# IOT BASED EARLY FLOOD ALERTING SYSTEM

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**Abstract -** The frequency and intensity of floods have increased recently in many parts of the world, increasing the need for cutting-edge technological solutions to mitigate the effects of these natural disasters. It is crucial to keep an eye on the water flow and get early emergency alerts regarding the water level based on the riverbed in order to prevent such disasters. The goal of this project is to create a system that employs cutting-edge sensors and a Wi-Fi module to detect the water level. The suggested system has a number of sensors that can track important variables, including temperature, humidity, and water level. If the level crosses a certain threshold, The system will send out early warnings to everyone, alerting them to the likelihood of floods. To process and store data, we have linked the Arduino UNO to each sensor. The system can notify a wider audience by sending email alerts, ensuring that individuals in flood-prone areas receive timely warnings. Additionally, the use of a Wi-Fi module enables real-time data transmission and remote monitoring of water levels, allowing authorities to take preemptive measures and minimize the impact of potential floods. By integrating advanced sensors with communication technology, this project aims to enhance early warning systems and contribute to more effective disaster management strategies in vulnerable regions. Ultimately, the implementation of such innovative solutions can significantly improve community resilience and reduce the adverse consequences of flooding events.

**Index terms –** IoT (Internet of Things), Arduino UNO, Social media integration, GSM (Global System for Mobile Communications) technology, Blynk application.

## INTRODUCTION

Floods are natural disasters characterized ed by the overflow of water onto land that is normally dry. Floods are caused by a confluence of hydrological, meteorological, and human elements. Strong rainstorms, cyclones, and tropical storms that deposit a lot of water over short distances are examples of meteorological causes. Such occurrences have the potential to overwhelm natural drainage systems and cause extensive flooding, particularly in places with poor water management infrastructure. Floods can be caused by hydrological causes such as abrupt temperature changes or quick snowmelt during warmer seasons. This may lead to an influx of water that fills rivers and streams to capacity and overflows them. In colder climates, ice jams can also impede water movement and cause localized floods as the ice builds up and suddenly melts. Storm surges, which occur when powerful winds from hurricanes or typhoons force saltwater inland, put coastal communities at risk of flooding. Stormy weather combined with high tides can result in coastal flooding, which affects ecosystems and coastal towns alike. Floods are also largely influenced by human activity. Deforestation lessens the amount of vegetation that naturally collects rainfall and lessens soil erosion. Urbanization increases the risk of flooding and surface runoff by replacing natural surfaces with impermeable materials like concrete. The effects of floods are made worse by poorly designed infrastructure, such as inadequate drainage systems or buildings built in high-risk areas. Floods also cause severe damage to both human life and property thus Highlighting the need for early alerting systems, in this project IoT (Internet of things) have been used to create an alerting system.

## LITERATURE SURVEY

Astile Peter, Bhavana P. Rajeev, Abin Thomas Jolly, and Albert Joshy Varghese developed an IoT-based system for monitoring and managing dam-related disasters. Their approach utilizes an ESP8266 Wi-Fi module to transmit data to a cloud server, enabling remote monitoring and control, with a focus on addressing various water-related concerns [1]. Similarly, Vikram B. Gaikwad, Nilesh S. Bawa, Kalpesh R. Deshpute, and Sagar S. Sawkar [2] designed an IoT-driven flood detection system. Their setup involves an ultrasonic sensor that, upon detecting flood conditions, triggers a signal to the microprocessor. The system displays the water level on the interface and automatically sends SMS alerts to residents in affected areas. Additionally, Dirk Draheim, Sufian Hameed, Zafer Sekedursun R, and Syed Attique Shah [3] explored the convergence of Big Data Analytics (BDA) and IoT in enhancing disaster management. Their research outlines an efficient approach to disaster management tasks by leveraging advanced big data analysis and a robust IoT infrastructure, providing insights into current trends and future directions for these integrated technologies.

Shah Abdullah, Amrul Faruq, and Mohammed Syafiq Mohd Sabre proposed a flood monitoring and warning system using Internet of Things (IoT) technologies. Their research emphasizes the development of a smart flood monitoring solution that utilizes the Blynk IoT platform, which is known for its affordability, efficiency, and flexibility. The system incorporates wireless sensor nodes that are integrated with the Blynk platform, making it an ideal choice for creating cost-effective and responsive alert systems to monitor flood conditions, perfect platform for keeping an eye on flash floods. Gowthamy J., Saransh Shrivastava, Pijush Meher, and Chinta Rohith Reddy Guddu Kumar [5] This study presents a prototype IoT-based water monitoring system. A few sensors are used for this. The data gathered from every sensor is analysed to provide improved solutions for water-related issues. The Wi-Fi module ESP8266 is used to transmit data to the cloud server. Thus, this application will be the greatest rival for real-time monitoring and control systems and be used to address any issue pertaining to water.[6] by Pradhan B., Verstaevel N., Ogie R., Barthelemy J., Arshad B., and Perez P. This study examined various IoT and computer vision-assisted solutions for improved flood mapping and monitoring.

Wahidah Md. Shah, F. Arif, A. A. Shahrin, and Aslinda Hassan introduced a flood warning system utilizing the Internet of Things [7]. This system is capable of detecting water levels, assessing the rate of water level rise, and alerting the local community. The evaluation of the system was conducted under controlled conditions. In a separate study, Pan, J.; Yin, Y.; Xiong, J.; Luo, W.; Gui, G.; and Sari, H. [8] created an automated surveillance network comprising remote measurement stations and a central control facility, employing techniques such as dictionary learning, deep learning, and the method of difference. Additionally, Elena Ridolfi and Piergiorgio Manciola [9] proposed using drones equipped with sensing devices, including cameras, to measure water levels at dam sites. Barthelemy J., Pradhan. B., Arshad B., Ogie R., Verstaevel N., and Perez P. reviewed a wide range of literature [11] concerning IoT-driven sensors and computer vision applications for monitoring and mapping floods.

Their research examined various IoT, and computer vision-based techniques aimed at enhancing flood monitoring and mapping efforts. Another flood warning system [12] based on IoT was again put forward by Wahidah Md. Shah and colleagues, with functionalities for water level detection, rise rate calculation, and local alerts. The testing of this system was similarly conducted in controlled environments. Pan et al. also developed an automated surveillance network consisting of remote measurement units and a control center [13], applying methods like the method of difference, deep learning, and dictionary learning. Moreover, Elena Ridolfi and Piergiorgio Manciola investigated water level monitoring via drones at dam locations [14], utilizing a combination of a drone and camera for assessment. Amina Khan and Sachin Kumar Gupta [15] contributed to the discussion by presenting the Het sen model for strategies related to flood management.

**METHODOLOGY**

**EXISTING METHODS:**

Earlier, a water level sensor of the Contact type was used in the system's initial design. Because of corrosion, these kinds of sensors need to be maintained on a regular basis. Additionally, their levels are regularly checked using analogue meters that are located at dams. The accuracy of the sensor data used by this system is not as high as it could be due to maintenance. Geographic Information Systems (GIS) and remote sensing technologies are useful for mapping areas that are susceptible to flooding, tracking changes in land use, and evaluating the amount of vegetation present. Aerial surveys and satellite photos offer important information for analyzing flood risk. However, this method offers less flexibility and covers on a large scale, not suitable for alerting the end user in real time.

**PROPOSED METHODS:**

In this project, we have developed an innovative system for tracking water levels in a dam by utilizing the Internet of Things (IoT) and ultrasonic sensors. This contactless water level monitoring system does not require any special maintenance. Users can remotely monitor real-time sensor data, including temperature, humidity, and water levels, through Internet technology using Blynk, which is based on IoT to effectively mitigate the effects of flooding, this project offers a state-of-the-art, IoT-based centralized flood detection system.

With floods posing serious risks, the system employs several natural indicators to identify flood conditions and aim to minimize or eliminate their impact. Since the system is Wi-Fi enabled, users can easily access the collected data from anywhere through the Internet of Things.

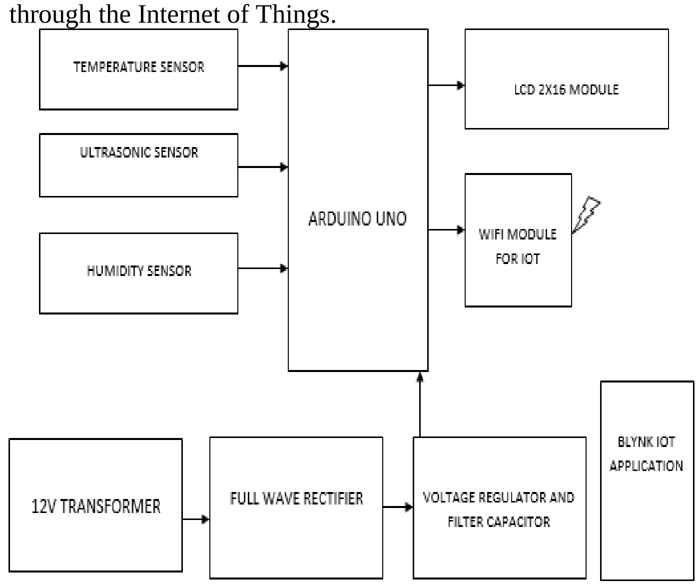


Fig 1: The Block diagram of the proposed system

**Specification of Hardware**

Power supply: The power supply setup of the system features a 230/12V step-down transformer that reduces the voltage to 12VAC. A bridge rectifier is used to transform this into direct current (DC). To minimize ripples, a capacitive filter is incorporated, along with a 7805-voltage regulator, which stabilizes the output to +5V. This regulated output is essential for powering a microcontroller and additional components.

Arduino uno: The Arduino Uno serves as the microcontroller board for this project. The program is developed using embedded C programming language. Code is uploaded through the Arduino IDE Compiler along with the integrated USB programmer. Sensor modules are connected to the board's analog pins, while an LCD and Wi-Fi modules are attached to the digital pins of the microcontroller board.


Fig 2: Arduino Uno

Sensors: The system tracks several environmental factors, such as temperature, humidity, and water levels in dams, to detect potential flooding. It uses various sensors to measure distinct metrics, collecting data on these natural components. One of the key sensors is the DHT11 Digital Temperature and Humidity Sensor, which monitors changes in temperature and humidity. This advanced sensor module features resistive elements that detect variations in both temperature and humidity. Additionally, an ultrasonic sensor constantly measures the water level. This sensor employs ultrasonic waves to gauge distance, calculating the height of the water from the sensor using the SONAR principle. The data from all these sensors is processed and stored by an Arduino UNO Microcontroller Board, which is connected to each sensor.

NODU MCU: NodeMCU is a development board that features the ESP8266 WiFi module, offering GPIO ports for connecting external sensors and devices, along with integrated WiFi capabilities. Its low cost, compatibility with various IoT platforms, and ease of programming through the Arduino IDE or Lua scripting language make it a popular choice for IoT projects. With built-in WiFi, NodeMCU allows for seamless network connectivity, cloud service integration, and provides remote control and monitoring functionalities, making it ideal for Internet of Things applications.

Fig 3: NOBU MCU

The system has Wi-Fi access, which is useful for Internet of Things access to the system and its data. A blynk Android application is given to the user so they can use internet connectivity to monitor the flood-causing parameters from anywhere in the world.

BLYNK: Blynk is an intuitive platform that simplifies the development of IoT applications. To connect a NodeMCU device to the Blynk platform, the first step is to install the Arduino IDE and add support for the NodeMCU board. Next, use the Arduino IDE’s Library Manager to install the Blynk library. Then, create a new project within the Blynk mobile app and record the authentication token provided.

In the Arduino code, include the necessary libraries, input the Wi-Fi credentials along with the authentication token, and initialize the Blynk connection. After uploading the code to the NodeMCU device, use the Blynk app’s widgets to control the pins on the NodeMCU board. At the same time, monitor the Serial Monitor in the Arduino IDE for debugging. Modify the code and widgets as needed to ensure smooth integration and functionality between the NodeMCU and the Blynk platform. This method enhances the development process, enabling efficient control and monitoring of IoT applications built with Blynk.

## RESULTS AND DISCUSSION

The IoT-based early flood alert system utilizes a range of sensors, including an ultrasonic water level sensor, a Dallas Temperature sensor for measuring water temperature, and a DHT11 sensor for tracking temperature and humidity. It also features a buzzer for sound notifications and a Liquid Crystal display (LCD) for visual output. At system startup, the setup function configures the sensors, pins, and the LCD display. The main loop function constantly reads data from the sensors and updates the LCD display with the current information.

The ultrasonic sensor is critical for detecting water levels; if the water level falls below a set threshold, indicating a potential flood risk, the system activates high-alert actions such as turning on the buzzer and displaying warning messages on the LCD.

Data is sent to a Node MCU in a customized format, which includes water level, humidity, and temperature information. This setup enables remote monitoring and analysis of flood-prone areas using real-time sensor data. flood-prone areas based on real-time sensor data.

The flood detection algorithm continuously tracks essential environmental parameters such as humidity, temperature, and water levels using dedicated sensors. An ultrasonic sensor consistently monitors water levels to provide timely alerts in case of irregularities. Once the water levels recede to a safe range, the system disables the alerts, restoring the buzzer and LED indicators to their default state.

The combination of Arduino Uno with sensors and alert systems offers a reliable early warning solution for potential flooding events. Its capability to monitor, analyze, and transmit real-time data is instrumental in proactive flood risk management and enhancing disaster preparedness in vulnerable areas.

## CONCLUSION

In conclusion, the development and implementation of an Internet of Things (IoT)-based early flood alert system marks a significant step forward in disaster management technology. By leveraging these technologies, the system enables real-time monitoring of water levels in flood-prone areas, providing critical information for early warning systems. The integration of ultrasonic sensors with the Arduino Uno ensures accurate and reliable water level detection, while the Node MCU facilitates easy internet connectivity for data transmission and analysis. The Blynk platform enhances the system's functionality by allowing remote monitoring and timely alerts through mobile devices or other interfaces. This IoT solution highlights the importance of accessible, user-friendly interfaces in strengthening community resilience and underscores the role of connected devices in disaster preparedness. By delivering early warnings, the system helps minimize loss of life and property during floods, enabling authorities and individuals to take proactive measures such as mobilizing resources, reinforcing infrastructure, and executing evacuations.

## FUTURE SCOPE

The proposed future scope of the Internet of Things (IoT)-based flood warning system envisions a robust and scalable infrastructure designed to enhance flood risk forecasting and assess the impacts in flood-prone areas with greater precision and efficiency. By incorporating machine learning models that process real-time data from IoT sensors tracking water levels, rainfall, humidity, and temperature, the system aims to increase the accuracy and timeliness of flood predictions. This integrated approach ensures the timely distribution of early warnings and supports informed decision-making for stakeholders and emergency responders.

The addition of GSM technology for SMS alerts, along with potential integration with other communication channels, plays a critical role in quickly notifying authorities, such as dam operators, when water levels surpass critical thresholds. This early notification system enables swift actions to mitigate damage during flood events.

Furthermore, the use of Geographic Information System (GIS) mapping tools and visualization techniques provides an effective spatial view of vulnerable regions, evacuation routes, and key infrastructure. This visualization supports the development of targeted emergency response plans and improves resource allocation during flood events by working alongside disaster management organizations and local government authorities.

These initiatives strengthen community resilience, reduce damage, and safeguard lives and infrastructure from the harmful effects of floods. Ultimately, the system's comprehensive approach and collaborative efforts are essential for efficient flood risk management and effective disaster response.

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