UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FLOOD DISASTER INDICATOR OF WATER LEVEL MONITORING BY USING GSM

This report is submitted in accordance with the requirement of Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours

by

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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 Electronics Engineering Technology (Telecommunications) with Honours. The member of the supervisory is as follow:

…………………………
(Wan Haszerila Binti Wan Hassan)

ABSTRAK

Banjir ialah satu bencana alam yang berlaku hampir setiap tahun di Malaysia menyebabkan kerosakan, kerugian hartanah dan kematian. Masalah ini kebiasaannya berlaku kepada penduduk luar bandar yang akan memberi satu impak tinggi kepada populasi yang boleh membawa maut disebabkan tiada amaran awal tentang banjir. Satu sistem yang boleh memberi amaran awal kepada penduduk di kawasan itu yang boleh terjejas oleh bencana banjir adalah penting. Jadi, sistem penunjuk musibah banjir ini dibangunkan untuk mengurangkan kerosakan, kerugian hartanah dan menyelamatkan nyawa. Sistem ini menggunakan Arduino Uno sebagai mikropengawal dan modul GSM. Untuk bahagian input, sistem ini menggunakan tiga penderia suis apung yang membezakan empat aras banjir: keadaan selamat, tahap berjaga-jaga, risiko sederhana dan risiko tinggi. Sistem ini juga dilengkapi dengan empat penunjuk masalah teknikal untuk tujuan penyelenggaraan. Setiap aras banjir diwakili oleh gabungan nombor unik penduaan yang mana dianggap sebagai data yang dikesan. Sebaik sahaja penderia mengesan aras banjir, data ditafsir oleh mikropengawal dan output dihantar kepada modul GSM. Modul GSM akan menghantar amaran berjaga-jaga kepada pengguna. Hasil projek ini merupakan sebuah prototaip penunjuk musibah banjir. Satu analisis dibuat untuk menunjukkan kecekapan sistem berasaskan tahap RSSI dari GSM. Keputusan menunjukkan bahawa meskipun RSSI rendah, tetapi masa penghantaran SMS kepada penerima adalah kurang daripada satu minit. Sebagai kesimpulan, dapat dikatakan bahawa sistem ini adalah cekap dan berfungsi dengan begitu baik.

ABSTRACT

Flood is a natural disaster that occurs almost every year in Malaysia causing damages, property losses and deaths. This problem happened at the rural residents that will give a high impact to the population that can be fatal issues due to no advance notice about the floods. A system that can give early warning to the residents in the areas that may affected by the disaster is important. Therefore, this flood disaster indicator system is developed to reduce damage, property loss and save life. The designed system uses an Arduino Uno board as the microcontroller and a GSM module. For the input part, the designed system uses three float switch sensors that distinguish the four flood levels: safe condition, alert level, moderate risk level and high risk level. The system is also accomplished with four technical problem indicators for maintenance purposes. Each flood level is represented by a unique binary number combination which is considered as the sensed data. Once the sensors sense the flood level, the data are interpreted by the microcontroller and the output is sent to the GSM shield. The GSM shield will send the alert to the user. The outcome of this project is a prototype of the flood disaster indicator. An analysis is done to show the efficiency of the system based RSSI of GSM coverage. The results that even though at a low RSSI, the time taken for the SMS to reach the receiver is less than one minute. To conclude, we say that the designed is efficient and functioning very well.

DEDICATION

To my parents, **Mohd Hizali Bin Abdullah** and **Siti Rukiah Binti Mustapha**, this work is dedicated to them.

ACKNOWLEDGEMENT

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INTRODUCTION

1.0   Introduction

This chapter gives a brief introduction of the project including the project background, problem statements, objectives and scope of work. Additionally the report structure is stated at the end of the chapter.

1.1   Project Background

Flood is natural disaster always happened throughout the world. It happens every rainy season every year. Nowadays, climate changed dramatically. Earthquake and other natural phenomena expected to happen without anticipated.

Flood is natural disaster considered as normal thing to Malaysia almost every year caused damage, property loss and life. Because Malaysia located nearby natural disaster equator most related climate that is worst is monsoon flood. Community that live around flood area with flood problem facing risk of loss cause flood. Flood disaster could not be eliminated but system-with early-warning, aftermath of disaster could be reduced. Forecast and warning system a method that is apparent may be loss impact that due to flood. Warning or warning to tell people on disaster that is future in early stage is very important as security steps that could be taken to avoid accident that is unwanted.

This project will focus to suitable equipment to warn the society. It can detect flood and warn or information continuously. Water level information could be detected through water level sensor. Project establishment objective is to warn society so that they are able to prepare themselves before natural disaster (flood) come around

their area. This can help society to escape and avoid any loss happened. Therefore, objective early-warning is to give opportunity to save themselves and property. Therefore, in an effort to reduce flood loss and flood impact, is important to exit system-with early-warning. According to him, system early-warning will be able to giving warning the occurrence of accurate flood in the time, which would give time local authority that is sufficient so that prepared for reaction that is effective and act accordingly to prevent from worse situation. Unfortunately, there is lack of attention in large system early-warning although technology widely available. Warning probably fail to reach local authority and sometimes it maybe not understood because warning device that is ineffective and not unsuitable from communication channel. Apart from that, warning system that is existing has no basic ability to monitor water level, to give urgent notification

New technology produce medium cost equipment and low that applicable to solve the problem. In this project, a few implements equipment are used like Arduino UNO board that function as tool control. This board have low cost, moderation in programming and capacity to contact with other devices. Other equipment is GSM shield that is prepared board offer with GSM network without additional interface circuit. In this project, SMS used as primary warning device. SMS text message is application that most used worldwide. Using SMS as communication mechanism is solution that is most interesting. At the same time, SMS message could cover wide area at the same time.

1.2   Problem Statements

Basically, this project based on unexpected situation flood disaster is happened. Usually, this problem happened at the rural residents that will give a high impact to the population that can be fatal issues. Over the years many residents who live in fear due to the flooding problem faced. This is due to no advance notice about the floods that can cause accidents.

1.3 Objectives

The objectives of the project are divided into three as follows:

1. To study about gsm and arduino function.
2. To develop a system for reducing damage, property loss and life.
3. To investigate performance of the system.

1.4 Scope

This project focuses on flood disaster to society that live around flood area with flood problem facing risk of loss due to flood. This project will create that can be applied by everyone with cost that is low and maintenance design that is low. This system will determine whether this condition is normal or dangerous by using sensor of water level detector. Warning signal will be sent directly part to all, public and local authorities based on water lever show flood by taking data achieved from censor. GSM will be used to sends water level signal to portable consumer when it receives signal from sensor.

1.5 Report Structure

The remainder of this report is organised as follows. Chapter 2 discusses the literature review which presents background knowledge for the main contributions of this report. Chapter 3 explains the methodology including list of equipments used, explanation of procedures followed and details of any necessary preparation. Chapter 4 discusses the results obtained from experiment together with diagrams, graphs and tables. Finally, chapter 5 gives the conclusion of the project finding.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

Nowadays, natural disaster warning systems have been developed according to effectiveness immediately to avoid any incident that not desired happened like death, damage, and injury. Almost every year flood disaster occurring at Peninsular Malaysia. Heavy rain during rainy season between October and Mac causes serious flood, especially in November and December. Most people in area during eastern coast of Malaysia, located in low areas. Aziz et al.(2008) said storm suddenly can cause loss that is large to coast features that are low prestigious, especially estuary, delta and river. Therefore, alert and get up-to-date information about upcoming flood to residents in low-laying areas.

2.1 Previous Related Projects

In this section, we discuss several previous projects related to system early warning. It was chosen based on their related information in completing this project.

2.1.1 Flood Early Warning System

Aziz et al.(2008) defined early-warning as information presentation on the dangers of or threat to people that is risky, to enable those take action that is accurate to reduce any negative impact towards themselves, persons under their care and their property. Therefore, objective early-warning is to enable people

to take action to save lives, reduce property damage and also reduces human suffering.

In an effort to build system early-warning flood that is effective and efficient, warning must be clear, communicate simple risk and giving guidance needed to flood victims. Apart from that, warning grant like that must be extensive and must educate public on potential risk to local area. It does not matter how many expensive or sophisticated, warning system could not become really effective without component that is accurate.

Private ownership communication network and device is important to relay disaster flood warning to people effectively risk. Detection of flood system the alert is co-operative where it forms introduction, detection and hazard evaluation risk, accurate introduction on people weakness that is risky, and finally, presentation of information threat to exposed people in sufficient time and clarity so that they can take action to prevent negative effects. In conclusion, it could be seen that inevitable danger but negative impact can be reduced. Communication network and device in disaster warning system can reduce loss of lives and financial problem potential if disaster warning system could be improved.

2.1.2 National Early Warning

Based on research in Asmara and Aziz (2011), it is proposed that SMS application also can be used to help people. One of ideas is to continue sensing system and send alerts or SMS warning showed any untoward incident to users. Alert SMS exploitable to be applied use system that is correct with sensing system that rightly. Usually flood disaster cases happened because unconscious people from rise in water level in their neighbourhood. Therefore, warning system that is correct need to be implemented to informing citizens in early stage so that security steps that could be taken to prevent any undesired incident. Warning system implemented now is through television broadcasting and radio to show that affected areas. Nevertheless, warning probably fail for those who affected due to information that is ineffective and were not late in the area. With

rapid expansion of technology, monitoring system that is continuous and can be trusted needed to protect society in any emergency case. By applying liquid sensor and GSM technology, this paper aims to build reaction time that is reliable and real water level alarm system that will detect water increase level in drainage or river and send SMS alarm to consumer mobile phone.

2.1.3 Communication Channels Used in Disaster Warning

Ali (2014), focused on water level monitoring from wirelessly. User will receive SMS warning straight away from system by using GSM module. Table 2.1 summarizes the comparison channel used in disaster warning.

Table 2.1: Comparison Channel Used in Disaster Warning

Channel	Advantage	Disadvantage
Radio and Television	widespread	Take time to get warning
Telephone(fixed and mobile)	Message delivery quickly	Problem of authenticity Does not reach non-user
SMS	Interactive multiple sources can be checked for accuracy of information	Congestion Does not reach non-users Local language problems
Internet or email	Interactive multiple sources can be checked for accuracy of information	Not widespread
Amateur Radio and Community Radio	Excellent for rural area, poor and remote communities	Not widespread
Sirens	Can be used even at night Good in rural areas	Maintenance of the system Cannot disseminate a detailed message

From comparison in Table 2.1, it can be clearly seen that SMS is tool that is best as warning to tell flood disaster victim flood. SMS is service that is available in most digital mobile phone which allowed short message delivery between mobile phone, handheld device other and also fixed-line phone. Figure 2.1 shows a statistic of US mobile data revenues in 2008.
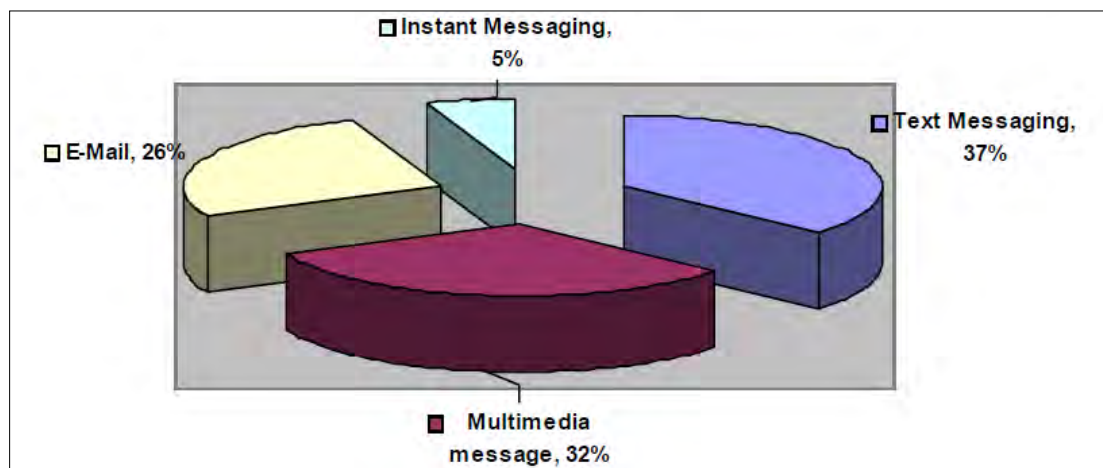

Figure 2.1: US Mobile Data Revenues 2008 Aziz et al. (2008)

This proves at year 2005 Hurricane Katrina disaster in United States, many beach area population that are affected could not make contact with relatives and friends use traditional land line telephone Aziz et al. (2008). Nevertheless, they could be communicating between one equally other via SMS easier when network function. This is because SMS functions in band that different and can be sent or accepted although congested telephone line. Apart from that, SMS also has another advantage compared to voice calls in that a message can be sent to group simultaneously. Therefore, these features is really important action as warning system to warn to people on the dangers of water level at the same time. Based on diagram 1, it was expected that text message widely used and mobile application that most popular since 80% from portable expenses will become message service C. Hsu (2007). According to Aziz et al (2008), 350 billion text message will be sent every month throughout the world. There is use of various functions from SMS which led to his success. Firstly, over SMS is form that is most rapid communication if measured with real

communication processing including the condition as friend that could not take call, outside radio coverage, listen to voice-mail, towed and others.

2.1.4 Feasibility Study on Application of GSM/3G–SMS Technology

Table 2.2 shows a comparative study between 3G and GSM use SMS technology to carry field data turnover and continue to investigating possibility that is corresponding in early monitoring system flood disaster.

Table 2.2: Comparative Feasibility Study on GSM/3G-SMS Technology

Area Of Difference	GSM	3G
Definition	Digital cellular phone technology based on TDMA that is the predominant system in Europe, but also used worldwide	3G systems represent the convergence of various 2G technologies into a single global system that includes both terrestrial and satellite components.
Number of mobile subscribers	64.8 million	200 millionth 3G subscriber had been connected
Data transfer rate	9.614.4 kbps(kilobits per second)	2 Mbps (megabits per second)
Benefits	GSM can provide better voice quality, network capacity, SMS, data encryption and roaming.	Ability to integrate existing cellular standards, such as GSM and TDMA, into one component The main features of 3G systems are "always on connectivity", "IP network", "Global roaming" and value added services.

Limitation	Not suitable for web browsing and multimedia applications. Could not meet the increasing demand for wireless data services. Severely limits the richness of information and complexity of the wireless data services and applications that can be offered User frustration with long download times.	Include high licensing fees required by mobile operators, great difference in the terms of acquiring licenses governed by state authorities and the high pricing of 3G enable mobile phones.

Based on investigation, best portable communication to send SMS to flood victims use GSM technology because some reasons below. First reason is GSM network provided portable station and low base cost and the most important is compatibility with other systems like Integrated Services Digital Network (ISDN) and difference with 3G that need 3G high price enabled mobile phone. Especially, GSM has coverage that is wider from rural areas, coverage in major towns and frequent without charger roaming to the customer will be pivotal because flood area most and victim in rural area and coverage that are wider needed on this policy.

2.2   Microcontroller

Microcontroller defined as computer on a chip or single integrated circuit small computer but it designed to carry application at one time. Typical microcontroller contain processor core, memory, input/output programmed, and important peripheral. Design for application lodge like product is automatically controlled and device. There is popular microcontroller in market like Arduino from Atmel and PIC from Microchip.

2.2.1 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). As show in Figure 2.2, Arduino Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.
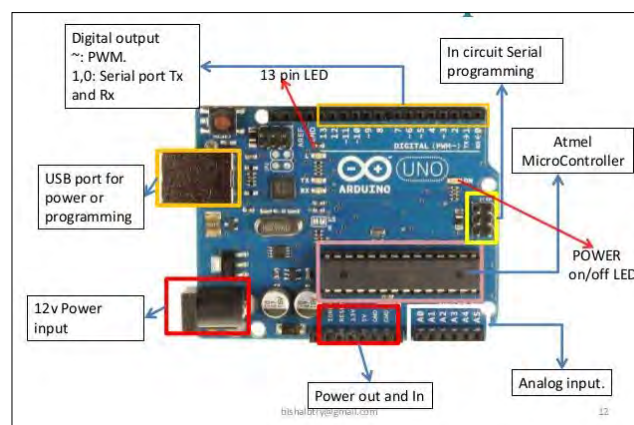

Figure 2.2: Arduino Uno Microcontroller

Table 2.3 summarizes characteristic of Arduino Uno. It consists of some characteristic along with its parameters.

Table 2.3: Summary of Arduino Uno

Characteristic	Arduino Uno
Microcontroller	ATmega168
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40mA
DC Current for 3.3V Pin	50mA
Flash Memory	32KB of which 0.5KB used by bootloader
SRAM	2KB
EEPROM	1KB
Clock Speed	16MHz

Arduino Uno have several facilities to communicate with computer, another Arduino, or other microcontroller. The ATmega328 provides TTL (5V) UART serial communication, that available in digital pin 0 (RX) and 1 (TX). An ATmega8U2 in the serial communication board channel on USB and emerge as virtual com port for software in computer. The 'firmware 8U2 uses COM USB driver standard, and have no external drive needed. Nevertheless, on Windows, *inf file needed. Software that Arduino includes series monitor which enabling simple text data to be delivered to and from Arduino board. RX and LED TX in board will blink when data are being dispatched through chip and USB extension to series to computer (but not for serial communication in pin 0 and 1). The ATmega328 in Uno Arduino comes pre baked with boot capacitor which enables to uploading new code to him without using an external hardware programmer.