“SAFE DRIVING USING MOBILE PHONES”

PROJECT REFERENCE NO. : 37S0527

COLLEGE : SKSVMA COLLEGE OF ENGINEERING AND TECHNOLOGY, GADAG
BRANCH : COMPUTER SCIENCE AND ENGINEERING
GUIDE : NAGARAJ TELKAR
STUDENTS : SPURTI K HONATTI
           PALLAVI KUNDAGOL
           PALLAVI KALASUR
           SHWETA R.N

Abstract

As vehicle manufacturers continue to increase their emphasis on safety with advanced driver-assistance systems (ADASs), we propose a device that is not only already in abundance but portable enough as well to be one of the most effective multipurpose devices that are able to analyze and advise on safety conditions. Mobile smart phones today are equipped with numerous sensors that can help to aid in safety enhancements for drivers on the road. In this paper, we use the three-axis accelerometer of an Android-based smart phone to record and analyze various driver behaviors and external road conditions that could potentially be hazardous to the health of the driver, the neighboring public, and the automobile. Effective use of these data can educate a potentially dangerous driver on how to safely and efficiently operate a vehicle. With real-time analysis and auditory alerts of these factors, we can increase a driver’s overall awareness to maximize safety.

Introduction

In the fast-paced society of today, the focused is on arriving at destination as quickly as possible. However, with this lifestyle are not always aware of all the dangerous conditions that are experienced while operating an automobile. Factors such as sudden vehicle maneuvers and hazardous road conditions, which often contribute to accidents, are not always apparent to the person behind the wheel.

In recent years, there has been tremendous growth in Smartphone’s embedded with numerous sensors such as accelerometers, Global Positioning Systems (GPSs),
magnetometers, multiple microphones, and even cameras. The scope of sensor networks has expanded into many application domains such as intelligent transportation systems that can provide users with new functionalities previously unheard of. Experimental automobiles in the past have included certain sensors to record data preceding test crashes. After analysis, crash scenarios are stored and analyzed with real-time driving data to potentially recognize a future crash and actually prevent it. With more than 10 million car accidents reported in the United States each year, car manufacturers have shifted their focus of a passive approach e.g., airbags, seat belts, and antilock brakes, to more active by adding features associated with advanced driver-assistance systems (ADASs) e.g., lane departure warning system and collision avoidance systems. However, vehicles manufactured with these sensors are hard to find in lower priced economical vehicles as ADAS packages are not cheap add-ons.

In addition, older vehicles might only have passive safety features since manufacturers only recently began to introduce an effective driver assist. Since sensors ultimately add onto the cost of a vehicle initially and cannot be affordably upgraded, target a mobile smart phone as an alternative device for ADASs that can assist the driver and compliment any existing active safety features. Given its accessibility and portability, the smart phone can bring a driver assist to any vehicle without regard for on-vehicle communication system requirements. With this as motivation, envision a cheap and convenient mobile device that is able to analyze and advise the driver on sudden and harmful situations that arise from vehicle maneuvers and environmental factors. This type of driver assist is only meant to complement the driver but not to take full control of the vehicle. Providing constructive feedback to the driver is crucial in correcting bad driving behaviors.

Recently, Ford and BMW have proposed ideas on this type of driver assist, where it can be integrated into their telemetric system, along with hundreds of other vehicles sensors. Given the sensing capability of smart phones, use the internal accelerometer and GPS of the phone in place of the expensive hardware installed in vehicles to assist active features provided in newer ADAS vehicles.

**Objective of the Project**

The motivation, envision a cheap and convenient mobile device that is able to analyze and advise the driver on sudden and harmful situations that arise from vehicle maneuvers and environmental factors. This type of driver assist is only meant to complement the driver but not to take full control of the vehicle. Providing constructive feedback to the driver is crucial
in correcting bad driving behaviors. Given the sensing capability of smart phones, using the internal accelerometer and GPS of the phone in place of the expensive hardware installed in vehicles to assist active features provided in newer ADAS vehicles.

**Methodology**

Here the use of the three-axis accelerometer of an Android-based Smartphone to record and analyze various driver behaviors and external road conditions that could potentially be hazardous to the health of the driver, the neighboring public, and the automobile. Effective use of these data can educate a potentially dangerous driver on how to safely and efficiently operate a vehicle. With real-time analysis and auditory alerts of these factors, This can increase a driver’s overall awareness to maximize safety.

![Figure 1.1 Nexus One and three-axis diagram of the accelerometer.](image)

In our proposed methodology we are using four modules. Namely,

- Device Background module
- Road Anomaly Detection
- Driving Pattern
- Sending data Alert SMS module

**Device Background**

The work reveals roads to be more complex than the identification resolutions presented by both Nericell [1] and Pothole Patrol [15], resulting in a wider array of classifications to reveal a particular road’s overall integrity. Here identify not only potholes but also bumps and rough, uneven, and smooth roads using multiple axes of the accelerometer. Also utilized a single measuring device rather than expensive external sensors placed in numerous places
around the vehicle, which ultimately increases infrastructure costs. A device, which is a mobile Smartphone, contains GPS, microphones, and an accelerometer offering flexibility in methodology and user implementation. Encouraging results in identifying numerous road anomalies and sudden driving maneuvers allow for the system to evaluate an entire road’s condition and help advice drivers on unsafe characteristics, respectively, both of which are distinguishable factors that can determine safety on the road.

Accelerometer sensor is going to sense x, y & z direction value.

If the vehicle is moving in normal position, then it will show x & y direction values.

If vehicle is out of control, then it will follow x, y & z direction.

<table>
<thead>
<tr>
<th>Axis</th>
<th>Direction</th>
<th>Typical Driving</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Left/Right</td>
<td>Lane Change</td>
</tr>
<tr>
<td>Y</td>
<td>Front/Rear</td>
<td>Acceleration</td>
</tr>
<tr>
<td>Z</td>
<td>Up/Down</td>
<td>Road Anomalies</td>
</tr>
</tbody>
</table>

Road Anomaly Detection

Poor road conditions can lead to repavement methods that can cause an increase in both traffic congestion and travel time. A distressed road can also increase the chance of an accident. By expanding on work presented in [1] and [15], extended road anomaly detection using a mobile phone’s accelerometer. The embedded accelerometer is capable of detecting subtle or extreme vibrations experienced inside the vehicle. For example, vibrations experienced as jerks can be caused by potholes or a rugged/damaged road from a rough road. Speed bumps and potholes are two nuisances that plague drivers on the road every day.

Using a Smartphone, look for these road characteristics using a combination of the x-axis and z-axis of the accelerometer. When a vehicle experiences a bump, it ascends onto the bump, resulting in a quick rise or spike in the value of the z-axis. This also results in a subsequent increase in the x-axis, depending on the bump formation. At high speeds, the spike in the value of the z-axis is very prominent. However, for low speeds, this rise is not as obvious but still leaves an apparent impact. To detect bumps at low speeds, compensate with
the x-axis and a dynamic threshold based on speed. If the difference between two consecutive acceleration values of the z-axis exceeds the threshold, as well as an x-axis threshold, a bump can be assumed [15]. Differentiating a pothole from a bump can be a difficult task using only a z-axis threshold, as seen in [15], but both are distinguishable using this method.

Driving Pattern

- **Lane Change:**
  To detect lateral movements or lane changes performed by the driver, here looking at the x-axis of the accelerometer. Using the previous phone orientation from the acceleration/deceleration patterns, it is possible to recognize lateral movements created by an automobile and differentiate a left-lane change from a right-lane change. These unsafe lane changes produce a g-force well over $\pm0.5$ g. It was observed that an average time to complete a safe lane change was 75% longer than a sudden lane change. These values are set as parameters to analyze future sudden lateral movements such as unintended lane deviations and the act of swerving in and out of high-speed traffic.

- **Sending data Alert SMS:**
  In this module, based on the variation of directions an alert message is sent to the Owner with data say car number or any etc.

Results and conclusions

Using a mobile Smartphone, have demonstrated some innovative applications that are integrated inside an automobile to evaluate a vehicle’s condition, such as gear shifts and overall road conditions, including bumps, potholes, rough road, uneven road, and smooth road. The road classification system resulted in high accuracy, making it possible to conclude on the state of a particular road. Along with these findings, an analysis of a driver behavior for safe and sudden maneuvers, such as vehicle accelerations and lane changes, has been identified, which can advise drivers who are unaware of the risks they are potentially creating for themselves and neighboring vehicles. The direction of lane change, as well as safe acceleration, compared with sudden acceleration, was easily distinguishable.

Future Scope

Using a multiple-axis classification method for bumps increased the bump and pothole classification accuracy, resulting in a better road anomaly detection system. Being fueled by
demand, future advancements in embedded hardware will yield the Smartphone and its sensors to be more powerful devices in terms of processing, sensitivity, and accuracy, paving the way for many more innovative applications. Unlocking its potential in intelligent transportation systems seems only logical as there are conceivably numerous of applications that can help reduce safety concerns on the road.