Autonomous Flood Alerting System

Anusha N
Dept. of Electronics and Communication Engineering
GSSSIETW, Mysuru, Karnataka

D Meghana
Dept. of Electronics and Communication Engineering
GSSSIETW, Mysuru, Karnataka

Apoorva K
Dept. of Electronics and Communication Engineering
GSSSIETW, Mysuru, Karnataka

Nisarga H P
Dept. of Electronics and Communication Engineering
GSSSIETW, Mysuru, Karnataka

Dr. Rajendra R Patil
Professor and Head
Dept. of Electronics and Communication Engineering
GSSSIETW, Mysuru, Karnataka

Priyanka P
Assistant Professor
Dept. of Electronics and Communication Engineering
GSSSIETW, Mysuru, Karnataka

***Abstract*—The autonomous flood alerting system we have designed, works in real time to alert the people, so that they can be proactive during the floods, which may save many lives and property. This alerting system we are providing has various alerting mechanisms and LoRa module for communication.**

I. INTRODUCTION

We are implementing this project to save the people from danger caused due to flood which causes huge distraction of the property every year. In this project, we are designing an early flood warning system, which consists of a field unit which is placed along the riverbanks. This field unit consists of various sensors which continuously keep monitoring the data and this data will be sent to the Wi-Fi node which is connected with LoRa. Once the data is received, it will be sent to Blynk server, based on which the decision will be taken and the respective alert will be given to people.

The alerting system that we are providing has various alerting mechanisms such as visual alerts like strobe lights, audible alerts like hooter and alerts through social websites such as Twitter, E-mail and notification alerts to the registered mobile numbers. This autonomous flood alerting system works in real time, so that people can take decisions priorly, and the

Government can help evacuate the people to the safe places, thus saving many lives and properties. At the time when the flood reaches the critical condition, the hooter starts alarming, thus posting the information in social websites and also providing alerts through notifications(SMS text messages) to the registered mobile numbers.

II. CONTRIBUTIONS AND RELATED WORKS.

The related works that we have referred to develop the prototype are as follows.

Pickering P has proposed an architecture that has D-LINK Dir-600,three LED's having red, yellow and green lights which says top level of the container, acceptable level and safe level respectively[1].

Hernandez Nolasco, J A Ovando, M A Acosta, F D Pancardo have proposed the architecture that senses the variations of water level by means of ultrasonic sensor Parallax PING.The ultrasound bursts emitted bysensor bounce off the water which says the level of the water , which can be published in Facebook and social medias[2].

Wister M A, Hernandez Nolasco J A Pancardo, Acosta F D Jara made a proposal oriented to the security area since this architecture is based on PIR sensor, to detect the presence of an individual or any visitor to alert them regarding the floods[3].

NasimuzzamannChowdhary, M ShibleeNooman, M Sarkar proposed a monitoring system focused on floods is exposed, since sensor networks are used topographically distributed along a body of water, we can see the potential of the LoRa communication protocol, it was concluded that environment may affect or benefit the data transfer,depending on the characteristics of the place and in its results it states that it did not obtain a data transfer at distances greater than 1600 m[4,5].

Sakib S N, Ane T Matin N and Kaiser M Shave presented a development that integrates LoRacommunication and the objective of this is to design an architecture for the control and monitoring of the water flow and water level[6].

As early warning system with computer tools and simulations can be performed, they acquire and process the data through simulations in real time. The acquisition and monitoring of data in real time is performed by the SCADA system, that visualize, control and collect the data on the process that is being carried out[7].

Monagas, and M G Sistema mentioned the interest of testing the communication protocols due to the fact that is being very attractive for companies, which are very favorable in terms of transmission ranges. Interactive environments can be developed on the free hardware plates, such as viewing the captured data , which can be observed by means of electronic devices thathas rangeofcoverage[8].

Neumann P, Montavont J and Noel J have proposed theZigBee communication protocol can be implemented since it has a range of 1 km distance for each node. This architecture

presents network of sensors communicated to a sever which transmits the data to devices that are in the range of coverage[9].

In the system alert to measure the water level , they haveexposed how to measure the water level in ponds , in such a way that it gives us the perception of measuring from an instrument ,In this case, they have used ultrasonic meter. Its technology proposal is made up of a remote unit installed at the site of interest and the local unit with the nearby laboratory, both developed with the BS2p microcontroller[10].

Ibrahim M. Elgamri, A Babiker, S Mohamed A have shown that Raspberry pi is very versatile, its environmental monitoring proposal measures how can clean the air is, variables of the environment such as temperature, humidity and luminosity , and also flood alerts is shown[11].

Based on the remote sensing and on wireless sensor networks for getting the data about the environment , employing UDP based on Wi-Fi communication, Bluetooth and HTTP. Use of IoT provides a virtual view via the internet protocol and WSN to access the status of the location of any object, use of WSN could not cover wide area in certain conditions[12,13]. The wireless sensor module, (IEEE802 15.4/Zigbee), Arduino microcontroller with ethernet or wi-fi network. Instant alert message will be received in phone via text or Gmail and can view weather forecast for that location[14]. The last contribution , has AT MEGA 2560,GSM module, microcontroller. The concept of portable sensor utilizes the fixed point of dam monitoring instead of focusing on flood hotspot area[15].

III. THEORY

The rain gauge sensor reads the data in real time along with the water level sensor, and this data will be sent to the server, where the reference values for each sensor will be fixed previously. Once the sensors crosses the reference level, the alerts will be given through various alternatives.

A set of components that can be used to measure the water level comprises of the data collection module, the client system and the server system.

In the data collection module, the first step would be to use a sensing device which can supply the information about the water level.

When the client system is placed the flood alert system, it requests for the connection with the server and starts sending sensor reading to it. The components used in the client system include a microcontroller unit(MCU),and the data collected by the sensors is sent to the server over the internet. The server system reads data from the client and then stores it in its database, that can be used for future reference.

The field units which are kept along the river banks sense the data in real time ad all the data that we get in real time is converted to a string format called socket and this socket contains the field unit ID, IP address, Port number, water level sensor value, rain gauge sensor value, and this format of values are sent to the server from client side.

If the sensor values are below the reference level, then green colored strobe light will glow at the field units indicating that there is no flooding at that particular field unit.

If the sensor values are above and near the medium level, the yellow colored strobe light will glow, indicating that the flood is arriving, and is in the moderate level.

When the flood level reaches the maximum condition, then the red colored strobe light will glow and the hooter will make sound, indicating high level flooding.

Apart from the water level sensor and rain gauge sensor, an ultrasonic sensor may be used to measure the distance of a target object as shown in the figure on the left.

LoRa-based devices allow different radio communication parameters to be configured, thus allowing several data rates and sensitivity levels to be chosen on the specific application requirements.

On the other hand, hooter is used to give alerts to the localities and is also used in many alerting places. Strobe lights are used to give the visual alerts to the people. Hooter and strobe lights will be ON once the sensor level reaches the critical.

In an autonomous flood alerting system, the sensors continuously senses the data and stores in the database and to detect flood, we are mainly considering the water level sensor and the rain gauge sensor. The field units will be kept along the river banks wherever the villages are located, and each field unit keeps sensing the data, which will be sent to the server. Upon sending the data to the server, alerts will be provided through various methods.

IV. SYSTEM DESIGN

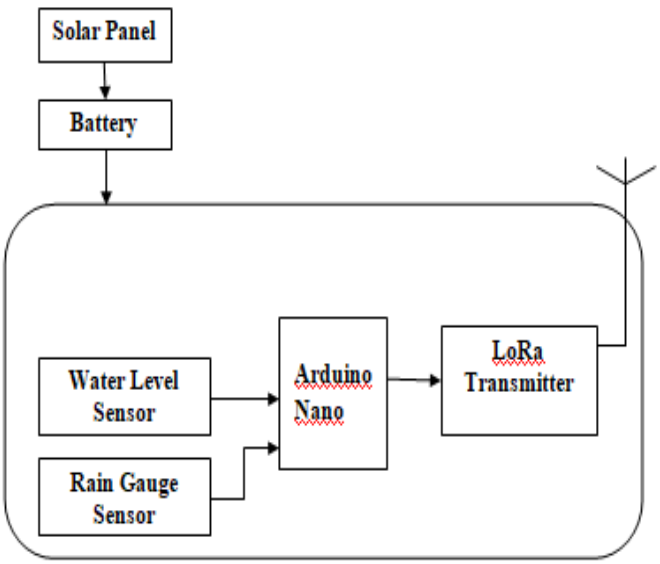

Fig 1: Block diagram of Transmiiter

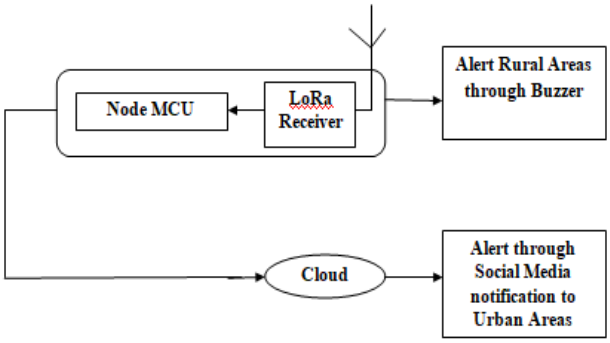

Fig 2: Block diagram of Receiver

The block diagram of transmitter and collector of the framework is appeared in figure1 and figure2. The fundamental piece of the venture is LoRa gadget. It is a long range , low force remote stage which gathers the information from the sensors through arduinonano and afterward it sends the information to the LoRa beneficiary which is interface with hub MCU. The got information in hub MCU is then send to cloud and alarm the individuals through Social Media. The provincial individuals are alarmed through drove's and signals.

This venture fundamentally manages cautioning the individuals whoever remains close to riverbanks or coastline through visual alerts(strobe alerts),audio alerts(hooters, ringers). Alarming the individuals in provincial zones through LoRa innovation and cautioning the individuals of urban regions through internet based life.

V. MEASUREMENT OF PARAMETERS

A. Water Level Sensor

The water level sensor has a progression of equal follows to gauge the volume of water so as to decide the water level. The yield of water level is simple sign. This yield simple qualities can be legitimately perused by means of ADC and can likewise be associated straightforwardly Arduino's simple info pins is appeared in figure3.

Fig 3: Water level sensor

Determinations of Water Level Depth Detection Sensor Module:-

- Working Voltage : DC 3-5V
- Working Current : <20mA
- Detection Area : 40 mm x 16 mm
- Size : 65 mm x 20 mm x 8 mm
- Humidity: 10% - 90% non-gathering

B. Rain Sensor

Raindrop Sensor is an apparatus utilized for detecting precipitation. It comprises of two modules, a downpour board that distinguishes the downpour and a control module, which thinks about the simple worth, and changes over it to a computerized esteem. The raindrop sensors can be utilized in the car part to control the windshield wipers consequently, in the farming division to detect downpour and it is additionally utilized in home computerization frameworks is appeared in figure4.

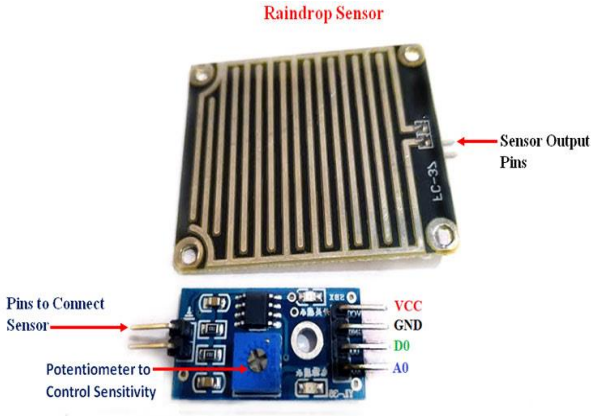

Fig 4: Rain drop sensor module

TABLE I. PIN CONFIGURATION OF RAIN SENSOR:

Sl .No:	*Name*	*Function*
1	VCC	Connects flexibly voltage-5V
2	GND	Connected to ground
3	D0	Digital pin to get computerized yield
4	A0	Analog pin to get simple yield

C. Solar Charge Controller

Fig 5: Solar charge controller

The above figure5 shows the sun powered charge controller gadget. Its component is as per the following:

- It works at 12V.
- Max. PV Charging Current = 5A; Max. Burden Current = 5A.
- Is Relay based.
- Battery High Cut-Off = 14.4V; Battery Low Cut-Off = 10.8V.

D. Solar Panel 12 Volt 5 Watt

It can yield 5 Watt of intensity at 12 Volts under perfect light conditions. It is 29 cm x 18.5 cm x 1.7 cm in size. Can be utilized in ease sun based tasks. You can interface two such sunlight based board in corresponding to get progressively current and you can associate them is arrangement for getting more yield voltage is as appeared in figure5.

Fig 6: Solar panel

E. Lead Acid Battery

This is a battery-powered 12volt 1.2AH Sealed Lead Acid Battery Our Power-Sonic or Equivalent valve managed fixed lead corrosive batteries are without support, simple to deal with, tough and efficient. It has a quality of high release rate, wide working temperature, long assistance life and profound release recoup. This item has Absorbent Glass Mat (AGM) innovation for prevalent execution. This item is valve directed and spill confirmation development permits safe activity in any position and the force/volume proportion yields unmatched vitality thickness. This item is endorsed for transport via air.

F. ESP-12E Module

The improvement load up prepares the ESP-12E module containing ESP8266 chip having TensilicaXtensa® 32-piece LX106 RISC microchip which works at 80 to 160 MHz customizable clock recurrence and supports RTOS.

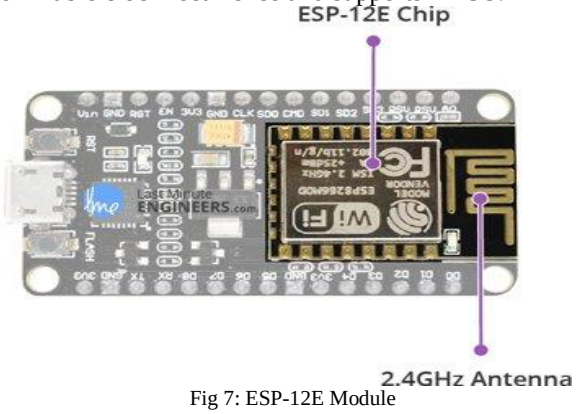

Fig 7: ESP-12E Module

There's likewise 128 KB RAM and 4MB of Flash memory (for program and information stockpiling) sufficiently only to adapt to the enormous strings that make up pages, JSON/XML information, and all that we toss at IoT gadgets these days. The ESP8266 Integrates 802.11b/g/n HT40 Wi-Fi handset, so it can not just interface with a WiFi organize and cooperate with the Internet, however it can likewise set up its very own system, permitting different gadgets to associate straightforwardly to it. This makes the ESP8266 NodeMCU much increasingly adaptable.

G. Power Requirement

As the working voltage scope of ESP8266 is 3V to 3.6V, the board accompanies a LDO voltage controller to keep the voltage consistent at 3.3V. It can dependably gracefully up to 600mA, which ought to be all that could possibly be needed when ESP8266 pulls as much as 80mA during RF transmissions. The yield of the controller is likewise broken out to one of the sides of the board and marked as 3V3.This pin can be utilized to gracefully capacity to outside parts.

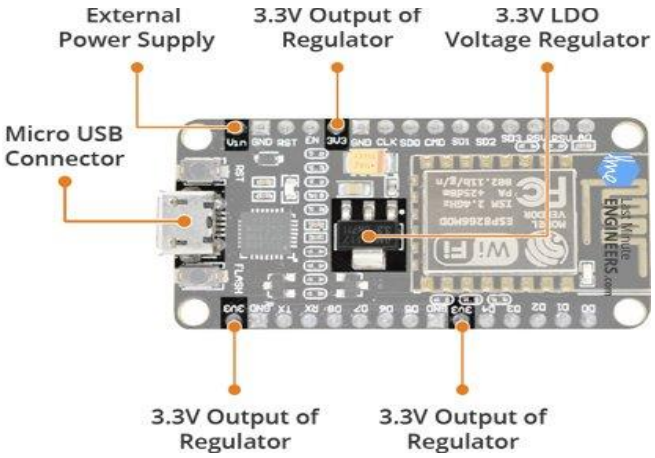

Fig 8: Power requirements

Its working Voltage is 2.5V to 3.6V,On-board 3.3V 600mA regulator,80mA Operating Current and 20 µA during Sleep Mode. Capacity to the ESP8266 NodeMCU is provided by means of the on-board MicroB USB connector. On the other hand, on the off chance that you have a managed 5V voltage source, the VIN pin can be utilized to straightforwardly flexibly the ESP8266 and its peripherals.

H. Peripherals and I/O

The ESP8266 NodeMCU has all out 17 GPIO pins broken out to the pin headers on the two sides of the advancement board. These pins can be relegated to a wide range of fringe obligations, including ADC channel and UART interface.Multiplexed I/Os are pin1 ADC channels, pin2 UART interface and pin4 PWM yields.

I. ESP8266 NodeMCU Pinout:

The ESP8266 NodeMCU has all out 30 pins that interface it to the outside world. The associations are appeared in figure8.

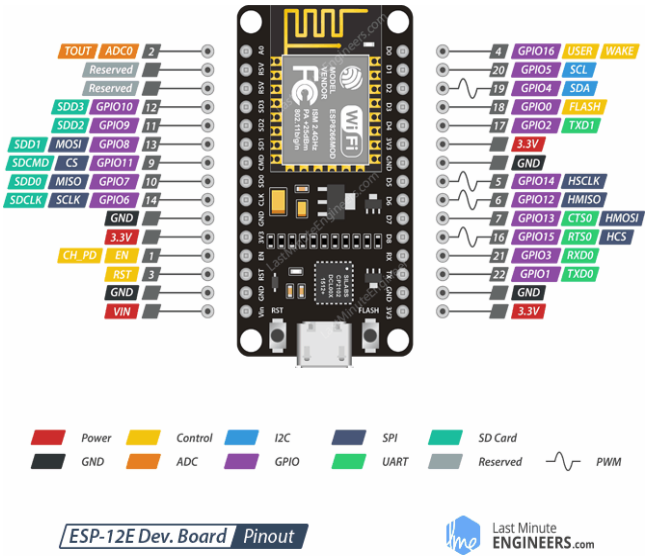

Fig 8: NodeMCU Pinout

- I2C Pins are utilized to connect a wide range of I2C sensors and peripherals in your undertaking. Both I2C Master and I2C Slave are bolstered. I2C interface usefulness can be acknowledged automatically, and the clock recurrence is 100 kHz at a greatest. It ought to be noticed that I2C clock recurrence ought to be higher than the slowest clock recurrence of the slave gadget.
- GPIO Pins ESP8266 NodeMCU has 17 GPIO pins which can be alloted to different capacities, for example, I2C, I2S, UART, PWM, IR Remote Control, LED Light and Button automatically. Each computerized empowered GPIO can be arranged to inside draw up or pull-down, or set to high impedance. At the point when arranged as an information, it can likewise be set to edge-trigger or level-trigger to create CPU interferes.
- ADC Channel The NodeMCU is installed with a 10-piece exactness SAR ADC. The two capacities can be executed utilizing ADC viz. Testing power gracefully voltage of VDD3P3 pin and testing input voltage of TOUT pin. Be that as it may, they can't be actualized simultaneously.
- UART Pins ESP8266 NodeMCU has 2 UART interfaces, for example UART0 and UART1, which give nonconcurrent correspondence (RS232 and RS485), and can convey at up to 4.5 Mbps. UART0 (TXD0, RXD0, RST0 and CTS0 pins) can be utilized for correspondence. It underpins liquid control. Be that as it may, UART1 (TXD1 pin) includes just information transmit signal in this way, it is generally utilized for printing log.
- SPI Pins ESP8266 highlights two SPIs (SPI and HSPI) in slave and ace modes. These SPIs likewise bolster the accompanying universally useful SPI highlights:
    1. 4 timing modes of the SPI format transfer
    2. Up to 80 MHz and the divided clocks of 80 MHz
    3. Up to 64-Byte FIFO
- SDIO Pins ESP8266 highlights Secure Digital Input/Output Interface (SDIO) which is utilized to straightforwardly interface SD cards. 4-piece 25 MHz SDIO v1.1 and 4-piece 50 MHz SDIO v2.0 are upheld.
- Control Pins are utilized to control ESP8266. These pins incorporate Chip Enable pin (EN), Reset pin (RST) and WAKE pin.
- EN pin – The ESP8266 chip is empowered when EN pin is pulled HIGH. At the point when pulled LOW the chip works at least force.
- RST pin – RST pin is utilized to reset the ESP8266 chip.
- WAKE pin – Wake pin is utilized to wake the chip from profound rest.

J. ARDUINO NANO

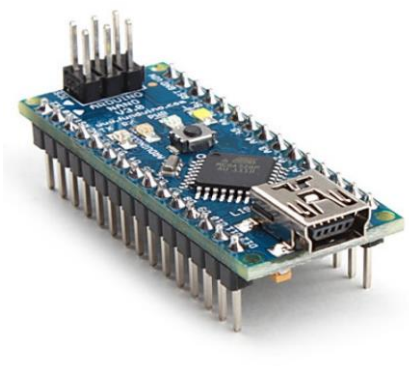

Fig 9: Arduino Nano

Arduino Nano is a microcontroller board planned by Arduino.cc. The microcontroller utilized in the Arduino Nano is Atmega328, a similar one as utilized in Arduino UNO. It has a wide scope of utilizations and is a significant microcontroller board as a result of its little size and adaptability. The Arduino Nano is appeared in figure9.

VI. RESULTS

Autonomous flood alerting system alerts flood considering the parameters such as water flow, water level and intensity of rain which increases the efficiency compared to the existing system.

It provides various means of communication such as audible alerting, visual alerting for the local people near the

river, web based alerting through the internet, SMS alert through mobile phones, Facebook alert and Twitter alert.

Farmers in remote areas will not have access to Wi-Fi technology. They are alerted using LoRa technology.

The autonomous system that makes use of Arduino and LoRa device which process the data with high processing speed and which is enough for real-time flood alerting.

VII. REFERENCES

[1] Pickering, P. Develop with LoRa for Low-Rate, Long-Range IoT Applications.

[2] Hernández-Nolasco, J.A.; Ovando, M.A.; Acosta, F.D.; Pancardo, P. Water level meter for alerting population about floods. In Proceedings of the International Conference on Advanced Information Networking and Applications, AINA, Crans-Montana, Switzerland, 23–25 March 2016.

[3] Wister, M.A.; Hernandez-Nolasco, J.A.; Pancardo, P.; Acosta, F.D.; Jara, A. Emergency population warning about floods by social media. In Proceedings of the 2016 10th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing, IMIS 2016, Fukuoka, Japan, 6–8 July 2016.

[4] Nasimuzzaman Chowdhury, M.; Shiblee Nooman, M.; Sarker, S. Access Control of Door and Home Security by Raspberry Pi Through Internet. Int. J. Sci. Eng. Res. 2013, 4, 550–558.

[5] Campos Avila, A flood monitoring system and evaluation and transmission by means of sensors along with LoRa, 2017.

[6] Sakib, S.N.; Ane, T.; Matin, N.; Kaiser, M.S. An intelligent flood monitoring system for Bangladesh using wireless sensor network. In Proceedings of the 2016 5th International Conference on Informatics, Electronics and Vision (ICIEV) 2016, Dhaka, Bangladesh, 13–14 May 2016; pp. 979–984.

[7] Implementation of system intelligence and IoT utilization protocols and communication, LORAWAN

[8] Monagas, M.G. Sistema: Automated system for early warning of potential flooding.

[9] Neumann, P.; Montavont, J.; Noel, T. Indoor deployment of low-power wide area networks (LPWAN): A LoRaWAN case study. In Proceedings of the International Conference on Wireless and Mobile Computing, Networking and Communications, New York, NY, USA, October 17–19, 2016.

[10] System alert to measure the water level.

[11] Ibrahim, M.; Elgamri, A.; Babiker, S.; Mohamed, A. Internet of things based smart environmental monitoring using the Raspberry-Pi computer. In Proceedings of the 2015 Fifth International Conference on Digital Information Processing and Communications (ICDIPC), Sierre, Switzerland, 7–9 October 2015; pp. 159–164

[12] Analysis of three Iot based wireless sensors for environmental monitoring.

[13] Design of a WSN platform for long term environmental monitoring.

[14] A wireless framework for environmental monitoring and instant response alert.

[15] Water level meter for alerting population about floods.