A Real Time Solution to Flood Monitoring System using IoT and Wireless Sensor Networks

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Abstract – *There are some places that are more prone to flooding than other placess, the implementation of flood alert systems near any major water area or body of water provides critical information that can protect property and save lives. Of course, the most effective flood warning methods are very costly and requires high maintenance and also requires highly qualified employee to operate it.*

Nowadays, there is no idea about when flood will occur so there is need to prewar people who are near the flooded area. Hence we are design this system to inform the people about the upcoming flood through notification and alert messages. For that purpose we are going to use some sensors which will helpful to give information about the flood. As well as we are going to give all safe places near the user location where user can migrate. Always we are using map for trace safe location. This system provides actual implementation to organizations, communities and individuals interested in establishing and operating flood monitoring and warning systems.

Key Words: Flood Monitoring, Node MCU ESP8266, Sensors, Android Application, Web Application

1. INTRODUCTION

To develop A Real Time Solution to Flood Monitoring Using IoT and Wireless Sensor Network, weproposed a flood warning system which requires attention to three basic factors: Data collection via gaging, data processing, and the hardware and software required, and the dissemination of flood warning information. While automated flood warning systems are often surprisingly inexpensive to implement, the primary factor determining cost for any such system is the number of gage site locations.[9]

Severe flooding affected Indian state of Kerala due to unusual high rain during monsoon season. It was the worst flooding in Kerala in nearly a century. In which over 373 people died within fortnight. Thirty-five out of 42 dams within the state open for the first time in history. Kerala received heavy monsoon rainfall on the midevening of August and resulting in dams filling to capacity in thefirst 24 hours of rainfall the state received 310 mm of rain.

2. LITERATURE REVIEW

Existing system refers to the system is to develop a local real-time river flood monitoring and warning system for the selected communities near river. This study focuses only on the detection and early warning alert system (via website and/or cell phone text messages) that alerts local subscribers of potential flood events.

For this project, we have referred some IEEE papers and what we have studied in these papers is shortly described as follows:

In this paper [10],[11],[12] proposed an IoT based water monitoring system that measure water level in real time. The prototype is based on idea that the level of water can be very important parameterwhen it comes to the flood occurrencesespecially in disaster prone area. A water level sensor is used to detect the desired parameter and if the water level reaches the parameter the signal will be freed in real time to social network like Twitter. A cloud server was configured as data repository. The measurement of water level are displayed in remote dashboard. The proposed solution with integrated sensory system that allows inner monitoring of water quality. Alerts and relevant data are transmitted over the internet to a cloud server and can be received by user terminal owned by consumer. The outcome of water measurement is displayed in web based remote dashboard.

In this paper [11], presents a neuro-fuzzy controller based on flood monitoring system using wireless sensor network. The distributed sensor nodes used IEEE 802.15.4 protocol, to collect sensor information such as water level data from the river. The Sensor information is send to distributed alerts center via Arduino microcontroller and Xbee Transceiver. At the distributed alert center, XBee transceiver and Raspberry pi microcomputer are used to generate flood alert based on sensor information and to detect flood data and this data are stored in database. This is not cost effective system. And performance also weak as compared to our system.

3. BASIC CONCEPTS/TECHNOLOGIES USED

3.1 Hardware module

In this project, some hardware is used that are Microcontroller, sensors, components required for power supply. The Hardware collects the water level, Pressure of water, Rainfall measure to detect the levels of the flood. The hardware consists of Wi-Fi enabled controller which connects to the server and allows to share the data to through internet.

1. **Microcontroller**- This does the controlling with processing .Microcontroller will take the information from the sensor .This information will sent to the admin through the database

2. **Sensors**-This will collect the information from the particular nodes which are located at certain site. There are four sensors we are going to use in this project. They are as follows:

Water level measurement: This sensor is used to measure the water level height. For that we are going to use **Ultrasonic sensor**which emits short, high frequency sound pulses at regular intervals. If they strike an object, then they are reflected back as **echo** signals to the sensors.

Rainfall measurement: This sensor is used to measure the average rainfall. For that we are going to use same ultrasonic sensor.**Ultrasonic sensor** is 4 pin sensor. Those are ground connection (GND), Trigger, echo and last current (VCC).

TemperatureandHumidity: This sensor is used to measure change in atmospheric temperature and humidity. For this we are using **DHT11** sensor which works on one wire protocol and gives digital output.

Pressure measurement: This sensor is used to determine the atmospheric pressure. For this we are going to use**BMP 180Barometric sensor**.

3. **Power Supply**- In real time we get 230v AC, in actual project we do not need this amount of power supply so we convert this AC power supply to DC power supply.

3.2 Software Module

In this module, we have done an android application as well as the Website application for this project. Admin web page will contain and display the information like Login, Registration, Number of users registered to the app, status of the sensor, safe places near flood affected area where people can migrate and that places are shown on the Map.

 The Android application will be used by the users who are register. After registration the user can login with aunique username and password. And then user can access all facilities provided by application. Application is provided

the information like current status of water level and temperature etc. This app contain map which are show the safe places near the user and also the current place where the user is.

3.3 Database Module

Microcontroller will send the values measured by the sensors to the server. This will contain the number of users registered to App; this will also show the safe places through the Map. The data uploaded on server is stored on the database. The stored data is then routed to the front end web applications and mobile application

4. PROPOSED SYSTEM

1. There will be a node as shown in above diagram.

2. This node is the independent flood monitoring node equipped with necessary sensors and connectivity modules.

3. It has three major stages, Including Sensors, Controller, Wi-Fi interface to upload the information on server.

4. Data from various sensors are collected by the ESP and is then computed and uploaded on the server.

 5. The data uploaded on server is stored on the database.

6. The stored data is then routed to the front end web applications and mobile applications.

Module Description

The overall system consists of 3 main stages –

1] Hardware nodes

2] Cloud Architecture

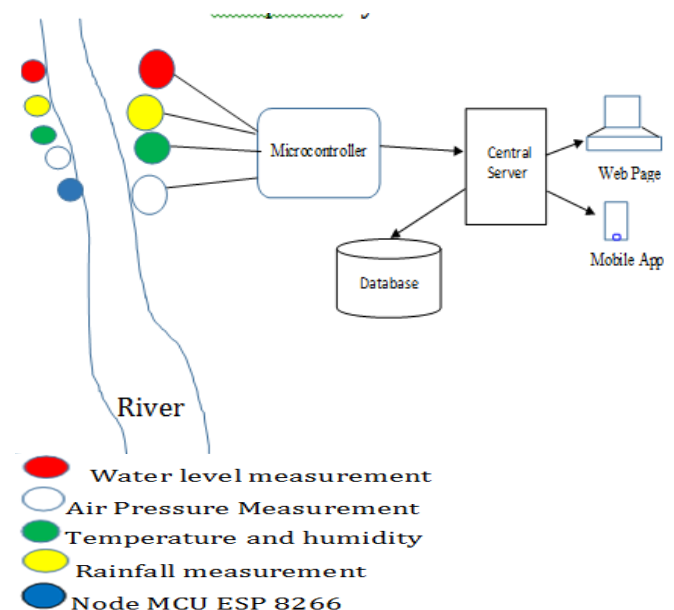3] Front end clients (mobile app)

Chart -1:Proposed System Architecture

The Hardware collects the water level, Pressure of water, Rainfall measure to detect the levels of the flood. The hardware consists of Wi-Fi enabled controller which connects to the server and allows to share the data to through internet .The architecture contains Server and database which handles the data coming from the devices and saves it in the database. The Front end apps will have http client to establish connection to device and backend. The app will collect the data from backend and represent it on the map. All these communication will be done over the internet though http protocol.

5. IMPLEMENTATION AND RESULTS
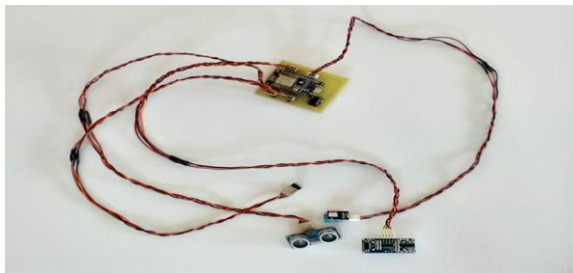
Fig: Hardware Implementation

Snapshot of website:
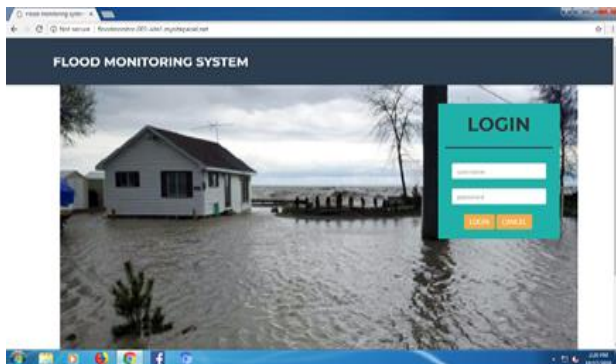
Website: Login page

Above snapshot is of the website login page (the first page of website) through which the admin can enter his username and password and have access to the facilities provided by the website.
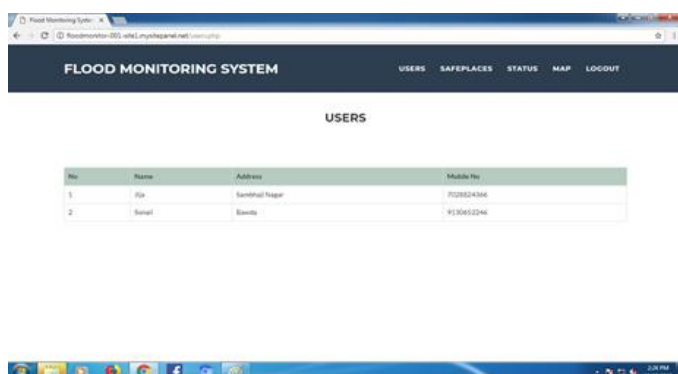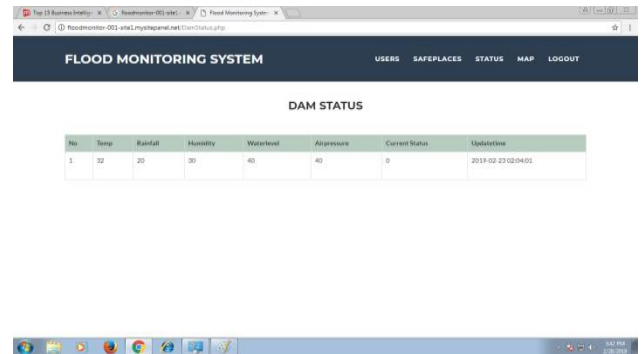

Website: Users

Above page shows the list of registered users to admin on website who have registered using the android application.
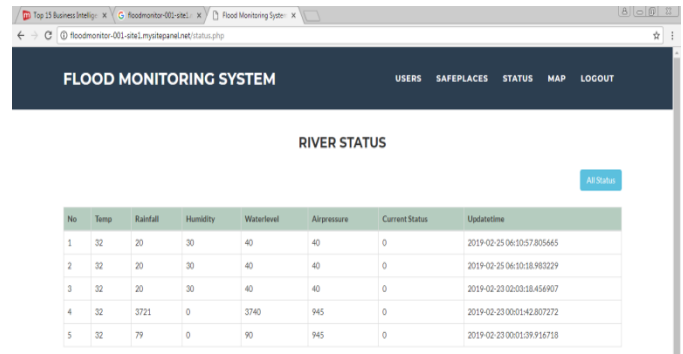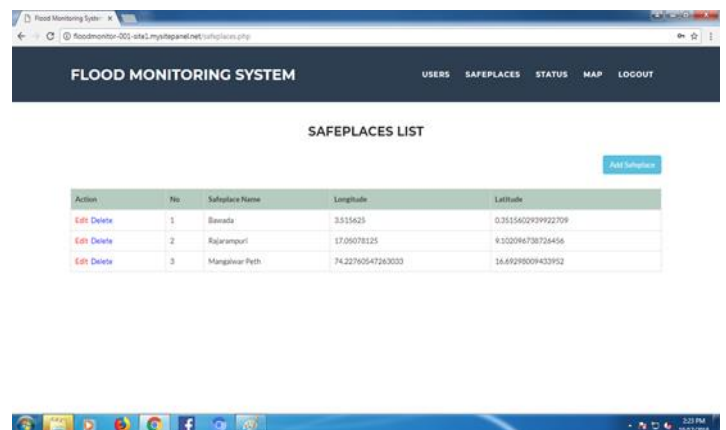

Website: River Status

Above page shows the current values detected by the sensors from river side, recent top 10 status updates are shown.
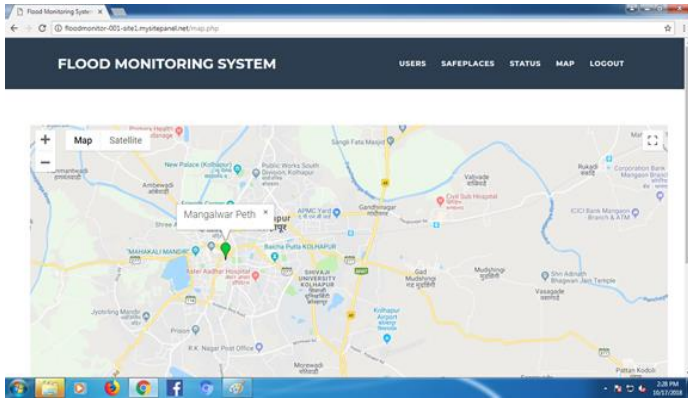

Website: Dam Status

Above page shows the current values at admin site detected by the sensors from dam side, recent top 10 status updates are shown.
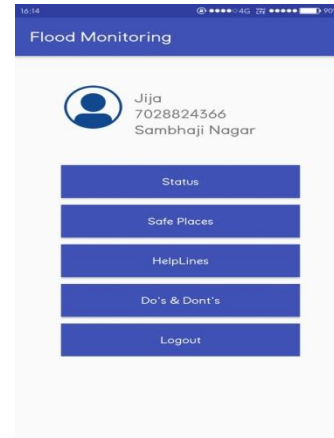

Website: Safe place List

Above page shows the safe places list where the people can migrate after the alert is received for migrating to a safe place. (Alert will be given after a threshold value is reached).
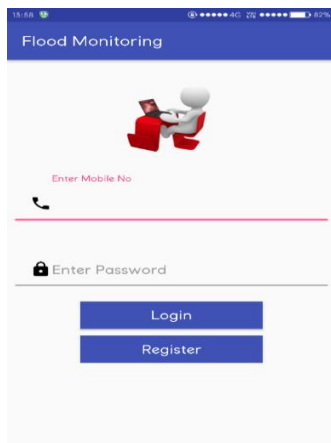
Website: Map

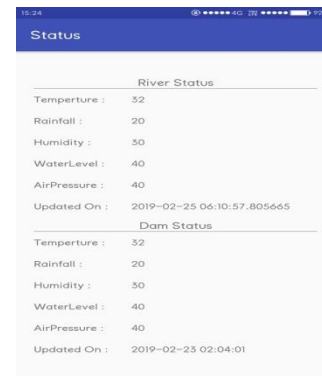Above page shows the map indicating the safe places.
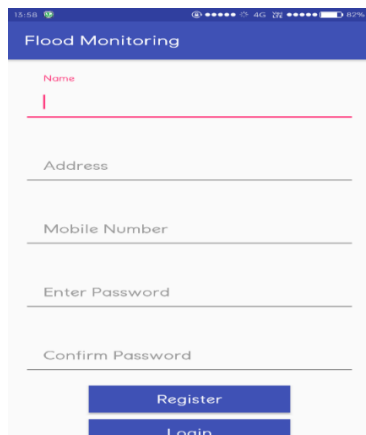
Snapshots of Android

Android: User Login

Above page is the login page of android application users who can login using their registered mobile numbers and password.

Android: Registration

Above page shows the registration page of android application where the users can register by entering their name, address, mobile number and password.

Android: Logged in page

Above page shows the application view after a registered user has logged in. We have provided five buttons which after pressing will direct the user to the status, safe places page helpline page,instructions page respectively. A third button is provided which is the logout button which the user will press when he/she wishes to leave the application.
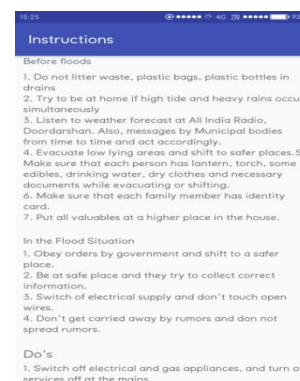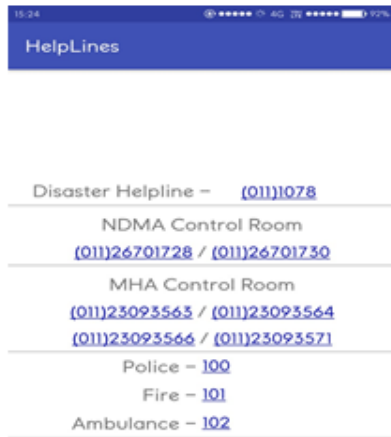

Android: Status Page

Above page shows the Android application view of the data that is detected by the sensors from both river and dam side. Most recent update will be shown to the user.
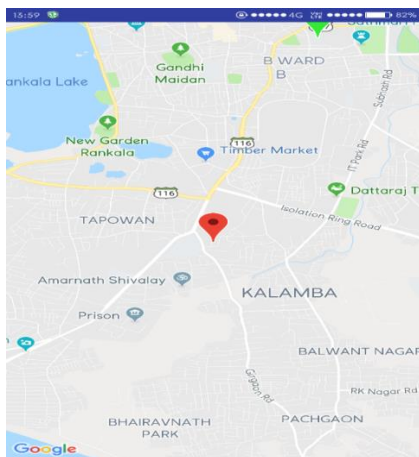

Android : Instructions

Above page shows the instruction for taking care during the floods.

Android : Helplines

Above page contains emergency helpline numbers. Through these numbers users can make call on those helpline number in emergancy by simply clicking on the number.

Android: Map

Above page shows the android application map view where the current location and safe location of the user is shown.

6. CONCLUSION

As India faced recent devastating flood in Kerala, there arise a need of efficient flood monitoring systems. Flood forecasting and the issuing of flood warnings are effective ways to reduce damage. The proposed system will be efficient because it has better coordination of monitoring, communication and transmission technologies which are adaptable to background condition. The proposed system also ensures increased accessibility for assessment of emergency situations and enhances effectiveness and efficiency in responding to catastrophic incidents. In summary, the proposed system would be beneficial to the community for decision making and evacuation planning purposes.

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