

Iot Based Flood Monitoring and Alerting System with Weather Forecasting



Garima Singh, Nishita Bisht, Pravesh Bisht, Prajwal Singh

Abstract: This paper represents the development strategies of Internet of Things based flood monitoring and alerting system with weather forecasting through open weather API. This project is based on the open source electronic platform i.e. Arduino. The Arduino Uno R3 is to be set up multiple different devices such as ultrasonic sensor for the water level detection by capturing the time between transmitting and receiving sound waves, temperature and humidity sensor DHT11/AM2302 for analyzing the moisture content and water flow sensor for evaluating the speed of water flow. Further, these values received by different sensors are to be transferred to the Android Application which is developed with the technologies such as Java, XML, Android studio.

The final system will be deployed in the flood prone areas for early detection and prevention of flood.

Index terms: Arduino, API, Ultrasonic sensors

I. INTRODUCTION

In a peninsular country like India, with extreme weather and climatic conditions, the occurrence of heavy rainfall is normal. [1] Multiple times, the arrival of very heavy rains results in the heavy discharge of water or because of the sudden melting of the glaciers due to global warming. Especially, in the monsoon which normally begins in the mid of June and lasts till October, thousands of people lost their lives by drowning and their habitats were collapsed. The left over were evacuated by the state and central disaster relief authorities. [2] The severe waterlogging brought daily work to halt. In order to save the lives of the people, their habitat and the economy, the major step is to monitor the data on real time basis and if the situation is reaching a certain threshold, then alert is to be provided to each individual living in the area which is currently at risk. Even if it is difficult to abandon the natural calamity but the mandatory steps are to be taken by the government agencies to shift the population to a safe region and the losses will get reduced to less than 30%.

In this modern era, there are multiple systems working and are deployed at different locations but the alert notification is passed to government agencies and this ends up in slowing down the process. [3]

The reason behind this is that flood is very spontaneous disaster and government agencies have to follow multiple steps before reaching to a decision. In this case, awareness among the people is very necessary along with the government officials. So that a combined and better result will be achieved. In our system, it is combined with prediction through weather forecasting. The flow of water is sensed by water flow sensor which will ultimately help in evaluating the intensity of flood and water level by the help of ultrasonic sensor which will be done by propagating sound waves. All these information will be showcased in the application.

The android application will be developed using Java, XML, Android studio. The application not only includes the data from IOT but also includes weather forecasting. The weather information will be gathered using Open Weather API which will provide real time climatic information. This will result in the avoidance of loss to mankind and economy as well.

II. RELATED WORK

The articles [4] and [5] have reviewed on the management of the natural calamity in Malaysia. In some areas in Malaysia during flood, water was up to 3-4m deep. An article by Leman et. al [5] highlights the best possible way to deal with when disaster strikes. The ideology has been divided into five phases of action:- Awareness, Preparedness, Revert, Recovery and Mitigation. Leman et. Al have researched on digital processing of image to obtain the feedback for instant flooding and waterlogging and remote cyber surveillance system [6].

For the development of flood risk reduction, the crucial role is to first understand the hazardous phenomenon and the highly dangerous consequences on the society. The IOT based systems are preferred by researchers because it senses the data from different sensors without human interference [7]. These systems are combined with water level sensors such as ultrasonic for water level detection but the major drawback is that it misses alert system [8].

Pressure sensors [9] were used to get water level measurements at each second so that accuracy has been increased. Jana Priya et. Al [10] and Satria et. Al [11] demonstrated the concept of measuring sensors. The trend in [12] shows the usage of mobile phones is very common and almost 80% of the audience holds a smartphone. So in Malaysia, they decided to provide SMS alert to give an early warning.

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III. OBJECTIVE

The aim of this project is to develop a certain system which is efficient enough to predict the weather conditions, level of the water and water flow. So that preventive measures is to be taken in prior.

IV. PROPOSED MODEL

1. System Overview

We have introduced an engineering that give early warnings to the citizens and to the government agencies. With the help of the android application, real time data will be available to the individuals instead of depending on the government for analyzing the situation.

With the help of the proposed hardware module, alert will be provided when values reach a pre defined threshold depending on the region. The idea is to develop a device which is going to save economy, society, lives and their habitat. Using various gadgets and sensors will increase the precision. Keeping that factor in mind, we are developing a device which a user need to install in the smartphone, rest all the analysis work is done by the system and alert is provided in the form of notifications.

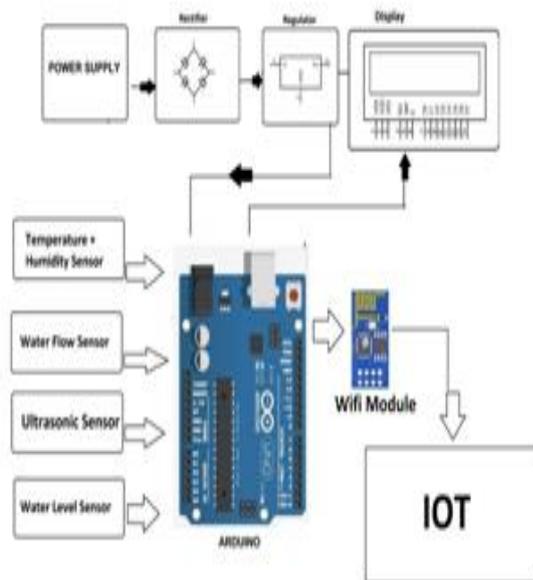


Fig 1. Hardware block diagram [13]

2. Equipment required

2.1 Hardware Requirements:

2.2 In this project, some hardware devices are used such as power supply, ultrasonic sensors, temperature and humidity sensors and electronic platform Arduino. The hardware is connected with Wi-Fi module which enable the system to connect and share the information through internet.

A. **Arduino-** Arduino is an open-source electronic platform that is based on connection between hardware and software and it is easy to use and implement. They are designed in

such a way that it read the input – water reaches a certain threshold and turn it into an output – sending the alert.

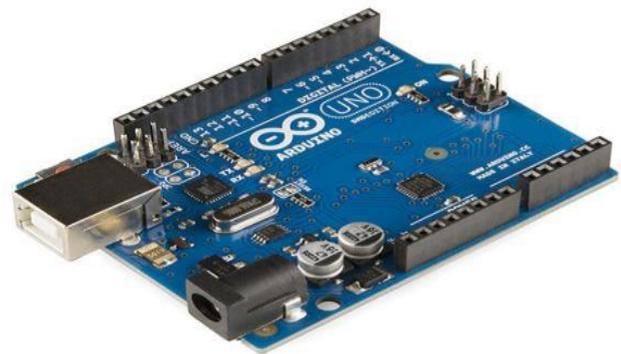


Fig 2. Arduino board[14]

B. **Sensors-** There are multiple types of sensors depend on their deployment field. They are located at certain site to fetch and sense the input. There are three different types of sensors used in this project. They are as follows-

Water level measurement sensor- For water level measurement, we have used ultrasonic sensors. This sensor will work on sound navigation and ranging. It will work by transmitting the wave of short and high frequencies and echo will get reverted back, depending on these the level will be measured. The distance between sensor and water level will be calculated as –

$$\text{Distance } L = \frac{1}{2} \times T \times C$$

Where L=Distance

C=Sonic speed

T=Time between transmission and reception



Fig 3. Ultrasonic sensor [15]

Temperature and humidity sensors- This will help in getting the real time temperature and humidity from the atmosphere.

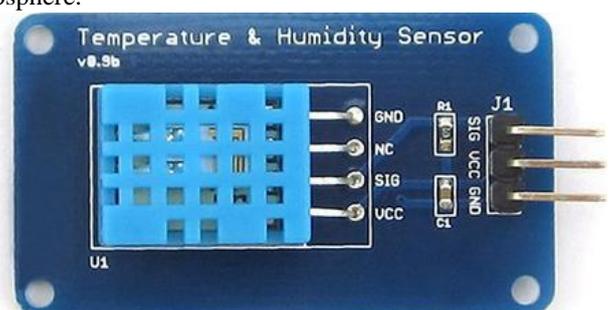


Fig 4. DHT11- Temperature and humidity sensor[16]

Water flow sensors- We have deployed this sensor to get the information if there is a sudden increment in the water flow.



Fig 5. Water flow sensor [17]

2.3 Software requirements:

Android studio- Android studio is an official Integrated Development Environment for the development of android applications. It has increased the efficiency of the application by providing fast performance and integrated with GitHub to build common app features.

Open Weather API- This is the simplest, fast as well as free to fetch the real time data like weather forecasts, clouds, winds, maps with precipitations.

Java- Http request can be sent to the URL of the API and grab the weather information. This will be achieved by various methods. Java is object oriented and it is designed to have as few implementation dependencies as possible.

XML- Layout xml files are used to define the user interfaces of the application and holds all the tools that user want to use.

3. Methodology

3.1 The Proposed Framework

There are many earlier works provided by the researchers in the field of IOT but most of them either lacks precision or they are highly expensive. Thus, they are inaccessible to the user. In this module, we are making a device which will sense the possibility of flood, firstly by analyzing values from the IOT device and then checking the weather forecast. The work will not end here, it will keep on reading the values at each and every second and updating if it is higher than threshold. So, by installing it now you can easily save your life as well as your society.

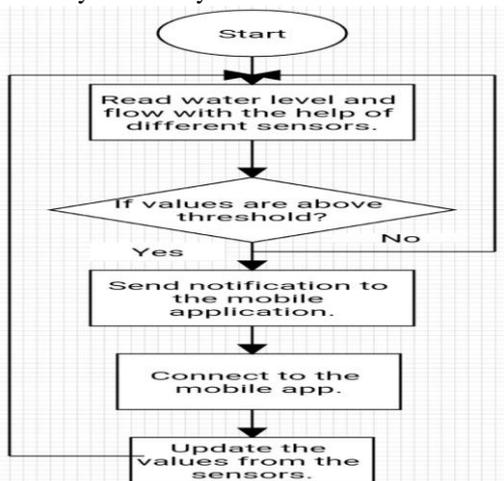


Fig 6. Flowchart of proposed system

3.2 Working

The implementation of the system which includes all the wiring that is to be installed on the breadboard along with arduino and other sensors. The coding of the arduino will be in arduino language which comprises of C/C++ functions that are needed to be called in the code. The android app is developed by using Async task, extracting JSON response and getting response from API. Here, Java is the project language. Adding internet permission is a must as we require internet connectivity in the android application. The layout will be designed using Drawable Resource file.

Again, crosschecking every one of the associations and then furnish capacity to the Arduino with battery. It will work as we decided earlier and early warning will be sent to user.

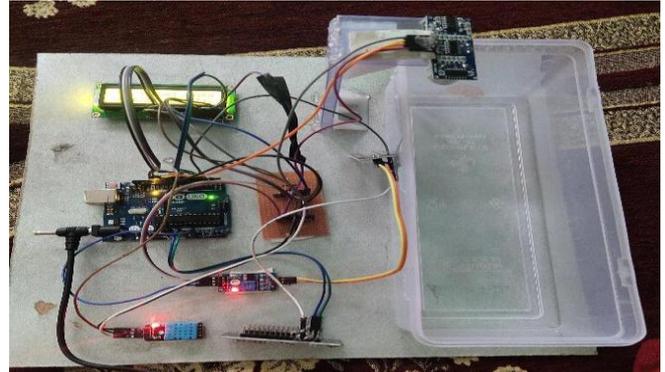


Fig 7. Hardware

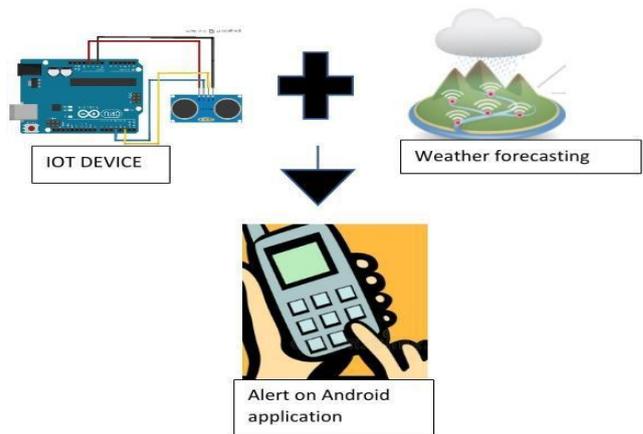


Fig 8: Working

V. IMPLEMENTATION AND RESULT



Fig 9. Login Page

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Above snapshot shows the login page of the application through which user can access all the information by entering some basic details.

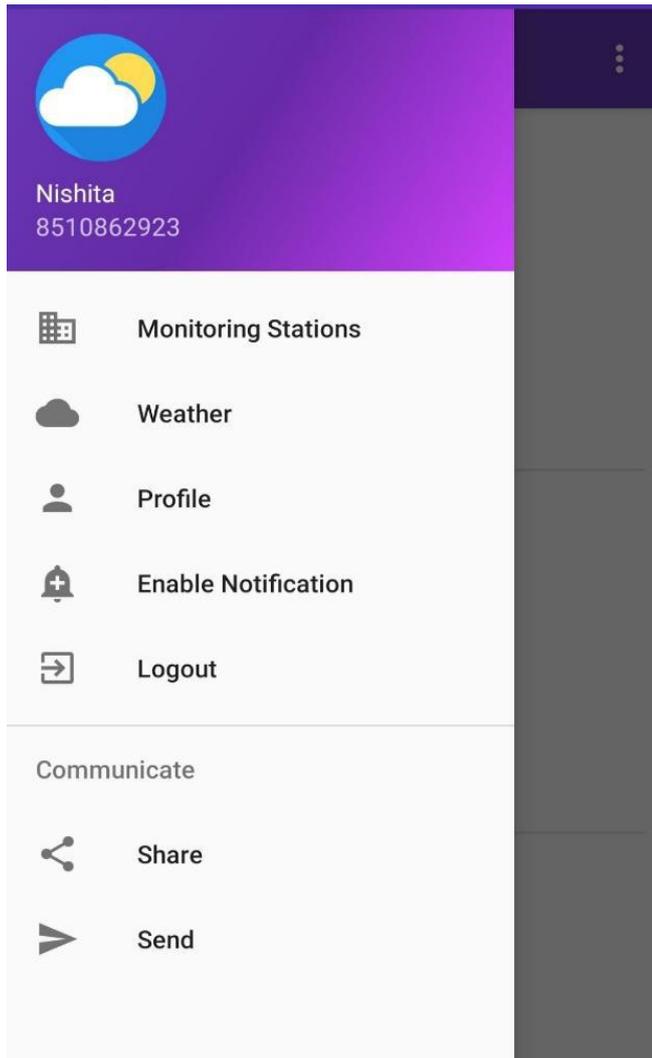


Fig 10: Application Interface

Above figure shows the different buttons clicking on which user can access the particular information.

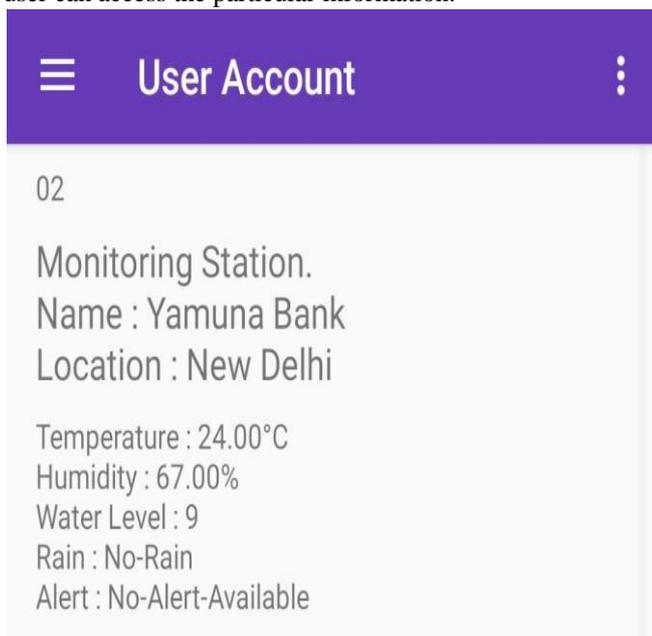


Fig 11: Fetching data from IOT

Above figure shows the data sensed by different sensors such as temperature, humidity, rain and water level.

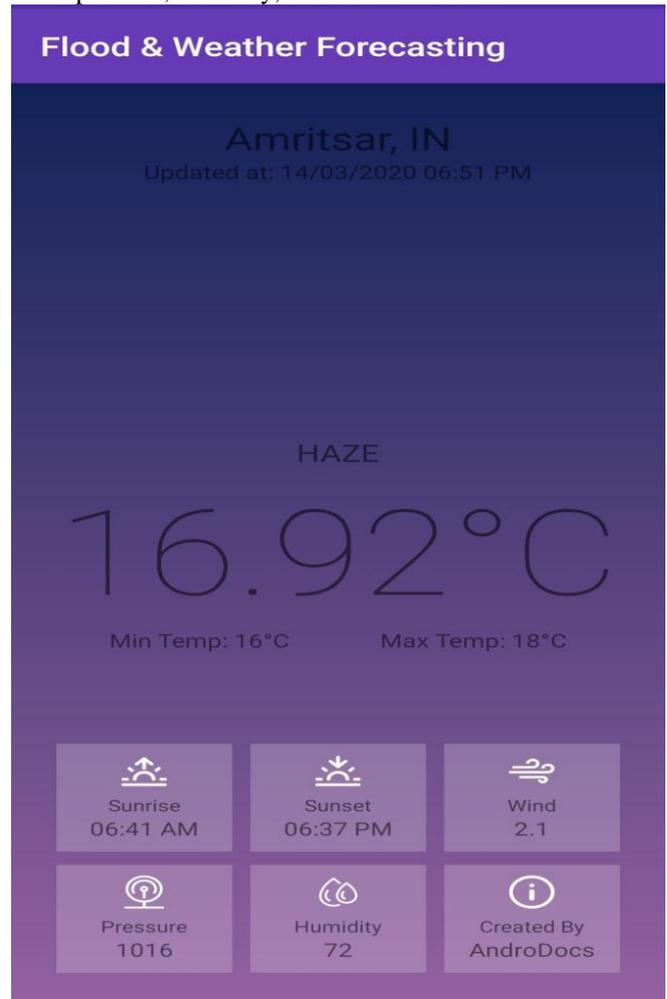


Fig 12: Weather information

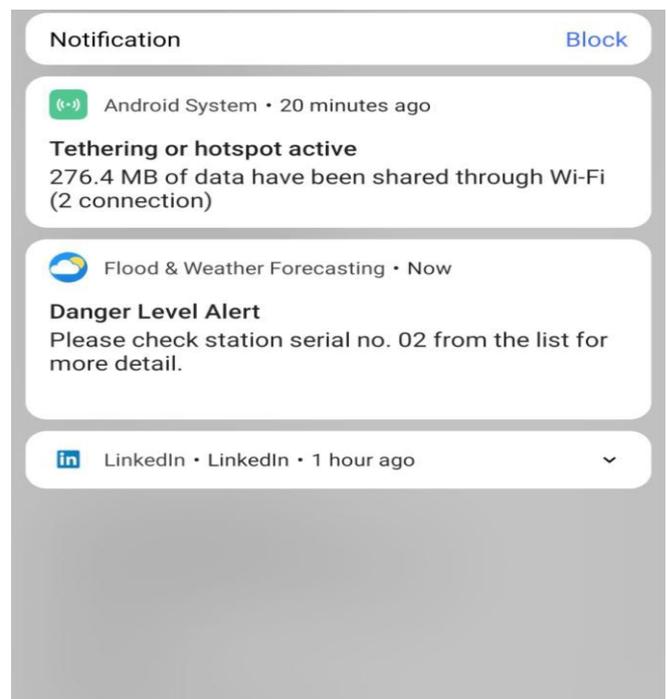


FIG 13: Alert On Android Application

VI. CONCLUSION

This project highlights the possibility to provide an alert system that will overcome the risk of flood. It can also contribute to multiple government agencies or authority that can ultimately help the society and mankind about the flood like hazardous natural disaster. The model proposed has been already tested and it is working as presented in this paper. It will monitor each and every aspect that can lead to flood. If the water level rises along with the speed, it will send an alert immediately. It also ensures increased accessibility in dealing and reverting to this catastrophic incident. In summary, it will help the community in taking quick decisions and planning against this disaster.

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