**Automatic Detection and Notification of Potholes**

**and Humps on Roads to Aid Drivers**

**ABSTRACT**

India, the second most populous Country in the world and a fast growing economy, is known to have a gigantic network of roads. Roads are the dominant means of transportation in India today. They carry almost 90 percent of country’s passenger traffic and 65 percent of its freight. However, most of the roads in india are narrow and congested with poor surface quality and road maintenance needs are not satisfactorily met.

Roads in India normally have speed breakers so that the vehicle’s speed can be controlled to avoid accidents. However, these speed breakers are unevenly distributed with uneven and unscientific heights. Potholes, formed due to heavy rains and movement of heavy vehicles, also become a major reason for traumatic accidents and loss of human lives. To address the above mentioned problems, a cost effective solution is needed that collects the information about the severity of potholes and humps and also helps drivers to drive safely. With the proposed system an attempt has been made to endorse drivers to ward off the accidents caused due to potholes and raised humps.

**INTRODUCTION**

One of the major problems in developing countries is maintenance of roads. Well maintained roads contribute a major portion to the country’s economy. Identification of pavement distress such as potholes and humps not only helps drivers to avoid accidents or vehicle damages but also helps authorities to maintain roads. This paper discusses previous pothole detection methods that have been developed and proposes a cost effective solution to identify potholes and humps on roads and provide timely alerts to drivers to avoid accidents or vehicle damages.

 Ultrasonic sensors are used to identify potholes and also to measure their depth and height respectively. RF transmitters are placed on the road where there is an hump and RF receivers are placed inside the car whenever there is a hump the RF receiver will receive the signal and will alert the driver through Buzzer and LCD display. The proposed system sends the information to the cloud through WIFI and this data can be accessible on Blynk installed on the Android smart phone. The sensed-data includes pothole depth, height of hump which is sent to the server (Mobile) via WIFI. Then this data is stored in the database (Mobile). This serves as a valuable source of information to the Government authorities and to vehicle drivers. The whenever there is any pothole or hump on the road the sensors will sense this and instantaneously the buzzer gets activated and will be displayed on the LCD to alert the driver so that precautionary measures can be taken to evade accidents.

The model proposed in this project serves 2 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.

**LITERATURE SURVEY:**

* **He Youquan, Wang Jian, Qiu Hanxing, Zhang Wei, Xie Jianfang, “A Research of Pavement Potholes Detection Based on Three-Dimensional Project Transformation”, *In Proceedings of International Congress on Image and Signal Processing,* pp.1805-1808, 2011.**

Nowadays frequent roads accidents are occurring due to the improper maintenance of roads and also due to the rash driving of the vehicle at crucial zones. This project provides a system to warn the drivers when their vehicle comes close to schools, hospitals and crowded areas. It also provides timely alert to the drivers by automatically detecting the presence of potholes and humps on roads. The indication of crowded zones is done with the help of two units such as transmitter unit which provides zone based information to the drivers and a receiver unit that contains a LCD to display the zone based information. The presence of holes and humps are identified by using an ultrasonic sensor and is indicated to the drivers by using a buzzer. This system provides a way to regulate the speed of the vehicle at crowded areas and also to prevent vehicle damage.

* **Mircea Strutu, Grigore Stamatescu, Dan Popescu, “A Mobile Sensor Network Based Road Surface Monitoring System”, *In Proceedings of IEEE Conference on System Theory, Control and Computing,* pp.630–634, 2013.**

This paper presents a road surface defect identification system based on 3D accelerometers, GPS and video modules deployed on vehicles. The mobile platform architecture and the central data aggregation algorithm are also discussed. Because the mobile system is deployed over a large outdoor area, we also present a solution for the wireless communication coverage problem. Finally, we are highlighting the importance of the gathered information by making it available for the users using a GIS platform.

* **Moazzam, K. Kamal, S. Mathavan, S. Usman, M. Rahman, “Metrology and Visualization of Potholes using the Microsoft Kinect Sensor”, *In Proceedings of IEEE Conference on Intelligent Transport System,* pp.1284-1291, 2013.**

Pavement distress and wear detection is of prime importance in transportation engineering. Due to degradation, potholes and different types of cracks are formed and they have to be detected and repaired in due course. Estimating the amount of filler material that is needed to fill a pothole is of great interest to prevent any shortage or excess, thereby wastage, of filler material that usually has to be transported from a different location. Metrological and visualization properties of a pothole play an important role in this regard. Using a low-cost Kinect sensor, the pavement depth images are collected from concrete and asphalt roads. Meshes are generated for better visualization of potholes. Area of pothole is analyzed with respect to depth. The approximate volume of pothole is calculated using trapezoidal rule on area-depth curves through pavement image analysis. In addition pothole area, length, and width are estimated. The paper also proposes a methodology to characterize potholes.

**GAPS IN THE LITERATURE**

* From the literature review carried out it was found that earlier there were some methods introduced for the detection of potholes and humps.
* These methods were limited only for finding the Potholes and humps and alerting the driver.

**PROBLEM STATEMENT:**

Bad roads are also having a major impact on our countries economy if a motorist encounters a pothole on the road even while driving, their vehicle will be damaged and affected this could result in serious injury, or even death. This is an issue that needs to be resumed by the government and brought to their urgent attention. If they are going to start the “countrywide pothole repair programme” then it needs to be managed and ensured that it is on track at all times in order for our roads to be safe.

**Disadvantages:**

* High Death Rate
* Several accident occur due to traffic
* Blind peoples may suffer

**OBJECTIVES:**

* To review literature on the sensors used for detecting the potholes and humps.
* To review literature on microcontrollers used in the existing methods.
* To learn about the Blynk app interfacing, how to use it for accessing information.
* To learn about the Arduino board and Atmega328 microcontroller.

**METHODOLOGY:**

**Block diagram:**

Cloud

Micro controller

Ultrasonic sensor

WI-FI

 Blynk

RF Receiver

16x2 LCD

GPS

Buzzer

**Transmitter side:**

Micro controller

RF Transmitter

**Components Used:**

**Hardware Requirements:**

* Microcontroller
* Ultrasonic sensors
* RF transmitter and Receiver
* Buzzer
* LCD
* WIFI
* Android Smart phone

**Software Requirements:**

* Programming language: Embedded C
* Software: Arduino IDE
* Blynk widget

**References:**

1. *India Transport Sector.* [Online]. Available: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/SOUTHASIAEXT/EXTSARREGTOPTRANSPORT/0,,contentMDK:20703625~menuPK:868822~pagePK:34004173~piPK:34003707~theSitePK:579598,00.html

2. Rajeshwari S., Santhosh Hebbar, Varaprasad G., “Implementing Intelligent Traffic Control System for Congestion Control, Ambulance Clearance and Stolen Vehicle Detection”, IEEE Sensors Journal, Vol.15, No.2, pp.1109-1113, 2015

3. I. Moazzam, K. Kamal, S. Mathavan, S. Usman, M. Rahman, “Metrology and Visualization of Potholes using the Microsoft Kinect Sensor”, *In Proceedings of IEEE Conference on Intelligent Transport System,* pp.1284-1291, 2013.

4. Sudarshan S. Rode, Shonil Vijay, Prakhar Goyal, Purushottam Kulkarni, Kavi Arya, “Pothole Detection and Warning System”, *In Proceedings of International Conference on Electronic Computer Technology*, pp.286-290, 2009.

5. He Youquan, Wang Jian, Qiu Hanxing, Zhang Wei, Xie Jianfang, “A Research of Pavement Potholes Detection Based on Three-Dimensional Project Transformation”, *In Proceedings of International Congress on Image and Signal Processing,* pp.1805-1808, 2011.

6. Jin Lin, Yayu Liu, “Potholes Detection Based on SVM in the Pavement Distress Image”, *In Proceedings of International Symposium on Distributed Computing and Applications to Business, Engineering and Science*, pp.544-547,2010

7. Faith Orhan, P. Erhan Eren, “Road Hazard Detection and Sharing with Multimodal Sensor Analysis on Smartphones”, *In Proceedings of International Conference on Next Generation Mobile Apps, Services and Technologies,* pp. 56-61, 2013.

8. Artis Mednis, Girts Strazdins, Reinholds Zviedris, Georgijs Kanonirs, Leo Selavo, “Real Time Pothole Detection using Android Smartphones with Accelerometers”, *In Proceedings of Distributed Computing in Sensor Systems Workshop,* pp.1-6, 2011.

9. Zhen Zhang, Xiao Ai, C. K. Chan and Naim Dahnoun, *“*An Efficient Algorithm for Pothole Detection using Stereo Vision*”, In Proceedings of IEEE Conference on Acoustic, Speech and Signal Processing,* pp.564-568, 2014.

10. Mircea Strutu, Grigore Stamatescu, Dan Popescu, “A Mobile Sensor Network Based Road Surface Monitoring System”, *In Proceedings of IEEE Conference on System Theory, Control and Computing,* pp.630–634, 2013.

11. Sachin Bharadwaj, Sundra Murthy, Golla Varaprasad “Detection of potholes in autonomous vehicle”, *IET Intelligent Transport Systems*, Vol.8, No.6, pp.543-549, 2013.

12. Sandeep Venkatesh, Abhiram E,Rajarajeswari S, Sunil Kumar K M and Shreyas Balakuntala, “An Intelligent System to Detect, Avoid and Maintain Potholes: A Graph Theoretic Approach”, *In Proceedings of International Conference on Mobile Computing and Ubiquitous Networking,* pp.80, *2014.*

13. Shambhu Hegde, Harish V. Mekali, Golla Varaprasad, “Pothole Detection and Inter vehicular Communication” *Technical Report of Wireless Communications Laboratory, BMS College of Engineering, Bangalore 19.*

14. The GPS website, *www.gpsinformation.org.*

15. Prachi More, Sudhish Surendran, Sayali Mahajan and Saurabh Kumar Dubey, “Potholes and pitfalls spotter”, IMPACT:IJRET, Vol 4, pp. 69-74, 2014.

16. X. Yu and E. Salari, “Pavement Pothole Detection severity Measurement using laser Imaging”, *In Proceedings of IEEE International conference on EIT,* pp.1-5, 2014.

17. Kongyang Chen, Mingming Lu, Xiaopeng Fan, Mingming Wei, and Jinwu Wu, “Road Condition Monitoring Using On-board Three-axis Accelerometer and GPS Sensor”, *In Proceedings of International ICST conference on Communication and Networking in China,* pp.1032-1037, 2011.

18. Fagen Li, Pan Xiong, “Practical Secure Communication for Integrating Wireless Sensor Networks Into the Internet of Things”, IEEE Sensor Journal, Vol.13, Issue 10, pp 3677-3684, 2013.

19. Alessio Carullo and Marco Parvis, "An Ultrasonic Sensor for Distance Measurement in Automotive Applications", IEEE Sensor Journal, Vol. 1, pp.143-147, 2001.