Machine Learning Based IoT System for Real Time Flood Detection and Alerting System

Dr.R. Elavarasi[1], V. Pavithra [2], V. Pavithra[3], Y. Punitha[4], R. Salini[5]
1Associate Professor, Department of Electronics and Communication Engineering, Er. Perumal Manimekalai College of Engineering, Hosur.
[2,3,4,5]UG Student, Department of Electronics and Communication Engineering, Er. Perumal Manimekalai College of Engineering, Hosur.

***Abstract*—The Internet of Things (IoT)-based flood recognition system aims to monitor environmental parameters and provide early flood warnings using advanced sensor technology and Nodemcu microcontrollers. The system uses ultrasonic sensors to measure water levels, while the moisture sensor detects the moisture content of the soil and provides important real-time data for both. This performance is provided by a regulated IC 7805 circuit to ensure stable voltage operation of the established components. The Nodemcu device, which acts as a central controller, handles moisture and ultrasonic sensor inputs and triggers a buzz alarm when predefined flood conditions are met. This integration allows seamless communication between hardware components, ensuring efficient flood recognition. The compact design of the system, cost-effective cost, and wireless connectivity make it a practical solution for far and endangered regions. With timely warnings, the proposed solution will help reduce the risk of flooding and secure human life and property. The system's IoT capabilities allow remote monitoring and data transmission, allowing for quick and proactive responses to flood conditions. The system is inexpensive, energy efficient, suitable for flooding and remote use, ensuring timely warnings to minimize property damage and life loss. Thanks to the integration of modern IoT solutions, this project closes the gap between technology and disaster management and provides a reliable means to prevent flooding and risk reduction.**

***Keywords*—Flood Detection System, Early Warning System, Smart Monitoring, Environmental Safety**

I. INTRODUCTION

Floods are one of the most devastating natural disasters, often leading to significant losses of life, property and infrastructure. Increased frequency of floods caused by climate change highlights the urgent need for reliable and efficient early warning systems. Traditional flood recognition mechanisms are often expensive and lack the accuracy required to reduce time and effectively mitigate risk. In this context, integrating IoT technology (the Internet of Things) into progressive sensor systems has proven to be a promising solution for improving flood forecasting and monitoring. IoT-based flood recognition systems are state-ART innovations that address the challenges of early detection and warning. At the core, the system uses nodemcu microcontrollers to manage and process real- time data from sensors. Ultrasonic sensors continuously monitor water levels, while moisture sensors assess soil moisture content and provide important environmental parameters. Combined with a regulated IC 7805 power supply area, these sensors ensure reliable and efficient operation under a variety of conditions. When the collected data exceeds a predefined threshold value indicating a potential flood risk, the system activates an audible scale alarm. This immediate responsiveness promotes timely evacuation and motivation that requires protection. Additionally, nodemcu's integrated wireless communications module enables seamless connectivity and enables remote monitoring and integration with cloud-based platforms for advanced analytics and alerting. The compact and inexpensive design of this system of the system is very suitable to provide it in far and economically restricted areas. Its robust architecture also ensures durability and consistent performance in hard environmental conditions.

A. Objective

IoT-based flood recognition systems are designed to provide a reliable and inexpensive solution for real-time monitoring of flood areas. The use of advanced

sensors such as ultrasonic sensors to measure water levels and moisture sensors to identify soil moisture content will collect system critical environmental data. The Nodemcu microcontroller acts as a central hub, processing sensor inputs and triggers an audible summer alarm when the

flood threshold is met. With timely warnings, the system improves disaster prevention, minimizes flood-related risks, and contributes to the protection of life and property. The compact and inexpensive design ensures accessibility and practicality and is an important tool for flood risk management.

II. RELATED WORK

Flood recognition and early warning systems have long been the subject of research and development, particularly in areas susceptible to natural disasters. Over the years, numerous flood monitoring systems have been implemented using a variety of technologies. This ranges from traditional devices with water level measurements to the expansion of television technology. However, recent progress in the Internet of Things (IoT) has significantly changed this domain by enabling the development of intelligent, real- time, and inexpensive flood recognition systems. For example, Tuan et al. (2019) proposed an IoT-based water level monitoring system with ultrasound sensors and GSM modules to send SMS warnings to users. Their system has proven to be localized flood monitoring, providing up-to- date information at the river level. Similarly, Yadav et al. (2020) developed a flood recognition system with Arduino and GSM technology. This will trigger the float sensor to detect water levels and warning messages. Although these systems were effective, these systems were often limited, internet- based data transmission was missing or had problems with high power consumption. In recent years, Nodemcu integration has developed microcontrollers with integrated WLAN, a more compact and efficient IoT- based system. Nodemcu allows you to send real-time sensor data through cloud platforms such as Sthingspeak, Blynk, and Firebase. This allows for remote monitoring and alarm spreading. Research by Shaikh Etal. (2021) showed a smart flood alert system with Nodemcu, ultrasonic sensor, and IoT-Cloud storage. Your system was able to provide flood warnings-based o historical data patterns and actual observations. However, most existing systems concentrate solely on water levels and often ignore other important environmental parameters such as soil moisture, which act as indicators of flooding potential in certain topography. For example, Khan et al. (2022) presented a dual-parameter system with soil moisture and rain sensors to identify future floods. Her study highlighted that several environmental indicator combinations improve prediction accuracy. However, the implementation is strong and not optimized for remote and rural areas where energy and cost- effectiveness are the most important. Research like Verma et al. (2023) highlighted the importance of the hybrid alarm model to ensure both local and distant perceptions of disasters. These systems addressed connectivity challenges by sending notifications on the site even if an internet error occurred on the website. The system proposed in this work relies on a combination of 7805 voltage control and a cost-effective, energy-efficient Nodemcu platform that functions through critical environmental monitoring tools (ultrasound and moisture sensors). This configuration ensures stable service delivery, reliable data collection, wireless communication capabilities, and at the same time receives the affordability and simplicity of implementation. Additionally, summer participation in local immediate warnings will be added to different levels of security. Suitable for remote control and disaster use on limited infrastructure. By creating and improving previous research findings, this work contributes to the continuous development of intelligent flood systems. The integration of real-time, local and far arm mechanisms of environmental sessions, and compact hardware designs demonstrates a practical and scalable approach to reducing flood risk. Focusing on IoT connectivity closes the gap between traditional environmental surveillance and moderndata- controlled disaster management strategies and provides a valuable tool to combat climate disasters.

III. EXISTING & PROPOSED SYSTEM

A. Existing System

Traditional flood recognition systems are often based on manual monitoring or traditional techniques, which are limited in terms of scope and efficiency. These systems typically contain independent sensors that do not integrate with physical inspections, basic alarm mechanisms, or

actual data processing. In many cases, data collection and communications are delayed, so early warnings are not provided, reducing the time available for preventive responses. In addition, traditional systems often require critical infrastructure investments, making them expensive and unrealistic for use in far or economically limited fields. Another limitation of existing systems is that it cannot effectively integrate some environmental parameters. Most solutions focus solely on water level detection, without considering other important factors such as soil moisture content, which are essential for a comprehensive assessment of flood risk. Given these challenges, existing systems are often insufficient to meet the growing demand for efficient and reliable flood recognition. This highlights the need for real surveillance, wireless communication, and progressive solutions that overcome these limitations with cost- effectiveness

B. Disadvantages

Existing flood recognition systems are exposed to several important drawbacks, which reduces their effectiveness when dealing with modern challenges in flood management. A key limitation is the lack of actual monitoring, as most traditional systems rely on manual inspection or delays in data collection methods. This delay in data availability disrupts modern decision- making-manufacturing, the effectiveness of early warnings, and increased risk. B. Measurements while ignoring other important factors such as soil moisture content, precipitation data, or environmental conditions. This harsh focus prevents a comprehensive assessment of flood risk and leads to more accurate predictions. The lack of wireless connectivity in traditional systems limits remote monitoring and data access, making it difficult for users to obtain timely updates, especially in remote or inaccessible areas. Furthermore, systems are often expensive and require extensive infrastructure or manual workers, making it unrealistic to use in economically restricted areas or rural areas.

C.Proposed System

The proposed IoT-based flood recognition system is an innovative solution for monitoring environmental parameters and providing high alerts to flood areas. The Nodemcu microcontroller is located in the center of the system. It is seamlessly integrated into a variety of sensors to collect and process real data. This system includes an ultrasonic sensor for accurately measuring water levels. This could be a good time to recognize how water will increase and potentially flood. Additionally, moisture sensors monitor soil moisture content and provide additional data to assess floor saturation levels. To ensure uninterrupted operation, the system is equipped with a regulated IC 7805 circuit that provides stable performance for all components. If the monitored parameter exceeds a predefined threshold, Nodemcu activates the audible summer alarm. This will focus on attention to flood risk in the near future. The inexpensive architecture ensures affordable prices without affecting reliability or performance. This proactive approach to flood management deals with the need for efficient disaster prevention and contributes to the establishment of resistant communities.

D.Advantages

IoT-based flood recognition systems offer several advantages that make them a practical and effective solution for monitoring floods and early warnings. One of the main advantages is the actual monitoring capabilities, which ensures ongoing observation of environmental parameters such as water levels and soil moisture content. Designed with affordable components such as the Nodemcu Microcontroller and Basic sensors, it provides access to economically limited communities and can be used remotely without significant financial burden. Compact and light design ensures easy installation and maintenance even in challenging locations. By including wireless connections via Nodemcu, users can monitor conditions from anywhere with seamless data transmission to remote devices or cloud platforms. An automatic alarm system with Automated Summer ensures that nearby people will be notified immediately if a critical threshold is exceeded. This provides a proactive approach to risk reduction.

D. Block Diagram

a. Hardware Block diagram

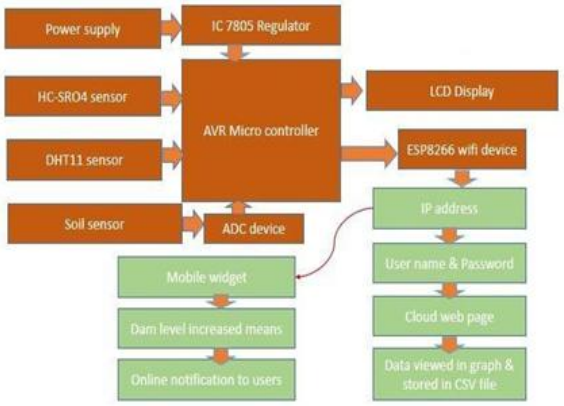

Fig .1. Hardware Block Diagram

b. Software Block Diagram

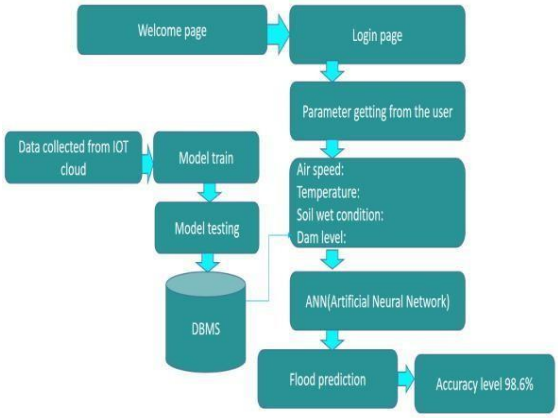

Fig .2. Software Block Diagram VI

VI. RESULT

IoT-based flood recognition systems represent significant advances in disaster management technology and provide practical and efficient solutions to mitigate flood-related risks. By integrating real-time monitoring capabilities with advanced sensors and Nodemcu microcontrollers, the system ensures accurate detection of potential flood conditions. An automatic alarm mechanism coupled with wireless connection allows timely notifications and remote monitoring, improving preparation and response efforts. The inexpensive design, compact construction and reliable performance of the system make it particularly suitable for use in remote and economically restricted areas. By providing early warnings and reducing reaction times, the proposed system not only protects life and property, but also builds resistant communities that can provide environmental challenges. This innovation highlights the potential of IoT technologies to meet important social needs and its role in promoting sustainable disaster management practices.

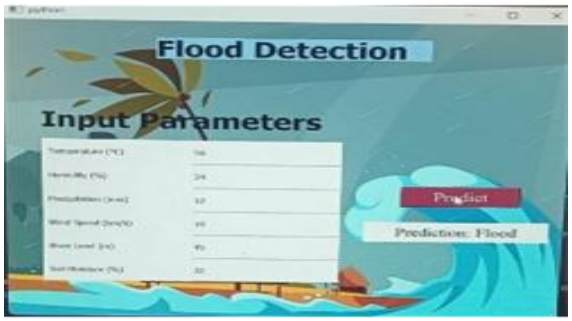

Fig. 3. flood Prediction

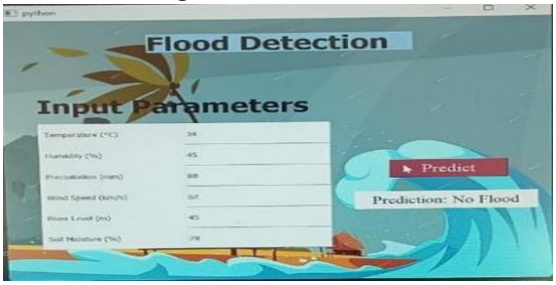

Fig .4. No flood Prediction

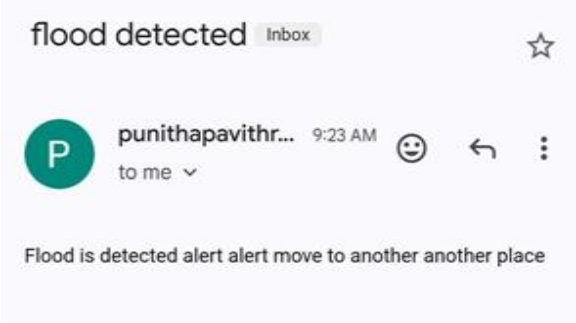

Fig .4. Software Alert

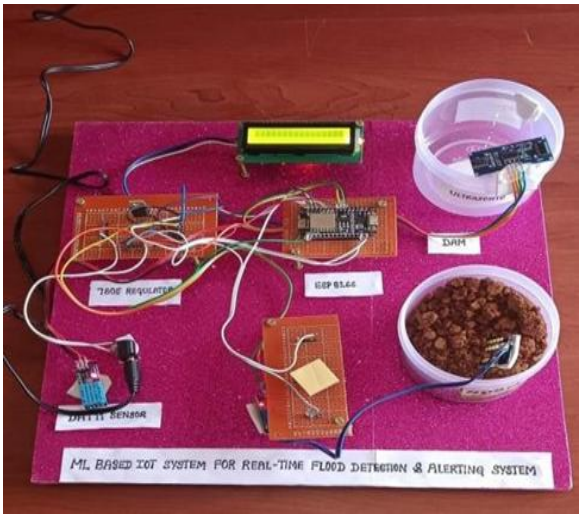

Fig .5. Kit

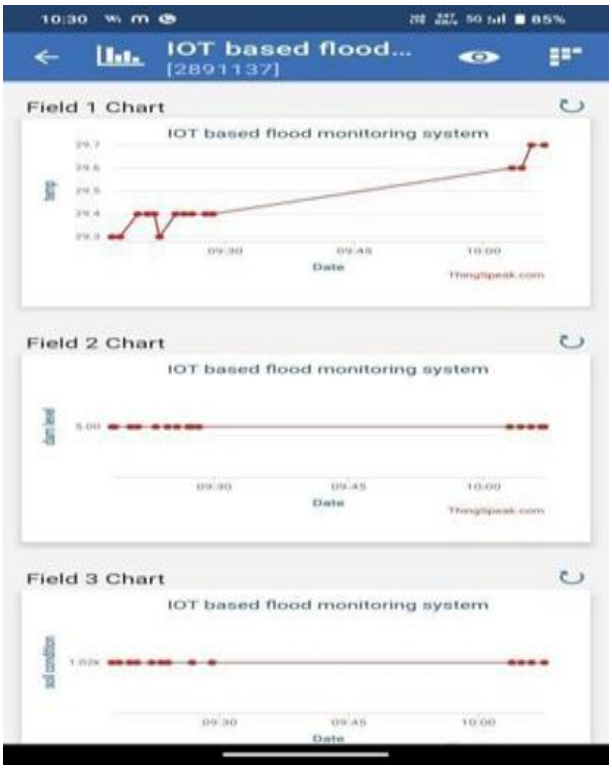

Fig .6. Thing speak Result

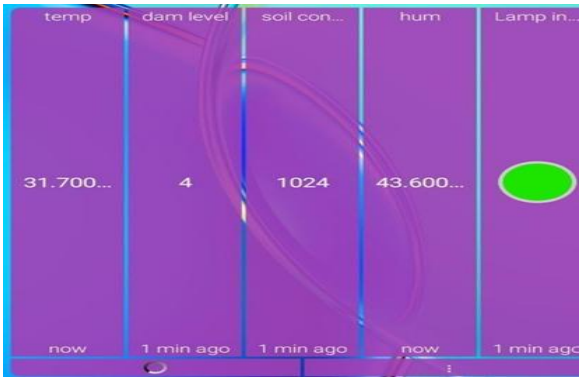

Fig .7. Data

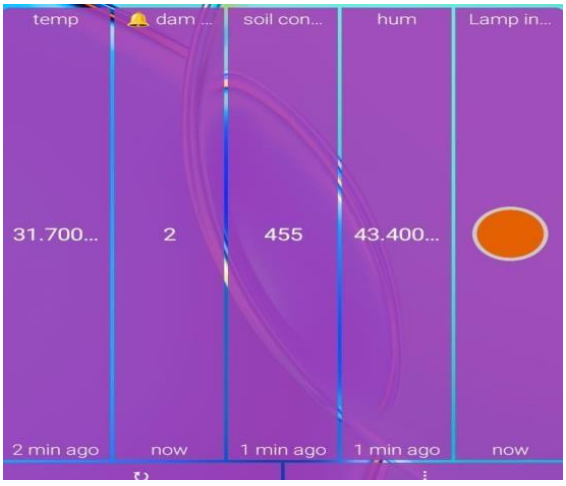

Fig .8. Data

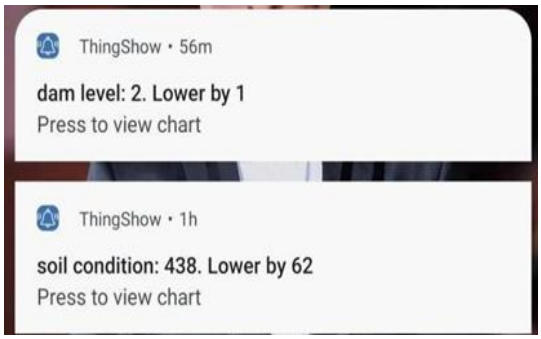

Fig .9. Hardware Alert

V. CONCLUSION

IoT-based flood recognition systems represent significant advances in disaster management technology and provide practical and efficient solutions to mitigate flood-related risks. By integrating real-time monitoring capabilities with advanced sensors and Nodemcu microcontrollers, the system ensures accurate detection of potential flood conditions. An automatic alarm mechanism coupled with wireless connection allows timely notifications and remote monitoring, improving preparation and response efforts. The inexpensive design, compact construction and reliable performance of the system make it particularly suitable for use in remote and economically restricted areas. By providing early warnings and reducing reaction times, the proposed system not only protects life and property, but also builds resistant communities that can provide environmental challenges. This innovation highlights the potential of IoT technologies to meet important social needs and its role in promoting sustainable disaster management practices.

REFERENCE

[1] Abhishek Raj, Nancy Hazra, Dr. Manoj R. Hans “Iot Based Flood Monitoring and Alerting System” International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 10 Issue VI June 2022.

[2] Harshali S. Mali, Ashwini R. Marathe, Priyanka K. Patil “ Flood Monitoring and Alerting System Based On Iot” Vol-7 Issue-3 2021 IJARIIE-ISSN(O)- 2395- 439614237.

[3] Bhushan Moundekar, Nitish Halde, Priyanka Waghulkar, Sunakshi Ganvir, Prof. S.D. Kakde

"Iot Based Flood Monitoring and Controlling System "Journal of Wireless Communication,2020, Network and Mobile Engineering Technology Volume 5 Issue 1 ISSN: 2457- 0516.

[4] Kiran Jadhav, Aniket Patil, Ajay Yamkar, Mrunmai Nagtode Iot Based Flood Monitoring and Alerting System International Research Journal of Modernization in Engineering Technology and Science 2021, Volume: 04/Issue:04/A.

[5] Garima Singh, Nishita Bisht, Pravesh Bisht, Prajjwal Singh"Iot Based Flood Monitoring and Alerting System with Weather Forecasting" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-6, April 2020.

[6] Sebin Sabu1 and Nora Elizabeth, "Kerela Floods- A Model of Rescue and Rehabilitation using Information Technology and Social Media based Crowd Sourcing", IEEE India Info. Vol. 13 No. 3 Jul-Sep 2020.

[7] H.A. Rahman, "Global Climate Change and its effects on Natural Habitat and Environment in Malaysia," Malaysian J. Environ. Manag., Vol. 10, No. 2, pp.17- 32, 2022.

[8] G. Furquim, F. Neto, G. Pessin, Jo Ueyama, J. P. De Albuquerque, M. Clara, Eduardo M. Mendiondo, V. C. B. De Souza, P. De Souza, D. Dimitrova and T. Braun, "Combining Wireless Sensor Networks and Machine Learning for Flash Flood Nowcasting", 28th International Conference on Advanced Information Networking and Applications Workshops, IEEE, 2021.

[9] B. Kontagora Nuhu, T. Arulogun, I. Adeyanju and Abdullahi I.M., "Wireless Sensor Network for Real-time Flood Monitoring Based on 6loWPAN Communication Standard", APTIKOM Journal on Computer Science and Information Technologies vol. 1, no.1, 2020.

[10] M. Ancona, A. Dellacasa, G. Delzanno, A.La Camera and I. Rellini, "An "Internet of Things" Vision of the Flood Monitoring Problem", The Fifth International Conference on Ambient Computing, Applications, Services and Technologies, 2021.

[11] S. Gangopadhyay and M. Mondal, "A Wireless Framework for Environmental Monitoring and Instant Response Alert", International Conference on Microelectronics, Computing and Communications (MicroCom), 23-25 Jan, 2021.

[12] P. Mitra, R. Ray, R. Chatterjee, R. Basu, P. Saha, S. Raha, R. Barman, S. Patra,S. Saha Biswas and S. Saha, "Flood forecasting using Internet of things and Artificial Neural Networks", Information Technology, Electronics and Mobile Communication Conference, IEEE, 2022.

[13] F. Ruslan, A. Manan Samad, Z. Md Zain, R. Adnan, "Flood water level monitoring and prediction using NARX neural network: Case Study at Kelang river", 10th International Colloquium on Signal Processing and its Applications, IEEE, 2021.

[14] Bern, C., Sniezek, J., Mathbor, G. M., Siddiqi, M. S., Ronsmans, C., Chowdhury,A. M., ... & Noji, E. (2022).

[15] Risk factors for mortality in the Bangladesh cyclone of Bulletin of the World Health Organization, 2021.