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RECOMMENDATION OF SENSORS FOR VEHICLES TO CONTROL ROAD ACCIDENTS

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Abstract: Nowadays, Road accidents have become a significant concern for people around the world. The rate of the road accidents in the country is increasing day-by-day. It has become very important to take measures for reducing the road accidents. The proposed framework suggests efficient real-time sensors based on certain attributes such as place of residence, usage of the vehicle and on an individual's past history. The main idea of this work is to suggest sensors in the vehicles in order to reduce road accidents. The sensor are suggested by analyzing the input data give by the user. The Framework would be useful to reduce the road accidents and thereby saving human lives.

Keywords: Data Analytics; Sensors; Road Accidents; Framework; Vehicles;

I. INTRODUCTION

Road accidents are the major cause of life threat in the recent years. Analyzing road accidents is given a major research importance and considerable time is spent on drawing out the useful results.

Data Analytics (DA) is the science of studying the raw data with the goal of forming conclusions about a particular information. Data analytics is applied in various industries to allow companies and organization to make better business decisions and in the sciences to verify or disprove existing models or theories.

The process analysis is a top-down approach, where a unit is broken down into separate individual units. The data analytics is the process of inspecting, cleaning, transforming and modeling the data in order to discover meaningful information and useful patterns from the data. With the help of these patterns, future analysis, and business decisions can be made effectively.

Once the required information regarding the road accidents are derived after the analysis, questions related to over speeding, accident caused due to negligence can be easily answered.

One of the key objective of data analytics in road accident is to find the factors and suggest sensors to reduce the number of accidents using sensors. Here we are going to suggest different sensors for different areas which can be used in vehicle in order to reduce accidents.

There are several existing applications such as preventing the accidents due to drowsy eyes, detecting accidents using smartphones, predicting and analyzing the traffic using GPS. The Proposed System will suggest sensors to the users based on certain criteria.

II. RELATED WORK

Shikhar A. et al., have focused upon how to analyze the accident data and save precious lives [3]. Since the matter of issue is regarding a life, a safer measure will always be given higher priority to be dealt with. The dataset which is examined contains various labels such as type of accident, severity caused, lighting condition during which the accident occurred, speed at which the vehicle was driven at and the state of the driver whether he had consumed alcohol or not. The main focus is given on the application to predict and reduce the road accident. The technique adopted for analyzing the data and training the past data is decision tree. The major cause for accidents are analyzed and results are plotted in form of graphs. Lee T. et al., have collected the data related to accident analysis through social media and sensors, the various attributes concentrated in this paper are previous accident data, road condition, the traffic condition and the comments of the surroundings are analyzed [6]. Firstly, after the data collection, the areas in which the accident are maximum are driven out of results and based on that ranks are provided. Even though it's a tough task to analyze the risk, this paper makes use of clustering techniques to differentiate between high risk areas and low risk areas and later results are derived. A unified cluster approach is adopted after performing a series of traffic risk mining operations. A PONMF algorithm also popularly known as partially ordered non-negative matrix factorization which is used to cluster the high risk accident prone areas.

Riveiro M. et al., stated the complex tasks that involves in detecting traffic problems using Anomaly detection [7]. The major task areas are exploring multidimensional data related to traffic. The model which is generated after analyzing process are further taken into consideration, then the events related to anomalies are detected and a detailed explanation is provided. At last a feedback form was reported back to Volvo groups. The tasks performed in [15, 16, 17] and [18] Deublein et al. [15] show an approach for the event prediction of the event of road accidents which employs a sequence of techniques for e.g., Bayesian algorithms and regression analysis.

Iyer V. et al., studied the history of traffic appraisal problems related to the urban population [8]. Due to increase in traffic and number of accident there is been a significant change in wasting the energy consumption. In order to solve this issue multi agent fuzzy logic is incorporated within the system which takes the real time traffic data as input in order to

provide traffic signal synchronization. By making use of fuzzy logic various levels which cannot be determined can be easily made solution driven. The one fact that fuzzy logic lacks behind is that it needs to update its rule base from time to time so the paper proposes the ideology of making use of Q Learning algorithm within the implemented model so that multi agent fuzzy logic works efficiently.

Al Najada H. and Mahgoub I. aimed at reducing the traffic crashes which indirectly increases road safety at the same time to reduce traffic congestion which is an unbearable issue faced by major cities [4]. The major data mining tools such as WEKA and H20 are used to analyze and predict traffic-related problems. The feature selection mechanisms are adopted to improve the efficiency of predictions. A sample size of 146322 is examined in order to gather insights related to traffic issues to analyze driver's behavior. These results can be further used for developing driving and traffic policies which can thereby improve the present traffic conditions.

B.Praveenkumar, K.Mahendrakan aimed at reducing the accidents caused due to drowsy eyes while driving a vehicle and also prevent drunken drivers from driving the vehicle by implementing alcohol detecting sensors.[1] Eyeblink ratio is the main attribute considered to examine whether the driver is drowsy or not. Drowsiness can be considered as a major cause of vehicle accidents. The system makes use of obstacle sensor which reduces the speed of moving vehicle so as to reduce the accidents caused due to drowsiness and it makes use of alcohol detecting sensors to reduce the accidents caused by alcoholic drivers by not allowing them to start the vehicle.

Schepers P. et al., provides a framework by considering a various attributes such as modal spilt, distribution of traffic, volumes and the risk factor associated with it[5]. The main deterministic attribute for the proposed framework are the transport cost, location of the incident. The main idea of this paper is to predict the risk factor associated with the accidents and notifying the users during such situations well in advance.

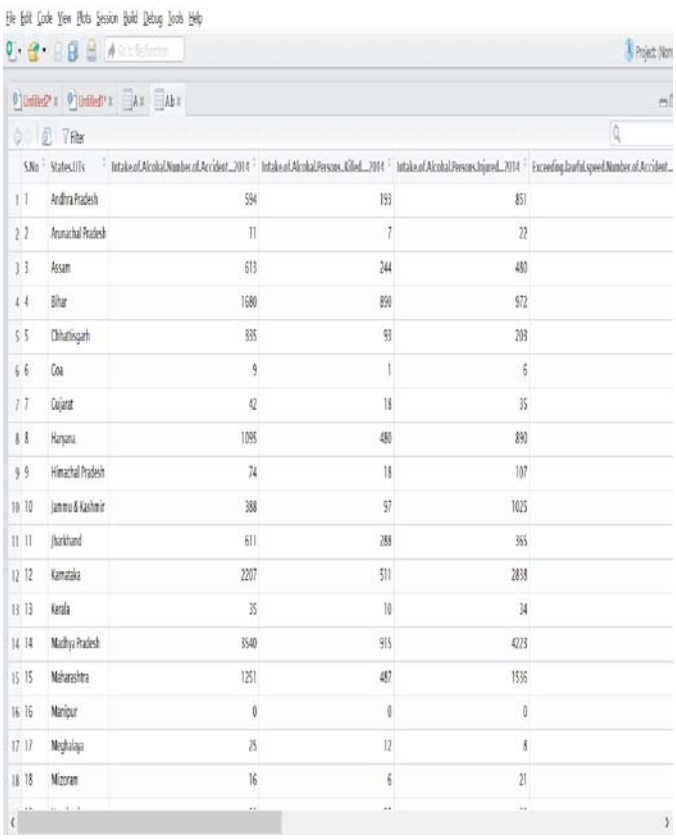
Sachin Kumar, Durga Toshniwal have performed accident data analysis in order to predict the road accidents [2]. Due to the unavailability of data analysis becomes hard. The k-mode clustering technique is adopted in order to differentiate the accidents occurred in various locations of Dehradun between 2009 and 2014. A graph is later plotted based on the derived results.The two models known as negative binomial [11, 12] and Poisson models [9, 10] are used widely to recognize the correlation amongst traffic accidents and the factors affecting it. There are numerous clustering algorithms are there in the record [13, 14].

Shiny L. implemented a physical hardware based project for vehicle navigation [19]. The major concerned areas are school zone and work zone were the vehicle speed should be in a controlled manner to reduce the risk of accidents, so when a vehicle is about to reach such sensitive zones a precautionary message will be sent to the user such as "School Zone ahead!!Drive Slowly". To achieve this an IR sensor was embedded within the proposed model to alert the users regarding sensitive zones and thereby reducing the risk of accidents.

Sowmya D. aimed at monitoring the behavioral changes within the user and to take precautionary methods beforehand to reduce the risk of future accidents [20]. With the availability of sensors, the user vehicle is controlled automatically if the user tends to lose the control of vehicle because of drowsiness or alcohol consumption. By proposing such system fatal accidents can be reduced by indicating the driver beforehand regarding his/her behavior and hence can prevent accidents.

III. PROPOSED FRAMEWORK

This work uses dataset which is taken from data.gov.in and it consists of various attribute values such as:
States/UT, Intake of alcohol-No. Of accident, Intake of alcohol-Persons killed, Intake of alcohol-Persons injured, Fatigue/sleepy-No. Of accident, Fatigue/sleepy-Persons killed, fatigue/sleepy-Persons injured, Over-speeding-No. Of accident, Over-speeding-Persons killed, Over-speeding-persons injured.
The original dataset constituted of 67 attributes. After pre-processing 10 attributes have been considered for which the real-time sensors are available. The tool used for pre-processing of dataset is R tool. The background data analysis process begins by importing the dataset as a CSV file into the R tool which in turn creates a duplicate file, all the unwanted column values are set to the NULL value and finally, the processed data is viewed within the R tool.



S.No	States/UTs	Intake of Alcohol-Number of Accident...2014	Intake of Alcohol-Persons...Killed...2014	Intake of Alcohol-Persons Injured...2014	Exceeding Lawful speed-Number of Accident...
1	Andhra Pradesh	594	193	851	
2	Arunachal Pradesh	11	7	22	
3	Assam	613	244	480	
4	Bihar	1680	890	972	
5	Chhattisgarh	935	93	209	
6	Goa	9	1	6	
7	Gujarat	42	18	35	
8	Haryana	1095	480	890	
9	Himachal Pradesh	74	18	107	
10	Jammu & Kashmir	388	97	1025	
11	Jharkhand	611	288	365	
12	Karnataka	2207	511	2838	
13	Kerala	35	10	34	
14	Madhya Pradesh	3540	915	4223	
15	Maharashtra	1251	487	1536	
16	Manipur	0	0	0	
17	Meghalaya	25	12	8	
18	Mizoram	16	6	21	

Figure 1. Pre-processed Dataset

The important functionality of this paper is to suggest sensors based on relevant information provided by the users, the information is analyzed based on the past experience of the user and habits related to a specific individual while riding his/her vehicle.

The fact of accidents is based on certain factors like road condition, lighting condition, speed of the car, weather condition, by the behavior of the driver like whether he is drowsy or drunk, vehicle condition and by considering various other factors decisions are drawn.

Based on these factors the system needs some mechanism to reduce road accidents. In the existing scenario, one or combination of two or three sensors is used to reduce the road accidents.

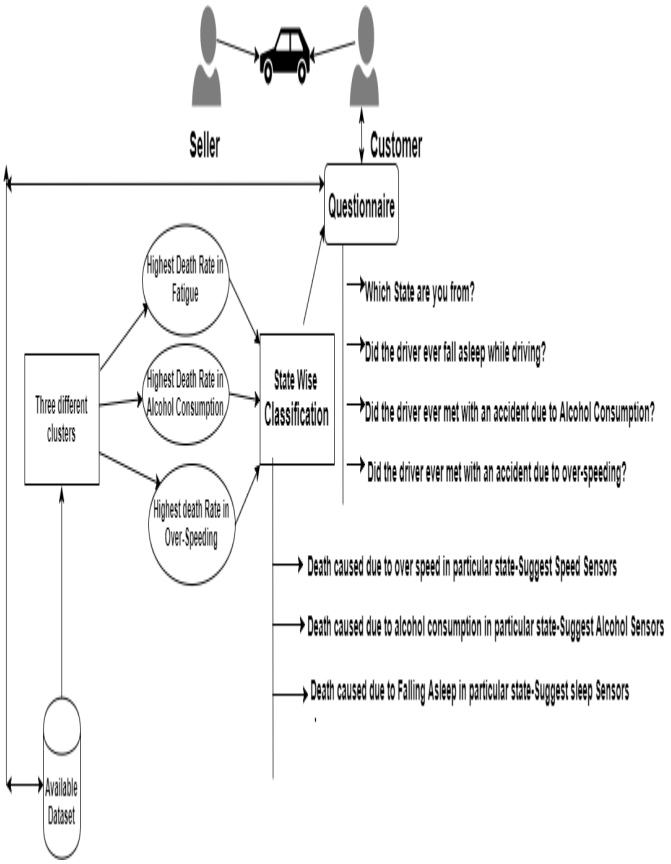


Figure 2. Framework for suggesting Sensors

The flow of the framework begins by checking from which state of India the user belongs to, and then the system checks for the highest death rate in the dataset and compares it with the cause of the accident. Based on the answers provided by the user various sensors will also be suggested. Based on the derived results specifically, related sensors will be suggested to the relevant user thereby the cause of the accident will be ultimately reduced.

To work on instant example for suggesting sensors, let's consider a situation where the user enters the state details by mentioning he belongs to Karnataka, based on the entered details the system compares it with the backend database. If the user states the details by answering YES/NO for the above mentioned questions, such as he states YES for sleeping while he takes a ride, YES for consuming alcohol while driving and NO for over-speeding based on this, the proposed framework suggests the desired sensors to reduce the road accident rate over a period of time.

IV. RESULTS AND DISCUSSIONS

The initial working of the proposed framework begins by asking the users a set of pre-defined questions like:

- Which State are you from?
- Did the driver ever fall asleep while driving?
- Do the driver consume alcohol while driving?
- Did the driver ever met with an accident due to over-speeding?

To test whether the proposed model satisfies the user's demand for reducing road accidents, an evaluation was conducted among a group of 30 people. The evaluation was done by asking whether the proposed model is efficient and accurate. Set of questions were asked to the group of people and based on their response the analysis has been made.

The questions asked to group of people are:

- Do you make use of transportation facilities such as Rental cars or Self-Owned Cars in-order to commute from one place to another?
- Do you consider to take safety measures during your travel time?
- Which state are you from?
- Are the safety measures taken by the government to protect people's life adequate? Rate on the scale of 5.
- Do you ever fall asleep when you are driving the vehicle?
- Do you have the tendency to consume alcohol while driving?
- Do you have the tendency to over-speed during nominal traffic?
- Do you think making use of speed sensor in the car can reduce road accidents?
- Do you think making use of sleep sensor in the car can keep driver awake while driving?
- Do you think making use of alcohol sensor in the car can reduce road accidents?

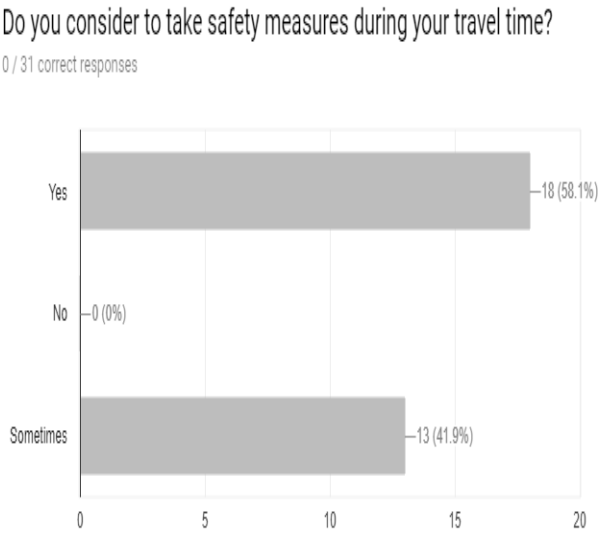


Figure 3. People who consider to adopt safety measures

The above figure suggests that the number of people considering to adopt safety measures during their travel period are more, which shows that the users are open to adapt towards new technology in order to protect themselves.

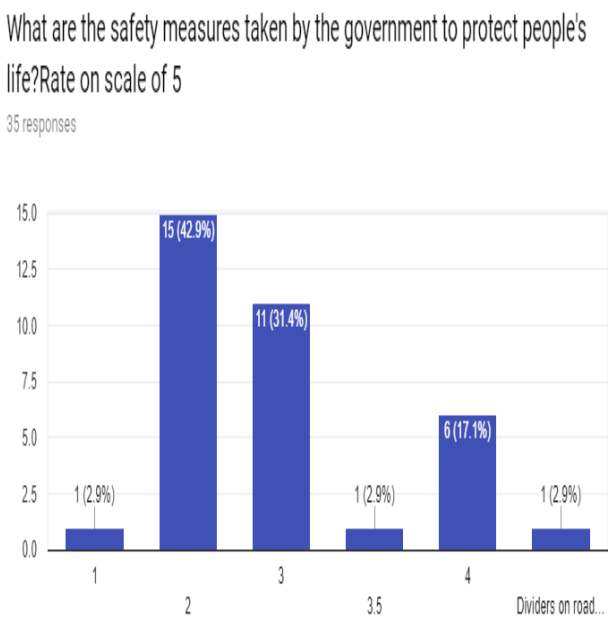


Figure 4. User's ratings on the safety measures

In the above mentioned figure, the users have rated the safety measures taken by the government to protect people's life on the scale 5.

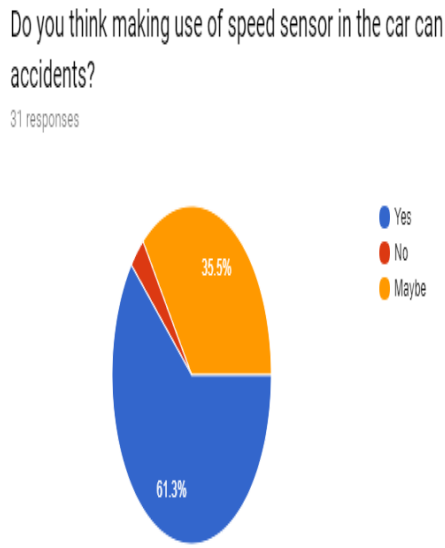


Figure 5. No. of people supporting towards incorporating speed sensor

In the above figure the number of people supporting towards incorporating speed sensor within one's vehicle are more when considered with the rest of the tested population.

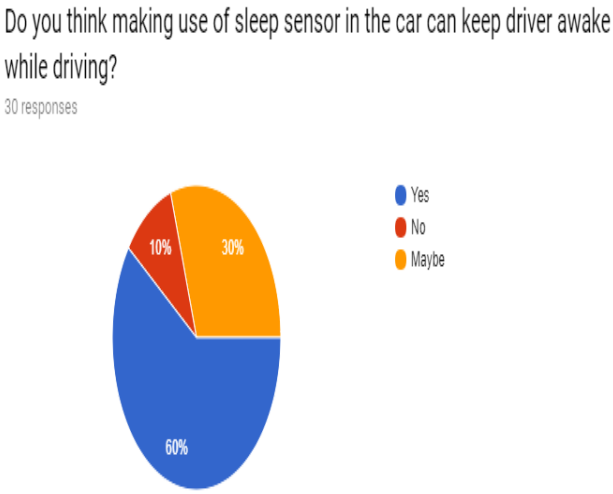


Figure 6. No. of people supporting towards incorporating sleep sensor

In the above figure the number of people supporting towards incorporating sleep sensor within one's vehicle are more when considered with the rest of the tested population.

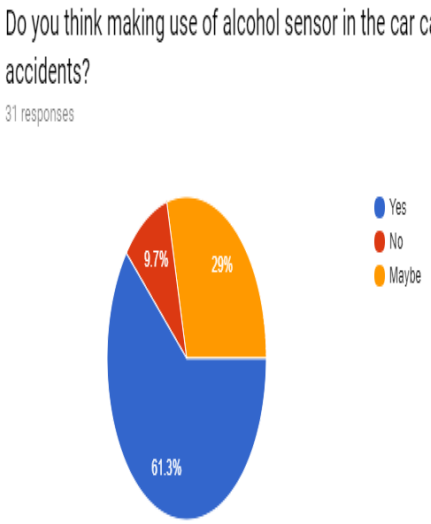


Figure 7. No. of people supporting towards incorporating alcohol sensor

In the above figure the number of people supporting towards incorporating alcohol sensor within one's vehicle are more when considered with the rest of the tested population.

V. CONCLUSION AND FUTURE WORK

Road accidents tend to occur in people's life which is life-threatening. But after considering the increasing number, a necessity has raised to check on this factor and reduce the cause of road accidents. Road accidents are undoubtedly the most frequent and, overall, the cause for most of the damage caused for our well-being. Casualties of the road accident are of greater concern and at present vehicles are extensively used by a number of people. Concerning the increased usage of private transport, the greatest problem is the growing number of deaths. Some injuries can have a short-term impact on day

to day life and then heal permanently, others can last for life. In order to overcome this, the proposed framework performs the task of suggesting sensors to the users based on which state user is from, usage of the vehicle and on an individual's past history. It is tested upon various attribute values to derive efficient results and to make the system more accurate in making better decisions.

The proposed system aims at reducing road accidents by suggesting sensors to the user based on the certain attribute. The sensors which are being used in the proposed system are minimal so as a future work more real-time sensors can be added to enhance the security of people's lives.

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