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Social Media based Flood Precautionary System with Raspberry Pi

Mayuresh Sudhir Sawant
UG Scholar, Department of Electronics and Telecommunication,
Ramrao Adik Institute of Technology, Navi Mumbai, Maharashtra, India
Email: mayuresh23sawnt@gmail.com

Abstract: *Every monsoon, Mumbai, the financial capital of India, gets paralyzed due to heavy rains. Although the Indian Meteorological Department provides some warnings, they have limited resources. To help understand flooding at a street level there is need for a system that monitors the root cause. The Flood Precautionary System is a system that can be set up in different streams, canals and sewers across the city which is food prone. Whenever the water level in them rises to a certain dangerous level, it automatically detects it and sends a warning and alerts people to stay away from that area Ultrasonic Sensor senses the water level and feeds the data to the Raspberry Pi. Raspberry Pi further analyses the data and calculates the distance from top of the water surface. This data is then transmitted through various channels and shared publicly. Also a WhatsApp AutoReply Chat Bot continuously is fed by the distance value which can be seen just by typing distance.*

Keyword: *Email; Facebook; Flood; Internet of Things; IoT; Python; Raspberry Pi; Twitter; Ultrasonic Sensor; Water Level; WhatsApp*

1. INTRODUCTION

The Flooding has become an increasingly common phenomenon in recent years. Many suffering localities have been unprepared or underprepared, with little reason to believe they were at risk until it was too late. A system that senses the water level and warns the people in real time can save a lot of lives.

The Flood Precautionary System uses approach of `Internet of Things', to create a system that warns you about the impending danger. Social media platforms like WhatsApp, Twitter and Facebook are very popular. There are over 300 million Twitter users, 1 billion WhatsApp users and over 1.8 billion Facebook users. So, a flood warning in such widely used social media platforms won't go unnoticed. Thus, we decided upon social media as our warning platform.

The system uses an ultrasonic sensor to read the level of water from the top. Whenever, this level decreases beyond a certain predefined limit, the system automatically makes a tweet & a Facebook post and sends an email. The system simultaneously runs a WhatsApp program where the distance can be known just by asking it to the system.

This paper explains the working of the system and compares it with the existing ones.

2. LITERATURE SURVEY

Iowa severe flooding in 2008 demonstrated the need for more extensive monitoring of the state's rivers and streams in real time [1]. To address this, the Iowa Flood Centre (IFC) developed and maintains a state-wide network of stream stage sensors designed to measure stream height and transmit data automatically and frequently to the Iowa Flood Information System (IFIS). The collected data is sent integrated into an advanced hydrological model.

Real Time Wireless Flood Monitoring System Using Ultrasonic Waves another project by Abubakr Rahmtalla Abdalla Mohamed and Wang Guang Wei of Tianjin University of Technology and Education, Department of Electronics Engineering [2]. The aim of this project is to develop prototype of water level detection that can be viewed as a part of control system of river Ow management system. This system uses Ultrasonic sensors, RF transmitters and LCDs.

Rivers in Honduras flood frequently, causing a major trouble to people and their lives there [3]. Seeing the pain that the Honduras citizens had to suffer from, daily prompted Robert Ryan-Silva, the director of DAI maker lab, to take on the "Hidrosnico project". Hidrosnico is a stream gauge using a MaxSonar HRXL MB7369 sonar rangefinder, a Seeeduino Stalker v3 Arduino-compatible microcontroller platform, and a FONA 800 GSM module [4].

The Oxford Flood Network is a citizen-based initiative for water-level monitoring, based on the "guerilla network" in the spirit of the crowdsourced Japan Radiation Map made by the public around Fukushima in response to a lack of official information [5]. They use an interactive, online map which visualizes river and stream levels around Oxford. This map shows the collective data of a set of sensors over the city which determines in which area the water level is high.

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3. PROPOSED METHODOLOGY

The system can be explained by dividing it into two parts: The overall system working and sensor working. The overall project methodology gives a general overview of how the system works as a whole. The sensor methodology shows how the distance is actually calculated in the program.

3.1 Overall System Methodology

The overall working of the system can be seen in the Fig. 1. The Project uses `Raspberry Pi 2' and `Ultrasonic Sensor to create a Flood Precautionary System. The Ultrasonic Sensor measures the distance from the top of the water level. The Raspberry Pi 2 is used as medium of communication between the Ultrasonic Sensor and the various channels of warning transmission. The various channels include the likes of Twitter, Facebook And Email. WhatsApp is another channel of communication which is used a bit different way. WhatsApp is used like a server channel. Where data can be monitored at each and every instant. It also gives a more accurate value of distance as the value sent in the message is Floating Point type.

3.2 Distance Measurement

First, we import the necessary libraries. Also, we need to assign import the access tokens and access secret generated for our twitter app. We need to add the email id and password of the sender (Raspberry in our case) and the receivers. Start the Gmail email server using SSMTP. Since we need to measure the water level until the program execution is stopped, we put in an infinite loop wherein the sensor will keep measuring the water level and then transmitting the warnings accordingly.

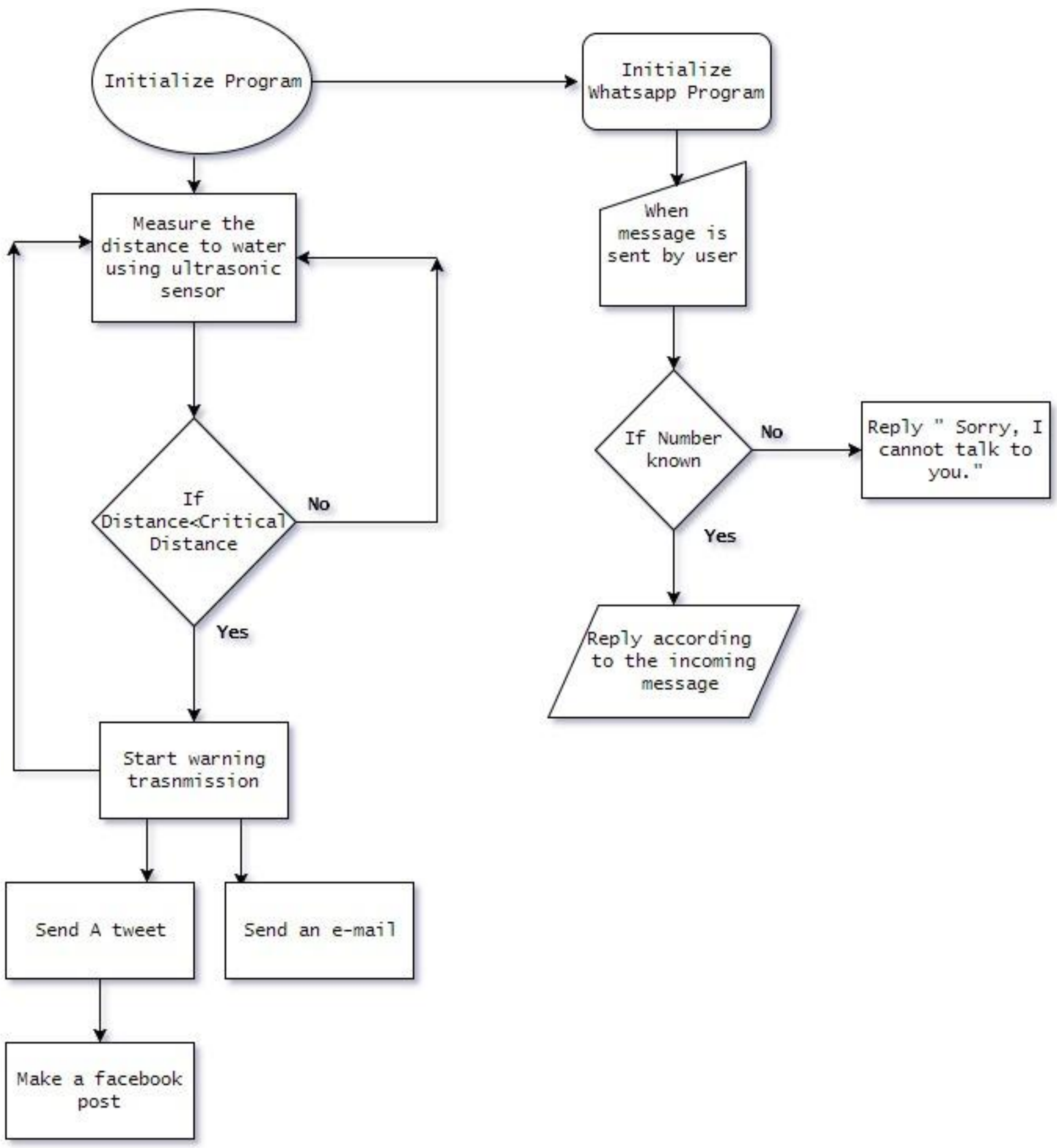

Figure 1 Overall system working

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The sensor requires a short 10uS pulse to trigger the module, which causes the sensor to start the ranging program. The ranging program sends 8 ultrasound bursts at 40 kHz to obtain an echo response [7]. A trigger pulse is created by setting the trigger pin high for 10uS then setting it low again.

The program works in such a way that it will record the exact time when the pulse is sent from the sensor and store it in a variable. It will also record the time instant at which the pulse is received back after reflection. Hence, we get the pulse duration by subtracting both the time instants. The distance is calculated using:

$$Speed = \frac{Distance}{Time}$$

The speed of sound varies on what medium its travelling through, in addition to the temperature of that medium. However, the speed of sound at normal conditions is 343m/s. Since the one travel time is approximately half the total time, we divide 'Time' by 2.

$$34300\ cm/s = \frac{Distance\ (cm)}{Time\ (s)/_2}$$

$$17150\ cm/s = \frac{Distance\ (cm)}{Time\ (s)}$$

$$Distance\ (cm) = \frac{17150\ (\frac{cm}{s})}{Time\ \ (s)}$$

We store the measured distance in a variable and calculate whether it is less than the predefined critical distance. If the distance is more, go back to measuring the distance. Else proceed further. Send a tweet using Twython. We have synced our Facebook page and Twitter account, whenever there is a Tweet the same text is posted on the Facebook page. Then we send an email using SSMTP. Then the process is repeated. The WhatsApp autoreply chatbot uses Yowsup to read the incoming message and reply accordingly.

4. RESULTS

The program was successfully executed. whenever the level water rose to the critical level a warning was transmitted via various channels. The following are the channels:

4.1 Email

An email alert was automatically sent as the water level reaches the critical level. The alert message has a warning statement `Stay Away' and states the distance from top.

4.2 Twitter

A Tweet alert was automatically sent as the water level reaches the critical level. The alert tweet has a warning statement `Please Stay Away' and states the distance from top. Also, the time was included in Tweet because if the water level remains the same for some time and a tweet is delivered then it will be considered as a duplicate tweet which is not allowed in Twitter. This will generate an error in program and effect the execution of program.

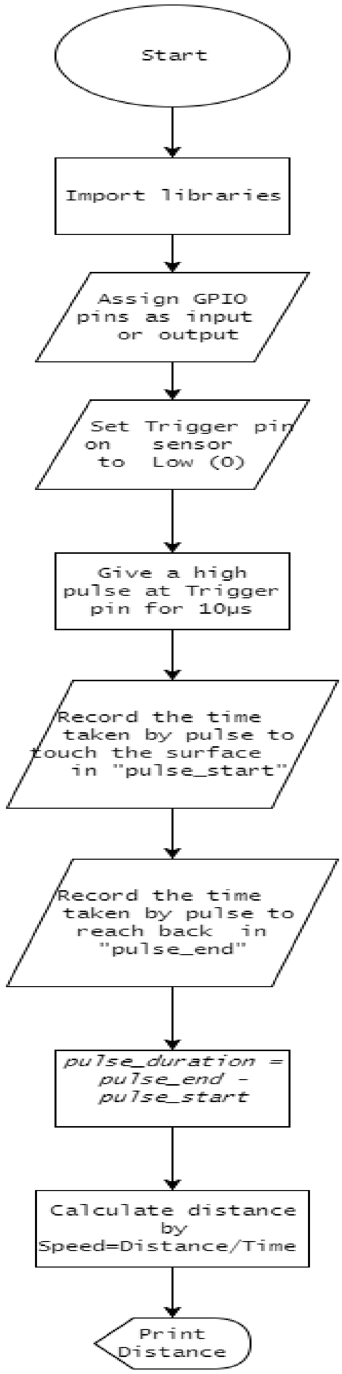

Figure 2 Distance measurement

4.3 Facebook

Facebook warning transmission was synced with Twitter. As soon as a warning was send on Twitter the same warning message was posted on the Facebook Page of the project.

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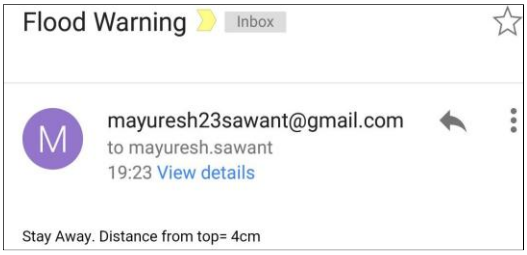
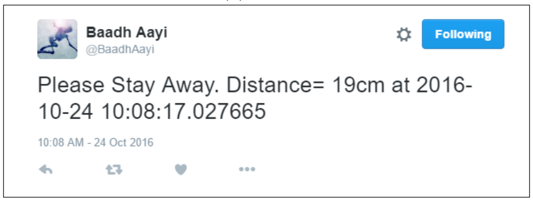
4.4 WhatsApp

WhatsApp was used as a Real Monitoring System. When the user types `Distance' the distance from top was displayed similarly the status and the temperature of the Raspberry Pi 2 was displayed for respective commands.

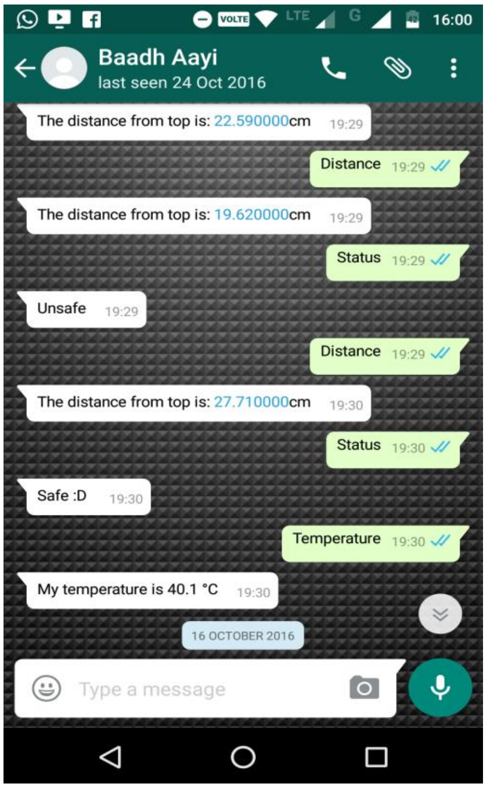


(a) Email



(b) Twitter

(c) Facebook



(d) WhatsApp

Figure 4 Results (a) Email (b)Twitter(c) Facebook (d)WathsApp

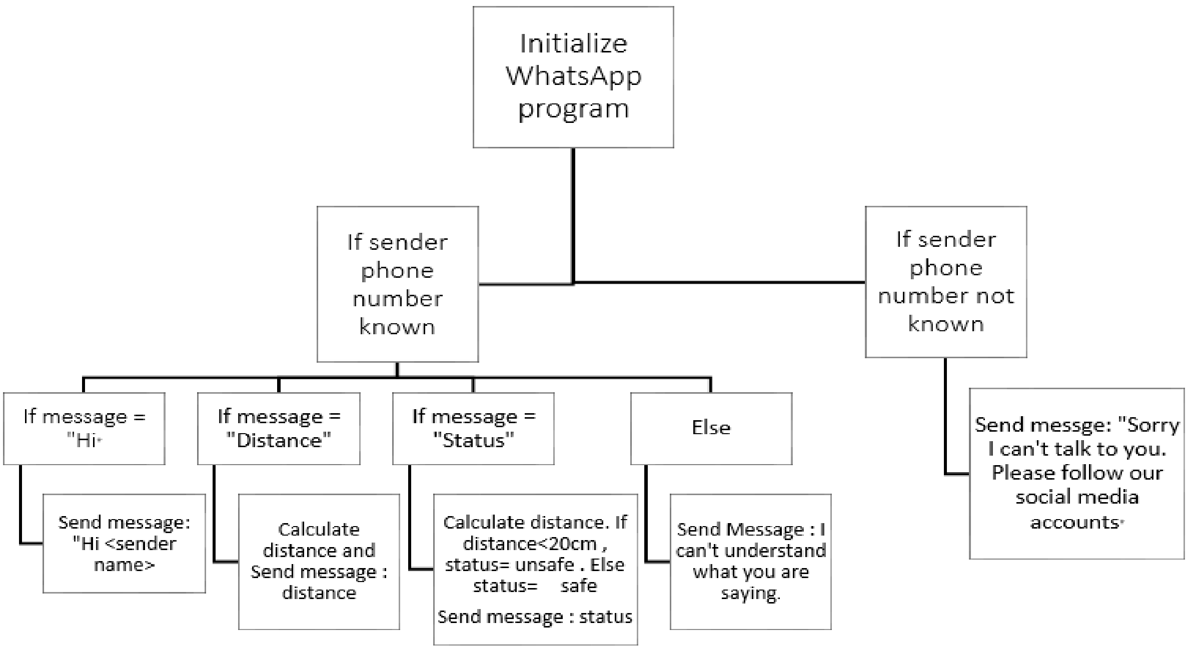


Figure 3 Whatsapp autoreply chatbot

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5. CONCLUSIONS

The Flood Precautionary System is a modern and efficient way of warning common people and the concerned authorities about the incoming flood with the use of small and effective components with Internet of Things. Real time monitoring system gives accurate predictions than the Met Department. This project will minimize the loss of life and property caused by the flood by issuing alerts well in advance.

A network of such devices across the city will help in bringing the data to the people on their devices. The system can also result in better management of traffic in case of a calamity, as it would alert the motorists about water logging in an area.

Cost involved in this project is a fraction of what the existing systems cost. The software used in it is all open source. This makes it free. The hardware is easy to set up with only a few components and requires minimal effort. The setup of the is sensor away from the main circuit because, in case of an actual flood, only the sensor will be damaged and not the entire circuit.

This system can be implemented across the world and the technology can be further improved upon by enthusiasts

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Authors Biography

Mayuresh Sawant is an undergraduate student at the department of Electronics & Telecommunication at Ramrao Adik Institute of Technology, University of Mumbai. His research interests are embedded systems, robotics, IoT and computer architecture.