

Flood Detection And Management System

Akash Bhujbal¹, Prasad Hole², Pranav Khedkar³,

Prof. Nilufar Zaman⁴

^{1,2,3}Computer Engineering, Trinity Academy of Engineering, Pune, India

⁴Faculty of Computer Engineering, Trinity Academy of Engineering, Pune, India

Abstract

In India, floods are the natural disasters that happen every year during the monsoon season from July until November. These flood caused serious damage to houses, roads, businesses, public facilities and even killed people. Though many steps have been taken by the government in order to prevent these incidents, but it seems went unsolved. Here, the Flood Detection and Warning System (FLoWS) is proposed in helping to monitor and manage this critical situation by providing crucial information (i.e. flood conditions, plan and preparation, and many others) to the public and the local authorities at the affected area. The system is able to measure the water level and alert the public and the local authorities by sending a notification (i.e. SMS and MMS) regarding the flood conditions. Furthermore, the system enables the public and the local authorities to see the live graph data of the water level using the Android application on the mobile phone.

Keywords—Monitor , IoT, Humidity, Temperature, Water Level, SMS, Sensors.

I. INTRODUCTION

Internet of Technology (IoT) based “Water Flood Detection and Early Warning System” is an intelligent technology which works with the help of internet. IoT technology plays a major role in our daily life and changes the life style of the people in a systematic way. In real life scenario, IoT technology reduces the man power to execute some critical task; with the help of sensors many real time problems can be solved. Natural Disaster management system keeps close watch over various natural factors such as water flood, forest fire etc. to predict a flood and to minimise the damage caused by the flood. This paper considers natural disaster namely water flood which leads to property damage and loss of living things and human life. In order to prevent the impacts of the water flood, the proposed system in this paper uses various natural factors to detect water flood. The proposed system uses Wifi connectivity to collect data and to access data from anywhere easily using IoT technology [1]. To detect a water flood, the proposed system monitors various natural factors related to water such as humidity, temperature, water level and flow level. These are all main features to detect water flood in different water bodies. This system uses HC-SR04 Ultrasonic Range Finder Distance Sensor which works on the principle of SONAR. This sensor is designed to measure the distance of an object from the sensor using ultrasonic wave [2]. All the sensors are connected to Arduino UNO to process and to save data. IoT based River flood monitoring system is a complex problem of maximum social relevance in densely populated areas. Flash

floods are becoming more and more dangerous every year due to an increase of rapid and extreme rainfalls events induced by climate changes the rivers flooded twice in twenty days. The complexity of the problem originates from the diversity of the territory involved in the monitoring process in regions like relatively far mountains (or plain regions) generally scarcely populated to densely populated urban areas traversed by streams often flowing underground. Environmental monitoring is classified at the 14th position among the Top 50 'Internet of Things' (IoT) applications for a Smarter. In addition to these features, IoT often provides interfaces for data streaming management in real-time, back end for data analysis and visualization. So that it is help for both Government and Public peoples [3] [4]. In order to develop a real-time water flood monitoring system, the proposed IoT based technique monitors the changes of water level in the river to send an alert SMS message to user through Global System for Mobile Communication (GSM) cellular network. Whenever the sensor detects heavy flood immediately sends an alert message also display the current temperature and humidity level of the water. Buzzer alarm message particularly to the municipalities near River indicates the water flood in the surrounding area.

II. LITURATURE SURVEY/BACKGROUND

Water Flooding is one of the major disasters occurring in various parts of the world. It is important to monitor the water level variations in rivers, dams, reservoirs etc. In paper [6]. Wireless Sensor Network (WSN) used to monitor flood conditions in the river. This method also be used for real-time monitoring of water conditions like water flow level and precipitation levels. Reservoir is the best infrastructures to save the water resources and plays a major role in flood control. Flood Limiting Water Level (FLWL) is an effective and value approach to provide safeguards to the people from water flood caused suddenly by nature.

The proposed system sends as an alert to people when the water level increases from the normal capacity. Advanced sensors are used to identify the level of water accumulated in dams, lakes and heavy water storage areas which are capable of operating without human intervention at any time regardless of the location being installed [7]. Predictive environmental sensor networks provide complex engineering and systems challenges.

These systems must withstand the event of interest, remain functional over long time periods when no events occurs that covers large geographical Regions of Interest (RoI) to the event and support variety of sensor types needed to detect the phenomenon. Prediction of the phenomenon on the network itself complicates the system further which require additional computation on the microcontrollers and utilizing prediction models that are not typically designed for sensor networks [8].

IoT is the latest rapidly growing technology which brings to a new approach such as disaster monitoring. Disaster monitoring technique proposed in monitors the natural disaster activity that the people not able to do in 24 hours. This system will monitor the potential drainage usually occur flooding and share the information in real time to the people those who are in nearby water bodies [9].

Water Flood occurs when water overflows from different water bodies like river, lake or due to heavy rainfall. Flooding can be very dangerous, when floods happen in an area that people live, the water carries along objects like houses, cars, furniture and even people. It can wipe away property, trees and many more heavy items which causes heavy flow of traffic on the roads. In rainy seasons, the motorists and computers are getting stuck in a

flooded areas and getting lost in finding possible routes just to go to their destinations in the correct also difficult to spread the message or to communicate with other.

Hence, in order to overcome this problem the “Arduino Flood Detector System” is developed to overcome this problem. It was invented based on problem faced by motorists.

Commuters when water flood occurs. This will help to avoid the traffic jam since the users have a time to find possible routes before going to be stuck in the flooded area [10][11]. The internet of things (IOT) provides the ability for human and machines to interact from billions of things that include sensors, services or other internet connected things which makes the world as “Smart World”. Internet of Things technology for urban flooding prevention management system discusses the demand and overall design of urban flooding prevention management system. The application process of the internet of things technology in flooding prevention management system is summarized in [12]. IOT technology brings new approaches such as disaster monitoring. Water flood disaster is the main concern since it can happen every year during the rainy seasons.

In [13], water flood detection method monitors an activity that people are not able to do it in 24 hours and sends an alert message with the help of Android Application. The headway of flood early warning technology has grown rapidly. The technology has led to improvements in terms of communication and information. Internet of Things Technology (IoTs) has greatly influenced the development of early warning information systems. In this article a prototype of flood monitoring system based on Google Maps has been designed by integrating ultrasonic sensors as a height detector, Arduino Uno as a processor, U-Blox Neo 6m GPS module and GSM module as the sender of water level and the coordinates to the flooded information system station. The design of the prototype produces flood altitude information along with its location based on Google Maps interface [14] [15].

METHODOLOGY

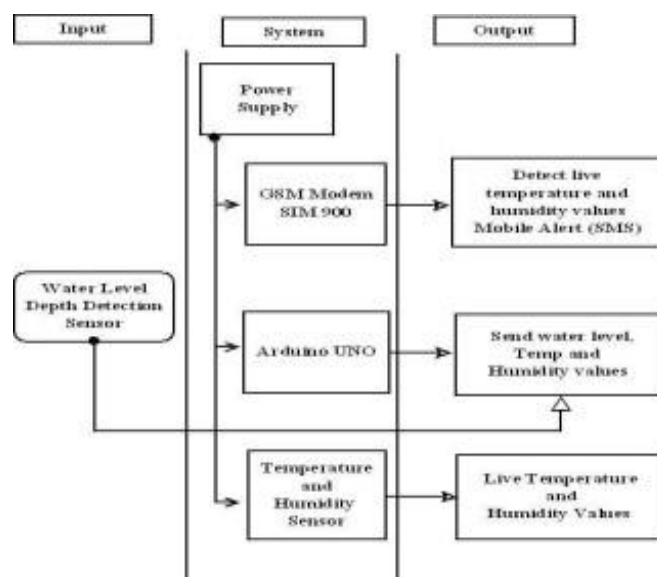


Fig.1 Block Diagram

Block diagram denotes the overall structure and working flow of the proposed method in this paper. This block diagram shows that the input to the proposed algorithm is taken from the water level sensor fixed near the water body. The system performs the operations (detecting the water level) and sends an alert message as an output to the peoples. Finally the level of the outcome of the proposed algorithm is shown as a flow graph of each values send by the sensor that will be viewed with the help of Thingview application. Flood disaster usually happens due to sudden changes in the earth and the atmosphere. Water flood occurs due to improper irrigation method in a housing area or the sudden increase of water level in the river. Water Flood disaster causes loss of property which damages the life. Since this disaster is considered dangerous to human life, an efficient countermeasure or alert system must be implemented in order to notify people in the early stage so that safety precautions can be taken to avoid any mishaps. This paper proposes architecture for an early warning floods system to alert public against flood disasters. This project focuses on monitoring water level remotely using wireless sensor network. The proposed method also utilizes Global System for Mobile communication (GSM), Internet of Things (IoT) and Short Message Service (SMS) to relay data from sensors to computers or directly alert the respective victim's through their mobile phone. It is hope that the proposed architecture can be further develop into a functioning system, which would be beneficial to the community and act as a precautionary action to save lives in the case of flood disaster [5]. The proposed algorithm in this paper uses an Arduino Microcontroller AT mega 328, Water Level Detection Sensor, Temperature and Humidity Sensor, GSM Module, Things view Android application and SMS early warning system.

III. PROPOSED METHOD

This paper proposes a prototype that will detect the current water level, Live temperature and Humidity across the watershed of River and its surrounding areas with the help of Water Level Detection Sensor, Temperature and Humidity Sensors. Each sensor signifies a warning level when water reaches maximum level and then temperature and humidity sensor display the live temperature and live humidity level.

When the water level sensor, senses critical level, an output values will be send to a microcontroller which serves as a switch that triggers the connected GSM modem to send an alert SMS message, temperature and humidity values to the server.

Then, the server will automatically send an alert text message to the numbers stored in the database and result will be displayed in the form of graph with the help of Thingsview Android Application. The process repeats as the water level continues to rise and triggers another sensor. The main task of sensors is to identify the critical point and send a warning message warning to the nearby areas.

IV. WORKING PRINCIPAL

To collect data of mentioned natural factors the system consist of different sensors which collects data for individual parameters. For detecting changes in humidity and temperature the system has a DHT11 Digital Temperature Humidity Sensor which is an advanced sensor module with consists of resistive humidity and temperature detection components. The water level is always under observation by a float sensor, which works

by opening and closing circuits (dry contacts) as water levels rise and fall. It normally rest in the closed position, meaning the circuit is incomplete and no electricity is passing through the wires yet.

Once the water level drops below a predetermined point, the circuit completes itself and sends electricity through the completed circuit to trigger an alarm. The flow sensor on the system keeps eye on the flow of water. The water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow.

V. DISCUSSIONS/RESULT

The main goal of the work is to develop the Flood Warning and Detection System (FLoWS) for monitoring flood situation and measuring the water level at the high risk area. The system be able to warn the public and the local authorities regarding the flood condition such that appropriate action can be engaged. The goal has been achieved as the system be able to measure and record the water level that can be categorized into three different levels. The hardware and software was successfully integrated thus it can communicate to each other very well and produced the expected results (i.e. image, live data graph/chart, nearest shelter).

In Phase 1, all the sensors were able to sense the required data (i.e. water distance/level, temperature and humidity) and the camera was able to capture the picture/image of the flood situation. The micro-controller also be able to records the data from all sensors. Besides, the raspberry Pi 3 was successfully functioned as a server to process and store output from the micro-controller. However the time that was needed to send data from micro-controller to the server took more than 1 minute.

Whereas in Phase 2, the system was able to display the water distance/level accordingly (i.e. live data graph). The Android application was able to show data in form of live graph. The system also was successfully disseminated warning alert when severe flood conditions were detected. But, the warning alert include only measurement (i.e. water distance/level, temperature and humidity) that was taken during the incident. Whereas other information such as image was sent separately.

This result was due to the limitation of characters than can be included in the message itself. Supposedly, the warning alert should include all measurement, shelter list and media (i.e. image/MMS) that was taken during the incident. Findings showed the system can be enhanced further due to some restrictions. First, the time taken for transferring data and image between the micro-controller and the server needs to be improved. Second, the warning alert should contain more information regarding floods situation by increasing the space in the message. Third, the Android application should be improved where the user can update their profile and password using the application.

Lastly, the service for sending media/image is recommended to be developed separately from the main system. This can be performed either adding another Arduino module separately from the sensor or create the MMS service inside the server. Nevertheless, a warning system is needed and it can be implemented successfully at the high risk area that affected by the floods. The system can be integrated with the existing system that can reduce the number of death and loss at the affected area caused by floods. In addition, selection of suitable components for the system is crucial in order to produce a system at minimal cost but greater

output.

VI. CONCLUSION

The Flood Warning and Detection System (FLoWS) offers another alternative in enhancing and improving the existing system that has been used in India for monitoring floods. The system was successfully developed by integrating the hardware and software components (i.e. the system was able to measure the water level and categorized into three different levels in order to alert the public and the local authorities of flood conditions). The system was able to send a warning alert automatically if the water level reaches to a certain level. The notification message contained information such as: warning level, current temperature, humidity, and water level. It is strongly suggested that the approach described in this paper to be used by the local authorities for monitoring flood situation and measuring the water level at the high risk area. Further, the system can also be implemented for monitoring flash flood as well. However, the system is not yet tested for real situation on the affected area by floods. Future work should consider the following factors for efficiency: 1) transmission of data (e.g. wireless communication), 2) multi-functional message and 3) multi-functional Android application. Based on the vast changes of information and communication technology in India, the establishment of this system (e.g. flood management system) is highly expected.

REFERENCES

- [1]. Zahir, Shahirah Binti, et al. "Smart IoT Flood Monitoring System." *Journal of Physics: Conference Series*. Vol. 1339. No.1. IOP Publishing, 2019.
- [2]. Priya, S. Jana, et al. "Flood monitoring and alerting system." *International Journal of Computer Engineering & Technology (IJCET)* 8.2 (2017): 15.
- [3] Hughes, Danny, et al. "An intelligent and adaptable grid- based flood monitoring and warning system." *Proceedings of the UK eScience All Hands Meeting*. Vol. 10. 2006.
- [4]. Fowdur, Tulsi Pawan, et al. "Performance analysis and implementation of an adaptive real-time weather forecasting system." *Internet of Things* 3 (2018): 12-33.
- [5]. Thielen, Jutta, et al. "The European Flood Alert System- Part 1: Concept and development." *Hydrology & Earth System Sciences* 13.2 (2009).
- [6]. H. McMillan, J. Freer, F. Pappenberger, T. Krueger, and M. Clark, "Impacts of uncertain river flow data on rainfall- runoff model calibration and discharge predictions," *Hydrological Processes*, vol. 24, no. 10, 2010, pp. 1270–1284.
- [7]. F. Pappenberger et al., "Visualizing probabilistic flood forecast information: expert preferences and perceptions of best practice in uncertainty communication," *Hydrological Processes*, vol. 27, no. 1, 2013, pp. 132– 146.

- [8]. M. Ancona et al., "On the design of an intelligent sensor network for flash flood monitoring, diagnosis and management in urban areas position paper," *Procedia Computer Science*, vol. 32, 2014, pp. 941– 946.
- [9]. M. Borga, E. Gaume, J. D. Creutin, and L. Marchi, "Surveying flash floods: gauging the ungauged extremes," *Hydrological processes*, vol. 22, no. 18, 2008, p. 3883.
- [10]. E. Gertz and P. Di Justo, *Environmental Monitoring with Arduino*. O'Reilly, 2013.
- [11]. Sadeka Sultana, Tawhida Akand, Mrinmoy Dey "Design and implementation of Flood detection security system using Node MCU" 2016 9th International Conference on Electrical and Computer Engineering (ICECE), 20-22 Dec. 2016, DOI:10.1109/ICECE.2016.7853980, IEEEXplore.
- [12]. Nikolay N. Bakin, Vasiliy I. Tuyev, Eduard F. Yauk "Arduino IDE" 2011 International Conference and Seminar on Micro/Nanotechnologies and Electron Devices Proceedings, 30 June-4 July 2011, DOI:10.1109/EDM.2011.6006944. ISSN: 1815- 3712, IEEEXplore.
- [13]. R. Vajeth, D. Dama, "IoT based flood detection using ultrasonic sensor", 2004 IEEE Africon. 7th Africon Conference in Africa, DOI: 10.1109/AFRICON.2004.1406747, INSPEC Accession Number: 8304644, IEEE Xplore.
- [14]. Carlos M. S. Rodrigues, Bruno S. L. Castro, "A Vision of Internet of Things In industry 4.0 With Esp8266" *International Journal of Electronics and Communication Engineering and Technology*, January- February 2018, ISSN Print: 0976-6464 and ISSN Online: 0976-6472, IAEME.
- [15]. Ganguly, S. SAR "Paper Battery-A Promising Energy Solution for India" *International Journal of Advanced Engineering Research and Studies*, E-ISSN2249 – 8974, Research Paper.