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Flood Monitoring Using Smart IOT System

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ABSTRACT
One of the natural disasters that cannot be prevented is flooding. It happened too quickly and had a huge impact on both people and property. Although it is extremely difficult to detect floods, early flood monitoring will assist society save a life. Water level rises and gets more erratic during a flood situation as it reaches a higher and higher level. In addition, because they lack information and data on the weather, the bulk of the population is unable to track and is unaware of when a flood will occur. All the issues with the current system will be resolved by using IoT flood monitoring system. The suggested technique works well in urban and rural settings. Additionally, if public has internet access, they can keep track of events and forecast whether or not a flood will occur at the web page. Suggested system is simple to maintain and has a minimal design cost. The web server's water level will be updated as a result of this project and the system will inform the public to evacuate so that quick action may be taken.
Keywords: IoT, Flood, Water level, Microcontroller.

1 Introduction

In recent years, there have been a tremendous number of flood instances due to the altered rainfall pattern. Flood catastrophes cause harm to the economy and to people's lives. Floods afflict millions of people each year. To reduce flood casualties, the government was compelled by this to develop a flood forecasting method [4]. The installation of alert systems near any significant body of water or water region gives vital wealth of knowledge that can both save lives and protect property. Some places are more prone to flooding than other places. Of course, the most effective flood warning systems cost a lot of money, require a lot of upkeep and require highly skilled personnel to operate them [9]. Every human being in the world needs access to water as one of their basic needs. A human life can be severely impacted by the poor management of a water storage system. The proposed model was created as a result of technological advancement to control water storage facilities like dams and lakes using sensor signals that are located remotely. Sensors placed in storage regions estimate the lakes' and dam's durability and capacity for storage. This increases the accuracy of flood predictions in river routes and enables the oncoming dam to release some water outside to make room for arriving waters. For the purpose of analyzing water flow management, the data produced dams that are connected to one another are stored in the cloud. To prevent cable connections, using an IoT platform, sensors in a lake or dam are connected. As a result, this model prevents unexpected floods occur when it rains, which assures the lake's and dam's physical strength through ongoing monitoring [7]. In the case of a flood, rivers that are close to populous or strategically significant places can harm property and put people at danger of injury. Radar and ultrasonic sensors used in conventional river flood monitoring systems might not be entirely reliable as well as usually need on site human calibration [8]. One of the natural disasters that cannot be prevented is flooding. It happened too quickly and had a huge impact on both people and property. Flooding is a natural occurrence that sparks interest around the world. Both lives are lost and the ecosystem is severely damaged as a result. Flooding is caused by heavy rains, faulty structures and a variety of human factors. Precipitation levels and rates, topography, geology, land use and preexisting moisture conditions all play a role in floods. Prior to this, the majority of the systems that have been developed only concentrated on a few areas. In addition, because they lack information and data on the weather, the bulk of the population is unable to track and is unaware of when a flood will occur. All the issues with the current system will be resolved by using IoT monitoring system. This is appropriate for urban and rural locations. Additionally, if a member of public has internet access, they can keep track of events and foresee the possibility of a web server flood. Its design is affordable and upkeep is simple. By doing so, the web server's water level will be updated and the system will inform the public to evacuate so that quick, required action may be done [6-5]. New low power wide area network (LPWAN) methods are being used as part of the plans of Internet of Things (IoT) systems, which has been a set of circumstances that is constantly evolving, for monitoring systems and to prevent future risks with smaller and less unaffordable structures. To provide the possibility to interface various types of sensors without significantly altering the proposed node architecture's hardware, the entire system is created from a modular perspective. The data is stored in a sensor and microcontroller equipped device that is linked to LoRa wireless module for data transmission, after then it is analyzed as well as saved via a web application framework where the flood alert feature is implemented. [3]. However, the system cannot solve flooding issues on its own. Public institutions must operate in tandem with civil society, volunteers, organized volunteer work organizations and community organisations. In order to decrease the danger of fatalities, property damage and environmental degradation, this paper can provide information to the relevant emergency services along with authorities. [2]. One of the most frequent and dangerous natural disasters is flooding. A better response to flood threats is required given the growing number of flood related deaths as well as financial losses seen every year around the world. It's interesting that in the past ten years, there have been numerous academic endeavors looking at how camera footage and wireless sensor data from IoT networks could improve flood management [1]. The presented work sheds light on the potential for creating an alarm system to reduce the risk of flooding. It is able to estimate how quickly the flood will occur by sending the user an alarm message along with the timing and pace of the water rise. Additionally, it has undergone testing in a controlled setting to gauge performance. For effective implementation, multiple sensors, such as a temperature sensor and a DHT11 sensor, might be combined [10].

2 Recent works

Linyi Li et al [2019] [11] to achieve improved performance, a new SMUF method that combines a general regression neural network and a support vector machine (FSVMGRNN) has been developed. A fusion criterion was created along with an SVM-SMUF method. FSVMGRNN-SMUF algorithm was subsequently created. Additionally examined and discussed was the FSVMGRNN-SMUF mapping accuracy in relation to the kernel functions.
Chalita Forgotson et al [2020] [12] proposes that system monitoring and early warning systems might aid in better preparing people to manage their reactions to such calamities, hence lessening the impact of such tragedies. Due to its critical role in the transmission of water and heat energy from ground to the sky, the partition of precipitation into infiltration and runoff as well as its subsequent impact on weather patterns and stream flow, soil moisture is an essential component of an effective warning system. In order to effectively limit the effects of extreme weather occurrences, the monitoring as well as early warning systems in which these organisations rely on could be strengthened.
Fan Yan et al [2019] [13] provides a heuristic technique to optimize the efficiency of a flooding process in low duty cycle wireless sensor networks by obtaining an optimal trajectory while accounting for the impact of the mobile sink's travelling delay (WSNs). However, traditional methods produce an excessively long flooding delay because there is only one static sink node acting as a single source.
Masato Ohki et al [2020] [14] offer a technique for employing interferometric phase statistics rather than the more popular coherence to identify floods in populated regions using L band synthetic aperture radar (SAR) pictures. Analyses of simulated as well as real SAR data show that phase statistics are more accurate than coherence, specifically when there are several point like scatters. A phase filter for interferometry was used to increase accuracy even more.
Jun Shang et al [2020] [15] in an industrial monitoring system, early classification of alarm floods can offer helpful data for effective handling of alarms. Flood, earlier trigger alerts often have more important responsibilities to perform. in a single alarm flood, leading to the suggestion in this article of a categorization technique known as exponentially attenuated component analysis (EACA). The Tennessee Eastman technique, a gold standard, is utilized for assessing an effectiveness of the proposed plan.

3 Proposed Work Explanation

Monitoring real time data is an essential first step in securing people's lives, homes and economies. Alerts must be made to everyone who lives in the area if the situation reaches a certain stage since it is now dangerous. Governmental organizations must take the required steps to relocate the populace to a safe place, minimizing the losses to less than 30%, even though fleeing a natural disaster is difficult. Several systems are active and installed in various locations at the moment, but sending an alarm notice to the appropriate government officials slows down the process.

This is because flooding is a very impromptu event and government organizations must go through several stages before making a decision. Along with government authorities, public awareness in this situation is crucial. In order to combine efforts and produce a better outcome. It is linked with prediction in our system through weather forecasting. Water flow sensors detect the movement of the water and ultimately assist in determining the flood's strength and water level with the aid of ultrasonic sensors, which work by sending out sound waves. The application will display all of this information. Java, XML and Android studio will be used to create android application. In addition to IOT data, the application includes weather forecasts. Open Weather API, which offers real time meteorological information, will be used to collect weather data. Losses to humanity and economy will be avoided as a result of this.

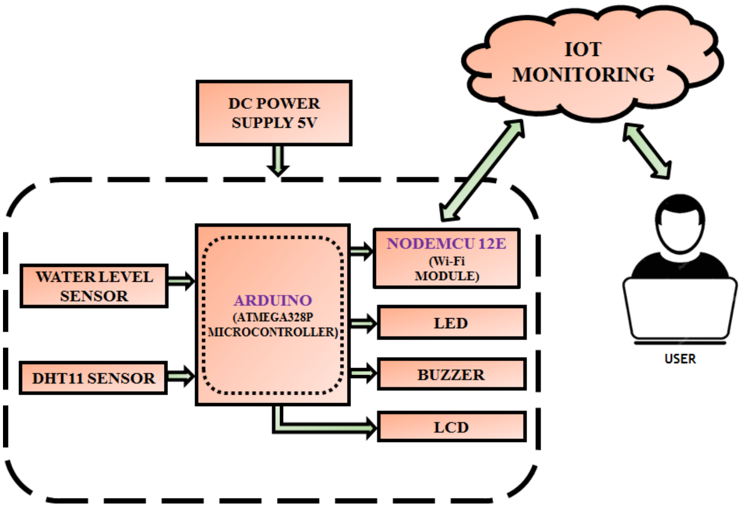

Figure 1.1: *Block diagram of proposed system*

Researchers prefer IOT based systems because they collect data from various sensors without the involvement of humans. For the purpose of detecting water levels, these programmes incorporate water level sensors. DHT11 sensor for temperature and humidity sensor and buzzer alert system were shown in Figure 1.2.

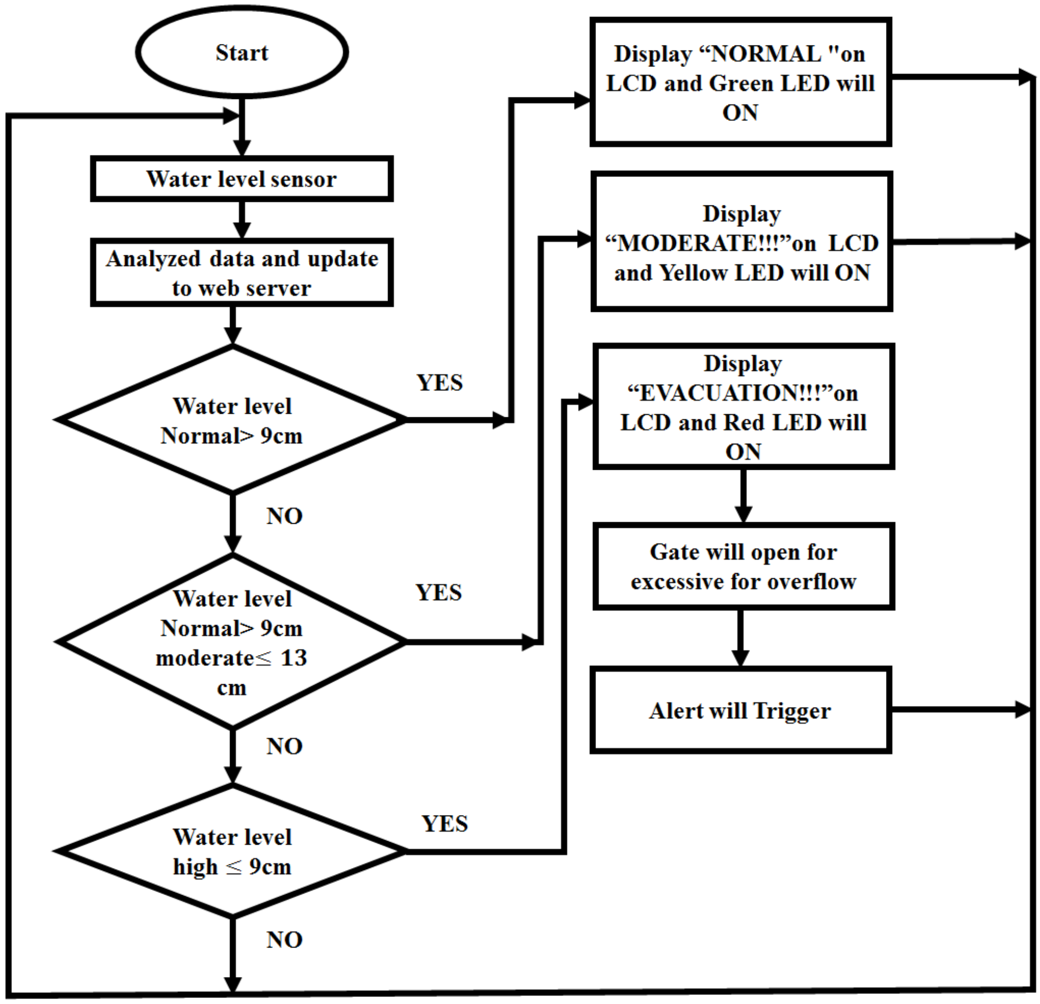

Figure 1.2: *The system's flowchart.*

Figure 1.2. demonstrates the flow chart of proposed system was built to alert the neighborhood's residents when a flood is anticipated. Water level sensor determines an amount of water in river, the process begins. Microcontroller receives the collected sensor data, aggregates it and sends it to the webpage for display. Data will next be examined and contrasted. The buzzer and stepper motor can both be wirelessly controlled by the user. Based on the information gathered, the flood's risk status will be decided. As a result, the web server and LCD will show the current water level. To show the level of the water, an LED will be turned on. Additionally, when flood level reaches a highest threshold value, the stepper motor will switch on to prevent the passage of excessive flooding and the alarm will sound instantly to inform the public. Therefore, before the flood even happened, the residents would have been well prepared for evacuation.

3.1 Buzzer

A mechanical, electromechanical or piezoelectric audio signaling device is a buzzer or beeper. Buzzers and beepers are extensively used as train announcements, alarm clocks, timers and confirmation of human input including mouse or keyboard clicks.

Figure 1.3: *Buzzer*.

An electromechanical, piezoelectric, or mechanical design might be used to create a buzzer or beeper, for instance Audio to sound conversion is the signal's primary function. DC voltage powers it, which is widely used in, alarm clocks, computers, timers, printers and other electronic equipment. Depending on the various designs, it can emit a range of sounds, siren, including alarm, bell and melody.

3.2 Interfacing DH11 to Ardiuno

In order to detect water vapour, between two electrodes, the DHT11 measures the electrical resistance. The humidity sensor component consists of an electrode surfaced substrate that can store moisture. In the process of absorbing water vapour, the substrate releases ions that improve the conductivity between the electrodes. The degree to which the resistance varies between the two electrodes depends on the relative humidity. With declining relative humidity and rising relative humidity, the resistance between the electrodes rises. The DHT11 to Arduino Unit is shown in Figure 1.4.

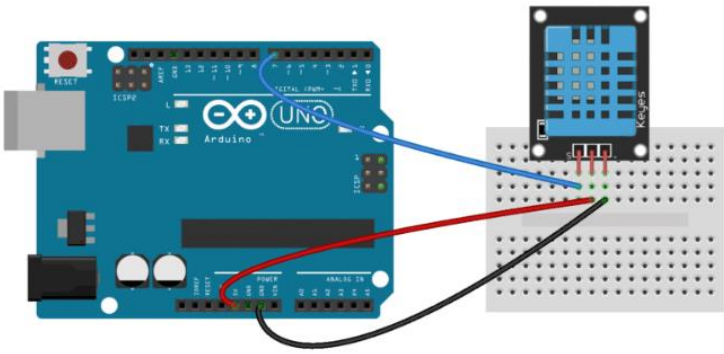

Figure 1.4: *DH11 to Arduino Unit.*

Relative humidity is converted from the resistance measurement by an IC located on the back of the device. Additionally, it regulates signal flow comparing Arduino with DHT11 and saves calibration coefficients. The DHT11 transmits data to the Arduino using just one signal cable.

Ground and 5V are supplied by independent cables. To ensure that the signal level is consistently high, a 10K Ω pull up resistor is needed between the signal line and the 5V line. The DHT11 is available in two different configurations. The second kind has three pins and is connected to a small PCB, while the first kind has four pins. The surface placed 10K Ω pull up resistor for the signal line on the PCB mounted version is great.

4 Results and Discussion

The circuit diagram and connections between each component are shown in Figure 1.5.ATmega328P microcontroller is coupled to the LCD, buzzer, Wi-Fi module, LED and water level sensor. Water level sensor, at least 5V required. The Wi-Fi module just necessitates 3.3v in an interim to provide data. Nevertheless, the SPI RX as well as TX pin interface is used for ESP8266 Wi-Fi module interface.

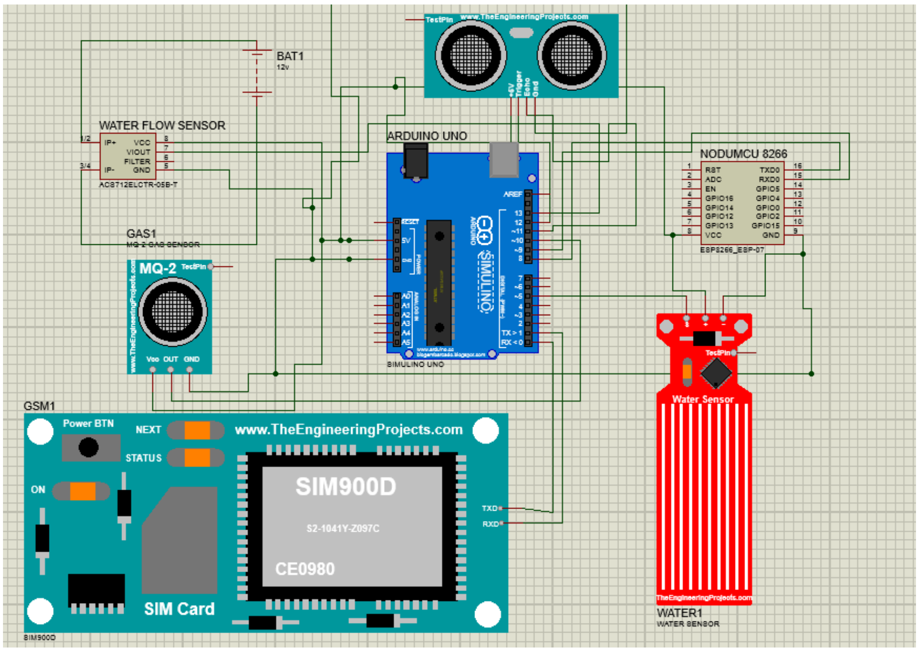

Figure 1.5: *Schematic diagram of Hardware view.*

Create a new Wi-Fi module and password first. The Wi-Fi configuration must then be checked to make sure it is operating correctly. The Wi-Fi routers and PASSWORD will produce a legitimate IP address if the configuration is complete. Because we must pay for a registered domain, the browser lacks a Domain Name System. It has been connected to the server and must have its own IP address, in order to control ATmega328P wirelessly. As a result, when a client connects to a server using IP address, server detects the client's desire to connect and responds with the web server. The IoT Monitoring server and LCD will show all the collected data.

5 Conclusion

The potential to create an alarm system that will mitigate the risk of flooding is highlighted by this project. In the case of a flood or other dangerous natural disaster, it might also support a variety of governmental bodies or authority, which might aid society and humanity. The suggested model has been tried out and is functioning as described in this project. It will keep an eye on all potential sources of flooding. It will quickly transmit a warning if the water level increases along with the speed. Additionally, it makes dealing with and recovering from this disastrous situation more accessible. In conclusion, it will aid the neighborhood in making quick judgments and preparing for this tragedy.

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