



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

WATER BILL SYSTEM TECHNOLOGY

This report is submitted in accordance with requirement of Universiti Teknikal
Malaysia Melaka (UTeM) for the Bachelor's Degree in Computer Engineering
Technology (Computer Systems) with Honours

by

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940527-10-6283

FACULTY OF ENGINEERING TECHNOLOGY

2016



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **WATER BILL SYSTEM TECHNOLOGY**

SESI PENGAJIAN: **2016/2017 Semester 1**

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DECLARATION

I hereby, declare that this thesis entitled “Water Bill System Technology” is the result of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as one of the requirements for the award of Bachelor's Degree in Computer Engineering Technology (Computer System) with Honours. The following are the members of supervisory committee:

.....

(En. Hasrul 'Nisham Bin Rosly)

ABSTRACT

“The Water Bill System Technology” is designed for everyone that facing a problem about over budget of water bill. This system is used to calculate the daily water bills and will be implemented at water meter. It will read the volume of water used daily and calculate the bill. This system also will connect to computer via wireless connection to display the usage of water and its bill. User can find out how much water use in every day. So, based on this data, it allows users to make a monthly budget for the water bill. The hardware that using in this project is Arduino MEGA that control the reading of water volume and the software use is Arduino software that make a program that can make the Arduino MEGA function well.

ABSTRAK

“Water Bill System Technology” direka untuk semua orang yang menghadapi masalah mengenai bajet bil air yang berlebihan. Sistem ini digunakan untuk mengira bil air setiap hari dan akan dipasang pada meter air. Ia akan membaca isipadu air yang digunakan setiap hari dan mengira bil. Sistem ini juga akan bersambung ke komputer melalui sambungan tanpa wayar untuk memaparkan penggunaan air dan bil. Pengguna boleh mengetahui penggunaan air berapa banyak dalam setiap hari. Jadi, berdasarkan data tersebut, ia membolehkan pengguna untuk membuat bajet bulanan untuk bil air. Peralatan yang menggunakan dalam projek ini adalah Arduino MEGA yang mengawal bacaan isipadu air dan perisian yang digunakan adalah perisian Arduino yang membuat program yang boleh membuatkan Arduino MEGA berfungsi dengan lebih baik.

DEDICATIONS

Alhamdulillah, praise to the Almighty Allah S.W.T This thesis is dedicated to :

My beloved parents, En. Abdul Halim Bin Abdul Wahab and Pn. Norhashimah Binti Shaari for raising me become who I am today. Also to my family who supported me physical, emotional, and financial support throughout the project.

ACKNOWLEDGEMENT

First and foremost, I would like to express my deepest gratitude to Mr. Hasrul 'Nisham Bin Rosly for giving me an opportunity working under her supervision throughout this project. Not forgetting the staffs of Faculty of Engineering Technology; my academic advisor, Madam Haryanti.

I'm also thank to En Ahmad Fairuz for his professional advices in programming the system, lab engineers for their assistance during my laboratory sessions, and also the other staffs who had been helping me indirectly.

Special thanks to my peers, my friends Muhammed Irsyad, Asyraaf Aizzad and Siti Fadilah who had been providing me remarkable ideas to improve the project. Lastly, I want to thank my family who supported me physical, emotional, and financial support throughout the project.

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LIST OF SYMBOLS AND ABBREVIATIONS

SMS	Short Message Service
IPv6	Internet Protocol version 6
AMRCS	Automatic Meter Reading and Control System
AMI	Advanced Metering Infrastructure
ICT	Information and Communications Technology
PC	Personal Computer
WiFi	Wireless Fidelity
IDE	Integrated Development Environment
PWM	Pulse Width Modulation
USB	Universal Serial Bus
ICSP	In-Circuit Serial Programming
AC	Alternating Current
DC	Direct Current
PCB	Printed Circuit Board
IC	Integrated Circuit
CPU	Central Processing Unit
RAM	Random Access Memory
ROM	Read Only Memory
ISP	In-System-Programming
I/O	Input/Output
SRAM	Static Random Access Memory
EEPROM	Electrically Erasable Programmable Read Only Memory
V _{in}	Voltage Input
RX	Receiver
TX	Transmitter
TTL	Transistor-Transistor Logic
LED	Light Emitting Diode
SPI	Security Parameter Index
TWI	Two Wire Interface

AREF	Analog Reference
WEP	Wireless Encryption Protocol
WPA2	WiFi Protected Access
OS	Operating System
LCD	Liquid-Crystal Display
SDLC	Software Development Life Cycle
HTML	Hypertext Markup Language
WLAN	Wireless Local Area Network
SSID	Service Set Identifier

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter introduces the project with its background, problem statement, objectives, scope and project significance, to provide a sense of purpose and reasons to proceed with this project.

1.1 Background

Water bill system technology is used to calculate the daily water bills and will be implement at water meter. It will read the volume of water used daily and calculate the bill. This system also will connect to computer via wireless connection to display the usage of water. User can find out how much water use in every day. The hardware that use in this project is Arduino MEGA that control other component such as water flow sensor to get the reading of water volume and Wi-Fi module ESP8266 that allow the Arduino connect with Wi-Fi. The software use is Arduino IDE software that make a program for Arduino MEGA to function well.

1.2 Problem Statement

Many companies or house owner around the world having their own problems. The problem that faced by some companies is over budget due to their utilities bill such as water bill. Other than that, the over usage of water also is the problem that faced by users. Nowadays, the reading of water bill is in monthly. So, user doesn't know the reading of water by day. The solution of this problem is monitor the usage of water everyday using computer via wireless connection and calculate the bill per day. The water bill system technology is designed to counter the problem that all users are facing.

1.3 Objective

The main objective of this project is deeply concentrated on aspect as listed below:

- i. To display the water usage based on daily used.
- ii. To develop a system that calculate the water bill every day.
- iii. To study how Arduino control the other component.

1.4 Project Scope and Limitations

Generally, all project have their own scope or limitation as a guideline. The scope of this project is divided into two which is hardware and software. The hardware use is Arduino that using basic coding as the main controller. The Arduino board will be connected with other hardware such as Wi-Fi module, water flow sensor and many more. The Wi-Fi module will allow to connect the Arduino and communicate with computer via wireless connection. It also can send data to the computer. The water flow sensor will give a reading about volume of water used. For the software, it use Arduino software to make a program that can make the

Arduino MEGA function well. A good programming will allow the modules to send information to each other with minimum delay. The functionality of the water bill system technology will be tested by making a simple model in which the model can make the water flow out in order to facilitate water flow sensor to calculate the total volume of water that comes out. Besides, a simple database will be create to collect the data from the Arduino and make user to monitor it using webpage. The possible flaws of the system will also be verified at the time and improvements will be made if possible.

1.5 Project Significance

Living in the globalisation era, most of the people are facing the problem to make the budget of water bill. This is because the over budget of water bill and usage of water. Many companies or house using water as main source for daily activities. At the company, the usage of water is due to the usage of employees or in the course of the work process. While at home, the usage of water is due to the daily activities such as take a bath, cook, washing the clothes, and many more. The water bill system technology will be able to help users to control this problem. With the opportunity that similar, the water bill systems technology are not common in Malaysia, this project will create awareness to the users of its feasibility and advantages it may provide in the future.

1.6 Thesis Structure

Chapter 1:

The first chapter introduces brief idea of the project. It focused on the overview of the project, the project objective, the problem statement, work of scope and outcome of the project.

Chapter 2:

In this chapter, projects background is discussed. The characteristic and specifications of the component that needed is stated in this chapter. Also, the software that related with this project will be discussed. In addition, the related research also will be discussed in this chapter.

Chapter 3:

This chapter will explained about the procedure and process flow of the project.

Chapter 4:

This chapter will discuss about the data collection and analysis data obtained from the project. It is also will discuss about the problems that had to face during design the project and how to overcome it.

Chapter 5:

This chapter will discuss about the summarization of the project.

1.7 Summary

In a nutshell, the water bill system technology use Arduino and some others hardware that will help the system to perform better. The purpose of this project is to eliminate the problem that all users are facing; the over budget of water bill and usage of water in monthly.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

In a nutshell, the water bill system technology use Arduino and some others hardware that will help the system to perform better. The purpose of this project is to eliminate the problem that all users are facing; the over budget of water bill and usage of water in monthly.

2.1 Past Related Researches

There are numerous researches on the water bill system in the past. Listed below is part of the past related researches.

2.1.1 Findings by others and similar projects

According to the article belongs to (Ravi Hosamani; Ravi Bagade, 2015), the present water billing system uses analog water meters. Modern electronic device such as water flow sensor can be used to overcome basic limitations of analog meter such as less accuracy, human error while billing and many more. From the case study, it is evident that flow sensor can produce very accurate results. The proposed system is a cost effective and reliable system compared to present water billing system. The process of monitoring water flow rate, transmitting the usage, calculating the bill and more is through pre-programmed Arduino controller and

hence no errors as it avoids human intervention. The billing information is sent through SMS which is a reliable and secured communication technique and also helpful for the user as the user gets the bill on time.

Due to the large number of consumers, it is not viable to collect data manually using traditional approach and analyze them on a day to day basis as it will be time consuming and data collected may be inaccurate (Palanichamy, C.; Babu, N.S.; Chelvan, R.K.; Nadarajan, C, 1999). Thus an automatic system that can measure the consumption, notify of any irregularities and is capable of providing real time data is required. With the substantial amount of advancement in technology, it is now possible to measure and acquire the consumption data and analyze them. Smart meters are the monitoring tools for energy, water and gas consumptions and are designed for recording and displaying real time usage data with the goal of reducing the energy consumption and costs. A smart meter facilitates real-time communication between the customer and the utility company offering various advantages to both the suppliers and the consumers.

Various researches have been carried out with the aim of developing a water bill system. However, currently there is no water bill system available in the market that is affordable, reliable, flexible, efficient, and sustainable. A number of researches have been carried out looking at different aspects of the smart meter system. In articles (Xu; Liu, 2013), they have designed a smart meter network system based on internet protocol version 6 (IPv6) and ZigBee protocol for measuring and monitoring residential power consumption. Thousands of meters will be interconnected in the smart meter network and as such in article (Rahman and Mto, 2013) have stated that 100 BaseT communication link is most suitable for smart meter network. In (Singh, J.; Singh, R.; Aggarwal, S.K.; Saini, L.M, 2011), the design and implementation of an Automatic Meter Reading and Control System (AMRCS) using reconfigurable embedded platform together with software developed in LabView graphical programming environment is presented.

The authors in (Carroll, J.; Lyons, S.; Denny, E., 2013) conducted a research in smart metering and their finding are that feedback significantly increases a household's knowledge but improvements are not correlated with observed demand reductions. The data used was from a randomized controlled smart metering trial in Ireland, which also collected extensive information on household attitudes towards the knowledge of electricity use. In article (Ahmad, S., 2011), the use of the smart metering and home automation technologies for efficient utilization of energy, thus paving the way for a cleaner and greener environment for future generations have been presented. The authors have stated that tremendous work is going on in Advanced Metering Infrastructure (AMI), Smart Metering and Home Automation. Countries like USA, Australia and Italy etc. have already started using AMI solutions while countries like China, South Korea, Austria, Spain, Sweden, Finland, Denmark, Netherlands, Norway, Ireland and UK are in process of implementing AMI. Smart metering and ICT solutions have been planned to increase efficiency, loss reduction, reduce energy theft and for efficient data collection for better energy accounting in the electrical sector.

2.2 Water Bill System Technology

This project is to design the water bill system to the people/user that have over budget due to their utilities bill such as water bill using Arduino. The purpose of using Arduino is to ease user to calculate the daily water bills. It will read the volume of water used daily by using the water flow sensor and calculate the bill. The function of water flow sensor is to measure the volume of water flow in pipelines. In this project, the system also will connect to computer (PC) via wireless connection to display the usage of water and its bill. The Wi-Fi (Wireless Fidelity) module that is ESP8266 will be use. It acts as a sender and will transmit the data. In this case, it will send the data to database. After that, PC that acts as receiver will receive the data from the database. Figure 2.1 shows the block diagram of Water Bill System Technology.

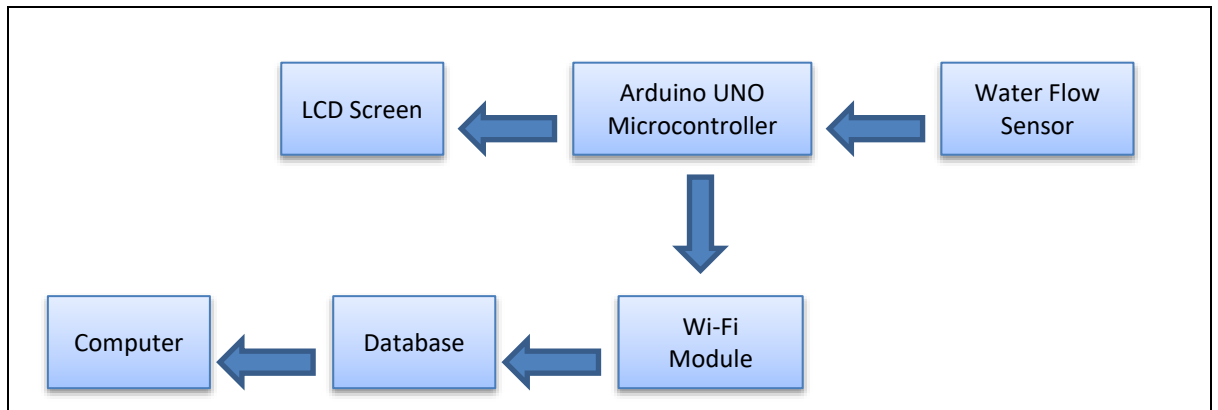


Figure 2.1 : Block Diagram of Water Bill System Technology

2.2.1 Advantage and Disadvantages

The advantages of water bill system technology is it will give an ease to the user. Since it can calculate the water bill per day, the user can spend a budget for a month to pay the water bill. After that, user can know the water usage and its bill by day. So, based on this data, it allows users to make an estimate monthly budget for the water bill. The water bill system technology not only saves the usage of water, but it will reduce the cost of the monthly water bill. This project is designed to help user to maintain the usage of water without wasting money on the monthly water bill. While, there are some disadvantages of this project. As mention before, the system will connect to the computer via wireless connection. It use Wi-Fi networks as a medium. Wi-Fi networks have a limited range, so that the user cannot exceed the range of Wi-Fi.