



Iot Based Flood Monitoring And Alerting System For Smart Cities

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Abstract:

One of the most devastating natural disasters that can happen anywhere in the globe is flooding. In order to keep an eye on the flood situation in the southern Thai province of Nakhon Si Thammarat, a system was put in place to track the water level, flow, and precipitation level in real-time. A web-based information source for the public, responding to their need for information on water conditions and flooding, and a channel for information about flooding between the involved authorities and experts to improve their duties and cooperation are the two primary goals of the created system. A sensor network, a processing/transmission unit, and a database/application server make up the created system. With the help of a wireless sensor network that communicates with the application server over mobile General Packet Radio Service (GPRS), it is possible to remotely monitor these real-time data of water condition. To facilitate communication between the application server and the remote sensors linked to a GPRS data unit (GDU), we designed a middleware known as VirtualCOM. The GDU acts as though it were a physical cable linking the distant sensors to the application server while using VirtualCOM. The application server is a web-based system that uses MySQL as its relational database and PHP and JAVA as its web applications. Water conditions, both current and predicted, can be viewed by users in real-time by web browser or WLAN. The created system proved that modern sensors can be used to wirelessly track water conditions in real-time.

Keywords: IoT, Flood Monitoring, Alerting System.

1.INTRODUCTION:

There is no way to completely prevent natural calamities, and floods are no exception. It was too sudden, and it destroyed homes and people. Prior to this, the majority of the systems that have been developed had narrow scopes. However, aside from that, most people don't have access to data or information regarding meteorological conditions, so they can't monitor the situation or predict when the flood would occur. All of the problems with the current system can be resolved with the help of a smart Internet of Things flood monitoring system. City and rural settings alike can benefit from the suggested strategy. In addition, anyone with an internet connection can keep

tabs on the situation and foretell when the web server will be flooded. Both the design and maintenance of the suggested system are simple and inexpensive. In order to facilitate prompt action, this project will monitor the water level on a web server and send out an evacuation alert signal to the general public.

2.OBJECTIVE:

- **Real-Time Monitoring:** To continuously collect data from sensors on water levels, rainfall, and weather conditions to detect potential flood risks.
- **Early Warning and Alert System:** To automatically issue timely alerts to authorities and the public through mobile apps, sirens, or messages when flood risks are detected.
- **Data Integration and Visualization:** To aggregate and visualize data on dashboards for city officials to support decision-making and resource allocation.
- **Infrastructure Protection:** To help protect critical infrastructure (roads, bridges, power stations) by predicting flood-prone areas and triggering preemptive actions.
- **Community Safety and Response Coordination:** To enhance emergency response and evacuation planning through real-time data sharing with disaster management teams.

LITERATURE SURVEY:

- **Real-Time Sensor Networks:** Several studies, such as those by Sharma et al. (2020), demonstrate the effectiveness of wireless sensor networks (WSNs) in monitoring environmental parameters like water level, flow rate, and rainfall, enabling early detection of flood conditions.
- **IoT and Cloud Integration:** Research by Patel and Singh (2021) highlights how IoT platforms integrated with cloud computing enable seamless data collection, storage, and analysis, improving scalability and accessibility for city-wide flood monitoring systems.
- **Machine Learning for Prediction:** Recent advancements, including the work by Chen et al. (2022), explore the use of machine learning models to analyze historical and real-time data to accurately predict flood events and minimize false alarms.

3. METHODOLOGY

3.1 System Design and Architecture

This chapter outlines the motivation behind developing an IoT-based flood monitoring and alerting system. It highlights the increasing frequency and impact of urban flooding due to climate change, poor drainage systems, and rapid urbanization. The chapter also introduces the role of smart city technologies and IoT in creating resilient infrastructure capable of real-time environmental monitoring. The second chapter explains the overall design of the system. It describes the architecture, which typically consists of distributed sensor nodes for monitoring water levels, rainfall, humidity, and other relevant parameters. These nodes are connected via wireless networks (e.g., LoRa, ZigBee, Wi-Fi) to a central IoT gateway. The gateway transmits the data to a cloud-based platform where further processing and analysis take place. covers the implementation of the alert system and data analytics. Based on predefined threshold values or machine learning models, the system triggers alerts via SMS, email, or mobile notifications. The chapter also discusses the integration of data analytics tools for trend analysis, anomaly

detection, and prediction of potential flood events.

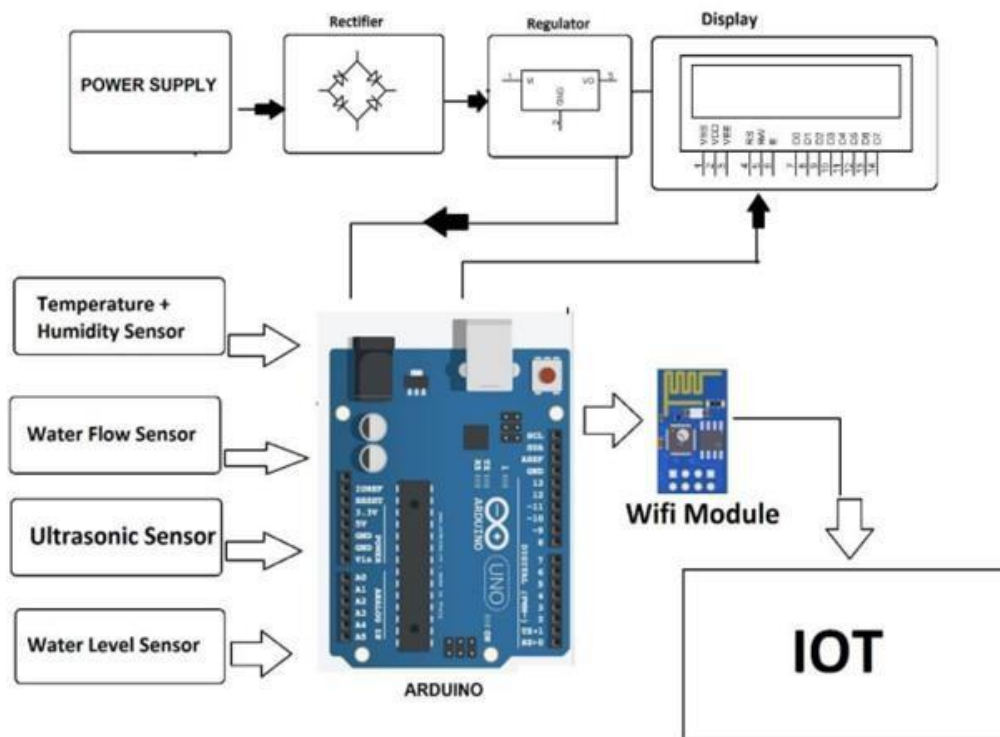


Fig no: 1 Block diagram of FDMS.

3.2 MODEL ARCHITECTURE

- Power Supply: Provides power to the entire system, including a 3.3V power supply for the microcontroller and sensors.
- Microcontroller: Central unit that connects and controls all components, such as the GSM, depth sensor, Wi-Fi, LED lights, and buzzer.
- Depth Sensor: Monitors water levels and sends real-time data to the microcontroller for analysis.
- GSM Module: Sends SMS alerts when flood levels cross a dangerous threshold.
- Wi-Fi Module: Enables internet connectivity for remote monitoring and cloud data transmission.
- LED Lights (Green/Red): Display flood status visually □ green for safe, red for danger.
- Buzzer: Emits an audible alert when water levels reach dangerous levels.

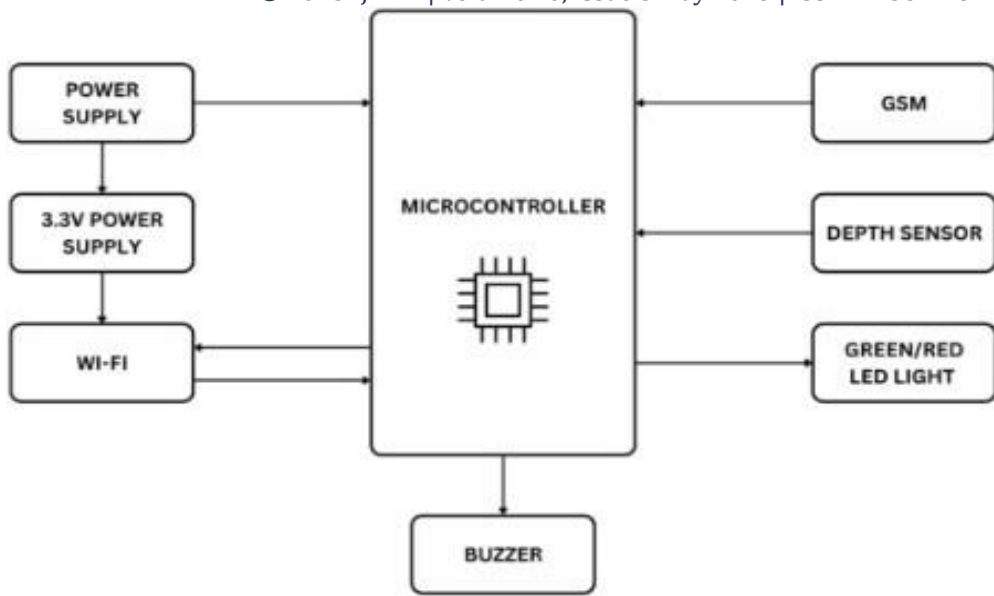


Fig no: 2 System Flow Chart for FDMS.

PROPOSED METHOD:

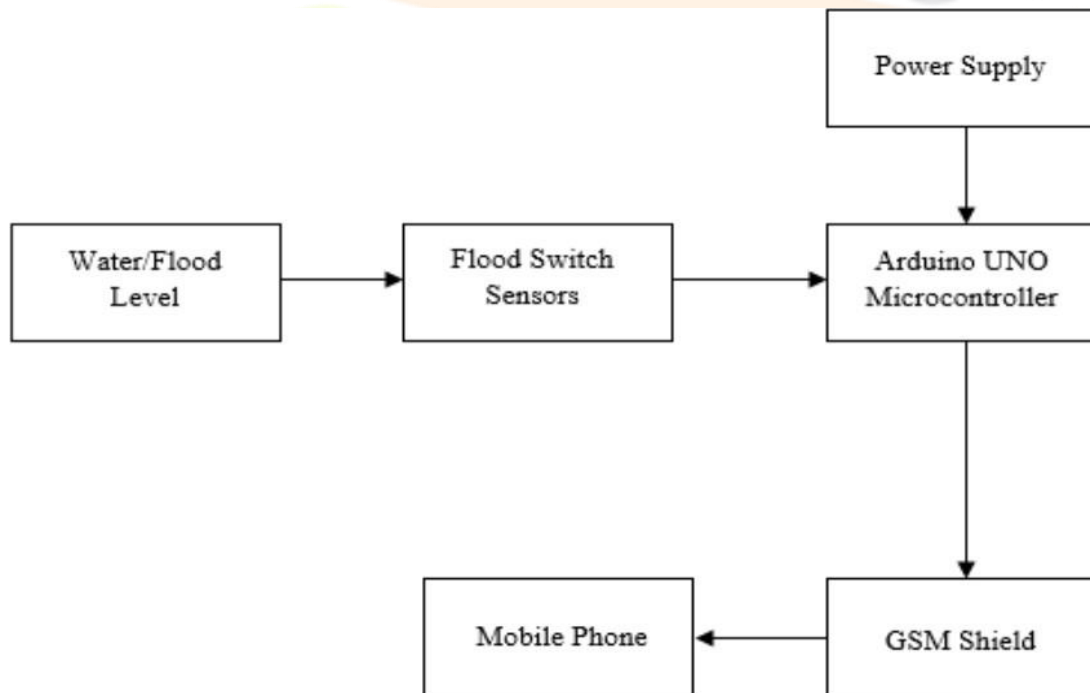


Fig no: 3 Proposed Block Diagram for FDMS.

This diagram represents the setup for a flood detection and notification system. It starts with monitoring the water or flood level using flood switch sensors. When the water reaches a certain level,

these sensors detect the change and send the signal to the Arduino UNO microcontroller, which acts as the central controller. The microcontroller processes this input and triggers further actions.

The system is powered by a power supply that ensures the entire setup works smoothly. When the flood level is detected, the Arduino sends a signal to a GSM shield, which is responsible for sending the notification. The GSM shield is connected to a mobile phone, enabling it to send an alert, such as a text message, to the user, warning them about the flood situation. This kind of setup can be particularly useful for early flood detection in vulnerable areas, offering timely alerts to prevent damage.

The suggested system is a disaster management system-based Internet of Things (IoT) flood detection system shown in figure 1. This solution addresses the potential for flooding with an Arduino-based alert system that incorporates a GSM module. A rectifier, LCD screen, ultrasonic sensors, GSM module, and Arduino make up the system's circuit. If the water level increases above the danger threshold, the mechanism will activate. The ultrasonic sensor initially communicates with the Arduino board by sending a signal at a speed of 10 milliseconds in order to detect the water level. Every other parameter is linked to Arduino. If there is a problem with the water level, the Arduino will detect it and communicate the information to the LCD screen and GSM module. This project's means of communication is the GSM module, a communicative device. Our proposed system's flowchart is as follows:

3.3 IMPLEMENTATION

- **Libraries Used:** Python, DHT, sensor libraries, Pho MQTT
- **Training Process:** The training process involves feeding data to a model, adjusting weights based on errors through backpropagation, and iterating until the model accurately predicts or classifies the target outputs.

STEP-BY-STEP IMPLEMENTATION WORKFLOW:

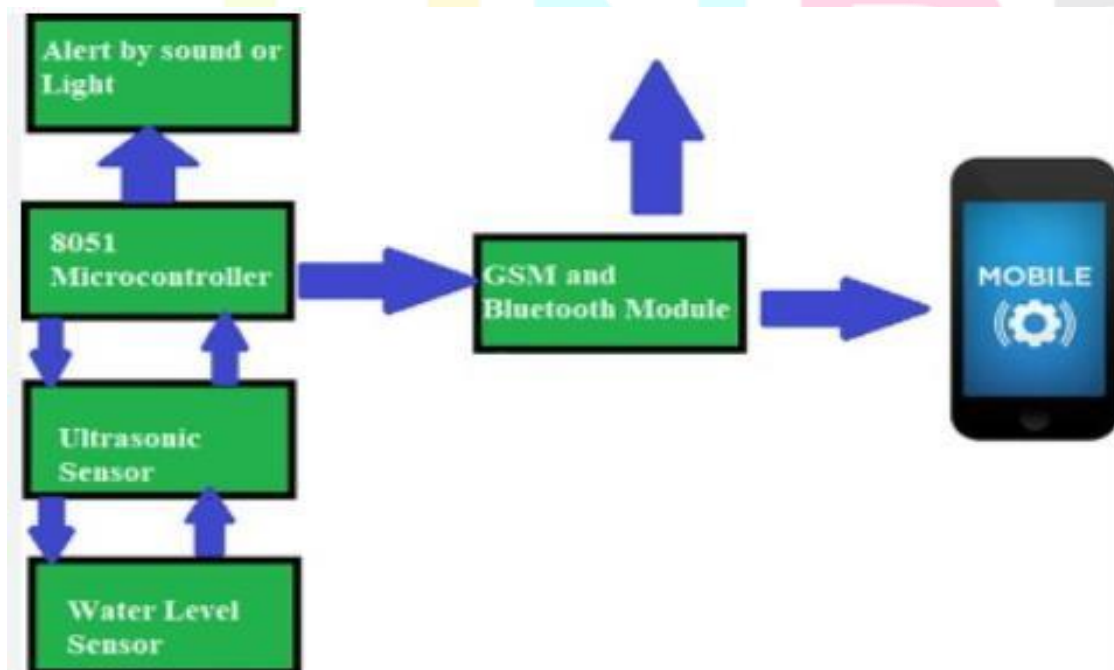


Fig no: 4 Implementation Workflow

4.SOFTWARE REQUIREMENTS

1. Programming Language: Python
2. Operating System: Linux
3. Libraries or Framework: Web Framework
4. AWS IoT
5. Docker
6. D3.js

HARDWARE REQUIREMENTS:

1. Sensors: Ultrasonic Sensors
2. Microcontroller: Arduino, ESP32/ESP8266
3. Connectivity Modules: Wi-Fi Modules
4. Power Supply: Solar Panels
5. Hard Disk: MicroSD card
6. RAM: 4 GB or 8 GB

5.1 RESULTS AND DISCUSSION

Shows the successful adaptation of new tactics into an existing flood disaster management system has the potential to lessen the likelihood of human casualties and property damage. The assertions stated earlier are backed up by this part, which displays some test findings obtained during the tests. The figure 3 shows alerting output of project, displays a time domain plot generated by the load balancer in real-time. The figure 4 shows the average consumption statistics from four separate cloud instances that handle rescue requests.

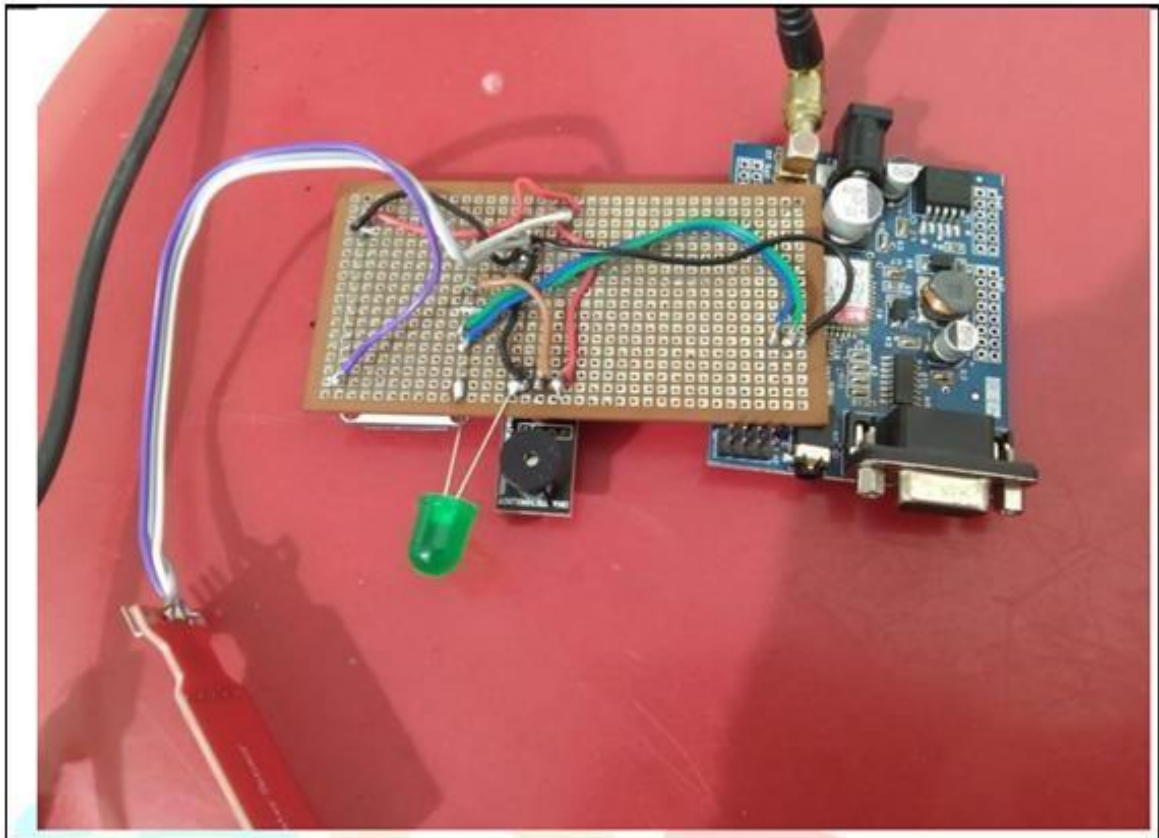


Fig no: 5 Project Implementation

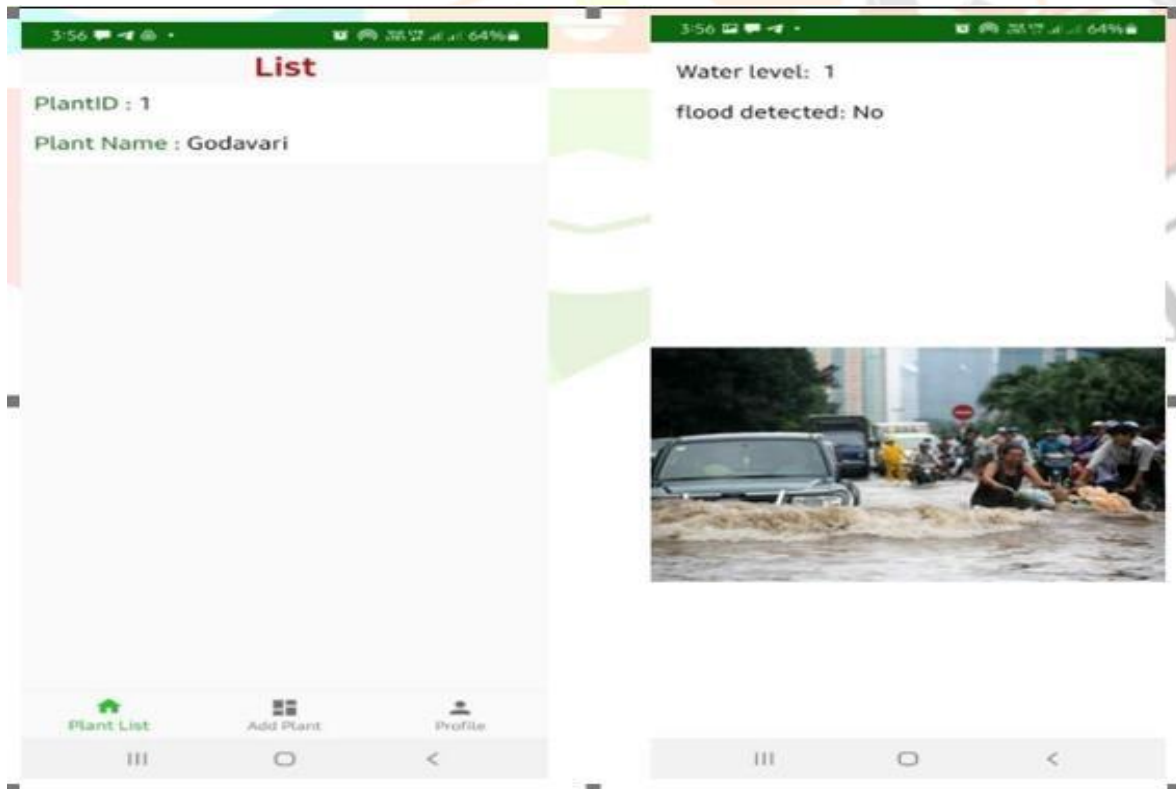


Fig no: 6 Alerting Output of the Project

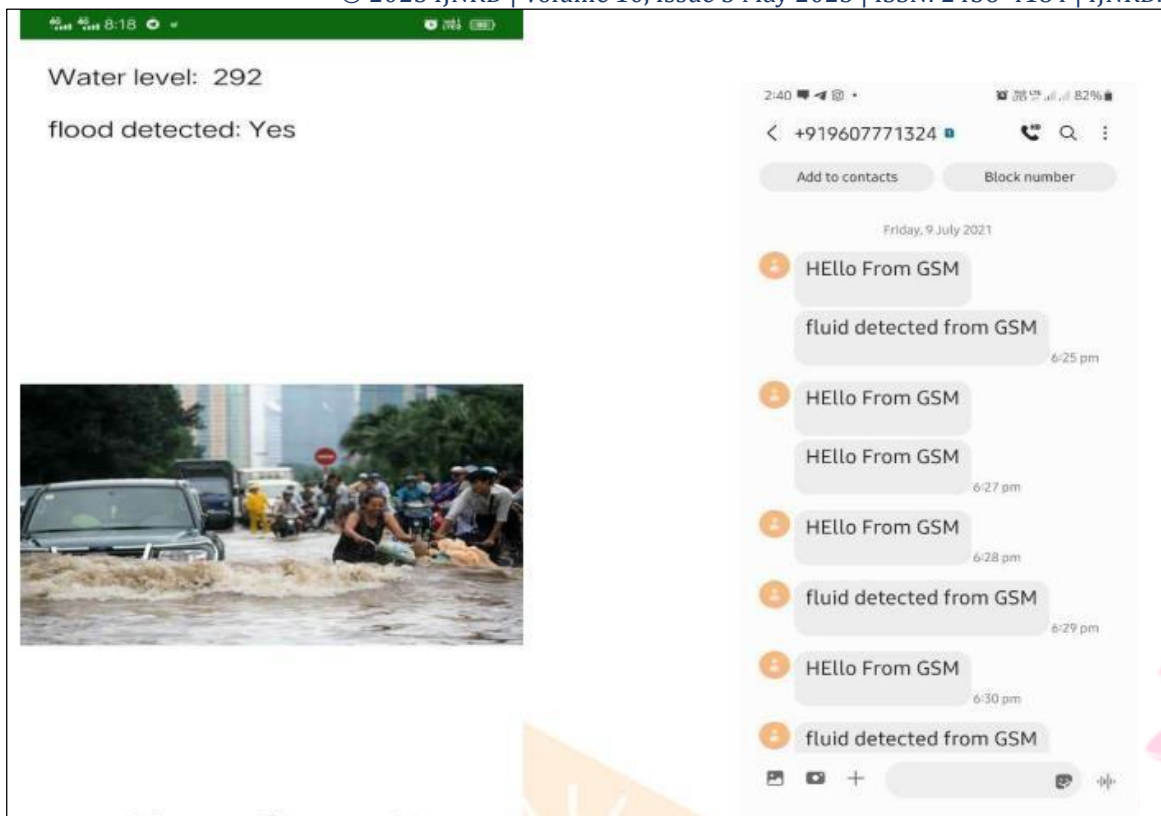


Fig no: 6 Alerting output of project

CONCLUSION

A proposed Internet of Things (IoT) flood disaster management system could use novel approaches to lessen the likelihood of human casualties and damage to large-scale facilities caused by natural and man-made disasters. This project lays out a plan to install low-cost wireless sensor network components that can detect natural disasters like floods, sparks, forest fires, and landslides, and then notify people living along a country's coastline. In conclusion, this study aims to present the groundwork for Internet of Things (IoT) disaster management systems so that we may understand the contributions of previous research and the direction of future research in this area, with the hope of solving various problems associated with disaster management systems. The integration of IoT devices with cloud platforms, edge computing, and predictive analytics offers immense potential to improve flood prediction, monitoring, and response times. As technology continues to evolve, these systems will become increasingly efficient, scalable, and accessible, playing a pivotal role in sustainable urban development and disaster management. The future holds great promise for the continued growth and refinement of IoT solutions in addressing climate-related challenges, ensuring safer and more resilient communities for generations to come.

FUTURE SCOPE

The future scope of IoT-based flood monitoring and alerting systems is vast and highly promising, driven by advancements in sensor technology, connectivity, and data analytics. As smart cities continue to grow, the integration of IoT devices into urban infrastructure will play a crucial role in managing environmental risks like flooding. The evolution of low-cost, high-accuracy sensors and edge computing devices will enable real-time data collection and analysis, improving the accuracy of flood predictions and response times. The use of AI and machine learning models for predictive analytics will enhance flood forecasting, while more efficient

cloud platforms will allow for seamless data integration and real-time alerts. Additionally, the increasing availability of 5G networks will facilitate faster communication between devices and centralized systems, ensuring timely

warnings. As climate change intensifies the frequency and severity of floods, the adoption of IoT-based solutions will become critical not only for disaster prevention but also for long-term urban planning and resilience. The integration of blockchain technology for secure data exchange and decentralized systems could also emerge, ensuring greater transparency and trust in flood management systems.

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