

Automatic Detection of Potholes and Humps on Road

Parag Kadale¹, Shivam Barde², Anand Pawar³

Abstract: Here we propose a 'Pothole detection system' which can assist the driver in avoiding the potholes on road by giving him prior warnings, thus reducing the number of road accidents causing due to potholes. Warnings can be like buzzer if the driver is approaching a pothole, or driver may be warned in advance about which road has how many potholes and their location. The government authority can also be notified through the database about the existing potholes and humps.

Keywords: Access point, GPS, humps, pothole detection system, road safety, ultrasonic sensor, wi-fi module

1. Introduction

With the increase in world's population, there has been increasing load on the infrastructure. Roads have been flooded with the vehicular traffic. It has become increasingly difficult to manage this traffic. This is the prime motivation behind making a vehicle intelligent enough to aid driver in various aspects.

India is considered one of the fastest developing countries as of today. India's road network is gigantic, giving it a thought about the condition of the roads. Roads indirectly contribute to the economic growth of the country and it is extremely essential that the roads are well built and strong. India is home to several bad roads be it the metropolitans, the cities or the villages.

Roads are normally placed with speed breakers that are used to control the speed of the vehicle. But these speed breakers have been a cause of accidents because a definite dimension is not followed throughout. Likewise, potholes are formed due to oil spills, heavy rains and also due to movement of heavy vehicles. These bad road conditions cause accidents, affect the quality of driving and also consumes more fuel. Hence, in this paper we have proposed a system that would notify the drivers regarding any hurdles such as potholes and humps and this information can be used by the Government to correct these roads effectively.

2. Problem Statement

Poorly maintained roads are a fact of life in most developing countries including our India. A well maintained road network is a must for the well-being and the development of any country. So, it is necessary to create an effective road surface monitoring system. Automated pot-hole detection is our focus in the system.

The aim is to develop a system based on IOT to detect potholes on the road which will be uploaded on server and notified to all the user and update the information as required.

3. Literature Survey

Aging roads and poor road maintenance systems result in a large number of potholes, whose number increase over time. Potholes jeopardize road safety and transportation efficiency. In India, many accidents happen due to poor road conditions.

In this survey, we analyze the systems of pothole detection previously implemented or proposed, ultimately aiming at improving road conditions.

For pothole detection system, various sensing technologies can be used. Existing systems can be mainly categorized into vibration based systems, laser-scanning based systems and vision-based systems.

Vibration based systems generally use accelerometers for pothole detection and track the gradient variation from the accelerometer data. The accuracy of the system is lower as compared to other sensors. Moreover, false detections can occur when vehicles pass over manhole covers. Nevertheless, this system is easy to implement if the accuracy can be compromised.

Laser scanning offers outstanding detection performance, compared to other methods. This approach is able to collect extremely detailed road surface information using a technique of reflection of laser pulses. Accurate 3d images can also be created using this method. However, whereas laser scanning is highly precise, the equipment needed is expensive. Furthermore, this method can't be employed for wider area as the laser radiations are harmful. The skin is usually much less sensitive to laser light than the eye, but excessive exposure to ultraviolet light from any source can cause short- and long-term effects similar to sunburn, while visible and infrared wavelengths are mainly harmful due to thermal damage.

Vision based system use digital image processing for detection of potholes. Many approaches use 2d data and a video feed for pothole detection. Pothole detection using 2d images was originally introduced Koch and Brilakis. Most existing vision based pothole detection systems use 2d images and require high resolution cameras. Owing to high resolution cameras, the cost of the system increases significantly. Moreover, the processing of images obtained require time for analysis. This system also requires image enhancement.

In this project, we propose to use an ultrasonic sensor for pothole detection. The ultrasonic sensor measures the distance in analog format which will then be converted to digital format using ADC. The data of the pothole's location obtained through GPS and it's depth will then be collected over a specified route. This system is durable and accurate. It can also be used over a wide range. The overall cost of the sys-

tem is considerably cheap. The size also is conveniently small.

4. Proposed Methodology

This system is divided into three subsystems.

- 1) The sensing subsystem which senses the potholes encountered by it, about which it did not have the prior information.
- 2) Then communication subsystem which transfers the information between Wi-Fi access point and mobile node.
- 3) Access Point broadcasts the data about potholes in its area.

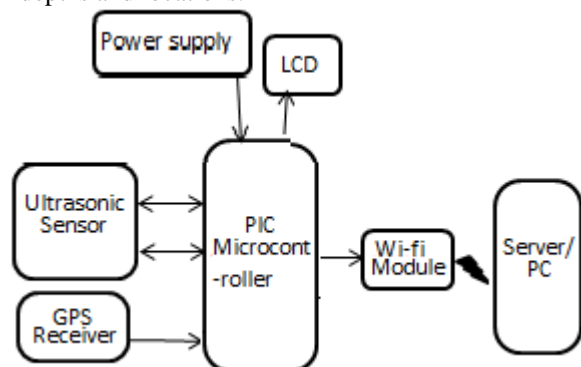
The ultrasonic sensor is used for measuring the depth of a pothole and height of a hump. The ultrasonic sensor measures the distance in analog format which is then converted into digital format using the ADC, to transfer the collected data to the PIC microcontroller.

The pothole detection system is based on IoT and distance sensor which is ultrasonic sensor. The data obtained from ultrasonic sensor is displayed on the LCD display and sent to the Wi-Fi module by the PIC microcontroller. The circuit works on a 5V power supply to power the PIC microcontroller. The GPS receiver obtains the location co-ordinates of the detected pothole or humps and then transmits them to the microcontroller which then can be eventually displayed on the LCD display. The location of all the detected potholes and humps is then stored in the database.

The collected data is then sent to the ESP 8266 Wi-Fi module by the microcontroller. The Wi-Fi module then transmits the data to the server or device to maintain the database of potholes and humps. Lastly the information must be conveyed in the manner which can be understood and used by driver. We in this project try to design and build such a system. In this system, the access point collects the information about the potholes in the vicinity of a wireless access point. Here, vicinity is a user defined term. Ideally the vicinity is every route till the next access point.

5. Architecture

The system architecture of the pothole detection system is as shown. The system consists of sensor, GPS receiver and a computer which processes the received data. The processed data is then used for a database creation of the potholes and their depths and locations.



6. Future Scope

In future we can use this system widely for safety and maintenance of roads. Potholes can be auto detected using acceleration data collected using vehicle mounted wireless sensors. We can use sensor network deployed over a public transport system to monitor environmental pollution and road surface condition. The proposed system can be further improved to display alerts such as 'Bad road ahead' in order to help the driver be more alert while driving/riding on such roads.

7. Hardware Implementation



8. Conclusion

The automatic detection of the potholes and humps is achievable with inexpensive and accurate system using ultrasonic sensor and GPS module. The pothole detection system here uses PIC microcontroller for processing of data.

In this project report we described about ultrasonic sensor, Wi-Fi technology, GPS receiver and implementation of pothole detection system, also benefits of the system.

We have achieved our target of detecting the pothole and creating the database of the detected pothole. We used ultrasonic sensor for sensing the depth of the pothole and GPS receiver for recording its location in the terms of latitude and longitude. We used Wi-Fi module for sending the data to the server through creation of hotspot on mobile.

The database of the recorded potholes could be observed over the server or the serial monitor.

9. End Sections

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