# Internet of Things (IoT) Flood Monitoring and Alerting System

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***Abstract*** **- In any water system, when there is an increased quantity of water, it causes flooding, like a river or lake overflowing. Many occasions are responsible for flooding such as heavy rainfall or dam fractures. In case of flooding or dam fractures, it rapidly releases a huge quantity of water and floods the river banks and surrounding areas. It causes loss of life and property also. Flood monitoring and alerting systems are helpful for monitoring and to reduce the losses faced by the society. On occasion a dam fractures, abruptly releasing a massive quantity of water. The outcome is that a number of the water travels into soil, and 'flooding' the region. Rivers involve river banks, in a station. Aside from lack of products and house and office property, streets infrastructure flood water consists of bacteria and sewage flow of waste sites and chemical spillage which leads to a variety of diseases afterwards. Flood predictions need information like: The speed of change in river stage on a real time basis, which may help indicate the seriousness and immediacy of this threat. In this system we make use of a Arduino Mega with water sensors, rain sensors to predict flood and alert respective authorities and sound an instant alarm in nearby villages to instantly transmit information about possible floods using IOT. These sensors provide information over the IOT using Arduino Mega. On detection of conditions of flooding the system predicts the amount of time it would take to flood in a particular area and alerts the villages/areas that could be affected by it. [5].**

***Index Terms*** **– SmartCity, Water Quality Monitoring, Arduino Mega, IoT, LPWAN.**

## I.INTRODUCTION

Flood is an unavoidable natural disaster in all over the world, causing heavy flow of water and also severe damage to properties and lives. Material, human, economic and social losses in flood areas, infection from water are the main effects of flood. As well as the risks to life suffered by families in these areas, the economic damage has also imposed the burden of having to recover from their financial losses. Flash floods and massive traffic jam on roads also caused by heavy rain . Thus, it is important to be able to warn the people who are most at risk, so that the effects of these disasters can be reduced.

Nature is a blessing for the humanity. But sometimes this scenario changes as the natural calamities take place. Natural disasters have become a major concern throughout the world. especially in the developing countries such as Bangladesh, Malaysia etc. Flood is also one of the natural calamity. In order to prevent the devastating effects of floods before such events occur, early warning for people to evacuate in the nearby areas can be effective in saving lives and to prevent disasters . Generally, flooding cannot be stopped and unavoidable, but early detection or warning system can be used to reduce losses faced by the citizen and government.

For this reason, we need to create flood level sensing devices which will detect the water level. This system is integrated to the microcontroller board which will help to send the data each time the water reaches the threshold value. Ultrasonic sensor is used to detect the water level. The Arduino Mega module will help to connect the internet and keep track of data on a daily basis. The data through the Arduino Mega module will be stored in a cloud. If water level reaches threshold value, people will get alert messages on through android applications. And LED and buzzer can be used to alert people. This system can predict the possibility of flooding before flooding takes place.

## II.LITERATURE SURVEY

Numerous literatures related to IoT-based sensors and Computer Vision for flood monitoring and mapping were outlined [1] by Arshad B.; Ogie R.;

Barthelemy J.; Pradhan B.; Verstaevel N. and Perez P. This attempt reviewed different applications aided with IoT and Computer Vision for better monitoring and mapping of floods.

Wahidah Md. Shah, F. Arif, A. A. Shahrin and Aslinda Hassan presented a flood warning system [2] based on IoT that was able to detect water level and calculate the speed of water level increased and alert nearby residents. The experiments were conducted in a controlled environment for testing the implemented system.

Pan, J.; Yin, Y; Xiong, J.; Luo, W.; Gui, G. and Sari, H. developed a network of automated surveillance composed of distant measuring stations and a control center [3]. They conducted tests using three methods, including the method of difference, dictionary learning and deep learning.

Elena Ridolfi and Piergiorgio Manciola proposed water level observations from drones at a dam site [4] which makes use of a sensing device composed of a drone and a camera to assess the water level.

TABLE 1- SUMMARY OF LITERATURE SURVEY

| Paper | Advantages | Disadvantages |
|---|---|---|
| Title : Flood Prediction Using Flow And Depth Measurement | - If we have required data accurate prediction can be done. - By providing accurate prediction, one can allocate resources to those in need or can predict the possibility of flood. | Inability to produce highly accurate results, - If there is no sufficient data flood prediction cannot be done. |
| Title: The Development of Smart Flood Monitoring System using Ultrasonic sensor | - It measures the level of water and gives warning to the person-in-charge. - It creates graphs on the data as if it is safe or dangerous. | -It saves the data into the database but doesn't use it, hence wasting the space. -It cannot predict the flood with its historic data. |
| Title : Advance Flood Detection and Notification System based on Sensor Technology | Random forest algorithm compared with other classification is more beneficial as it offers more accurate Outcome. | -GPS module track is not upgraded in the system -Hyper pipes algorithm considered as having the lowest accuracy percentage. |

The existing flood monitoring system consists of two microcontrollers and one sensor. The microcontroller used here is nodeMCU and the sensor used is an ultrasonic sensor which senses the level. The ultrasonic sensor continuously monitors the level of water each time it reaches the certain defined level. It records the data through ultrasonic and these data are sent to nodeMCU from time to time. Two nodeMCU are used here, the first one acts as transmitter and second as a receiver. Initially, the first NodeMCU attached with an ultrasonic sensor will detect the flood level. Then, it will display the data on the LCD screen. The data will be sent to the Blynk application via wireless connection. The data also will be displayed in the application. At the same time, the data is stored in a CSV database, through email this data can be converted into excel form, as well as being transmitted to the second NodeMCU via Blynk Bridge. This data will alert the local authority for further action once the level reaches warning and critical level which triggers the buzzer and LED. Though this system sends the alert messages to authority and displays it in LCD but this is done only when the water reaches the critical level. It cannot predict the chances of flood prior so that it can be prevented in the first place. [8]

Limitations of existing systems:

1. There are many sophisticated system widely in practice by some organizations and responsible authorities in monitoring flood level in a certain location.
2. Most of these devices are very high in costly to be used and maintained.
3. Apart from that, these devices are usually used only for monitoring purposes between the flood prone location and the monitoring station. [9]

Because of these limitations and to overcome them we introduce the proposed system which helps overcome the limitations in the existing method. [7]

## III. PROPOSED WORK

To create an IOT Based centralized web portal to monitor and alert flood detection. System automatically detect the flood by using IOT Devices and update the details to a webserver.

Information's collected from IOT device is transfer to a centralized web portal. Different categorized users are connected with this web portal. All users will get proper information's based on their priority. In our

proposed system, an Ultrasonic sensor is used to create flood level sensing devices which will detect the water level. Ultrasonic Sensor is connected to an Arduino Mega from which we can see the readings. Arduino Uno is connected to LED and Buzzer is connected. Serial Communication will take place between Arduino Mega and Servo Motor. Servo Motor will connect to the cloud. The water level readings will be stored in the cloud. For Prediction purposes we need the data in csv format. From the cloud we can convert the data in csv format because we need historical data for prediction purposes. To Alert the people, LED light and Buzzer can be used and people will get alert messages on their mobile phones through an Android application.

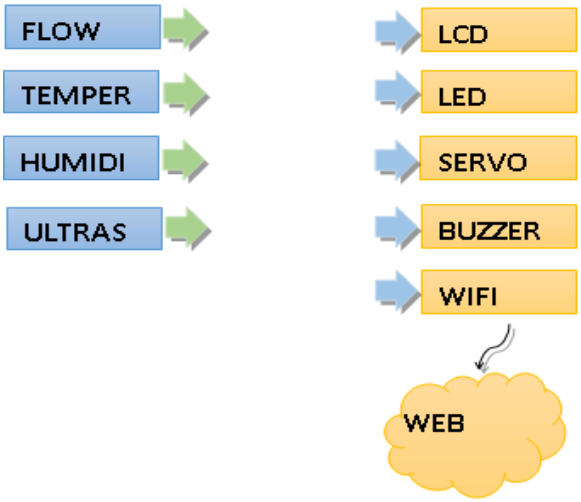


Fig 1 Proposed Work Block Diagram

An architectural diagram is a diagram of a system that is used to abstract the overall outline of the software system and the relationships, constraints, and boundaries between components. It is an important tool as it provides an overall view of the physical deployment of the software system and its evolution roadmap.

Here the below displayed diagram explain the overall functionality of our proposed system. Here IOT devices send collected information to a web server through wi-fi module. The webserver then provide information to its user. Different categorized users are link through the centralized web portal. A user can search different services like Blood bank, Ambulance and hospital through the portal. Registered volanteer can provide helps to required peoples

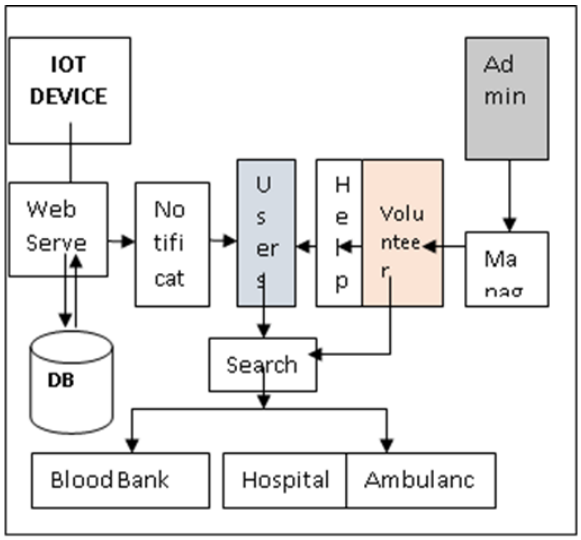


Fig 2 Architecture Diagram

3.1 SOFTWARE DESCRIPTION

A. PHP : Hypertext Preprocessor

PHP is a general-purpose scripting language especially suited to web development. It was originally created by Danish-Canadian programmer Rasmus Lerdorf in 1994. The PHP reference implementation is now produced by The PHP Group. In our project PHP is used as server side Scripting Language. It uses Apache as Webserver.

B. HTML, CSS, Bootstrap

These technologies are used as UI design tools. User interface is designed using HTML, CSS helps to provide style to HTML Page. We are developing the web application as responsive portal. For making responsive we are integrating Bootstrap. Responsive web design is an approach to web design that makes web pages render well on a variety of devices and window or screen sizes from minimum to maximum display size.

C. MySQLi

The MySQLi Extension is a relational database driver used in the PHP scripting language to provide an interface with MySQL databases. Our project use MySQLi as database backend.

## IV.RESULTS AND DISCUSSION

1. Web portal development completed.
2. Admin can add different service providers.

3. Information from IOT is received successfully.
4. Hardware device connection completed.


Fig 3: Web portal homepage

The main screen of the web portal is shown in Fig 3. Options such as Login, Hospital Registration, Home etc available to the users.

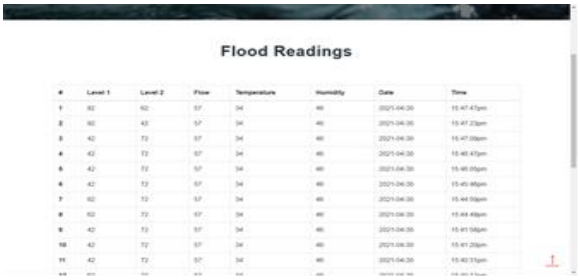


Fig 4: Web Portal of observed readings

Fig 4 shows the flood readings such as the water flow rate, the water level rate, temperature and humidity readings etc.


Fig 5: Web Portal of Hospital

Fig 5 shows the web portal of hospital module. Hospitals and healthcare providers can register patients based on geo location, receive alerts and communicate with users.

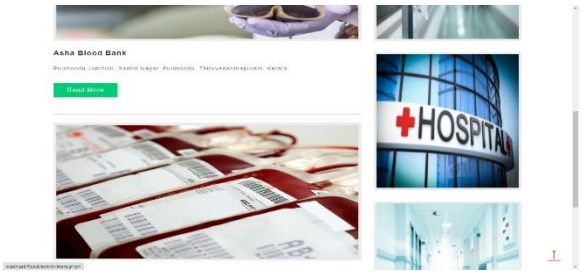


Fig 6: Web Portal of Blood Bank

Fig 6 shows the web portal of blood bank. Blood banks can keep track with storage quantity, blood types, temperature and other metrics that can be published online for hospitals and other healthcare providers.

## V.CONCLUSION AND FUTURE WORK

The IoT-based early detection of the flood helps to save many lives and enables real-time updates about water level to nearby people so they can relocate to safe places with their valuables. The detection helps to prevent damage of houses and businesses due to floods. This innovative approach assists concerned authorities to have access to real-time data in order to generate reports and perform analysis. This project based on the Early Flood Monitoring using IOT to detect & monitor the water level. In this project we are using Raspberry pi, LED, Buzzer, ultrasonic sensor, Android Application. Through Android Application the user can get information about flood. The rescue team will be alert by using LED & Buzzer that will give information about the person in danger. This system can also predict the flood by using historic data. Prediction of flood is done by Machine Learning Algorithm. Through this system one can monitor & predict the flood.

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