FLOOD MONITORING SYSTEM USING IOT

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Abstract:

When the water overflows and make the dry land submerged in it, it is called as flood. Flood is one of the biggest natural disasters that our world faces today. Especially in the rainy season, the water level of the rivers starts rising, causing land nearby it to be submerged in the water. But its not just the land that goes inside the water, It's the people. Yeah, Flood causes deaths as well. Every year hundreds of people die in India due to Flood. And when it comes to the world the number increases to thousands. And this is what I am talking about a normal year. Sometimes, the flood causes way more destruction than this, take the North India flood of 2013 foe example, that flood along causes 6,054 casualty in lives. And not just lives, flood also causes economical losses. In our country, the losses due to flood every-year ranges from 10,000 to 15,000 crore Indian rupees, and in the world it can the economic losses are around 7.5 billion dollars, estimated around 52,000 crore Indian rupees. So, if this much of money is already getting wasted due to flood, why not put some money, make some technology and save lives. I tried to make this technology as economically affordable as possible. So, I am making this Flood Monitoring System using IOT, in which I have used ESP32 as the main board.

Introduction:

Flood Monitoring System using IOT monitors the increasing level of river water in an affordable way and takes the necessary action accordingly. It is made using ESP32 board which is a chip-microcontroller with embedded Wi-Fi in it.

The project has many objectives:

It provides Real-time Monitoring: This technology makes use of both cloud and edge computing. Though when it comes to send alert to the people nearby, it uses cloud technology, however when it comes to act like starting the water pump, it uses edge computing.[1]

Before-Flood warning: As I said, it uses cloud to give alert to the user that flood is coming but that doesn't make it slow, in fact that allows the normal citizen to know about the flood even before the flood comes to their city. We monitor the flow of the flood, in which way the flood is moving, and send the alert to the city which has the chance to get impacted from the flood.[2]

Remote Management of Flood: Even if most of the system designed is autonomous, we still some authority like starting the pump in exceptional cases through apps. The authorised person can control the water pump remotely.

Cost-efficient: The best part of this technology is that its not that expensive. It uses the minimum number of sensors and accessories required.

Literature Review:

To make this technology the best, I had to read some of the previous work done in this field. And reading for that came across already developed technology that is working in this field. There were some benefits and

some limitations to their works. I am going to discuss the same below.

ISRO-SAR flood monitoring system: ISRO uses SAR technology for monitoring flood. It uses microwave that are send from the space to earth from satellite and make images from the data received. Though this system can detect flood, but it can detect flood after the flood is already there, but I am more interested in de3tecting flood before it causes losses and taking decision accordingly.

IOT-BASED EARLY FLOOD DETECTION AND AVOIDENCE: This paper is written by a bunch of students from RKGIT college of UP, India. This technology uses Arduino board, esp8266 board and ultrasonic sensor as its main components. Though is project being efficient in detection the flood early, but it's expensive and neither it takes the necessary steps that can save lives.[1]

IOT BASED FLOOD MONITORING AND ALERTING SYSTEM: This paper is written by students od VIT, Maharashtra. Just like earlier project this system also uses Arduino board and ultrasonic sensor for flood detection and send email as alerts.[2]

FLOOD DETECTION AND WATER MONITORING SYSTEM USING IOT BASED ON DISASTER MANAGEMENT SYSTEM: Written by people of SGOICOE Belhe, India. The good part about this technology is that it senses various levels of flood. But even this fails to make it cost-efficient and take necessary decisions which could solve the problems. [3]

After reading few more paper like this, I concluded, that I need to make my technology more affordable and easily accessible. Also, just sending alerts to the people is not enough, we also need to do something, something that can help up get the river water level back to normal and hopefully saves lives and losses.

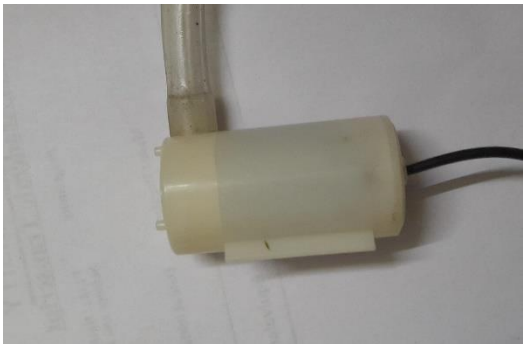
Components:

ESP-32 board: ESP-32 is a dual-core-chip-microcontroller board developed by espressif systems, which is an affordable module with inbuilt Wi-Fi and Bluetooth. The esp32 that I will be using is a 30 pin esp32, which has 25 GPIO pins in which 9 are touch pins. In those 9 touch pins there are touch sensors, which can detect touch based on conduction due to electron flow.

(img 01) Esp32

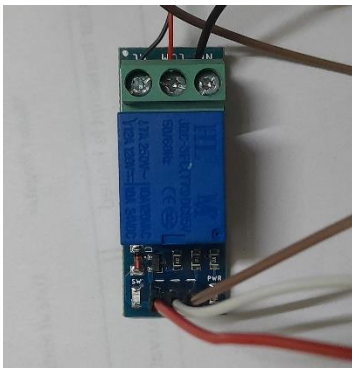
(img 02) Wires working as touch sensors

Water-Pump: The water pump that I am using requires 9 watts of power. I am using it to transfer the water from river to the man-made reservoir.



(img 03) Water pump

Relay: In order to make the water-pump work I need to give it an external power supply, but the external power supply can damage the main board, so to control the transfer of power, I need a relay to make it work.

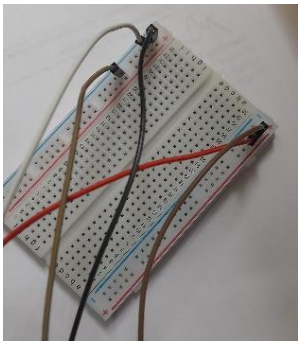


(img 04) relay

External Power supply: The power needed to make the water pump work is given by an external power supply, in the project I am using a 9-watt HW battery.

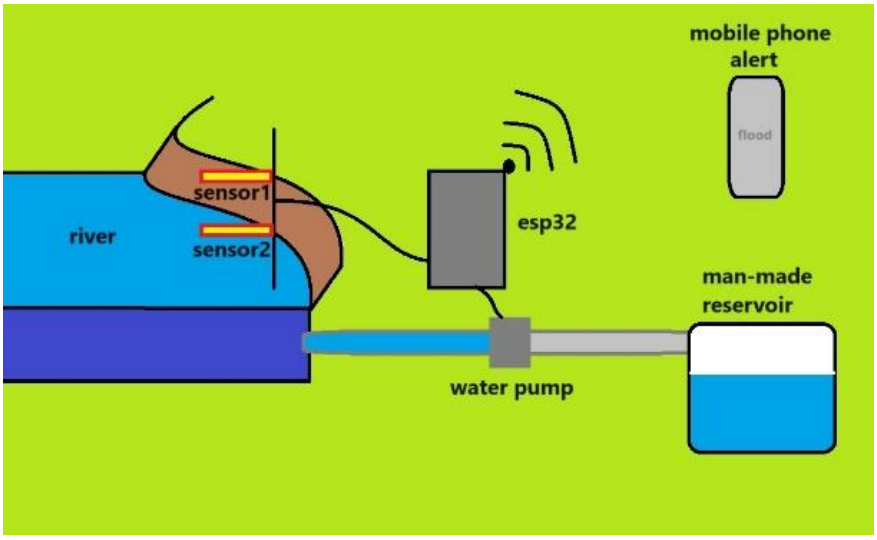
(img 05) Power supply

Breadboard: To make maximum use of the ESP-32 board and to arrange our circuit nicely, I am using a breadboard for it.

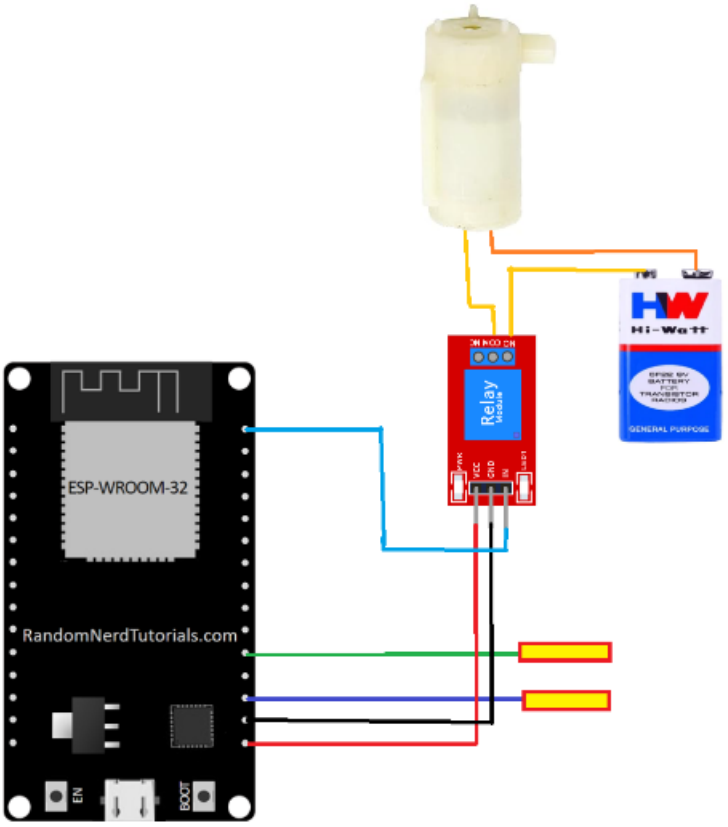


(img 06) breadboard

Working:



(fig:01)



(fig:02)

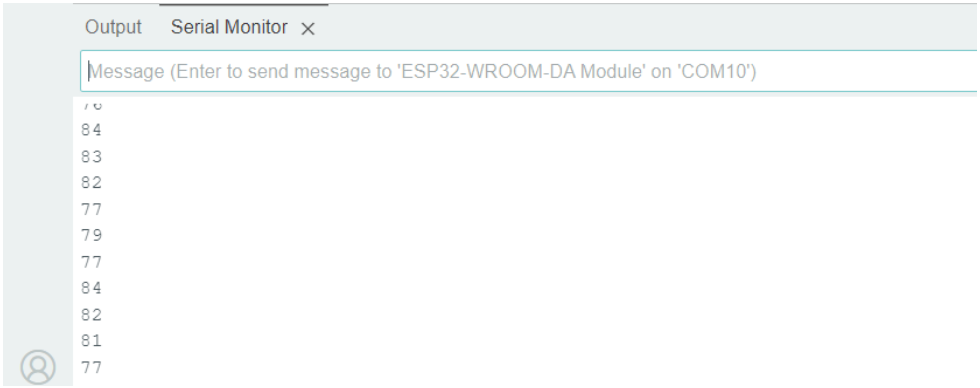
The image above (fig:01) shows the working of the Flood Management System. Over here we are taking the data from sensor1 and sensor2. Here sensor1 and sensor2 are nothing but the touch sensors which are already available with the esp32 board. We could had used moisture sensor or ultrasonic sensors, but as ultrasonic sensor had their own limitation of range, and we were also interested in doing the cost cutting and making this project work efficiently in very minimal cost so that it could be adopted in a real-life scenario. We decided to use the already available touch sensors.

From over there we are taking the input from the touch sensors, we are also elimination the changes of touch sensors showing wrong data because of a rainfall. So, we are considering the data which are available to us only if sensor2 senses the water first and sensor1 sensor the water after that. If in any case sensor1 senses the water before or at the same time, that might be the result of rainfall and not actual flood. After that if it shows a case of flood, we would like to start the pump and let the water flow into the man-made reservoir. This not only reduces the water level of the river saving from the problem of flooding, but this water can also be used after that for other purposes.

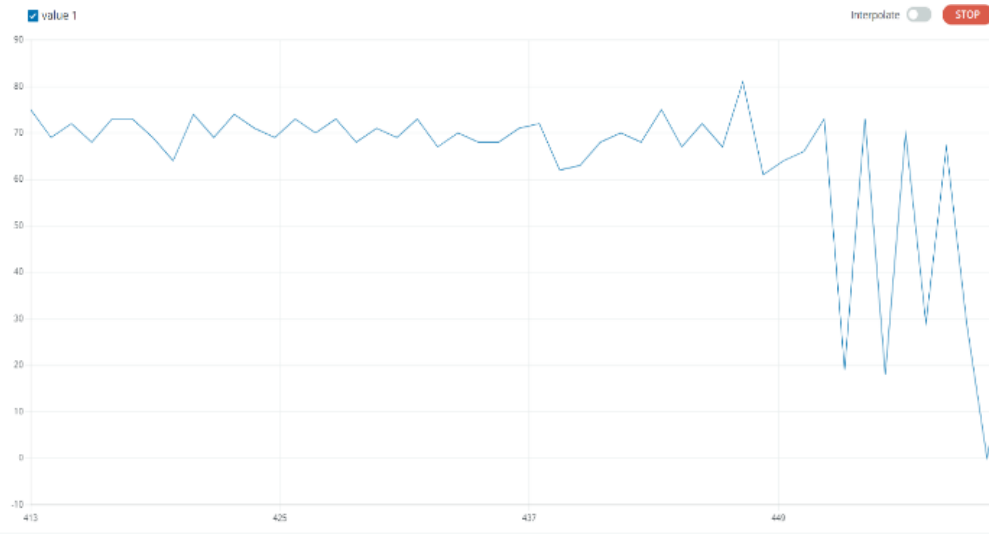
Other than this, we are also uploading the data of the flood onto the cloud, and in case of flood we are sending normal people who lives in that area an alert that flood is coming.

Result:

The input taken from the touch sensors comes in a variety of integer value, ranging from 0 to 100. Normally when the pins are left untouched, or there is not much conductance (it's in the air) the value are from 70-90 and when places in water or touched the value comes below 60. I am making use of this property and taking the input.



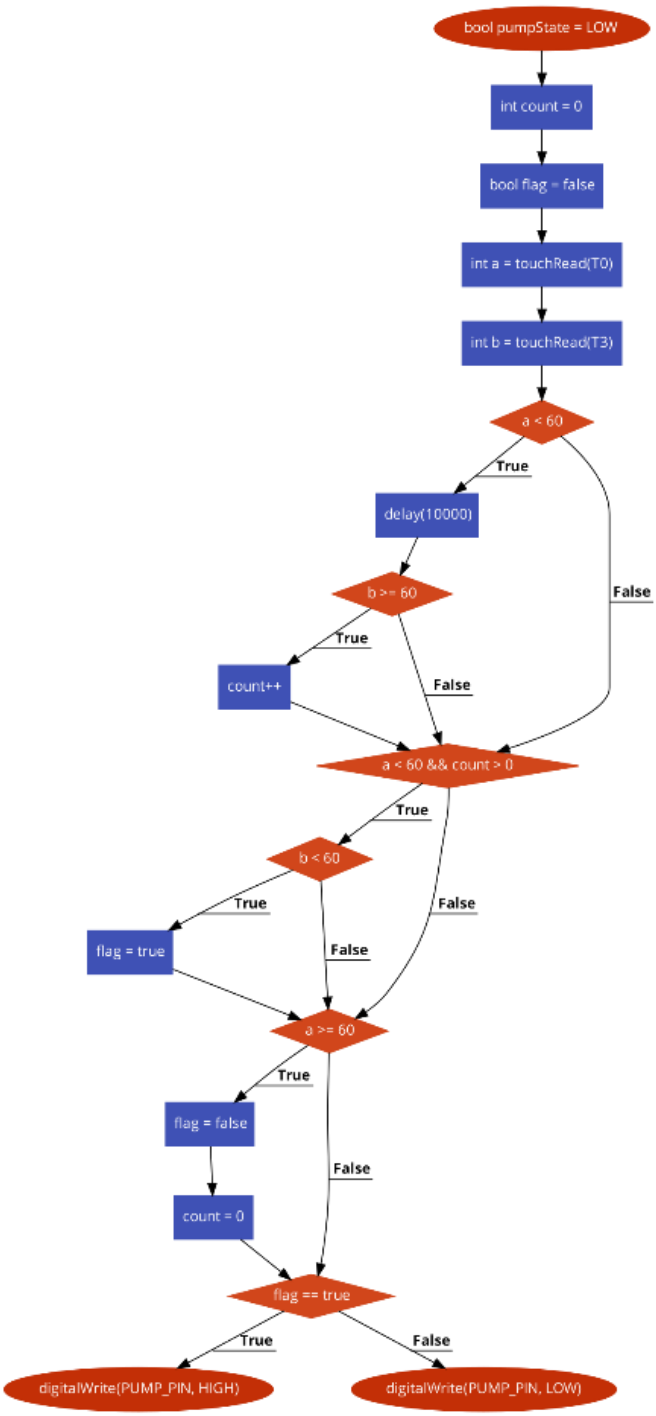
(img 07) Data shown in serial monitor before flood.



(img 08) Data shown in serial plotter before and after flood.

The pics above shows the value of touch pins in serial monitor and serial plotter, you can see the variation in data when the touch sensors senses conductance.

After taking this data, we check the data and decides whether conductance is due to rain or its flood.

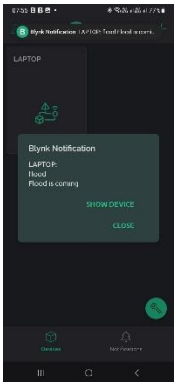


(img 09) The flow of the working of the system

The above is the flow-chart to check whether the data received resembles the pattern of rain or of flood. Like if the above sensor senses conductance first, or at the same time as sensor 2, its raining however if the lower sensor senses conductance and after some time the above sensor senses conductance, we can say that its flood.

Now that we have concluded that its flood, its time to turn the water pump on and transfer some of the river water to the reservoir that we prepared to store the flood water. The

water pump will turn on when its flooding and it will automatically turn off when its not. This way we are keeping the water level normal, and that water can also be used for future.
I will also be sending alert to the people, near the city.



(img 10) mobile alert

The image (img 10) above shows a mobile screen with a notification showing “Flood is coming” as message. Which will give the people an alert to evacuate the place as soon as possible.

Conclusion:

Flood is one of the biggest natural disasters that our world faces today. Every year hundreds of people die in India due to Flood. And when it comes to the world the number increases to thousands. And this is what I am talking about a normal year. And not just lives, flood also causes economical losses. In our country, the losses due to flood every-year ranges from 10,000 to 15,000 crore Indian rupees, and in the world it can the economic losses are around 7.5 billion dollars, estimated around 52,000 crore Indian rupees. So, if this much of money is already getting wasted due to flood, why not put some money, make some technology, and save lives. Flood Monitoring System using IOT monitors the increasing level of river water in an affordable way and takes the necessary action accordingly.

It provides Real-time Monitoring, Early-Flood warning, Remote-monitoring and control and affordability.
In this we have two sensors. We are taking the data from sensor1 and sensor2. Here sensor1 and sensor2 are nothing but the touch sensors which are already available with the esp32 board. From over there we are taking the input from the touch sensors, we are also elimination the changes of touch sensors showing wrong data because of a rainfall. After that if it shows a case of flood, we would like to start the pump and let the water flow into the man-made reservoir. This not only reduces the water level of the river saving from the problem of flooding, but this water can also be used after that for other purposes.

Other than this, we are also uploading the data of the flood onto the cloud, and in case of flood we are sending normal people who lives in that area an alert that flood is coming.

Future-expansion:

This technology has a lot of potential to save lives of people, it also saves billion of dollars lost due to the flood. So, keeping in the mind that this technology is not that expensive, the expenses it has is way too less then the losses we suffer, I would like to work with the Indian government to implement this technology all over the country. This Technology will not only solve the problem of flood, but also will be able to help the common people by providing the flood water stored in the times of drought.

We can also connect various other technology like machine learning and computer vision in it. Through Computer Vision we can detect the water level rising through cameras and through machine learning we can keep a track on the data

being uploaded to the could take decision for the future.

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