IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

ISO 3297:2007 Certified ⁜ Impact Factor 7.918 ⁜ Vol. 12, Issue 2, February 2023

DOI: 10.17148/IJARCCE.2023.12243

Urban Draining: Flood Monitoring and Alerting System Using Deep Learning and IOT

Prof. ANOOP PRASAD N[1], SAHANA L[2], ROOPASHREE N[3], SAHANA H R[4]

Assistant Professor Of The Department, Computer Science, East West Institute of Technology, Bangalore, India[1]

Student, Computer Science, East West Institute of Technology, Bangalore, India[2-5]

Abstract: Among the most frequent and costliest natural disasters to impact humanity. Therefore, the most effective partial solutions for reducing flood damage and loss are systems for flood forecasting and warning. For a sufficiently lengthy initial time, a reliable flood forecast and warning system is necessary. The goal of the a forementioned project is to establish guidelines for giving enough lead-time warnings of flash floods in urban streams based on rainfall. It also proposes a technique for analysing a tsunami forecasting and warning system. The findings of our study will be applied to modelling for flood disaster forecasts in the future as well as flood control.

Keywords: flash flood, flood forecasting, urban streams, observing system.

I.INTRODUCTION

The frequency of extreme climatic circumstances, such as heavy snowfall and rain, has increased due to climate change, in addition to the amount of flooding damage from locally concentrated high rainfall. Due to ongoing urbanisation, increased runoff, and a lack of pervious areas to absorb and store rainfall, there is also a larger risk of flood damage. Techniques that are structural and non-structural can both be used to reduce flood damage in urban areas. The maintenance of streams, embankments, and drainage infrastructure like pipes are examples of common structural measures. IoT technology can be used to track floods and provide useful information needed to make flood predictions in the future. However, the enormous volume of incoming data that this system must process results in significant lag for real-time scenario evaluation. Global experiences have demonstrated the importance of flood early warning as a strategic approach to reduce floods and as a way to improve its efficacy. By utilising a single management technique, the performance of FF and FW systems has thus been enhanced in this research for a variety of watershed scenarios. Because it is a typical metropolitan area with a significant risk of flooding and subsequent flood damage, the study location was chosen for the research. The goal is for decision-makers to use flood forecasting and warning systems, analyse the situation in light of rainfall dependence, and provide enough time before an evacuation by considering the temporal distributions of various types of rainfall forecasts. The main goal will be to minimise the quantity of lives and property lost as a result of flooding.

II.LITERATURE REVIEW

A. Urban Draining:

Prior to 1980, controlling floods was mostly done through structural measures. Flood control has developed since the early 1990s to include both structural and nonstructural solutions, or a holistic approach to combining multiple tactics. As a fresh strategy for managing floods in the twenty-first century, the idea of "Living with flood" seems to have emerged. Until recently, FF and FW were thought to as non-structural "living with flood" methods. Alternately, the necessity for flood plain management must be taken into account as an inherent part of society's approach to living with and coexisting with flood in order to assure the efficacy of utilising an all-encompassing strategy in the future. Iran is now engaged in FF and FW initiatives. for five Iranian rivers and basins. As the estimated inflow, computed B, summarized a range of literatures for flood monitoring and mapping, IoT-based sensors, and computer vision. That one project looked at different IOT and machine learning applications for better flood observation and locating. The IoT-based flood warning system developed by F. Arif, A. A. Shahin, Wahidah Md. Shah, and Aslinda Hassan could measure water level and water speed. Residents in the area started to notice the danger as the level climbed. Tests were conducted in a controlled setting with the goal of evaluating the current system. J. Pan, Y. Yin, J. Xiong, W. Luo, G. Gui, and S. Sari designed an automated security camera system made up of scattered measurement devices and a command center. The difference's method, dictionary learning, and deep learning were all put to the test .According to a suggestion submitted by Elena, a sensor comprised of a drone and a camera can be used to measure the water level at a dam site The UK has a three-step flood warning system and offers maps showing flood zones and risk of flooding for all riverine locations nationwide. Flood warnings are given out in the US based on measurements of streamflow from more than 6800 stream gauges that are spread over the nation's landscape and 75% of the threshold water level. In-depth research has been done on flood warning

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and response systems, as well as the issue of flood risk in urban watersheds, as was previously mentioned. However, there is still room for improvement in the understanding and use of prediction techniques. Most significantly Speed is a crucial factor in the forecasting and warning of floods. The use of the flood forecasting and warning system is directly impacted by an appropriate lead time that ensures prompt response. The ability of models that use distributed models, parametric optimization, and hydro-geomorphological aspects to predict and warn of floods is fundamentally constrained. Indisputable evidence points to rainfall-runoff analysis-based research approaches as the most successful in terms of speed and accuracy-based practical elements for ensuring adequate lead time.

B. Flood Monitoring and Rescue System:

Ogie R, Arshad B, Barthelemy J, Pradhan B, Verstaevel N, and Perez P summarized a range of literatures for flood monitoring and mapping, IoT-based sensors, and computer vision. That one project looked at different IOT and machine learning applications for better flood observation and locating. The IoT-based flood warning system developed by F. Arif, A. A. Shahrin, Wahidah Md. Shah, and Aslinda Hassan could measure water level and water speed. Residents in the area started to notice the danger as the level climbed. Tests were conducted in a controlled setting with the goal of evaluating the current system. J. Pan, Y. Yin, J. Xiong, W. Luo, G. Gui, and S. Sari designed an automated security camera system made up of scattered measurement devices and a command center. The difference's method, dictionary learning, and deep learning were all put to the test .According to a suggestion submitted by Elena, a sensor comprised of a drone and a camera can be used to measure the water level at a dam site. Due to its wide range of applications in urban, household, industrial, agricultural, healthcare, transportation, and public safety contexts, IoT technology offers solutions that enhance quality of life by making life simpler, safer, and more comfortable. The use of this technology to lessen the effects of natural disasters like floods is an important application. In addition to discussing different technologies that can be used to remotely sense ,appropriate approach to handle a particular flood problem. integrating employing geographically become more feasible thanks to advances in computer technology. reported diffusive transport using a GIS-based model, noting that runoff behaviour plays a significant influence in runoff routing. gathered over the preceding , they were able to verify the model since the anticipated and observed values produced similar hydrographs. Khalfallah and Saidi presented the flood simulation findings from using the prediction results to the River Analysis System of the Hydrologic Engineering Center to forecast runoff probabilities based on GIS-based rainfall frequency mapping (HEC-RAS) Only the swift and precise dissemination of accurate flood forecasting and warning information will be able to accomplish this goal.

C. Flood Forecasting and Warning System:

Regarding weather whims and the sudden and rapid onset and dramatic progress of extreme weather events, the only effective and sufficiently flexible method of early warning system is based on electronic sirens. Floods caused primarily by torrential rains, melting snow, or steady rains accompanied by abundant rainfall pose a severe danger to both humans and their property. Telegrafia's cutting-edge early flood warning systems are built as small to medium-sized systems that combine a warning and notification system with one or more monitoring systems. the rate at which the river's stage changes in real time, which may assist signal the gravity and immediacy of the hazard. Knowing the characteristics of the storm that produced the moisture, such as its length and strength Knowing the type of storm that produced the moisture, including its length, intensity, and actual extent, is important for determining the probable severity of the flood. We use a raspberry pi equipped with water sensors and rain sensors in this system to forecast floods, notify the appropriate authorities, and sound an instant warning in neighbouring communities to instantly relay information about potential floods via IOT. Three separate sites' water levels are measured using the water sensors. The level of rainfall in those 3 places is also measured using 3 distinct rain sensors. These sensors use a Raspberry Pi to transmit data over the IOT. The technology estimates how long it would take for a certain area to flood upon detection of flooding conditions. The algorithm also determines how long it would take for a flood to reach them and gives people a window of time to evacuate in accordance with that estimate. This project's goal is to measure the water level in river beds and determine if they are in good condition. It warns people with buzzer sound and LED signals if they go above the limit. When the water level exceeds the limit, it also sends emails and SMS alerts to the users.

D. Impact Assessment of Urban Flood:

Climate changes have a negative impact on The threat of climate change must be taken seriously. Balance and our interaction with nature are ultimately what matter. This essay discusses preemptive steps made to avoid flood damage and to warn the general public. Information on the current weather and several water-related indicators are regularly tracked. Also, this article uses the ESP32 microcontroller, GSM, and IoT to successfully communicate the data obtained (Blynk). One of the disastrous occurrences that cannot be kept at a safe distance is flooding. It happens really quickly and has a big impact on a lot of people's lives and properties. Due to inadequate early warning, the number of flood-related deaths rises every year. Because they lack any true knowledge of when the flood would occur, the majority of individuals

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in general are unable to screen. In addition, this study uses the ESP32 microcontroller, GSM, and IoT to communicate the data that was successfully gathered (Blynk). One of the catastrophic occurrences from which a safe distance cannot be maintained is flooding. It takes place very quickly and affects a sizable number of people and assets. Due to a lack of early warning, the number of deaths from floods rises every year. Because they lack any accurate information, the majority of people cannot screen, and as a result, they cannot predict when a flood will strike. The few drawbacks of the current methods can be lessened by the proposed system. If the general public has access to the internet, they can monitor what is happening and determine whether a flood is imminent. The suggested solution is less expensive in terms of design and upkeep. To identify a flood, rising water levels are measured. To measure temperature, humidity, and water levels at each stage, the system employs three sensors. The PIC Microcontroller is used to process the detected sensor values, and a Wi-Fi module is used to transfer them to the IOT. A significant loss of human life and property occurs as a result of the absence of early prediction and warning systems. If a flood is anticipated and warned of in advance. It is necessary to monitor all of the nearby water bodies, and further action must be done based on the results. It is crucial to alert residents in flood-prone areas about impending floods so they can be ready to flee. The installation of a flood alert system close to any region that is vulnerable to flooding can offer vital information about the situation, help protect properties, and even save lives. The Internet of Things (IoT) water level sensors used in this paper's real-time flood monitoring system are powered by the Raspberry Pi board.

E. Natural Hazard:

The introduction of an IoT-based system that notifies the authorities of impending flooding In rivers and drains, the water flow rate is determined by an IR sensor, and the water level is determined by an ultrasonic sensor. These sensor readings are sent over Wi-Fi to the main controller, which checks them, and if the values differ by more than a certain amount, an alarm (buzzer) and an alert Short Message Service (SMS) are sent to a mobile device. The plot of the water levels and flow rates is available online. The website also offers weather forecast information that was found online. The controller that uses sensor data to process water level and flow rate readings, as well as transmits those results. A new product made possible by this technology is disaster monitoring. In Malaysia, flooding calamity is the biggest worry because it occurs every year. We can monitor activities that people are unable to undertake for 24 hours using this technology and immediately notify the user. In this essay, we suggest an Internet of Things solution known as a flood alerts system with an Android app. This device will keep an eye out for any flooding that can result from drainage problems, which frequently do. The entire planet has suffered greatly as a result of the flood. A significant loss of human life and property occurs as a result of the absence of early prediction and warning systems. Many lives will be saved if the flood is forecast and an early warning is given. The neighboring water bodies must all be monitored, and depending on the results, more action must be done. It is suggested that an IoT Framework can address these issues. With the aid of IoT devices, the Framework will keep an eye on waterbodies and the level of the groundwater. The devices will convey frequent information about the water levels of the waterbodies and the level of the groundwater, and further actions will be taken based on the information gathered. Depending on the outcome of the process, the local population will be informed. People will receive an alert message with pertinent information, along with appropriate instructions on how to proceed. The human life will be saved as a result of this. One of the most frequent and destructive natural catastrophes, floods seriously destroy the economy, property, and human lives. Climate change has made it difficult for scientists to anticipate where the next flood disaster will occur, making it impossible to alert the public. Building and home damage is widespread and expensive to repair. Flood monitoring is a clever approach to keep an eye on floods and minimize damage in the event of a crisis. Residents in flood-prone areas need to be alerted to impending floods so they can prepare. People will receive the alert message and accompanying information, along with appropriate instructions on how to proceed. The installation of a flood alert system close to any region that is vulnerable to flooding can offer vital information about the situation, help protect properties, and even save lives. The Internet of Things (IoT) water level sensors used in this paper's real-time flood monitoring system are powered by the Raspberry Pi board.

F. River Core IoT Device for River Water Level Monitor:

Due to climate change and human activity, pluvial flash floods are occurring more frequently in metropolitan areas, which has an adverse effect on the infrastructure, way of life, and productivity of a community. When heavy rain exceeds the capacity of urban drainage systems, dangerous flash floods result from water accumulating. Early Warning Systems (EWS) are utilised to reduce casualties even though flash floods are difficult to forecast due to their quick creation. We carried out a comprehensive review to establish the fundamental format of an EWS for rain-related flash floods. The review is organised as follows: First, Section 2 outlines the key elements that influence pluvial flash flood strength during rainfall occurrences. The essential components and participants in an effective EWS are defined in Section 3. Section This project uses cross-correlation techniques to calculate the precipitation movement field using the most recent radar observations in addition to providing real-time radar data. The method generates the 30 minute accumulation using a

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moving window scheme once both the radar data and radar nowcasting are available.A online platform dynamically displays georeferenced data from nowcasting and real-time radar observations to visualise the information. The progression of the maximums of the 30-minute accumulation in the intelligent area surrounding the site of interest, as well as the locations that may be impacted by rainfall accumulation in 30 minutes surpassing the user-defined thresholds, are also displayed. A number of cameras positioned at significant crossroads make up the Network Video Recording Module. Using cameras, traffic. The uppermost end of the region affected by the backwater effect passes the Siddurim Bridge prediction point.. Only the swift and precise dissemination of accurate flood forecasting and warning information will be able to accomplish this goal. Speed is a crucial factor in the forecasting and warning of floods. The use of the flood forecasting and warning system is directly impacted by an appropriate lead time that ensures prompt response. The ability of models that use distributed models, parametric optimization, and hydro-geomorphological aspects to predict and warn of floods is fundamentally constrained. Indisputable evidence points to rainfall-runoff analysis-based research approaches as the most successful in terms of speed and accuracy-based practical elements for ensuring adequate lead time.

III.CONCLUSION

Large streams and rivers have been the subject of the majority of studies done built in connection to flood forecasting and warning. However, the number of flooding incidents in tiny streams and associated flood damage have increased recently. Particularly vulnerable to flooding damage and overflow over stream embankments are numerous cultural and recreational areas built along urban streams. preventing aren't many results of systematic analyses related urban streams, and there aren't many systems in place for forecasting and alerting flash floods.

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