ISSN 2395-1621

Road Sense Analysis Using Ultra-Sonic Sensor

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ABSTRACT

Road survey requires more manpower, time and money. To resolve these problems we need an effective system. In the proposed system, research has been carried out to gather up data from the municipal buses. The gathered data from the sensor is easy to manage value in the frequency domain to compute magnitudes of the shakiness. Road-sense web app provides whole information about the road to be followed while traveling in the vehicle. It as well provides information to municipal corporator of road surface roughness conditions, which can be easily monitored by municipal corporator to improve road conditions. Smartphones are nowadays the most effective thing which is adopted by every person in the world. And the use of a smartphone can be used for measuring not only the road conditions but also its surface roughness.

ARTICLE INFO

Article History

Received: 8th March 2020

Received in revised form :

8th March 2020

Accepted: 10th March 2020

Published online :

11th March 2020

I. INTRODUCTION

For monitoring the road infrastructure and plan for maintaining a huge amount of data is required and it should be up to date. Data of the road conditions should be monitored continuously and the data about road conditions such as road surface, road roughness, potholes, and the depth about the potholes should also be gathered simultaneously. Conditions of the roads change frequently. And it also requires a huge amount of investment for road maintenance. Obtaining road conditions which change frequently is one of the biggest challenges that every government and municipal corporation are facing regularly. Road's roughness can be one of the biggest problems and important road conditions. Due to road condition vehicle maintenance costs gets affected, such as fuel consumption, safety, and so on. Measurement of the road can be done in using one or more combinations in which one approach is where we use labors for the measurement of roads, and another approach is where some professional people and highly skilled people do the measurement of roads. In the smartphone era, every person has his own Smartphone. We can use smartphones together or collect the road conditions and can get the roughness of the road. Nowadays every smartphone consists of sensors such as Accelerometer and Gyroscope which is most frequently used in gaming. There are some scientists (researchers) who revealed that smartphones can be used to detect road conditions using its built-in sensors also can detect where the road conditions are more critical so that accidents can be avoided. The Final Goal is to develop an application that can be used to detect and identify road conditions and inform the road conditions to the municipal corporation.

II. LITERATURE SURVEY

Road Condition Monitoring Using Onboard Three-axis Accelerometer and GPS Sensor [6]: A study by the US Federal Highway Administration has shown that road condition is an essential factor of highway quality, and smooth roads will lead to more comfortable driving experience and less municipal investments. In this paper, we present a lowcost vehicle-based solution, Road Condition Monitoring with Three-axis Accelerometer and GPS Sensors (RCMTAGPS), by using a cheap three-axis accelerometer and a GPS sensor embedded in a vehicle to monitor the road condition. We analyze the Power Spectral Density (PSD) of pavement roughness, estimate IRI, and classify the pavement roughness level into four levels according to a Chinese industry standard. Experimental results show that RCMTAGPS can evaluate pavement roughness level correctly, even under some interference like potholes, manholes and decelerating belts, and the total cost of RCMTAGPS in each vehicle is no more than 50 dollars, which is about 1/4400 to 1/160 of the existing system used in civil engineering and municipal engineering.

An Estimation of Road Surface Conditions Using Participatory Sensing [1]: When natural disasters occur, some roads could be blocked and cannot be used. Road surface conditions also deteriorate. Thus, collecting and providing information on usable roads and road surface conditions can allow people to be evacuated safely. In this study, we proposed an estimation system of the road surface conditions by collecting Accelerometer data from pedestrians' smartphones. The method estimates whether the road surface condition is flat pavement road, a rough road, a slope or a stair by using the supervised machine learning method. From the results of the experiment, we found that the system can estimate six types of road surface conditions with high accuracy when training the model with the data from the users.

Mahalanobis Distance-Based Road condition Estimation Method using Networkconnected Manual Wheelchair [2]: This paper describes a method to estimate road conditions using our developed network-connected manual wheelchair. We have been developing the wheelchair on which torque sensors, an accelerometer, and a GPS receiver are implemented, for gathering the road condition data onto our server PC. Our final purpose is to develop a\ system which displays traffic disturbance for manual wheelchairs on the digital map automatically. For this purpose, this study aims to associate the sensor values with road conditions using Mahalanobis distance. In this paper, firstly, our developed wheelchair is explained briefly. Then, characteristics of acquired data are shown. After that, definitions of unit space for this problem and calculations of Mahalanobis distance are described. Finally, the possibility of categorizing road conditions using the Mahalanobis distance defined by significance level is explained in detail with the experimental data.

III. PROPOSED SYSTEM

Proposed system is used to analyse the road conditions and road surfaces using ultrasonic sensor. It identifies bad road patches and gives notification or alert message to the navigation system i.e. android application user via alert pop-up window. The application uses this data to inform or give alerts to other android application user and also municipal corporation about road conditions.

IV. SYSTEM ARCHITECTURE

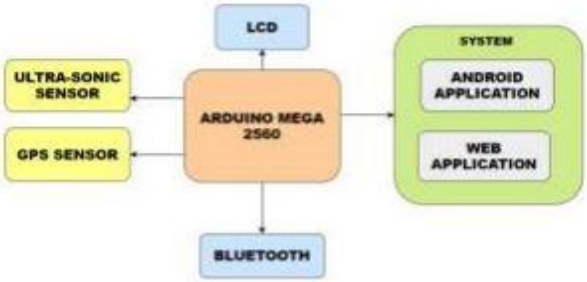

Figure 1. SYSTEM ARCHITECTURE

In the above architecture, Arduino Mega 2560 is a microcontroller board used for connecting sensors to the board. Bluetooth chip is used for connection between the Arduino Mega and System (Android application and Web Application). An ultrasonic sensor is used to calculate the depth of the road surface whereas GPS sensors used for tracing the actual coordinate location of the roads. LCD is used to display the distance calculated by the Ultrasonic sensor in cm or inches.

V. WORKING

In the initial stage, the connection between the Microcontroller (Arduino Mega 2560) and System (Android Application and Web Application) is done via Bluetooth module. Once the connection is done, the ultrasonic sensor sends the inaudible sound waves to the road surface in order to detect the potholes. If the pothole is detected then the ultrasonic sensor calculates the distance i.e. depth of the pothole. If the pothole is too deep

then it gives an alert message to the android application user then the user stores the data of pothole detected to the database. Once the data is stored in the database the admin can log in and see the newly updated road condition data if they are too severe then the admin sends that data to the contractor of Municipal Corporation. Simultaneously GPS module tracks the actual coordinate location of the road.

VI. METHODOLOGY

A. Ultra-Sonic Sensors: Ultrasonic sensors are generally wont to measure distance using ultrasonic waves. This sensor first sends the inaudible sound waves and calculates the distance. In this, Ultrasonic sensors are connected to Arduino Mega 2560. Once the sensor collects the data, it calculates the distance and sends the complete data to Municipal corporator.

B. GPS: Generally, GPS stands for Global Positioning System. GPS is generally used to get the actual location or position of something or someone. In this, we have used GPS to get the actual location of the municipal bus. By using the GPS or actual location of the municipal bus we can get the road condition and municipal corporator can manage to improve the road condition.

C. Bluetooth: Bluetooth is generally used for communication between something in a shortrange. In this we have used Bluetooth for connection between Hardware and Software. By using Bluetooth we can connect both hardware and software in a short-range or specific range. General range of Bluetooth is 10 m – 100 m.

D. Arduino Mega 2560: The Arduino Mega 2560 is generally a micro-controller board which is based on ATmega2560. It contains more memory space and I/O pins. It generally contains 54 digital I/O pins. In this, we have used Arduino Mega 2560 for connection of Ultrasonic sensor, GPS sensor, and Bluetooth.

VI. RESULT

Figure 2. WEB APPLICATION HOME PAGE

Web Application Home Page is the first page to the web application for login purpose for The Admin and The Contractor. The Admin can log in and see the pothole's location and its depth. If the pothole is too deep then admin sends the same to the contractor. The contractor also can log in and see the pothole's details sent by the admin.

Figure 2. USER REGISTRATION PAGE

User Registration Page is the second page of the android application used for registration of the new users. In the android application once the user is registered to the application then he can log in to monitor the road i.e. he can do the analysis of the road.

Figure 3. USER LOGIN PAGE

User Login Page is the first page of the android application. If the user is not registered to the android application then he goes to the registration page for registering himself. Once the user is registered to the application then the user can log in to monitor the road i.e. can do the analysis of the road.

Figure 4. MONITORING PAGE

Monitoring Page comes after login in successfully to the android application. This page is used to monitor the road using the ultrasonic sensor and a GPS sensor. In this ultrasonic sensor calculates the distance and notify the user if the depth or distance of the pothole is too deep.

VII. CONCLUSION

The proposed system uses an Ultrasonic sensor for assembling data and GPS sensors for plotting the road location trace in Google Maps. The accuracy of the ultrasonic sensor depends upon the environment and its temperature i.e. air temperature, humidity, and air pressure. Also, the accuracy of the GPS module depends upon the number of channels, satellites and signal interference caused by the buildings. The application is an effort to gear up its municipal corporation with better knowledge about the routes of their condition to improve. Thus, we have developed a Smartphone Application for RoadSense. The RoadSense application is an effort to give its users with better and high knowledge information about the routes of their transportation.

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