International Journal of Electronics Communication and Computer Engineering
Volume 5, Issue (4) July, Technovision-2014, ISSN 2249–071X

Technovision-2014: 1st International Conference at SITS, Narhe, Pune on April 5-6, 2014

Assistance to Driver and Monitoring the Accidents on Road by using Three Axis Accelerometer and GPS System

Roma K. Goregaonkar
E & TC Department, RMDSSOE, Warje, Pune, India
Email: romasharvin@gmail.com

Prof. Mrs. Snehal Bhosale
E & TC Department, RMDSSOE, Warje, Pune, India
Email: snehalbhosale@sinhgad.edu

***Abstract* – Since the vehicle users are increasing day by day it has become necessary for the driver to get assistance on road on highway while travelling. For safety purpose the user should be aware of the road conditions. With advanced technology mobile phones are well equipped with three axis accelerometer and GPS system. Android operating system of smart phone having three axis accelerometer and the GPS tracking system that can be used to analyze the road conditions for driver's awareness and maximize safety. In this paper the emphasis is to provide assistance to the driver while travelling. The data available can educate the driver as how safely and efficiently he can drive the vehicle. In addition to this a device similar to wireless black box can be used in a same vehicle to monitor if the accidents occur. The device consists of collision sensor, microcontroller unit, GPS and GSM module. This wireless device will send a short message to the relatives informing that the event of accident has occurred.**

***Keywords* – Three-Axis Accelerometer, GPS System, GSM Module, Road Condition, Smart Phone.**

I. INTRODUCTION

While travelling we are focused on arriving at our destination as early as possible. But we are not aware of the factors such as bumps, potholes, lane change or any hazardous road conditions that can cause sudden vehicle fall. The easiest method is to do the manual analysis of the road conditions and upload on central serve, but this method requires strong participation of the users and manual image analysis which requires expensive equipment's and can limit the accessibility [5]. Smart phone that is embedded with sensors like three axis accelerometer, GPS tracking system, cameras, microphones etc. [3] with this assistance can be provided to the driver with embedded sensing device without vehicle communication system requirement. A feature selection algorithm is used to get the knowledge of the road features and predict the road conditions [6]. Using the technology used in a smart phone, it can be used to analyze and provide assistance to the driver on sudden and hazardous situations that arise from vehicle fall and environmental factors [1].This paper describes the road irregularity detection and evaluation using positive data rate with real data world using Android OS based smart phone. Evaluation will be carried out on Pune - Mumbai highway with promising results. The entire road condition detection data is sent to the web server and this data is used by the user while travelling. This will also help the other person who is unaware of the road condition. In addition to providing assistance to the driver a black box device will be developed that tracks the vehicle fall and monitors the accident. [2]The fall detection or the accident alarm will save the life on time by giving medical treatment.

II. SYSTEM DESCRIPTION

In today's life we are not always aware of all the dangerous conditions that are experienced while operating an automobile. Factors such as sudden vehicle fall and hazardous road conditions such as bumps, potholes etc. which often contribute to accidents of vehicles. So the automated approach for detecting potholes or bumps with fewer errors that is the use of embedded sensing devices or smart phones. Due to tremendous growth in smartphones embedded with numerous sensors such as accelerometers, Global Positioning Systems (GPSs), multiple microphones, and even cameras [3], 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. Car manufacturers are focused on passive approach, for example airbags, seat belts, and antilock brakes, lane departure warning system and collision avoidance systems. With more than 10 million car accidents reported on highway car manufacturers have shifted their focus of a passive approach manufactured with sensors. But it is hard to find in lower priced economical vehicles as they are not cheap add-ons. Since external sensors ultimately add onto the cost of a vehicle initially and cannot be afforded or upgraded. So we target a mobile smartphone as an alternative device that can assist the driver and compliment any existing active safety features. Given its accessibility and portability, the smartphone can bring a driver assist to any vehicle without regard for on-vehicle communication system requirement.

With this as our motivation we 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 fall and environmental factors. In addition we can also develop a system that makes use of

accelerometer to implement a fall monitor. Accident in public is a major problem in many countries and quick assistance is not reached to the people who got the accident. Intelligence schemes [2] such as fall or accident detection with tracking system has been devised to notify the accident to the related people. In this work a device similar to wireless black box using GPS system along with GSM module is developed for accident monitoring. This paper presents a method for road flow map using the data received from the GPS.

III. System Overview

Step 1- start
Step 2 - initialize all the parameters initialize x=left /right
y=Acceleration/breaking
z= up/down vibrations
Step 3 - read the values of all the parameters of Accelerometer using default period
Step 4 - check whether all the parameters are read or not if yes go to step 5 if no go to step 3 again
Step 5 - Get GPS location if read go to step 6 if No go to step 5
Step 6 – End

A. Block Diagram Description

We are going to detect the road conditions by using smart phones. The application is to collect the information of road condition and send the information back to the user through web server. The block diagram of the system is as shown in the Fig 1.The system involves different features collected by three axis accelerometer, GPS location detected by smart phone that is given to the web service. According to [3] the system is used in cars to identify the fatigued surface on the road. Similarly petrol pump, food mall, toll plaza can also be detected by GPS which will be helpful to the user while travelling on road. The main idea of [1] [4] is to find the road anomalies and mapping of the road conditions. Once the reorientation [1] [7] of the axis of the phone is done the accelerometer reading is estimated to detect the road conditions. The table 1 gives the analysis of the axis. As shown in Fig2.The Y- axis shows that the vehicle is in motion. The X-axis shows left or right change of the vehicle that is the lane change. The Z –axis shows the vibration that means it detects the bumps or the pot holes. 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 X-axis, depending on 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.

Table 1: Significance of Three Axis Accelerometer

Axis	Direction	Driving condition
X – axis	Left/right	Change in lane
Y – axis	Front/Back	Acceleration
Z – axis	Up/Down	Vibration

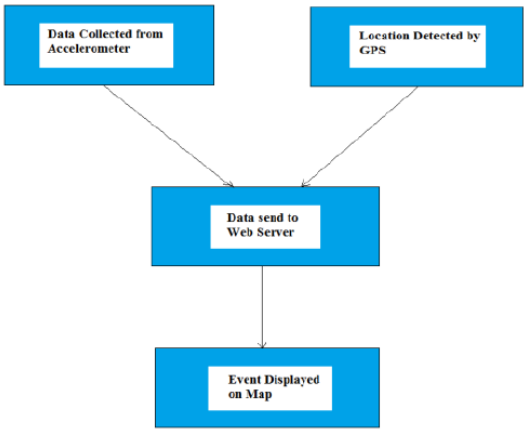


Fig.1. Block Diagram of System Overview

To detect bumps at low speeds, we 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.

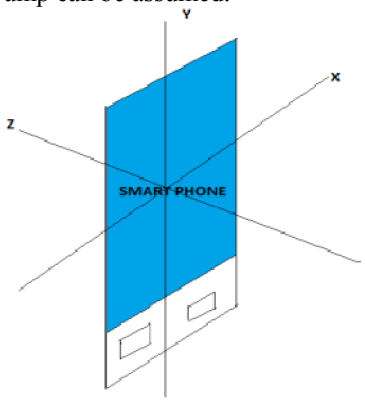


Fig.2.Three Axis in Smart Phone

The feature selection algorithm is used to record the different features of road and recording the data of accelerometer and latitude and the longitude coordinates and the exact area from the GPS. These road anomalies are defined as bumps, potholes speed breakers or uneven road conditions. If the accelerometer gives the multiple readings then a threshold value is assigned that designates the particular value of the road.

B. Feature Selection Algorithm

The Feature Selection Algorithm [6] is a machine learning algorithm. According to this algorithm a training data set will be taken. A data set will be taken and the initial set will be X with n features. Each set will have different features and the final predicted data set will be the union of all the features. The overview of the algorithm is as shown in Fig.3.

Step 1 - Let X be the training data set and Ω be the initial set of *n* features
Step 2 - Relabel data in X with freeway samples as “1” and all Others as “0.” Denote this training data set as X1. Select the best features from Ω that can classify all the

freeway data against all other data in /X1. Denote this feature set as Ω1.
Step 3- Relabel data in X with freeway ramp samples as "1" and all others as "0." Denote this training data set as X2. Select the best features from Ω that are not in Ω1 and that can classify all the freeway ramp data against all other data in X2. Denote this feature set as Ω2.
Step 4- Relabel data in X with arterial data samples as "1" and all others as "0." Denote this training data set as X3. Select the features that are not in Ω1∪ Ω2 and that can best classify all the arterial data against all other data in X3. Denote this feature set as Ω3.
Step 5- Relabel data in X with local roadway data samples as "1" and all others as "0." Denote this training data set as X4. Select the features that are not in Ω1 ∪ Ω2∪Ω3 and that can best classify all the local roadway data against all others in X4. Denote this feature set as Ω4.
Step 6 - Output feature set Ωnew =Ω 1∪ Ω2 ∪ Ω3 ∪ Ω4.

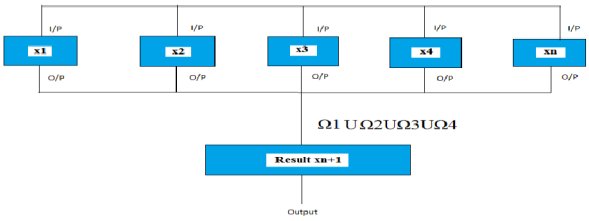


Fig.3. Overview of Feature Selection Algorithm

C. Technical Requirements

There are some technical requirements that are to be considered as suggested by the author [5]
1) Event should be detected by the system in real time.
2) Android OS based Smartphone should be used with accelerometer sensors.
3) The smart phone used should be able to perform communication task at quality level.
4) Detection of road condition should be done by five to six vehicles.

IV. System Description of Monitoring the Accidents

Overview of monitoring the accidents in shown in Fig.4. The device will be classified as linear fall and non-linear fall. The nonlinear fall is free falling without external force and linear fall is due to the external force that is due to the collision of the vehicle. The system overview is as shown in fig.4.

When the external force collides the vehicle, it will send a short message to the relatives indicating that the event has occurred and the person in the vehicle requires medical help. The fig.5 shows the block diagram of monitoring the accident. System is like a black box consisting of switch indicating a collision sensor, a microcontroller unit. The signal from the microcontroller unit will be given to the smart phone. The GPS module of the smart phone will give[8] the exact location of the accident and the GSM network will send a short message to the relatives about the event of accident.

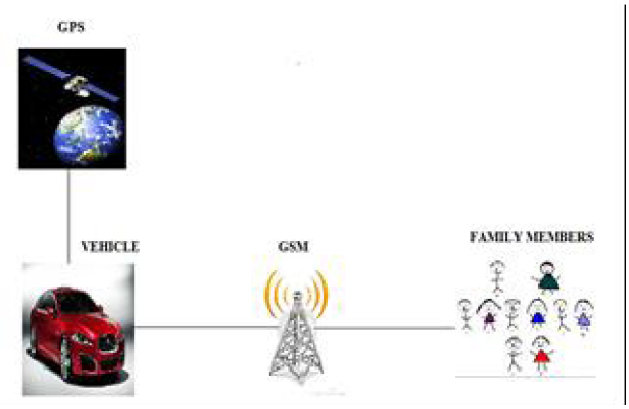


Fig.4. System Overview of Monitoring the Accident

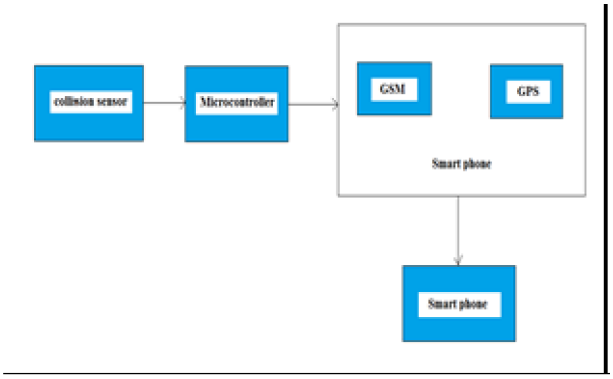
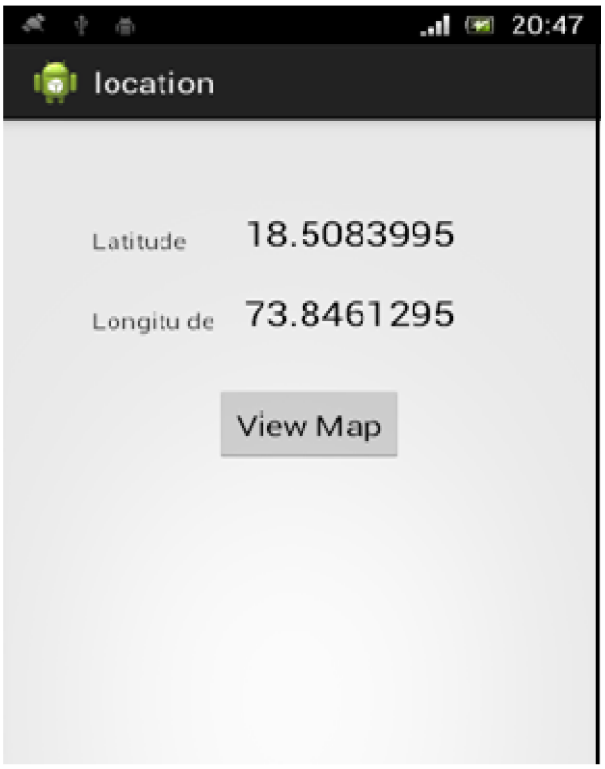
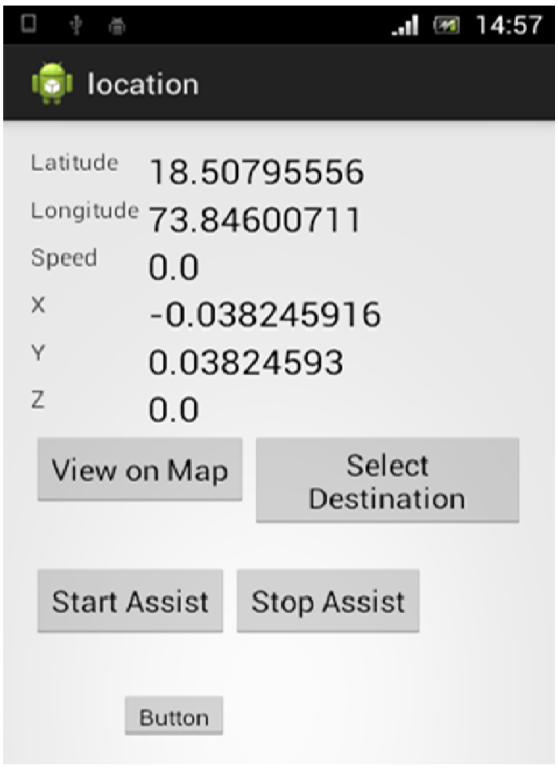
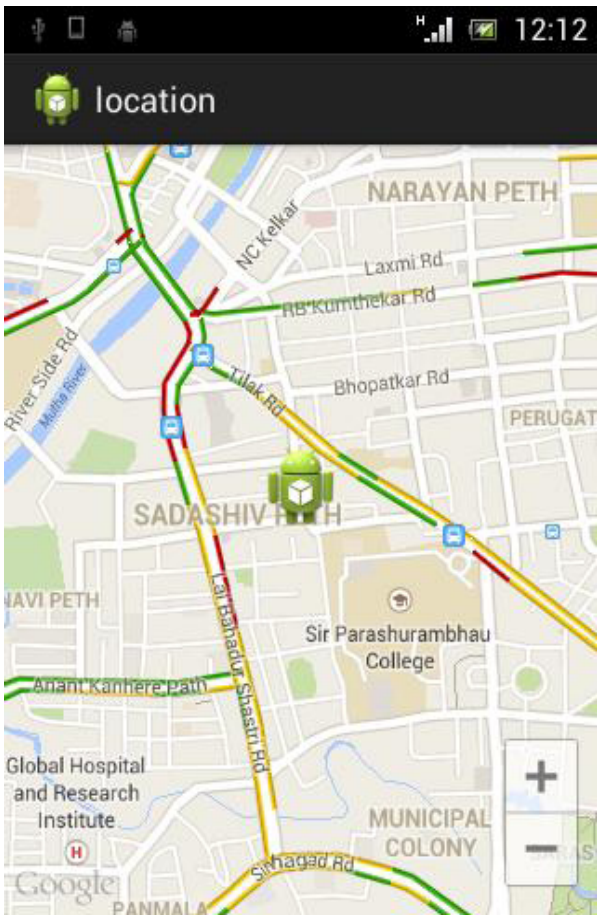


Fig.5. Block Diagram of Monitoring the Accident

The main purpose of the device [8] is to decrease the death rate and record the information of the vehicle. The smart phone will transmit all the data through SMS to other mobile. Hence a short message from the wireless device using GSM and GPS tracking device that will give the exact geographical location (latitude and longitude) and the area where the accident has occurred.







V. Experimental Results

The snapshoots attached are the output results
(a) Three axis Accelerometer readings. These shows the X-axis, Y-axis, Z-axis coordinates.
(b) Latitude – Longitude coordinates of the GPS Location.
(c) GPS location.
(d) In this screen the viewmap button will give the exact area by the GPS while travelling. The user will select the destination by using destination button. Road condition assistance will be provided to the user by using Start Assist button till the user reaches destination. After reaching the destination point the user may click on Stop Assist button.

VI. Conclusion

Using a smartphone, some innovative applications that are integrated inside an automobile can evaluate the overall road conditions including bumps, potholes, rough road, uneven road, petrol pum and food mall. Along with these findings, an analysis of driver behaviour for safe driving such as vehicle accelerations and lane changes can be identified, which can advise drivers who are unaware of the risks they are potentially creating for themselves and neighbouring vehicles. Along with this a GPS tracking system can be developed for vehicle accidental monitoring. The system can detect type of accident from accelerometer, posture after crashing of vehicle and GPS ground speed. After accident is detected, short alarm

message data that is alarm message and position of accident will be sent via GSM network. Thus our overall work will give safety for the driver inside the vehicle.

ACKNOWLEDGEMENT

This is a great pleasure & immense satisfaction to express my deepest sense of gratitude & thanks to everyone who has directly or indirectly helped me in completing my dissertation work.

A dissertation work of such a great significance is not possible without the help of several people, directly or indirectly. First and foremost I have immense happiness in expressing my sincere thanks to my guide Prof. Mrs. Snehal Bhosale, HOD of Electronics and Telecommunication Department for her continuous encouragement and for developing a keen interest in this field. I feel a deep sense of gratitude to Prof. Rajesh U Shekokar, ME coordinator Electronics and Telecommunication Department for his valuable suggestions, co- operation and continuous guidance. It's my pleasure to thank Prof.Dr. P. M. Patil, Principal, who is always a constant source of inspiration. I am very much thankful to all my faculty members whose presence always inspires me to do better. No words are sufficient to express my gratitude to our parents for their unwavering encouragement.

REFERENCES

[1] Mohamed Fazeen, Brandon Gozick, Ram Dantu, Moiz Bhukhiya, and Marta C.González, "Safe Driving Using Mobile Phones" IEEE Transactions On Intelligent Transportation Systems, Vol. 13, No. 3, Pp.1462- 1468, September 2012.

[2] N. Watthanawisuth, T. Lomas and A.Tuantranont, "Wireless Black Box Using MEMS Accelerometer and "GPS Tracking for Accidental Monitoring of Vehicles" Proceedings of the IEEEE MBS International Conference on Biomedical and Health Informatics, pp.847-850,Jan 2012.

[3] P. Mohan, V. N. Padmanabhan, and R. Ramjee, "Nericell: Richmonitoring of road and traffic conditions using mobile smartphones," in Proc. ACM SenSys, Raleigh, NC, Nov. 2008. Gabriel Agamennoni, Member, IEEE, Juan I. Nieto, Member, IEEE, and Eduardo M. Nebot, Senior Member, IEEE, "Robust Inference of Principal Road Paths for Intelligent Transportation Systems", IEEE Transactions On Intelligent Transportation Systems, Vol. 12, No. 1, Pp.298- 308, March 2011.

[4] Mendis.A; Digital Signal Process. Lab., Inst. of Electron. & Comput. Sci., Riga, Latvia, Strazdins.G, Zviedris.R, Kanonirs.C, "Real time pothole detection using Android smartphones with accelerometers" Distributed Computing in Sensor System and Workshops, IEEE CONFERENCE PUBLICATIONS, pp.1-6, June2011.

[5] Jungme Park, Zhihang Chen, Leonidas Kiliaris, Ming L. Kuang, M. Abdul Masrur, Senior Member, IEEE, Anthony M. Phillips, and Yi Lu Murphey, Senior Member, IEEE, "Intelligent Vehicle Power Control Based on Machine Learning of Optimal Control Parameters and Prediction of Road Type and Traffic Congestion", IEEE Transactions On Vehicular Technology, Vol. 58, No. 9, Pp.4741-4765, November 2009.

[6] Bhaskar.R, Vankadhara.V, Raman.B, Kulkarni.P, "Wolverine:Traffic and road condition estimation using smartphone sensors", IEEE Conference Publications.

[7] Abdallah Kassem, Rabih Jabr, Ghady Salamouni, ZiadKhairallah Maalouf Department of Electrical and Computer Engineering, Notre Dame University, "Vehicle Black Box System", SysCon 2008 - IEEE International Systems Conference Montreal, Canada,pp.1-6, April 2008.