International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

Improving Road Travel with Route Suggestion using Decision Tree Algorithm

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Abstract - *Use of Smart phones is nowadays a necessity for monitoring as well as identifying the different road conditions. In the proposed system, accelerometer and gyroscope which are inbuilt sensors in mobiles are used. The collected data is processed using certain algorithms. Taking into account, data from both accelerometer and gyroscope, helps in achieving better estimation than the model that takes into account the magnitude from the accelerometer and the average speed alone. GPS system of the smart-phones will be used for capturing the location.*

Key Words: **Classify collect data, Send collect data for classification, Update for current location, Road condition of current location, Accelerometer.**

1. INTRODUCTION

Roads have been used as a mode of transport from ages. It is considered as the most basic mode of transport which connects places in urban cities as well as rural places to some extinct. The United States have the largest road network across the world, followed by India in second position. The road network in India is around, 5,903293 km (by 2017). This road network helps in transporting 64.5% of the all goods in the country, also 90% of citizens of India use roads for their daily commutation. According to the Ministry of Road Transport and Highways, India, 1, 46,000 people had died due to road accidents in 2015.So approximately 10-12% of the fatalities occurring in road accidents have been recorded in India. Deadly road accidents are witnessed quite often in India due to the bad condition of roads as well as reckless, negligent driving. According to an official report, on an average 400 deaths take place every day in India due to road accidents. The condition of roads changes rapidly due to usage and natural calamities. It also usually requires a huge investment of time to collect the data on a regular basis. Obtaining such data is often a challenge that the government is facing, especially in countries where budget is limited and advance technology is still not affordable. The roughness of a particular road surface is an important aspect while analyzing the road conditions, because it affects various factors such as vehicle maintenance costs, fuel consumption, comfort, and safety of the passengers. The different conditions of road are measured normally using one or a combination of two main approaches, which include a ratings based on personal opinions and experiences or a visual inspection, an approach that is consumes a lot of time and requires a lot of man power; and the use of the sophisticated pro-filers, which are highly accurate but costly to obtain, operate and maintain, requires skillful operators as well as cumbersome calibration before deployment. Our system works on providing a route to the user which is comfortable to travel i.e. a road in good condition. This system includes incorporation of mobile-based sensors along with GPS to provide routes.

2. LITERATURE SURVEY

- In [1] the researchers explore a low cost and easier way for continuous road condition monitoring by obtaining road surface(roughness) and traffic conditions using data collected by sensors from smart phones under realistic settings in which the smart phones are placed at more realistic locations and under realistic manner inside a moving vehicle, to evaluate its relationship with the actual road pavement roughness.

- In [2] the researchers have identified bad road conditions such as potholes, bump which helps drivers as well as authorities to use and maintain the roads. Use of mobile sensors are most important part of the evolving technology; this is explained in this paper. By supervising roads and using algorithm to detect and store the data about potholes this paper gives us all analogies. Different mobile sensors such as gyroscope, magnetometer and accelerometer are being used to create valuable data which further is used for algorithms

- In [3] a vibration based approach has been presented which automatically detects the pothole and speed-breakers with their severity levels. This paper discusses about the monitoring of road condition using android's built in accelerometer which records 3-axis acceleration. This is stored in local database. Various technologies like P2(Pothole Patrol) is discussed. Proposed approach can be very easily deployed on any android based smart-phone.
- In [4], researchers have built a system which is capable of collecting data regarding road's condition with the help of an accelerometer and helps visualizing this data by integrating with GPS. Data collected was processed which yielded almost accurate results. As data collection through this method needs more efforts, researches have

concluded that in future a system working with less efforts can be developed.

- In [5], the researches have involved a machine learning method which is supervised learning. Here data regarding the road is collected by an accelerometer of a smart phone. The end result helped the researches to distinguish among the six types of road conditions such as slope, stairs, rough etc.

- In [11], data was collected from accelerometers as well as gyroscope along with additional hardware such as Raspberry Pi, all mounted on a test vehicle. Then a genetic type algorithm like GALGO [12] is used for processing this data.

- A sensor known as accelerometer is used here to collect data. Also they have integrated with GPS for collecting the data. An approach to monitor road surface with accelerometer along with GPS is done in [9]

3. LIMITATIONS OF EXISTING SYSTEMS

Existing systems provide only status of road and not any other information like traffic update. The computations involved are very complex and require a lot of calculations. Most of the existing systems require external hardware devices and sensors which increases the cost.

4. PROPOSED SYSTEM

Proposed system uses smart phones which analyzes the road condition and road surface. Sensors present in mobile such as accelerometer and gyroscope are being used, along with GPS in Google Maps. These conditions are saved in a database. If the user is going to that destination for the very first time, then system will show the shortest path or best route as per the Google maps. Then Decision tree algorithm is applied on the inputs taken in the database detected by the sensors. Proposed system is having a database which collects data with the help of android smart phones present in the vehicle. This data updates in real time periodically. Application utilizes this data to inform other application users about road condition. Proposed system doesn't need any extra hardware. This system utilizes sensors already present in most of the smart phones today.

4.1 System Architecture

The user will place smart phone on dash board of a car and it will start the application. The application will start collecting data through the sensors. The collected data from the application will be analyzed and classified into various categories and then it will be uploaded on the server. Server will store the data into the database. The application will collect real time data about the road condition. The data stored in the database will be updated into the database frequently. If there is any other application user on same location, then the system will inform that user about the road condition and traffic status. The architecture is shown in Figure 1.

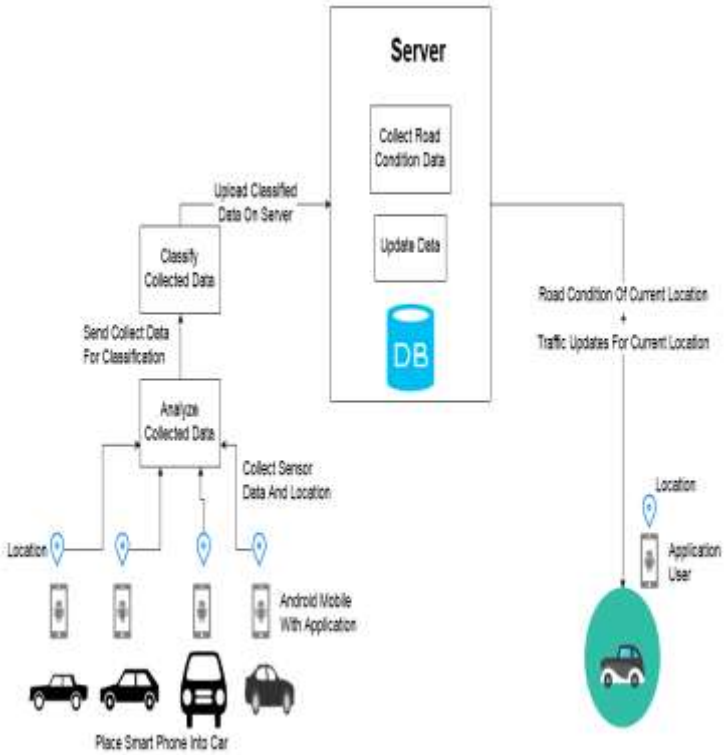

Figure 1 System Architecture

4.2 Algorithm

To improve and yield better system result we use decision tree algorithm. Decision tree is a type of supervised learning algorithm. It is mostly used in machine learning classification problems in which predefined output is provided for particular input. In this technique, the data is split into two or more groups or sets based on certain logic or conditions applied on the input variables. An example is shown in Figure 2 for reference.

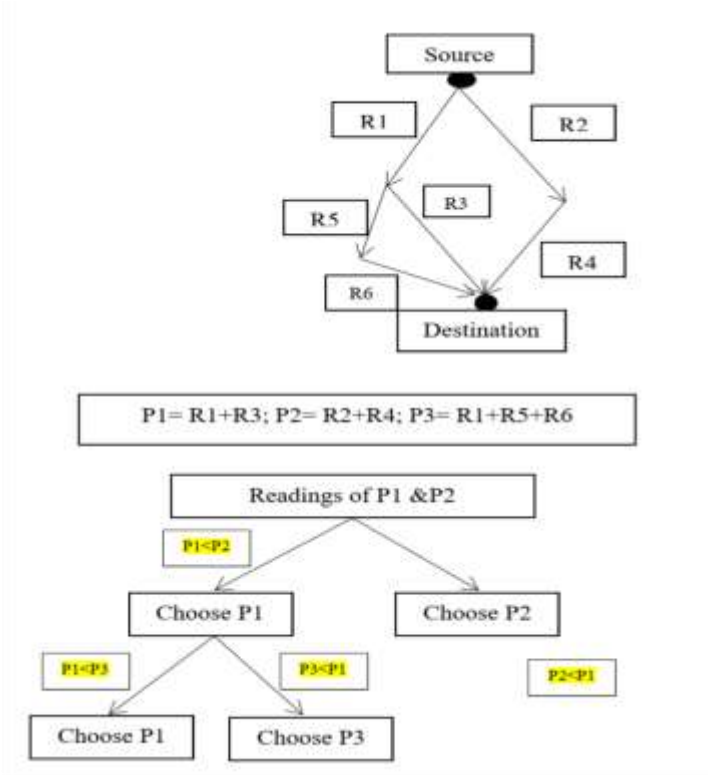

Figure 2 Decision Tree Algorithm

4.3 Implementation

System's first requirement will be the GPS must be on for user's current location. So user has to enable GPS first. Then system will start the service and will show initial values of accelerometer and gyroscope in the form of X, Y and Z co-ordinates (Figure 3). After that user needs to enter the source and destination. As soon as user starts moving the values of accelerometer and gyroscope start updating. In the end if the average value of accelerometer and gyroscope is beyond threshold value then that route will be considered as bad route. If the value is below Threshold value, then it will be considered as comfortable route. It measures the vibration of motion of a structure. The force because of vibration, an electrical charge is created t is proportional to the force exerted upon it. Using this statistics accelerometer generates the required value. Gyroscope works on the rotational axis configured (Figure 4), according to the movement of the mobile phone it gathers the calculated values of movements. It identifies potholes and gives notification to system. Along with this decision tree algorithm is used.

Figure 3 Screenshot of Application

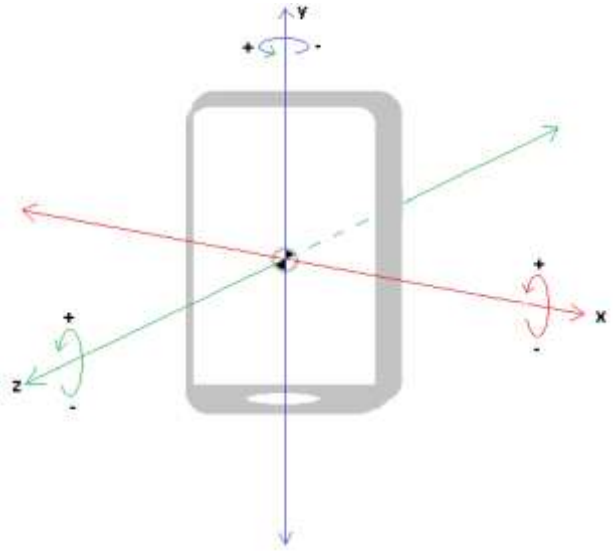

Figure 4 Gyroscope Axis

5. FUTURE SCOPE

This system application can be used by all the frequent road travelers for safer and comfortable travelling. Various cab providing services such as uber, ola etc. can use this application for safer and comfortable customer experience. Cab drivers can choose more comfortable route according to the customers' comfort level. Various travel agencies as well as public transport can make use of this application for smooth functioning. This application can also prove to be very beneficial in emergency cases such as providing route to ambulances. If there is any bump or speed breaker on the road the system application will immediately detect it. In this way, it will provide safer environment for the patients in critical condition. Various speed breakers, potholes, bumps

are not visible at night times. People who travel at night times can use this application for a safer travel experience. People who travel through village roads can use this application for a safer travel experience as village roads are full of potholes and not in proper condition. Dangerous road accidents can be avoided by making use of this application.

6. CONCLUSION

We have used an accelerometer as well as gyroscope sensor in the Proposed system which collects the data. Also GPS is used for current location. Decision tree algorithm will be implemented in this system, grouping of two sensors; accelerometer and gyroscope will yield better results. Hardware usability is reduced, due to this approach as this includes the use of software. As smart phones are used by a numerous amount of people and they also travel on a large scale this will help in every aspect to provide more comfortable travelling suggestions. Because of the smart phones we need not to deploy special sensors in vehicle. As number of smart phone users is increasing day by day hence using smart phones is a biggest advantage. Thus, this system aims to provide its various users a better brief about the routes of their transportation.

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