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# Development of Speed Breaker Identification System Using Smart Phones

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**ABSTRACT:** Speed breakers and uneven streets are a significant danger to drivers that inquiries their security. The accident happens in view of no sign sheets showing the speed breaker, helpless perceivability around evening time and street works that are frequently completed with no appropriate indications of street deviations and furthermore the carelessness of the driver. Every one of these variables put the existence of the people to no end making harm the vehicle just as life. Rough streets have become an issue for vehicles with less ground leeway. The focal point of the paper is on planning an early admonition framework recognizing both speed breakers and awful street conditions. The methodology utilized in this paper is a continuous arrangement and is created as an android administration that runs behind the scenes and depends on Google Maps application in the cell phone. This assistance will toss an alarm giving early admonition if the client is moving toward the speed breaker or an uneven street. Aside from simply giving an early aware of the client, it additionally furnishes the client with another option and a superior course. The arrangement proposed in this work is a type of publicly supporting where clients share and get information, along these lines making the framework financially savvy.

## I.INTRODUCTION

Speed breakers are for the most part laid for the security of the walkers in private zones and school zones to control the speed furthest reaches of the vehicle, in this way keeping away from mishaps. However, nowadays, numerous quantities of unapproved speed breakers are laid superfluously, which don't keep the standard size proposed by National Highway Authorities. Speed breakers are basic in agricultural nations like India, China, Pakistan, and so forth since sign sheets like "stop", "yield" and "speed limit" and so on won't work because of absence of traffic implementation assets. Despite the fact that there is proof that speed breakers diminish speed related mishaps, there are additionally circumstances causing mishaps and extreme wounds. Driver carelessness, the speed of the vehicle, low perceivability at evenings will bring about intersection the speed breaker in more noteworthy speed. There are not many occurrences detailed [1], where cruisers, bikes, and vehicles are defenseless on the grounds that unseen speed breakers may rattle them causing serious mishaps and harms.

As a feature of this work, an overall review was directed to conclusions from various individuals. A considerable lot of them have grumbled that their vehicles are rattled, particularly when they are going in new courses and in the evenings. For instance, many have griped that Bangalore is one such city where late evening voyaging is monotonous and perilous as the majority of the speed breakers are colossal and there could be no legitimate sign sheets introduced. Additionally, the current form of the Google guides will give information about continuous fixes on a street in any case, it won't give any information about speed breakers and awful street conditions. This gives us a chance and inspiration to foster an answer that will caution the client about the speed breakers, especially when he is going on new courses.

The proposed solution will not make use of any additional hardware equipment rather it uses the data from the sensors. In this Smartphone era, every person possesses a Smartphone that is GPS enabled and always connected to the internet. This enables us to develop an Android application that uses the data generated out of the existing sensors in the Smartphone to alert the user regarding bumps and bad roads. The challenge for this application is in populating data with the speed breaker locations. The same smartphone that takes the data from the server will also provide the data about new speed breakers and bumpy roads to the server, just like the concept of torrents: "if you want something, you

need to share something". This paper gives a proof of concept that is being developed as an android service which will run relying on the Google maps application. The rest of this paper is organized as follows: related work in Section 2, proposed system and its architecture in section 3, implementation of the system with detection techniques, classification, datasets and results in section 4 and conclusion in section 5.

## II. RELATED WORK

Most of the existing systems use an additional hardware to detect the Speed breakers, most of which are expensive. Some of the existing approaches are discussed in this section.

Magnetometer and accelerometer are the two cell phone sensors utilized by the framework proposed by Wolverine [3]. This technique utilizes accelerometer sensor of a cell phone to gather the information for the checking of traffic and distinguishing the street bumps. The Magnetometer is utilized for the reorientation of the tomahawks of the vehicle and gadget since the gadget might be set inside the vehicle at any self-assertive direction. This should be possible in two phases. In the principal stage, mathematical tomahawks and telephone's tomahawks ought to be adjusted. In the subsequent stage, the new gadget's tomahawks are lined up with vehicle tomahawks. GPS is utilized to find the course of movement of vehicles to discover the point of movement of the vehicle with attractive north to change the gadgets tomahawks towards the vehicle tomahawks. The information from the sensor is arranged into two classes utilizing K-implies grouping calculation and they are physically named as one or the other smooth or rough and break or not. SVM is prepared utilizing this named information for order of information focuses during test face for vehicle state forecast. For knock recognition, this framework produces 10% bogus negative rate and for the discovery of breaking the framework produces 21.6% bogus negative rate and 2.7% bogus positive rate. The principle disadvantage of this framework is it requires magnetometer for reorientation, however magnetometer is absent in all telephones that are under use and builds the battery utilization.

Hull et al. [4] proposed a distributed mobile sensor computing system, which records the data collected by the sensors that are installed on the vehicle. The sensors like camera, GPS, Bluetooth and wifi are used for collecting data during a travel by the vehicle. The collected data is used only for route planning and to calculate the time taken to travel. This application does not detect any bad road or speed breaker during the travel.

Singh et al., [5] proposed a mobile phone application that uses GPS, accelerometer and microphone to collect the data. This application detects road and traffic conditions along with driving behavior. This application is used to detect various events based upon the patterns observed. This application does not use machine learning. It is completely based upon the patterns obtained from the sensor data.

Researchers from University of Jyväskylä [6] designed an offline data mining technique for pothole detection. They pre-processed raw data collected by accelerometer using band-pass filters, further they used the feature detection algorithms such as mean, peak-to-peak ratio, standard deviation, root mean square, variance wavelet packet decomposition and power spectrum density. Further to reduce the features backward and forward selection and genetic algorithms were used. Although this approach shows a good performance in detecting the potholes but this is too complex to be implemented over small devices like Smartphone because of less processing power and small memory size.

## III. PROPOSED ARCHITECTURE

The proposed framework is an android administration that begins behind the scenes when the client is utilizing the Google maps. The framework brings the subtleties for example scope and longitude information of all the speed breakers and awful streets inside a range of 20 kms from the current client position. At first the information base is void, it is populated when various clients are announcing about the speed breakers. The proposed framework is planned so as to not need any human mediation in announcing worker about the speed breakers. At the point when a client is running over a speed breaker the abrupt change in the plentifulness of accelerometer information from the portable is noted. This abundance information alongside lat-long information are shipped off the worker. As we can't finish up on ordering speed breaker and awful streets from a solitary client which may bring about bogus positives. At the point when various clients are detailing the roughly same plentifulness information close to a similar lat-long positions, we assemble a trust esteem dependent on the quantity of clients announcing a similar sort of information. This empowers us to populate the information in the worker. Presently, we should analyze the situation where the client is going in another course. At the point when he begins the route on Google Maps, our application runs behind the scenes, in light of his present area, the framework gets the information from the worker. This information is about the speed breakers and terrible streets is brought for each 20 kms. At the point when the client is moving toward a speed breaker the

framework will show him a caution on the screen as demonstrated in Figure 10. This alarm is shown roughly 200 meters before the vehicle moves toward the point, giving adequate time for the vehicle to back off. In the event that the client is moving toward a terrible street, an alarm will be tossed before he moves toward the street and an elective course will be recommended. The entire framework is portrayed in Figure 2 and will be working in two stages as follows:

1. When the applications starts, the server pushes the data about the currently logged markers (both speed breaker and bad roads) and shows an alert when the user is approaching the marker. In case of a bad road it also suggests an alternate route.
2. If the car has encountered a new speed breaker or a bad road which is not yet marked in the database, application pushes that new data to the server. A trust value will be built when multiple users are reporting same data

For a particular latitude and longitude value, many users may provide the information like it is speed breaker or a bad road. The trust value for a particular latitude and longitude value is calculated based on the number of users mention it as speed breaker/bad road. The attribute which is having the higher trust value decides whether it as speed breaker/bad road. In this application 50 users' suggestions are taken into account and based on the trust value it is classified as a speed breaker or a bad road. The trust value keeps changing when a new user reporting for a particular latitude and longitude value as a speed breaker/bad road. The classification of speed breaker and the bad road are made based on the changes in amplitude values of the accelerometer. The values of the peaks in the accelerometer graph are taken and those values are normalized based on the following normalization Equation  $x - \text{mean}(x) * SD$ .

From Equation 1,  $x$  denotes the set of amplitude values that are collected by crossing a speed breaker or a bad road. Mean denotes the average of the amplitude values for a particular speed breaker or a bad road. SD is the standard deviation that is observed from the amplitude values.

If the sum of all the normalized value for a particular latitude and longitude amplitude is zero, then it is classified as a bad road otherwise it is classified as a speed breaker. The system frequently updates the database with the current latitude and longitude values from the bad road and the speed breakers. In this approach the use of the magnetometer is not required since the application does not need the reorientation of the device axes with the vehicle axes. This overcomes the drawback of the method proposed by Wolverine for the detection of the speed breakers. This method classifies the speed breaker and bad roads, hence it outperforms all the available exiting systems.

For arrangement support vector machines are utilized, since SVM is a basic classifier in AI calculations and the exactness of the SVM classifier is more for the mathematical informational collection contrasted with different classifiers. The date utilized here for arrangement is a standardized mathematical information and the characterization did not depend on the precise qualities. To group the information that falls close to the edge is named one class (speed breaker/terrible street) and the qualities separated from the minimal are delegated another class (speed breaker/awful street). So far we have talked about how to log the information to the worker, however we haven't depicted when we need to dispose of the information as it gets invalid throughout some stretch of time. The proposed framework will monitor the keep going updates dependent on the timestamps, the marker that is having the most seasoned time stamp will be taken out if the thing that matters is over multi month for a speed breaker and multi week for an awful street. It is expected that the awful street conditions are because of the upkeep work that is done and it won't keep going long, though a speed breaker has a bigger lifetime, changes to speedbreaker are done once in a while.

#### IV.IMPLEMENTATION

To execute the proposed framework a keen portable handset with web association is utilized. The tomahawks of Smartphone won't be lined up with the vehicles tomahawks since the area [11] of the Smartphone might be in a gasp pocket, wallet, dashboard and seat and so forth, The reorientation of tomahawks isn't needed in this application for the proposed framework focuses just on the varieties of the vehicle's Z hub. The application comprises of four modules:

1. Data collection for speed breaker
2. Data collection for bad road condition
3. Dynamic detection of speed breaker and bumps
4. Notification and route recommendation

The developed mobile application works independently on any vehicle and on any Android device. Data collections for speed breaker and bad road condition module gathers data by an accelerometer and location related data are sent to the cloud server where the probable location of speed breakers are identified. Nearby speed breakers are grouped within a

single route and that information is fed into a database. When a vehicle travel in a particular route, the latitude and longitude values of speed breaker are recorded and send to the server database and the process is shown in Figure 1

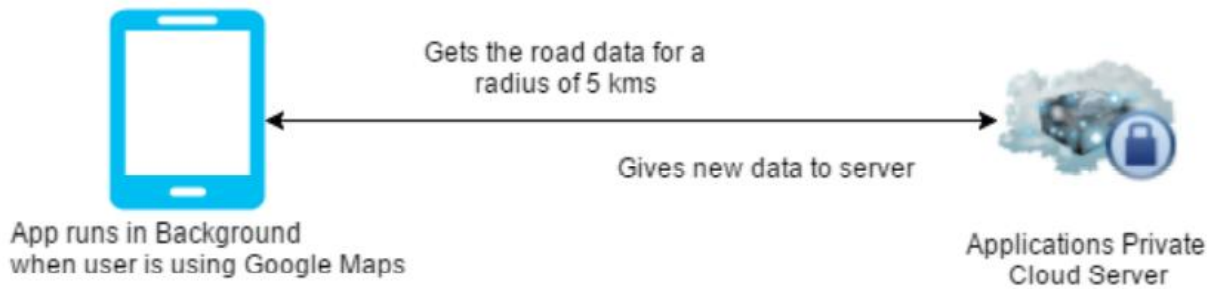


Figure1. Updating the server database with speed breaker and bumpy road information

When the application starts the dynamic detection of speed breaker and bumps module the list of speed breaker and the list of bad road condition for a particular route is loaded into the local device from the cloud database. Then, the vehicle's current location is compared with the speed breakers and bad road of the matching location from the local database.

When a vehicle travels in particular route, the location of all the speed breakers in the route and the bad road are summarized and notified to the user and also the other routes are recommended by the system with the minimum number of speed breaker and bad road than the current route that can be opted by the driver. When a vehicle is approaching a speed breaker and the speed breaker is found within 200 meter distance from the vehicle's current location and a warning message will be provided. The data for the 20KM radius around the current location of the vehicle is fed into the local device.

To detect speed breaker only the amplitude of the acceleration vector is sufficient. The amplitude consist of forces experienced along all the three axes, it already has the component of forces experienced along the z-axis of the vehicle, so that a detection of speed breaker from the time series of amplitude data is possible.

#### 4.1 Detection Techniques

The application is started when the user is navigating using Google Maps. When the car is moving in normal road or a plain surface as shown in Figure 4, the amplitude of the accelerometer does not have much variation as shown in the Figure 2.



Figure 2. Car Moving in a normal Mode

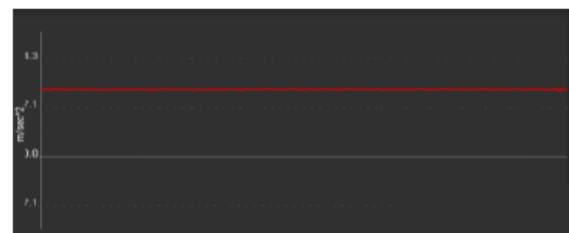


Figure 3 .Accelerometer graph on normal road

When the car is approaching a speed breaker as shown in Figure 4, the amplitude of the accelerometer suddenly varies for the time period that is taken from the car to cross the speed breaker and the amplitude becomes normal when the car had crossed the speed breaker as shown in the Figure 5.



Figure 4. A car approaching a speed breaker

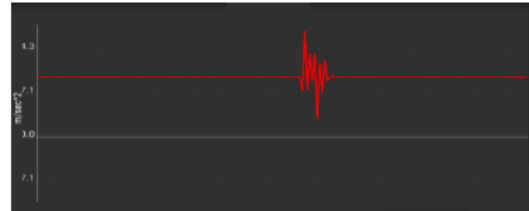


Figure 5. Accelerometer graph on speed breaker

When the car is approaching a bumpy or bad road as shown in Figure 6, the amplitude of the accelerometer varies till the car crosses the bad road as shown in Figure 7.



Figure 6. A car approaching a bumpy bad road

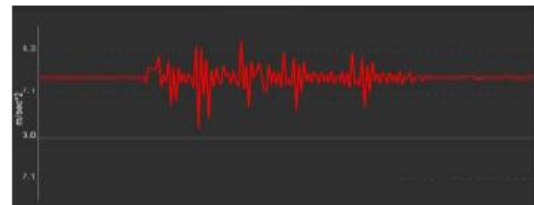


Figure 7. Accelerometer graph on bad road

## 4.2 Classification

The information have been gathered from various individuals on different streets in Coimbatore, Tamilnadu, India is utilizing a few kinds of vehicles like vehicles, bicycles and auto carts. For a specific drive dependent on the accelerometer information, the element vector are named as a speed breaker or not a speed breaker or a terrible street. The AI calculation utilized for the arrangement is a Support Vector Machine (SVM) since it is a nonlinear, separating and no compelling reason to make a presumption of information boundaries. Each element was standardized by taking away the mean and isolating by the standard deviation

## 4.3 Datasets

The information have been gathered from various individuals on different streets in Coimbatore, Tamilnadu, India is utilizing a few kinds of vehicles like vehicles, bicycles and auto carts. For a specific drive dependent on the accelerometer information, the element vector are named as a speed breaker or not a speed breaker or a terrible street. The AI calculation utilized for the arrangement is a Support Vector Machine (SVM) since it is a nonlinear, separating and no compelling reason to make a presumption of information boundaries. Each element was standardized by taking away the mean and isolating by the standard deviation

## 4.4 Results

The aftereffects of the proposed framework are appeared in the underneath screen captures. Figure 10 shows the markers demonstrating the speed breakers with a blue marker and the awful streets utilizing a purple marker. These markers get refreshed as and when the client is voyaging. Figure 11 shows how the alarm messages will show up in the closer view when the client is driving with maps..

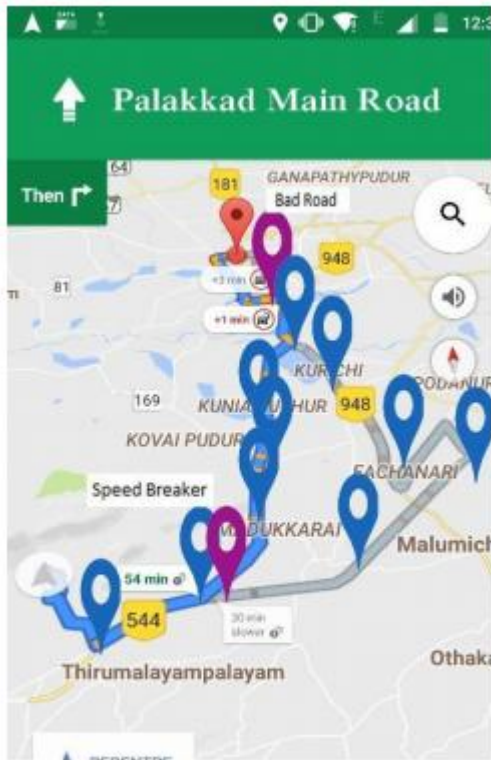


Figure 10. Screenshot of Map

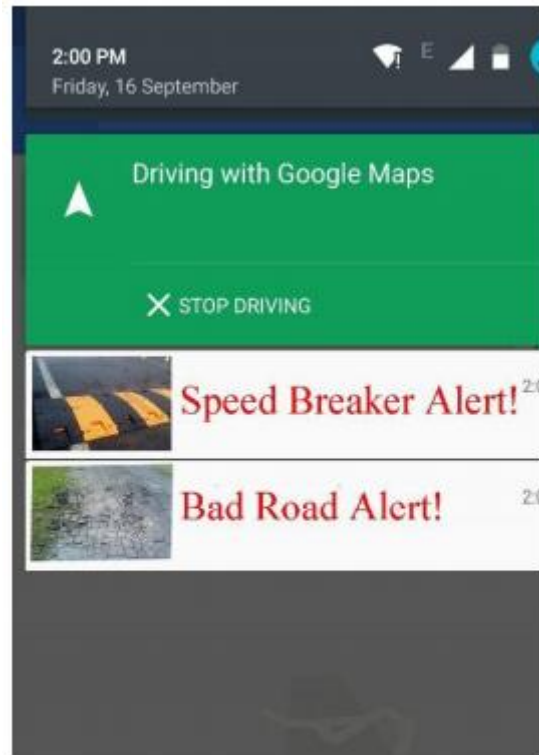


Figure 11. Screenshot of Alerts

## V.CONCLUSION

This paper has proposed a proof of idea by fostering an android administration that goes about as a foundation administration to Google guides and gathers information on the event of speed breakers or terrible streets. An alarm is given to the vehicle drivers, which is more effective as far as reaction time. The proposals of backup course of action are given as an alarm to the driver when he/she is moving toward an awful street. The magnetometer isn't needed since the reorientation is kept away from in this framework. It is shown that the framework beats the past works and furthermore functions admirably when the cell phone is put in four wheelers.

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