FLOOD MONITORING AND ALERT SYSTEM USING IOT

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ABSTRACT

The "Flood Alert System Using Ultrasonic Sensor and IOT over ThingSpeak" is an innovative project that addresses the pressing issue of flood monitoring and early warning systems. This system leverages ultrasonic sensors and Internet of Things (IOT) technology to detect water levels and communicate crucial flood data in real-time via the Thingspeak platform. The primary objective of this project is to enhance flood preparedness and response by providing accurate and timely flood alerts. The ultrasonic sensor continuously measures water levels in rivers, reservoirs, or flood-prone areas. When water levels rise to critical points, the system activates. Nowadays natural calamities like flooding turn up drastically, and it severely affects standard of living. In this project the development of flood monitoring system using IOT to keep track of the conditions nearby the reservoir with the help of Arduino, the prototyping platform and the compactible sensors such as level, temperature, humidity and flow distinctly presented. Firstly the hardware unit is placed in the flood prone areas, the Wi-Fi module (ESP8266) act as the transmitting unit and the sensors associated with the system measures the corresponding parameters. Then the accurately measured parameters are displayed through the LCD display and passed to the IOT web application. Here the Things peak web application is used to store data in private channel and the web application then alerts the authority and people while flood occurs.

Introduction

Natural calamities happen everywhere in the world, and which affects the human life and economy of the country. Economy and growth of any country depends upon the agriculture, hence the proper alert makes the farmers vigilant to protect the crop from flooding.

In order to detect and avoid flood like disastrous calamities in a timely manner, current world technology plays a vital role. We can prevent natural disaster caused by flood, with the aid of an IOT based early flood related parameter monitoring and detection system and its avoidance using the Arduino project, is proposed as a solution to the mentioned problem.

The proposed model is very much utilized for monitoring of the water level, flow variations, humidity and temperature variation in the river and the same can be used at dam or reservoirs. The measured values are regularly updated on the web server which is very much useful to send flood alerts to authority and people for faster action.

The entire system consists of five different Arduino compactible sensors which are temperature, humidity, water level, flow and ultrasonic sensors. Also it consist of an Arduino controller, a Wi-Fi module, an LCD display an alarm and an IOT remote server based platform. In this

advanced system the initial stage indicates the level of water and the other parameters like flow rate temperature and humidity. Then these information is passed to the web server or the IOT via a Wi-Fi module, here the ESP8266 is used as Wi-Fi module. Which transmit and DHT11 is the temperature and humidity sensor, it is a basic low cost digital temperature and humidity sensor. And HC-SR04 ultrasonic sensor used as the water level sensor, which works on the SONAR principle. In this project the main objective are implement a system which covers both the IOT based system and the sensor network interfaced with both ESP8266 and the Arduino Uno R3 board for detecting floods and for sending alert to organizations and the society. The LED and buzzer act as alerting system when there is rise in the water level and the associating parameters.

Nowadays at most of the times the ordinary system notifies only the respective governed registered organizations, result in the slowdown of the process in rescuing citizens and also most of their belongings cannot be stored. In present condition it is necessary to develop the design of accurate smart flood monitoring system using sensors and IOT thus the system efficiency can be increased and can be imposed as the real time monitoring system. In this project the main objectives are to implement a system. which covers both the ESP8266-based technology, sensor network

components, IOT and web applications for detecting the floods for sending an alert to the organization.

Literature Review

Internet of Things Based Real Time Flood Monitoring And Alert

Management System - The system is much advantaged for protecting the lives of people and animals. This system is very much utilized for monitoring of the water level, flow variations in rivers and the same can be used for measuring of the water level at Dam/ Reservoirs. The measured values are regularly updated on the web server which is very much useful to send flood alerts to consistent authority and people for faster action. This constitute a wireless sensor nodes which called as a mote and the motes are placed along the river beds to monitor water condition. Each Node is connected with a GSM module. The measured parameters are processed by the Raspberry pi3 which contains 64-bit ARM Cortex A53 processor. The processed information transmitted from corresponding node to alert management system using GPRS. Google spread sheet Application program interface (API) created and this API is used as a data logger.

An Intelligent Flood Monitoring System for Bangladesh Using Wireless Sensor Network - A neuro-fuzzy based flood alert system using WSN has been proposed. The distributed sensor nodes use low rate wireless personal area network to collect water level data from the river, rainfall data, wind speed data and air pressure data from the selected site. The sensors information are sent to the distributed alert Center via Arduino micro controller and the XBEE Transceivers. At the distributed alert Center XBEE Transceiver and a Raspberry Pi microcomputer are used to generate flood alert based on sensor information. Two decades flood monitoring data have been used to

estimate the duration of the flood and these data are stored in a database. An intelligent NFC is created in Raspberry Pi microcomputer which uses sensor data to announce broadcast the flood alerts.

Development Of A Low Cost Community Based Real Time Flood

Monitoring And Early Warning System - The proposed system employs the use of low cost Arduino Uno micro controllers and other low cost devices to detect potential flood and alert the community in real time. Results obtained from the system prototype/field test demonstrated its capability in mitigating the devastating impacts of floods especially for the poorest and most vulnerable communities in developing countries.

SMS Based Flood Monitoring and Early Warning –

This monitoring system is fast, cheaper and reliable hence it helps prevent the loss of lives damage to properties. One problem in the system may develop if the network provider makes changes to the network. The GSM module cannot upgrade itself. The system is further improved by make it independent by incorporating a solar battery charging system. This can be supported by the GSM module. GSM module has a feature that enables it to check the battery level at any time. Since the setup will be in a remote area, the solar charging system will allow for the battery to be constantly charged. The user can also check the battery status through the GSM module. The module should be able to feedback the battery level to the user via SMS. Further remote top-up, adding resident numbers are also incorporated to make the system fully efficient.

Proposed Model

Block Diagram

To detect a flood the system observes various natural factors, which includes humidity, temperature, water level and flow level. To collect data of mentioned natural factors the system consist of different sensors which collects data for individual parameters. For detecting changes in humidity and temperature the system has a DHT11 Digital Temperature Humidity Sensor. It is a advanced sensor module with consists of resistive humidity and temperature detection components. The water level is always under observation by a float sensor, which work by opening and closing circuits (dry contacts) as water levels rise and fall. It normally rest in the closed position, meaning the circuit is incomplete and no electricity is passing through the wires yet. Once the water level drops below a predetermined point, the circuit completes itself and sends electricity through the completed circuit to trigger an alarm. The flow sensor on the system keeps eye on the flow of water.

The water flow sensor consists of a plastic valve body, a water rotor, and a hall-effect sensor. When water flows through the rotor, rotor rolls. Its speed changes with different rate of flow. The systemalso consist of a HC-SR04 Ultrasonic Range Finder Distance Sensor. The Ultrasonic sensor works on the principle of SONAR and is designed to measure the distance using ultrasonic wave to determine the distance of an object from the sensor. All the sensors are connected to Arduino UNO, which processes and saves data. The system has Wifi feature, which is useful to access the system and its data over IOT.

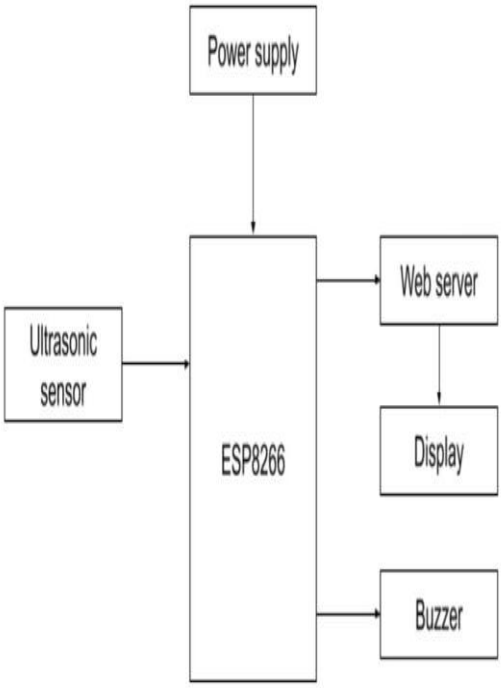


Fig -Basic Model of the System

HARDWARE SPECIFICATIONS AND SOFTWARE SPECIFICATIONS

Hardware Specifications

ESP8266 NodeMCU Development Board

The ESP8266 is a Wi-Fi System on a Chip (SoC) produced by ESPRESSIF Systems. It's great for IoT and Home Automation projects. This article is a getting started guide for the ESP8266 development board.

It can be used as a standalone device, or as a UART to Wi-Fi adaptor to allow other microcontrollers to connect to a Wi-Fi network. For example, you can connect an ESP8266 to an Arduino to add Wi-Fi capabilities to your Arduino board. The most practical application is using it as a standalone device.

Wi-Fi Module – ESP8266

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box) The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

The ESP8266 Module is not capable of 5-3V logic shifting and will require an external Logic Level Converter. Please do not power it directly from your 5V dev board. This new version of the ESP8266 Wi-Fi Module has increased the flash disk size from 512k to 1MB

Ultrasonic sensor

At its core, the HC-SR04 Ultrasonic distance sensor consists of two ultrasonic transducers. The one acts as a transmitter which converts electrical signal into 40 KHz ultrasonic sound pulses. The receiver listens for the transmitted pulses. If it receives them it produces an output pulse whose width can be used to determine the distance the pulse travelled. As simple as pie. The sensor is small, easy to use in any robotics project and offers excellent non-contact range detection between 2 cm to 400 cm (that's about an inch to 13 feet) with an accuracy of 3mm. Since it operates on 5 volts, it can be hooked directly to an Arduino or any other 5V logic microcontrollers.

Water flow sensor

Water flow sensor consists of a plastic valve from which water can pass. A water rotor along with a hall effect sensor is present the sense and measure the water

flow. When water flows through the valve it rotates the rotor. By this, the change can be observed in the speed of the motor. This change is calculated as output as a pulse signal by the Hall Effect sensor. Thus, the rate of flow of water can be measured.

The main working principle behind the working of this sensor is the Hall Effect. According to this principle, in this sensor, a voltage difference is induced in the conductor due to the rotation of the rotor. This induced voltage difference is transverse to the electric current. When the moving fan is rotated due to the flow of water, it rotates the rotor which induces the voltage. This induced voltage is measured by the Hall Effect sensor and displayed on the LCD display. The water flow sensor can be used with hot waters, cold waters, warm waters, clean water, and dirty water also. These sensors are available in different diameters, with different flow rate ranges. These sensors can be easily interfaced with microcontrollers like Arduino.

Fig: Water flow sensor

Software Specifications

Internet of things (IOT)

The Internet of things (IOT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. The definition of the Internet of things has evolved due to the convergence of multiple technologies, real-time analytics, machine learning, commodity sensors, and embedded systems. Traditional fields of embedded systems, wireless sensor networks, control systems, automation (including home and building automation), and others all contribute to enabling the Internet of things.

Fig : Internet of Things (IOT)

Thing Speak web server

According to its developers, ThingSpeak is an open-source Internet of Things (IOT) application and API to store and retrieve data from things using the HTTP and MQTT protocol over the Internet or via a Local Area Network. ThingSpeak enables the creation of sensor logging applications,

location tracking applications, and a social network of things with status updates. ThingSpeak has integrated support from the numerical computing software MATLAB from Math Works, allowing ThingSpeak users to analyze and visualize uploaded data using Matlab without requiring the purchase of a Matlab license from Math works.

THINGSPEAK WEB SERVER

ThingSpeak in Arduino IDE

ThingSpeak allows you to publish your sensor readings to their website and plot them in charts with timestamps. Then, you can access your readings from anywhere in the world.

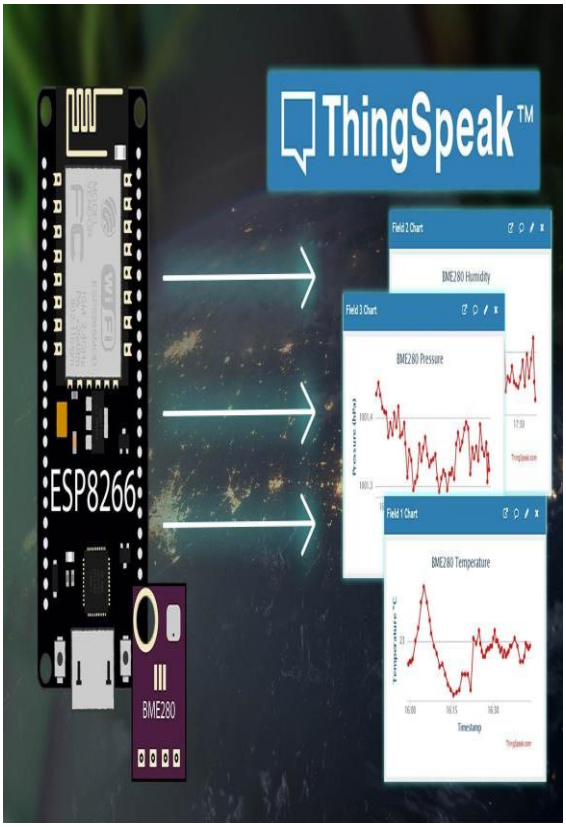


Fig - Thingspeak Webserver

There are many ways to send sensor readings to ThingSpeak. In this tutorial, we'll use one of the easiest ways—using the thingspeak-arduino library. This library provides methods to easily publish sensor readings to single fields or multiple fields. You can check the library examples on its GitHub page.

We'll cover how to publish to a single field and how to publish to multiple fields.

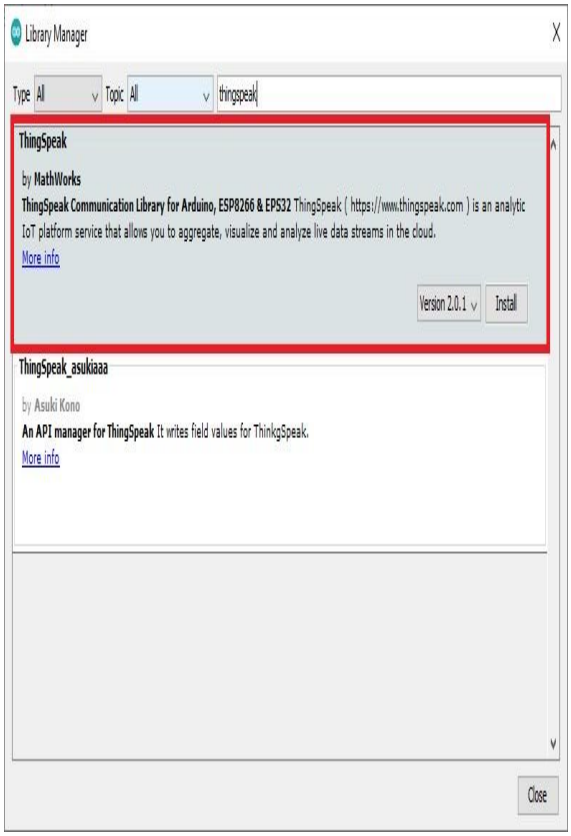
Preparing Arduino IDE

For this tutorial we'll program the ESP8266 using the Arduino core. So, make sure you have the ESP8266 add-on installed in your Arduino IDE Installing the ESP8266 Board in Arduino IDE (Windows, Mac OS X, Linux) .

Installing the ThingSpeak Library

To send sensor readings to ThingSpeak, we'll use the thingspeak-arduino library. You can install this library through the Arduino Library Manager. Go to **Sketch** > **Include Library** >

Manage Libraries… and search for "**ThingSpeak**" in the Library Manager. Install the ThingSpeak library by MathWorks.



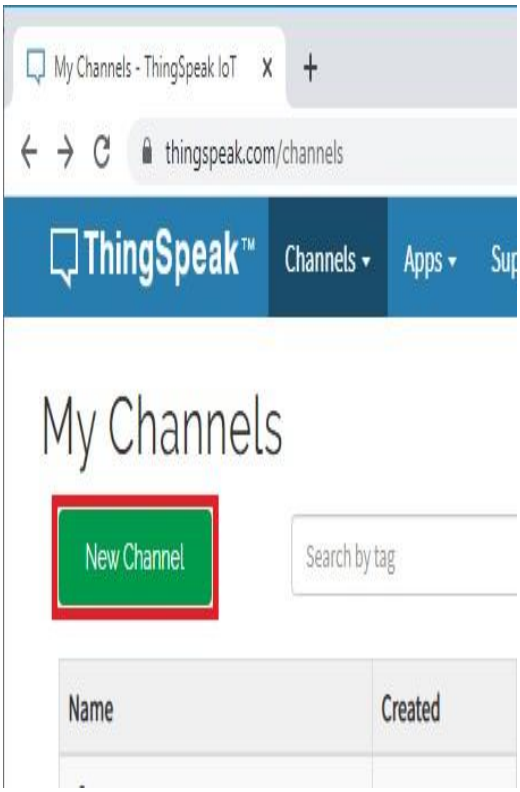
ThingSpeak – Getting Started

Go to ThingSpeak an click the "**Get Started For Free**" button to create a new account. This account is linked to a Mathworks account. So, if you already have a Mathworks account, you should log in with that account.

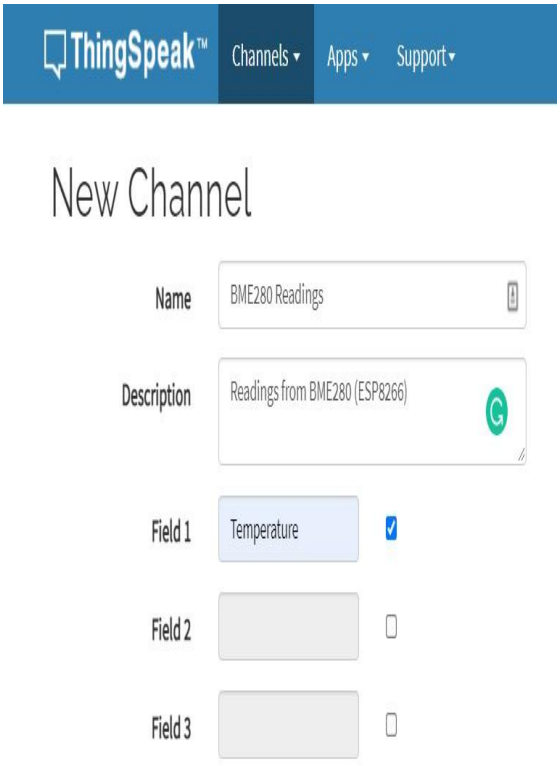
Creating New Channel

After your account is ready, sign in, open the "**Channels**" tab and select "**My Channels**".

Press the "New Channel" button to create a new channel.



Type a name for your channel and add a description. In this example, we'll just publish temperature. If you want to publish multiple readings (like humidity and pressure), you can enable more fields.



Click the **Save Channel** button to create and save your channel.

Customizing Chart

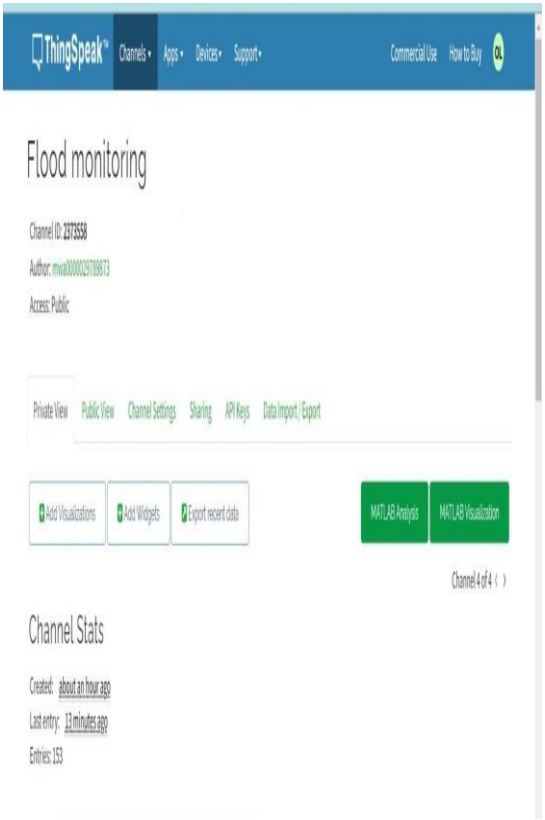
The chart can be customized, go to your **Private View** tab and click on the edit icon.

Demonstration

After inserting your network credentials, channel number and API key, upload the code to your board.

Open the Serial Monitor at a baud rate of 115200, and press the on-board RST button. After 30 seconds, it should connect to Wi-Fi and start publishing the readings to ThingSpeak. Go to your ThingSpeak account to the channel you've just created, and you'll see the temperature readings being published and plotted on the chart.

Now, you can get access to those readings from anywhere in the world by accessing your ThingSpeak account.



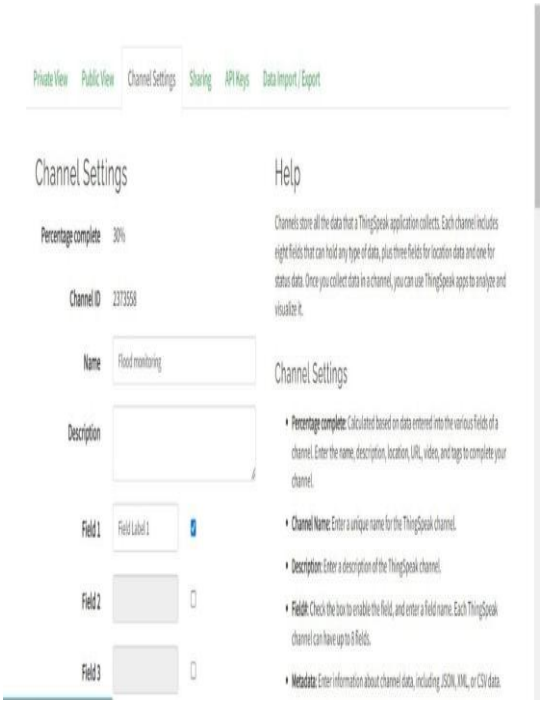
You can give a title to your chart, customize the background color, x and y axis, and much more.

Sending Multiple Fields (Temperature, Humidity, and Pressure)

In this section, you'll learn how to send multiple fields—this is sending more than one value at a time—we'll send temperature, humidity, and pressure readings.

Enable Multiple Fields – ThingSpeak

First, you need to create more fields in your ThingSpeak account. This is simple. You need to go to your **Channel Settings** and add as many fields as you want. In this case, we've added two more fields, one for the humidity and another for the pressure.



Now, if you go to the **Private View** tab, you should have three charts. Edit the newly created charts with a title and axis labels.

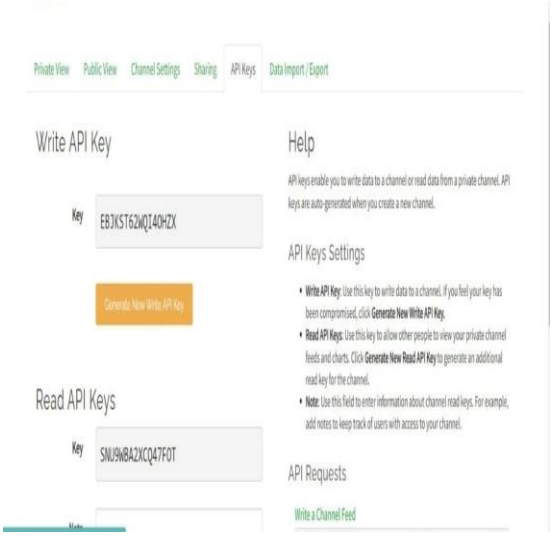
If you go to your ThingSpeak account, under **Private View**, you can see three charts with the sensor readings.

When you're done, press the "**Save**" button.

API Key

To send values from the ESP8266 to ThingSpeak, you need the Write API Key. Open the

"**API Keys**" tab and copy the Write API Key to a safe place because you'll need it in a moment.



Conclusion

This Paper highlights the possibility to provide an alert system that will overcome the risk of flood. As the pape is enabled with IOT technology and hence the sensor data can be monitored from anywhere in the world. More sensors can be integrated into the system in order to create more accurate and efficient flood detection system. It can also contribute to multiple government agencies or authority that ultimately help the society and mankind about the flood like hazardous natural disaster. It will monitor each and every aspect that can lead to flood. If the water level rises along with the speed, it will send an alert immediately. It also ensures increased accessibility in dealing and reverting to this catastrophic incident. In summary, it will help the community in taking quick decisions and planning against this disaster mankind about the flood like hazardous natural disaster.

Future scope

The Future scope of the project is, flood can also be related to the intensity of rainfall, which is the height of the water layer covering the ground in a period of time. Hence the development of a rainfall forecasting sensor eventually turn up to the early flood monitoring and detection, Scholarly studies are ongoing and can be implemented to our existing system in future.

References

[1]. S Vara Kumari, O Sailaja, N V S Rama Krishna, Ch Thrinisha Early Flood Monitoring System using IoT Applications.

[2]. Edward N. Udo1, Etebong B. Isong2 Flood Monitoring and Detection System using Wireless Sensor Network.

[3]. Sheikh Azid, Bibhya Sharma, Krishna Raghuwaiya, Abinendra Chand, Sumeet Prasad, A Jacquier Sms based flood monitoring and early warning system.

[4]. by Abimbola Atijosan, Ayodeji Olalekan Salau, Rahmon Ariyo Badru, Taofeek Alaga Development of low cost community based real time flood monitoring and early warning system [5]. by Jagadeesh Babu Mallisetty1 and Chandrasekhar IOT based real time flood monitoring and alert management system.

[6]. A.C.Khetre1, Prof.S.G.Hate2 Automatic monitoring & Reporting of water quality by using WSN Technology and different routing methods.

[7].https://lastminuteengineers.com/water-levelsensor-arduino-tutorial/

[8].https://store.arduino.cc/usa/arduino-uno-rev3

[9].https://www.maxbotix.com/articles/how-ultrasonic-sensors-work.htm

[10].https://www.elprocus.com/a-memoir-on-water-flow-sensor/