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IoT Based Early Flood Detection and Alerting System

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ABSTRACT

Flooding is the major turn-up disasters that occur in different parts of the world. As these causes a huge amount of loss in the human environment. To reduce and make the system from alert, detecting these conditions is very crucial. "IoT Early Flood Detection & Alert System" is an intelligent system which keeps close watch over various natural factors to predict a flood. To eliminate or lessen the impacts of the flood, the system uses various natural factors to detect flood. The system has wifi connectivity, thus its collected data can be accessed from anywhere quite easily using IoT. To detect a flood the system observes various natural factors, which includes humidity, temperature, and water level of Dam. For detecting changes in humidity and temperature the system has a DHT11 Digital Temperature Humidity Sensor. The water level is always under observation by a Ultrasonic Sensor. All the sensors are connected to Arduino UNO Microcontroller Board, which processes and saves data. The system has wi-fi feature, which is useful to access the system and its data over IoT. User is provided with a Android Application to Monitor the Flood Causing Parameters from anywhere in the World using Internet Connectivity. This paper also incorporates communication of the information collected effectively by using GSM.

Keywords – Arduino UNO, DHT11, Flood, GSM, Ultrasonic sensor.

1.INTRODUCTION

Flooding happens when water from a river, lake, or severe rainfall overflows, and it can occur at any time of year. Flooding may be extremely dangerous because when it occurs in an area where people live, the water carries objects such as houses, automobiles, furniture, and even people with it. It has the ability to destroy property, trees, and a variety of other heavy stuff. Flooded roadways have been a concern in various cities for years. There is a significant flow of traffic as a result of this. Both cars and passengers are becoming stranded in flooded areas, unable to find alternate ways to their objectives. People's money, time, and effort were squandered when traffic occurred. Despite the fact that the local government unit in charge of flood control has been increasing their efforts to notify commters about the situation in flooded areas during the rainy season, the dissemination of information to residents is still insufficient. Taking preparations and keeping everyone in the area informed about weather and flood conditions is preferable to coping with flood after effects. Floods are caused by a variety of factors and activities, and the consequences for people who are affected are severe. When individuals are alerted to the impending flood, they can be evacuated to safe locations and their belongings safeguarded. It is also possible to save the lives of animals. Considering the various challenges faced by the people and geographical places, an IoT based early flood detection and alerting system was created to assist road users in avoiding this hazard. By

using an ultrasonic and rain gauge sensor in conjunction with a microcontroller to monitor the amount of water and predict the arrival of rain at any particular time. Using IoT, receive all of the parameters and alert the individuals in the area to save their lives. Incorporating a GSM module to send alert notifications through SMS. Because mobile phones have become a popular communication instrument among people all over the world, the notion of an SMS-based warning system was proposed. Because GSM is used in all mobile phones, they can communicate.

2.LITERATURE SURVEY

2.1. INTERNET OF THINGS BASED REAL TIME FLOOD MONITORING AND ALERT MANAGEMENT SYSTEM - The method has a lot of advantages when it comes to protecting people and animals' lives. This system is widely used to monitor water levels and flow fluctuations in rivers, and it may also be used to measure water levels at dams and reservoirs. The measured values are updated on a regular basis on the web server, which is extremely beneficial for sending flood notifications to the appropriate authorities and people in a timely manner. This is made up of wireless sensor nodes known as motes, which are placed along river beds to monitor water quality. A GSM module is attached to each Node. The Raspberry Pi3, which has a 64-bit ARM Cortex A53 processor, processes the measured parameters.The processed data is sent via GPRS from the associated node to the alert management system. Spreadsheet on Google Created an application programme interface (API) that is utilized as a data logger.

2.2. AN INTELLIGENT FLOOD MONITORING SYSTEM FOR BANGLADESH USING WIRELESS SENSOR NETWORK - The use of WSN to create a neuro-fuzzy based flood alarm system has been proposed. The dispersed sensor nodes collect water level data from the river, rainfall data, wind speed data, and air pressure data from the chosen site using a low-rate wireless personal area network. The data from the sensors is delivered to a dispersed alert center using an Arduino microcontroller and XBee transceivers. A Raspberry Pi microprocessor and an XBee Transceiver are utilized at the distributed alert center to create flood alerts based on sensor data. Flood monitoring data from the past two decades has been utilized to estimate the duration of the flood, and these data have been recorded in a database. In the Raspberry Pi microcomputer, an intelligent NFC is created that leverages sensor data to communicate flood alarms.

2.3. DEVELOPMENT OF A LOW COST COMMUNITY BASED REAL TIME FLOOD MONITORING AND EARLY WARNING SYSTEM- The suggested system uses low-cost Arduino Uno microcontrollers and other low-cost gadgets to detect possible floods and send out real-time alerts to the community. The prototype/field test results showed that the system is capable of minimizing the destructive effects of floods, particularly for the poorest and most vulnerable communities in developing countries.

2.4. SMS BASED FLOOD MONITORING AND EARLY WARNING - This monitoring system is quick, inexpensive, and dependable, which helps to prevent deaths and property damage. If the network provider makes changes to the network, one difficulty in the system may arise. The GSM module does not have the ability to upgrade itself. The system is further improved by including a solar battery charging mechanism, which makes it self-sufficient. The GSM module may be able to help with this. A characteristic of the GSM module allows it to monitor the battery level at any moment. Because the setup will be in a distant location, the solar charging system will keep the battery charged at all times. The GSM module can also be used to check the battery state.The module should be able to send the user an SMS with the battery level. To make the system completely functional, additional remote top-up and resident number additions are included.

3.METHODOLOGY

The methodology is a model to defined techniques or methods to develop and design a project. This session explains about working of system and applications with hardware and software that will be used for developing a system.

A) OVERVIEW

The suggested framework is made possible by the use of a variety of sensors and a microcontroller. The main goal

is to identify the impending flood and monitor any other climate-related indicators, which is accomplished using the DHT11 sensor and rain sensor. It also has the goal of calculating the water level in dam rivers and keeping track of the pace of water flow, both of which are displayed on an LCD display and transmitted via a mobile app. When the threshold condition is met, the value is set based on the location where the model will be retained. When a dangerous circumstance occurs, the buzzer is activated, and an alarm message is sent via the mobile app as well as SMS via the gsm module.

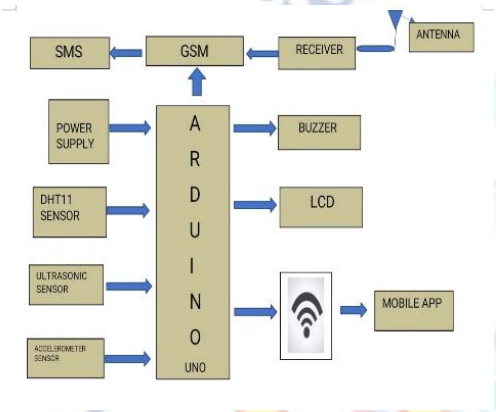


Figure:1 Block diagram for flood detection near the DAM/ RIVER

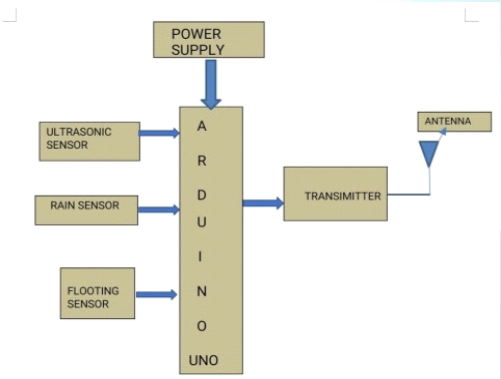


Figure:2 Block Diagram for flood detection in LOW LYING AREAS

B) HARDWARE SPECIFICATIONS: -

1) ARDUINO UNO: It is a microcontroller board. It uses AT mega32p. It has 14 digital input/output pins as well as 6 analogue inputs. It acts as an interface between the hardware part and the software part of the project. It can read input like detection motion, light and gives output on it. In Arduino Uno we can store the programming code it acts like a brain.

2) ULTRASONIC SENSOR: The HC-SR04 Ultrasonic distance sensor consists of two Ultrasonic transducers. The one acts as a transmitter which converts electrical signal into 40KHz ultrasonic sound pulses. The receiver listens for the transmitted pulses. The sensor is small, easy to use in any robotics and offers excellent non-contact range detection between 2cm to 400cm with an accuracy of 3mm.

3) ACCELEROMETER SENSOR: Accelerometer (when all is said and done) is an electromechanical gadget that estimates the quickening powers. The sensor is a 3-axis accelerometer sensor which is capable of finding different physical changes like tilt, tap, shake etc...

4) DHT11 SENSOR: DHT11 is a low-cost digital sensor for sensing temperature and humidity. This sensor is used to keep a track on various parameters like temperature and humidity and the recorded value is seen in LCD Display. This sensor can simply be connected to any microcontroller, such as an Arduino or a Raspberry Pi.

5) RAIN GAUGE SENSOR: A Rain Gauge is a metrological instrument to measure the precipitating rain in a given amount of time per unit area.

6) GSM: GSM is aacroynm which means Global system for mobile communication (GSM). This module is able to receive serial data from radiation monitoring devices and transmit the data as text SMS to a host.

7) LCD Display: LCD (Liquid Crystal Display) is a type of flat panel display which uses liquid crystals in its primary form of operation.

8) BUZZER: A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, Microwave ovens or game shows are examples of domestic appliances.

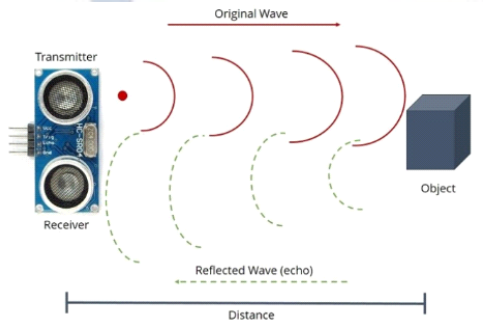
C) SOFTWARE SPECIFICATIONS: -

1) The Arduino IDE is a programme that allows you to programme with the Arduino microcontroller. The Arduino Integrated Development Environment (IDE), also known as the Arduino Software, includes a text editor for creating code, a message box, a text console, a toolbar with buttons for common functions, and a series of examples. menus. To upload programmes, it connects to the Arduino and Genuine hardware and keep in touch with them.

2) Web server for Thingspeak, according to its creators, is an opensource Internet of Items (IOT) application and API for storing and retrieving data from things over the Internet or over a Local Area Network utilising the HTTP and MQTT protocols. Sensor logging applications, location tracking applications, and a social network of things with status updates are all possible with Thingspeak. ThingSpeak now includes support for Math Works' MATLAB numerical computing programme, allowing ThingSpeak users to analyse and display uploaded data using MATLAB without having to acquire a MATLAB licence.

D) CALCULATION OF THE WATER LEVEL: -

We can calculate the water depth using ultrasonic sensors by measuring the distance between the transceiver and the water's surface. We can measure the transit time of that pulse (the echo) to the liquid and back by using the sensor to send a short ultrasonic pulse.



To measure the distance the sound has travelled we use the formula:

Distance=(time*Speed of sound)/2

The 2 is in the formula because the sound has to travel back and forth. First the sound travels away from the sensor, and then it bounces off of a surface and returns back.

4.RESULT

The following results have been obtained based on the performance of the flood detecting and alerting system, the flood detecting and alerting system monitors the development of floods and then send the alert notifications using IoT and GSM to the deliver team for necessary action to be taken to saves human lives and their properties.

Figure:3 Shows the values of water level, temperature and humidity

The Water Level, Flow Rate, temperature, humidity and the amount of rain fall is continuously monitored as it is displayed on the LCD screen and on the THINGSPEAK application.

Figure:4 Graphical representation of HUMIDITY

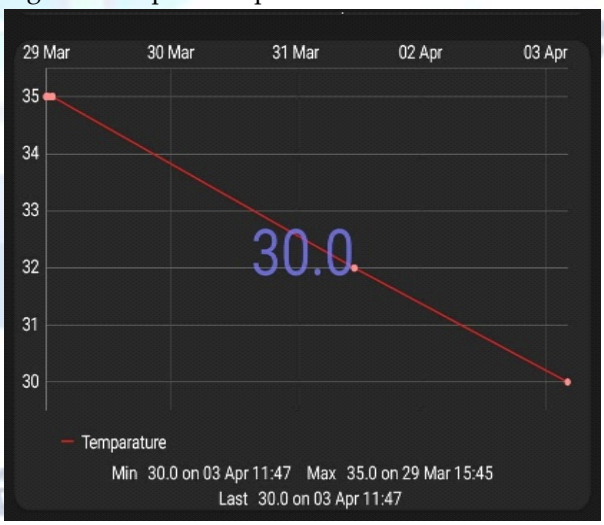


Figure:6 Graphical representation of TEMPERATURE

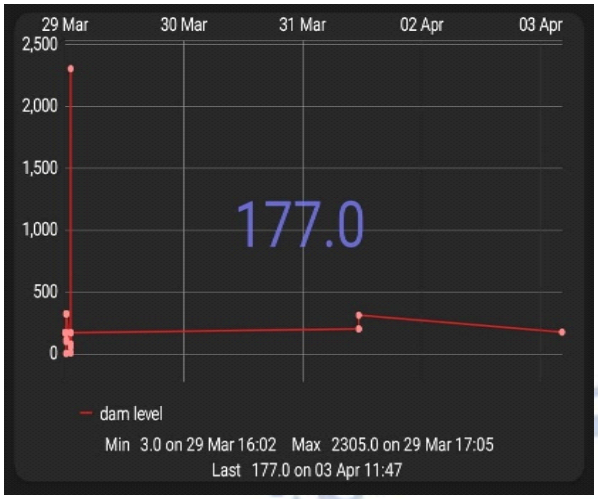


Figure:5 Graphical representation of DAM LEVEL

As mentioned above once the threshold condition is met, the alert notification is popped on the notification bar in the phone. If there is no access to the Wi-Fi in a particular area then the simple text message is sent via the GSM module to the registered contact numbers

5.CONCLUSION

Time is key during a flood disaster.All essential information must be gathered as soon as possible in order to determine the scope of the flood event and its damage. Therefore, tools to filter, collect, process and analyze data from several channels must be available ahead of time. The Internet of Things (IoT) was created in response to a need for a comprehensive solution that connects all types of semi-intelligent gadgets and human-operated technology, allowing data to be collected for a given flood disaster. After collecting data, the IoT platform filters and searches for the relevant data and applies analytics to it, providing comprehensive insight into the extent of the flood event and its flood impact. As a result, emergency search and rescue teams can be dispatched more quickly and efficiently, as well as the location and size of field hospitals and emergency shelters.

6. FUTURE SCOPE

The future scope of the proposed design is to predict the risk analysis of the effect over the low-lying areas and adverse effect analysis over that condition. Implementing a map to locate the safest location and route for evacuating from an approaching danger. Developing an Escalation protocol for automation i.e., if the admin is not able to take a necessary action within 5 minutes after red alert, automatically an action has to be taken place. Implementing the temporary multi network for communication.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

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