UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FLASH FLOOD INTIMATION OVER GSM NETWORK

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

by

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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SESI PENGAJIAN: **2014/15 Semester 2**

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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) (Hons.). The member of the supervisory is as follow:

…….

(Project Supervisor)

ABSTRACT

The main goal of this project is to design and build a small scale of Global System for Mobile (GSM) based prototype Flash Flood Intimation over GSM Network system. This project will be developed as an educational training tool to demonstrate, promote awareness and knowledge in order to solve the traffic congestion problem and minimize the traffic accidents in Malaysia. The GSM is a technology that acts as the system‟s main controller will be used to control the overall system, which GSM modem will sending an alert message through the short message service (SMS) to desired phone number address. The prototype design use water level sensor to detect any water flow that flow through the flash flood and when the water level beyond danger mark at a considerable distance from the road, it will send the alarm signal to the microcontroller. These prototypes utilize the arduino R3 which is used to receive the data from the sensor. This arduino will compute and analyze the data signal from the water level sensor and sending the data signal to the GSM to alarming the people about the system status. The prototype system is expected to be fully functioning with the capability to remotely control and monitor as well as analyze the system status by integrating the GSM technology system, which can also be implemented as an educational training tool for community for them to have better awareness and understanding on environment and how the technology can be utilized in enhancing humans‟ quality life

ABSTRAK

Matlamat utama projek ini adalah untuk mereka bentuk dan membina skala kecil prototaip Sistem Global Mobile (GSM) berasaskan pemberitahuan banjir kilat atas system rangkaian GSM. Projek ini akan dibangunkan sebagai alat latihan pendidikan untuk mempamerkan dan dalam masa yang sama meningkatkan kesedaran dan pengetahuan untuk menyelesaikan masalah kesesakan lalu lintas dan mengurangkan kemalangan jalanraya di Malaysia. GSM adalah teknologi yang bertindak sebagai pengawal utama sistem yang akan digunakan untuk mengawal keseluruhan sistem, dimana GSM modem akan menghantar isyarat mesej melalui khidmat pesanan ringkas (SMS) kepada alamat nombor telefon yang di ingini. Reka bentuk prototaip ini juga menggunakan sensor pengesan paras air untuk mengesan mana-mana aliran air yang mengalir melalui banjir kilat dan apabila paras air melepasi paras bahaya pada jarak yang agak jauh dari jalanraya, ia akan menghantar isyarat penggera untuk mikropengawal. Reka bentuk prototaip ini menggunakan arduino R3 yang digunakan untuk menerima data dari sensor. Arduino R3 ini akan mengira dan menganalisis isyarat data dari sensor paras air dan menghantar isyarat data kepada GSM untuk memberitahu orang ramai tentang status sistem. Sistem prototaip dijangka sepenuhnya berfungsi dengan keupayaan untuk mengawal dan memantau dari jauh serta menganalisis status system dengan mengintegrasikan system teknologi GSM, yang juga boleh dilaksanakan sebagai alat latihan pendidikan untuk masyarakat untuk memupuk kesedaran yang lebih baik dan pemahaman terhadap alam sekitar dan bagaimana teknologi boleh digunakan dalam meningkatkan kualiti hidup manusia.

DEDICATIONS

To my beloved parents

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLE

CHAPTER 1
INTRODUCTION

1.0 Introduction

This chapter will discuss the overview of project background on flash flood intimation over GSM network, problem statements of the project, the specific objectives and work scope of the project.

1.1 Background

Flood occur most commonly when water from heavy rainfall, from melting ice and snow in the country that having cold weather, or from a combination of these exceeds the carrying capacity of the river system, lake, or ocean into which it runs. Usually the combined flow of several water-swollen tributaries causes flooding along a river bank or shoreline. Flood occurs because of the localised continuous heavy rainfall, tidal backwater effect and inadequate river capacity. The geographical location also one of the factors that caused flood occur, where the cyclical monsoons during the local tropical wet season. Due to the floods, many lives and the property are found destroyed. The floods make a traffic jam, an accident and any dangerous to road user. For this reason, the "Flash Flood Intimation over GSM Network" is been created, to help the road user to avoid this problems happened. It was invented based on the problem faced by road user when flood occurred. This will avoid the traffic jam and accident because the users have a time to find an alternative road before them going to be stuck at the flood area. This system will function which is a water sensing arrangement is made which is interfaced a programmable microcontroller. During flash flood conditions if the device senses a rise in water level beyond a danger mark at a considerable distance from the road tracks, it will alert the control centre via SMS.

1.2 Objectives

The objective is expressed the total result or effect of the project and aim of the project when it is complete. The objectives of this project are:

a) To study the GSM in this recent technology.

b) To analyze the flash flood intimation system based on GSM.

c) To develop a prototype of the flash intimation over GSM network.

1.3 Problem Statement

The flood make a traffic jam, an accident and any dangerous to user road. Because of this flood, this area always has a traffic jam. Although the government have repaired drainage in this area and enlarge road, yet fixed congestion occur when heavy rain happened. Therefore this project is designed to tackle this problem. Besides that, lots of time will be wasted if the flood occurs. It will cause the road user cannot go anyway because had stuck in the middle of the road. The other problem that will be faced by road user, many vehicles will be damaged where the water will slowly enter into the engine especially the car and motorcycle. A system called "Flash Flood Intimation over GSM Network" is invented and will be functioned or detected if the water along the road is over the limit of water level sensor. This water level sensor then will transmit a signal to the microcontroller that is programmed in such a way that it will send an alert stored SMS to the SIM mounted GSM modem to the control centre"s mobile number to avoid the accidents. By referring to the existing project that have done the similar with this project which is "Flood Detection System", that build the similar project with the same goal to resolve the existing problem that occur from flood. The system is used to detect the rising water level in the river. The limitation of "Flood Detection System" is when the water rises till the level, it will contribute a signal from the circuit to the computer and from the computer to the mobile phone. Nowadays, many wireless

technologies can be used without using infrared and wave such as GSM mobile phone which is been using in this

1.4 Work Scope

The main archive of the project is developing flash flood intimation over GSM Network. When the heavy rain is happened which can cause flood, traffic jam and accident always happen that is very dangerous to the road users. This is because they are late or didn‟t get the information about the area will be flood from the respective authorities. Sometimes the respective authorities also didn‟t notice with the certain area that will be flood because of the current system they used are not very accurate to inform them the water level is beyond a danger mark at a considerable distance from the road track. Nowadays, many wireless technologies are available to be used such as people are using the GSM mobile phone. By using GSM network in this project, it will alert the respective authorities via SMS when the water level is beyond a danger mark so that they can alert to the road user earlier which it is can avoid from the traffic jam and accident happens.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter covered all elements like authentication methods, hardware overview and wireless technology that have been used in this project. The literature review that has been done show the process in this project. Other than that, this chapter also included the research on the journal from the previous project.

2.1 Flood Case in Malaysia

Malaysia has an equatorial climate with constant high temperatures and high relative humidity. The climate is influenced by the northeast and southwest monsoons. The former, prevailing between November and February, brings heavy rainfall (as much as 600 mm in 24 hours in extreme cases) predominantly to the east coast of Peninsular Malaysia and to Sabah and Sarawak. Rain bearing winds also comes with the southwest monsoon from April to September, though rainfalls during this period are generally less than during the northeast monsoon. There are, in addition, two transitional periods between the monsoons (inter-monsoon) when convectional thunderstorms are common. (Wing, 1971)

The annual average rainfall is 2,420 mm for Peninsular Malaysia, 2,630 mm for Sabah and 3,830 mm for Sarawak, with heavier precipitation recorded in the east coast of Peninsular Malaysia and the coastal regions of Sabah and Sarawak. (Wing, 1971).

There are two basic types of rainfall causing flooding viz.

(i) Moderate intensity, long-duration rainfall covering a wide area.

(ii) High intensity, short-duration localized rainfall.

In addition, flood records indicate that there is a seasonal pattern of flood occurrences. The east coast and the southern part of Peninsular Malaysia, Sabah and Sarawak are mainly affected by floods during December to January when the northeast monsoon is prevailing. Flooding occurs due to widespread prolonged heavy rainfall resulting in a large concentration of runoff which is very much in excess of the capacities of streams and rivers. Extensive areas are often inundated. (Wing, 1971).

The west coast of Peninsular Malaysia, on the other hand, is mainly affected from September to November during the inter-monsoon period when convectional thunderstorms become prevalent. Such storms bring short but very intense rainfall, which severely overloads the drainage systems, causing localized „flash" floods. (Wing, 1971).

These statistics show the rainfall that often occur in certain places in Malaysia.(Abdullah, 2004).

Table 2.1: The duration, intensity and period of rainfall occur in JPS Ampang, Selangor, Malaysia, 2001

26 April 2001

Location of Rainfall Station	Rainfall Duration	Rainfall Intensity	Return Period
JPS Ampang	1 hour	103mm	50 years

Table 2.2: The duration, intensity and period of rainfall in UluTekai and Kuantan, Pahang, Malaysia, 2001

Pahang - December 2001

Location of Rainfall Station	Rainfall Duration	Rainfall Intensity	Return Period
Ulu Tekai	1 day	321 mm	100 years
Kuantan	2 days	528 mm	50 years

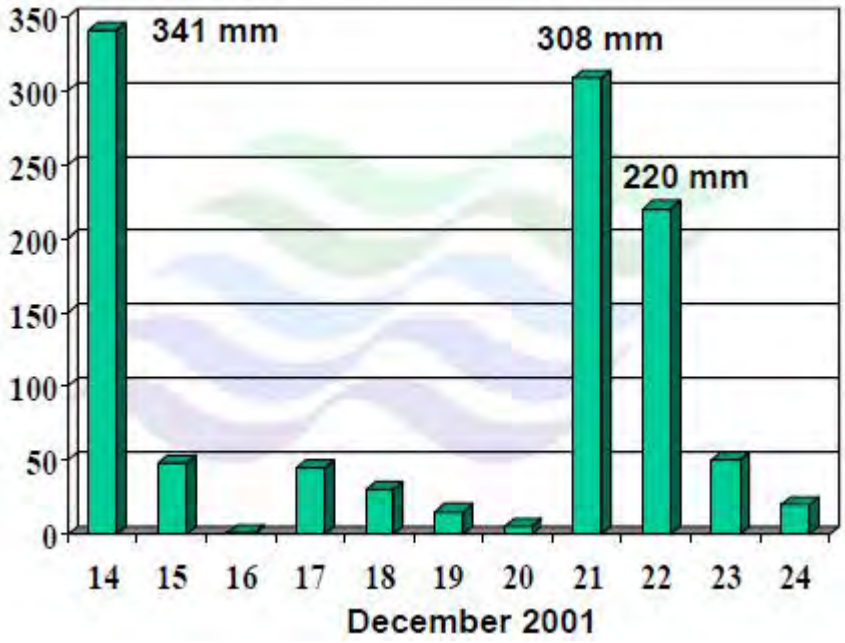

Figure 2.1: The rainfall at JPS station in Kuantan, Pahang, Malaysia, 2001

Table 2.3: Flood occurrences by heavy rainfall

Date	Location	Rainfall Intensity	Monthly average Rainfall
26/04/01	JPS Ampang	103 mm/1 hr	288 mm
17/09/95	Butterworth	350 mm/day	338 mm
04/09/99	Bayan Lepas	288 mm/day	339 mm
22/12/95	Petaling Jaya	169 mm/day	263 mm

No	Rainfall Station	District	2/10	3/10	4/10	5/10	Total (2–5 Okt)	3 Days Rainfall (Maximum)	Return Period 3 Days (Maximum)
1	Ladang Victoria	Seberang Perai Utara	38	122	177	64	401	363	>100
2	Pinang Tunggal	Seberang Perai Utara	58	149	195	127	529	471	>100
3	Bumbong Lima	Seberang Perai Utara	93	138	110	72	413	341	100
4	Ara Kuda	Sebarang Perai Tengah	95	105	293	114	607	512	>100
5	Simpang Ampat	Seberang Perai Tengah	127	108	139	49	423	374	>100
6	Pulai	Baling	28	29	101	22	180	150	normal
7	Kuala Pegang	Baling	43	56	120	27	246	219	50
8	Jam. Syed Omar	Kuala Muda	32	79	148	57	316	284	>100
9	Kedah Peak	Kuala Muda	147	238	252	128	765	637	>100
10	Sg. Petani	Kuala Muda	47	124	177	68	416	369	>100
11	Pendang	Kota Setar	34	72	41	15	162	147	normal
12	Alor Setar	Kota Setar	33	60	33	26	151	125	normal
13	Sik	Sik	96	80	220	85	480	396	>100
14	Jeniang Klinik	Sik	71	90	115	96	372	301	>100
15	Kulim	Kulim	12	74	242	77	403	392	>100
Arithmetic Average Catchment Rainfall			69	103	148	71	390		

Figure 2.2: Summary of rainfall and return period (mm), 2003

2.2 Flood Warning System

Flood warning is firmly connected to the task of authorities which is the flood forecasting. The flood forecasting is the one that set the forecast time-profiles of channel flows or river levels at many areas. Flood warning means the respective authorities is given the responsible to make the decision about whether warnings of floods should be alert to the public or the previous warnings must be rescinded or retracted.("Flood warning - Wikipedia, the free encyclopedia," n.d.) The main purpose flood warning system is organized is to enable the people to take action for

saving lives and their belongings. Besides that, flood warning system also can help the respective authorities to carry out evacuation of the population when flood is happen. According to Nigg (1995), flood warning system must be satisfying with two basic functions:

- Assessment – from the moment that particular danger is detected to the point when a danger message is created for the threatened locality.
- Dissemination – is issuing and transmitting the caution message to a target audience.

Other than that, the flood warning system can be effective when the basis of the warning must be trustworthy, the warning message must be explain to which a particular area is currently at risk and people must be noticed what they can do to avoid from danger.

2.3 Previous Journal Related

There are many existing project which is similar with this project had been done before. Previous journal that related with this project included:

2.3.1 Flood Detection System (Johari, 2004)

This project is developed to detect the profundity of water when it is over the standard level of water sensor detector which it is placed that always occur a flood.This system is completed with the warning light, to alert the user road about the flood and also to alert the control centre about the information through microcontroller Atmel 89S51. The water level sensor for this system will be partitioned into three levels.

This system is used Radio Frequency (RF) as Transmitter and Receiver to send the sign to microcontroller Atmel 89S51. The microcontroller than enacted the

LED at the road and told the control centres the information of flood"s level. This project is used the LED Display as output sign to the user road.

As the result, the user road will know the flood occurred when they notice the warning light that been set on the road. These warning light shows as an indication of the flood, where it is isolated into three colours, each colour represented each level. In the same time, the information of the flood is sent to the control centre to verify the further action will be made by the authorities.

There are many lacks that been seen in this system, where the user have to be neared to the flood area to get the information, so the information will late to be known by the user. Another problem that occurred, not all user maybe alert with the warning light sign that been placed in the flood area. Finally, the time will be wasted and also caused a trouble to user, where they have to find an alternative road for the last minutes.

2.3.2 A Low-Cost Wireless System for Autonomous Generation of Road Safety Alerts (Banks, Harms, SedighSarvestani, &Bastianini, 2009)

This project describes an autonomous wireless system that creates road safety alerts, through SMS and email messages, and sends them to user road subscribed to the service. The user road who regularly travel over a particular route are the main beneficiaries of the proposed system, which is planned for sparsely populated rural areas, where information accessible to user road about road safety, particularly bridge conditions, is very limited. This project used the SmartBrick wireless system for remote structural health monitoring that has been introduced in the previous work. Sensors on the SmartBrick network regularly gather the information on water level, temperature, strain and other parameters essential to safety of a bridge.

The information is stored on the device, and sends to a remote server over the GSM cellular infrastructure. The system produces the alerts indicating hazardous road conditions when data surpasses limits that can be remotely changed. The remote server and any number of assigned authorities can be alerted by email, FTP, and

SMS. Drivers can see road conditions and subscribe to SMS or email alerts through a web page. The subscription only form of ready era has been purposely chosen to mitigate privacy concerns. The proposed system can altogether expand the safety of travel through rural areas. Constant accessibility of information to transportation authorities and law enforcement officials facilitates early or proactive reaction to road hazards. Direct notice of drivers further builds the utility of the system in increasing the safety of travelling public.

The diversity of road hazards confuses the design of related alert systems, particularly where self-sufficiency is concerned. Safety hazards on roadways can be ascribed to two main sources, which are user road error or vehicle breakdown, and natural phenomena or infrastructure failure. The safety alert system proposed in this paper looks to mitigate hazards emerging from the second category, which includes phenomena, for example, flooding and bridge collapse.

The system is independent, which is especially helpful in scantily populated provincial areas with rare assets accessible for checking road conditions. Structural and environmental checking, with the means of connecting to the cellular network, plays the instrumental roles in the safety alert system. This paper portrays an autonomous, wireless system which produces the safety alerts to user road. The system uses a wireless sensor network to gather information about certain key parameters of a bridge and its surroundings, including tilt, vibration, acoustic emissions, temperature, and water level. The information from the sensor network is handed-off to the SmartBrick, a structural health monitoring device developed by the creators and introduced in previous publications.

The SmartBrick serves as the base station and information sink for the sensor network, and is in charge of handling and reporting of the collected information. The device has an on board quad band modem, which allows it to connect to the cellular network for regular communications of data reports and cautions to various beneficiaries. Earlier prototypes of the system could be designed to report by one or a greater amount of FTP, text messaging, and email. The beneficiaries of these reports were a remote server, the system administrators, and any authorities in charge of completing security measures, for example, closing a bridge during flash flood.