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Intelligent Road Accidents Avoidance: A Review

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ABSTRACT
With the increase in population and so also the number of vehicles on the roads there have been an increase in the number of road accidents taking place daily. This era is called as the era of Machines and Artificial Intelligence. It would be worthy if some intelligent techniques are used to avoid road accidents thereby protecting the human lives from accidental deaths. Literature shows a number of such techniques are in place which makes use of one or more parameters to predict the likelihood of accident and alerts the driver. In this paper we have reviewed many such papers to gain insight into the state-of-the-art and find out areas of improvements in those techniques. The results of the literature review indicate that many techniques for avoiding road accidents are proposed. Some makes use of data mining, some makes use of IoT, Cloud, and Neural networks. Various parameters such as driving pattern, speed and drowsiness are used to predict the likelihood of accidents.
Keywords: *Driving behavior, Patterns, Drowsiness.*

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I. INTRODUCTION

Deaths due to road accidents have become a common phenomenon nowadays. As the rate of the population is growing likewise builds the rate of road accidents. Main causes behind these road accidents are lack of training institutes, unskilled drivers, poor road conditions, use of cell phone during driving, consuming alcohol while driving; overloading. As per the World Health Organization (WHO), street crashes kill 1.2 million. [1] Throughout the most recent decade, street crash has turned into the tenth driving reason for death on the planet, and is predicted to rise to the fifth position by 2030. India is the main supporter of worldwide street crash mortality . In the most recent decade alone, India lost 1.3 million individuals to street crashes and another 5.3 million were debilitated forever. In the most recent decade alone, India lost 1.3 million individuals to street crashes and another 5.3 million have been truly harmed [2]. One serious road accident in the country occurs every minute and 16 die on Indian roads every hour.1214 road crashes occur every day in India. Two wheelers account for 25% of total road crash deaths.20 children under the age of 14 die every day due to road crashes in in the country.377 people die every day, equivalent to a jumbo jet crashing every day[3]. Two people die every hour in Uttar Pradesh – State with maximum number of road crash deaths Various Techniques are being introduced to reduce accidents. Many monitoring methods are come to analyze Driver behavior. Drowsiness is recognized as an important factor in a vehicle accident. In recent years, driver drowsiness and distraction have been important factors in a large number of accidents because they reduce driver perception level and decision-making capability, which negatively affect the ability to control the vehicle. One way to reduce these kinds of accidents would be through monitoring driver and driving behavior and alerting the driver when they are drowsy or in a distracted state.

II. LITERATURE REVIEW

Several research papers in the area of road accident avoidance were reviewed systematically. Some of the most relevant researches have been briefed in this section.

In this paper [4], a D&R sense System is proposed that helps in categorizing the driving style of drivers, access the road quality and also warned the driver in real time to make safe driving with the help of GPS, accelerometer and Smartphone sensor. An algorithm named SVM is used to do pattern recognition into different categories such as aggressive or calm driving, bumpy roads, etc. The result shows that the locally running fast DTW gives an accuracy of 86.36% and SVM gives 95.45% but when the same thing was tested on a threshold-based algorithm, accuracy decreases dramatically.

In this paper [5], the author presents an overview of different studies on monitoring $ detection of drowsiness and micro sleep (MS) while driving. At first, a framework is proposed for utilizing methods of pattern

recognition $ of computational intelligence in order to detect $ provide AS. Secondly, comparisons of different biosignals are done to their values for MS detection. Thirdly, comparisons algorithm are done and also the pros and cons of SVM for this task. Fourthly, investigation of automatic relevance determination introduced. Fifthly different problems of inter and intra individual variability are addressed. Sixthly, By learning from data, the MS detection algorithm has been established which should be kept in mind. Seventhly, a new measure of drowsiness $strong central fatigue is presented which is known as MS density. Eighthly, the method to evaluate commercial fatigue monitoring terminology (EMT) is presented in the form of applications.

In this paper [6], the author proposed an assistance strategy for safe driving which mainly aims for the normality of driver's behavior. An analysis is done on the driver's behavior using steering wheel operation. Fundamental experiments are done with the help of driving simulators system validate the proposed system. Results show that 80% of the subject drivers are not aware of their driving style.

In this paper [7], the author checks the possibilities of automatic detection of the distraction of driver due to lots of cognitive tasks from driving behavior was studied and with the help of seveors data, a recording of a driving simulator which was further accessed for analysis. For a cognitive test, the driver was asked to engage in conversation with the co-passengers and also do verbal observed that there was a big difference in terms of a statistical test in driving behaviour for action driving and distracted driving. The difference for an inexperienced driver was critically high whereas or expert drivers it is low.

In this paper, [8] presents a real-time lane detection and driver fatigue or driver drowsiness detection system, which can effectively detect the anomaly while driving. The main concentration of the author on avoiding the road accident by concentrating on drunk drivers or drowsiness. Firstly lane detection using Hough Transform and secondly Eye detection of the driver is done. Blinking time of the driver are used. He closes his eyes more than 10 to 15 sec an alarm showing alert will glow. The image segmentation is done, Otsu thresholding is performed and Canny edge detection is done, the result obtained is then applied with Circle detection Hough Transform, to detect the eyes. For lane, detection is done if the driver changes the lane without signal than the system takes an error and sends the warning sign. The webcam is used to detect lane and to monitor face. This system will be particularly useful for drivers travelling on long routes, night drivers and for people who drink and drive.

In this paper [9], the author predicts driving behavior through analyzing driver Gaze pattern. Our experiments suggest that a driver's gaze patterns appear prior to and correlate with the driving behaviors for driving behavior prediction. We accordingly propose GazMon, an active driving behavior monitoring and prediction framework for driving assistance applications. CNN and LSTM algorithm are used with cuDNN on Nvidia GTX1050TiGPUS. Nvidia surrounds technology enables to combine display to create the most combine display to create the immersive emulating. In this Tobi eye X 4c3 as use for eye tracking device. CNN gives 22% hi accuracy LSTM gives 36% and 40 % accuracy with SVM.

In this paper, [10], the author focused on the application layer in the cloud computing platform. Python has adopted in this to calculate the Kurtosis and skewness in statistics of each driving route. That decision tree, classification technique is used to generate the analyzing knowledge for driver behaviour analysis. At last summarized from completed the decision tree whether the drive is defensive, weak defensive, aggressive, and weak aggressive. A sequence of analysis is done in this paper: data clean, data integration, data selection, data transformation, Data Mining, and evolution is done

In this paper [11], driving features such as speed and acceleration distribution in the specific time intervals were determined. For the input of data, Tachograph paper disk technique was used. A digital camera is used for monitoring the exterior driving conditions. Next analysis was comparing disks of two drivers. The last analysis is aimed to designate a change in speed profile resulting from driver fatigue. 1200 dpi scanning resolution and disk with speed range 125km/hr allow obtaining accuracy about 0.004m/sec.

In this paper [12], the author describes a system to reduce accidents to a vast extends by checking eye blinking of the driver which shows the drowsiness, obstacles situated in the road and the drunken condition of the drivers. By utilizing the hardware platform comprising of Alcohol sensor MQ3, small scale controller, Li-Fi framework, GSM module, ECU of vehicle. The planned framework would complete the capacity of speaking with the base station by means of Li-Fi, GSM furthermore, control of different parameters. The entire Control framework has the advantage of a little volume and high reliability.

In this [13] study, an accident avoidance strategy is outlined and a case study is examined considering road accidents caused by drowsiness and sleepiness. Drowsiness or driver vigilance, in general, can be monitored using a multi-sensor system to obtain estimates of the drowsiness level of the driver. The proposed design, drowsiness checking framework is joined with a versatile and robust lateral controller. Drowsiness is viewed as identified with the uncertainty in directing wheel directions for the vehicle lateral movement. Utilizing a robust control theory plot, the uncertainties from road vehicle powers and driver inputs are tended to bringing about a lateral controller. The controller is capable to re-shape the recurrence reaction of the vehicle in both side slip angle increasing speed and side-slip point, moving the reaction into additional stable regions in the Nyquist

diagram. An extra speed decrease concludes the total adjustment of the vehicle-driver framework. This examination has two essential contributions to the current examine inactive safety framework development. Initial, a driver observing framework is consolidated to a controller satisfying its ability for preventing the accidents or moderating the effect. Second, the framework design may establish a response to the issue of the expert progress between the controller and driver on account of imminent accidents.

In this paper [14], accurately predicting vehicle speed for an individual trip is a challenging topic because vehicle speed is subjected to various factors such as route types, route curvature, driver behavior, and weather and traffic condition. a big data based deep learning frame work is presented to address various factors such as driver behavior, route type, traffic and weather condition, while predicting vehicle speed. This BDDL-SP algorithm is applicable for trips with any route types. The input data for the trip of interest is extracted and structured by big data management software, then this input information is used by a trained ANFIS model to predict vehicle speed. This big data based deep learning speed prediction algorithm is implemented in MATLAB .Experiment results indicate that the proposed algorithm is capable of accurately predicting vehicle speed for both freeway and urban traffic networks. It take many data , it is not good for small data.

In this paper [15], the author introduced A fatigue assessment method based on the weighted Dempster-Shafer (D-S) theory has been proposed by using the detected multi-source information such as the image, human pulse and the steering wheel movement in an imperceptible way so as to enhance the fatigue monitoring accuracy and system robustness. The data fusion results based on multiple sensor with enhanced fatigue monitoring accuracy and system robustness have manifested more practical significance than that from single sensor in monitoring driver fatigue.

In this paper [16], the author elaborate the risk level assessment based on the driving activities exceeding a given threshold acceleration and speed value. This paper is organized as follows: Related work on sensor fusion and Bayesian approach for prediction of risk is presented in Section II. The theory of belief functions is revisited in Section III. In Section IV, we elaborate the procedure of risk level identification. Finally, some conclusions are given. Statistical analysis and probability density function of three main risk levels such as Low, Medium and High is derived using the vehicle collision property damage reports provided by a legal authority. A dataset of 137 vehicles over 6 month's period is studied. Evaluation results show that without significant reduction in the total risk prediction accuracy, the 'most-valuable' group, High Risk level, prediction is achieved at an acceptable level, and predictions' accuracy of possible risk classes are distributed evenly.

This Paper [17] , provides a drowsiness detection system and a method that detects the driver's drowsiness in real-time. Existing approaches have used vehicle-based and psychological measurements to detect the drowsiness of the driver. In contrast to the beforehand determined issues, author proposed a system that implements a non-intrusive technique for determining the driver's fatigue. This system consists of a Raspberry-Pi and a Pi camera module that continuously keeps scanning for facial landmarks. These landmarks are localized using facial landmark detector and then the eye landmarks are used to calculate the eye aspect ratio (EAR). If the EAR value decreases from the threshold value and the eyes remain closed for too long then the system immediately alerts the driver with the aid of a buzzer. Furthermore, to ensure that the problem has been taken care of, a notification is sent to the owner of the vehicle through e-mail when the driver dozes off for more than a couple of times.

In this paper [18] the author proposed a system to prevent the car accident, the assistance strategy for safe driving which focuses the normality of driver's behavior. The driver's behavior by using the steering wheel operation has been examined. To validate the proposed method, fundamental experiments using Driving Simulator system have been conducted. The experimental results of grabbing style for steering wheel and statistical analysis using simple correlation between steering operation and vehicle velocity show the possibility to estimate the internal state of drivers. And finally, Prototype of Steering wheel Sensing system has been proposed based on these basic experiments and analysis.

III. COMPARATIVE ANALYSIS

Table1 depicts a comparative analysis of the several research papers that were reviewed as part of this study.

Table1: Comparative Analysis of State-of-the-Art

S. No.	Reference No.	Parameters used	Method Applied
1	4	Driving style	GPS, accelerometer and smart phone is used. SVM algorithm is used for pattern
2	5	Drowsiness, Pattern	EMT is used
3	6	Driver's behavior	Using the steering wheel operation and driving stimulator is used
4	7	Driver's behavior	Data mining and cognitive test
5	8	Drowsiness	Using hough transform and Canny edge detection

6	9	Driver's behavior	Using Gaze pattern , CNN and LSTM algorithms are used
7	10	Driver's behavior	Cloud computing , decision tree is used
8	11	Speed	Tachograph technology and digital camera are used
9	12	Drowsiness	Alcohol sensor MQ3, Li-Fi framework , GSM module and ECU of vehicle
10	13	Drowsiness	Multi sensor system
11	14	Drowsiness	BDDL-SP algorithm and ANFIS model
12	15	Fatigue and wheel turning	Dempster-Shafer (D-S)
13	16	Fatigue	Dampster shafer theory
14	17	Drowsiness	Raspberry-Pi and a Pi
15	18	Driver's behavior	Driving Simulator system

IV. CONCLUSION

From the papers that were reviewed as part of this study it came to light that most of the methods employ single parameter to detect the likelihood of road accidents. The driver's behavior, fatigue, drowsiness and speed were some of the commonly applied parameters. The results was also not accurate, whereas if we introduce a system that will monitor drivers behavior using more than one parameter involving intelligent machine learning algorithms we can have better accuracy in predicting the likelihood of occurrence of road accident.

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