UNIVERSITI TEKNIKAL MALAYSIA MELAKA

FLOOD MONITORING & WARNING SYSTEM USING NODEMCU WITH BLYNK APPLICATION

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

by

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Date: 17/2/2021

APPROVAL

This report is submitted to the Faculty of Electrical and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automation Industry and Robotics) with Honours. The member of the supervisory is as follow:

Signature: ……kamilah jaffar……

Supervisor: Puan Kamilah Binti Jaffar

Signature: ……fareq……

Co-Supervisor: Encik Muhammad Fareq Bin Ibrahim

ABSTRAK

Perkembangan system pemantauan banjir terdiri dari permukaan air, pengesanan hujan dan aplikasi Blynk waktu sebenar dan sistem amaran. Mikrokontroler nodeMCU digunakan untuk mengawal sistem yang terdiri daripada sensor ultrasonic dan sensor tolok hujan dan menulis data ke aplikasi Blynk melalui WiFi. Memantau papan pemuka dan amaran sistem dibangunkan menggunakan aplikasi Blynk. Sistem pemantauan banjir ini dikembangkan untuk memantau permukaan air dan mengukur jumlah hujan dalam waktu sebenar dan segera memberi isyarat kepada pengguna apabila berlaku situasi amaran yang ditentukan melalui aplikasi Blynk. System ini akan ditempatkan di kawasan longkang yang terdedah kepada sistem saliran banjir. Data dikumpulkan dan disimpan dalam pangkalan data Blynk serta merta untuk tujuan rakaman. Objektif sistem yang dicadangkan adalah untuk menghantar maklumat banjir menggunakan prosedur yang lebih efisien sehingga pengguna akan menerima maklumat mengenai keadaan banjir dengan lebih awal menggunakan aplikasi Blynk yang dapat diakses dengan lebih mudah dengan bantuan WiFi binaan bagi mewujudkan sambungan ke internet menjadikan sistem yang lebih jauh efisien berbanding dengan sistem sedia ada. Sistem ini tidak hanya berhenti disitu sahaja, tetapi terus memberi peringatan pada tiga tahap iaitu tahap Selamat, tahap Peringatan dan tahap Bahaya melalui aplikasi Blynk.

ABSTRACT

This development of a flood monitoring system consists of water level, rain detection and Blynk apps real-time monitoring and alert system. The microcontroller nodeMCU is used to control the system which consists of ultrasonic sensor and rain gauge sensor and write the data to Blynk apps via WiFi built-in. Monitoring dashboard and warning system were developed using Blynk application. This flood monitoring system is developed to monitor the water level and to measure amount of rain in real time and alert the user immediately when the defined alert condition occurs through the Blynk application. The system will be placed at area that prone to flood drainage system. The data are instantly collected and stored in a Blynk database for recording purposes. The objective of the proposed system is to send flood information using more efficient procedure thus the users will be receiving information about the flood earlier using Blynk application that can be access easily by users, with the help of WiFi built-in to establish the connection to the internet makes the system far more efficient compared to the existing system. The system however does not just stop there but proceed to give alert for three-level that are Safe level, Warning level and Danger level via Blynk application.

DEDICATION

To my beloved parent is Muhamad Bahar Bin Jaapar and Azura Binti Jalani, the one who support me to get through everything during my studies here. To the most caring Academic Advisor, En Mazree Bin Ibrahim. To my beloved supervisor, Puan Kamilah Binti Jaffar.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

IoT	Internet Of Things
SMS	Short Messaging Service
GSM	Global System for Communication Mobile
GUI	Graphical User Interface

CHAPTER 1

INTRODUCTION

1.1 Research Background

Flood is not a new issue in Malaysia every year flood occurs in Malaysia due to climate change and constructions. Flood is the most devastating natural disaster experienced in Malaysia, as a developing country flood issue must be taken seriously. Improper drainage systems are the primary causes of flooding. The worst flood occurred in Malaysia have been described in December 2015, where more than 200,000 peoples were affected while 21 were killed [1]. In Kuala Lumpur, the drainage system that existed along with the city already old and no longer efficient in accommodating and running water from more torrential rain. In metropolitan areas, the lack of impervious area affects water quantity and capacity of the drain channel [2]. Flooding also causes a lot of damage to property and assets such as houses, transportations, and business. The existing system only notifies certain agencies, and the act of rescue by the agencies takes time. The victims also need easy access to the current water level in the drainage. Flood victims need an early warning to prepare to face the flood so that the damages caused by floods can be minimized. The amount of damaged caused by the floods is interacting closely with the period of warning given before the flood event happens. The victims need easy access to the real-time water level in the drain.

It is important to develop the smart flood monitoring system using wireless connection so that the system can be more useful, and can be tested in real-time

monitoring. This flood monitoring system is to alert the user about the water level; for this system, it will give alert for three levels that are Safe level, Warning level, and Danger level. This system will give alerts through the Blynk Application. Most of the existing systems only give alert to the specific organization. With this system, the system will give alert to everyone that using the Blynk application. This project will be using more efficient procedures; thus, the users will be receiving information about the flood earlier using the Blynk application that can be accessed by users. Since most citizens have access to the internet, with the help of WiFi to establish the connection to the web makes the system far more efficient compared to the existing system.

1.2 Overview

Flood is not a new issue in Malaysia every year flood occurs in Malaysia due to climate change and constructions. Flood is the most devastating natural disaster experienced in Malaysia, as a developing country flood issue must be taken seriously. Improper drainage systems are the main causes of flooding. In Kuala Lumpur, the drainage system that existed along with the city already old and no longer efficient in accommodating and running water from heavier rain. In urban areas, the lack of impervious area affects water quantity and capacity of the drain channel. Flooding also causes a lot of damage to property and assets such as houses, transportations, and business. The existing system only notifies certain agencies, and the act of rescue by the agencies takes time. The victims also need easy access to the current water level in the drainage. Flood victims need an early warning to prepare to face the flood so that the damages caused by floods can be minimized. The amount of damaged caused by the floods is interacting closely with the period of warning given before the flood event

happens. The victims need easy access to the real-time water level in the drain.

1.3 Problem Statement

The main objective of this project as follow:

a) To Develop Flood Monitoring System that can help people to indicate early information on flood to prevent water damage.

b) To measure water level and rainfall –To measure water level rainfall using the ultrasonic sensor and rain gauge sensor.

c) To design the system to alert the user about the water level and send flood information using the blynk application.

1.4 Objectives

The flood monitoring system using IoT is designed to monitor the potential for flooding and to give early warning on flood events. A few readings will be collected and being monitor, which is the amount of rainfall and water level in the drainage. The equipment will be placed at the drainage system and attached to the solar panel as an alternative to a limited power source in the area. The project will also be installed with a wireless network system to have internet access to be able to send the data to the database server. All data will be sent to the database continuously. A mobile phone application platform will be used to visualize the data and to give alert to the user.

1.5 Limitation of Project

There are several identifiable constraints of this project. First, this system only covers the monitoring and warning system part, in which there is no element that can be manipulated or controlled by the system to prevent a flood from happening. Moreover, this system needs internet access continuously. For this IoT concept to works, all sensor nodes need to be connected to the cloud server using the internet network

CHAPTER 2

LITERATURE REVIEW

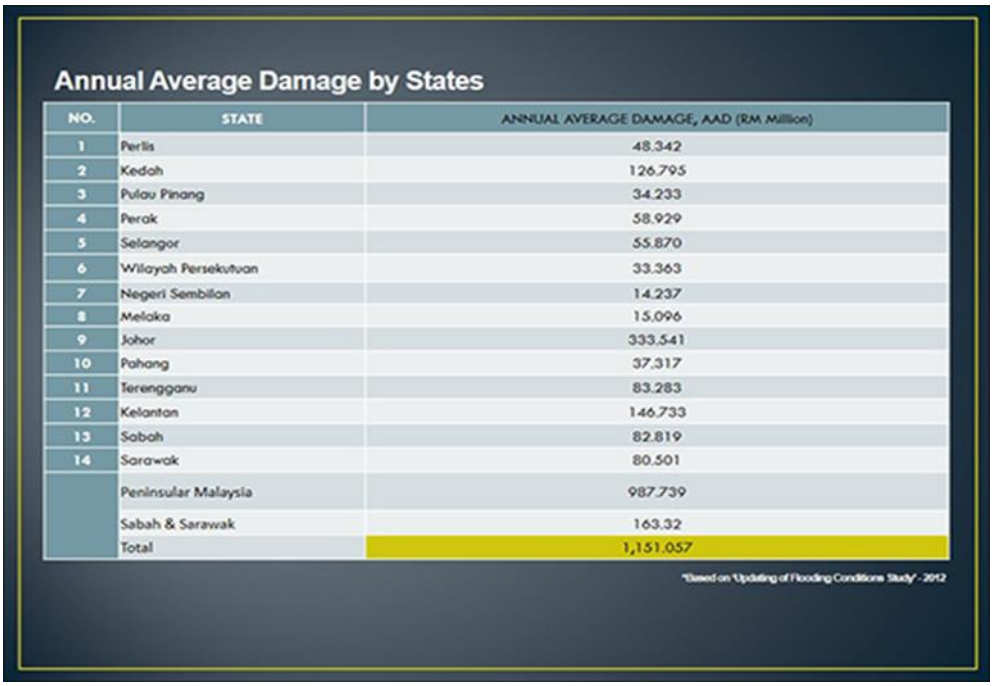
2.1 Introduction

In this chapter, it consists of literature review that have been done to provide a comprehensive review of previous flood monitoring system. The review is used to discuss what components and features that are used to develop previous flood monitoring system.

2.2 Flood Scenario in Malaysia

The flood can be determined as a body of water, rising water, swelling and overflowing land that cannot be covered. Furthermore, overflowing of the riverbank, lake or drainage system of water onto adjacent land as a result of the storm, ice melt, tidal action and channel barriers [3]. There are no specific categorizations of floods in Malaysia but casually categorized as monsoonal, flash or tidal surges at someplace. Floods can also describe based on its location, characteristics, why it happens, timing when it occurs and its duration. In Malaysia, flooding always is a big problem that dominated from the 1880s until right now. Flood is a natural disaster caused by climate factors such as heavy rainfall, temperature too hot, evaporation, wind and movement of natural conditions on earth and so on. Flooding is a natural disaster that achieves 40% to 50% of all types of accidents can cause deaths in the world [4].

The causes of the flood can be divided into two. First, natural causes of the wave: Short and too much amount of rain can lead to a flash flood widespread heavy rain leads to land inundation. Second, human-induced floods: Disposal of solid wastes into rivers, sediments from land clearance and construction areas, increases in inaccessible regions and obstruction and refinement in the rivers. The flood gives an impact on both positive and negative effect in our life. The wave actually can help maintain, enriching and reconstruct some sector of biodiversity in the flood plains area, replenishes the land with nutrient-rich soils and therefore suitable for agriculture and natural vegetation, clear debris as well from the flooded area and recharges groundwater storage. But the flood also has a negative effect, like it can affect lives, interrupt social and economic activities and destroy properties, causes trouble and recovery from the flood of course cost high for both to individuals and the government, and prevent or slow down new investments in the flood-prone area [3]. Flood damages can be generally divided into two main types; tangible and intangible costs [5]. Physical damage is the damage that can be measured directly in money terms while immaterial damage is not. Invisible damage such as losses of ecosystem functions is painful to translate because the monetary value is not readily assessed. Flood damages can also be experienced in a direct or indirect way. Hence, the tangible and intangible damage can be further divided into two subtypes, direct and indirect cost. Direct losses are the damage that occurred due to the physical contact of floodwater with humans, property or any other asset [6], such as building and inventory items [5]. The indirect damage is the damage that is induced by the flood impacts and happens in space and time, outside the flooded area [6].



Annual Average Damage by States

NO.	STATE	ANNUAL AVERAGE DAMAGE, AAD (RM Million)
1	Perlis	48.342
2	Kedah	126.795
3	Pulau Pinang	34.233
4	Perak	58.929
5	Selangor	55.870
6	Wilayah Persekutuan	33.363
7	Negeri Sembilan	14.237
8	Melaka	15.096
9	Johor	333.541
10	Pahang	37.317
11	Terengganu	83.283
12	Kelantan	146.733
13	Sabah	82.819
14	Sarawak	80.501
	Peninsular Malaysia	987.739
	Sabah & Sarawak	163.32
	Total	1,151.057

*Based on 'Updating of Flooding Conditions Study' - 2012

Figure 2.1 Annual average damage by states 2012. (Department of Irrigation and Drainage)

Malaysia is a country with equatorial climate with high temperatures and humidity. According to the Drainage and Irrigation Department (DID) Malaysia, annual average rainfall in whole Peninsular Malaysia, Sabah and Sarawak are 2,420 mm, 2,630 mm and 3,830 mm, respectively [7]. Heavier precipitation is typically recorded in the east coast of Peninsular Malaysia and the coastal regions of Sabah and Sarawak. The northeast (November - February) and southwest (April - September) monsoons bring most of the rainfall, with the former being more severe. It is not surprising to record as much as 600 mm in 24 hours in high cases. Overall, it is estimated that 9% or 29,800 square kilometres of the country are flood-prone (see Fig. 2) involving 4 million people [7]. This includes places such as Rantau Panjang (Kelantan), Kota Bharu (Kelantan), Dungun (Terengganu), Pekan (Pahang), Segamat (Johor), Kota Tinggi (Johor), Alor Setar (Kedah), Perlis, and Penang. The urbanized west coast of Peninsular Malaysia is exposed to flood mainly from the month of September to November during the inter-monsoonal period when thunderstorms are frequent. These storms bring short but very

high rainfall as highlighted above, which can overload the drainage systems within short time-period, causing a localized flash flood. The Director-General of the Meteorological Department, Che Gayah Ismail, has mentioned that a 'heavy rain' as low as 30 mm may trigger flash flood in some low-lying regions in the Klang Valley, namely places such as Gombak, Jinjang, Sri Hartamas, Setapak, Cheras, and Sungai Besi [7].

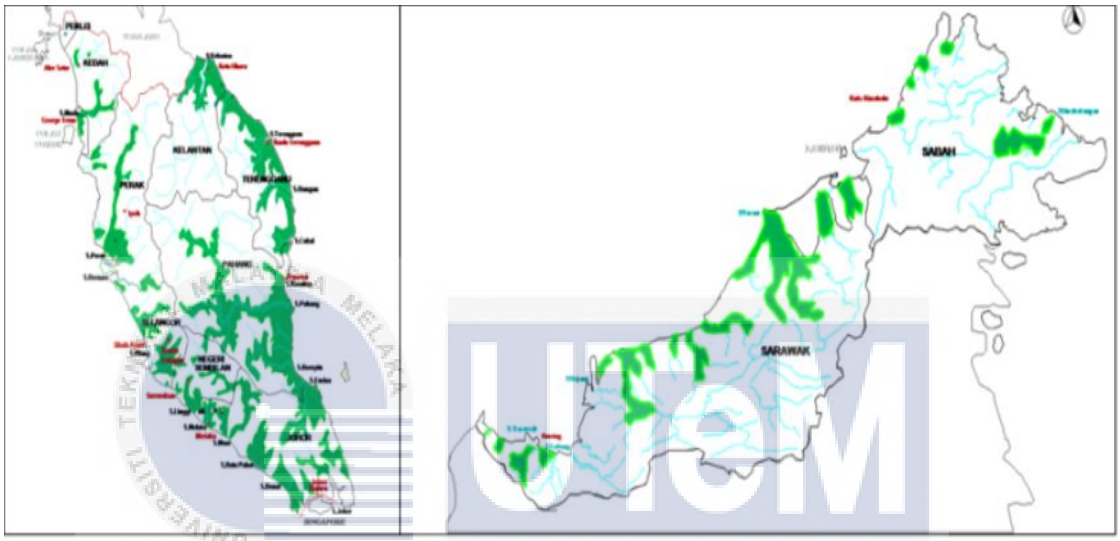


Figure 2.2 Flood-prone area in Malaysia 2012. (Department of Irrigation and Drainage)

Kuala Lumpur is one of the fastest-growing metropolitan areas of the country. Kuala Lumpur, as a developing city, flood can occur quickly. Some cases in Kuala Lumpur, it has a lot amount of rain that reached a high of 122.8mm per hour was the main cause of the floods another cause of the problem is the rubbish found in the drains because of rampant littering made by irresponsible human [8]. Usually, in the case of construction, it is clay that causes drains to become silted. In Kuala Lumpur, the drainage system that existed along with the city already old and no longer suitable in accommodating and running water from the heavy rain. So, most of the existing drainage is seem to cannot handle as the water overflow to the road. Furthermore, the old drainage system, weak and low maintenance also contributes to flooding [2]. In