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Real Time Urban Flood Prediction and Alerting System

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Abstract: *The proposed system integrates rain sensors to monitor precipitation levels in urban areas. These sensors continuously measure rainfall intensity and send data to a central control unit. By analyzing the rainfall data in real-time and comparing it with predefined thresholds, the system can predict the likelihood of a flood event.To actively manage floodwaters, the system utilizes water pumps strategically placed in critical areas prone to flooding. When the rain sensor detects rainfall exceeding a predetermined threshold, the control unit triggers the water pumps to start extracting excess water from the affected area. This proactive measure helps to prevent the accumulation of water and minimize the risk of flooding.*

Keywords: Flood detection

I. INTRODUCTION

An urban flood is a sudden local flood characterized by a great volume of water and a short duration it occurs within minute or hours of heavy rainfall or due to the increase in levels of sewage water by excessive rainfall. Urban floods are dangerous because the watersin a urban flood often move at destructive speeds, and they often occur with very little warning. Rainfall intensity and duration are two key elements of a urban flood. Topography, soil conditions, and ground cover also play important roles. Steep terrain can cause rainwater to flow toward and collect in low-lying areas, causing water levels to rise rapidly. If the soil issaturated with water, it cannot absorb more, so the excess water runs off the land quickly. Urban flooding is a growing problem in many cities around the world, particularly in areas with poor drainage systems, high population densities, and a lack of green spaces. Urban flooding can have serious consequences, including property damage, loss of life, anddisruption to critical infrastructure such as roads, bridges, and public transport. Real-time urban flooding monitoring and alerting systems are designed to address this problem by providing timely information on water levels in urban areas and alertingauthorities and residents to the risk of flooding. These systems use advanced sensor technology and data analytics to monitor water levels in real-time, enabling authorities to plan for and respond to floods more effectively

.These systems are an important tool for managing flood risks in urban areas, particularly in areas that are prone to flooding due to their location, topography, or other factors. By providing early warning alerts and real-timeinformation on water levels, these systems can help to minimize the damage caused by floods and reduce the risk of loss of life.

II. LITERATURE SURVEY

The purpose of this literature survey is to know more about thealternative solutions that are implemented instead of our proposed model related literature review and to get the knowledge about the different technologies that are implemented to design a system.

[1]. The authors are Rajiv Kumar Das and Neelam Rup Prakash has designed a tipping bucket rain gauge for the measurement of rainfall as well as for snow precipitation. Here the tipping bucket rain gauge supplies faster rainwater and snow water data, they propose the operating principle of tipping bucket rain gauge. Both the rainfall and snow precipitation are measured.

The snow precipitation is measured by antifreeze techniques attached on it. It consists of a catch tube anti- freeze reservoir and overflow tube. This snow melts and fall on to tipping bucket there by the amount of snow precipitation is measured, Rain fall is directly allowed to pass to the tipping bucket through the funnel and amount of rain fall can be

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measured. IoT based rainfall monitoring and weather monitoring provides different technologies for rainfalland weather monitoring using IoT

[2]. The authors are Onkar male and Rupali they design a rainfall monitoring system for transmitting and receiving data over a cellular network by using GPRS. The main aim of their approach is a proper water management.

[3]. The authors are Jigar Parmar, Trishal Nagda, PranayPalav, Hezal Lopez initiate systemfor weather intelligence. Atmosphere is getting polluted by different harmful gases from many industriesand vehicles. The different sensors on the system identifies the temperature humidity and noise in theatmosphere and transmit these data's through Wi-Fi to the users end it can be viewed on different electronic platform. Different sensors are used for measuring rainfall.

[4]. Zaheer Ullah Khan et al. utilized different information digging methods for expectation of climate determining including diverse groupings like K-Nearest Neighbor, Decision Trees. Among the order algorithms, decision tree has accomplished promising outcomes contrasted with different calculations

[5]. Zaheer Ullah Khan et al. utilized different information digging methods for expectation of climate determining including diverse groupings like K-Nearest Neighbor, Decision Trees. Among the order algorithms, decision tree has accomplished promising outcomes contrasted with different calculations. In this paper they have achieved an accuracyof 82%.

[6]. Siddharth S. et al. have utilized information mining strategy and Decision tree calculation to group climate parameters like least temperature and most extreme temperatureas far as day, month and year.

[7]. Radhika et al. presented a paper on the use of Support Vector Machines for climate forecast. Time arrangement information of every day greatest temperature at an area was dissected to anticipate the most extreme temperature of the following day at that area dependent on the day by day most extreme temperatures for a range of past n days alluded to as request of the info. Non straight relapse technique was utilized to prepare the SVM forthis application.

[8]. Divya Chauhan et al. utilized information mining, an instrument that predicts practices and future patterns, enabling organizations to settle on proactive choices. This paper introduces the survey of data mining techniques for weather prediction and concentrates theadvantage of utilizing it. The paper can be utilized to foresee meteorological information thatis climate expectation. The paper gives a review of accessible writings of a few calculations utilized by various specialists to use different information mining methods for weather prediction.

[9]. Real-time urban flood monitoring and prediction using social media and remote sensingdata by Li et al. (2014): This study explores the integration of social media data and remotesensing techniques for real-time urban flood monitoring and prediction. The research demonstrates the potential of leveraging crowd-sourced information from social media platforms along with satellite imagery and rainfall data to enhance flood monitoring and prediction capabilities.

Summary of the Literature survey

The outcome for the literature survey are as follows:

1. There is a need for development of system which gives to alert to residence people about urbanflooding in proper way and monitoring about the proper management of drainage system
2. In this proposed system we are rain sensor to detect the rainfall density and ultrasonic sensor to drainage blockage detection.
3. The system uses water pump which is integrated with ultrasonic sensor to avoid the drowning of water into the houses
4. It also sends this data to concerned authorities so that necessary actions may be taken.
5. It make informed decisions regarding the design and implementation of real-time urban flooding monitoring and alerting systems

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Methodology

III. METHODOLOGY

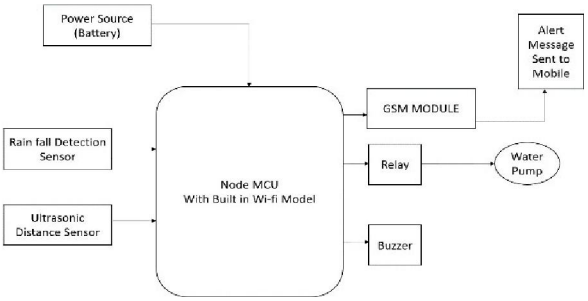

Figure 1. Block diagram

The below block diagram shows how the urban flood
alert system will work. Here the rain sensors the main sensor in this project because this sensor will only capture the rain fall density, here in this project the rainfall density is divided into three parts, the first one is lowdensity rainfall, the second one is medium density rainfall, the third one is high density rainfall. The water pump is turned ON when the rain density is high density, at the same time an alertmessage is sent to the authority or to the residential person in that particular area.

An ultrasonic sensor is used as the drainage blockage detection, if the drainage is blocked then alert is sent to the respected and authority persons. Because of using such system in the urbanregion, the residence people can keep their valuable assets in a safe place and can avoid the things missing due to flooding in the floods and also, we will stop water drowning into the houses. Once the rainfall goes below the high rainfall density is detected then the water pump turned OFF. The buzzer will be turned on once the rainfall density is high, and all theevents will be displayed on the LCD Display, here the alerting system is to send alert message or notifications regarding the abnormal events occurred across the system.

These rains fall amount data are transmitted to the rain monitoring authority they analyze these values if the amount exceeds safety thresholds, they will take necessary precautions and alert the public about the situation. These rains fall amount are transmitted to a cloud platform and these can be viewed by any individuals at anywhere any time in the world. Along with rain fall amount temperature and humidity readings are transmitted to both the cloud platform and to the monitoring authority.

Brain of a system is node MCU. All the senses and actuators are connected node MCU we use rain sensor to detect the rain fall by starting the timer and counting the seconds and we can estimate the time of rain. If it crosses set an threshold, it will be considered as over rainfall or more rainfall.

IV. RESULTS AND DISCUSSIONS

In this project the first thing to do is to prepare the inputs and outputs of the control the system. The prototype of the system with rain sensor to detect the rainfall density and give a high o/p value to controller and ultrasonic sensor is used detect the blockage of drains and monitor them continuously.

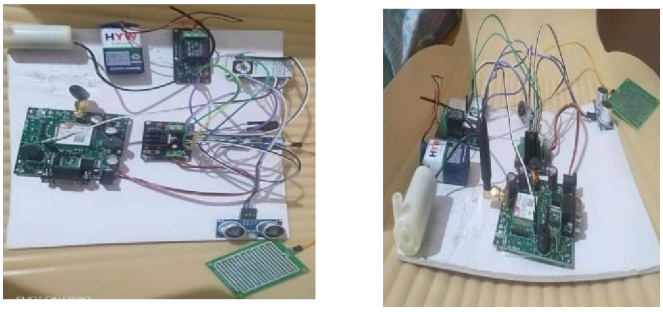

Figure 2. Proposed Model of "A real time UrbanFlood prediction and alerting system"

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The Node MCU controller is connected to the external power supply for the flow of current the buzzer is interfaced with rain sensor to give an alarm when rain density is high at same time an alert notification will be sent to the authority and respected people This system with water pump which will turn on when the rain intensity is high and an condition of drainage blockage which will avoid the drowning of water into the houses.

V. RESULT ANALYSIS

Figure 4.1 shows the Proposed model of "A real time urban flood prediction and alerting system", An urban flood prediction and alerting system using rain sensor, ultrasonic sensor, and water pump can help mitigate the impact of flooding in urban areas. The system worksby monitoring the rainfall and water level in the drainage system and providing early warning alerts to residents and authorities.

The rain sensor detects the amount of rainfall and sends the data to a central computer or microcontroller. The ultrasonic sensor measures the water level in the drainage system and sends the data to the same central computer or microcontroller. Based on the data from bothsensors, the system can predict the likelihood of flooding and issue alerts accordingly.

If the system detects a high likelihood of flooding, it can activate the water pump to pump excess water out of the drainage system and into a nearby reservoir or other collection point.This can help prevent flooding and reduce the damage caused by flooding.

A real-time urban flood prediction and alerting system using rain sensor, ultrasonic sensor,and water pump typically works in the following way:

- **Rain Sensor:** A rain sensor is installed in a specific location in the urban area to measure the amount of rainfall. It sends the data to a central computer or microcontroller.
- **Ultrasonic Sensor**: An ultrasonic sensor is installed in the drainage system of the urban areato measure the water level. It sends the data to the same central computer or microcontroller.
- **Data analysis:** The central computer or microcontroller analyses the data from both sensorsin real-time to determine the likelihood of flooding. This analysis can be based on predetermined thresholds for rainfall and water level data.
- **Alert System**: If the system detects a high likelihood of flooding, it activates the alert system. The alert system sends notifications to relevant authorities, such as the city's emergency management center, and to residents in the affected areas.
- **Water Pump:** If the system determines that there is an imminent risk of flooding, it activatesthe water pump. The water pump begins pumping excess water out of the drainage systemand into a nearby reservoir or other collection point.
- **Monitoring:** The central computer or microcontroller continues to monitor the sensors andadjust the pump operation as needed to prevent flooding.

Overall, the real-time urban flood prediction and alerting system using rain sensor, ultrasonic sensor, and water pump is designed to help prevent flooding in urban areas by providing early warning alerts to authorities and residents, and by pumping excess water out of the drainage system in real-time.

VI. CONCLUSION

The real-time urban flood prediction and alerting system that uses rain sensors, water pumps, and ultrasonic sensors is a valuable tool for managing and mitigating the effects of urban flooding. This system uses data from sensors to monitor rainfall levels and water levels in drainage systems and streams, and provides real-time alerts to residents and emergency responders when flood conditions are imminent. By providing early warnings and alerts, thissystem can help reduce the risk of property damage, injury, and loss of life during flooding events.

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