Identification of Road Distress with Notification System

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Abstract— *Today a large number of accidents occur due to the bad conditions of roads. Potholes and humps are the major problem which leads to accidents. Potholes and humps occur due to wear and tear of roads, resulting in poor road conditions. Sometimes, such potholes or humps may lead to any major accident. We through this paper, have proposed a system that will focus on this major issue of bad road conditions. We have implemented a system that will be used to identify nearby pothole or hump. Using this system, the potholes and humps can be located and the user will be informed if a pothole or hump is approaching the user's way and also the reports of the same can be generated for the maintenance of roads and concerned authorities will take the appropriate measures to repair it. The system uses a Global Positioning System (GPS) receiver to locate the current position of the vehicle in which the device is installed. The ultrasonic sensor will first identify the pothole or hump and then capture their depth or height respectively. The server database will store this data and a website will provide alert in the form of a notification whenever the vehicle will come across any pothole or hump.*

Keywords—GPS, Ultrasonic sound, database, web application, GSM.

1. INTRODUCTION

Although India is doing exceptionally well in various fields but there are still certain areas where the country is lagging behind. India's road network is gigantic, but one of the striking underlying drawback is the condition of the roads. [5] Since roads indirectly contribute to the economic growth of the country it is extremely essential that the roads are well laid out and strong. India is home to several bad roads be it the metropolitans, the cities or the villages. This problem is being addressed since the last 30 years. According to the road accident report, in 2014, around 4,726 lives were lost in crashes due to humps and 6,672 due to potholes and speed breakers. According to the research, in India the highest number of road accidents has occurred in Tamil Nadu; followed by Maharashtra, Madhya Pradesh, Andhra Pradesh, Karnataka and Kerala. The reason for such accidents is the uneven potholes and humps. This may be due to lack of attention paid on maintenance of roads or lack of labour. The following figure shows the graph of road accidents occurred in the respective states.

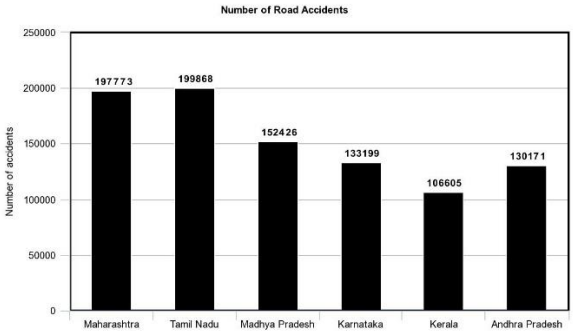

Fig -1: Accident Statistics of different states in India.

2. HISTORY

As we see in the Fig.1 the accidents have increased tenfold due to bad conditions of the road. Detection of pothole is an important topic of research and various researchers have been working on different pothole detection techniques. [2][3] Few of the researches have been highlighted below to comprehend various studied systems.

Moazzam et al. have proposed a model which makes use of low cost kinetic sensors and it gives the direct depth measurements which reduces the computing cost. [2] This model is used for analyzing 3D distress images. This sensor consists of two cameras – RGB camera and IR camera wherein they capture RGB images and depth images. A MATLAB environment is used to analyze these images to determine the actual depth of potholes by extracting various characteristics of image and the approximate volume of pothole is calculated using trapezoidal rule on area-depth curves through pavement image analysis. [2]

Mednis et al. has proposed a model which makes use of smartphone along with accelerometer to detect the potholes. The smartphone consists of built-in accelerometer which is used to sense the movement and vibrations and detect potholes. Various algorithms are used to measure the difference between the amplitude value like Z-thresh and

STDEV(Z) finds out the standard deviation of vertical axes acceleration and G-Zero are used to identify potholes.[4]

We have implemented our system works by using sensors, microcontroller and using GSM SIM communicates with the user regarding pothole alerts. [1]

3. METHODOLOGY

The four components of our system are explained below:

1) Atmega16 Microcontroller: The heart of the proposed system is an Atmega16 Microcontroller which is a 40 pin microcontroller with 8k program memory. It is the component on which, other components are attached and the tasks of them like getting the details of pothole to notifying the driver is done.

2) Ultrasonic sensor HC-SR04: Ultrasonic sensor HC-SR04 is an easily affordable sensor used to avoid any object which is in its way by determining the distance between them. In the proposed system the sensor is used to determine the distance between the device and the pothole. It consists of a transmitter and a receiver. The transmitter transmits high frequency sound waves and reflects from the pothole or humps and is received back by the receiver. The time taken to receive the waves is used to measure the distance. [1]

3) GPS receiver: In our proposed system, the GPS receiver is used to capture the location the current location of the vehicle. It captures the latitude and longitude and transmits it to the server using the network connection provided by Sim808. [1]

4) GSM SIM 808: In our system, GSM SIM 808, is used to provide network connectivity to the system. [1] When GPS receiver captures the location of the pothole/hump, the coordinates are sent to the server using the network provided by SIM808. Fig-2 shows the interaction of various components of proposed system.

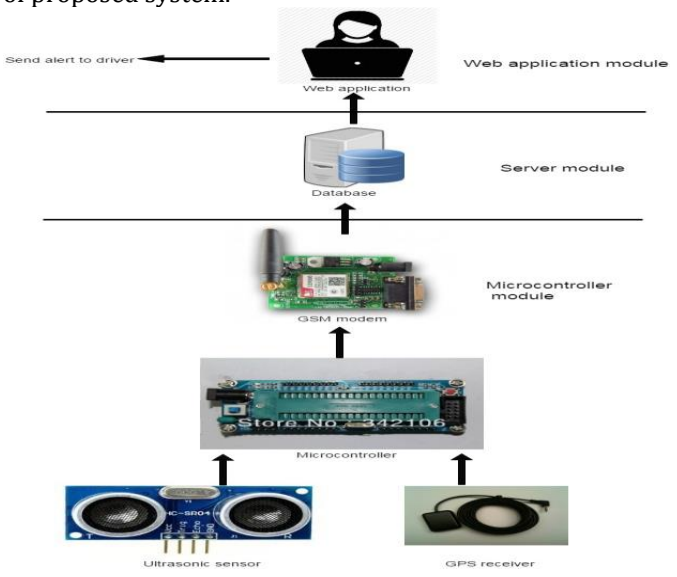

Fig -2: Interaction of various components of the system

The Fig.3 shows the sequence diagram of the implemented system. The main entities of the system are the admin, application, database and the user. The sequence diagram shows the step by step execution which gives the clear idea of how the system works and operates in real world when the vehicles are attached with proposed system. [1]

The admin logs in with appropriate login id and password. The ultrasonic sensor attached at the bottom of the vehicle provides information about potholes to the database entity. The admin remains updated about pothole details by checking it in the database through web application. The sensor sends the GPS location to the database entity and admin checks it again by requesting the database by sending the request through application entity.

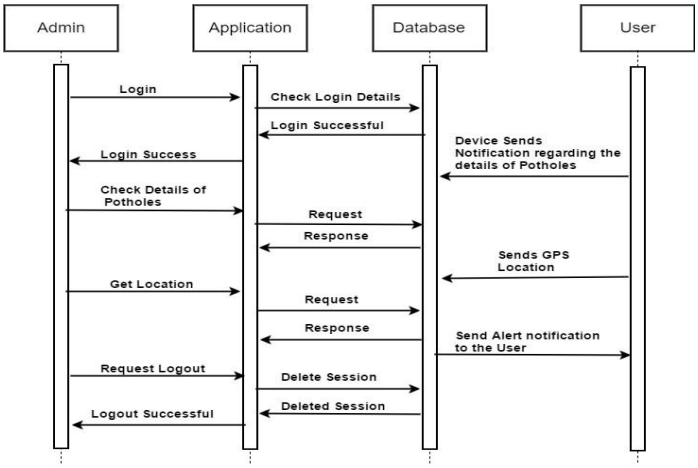

Fig -3: Sequence Diagram of the implemented system.

4. IMPLEMENTATION

4.1Microcontroller panel:

4.1.1 Hardware connection:

The first step of using the system is to attach the device at the bottom of the vehicle to capture the current location of the vehicle and detect pothole or hump. The micro-controller panel used is as shown in the Fig 4.

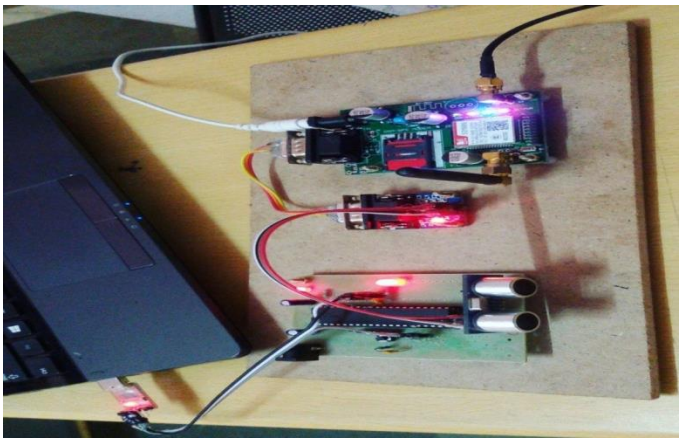

Fig -4: Micro-controller Panel

4.1.2 Spoofing of transmission of coordinates:

In the proposed system we have used an open-source software called the Tera Term. Tera Term is used to spoof the coordinates that has been sent by the microcontroller panel to the web application module. Fig 5 shows Spoofing of co-ordinates using the Tera Term Software

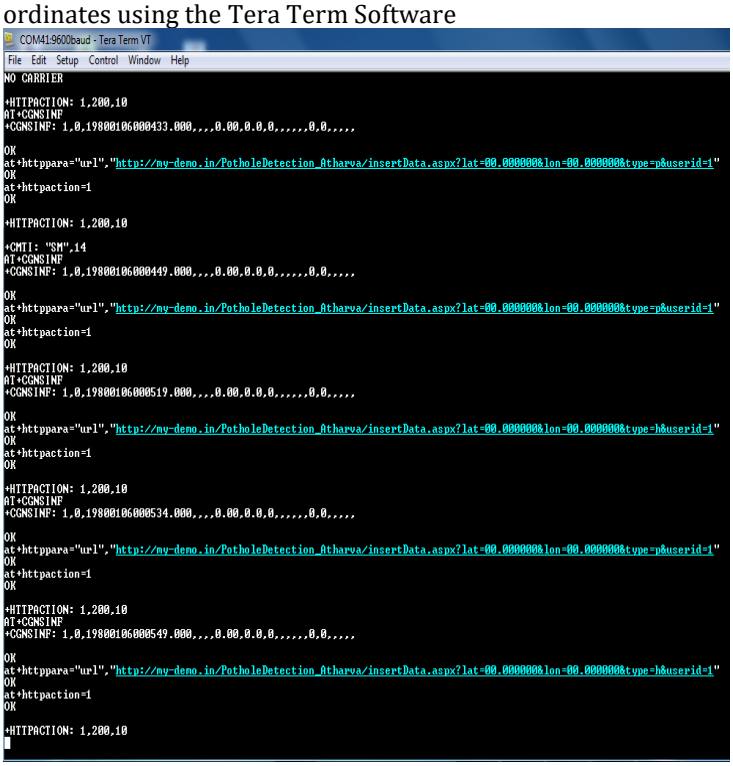

Fig -5: Spoofing of the Transmission of Co-ordinates

4.2 Web application module:

4.2.1 Admin Login page

The admin needs to enter valid credentials to login to the admin panel. If the credentials are wrong, the admin cannot access the panel. Fig 6 shows the Admin login page.

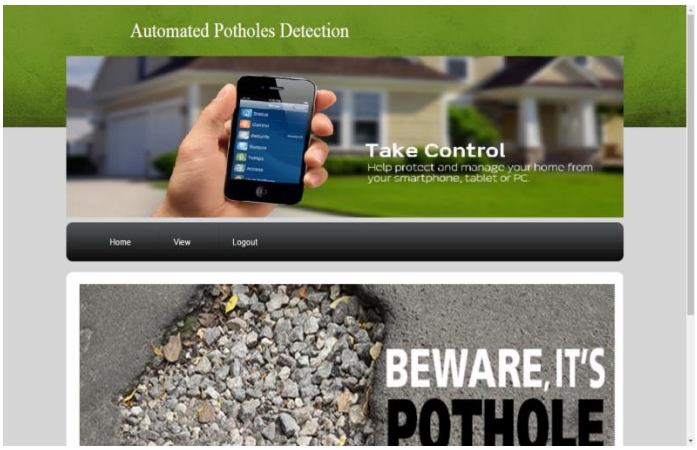

Fig -6: The Admin Login Page

4.2.2 Viewing the Co-ordinates

The co-ordinates recorded by the database entity from the sensors can be viewed by admin. The admin can click on the "View" button to view the coordinates. Fig 7 shows the admin viewing the co-ordinates.

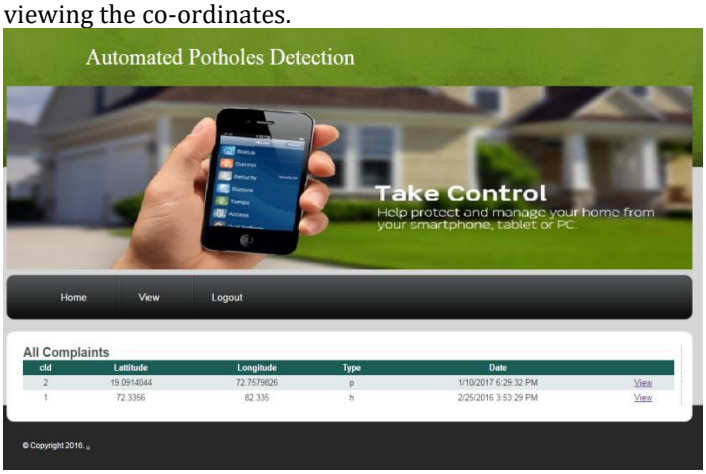

Fig-7: Viewing the co-ordinates

4.2.3 Viewing the Location

The location of the potholes identified by the sensors are stored in database and admin can access them. Fig 8 shows how user enters the latitude and longitude and Fig 9 shows the location displayed.

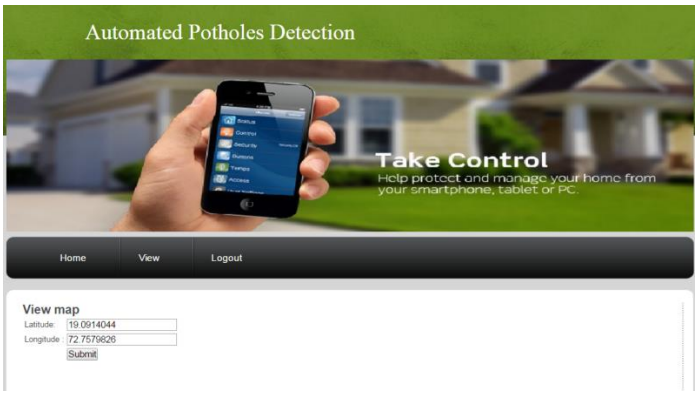

Fig-8: Viewing the location (a)

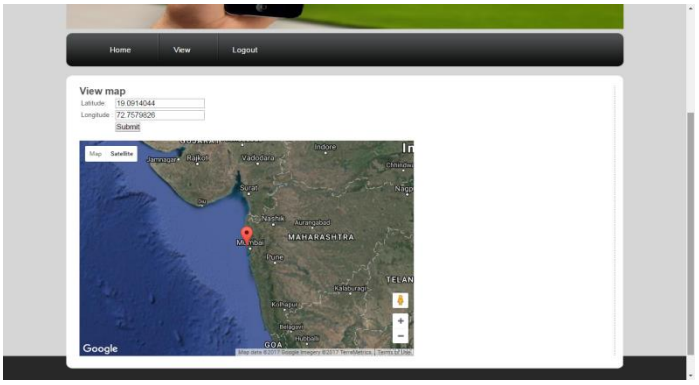

Fig-9: Viewing the location (b)

4.3 Notifying the user:
When the user is within a range of 1 km of a pothole or a hump that is stored in that database, the user will be notified with a text message and an email as well.

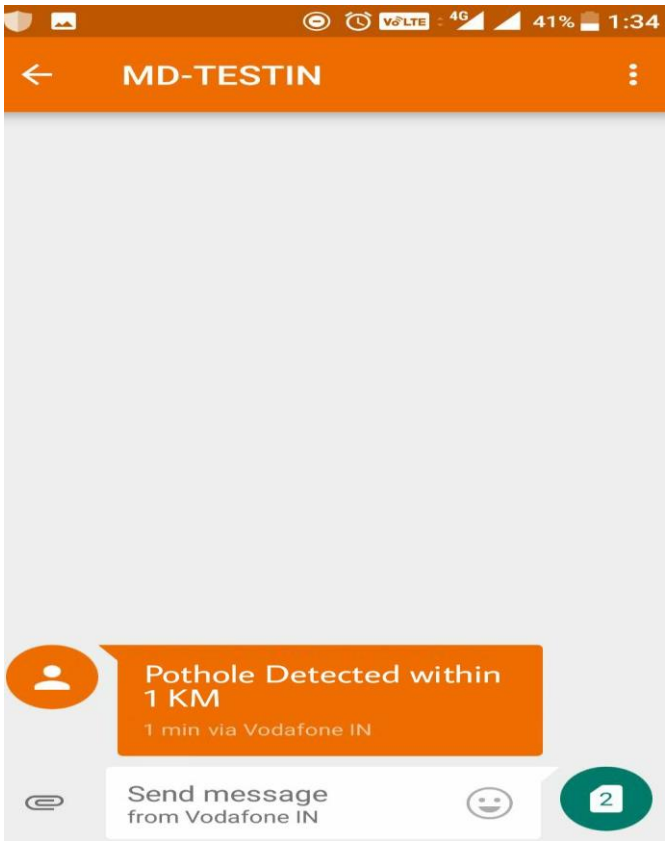

Fig-10: Text Message received by the user in 1km range of a registered pothole

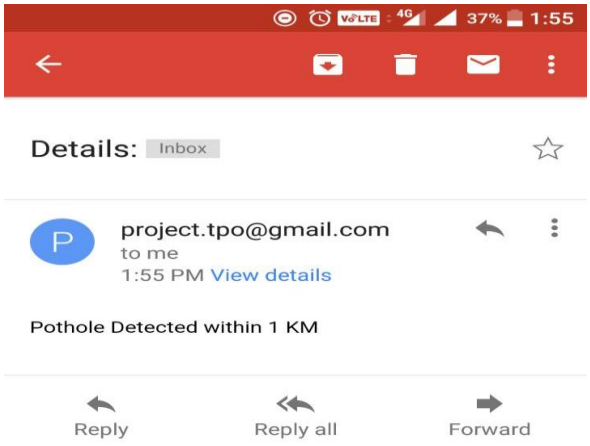

Fig-11: Email received by the user in 1km range of a registered pothole.

6. CONCLUSION

In this paper, we have put forth a working system that will be placed at the base of any two wheeler/three wheeler/four wheeler vehicle. The system will consist of two sensors i.e. ultrasonic sensor and GPS receiver. The ultrasonic sensor will detect the presence of pothole/hump and the GPS receiver will capture the locations of the pothole/hump and store the coordinates in the database maintained at the portal. With the help of the stored coordinates of the pothole/hump, the registered user will be notified with an alert message and simultaneously a complaint will be registered at the portal maintained by an administrator.

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