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FLOOD DETECTION AND AVOIDANCE SYSTEM USING IOT

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ABSTRACT

Flooding is typically brought on by an increased quantity of water during a water system, sort of a lake or a river overflowing. Occasionally a dam fractures, abruptly releasing a huge quantity of water. The result is that an enormous amount of the water travels into soil, hence flooding the region. Flood predictions need real time data analysis like: speed of change within the river stage on a true time basis, which can help to indicate the seriousness and immediacy of this flood threat. Understanding of the shape of storm generating the moisture, like length, intensity and a true extent, which is effective for locating potential seriousness of the flood. In this particular system we are using an Arduino Uno interfaced with four different sensors, named as ultrasonic sensor for measuring the water levels, float sensor for detecting full water, flow sensor for knowing speed of water and humidity sensor. This combination of sensors is used to predict flood and alert respective authorities with the help of IoT and sound an instant alarm in the adjacent villages to instantly transmit information about possible floods. These sensors provide information over the IoT using Wi-Fi module. On detection of the conditions of flooding, the system predicts the quantity of your time it might fancy arrive a specific area and alerts the villages or the areas that would be suffering from it.

Keywords- Alarm, Flooding, IoT, Sensors.

I. PAPER DESCRIPTION

As we all know that in India, we are facing floods almost every year in different parts of our country and there is tragic loss of life as well as property. Some of the loss can be avoided. This paper focuses on how the loss could be minimized and the threats of flood could be detected timely and all the necessary measures could be taken to reduce the loss. This paper also focuses on growing technology like IoT and its application in our paper. It shows how a small, portable and inexpensive equipment could monitor the real time data on site using respective sensors and shows it on display as well as on website designed specifically and also sounds an alert.

II. INRODUCTION

‘Flood Detection and Avoidance System using IoT’ is a smart system developed which will be calculating various natural factors on real time basis to predict a flood, so that we can prepare ourselves for attention, to minimize the damage which can be caused by flood [1]. Natural disasters sort of a flood are often devastating, resulting in damage to public belongings and loss of living beings. To reduce the consequences of the flood the smart system uses numerous

natural factors to detect the incoming flood. This smart system has Wi-Fi connectivity, thus the data collected can be easily accessed from anywhere across globe just by having basic internet connection. To sense a flood the smart system measures various natural factors on site like humidity, temperature, water level and water flow [2]. To collect real time data of the above-mentioned natural factors, the smart system consists of four different sensors which will be collecting the data for every single parameter. To detect the changes in humidity and temperature, the smart system is equipped with a DHT11 Digital Temperature Humidity Sensor. The water level is usually kept under observation by a float sensor, which works by opening and shutting circuits which are its dry contacts, as water levels rise and fall. The float sensor basically rests in the closed position, which means that the circuit is incomplete and no electricity is passing through the wires yet. Once the water level starts dropping below a predetermined point, the circuit completes itself and sends electricity through the complete circuit to sound an alarm. To keep an eye over the flow of the water the smart system is equipped with flow sensor, it consists of a plastic valve body, a water rotor, and a hall-effect sensor [3]. When water flows through the rotor, rotor rolls. Its speed varies with change in rate of flow, and hence the rate of flow of water is

depicted in liters per hour. Also, to monitor the rise in water level the system is equipped with HC-SR04 Ultrasonic Range Finder Distance Sensor, it works on the principle of SONAR and is designed to measure the distance using ultrasonic waves to determine the distance of water level from the sensor. All these sensors are connected to a common base that is Arduino UNO which store and process the data [4].

III. BLOCK DIAGRAM

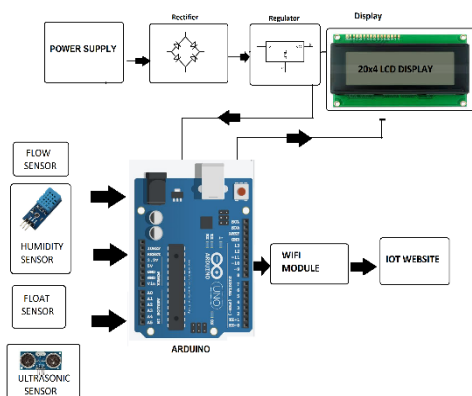


Figure 1: Block Diagram

IV. HARDWARE COMPONENTS

Hardware components used for these projects are flow sensor, float sensor, ultrasonic sensor, humidity sensor, WIFI module, LCD display, Arduino UNO board, power adapter and microcontroller. All these components collectively gather the data and updates it on display and on IoT server [5].

A. Microcontroller

In this project the microcontroller used is ATmega328 which is an eight-bit microcontroller. It can handle the data sized up to eight bits. It consumes low power and is highly efficient.

B. Sensors

In our project we are using four sensors who will collect the real time data and provide for analysis. They are as follows:

C. Temperature and Humidity

This sensor is DHT11 and is used to calculate the temperature of the site at which it is fitted and also calculate the humidity in the atmosphere of the site.

D. Ultrasonic Module

This sensor emits short and high frequency sound pulses after regular intervals. If they strike at an object, then they are reflected back as echo signals to the sensors by which the distance of water level is measured. It is particularly HC-SR04 Ultrasonic Range Finder Distance Sensor.

E. Flow Sensor

The flow sensor is fitted to check the flow of water on the site on bases of liters per hour.

F. Float Sensor

This sensor observes the water level; it works by opening and closing circuits which are dry contacts. It sends the alarm when the water level rises.

G. WI-FI Module

ESP8266 Wi-Fi Module is an integrated TCP/IP protocol stacked with an independent SOC and with that it can give any microcontroller access to our Wi-Fi network.

H. Arduino UNO

The Arduino Uno may be a microcontroller board supported the ATmega328. It has 14 digital input/output pins (of which 6 are often used as PWM outputs), 6 analog inputs, a 16 MHz quartz oscillator, a USB connection, an influence jack, an ICSP header, and a reset button. Also, 32 KB of flash memory for storing our code.

I. LCD

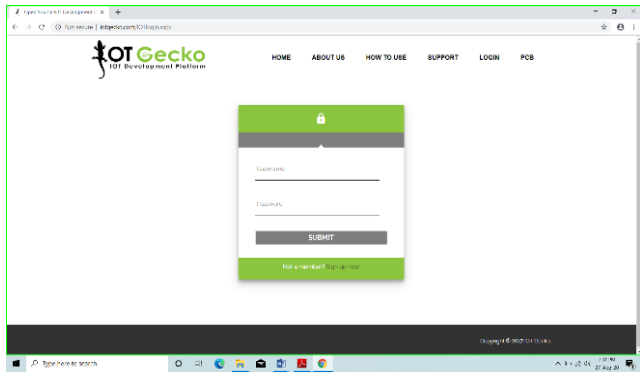
LCD is connected to show all the data collected by the respective sensors. The LCD used in this project is an alphanumeric and is 20x4. Each character is built by 5x8 pixel box.

V. SOFTWARE COMPONENTS

There are not many software requirements like hardware, only a few things are required such as Arduino, program for Arduino, website for data base. Arduino software is easily available on internet with the latest stable version and can be downloaded easily [3]. Now the program

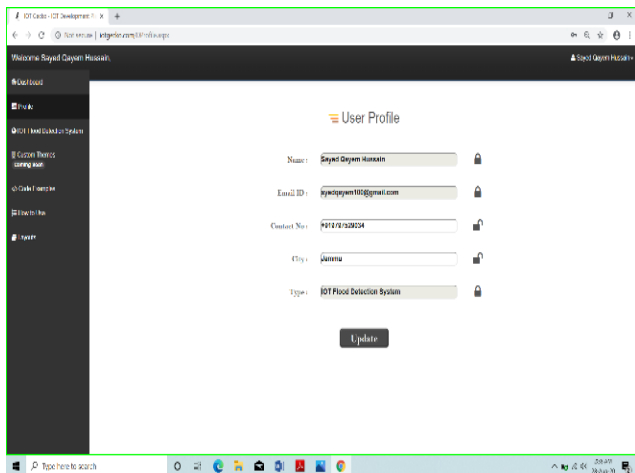
for Arduino is major concern because without programming there will be no results. Therefore, we developed a program with respect to our credentials and stored it in the Arduino Uno board which possess a flash memory of 32KB only to store program. Also, the website is developed where user has to login using login id and password and after logging in he will find a dashboard from where he can view the profile and also access the data collected by our project at site.

VI. SNAPSHOT of WEBSITE



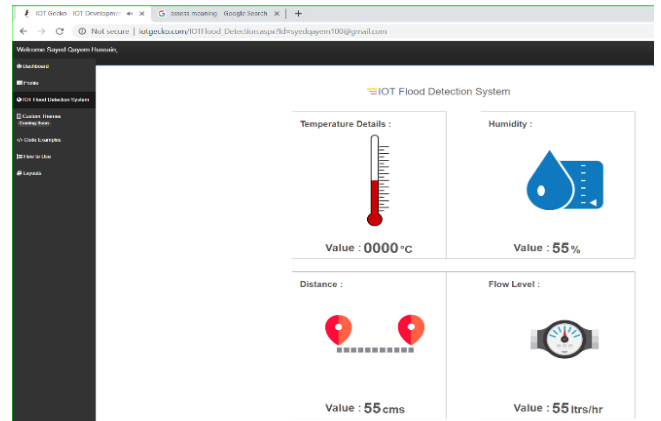
Website: Login page

Above snapshot is the website login page through which the user can enter his login id and password and have access to the facilities provided by the website.



Website: User Profile

In the above snapshot the user profile can be seen in which user's credentials are shown and also the dashboard on left side to access many other options.



Website: Real time data at website

In the above snapshot the real time data collected at the site is sent to the server and is displayed on the website.

VII. IMPLEMENTATION AND RESULTS



Figure 2: Hardware Implementation

In the above figure the hardware implementation of our project can be seen and here our site is considered as a mug full of water



Fig 3: LCD displaying data

In the above figure we can see the real time data collected by sensors being displayed on LCD.

VIII. WORKING

This project is based on a real time analysis and is based on Arduino and IoT [3, 4]. The components used are highly specific for this project. The working of the project can be described as follows:

- Initially the power is supplied to the rectifier circuit (power adapter) which provides the desired power output to all the components.
- The Arduino starts running its pre stored program.
- Simultaneously, all the components connected on PCB start working as they are interconnected to one another and also to Arduino.
- When the program runs it makes all the sensors to take a real time reading.
- The temperature and humidity sensor (DHT11) measures the real time humidity and temperature of the site.
- The flow sensor measures the rate of flow of water in liters/minute.
- Float sensor moves up and down due to buoyancy and measures the rise or fall level of water. A reed switch in the stem is activated by a magnet in sensor, and outputs the detection signal.
- Ultrasonic sensor emits short and high frequency sound pulses at regular intervals. If they strike an object, then the sound pulses are reflected back as echo signals to the sensor, which itself calculates the distance to the target based on the time span between emitting the signal and receiving the echo. Here the reference point is water level.
- As the project is IoT based and it needs to be connected to the internet, for that purpose we have the Wi-Fi sensor which also requires a connection from a local router and the SSID of the router must be set as 'iot' and the password be set as 'project1234', this is because the same is mentioned in the preloaded program.
- When it is connected to the Wi-Fi it starts displaying the real time data collected by all sensors on the LCD.
- This data is sent to a website <http://iotgecko.com> . By logging in into this website using an id and password, same as in preloaded program we can access the real time data from anywhere in the world.
- To initiate alert, we must include the parameters of river, dam or pond into the program i.e. up to what

extent the rise in level is safe and what level is an alarming level. When such parameters appear on real time data the alarm is automatically buzzed.

IX. APPLICATIONS

- To monitor the real time parameters such as humidity, temperature, rate of flow of water, rise or fall in water level.
- The data collected can also be used for long term data analysis.
- It also sends the real time analysis to IoT from where multiple users can view the live data.
- It sends out an alarm, when the real time data matches with the preloaded warning data.
- The equipment can be attached on dams, river basin and bridges, making it portable and easy to handle.
- The timely operation of flood control structures, (e.g. gates, temporary flood defenses) prevents inundation of property and land [5].
- It offers pre-event maintenance operations to ensure free channel conveyance which includes installation of flood resilience measures such as sandbags, property flood barriers.

X. CONCLUSION

Flood warning is that the provision of an advance warning of conditions that are likely to cause flooding of property and a possible risk to life. The first purpose of flood warning is to save lots of life by providing people support and emergency services, and also ample time to organize for floods. The secondary purpose is to scale back the consequences of injury of flood (Bihar, 2020). The advantages associated with flood forecasting and warning are inextricably linked with the effectiveness of the warning dissemination programs and thus the activities of the overall public and supporting agencies (both voluntary and official). The entire benefits are often defined as 'the reduction in losses (tangible and intangible) resulting from the availability of a warning as compared to things before the operation of the warning system'. Tangible losses are the worth of the damage arising as a consequence of the physical contact of floodwater with property (direct losses), and thus the losses which are consequent upon direct flood damage (indirect losses). Flood warning systems can provide a reduction in direct losses through:

- the timely operation of control structures (e.g. gates, temporary flood defenses) preventing inundation of property and land;
- pre-event maintenance operations to make sure free channel conveyance;
- the installation of flood resilience measures (e.g. sandbags, property flood barriers);
- the evacuation of individuals to somewhere above the flood level or out of the flood plain.

Intangible losses include loss of life and injury, and thus the damage caused to human health and long-term well-being. Such losses are extremely difficult to quantify in economic terms, but are important considerations when evaluating the benefits of any flood management scheme, particularly flood warning where significant impacts are often made through facilitation of timely evacuation of these in danger.

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