Measurement of Road Surface Undulations using a Low-Cost Accelerometer Sensor

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Abstract

International roughness index (IRI) is the main parameter that measures the comfortability of using a road. This index is also taken as a thumb rule when taking the road maintenance and rehabilitation decisions. Main problem of this method is the high cost of the equipment required. Low cost alternatives like travelling beam method is time and labor intense compared to the IRI measuring device. There are numerous researches done on the use of built-in smart phone accelerometer to determine the IRI value as a low-cost alternative.

Aim of this research is to improve the accuracy of the measurement of IRI by smart phone method using a low cost off the shelf accelerometer without compromising the cost aspect. In this method, accelerometer is fixed to the axle of a vehicle and collect the data via Bluetooth to a smartphone. Since the measurement is not damped by the shock absorbers of the vehicle, the readings are much more realistic. A machine learning algorithm is used to analyses the collected data and predict the road condition. This algorithm should be trained using a training data set prior to the use. This process involves to collect and label data according to the prior knowledge and available data. This was done by first collecting data using a smartphone application while manually labelling the data points. Then this data was separated as training and testing data as appropriate and training data was fed into the algorithm with the manually labelled data as a reference. After training the algorithm, testing dataset was fed to the model.

Second part of the research was carried out to train the algorithm on detecting potholes without human involvement. For this, the data collection application was slightly modified to label the pothole data points. Then the previous training and testing method was carried out.

Accurate results were observed during both instances with reference to the labelled data. It was observed that the more training data makes the prediction model more accurate.

Since this is a low-cost method to determine the road surface condition, local road authorities can implement this as a network to collect real time data and carryout the future road maintenance works effectively.

Keywords: IRI, Pavement, undulations

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