The Automated Flood Detection and Warning System by using Sensors

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Abstract **- The ultimate aim of our project is to develop a real-time flood monitoring and alerting system by using sensors in the flood prone areas. The technique of using ultrasonic sensor and pressure sensor is widely used in various fields of engineering. The main advantage of using ultrasonic sensor is it outstanding capability to probe inside an object non-destructively as the ultrasound can propagate through any kinds of media including solids, liquids, and gases. This project focuses on the water level detection and early warning system (via buzzer sound and/or SMS) that alerts concern authorities and individuals living in the nearby areas. Furthermore, inquiry system is also included in this project to become more interactive wherein individuals in the community could inquire the status of the desired area or location affected by flood through buzzer sound and SMS notifications. The project aims in helping citizens to be prepared and knowledgeable about the flood. The novelty of this work falls under the utilization of the ultrasonic and pressure sensors, GSM, LPC2148Microcontroller and LCD display. Thus, by using this method, the effects of flash flood can be reduced to a great extent.**

Index Terms **- Ultrasonic sensor, Pressure sensor, Global System for Mobile communication (GSM), LPC2148 Microcontroller and Liquid Crystal Display (LCD).**

1.INTRODUCTION

Natural disasters are usually unavoidable. But an early warning can save lot of lives and properties. In order to prevent the devastating effect of flood, early warning is given to the people to evacuate them to safer places. Generally, a Flood is an overflow of water on normally dry grounds. They are most commonly due to the dam breaks, snowmelt, overflowing river or heavy rainfall. Generally natural disasters like flood cannot be stopped but can be reduced by using this method. In this method, we are going to use and ultrasonic sensor and a pressure sensor to detect the water level in the dam and to alert the people when the water level rises beyond the normal limit. Sometimes, due to the high-water level, there is a risk of failure in Dam like the formation of crack. To avoid the circumstances, we are using the pressure sensor and ultrasonic sensor to monitor the water level in the dam and to alert the people living nearby if there is a risk of flooding. Flood alert system using GSM & ultrasonic and pressure sensors is one of the important technologies which is useful to make the people alert from flood. Every year disaster flood has its adverse effects. Due to this government have to face more critical problems. Many people with animals have to strive for their life. Overall, it affects the ecological balance crops diorites due to excess water and is carried away with it. Soil erosion takes place to large extent. We are helpless in front of flood. Flooding is accentuated by erosion and silting leading the tributaries and retardation of flow due to tidal effects lead to major floods.

1.1 OBJECTIVES

To monitor the flood situation and send alert in case of danger and to detect the rising water level in a dam at a reasonable distance from the rail track, roadways, and intimate that to the respective authorities through SMS, to take the appropriate action. To alert the nearby people by producing a buzzer sound.

1.2 NEED FOR STUDY

Upon receipt of the flood warnings, surrounding people can make themselves migrated to the safer places. When the time to detect the flood and alerting the people decreases, its associated losses will also reduce. In this fast-moving world with advanced communication technology, delay in conveying the

information is unacceptable likes the incident in the Telangana.

2. MATERIALS

2.1 LPC2148 Microcontroller

It consists of 64 pins and the group of these pins are called as port. It is the one where all the sensors and modules are connected. It functions like the brain of the system. The LPC2148 microcontroller is designed by Philips with several inbuilt features and peripherals. It will be more reliable as well as efficient for an application developer. LPC2148 microcontroller based on ARM7 family.

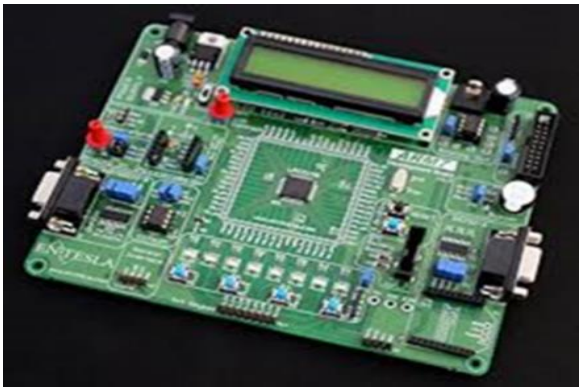

Fig-1: LPC2148 Microcontroller

2.2 Ultrasonic sensor

It is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves and convert the reflected sound into electrical signal. These waves travel faster than the audible sound of a human.

Fig-2: Ultrasonic sensor

2.3 Pressure sensor

A pressure sensor works by converting pressure into an analogue electrical signal. The demand for pressure measuring instruments increased during the steam age. When pressure sensing technologies were first manufactured, they were mechanical and used Bourdon tube gauges to move a needle and give a visual indication of pressure. We measure pressure electronically using pressure transducers and pressure switches.

2.4 GSM

GSM procedures are sets of steps performed by the GSM network and devices on it in order for the network to function. GSM (Global System for Mobile Communications) is a set of standards for cell phone networks. GSM use two frequency bands of 25 MHz width: 890 to 915 MHz frequency band for up-link and 935 to 960 MHz frequency for down-link.

Fig-3: GSM

2.5 Liquid Crystal Display

Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome. LCDs are used in a wide range of applications, including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor.

Fig-4: LCD

3. METHODOLOGY

3.1 General

During normal days, the water level in the dam remains constant. But during rainy season, the water level may rise due to which flash floods may occur. To detect these kinds of floods, we are using the ultrasonic and the pressure sensors The ultrasonic sensor will

determine the distance to the water by transmitting sound pulse that reflects from the surface of the water and measures the time it takes for the echo to return. The pressure sensor will determine the pressure acting on the dam After initializing the sensors, the values are detected by using a microcontroller LPC 2148 which is displayed on the LCD. If the water level is normal, then nothing will happen. If the water level is abnormal, then a buzzer sound will be produced along with SMS regarding the condition. If the water level is in extreme condition, then a buzzer sound will be produced along with the discharge of water. Thus, alerting the people to evacuate themselves to a safer place. Then the water is released from the dam wall to avoid heavy damage.

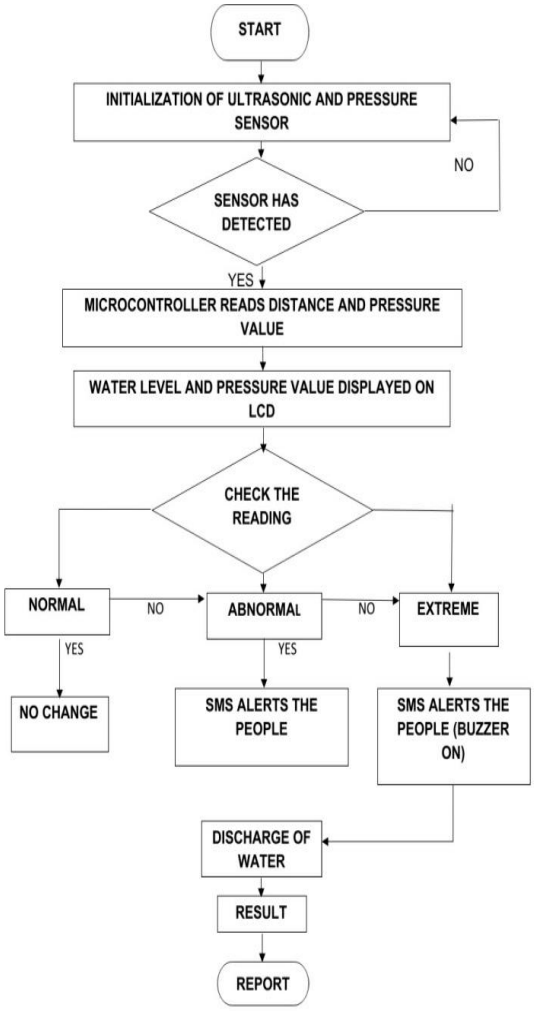

Fig -4: Flowchart

3.2 Dam Prototype

Fig-5: Dam prototype

3.3 Experimental setup

- The Display module is used to establish the user interface by adding an LCD Display integrated with LPC 2148 Microcontroller.
- The Pressure sensor HX710B is integrated with LPC 2148 Microcontroller by using one UART 1
- The Ultrasonic sensor is also integrated with LPC 2148 Microcontroller by using the Echo and Trigger pin.
- With the help of these pins the distance is measured.
- The GSM is integrated with UART 0 in LPC 2148 Microcontroller.
- The 12-volt Motor pump is integrated by LPC 2148 with the help of a 5-volt relay, whenever we have an input from P1.30, the motor gets initiated.
- For all the conditions, the appropriate result is established in the form of SMS, buzzer, and light.

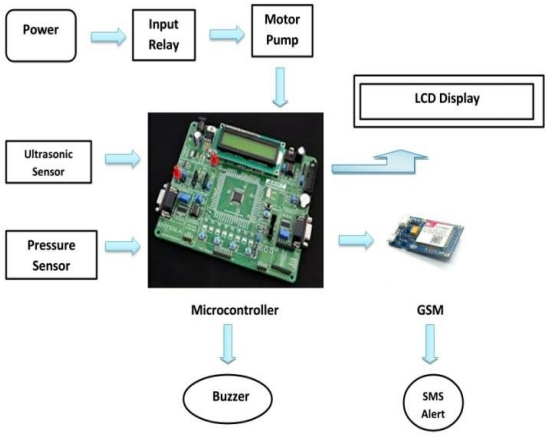

Fig 6: Circuit Diagram

3.4 Experimental Programming

```
#include<lpc214x.h>
int main()
{
if(ultrasonic<7)
{
  Buzzer_ON();
  Send_SMS();
}
if(ultrasonic<13)
{
  Buzzer_ON();
  Motor_ON();
}
if(pressure>98&&pressure<127.5)
{
  Buzzer_ON();
  Motor_ON();
}
}
```

4. RESULTS AND DISCUSSION

4.1 Ultrasonic sensor

Table -1: Ultrasonic Sensor Reading

Ultrasonic Reading (cm), S	Water Level (cm) [$W_s = H_s - S_]$	Water Level at Chembarambakkam Lake(m)	Status
12	13-12= 1	2	No Change
10	13-10= 3	6	No Change
9	13-9= 4	8	No Change
7	13-7= 6	12	Buzzer sound along with SMS notification
5	13-5= 8	16	Buzzer sound along with SMS notification
2	=13-2= 11	22	Buzzer sound along with Discharge of water

- When the water level in the reservoir is less than 6 cm, nothing will happen, and the dam is in its normal condition.
- When the water level is above 6 cm and less than 9 cm, a buzzer sound will be produced along with the SMS notification as “EMERGENCY Flood at your area!!” at one-minute interval.
- If the water level is more than 9 cm, an intensive buzzer is produced, and the water will be discharged to prevent heavy flood.
- Here also the ratio between the prototype and the Chembarambakkam lake is about 1:200 i.e, for 0.01m(1cm) water level in the prototype is equal to the 2m in the Chembarambakkam lake.

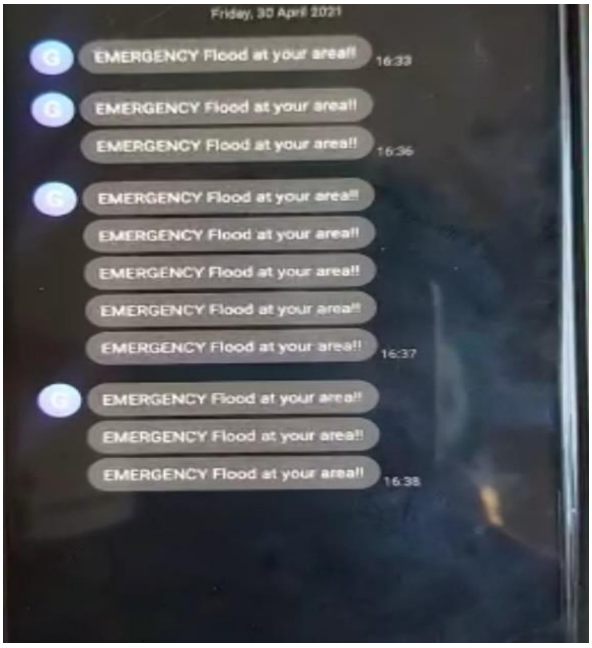

Fig-6: SMS

4.2 Pressure sensor

Table -2: Pressure Sensor Reading

Ultrasonic Reading (cm)	Water Level (cm)	Chembar am-bakkam Lake (m)	Pressure Reading (bar)	Pressure Reading at Chembar am-bakkam Lake (bar)	Status
13	0	0	0	0	No Change
11	2	4	19.62	3924	No Change
8	5	10	49.05	9810	No Change
6	7	14	68.67	13734	Buzzer with SMS notification
3	10	20	98.1	19620	Buzzer with Discharge of water

PRESSURE CALCULATIONS IN THE PROTOTYPE:

Pressure = depth * density of water * acceleration due to gravity

=0.1 * 1000 * 9.81

=98.1 bar

PRESSURE CALCULATIONS IN THE CHEMBARAMBAKKAM LAKE:

Pressure = depth * density of water * acceleration due to gravity

=20 * 1000 * 9.81

=19620 bar

- Hence it is the maximum pressure that the reservoir can withhold.
- Therefore, when the pressure sensor reads 98 bar and above, then a buzzer sound is produced along with the discharge of water to prevent the dam failure.
- Hence, it is the pressure that is about 77% of the maximum pressure that the dam can withhold.
- Here the ratio between the prototype and the Chembarambakkam lake is about 1:200 i.e, 98.1 bar pressure in the prototype is equal to the 19620 bar in the Chembarambakkam lake.

5. CONCLUSIONS

- Flooding warning system based on sensors is very interesting one, because by using this technology we can prevent many losses of property or life.
- This research has represented an effective system of detection of flooding with Ultrasonic and Pressure sensors, GSM to speed up flooding information to the people.
- This research also prove that water characteristic can be came an important parameter for flooding warning information.
- Thus by using this technology, we can reduce the effects of the flash flood which occurs during the rainy seasons by getting prior intimation of the water level status.
- It further reduces the risk of loss of lives and properties by evacuating the nearby people on time.

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