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A Survey on Pothole and Hump detection system using IOT

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Abstract— The major problems still exist in Indian transportation system is the maintenance of roads. Well maintained roads contribute to the major portion of the country's economic development. The Identification or detection of pavement anomalies such as potholes and humps can not only help the drivers to avoid meeting with accidents or vehicle damages, but also helps the municipal authorities for the correct maintenance of the roads. This work is an attempt to produce and implement an IOT based cost effective module to detect/identify the potholes and humps along the roads. Ultrasonic distance sensors are used for the identification of the potholes and humps and also to measure their depth and height, respectively. Sends the pothole location to the highway authority. The measured information's are stored in Thingspeak.com an IOT open server for future analysis.

Keywords—Pothole detection, Hump detection, Ultrasonic distance sensors, Thingspeak.com, IOT.

I. INTRODUCTION

India is noted for having a vast network of roadways and is the second most populated nation in the world with a rapidly expanding economy. In India nowadays, roads are the primary form of transportation. They transport almost 90% of the nation's passenger traffic and 65% of its freight. Unfortunately, the majority of Indian roads are crowded, narrow, and of low quality, and the country's needs for road maintenance are not adequately satisfied. Driving in India is always a breath-holding, multiple-mirror involved, and sometimes fatal activity.

The number of vehicles has dramatically increased during the past 20 years. The rise in vehicles has caused issues like traffic congestion and an increase in traffic accidents. Poor road conditions are a contributing element in traffic jams and accidents. Research is being done in the domain of vehicular area networks, which are essential for today's traffic congestion control.
Speed breakers are typically used on Indian roads so that the speed of the vehicle can be controlled to prevent accidents. Unfortunately, the distribution of these speed bumps is irregular, and their heights are arbitrary.

Potholes that are created by heavy rains and the movement of large vehicles are a significant contributor to tragic accidents and the loss of life. The ministry of road transport and highways' survey report "Road Accidents in India, 2011" states that 1,42,485 individuals lost their lives as a result of fatal road accidents. Around 1.5% of these, or roughly 2,200 fatalities, were as a result of bad road conditions. There is a need for a reasonably priced system that both gathers data on pothole and hump severity and aids in safe driving. With the planned approach, an effort has been made to encourage drivers to prevent accidents brought on by higher humps and potholes.[6]

The IoT paradigm refers to the widespread and pervasive networking of billions of embedded devices that are capable of being individually recognized, localized, and communicated. The use of IoT services is now significantly influenced by sensor technologies. Modern devices with embedded sensors are currently being created extensively.[4]

II. BACKGROUND AND RELATED STUDY

A stereo vision-based method for detecting potholes is suggested in this study [4]. Without the need for expensive, specialized laser scanners, stereo vision can tell us how big the pothole is. For the purpose of creating maps and identifying potholes on the fitted quadratic road surface, a disparity calculation approach is applied. The technology generates information about the size, number, and location of the potholes so that their severity may be taken into consideration while prioritizing their repair. Variations in camera angle, road drainage, and uphill/downhill slopes are all supported by the quadratic road surface model. It will be feasible to continually identify and assess potholes by mounting the technology on a vehicle that patrols the roadways. To minimize data storage, it is crucial that now the system can detect potholes in real-time. 'The road condition is monitoring utilizing 3 axis accelerometer and GPS server'. In this context, the term "3

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axis accelerometers" refers to a device with all three axes, namely the x, y, and z axis. They provide a low-cost vehicle-based system called Road Condition Monitoring with Three-axis Accelerometers and GPS Sensors (RCM-TAGPS), which uses a GPS sensor and an inexpensive three-axis accelerometer to monitor the state of the road. The crucial measure that must be considered in this situation is pavement roughness.

Pavement roughness is the general term for surface flaws that compromise a vehicle's ride quality. With RCM-TAGPS, the pavement roughness levels are assessed using a central server and a group of sensor-embedded cars for data collecting. The system's location is of greatest priority. It is positioned on the right side of the car to make it easier to analyze all three axes. The algorithms implemented in this case are the pavement roughness level algorithm and the data cleaning method. Data cleaning algorithms evaluate the raw data that was gathered during a survey and eliminate any irrelevant data. While driving on smooth roads, the acceleration data are very smooth with just minor oscillations, indicating that the overall road condition is excellent, according to the evaluation by pavement roughness level algorithm. On common highways, there are a few immediate, significant pulses in the Z-axis acceleration.

In order to analyze 3D pavement distress photos, I. Moazzam, et al. have suggested a low-cost model. It uses the low-cost Kinect sensor, which provides the direct depth measurements and lowers the cost of processing. The RGB and IR cameras that make up the Kinect sensor record RGB pictures as well as depth images. To assess the depth of potholes, these photos are analyzed using the MATLAB environment by extracting metrological and distinctive properties. A model was created by He Yuquan, et al, to identify pavement potholes in three dimensions. The technique takes pictures of the pavement using two CCD (Charge Coupled Device) cameras and LED linear light.[6]

After that, IT uses a variety of digital image processing techniques to determine the depth of potholes, including picture pre-processing, pattern classification, thinning, three-dimensional reconstruction, error analysis, and compensation. LED light intensity and ambient conditions do, however, impact the findings. An SVM-based technique for pothole identification has been presented by Jin Lin et al. (Support Vector Machine). This technique separates potholes from other flaws like cracks. Using partial differential equations, the pictures are divided into segments. The technique trains the SVM using a series of pavement photos to find potholes. If the photos are not sufficiently lighted, the training model is unable to identify the pavement faults.

According to [4], smartphones have evolved into a fundamental requirement for practically everyone. It can have a huge impact in this era of the internet. Smart applications, such as in car mobile apps for smart cities, are now possible because of the sensing, computation, and communication capabilities of smartphones. With the aid of the sophisticated features of smartphones, we refer to a framework in this study that facilitates the quick and simple creation of signal and image processing-based smart mobile apps. We may assume that an example mobile application is also created as part of the research to show how the framework can be used. Many drivers can quickly become aware of traffic occurrences thanks to the detection being shared with them via a central application. This program is designed to find road imperfections like potholes and speed bumps and automatically extracts the video and picture of the associated road segment containing the imperfection.

The program immediately alerts users in the area of any such critical threat when it is detected. Potholes may be located using changes in the vertical accelerometer readings, and changes in horizontal acceleration can also be utilized to estimate changes in the car's speed. Seven taxis operating in the Boston region utilize this to create a mobile network system called Pothole Patrol. Each of the seven taxis required a Linux operating system, a Wi-Fi card for transferring the data obtained, and a 3-axis accelerometer. The above mentioned method has three general issues. The first is the sheer volume of occurrences, such as sudden swerves, knocks on doors, and traffic jams.[4]

The system's inability to distinguish between a pothole and a road bump is the second issue. The third issue is that depending on the speed of the automobile and how the sensors are positioned on the vehicle, the values that the sensors report might vary. The Jaguar and Land Rover manufacturer recently disclosed that they are investigating a new connected vehicle technology that would enable a vehicle to identify hazardous potholes in the road and then communicate information in real time with other cars and traffic authorities.

III. LITERATURE SURVEY

The literature survey provides an overview of the current state of research related to the detection of pothole and hump using various technologies. The articles and studies reviewed in this section have shed light on the various applications. The literature survey highlights the various approaches and mechanisms proposed by researchers for addressing these challenges and for improving the detection of pothole.

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Table 1 Advantages, disadvantages, and methodology of existing models

Related Studies	Advantages	Disadvantages	Methodology
[1]	Detects pothole and locates the location which is further stored in cloud	Mobile phone is must, information about the pothole location is stored in prior.	consists of two components one is mobile node and other is the access point 1.Access points responsible for storing the information about potholes in its vicinity 2.Mobile node which is the small device placed in vehicle is responsible for sensing those potholes which it did not have previous information
[2]	Pothole is detected bit faster.	Active internet connection is required. Bit expensive.	This study offers a pothole detection system that uses deep learning algorithms to detect potholes on the road using only a camera mounted on a car's dashboard and an internet connection.
[3]	Small Data Sets, Minimal Resources, Simplicity	Image processing, doesn't work good for multiple potholes, average accuracy rate is 81.02%	1. The original pothole image captured 2.Convertion of real image into grayscale image.
[4]	The mobile application used in this system is an additional advantage as it provides timely alerts about potholes and humps.	Active Internet Connection, Values reported by sensors depend on the car's speed.	The sensor is used to identify potholes through changes in the vertical accelerometers readings and can also determine the variations in the car speed though change in horizontal acceleration.
[5]	Pothole is detected bit faster.	Active internet connection is required. Very expensive.	This study offers a pothole detection system that uses deep learning algorithms to detect potholes on the road using only a camera mounted on a car's dashboard and an internet connection.
[6]	Cost effective, works in rainy season when potholes are filled with muddy water	Mobile phone is must, The sensors does not provide accurate data every time.	1.Ultrasonic sensors are used to identify potholes and humps and also to measure their depth and height respectively. 2.system captures the geographical location coordinates of potholes and humps using GPS receiver. 3.An android application is used to alert drivers

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CONCLUSION

This paper introduces the application, existing problems, and solutions for detection of pothole and Hump to avoid accidents. Firstly, we found several concerns involved in detection of pothole and Humps using various technology in which we found that use of IOT resolves the issue in a better way.

Further we found that there are separate devices to find pothole and hump but Our approach is to detect potholes on the road using Ultrasonic Sensor and manage to maintain road infrastructure by connecting citizens and authorities together. In our project we Detect both potholes and Humps. After detecting it alarms the driver and the location of pothole is sent to the road highway authority so that it can be filled which leads to reduction of accidents.

CONFLICT OF INTEREST

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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