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The Pothole detection: Using a Mobile Sensor Network For Road Surface Monitoring

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***Abstract*—**

Dangerous road conditions may be the result of natural events, such as tropical rains and flooding, that make driving unsafe. Dangerous conditions can also arise from the poor physical condition of a road and its surroundings. It may cause road accidents. Also while driving in the night just the headlights might not be a sufficient assistance for driver. Unexpected hurdles on road may cause more accidents. Also because of bad road conditions, fuel consumption of the vehicle increases; causing wastage of precious fuel.Pothole Detection system is a unique concept and it is very useful to whom which face the problem of pothole in their route. The technology is purely new and idea is generated a profile for pothole in our vehicle journey. It is an application which is Accessing to timely and accurate road condition information, especially about dangerous potholes is of great importance to the public and the government. We are going to develop an effective road surface monitoring system for automated pothole detection. It is a unique concept where it a low cost solution for the road safety purpose. This will help to avoid accidents and can use to identify problem areas early. The authorities can get information about the potholes so that they can take preventive actions. 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 that we are going to create an effective road surface monitoring system. Automated pothole detection is our focus in the system.

Keywords— **Real time tracking, GPS, Road surface analysis, Pothole detection, Internet of Things.**

Introduction

. 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 roads conditions because accidents, affect the quality of driving and also consumes more fuel. It achieves an effective road surface monitoring system for automated pothole detection. It contains the wireless sensor network for pothole detection. The goal of our project is to design a Pothole detection System which assists the driver in avoiding potholes on the roads, by giving him prior warnings. The scope of the project lies, where the irregularity of the road affects public people. This can be used in 4 wheelers, especially for ambulance drivers so that they could save many lives in time.

Related Work

In this a novel scheme, called P 3, which utilizes smart phones placed in normal vehicles to sense and estimate the profiles of potholes on urban surface roads. In particular, a P 3 -enabled smart phone can actively learn the knowledge about the suspension system of the host vehicle without any human intervention and adopts a one degree-of-freedom (DOF) vibration model to infer the depth and length of pothole while the vehicle is hitting the pothole. Furthermore, P 3 shows the potential to derive more accurate results by aggregating individual estimates. In essence, P 3 is light-weighted and robust to various conditions such as poor light, bad weather and different vehicle types. We have implemented a prototype system to prove the practical feasibility of P 3. [1]

Proposed Work

In order to detect the three-dimensional cross-section of pavement pothole more effectively, this paper proposes a method which employs optical imaging principle of three dimensional projection transformations to obtain pictorial information of pothole's cross-section in pothole detection. Multiple digital image processing technologies, including: image preprocessing, binarization, thinning, three-dimensional reconstruction, error analysis and compensation are conducted

in the series of image analysis and processing. Experimental results indicate that the method is markedly superior to traditional methods in many aspects. For its simple detection principle, low cost and high efficiency, the method suggests great practical and promoting value. [2]

System Architecture

In this paper we have proposed a system it automatically detects the potholes and humps and sends the information regarding this to the vehicle drivers, so that they can avoid accidents. This system is effective even in rainy season when roads are flooded with rain water as well as in winter during low visibility, as the alerts are sent from the stored information in the server/database. This system helps us to avoid dreadful potholes and humps and hence to avoid any tragic accidents due to bad road conditions.

System can give alert information regarding the pothole for road safety purpose. In main system we classified into the four sub systems.

1. Sensoring subsystem
2. Data processing subsystem
3. Logging and reporting subsystem
4. Power subsystem

Power subsystem

It starts the vehicle and it enables the sensors and data processing module to start its working.

Data processing module

It will examine the information from the sensors and output pothole data to the reporting and logging subsystem.

Logging and reporting subsystem

It build on the android mobile device, will store the pothole locations on a network server.

Sensoring subsystem

It will sense the information about the potholes and humps through the ultrasonic sensor.

Implementation Modules:

1. Mobile Application Module: User can collect the pathole notification from the system for his safe journey.

2. Server Module: The server module is nothing but the database for system. It is an Intermediate layer between sensing and mobile application module. Its function is to store the updated information received by the sensor and provide to the requested user whenever needed. This module can also be updated frequently for information related to the potholes and humps.

3. Microcontroller Module: The Module is responsible for coordinating the hardware and server.

4. Sensing Module: This model consist GPS receiver, ultrasonic sensor(HCSR04) and GSM SIM 900 modem. A threshold value is set such that the value based on ground clearance of transport vehicle. The calculated distance(depth parameter) is compared with the threshold value to detect pothole or hump. If the calculated distance is greater when compared with the threshold value, then it is classified to be a pothole, and if the measured distance is less, then it is classified to be a hump. The location co-ordinates fetch by the GPS receiver, along with this data the information regarding the detected pothole or hump at a particular location co-ordinate is broadcast to the server using a GSM modem.

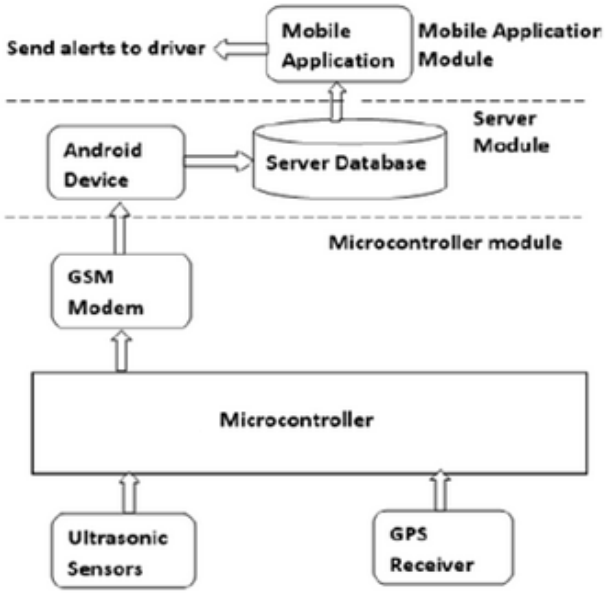

Fig 1. Architecture Diagram

Algorithm

Input: Sensor Value

Output: According to the system the of output is positive that is one when the proposed pothole detection system face the pothole in car journey. Following code shows, how operations performed within the system and the sequence in which they are performed.

```
Sensorreadingarray [ ]    //depth parameter
for (k=0 ; k isgreater noofsensor ;k++)
x=Sensorreadingarray[k];    //values will be check
y=Sensorreadingarray[k+1];    // through threshold
if(abs(x-y) isgreater patholethreshold)    //make sure hardware
if function is not malfunction pathole
ag = true;
timestamp =currenttime;
```

Equations

To find distance of the pothole and to decide it is a pothole or a hump.

```
Duration1 = pulseIn(Ledpin2,HIGH)
Distance1 = (Duration1 / 2) / 29.1
Compare(Distance , Threshold Value)
```

Conclusion

System alerts the driver regarding the upcoming pothole in vehicle journey. In our proposed system which aims at providing appropriate information to the driver about potholes. It is a low cost solution for the road safety purpose.

This will help to avoid accidents and can use to identify pothole problem areas early. In countries where updated economic growth and excellent technology have increase to gives impact on the quality of traditional transport system over intelligent transportation system.

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