IJERST

International Journal of Engineering Research and Science & Technology

www.ijerst.org

ISSN : 2319-5991

Vol. 21 No. 4 (2025)

ijerst.editor@gmail.com

editor@ijerst.com

ISSN 2319-5991 www.ijerst.com
Vol. 21, No. 4, 2025

Research Paper

IOT AND GSM BASED FLOOD ALERT SYSTEM

Manthri Rohith[1], V. Mahender[2]
[1]M.Tech Scholar, Dept of ECE, Kakatiya University Campus, Warangal, Telangana, India.
[2]Assistant Professor and HOD, Kakatiya University Campus, Warangal, Telangana, India
manthrirohith6@gmail.com[1] and mahenderveshala@kakatiya.ac.in[2]

ABSTRACT
One of nature's most devastating calamities, floods cause a great deal of property damage, community upheaval, and fatalities. Systems for timely warning are necessary to reduce these effects. This study describes a low-cost, Arduino-based flood alert system that can quickly generate alerts and monitor water levels in real time. The system continuously monitors rivers, tanks, or drainage systems for rising water levels using a water level sensor.

When the water level rises above a certain point, the device shows the current status on an LCD screen and sounds a buzzer to provide instant local alerts. The integration of a GSM module facilitates communication even in rural locations without internet connection by sending SMS notifications to local authorities or inhabitants. Furthermore, an Internet of Things platform is linked to the system, enabling remote data logging and monitoring.

Because it is powered by a regulated power source, the microcontroller operates steadily. In locations susceptible to flooding, the integration of local and remote alert systems guarantees quicker reaction times. The entire arrangement may be deployed in both rural and urban areas and is easy to use, portable, and reasonably priced. The suggested system's hardware design, software implementation, and testing outcomes are highlighted in this study. The outcomes show how successful it is at sending out flood warnings in a timely manner. This approach could improve a community's ability to withstand flooding disasters.

KEYWORDS: Arduino Micro Controller, LCD, GSM, Flood, Water Level Sensor, IoT

Received: 05-9-2025 Accepted: 06-10-2025 Published: 13-10-2025

1. INTRODUCTION

Floods are one of the most common and destructive natural catastrophes that impact millions of people each worldwide. They cause long-term socioeconomic losses, infrastructure disruption, agricultural damage, and a considerable number of fatalities. The frequency and severity of flooding have significantly increased in many areas due to factors like deforestation, growing urbanization, and the consequences of climate change. Thus, early detection and timely warning systems are crucial for reducing the effects of such occurrences and assisting with disaster response and emergency planning efforts. Conventional flood detection techniques frequently depend on manual measurements, satellite imagery, or extensive infrastructure, all of which might not be practical or available in rural or isolated locations. In addition to being prone to delays, these techniques are less successful at sending out real-time alerts. Smart systems that employ sensors, microcontrollers, and wireless communication technologies to effectively monitor and react to environmental changes have become feasible as a result of technological advancements.

This paper introduces an Arduino microcontroller-based smart flood alert system that combines a water level sensor, GSM module, Internet of Things connectivity, buzzer, and LCD display. Rivers, reservoirs, and urban drainage systems can all have their water levels continuously monitored by the system. A buzzer for a local warning is activated, a message is shown on the LCD, and SMS warnings are sent via the GSM module as soon as the water level surpasses a predetermined threshold. Additionally, the data is sent to an Internet of Things platform, allowing for remote monitoring and data logging for additional analysis.

Its low cost, simplicity of use, and compatibility with both connected and disconnected contexts are its key advantages. Real-time monitoring and community-level awareness are connected by the suggested approach, which combines distant communication with local alert systems. Since there is a dearth of extensive flood detection infrastructure in rural and flood-prone locations, it is especially helpful in these places. The purpose of this study is to show that a small, dependable, and reasonably priced flood alert system is both feasible and practical. This system's ability to integrate hardware and software components makes it appropriate for widespread deployment, aiding in early warning efforts and lowering the financial and human costs associated with flooding.

2. LITERATURE SURVEY

Numerous studies have been carried out in recent years on the creation of flood monitoring and alert systems utilizing sensors, microcontrollers, GSM modules, and Internet of Things technologies. The rise in natural disasters brought on by urbanization and climate change has prompted academics to create effective, affordable, and real-time technologies for early flood detection.

Sushma M. P. et al. (2021) used an Arduino Uno and NodeMCU to propose an Internet of Things-based flood monitoring and alerting system. Utilizing ultrasonic sensors, their system measured water levels and sent the information to a cloud dashboard via Wi-Fi. The Blynk platform was also used by Patil et al. (2020) to design a system that combined water sensors and GSM, allowing for both SMS-based and remote notifications.

Urban areas were the focus of Uma et al.'s (2022) study on a smart flood monitoring system that tracks water levels in drainage systems continually using sensors and the Internet of Things. They focused on notifications and user-friendly interfaces. A GSM-based flood alert system with an emphasis on offline communication via SMS was proposed by Rahman et al. (2019) for rural and distant locations without internet access.

In their investigation of LoRaWAN-based long-range wireless communication, Dhebe et al. (2021) emphasized its wide-area coverage and low power consumption. Water level sensors and rainfall intensity detection were coupled by Sayyad et al. (2020) to provide early warnings before water levels became critical. By incorporating AI into their system and examining trends in water level fluctuations to generate predicted alerts, Pathan et al. (2021)

demonstrated how intelligent models can aid in decision-making.

Kumar et al.'s "FLOODGUARD" system from 2022 is another noteworthy example; it forecasts flash floods by combining meteorological and hydrological data. They combine predicting algorithms with real-time sensors in their hybrid system. In a similar vein, Zhou et al. (2020) developed a flood extent mapping system that integrates machine learning and satellite photography.

A solar-powered flood detection system with GSM notifications was instituted by Singh et al. (2019) in an effort to solve power outages. Their methodology guarantees dependability in places where power supply fluctuate. Reddy et al. (2021) investigated the application of ZigBee networks in multi-sensor flood detection systems for low-energy, short-range communication.

Sharma et al. (2020) presented an Android application that allows users to track flood data obtained from an Arduino-based sensor system. They focused on visualizing and interacting with users. The Arduino-based water tank monitoring system first shown by Patil and Mehta (2018) was later modified for riverbank flood detection. A system that uses an ultrasonic sensor installed on bridges to detect river overflow was created by Ali et al. (2021) and could be communicated to authorities via GSM. Khan and colleagues (2020) suggested a rural-specific method that minimized costs by utilizing SIM800L GSM module and simple float sensors. They demonstrated how beneficial it was to use even basic sensors in alarm systems. In 2022, Shinde et al. created a comprehensive disaster management platform that used IoT and GSM to integrate gas and fire alarms with flood detection.

George et al. (2019) conducted an analysis of current flood alarm systems and suggested incorporating meteorological APIs to predict flooding scenarios in a more comprehensive study. Nath et al. (2020) used Google Firebase to work on real-time data logging, which gives authorities access to both historical and current flood data.

By detecting waterlogging in urban areas using camera vision and image processing, Chatterjee et al. (2021) demonstrated how visual data may be employed in addition to traditional sensors. The promise of underwater technology was demonstrated by Joshi et al.'s (2019) experiment with an underwater sensor network for flood detection in reservoirs.

In order to interpret water level data and send out alerts using Telegram bots, Kaur and Gill (2020) created a Python-based backend, introducing a novel method of mass communication. The MQTT protocol was investigated by Thomas et al. (2018) for real-time communication between servers and sensors in low bandwidth settings. According to Fernandes et al. (2021), a modular sensor architecture with independent communication between several units might be connected along the river at various checkpoints. In order to prepare towns downstream, they concentrated on early upstream warnings.

Some studies have looked at the implementation and policy issues. Patel et al. (2021) emphasized the significance of incorporating local governments into the flood warning system and offered a disaster response team concept that makes use of GSM alerts. An interactive dashboard was developed by Ramesh et al. (2022) to enable district officials to make choices in real time using data from flood sensors.

For usage in classrooms and academic labs, Dutta et al. (2019) created an inexpensive flood alert prototype that encourages students to experiment with real-world problem-solving. Meena et al. (2022) targeted visually challenged people in flood-prone areas with voice call notifications conducted over GSM. By using rainfall and soil saturation data to identify flood-prone areas, Prasad et al. (2021) investigated machine learning classification techniques, demonstrating the potential for sophisticated forecasting. Finally, utilizing cloud computing and the Internet of Things, Verma et al. (2020) suggested a centralized control system that offers scalability and integration with emergency services.

3. PROPOSED SYSTEM

The suggested system is an Arduino-based flood warning system that operates in real time and is intended to track increasing water levels and send out instant notifications via a variety of communication channels. In order to continuously check the water height against predetermined thresholds, it incorporates a water level sensor (usually an ultrasonic or float sensor) that is connected to an Arduino microcontroller. The device simultaneously shows the alert message on an LCD screen and sounds a buzzer for local auditory warnings when the water level beyond the warning or danger point. People around will be given a clear and immediate warning as a result, enabling prompt action and evacuation if needed. A controlled power source, which can be solar-enabled or battery-backed, powers the system and keeps it running even during storms and power outages.

The system is outfitted with a GSM module that sends SMS notifications to registered phone numbers, such as local authorities, disaster response teams, or neighboring citizens, in order to enable wider communication, particularly in rural or flood-prone locations where internet connectivity may not be reliable. Furthermore, the gadget is linked to an Internet of Things platform by Wi-Fi (using an ESP8266 or comparable module), allowing for remote monitoring, long-term data analysis, and real-time data logging. Cloud-based monitoring, mobile SMS, and local alerts work together to provide complete coverage and communication redundancy. The low cost, energy efficiency, and scalability of this system make it appropriate for use in riverbank communities, urban drainage systems, and rural flood-prone areas. Because it is modular, it can also be integrated with other sensors in the future, such flow meters or rain gauges.

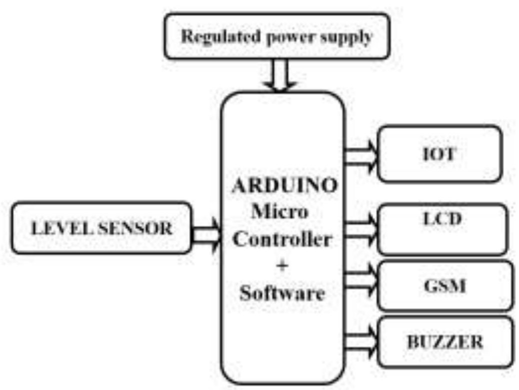

Fig.1. Proposed block diagram

WORKING MODEL:

A block diagram of the planned flood alarm system shows how all of the key parts that are involved in identifying and reacting to rising water levels are connected. The Arduino microcontroller is the central processing unit and the brains behind the system. In order to continuously measure the height of water in a river, drainage canal, or reservoir, the water level sensor—usually an ultrasonic or float sensor—provides input signals to it. This sensor allows the system to keep an eye out for unusual or hazardous water level rises by transmitting real-time analog or digital data to the Arduino. Based on preset criteria, the Arduino initiates a variety of output actions after processing the incoming data. An audible alarm is produced by the buzzer, warning anyone in the vicinity if the water level reaches a warning level. Concurrently, an LCD display that is linked to the Arduino provides visual indicators of the present flood state by displaying real-time messages like "Normal," "Warning," or "Danger." To transmit SMS messages to registered users or emergency services, the system employs a GSM module (such as the SIM800L) for remote alerts. This guarantees that alerts can be received even in places where internet access is unavailable. The system also incorporates an Internet of Things module, usually based on ESP8266 Wi-Fi, which sends sensor data to a cloud platform like ThingSpeak or Blynk, in addition to GSM. This makes it possible to remotely check water levels using computers or smartphones, giving authorities or locals real-time access. The entire system is powered by a regulated power source, which might be solar or battery-powered to guarantee system dependability in the event of severe weather or power outages. Every module is linked together using common communication protocols (such I2C or UART), guaranteeing precise and effective data flow. Since the system is modular, additional sensors or alert devices can be added as needed in the future.

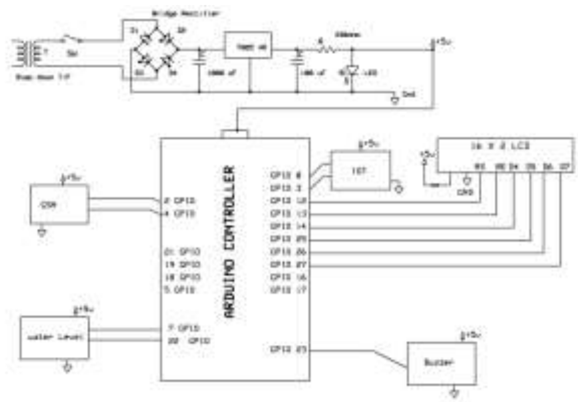

Fig.2. Circuit diagram

4. RESULTS

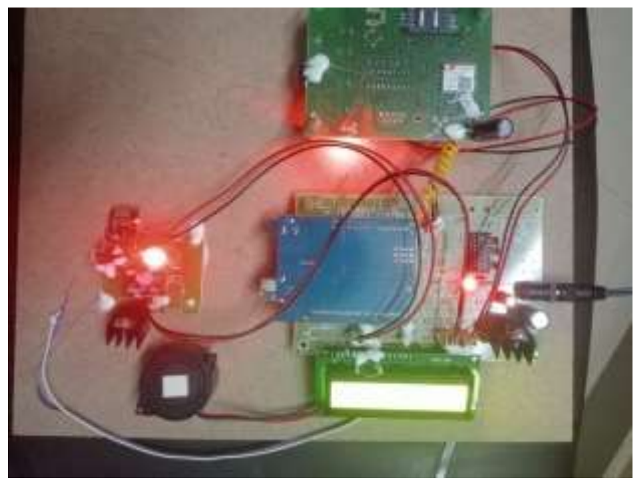

Fig.3. Proposed Output model

A 12-volt regulated power source that is transformed into 5 volts DC via a voltage regulator circuit powers the suggested flood level monitoring system. Sensors, output devices, and the microcontroller are among the essential parts of the system that can be powered by this 5V DC output. To verify that the 5V supply is present, an LED indicator is utilized. When the system obtains the proper voltage, the indicator automatically illuminates, signaling that the circuit is prepared for usage. This regulated 5V DC supply powers each piece of hardware in the system to guarantee dependable and steady operation.

It is also possible to configure a vibration sensor, which is commonly used in motion sensing or fall detection applications, to act as a trigger or switch in this system. Though uncommon in flood detection, it might be used to identify anomalous events or structural vibrations (such as bridge or embankment integrity). When the sensor is activated, the microcontroller receives the signal, decodes it, and interprets it as an event that needs to be addressed. After then, an Internet of Things server receives this data via a Wi-Fi module (like the ESP8266). The server is linked to a real-time web-based dashboard that ensures near real-time monitoring by updating the flood level and system status data frequently, usually every 5 seconds.

A piezoelectric buzzer and an Internet of Things server output are used by the system as alarm mechanisms. Activated when water levels surpass the danger threshold, the buzzer functions as a local audio alert system. The IoT server simultaneously transmits the flood status to a mobile application or web page, allowing users or authorities to monitor the situation remotely. When combined, these output modules offer thorough local and remote notifications, which enhances the system's efficacy in both urban and rural deployments.

Fig.4. LCD Output

Fig.5. Web server Output

Fig.6:GSM DISPLAY

Table.1 Results comparison Table

Parameter	Existing Model	Proposed Model
Microcontroller	8051	Arduino
Speed	Low	High
Complexity	High	Low
Efficiency	LOW	HIGH

5. CONCLUSION

The suggested flood alarm system offers an affordable, effective, and expandable way to monitor and warn of floods in real time. Water level sensors are integrated with an Arduino microcontroller, GSM module, buzzer, LCD display, and Internet of Things connectivity to provide timely notifications via local (visual and audio) and distant (SMS and web dashboard) channels. This hybrid communication strategy allows the system to be implemented in remote, urban, and rural locations with limited power or internet connectivity. Automatic alarms, regular monitoring, and an easy-to-use interface greatly improve readiness and can lessen the effects of flooding on local populations. Predictive analytics and solar power integration are two more improvements that might make this system an essential part of emergency response planning and disaster risk reduction.

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