Potholes Detection System for The Safety Of Pedestrians

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Abstract : The potholes on road leading to worsened road conditions have given rise to fatal accidents thereby leading to death in most of the cases. Many reasons like rains, oil spills wear and tear make the road difficult to walk upon. According to the analysis by road transport authorities near about 10000 people died in the country during a course of three years.Interests in pothole detection system come from problems caused by traffic congestion worldwide. The purpose of this paper is to devise a system that will give prior warnings to a pedestrian thereby ensuring safety. The potholes are invisible to our eyes during floods this increases the risk of fatal accidents. The system works on surveying method where the device will detect potholes and save location on a cloud server and during flood while surveying we found that the system detects the potholes accurately within the range of 5m.when the user will come in the vicinity of the saved location, the system then gives the warning to user.

I. INTRODUCTION

Your vehicle's wheels and suspension can be seriously damaged because of potholes . You can precisely know the location of a pothole only if you know the area well. Otherwise there's no way to see the potholes unless it is right in front of you. Plus, in many parts of the country, these annoyances can go unrepaired for months at a time, especially during the winter. One of the biggest killers on Indian roads are potholes. With almost 30 deaths every day, potholes and speed breakers have claimed over 10,000 deaths for the last three consecutive years.

Figure 1: statistics

10,876 people died due to potholes and speed breakers on roads, according to data provided by state police headquarters. Maharashtra had maximum fatalities. Construction quality of rural roads is worse than urban road, as a result of which they are more prone to potholes .

There is no scientific method for reporting the road accidents in India, therefore the number accidents can be higher. Many accidents go unreported and there is no detailed investigation into causes of road deaths in our country.

Police headquarters of various states and union territories and big cities with population of over 10 lakh report data on road accidents. The data is reported to the Transport Research Wing (TRW) of Ministry of Road Transport and Highways.

One of the factors responsible for pothole is the ill-conceived drainage system in cities. The situation worsens in Monsoon. The existing drainage system fails due to excess water flow and thus water stagnates on the roads resulting in enlarged surfaces, when a vehicle exerts a pressure on this surface it results into a pothole.

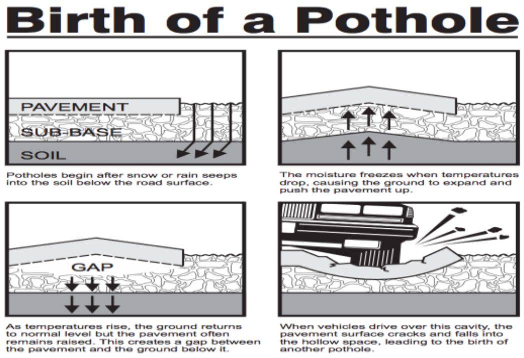


Figure 2:Birth of a pothole

II. LITERATURE SURVEY

1]Pothole detection system using 2D LiDAR and camera
Byeong-ho Kang Su-il Choi
Abstract:
Automatic Pothole detection is important task for determining proper strategies of asphalt-surfaced pavement maintenance. In this paper, we develop a pothole detection system and method using 2D LiDAR and Camera. To improve the pothole detection accuracy, the combination of heterogeneous sensor system is used. By using 2D LiDAR, the distance and angle information of road are obtained. The pothole detection algorithm includes noise reduction pre-processing, clustering, line segment extraction, and gradient of pothole data function. Next, image-based pothole detection method is used to improve the accuracy of pothole detection and to obtain pothole shape. Image-based algorithm includes noise filtering, brightness control, binarization, addictive noise filtering, edge extraction, and object extraction and pothole detection. To show the pothole detection performance, experiments of pothole detection system using 2D LiDAR and camera are performed.

2] Laser-based detection and depth estimation of dry and water-filled potholes: A geometric approach
Kiran Kumar VupparaboinaRoopak R. TamboliRoopak R. TamboliSoumya Jana
Abstract:
In secondary Indian roads, one often encounters potholes which can be either dry or water-filled. Accordingly, to ensure safe driving, it is imperative to detect potholes and estimate their depths in either condition. In this paper, we develop a physics-based geometric framework, where such detection and depth-estimation can be accomplished using suitable laser. Specifically, we relate dry pothole depth to measured optical deviation using simple ray optics. Further, we use Snell's law of refraction to obtain a quartic equation, and its appropriate real root to relate water-filled pothole depth to the corresponding optical deviation. Here we take into account diminishing resolu- tion with increasing distance from the camera. We conclude by experimentally validating our method.

3] Crowdsourcing undersampled vehicular sensor data for pothole detection

Chen Fan Andrew Fox B.V.K. Vijaya Kumar JinzhuBai

Abstract:

The increased availability of embedded vehicle sensors allows for the detection of road features such as potholes. Despite being a promising approach, current vehicle embedded sensors operate at low frequencies and under sample sensor signals, thus degrading detection accuracy. One emerging solution is to crowd source such under sampled sensor data from multiple vehicles to increase the detection accuracy. Aggregating sensor data from multiple vehicles, nonetheless, is a challenging task given the heterogeneity among vehicles, asynchronous sensor operation, GPS error, and sensor noise. Additionally, there may be bandwidth restrictions in vehicular networks which limit the amount of data available for aggregation. We investigate these issues by focusing on the problem of pothole detection. To quantify the detection accuracies and effects of real-world limitations, we design and evaluate three crowd sourcing pothole detection schemes involving vehicles and the Cloud. We also address the issue of lack of extensive model training data by demonstrating that a detection model applicable to real-world systems can be derived

4] Detection of potholes in autonomous vehicle

SachinBharadwajSundra Murthy GollaVaraprasad

Abstract:

Pothole avoidance may be considered similar to other obstacle avoidance, except that the potholes are depressions rather than extrusions from a surface. This study discusses a solution for detection of potholes in the path of an autonomous vehicle operating in an unstructured environment. Here, a vision approach is used since the simulated potholes are significantly different from the background surface. Furthermore, using this approach, pothole can only be detected in case of uniform lighting conditions. The solution to the problem is developed in a systematic manner. Initially, a specific camera and frame grabber are chosen, then camera is mounted on top of the autonomous vehicle and the images will be acquired. Then, a software solution is designed using MATLAB. The method is tested under real-time conditions and results demonstrate its reasonable efficiency.

III. METHODOLOGY

The GPS continuously sends the langitude and latitude co ordinates to the processor. The processor the send a signal to the GPRS in GSM module about the location it received from the GPS module. The GPRS then send the location to the server. We have already surveyed all the area using a Sonar and GPS.

The sonar has a transmitter and a receiver. The transmitter continuously sends sound wave and the receiver receives it. The time of travel of the wave is calculated. We know the speed of sound. Using the speed formula the distance travelled by the sound wave is calculated. The distance of the surface from the sensor is half of this distance travelled. We pre determine a safe limit and save it. If the distance measured by the sonar technique is within this predetermined value we consider it is safe to move forward. But if the distance is beyond the value, then we consider it as a pothole and it's location is saved in the database.

From this information obtained by surveying, we have created a database by storing the locations of the potholes. Thus the latitude and longitude of the pothole location is in database. The latitude and longitude obtained from the server through GPRS through GPS is compared to the pothole locations stored in the database. If a match is found, it means that there is a pothole ahead of us. This is indicated to us via vibrator and buzzer.

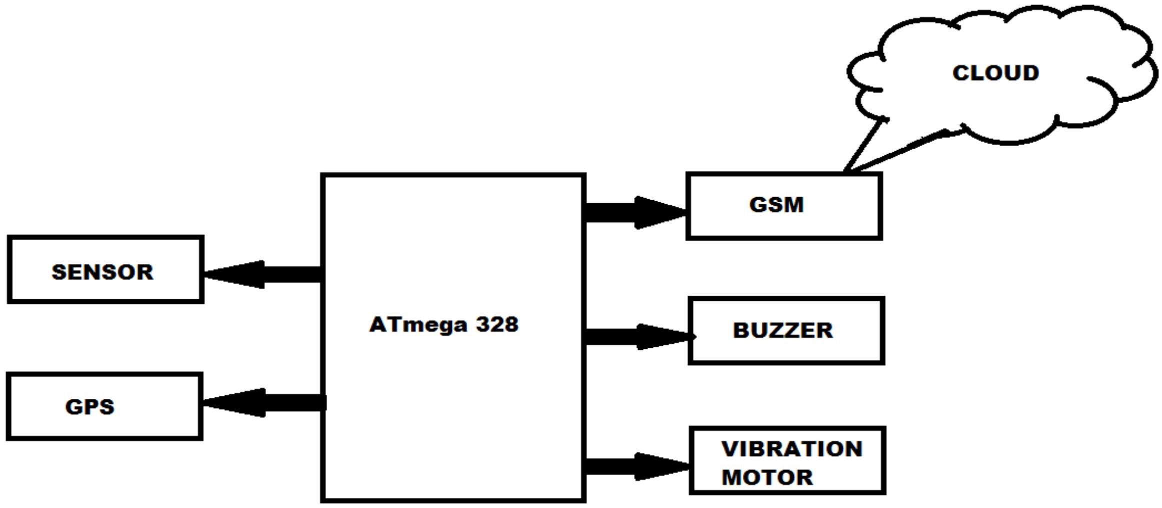


Figure 3: Block Diagram

At the very initial phase, calibration of SONAR sensor and GPS receiver is being done to ensure the correctness of data coming from these sensors. In order to calibrate SONAR sensor, we have to make sure there shouldn't be any object atleast 30 cm from the sensor for the first 6-8 seconds upon power on. The calibration of GPS means, upon power on the first 20-25 GPS NMEA data shouldn't be used for either the survey and/or the navigation as mostly it might be wrong value.

The next procedure involves GPS accuracy and its repeatablity test while performing the real time survey. This test involves marking of multiple points on open ground and move the whole system along with the GPS and log the GPS data coming from the GPS receiver for the marked points. The above procedures has to be repeated in an iterative approach and log the data every time. After taking log multiple times for the marked positions, we now calculate the average error in position for the marked location. The log taken for multiple times is also used to analyse the GPS data for its repeatability.

We now do the survey for the pothole.This step also require prior setting of threshold distance for the potholes. Now we do the navigation survey with the whole system and we continuously monitors the SONAR sensor distance along with the GPS location data, whenever we find any pothole(as defined by the threshold value), the location of that pothole will be stored locally during the survey.

Thingspeak remote cloud server is used to store the location of such potholes. During the survey for the potholes, we generally collect 10-15 such pothole locations locally and then we update it to the remote server. The update rate of such location can be quite less frequent because of the less probability of its high occurance across the roads.

Now, when the survey for the potholes and synchronization with the remote cloud server is over, the system is ready to use. The system can be used offline as well as online. The online method will use the database of remote server for location alert for such potholes and is not that much fast compared to offline method. The offline method will download the database for 10-15 km from the remote server and then can navigate and alert the user for the potholes by looking into the downloaded database locally without internet connectivity. After 10-15 km, again it will download for the next such k.m. range or may be it can store the database for the whole city. Offline method is fast as compared to online method where there is risk involves where we do not have mobile/GPRS coverage.

IV. SOFTWARE

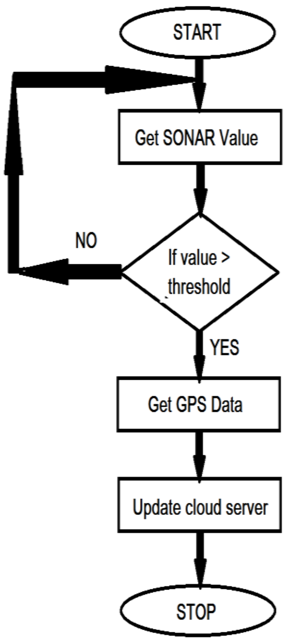


Figure 4: Flow Chart

The flowchart above is for the surveying method. The sensor continuously send the values, we have assigned a particular threshold value so that the smallest potholes can be avoided. If the values sand by the sensor is greater than the threshold value the longitude and latitude as recorded by the GPS for that particular location are updated in a cloud server and the location is saved.

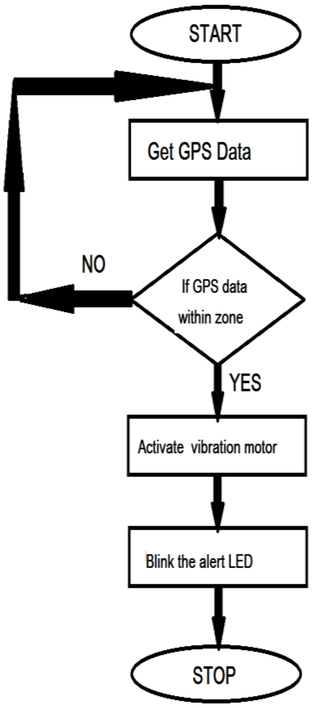
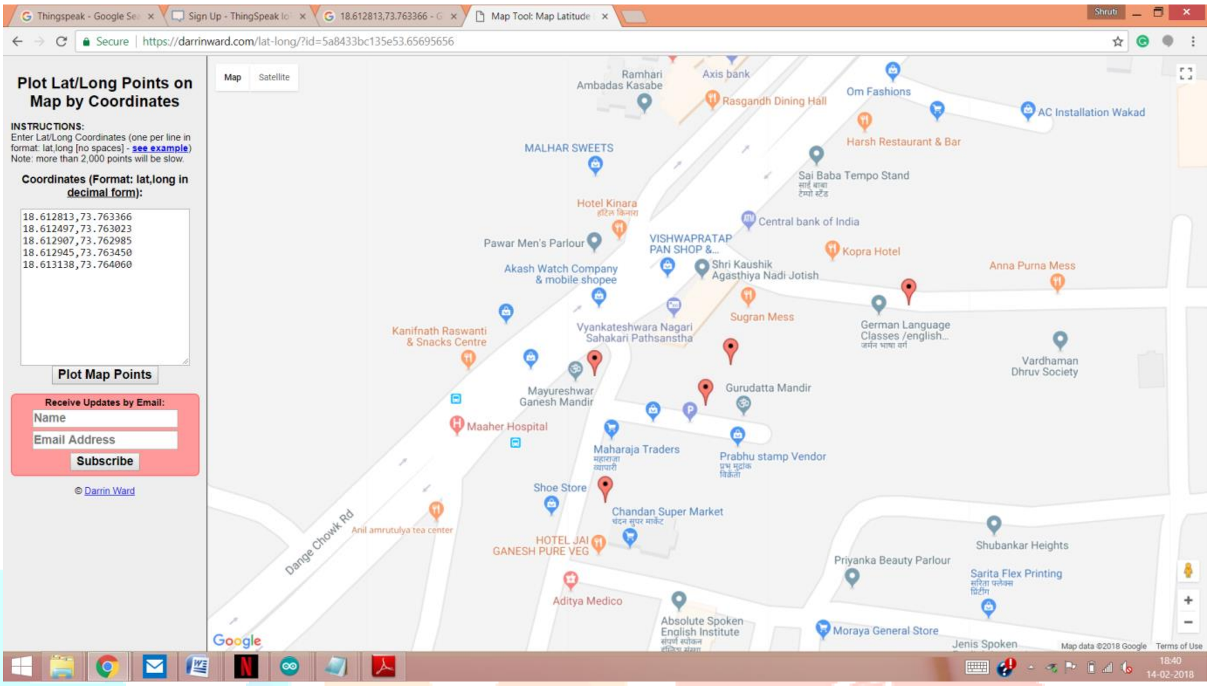


Figure 5: Flow Chart

The activity flowchart is as shown above now when the GPS data a matches with the locations that are saved during surveying, then the vibration motor starts and led blinks.

V. RESULT

After surveying we were successfully able to detect potholes and saved the locations on cloud server. The saved locations are depicted in the figure below.



VI. CONCLUSION

Thus, while walking on a road if a pedestrian is unable to see a pothole the system is able to assist. The pedestrian is intimated of the pothole that could hurt them. For this purpose, a vibrator and a buzzer is used.

ACKNOWLEDGMENT

We express our deepest sense of gratitude towards our Honorable Head of Department(e&tc) **Dr. A. N. Paithane** for giving permission to use the college resources and his constant encouragement for this work. we are thankful to our entire staff of **Electronics and Telecommunication Department** for their timely help and guidance at various stages of the progress of the project work.

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