

Flood Monitoring System using Internet of Things (IoT)

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Abstract

There have been severe floods in certain parts of Malaysia recently. It strikes quickly and has an impact on many different types of individuals and structures. Most individuals are unable to forecast when the next flood will occur because they do not have access to trustworthy information on weather trends. The development and design of an Internet of Things (IoT) flood monitoring system with the capability to identify possible flooding situations is the primary goal of this project. In order to simulate flood submergence, this project uses an pp float switch water level sensor to measure the height of the floodwater in a laboratory-scale terrain modality. In this setup, a Durian UNO serves as the microcontroller, and data is sent from the microcontroller to the Blynk application via the WIFI module (ESP 8266). Additionally, this system has a buzzer that will sound when the floodwater level rises when achieve 'HIGH' level. When the water level reach danger level or 'HIGH' was reached, the system would notify the user via the Blynk app and the Blynk dashboard colour will turn yellow if in 'MEDIUM' condition and will turn red if in 'HIGH' condition. By informing users when a flood is imminent, this Internet of Things flood monitoring device could help save lives and property in flood-prone areas.

1. Introduction

Due to the prevalence of this natural hazard, Malaysia, like any other country, is susceptible to floods. Floods are high water flows that are greater than the capacity of natural or man-made barriers, and they can happen anywhere along the river system. Because of this, when a riverbank overtops, water spills over the flood plain, creating a threat to civilization that may result in a considerable number of fatalities, the spread of disease, damage to property, and loss of economic output. Floods in Malaysia are categorised as flash floods, tidal floods, and monsoon floods by the Malaysian Drainage and Irrigation Department [1].

Scientists find it challenging to anticipate where and when a flood catastrophe will occur in Malaysia because of the country's very unpredictable climate, which can cause it to be bright one minute and begin to rain steadily the next. As a result, people cannot be warned by making predictions. Due to three days of heavy rain, eight states of the peninsular were inundated on December 16th, 2021. Over 125,000 people were affected by the flood, which also took the lives of 54 individuals and left two people missing. [2,3].

Flooding events will not stop happening, but we can lessen the damage they do to our way of life. Flood monitoring is a practical method for tracking floods and avoiding damage. It is important to notify locals in flood-prone areas in advance of anticipated flooding so they can make evacuation plans. A flood alert system installed close to any flood-prone location can provide essential information about the situation, enabling the protection of the property and the saving of life.

This project proposes a flood monitoring system using Internet of Things (IoT) which can used to be detect the water level in some rivers, ponds, dams, or reservoir. This project consists of 2 Polypropylene Float Switch

water level sensor, Durian UNO board, ESP8266 module, buzzer, Blynk IoT platform, Android apps and water level sensor would be used to sense the water level to measure whether it is in normal condition or reach the water limit level. The system also collects data from sensor, stores it into Blynk platform web server and monitors data from the platform. The proposed system provides simple and basic Android application monitoring interface and cost-effective system. ESP 8266 as a single microcontroller that receives the input signal from water level sensor and providing output by sending data to web server and triggered the buzzer. All the data regarding the water level and the live situation of the flood can be viewed by the user's smartphone.

2. Methodology

The schematic block diagram for the system's operation is displayed in Figure 1. The primary element in this system for determining the height of the water level is the pp float switch, or water level sensor, which is where this operation began. Next, it goes to the Durian UNO, the system's microcontroller. When the water level is low, the Blynk dashboard shows a low and green colour screen; when it is medium, the dashboard shows a yellow screen; and when it is high, the dashboard shows a red screen, a high screen, and a buzzer sounds.

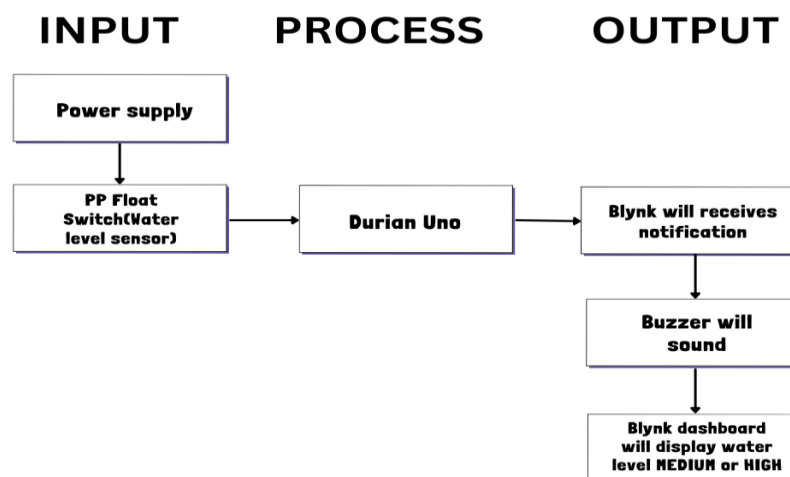


Fig. 1 System block diagram

The constructed water level monitoring system integrated with two pp float switches (water level sensors) is depicted in Figure 2 as an overall flowchart. A Durian UNO microcontroller is connected to this straightforward circuit, and it begins by initialising the port that has been previously defined. Next, two pp float switches (water level sensors) are positioned within the little "flooding model" at a specific height. The two-pp float switch, also known as the water level sensor, is used to measure the water's height. The Blynk dashboard would indicate medium or high-water levels when the water level rose above the ground. The buzzer functions as an alert warning and will sound if the water level rises above the threshold. The screen colour will also be altered by the Blynk dashboard. Next, all the information on the floodwater in Blynk would be obtained by the server.

The most crucial part of the project is the hardware development phase. Three primary elements are crucial to the advancement of this apparatus. In this project, the water level sensor, or pp float switch, serves as an input component. It is employed to calculate the floodwater's displacement. The project's central component, the Durian UNO microcontroller, comes in second. This microcontroller stores all the source code. The buzzer and warning users come last. The Blynk application will then show each of these outcomes.

One kind of level sensor is the Polypropylene Float Switch. It is used to find out how much liquid is in a tank. Most of the flow switch's typical uses are as follows: pump control, tank water level indicator, alarm, and device pairing for control. The wide input power supply range of the Durian UNO (DC 3.7V to 12V). The Durian Uno, in contrast to the Arduino UNO, features VCC and GND pins that facilitate module connections without the need for a breadboard. Durian UNO also makes servo motors directly plug-and-play capable. An MG995 servo motor and six SG90 micro servo motors can be driven simultaneously with DC current for 5V (VCC) up to 1A without sacrificing stability [7]. When floodwater reaches the threshold height, this mechanism notifies the user by a buzzer. The Cylewet 5V active buzzer (CYT1036) is the kind of buzzer that is utilised [8].

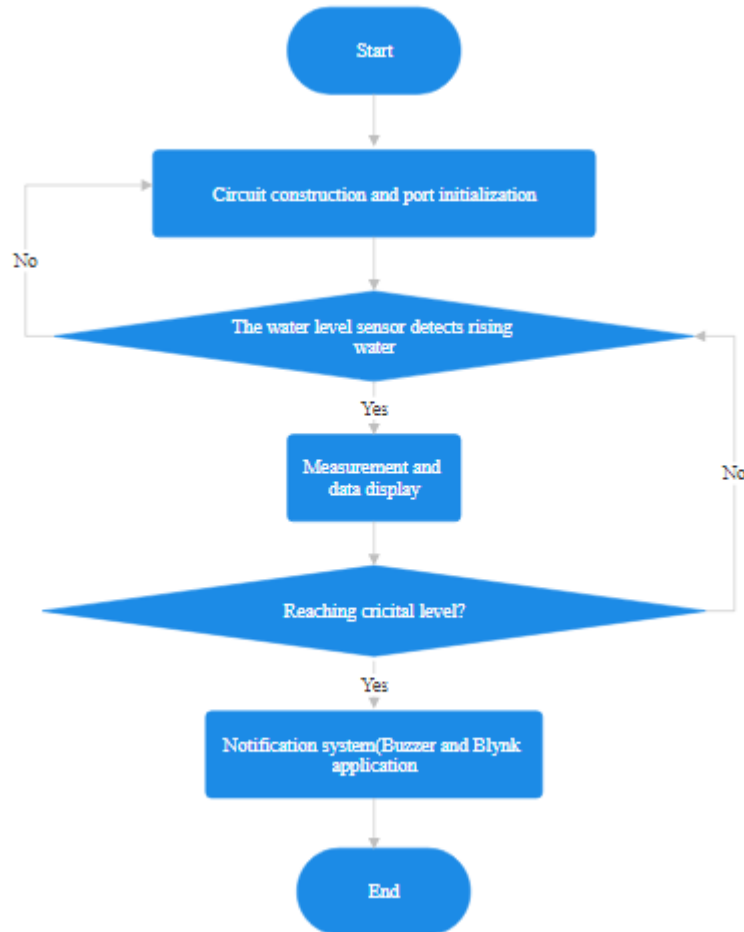


Fig. 2 Project flow

The two primary components of the flood monitoring system project are software and hardware development. All of the hardware components utilised in this project are included in the hardware development section. Among the ESP 8266 Wi-Fi module, a buzzer, a battery/power supply, and a microcontroller (Durian UNO). The Arduino IDE software is used for programming, and the Blynk application is used to connect as an Internet of Things platform.

The experiment is repeated five times to check if there is any variation in the pp float switch (water level sensor) sensitivity in detecting the water level. To ascertain the sensor's sensitivity, the experiment is therefore conducted five times in a row. The experiment was run five times to record the amount of time it took for the message to be received, to test the transmission time for the receiver to accept the message from the system.

3. Result and Discussion

A few factors, including system stability and the quantity of signals the user receives, influence the system's output. It also has a prototype system design that simulates a real-world scenario that could result in flooding. This prototype's primary goal is to assist a resident in a flood-prone location in leaving the area as quickly as possible. The tank is separated into two segments based on the prototype that is being constructed. These segments symbolise a monsoon drain and land adjacent to each other. This illustration comes from a neighbourhood where, during the wet season, the monsoon drain would overflow. Water is manually poured into the tank to add water to the prototype design.

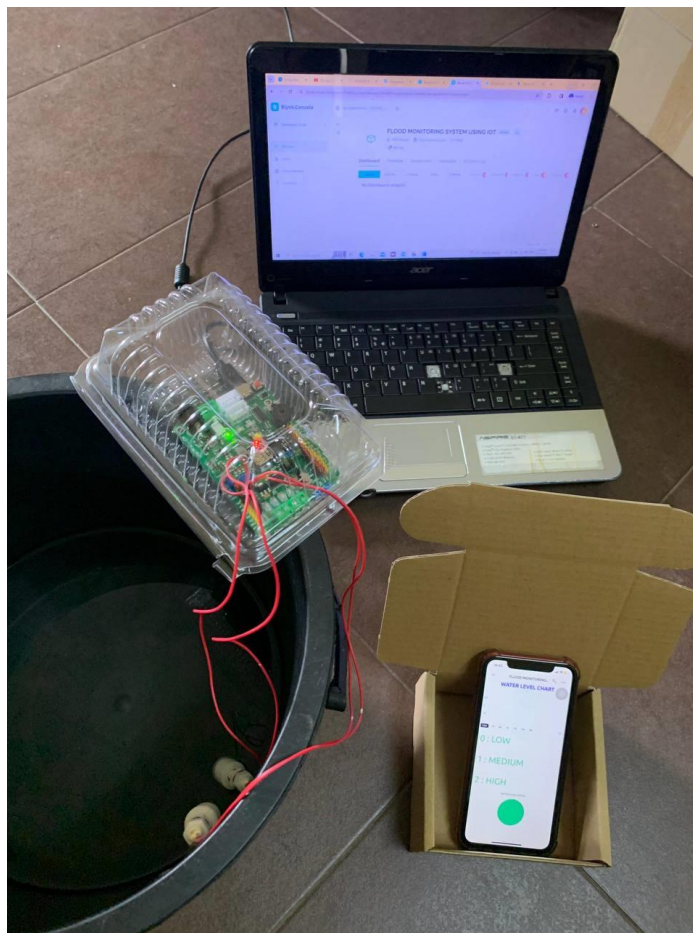


Fig. 3 Top view

Measuring the floodwater's distance is the most crucial stage in this approach. The water level sensor will be installed on the tiny tank used for this experiment. In this experiment, the tank is a monsoon drain. In this system, the water level sensor would serve as the reference point, with zero (0) as the beginning value. The buzzer will sound to inform the user as the flood water rises and over the threshold value, and the dashboard in the Blynk will turn red. After that, a notification would appear on the Blynk app for the user. The calibration of the water level sensor is checked by running the same experiment to see if there is any error occurred in detecting the level of water. The Blynk would display a 'LOW', 'MEDIUM' and if the water level pass the threshold value it will display as 'HIGH'.

The experiment is repeated five times in a row simultaneously to determine the sensitivity of the sensor and the time taken for the Blynk application to receive the notification from the system. The Blynk application is used in this system to receive messages regarding the flood water level. The alerting message would be sent to the user's smartphone where the Blynk application is installed. As the water level in the monsoon drain increases to a dangerous level, the buzzer would trigger making the Blynk application. To test the transmission time for the receiver to accept the message from the system, the experiment is repeated a few times to record the time taken for the message to be received.

Both Figure 4 and 5 show the notification delivered to the user through the Blynk application. The content of the notification from Blynk is very simple and easy for everyone understand. The advantage of using the WIFI module is that it does not charge for any notification from the Blynk. Moreover, the other advantages of using WIFI module is the fast transmission of the message to the user. This can help people to evacuate n the shortest time.

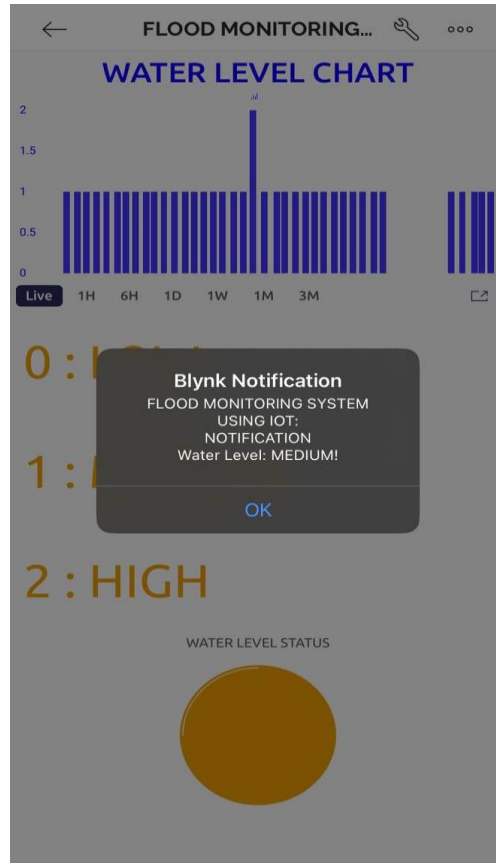


Fig. 4 Blynk notify user and turn to yellow in 'MEDIUM' mode

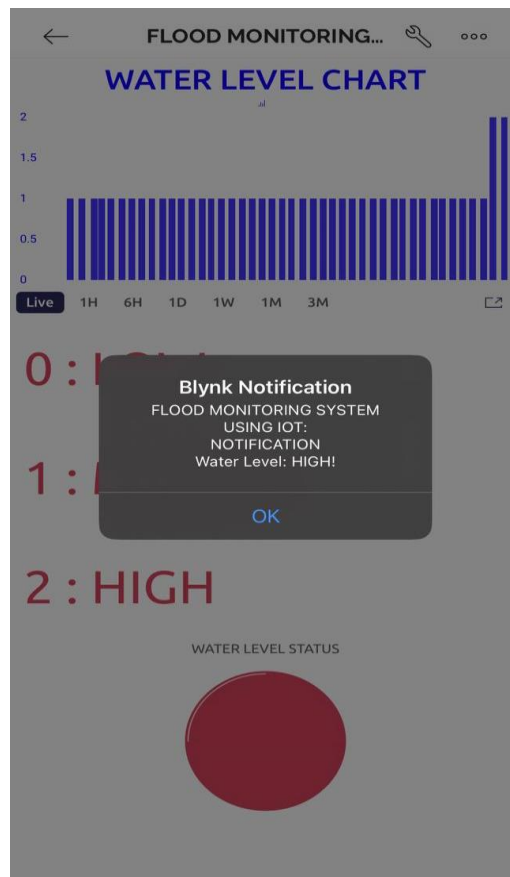


Fig. 5 Blynk notify user and turn to red in 'HIGH' mode

4. Conclusion

All project goals have been met, faults and all, according to the findings of studies conducted on the flood management system. The water level sensor precisely measured the water's distance, which was set at a threshold value. In addition, when the flood water level is considered high, the user will receive a notification from Blynk application. Therefore, this system could be used as a pre-warning system for flood safety by sending notifications to a smartphone via the Blynk app.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

*The authors confirm contribution to the paper as follows: **study conception and design:** Mohamad Alif Aiman Abdullah; **analysis and interpretation of results:** Mohamad Alif Aiman Abdullah; **draft manuscript preparation:** Mohamad Alif Aiman Abdullah, Intan Sue Liana Abdul Hamid. All authors reviewed the results and approved the final version of the manuscript.*

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