supply Circuit

Table 2.1: Function Each Component in Power Supply Circuit.

Component	Function
Voltage Regulator (LM7805)	Regulate the input voltage from 9V to 5V to supply PIC16F877A and pull-up the push button (input).
Diode (UF4001)	Protection to circuit in case polarity of the power supply is incorrect.
Capacitor	Stabilize the voltage input and output of the LM7805.

2.3 Sensing of Water

The sensors used in this project are made of conductors with high conductivity. Conductivity is the measure of the ease at which an electric charge or heat can pass through a material. A conductor is a material which gives very little resistance to the flow of an electric current or thermal energy. Materials are classified as metals, semiconductors, and insulators. Metals are the most conductive conductors and insulators (ceramics, wood, plastics and etc) the least conductive. Figure 2.3 show a commonly conductor and insulator used.