IMPLEMENTATION OF EARLY FLOOD DETECTION AND AVOIDANCE SYSTEM USING LORA

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Abstract –*Among the most common impact towards mankind, flooding is the most common natural disaster. Floods are known to cause widespread damage. There are many sophisticated systems widely in practice by the organizations and responsible authorities in monitoring the flood level in flood a high risk area. Most of these devices are very costly to be used and maintained. In the proposed system, the information collected by the sensors such as temperature and humidity, water level, water flow and ultrasonic sensor can be sent to cloud by using IOT device and if threshold values of the environmental conditions increases, the warning message will be sent to responsible authorities and in turn will be intimated to the people living in the flood prone region. Such a system enables both private and government organizations to work on their before the flood situation increases, make an emergency flight and mitigation methods.*

Key Words: **Arduino Microcontroller, Temperature and Humidity sensor, Ultrasonic sensor, Water level sensor, Water flow sensor, Wifi module, GPS Module, LCD**

1. INTRODUCTION

Flooding is one of the globe's most common natural disasters. Although we can estimate rainfall or track cyclone paths with great precision using satellite images, having real-time monitored data such as flow, precipitation level, or water level is critical for making smart decisions regarding the actions that must be taken to prevent flooding. Flood damage costs are highly correlated with the amount of warning time provided prior to a flood event, making flood monitoring and forecasting vital to limiting flood damage costs. Different types of Floods are:

- **Flash floods** are rapid-moving waves that engulf everything in their path. They are brought on by strong rain or a quick thawing of the snow. Flash floods typically cover a short region and strike with little to no warning, lasting less than six hours. Large things like as automobiles, rocks, and trees can be moved by the rapid water torrents.
- **Coastal floods** or storms moving towards a coast during high tide cause coastal floods. The area is regularly inundated when high waves breach the dune or dike along the coast. The coastal regions with the fewest defense and the lowest elevations are the hardest hit.
- **River floods** are defined by progressive riverbank overflows caused by large amounts of water. The region flooded by river floods is controlled by the river's size and the volume of water in river precipitation. Although river floods rarely result in fatalities, they can cause significant financial damage.
- **Urban flood** events when a city's or town's sewage system fails to absorb water from intense rainfall. Flooding can also be caused by a lack of drainage system in a city. Water spills into the street, making driving extremely hazardous. Urban floods can wreak major damage even if the water levels are only a few inches deep.
- **Pluvial floods** occur in flat locations when the land is unable to absorb rainwater, resulting in pools and ponds. Pluvial flooding, which mostly occurs in urban areas, is similar to urban flooding, which mostly occurs in remote regions. Agricultural enterprises and properties in areas prone to pluvial flooding could be severely harmed.

The "Early Flood Detection and Avoidance System" is a smart system that keeps track of a range of variables of natural occurrences in order to predict floods. Natural disasters such as flooding and other natural disasters can be severe, causing property damage and even death. The system identifies floods by analyzing a variety of natural parameters in order to eliminate or mitigate the flood's impacts. The obtained data may be accessed by government officials from anywhere using IoT because the system is Wi-Fi enabled. The system monitors a variety of natural elements, including rainfall, water level, and flow rate, to detect a flood. The system is made up of numerous sensors that collect data on individual characteristics in order to collect data on the natural components described above. Water level and water flow sensors are installed at various sites across the river and dam, collecting data on water level and water flow from the dam and rivers. The occurrence of floods is predicted based on this information. The main purpose of this work is to develop

and build a flood monitoring and detection system based on the internet of things. The main goal is to create an early flood detection system that will automatically identify floods and provide data to the Local Government Unit and citizens. The precise goals of this work includes detecting the current level of water in rivers at various locations, predicting river water levels, warning residents about floods, and updating government officials about the situation of the floods, and informing government officials about the situation.

2. METHODOLOGY

Floods are natural disasters that cause excessive loss of life and property. When the water level rises above the required level, a flood occurs. This system can help reducing the loss caused by floods by implementing an early flood detection mechanism. The objective of this telemetry based work is to monitor the flood situation at the earliest,in the case of a risk, a warning will be posted on a government-controlled website, so that individuals can avoid making incorrect assumptions. IoT allows the notification to be read all over the world. The microprocessor is coupled to an ultrasonic sensor, which monitors the value of water in dams or rivers and delivers the data to the microcontroller. The LoRa sends that notification through the internet on the webpage using IoT network. The main objective of the proposed system is to provide information on the current water level in the particular area, such as river and dam. When, the water level increases beyond the critical level, the system sends the alert notification to the user.

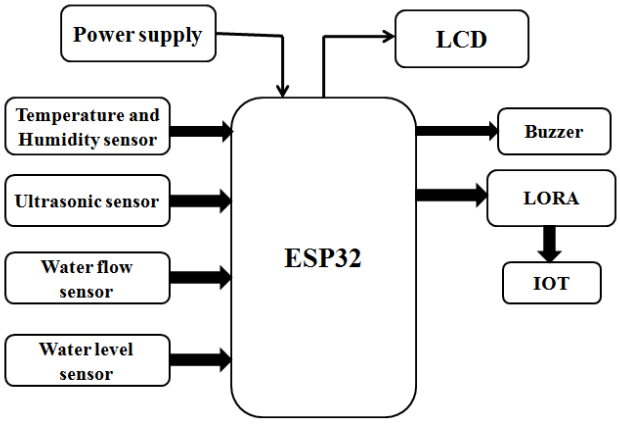

Fig: BLOCK DIAGRAM

To detect a flood the system observes various natural factors, which includes humidity, temperature, water level and flow level. The system consists of various sensors that collect data for individual parameters in order to collect data on the specified natural variables. Changes in humidity are monitored using a DHT11 Digital Temperature Humidity Sensor. It's a rising sensor module with components for resistive temperature and humidity measurement. A float sensor constantly monitors the water level by opening and closing circuits (dry contacts) when the water level rises and falls. It is generally in the closed position, indicating that the circuit is incomplete and that no electricity has yet passed through the wires. The circuit completes itself when the water level falls below a predetermined level, and electricity is sent through the completed circuit to trigger an alarm. The flow sensor in the system monitors the water flow. A plastic valve body, a water rotor, and a hall-effect sensor compose up the water flow sensor. The device also includes an HC-SR04 Ultrasonic Range Finder Distance Sensor. The ultrasonic sensor is based on the SONAR concept and is used to measure distances Ultrasonic waves are used to determine the distance between an object and a sensor. All the sensors are connected to ESP32 microcontroller, which processes and saves data. The system has Wi-Fi feature, which is useful to access the system and its data over IOT.

3. SIMULATION PROCESS

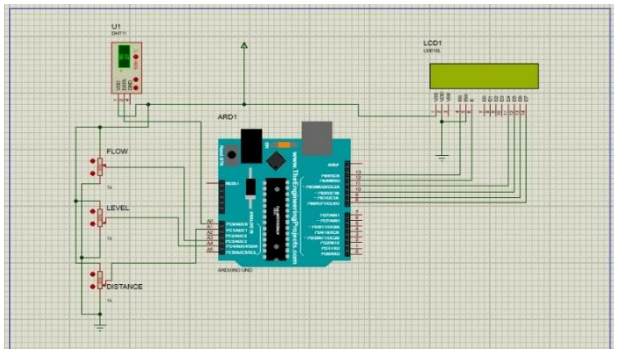

Fig: Overall setup of Software Simulation

The Simulation for the Implementation of Early Flood Detection and avoidance System using LORA was done using Proteus 8 Professional. The above figure shows the overall setup of simulation process.

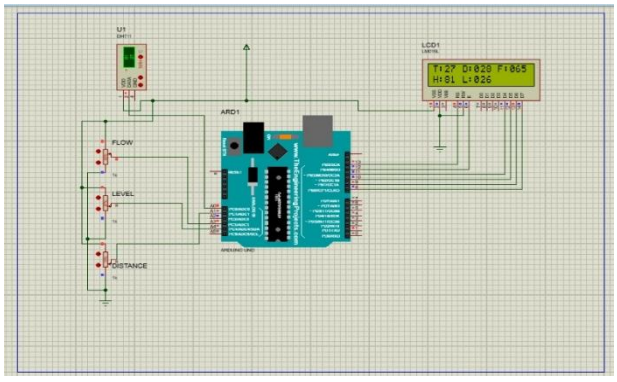

Fig: Result of the Simulation process

DHT11 denotes Temperature(T) and Humidity (H), FLOW (F) denotes the water flow, LEVEL (L) denotes the water from the street level DISTANCE (D) denotes the distance between the water and the setup. Here, the values of temperature and humidity kept as constant.DHT11, FLOW, LEVEL, DISTANCE monitoring unit terminals are connected to anArduinoUNO. If the change occurs in the water condition, the values of the sensor will send to the Arduino UNO and the output will be displayed in the LCD screen.

4. EXPERIMENTAL SETUP

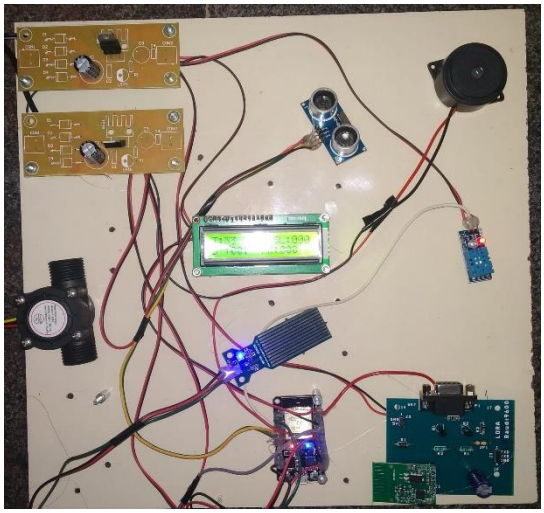

Fig: Transmitter side of the hardware module

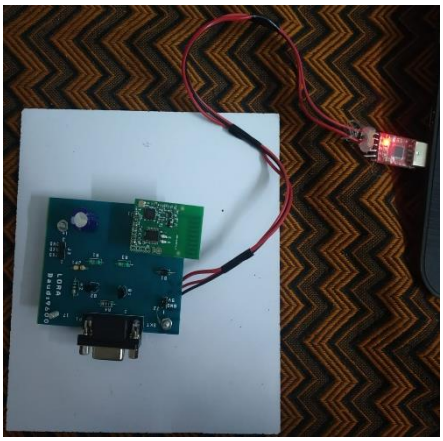

Fig: Receiver side of the hardware module

The proposed methodology made up of the following sections:

1. **TEMPERATURE AND HUMIDITY SENSOR:** This sensor is used to detect the temperature and humidity of the surrounding environmental condition.
2. **ULTRASONIC SENSOR:** This sensor is used to detect the water level of the dam.
3. **WATER FLOW SENSOR**: This sensor is used to detect the speed of the water flow in the dam.
4. **WATER LEVEL SENSOR**: This sensor is used to detect the level of the water from the street level in the dam.
5. **POWER SUPPLY:** We use 12V power supply to provide the dc voltage in the board.
6. **ESP32 MICROCONTROLLER:** It plays an important role. It gets the information from the sensors and processes it. It compares the receiver data with the threshold level and accordingly output is generated.
7. **LORA:** It is used to transmit the information from the sensors to the cloud.
8. **BUZZER:** If the sensor values reaches its maximum value Beep sound is occurs in the buzzer.

5. RESULTS AND DISCUSSION

Fig: Sensor values displayed in the LCD screen

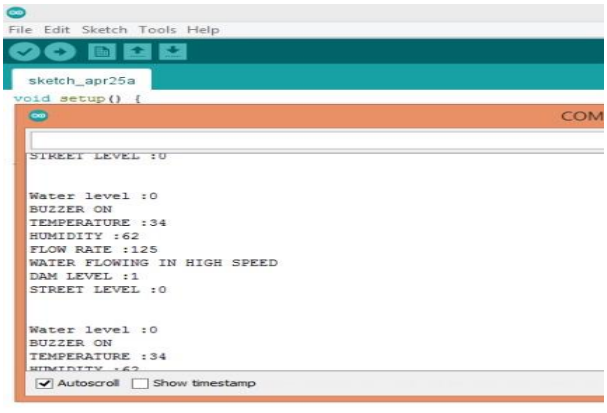

Fig: Result

In this paper, a smart flood detection system is attached with the advanced sensor implemented with the help of IoT technology. It is an user-friendly device and any one can operate easily as the values are displayed in the LCD display. It reminds the user by sending the notification

through the android application if any change occurs in water in the dam. On detecting the flood at right time, it is possible to reduce the damages caused by the flood.

6. CONCLUSION

This work enlightens the possibility to provide an alert system to overcome the flood risk. It can also help an authority or company, such as a fire department. The government has set up a state agency to aid the people in the event of disaster. The proposed prototype system has been thoroughly tested and found to perform as intended. It can send an alert message to the user with the time of the water rise as well as the speed of the water rises in order to predict how high the water will rise quick is the flood is happening. It has also been put through its paces in a controlled environment to see how well it performs. For accurate detection, numerous sensors, such as a pressure sensor and a camera, may be used in the real world.

7. APPLICATIONS

- Able to check water level on a remote place autonomously.
- Collect data on water level status from all locations and send it to a central server.
- Have a web-based system that users may access 24 hours a day, seven days a week via an internet connection.
- Provide a trending function that displays real-time or historical data.
- Use a split screen to compare water movement from four distinct locations at the same time.
- A map of the entire monitoring area that shows the current status of each station.

8. ADVANTAGES

- This module is constructed with easily available and reasonably priced components and hence provides a cost-effective solution for flood detection.
- Since the initiative uses IoT technology, the sensor data may be viewed from anywhere in the world. In order to produce a more effective and precise flood detection system, more sensors can be included into the system.
- A network of similar models can be built to cover a broad area, resulting in the formation of a national or state-level disaster management system.

9. DISADVANTAGES

- Climatic changes
- Network connectivity
- It saves the data into the database but doesn't use it, hence wasting the space.]

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