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Potholes Detection Using Ultrasonic Sensor

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ABSTRACT: Here we propose design of Pothole detection System which assists the driver in Avoiding potholes on the roads, by giving him prior warnings. In the form of a buzzer, warnings can be issued to the driver who is approaching the potholes. Alternatively, he could be provided with prior information about the position of potholes. The project is divided into three sub-type, First is sensing the potholes using the sensors about which did not have a prior information. Second is communication system to transfer the information between Wi-Fi accessed point and mobile points. Third is localization subsystem which reads the data given by Access points and warns the driver regarding the occurrence of pothole.

KEYWORDS: Smart Drivers, Potholes Detection

I. INTRODUCTION

India, the second most populous Country in the World and a fast-growing economy, is known to have a gigantic network of roads. India has a widespread network of roads which makes it the most important mode of transportation. They carry almost 90 percent of countries passenger traffic and 65 percent of its freight]. However, most of the roads in India are victims of narrow and congested surface quality and road maintenance needs are usually not satisfactorily met. No matter which state you live in, driving is a breath-taking task which requires tremendous caution. Over the past couple of decades, there has been a significant rise in the number of road accidents. The rise of production of personal vehicles and their usage has increased the amount of traffic congestion as well. But while dealing with traffic congestion, one cannot ignore a salient factor which is the poor conditions of roads. Researchers are working in the area of traffic congestion control, an integral part of vehicular area networks, which is the need of the hour today. In order to limit the speed of vehicles, speed breakers are installed at various intervals of roads. However, these speed breakers are prone to uneven distribution and unscientific heights. Heavy rains is also a major factor for worsening the condition of roads, wherein, water gets lodged in the cracks to cause traumatic accidents and in some cases, even loss of life.

II. LITERATURE SURVEY

The latest survey done in this field is described here. Rajeshwari Madly et al., [1] describes about detecting Potholes and humps on roads by using ultrasonic sensors and an android application is developed to notify the drivers about the presence of Potholes with its corresponding geographic location.

Eriksson et al., [2] describe an application of mobile sensing: detecting and reporting the surface conditions of roads. It explains a system and with its associated algorithms to monitor these 184 important civil infrastructures using a collection of sensors equipped vehicles. This system is called as the Pothole Patrol (P2), wherein, we use the mobility of participatory vehicles to gather data from vibrations as well as GPS sensors. This data is further processed to assess road surface conditions.

Rode et al., [3] proposed a pothole detection and warning system which is divided into three subsystems. First is, sensing subsystem that senses the potholes encountered by it, about which it did not have the prior knowledge. Second is communication subsystem that handles the information transfer between Wi-Fi and Mobile Node. Third is the

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localization subsystem which sort out the data received from Access Points and warns the driver regarding the occurrence of potholes.

Mertz et. al., [4] uses service vehicles to detect road damages. The system consists of light sensor and a camera mounted on vehicles which travel the roads. It makes use of sensors and equipment present on the vehicle, like GPS on transit buses. The data collected from many vehicles is aggregated and analyzed at a main location and the assessment results are displayed interactively for road maintenance.

De Zoysa et al., [5] proposed a method of detecting potholes where pothole data and its GPS coordinates are saved in the sensor. The stored data is uploaded to the base station when the bus reaches the station. The station acts as a server which is given to the buses that travel in that route.

Murthy and Paraphrased et al., [6] have proposed a system that detects potholes based on a vision-based approach. The images of the road surface are captured using a camera. The images are then processed using MATLAB to detect the presence of potholes. It is a 2D vision-based solution and works only under uniform lighting conditions and also the system does not include any kind of warning system. The above solutions are limited only to the identification of a pothole. These solutions do not provide any aid to the driver to avoid accidents due to potholes and humps.

III. SYSTEM ARCHITECTURE AND COMPONENTS

Microcontroller module: This module constitutes of 4 components, namely, PIC16F877A microcontroller, ultrasonic sensors, GPS receiver and GSM modem. Microcontroller receives the data about distance measured between the car body and the surface pothole. Threshold distance is defined as the distance between a car body and a surface, given that it is a smooth surface. Threshold value depends on the ground clearance of vehicles and can be configured accordingly. If the distance measured by ultrasonic sensor is greater than the threshold, it is classified as a pothole. Alternatively, if it is smaller, it is considered to be a hump; otherwise it is a smooth road. The GPS receiver captures the location coordinates of the detected pothole or the hump and Department of Computer Engineering, JSPM'S RSSOER, Pune 10 POTHOLE DETECTION SYSTEM sends messages. The android device that acts as server. The messages that we send to the end-user would contain information of the depth of pothole, height of the hump and it's accurate coordinates.

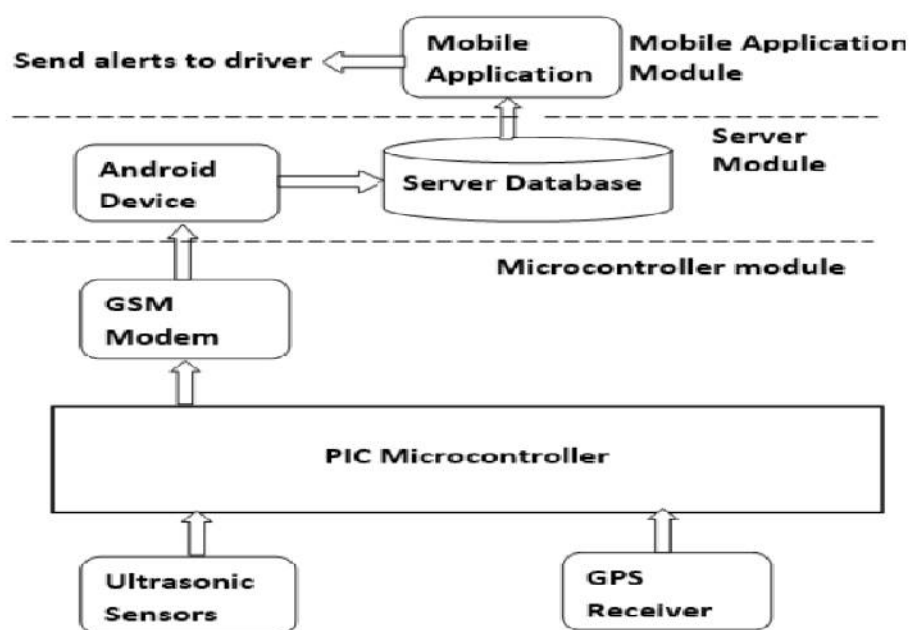


Fig 01 System Architecture



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Server module: This module comprises of two parts; the android device and the database to store the corresponding information. It acts as an intermediary layer between the microcontroller module and the mobile application. The server module is implemented as an android application that runs on a device and is responsible for reading messages. The processed contents of this message are stored in the database (cloud). Integrating sensor networks with cloud and Internet of Things, it is possible to allow broader access to sensor data.

Mobile application module: This module is implemented as an android application that is installed on the vehicle drivers mobile phone to provide timely alerts about the presence of potholes and humps. The application continuously runs in the phone background. At first, it fetches the current geographic location of the vehicle and then accesses the locations of the already located potholes and humps stored in the server database to provide the user with some much needed insight. The distance between the location of the vehicle and that of the pothole are stored in the database for further computations. If the distance between the two is within 100 meters, an alert message pops up on the mobile screen. An audio beep is assigned for such a message so that the driver can easily distinguish this type of alert from that of a casual text notification.

Data Processing Units:

2 GB RAM minimum, 4 GB RAM recommended

1 GB for Android SDK, emulator system images and cache

PIC Microcontroller

Ultrasonic Sensor

Power Supply

Mobile phone running Android Operating System

IV. CONCLUSION

The model proposed serves two important purposes; automatic detection of potholes and humps and alerting vehicle drivers to evade potential accidents. The proposed approach is an economic solution for detection of dreadful potholes and uneven humps, as it uses low cost ultrasonic sensors. The mobile application used in this system is an additional advantage as it provides timely alerts about potholes and humps. The solution also works in rainy season when potholes are filled with muddy water as alerts are generated using the information stored in the database. We feel that the solution provided in this paper can save many lives and ailing patients who suffer from tragic accidents. The proposed system considers the presence of potholes and humps. However, it does not consider the fact that potholes or humps get repaired by concerned authorities periodically. This system can be further improved to consider the above fact and update server database accordingly. Also, Google maps and SATNAV can be integrated in the proposed system to improve user experience.

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