UNIVERSITI TEKNIKAL MALAYSIA MELAKA

WATER LEVEL MONITORING SYSTEM USING ARDUINO

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

by

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FACULTY OF ENGINEERING TECHNOLOGY

2015

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **WATER LEVEL MONITORING SYSTEM USING ARDUINO**

SESI PENGAJIAN: **2014/15 Semester 1**

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DECLARATION

I hereby, declare this report entitled "Water Level Monitoring System Using Arduino" is the results of my own research except as cited in references.

Signature : .....

Author's Name : NUR IZZATY BINTI MAHTAR

Date : 14 JANUARY 2015

APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for Bachelor's Degree in Computer Engineering Technology (Computer Systems) (Hons.). The member of the supervisory is as follow:

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ABSTRAK

Kekurangan dan pembaziran air adalah antara masalah utama yang dihadapi oleh kebanyakan bandar-bandar besar di seluruh dunia. Ini adalah salah satu motivasi untuk kajian ini dilakukan, untuk menggunakan teknik-teknik pemantauan paras air dalam bagi mewujudkan halangan kepada pembaziran agar tidak hanya memberikan keuntungan kewangan yang lebih dan penjimatan tenaga, tetapi juga membantu alam sekitar dan kitaran air yang seterusnya memastikan kaedah ini boleh menjimatkan air untuk masa depan kita. Projek ini membentangkan proses yang digunakan untuk membangunkan sistem pemantauan paras air menggunakan Arduino melalui penggunaan teknologi yang berbeza dalam reka bentuk, pembangunan, dan pelaksanaan. Tujuan projek ini adalah untuk meningkatkan ketepatan dalam air dengan mengukur tahap kedalaman air di dalam empangan dan juga tangki. Ia juga bertujuan untuk memberi maklumat tentang tahap air supaya penggunaan air yang boleh disimpan. Selain daripada itu, pengesan paras air juga boleh digunakan dalam industri mengawal cecair kimia itu daripada melimpah keluar, dengan itu kualiti alam sekitar boleh diperbaiki. Tahap Air Sistem Pemantauan terdiri daripada platform perkakasan yang dikawal oleh mikropengawal. Mikropengawal Arduino digunakan untuk tujuan ini. Sistem ini boleh memantau paras air secara jauh dengan menggunakan pengesan jarak ultrasonik dan modul GSM (Sistem Global untuk Mobile) . Modul GSM boleh menyambung ke internet Arduino menggunakan GPRS (Perkhidmatan Radio Paket Umum) rangkaian tanpa wayar. Semua perkakasan ini dikawal oleh mikropengawal Arduino.

ABSTRACT

Water scarcity and wastage are among the major problems faced by most of the big cities around world. This is one of the motivations for this research, to deploy monitoring water level techniques in creating a barrier to wastage in order not only provide more financial gains and energy saving, but also help the environment and water cycle which in turn ensures that can save water for our future. This project presents the process used to develop the water level monitoring system using Arduino through the use of different technologies in its design, development, and implementation. The aim of this project is to improve the accuracy in measuring with the water level inside the dam and also tank. It also aims to provide information about the level of the water so that the usage of the water can be saved. Other than that, this water level sensor also can be applied in industry where the chemical liquid is going to overflow, thus the quality of the environment can be improved. The Water Level Monitoring System consists of a hardware platform that is controlled by a microcontroller. An Arduino microcontroller is used for this purpose. The system can monitor the water level remotely by utilizing ultrasonic distance sensors and a GSM (Global System for Mobile) module. The GSM module can connect the Arduino to internet using the GPRS (General Packet Radio Services) wireless network. All of this hardware is controlled by the microcontroller's embedded firmware.

DEDICATION

This thesis is dedicated to the sake of Allah, my Creator and also for both my parents. My father, the late Mahtar Bin A.Manap did not only raise and nurture me but also taxed himself dearly over the years for my education and intellectual development. My mother, Saharah Binti Janor has been a source of motivation and strength during moments of despair and discouragement. Her motherly care and support have been shown in incredible ways recently. My supervisor, Dr. Abdul Kadir and messenger, Muhammad (May Allah bless and grant him), who taught us the purpose of life. Last but not least, to my families and my friends who encourage and support me, I dedicate this research.

ACKNOWLEDGEMENT

First and foremost, I thank Allah S.W.T for letting me live to see this thesis through. I have to thank my parents for their love and support throughout my life. Thank you to both for giving me strength to reach for the stars and chase my dreams. My sisters and brothers deserve my wholehearted thanks as well.

I would like to sincerely thank my supervisor, Dr.Abdul Kadir, for his guidance and support throughout this study, and especially for his confidence in me. I learned from his insight a lot. I would also like to thank Mr.Hasrul' Nisham bin Rosly as a co-supervisor for my project. His comments and questions were very beneficial in my completion of the project report. Also, I would like to thank both my academic advisor Mr.Rostam Affendi bin Hamzah and Mrs.Raeihah binti Mohd Zain, in a special way, I express my heartfelt gratefulness for her guide and support that I believed I learned from the best.

To my classmates especially in Bachelor of Engineering Technology Computer Systems (BETC) and to all my friends, thank you for your understanding and encouragement in my many, many moments of crisis. Your friendship makes my life a wonderful experience. I cannot list all the names here, but you are always on my mind.

Thank you for all of you that always being there for me.

This final year project report is the only a beginning of my journey.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

GPRS	-	General Packet Radio Service
GSM	-	Global System for Mobile Communications
ICT	-	Information and Communications Technology
LED	-	Light-emitting Diode
PCB	-	Printed Circuit Board
SCADA	-	Supervisory Control and Data Acquisition
SMS	-	Short Message Service
UV	-	Ultraviolet

CHAPTER 1

INTRODUCTION

1.1 Background of Study

Water is a precious resource in the world. Many people rely on the water tank to supplement their water supply by storing rainwater collected or pumped from wells, rivers or dams. Sometimes, people do not know to measure the water level either already full or empty. The another problem, need to know the water level in some places that very far away to control it. Dams were used to control the water level and usually placed far away from human being like in the wild. A human need to monitor and control at all times, especially in flooding situation. People still use traditional way to control the water level for instance, pillar equipment function is to scale the depth of water level. Pillar equipment has many weaknesses and although it is a cheap solution. Therefore, it is needed to find alternatively way to control the measuring of water level.

By using wireless technology, remote measurement of water supply is actually can be accomplished. A special sensor is used to measure the water level of water source such as dams. Then, the information of water level is sent remotely anytime. This source system allows monitoring the exchanges of water level flexibly.

This approach can be also used to control something when the certain level of water is reached such as water level tank in higher or deeper places. During these days of high rise buildings, apartments, commercial houses and industries, it has become necessary to store water in overhead water storage tanks. It is very difficult for

someone to monitor water level in ground and overhead. So a water level monitoring system prevents overflow & dry running of water pump, thus saves water, and electricity.

Moreover, whenever variations of weather conditions are present such as drought, rain or tide changes, it will affect the water levels. As we know that Malaysia is one of the monsoon countries which having Southwest Monsoon Rain from late May to September, and Northeast Monsoon Rain from November to March. Especially during the Northeast Monsoon Rain developed by the Siberian High and getting heated during moving from Northern Hemisphere to Southern Hemisphere, it brings heavy deadly rains which cause severe floods along the east coast states of Malaysia. Especially people live on the river, which can be both a convenience and a danger. Therefore, a water level monitoring system is necessary to monitor the levels of the river for the safety of the villagers. This approach also can be as security and to protect the safety of the live stocks and peoples living beside the river or seas. There are many side usage through this system, which is not only flood monitoring.

In addition, there are many others technologies available to communicate with the water level monitoring system such as satellite technologies. However, compared to satellite monitoring, GSM technologies has better advantages by sending Short Message Service (SMS) to multiple recipients which is faster cheaper and more popular way. It proves no boundary to communicate between two different devices at two different places at the same time.

1.2 Problem Statement

Traditional way to measure the water level that is depended to human being have many weakness such as difficult to install, waste time and it might be dangerous for users. At the same time, some of the system nowadays cannot be handle by using a system that utilizes by using the Information and Communication Technologies (ICT). Sometimes equipment only for measure the water level but it cannot measure automatically by using technologies.

process the data signal and send data to the personal computer PC and software Arduino program is needed to interface the data. At the same time, Arduino will send data to the GSM module and a person will receive an alert message.

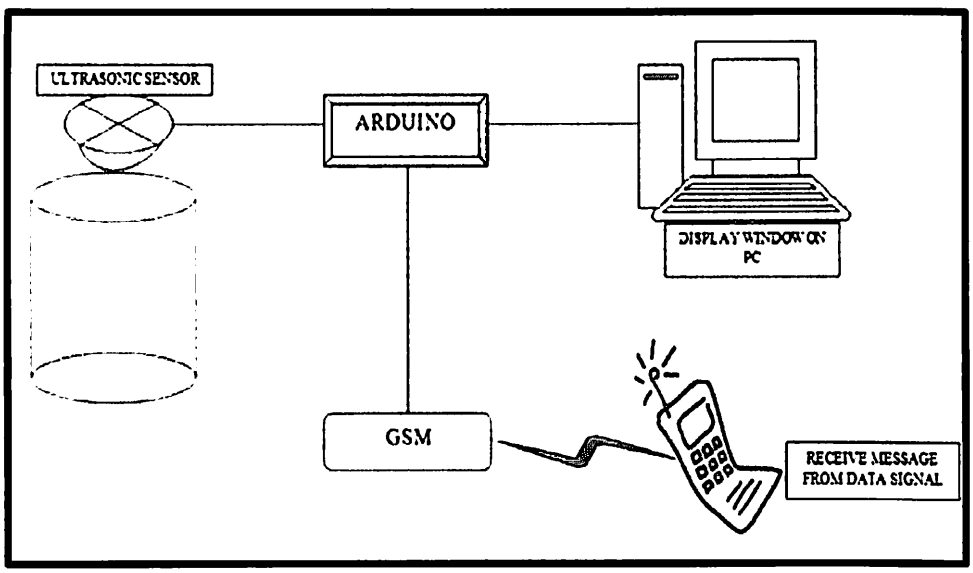

Figure 1.1 Block Diagram

Water level monitoring system by using Arduino is different from other application. Sometimes equipment only for measure the water level but it cannot measure automatically. In addition, when the water level over the limitation, it is difficult to control back the water flow. By using the Arduino microcontroller is very easy to implement compare with other microcontroller. Arduino is an open source electronics prototyping platform. Arduino microcontroller can be stand alone, or they can communicate with software running on computer.

1.5 Project Significance

A water level monitoring is a device that manages water levels on a variety of systems such as water tanks, pumps and dams. The basic function of a water level monitoring is to regulate water flow and optimize system performance. Using a water level monitoring saves power. This is because water levels are controlled automatically, which limits the amount of electricity used. As a result, less water and

power are used to regulate a water supply. In an age where energy conservation is of utmost importance, using one of these devices is very beneficial.

Additionally, water usage can be maximized with a water level monitoring. Often, water pumps get more use during the middle of the day. A water level monitoring is helpful because it automatically provides more water during the middle of the day and less water at night. As a result, water remains at its appropriate level at all times.

In lots of countries, high rise buildings use overhead tanks to store usable water, which is pumped up from ground level. Such a system will save a lot of energy by pumping water only when it is required. Hence most, if not all, wastage will be cut down. Moreover, independent water levels management with minimal human monitoring.

1.6 Conclusion

Water level monitoring system is a project that can be applied in controlling water sector. This project is the solution to help the user. This system is connected in serial connection between microcontroller and PC interfacing. This project will be more effective if it can be replaced with wireless connection which is accomplished without the use of a "hard wired" connection.

With wireless communication, the information or data can be transfer more efficiently between monitor system and pump system for any distances involved.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Human technologies have never halt evolving ever since human find its minor existence on this earth. Communications have never ceased its importance in alerting human of the dangerous lies ahead. Once, communications made between two areas are to protect their own ethnic group from being attacked by others. Humans gradually turn out to communicate in various ways and for different purposes in different languages at any time, in anywhere and by anyone and not only human but even machines in parallel with the rapid growth of human technologies. Therefore, it would be a waste to communicate without knowing the stories behind the development of communication. One of the vast contributions technologies in communications is none other than GSM module technology.

In this chapter, literature review will be focused on Arduino Uno, ultrasonic sensor, GSM introduction and GSM module.

2.2 Water Level Monitoring System with Different Existing System

2.2.1 Wireless Water Level Control using Radio Frequency Communication

Figure 2.1 shows design and implementation of water level control system which is wireless, automatic, cost effective and reliable. It uses two radio frequency transceivers along with a controller each installed at the tank and sump. Radio Frequency transceivers are used for wireless communication. It is completely

automated with the help of a micro controller. The system doesn't need any attention of the user unless the sump is empty. Installation cost is reduced since the system is wireless. It is reliable because it has no problems arising after installation such as breakage of wire (Shankari, Jyothi, Manu, Naveen & Harsha, 2013). Basically a transceiver is a module which has a transmitter and a receiver. It use a R.F transceiver which transmits and receives R.F signal. The frequency range of the signal is 433MHz. The module modulates the data using a carrier signal of frequency 433MHz and transmits through an antenna. On the other hand it demodulates the received signal. The modulation which takes place here is amplitude shift keying. The module requires an external antenna connected to it to transmit the signal. The length of the antenna is 1/4th of the wavelength of the signal. And wavelength (λ) is calculated from $C = f\lambda$ Where C is the speed of light, f is the frequency of module and λ is the wavelength of the signal. For the 433MHz module it is around 17cm.These transceivers are placed at the sump and the tank for the purpose of error free communication. So for every request signal from the controller placed at the tank, an acknowledgement signal is transmitted from the controller at the sump. Suppose an error or loss of data occurs during transmission, then the system is programmed to re-transmit the data.

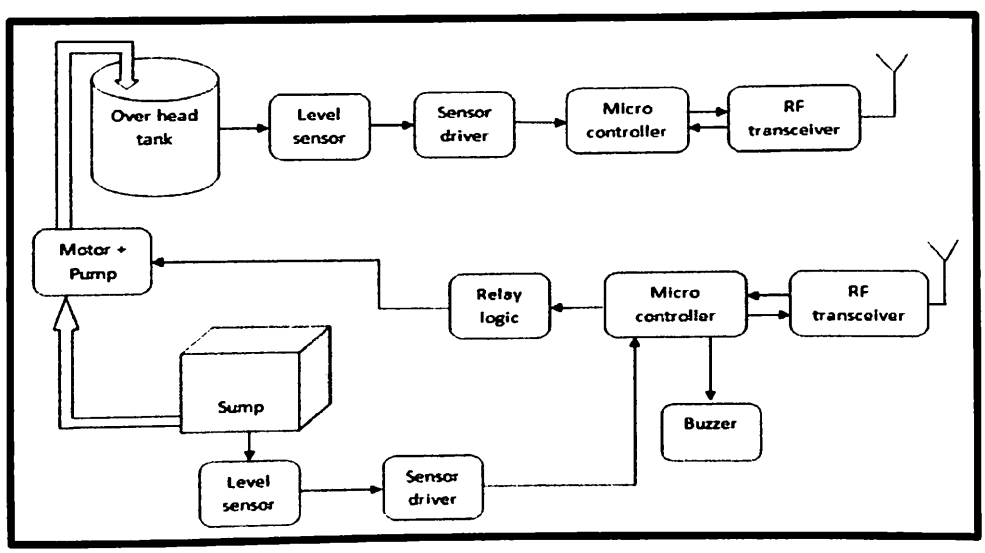

Figure 2.1 Water Level Control using Radio Frequency Communication

(Source: http://www.ijareeie.com/upload/april/44_Wireless%20Automatic.pdf)