



**Faculty of Electrical and Electronic Engineering Technology**



**Development of an Intelligent Flood Monitoring System using IoT  
Based Platform**

**SYAMSUL HILMI BIN JORI**

**Bachelor of Electronics Engineering Technology (Industrial Electronics) with  
Honours**

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**Development of an Intelligent Flood Monitoring System using IoT Based Platform**

**SYAMSUL HILMI BIN JORI**

**A project report submitted  
in partial fulfillment of the requirements for the degree of  
Bachelor of Electronics Engineering Technology (Industrial Electronics) with  
Honours**



**Faculty of Electrical and Electronic Engineering Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

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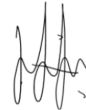
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**TIDAK TERHAD**

Disahkan oleh:

*syamsul*



Syamsul Hilmi Bin Jori  
(TANDATANGAN PENULIS)

Alamat Tetap: PPD 12 Parit Penyengat  
Darat, Parit Jawa, 84150 Muar, Johor

(COP DAN TANDATANGAN PENYELIA)

TS. DR. IDA SYAFIZA BINTI MD ISA  
PENSYARAH  
FAKULTI TEKNOLOGI KEJURUTERAAN  
ELEKTRIK DAN ELEKTRONIK  
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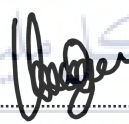
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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

Signature : 

Supervisor Name : TS DR IDA SYAFIZA BINTI MD ISA

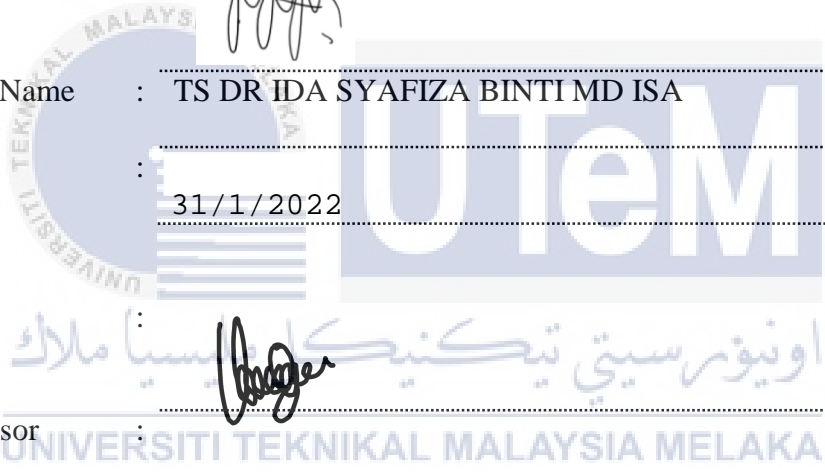
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Signature : 

Co-Supervisor : VIGNESWARA RAO A/L GANNAPATHY

Name (if any)

Date : 31/1/2022



## DEDICATION

*To my beloved mother, JUNAIDAH BINTI AHMAD, and father, JORI BIN RAMIJAN,*



## ABSTRACT

Flooding is a natural calamity that strikes Malaysia and the rest of the world every year. It devastates infrastructure and results in casualties. Flood Monitoring system can track the level of flooding and alert people to the danger. Existing flood monitoring techniques include multi-satellite analysis, image classifications and wireless sensor networks. This research aims to create technology that can tolerate Malaysian weather conditions. Its goal is to keep an eye on the water level and notify authorities as well as victims. Data on water level and velocity are critical for predicting flood disasters. This mechanism's operating premise starts with sensors gathering flood parameter at certain location, then transmitting these parameters from node to base stations. The system measure parameter such as distance, rise level and water velocity to the chance of a flood disaster occur. An application is used to show real-time monitoring while it has a prediction water rises, it's also friendly user and has the table for authorities look the data and the public view for the public uses. The data information can also be used to make future comparisons and observations.

## ***ABSTRAK***

Banjir adalah malapetaka semula jadi yang melanda Malaysia dan seluruh dunia setiap tahun. Ia merosakkan infrastruktur dan mengakibatkan korban jiwa. Sistem Pemantauan Banjir dapat mengesan tahap banjir dan memberi amaran kepada orang-orang tentang bahaya. Teknik pemantauan banjir yang ada merangkumi analisis multi-satelit, klasifikasi gambar dan rangkaian sensor tanpa wayar. Penyelidikan ini bertujuan untuk mencipta teknologi yang dapat bertolak ansur dengan keadaan cuaca Malaysia. Tujuannya adalah untuk mengawasi permukaan air dan memberitahu pihak berkuasa dan juga mangsa. Data mengenai paras dan halaju air sangat penting untuk meramalkan bencana banjir. Premis operasi mekanisme ini dimulakan dengan sensor mengumpulkan parameter banjir di lokasi tertentu, kemudian mengirimkan parameter ini dari mod ke stesen pangkalan. Sistem mengukur parameter seperti jarak, tahap kenaikan dan halaju air untuk kemungkinan bencana banjir berlaku. Aplikasi digunakan untuk menunjukkan pemantauan masa nyata sementara ia mempunyai ramalan kenaikan air, ia juga pengguna yang ramah dan mempunyai jadual untuk pihak berkuasa melihat data dan pandangan umum untuk kegunaan orang ramai. Maklumat data juga dapat digunakan untuk membuat perbandingan dan pemerhatian di masa depan.

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# CHAPTER 1

## INTRODUCTION

### 1.1 Background

In Malaysia most common natural disaster that occurs is flooding. Some of the floods are caused by natural factors such as continuous rain, monsoon season or storm over a night. Also, the flood's effect is caused by human factors too, such as trash thrown on the drain or the construction on the place that has no flow of the water. Floods can happen suddenly and quickly, but for certain situations like small floods, people can manage. However, in the worst-case scenario, the flood has reached a deadly level without our knowledge [1]. This product highlights one of a possible flood detection and warning system to efficiently monitor critical flood-prone locations in real time basis via IoT based platform. An automated flood monitoring system is being developed to provide water level or water rise data from remote flood-prone sites where human access is limited due to distance and weather conditions.

The goal of this project is to create an intelligent flood monitoring system using an IoT-based platform. We utilize IoT because it is quite popular and widely utilized nowadays. IoT is highly convenient since it is simple to link physical objects to the internet and it can also save and exchange data.

The ultrasonic sensor and the water flow are both wired connections, but when the nodeMCU esp8266 is paired with it, the data can be transferred wirelessly and monitored



from anywhere because it uses the internet.

## 1.2 Problem Statement

Natural disaster is not as common in this century since we now have technology that allows us to identify the presence of natural disaster such as earthquake, floods and even pandemic. However, there is an issue with this technology, and that is the absence of information regarding natural disaster. When it comes to natural disaster, knowledge is extremely valuable because it allows us to foresee whether the disaster will be normal or atypical. Without it, unable to alert people when they are already in the warning phase.

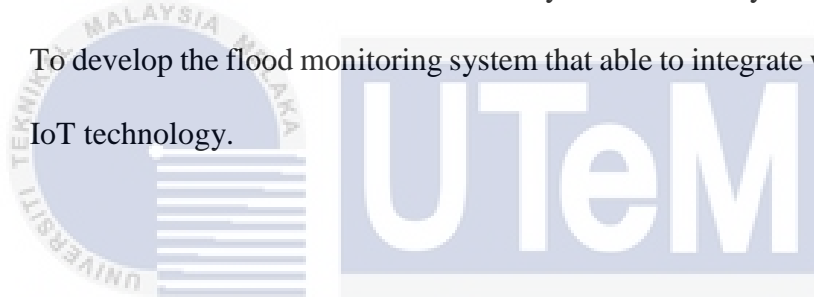
Apart from that, internet technology is used every day in Malaysia as it is their way of life, and with Google Street we can observe the state of the street seeing. However, these services cannot give real-time information in the event of a natural disaster, therefore thus cannot be used as a warning tool. When dealing with a natural disaster, quick action is essential, as it is the key to maintaining control over people and minimizing the destruction of property.

As a result, this project will address this issue by inventing a device that can continuously monitor the rise of the water level. Furthermore, this device sends data from the device to their mobile data, and it has an application that can be monitored at all times, no matter where you are.

### 1.3 Project Objective

The objectives of this thesis in completing this project will be guidance for developing the project:

- a) To design an efficient system that able to inform the Emergency Rescue Team on the severity of flooding and early warning to the people before it become severity.
- b) To develop a real time based flood monitoring system that able to predict the water rise level and indicated the severity and immediacy of the threat.
- c) To develop the flood monitoring system that able to integrate with the current IoT technology.



### 1.4 Scope of Project

Internet of thing (IoT) is the internet networking that connects any smart or physical devices to the cloud or Internet. The smart devices can be accessed the data from anywhere as long there have internet connection. Besides that, controller connected to water flow sensor and ultrasonic sensor both measure the height of the water level and the flow of the water, and the data were transmitted using nodemcu esp8266 Wi-Fi module.

This project aims to investigate a project that can obtain accurate data from sensor and send data and warning through application in real-time. The nodemcu esp8266 was used as the controller to oversee the system's operations. The ultrasonic sensor SC-HR04 and water flow sensor YF-S201 were employed. This sensor will detect the water level by reflecting soundwave in the water surface via transmitter

and receiver, and it will also sense the velocity of water flow. The data when to cloud as its database and then the data from cloud that is Thingspeak send the data through phone application to show the data on the phone that create from MIT app inventor.



## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

There were many research journal or thesis regarding the flood monitoring and alert system. In this field of study many had their different analyst and specialties and how the hardware is used but this system had been implanted to aimed improved the research and avoiding unnecessary repetition problem in this area of study.

#### 2.2 Previous Project Research

Based on literature review that can be summarize by on research and finding information that related with the project through the existing resource such as internet, journals, books, etc. So, by this method, understanding of project can be achieved.

##### 2.2.1 Flood Monitoring and Prediction System: An Implementation of Dynamic Web (PHP) and Internet of Thing (IoT)

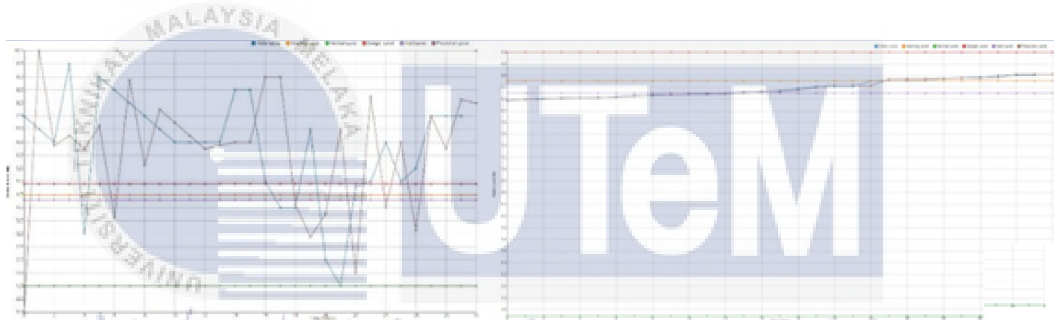
Based on [1]. Flood is most frequent catastrophic events in the monsoon season, so for that Flood monitoring system and tracking system are important to minimize the cost of flood using dynamic web and IoT method for the fast response.

By using Arduino Machine as the main microcontroller and ESP8266 module to get the wi-fi. This controller received data from the HC-SR04 ultrasonic sensor that measure at certain height, and they have addition sensor such as the led and buzzer sensor to alert the people surrounding them. The data that read by ultrasonic is send to the client and process

to the application and then it saves at its database server.

The result figure 2.6 show that have predict graph and actual event when do the project by using excel to get the data.

The objective for this research was achieved, but some part can be improved to increase the effectiveness of the project, so it works conveniently to use. The usage of the HC-SR 04 ultrasonic sensor was considered one of the best options to use in this project because its performance. This sensor has it maximum range for 2 meters thus it good to measure the water level.



**Figure 2.1 - Prediction data VS actual data from PHP**

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### **2.2.2 Real-time flood monitoring and warning system**

Over the world had experience the flood phenomenon and the cause by the flood thus, many countries deploy their engineer to solve the flooding problem but in this research paper[2], there are using other than ultrasonic sensor and water depth sensor that is STARFLOW sensor.

Based on this paper they have two parts of the system, first is the remote site that have a monitoring system and GPRS Data unit. In monitoring systems, they are using

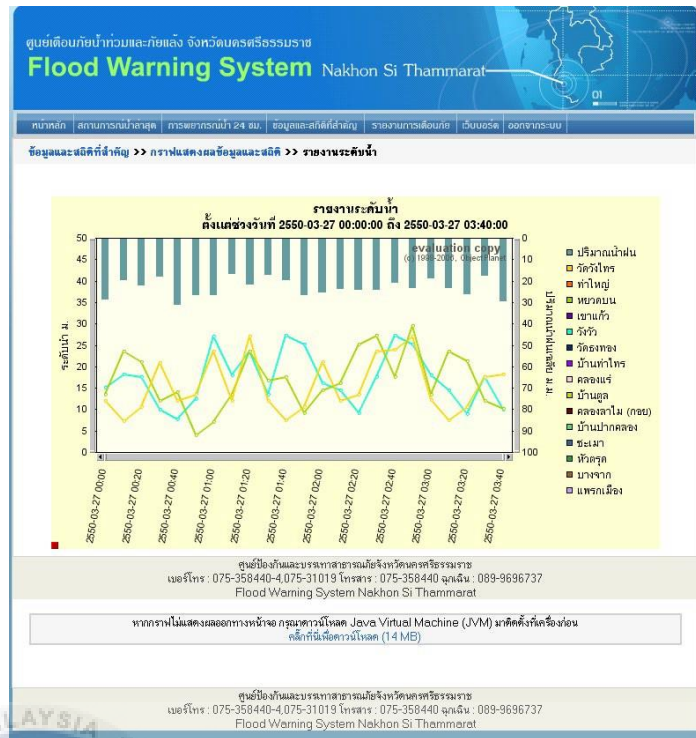
STARFLOW that consists of water level, water velocity/flow and rainfall. The second part is the control center with Database and Web Application Server and GPRS Gateway Server. And their communication between those two are the mobile GPRS.



**Figure 2.2 STARFLOW sensor**

Base on their outcome the figure 2.2 graph shows that the data collect at midnight till morning (00:00 – 03:40) this is showing the sensor is active when outside of human services, the data were sent to the back-end system (web-based monitoring application) for further analysis and visualization. The data were visualized in various graphs to ensure users can analyze the system in real-time, daily, or monthly.

The main objective for this project to develop a real-time flood monitoring and warning system for a selected area and there are completed their objective. This project might have a sum amount to use the STARFLOW sensor. Because of that it might not convenient to use on the small-scale but this is provide that it using remote sensing sensor to its fullest on their location.



**Figure 2.3 View of water condition**

### 2.2.3 Smart IoT Flood Monitoring System.

This project[3], contains several components that were combined to make it whole complete system. The system was controlled by ARM Mbed NXP LPC1768 as their main controller. This system is also equipped with an ultrasonic sensor to measure the water level also it has a ESP8266 wi-fi module that add on as external to sense the data and share the data to the cloud. The using led and lcd is to display and indicate the level of the water. For the cloud they are using the ThingSpeak.

In this project the author using the ARM Mbed because this MCU offer the operating system and many cloud services and, it's a based internet of thing (IoT) solutions and LPC1768 has a programming drag and drop with the USB drive it easy to use online tools.

#### **2.2.4 Flood Detection and Water Monitoring System Using IoT**

This design has been conducted by the Dept of Computer Science and Engineering in India[4]. The purpose of this design is to see the speed of change in the swash stage on a Real-time basis, which may help indicate the soberness and proximity of this trouble understanding the shape of a storm that generates the humidity, like length, intensity and areal extent, which is effective for locating the implicit soberness of deluge.

They using Arduino Wemos D1 R1 as their main microcontroller which it has wi-fi build in the arduino and the data from arduino can upload every 1 second, with the component such as ultrasonic sensor to measure distance of water, flow sensor to measure the flow water transferred DHT11 to measure the humidity and temperature and Float sensor to acts as switch when water level hits the float sensor to move up connecting the circuits and hence sends a stress signaling alarming the user for possible rise in water level.

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#### **2.2.5 IoT based Monitoring and Control System for Home Automation**

Velammal Engineering College carries this research to study IoT based Monitoring and Control systems for Home Automation[5]. This project aims to control domestic equipment via smartphones with Wi-Fi as a communication protocol and raspberry pi as a server system, Providing extra consoles, protection and security with various decisions from economic power use. Without human interference, the user can track and handle their home portals and various devices and turn the TV on / off.