Aqua Alert Disaster Management System

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***Abstract*— Flood had affected significant risk to communities, often leaving little time for effective response. Our paper "Aqua Alert Disaster Management System" a solution which integrates IOT and Web based Platform to enhance flood detection and emergency response. The IOT platform uses Arduino Uno, GSM SIM 800 module, and Water Level Sensor to monitor levels in real time. When levels reach a critical point the GSM module triggers an alert call, instantly notifying locals in nearby areas to take safety precautions. A web-based platform is provided for local residents allowing them to input their location, enabling rescue teams to coordinate efforts. The platform also includes donation gateway, where people can contribute funds to support affected communities. To predict nearby areas where the flood can reach, our system gathers sea level distances of nearby villages and day to day rain fall data. This paper discusses technical architecture and potential impact on improving disaster preparedness and response**

Keywords—Arduino Uno, GSMSIM800 Module, Water Level Sensor.

I. Introduction

Flood is one of the most devastating natural disasters which has occurred in the world causing wide spread loss to life and property. The early detection of flood and timely response is essential to avoid the damage and the impact which can affect the communities. There are few flood causing events which have occurred in India. The recent flood causing incident is of Assam which had caused around 109 deaths and affected around 1,325 villages across 19 districts. In July 2024 the Flood causing incident occurred near Pune had relentless rainfall leading to prompting evacuations from affected housing societies. Traditional system though it was effective lack real-time data integration affecting communities to high water levels flood-prone areas where resources for rapid disaster response may be limited.

The "Aqua Alert Disaster Management System" is designed to address these issues. It combines Internet of Things(IOT) and Web-based platform for improving flood detection and response coordination. This system uses water sensor to continuously measure water levels when threshold is met.
These alerts then are sent to locals automatically through telephone calls to provide critical early warning to help residents take immediate action.

Along with this there is a real time monitoring of web-based platform which allow users to input their current location, also help users to contribute financially to relief with the help of donation gateway.

In this paper we discussed the accessible and scalable solution which will help disasters preparedness and response ultimately saving lives and reducing damage

II. Literature Survey

The Aqua alert flood detection system gives real-time flood alert to the users. The system includes enhanced features for exact prediction of flood. In this section we will discuss some of the previous works related to flood alert. In paper [4], authors used early proximity sensors to detect the water level. The water level sensor predicts water levels based on water conductivity. The data collected by the water level sensor is constantly fed to an Arduino ATMEGA328P microcontroller [4]. This microcontroller is mono-tasking and has a small memory so that data processing performance degrades. Arduino has many libraries to develop various embedded system applications in the field of disaster mitigation. The integration of Arduino with water level sensors is done in [6]. This paper discusses the use of GSM in data communication media.SMS Gateway is one of the services offered by GSM, along with many of the communication services it provides. Some research on disaster information systems has used SMS Gateway including the use of SMS Gateway services in flood warning systems for villages and community information [7]. Next is an SMS-based flood early warning system [9]. Followed by a location-based flood early warning system using GSM communication [10]. Several flood information systems have been built with SMS-based and web-based interfaces. Studies have also been made to display the visualization of floods in real-time to find information of water levels. This flood visualization system can help many workstations simultaneously [4].

Our Aqua Alert flood detection system aims to build a flood alert system that works in real time using an SMS-based data delivery system. The system will notify the users through phone calls and offer personalized alerts. Further integrated with a web-based platform that delivers many features initially helps the users to track their location via Google Maps. Additionally, the platform will allow users to contribute through donations and enable volunteers to register for help.

The main feature of Aqua alert system is to continuously monitor the water levels through sensors then provide this data along with sea level distance and day to day rainfall data to the algorithm to predict the flood.

III. Problem Statement

The problem statement points out the urgent requirement for an advanced flood monitoring system, especially in areas prone to floods, where the present methods are often outdated, do not have real-time communication, and do not provide accurate data. Traditional flood monitoring systems are not precise enough and do not facilitate effective coordination between users, emergency responders, and government agencies. The Aqua Alert Detection System will address the gaps in place by using IoT sensors for real-time water level monitoring, immediately sending phone call alerts when critical thresholds occur, and incorporating community involvement through volunteer registration and donations. The system also uses Google Maps for the real-time visualization of affected areas to help authorities and rescue teams in the efficient allocation of resources. The Aqua system is designed to be low-cost, scalable, and user-friendly, with the goal of enhancing flood preparedness, improving response times, and protecting vulnerable communities.

IV. Methodology

The method of building a flood detection system involves two systems development, namely a flood detector system and a flood alarm system. Initially the flood detection system begins with a system analysis that describes how the system is used by the user or how the system should work. The next phase is the System design which will explain the workflow through block diagram.

1) System Analysis:

The flood detection phase begins with the detection of water by using a water level proximity sensor. The water level sensor works on the mechanism of calculating the height of the water. The water height data, sea level distance and rainfall data is processed by the flood detector system. The flood detector system calculates the threshold value which decides there is a possibility of flood and sends an alert through the GSM transmitter module. The rainfall data is collected from IMD and sea level distance data from the India Topography and Elevation Map.

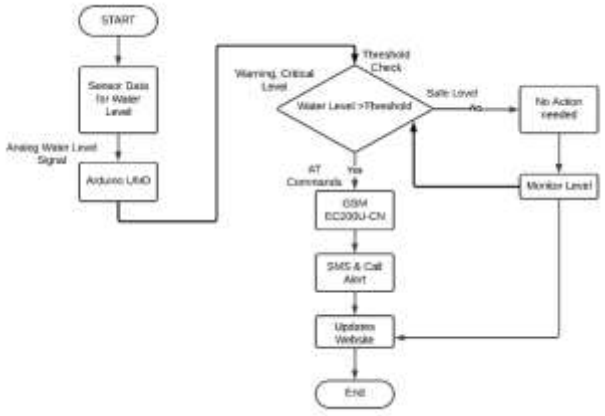

Figure.1.Block diagram of Flood Warning System

The data is given to Arduino for further processing and decides whether the flood alert is to be sent or not. Following diagram shows the working of the circuit

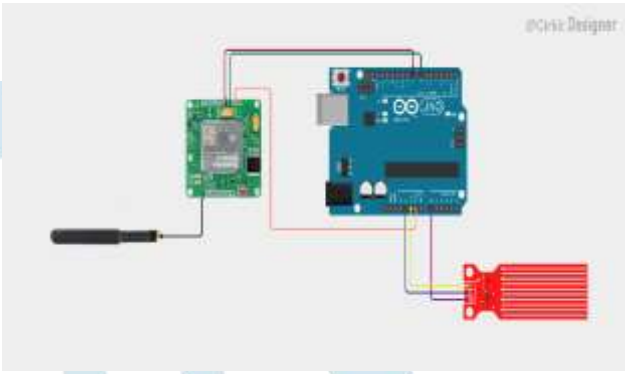

Figure.2.Circuit Diagram of Flood Warning System

2) Design

The system design involves hardware and software.There are three important devices Arduino Uno used as the microcontroller which receives input signals from Water level Sensor processes it, and then sends the output signal to GSM module [SIM 800L].

Water Level Sensor, used to measure the current water level inside water reservoirs by detecting changes in electrical resistance between two electrodes sensor. As the water level rises, it covers more of these electrodes, allowing ions in the water to create conductive pathways between them. This increased water contacts lower the resistance allowing more current to pass. The sensor converts these resistance changes into a voltage signal, which the Arduino reads. The Arduino then interrupts the voltage to access water levels produce higher voltage readings due to lower resistance. When the voltage surpasses a certain threshold, indicating a flood condition. The sea level height of the area and rainfall data also given as the input to detection system. The Arduino triggers the alert through the GSM module to notify users and update the web app to reflect the food status. This process enables the system to monitor and respond to water level changes effectively

The detection system includes three levels where the water is measured at the safe level, warning level and critical level. Water sensors are used to detect the water level for each level and for each level the depth has been decided where for the condition to beat safe level the water must be less than 14cm deep while for warning level water has to reached the depth which has been decided where for the condition to be at the safe-levels water has reached a depth between 14cm to 18cm. The critical level is used where the water is over 18cm deep. Throughout the three levels, users are able to indirectly monitor the current water level in reservoirs at their location through a web-platform on their phone. During the safe level, there is no triggering. However, as the water continues to rise to the warning level, users will start to receive an notification alert on their phone to remind them of the current water level. The same method applied when the water level reaches the critical level. Users will once again receive a call alert but this time it will warn users of the critical water levels.

Table.1.Water level ranges

Water Level Status	Water Level Range(cm)
Safe Level	<14 cm
Warning Level	14cm <=water level <18cm
Critical Level	>=18cm

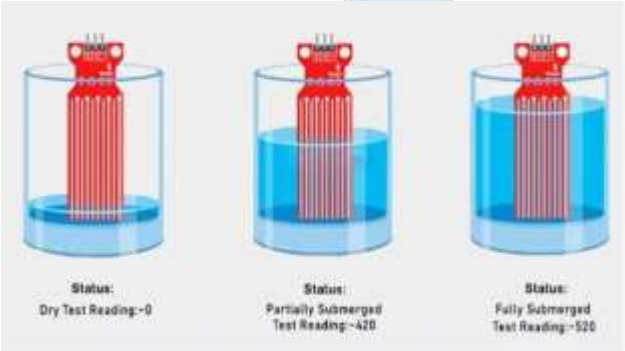

Figure .3.Calibration of Water Level Sensor

V. RESULTS

Below diagram shows the how the overall system will look like. First the sensors will collect the data and send it further to Arduino. When the voltage surpass certain limit Arduino triggers GSM to notify users via call

Figure.4.Result of the flood detection system

Below images are the location and donation gateway which we have included in our system. The location part will help the victim to locate its location so that the immediate help can be send. Also our system has payment gateway for donation which will help the victims who were already affected by the flood.

Figure.5.Location to detect the position of victim

Figure.6.Donation Gateway

VI. CONCLUSION AND FUTURE SCOPE

This project demonstrates the potential of an IoT- based flood alert system that allows real-time sensor data monitoring from anywhere globally, helping mitigate flooding risks. By integrating additional sensors, the system can become more accurate and effective in flood detection, providing critical alerts when water levels rise and speed increases. The system's development can support multiple government agencies and improve disaster management.

Future improvements include the integration of advanced sensors and machine learning for better flood prediction, developing a mobile app for real-time alerts and community engagement, and upgraded website for interactive data visualization and volunteer coordination. Furthermore, exploring scalability for deployment across multiple regions will maximize the system's effectiveness in flood management and disaster preparedness.

REFERENCES

[1] Design of Flood Warning System Based IoT and Water Characteristics Herman Yulian doko, Subono Subono, Vivien Arief Wardhani, Sholeh Hadi Pramono, Ponco Suwindarto

[2] Design of an IoT-based Flood Early Detection System using Machine Learning. Fatereh Sadat Mousavi; Saleh Yousefi; Hirad Abghari; Ardalan Ghasemzade

[3] Application of GSM Communication System on Flood Alarm Systems Dedi Satria1*, Syaifuddin Yana2 , Taufik Hidayat3 , SaumiSyahreza4 , Elin Yusibani5 , Rizal Munadi

[4] Implementation of GSM Communication on Flood Monitoring Systems Based on Multiple Locations Visualization

[5] Flood Detection and Water Monitoring System Using IOT Minakshi Roy,Prakar Pradhan, Jesson George, Nikhil Pradhan

[6] Prototype of Google Maps-Based Flood Monitoring SystemUsing Arduino and GSM Module

[7] D. Satria, S. Yana, R. Munadi, and S. Syahreza, "Design of Information Monitoring System Flood Based Internet of Things(IoT)",inMalikussalehInternationalConferenceonMultidisciplinaryStudies

[8] K.Vinothini, Dr.S.Jayanthy "IoT Based Flood Detection and Notification System using Decision Tree Algorithm

[9] E. Kuantama, P. Mardjoko, and M. A. Saraswati, "Design and Construction of Early flood warning system through SMS based onSIM300C GSM modem,"

[10] S.Azid,B.Sharma,K.Raghuwaiya,A.Chand,S.Prasad,andAJacquier,"SMSBasedFloodMonitoringandEarlyWarningSystems,"