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Automated Web Based Road Anomalies Detection System

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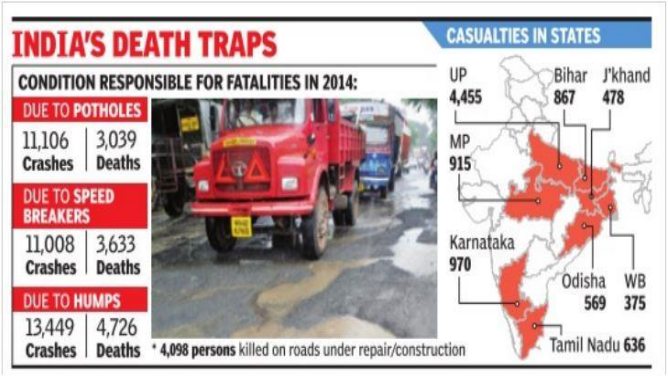
***Abstract*— The poor state of roads in India has significantly increased the number of road accidents, preceding to loss of lives. India's currency and trade highly depends on the roads. Establishing the identity of pavement discomforts such as potholes and humps not only helps drivers to avoid road accidents, but also helps government authorities to maintain roads. Here a web based cost effective solution is proposed to identify the potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages. The survey module measures depth, height and geographical location coordinates of potholes and humps. This data is stored in the database server which updates the information on the web server. The mobile application is further linked to the website to give alerts. This serves as an estimable source of information to the government authorities and vehicle drivers. An android application is used to alert drivers so that precautionary measures can be taken to prevent accidents.**

***Index Terms*— Humps, Mobile application, Potholes, Web Server.**

I. INTRODUCTION

Potholes and humps are amidst the most vexatious part of our daily commute. But did you know; they actually killed thousands of people. Are you wondered? Believe it or not it's the fact. The Ministry of Road Transport and Highways published 2014 Road Accident Report, as in figure 1. The actual figures could be even higher than those marked there, because accidents are often known to be placed in the 'other' category. Construction and more than that, maintenance of roads is one of the head-breaking task. But if done finely; can save thousands of lives. Roads are the prevailing and wherewithal means of transportation in India. The nation has a huge network of roads. Failure in a roadway is called pothole. Water present beneath the soil built up and traffic moving over the influenced area; are few of the extents for defenseless accidents and loss of human lives. Speed breakers are the traffic calming measure in India. But actuality is that these are not apportioned in a fair manner. They have been placed amass. Potholes and humps have become one of the greatest concerns in the country. These things have made driving a breath-holding task. Scornfully pity state of roads is an important factor causing traffic jam and accidents. To point out the referenced problems above, an affordable plan is needed that gathers the information about the path distress and also helps to drive safely. With the intended system a plan is put forth to avoid accidents due to potholes and speed bumps rather called as humps. It is an approach to bring out a system to monitor and manage road infrastructure.



2014: Deaths caused by potholes, speed breakers and humps on roads; Graphic courtesy: *The Times of India* (http://epaperbeta.timesofindia.com/Article.aspx?eid=31808&articlexml=Over-11000-killed-by-potholes-humps-speed-breakers-14092015001048)

Fig. 1: Survey Report

II. RELATED LITERATURE SURVEY

Pavement distress detection is an important and complex topic of research today. This section gives a brief description about the existing solutions for detecting potholes and humps on roads. Authors of [1] have set an automatic detection and notification system in which an android application is used to alert drivers. But they have not considered the fact that potholes or humps get repaired by concerned authorities periodically. The work in [2] put forth the idea to build a robot vehicle that is capable of detecting the potholes and transferring this information to the nearby vehicles in the vicinity. In the paper by Zhen Zhang and Xiao Ai [3] a stereo vision based pothole detection system is proposed. The system produces the size, volume and position of the potholes which allows the pothole repair. Chih-Sheng Chou and Andrew P. Nichols [4] evaluated and quantified the safety impact of incidents considering EOQ properties. Authors of [5] used a vision approach, in which pothole can only be detected in case of uniform lighting conditions. Tom Vanderbilt [6] evaluated the speed bumps as different traffic calming ways and why they are not universally loved. Eric S. Li [7] came forth with physical optics model for the backscatter response of road-surface faults for which two types of the surface faults are considered, cracks and potholes. In the work [8] a low cost model for analyzing 3D pavement distress images is specified. It makes use of a low cost Kinect sensor, which gives the direct depth measurements, thereby reducing computing costs. Youquan et al. [9] developed a model to detect the three-dimensional cross section of pavement pothole and LED linear light and two CCD (Charge Coupled Device) cameras to capture pavement image. In [10] a method for pothole detection based on SVM (Support Vector Machine) is given. This method distinguishes potholes from other defects such as cracks.

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III. Proposed Work

A. *Motivation*

The reality that potholes or humps defects are fixed every time motivates to propose a web based system to give real time alerts. The system needs offline and online database as well.

B. *Objective*

The objectives of this proposed work are:

i) Design and implementation of microcontroller based survey module for collecting the real time information/ data about potholes and humps.
ii) Development of database server to store the data collected by the survey module.
iii) Development of web server (website) and updation of the data.
iv) Development of android based android application for providing alerts to the end user.

Here the potholes and humps are thought as impediments, where the potholes are lowerings and humps are high end rails. The block diagram present in figure 2 intends to develop a website on which the real time data about potholes and humps collected by the survey module and stored by the database will keep updating. The website will be linked with the android application module. Due to the updation of data on the website correct indication of potholes and humps will be given to the end user.

IV. Components Used in the Proposed System

A. *ARM 7 LPC2148 Microcontroller*

LPC2148 is a microcontroller based on ARM7 TDMI. It is high in performance and 32-bit RISC and 32KB RAM. It has 512KB Flash memory.

B. *HC-SR04 Ultrasonic Sensor*

It follows the object detection principle as bats or dolphins do. It provides superior range finding without direct object contact. The principle of working is shown in figure 2. Distance in inches = Time/148.

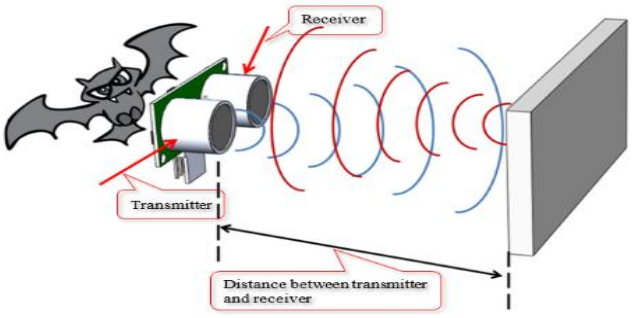

Fig.2: The principle of working of the Sensor

C. *GPS Receiver, GSM SIM 900 and LCD 16X2*

The SKG13BL is a highly sensitive module. This GPS unit is a receiver. It has ultra-low power and small form factor. It follows NMEA protocol. The GSM SIM900is a modem that works as a mobile phone. It has its phone number universally unique. It is used to send SMS. LCD is for Liquid Crystal Display. It is formed by combining solid and liquid state of matter. Here it is used for debugging purpose.

V. Architecture and Implementation

The architecture of the plan of action is shown in figure 3. It consists of three units; survey unit, control unit and the end user unit.

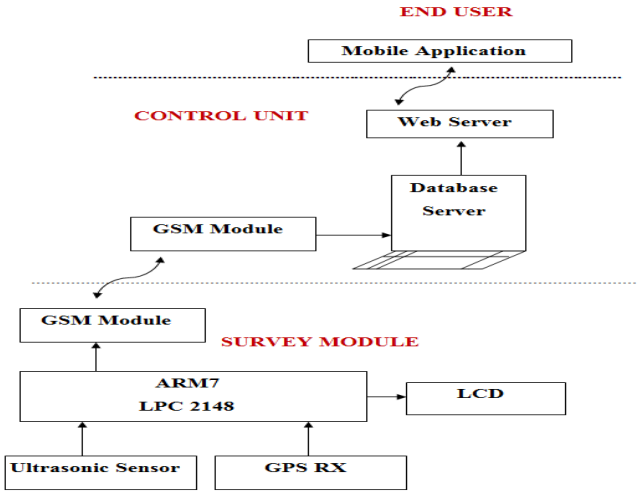

Fig.3: Architecture of Proposed System

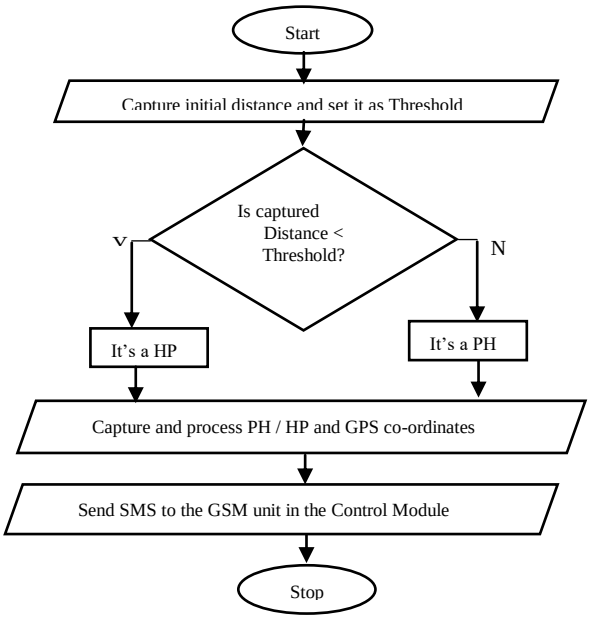

Fig.4: Work Flow of the Survey Module

The Survey unit consists of five components: (i) ARM LPC2148 microcontroller; (ii) ultrasonic sensor; (iii) GPS receiver; (iv) GSM modem and (v) LCD.
Ultrasonic sensor measures the distance between the vehicle/robo- car body and the road surface. This information is collected by LPC2148. Figure 4 illustrates the working of survey module.
The control unit consists of three parts:
(a) GSM unit / mobile phone, (b) database server and (c) web server. When survey is done the information regarding potholes and humps is sent in the form of SMS by the GSM unit in the survey module to the GSM unit in the control module. These messages are exported in the database format. Database server is further linked to the web server. The working principle of web server is presented in figure 5. The website is created using PHP and HTML. When required, database can be updated once a week and so on. Database server is further linked to the web server. The website is created using PHP and HTML. When required, database can

be updated once a week and so on. Figure 6 shows general web database structure. It follows six stages as described below:

1. Web browser requests for a web page.
2. Web server gets call for results.php and fetches file
3. PHP engine parses script.
4. MySQL server accepts query and dispatches outcome to PHP engine.
5. HTML is passed back to web server.
6. Web server sends HTML to browser.

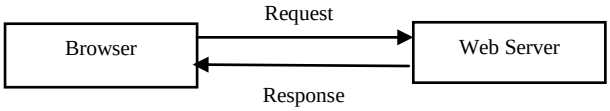

Fig.5: The Operation of a Web Server

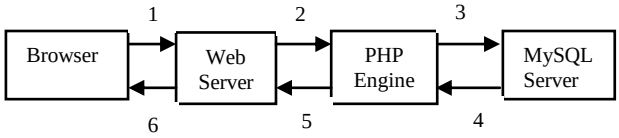

Fig.6: The Basic Web Database Architecture

The end user unit is developed as an android application which is installed on the vehicle driver's android mobile phone, which is further linked with the online web server to access the database on the web server. Figure 7 shows the work-flow of the android application. MySQL is a system based on relational database management. MySQL is an open source license. PHP and HTML script is used to develop website. A local web server is being used for this purpose.

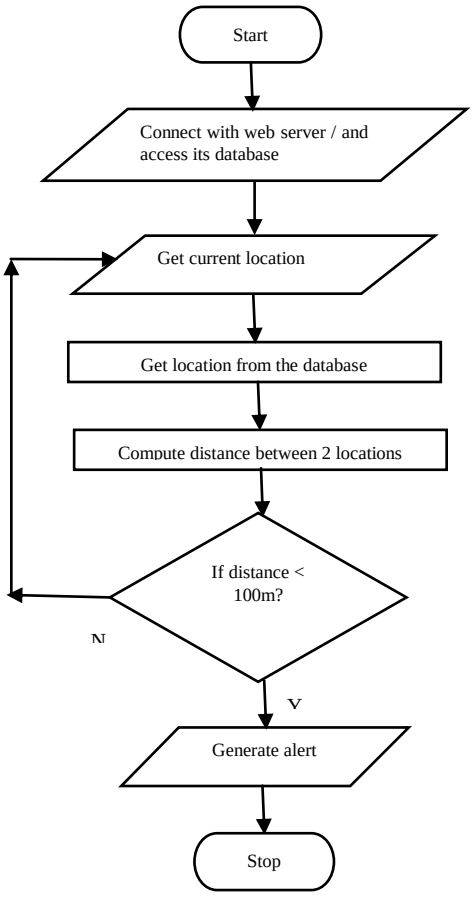

Fig.7: Work Flow of Android Application

VI. Experimental Results

The survey module fixed on the robo car is mounted on a two wheeler as in figure 8. The snapshot of some of those readings in the form of SMS is in figure 9. The database is created using the MySQL5.5. Database can be created and viewed with the steps in figure 10. The snapshots of the created website Login Page pages is shown in figure 11 and the Survey Database retrieval is shown in figure 12. The snapshots of the android App alerting system is shown in figure 13.

Fig.8: Survey Module Mounted on TVS Jupiter

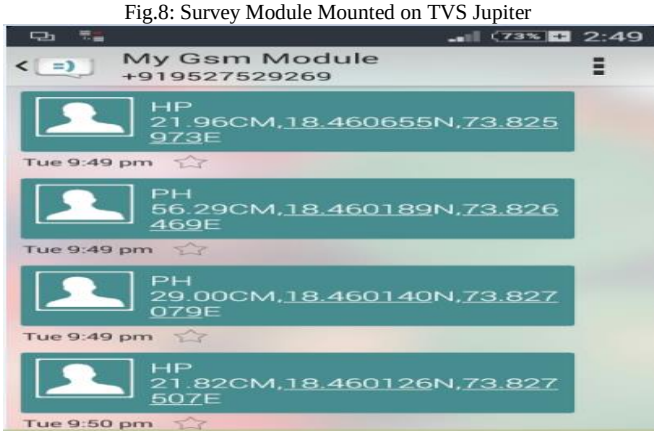

Fig.9: Real Time Readings Taken by the survey module

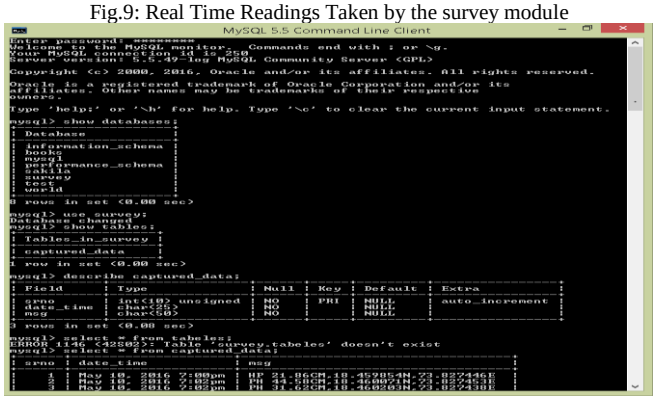

Fig.10: Database 'Survey' created using MySQL 5.5

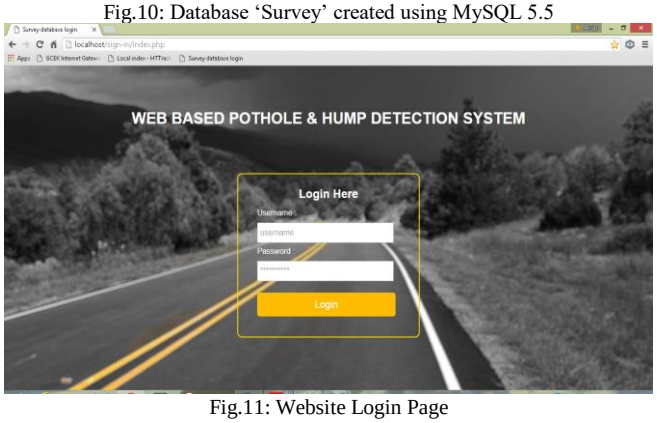

Fig.11: Website Login Page

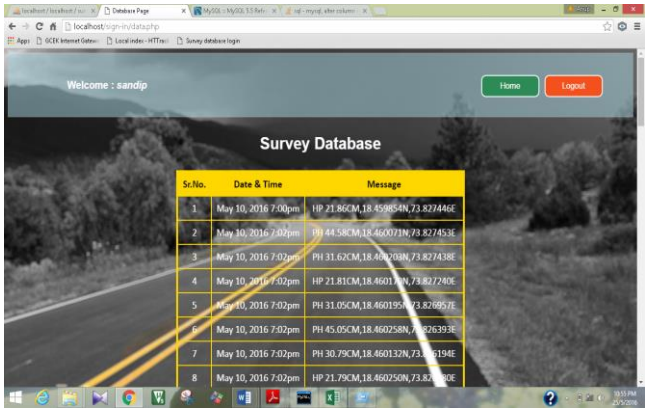

Fig.12: Website Survey Database Page

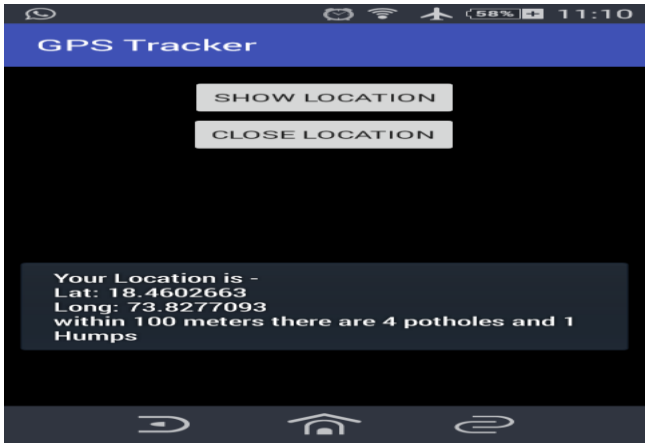

Fig.13: Snapshot of the Android App 'GPS Tracker' Giving Text (& Voice) Alert

VII. Conclusion and Future Enhancements

The paper puts forth three important goals; auto-detection of potholes and humps, web server to access the database in android application and alerting vehicle drivers to prevent accidents. Here it is considered that road defects can be corrected. The system can further be enhanced by using RF connected displays on the dashboard of the vehicle.

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