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Smart Monitoring of Drunk Driver Using IOT and Machine Learning Based Anomaly Detection

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Abstract Now-a-days, many road accidents are occurring due to the alcohol consumption of the person who is driving the vehicle. Though drunken driving is a threatening issue, detection of drunk driver has become a cumbersome issue. Hence, a stable system is required with continuous monitoring of drunk driver. The Smart Monitoring of Drunk Driver using IOT and Machine Learning helpful to the owner of the vehicle if he handovers the vehicle to the driver. The owner of the vehicle can continuously monitor the vehicle movements by using the features such as GPS and can track the driver mannerism by using the IOT sensors that sense both alcohol and abnormal movements of the vehicle. This requires a two-step procedure, first using Internet of Things Drunk Driver Detection (IOTDDD) and next adapting Support Vector Machine Learning Based Anomaly Detection (SVMAD). This system helps police in easily identifying the drunk drivers in heavy traffic.

Keywords Smart Monitoring of Drunk Driver using IOT and Machine Learning · Internet of Things Drunk Driver Detection(IOTDDD) · Support Vector Machine Learning Based Anomaly Detection (SVMAD)

1 Introduction

Drivers who consumed alcohol have many times lost control over the vehicle and loose the road sense and hence make dangerous accidents. The threatening reason behind all road accidents that is common to all countries in the whole world is drunk driving. Metropolitan cities are facing major issue and higher count of accidents are

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on highways at the city outskirts which are due to drunken drivers and clearly no special method is adapted to eradicate these accidents [1].

Andhra Pradesh has been placed third on the list of states with the highest accident rates in 2017.A.P. witnessed 30,045 road accidents with 8,210 deaths which makes 7.52% of the country's total. The below table shows the accident rate and cause for the accidents in A.P. Out of these 30,045 accidents, 20% are only due to drunken driving.

Vehicle Driving needs quick and smart decisions, actions that are reflexive, ultimate concentration in order to avoid major accidents. The function of the brain will be improper and that results in unwanted incidents on road if any person consumes alcohol beyond safety limit. This is a problem for driver, fellow-passenger and also the other people who are pedestrians or driving other vehicles [2].

The drunk drivers lose their concentration and they do common mistakes like moving with high speed, jumping signal and damage the vehicle by hitting static objects such as trees, buildings. In present scenario, traffic-cops use breath analyzers for detecting drunken persons which is difficult to check in modern-day traffic. The disadvantages of the present system are becoming a challenging task to police in checking vehicles and there is a chance for drunk drivers to escape from the police in the traffic. So, there is a need for an effective system to check every drunk driver. Hence, this is becoming a issue for government as well as police [3].

2 Smart Monitoring of Drunk Driver Using IOT and Machine Learning (SMDDIM)

Smart Monitoring of Drunk Driver using IOT and Machine Learning involves two step process where the first module uses IOT and next module uses Machine Learning techniques to analyze the behavior of the driver. When a person enters the vehicle to ignite the engine by turning the key the system starts working activating the sensor and detects the level of alcohol content. When the alcohol consumed by driver is crossing the extreme limit, immediately the owner and nearby police station server get the notification.

The objectives of the SMDD are as follows

- This system can be used in the various vehicles for detecting the drunken driver. As the project is based on IOT an alcohol sensor is to detect.
- It can immensely decrease the rate of drunken driving cases which often leads to accidental deaths.
- An android application is used by both police and the owner of the vehicle in order to get notified when the driver was drunk.
- Through GPS, the vehicle can be tracked by the police as well as the owner.
- Severe punishment will be given to the drunk driver by the police so the driver may not repeat drunk driving in future. Repetition of this activity is known that may indulge to permanent seize of driver's license.

- Machine learning technique Support Vector Machine-Based Anomaly Detection is used for detecting the abnormal behavior of the driver when he is drunk.

2.1 Internet of Things Drunk Driver Detection (IOTDDD)

The IOT kit contains MQ3 Alcohol sensor, NodeMCU ESP8266, Transformer, Bridge rectifier, Voltage Regulator, HC-05 Bluetooth module. The architecture of the IOTDDD is shown in Fig. 1.

- Alcohol concentration level is detected by MQ3 alcohol sensor.
- The NodeMcu consists of ESP8266 Wi-Fi module which provides internet connectivity.
- Step down transformers are used to decrease the voltage from 230 to 12 V
- Alternating Current (AC) to Direct Current (DC) is done by bridge rectifier.
- Voltage Regulator 12 V DC received from bridge rectifier splits into 5 V each to Node MCU, and MQ3 sensor.
- Serial connection for wireless connection is done by HC-05 Bluetooth Module with SPP.

In this system, in order to notify the owner and police Mobile App is used. The block diagram is as shown in Fig. 1.

This kit is placed in the vehicle by the owner who handovers the vehicles to driver. However, it is required to analyze the behavior of the driver as the owner is accused even if the mistake is done by the driver and he has to bear all the loss on concerned vehicle.

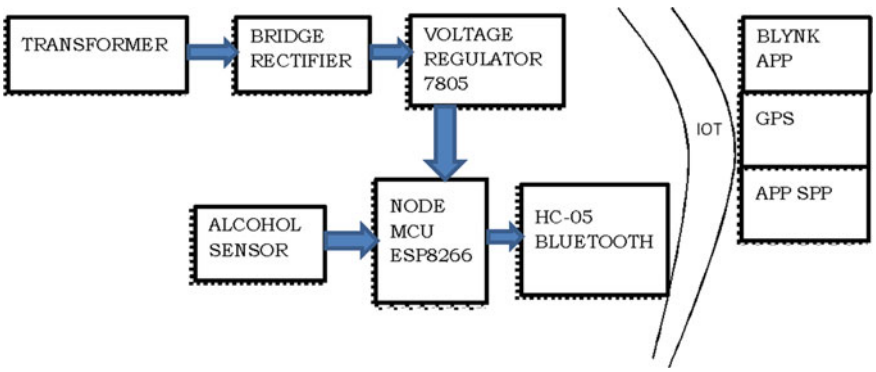

Fig. 1 Block diagram of IOTDDD

2.2 *Support Vector Machine Learning Based Anomaly Detection (SVMAD)*

Anomaly detection plays key role in machine learning and this is used to detect the abnormal behavior of the driver. One class Support Vector Machine abbreviated as SVM is utilized for Anomaly Detection on unsupervised problem where unlabeled training data is used. This algorithm detects the unusual behavior of the driver by analyzing the vehicle movements and informs the concerned to make a check of drunk driver. Sensors are used to identify the vehicle abnormal motion analysis [4].

SVM is the classifier that uses a hyperplane that uses maximization of margin that separates two classes as shown in Fig. 2. This is based on statistical learning method over the training data set. SVM follows an assumption that in training set all samples used are distributed independently. The SVM training algorithm makes the decision surface to deviate from position optimal in features [5] (Fig. 2).

The algorithm is as follows

1. First the margin is maximized as an optimal hyperplane is defined.
2. Trace the misclassifications by extending to non-linear separable problems.
3. Problem reformulation is done by mapping data to high dimensional space that makes easy to classify.

Training set that is given as input is collected from the sensor used to predict the sudden variations such as frequent sudden brakes, sharp cuts and so on. The sensor originally delivers the unstructured data and then the data is converted to structured and given as input to SVM. The procedure is shown in Fig. 3 [6].

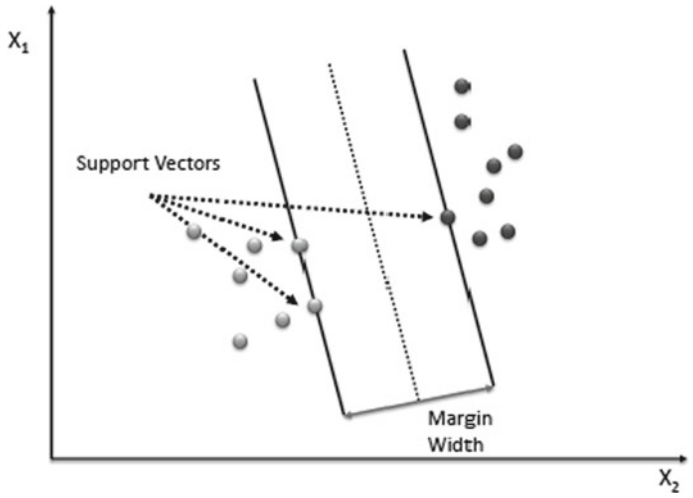

Fig. 2 SVM classification

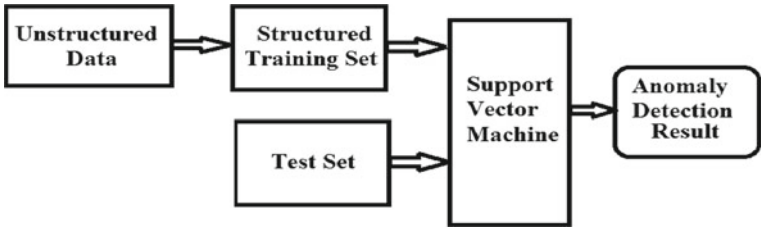

Fig. 3 Anomaly detection using SVM

3 Results and Discussion

3.1 Experimental Setup of IOTDDD

The Internet of Things Drunk Driver Detection is assembled as shown in Fig. 4, testing is being done by exposing the sensor to alcohol, the exact proportion of alcohol in air is being sensed, and the data is examined for analysis.

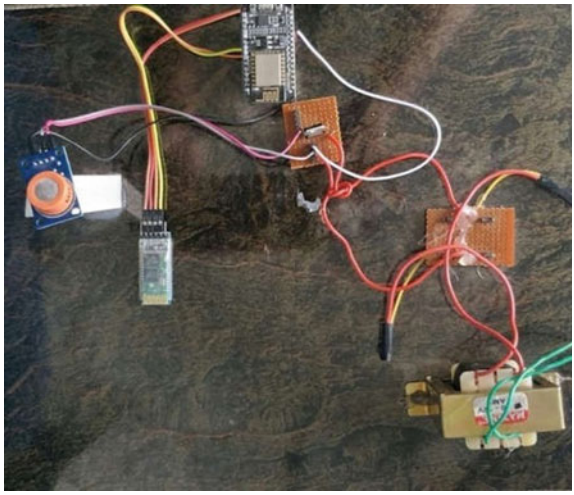

Fig. 4 IOTDDD simulating model

Table 1 Confusion matrix

No of samples = 10,000	Predicted No	Predicted Yes	
Actual NO	TN = 7160	FP = 40	7200
Actual YES	FN = 8	TP = 2792	2800
	7168	2832	

The confusion matrix performed on a dataset using 10,000 samples for both training and testing is as shown in Table 1. True Positive, True Negative, False Positive, False Negative, are represented as TP, TN,FP, FN, respectively.

The accuracy is calculated as (TP/TN)/(No of Samples) = (2792 + 7160)/10000 = 0.9952. Hence, the system is proved to be adaptable due to the accuracy and Positive rate.

4 Conclusion

Major problem observed in accidents is due to Drunk and Driving everywhere. The threat is not only for drivers but to innocent tress passers. Mainly children and adults having less awareness on vehicle speed estimation and road crossing rules are affected. Some are deceased and others have to lead their life handicapped. This will effect economically the entire family due to medical expenses. In this paper, real-time model is presented that can reduce the accidents due to drunken driving. Therefore, using this toolkit, alcohol-related road accidents can be reduced, and hence, this kind of detectors has greater importance in future. Automating this IOT system using machine learning will increase the probability in detection and sends timely alert. Through this Smart Monitoring of Drunk Driver using IOT and Machine Learning the owner of the vehicle or police can do continuous monitor of alcohol detector and preventive device of accidents. The future scope is to implement Multicore parallel processing based SVM using parallel processing proposed by the authors in Multicore Parallel Processing Concepts [7].

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