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IOT BASED EARLY FLOOD DETECTION AND AVOIDANCE

[1]KAUSALYA.S, KALAIYARASI
[1]Assistant professor, Assiatant professor
[1]ECE Department,
[1]K.S.Rangasamy college of Tecgnology, Namakkal, India

Abstract- Flooding is a natural phenomenon which has attracted global attention as a result of its negative impact on the society. Developing nations such as India have been predicted to experience increased flood occurrences in the coming decade. The events of flooding are unlikely to change, however, its impact on our society can be very well reduced. There are some places that are more prone to flooding than other places, 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.

Hence we are designing this project to inform the people about the upcoming flood by making use of the concept of Internet of Things. For that purpose we are going to use an android Application to intimate the users. This Project focuses on providing early detection of flooding and the measures to minimise and avoid floods. The system involves the deployment of sensor nodes at specific flood vulnerable locations for real-time flood monitoring and detection. Flood events relating to flash flooding and run-off water or overflow are successfully monitored in real time which saves individuals plenty of time to prepare against predicted flood occurrence, saving them from the aftermath of flood disaster.

Indexed Terms- Arduino, Android, BLYNK IOT, ESP8266 Wifi Module, Moisture Sensor, Ultrasonic Sensor

I. INTRODUCTION

In India, the rainy seasons occur each year from June to October. Early rainfall is usually in June with full commencement in July, and stops in the months of October each year, with a few showers in November. Flooding is a natural phenomenon which attracts global interest. It results in tremendous environmental destruction and loss of lives. Flooding is a result of substantial rainfalls, structural failures and a large number of human factors. Floods rely on precipitation amounts and rates, topology, geology, land use, and antecedent moisture condition.1

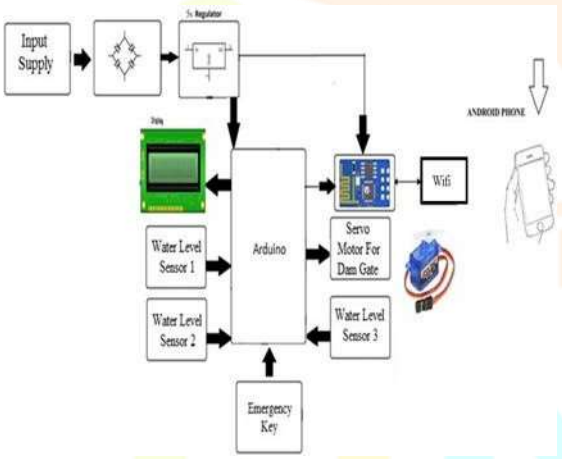
In the year 2018 Severe flooding affected Indian state of Kerala due to unusual high rain during monsoon season. It was the worst flooding in Kerala in nearly a century. In which over 374 people died within fortnight. Thirty-five out of 42 dams within the state open for the first time in history. Kerala received heavy monsoon rainfall on the mid evening of August and resulting in dams filling to capacity in the first 24 hours of rainfall the state received 310 mm of rain.

The events of flooding is unlikely to change, however, its impact on our society can be very well reduced. Efficient forecasting and early warning systems can help mitigate the effects of flooding. The concept of Internet of things can be used to collect Real time information from a wide range of environmental phenomenon.To develop A Real Time Solution to Flood detection and avoidance Using IoT and Sensor Network, we proposed a flood detection and avoidance

model which requires attention to three basic factors: Data collection via water level sensors, data processing, and the dissemination of flood warning information. While automated flood warning systems are often surprisingly expensive to implement, the primary factor .To tackle the problem of detection of the flooding, we are using the Y89 Moisture sensor's which will act as the water level sensor. Where the resistance value will be proportionate to the moisture in the soil.The HC SR04 Ultrasonic sensor will be used to monitor the water level in a body which stores water which can easily be water dams in our case.For making this project IOT compatible we are using the ESP 8266 WIFI module which will allow our project to communicate to different elements using wifi connectivity for internet. An 16x2 LCD is used so that the information and acknowledgement of the operation of the project can be displayed on the board itself. The Android application is developed using the BLYNK IOT platform so that the different sensors can be integrated with the Android Application on a smartphone.

II. DESIGN METHODOLOGY

A. Block Diagram



As we follow along the block diagram it is evident the the the CPU used here is the Atmels ATmega328p which is a single chip CPU and all the different modules and sensors are connected to it. We are using a pair of the Y89 soil moisture sensors to detect the water level in accordance with the ground, whereas for determining the reference of the water level in a stored water body like Dams or reservoirs we have used an HC SR04 Ulrasonic Sensor.The 16x2 LCD display is used to determine the operation status of the project on the board and the connectivity to the internet is made possible through the ESP 8266 wifi module. The provision to disperse the critical level of water in the water body is being relalised through connecting a servo motor which represents the heavy duty motors that can be used to control the Dam gates as the need arises. For alerting the users in the area of the flood the BLYNK IOT platform and the Android application on the smartphone is being used where all the alerts for the user can be delivered and the data about the crisis
can disaster control can be obtained by the user as necessary.Submit your manuscript electronically for review. prepare it in two-column format, including figures and tables(untill it don't fit properly and data is not visible).

B. Flow Chart

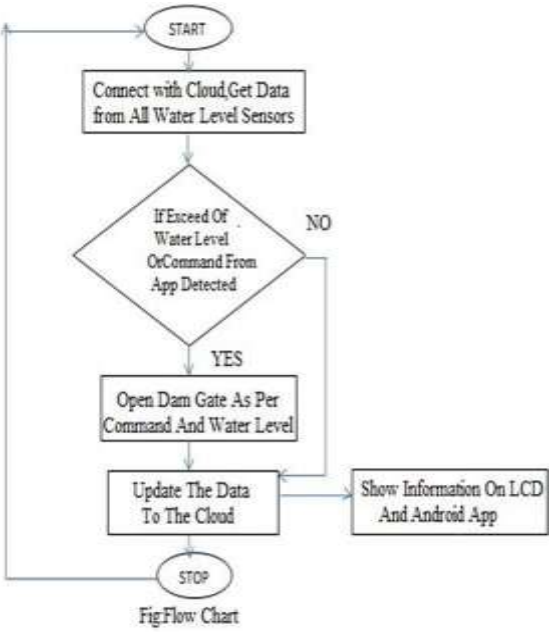


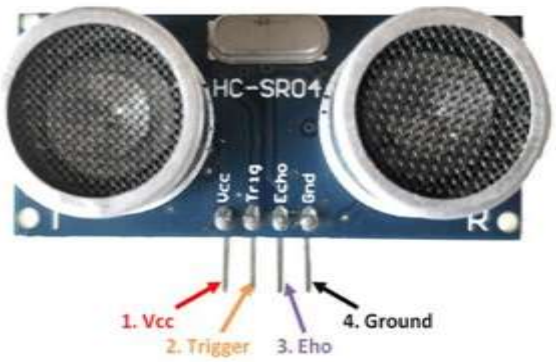
Fig:Flow Chart

Once we turn on the circuit the ESP 8266 WIFI module will try to establish an wifi connection and once the connection is successful and the circuit is connected to the internet and cloud services the data from all the relevant sensors will be logged,

This data will then be compared with the reference safe and critical values saved on the cloud, if the values from the sensors is beyond the critical value then the data will be updated on the cloud, the user will be alerted on the android app via a push notification and if required the Dam gates would be opened via the servo motor and the water will be let out to the extent that the dam is under critical limit. Now, if the values are well under the safety range then the data will only be updated on the cloud and the information will be displayed on the LCD display as well as the graphical interface of the Android application on the user's smartphone.

III. HARDWARE DETAILS

1. Ultrasonic Sensor HC SR04



The HC SR04 Ultrasonic sensor is used to determine the water level in a contained water body such as Dams or Reservior. It can be Powered the using a regulated +5V through the Vcc ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that is:

Distance = Speed × Time

2. Soil Moisture Sensor

The soil moisture sensor consists of two probes which are used to measure the volumetric content of water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance.

3. ESP8266 WIFI Module

The ESP8266 WiFi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi 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, hence we can simply connect it to the Arduino chip.

4. SG90 Servo Motor

Servo motors have a geared output shaft which can be electrically controlled to turn one (1) degree at a time. For the sake of control, unlike normal DC motors, servo motors usually have an additional pin asides the two power pins (Vcc and GND) which is the signal pin. The signal pin is used to control the servo motor, turning its shaft to any desired angle. The SG90 motor has a 2.5kg/cm torque which means it can pull a weight of 2.5kg when suspended to a distance of 1cm, for the purpose of the demonstration this motor is ideal for our model.

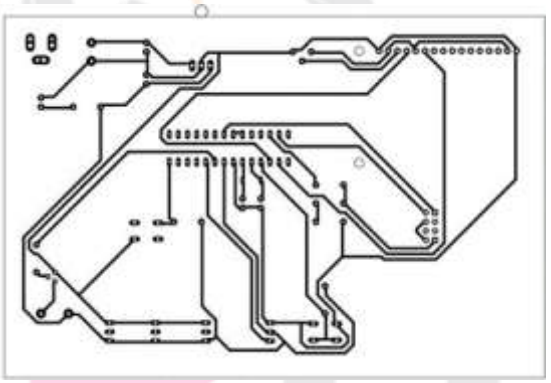
IV. SOFTWARE DETAILS

1. Arduino IDE

Arduino IDE is an open source software that is mainly used for writing and compiling the code into the Arduino Module. It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process. It is easily available for operating systems like MAC, Windows, and Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment. The IDE environment mainly contains two basic parts: Editor and Compiler where former is used for writing the required code and later is used for compiling and uploading the code into the given Arduino Module. This environment supports both C and C++ languages.

2. Eagle Software

EAGLE stands for Easily Applicable Graphical Layout Editor, EAGLE is a scriptable electronic design automation (EDA) application with schematic capture, printed circuit board (PCB) layout, auto-router and computer-aided manufacturing (CAM) features. EAGLE contains a schematic editor, for designing circuit diagrams. Schematics are stored in files with. SCH extension, parts are defined in device libraries with .LBR extension. Parts can be placed on many sheets and connected together through ports. The PCB layout editor stores board files with the extension .BRD. It allows back-annotation to the schematic and auto-routing to automatically connect traces based on the connections defined in the schematic.



3. BLYNK IOT Platform

Blynk was designed for the Internet of Things. It can control hardware remotely, it can display sensor data,

it can store data, vizualize it and do many other cool things. There are three major components in the platform:

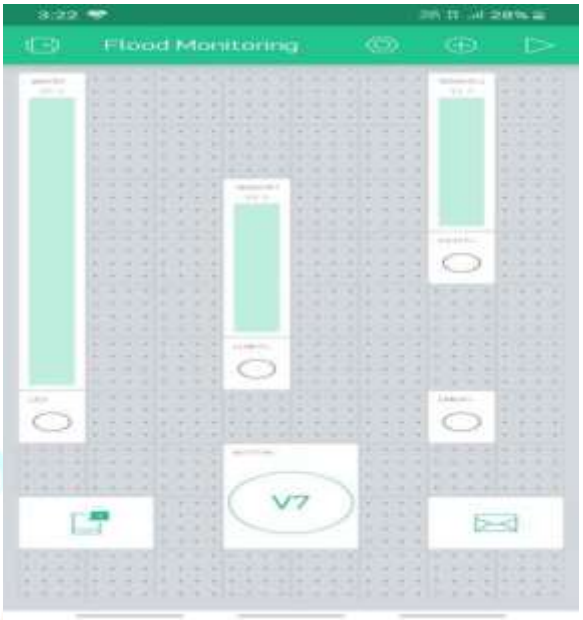
Blynk App - allows to you create amazing interfaces for your projects using various widgets provided.

Blynk Server - responsible for all the communications between the smartphone and hardware. we can use Blynk Cloud or run your private Blynk server locally. It's open-source, could easily handle thousands of devices and can even be launched on a Raspberry Pi.

Blynk Libraries - for all the popular hardware platforms - enable communication with the server and process all the incoming and outcoming commands.

V. RESULT

The existing problems faced by the authorities for disaster control related to floods can be overcome by using the proposed model. The project can be successful in engaging the users and keep them informed with all the necessary information needed during the time of crisis. The water managing authorities as well as the users will be able to monitor the information in real time, moreover when this model is used for a long time due to the integration of the cloud services all the data will be logged and saved on the servers.



The status of the operation can be observed on the circuit of the project itself as the 16x2 LCD display will indicate the mode of operation which can be beneficial for certain operators where safety protocol requires a person to keep personal electronic devices like phones away from the operating area.Further there is a massive room for improvement like the data of repeated years from the cloud can be given to a artificial intelligence or machine learning algorithm like linear regression and a prediction of the rainfall and the flooding can be made very early which will help the authorities as well as the users to take the necessary precautions.

CONCLUSION

When this project is compared to the existing practices which are being used for estimation of water level in water bodies and Flood control and management very significant improvement in efficiency will be noticed. The system is relatively inexpensive to produce install and maintain and there is no cost involved for the user to use the Android application as well as the cloud service as any working internet connection can do the

job, as the mobile app is backward compatible towards android 4.0 (version Ice-cream sandwich) approximately 89% of android users can use the application.

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