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Detection and Identification of Abnormal Driving Behaviors

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Abstract - *Real-time abnormal driving behaviors monitoring is basically help to improve the driving safety. Available systems are totally works on driving behaviors which is monitored by using mobile devices only so that they can provide a basic expected result, i.e. it helps to detect abnormal driving behaviors from normal behaviors. To enhance drivers behaviors' of their driving habits so as to avoid the car accidents. So, we need to consider a basic fine-grained monitoring approach, which not only detects rash or unusual driving behaviors but also identifies specific types of rash driving behaviors like drifting and sudden change in acceleration. By doing deep study of the 6-month driving cases collected from real driving environments, we found that all of the six types of driving behaviors have their unique trends. After recognizing this cases, we have proposed a fine-grained Rash Driving behavior Detection system which helps to perform real-time highly correct abnormal driving behaviors which is going to be monitoring by using Accelerometer sensor. We have extracted the efficient features to detect the trends of rash driving behaviors. Afterwards, Drink and driving, or officially driving under the Influence (DUI) of alcohol, is a major reasons behind some of traffic accidents across the globe. In this, we have proposed a highly efficient way that aims to early detection and help to alert the dangerous vehicles typically related to rash driving. The whole solution requires only a mobile device which should be carried in vehicle. An application which is installed on cell phone, helps to calculate accelerations and velocity based on the sensor readings. It then compares with traditional driving patterns extracted from real driving tests. If in case of rash driving, any evidence against the rash driving case then the mobile phone will automatically alert to the driver and to the government authority.*

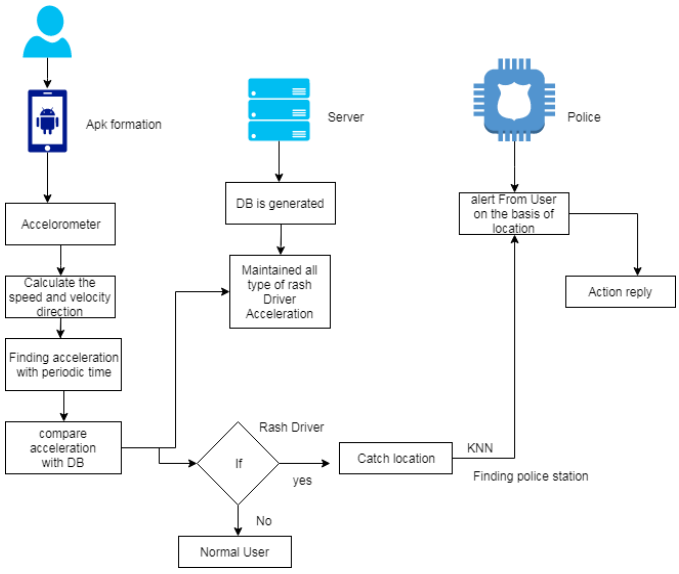
Key Words: Sensing, Smartphone, IMU, Data, Behavior, SenSpeed, VANET.

1. INTRODUCTION

According to the figures from World Health Organization(WHO), road accidents have become one of the leading reasons behind the deaths in the world. Specially, road accidents claimed nearly 400 people looses their life per day in 2017. As per study which signifies the most number of road accidents are carried out due to human natures. So, it is mandatory to detect drivers' behaviors to alert the drivers. Though there has been works on rash driving behaviors, it focuses on how to detect driver's nature based on some cases alcohol sensor, infrared sensor and cameras, which incurs the high installation cost. As far as smart phones have received very much popularity in the recent times. Rash driving behavior analysis is also a popular way of smartphone-based vehicular applications. However, current systems based on driving behaviors detection using smartphones can only provide the correct results distinguishing rash driving behaviors from the normal behaviors. Therefore, those solutions cannot provide proper identification. Moving to the next, we have to consider the proper approach, which uses mobile phone sensors to collect rash driving behaviors. The rash driving behaviors monitoring can help to improvise the drivers' awareness of their driving natures. More on, some rash driving behaviors can easily be ignored by the drivers. If we are able to detect the drivers' rash driving behaviors automatically then the drivers will get aware of their bad driving natures.

2. Design and Implementation

System Architecture:



System design contains the Android application which should enable the Car Mode so that the accelerometer sensor can sense the velocity and help to detect whether the vehicle is in normal mode or rash mode. For that, ideal entries are stored in the database. Current entries will be compared with ideal database. If it is found that the

current entry is matching with the ideal entries then the result will be generated. Then the particular entry will be send to the nearest Police Station and to the user also so that it can be helpful for him to slow down the vehicle.

Implementation:

A) KNN Algorithm: In k-NN classification, the output is a class membership. An object is classified by a majority vote of its neighbors, with the object being assigned to the class most common among its k nearest neighbors (k is a positive integer, typically small). If k = 1, then the object is simply assigned to the class of that single nearest neighbor.

K-nearest neighbors KNN algorithm:

1. Determine parameter K = number of nearest neighbors

2. Calculate the distance between the query-instance and all the training samples

3. Sort the distance and determine nearest neighbors based on the K-th minimum distance

4. Gather the category y of the nearest neighbors

5. Use simple majority of the category of nearest neighbors as the prediction value of the query instance

KNN pseudocode:

Classify (X, Y, x) // X: training data, Y: class labels of X, x: unknown sample

for i=1 to m do

Compute distance d(Xi, x)

end for

Compute set I containing indices for the k smallest distances d(Xi, x).

return majority label for {Yi where i E I}

B) Haversine Algorithm: The haversine formula determines the great-circle distance between two points on a sphere given their longitudes and latitudes. Important in navigation, it is a special case of a more general formula in spherical trigonometry, the law of haversines, that relates the sides and angles of spherical triangles.

- R is the radius of earth in meters.
- Lat_O = latitude of origin point, $Long_O$ = longitude of origin point
- Lat_T= latitude of target point, $Long_T$= longitude of target point
- Difference in latitude = Lat_O-Lat_T
- Difference in longitude = $Long_O$-$Long_T$
- Φ =Difference in latitude in radians
- Λ =Difference in longitude in radians
- O= Lat_O in radians.
- T= Lat_T in radians.
- A= $\sin(\Phi/2) * \sin(\Phi/2) + \cos(O) *\cos(T)*\sin(\Lambda/2)*\sin(\Lambda/2)$
- B= min(1,sqrt(A))
- Distance = 2*R*B

3. Mathematical Model

- Let 'S' be the system

  Where

  S= {I, O, P}

  Where,

  I = Set of input(sensor data)

  O = Set of output (classify driving is rash driving, normal driving or drunk driving)

  P = Set of technical processes

- Let 'S' is the system

  S = {……

- Identify the input data S1, S2, …. , Sn

  I = { X, Y, Z, L}

  X= Vector value of X axis

  Y= Vector value of Y axis

  Z= Vector value of Z axis

  L= User current location

- Identify the output applications as O

  O = {{classification of driving as normal, rash, drunk}, {inform nearest police station about drunk driver}}

- Identify the Process as P

  V=S/T

  A=V/T

  V= Velocity

  A= accelerometer

  S= speed

  T= time

  Rp = Resultant Places

  Distant from source to Rp < distance of police station.

4. Advantages

- Our system is built on fully automated system
- Uses the accelerometer sensors from Android mobile to match the rash driving and drive pattern.

- Automatically sends a message for Help.
- Displays on the Screen a message.

5. Summarized Results

- System gives the alert notification to the driver through the voice (text-to-speech engine).
- The notification is sent to the RTO office if the rash driving occurs again and again.
- The text message is sent to the driver along with the proof of latitude and longitude.
- The entry is sent to the Police Login and the map is provided to reach towards the suspect.

6. Conclusion and Future Scope

We are presenting a highly efficient mobile phone application based rash driving detection system. The mobile device collects and analyzes the data from the accelerometer sensor which helps to detect any rash driving behaviors and sends a message to alert. We are addressing the problem regarding rash or unusual driving behaviors detection and identification to enhance the safety. In this, we have implemented a system which detects rash driving behaviors by sensing the vehicle's acceleration and velocity using Smartphone sensor. Because of this application, driver will get the alert notification on his/her device. In future scope, the application will help to inform the hospitals to help the needy ones.

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