AN ENHANCED APPROACH FOR REDUCING ROAD ACCIDENTS USING IOT AND DATA MINING

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Abstract
The road accidents are emerging as an increasing threat around the world. These are due to insufficient attention and unsafe state. The continuous increase in vehicular population leads to enormous growth of accidents which molds the safety measures. The major cause of road accidents is based on two issues, (i.e.) excessive speed and drunken driving. This paper deals with an accidents reduction system using IoT and Data Mining Techniques. Drunk and drive can be dealt with gas sensor which is installed at the middle of the steering to detect the alcohol consumption of the driver. The next important cause for more number of fatalities is rash driving which can be reduced by collecting the data with the speed and location and thereby analyzing them using Data Mining Techniques. Further the notification is given to the RTO or traffic authority. In case of repeated violation of speed limit, results in blocking of his or her license.
Index Terms: Drunk and Drive, Rash Driving, IoT, Data Mining Techniques, RTO, GPRS, Gas Sensor.

I. INTRODUCTION

As we see in today's world the count of vehicles on the road are increasing at a terrifying rate. The continuous increase in vehicular population leads to enormous growth of accidents which moulds the safety measures. In recent times, it has been estimated that more than half of the unnatural fatalities are due to road accidents. The research on this is**sue evince that the major cause** for the current condition are drunk and drive and rash driving.

At present, police uses screening device to detect the alcohol intake of the driver, since an automatic detection methodology using sensors could detect drunk and drive in an efficient way. Current system to control rash driving could only lock the speed of the vehicle at a fixed value, irrespective of the location. In case of violation, location will be send to the traffic authority.

The proposed system uses IoT for alerting the authority; and Data Mining to detect and control rash driving depending on the location of the vehicle. The proposed system can overcome the above limitations by using gas sensor for an automatic detection of drunk and drive. Rash driving can be significantly controlled by continuously monitoring the speed of the vehicle through GPS and comparing to the specific location's permissible limit that has been stored in the database.

Problems faced by the previously proposed systems are cost, difficulty in implementation, scalability, accuracy and complexity. Therefore the proposed model need to be cheap, easy implementation along with efficiency and accuracy. The detailed description about the system proposed has been given below along with its pros and cons.

The existing system has a set of disadvantages that are thereby necessary to overcome in order to achieve the required essential enhancement in the system that is being developed. The drawbacks of the current rash driving system can be cleared by collecting and maintaining the predefined set of data that contain the details of location and their respective permissible speed limit. Thus the

database is used by the system for the detection of rash driving of the vehicle.

Table 1 gives the details about road accidents that occurred in the year 2014 and 2015 comparatively.

TABLE I
ROAD ACCIDENT PARAMETERS – 2014 AND 2015

PARAMETER	2014	2015	% CHANGE BETWEEN YEARS
TOTAL ACCIDENTS IN INDIA	489400	501423	2.5
TOTAL NUMBER OF PERSONS DEAD	139671	146133	4.6
TOTAL NUMBER OF PERSONS INJURED	493474	500279	1.4
ACCIDENT SEVERITY*	28.5	29.1	2.1

- NUMBER OF PERSONS DEAD FOR PER 100 ACCIDENTS
-

II. THE BASIC COMPONENTS

1) An MQ3 Gas sensor.
2) A Speed sensor.
3) A DC motor.
4) An Ardunio UNO Board.
5) Relay Controller.
6) LCD Display.
7) A GPRS Module.
8) A GPS Module.

A. Existing System:

The current alcohol detection system uses AL9000P alcohol sensor which is interfaced with an Arduino UNO to detect the alcohol content in the driver's breath. In India, the legal limit of alcohol content in driver's breath is 0.03%. In this system, the AL9000P alcohol sensor is placed on top of the steering so that whenever the driver exhales, the sensor calculates the alcohol level in his/her breathe and also the location of the vehicle is being continuously monitored using GPS technology. After the engine is ignited, if the alcohol content in the driver's breath is in the range of 0.02-0.03%,an automatic signal is generated and sent to the actuator, which controls the working of the valve, by controlling the supply of the fuel to the engine. Thus the maximum speed of the vehicle is limited to 20KMPH. This is done by closing thevalve of the engine, so that the fuel supply to the engine is stopped when required. Also if the alcohol content is beyond 0.03% then the valve of the vehicle is closed and not permitted to move thus limits the speed of the vehicle to 0KMPH with an alert message being sent to driver's nears and dears via GPS technology.

The current rash driving detection system, detects rash driving by calculating the speed of the vehicle using the time taken to travel between the two set points at a fixed distance and then transmit the data to the central control room. In this system the infrared transmitter LD271H which is a gas infrared emitting diode, fabricated in a liquid phase epitaxy process is used. This LD271H is highly reliable and has a capability of high pulse handling. The receiver used here is PNA4602M which is usually used to absorb the equivalent amount of infrared rays emitted by the transmitter LD271H. The maximum extension distance is 8m or more. The LCD is also used to display the speed of the vehicle. If the vehicle crosses the speed limit, a buzzer sounds to alert the driver, also alerting the police both at the location and wirelessly at the control room. This system provides an automated method for detecting the rash driving of vehicles and charging them fine at the Toll or by directly call through number plate.

Thus the existing system for both drunk and drive, rash driving is inefficient in certain way.

B. Problem Definition:

The cons identified in the existing system of drunk and drive tracking the exact location of the vehicle is difficult because of the range of the GPS used. If the GPS signal is lost, tracking the vehicle cannot be done which makes the system fail. Whole system depends only on the MQ3 sensor, if the sensor got damaged results in failure and the threshold value of the system is static. Some MQ3 sensor may detect other gases also so it stops the vehicle. Here only the message is transmitted which is of no use at times. Since the vehicle cannot be controlled by the system, it is inefficient. If the driver consumes alcohol while driving it leads to

sudden stop of the engine on detecting the alcohol may be dangerous as driver driving a vehicle at a high speed and it may lead to chance of accident.

In rash driving the vehicles time taken to travel between the transmitter and receiver of the RF module is used to calculate the speed of the vehicle in which either one of the module is damaged the communication establishment between the modules is lost. Threshold value cannot be changed at different areas. The transmitter widely used is LD271H which is not highly reliable and efficient for transmitting the signal. Immediately after detecting that the vehicle crossing the speed limit the system intimates the police authority which makes the system inefficient in the case of the vehicle travelling in the emergency case.

C. Proposed System:

The proposed system detects drunken drive and rash driving in an efficient way. The drunken drive is detected by placing an alcohol sensor in the middle of the steering so that whenever the driver exhales, the sensor calculates the alcohol level in his breath. If the alcohol consumption is detected, then engine gets locked automatically; with an alert given to the driver via IoT. On the other hand if the alcohol consumption is detected while driving then the speed of the engine gets reduced and then gradually stops with an alert being given to the driver. Rash driving can be detected by initially creating a database and thereby comparing the permissible speed limit with the current speed of the vehicle with respective of the location. The database is created by collecting various locations along with their permissible speed limit. While the vehicle is in move, the location along with its speed is updated in the server and compared with the data in the database using data mining techniques. If rash driving is detected, then that data is stored in the server and also a notification is given to the RTO or traffic authority. In case of repeated violation of speed limit and drunken drive, the license of the driver is being blocked.

D. Methodologies Used:

In drunk and driving for detecting the alcohol consumption MQ3 sensor is used which is interfaced with Arduino UNO programmable circuit board. MQ3 is a breath analyser provides the resistive output based on alcohol concentration. To control the ignition system DC motor this is a brushed electric motor with a two-pole rotor (Armature) and permanent magnet stator.

In rash driving initially the data base is created with oracle MYSQL cloud service which includes the permissible speed limit for the different locations. To detect the speed, vehicle speed sensor (VSS) which is an type of tachometer. It is a sender device used for reading the speed of a vehicle's wheel rotation. To track the location of the vehicle GPS is used as an navigator to get update of the location. When the vehicle crosses the permissible speed limit the data is updated to the sever technique using the GPRS. GPRS transmits the data as packet to the server across GSM network and it does not require a network to have continuous data transmission. The sever using the Data Mining technique examines the existing database in order to generate the required information. Specifically K nearest neighbour (KNN) algorithm is used for classification based on the similarity measure (e.g. Distance functions). It calculates the nearest neighbour speed and makes the decision based on the majority results. Then the notification is sent to the RTO authority through GSM network. The RTO checks for the particular vehicle information and an alert is given to the driver.

1) The Alcohol Detection Mechanism

The infrared rays can be obtained with the help of ordinary infrared lamps. These have tungsten filament that can withstand heat up to 3000 c and they emit infrared light. In case the driver is drunk there will be a certain amount of alcohol in his breathe. This alcohol content in the breath will be relatively proportional to the amount of alcohol intake. The alcohol in the vapour state has the property of absorbing infra red light. The infrared light emitted passes through the air medium and reaches the sensor [PNA4602M], which detects the loss of the infrared light due to the absorption of alcohol present in the surroundings. This sensor then measures the loss by comparing the received amount of radiations with a fixed parameter that is predefined. The sensor is calibrated in such a way that the amount of loss is directly equal to the amount of alcohol present in the atmosphere. The energy consumed by the IR system is very less. Also the detection

need not take place continuously. It can be done at discrete intervals.

2) KNN Classification Algorithm

The KNN Classification Algorithm is used for the purpose of comparing the permissible speed limit available in the database with that of data updated in the server continuously, thus the detection of rash driving is done. The algorithm calculates the distance between two points using the Euclidean distance formula;

$$d(x,y) = \sqrt{\sum i = 1 \rightarrow n(xi - yi)^2}$$

Since the KNN Algorithm uses the neighbour points information to predict the target result; the Fig.1 shows the working of KNN Classification Algorithm. The procedure of KNN Algorithm is –

Sort all the calculated n Euclidean distances values in non-decreasing order. Determine parameter k = number of nearest neighbours. Gather the category of nearest neighbours. Use simple majority of the category of nearest neighbours as the prediction value of the specific speed value.

The KNN Classification Algorithm is used for the purpose of detecting the vehicle that drives rashly at an accurate rate.

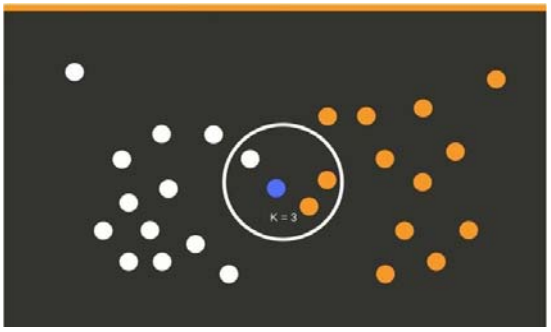

Fig.1 KNN Classification Algorithm Working

If

$k_i > k_j \; \forall \; i \neq j$ then put x in class i.

Thus the entire process of classification is done continuously for the detection of rash driving by the system.

III. BLOCK DIAGRAM

The block diagram of the project gives the entire set of components used in the proposed system. Usage of an alcohol sensor is for the detection of alcohol by which the driver is permitted to start the engine or not. The rash driving detection is also made efficient by designing the system to use the predefined data to make the decision of rash driving.

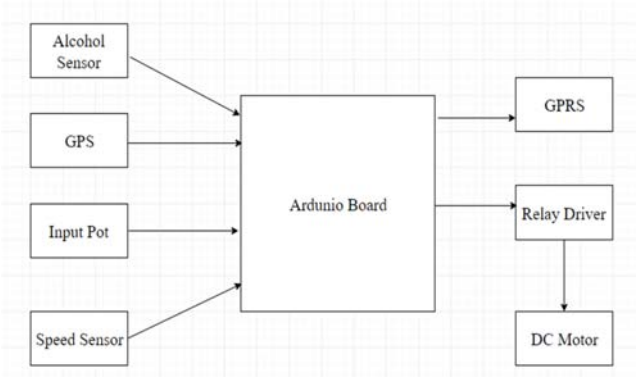

Fig.2 Proposed System

Fig.2 shows the bock diagram of the system proposed in which initially the alcohol sensor detects the alcohol content level of the driver, if alcohol content is detected in the Driver's breathe then the engine of the vehicle is locked automatically with an alert being given to the driver. The speed along with the location of the vehicle is being monitored using GPS module. The speed of the vehicle with respect to the location is also compared with data base created previously. If rash driving is detected an alert is given to the driver and if the rash driving is done for repeated number of times continuously, then an alert is the RTO blocks the license of the particular driver by giving an alert to the respective driver.

IV. RESULTS

Fig.3 Proposed System Prototype

Fig.3 shows the Screenshot of the prototype of the system being proposed. The prototype is being tested with different set of speed values and different orders of smell.

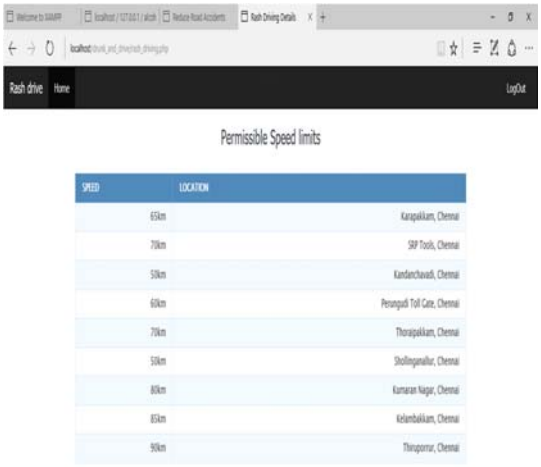

Fig.4 Predefined Database

Fig.4 shows the database created which contains the maximum permissible speed limit of every specific location that is previously defined. These data are thereby used for making the decision of rash driving or not in the server side.

V. FUTURE SCOPE

In future, the above proposed concept can be extended by using them in companies to detect the alcohol consumption of the employee and by integrating a camera with the system that captures the image of the number plate of the vehicle to send to the traffic authorities. The rash driving detection technology's efficiency can be improved by adding some more details of the driver and the vehicle to the system.

VI. CONCLUSION

Nowadays as the number of road accidents increases numerously, in order to reduce them, it is necessary to check whether the driver is drunk or not; Detect and maintain the speed of the vehicle at appropriate locations. In the above proposed system, rash driving has been detected efficiently using the Data Mining techniques and drunken-drive detection is made fully automatic with high level of accuracy. Thus the system reduces the work load of the traffic police and also assures an accident-free environment for the public.

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