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Road Condition Detection Using Arduino Based Sensing Module And Android Smartphone

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Abstract :*The project aims to produce a Road Condition Detection Device (RCDD).The main components of the project are the arduino module and the Android smartphone. The arduino will be used as a sensing module and the smartphone will be user interface. The road conditions will be evaluated in real time using the arduino and the data collected by it will be sent to the android smartphone using the bluetooth module. The collected data will be used by the android application to and the relative condition of the road and the abnormal road condition will be marked on the Google Maps using GPS of the smartphone. So, the road condition will be known to the driver and they can change their driving behaviors for improving the safety of the people, comfort and efficiency. The amount of accidents which are caused by the bad road condition will be lowered*

Keywords: *arduino ; G-sensor; accelerometer; smartphone ; GPS ; bluetooth; IOT*

I. INTRODUCTION

This paper proposes a road condition detection device (RCDD),It consists of an arduino based sensing module and an Android smartphone based user interface,.It is to be designed and implemented for vehicles.Road conditions are a key part for the driving safety,comfort and efficiency of traffic in people's day-to-day lives.It is desirable to have a mechanism by which people can know about the road conditions in the routes on which they wish to travel,in real time.Also understanding conditions of road surface is also very important for road maintenance and asset management.By using these mechanism,we can improve safety,efficiency and comfort.

Literature Survey:

[1]Title:-Wolverine : Traffic and Road Condition Estimation using Smartphone Sensors(IEEE 2012)
Authors:-Ravi Bhoraskar, Nagamanoj Vankadhara ,Bhaskaran Raman ,Purushottam Kulkarni
Advantages:-1)Use of a centralized server.
Disadvantages:-1)Some filtering techniques and advanced machine learning methods are to be applied to further improvement.
The proposed system uses sensors present on smartphones. These paper studies to improve the algorithm based on using accelerometer,GPS and magnetometer sensor readings for traffic and road conditions detection.

[2]Title:-The Pothole Patrol: Using a Mobile Sensor Network for Road Surface Monitoring
Authors:-Jakob Eriksson, Lewis Girod, Bret Hull,Ryan Newton, Samuel Madden, Hari Balakrishnan
Advantages:-1)A simple machine-learning approach, paper show that are able to identify potholes and other severe road surface anomalies from accelerometer data.
Disadvantages:-1) placement of accelerometers inside the vehicle might affect the quality of the signal.
This paper investigates an application of mobile sensing: detecting and reporting the surface conditions of roads. This system,uses the participating vehicles, gathering data from vibration and GPS sensors,and processing the data to assess road surface conditions via careful selection of training data and signal features.

[3] Title:Road Condition Detection Using Smartphone Sensors: A Survey

Authors: Gunjan Chugh, Divya Bansal and Sanjeev Sofa,

Advantages:-The location of abnormal road condition can be detected and saved in open source traffic data center in the future.

Disadvantages:- 1)Continuos Internet access required.
2) Data should be gathered before applying.
The reasons for extending research in this field are,1)It will ensure safety and comfort to various road users; 2)Smooth roads will lead to less vehicle damage and government investment;3).The availability of low cost sensors in Smartphones;4)The rapid increase in the rate of smartphone users. Thus, it is goal of the project to develop system which are able to detect road conditions using low cost sensors present in smartphone.

[4]Title:- Pothole Detection System using Machine Learning on Android(IJETAE 2012)
Authors:- Aniket Kulkarni , Nitish Mhalgi , Sagar Gurnani , Dr. Nupur Giri
Advantages:- 1) Despite hardware differences in terms of GPS accuracy, accelerometer sampling rate and noise, we postulate that accurate pothole detection is possible.
Disadvantages:-1) Applications utilizing the machine learning implementation should have permissions matching those of the sensors used.
2) The raw sensor data should be evaluated in real time.
This paper investigates an application of mobile sensing: detection of potholes on roads.The paper describe a system and an associated algorithm to monitor the pothole conditions on the road. This system, uses Accelerometer Sensor of Android smartphone for detection of road condition and GPS for mapping the location of potholes on Google Maps.The road condition detection algorithm detects the potholes in real-time.. Accelerometer data and road condition data can be mailed to any email address in the form of a .csv file. While sending the data,the approximate value of the accelerometer can be compared to some threshold value for detecting road condition.If the calculated value is more than the threshold,then the corresponding location is plotted on the Google Maps as a bad conditioned road.

[5]Title:- Road Conditions Detection Using Arduino Based Sensing Module And Smartphone
Authors:- Syuan-Yi Chen, Annie Shih and Chun-Yi Hsiao
Advantages:- 1)The vehicle can obtain nearby road conditions information easily.
2)Traffic management
3)Road accident prevention
Disadvantages:- 1)Continuous internet access.
2)Sensing module should be mounted externally
The aim of the project is to produce a road condition detection device(RCDD), which consists of an Arduino based sensing module and an user interface on android smartphone. It is designed and implemented for vehicles. The Arduino based sensing module is designed to detect the road conditions in real-time and send
the result with raw data to the smartphone. The smartphone receives the data from sensing module, the designed Android user interface application will mark the position with abnormal road condition on Google Maps using the GPS
of smartphone. Therefore, the vehicle can obtain road conditions information via the data shared by nearby vehicles in real time. According to the map, the drives can change their driving patterns to improve driving safety, comfort and efficiency.

[6]Title:- Real Time Pothole Detection using Android Smartphones with Accelerometers(IEEE 2011)
Authors:- Artis Mednis , Girts Strazdins , Reinholds Zviedris , Georgijs Kanonirs , Leo Selavo
Advantages:-1) 90% of real world data is used.
2)Pothole detection algorithms for deployment on devices with limited
hardware/software resources
Disadvantages:- 1)7% pothole clusters were not detected by any of used algorithms.
2)When the speed of the vehicle is low then the potholes in there wil not be detected
For ensuring road condition and surface quality,it should be monitored continuously and repaired as necessary. Various low cost sensors can be used for collection of such data. The paper is describing a mobile sensing system for road condition detection using android OS based smart-phones.

Problem Statement: Detection of bad road conditions such as potholes ,bump,steep shoulders and objects on the road. Therefore, proposing a system by which people can know in real time road conditions in the routes on which they wish to travel.

The goal of our project is to make use of an arduino based sensing module which will send raw data to the smartphone. The google map will be updated using GPS.
The objective of the proposed system is road condition is detected and the drivers can change their driving behaviors for improving driving safety, comfort and efficiency

Proposed Work:

In this system there is a arduino based sensing module and android based user interface.The low cost modules are placed on the vehicles so its efficient for users as they don't have to have an external sensing function when they get on or off the vehicles.The system also has bluetooth module so that the data taken from the accelerometer sensor is passed on to the android based smart phone.The accelerometer is with +-2~8g and baud rate of the bluetooth is 57.6 khz.The various values of the different 3 axes value noted by the accelerometer are been taken and the initial data collected for various road conditions is been send to the android based smart phone with help of the Bluetooth module. Then the smart phone detects the vehicles position on GPS with information including latitude and longitude data if the vibration level is bigger than the predesigned threshold.

System can be divided into two parts first the arduino part and second one android part.
The arduino part as to take the raw data form the accelerometer and pass this information to the smart phone using the bluetooth module. The android part consists of getting the data from the arduino, processing it and locating the position on the Google Maps. Because of this the driver can change their route accordingly.

Hardware And software Components:

Hardware Requirements:
Arduino Uno
Bluetooth
G-Sensor

Software Requirements:
IDE for arduino
IDE for android based development

Algorithm:

The slope and average are been calculated by using the following methods.These road condition evaluation techniques are been done on the arduino part.the ardunio part has two loops one the main loop and other one based on intrrupt service routine. The main loop reads the value of z-axis g value with an interval of 0.1 second.Then the average of the values are been calculated every 2 seconds .finally all the computions are been given to the Android part with the help of bluetooth module.

The Android programing part is designed to enable Bluetooth communication, GPS, and Google Maps API. Moreover, if the values of slop and average of accelerations are larger the pre-defined thresholds, the specific GPS position will be marked in Google Maps and the driving raw data will be saved in SD card.

Arduino Input: I={a1,a2,a3,..an} G-sensors z-axis g value from accelerometer to Arduino

Android Input: Average and Slope Calculation that is done on Arduino

I={A,S} A= Average S= Slope

Arduino Output: The average is calculated of the accelerometer z-axis.

$$Average = \frac{\sum_1^n z - axis\ g\ value}{n}$$

$$Slope = \frac{G[a]-G[a-1]}{(a)-(a-1)}$$

Android Output: The bad road condition region mapped on google maps

Functions :

1.getVals() Receive the input from accelerometer

2.Store Data

3.average() Calculate average every 2 seconds

4.sendData() [Arduino] Send data serially using bluetooth module to android smartphone every 2 seconds

5.getData() [Android] Receive the data sent by bluetooth module serially

6.isDetected() check if data is abnormal i.e. above threshold value (when A i 0.5G, A = Average, 0.5G = Threshold value)

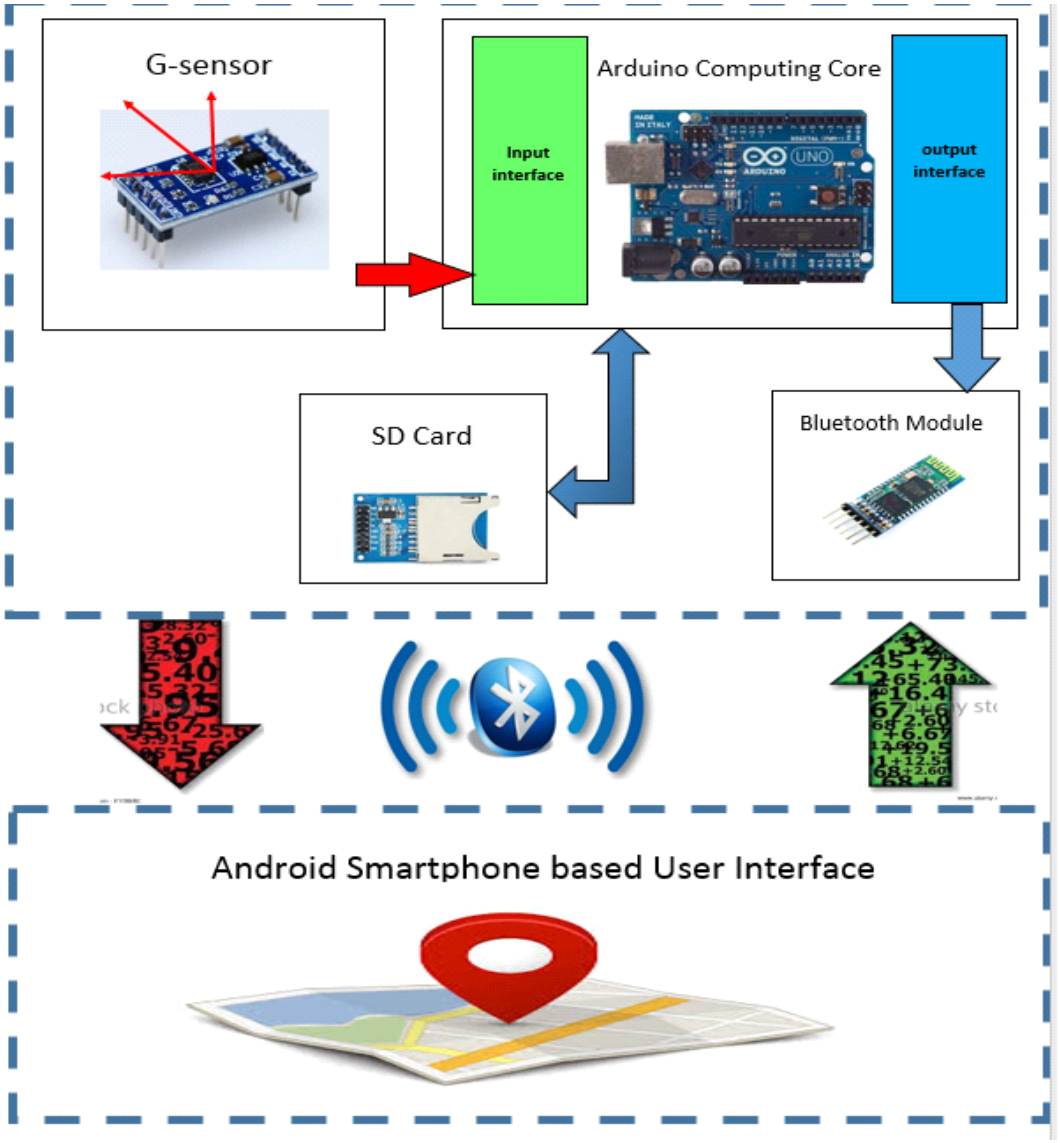
7.pinPoint() get Longitude and Latitude(eg. 37.459545, -122.125468) from Google Maps API and pin it on Google Maps

Success Conditions: S={The road condition is detected and located on google map.}

Failure Conditions: F={Google map is not updated and the road condition is not found.}

System Architecture:

The interaction of the various modules are been shown in the fig .It has the arduino part and the android part which communicate by passing data serially using bluetooh module.



Conlusion:

According to the real time road conditions evalution,the abnormal road condtion can be detected and saved in traffic center.The drives of the vehicles can be obtain nearby road information from the other vehicles via active waring signals or google Maps to manage their driving behaviors for improving driving safety,comfort and efficiency.The road conditions can be improved and there will be comfort for the people.

Future Scope :

The system can be made useful as a part of smart city campaign.Also, applying machine learning techniques in classifying data can help the system to adapt to changing factors like nature of the road and vehicle type the users use. And the data collected can be sent to the government so that they can take the care for improving the road condtions.

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