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E-way approach to sense the road condition using machine learning

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Abstract *— Smartphones are mainly functional to be adopted as a money-spinning and easy to execute tool for the measurement of road surface roughness condition, which is very essential for road monitoring and maintenance planning. In this study, an experiment has been carried out to collect data from accelerometers and gyroscopes on smartphones. The collected data is processed in the frequency domain to calculate magnitudes of the vibration. Road roughness condition that is modeled as a linear function of the vibration magnitudes, taking into account of both data from accelerometer and gyroscope as well as the average speed, achieves better estimation than the model that takes into account the magnitude from the accelerometer and the average speed alone. The finding is potentially significant for the development of a more accurate model and a better smartphone app to estimate road roughness condition from smartphone sensors.*

Keywords-component; **Road monitoring, Accelerometer, Gyroscope, Android**

INTRODUCTION:

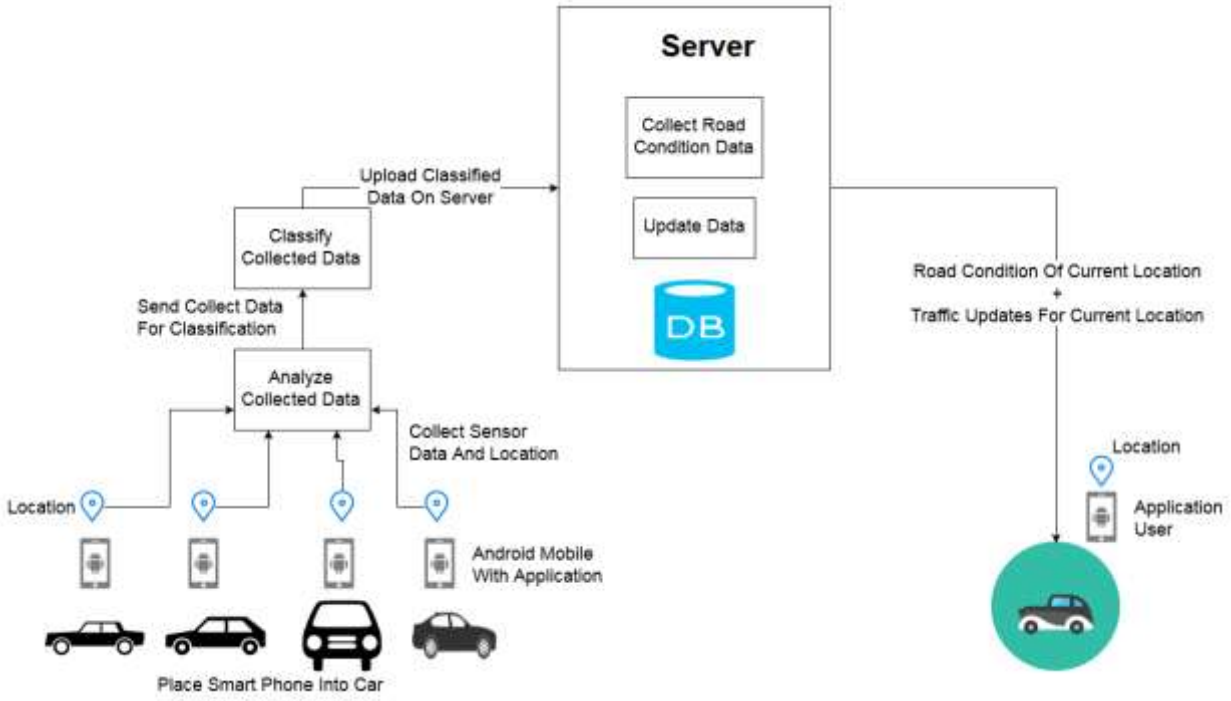
To properly monitor, plan for maintenance and manage road infrastructure, substantial amount of data is always needed, particularly time series and up to date road condition data. Road condition data changes over time; since it also usually requires considerably significant investment and time to collect the data on a regular basis, obtaining such data is often a challenge that many governments are facing, especially in countries where budget is limited and advance technology is still unaffordable. Road surface roughness is regarded as one of the most important road conditions, because it affects vehicle maintenance costs, fuel consumption, comfort, and safety. Road measurement is normally done either by one or a combination of two main approaches, which include a subjective rating or a visual inspection, an approach that is labor intensive and very time consuming; and the use of sophisticated profilers, which are highly accurate but costly to obtain, operate and maintain, requires skillful operators as well as cumbersome calibration before deployment. In the smartphone era, where the number of smartphone users is increasing steadily, using smartphones to collect road condition data and estimate road roughness condition could change the way the government monitor, plan for maintenance and manage the road infrastructure forever, because the chance of having plenty of up to date data with inexpensive investment is huge. On the other hand, today's smartphones usually come with sensors that are capable of recording useful signal for road surface condition estimation similarly to those used in many high-tech equipment. There are some studies that are relevant to this work, such as the use standalone, mobile and smartphone sensors to assess and monitor road and traffic conditions, detect road bumps/anomalies and their locations, and analyses events/features of different road defects; in simulation and real-life traffic conditions Further development includes the introduction of smartphone apps that claim to work in detecting road bumps and roughness condition. The final goal of this project is to develop a significantly simpler app that identifies road condition and inform other application user about traffic update.

Literature survey:

Sr no	Paper name	Author	Advantages	Limitations/ Disadvantages
1	Road Condition Monitoring Using On-board Threeaxis Accelerometer and GPS Sensor	Kongyang Chen, Mingming Lu, Xiaopeng Fan, Mingming Wei, and Jinwu Wu	Authors present a low-cost vehicle-based solution, Road Condition Monitoring with Three-axis Accelerometers and GPS Sensors (RCM-TAGPS), by using a cheap three-axis accelerometer and a GPS sensor embedded in a vehicle to monitor the road condition	Need Extra hardware
2	An Estimation of Road Surface Conditions Using Participatory Sensing	Yukie Ikeda, Masahiro Inoue	found that the system can estimate six types of road surface conditions with a high accuracy when training the model with the data from the users.	System design for walking persons and not for cars
3	Road Test Experiments and Statistical Analysis for Real-Time Monitoring of Road Surface Conditions	Amr S. El-Wakeel, Abdalla Osman, Aboelmagd Noureldin and Hossam S. Hassanein	System work use image processing to detect road condition	Need extra camera which is attach to wind shield
4	Mahalanobis Distance-Based Road Condition Estimation Method using Network-Connected Manual Wheelchair	Kazuyuki Kojima, Hiroki Taniue and Jun'ichi Kaneko	System is design for wheelchair	Need extra hardware

Propose System:
Propose system analyze the road condition and road surface. It identify bad road patches and gives notification to navigation system. For that we used inbuilt accelerometer sensor and gyroscope sensor. To improve the system result we use decision tree algorithm. Propose system has self-managing database which collect data from vehicle drivers android smart phones. This data update in real time periodically. Application utilizes this data to inform other application users about road condition.
Architecture

System architecture



Architecture explanation
User will place smart phone on dash board of car and start application. Application start collecting sensor data. This data analyze and classify into categories then upload on server. Server store data into database. Server updates those data into database frequently. If any other application user on same location then inform user about road condition and traffic status.

Conclusion
Propose system uses an accelerometer and gyroscope sensor for collection of data and GPS for plotting the road location trace in Google map. We are going to implement decision tree algorithm. Our best results is obtained thanks to a alliance of two sensors; accelerometer and gyroscope. We also leaving to inform nearest user about traffic. The smartphone-based technique is very useful because it remove the need to deploying special sensors in vehicle. It has the benefit of high scalability as smartphone users increases day by day. Thus, we have developed a smartphone application. This application is an effort to provide its user with better knowledge about the route of their transportation.

References

[1]Yukie Ikeda ; Masahiro Inoue "An estimation of road surface conditions using participatory sensing". 2018 International Conference on Electronics, Information, and Communication (ICEIC)

[2]Kazuyuki Kojima ; Hiroki Taniue ; Jun'ichi Kaneko "Mahalanobis distance-based road condition estimation method using network-connected manual wheelchair". 2016 IEEE International Conference on Consumer Electronics-Taiwan (ICCE-TW)

[3]Takumi Satoh; Akihito Hiromori; Hirozumi Yamaguchi; Teruo Higashino "A novel estimation method of road condition for pedestrian navigation". 2015 IEEE International Conference on Pervasive Computing and Communication Workshops (PerCom Workshops)

[4]Juan C. Tudón-Martínez; Soheib Fergani; Olivier Sename; John Jairo Martinez; Ruben Morales-Menendez; Luc Dugard, "Adaptive Road Profile Estimation in Semiactive Car Suspensions" IEEE Transactions on Control Systems Technology. Year: 2015, Volume: 23, Issue: 6

[5]Viengnam Douangphachanh; Hiroyuki Oneyama "Estimation of road roughness condition from smartphones under realistic settings", 2013 13th International Conference on ITS Telecommunications (ITST)
[6]Kongyang Chen; Mingming Lu; Xiaopeng Fan; Mingming Wei; Jinwu Wu "Road condition monitoring using on-board Three-axis Accelerometer and GPS Sensor", 2011 6th International ICST Conference on Communications and Networking in China (CHINACOM)

[7]Amr S. El-Wakeel; Jin Li; Aboelmagd Noureldin; Hossam S. Hassanein; Nizar Zorba "Towards a Practical Crowdsensing System for Road Surface Conditions Monitoring", IEEE Internet of Things Journal, Year: 2018, (Early Access)

[8]Amr S. El-Wakeel; Abdalla Osman; Aboelmagd Noureldin; Hossam S. Hassanein "Road Test Experiments and Statistical Analysis for Real-Time Monitoring of Road Surface Conditions", GLOBECOM 2017 - 2017 IEEE Global Communications Conference

[9]Quan Yuan; Xinze Li; Cai Wang; Yibing Li; Yan Gao, "Cluster and factor analysis on data of fatal traffic crashes in China", 2017 4th International Conference on Transportation Information and Safety (ICTIS)

[10]Kenta Ito; Go Hirakawa; Koji Hashimoto; Yoshikazu Arai; Yoshitaka Shibata "Road Surface Condition Understanding and Sharing System Using Various Sensing Technologies", 2017 31st International Conference on Advanced Information Networking and Applications Workshops (WAINA)