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A Compact and Low Cost Online Flood Level Monitoring

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DECLARATION

I declare that this project entitled "A Compact and Low Cost Flood Level Monitoring" is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : SHUHADA

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Date : 5 Januari 2023

APPROVAL

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 Bachelor of Mechanical Engineering Technology (BMMV) with Honours.

Signature : 

Supervisor Name : Ts. Dr. Nor Azazi Bin Ngatiman

Date : 10 Jan. 23

DEDICATION

In particular, I would want to dedicate my project to my supervisor, who supported and guided me through the process of successfully completing this project.

In addition, I would like to dedicate my project to my beloved father, who has been an unbelievable supporter until the very end, as well as to my dear mother, who has been encouraging me for months. Both of these people have been very supportive of me during this project.

ABSTRACT

Flash flood has been a common phenomenon in Malaysia and most had a hard time. Without adequate flash flood disaster management, the consequences can be severe, ranging from property damage to life-threatening situations. One of the primary challenges that the neighbourhoods has is not being informed of flash floods that occur nearby. This project's main objective is to help the community and the government in lessen the impact of flood especially on life-risk and the damage on property (public/private). To better control flash flood disasters, a more efficient flash flood management system is proposed. Real-time updates and notifications for flash flood situations can be sent directly to the community using Internet of Things (IoT) technologies. Early warnings can aid in the mitigation of possible disasters as well as the management of such disasters by relevant authorities. With the advancement of technology, early warning systems for flood management have been swiftly developed. These systems use the Short Message Service (SMS) via the Global System for Mobile Communications to inform individuals early (GSM). This paper describes a simple, portable, and low-cost early warning system that uses an Arduino board to manage the system and a GSM module to transmit data. The hardware and software components of the system have been designed and implemented. The device uses an ultrasonic sensor to monitor the water level, then analyses the data to approximate the first warning. When water comes into contact with the water level sensor, it processes the data and determines the second warning. The user is notified of the discovered warning by receiving an alert message. The GSM network is utilised to send SMS messages between the various system components. This paper proposes the development of river monitoring technologies in Malaysia, mostly for flooding disasters, to reduce the property damage and lives. Through the utilization of sensors network system that is more reliable than the current methods, this project will aid Malaysian authorities in their efforts to control flooding. Utilizing GSM technology, the prototype of the proposed design was capable of recording the water level (distance) and transfer the data to the user in a SMS text message.

ABSTRAK

Banjir kilat telah menjadi fenomena biasa di Malaysia dan kebanyakannya mengalami masa yang sukar. Tanpa pengurusan bencana banjir kilat yang mencukupi, akibatnya boleh menjadi teruk, daripada kerosakan harta benda kepada situasi yang mengancam nyawa. Salah satu cabaran utama yang dihadapi oleh kejiranan adalah tidak dimaklumkan tentang banjir kilat yang berlaku berhampiran. Objektif utama projek ini adalah untuk membantu masyarakat dan kerajaan dalam mengurangkan kesan banjir terutamanya terhadap risiko nyawa dan kerosakan harta benda (awam/swasta). Untuk mengawal bencana banjir kilat dengan lebih baik, sistem pengurusan banjir kilat yang lebih cekap dicadangkan. Kemas kini masa nyata dan pemberitahuan untuk situasi banjir kilat boleh dihantar terus kepada komuniti menggunakan teknologi Internet of Things (IoT). Amaran awal boleh membantu dalam mengurangkan kemungkinan bencana serta pengurusan bencana tersebut oleh pihak berkuasa yang berkaitan. Dengan kemajuan teknologi, sistem amaran awal untuk pengurusan banjir telah dibangunkan dengan pantas. Sistem ini menggunakan Perkhidmatan Pesanan Ringkas (SMS) melalui Sistem Global untuk Komunikasi Mudah Alih untuk memaklumkan individu awal (GSM). Makalah ini menerangkan sistem amaran awal yang mudah, mudah alih dan kos rendah yang menggunakan papan Arduino untuk mengurus sistem dan modul GSM untuk menghantar data. Komponen perkakasan dan perisian sistem telah direka bentuk dan dilaksanakan. Peranti menggunakan sensor ultrasonik untuk memantau paras air, kemudian menganalisis data untuk menganggarkan amaran pertama. Apabila air bersentuhan dengan penderia paras air, ia memproses data dan menentukan amaran kedua. Pengguna dimaklumkan tentang amaran yang ditemui dengan menerima mesej amaran. Rangkaian GSM digunakan untuk menghantar mesej SMS antara pelbagai komponen sistem. Kertas kerja ini mencadangkan pembangunan teknologi pemantauan sungai di Malaysia, kebanyakannya untuk bencana banjir, untuk mengurangkan kerosakan harta benda dan nyawa. Melalui penggunaan sistem rangkaian sensor yang lebih dipercayai daripada kaedah semasa, projek ini akan membantu pihak berkuasa Malaysia dalam usaha mereka mengawal banjir. Menggunakan teknologi GSM, prototaip reka bentuk yang dicadangkan mampu merekod paras air (jarak) dan memindahkan data kepada pengguna dalam mesej teks SMS.

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Distance	-	cm (centimeter)
	-	mm (milimeter)
Frequency	-	Hz (Hertz)
Flow Rate,Q	-	$cm^3 min^{-1}$
	-	$m^3 s^{-1}$
Velocity	-	$cm\ min^{-1}$
Cross-sectinal area	-	cm^2
Time Interval	-	Min (minutes)
Voltage	-	V
Current	-	mA (miliampere)
	-	A (ampere)
Angle	-	degree
Time	-	ms (milisecod)
Temperature	-	◦C
Weight	-	g (gram)
IoT	-	Internet of Things
GSM	-	Global System for Mobile communication
DID	-	Department of Irrigation and Drainage
ICID	-	International Commission on Irrigation and Drainage
SMS	-	Short Message Service
GIS	-	Geographic Information Services
ICT	-	Information and communication technologies
PVC	-	polyvinyl chloride
WIPP	-	Water Inflated Property Barrier
STEM	-	Science, Technology, Engineering and Math
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
IDE	-	Integrated Development Environment

GPIO	-	General Purpose Input/Output
I/O	-	Input/Output
PWM	-	Pulse Width Modulation
VIN	-	Voltage Input
DC	-	Direct Current
USB	-	Universal Serial Bus
ICSP	-	In-Circuit Serial Programming
KB	-	Kilobytes
SRAM	-	Static Random Access Memory
EEPROM	-	Electrically Erasable Programmable Read-Only Memory
UART	-	Universal Asynchronous Receiver/Transmitter
RXD	-	Receive Data
TXD	-	Transmit Data
MIC	-	Microphone
SIM	-	Subscriber Identity Module
MPPT	-	Maximum Power Point Tracking
KSB	-	(Kelompok Siaga Bencana) / Disaster Preparedness Group
PKK	-	(Pembinaan Kesejahteraan Keluarga) / Family Walfare Empowerment Group
RT	-	(Rukun Tetangga) / Neighborhood Group
LINMAS	-	Community Protection Agency

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CHAPTER 1

INTRODUCTION

1.1 Background

Floods are one of Malaysia's most prevalent natural disasters, happening almost every year, especially during the rainy season. The shores of Peninsular Malaysia are extremely vulnerable to flooding, especially from October to March, when the northeast monsoon season arrives. The majority of floods in Malaysia are triggered by cyclical monsoons during the local tropical wet season, which lasts from October to March and is marked by strong and consistent rainfall. It is also caused by poor drainage exacerbates the consequences of heavy rain in many metropolitan areas (D/iya et al., 2014).

As a result, unless a solid coping mechanism is built in advance, the disturbing trend of flood-related destruction in emerging countries will continue. Consequently, the issue could not be remedied as industrialized countries have done due to a lack of knowledge, resources, and a suitable approach. This threat of developing a countries' highlights the urgent need to enhance cost-effective structural and non-structural preventive actions that are relatively quick, technically manageable, environmentally friendly, and socially acceptable. These preventative measures should be planned and implemented by communities based on actual necessities and affordability (Ward et al., 2020).

In advance, this product will be a device that has the ability to monitor the water level of the river and the water level at the flash-flood areas as the water is starting to rise. The device will be put at the river jetty or at the road divider to estimate the final water level for preparation for floods and give warnings to the authorities and to the residents. As the water level reaches this device, it will react by sending the data to the authorities and residents.

Thus, people can acquire the information of the water level are begun to rise and they can take care of their important things as a preparation for floods.

1.2 Problem Statement

People have to be ready early whenever the flood warning is announced. They have to save their important belongings and save their lives from the disaster. However, there is some lack of flood preparation by the folks because of the lateness of the warning announced by the authorities. Hence, the administration needs a new way to detect the upcoming flood early. As for now, the authorities only depend on the rainfall warnings from the Malaysian Meteorological Department (MMA or MetMalaysia) as a flood preparation. Sometimes, the residents have to look at the water level themselves as there was no declaration of floods stated by the authorities.

These activities supposedly should no longer be implemented as the technologies are more advanced nowadays. In addition, a sensor-like device could be built to monitor the water level of the river or it can be placed at the flash-flood areas. This device could help the authorities to know the circumstance of the area and early made an announcement to the folks.

1.3 Research Objective

The main aim of this project is to help people to decrease the number of damages and also can save many lives as there is an early warning from the authorities that help people more concerned about their surroundings and not endangering themselves and inconveniencing the public. Specifically, the objectives are as follows:

a) To monitor the water level of the river as preparation for floods using the water level sensor and the ultrasonic sensor.

b) To alarm the upcoming disaster (flood) early by sending message through GSM transmitter.

c) To measure the performance of this device through the efficiency of both sensors in monitoring river water level.

1.4 Scope of Research

The scope of this research are as follows:

- The Consequences of a Flood Disaster.

  Flooding has immediate repercussions, including loss of life, property damage, agricultural destruction, livestock loss, and health complications from watery illnesses. As communication links and structures such as power plants, roadways, and bridges are wrecked or disrupted, some economic activity may come to a standstill, forcing citizens to leave their homes and disrupting the daily life.

- Choosing a suitable sensor device for outdoor usages.

  New sensor capabilities are being created as a result of advancements in wireless connectivity. Current advancements in sensor networks are critical for environmental applications. The Internet of Things (IoT) connects various devices that can exchange and collect data. By utilizing Industry 4.0, IoT extends its capability to environmental issues in addition to the electronics field (Pasika and Gandla, 2020).

- Construct a practical programing to monitor water level and a warning announcement.

  The working principle of the sensors is different from each other. Its shows different results of different sensors. All the inputs were obtained from the river water level and the instruction (warning) will be sent to the GSM module to be distributed to the authorities and the community living nearby.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A tropical depression made landfall on the east coast of Peninsular Malaysia on December 16, 2021, delivering three days of severe rainfall towards the peninsula. At least 54 people have perished and two remain missing as a consequence of the floods that have affected eight states across the country. In its most severe phase, it displaced around 71,000 people and had an overall impact on over 125,000 people (*2021–2022 Malaysian floods*).

Due to the delay in providing information and the carelessness of individuals who did not take safeguards in advance because they were unaware of the scale of the flood, the public was affected by the flood, as depicted by the aforementioned data. Therefore, a robust adaptive gadget could possibly aid people in learning the news instantly and responding to avoid unfavorable situations from worsening.

2.2 Flood Disaster in Malaysia

As far as natural disasters concerned, floods are the worst offenders in some countries, like Malaysia. Fresh water, which may be found in lakes, rivers, the earth, and the atmosphere, makes up only 0.014 percent of the planet's total water. There are two types of flooding in Malaysia: flash floods and monsoon floods, according to the Malaysian Drainage and Irrigation Department (DID, 2000a). These two disasters are clearly distinguished by the time it takes to restore normal river flow levels from a meteorological perspective. The time it takes to recover from a flash flood is only a few hours, whereas a monsoon flood could take weeks or even months (Noorazuan, 2006).

According to the Department of Irrigation and Drainage (DID), there are a total of 189 waterways in Malaysia, including Sabah and Sarawak, that have primary flows that run directly into the South China Sea. Of these 189 waterways, 85 are prone to repeated flooding (89 of the river basins are in Peninsula Malaysia, 78 in Sabah and 22 in Sarawak). The anticipated region that is at risk of flooding is around 29,800 km2, which is equivalent to nine percent of Malaysia's total landmass, and it impacts nearly 4.82 million people, which is equivalent to approximately twenty-two percent of the country's total population (DID, 2009).

2.2.1 Interpretation of Flood

According to the Multilingual Technical Dictionary on Irrigation and Drainage (ICID), a flood is described as a comparatively high flow or stage in a river that is much higher than usual. This is in comparison to the normal flow or levels. In addition, according to the International Commission on Irrigation and Drainage, a flood is a reasonably high flow or stage in a river that is much higher than typical. This definition also includes the inundation of low terrain that may follow from the flood. Flooding occurs along a river when the river's capacity to contain the discharge from its watershed area is surpassed, causing the river to overflow its banks (Sharma & Priya, 2001). River floods, rainstorm floods, flash floods, coastal floods, tropical storm floods, and urban floods are some of the other types of floods that can be classed according to their location (Chowdhury et al., 1997). There is also the possibility of classifying floods as "regular," "abnormal," or "extreme" events. The term "flooding," according to Houston (2011), refers to any region that is covered by water. It's possible that floods are a natural part of the natural environment, yet they're also unpleasant and can cause major issues in metropolitan regions.

Many other elements, including geology and region, might contribute to the occurrence of flooding (i.e. lower ground). According to Houston, when fluvial flooding occurs, the height increases in rivers as a result of volume-rich rain events that occur in upstream sub-catchments. When this happens, the water level rises above the riverbanks and begins to disperse across the land (2011). When coastal flooding occurs, which is produced by a combination of storm surges, wave action, and tidal cycles, the level of the sea increases over that of the land. Pluvial flooding happens when rainwater flows on the ground and collects in ephemeral ponds in depressive episodes because there is not enough conveyance capacity compared to the amount of rainfall that has fallen.

2.2.2 The Impact of Flood Disaster

Floods can have both beneficial and bad effects depending on its locations, duration, depth, and pace, as well as the worth and frailty of the natural and man-made habitats that influence. A flood's social, economic, and environmental impact can be felt by both individuals and populations. Water - borne diseases infections, death and property loss are just a few of the direct impacts that flooding has on people's health and well-being that are well-known for many people. People may have to abandon their houses and their regular life may be disrupted if communication linkages and infrastructure like power plants, roads, and overpasses are damaged or destroyed. Some economic operations may come to a standstill. As a direct result of this, people may lose their jobs when industries are disrupted. Damage to infrastructure can also have long-term repercussions, including interruptions in services such as those providing clean water, sewage treatment, energy, transportation, telecommunications, education, and medical care. Communities in floodplains can be made economically vulnerable if people lose their means of subsistence, if consumers spend less money, and if natural resources are depleted. Floods have the potential to cause victims and