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Review IJDSS

Early Flood Detection and Avoidance Using IoT

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Abstract

This project presents an advanced flood alert system powered by IoT technology, designed to enhance public safety and minimize flood-related damage in high-risk areas. The system uses various sensors to keep track of environmental conditions, especially changes in water levels. These sensors are strategically placed in critical zones to detect early indicators of flooding, such as sudden increases in water level, surface runoff, and river overflow. The gathered information is sent to a main system, where it is examined to determine the possibility of a flood. An Android-based mobile application is used to instantly notify users when water levels reach dangerous thresholds. This early warning allows residents and emergency services to respond promptly minimize property damage and ensuring safety. The real-time nature of the system ensures constant monitoring, making it possible to react before situations escalate. Designed to be reliable, responsive, and user-friendly, this solution bridges the gap between environmental monitoring and community awareness. It empowers both individuals and authorities with timely information, helping them take preventive actions during critical moments. By leveraging IoT for disaster management, the system contributes to a more resilient and informed society, capable of facing natural hazards with greater preparedness.

Keywords: IoT, flood detection, advanced sensors, devices, ESP32, GSM, LoRa, technology

INTRODUCTION

A sophisticated system called the "IoT Early Flood Detection and Avoidance System" closely monitors a number of natural variables in order to forecast floods. This allows us to take preventative measures and lessen the harm that floods can bring. Floods and other natural disasters can be catastrophic, causing property damage and fatalities. The system detects floods using a variety of natural factors in order to prevent or mitigate their effects. Because of the system's Wi-Fi connectivity, its collected data may be easily accessible via the Internet of Things from any location. Flooding will probably continue to occur, but its effects on our society can be greatly lessened. Early warning systems and effective forecasts can lessen the effects of flooding. Real-time data from a variety of environmental phenomena can be gathered using the Internet of Things idea. To provide a real-time flood detection and prevention solution, we suggested a flood detection and avoidance model using IoT and sensor networks that takes into account three fundamental elements: data processing, data collection using water level sensors, and the distribution of flood warning information. The number of sensor site locations is the main determinant of cost for any automated flood warning system, even though their implementation can be shockingly costly.

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BLOCK DIAGRAM OF THE SYSTEM

Water Level Sensor

A water level sensor measures the height of water in various sources such as tanks, rivers, wells, and reservoirs. It is commonly used in industrial processes, water resource management, flood monitoring, and IoT-integrated smart systems. The

primary function of this sensor is to detect and determine the presence or absence of water at a particular level. It operates based on physical principles such as pressure variations, float displacement, capacitance changes, or ultrasonic wave detection (Figure 1).

Ultrasonic Sensor

An ultrasonic sensor is a gadget that measures distance using sound waves, specifically ultrasonic waves. It is extensively utilized for IoT applications, flood detection, water level monitoring, obstacle identification, and distance measurement.

Temperature Sensor

A temperature sensor is a device that measures and detects heat levels, transforming the data into an electrical signal. These sensors are extensively used in multiple fields, such as medical equipment, smart home technology, industrial operations, weather forecasting, and IoT-based applications.

Humidity Sensors

Humidity sensors, also referred to as hygrometers, measure the amount of water vapor present in the air. These sensors typically provide a relative humidity (RH) value, indicating the moisture level in the air compared to the maximum it can hold at a given temperature.

ESP32 Wi-Fi Model

The ESP32 is a low-cost, power-efficient microcontroller made by Express if Systems. It has built-in Bluetooth and Wi-Fi and a dual-core CPU, making it popular for robotics, smart homes, IoT devices, and industrial use.

Internet of Thing (IoT)

IoT describes a network of smart devices that are connected and able to exchange information through the internet without needing direct human input. These devices, such as sensors, household gadgets, and vehicles collect real-time data and send it across the network. This allows for automated processes and the ability to monitor systems remotely. How it works:

1. ESP32 connects to Wi-Fi and Blynk Cloud.
2. DHT11 sensor reads temperature and humidity.
3. Data is sent to the Blynk app, where it is displayed in real-time.

Advantages

1. Real-Time Monitoring; and
2. Automated Alerts and Responses.

Disadvantages

1. Dependence on Connectivity; and
2. Privacy and Security Concerns.

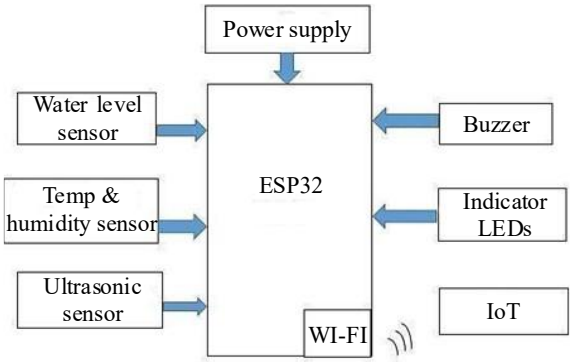


Figure 1. Block diagram of system.

LITERATURE REVIEW

Flood detection and warning systems are essential for identifying areas that are at risk of flooding and for sending alerts to both emergency teams and local people. These alerts, often sent through SMS, help prepare communities before a flood happens. By using such systems, it becomes easier to reduce the damage caused by floods, protect lives, and lessen the economic impact on affected regions [1–4].

The Internet of Things (IoT) is a system of digitally and mechanically integrated devices that are able to connect and exchange data through the internet. Each device has a unique identity and can operate independently, without needing human input to transfer information. Over time, the concept of IoT has advanced significantly due to improvements in areas like real-time data analysis, intelligent sensors, and machine learning. These developments have enhanced the functionality and reliability of IoT applications across many industries [5–10].

Floods pose serious threats to human lives, homes, and public infrastructure, making it essential to monitor conditions closely and take timely preventive actions. This project introduces a modern solution for improving flood control by combining IoT technology with machine learning techniques. This integration allows for smarter, faster decision-making in detecting and responding to flood risks [11–15].

When urban areas grow and natural land is covered with roads and buildings, the natural flow and absorption of rainwater are greatly affected. Surfaces such as concrete and asphalt do not let water pass through, which reduces the soil's capacity to absorb rainfall. As a result, when it rains heavily and the ground cannot absorb all the water, the excess quickly runs off across these hard surfaces and collects in drains or water channels, raising the chance of flooding [16, 17].

RESULT

Result Explanation

IoT-Based Flood Warning System: This project is designed to warn people early when there is a chance of flooding. Sensors are used to continuously monitor water level, temperature, and humidity (Figure 2). An ultrasonic sensor is responsible for detecting the height of the water. These sensors are linked to a compact microcontroller that processes the collected data in real-time. which reads the data and decides if there is any danger. When the water level rises beyond a certain point, a red indicator light is activated to warn of possible flooding, signaling people to prepare or relocate to a safe area. A green light confirms that the system is active and functioning normally.

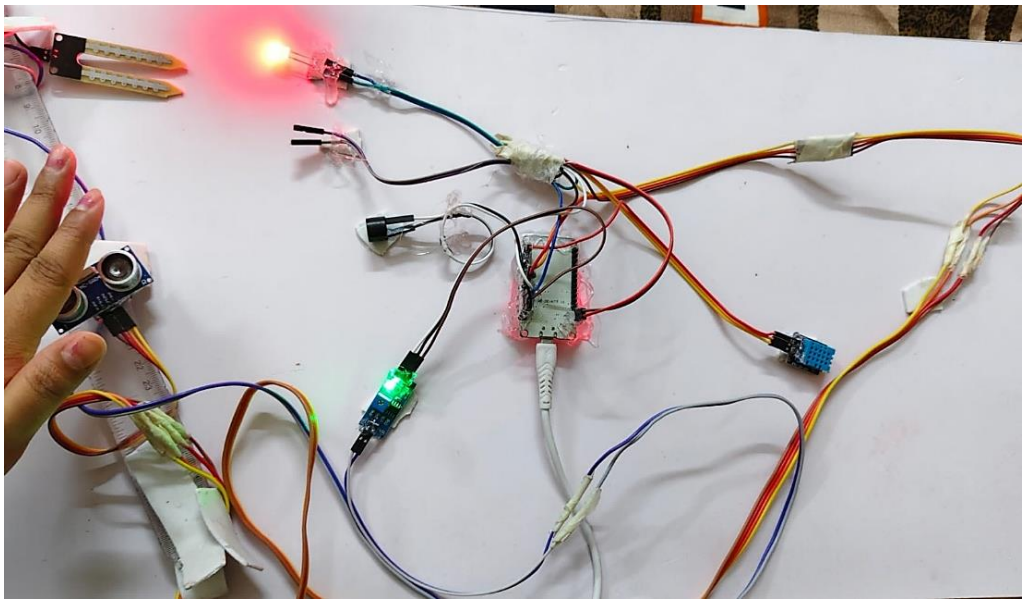
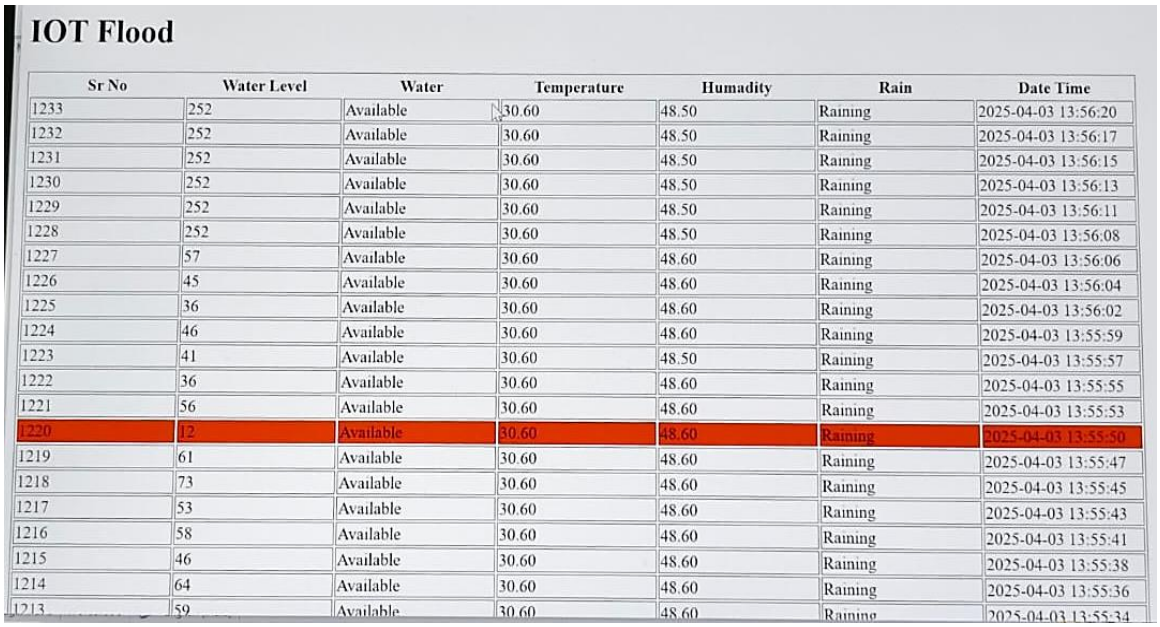


Figure 2. Hardware setup.



IOT Flood

Sr No	Water Level	Water	Temperature	Humadity	Rain	Date Time
1233	252	Available	30.60	48.50	Raining	2025-04-03 13:56:20
1232	252	Available	30.60	48.50	Raining	2025-04-03 13:56:17
1231	252	Available	30.60	48.50	Raining	2025-04-03 13:56:15
1230	252	Available	30.60	48.50	Raining	2025-04-03 13:56:13
1229	252	Available	30.60	48.50	Raining	2025-04-03 13:56:11
1228	252	Available	30.60	48.50	Raining	2025-04-03 13:56:08
1227	57	Available	30.60	48.60	Raining	2025-04-03 13:56:06
1226	45	Available	30.60	48.60	Raining	2025-04-03 13:56:04
1225	36	Available	30.60	48.60	Raining	2025-04-03 13:56:02
1224	46	Available	30.60	48.60	Raining	2025-04-03 13:55:59
1223	41	Available	30.60	48.50	Raining	2025-04-03 13:55:57
1222	36	Available	30.60	48.60	Raining	2025-04-03 13:55:55
1221	56	Available	30.60	48.60	Raining	2025-04-03 13:55:53
1220	12	Available	30.60	48.60	Raining	2025-04-03 13:55:50
1219	61	Available	30.60	48.60	Raining	2025-04-03 13:55:47
1218	73	Available	30.60	48.60	Raining	2025-04-03 13:55:45
1217	53	Available	30.60	48.60	Raining	2025-04-03 13:55:43
1216	58	Available	30.60	48.60	Raining	2025-04-03 13:55:41
1215	46	Available	30.60	48.60	Raining	2025-04-03 13:55:38
1214	64	Available	30.60	48.60	Raining	2025-04-03 13:55:36
1213	59	Available	30.60	48.60	Raining	2025-04-03 13:55:34

Figure 3. Dashboard.

Additionally, the system is connected to an Android application, which sends instant notifications to users' mobile devices. This feature ensures that both residents and emergency services receive timely alerts, allowing them to respond quickly and reduce potential harm (Figure 3).

This screen shows the live data collected from the flood detection system. It helps us keep track of water levels, weather, and rain conditions. Each row shows one reading taken at a certain time.

Here is what each column means:

- *Sr No:* The number of the reading.
- *Water Level:* How high the water is.
- *Water:* Shows if water is present (it says "Available").
- *Temperature:* Shows the air temperature.
- *Humidity:* Tells how much moisture is in the air.
- *Rain:* Tells if it's raining at the time of the reading.
- *Date Time:* The exact date and time the data was recorded.

One row (Sr No 1220) is marked in red. That means Flood is detected.

CONCLUSION

The flood detection system aims to warn people of all backgrounds about possible flood risks. It helps farmers, industries, and regular citizens stay prepared. Since floods are unpredictable, taking precautions is important. This system monitors water levels in specific areas and may expand to track multiple locations in the future. A website will display data, supported by decisions from authorities. The Early Flood Detection and Prevention System uses IoT technology to automatically track water levels in real time, forecast potential flooding, and notify individuals in advance. It ensures fast, accurate, and remote tracking of flood-prone areas. The system combines sensors (for water level, temperature, rainfall, and humidity), IoT devices (ESP32, GSM, LoRa), and cloud platforms (AWS, Thing Speak, Blynk) to provide reliable flood warnings.

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