IoT-based Flood Monitoring and Alerting System using Raspberry Pi

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Abstract. The loss of properties and living population is getting enhanced by every year due to the dynamic alterations in weather conditions which results in heavy floods. Therefore, implementation of an intelligent analysis of flood risk is necessitated for the field of research in Disaster management. This article implements an intelligent IoT-based flood monitoring and alerting system using Raspberry Pi model, where water sensors and rain sensors are utilized to alert the authorities regarding the heaviness of rain and monitoring of water level in a lake or river. This system alerts the people in nearby villages since it utilizes IoT system for notifying the village people.

1. Introduction
Flood in Malaysia is a frequent natural catastrophe that happens almost annually mostly during southwest monsoon. In 2010 some communities in eastern Malaysia were inundated by the north eastern northeast monsoon of Sabah, & the states of, Malacca, Pahang[1]. Among five of them, Johore is worst affected country, with far more than 30k people displaced. Mostly during storm, power was shut down in some areas, while some shelters allegedly suffered from crop shortages & water shortages. This catastrophe is unavoidable, but devastation can be minimised with appropriate response & reaction from the local authorities. This flood detection scheme has also been developed to support local authorities in delivering a more holistic approach. The device as a whole can be seen. A detector placed in the specified location, such as the banks of the river or low-lying areas, measures the difference in water levels. This detector generates a signal & sends it to the Control Center for 24 hours. The rough data from the detector is compiled & computed in this centre. Each variety is seen & maintained in a server. When an alarm situation happens, the control server will trigger an sms directly to the ones responsible for their prompt intervention. The influx of groundwater, like a river, is normally triggered by an rise in water supply. Sometimes a reservoir breaks up, releasing a large amount of water suddenly. The result is that many water passes into the ground & the province is 'flooded.' The street drainage of floodwater includes the untreated bacterial & sewage water intake from waste facilities, as well as hazardous waste spills that result in multiple diseases afterwards. Rivières are located on the banks of the river, at the station.

Flood predictions need information like:

- The pace of change in real time in the river stage that can lead to the gravity & immediacy of the danger. Comprehension of storm type, which produces precipitation, such as volume, strength & extent & which is necessary to detect possible flood gravity.
2. RELATED WORK

The Earlier several researchers implemented flood monitoring and alerting system based on ARM7 processor and Arduino controller. But, ARM7 wasn’t real time operating system (RTOS) [2-4], speed is very less and more expensive. Arduino is a controller and additionally it requires extra modules to interact with cloud like the global system for mobile communications (GSM), blue tooth, Wi-fi and LAN cable [5-7]. Several works like [8, 9] investigated a study on flood disaster and its management in the country of Malaysia, where they centered the significance of identifying best solutions to educate if there was a strike of disaster. In addition, author in [5] suggested four action states such as readiness, reaction, reconstruction and reduction. In this way, recent days most of the researchers tried to find out the mitigation of flood control and there by reducing the risks. Later, due to the easiness and wider range of applications in various field, IoT-based system attracts the researchers to implement an intelligent flood control and alert management system.

3. PROPOSED SYSTEM

Our proposed methodology includes Raspberry pi with water and rain sensors to reckon flood symptoms and alert official authorities with notification. Further, it provides an alarm to nearby villages, which alerts them to vacate from there since there will be a chance of flood occurrence. In this project, measurement of water level is done by utilizing water sensors. In addition, rain sensors also employed to assess the level of rain in particular area. Later, these sensors send the information regarding water and rain measurements to raspberry pi over IoT. Now, at the controlling end, once it exceeds the threshold limit value then the system reckons the time duration that would assume to flood in an area and alert the village people.

Working
The sensors deployed near by the water bodies are connected to cloud which senses the level of water and rain fall, the date is stored in cloud and when they cross the threshold value it triggers a notification to the concern person and from him the notification is broadcasted.

4. HARDWARE DESCRIPTION

4.1. Raspberry Pi

Generally It is an ultra-cheap minicomputer with 5.5 cm width and 9 cm length. It consists of a component named System on Chip (SoC) which comprises of single core CPU with a supportive processor for computing floating points, GPU and RAM with 512 MB size (SD-RAM). Moreover, it consumes less power, which is just around 5-7 watts. The architecture of raspberry pi is given in figure
2. It has couple of cache memory levels, where first level is of 32KB size and the latter is of 128KB size. These are utilized to store recent programs and ALU is utilized to execute instructions.

![System architecture of raspberry pi](image1)

**Figure 2.** System architecture of raspberry pi

| Chip              | Broadcom BCM2835 SoC |
|-------------------|----------------------|
| Core architecture | ARM 11               |
| CPU               | 700 MHz Low power ARM1176JZFS |
| RAM               | 512 MB (SD-RAM)      |
| OS                | Linux                |
| Dimensions        | 85.6 × 53.98 × 17 mm |
| Power             | Micro USB socket, 5 V, 1.2 A |

**Table 1.** Specifications of Raspberry pi

It is a very small device and can incorporate other devices also. It consists of both the hardware and software.

It requires an SD card and a power supply to related mouse and keyboard. Additionally, a display also exists for functioning OS such as Windows and Linux.

### 4.2. Rain Sensor

This is an instrument that has been triggered by the storm. There are almost many major rain sensor applications, where the first one is a device connected automated irrigation system which makes the system to turnoff in case of any rain fall and the latter is a device utilized to defend an automobile interior from rain and assist the robotic mode of windscreen wipers. The model of rain sensor is disclosed in Figure 2.

![Rain sensor](image2)

**Figure 3.** Rain sensor.
4.3. Water Sensor

This is sensor utilized to detect the level of water, rainfall sensing and even the liqueate leakage. Majorly, it is consisted with three parts:

1. An electric brick connector.
2. A resistor with $1\,\text{M}\Omega$.
3. Bare conducting wires with few lines.

5. EXPERIMENTAL RESULTS

Proposed methodology is implemented on Raspberry Pi processor with python programming. Underneath figure discloses the fold monitoring system with IoT, where it consists of water and rain sensors for monitoring and alerting process. Once the Raspberry Pi detects that there is any emergency, it will sends an information or notification alert to the near by village people and respective higher authorized persons as well.

6. Conclusion

This paper implemented an intelligent flood prediction and alerting system using IoT and Raspberry Pi which utilized water and rain sensors for alerting the authorities and monitoring of water level in a lake or river. Further, we sent a notification alerts to the people in nearby villages using IoT system. This system is low-cost and self-guiding, hence there is no requirement of real-time training. In addition, our system obtained good performance, low-cost and flexibility. In the meantime, the use of
a global positioning system (GPS) that monitors device positioning in the target area could be advised. Furthermore, Solar power can be used rather than direct power to save the power usage.

7. References

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