

DESIGN AND DEVELOPMENT OF A WIRELESS WATER LEVEL MEASURING
AND NOTIFICATION SYSTEM

MOHD IZUDDIN BIN ZAKARIA

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Faculty of Electronic Engineering and Computer Engineering
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UNIVERSITI TEKNIKAL MALAYSIA MELAKA
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BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek: DESIGN AND DEVELOPMENT OF A WIRELESS MONITORING WATER LEVEL MEASURING AND NOTIFICATION SYSTEM

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Signature :

Supervisor’s name : Dr. Amat Amir bin Basri

Date :

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Signature :

Student's name : Mohd Izuddin bin Zakaria

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This thesis is dedicated to

My family for their supports
and guide me throughout my academic career

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ABSTRACT

This research has been done to improve the performance of monitoring system by introducing communication device to notify user the situation or condition of monitoring system. This will improve productivity of the system by reducing human effort and introduce human to technology nowadays. For this project, GSM modem which is a modem that allow a SIM card to allow it work like mobile operator such a phone is introduce as communication device to deliver the information from monitoring system to user via SMS. GSM is a multitasking modem that can deliver message, receive message and store message. GSM modem can be connected using USB or Bluetooth but Bluetooth only cover in short range. GSM modem developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) cellular networks used by mobile phones, first deployed in Finland in December 1991. GSM networks operate different number of carrier frequency ranges with most 2G GSM networks operating in the 900 MHz or 1800 MHz bands. Where these bands were already allocated, the 850 MHz and 1900 MHz bands were used instead. In rare cases the 400 and 450 MHz frequency bands are assigned in some countries because they were previously used for first-generation systems. So, GSM modem advance technology that always improved by time.

ABSTRAK

Kajian ini telah dilakukan untuk meningkatkan prestasi sistem pemantauan dengan memperkenalkan alat komunikasi untuk memberitahu pengguna situasi atau keadaan sistem pemantauan. Ini akan meningkatkan produktiviti sistem dengan mengurangkan usaha manusia dan memperkenalkan manusia kepada teknologi masa kini. Untuk projek ini, *GSM* modem yang merupakan modem yang membenarkan kad *SIM* untuk membolehkan ia berfungsi seperti pengendali mudah alih seperti telefon adalah sebagai alat komunikasi untuk menyampaikan maklumat dari sistem pemantauan kepada pengguna melalui *SMS*. *GSM* ialah modem multitask yang boleh menyampaikan mesej, menerima mesej dan menyimpan mesej. *GSM* modem boleh disambungkan menggunakan *USB* atau *Bluetooth* tetapi *Bluetooth* hanya meliputi dalam jarak dekat. *GSM* modem yang diperkenalkan oleh *European Telecommunications Standards Institute* (ETSI) untuk menerangkan protokol generasi kedua (2G) rangkaian selular yang digunakan oleh telefon bimbit, pertama digunakan di Finland pada Disember 1991. Rangkaian *GSM* berikut mempunyai perbezaan frekuensi pembawa antara dengan kebanyakan 2G rangkaian *GSM* yang beroperasi di 900 MHz atau 1800 MHz jalur. Di mana *band* ini memperuntukkan, 850 MHz dan 1900 MHz band telah digunakan. Dalam kes-kes yang jarang berlaku 400 dan 450 jalur frekuensi MHz ditugaskan di beberapa negara kerana mereka sebelum ini digunakan untuk sistem generasi pertama. Jadi, *GSM* teknologi modem merupakan teknologi yang selalu berkembang dengan masa.

TABLE OF CONTENTS

CONTENTS	PAGE
PROJECT TITLE	ii
SUPERVISOR DECLARATION.....	iii
STUDENT DECLARATION.....	iv
DEDICATION.....	v
ACKNOWLEDGEMENT.....	vi
ABSTRACT.....	vii
ABSTRAK.....	viii
TABLE OF CONTENTS.....	ix
LIST OF FIGURES.....	xiii
LIST OF TABLES.....	xv
LIST OF ABBREVIATIONS.....	xvi

CHAPTER 1: INTRODUCTION

1.1 Project background.....	1
1.2 Objective.....	2
1.3 Problem statement.....	2
1.4 Scope of project.....	3
1.5 Report organization.....	3
1.6 Conclusion.....	4

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction.....	5
2.2 Research background.....	6
2.2.1 Sensor.....	6
2.2.2 Microcontroller.....	8
2.2.3 Wireless communication device.....	9
2.3 Analysis.....	10
2.3.1 Limitation.....	10
2.4 Conclusion.....	11

CHAPTER 3: METHODOLOGY

3.1 Introduction.....	12
3.2 Project flowchart.....	12
3.3 Software development.....	14
3.3.1 Arduino Uno compiler.....	15
3.3.2 Proteus 8.....	17
3.3.3 Software flowchart.....	19
3.3.3.1 Arduino Uno.....	20
3.3.3.2 Proteus 8.....	21
3.4 Hardware development.....	22
3.4.1 Ultrasonic sensor.....	22
3.4.2 LEDs and buzzer.....	22
3.4.3 LCD display.....	23
3.4.4 Microcontroller.....	23
3.4.5 GSM modem.....	24

3.4.6 Hardware flowchart.....	24
3.5 Prototype.....	25
3.5.1 PCB fabrication.....	27
3.5.1.1 Image transfer.....	28
3.5.1.2 Exposing and developing resist layer.....	29
3.5.1.3 Etching process.....	29
3.5.1.4 Electroplating process.....	30
3.5.1.5 Drilling printed circuit.....	31
3.5.1.6 Soldering.....	31
3.6 Conclusion.....	32

CHAPTER 4: RESULT AND DISCUSSION

4.1 Introduction.....	33
4.2 Block diagram.....	34
4.3 Software design.....	34
4.3.1 Arduino Uno.....	34
4.3.2 Proteus 8.....	37
4.4 Hardware design.....	39
4.5 Analysis.....	41
4.6 Discussion.....	42
4.7 Conclusion.....	42

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.1 Conclusion.....	43
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5.2 Recommendation.....44

REFERENCES.....45

APENDIX A

APENDIX B

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
2.1	Ultrasonic sensor level transmitter	6
2.2	Pulse module timing diagram	7
2.3	Theoretical equation	7
2.4	Arduino Uno	8
2.5	GSM modem	9
3.1	Project flowchart	13
3.2	USB port setting	17
3.3	Component selection	18
3.4	Uploading coding to microcontroller in simulation	18
3.5	Example PCB layout	19
3.6	Coding development flowchart	20
3.7	Simulation flowchart	21
3.8	Hardware development flowchart	24
3.9	Prototype front view	26
3.10	Prototype upper view	26
3.11	Control box components	27
3.12	Project PCB layout	28
3.13	Printed schematic	29

3.14	Interface circuit layout	30
3.15	Soldered interface circuit	31
4.1	Block diagram	34
4.2(a-f)	Coding system	35
4.3	Simulation circuit	38
4.4	Interface circuit PCB layout	38
4.5	Start-up system	39
4.6	First condition	40
4.7	Second condition	40
4.8	Third condition	41

LIST OF TABLES

TABLE NO.	TITLE	PAGE
3.1	Example Arduino library	15
4.1	Condition water level	39
4.2	Analysis of the system	41

LIST OF ABBREVIATIONS

ETSI	European Telecommunications Standards Institute
2G	Second Generation
LED	Light Emitting Diode
GSM	Global System for Mobile
CDMA	Code Division Multiple Access
SMS	Short Message Service
USB	Universal Serial Bus
SIM	Subscriber Identity Module
LCD	Liquid Crystal Display
PIC	Programmable Integrated Circuit
PCB	Printed circuit board
GPS	Global Positioning System
UV	Ultraviolet
DC	Direct Current
M	Mega
K	Kilo
Hz	Hertz
V	Voltage
cm	centimeter
mm	millimeter
us	microsecond

CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Wireless water level measuring system and notification system is a system to detect water level and allow user to interact with system to get the condition of water level in a container. This system required a suitable sensor to detect the surface of water to measure its distance. To perform this, a non-contact distance measurement sensor will be used to detect surface of water level. Then sensor will detect several stage of water level by using a microcontroller as control circuit.

A program is construct to control circuit for performing the sensor to detect 3 stage of water level then LED display will display the measurement. LEDs and buzzer are introduce to indicate the water level to user under a program from control circuit. Then information from control circuit will directly connected to GSM modem.

The information will transfer to GSM modem for further action. From GSM modem, a sim card will use to create a wireless communication device so that it will transmit the information from control circuit via short message service (SMS). User also can send message directly to GSM modem to ask the information for water level.

1.2 OBJECTIVE

To overcome this, there were few objectives to complete:

- i. To construct and study the application to monitoring water level
- ii. To study and analyze the ability of GSM modem
- iii. To design and develop wireless notification system

1.3 PROBLEM STATEMENT

Monitoring system is not a new invention, Problem happen with current system is information cannot be transfer to user directly. So, suitable way to overcome this problem is using GSM modem. There are several type of way to connect GSM modem etc. Bluetooth and USB. But this project will use a SIM card to create a wireless communication device to connect to cell phone.

GSM modem act as wireless communication device to transmit data. It is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. It can send information via SMS. From this, a wireless notification system can be created by using GSM modem.

1.4 SCOPE OF PROJECT

The sensor will be choose by analyse several type of water sensor. This sensor need to detect water so it need to be fit with the environment because water is liquid. Suitable sensor was identified and give satisfactory result. Then, construct a control circuit to make the sensor detect 3 stage of water level. Control circuit is the main of the system and take care all of the system.

To develop this, a microcontroller is used for control circuit. Microcontroller perform using C++ language to activate the sensor. So, a microcontroller compiler will be utilized to create the program. Then build connection from control circuit to communication device to transfer the information. GSM modem will take part as a communication device.

1.5 REPORT ORGANISATION

This report is represented in 5 chapters. Chapter 1 focuses on brief introduction of the project carried. The important overview or description including problem statement, project objective and project scopes are also explained in this chapter.

In Chapter 2 is based on literature review of the project. It is mainly focused on the review of previous project that have done. Some analysis is done to identify the progression and method that has been used for the previous project.

Chapter 3 will explain on the concepts, theories and principles used in order to complete the project. This part consists of the methodology and also the information on research and experiment during the project development.

In Chapter 4, the preliminary result and discussion are included in this chapter to explain the result that has been achieved after did hardware and software implementation.

In Chapter 5, the conclusion and recommendation of future work are discussed. All chapters are summarized and recommendations are given for a better result in future work.

1.6 CONCLUSION

In conclusion, this system is considered as a good project to be developed where it make user can interact with system easily. In addition, this system also easy to handle and it more advance than normal system since user can get the information directly without in touch with the system. The next chapter is about literature review of famous and reliable techniques.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A literature review is an evaluative report of information which related to Wireless water level measuring system and notification system. This chapter will give a detailed description about what have been published on some topics by scholars and researchers. The main purpose of writing this literature review is to gets knows knowledge and ideas that have been established about the system that focusing sensor will be used to detect the surface of water level. It also will show the strength and weakness of the system.

Besides that, there are resources on the topic of monitoring system have been widely published. The information has been collected from different resources such as published documentation, white paper and journals in the web site.

Basically Literature Review is a result after reading, analyzing different types of resources, collecting information from the websites, books and materials. Furthermore, the facts and finding also can based on the major components of the

enhanced system such as backup and recovery, system architecture, circuit design, export and import data and the integrity within the different application.

2.2 RESEARCH BACKGROUND

2.2.1 SENSOR

Ultrasonic sensor is non-contact measurement distance sensor. This sensor used ultrasound pulse beam to measure distance of an object. Ultrasonic sensor consists of two part that is transmitter or transducer and receiver. For this, transmitter is output that will produce ultrasound beam. Ultrasound pulse beam move in the air from transmitter to object and reflect it back to receiver ^[1]. Figure 2.1 show how ultrasonic sensor work.

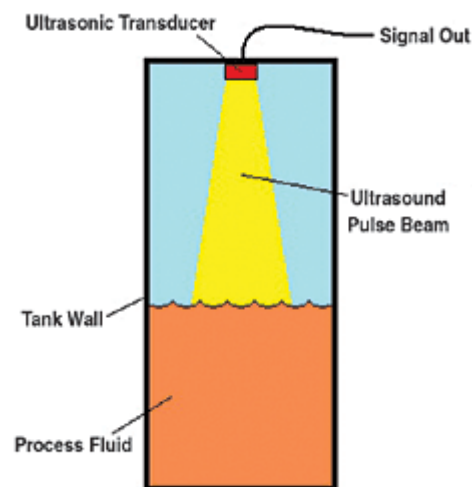


Figure 2.1: Ultrasonic sensor level transmitter

Ultrasonic sensor can cover measurement distance between 2cm to 400cm and it ranging accuracy can reach to 3mm. The pulse works on the natural phenomenon of sound. The pulse is sent for 10us to trigger the module consist of sends 8 cycles of 40 KHz automatically of ultrasound signal. Then signal after reach with an obstacle

reflect back to the receiver [2]. Figure 2.2 show the pulse module send by trig pin at ultrasonic sensor.

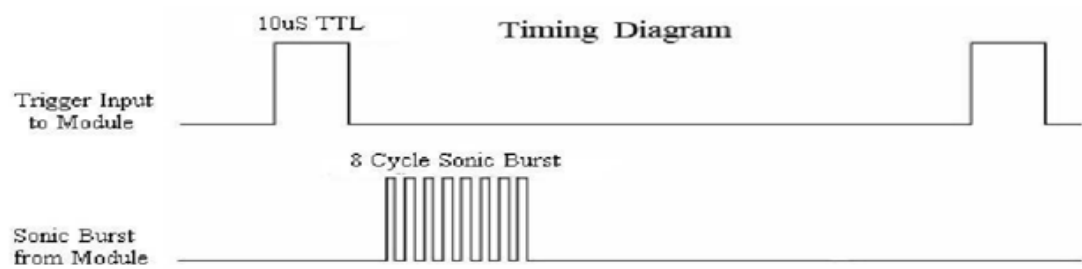


Figure 2.2: Pulse module timing diagram

To perform ultrasonic sensor, theoretical equation must be applied in coding. The calculation for this equation is as Figure 2.3 below.

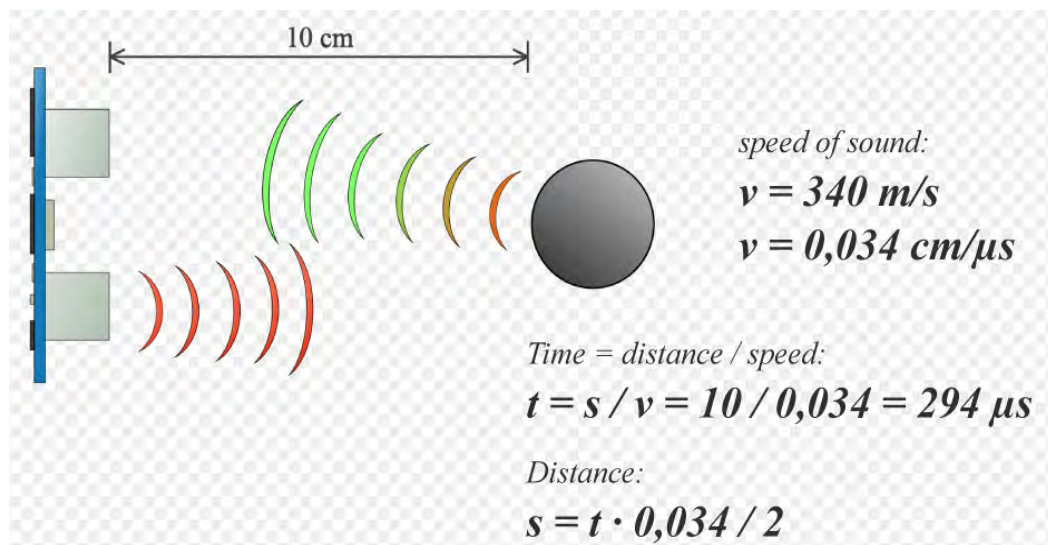


Figure 2.3: Theoretical equation

Time will become the subject to perform the distance measurement for Arduino according to time taken of wave form from receiver and reflect when collapse with object to receiver.

2.2.2 MICROCONTROLLER

For this approach, Arduino is an open source project to interactive objects that can sense and control physical devices micro. Arduino 1st introduced in 2005 that aiming to help user create device to interact with their environment [3]. Arduino is also easy to handle by user, so it is widely used for projects and the language used for coding is simple. Arduino uses C++ language coding but it is different with PIC. Figure 2.4 shows the microcontroller used for this project.



Figure 2.4: Arduino Uno

Arduino Uno also uses an I/O system. Input captures data from the environment using components used by the user, and the output processes the data for further use. The output can control the condition of a component, whether to turn on or turn off, such as an LED or motor. Arduino also consists of analog and digital pins to create an interface for the environment. Compared to Arduino Mega, Arduino Uno has fewer pins but the function is still the same as Mega. This board also includes a Universal Serial Bus (USB) for loading code from a computer [4].