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FLOOD MONITORING AND EARLY WARNING SYSTEM USING RASPBERRY PI

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Abstract— Despite enormous technological advancement, humans are still unable to combat natural disasters. Natural disasters cannot be eliminated or averted, it is a truth. However, technology has advanced significantly in order to save lives.This project is entirely focused on warning the public about the impending flood so they may leave the perilous area before it occurs. Ultrasonic sensors, water level sensors, moisture sensors, rain sensors are used to monitor the rise in water level. for monitoring changes in temperature and humidity Temperature and humidity sensors are used. In order to determine the amount of water, the microprocessor reads the data from the sensors and analyses it. The microcomputer activates the LED and buzzer if the water level is below the specified threshold value. Additionally, the database is updated with the information collected from the microcomputer. The database table allows for the real-time monitoring of the sensor values. The trigger is set, and the database table's content is connected to the GSM. Now the trigger is set off when the water level reaches the threshold value, and the GSM module sends the SMS to the registered phone number.

Keywords—Raspberry pi, GSM Module, DHT11 sensor, Water Flow sensor, Rain sensor, Moisture sensor, PCB, Ultra-sonic sensor, Light, Buzzer.

I. INTRODUCTION :

a significant overflow of water that exceeds usual levels, especially over ordinarily dry land. A flood is when water overflows and engulfs land. The term "flowing water" can also be used to describe the tide coming in.

Floods are a topic of research in the hydrology field and are very important to the fields of agriculture, civil engineering, and public health.

Flooding can happen when water from water bodies—such as a river, lake, or ocean—overflows and destroys levees, allowing part of the water to escape its regular confines. It can also happen when rainwater collects on wet ground and causes an area flood.

While seasonal variations in precipitation and snowmelt will affect the size of lakes and other bodies of water, these changes are unlikely to be significant unless they cause property to flood or domestic animals to drown. While some floods take time to form, as flash flood scans, others happen quickly and without any outward symptoms of rain.

Bangalore came to a complete standstill during the last week of August and the first week of September due to heavy rain. Traffic jams, power outages, and flooding of homes and businesses were all reported in India's Silicon Valley. As a result of the In orapalya lake's burst banks, flood waters were released onto the Bengaluru-Mysuru Highway on August 27. Three days later, the Savalakere lake overflowed, flooding the outer ring road. The monsoon season has taken several lives and damaged numerous public and private properties throughout the State this year, notwithstanding the recent media attention given to the floods in Bangalore. Since June, 1,471 bridges and 2,223 km of roads have been damaged, 5.8 lakh hectares of crops have been lost, and up to 96 lives have been lost. The estimated losses came to a total of 7,647core.

1. Kerala floods in August 2018: The Indian state of Kerala saw severe flooding in the wake of torrential rains beginning on August 8 and excessive rainfall in late August 2018. As a result, over 445 people died.

2. India floods of 2019 are included. karnataka floods: Over nine Indian states were impacted by a series of floods in 2019 as a result of heavy rain in late July and early August. The most badly impacted states were Kerala, Madhya Pradesh, Karnataka, Maharashtra, and Gujarat.

3. 2021 Uttarakhand Flood: An avalanche from Ronit Peak produced a flood in Uttarakhand in February of that year. Nearly 22 districts and taluks in Bangalore were damaged, and a preliminary estimate places the loss of agricultural and horticultural cropland at 6.9 lakh hectares.

II. LITERATURE SURVEY :

Research projects addressing issues similar to those in this project have already been conducted at the national and international levels, but each of these projects has different features. In the system we've proposed, we've tried to combine features from different research articles into one system.

"Snow- influenced Floods are more strongly connected in space than purely rainfall-drivenfloods"ManuelaIrene,BrunnerSienaFischer, 0ct 2022. Snow-influenced events show stronger spatial connections than rainfall-driven events. The spatial connectedness of rainfall-driven events depends on the rain fall duration, and the connectedness decreases with increasing duration. These findings have potential implications for flood risk in a warning climate, both locally and regionally. The projected decrease in the frequency of occurrence of snow melt-influenced floods may translate into a decrease in the frequency of severe and wide spread floods in catchments where snow melt processes are important for flood generation. The database provides catchment boundaries to compute area laverages of climatic data and information on human influences (number of dams) to identify 'nearly' natural catchments . Third, they are nearly natural, i.e., uninfluenced by dams according to the GSIM database . first compile a dataset consisting of the dates of flood occurrences across all catchments, following the procedures proposed by Brunner and Gilliland(2021).[1]

"Systematization of floods and anti-flood measures". Poroshenko, Olekisy V. porohenko,Jun 2022.The first functional alternative, the flood flow is diverted from the flood risk zone through the river bed. By the second functional alternative, part of the flood flow is in hibitedand delayed in front of the flood risk zone. A system scheme of hydro-technical flood control measures was hydro-technical measures are given.[2].

"IoT Based Flood Monitoring and Alerting System with Weather Forecasting" Garima Singh, NishitaBist, Pravesh Bisht, Prajjwal Singh, April2020. Arduino UnoR3istobesetupmultiple different devices such as an 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 a 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, and Android studio .It can also contribute to multiple government agencies or authority that cam ultimately help the society and mankind about the flood like hazardous natural disasters. 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.[3]

"Study on Real-Time Flood Monitoring System Based on Sensors Using Flood Damaging Insurance Map" SYeon, Issue 2018: Typical types of natural disasters that occur in Korea are damages from heavy rain, storm, and heavy snow. In order to prepare for this, the storm and flood damage insurance program is operated. For this purpose, the risk of these damages is calculated for each region, and the storm and flood damage insurance map are created based on the risk. This map can provide insight into the degree of risk to wind and flood, snow damage, as well as policies to prevent and prepare for each type of natural disaster. In order to support decision-making by utilizing this insurance map, it is necessary to use with Storm and Flood Damage Information contents.

In order to efficiently construct such disaster information contents, it is possible to utilize public data produced by various organizations. Korea has a public data portal to open various administrative information. The public data portal currently publishes and updates about 25,000 data from 700 organizations. In this study, the linkage system is designed that can construct disaster information contents by collecting public data and processing it so that itcan be overlapped with the insurance map. The system automatically links public data to keep up-to-date disaster information content.

It is expected that it will be able to prevent and prepare for natural disaster by supporting the decision making of decision makers related to flood damage.[4]

"Flood Monitoring and Early Warning System Using Ultrasonic Sensors. J. Priya, S.Akshaya, E. Arunah, J. A. M. Julie, and V. Ranjani, Mar 2017.Aims in helping citizens to be prepared and knowledgeable whenever there is a flood. The novelty of this work falls under the utilization of the Arduino, ultrasonic sensors, GSM module, web-monitoring, and SMS early warning system in helping stakeholders to mitigate casualties related to flood. Most of these technologies being developed commonly apply in weather forecasting, flood detection, and monitoring system using sensing devices, modeling software, Internet, and mobile technology. However, these systems are usually for one-way communication only. In order to get an update or latest information, local communities need to access the website. It envisions a safe, prepared and less casualty community before, during and after typhoon devastation. The model also promotes the use of real-time monitoring system through the developed web-based application and SMS notification system as an easy medium in disseminating information particularly in the remote areas. By allowing the system in two-way communication, it gives more flexibility in providing important information to the community.[5]

"SMS Based Early Flood Warning System Using Raspberry PI" S. Azid, B. Sharma, K.Raghuwaiya, A. Chand, S. Prasad, and A. Jacquier, 2015. The Global System for Mobile Communications (GSM) module is used for sending the mobile text messages while the Arduino Uno microprocessor is used to read in the input from the pressure sensor and then calculate the height of water. The idea of an SMS based warning system was proposed because mobile phones have become a popular communication device amongst people all over the world.

This paper addresses the design and implementation of an SMS-based flood monitoring and early warning system. The fact that there is a perfect linear relationship between the pressure and the height of the water level satisfactorily validates the usage of pressure sensors in a water level monitoring system. If the network provider changes the network, one issue with the system could arise. The GSM module is unable to update itself. The system is further enhanced by adding a solar battery charging mechanism to make it independent. The GSM module might be able to support this.[6]

OBJECTIVE AND SCOPE OF THE PROJECT :

To continuously monitor the environment's temperature, humidity, and water flow.

To issue a warning using the SMS system.

To instantly determine the water level.

Identifying the flood and warning those who live nearby so they can leave the flood zone and safeguard their valuables.

When the system is improved in accordance with the demands of the relevant field, this project can be used for a variety of reasons. However, the main focus here is on improving the system so that it can be very useful for determining the water level in rivers and alerting the public in real time. The further improvement that could be made would be :

The usage of temperature and humidity sensors in various places can be made possible by their wider functioning range.

A larger system can use a distance sensor with a wider operating range. The water flow sensor can be used to measure water discharge, which helps with flood early detection.

The system can be used in many different locations, and the data from one system can be used to warn other related systems, making the system more practical, quick, and efficient.

The GSM module can be upgraded to handle the combined data from many systems.
In addition to SMS, consumers can also receive alerts via phone calls, Android apps, websites, etc.

V. METHODOLOGY :

Block Diagram :

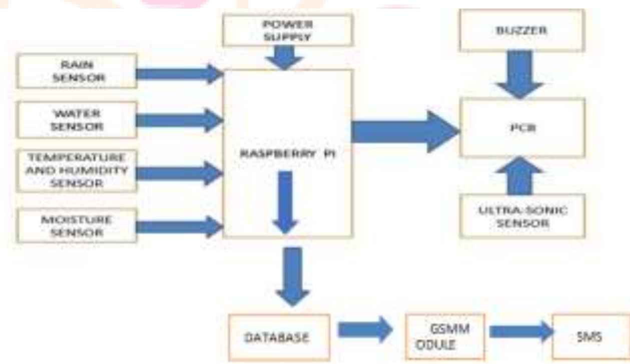

Figure 5.1:Block diagram

Figure 5.1 displays the block diagram of the entire system. The data are read by the sensors that are positioned at various locations, and the values of the sensors are then presented. Values that are repeatedly collected are reported to a database, and a warning message is delivered to a predetermined number via the GSM module. The project's brain is the raspberry Pi that was used. It is in charge of gathering information from sensors, processing it, storing it, communicating it, and finally performing events.

Raspberry reads information from the moisture sensor, rain sensor, temperature & humidity sensor, and ultrasonic sensor (HCSR04). The Raspberry Pi next processes the sensor value that was collected and displays it. The level of water is determined using the value from the ultrasonic sensor.

The distance between the ultrasonic sensor and the river has a set threshold value, and the value of the distance determined by the ultrasonic sensor is updated often as the water level changes. The led and buzzer will turn on if the distance value is less than the predetermined threshold value, signaling that there is a strong likelihood that a flood may occur.

The LED and buzzer will remain off if the distance value exceeds the predetermined threshold value, indicating that there is no need for concern. Temperature, humidity, and the separation between the sensor and the river are also displayed by the Raspberry Pi in its local terminal.

Sensor values are repeatedly collected over a predetermined period of time. As a result, the sensors' real-time values are determined. Using the database, the collected values are uploaded to the Raspberry Pi's local server. Date, time, temperature, humidity, distance between the ultrasonic sensor and the river, and any flood markings are the data that were collected from the Raspberry Pi and entered into the database. Since no sensor input data is needed, the date and time have to be increased. The database table is updated as the temperature and humidity values change in accordance with changes in the surrounding environment. The ultrasonic sensor plays a key function in this situation. The distance is displayed by the ultrasonic sensor's value, which is updated repeatedly every predetermined amount of time.The warning message about a flood will be displayed in there markings if the distance value is less than the threshold value, and remarks will display the default message if the distance value is larger than the threshold value.

The database table's data is automatically updated every 6 seconds. The GSM module now serves as the system's primary means of warning the public of impending flooding.
The GSM module is connected to the data from the data base.

The GSM module regularly reads sensor values from the database as part of its function. The contact information for the residents is also uploaded in the modules, and by sending an SMS warning to those whose numbers are on file, it swiftly alerts the community to flooding.

VI.SOFTWARE ALGORITHM AND HARDWARE IMPLEMENTATION :

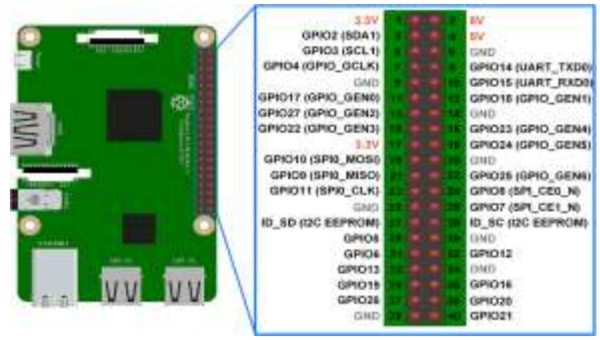

Figure 6.1 : Raspberry Pi

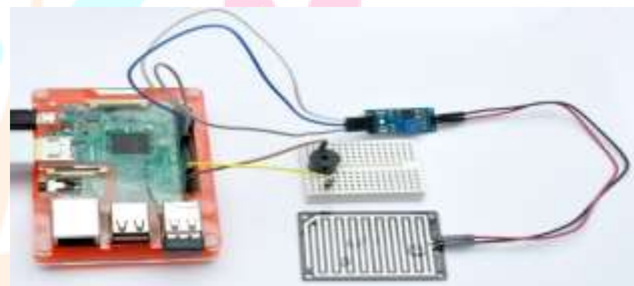

Figure 6.2 : Rain Sensor

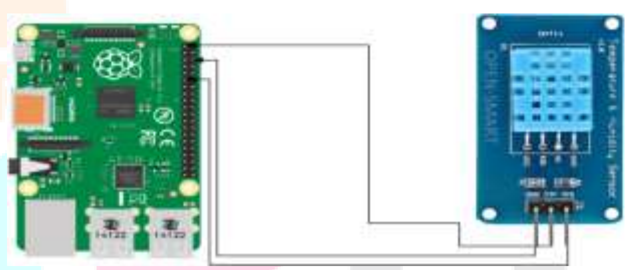

Figure 6.3 : Temperature and Humidity Sensor (DHT 11)

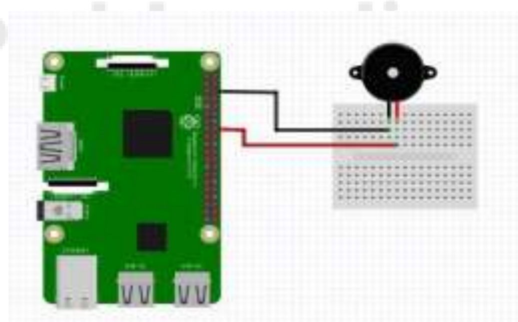

Figure 6.4 : Buzzer

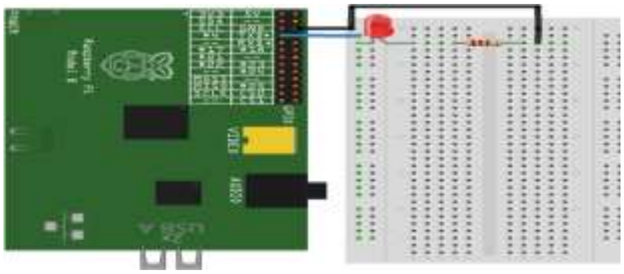

Figure 6.5 : LED

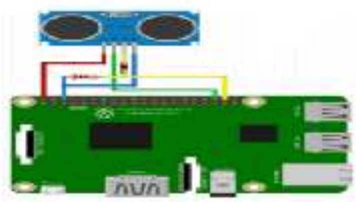

Figure 6.6 : Ultra Sonic Sensor

VII. REAL TIME MONITORING :

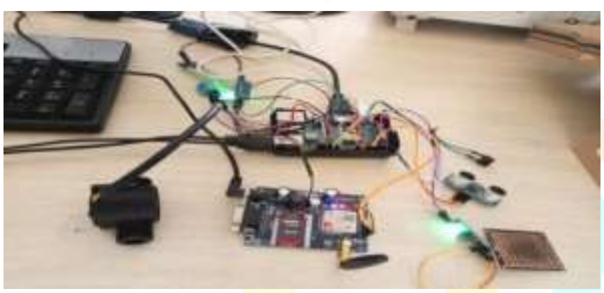

Figure 7.1 : all sensors connected to raspberry pi

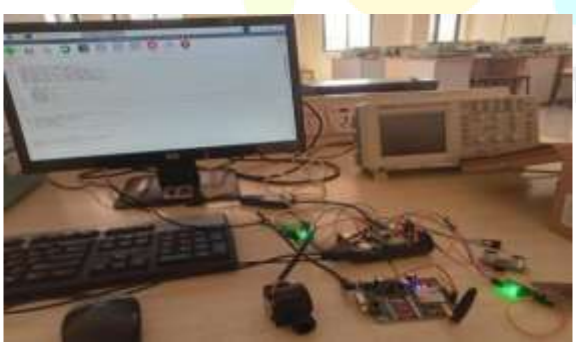

Figure 7.2 : code for sensors

Figure 7.3 : alert message to people

Figure 7.4 : output of a ll sensors

VIII .CONCLUSION :

The system can identify and predict the flood early, it is finally concluded. Embedded systems and closed-loop control systems are the foundation of the project. To detect the water level of rivers, dams, and other structures, the system consists of hardware and software programmes. When the water level drops below the threshold (less than 20 cm), the system automatically recognises the change and warns the system.The device has an ultrasonic sensor to track the rise in water level and to inform the user if the water is within 20 cm of the sensor. The temperature and humidity are sensed by DHT11, which aids in the investigation of the environmental factors causing flooding. If the water level rises beyond the set threshold, the Raspberry Pi activates a buzzer and an LED to signal an impending flood.

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