Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF MOBILE BASED FLOOD DISASTER MANAGEMENT SYSTEM

MOHD ARIFUDDIN BIN MOHD ROFI

Bachelor of Computer Engineering Technology (Computer Systems) with Honours

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A project report submitted
in partial fulfillment of the requirements for the degree of
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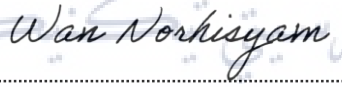
Signature	:	
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DEDICATION

I dedicate this project to my beloved parents for providing all the support and assistance that have made possible the fruition of our efforts. They have never given up and will always be remembered in this heart.

Next, I dedicate this project to my supervisor lecturer for all support and cooperation during the Final Year Project. Your patience, knowledge, and words of encouragement gave me immense strength throughout the project.

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ABSTRACT

Flooding has become one of the world's most growing natural catastrophes. It is one of the worst natural catastrophes in many nations and affects low-lying or flood-prone regions. For both flood management and emergency response activities, a complete and thorough decision-making tool is needed to reduce loss of life and economic damages. In this project, we propose our research design to create a mobile disaster management system for floods. We have identified three research objectives. The initial stage will be to define key flood risk assessment criteria, followed by the creation using Geographic Information System (GIS) and Multi-Attribute Decision Making (MADM) and data mining methods of a relative flood risk measuring model. In the third goal, the integrity of communication technology and other ICT-related needs is a holistic architectural design for mobile decision assistance. The third objective is to verify the efficiency of mobile based flood disaster management system by getting survey form from 50 respondents. The case study approach is used to understand the flood event and to verify the model of support for the decision. Flood maps based on data gathered through questionnaire answers by experts, a field survey, the satellite pictures and papers from flood control organizations have been produced using well-defined methods. They aim to offer important comprehensive information for flood risk management, evacuation and communication by combining a mathematical model, GIS and a mobile application in the flute risk assessment. The decision-making support design for this project may enhance the warning system and help to reduce casualties.

ABSTRAK

Banjir telah menjadi salah satu bencana alam paling berkembang di dunia. Ia adalah salah satu bencana alam terburuk di banyak negara dan khususnya di kawasan rendah atau rawan banjir. Untuk kedua-dua aktiviti pengurusan banjir dan tindakan kecemasan, alat membuat keputusan yang lengkap dan menyeluruh diperlukan untuk mengurangkan kehilangan nyawa dan kerosakan ekonomi. Dalam projek ini, kami mencadangkan reka bentuk penyelidikan kami untuk membuat sistem pengurusan bencana bergerak untuk banjir. Kami telah mengenal pasti tiga objektif penyelidikan. Tahap awal adalah menentukan kriteria penilaian risiko banjir utama, diikuti dengan penciptaan menggunakan Sistem Informasi Geografi (GIS) dan Multi-Attribute Making Making (MADM) dan kaedah perlombongan data model pengukuran risiko banjir relatif. Dalam tujuan ketiga, integriti teknologi komunikasi dan keperluan lain yang berkaitan dengan ICT adalah reka bentuk seni bina holistik untuk bantuan keputusan mudah alih. Objektif ketiga adalah untuk mengesahkan kecekapan dan keberkesanan sistem pengurusan bencana banjir berasaskan mudah alih dengan mendapatkan jawaban soal selidik daripada 50 orang responden. Pendekatan kajian kes digunakan untuk memahami peristiwa banjir dan untuk mengesahkan model sokongan untuk keputusan. Peta banjir berdasarkan data yang dikumpulkan melalui jawaban soal selidik oleh pakar, tinjauan lapangan, gambar satelit dan kertas dari organisasi kawalan banjir telah dihasilkan dengan menggunakan kaedah yang ditentukan dengan baik. Mereka bertujuan untuk menawarkan maklumat komprehensif penting untuk pengurusan risiko banjir, evakuasi dan komunikasi dengan menggabungkan model matematik, GIS dan aplikasi mudah alih dalam penilaian risiko seruling. Reka bentuk sokongan membuat keputusan untuk projek ini dapat meningkatkan sistem amaran dan membantu mengurangkan korban.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

A flood is a natural event that may have far-reaching implications for both humans and the environment. Flooding is defined as reasonably high streamflow overturning the natural or manmade banks in any section of the river, lake, lake or dam before joining a stream and/or coastal flood produced by super-high levels of the sea and/or waves which overload shoreline defenses. The language used must be consistent and comprehensible given the various ideas being discussed. A flood is an overflowing body of water that normally is not inundated. In Malaysia all kinds of floods occur: Monsoon floods, urbanflash, debris flow, mudflow, landslides, tidal floods, dam releases and bund breach. In general, floods are divided into two types: river floods and coastal floods, each having its own specification, which is:

1.1.1 River Floods

Due to flows surpassing the capacity of stream systems and spilling natural or manmade barriers, floods occur mainly on floodplains or wash land. Normally dry land flooding is produced by water overflowing a stream, river, estuary, lake, or dam's naturalor manmade bank. In rainy circumstances, floodplain or other flat regions may flood when an already shallow water table rises above ground level. This kind of water table flooding is often an early warning indication of stream flooding. Under dry circumstances, huge flat regions may flood when the ground surface is baked hard or crusted. Rainwater flooding is anticipated in dry and semi-arid areas, although it

also occurs elsewhere. Overflow or surface ponding, as mentioned above, often causes flooding in urban settings, but it may also occur when urban stormwater drains become overloaded and overflowing. Stormwater is caused by storm runoff. During a rainstorm,some water stays on the surface or is retained as groundwater in the soil or undergroundaquifer, some water is utilized immediately by plants, and the remainder runs over the surface. This overland flow is called stormwater. Local Overland Flooding occurs whenlocal runoff inundates a stream, river, estuary, lake, or dam rather than overbank discharge from a stream, river, lake, or dam. Coastal Flood.

Floods in low-lying coastal areas, including estuaries and deltas, involve brackishor saline water inundating the land. Brackish-water floods occur when river water overflows embankments in coastal reaches due to high tide conditions impeding flow into the sea. Overspill is exacerbated when high tide levels rise above average due to storm surges or when large freshwater flood flows move down an estuary. When huge wind-produced waves are driven into semi-enclosed bays under severe storm or storm- surge conditions, or when so-called 'tidal waves' created by tectonic activity-travel into shallow coastal waters, direct inundation by saline water floods can occur.

1.1.2 Coastal Flood

Floods in low-lying coastal areas like estuary and deltas include the inundation ofbrackish or saline waters. Brackish-water floods occur when river water overflows into the sea beds of the coast due to high conditions of tide that impede sea flow. The excessis increased by high tide rises above average by storm surges or when substantial fluxesof freshwater travel down an estuary. In extreme stormy or tempest conditions when big waves of the wind are carried into semi-closed bays, or when the so-called

'tidal waves'arise by tectonic activity in the shallow coastal waters direct floods may occur.

1.2 Problem Statement

A flood is usually produced by a combination of heavy rain and river or coastal overflow from their banks, and it may occur at any time of year. Most river floods are triggered by climatological events such as heavy and unusually prolonged rainfall. Significant flooding happens often during the time of snowmelt and ice melt in spring and early summer in cold-winter regions where snowfall accumulates, particularly whenmelt rates are high. River floods may also occur when landslides fall directly into upstream lakes or reservoirs, causing a rapid increase in water level that exceeds the outlet or dam. Coastal areas are also susceptible to sea flooding, which is usually causedby a combination of high tides, increased sea levels, and massive waves associated withstorm surges caused by severe cyclonic weather systems and low air pressure. The problem with disaster management systems is not a lack of technology or the availabilityof critical information. It is often related to a lack of information accessibility. Having the correct information on the right person at the right time may be crucial in reacting toa flood. The ability to use data more quickly to manage, discover, and critically evaluatethe situation is essential to resolving the flooding problem. These issues include an imbalance in disaster risk management planning approaches between top-down and bottom-up approaches, a lack of coordination in executing the disaster risk managementcycle, and a lack of long-term planning (particularly for recovery / post-disaster), whichhas resulted in low community and stakeholder resilience to disasters.

1.3 Project Objective

The main aim of this project is to design a project that control and develop measurement model for relative flood risk using Geographic Information System (GIS), Multi-Attribute Decision Making (MADM) and data mining technique. Specifically, the objectives are as follows:

a) To develop a Geographic Information System (GIS) to approach flood disaster management system in Melaka effectively.

b) To develop a firebase in the mobile-based flood disaster management system application that is user-friendly.

c) To verify the efficiency of river water level push notification to the problem statement by conducting a survey that consists of 10 survey questions and 50 respondents of Melaka residents.

1.4 Scope of Project

The scopes will be helpful to keep the projects in line to achieve their goals. The development of the mobile application by the project is also limited by a specific requirement. The criteria include the acquisition of the ecosystem in a disaster management system, a functional MDMS system and the enhanced responsiveness of the company in natural catastrophes. The present technique of disaster recovery focuses on telephone conversations. This, however, is not a totally dependable or feasible futurestrategy. More research should be carried out on the existing system, including interviews with key individuals and observations of the present usage of the system.

This will enable the project's requirements to be more precise. There are difficulties with scalability, and there are almost no continuity or redundancy preparations. Suppose a natural catastrophe, like an earthquake, is destroying telephoneconnections. In this situation, unless Internet services providers and telecommunicationsfirms fix the problem, there is no way to restore telephone networks.

The mobile application needs to enhance the reaction capabilities and ability of the disaster management system to communicate with the public. A mobile application mayoffer individuals in the impacted region with vital information such as updates from thecountry's disaster warning system, local information for people to assist, and effective disaster recovery. A cloud-based approach also increases system stability considerably and makes it stronger than the traditional, earthquake-prone telephone system. Enablingpush notifications on mobile devices will enhance the efficiency of the system by givingfast and efficient notice of those in danger. A cloud-based solution is also less expensivesince the business does not pay for resources not utilized.

1.5 Thesis Structure

Chapter 1:

The first chapter gives a brief overview of the idea. This chapter is about the background of the project. The focus was on the project overview, goals, problem statement and project scope.

Chapter 2:

The second chapter covers the concept, theory and some of the hardware components employed in this project. This chapter further explains the word used for this research project.

Chapter 3:

The methodology is explained in this section. The methodology chapter is a timetable or steps to complete and structured reports of studies to be carried out to achieve this goal. This chapter explains the procedure for completing the project and detailed information on the development of this project.

Chapter 4:

This chapter discusses the results and the feedback we get based on the methods.Both models, data collection and analysis, have been thoroughly discussed. The results were compared with the objectives outlined to present those theories and conclusions.

Chapter 5:

The conclusion and future work are discussed in this chapter. This section ends with guidelines for improved system performance based on desired outcomes.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In the last three decades floods have been a major danger globally and are presently becoming more frequent in Malaysia It led to the death and destruction of persons and property. It is one of the natural disasters which hinders the growth of a nation. Flood was the most common disaster in Malaysia since the 1920s and affected abroad variety of areas, especially lowlands. Previous studies show that the developmentof the area is responsible for almost 9% of all disasters, while the flood affects around 22% of the whole population directly. Indeed, due to increased migration from rural to town areas, unregulated land structure changes, poverty and another flood risk factors the flood disaster is expected to worsen. The frequency of rainfall increases and the sea level in some parts of the nation grows and flooding in Malaysia increases.

The two most frequent types of flooding in Malaysia are the monsoon and flash floods. Monsoon floods are the most prevalent between May and August (Southwest Monsoon) and November and February (Northwest Monsoon). In crowded cities, on theother hand, flash floods are more frequent. This is the consequence of uncontrolled human activities, such as the construction of infrastructure near river areas and large waste, leading to clogged drains and waterways.

2.2 Result and Statistical Information

As suggested flow disasters may be classified into three main phases: pre- catastrophe, post-catastrophe, and post-disaster, which need and address all processes inany Flood Early Warning and Response System (FEWRS) plan. FEWRS may also include early warning and preplanning, since flood damage may be significantly minimized. The implementation of the FEWRS provides additional information to prepare people for natural disasters such as tsunamis or floods. FEWRS will also react swiftly to mitigate damage prior to the occurrence of a disaster. Early warning systems may also be used to predict floods and allow local governments time to evacuate residents.

This is because the pre-disaster stage is a realistic first step in incorporating general flood-related situations and provides real-time access to flood mitigation and preventive knowledge. Academics in the field of information systems think that information systems may play a critical role in improving the efficiency and effectiveness of disaster management activities in emergency circumstances. The foundation for flood and early warning systems, which includes natural or man-made disasters such as floods, cyclones, tsunamis, or earthquakes.

As shown in figure 2.1. This research focuses on floods by using an Early Warningand Reaction System as a means of mitigating flood damage. This study falls under the category of information systems since it makes use of an Early Warning and Flux Response system. The FAEWRS, shown in figure 2.1, is an example of an information system of this kind. It provides data on factors influencing the efficiency of information systems used to handle natural catastrophes. Disaster techniques based on data, such as FEWRS, can forecast and provide recommendations for natural disasters based on factors that aid in disaster

management. Thus, it is critical that information-based disasterprediction systems provide adequate time for policymakers and the community to respond to evacuation. Additionally, an early warning system must have a response component to guarantee the full effectiveness of information-based disaster systems.

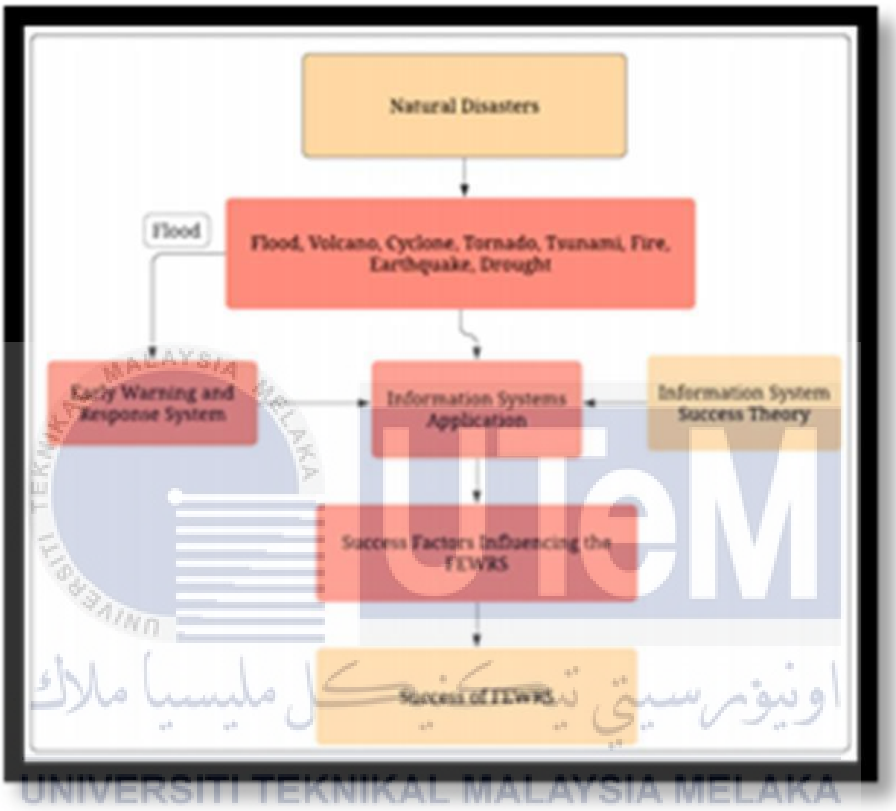

Figure 2.1: Framework of The Flood Early Warning and Response System

2.2.1 Flood Early Warning and Response System (FEWRS)

Flood disasters and flood related risks are linked to one another, and thus FEWRSDecision-makers utilize both concepts mainly for the sake of reducing flood levels tolerable at different disaster management phases.