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Smart Flood Monitoring and Alert System using IoT

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Abstract: *The primary goal of this venture is to lay out a flood detection and avoidance device to be able to stumble on and ship the records about the flood routinely to the close-by Government Unit and to defend the harm as a result of the flood and to citizens with the use of an Arduino. While the method removes the effects of flood, the device makes use of numerous elements to stumble on the flood. We place a sensor to degree a water stage in rivers, lakes, and streams primarily based totally on IoT. The motive of flood warning is to stumble on and forecast threatening flood activities 5so that the public may be alerted in advance. Flood warnings are relatively adaptive in which safety thru huge scale, difficult defenses, isn't desirable. Sensors, GSM, and wireless modules are used to provide records about the flood. In this proposed layout, the alerting device will screen close to with the aid of using dams concerning the reputation of the floods with sensors and the records may be dispatched the use of GSM module.*

Key Word: *Internet of things (IoT), , Sensors, LCD Display, Arduino UNO board, Wi-Fi module, GSM module*

I.INTRODUCTION

Flood is one of the natural disasters that cannot be avoided. It happens too fast and affects so many lives and properties. Before this, most of the existing systems developed only focused on certain areas. Consequently, majority of the public cannot monitor and have no idea about when the flood is going to happen since they do not have any information and data about the weather condition. Having Smart IoT Flood Monitoring System will solve all the drawbacks of the existing system. The proposed system is suitable for cities and village areas. Furthermore, the public nowadays has internet access so they can monitor what is happening and predict if there is any upcoming flood at the web server. The proposed system is low cost in design and easy to maintenance. This project will update the water level at the web server and the system will issue an alert signal to citizens for evacuation so that fast necessary actions can be taken.

In a peninsular country like India, with extreme weather and climatic conditions, the occurrence of heavy rainfall is normal. Many a time, arrival of very heavy rains results in heavy discharge of water or also due to the sudden melting of the glaciers due to global warming.

The left were evacuated by the state and central disaster relief authorities. The severe water logging brought daily work to halt. In orderto save the lives of the people, their habitat and the economy, the major step is to monitor the data on real time basis and when the situation is reaching a certain threshold, then to provide an immediate alert to each individual living in the area which is currently at risk.

Even though it is difficult to avoid any occurring natural calamity, mandatory steps need to be taken by the government agencies to shift the population to a saferregion and by this the losses will get reduced to less than 30%. In this modern era, there are multiple systems working towards calamity forecasting, mitigation and are deployed at different locations of all nations and alert notifications are passed to government agencies; however, all this ends up only in slowing down the process.

The reason behind this is that flood is very spontaneous disaster and government agencies have to follow multiple steps before reaching to a decision. In this case, awareness among the people is very necessary along with the government official so that a comprehensive and better result can be achieved. In our system, it is combined with calamity prediction through weather forecasting. The flow of water is sensed by water flow sensor which will ultimately help in evaluating the intensity of flood and water level by the help of ultrasonic sensor which will be done by propagating sound waves.

Flooding is a major turn-up of disasters that occur in different parts of the world. As these cause a huge amount of loss in the human environment, to deduce and make the system for detecting these pre-disaster conditions is very crucial for issuing timely alerts.

II.SMART FLOOD MONITORING AND ALERT

SYSTEM" is an intelligent system which keeps close watch over various natural factors to predict a flood, so that we can equip ourselves for caution, safe movements to minimize the damage caused by the flood.

Natural disasters like a flood can be devastating, leading to property damage and loss of lives. To eliminate or

lessen the impacts ofthe flood, the system uses various natural factors to detect flood. The system has Wi-Fi connectivity, thus its collected data can be accessed from anywhere quite easily using IoT.

III.PROPOSED WORK

The aim of this project is to develop a certain system which is efficient enough to predict the weather conditions and level of the water in water reservoirs so that preventive measures can be put in place priorly. This project is based on the open source electronic platformi.e. Arduino. The Arduino Uno R3 is to be set up multiple different devices such as water level sensor for the water level detection by capturing time between transmitting and receiving values, temperature and humidity sensor DHT11 for analyzing the moisture content.

Severe water logging brings daily work to a halt. In order to save the lives of the people, their habitat and the economy, major step is to monitor the data on real time basis and if situation is reaching a certain threshold, then alert to provide to each individual living in the area which is currently at risk. Even if difficult to avoid the natural calamity but mandatory steps are to be taken by the government agencies to shift population to a safe region and the losses will get reduced to less than 30%.The reason behind this is that flood is a very spontaneous disaster and government agencies have to follow multiple steps before reaching to decision. In this case, awareness among the people is very necessary along with the government officials so that a comprehensive and better result will be achieved.

IV.SYSTEM DESIGN

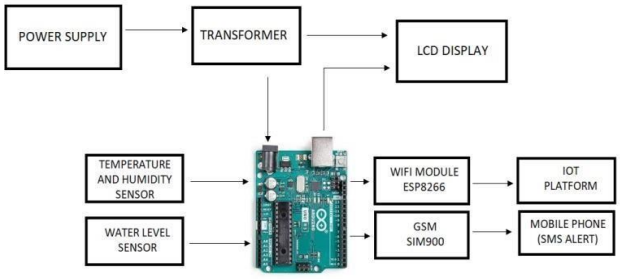

Fig-1: Block diagram for Flood Monitoring

V.BASIC COMPONENTS FOR SMART IDEAL FARMING

A. Water content sensor[14]:

This sensor is helpful for determining the amount of water in the soil. By measuring the water content, the sensor would gather data on how much water is present in the soil relative to the overall volume of the test soil. Tensiometer, capacitance, dielectric technique, gypsum blocks, volumetric, and neutron probes are the most popular forms of soil water content sensors. The proposed model can monitor and provide data about the soil moisture content utilizing drones by using intelligent passive sensors that are mounted to the drones.

B. Arduino UNO board [14]:

Arduino is an open source platform which is used to develop electronics project. It can be easily programmed, erased and reprogrammed at any instant of the time. There are many Arduino boards available in the market like Arduino UNO, Arduino Nano, Arduino Mega, Arduino lilypad etc. with having different specification according to their use. In this project we are going to use Arduino UNO to control home appliances automatically. It has ATmega328 microcontroller IC on it which runs on 16MHz clock speed. It is a powerful which canwork on USART, I2C and SPI communication protocols. This board is usually programmed using software Arduino IDE using micro USB cable. ATmega328 comes with pre programmed onboard boot loader which makes it easier to upload the code without the help of the external hardware. It has vast application in making electronics projects or products. The C and C++ language is used to program the board which is very easy to learn and use. Arduino IDE makes it much easier to program. It separates the code in two parts i.e. void setup and void loop. The function void setup runs only one time and used for mainly initiating some process whereas void loop(consists the part of the code which should be executed continuously. This model consists of 6 analog input pins and 14 digital GPIO pins which can be used as input output 6 of which provides PWM output and analog using pin Mode, digital Write, digital Read and analog Read functions.6 analog input channels channels are from pins A0 to A5 and provide 10 bit resolution. The board can be powered either from using USB cable which operates at 5 volts or by DC jack which operates between 7 to 20 volts. There is on board voltage regulator to generate 3.3 volts for operating low powered devices.

C. WIFI module ESP 8266 [14]:

The **ESP8266** is a low-cost Wi-Fi microchip, with built-in TCP/IP networking software, and microcontroller capability. The chip was popularized in the English-speaking maker community in August 2014 via the **ESP-01** module, made by a third-party manufacturer Ai- Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes- style commands. However, at first, there was almost no English-language documentation on the chip and the commands it accepted.[2] The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, the chip, and the software on it, as well as to translate the Chinese documentation. The

ESP8285 is a similar chip with a built-in 1 MiB flash memory, allowing the design of single- chip devices capable of connecting via Wi-Fi.[4]These microcontroller chips have been succeeded by the ESP32 family of devices.

D. Temperature sensor[14]:

Crops require the proper kind of temperature in their surroundings. Although it could appear to be a relatively trivial justification for farming, this temperature regulates the growth of the plant. Plants also need temperature- sensitive enzymes for optimum growth. Therefore, it is imperative to have a sensor that can warn farmers when temperatures deviate from the ideal range for their crops.

E. SIM 900 GSM- Module [14]:

GSM modem is a wireless modem. It works on wireless network. This modem works like a dialup modem and sim is required for communication. In dialup modem the data is send or received through the fix telephonic line but in GSM modem data is send orreceived though the radio waves.

F. LCD Display [14]:

The PCF8574 device is an 8-bit I/O expander for the two-line bidirectional bus (I2C) is designed for 2.5-V to 5.5-V VCC operation. A typical I2C LCD display consists of a Hitachi's HD44780 based character LCD display and an I2C LCD adapter. A regular LCD requires a lot of wires (parallel interface) to be connected with a Microcontroller. The Serial LCD backpack built on PCF8574 IC uses the I2C bus to convert the parallel interface to a serial one. This needs only 2 wires SDA & SCL. The I2C backpack can be soldered on to the LCD. The I2C device has a HEX address by which a microcontroller can communicate with it. This is set by the 3 bits A0, A1, A2.The device will generate an alarm system with three different colors of LEDs indicating three levels of detection for flood level and send Alert notification to the people on incoming flood in that area.

GSM Module is used to send alert SMS to the People When the water level reaches a certain level of hazards, the device will generate an alarm system with three different colours of LEDs indicating three levels of detection for flood level and send Alert notification tothe people on incoming flood in that area.

VI.METHODOLOGY

In this project, flood monitoring system using wireless sensor node is developed to observe the status of flood which can alert people whowill be in the area frequently affected by floods. Arduino UNO board acts as the Processing Unit of this system that attached with ultrasonic and rain sensors to form a wireless sensor node and placed at a high prone area of flood. When the sensors were triggered, all the data will be sent to Things View application to be viewed on user's smart phone via the wireless connection. Two sensors, Ultrasonic and Rain sensors are used as inputs to the Raspberry pi and power supply of 5V is used to power up the system to function well. The ultrasonic distance sensor is used to detect the flood level at a high prone area of flood (maximum is 4m away from it). In this project, 50cm of distance from the ultrasonic sensors and the water level will trigger the LED. The Things View application provides an interactive and easy to access platform for user or victim to get accurate information on the incoming floods by displaying current condition of flood water level and rain intensity in real-time condition. When there are changes in flood level, the graphs captured the data and change the measurements accordingly. So, when there is immediate change in the measurement, the LEDs will turn on which act as alerting purposes. GSM Module is also used to send alert SMS to the People when the flood water level reached a certain point of hazard.

The implementation of the system which includes all wiring that is to be installed on the circuit extender along with Arduino and other sensors. The coding of the Arduino will be in Arduino language which comprises of C/C++ functions that are needed to be called in the code. The website is developed by using HTML, cross checking every one of the associations and then furnishes capacity to the Arduino. It will work in the manner as explained above and early warning will be sent to user.

VII.EXPERIMENTAL EVALUATION

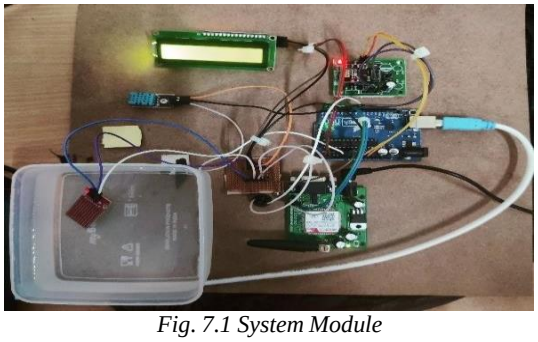

Fig. 7.1 System Module

The basic hardware components that are required are shown in Fig. 7.1. The terminal output obtained regarding the temperature andhumidity is shown in Fig. 7.2

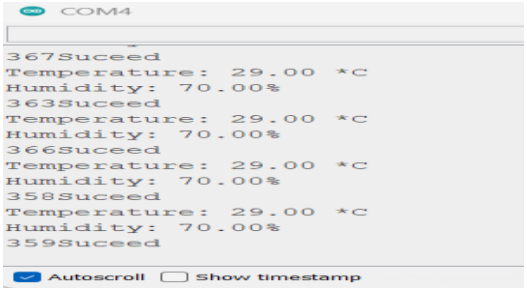

Fig. 7.2 Terminal output

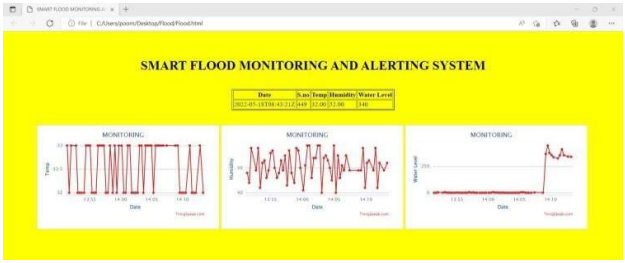

Fig. 7.3 Website interface

Fig. 7.3 shows the temperature, humidity and moisture variations that are recorded and the alert messages are sent to mobile phones asshown in Fig. 7.4.

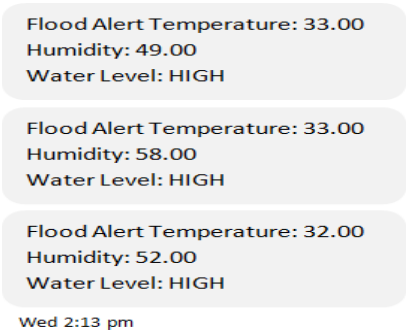

Fig. 7.4 Alert through messages

VIII.APPLICATIONS

This system can be implemented for the real-life operation purpose. The system will alert you with appropriate information about the Flood. It can detect even an inch raise of water level and give alert. We have tested this system by real time for water level measurement successfully. If the water level increases, it will send an alert immediately. It can be used to monitor natural calamities. It can be used to monitor the floods water level. System has ability to send alert messages to the people through GSM modem. Users can also monitor flood level from smart-phone application. The main objective of this project is to achieve a close watch over various natural factors causing the calamity of floods, and to minimize the damage caused by them.

IX.CONCLUSION

Finally, the developed "flood monitoring and early warning system" that aims to detect water level, functions perfectly according to the specification provided. It successfully passed several tests based on different parameters. The project contributes towards economy and citizens. It envisions safe, prepared and less casualty community before, during the project contributes towards safeguarding the citizensand his environment, and protecting the economy. It envisions a safe, prepared and less–casualty-prone community before, during and after calamities like cyclone/typhoon, floods and their ensuing devastation. The model promotes the use of real-time monitoring system through the developed web-based application and SMS notification system as a simpler and practical medium in disseminating calamity related information particularly in remote areas. By allowing the system in a two-way communication, it gives more flexibility in providing crucial, timely information to the community. In this study, the prototype is only using a small scale of sensor detection within 50cm. In actual world, the system needs to detect the flood for about 1 to 2 meter if the system is placed at the riverside to detect flood. Besides, this prototype needs to be improved on the water-resistant features so that when the rain started to fall, it cannot damage the sensor node. A proper installation needs to be done so that the system can be put at any kind of surfaces to avoid it being fall down when water level rise up. Therefore, the system could help a huge number of victim's life whenever the future work could be done on it.

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