FLOOD MONITORING AND EARLY WARNING

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1. INTRODUCTION

The Internet of Things builds on three major technology layers: Hardware (including chips and sensors), Communication (including mostly some form of wireless network), and Software (including data storage, analytics, and front end applications). IoT describes a system where items in the physical world, and sensors within or attached to these items, are connected to the Internet via wireless and wired Internet connections. The physical objects that are being connected will possess one or more sensors. Each sensor will monitor a specific condition such as location, vibration, motion and temperature. In IoT, these sensors will connect to each other and to systems that can understand or present information from the

In developed country like US, Japan etc. the flooding problem is minimized significantly and do not affect much due to availability of emergency system. But the developing countries like India, Brazil etc. is suffering a lot during flood.

Every year number of deaths due to flooding keeps increasing in different part of our country. Two years ago the flood occurred in Chennai, the capital of Tamilnadu resulted insignificant loss of life and property. Whenever, flooding happens living area near the riverbank and downstream area are affected severely than others. They need to be alerted much earlier to have extra time to evacuate immediately. During Chennai flood in 2015, fake news were spread for instance, A false message which said two lakes had breached and Chennai had been cut off from rest of the districts, spread panic among commuters, especially those that were stranded for hours together on the arterial Mount Road on Monday night. To avoid this situation we need authorized warning system. Our system provides such information so that people can avoid false news .And the system makes use of voice call as it is helpful for people who do not know how to read the text message.

3. PROPOSED MODEL

FLOOD MONITORING AND ALERTING SYSTEM alerts the user nearby the river area through voice call. An Arduino Uno microcontroller is used to control the whole system. It is interfaced with GSM modem, ultrasonic sensor, Ethernet shield [1]. The distance between the ultrasonic sensor and water is measured and the height level of the water is calculated [2]. The calculated height value is updated in the web page. The water level calculated would then be compared with the set threshold and if the current level is more than the set threshold value, the microcontroller would enable voice call to be sent to residence to alert them via the GSM module. We are using ARP33A3 device to record voice and it is interfaced with the GSM modem so that the recorded voice is played when the call is attended.

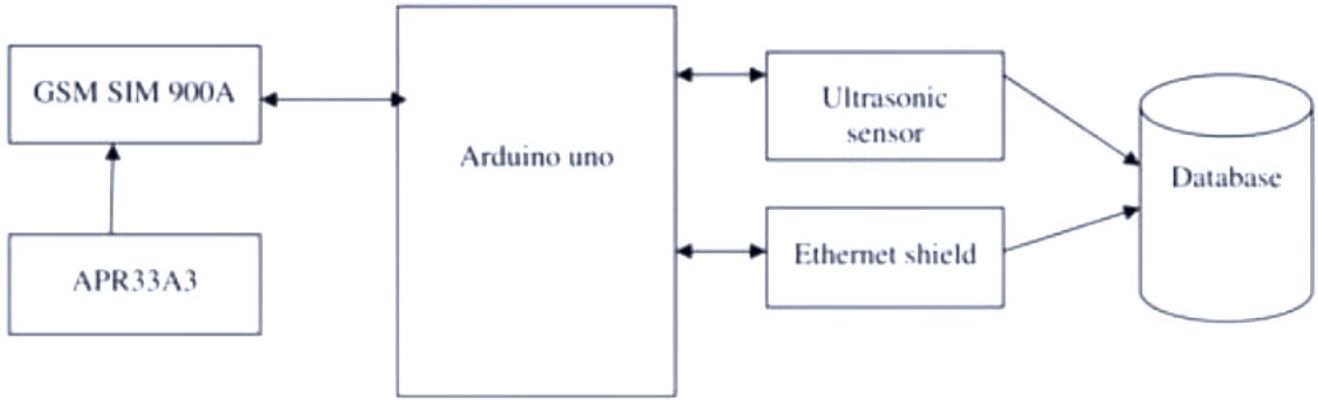


Figure 1 Block diagram of proposed model

4. SYSTEM OVERVIEW

4.1. Flow Chart

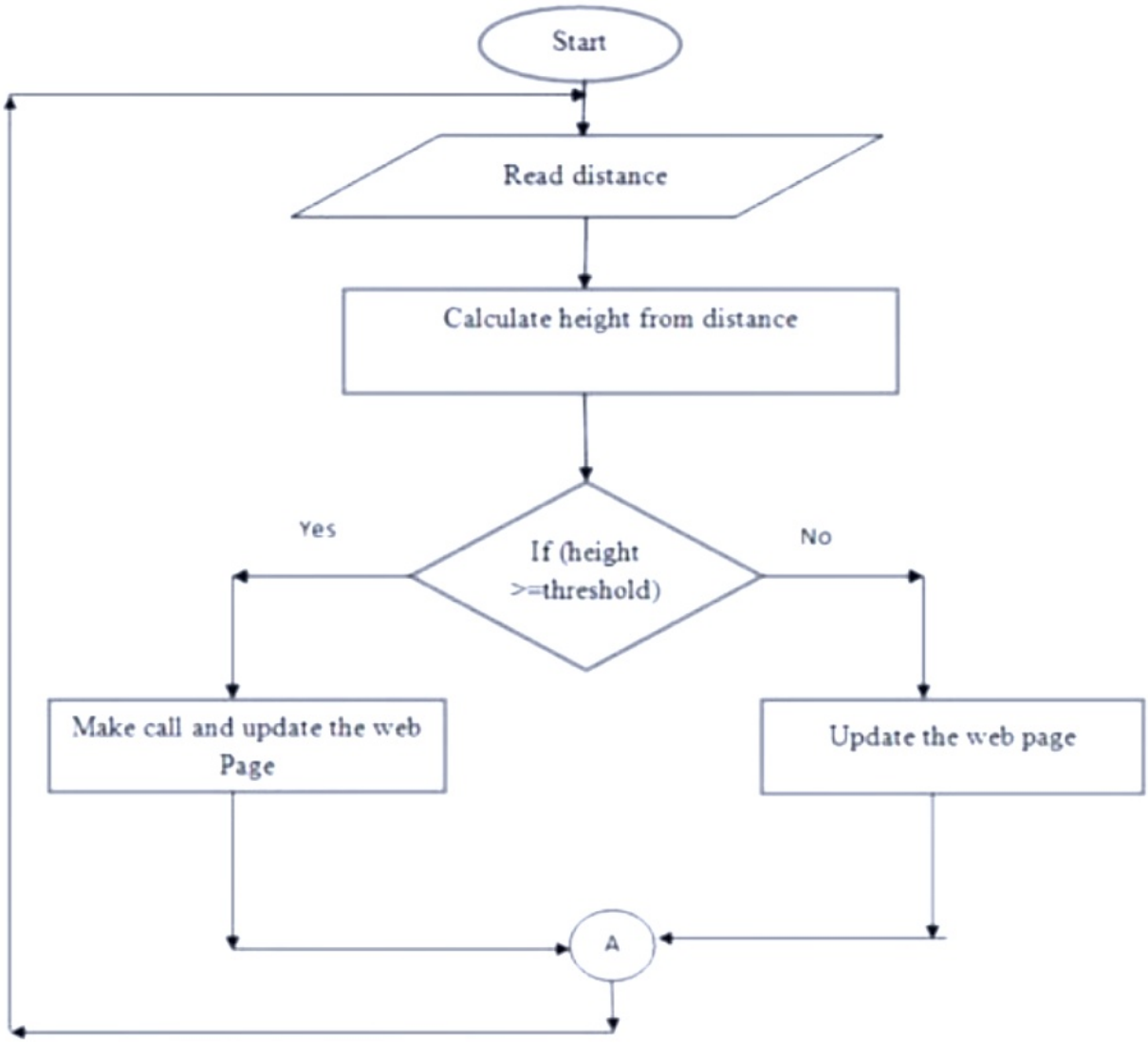


Figure 2 Flow Chart

4.2. Ultrasonic Sensor

Figure 3 Ultrasonic Sensor

Ultrasonic sensor HC SR04 can measure the distance from 2cm to 4m with accuracy of range of 2mm.It emits ultrasonic sound at 14000/4 Hz which will travel in air. If there is an object, sound is bounced back to sonar. Using receiving time of sound and speed of sound, we can calculate the distance of object from sonar.

Speed of sound =340m/s=0.034 cm/micro sec. or 29 micro sec/cm

Time = Distance/speed.

Since the sound waves travel froth and bounce back from object and so time received is twice the actual time. Thus,

Distance in cm=time*0.034/2 or Distance in cm=time/29/2

Based on distance, height of water is calculated.

4.3. Related Work

The static web page is created using HTML and CSS which is served from the SD card [5]. The Ethernet shield brings the internet connectivity to the arduino shield and make it to act as a server [6][10]. The Ethernet shield is connected to the system with internet connection with the help of RJ45 cable. This webpage can be accessed from any system that is connected in the same LAN as that of the Ethernet shield. A static ip address is allocated to Ethernet shield. Whenever the user wants to access the page the user must enter the ip address of the Ethernet shield in the URL bar. The static webpage content will be fetched from the sd card and the dynamic content that is the water level information will be fetched from the database and displayed in the webpage.

4.4. Making Call

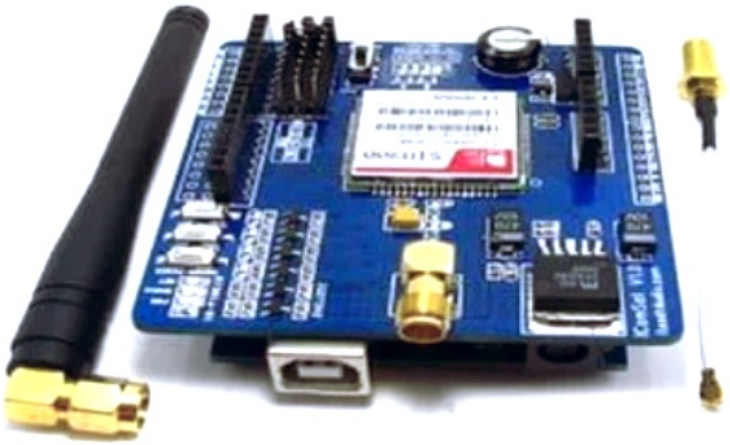
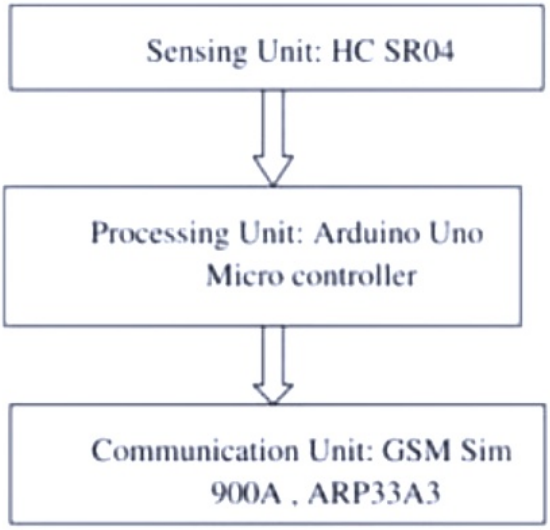


Figure 4 GSM sim900A

When the water level reaches the threshold level, call must be made to the residence. To make call using GSM module AT+ATD command is used when the call is attended the recorded voice message should be played [3][4]. The APR33A3is interfaced with gsm module [9]. This APR33A3 operates in two modes. The first mode is record mode in which the audio can be recorded into any of the seven channels. The second mode is playback mode in which the recorded audio can be played from the channel when the call is attended.

5. PROCESSING STEPS



6. CONCLUSION

This project aims at monitoring the water level in one particular water body. In future it may be enhanced to monitor multiple locations at the same time and the web page must be able to display the information based on the selection done by the authority.

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Background of the Study

President Benigno Aquino III stated in his 2013 State of the Nation Address that the Philippine economy loses an estimated 2.4 billion pesos every day because of Metro Manila traffic. And this number even goes up whenever motorists get stuck during the wet season. During rainy seasons, local commuters in Metro Manila have been expecting to encounter one or two flooded roads along the way. But still, motorists get stuck on their way for they are not able to get real time information on the situation of the flooded areas.

Since the boom of the social media, the Metro Manila Development Authority (MMDA) found ways other than news on the radio and television on how to reach out to the commuters. This government institution used social media accounts in Facebook and Twitter to inform motorists about the traffic condition in Metro Manila. This is very helpful to the locals who always have their smartphones on the go.

According to a survey conducted by Taylor Nelson Sofres, a marketing research firm, 53 percent of smartphone users in the Philippines comes from Metro Manila. Among the cities in the country's capital, Makati City has a large number of smartphone users considering the fact that it is the business capital of the Philippines.

According to Hossain and Davis, flooding is considered to be one of the most catastrophic forms of natural disaster. They also added that the adverse effect of flooding is recognized when it disrupts the road transportation system of a country since it is considered as a country's socio-economic lifeline.

Metro Manila Development Authority uses different methods in detecting flood levels in certain roads to inform the commuters. The use of closed-circuit television (CCTV) cameras and flood height pole indicators are one of the few.

Despite maximizing the use of the Internet and social media, information from the MMDA are only limited to the current situations on the major roads in Metro Manila.

This work will present a design project that will help provide sufficient real-time information on the current flood condition on a chosen flood prone area. This project will also help in facilitating the dissemination of information to the people.

Statement of the Problem

Informing locals about flooded roads during rainy seasons have been a problem in Metro Manila for years. And to help solve this problem, the design project aims to develop "Road Flood Sensor with Web and Mobile Application Support."

Specifically, this study aims to answer the following questions:

1. How can the design project help the locals measure flood height on roads?
2. What mobile and web application can help commuters be informed about passable and unpassable roads due to flood?
3. How can the design project help the dissemination of information on an impassable road and its height to the locals during rainy season?

Theoretical Framework

Using ultrasonic sensors, proponents can create their own flood level sensing device which will then be attached to gizDuino™ (e-Gizmo Mechatronix Central version of Arduino™, an open source computing platform based on simple input/output board and the use of standard programming language) to process the sensor's signal into a usable data input. The derived data from sensor's signal will be passed to the web server through the use of GSM/GPRS shield. GSM/GPRS shield is used to establish communication between a computer and a GSM-GPRS system. Global System for Mobile communication (GSM) is an architecture used for mobile communication in the Philippines. GSM requires a Subscriber Identity Module (SIM) card just like mobile phones to activate communication with the network. It also has International Mobile Equipment Identity (IMEI) number similar to mobile phones for identification. The GSM/GPRS shield can send, receive, and delete Short Message Service (SMS) messages in a SIM. The SIM's network that we are going to use will be based on signal strength on the desired testing location.

The microcontroller (gizDuino™ and GSM/GPRS shield) requires finite power supply to make it work on its stable and functional state. Unstable power supply may cause the units interrupted, malfunction, or damaged. gizDuino™ needs a power input of 5 volts or within the range of 5 to 12 volts with an ampere rate of 500 milli-Amperes. While the GSM/GPRS shield requires a power input of 5 volts or within the range of 5 to 7.5 volts with an ampere rate of 1.5 Amperes. The operating temperature of the

Conceptual Framework

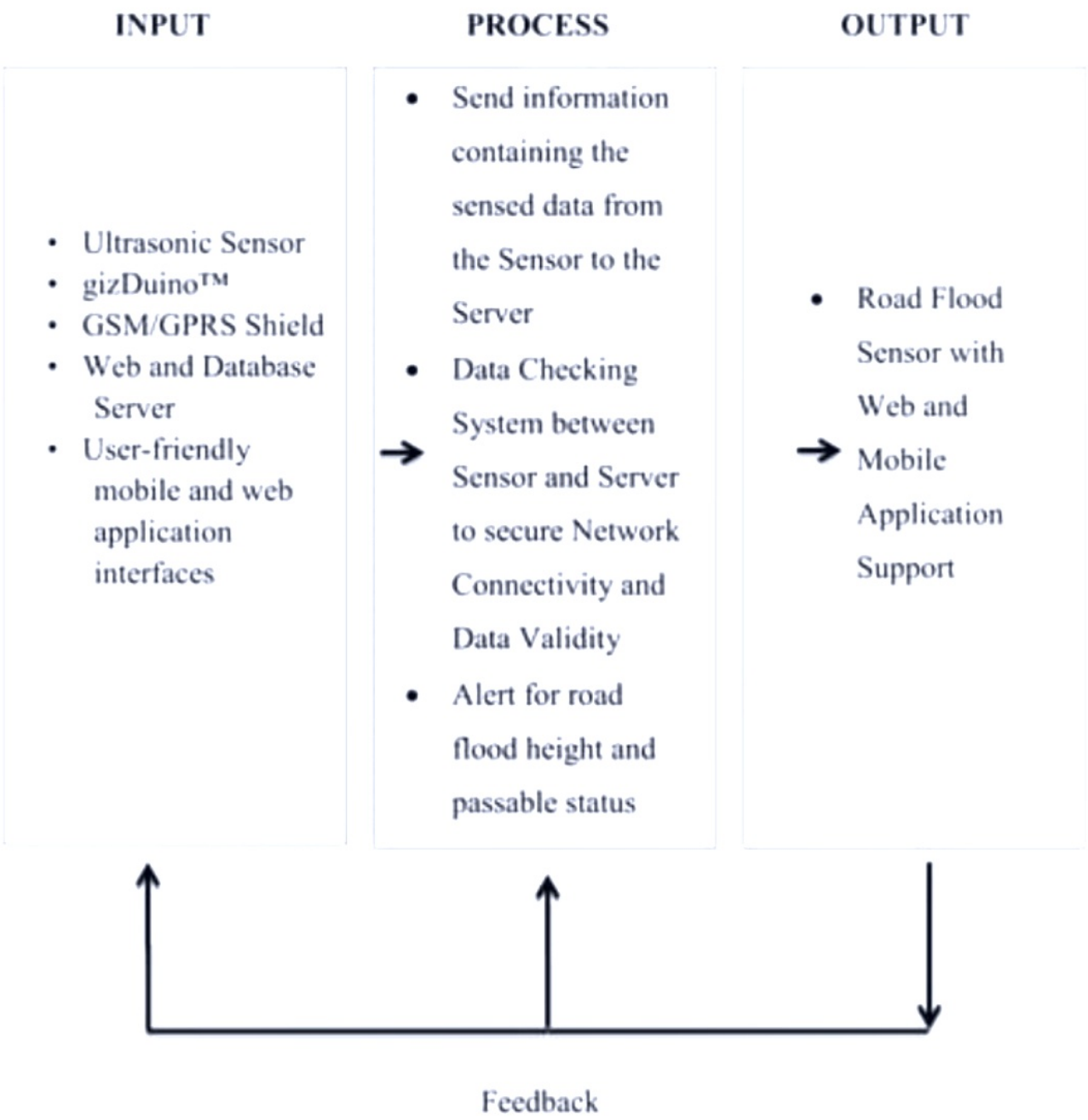

Figure 1.1 Conceptual Framework of the Road Flood Sensor with Web and Mobile Application Support

Figure 1.1 illustrates the general flow and structure for the path of this study. The idea of having the Input-Process-Output system approach was used to describe the conceptual framework of the study conducted. Based from the figure, the inputs gathered through information from the specific contributors and software and hardware requirements were listed to make the design project possible. Then, a process shall take place. It shall analyze all the inputs provided and act accordingly. The output of the research process involves a prototype that can sense the water level of flood on a specified road, a mobile application for motorists and commuters regarding certain impassable flooded areas, and a web application for web browser viewing in case of incapability of installing the Android app or make it available for PC viewing and for authorities to monitor and control what information would be given to the public. A feedback provides a data which serves as a guide in making changes on the input or processing activities, thus modifying the outputs for data integrity and helps to have a better result for the enhancement of the research.

Scopes and Limitations of the Study

The design "Road Flood Sensor with Web and Mobile Application Support," is proposed to build a flood level sensor with mobile and web application support. Conducting this project starts from June 2013 and ends on January 2014.

The device shall contain ultrasonic sensor to sense the water level of flood on the road and GSM/GPRS shield as a means of communication protocol between the device and web server. The unit containing the sensor will be placed to the intersection

of Anonas and Hippodromo streets for testing. The position of the sensor must be placed perpendicular to the flood water, otherwise, there will be an imperfect reflection of ultrasonic waves and cause measurement errors.

The sensor is suggested to be placed on a pole with a height of about 3 to 3.5 meters. The flood sensors and microcontrollers will be powered by a circuit that converts Alternating Current (AC) to Direct Current (DC). This circuit will also have the capability of charging a rechargeable battery. In case of AC power outage, the circuit will automatically rely on the battery for the benefit of continuous operation of water flood height detection and network data transmission. The back-up battery shall last for 9 to 10 hours.

Every two inches difference of flood water height level detection through the analysis of Gizduino will be automatically send the information to the server to have an initial data to be saved on the server. The server will then request to resend the information to verify the validity of data. If it is still the same information, then it will be recorded to the database and ready for dissemination on web, mobile and cellular phones.

There will also be a web and a mobile application available for the locals who have their smart phones. The mobile and web application shall contain search fields and pictorial representation about the metric level of water based on vehicle types and human body. These applications could only be used with an Internet access. Updates and notifications will also be automatically extended to Twitter and Facebook. The design project will also incorporate SMS subscription to be able to inform cellular phone users without Internet capabilities.