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Date : 15/6/17

DISASTER ALERT SYSTEM (DISAST)


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**A report submitted in partial fulfilment of the requirements for the degree of
Bachelor of Mechatronics Engineering**

**Faculty of Electrical Engineering
UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

2017

I declare that this report entitle “*Disaster Alert System (DISAST)*” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : TEOW BOON PEI

Date : 15/6/2017

To my beloved mother and father

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ABSTRACT

Earthquake is a type of natural disaster that cannot be predicted accurately while flooding is the most common natural disaster where the effect vary greatly especially in terms of property damage. Therefore, a Disaster Alert System is proposed where the system could detect earthquake and flood disaster by using sensors and then send the alert message to the recipient with an image of water level condition through smartphone application. In this system, accelerometer is used to sense the vibration (earthquake) while ultrasonic sensor is used to sense the water level (flood). Then, both signals are transmitted into Raspberry Pi, where it is used as a controller in this embedded system. A medium range earthquake disaster and a low level to high level of flood disaster are measured by this system. In addition, a USB camera is used to capture the image of water level condition once the ultrasonic sensor is triggered and the image is saved in JPEG format. Next, Raspberry Pi is triggered by the input signals of both sensors and then the alert message is sent to the recipient's mobile phone with the saved image through Telegram messenger application which is pre-installed in the mobile phone. This will help to alert the users to take the safety precaution in a shorter period when the earthquake and flood disaster are happened in order to save their lives. The experiments on time needed for detecting earthquake and flood disaster, sending, receiving and displaying the message are conducted since time is a crucial parameter that will affect the efficiency of the victims to take the precaution measurement. The effectiveness of this system is demonstrated by the results of the experiments. It is believed that many innocent lives could be saved with the introduction of this system.

ABSTRAK

Gempa bumi merupakan salah satu jenis bencana alam yang masa berlakunya tidak dapat diramalkan secara tepat manakala banjir merupakan kejadian yang biasa di mana kesannya amat teruk terutamanya kerosakan harta benda. Oleh itu, satu sistem telah dicadangkan di mana sistem ini boleh mengesan gempa bumi dan banjir dengan menggunakan sensors, dan menghantar mesej amaran kepada penerima bersama dengan gambar keadaan paras air dengan melalui aplikasi telefon pintar. Dalam system ini, sensor getaran telah digunakan untuk mengesan getaran (gempa bumi) manakala sensor ultrasonik telah digunakan untuk mengesan paras air (banjir) dan kedua-dua isyarat ini akan dihantar kepada Raspberry Pi, di mana ia merupakan pengawal dalam sistem ini. Sistem ini akan mengukur gempa bumi dalam rangkaian yang sederhana dan mengukur banjir bagi tahap rendah hingga tahap tinggi. Tambahan lagi, satu kamera USB telah digunakan untuk menangkap gambar keadaan paras air sesekalinya ultrasonik sensor dicituskan dan gambar tersebut akan disimpan dalam format JPEG. Seterusnya, isyarat input daripada kedua-dua sensor itu telah mencetuskan Raspberry Pi untuk menghantar mesej amaran kepada telefon bimbit penerima bersama dengan gambar tersebut dengan melalui Telegram aplikasi yang dipasang dalam telefon bimbit dari awal lagi. Ini akan membantu pengguna untuk mengambil langkah keselamatan dalam masa yang singkat demi menyelamatkan nyawa mereka apabila berlakunya gempa bumi dan banjir. Eksperimen pada masa yang diperlukan untuk sistem ini mengesan gempa bumi dan banjir, menghantar, menerima dan memaparkan mesej telah dijalankan disebabkan masa merupakan satu parameter utama yang akan mejejaskan kepantasan mangsa untuk mengambil langkah keselamatan. Keberkesanan system ini telah ditunjukkan oleh keputusan eksperimen. Ia dipercayakan bahawa kebanyakan nyawa yang tidak berdosa dapat diselamatkan dengan pengenalan system ini.

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LIST OF ABBREVIATIONS

PWM	-	Pulse Width Modulation
ADC	-	Analog-to-Digital Converter
USB	-	Universal Serial Bus
FPGA	-	Field Programmable Gate Array
IP	-	Internet Protocol
RAM	-	Random Access Memory
CPU	-	Central Processing Unit
GPU	-	Graphical Processing Unit
ARM	-	Advanced RISC Machine
GPIO	-	General Purpose Input/Output
SoC	-	System on Chip
g	-	Gravity Force
Trig	-	Trigger
LED	-	Light Emitting Diode
SMS	-	Short Messaging Service
HDMI	-	High Definition Multimedia Interface

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CHAPTER 1

INTRODUCTION

1.1 Overview

There are five subtopics will be presented and discussed in this chapter, which are motivation, problem statement, objective, scope and report outline. Besides that, limitation and target of the project will be explained throughout this chapter. In addition, statistic of reliable fact which is related to the project will be shown.

1.2 Motivation

Among top five of most common type of disaster that happened globally from year 2005 to 2014, flood was considered as the most common while earthquake was considered as second for of natural disaster as shown in Figure 1.1 [1].

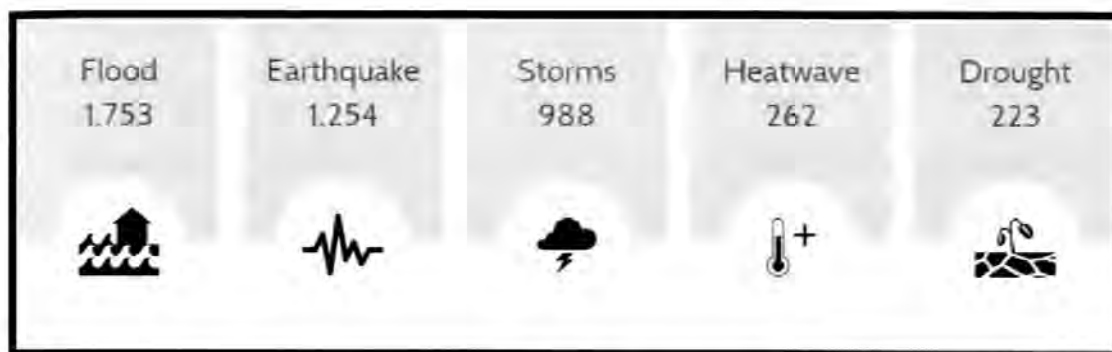


Figure 1.1: Top 5 most common disasters in worldwide from year 2005-2014 [1].

In Malaysia, flood disaster considers as a regular natural disaster which will happen almost every year during the monsoon season [2]. The most common natural disaster that happened in Malaysia are floods and landslides as well as forest fire and haze [3]. On 18 July 2016, flooding was occurred at two areas of Kedah state, Yan and Baling. 441 people were removed out from the affected regions and moved into three relief centres that prepared by NADMA. On the same day, parts of Penang state were also reported flooding, where the affected regions consisted of Teluk Bahang, Penang International Airport, Relau, Natu Maung, Teluk Kumbar and Bayan Lepas. Teluk Bahang was the worst hit region, where the flood water increased up to 50 cm deep due to the combination of heavy rain and rivers overflow [4].

Next, an extreme rainfall that happened from 7 March 2016 to 9 March 2016 at Sarawak had caused an inland flood which affected many villagers where the rain fell about 93.2mm within 24 hours in the first two days [5]. Besides that, floods had affected two districts of Malacca state on 8 February 2016, Alor Gajah and Jasin, due to the overflowing of Malacca River and flash floods on 5 February 2016. About 8000 people were affected and 47 families were housed in the relief centres of the state [6]. Besides of Malacca, the heavy rain that started on 5 February 2016 had seriously affected Johor, Negeri Sembilan and Sarawak. Two people were reported that they died during the flood disaster in Johor [6].

Not only in Malaysia, Indonesia is a country that often facing flood disaster [7]. Garut Regency, Indonesia had experienced a severe flooding due to the heavy rain on the evening of 20 September 2016, where the height of the flood water up to about 2 meters. During the flood, around 23 people had considered as dead while they were 18 persons still in missing.

On the same day, two people had died due to the landslide that happened in Cimareme, Sumedang [8].

Furthermore, some of the countries in Southeast Asia also experienced serious flooding, such as Thailand, Laos and Vietnam on 12 August 2016 [9]. In Thailand, five districts were affected, seven bridges and more than 20 buildings were destroyed at Mae Hong Son while at Nan Province, the flood was affected 127 small districts and the flood water level up to 3 metres deep [10]. 4977 people were affected by the flooding happened in Laos. In Vietnam, seven people were died due to the Typhoon Dianmu, at least 44 homes were devastated by the storm, two people were missing during the flood and more than 600 houses were destroyed.

Moreover, in Northeast Asia, such as Korea, also facing a severe flood disaster due to the typhoons and localised concentrated rainfall, which caused 35 people killed, and 13 others missing [11].

Other than flood disaster, earthquake also happened worldwide during these days. In India, there was an earthquake on 12 October 2016 at 4.01am with a Richter scale of 5.3 that hit Lakshadweep Sea area [12]. On 26 August 2016, there was an earthquake in Ranau, Sabah, East Malaysia at 9.39am, which measured 4.0 on the Richter scale and a depth of 10km [13]. Climbers were rushing down quickly from 4095m peak of mountain with the assistance of mountain guides. It was smaller in the magnitude when compared to the earthquake which happened on last year, 5 June at the same place but with a highest magnitude of 6.0 on the Richter scale which lasted for 30 seconds where it was the strongest earthquake that hit Malaysia since 1976. During that earthquake, 18 people died on the Mount of Kinabalu.

There is a total number of reported natural disasters in five continents, which are Asia, Europe, Africa, Americas and Oceania in the year of 2011 to 2015 as shown in Table 1.1 and Table 1.2 [14]. From Table 1.1 and Table 1.2 below, it can be concluded that the continents number of flood disaster from year 2011 to 2015 is higher than the number of earthquake disaster.

However, the total deaths in 2015 due to earthquake disaster is more than the total deaths of flood disaster. Malaysia is a country still outdated in flood and earthquake disaster management and many citizens thought that Malaysia is a country free of disaster. Hence,

Malaysians do not have any precaution or preparation when there is a disaster happens. People start to get panic and do not know what to do. Therefore, we have to explore more on flood and earthquake management, so that the total loss of lives and property damage will be reduced.

Table 1.1: Total number of reported flood disaster in continents between 2011 and 2015.

FLOOD	2011	2012	2013	2014	2015
No. of Disaster	156	136	149	135	152
Total Deaths	6,163	3,544	9,836	3,532	3,433
Total Affected	1,364,477,230	639,620,190	32,075,880	415,692,120	34,774,984

Table 1.2: Total number of reported earthquake disaster in continents between 2011 and 2015.

EARTHQUAKE	2011	2012	2013	2014	2015
No. of Disaster	30	29	28	26	21
Total Deaths	20,946	711	1,120	773	9,526
Total Affected	1,747,620	28,602,580	70,311,620	32,118,620	71,709,830