INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X
Impact factor: 4.295
(Volume3, Issue3)
Available online at www.ijariit.com

The Role of Satellite Zigbee Technology in Flood Monitoring and Communication System

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Abstract: ***India is facing a severe provocation with an increasing frequency of flood nowadays. It is pivotal to utilize the state of the art sensing and communication technologies to monitor and detect the flood occurrences. In this paper, various weather monitoring techniques have been reviewed. The system displays these readings in real time on a display. It also keeps track of historical information on an hourly and daily basis. The historical data can be pulled up on the display at the request of the user. Various techniques are used to monitor the weather like satellites, radars, microcontrollers, wireless sensor network and many other simple instruments. Weather can also be monitored by using remote wireless sensors. In this system we use ZigBee technology. ZigBee is the latest wireless weather monitoring techniques.***

The vital role of the designed satellite ZigBee technology in flood monitoring and communication system is based on Mobile App. This Mobile App is used to communicate with the people during flood times and is to continuously monitor, detect and report the environmental status to a control unit using water level sensor, satellite ZigBee and the readings are displayed in it. The main objective of this project is to rescue the people who are present in flood areas by sending and receiving the messages using this Mobile App. This system was developed using Embedded C language with the help of Proteus software. The developed system gives a timely alert of flood occurrences. The proposed system can be beneficial to the neighborhood and act as a precautionary action to save lives and properties of the people in the case of flood times.

Keyword: Flood Monitoring System, ZigBee RFM 75, Mobile App, OTG cable, Water level sensor, Microcontroller, LCD, UART.

I. INTRODUCTION

This system can be seen that there is a considerable scope for the improvement in such scenarios by shifting the prediction model of flood monitoring to the ZigBee wireless techniques. The whole system is low power and low cost effective as the sensors are able to adjust their power consumption according to dry and rainy days.

This project demonstrates the system that it can be able to communicate with the people during flood times using Mobile App and to rescue them. It will not rely on any network coverage support. This Mobile App is used to send and receives the messages between the devices and is implemented with low cost, low power and highly reliable.

II. SYSTEM ANALYSIS

A. Existing System

In the Existing system, we are not using any App and dependent on network coverage support for flood monitoring system. This flood monitoring system is able to read the water level every second, displaying it to a supervisor and alert the affected populace and relevant authorities by means of a Short Message Service (SMS). When the level of water surpasses a user defined threshold, Global System for Mobile Communication (GSM) network has been used for sending the mobile messages to rescue the people.

Drawbacks

Global System for Mobile Communication (GSM) network has been used means the network problem arises if the signals are not reachable. So we can't able to monitor the weather condition continuously and can't able to read the water level at every second during the flood. Because of this problem, we can't able to rescue the people in time. Therefore there exists the high level of damage to properties and loss of lives.

B. Proposed System

In the proposed system, even when there is no network coverage, this project helps us to communicate with the people using Mobile App. Here, we use a satellite ZigBee communication protocol to communicate between the two mobiles. This App is used to send and receive the messages between the devices. This Mobile App is implemented with low cost and low power. OTG cable is used to connect the mobile and ZigBee. The water level is monitored for flood detection using water level sensor. This system helps us to save the lives and properties of people.

Advantages

The main advantage of this project is able to communicate with the people using Mobile App without the network. This system is designed with a simple, low-cost, small-size, easily configurable, scalable, efficient, low power, highly reliable and low data rate application of ZigBee technology for flood monitoring system.

III. SYSTEM DESIGN AND IMPLEMENTATION

The flood monitoring system uses a satellite ZigBee RFM75 which is the only standard-based technology designed to address the unique needs of low-cost, low-power wireless and control networks. The ZigBee modules end the information, it receives from the device to the microcontroller for processing. The microcontroller can also send packets received from the sensors to the ZigBee module so that it can be radiated and received by other devices.

The system consists of three modules. The three modules are sensor field, microcontroller, and mobile phone modules. The sensor field module comprises of sensors for sensing and communicating parameters values. Mobile phone module represents the occupants of the flood prone region who will receive the alert via the SMS using Mobile App. The microcontroller is used to interface the modules and also used to read in the input from the sensor and then display the result.

We design flood monitoring system using water level as monitored variables for flood detection. A number of rainfall values are used to predict the water level. The water level will determine the extent of the flood as low or high. This will enhance early flood detection. The flood status is sent directly to the occupants of the flood prone region directly from the Mobile App. We designed a disaster and alert system using Mobile App to send and receive weather information and disaster alerts by a ZigBee module.

A. Flow diagram of the System

The fig.1 shows how the system reads the water level through the water level sensing device and by converting the analog signal into digital it calculates the height if the height is greater than the threshold defined by the designer. Then the system sends the SMS by using Mobile App to the concerned authorities regarding the rise in the water level. The system further keeps on checking the level of the water and provides an efficient notification system.

The fig.2 describes that how the Mobile App is paired with the ZigBee RFM 75. The ZigBee RFM 75 is interfaced with OTG cable and the same is connected to the mobile. If the devices are paired, then the data is communicated with the other devices.

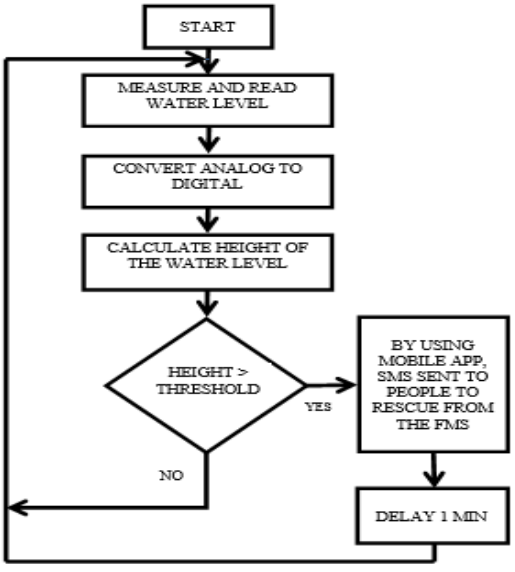

Fig.1 Flow diagram

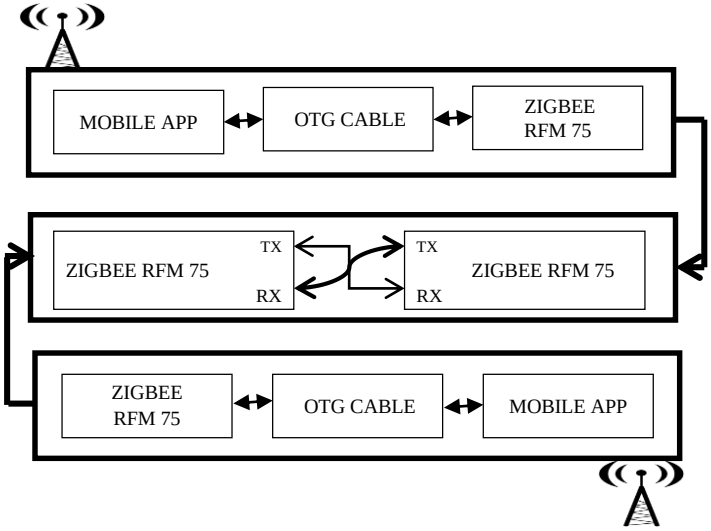

Fig. 2 Block diagram of ZigBee module

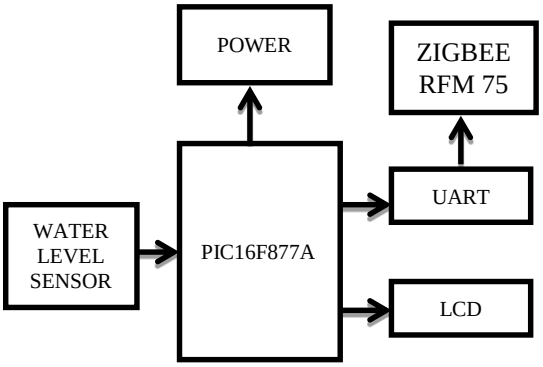

Fig. 3 Block diagram of water level sensor

B. Hardware Description

OTG Cable: On-The-Go (OTG) is a USB specification that allows USB devices to connect each other. USB OTG products can communicate with each other without the need to be connected to a computer.

ZIGBEE RFM75: RFM75 data modem working at 2.4 GHz frequency in half duplex mode with automatic switching of receive/transmit mode with LED indication. Receives and Transmits serial data of adjustable baud rate of 9600/4800/38400/19200 bps at an RS232 level for direct interfacing to PC USB port or such devices.

PIC16F877A Microcontroller: PIC stands for Peripheral Interface Controller given by microchip technology. PIC microcontroller 16F877A, which is a flash microcontroller and it has got a serial data transfer support. In this microcontroller two nos. of 8 bit bi-directional I/O lines and one 6 bit bi-directional I/O lines are available.

UART: A universal asynchronous receiver/transmitter is a computer hardware device for asynchronous serial communication in which the data format and transmission speeds are configurable. In this Project, it is used to transmit the messages between the devices.

LCD: A Liquid-Crystal Display (LCD) is a flat-panel display or other electronic visual display that uses the light modulating properties of liquid crystals. In this project, it is used to indicate the water level.

C. Software Description

PROTEUS: ISIS AND SIMULATION

ISIS provides the development environment for PROTEUS VSM, our revolutionary interactive system level simulator. This product combines mixed-mode circuit simulation, microprocessor models and interactive component models to allow the simulation of complete micro-controller based designs.

ISIS provides the means to enter the design in the first place, the architecture for real-time interactive simulation and a system for managing the source and object code associated with each project. In addition, a number of graph objects can be placed on the schematic to enable conventional time, frequency and swept variable simulation to be performed.

Major features of PROTEUS VSM include

- Truly mixed mode simulation based on Berkeley SPICE3F5 with extensions for digital simulation and truly mixed mode operation.
- Support for both interactive and graph based simulation.
- CPU models available for popular microcontrollers such as the PIC and 8051 series.
- Interactive peripheral models include LED and LCD displays, a universal matrix keypad, an RS232 terminal and a whole library of switches, pots, lamps, LEDs etc.
- Virtual Instruments include voltmeters, ammeters, a dual be an oscilloscope and a 24 channel logic analyzer.
- On-screen graphing-the graphs are placed directly on the schematic just like any other object. Graphs can be maximized to a full screen mode for cursor based measurement and so forth.
- Graph based analysis types include transient, frequency, noise, distortion, AC and DC sweeps and Fourier transform. An audio graph allows play back of simulated waveforms.
- Direct support for analogue component models in SPICE format.
- Open architecture for 'plug-in' component models coded in C++ or other languages. These can be electrical, graphical or a combination of the two.
- Digital simulator includes a BASIC-like programming language for modelling and test vector generation.
- A design created for simulation canal so be used to generate a net list for creating a PCB –there is no need to enter the design a second time.

D. Designing A Mobile App

FREE USB SERIAL TERM

1. Smartphones serial terminal program.
2. USB equipment using silicon laboratories CP210X, FTDI FT232 and prolific PL2303, CDC/ACM UART to USB bridge chips can be used to connect to your smartphone.
3. ZigBee chip TI CC2531 (USB-enabled SOC solution for 2.4-GHz IEEE 802.15.4 and ZigBee App) can be used also.
4. Provides the same functionality and the PC for the serial communication terminal.

Peripheral features

Supported Peripherals	Features
UART to USB bridge chip	Silicon Laboratories (CP210X), FTDI (FT232), prolific (PL2303).
ARDUINO	FTDI (CDC/ACM).
Smart phones	Specially Samsung galaxy2/ galaxy3/galaxy note/galaxy note2/ Galaxy On 7/ Vega Racer R3/and all smart phones.
Android version	Android version 3.1 to 6.0.1.

IV. RESULT

The corresponding window appears displaying "FLOOD MONITORING SYSTEM" on the LCD as shown below:

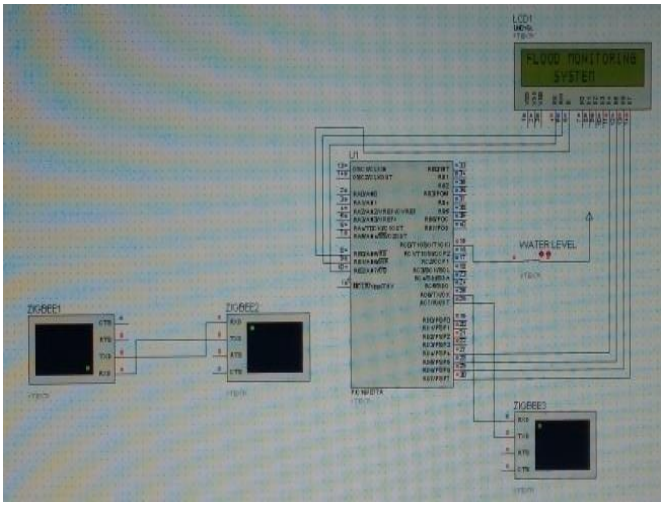

Fig. 4 Display of flood monitoring system

The indication of water level is displayed on the LCD as well as on the user mobile. Here the user mobile is a virtual terminal – ZigBee Module 3 as shown below

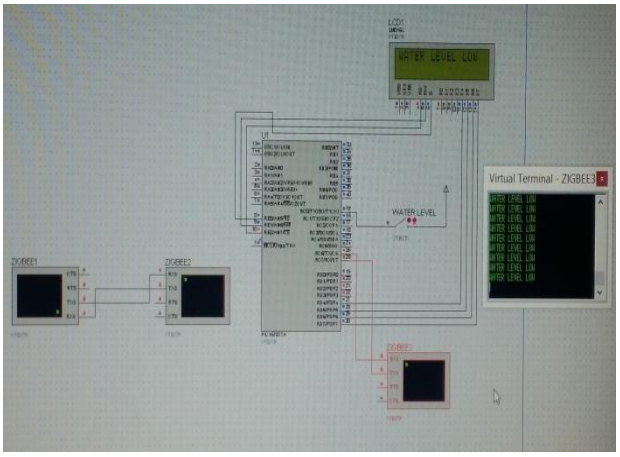

Fig. 5 Display of low-level water indication in LCD and user module

The indication of water level is displayed as "WATER LEVEL HIGH" on the LCD and as well as on the user mobile as shown below

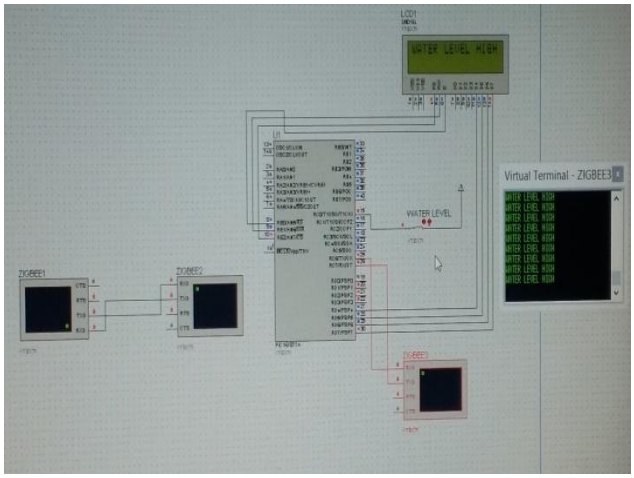

Fig. 6 Display of high-level water indication in LCD and user module

Once the water level is "HIGH" the full duplex communication is made available between the devices.

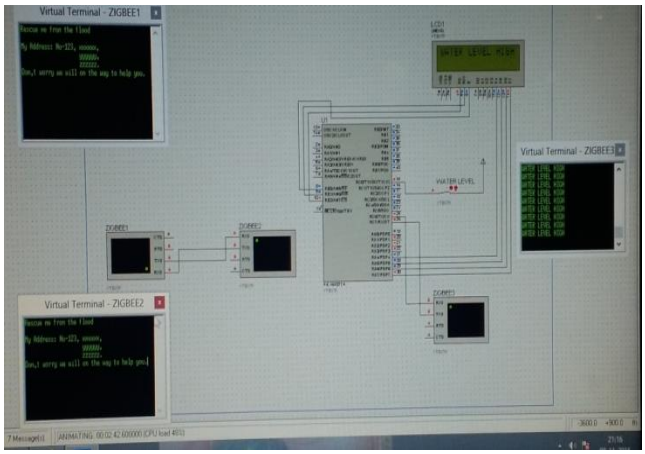

Fig. 7 Display of communication mode between the devices

In order to simulate the required result a Mobile App is needed.

Fig. 8. Appearance of transmitter and receiver screen

One must ensure that ASCII character must be ticked in order to transmit or receive a message or information.

In order to transmit information, the field below the TX must be used to write a message and click on the arrow button beside it to send.

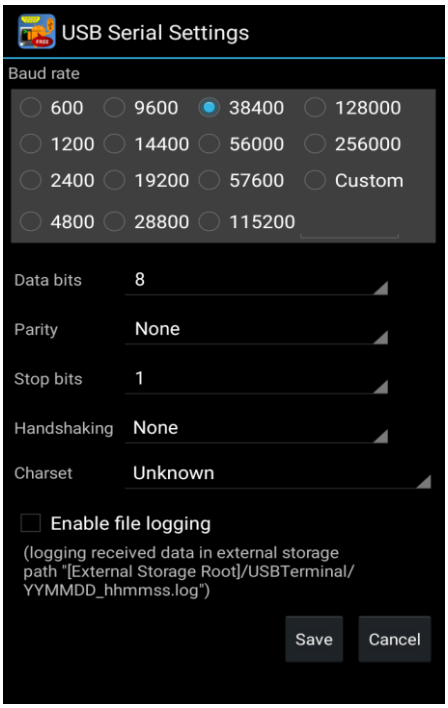

Fig. 9. Appearance of USB serial settings

The above-required parameters must be set as default and save the settings.

The hardware implementation of outputs is shown below

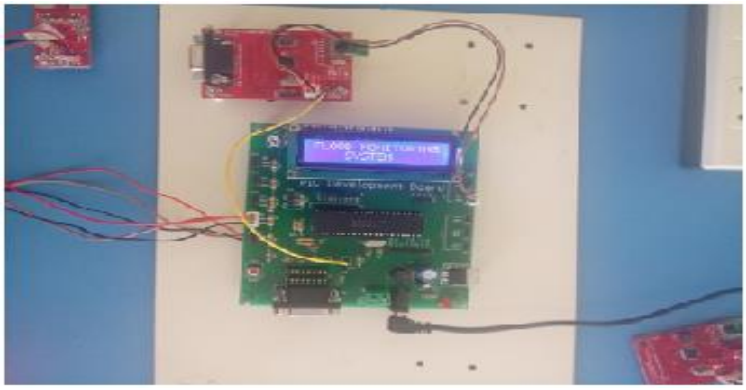

Fig. 10. Implementation of flood monitoring system

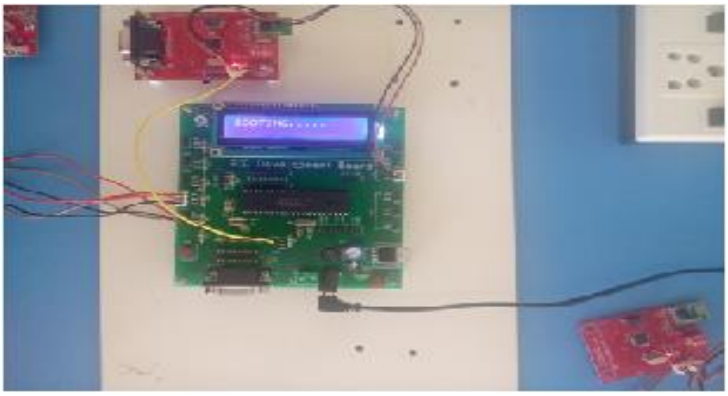

Fig. 11. Processing of the system

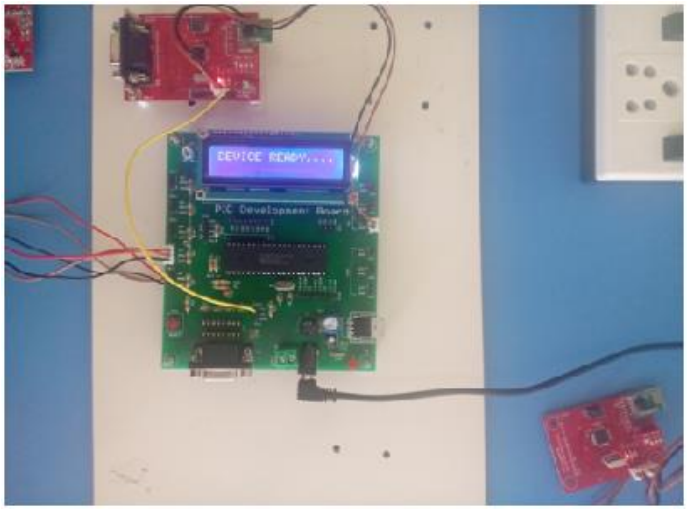

Fig. 12. Readiness of the system

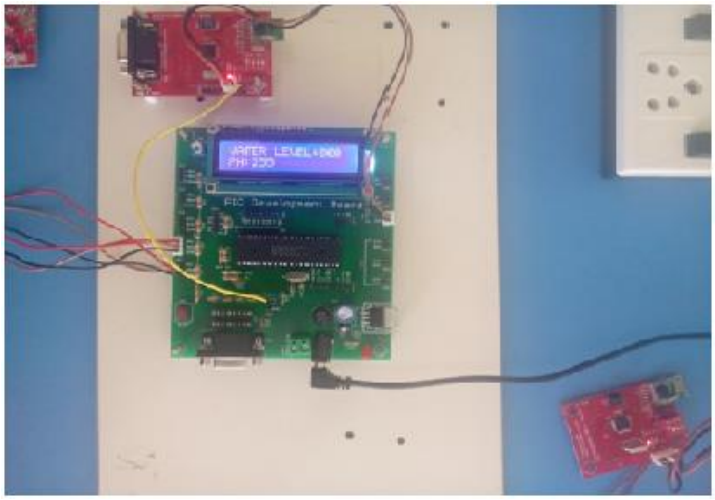

Fig. 13. Detection of water level at the initial stage

Fig. 14. Status of connection between the devices

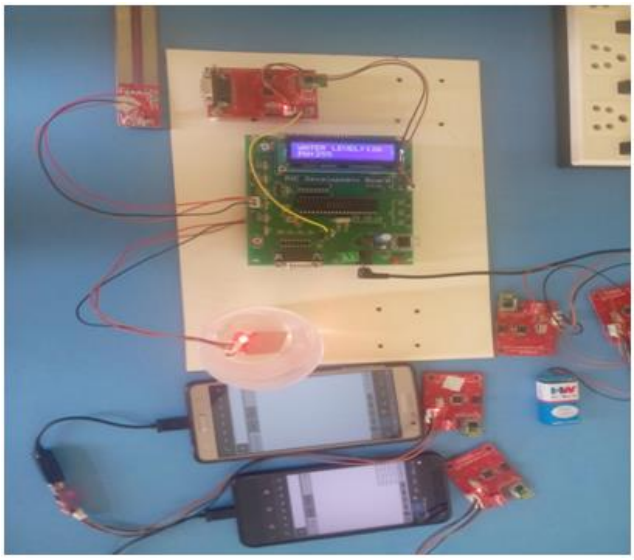

Fig. 15. Sensing the increasing of water level

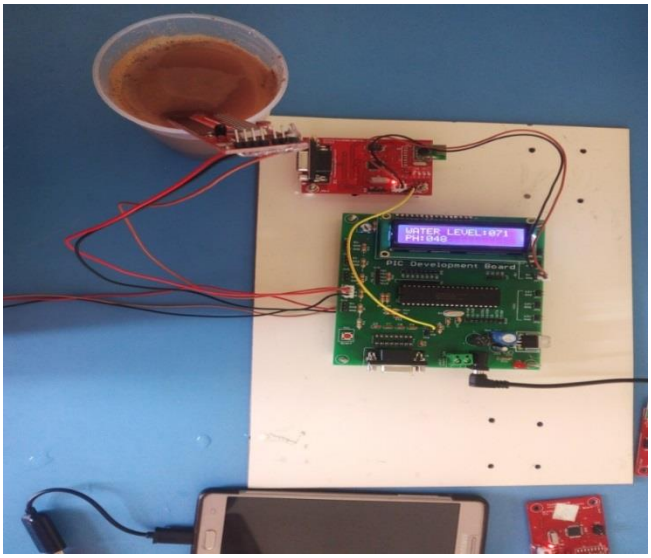

Fig. 16. Determination of pH level

V. CONCLUSION

Floods are responsible for the loss of precious lives and destruction of large amounts of property. Chennai has experienced severe flood situation recently. A lot of effort is required to be put in developing systems which help to minimize the damage through early disaster predictions. This project shows a simple, cost effective, efficient and rapid way of flood monitoring and control using ZigBee. ZigBee plays an important role in the field of communication and also helps to increase the communication distance between the devices. Also, a messenger service can be created by which the people can get messages from the devices which use this Mobile App regarding flood.A complete flood monitoring system has been proposed in this project, the system uses the sensors to monitor the weather condition, water level, flow and rainfall in the region which is prone to flood. The proposed monitoring system presents useful characteristics such as large network capacity, sensor hardware compatibility, long-range communication, and minor impact on the natural calamities. This developed system gives a timely alert of flood occurrences and helps to rescue them.

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