



**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

**DEVELOPMENT WATER BILLING SYSTEM BY USING  
ARDUINO**

This report submitted in accordance with requirement of the Universiti  
Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of  
Engineering Technology (Industrial Electronics) (Hons.)

by

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FACULTY OF ENGINEERING TECHNOLOGY

2017

**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

TAJUK: **Development Water Billing System Using Arduino**

SESI PENGAJIAN: **2017/18 Semester 1**

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## **APPROVAL**

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Industrial Electronic) with Honours. The member of the supervisory is as follow:

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(Ir Mohd Syahrin Amri bin Moohd Noh)

## **ABSTRACT**

Water is precious available natural resource on the earth. However water is considered as the primary need of human beings. Population growth causes uneven distribution of drinking water in cities and need to monitor and control the consuming of water on minimum requirement base so proposed system improve the water supply monitoring and consuming of water for domestic. The available water billing system is tedious and time consuming process. Error in water billing can occur because of human interference. An arduino development board as central console of embedded system, it reads the sensor to monitor the water usage for houses or domestic purpose. The billing of the water usage will be done automatically and the same will be sent to the user using SMS facility. System gives adequate security support as it uses Short Message Service (SMS) service and also gives an accurate water bill as the entire process will be automatic.

## **DEDICATION**

This report is dedicated to my beloved parents who educated and supported me throughout the process of doing this project.

## ACKNOWLEDGEMENT

Final year project is like a bridge between theoretical and practical working. With this willing I joined this particular project. However, this project could not finish without the kind support and help of many individuals and organizations. First of all, I would like to thank the supreme power the Almighty God for gave a good health to me and grace to this project become a reality. I would like to extend my sincere to Mr. Mohd Saad Bin Hamid head of department of JTKEK, for providing me with all the necessary facilities for the lab and research. I am feeling obliged in taking the opportunity to sincerely thanks to Assoc. Professor Mohd Rahimi Bin Yusoff, Dean of the Faculty of Engineering Technology. My special thanks to my worthy Project Supervisor Madam Norain Binti Rahim. I express my thankful for the patient guidance, encouragement and advice she has provided throughout my time as her student. I have been extremely lucky to have a supervisor who cared so much about my work, and who responded to my questions and queries so promptly. I am feeling obliged in taking the opportunity to sincerely thanks to all of the Department faculty members for their help and support. I must express my gratitude to my parent for continued support and encouragement. I also place on record, my sense of gratitude to one and all, who directly or indirectly, have lent their hand in this venture.

## Table of Content

<b>1</b>	<b>INTRODUCTION.....</b>	<b>1</b>
1.1	Introduction .....	1
1.2	Project Background.....	4
1.3	Problem Statement .....	4
1.4	Project Objectives .....	5
1.5	Scope of Project .....	5
<b>2</b>	<b>LITERATURE REVIEW.....</b>	<b>7</b>
2.1	Introduction .....	7
2.2	Previous Project.....	7
2.2.1	Arduino Based Water Billing System for Domestic Purpose.....	8
2.2.2	GSM Water Billing System .....	8
2.2.3	Potable Water Quality Monitoring and Automatic Billing System.....	9
2.2.4	Implementation of GSM Based Water Meter a Step Automation in Billing System.....	9
2.2.5	Design and Implementation of Water Bill Control System Based GSM.....	10
2.2.6	Implementation of Automatic meter reading system using zigBee-Integrated Raspberry Pi,GSM Network .....	10
2.3	Microcontroller Review .....	11
2.3.1	Arduino .....	11
2.3.1.1	Arduino Uno .....	11
2.3.2	8051 Microcontroller .....	13
2.3.3	Raspberry Pi.....	15
2.3.4	Flow water meter .....	17



2.3.5	LCD Display .....	18
2.3.6	Mobile Phone .....	18
2.3.7	Global System for Mobile Phone.....	19
2.4	Software Review .....	20
2.4.1	Arduino IDE.....	20
<b>3</b>	<b>METHODOLOGY.....</b>	<b>22</b>
3.1	Introduction .....	22
3.2	Flow Chart.....	22
3.3	Research Project Concept.....	24
3.3.1	Research on Hardware .....	27
3.3.2	Research on Software .....	27
3.3.3	Design Project.....	27
3.3.4	Hardware requirement .....	28
3.3.5	Implementation .....	29
3.3.5.1	Flow Sensor Interfacing with Arduino .....	29
3.3.5.2	LCD Interfacing.....	30
3.3.5.3	GSM Interface .....	30
3.3.5.4	Keypad Interface.....	31
3.3.6	Flow Chart of the Code.....	31
<b>4</b>	<b>Result &amp; Analysis.....</b>	<b>32</b>
4.1	Overall Implementation.....	32
4.2	Design Analysis.....	39
4.2.1	High Container versus Pulse Counter and Time Taken.....	39
4.2.2	The number of water castings in thr busket versus Pulse Counter and Time Taken .....	40

4.2.3	Quantity of water versus Price of water bill .....	41
4.3	Device and Module Testing .....	44
<b>5</b>	<b>CONCLUSION &amp; FUTURE WORK.....</b>	<b>50</b>
5.1	Conclusion.....	50
5.2	Recommendation and Future Work .....	51
5.2.1	Problem Faced .....	51
5.2.2	Recommendation .....	51
5.2.3	Future Works .....	52
<b>6</b>	<b>Reference: .....</b>	<b>53</b>

## Table of figure

Figure 1.1 : Distribution of Water.....	1
Figure 2.2 8051 Microcontroller Pinout .....	15
Figure 2.3: Schematic Diagram Raspberry Pi 1 B+.....	16
Figure 2.4: Water Flow Sensor .....	17
Figure 2.5: LCD Display.....	18
Figure 2.6: Evolution of Mobile Phone .....	19
Figure 2.7: GSM modem .....	20
Figure 2.8: Arduino Software .....	21
Figure 3.1: Flowchart design .....	<b>Error! Bookmark not defined.</b>
Figure 3.2: Flowchart project.....	<b>Error! Bookmark not defined.</b>
Figure 3.1 : Simple project design .....	26
Figure 3.2: Flow sensor – Arduino Interface circuit.....	29
Figure 3.3: LCD – Arduino Interface Circuit .....	30
Figure 3.4: GSM-Arduino interface circuit .....	30
Figure 3.5: Keypad Arduino Interface .....	31
Figure 4.1: The title of project.....	32
Figure 4.2: GSM Module Send Text Message.....	33
Figure 4.3: Water Bill and Price .....	33
Figure 4.4: Top View of The Prototype.....	35
Figure 4.5: Front View of The Prototype.....	36
Figure 4.6: Side View of The Prototype .....	36
Figure 4.7: Top View of the Circuit Prototype .....	37
Figure 4.8: Front View of the Circuit Prototype.....	37
Figure 4.9: Side View of the Circuit Prototype .....	38
Figure 4.10: Inside View of the Circuit Prototype.....	38
Table 4.1: High Container versus Pulse Counter and Time Taken.....	39
Table 4-2: High Container versus Pulse Counter and Time Taken .....	40
Figure 4.11: Quantity of water.....	40
Figure 4.12: 10 Liters.....	41

Figure 4.13: 20 Liters.....	42
Figure 4.14: 30 Liters.....	42
Figure 4.15: Water Flow sensor value display on serial monitor .....	44
Figure 4.16: Testing keypad interface with Arduino .....	45
Figure 4.17: Testing keypad display at serial monitor.....	45
Figure 4.18: Testing interface between LCD display and Arduino .....	46
Figure 4.19: Testing LCD display at serial monitor .....	46
Figure 4.20: : Testing interface between GSM and Arduino.....	47
Figure 4.21: Testing GSM to send SMS.....	47
Figure 4.22: Testing interface RTC and Arduino .....	48
Figure 4.23: Testing RTC value shows at seral monitor .....	48

## Table of table

Table 2-1 Technical Specification of Arduino.....	12
Table 2-2: Example type of 8051 Microcontroller Technical Specification .....	14
Table 2-3: Technical Specification for Pi 1 B+ .....	16
Table 4-1: Operation of project.....	34
Table 4-2: High Container versus Pulse Counter and Time Taken .....	40
Table 4-3: Quantity of water versus Price of water bill.....	41

## **Table of Equation**

Equation 4-0: Volume of water.....	43
Equation 4-1: Total Price .....	43

## **LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE**

A/D	-	Analogue/Digital
AVR	-	Automatic Voltage Regulator
CPU	-	Central Processing Unit
CF	-	Calibration Factor
CPR	-	Cardiopulmonary Resuscitation
CTM	-	Cellular Text Telephone Modem
DC	-	Direct Current
GSM	-	Global System for Mobile
ICSP	-	In-Circuit System Programming
LCD	-	Liquid Crystal Display
MHz	-	Megahertz
RAM	-	Random Access Memory
SMS	-	Short Message Service
TFT	-	Thin Film Transistor
USB	-	Universal Serial Bus

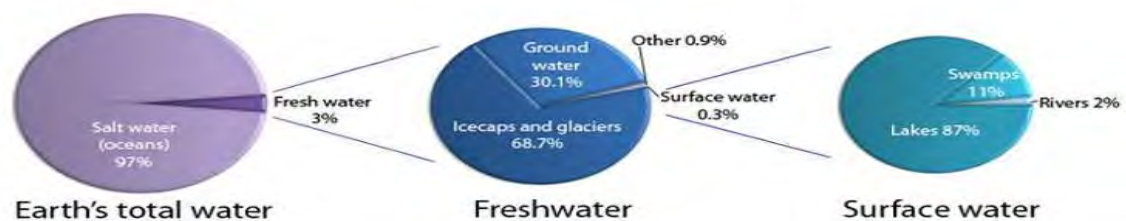
## CHAPTER 1

### INTRODUCTION

This chapter aims on the project's introduction, background, problem statement, objectives and project's scope based on the project. Problem statement states the reason why this project is being selected. Lastly, of the chapter the organization of the thesis will be explained in details.

#### 1.1 Introduction

Water is the renewable and an abundantly available natural resource on the earth. Water covers 70% of the Earth's surface. Out of this, only 3% of the water is portable. Water has its utility in domestic purposes, industrial usage, agricultural field etc. Population growth causes insufficient and uneven distribution of drinking water.



**Figure 0.1 : Distribution of Water**

Figure 0.1 shows the chart of water distribution on the earth's surface. Earth consists of 97% of salt water and 3% of fresh water in total. Of this 3% of fresh water, 68.7% constitutes of ice caps and the glaciers. 30.1% consists of ground water, 0.9% of other water and 0.3% of



surface water. Of this 0.3%, 87% consists of lake water, 2% of river water and 11% for swamps. The rapid development of science and technology improved the sensors and flow meter designs to achieve proper water supply through storage tanks, pipes etc. [6]. To facilitate the domestic and industrial water supply needs, government has formed water boards which monitor the proper supply of water throughout the nation. It acts as the regulating body abided by the rules framed by the government. Water acts as a primary source in the industries; hence, there arises a need of accurate measurement of water flow. In the domestic sector, water is used for all household activities. Excessive usage of water needs to be avoided and a system is required to monitor the over usage of water. In the present water billing system, water board representative should need to travel to customer premises to read the generate the water bill form analog water meter on monthly basis [1]. The present water billing system is tedious and time consuming process. Human interference based water billing can cause faults in billing. This is undesirable error. Automation in the water billing reduces the process time and avoids human errors.

Human life depends on water as evidenced by the beginning of human civilization on the river bank as Mesopotamian civilization of the Tigris and the Nile in Egypt. Human life depends on water for domestic, industrial, agricultural, animal husbandry and transport. Without water to produce food and all other necessities required by humans, population growth will not be realized. Domestic water consumption is the use of water by households within and outside the home such as flush toilets, washing dishes, cooking, washing clothes, bathing, watering plants, and the activities of other households (Abrashinsky, 2004). Per Olmstead and Stavins (2007), the use of domestic water represents 40 to 60 percent of the total water supply. Water consumption is measured by the volume in liters of daily water consumption per capita is called per day (LPD). Per Wentz and Scrooge (2007), the water consumption rate will increase or decrease due to factors such as climate, socio-economic, water use, water quality, water pressure in the distribution system pipes, the cost of water meter installation and basic, the type and function of water equipment, and civic consciousness of people in the water. United Nations suggest that the total water needs of everyone is 165 liters per day (Cherian, 2009). However, water consumption by Malaysians recorded up to 300 liters per day, which is almost double than that proposed by the United Nations. According to Chan (2004), Malaysia's domestic water use (LPD) is increasing whereas in the 1970s, domestic water consumption in

Malaysia is less than 200 LPD and this figure rose to 250 LPD in the 1980s. Currently, Malaysia continued to record the level of water consumption by an average of 226 LPD in which more than 61 liters per capita per day as recommended by the United Nations (UN) for 165 LPD Every individual only. Per SPAN (2011), domestic water consumption has used 62.1% of water supplies in Malaysia. Per Green Technology (2011), the use of domestic water in Malaysia by category is divided into 30% is used in outdoor, 19% is used in the toilet, 15% is used for washing clothes, 12% is used for bathing, 9% used to provide food and minimal, 9% is leaking and 4% is for domestic use such as cleaning the house. Water resources in Malaysia does not decrease, but due to contamination of water resources, population growth and climate change, the water can be safely reduced (Chan, 2008). Since independence, Malaysia has experienced economic and social development of rapid and together with better education, had raised hopes of a better standard of living and make a difference in water use and water demand (Cassey L., 2005). In addition, the use of Malaysian water per capita per day increased by about 7.6 liters per year. The increase in water consumption does not match the increase in water reserves. Since 2005, Malaysia's reserves of water per capita per day is declining at a rate of 5.8 liters per year. At this rate, India will face a lack of water reserves in 2025 (Christopher T. 2011). Per the Malaysian Water Association Guidelines, the per capita water consumption can be divided to 3 categories as urban, suburban and rural areas. There are clear differences in the use of water in which the urban area has a population of more than 10000 the average use of water per capita per day is 230 LPD to 320LPD; covering suburban areas between the urban and the rural average consumption per capita is between 180LPD water per to 230LPD and rural areas which have little population also depends on the type of land use. According to Abu Bakar Yang (2002), the shelter will affect the use of the available water more stout urban areas using water as compared to rural areas and advanced town. In modern times, people do not experience any difficulty in obtaining clean water for 92% of the area Malaysia continues to be supplied with tap water to residential areas without knowing the source of water supply. For this reason water is easily available at a price tariff primary cause of domestic water consumers do not appreciate the water and they continue to waste endless and not practicing any austerity and lead domestic water consumption per capita in Malaysia continued to increase (Mr. Mrs. Bar Council et al., 2004 ). In Malaysia, many people waste

their water in daily life. The citizen always think in Malaysia had enough water but there didn't know the statistic about water.

## 1.2 Project Background

Water resources around the world are getting scarcer day after day. Climate, global warming, and irresponsible usage are major factors that make the situation even harder. Tremendous population growth causes insufficient and uneven distribution of water. So, measuring the water usage and providing it with proper amount will limit the wastage of water in society. This project to develop of automatic water billing system is used to community in Malaysia. For information, people always keep easy about water and not prepare anything to back up. When water bills come to them and angry because amount of usage higher. That's why this project will help them. After there are used water, this project will analyze and count pulse number of water used. Then, there get the signal or SMS. There can manage how much water to use in daily life.

## 1.3 Problem Statement

The usage of the water with uncontrolled will cause wastage and water bill will increase. One of the methods that can reduce waste water usage is with increasing the awareness among the residential community toward the energy saving cost. To increase the awareness among the consumer, the user needs to know about their water usage at any time they want. The problem is, consumer does not realize the waste water at their house because of they do not know how to calculate the water usage. It's impossible to the user to calculate the amount of the energy usage by using data description for all equipment. The meter analog can show the water usage but, not all users know how to calculate water bill from the meter reading. The volume of water provider which is SPAN ( Suruhanjaya Perkhimatan Air Negara) will check liters of water used consumption monthly at our house and give our water bill every month. Users only know about water bill for every month and it difficult for the user to manage their water usage. The system designs for water monitoring have been study before, but need to involve water provider.

## 1.4 Project Objectives

This proposed project that is the development of water system using Arduino was developed by using the latest technologies to display amount of water used and the price needed to pay off. Instead, there are several objectives as follows:

- i. To design a system that can easily update water consumption and water bill at any time to consumer
- ii. To create a system that can calculate volume of water used and water bill.
- iii. To design a user-friendly system
- iv. To simplify the existing water billing system in Malaysia
- v. Educate customer to control their water bill.

## 1.5 Scope of Project

The scope for this project is to develop a water billing system using Arduino. Conventionally, at house, the water flow through the pipe from meter analog is measured using the flow sensor. The flow sensor is and sensor is read by the Arduino board. Based on the flow sensor calibration factor (CF), the number of liters of water consumed is determined. This is a continuous process until the water flow stops through the pipe. The liters consumed data is transmitted to Arduino controller. Based on the liters of water consumed, the amount will be calculated using the Arduino controller. The bill will be stored in the controller. Using keypad Matrix just to control of LCD display the bill is shown, which is interfaced to Arduino. Meanwhile, the same is sent to the customer using GSM technology.

The project assessment only cover at area at house has pipe and meter analog. The components:

- 1) Flow sensor: this component only cheap and easily connect to Arduino, and light

- 2) Arduino: as microcontroller, easy to understand, many component can connect to it, cheap, easy to understand than Raspberry Pi,
- 3) Keypad Matrix: just accessory and study new component based on coding.
- 4) LCD display: to display result of project, cheap, easy to connect to Arduino.
- 5) GSM: just send SMS only, have data and need learn something new but cheap.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **1.6 Introduction**

This chapter will focus on the review from the previous study that related to this project and understanding of concept for some hardware and software before starting the project. To start this project, some reviews have been made from other researcher to know about the existing and the method that used in their project before. These projects have been studied in detail to get some information and ability to proceed on this project. From the literature review, the problem existing before can be avoided and can be improved to get the best system. Besides that, there are many ideas that can be implemented and combined in this project from the other study. The process on the finding previous study will be continued until the project completed. It is because, to make this project successful the procedure and precaution need to be followed one by one to avoid any bad situation occur.

#### **1.7 Previous Project**

Previous project was a part of research based on the previous project or research that had been found in the journal, confession paper, and thesis of project. Previous project was an important part, because this project can be reference for this project. So, from this previous project, many theoretical and construction hardware has been elaborated in this part. Furthermore, it also had a lot of experiment and result can make for reference.

### **1.7.1 Arduino Based Water Billing System for Domestic Purpose**

Ravi Hosamani and Ravi Bagade (2015) aims for this project to create water billing system using Arduino for microcontroller and GSM for signal or give SMS to owner house. It used two Arduino as receiver and transmitter. The controller unit as receiver at consumer premises as water flow starts through the pipe, the square of pulses generated by the flow sensor read through pin D0 at Arduino of controller unit. Once the pulse count matches with predefined count per liter that is 450 counts per liter. Once it searches to define count, sends the When it reaches to the specified count a signal will be sent to the control station. Based on these counts, in the control station as transmitter water consumed will be calculated and the usage will be sent to the user using SMS facility. Ravi Hosamani and Ravi Bagade (2015)

### **1.7.2 GSM Water Billing System**

Abnave Pranita, Dandage Rageshwari, Gawade Anil N, and Prof. Minal Deore (2015) had created this project to develop water billing system using GSM. This is achieved by using PIC16F877 and GSM module. This system details the practice for establishing a metering plan to account for usage and loss in the water distribution system. The bill amount will be sent to respective customers. The deployment of the proposed system uses the existing GSM network, where the water meter system can send its readings directly to a server application using a GSM modem. The application itself can notify subscribers of their bills using SMS messages as well. Abnave Pranita, Dandage Rageshwari, Gawade Anil N, and Prof. Minal Deore (2015).

### **1.7.3 Potable Water Quality Monitoring and Automatic Billing System**

Thamarai Selvi D, and Anitha S.R (2015) state that the main purpose for this research is to design a real-time system for monitoring drinking water quality and quantity at customer sites. Also, automatic billing system is done using GSM Modem. This system consists of several sensors that can reliably monitor the water quality based on parameters like water pH, Total Suspended Solid(TSS), Total Dissolved Solid(TDS), color of water, Dissolved oxygen. The customer usage water is measured using flow sensor. The parameters values are displayed in customer sites using LCD. If it exceeds the threshold value, alarm will be indicated. Then monthly water usage can be sent to municipal corporation office base station within fraction of seconds in the form of text message using GSM Modem. The calculated bill is based on the amount of water consumed by the customer and then the billing amount will be sent to the customer site through SMS. This text message consists of bill amount with due date. If the customer payment process is completed on or before the due date, then water supply will be connected otherwise water supply connection will be disconnected. Thamarai Selvi D, and Anitha S.R (2015) .

### **1.7.4 Implementation of GSM Based Water Meter a Step Automation in Billing System**

Such metering system reduces manpower, with higher accuracy and less power consumption. It gives better results than any other metering systems such as mechanical, ultrasonic, electro-magnetic systems. By using this system water consumption can be observed in real time with controlled use of precious water resources. Water resources be managed for future planning. Non-revenue water will be detected and loss can be avoided in distribution system. Yogendra P Joshi and M. B. Tadwalkar (2014).