AI-Powered Driver Behavior Analysis and Accident Prevention Systems for Advanced Driver Assistance

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Abstract

AI-Powered Driver Behavior Analysis and Accident Prevention Systems for Advanced Driver Assistance. Over 1.3 million people die each year in traffic accidents, and an additional 20 million to 50 million sustain non-fatal injuries, nearly establishing worldwide epidemics. Traffic accidents are most often caused by mishaps by drivers significantly affected by their behavior and physical-emotional state. Major technological advancements have enabled precise driver behavior analysis and highly effective systems providing solutions for real-time monitoring and timely prevention of accidents. An in-depth review identified over 120 scientific and professional reports published during the last 25 years on driver behavior monitoring and accident prevention, and 46 patents issued during the last 15 years describing novel AI-powered systems for advanced driver assistance. These advancements were reviewed in terms of their AI-powered sensor fusion, multi-modal driver behavior analysis, and real-time driving accident risk assessment. They provide comprehensive capabilities for timely accident risk prevention according to the recommendations of experienced professional drivers and other transportation specialists.

Keywords: *AI-powered driver behavior analysis, accident prevention systems, advanced driver assistance, driver monitoring technologies, real-time risk assessment, driver emotional state analysis, physical state monitoring, traffic accident reduction, sensor fusion technology, multi-modal data analysis, AI in transportation safety, driver fatigue detection, real-time intervention systems, intelligent transportation systems, driver risk profiling, behavioral pattern recognition, machine learning in driver safety, driver distraction detection, preventive safety systems, autonomous vehicle assistance.*

I. INTRODUCTION

Accidents, driver aggression, and driving style are deeply associated with driver behavior and sustainable development. Efficiently identifying driving behavior from the vehicle and driver is directly connected to the vehicle, the road, the driver, and many factors. Studies have shown that a significant percentage of the accidents leading to death are related to driver fatigue. In this way, the most common driver faults include inadequate speed, alcohol use, inability to focus, and inadequate street leaning. Inefficient drivers or driver communication with the vehicle cause traffic crashes. In recent years, through various studies, researchers have tried to move into different aspects of driver behavior identification, such as fatigue, distraction, and drowsiness. The research has contributed to the growing appreciation for monitoring drivers.

The significance of understanding behavior in the automotive domain has resulted in an increasing interest in research on behavioral analysis and identification due to the ever-growing number of vehicles in the world. By detecting driver behavior, an attempt is made to stop potential accidents from taking place. After the driver starts to feel extremely tired, it is too late to do something. The key objective of driver behavior analysis and recognition is to provide early warnings to prevent the occurrence of crashes. North America, Asia Pacific, and Europe are expected to have the biggest share of the market for driver behavior and accident prevention systems powered by artificial intelligence. Due to the deployment of vehicles and government regulations for vehicle safety, these regions dominate the market. In-theme research revealed that a modified vehicle security consideration could drastically decrease occurrence rates for collisions and deaths. As a supplementary vehicle safety method, dynamic driving assistance in predictive conditions helps reduce energy usage. During the forecast period, the introduction of driver behavior alerts in most vehicles resulting in fewer accidents, and government regulations regarding vehicle safety are also likely to drive the driver behavior and accident prevention system market.

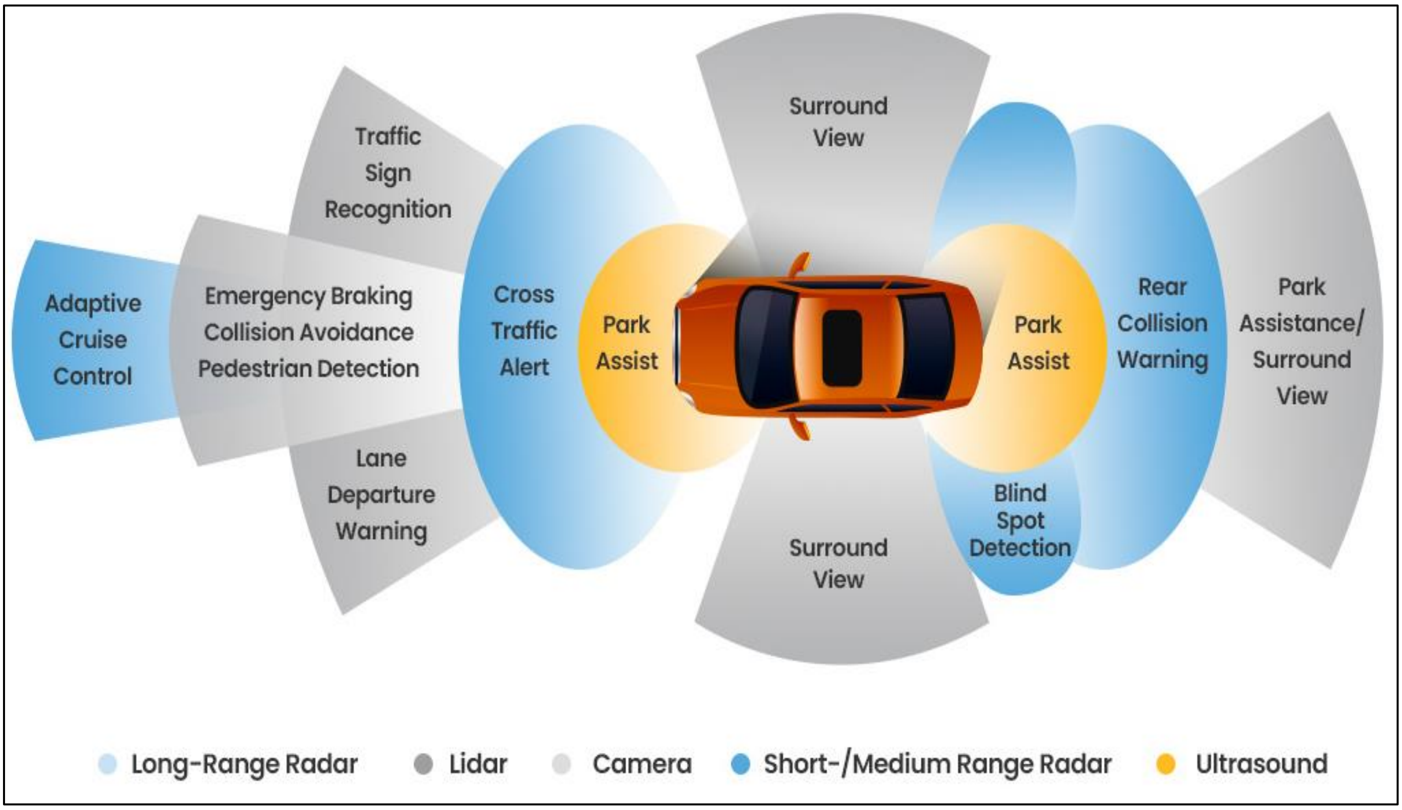

Fig 1 Advanced Driving Assistance Systems (ADAS)

➢ *Background and Significance*

Road safety is a global problem that needs urgent intervention to avoid disasters. Road traffic accidents will be the leading cause of death worldwide by 2030. Road traffic accidents are currently the leading cause of death among young people aged 15–29, accounting for 1.35 million deaths annually and causing between 20 and 50 million non-fatal injuries. Reducing the number of deaths and injuries must be a global priority, for which traffic safety measures must be reinforced. These measures can be classified into four categories: improved road infrastructure, safer vehicles, new legislation, and good driving behaviors.

The fifth United Nations Sustainable Development Goal recommends reducing the number of deaths and injuries caused by road accidents by 50% before 2020. Technological innovations have made up for this shortfall in reducing the number of deaths and injuries by creating advanced driver assistance systems capable of predicting and preventing possible accident events and providing different levels of driving autonomy. These systems are evolving from solely supporting drivers to taking full control of vehicles. For these systems to be effective and reduce the number of deaths and injuries, they must have the capacity to analyze human behavior, which involves understanding human intentions, adapting to changes in the internal or external conditions of each person, and being able to replicate observed behaviors. The purpose of these systems is to avoid accidents, reduce costs and stress caused by congestion, and help the environment by reducing emissions associated with traffic. With all these measures, we will be able to improve the quality of life for both drivers and other road users, reduce the number of collisions, and be on our way to a future with zero victims.

- *Equation 1 : Driver Attention Detection (Eye Tracking Model):*

$$A = \frac{t_{\text{focus}}}{t_{\text{total}}}$$

A: Driver attention ratio

t_{focus}: Time driver spends focusing on the road

t_{total}: Total time analyzed

➢ *Research Objectives*

The primary endeavor of this research is to develop a driver behavior analysis and safe driving promotion model through various experiments using AID. The model produced is a user-in-warn and user-in-notice accident prevention system that warns or informs strict and sun-safe driving upon detecting any erratic or dangerous driving demeanor by analyzing driver behavior, hence eventually preventing accidents. The user is notified by the AI system via typical messages that they should read or memorize. The messages can also be expanded into media content to warn the driver, but print documents or images consume too many pages to be carried around, and it is impractical to produce tens of thousands of different motion images to display inside a car.

First and foremost, the scope of the research includes identifying optimal AI-based driver attention detection technology to assist in overcoming some of the severe limitations of existing technologies, which tend to have inferior algorithm design performance and operate with considerable data from the drivers to function. The research work aims to analyze driver behavior by detecting, predicting, and preventing accidents just before they might occur using AI-powered driver behavior monitoring technology. Ultimately, this research work anticipates enhancing the overall traffic safety of the transport environment effectively and efficiently.

II. LITERATURE REVIEW

The following work introduces existing research relevant to the Ai-SRS application. However, to start with, the first relevant question is, "What exactly are currently present Ai-DBA and Accident Prevention Systems (Ai-APS)?" Ai-DBA systems typically use real-time footage from one or more on-board cameras pointed at the driver's behavior and can, among others, measure eye movement, eye closure, head movement, and hand position. Some of these systems, the most mature ones commercially oriented, are also capable of detecting drowsiness events in drivers from the database of observed driver behaviors. Ai-APS is an evolution of Ai-DBA, which derives the earlier DBA name, incorporating other factors than the driver's behavioral data for further analysis of the driving environment. Explicit classification, discrimination, and recognition of driver's behavior states show really promising results. We believe Ai-SRS has the potential to: A. settle disputes about the cause of an accident; B. reduce and eventually help avoid accidents; C. increase the car driving experience and its economic use, particularly for long commercial trips; D. significantly contribute to a decrease in road trauma. The reported interest and applications to which the personal health SigAd is aiming are just an instance of the much more numerous possible applications. The intent is to indicate that the interest in these systems is rapidly increasing and signals the need for development in this emerging field.

➢ *Existing Driver Behavior Analysis Systems*

Vehicle safety has long been a significant concern for researchers working in the field of intelligent transportation systems. Inside the research field, particular focus was placed on video vision-based vehicle control and safety, particularly driven by the significant resources being expended on visual navigation. The recent proliferation of video camera-equipped smart automotive gadgets has showcased many other potential uses and applications for such general technology. In this paper, single-image vision-based driver behavior models are evaluated just as they have been since machine learning techniques were established. The driver behavioral model is unique in properly encapsulating the data in a manner that has very little in common with existing visual models, which generally use shape recognition or features supplemented by heavily constructed features and models created directly from those features.

Before these relatively recent driver behavior synthesis and analysis models, very little work had been done in performing driver-specific tasks using visual image data. The pre-2000 work that does exist includes various methods of gaze tracking and attention setting, work done on messaging, detecting the driver’s eye states, fatigue detection, monitoring the position of the driver’s head, driver-to-vehicle interfacing, event data recording, and recognizing emergency forces such as heavy braking and severe vehicle turning. None of this work attempted to combine the data from the in-vehicle sensors and components to create a driver behavior synthesis or analysis model; the shown method only uses video information.

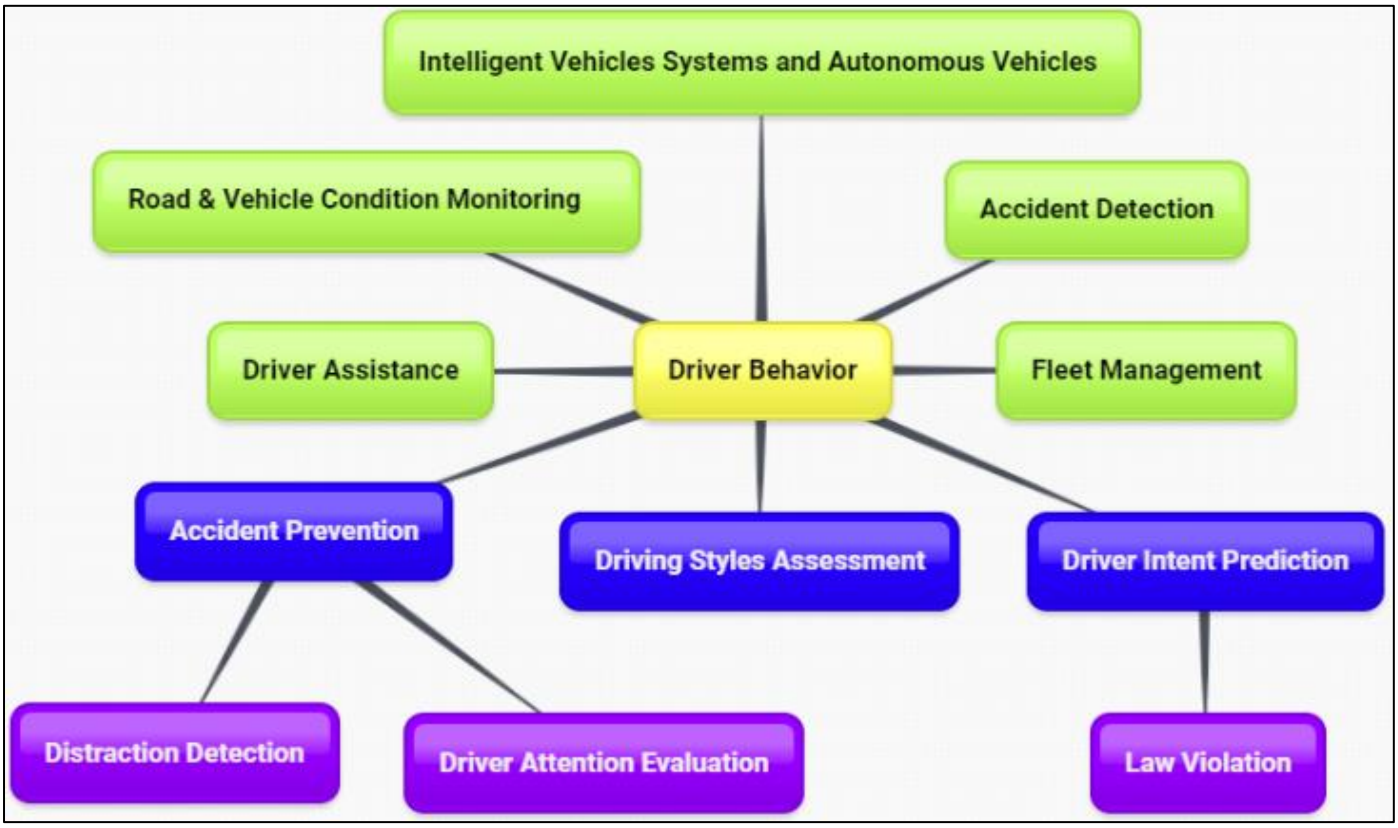

Fig 2 Application Fields of Driver Behavior Analysis

➢ *AI Applications in Accident Prevention Systems*

The current vehicle safety systems rely on hardwired algorithms, such as a straight-line trajectory. Most of these systems are object-based, where accidents are prevented or minimized by avoiding obstacles. Monocular and stereo camera-based systems, where machine vision technology is used, have issues in distinguishing geometric details of surrounding objects in low light, fog, rain, and snow conditions. These visual systems also have a hard time separating or merging objects that have similar color surfaces, infrared temperature patterns, or reflectance properties in their operating ranges using thermal or LIDAR imaging systems. Although cost-effective and virtually reliable in sensor fusion, camera-based object detection and distance measurement systems have challenges in describing and understanding complex driving scenarios promptly. In the physically accurate simulation environment created for testing autonomous driving using road test data collected in mixed driving scenarios, object-based simulation performance, and real-world ACC/CACC.

Artificial intelligence can change the current approach from a response-based vehicle control using hardwired algorithms to an analysis and prediction-based preventive vehicle control using a sophisticated algorithm structure that reflects basic perception, reasoning, and behavior modeling characteristics of a human driver who has internal and external dynamical models. These advanced collision prevention and accident reduction systems utilize deep neural networks mainly for environmental recognition and classification tasks. Facial recognition and eye tracking are often employed for situational awareness studies. Very few studies use AI to directly extract vehicle dynamics, model and predict driver behavior, and develop a predictive controller. Due to the restricted real-time performance, high-level driving behavior, such as the intention of the driver and vehicle trajectory predictions with data sharing, has limited capability in vehicle-level collision prevention before driver control commands. Data scientists are working on developing driver-level crisis predictive algorithms using human kinematics and related driving force data as part of the ADAS system expansion.

III. METHODOLOGY

The methodology for driver inattention and distractedness detection is based on monitoring the eye behavior and head pose of a driver, requiring a specific model trained to detect these states. Despite the state of the art in gaze tracking and facial landmark extraction algorithms, the presence of a driver in the image reduces the performance of common techniques in these tasks. To surpass this limitation, the idea is to use a deep learning image-based model to detect the different states using only the camera snapshots. This model is built upon a visual representation process of predefined areas of interest of the face and eyes based on machine learning. The main idea, in this case, is to take advantage of already trained facial and gaze classification CNNs, extending their use to multiple faces in the image and generalizing coverage of these networks to a full front view and the presence of non-driving faces. In the following section, an end-to-end ready-to-deploy implementation will be presented. The system creates a real-time output of valuable data from a front-facing camera that can be used for driver inattention, fatigue, and distraction detection. The suggested applications go further and encompass other safety and comfort features such as driver identification through facial recognition and head pose estimation. Additionally, the proposed approach is ready for integration with an in-vehicle cabin communication system that receives the driver's attention and feedback to support a multimodal man-machine dialogue. The major contributions of the work are the high speed and accuracy of the algorithms in real-time analysis, powered by the new architectures of deep neural networks.

➢ *Data Collection and Processing*

Driver behavior has a significant role in the occurrence of traffic accidents. The study of statistical data on accidents shows that the majority of them are due to the human factor. Thousands of people are killed every year in traffic accidents, and tens of thousands are left with severe injuries or become handicapped. The economic cost is enormous, not only to the families directly involved and affected but also to the rest of society. The detection of behaviors leading to traffic accidents is crucial for the design of advanced systems to prevent them. These systems use AI techniques to analyze driver behavior through the processing of image and sound sensor data and can raise alarms, and most importantly, act to prevent the occurrence of the typical chain of events leading to a traffic accident.

The first important step in developing such a system is capturing the data that will be used for its implementation. Several data sets exist that have been captured and are publicly available. Those data sets are quite useful, and researchers have found ways to make use of them. The major shortcoming of that data is that it is limited to a small group of drivers and is typically captured under controlled conditions with no image obscuration, such as wearing sunglasses, different types of lighting, and data from adverse weather conditions. To address this shortcoming, a new data collection campaign was performed, spanning the period from March 2019 to February 2020, and captured under conditions resembling real-world ones, and included volunteers of great diversity in genders, ages, and backgrounds. Data were captured in different European cities during the day and then at night, covering a wide range of driving scenarios such as residential, commercial, industrial, and inter-city routes.

- *Equation 2 : Heart Rate Variability (HRV) for Stress Monitoring:*

$$\mathbf{HRV} = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(RR_i - \bar{RR})^2}$$

RR_i: Time interval between consecutive heartbeats

$\bar{RR}$: Mean RR interval

N: Total number of RR intervals

➢ *Machine Learning Algorithms for Driver Behavior Analysis*

The major focus of machine learning is classification, and it involves supervised learning methods. Broadly, machine learning can be divided into five major approaches: supervised, unsupervised, semi-supervised, reinforcement, and deep learning. Although deep learning performs best on many real-world problems, it requires a large amount of data and more computations. Supervised learning means that an algorithm learns from an already labeled dataset. In the field of UWA, a machine learning model can understand the fastest route from the starting point to the endpoint, and the model segments or classifies different types of trips, such as aggressive driving, normal driving, and slow driving. Driver trip segmentation, aggressive driving recognition, and sub-environment classification can be achieved through supervised learning. On the other hand, unsupervised learning is performed when the information used to train is not in the form of data that has already been labeled. Most of the existing road accident databases are supervised. The schematic representation of unsupervised learning for accident detection may be combined with the reinforcement model. Semi-supervised learning is a combination of both and can be considered to involve partially labeled data. Although the existing data sources do not contain sufficient data for driver behavior and road anomalies that can lead to accidents, few models include unsupervised learning. The driver's drowsiness level is a crucial factor that can lead to serious accidents. An unsupervised model for vision-based drowsiness classification has been developed. This research aims to find hidden patterns in road accident data, which involves the visualization of drivers identifying those patterns and various clustering results that demonstrate the possibility of detecting different driver behavior patterns, even if the data is not labeled, as quickly as possible. The two categories of applications, traffic management and road accidents, can solve civil engineering problems.

Fig 3 The Benefits of Driver Behaviour Analysis Using AI

IV. IMPLEMENTATION AND CASE STUDIES

CLEANCAM's power comes from the implementation of required cloud-based hardware, which can monitor driver behavior and provide results collected from data processing in real time. It does this by running a deep learning model, detecting eye blinks, and a k-means clustering model that helps identify potential unexpected future risks. The deep learning model is trained on face images to detect eye blinks with an accuracy of 99.5%. The camera is also necessary hardware due to the possibility of covering all areas in a car. To reduce costs and effectively increase the efficiency of the AI-powered Drowsy Driving Multi-level Alert System, we chose to replace specialized hardware with a camera in CLEAN ROOM. Additionally, since cameras have become cheaper these days, developing AI-powered solutions by combining deep learning with images or videos captured by a camera has become a trend and is a cost-efficient solution.

Driver inattention and drowsy driving are major challenges for the automobile industry, as they contribute to a large number of accidents. CLEANCAM endeavors to compete with the current drowsy and inattention monitoring techniques and augment advanced driver assistance systems to relieve driver inattention or drowsy driving, thereby increasing overall road safety. In this context, the system highlights the innovative and cost-effective deployment of a deep learning network, a k-means clustering model in terms of time, or LIDAR in terms of distance and camera. It also includes a novel method to communicate the system's results to the driver in real-time. Fast and accurate data processing, the response to drowsy drivers, communication with the driver, and adherence to safety guidelines are key to its success.

➢ *Real-World Applications of AI in Driver Assistance Systems*

There are numerous real-world applications of AI in driver assistance systems. Typical driver assistance systems provide autonomous driving capabilities, such as lane-keeping assist, adaptive cruise control, and parking assist, to improve driving safety or increase driving comfort. Smart driver monitoring systems are also important to ensure safe driving and have been integrated into high-end vehicles. The systems typically use camera-based sensors to track and analyze the driver's condition, such as detecting falling asleep at the wheel or an inattentive driving state. AI techniques can be both offline trained and online computable for driver state recognition.

In addition, recent studies have focused on the applications of deep reinforcement learning techniques as a black-box model for sequential decision-making tasks. The major innovative applications range from lane-change policy learning, and traffic-light management optimization, to autonomous car racing. These AI algorithms generate policies that learn dynamic motion control strategies to enhance autonomous driving models by maximizing the sum of uncertain rewards. There exist various reviews discussing the details, algorithms, and challenges of AI applications in driver assistance systems. Despite the mentioned achievements, there is a key challenge that remains unresolved. The models discussed earlier are commonly open-loop vision-based systems. However, vehicle dynamic monitoring data provide all kinds of vehicle status changes, such as lane keeping on curved roads and overtaking operations. Slightly reducing vehicle speed or slightly adjusting driving instructions can avoid potentially dangerous situations, so closed-loop control in real-time behavior is always indispensable.

- *Case Studies of Successful Accident Prevention Systems*

Driver behavior monitoring and driver accident prevention systems have evolved over many years. Current technology has developed AI-powered accident prevention systems that can monitor dangerous driver behavior and use these insights to alert drivers who are getting into dangerous situations. In this section, we have showcased four commercial AI-powered telematics systems provided by four leading telematics service providers, and we include their AI algorithms that can be used as part of intelligent vehicle telematics systems. All the presented systems are low-cost, easy to deploy, and can be used as an accident prevention system in vehicles. The four AI-powered telematics systems are further discussed in Section 5. From these four commercial telematics systems, there is a clear demarcation that all the vendors make use of real-time algorithms to detect dangerous driver behavior, which includes detecting driver fatigue, risky driving, and driver smartphone use, such as holding, picking, contacting, and dialing a phone while driving, as well as the operation of GPS navigational devices.

Finally, in this case study, we discuss tunnel accidents as they are very challenging for drivers. In the case where the vehicle enters the tunnel and rapidly changes the external light levels, the system would not be able to operate perfectly. By recognizing that the vehicle has entered a tunnel, the system can suppress the high-risk scoring of monitoring eye contact on the monitor. Advanced Driver Assistance Systems use intelligent algorithms and sensors to help you drive better by alerting, assisting, and interrupting racetrack mode driving behavior. These driver assistance systems can be adapted to recognize and help the driver using real-time algorithms. Driver assistance systems can assist in maximizing the efficiency of the driver's help by alerting the driver in real-time for important driving events and threatening traffic conflicts that need to be solved in the shortest time and the appropriate manner. These included items such as steering control, tire regulation, throttle operations, and brake moderation, where algorithms could be useful to prevent accidents through tracking sensitive driving situations, as well as other types of lane attacks, such as unexpected speed controls.

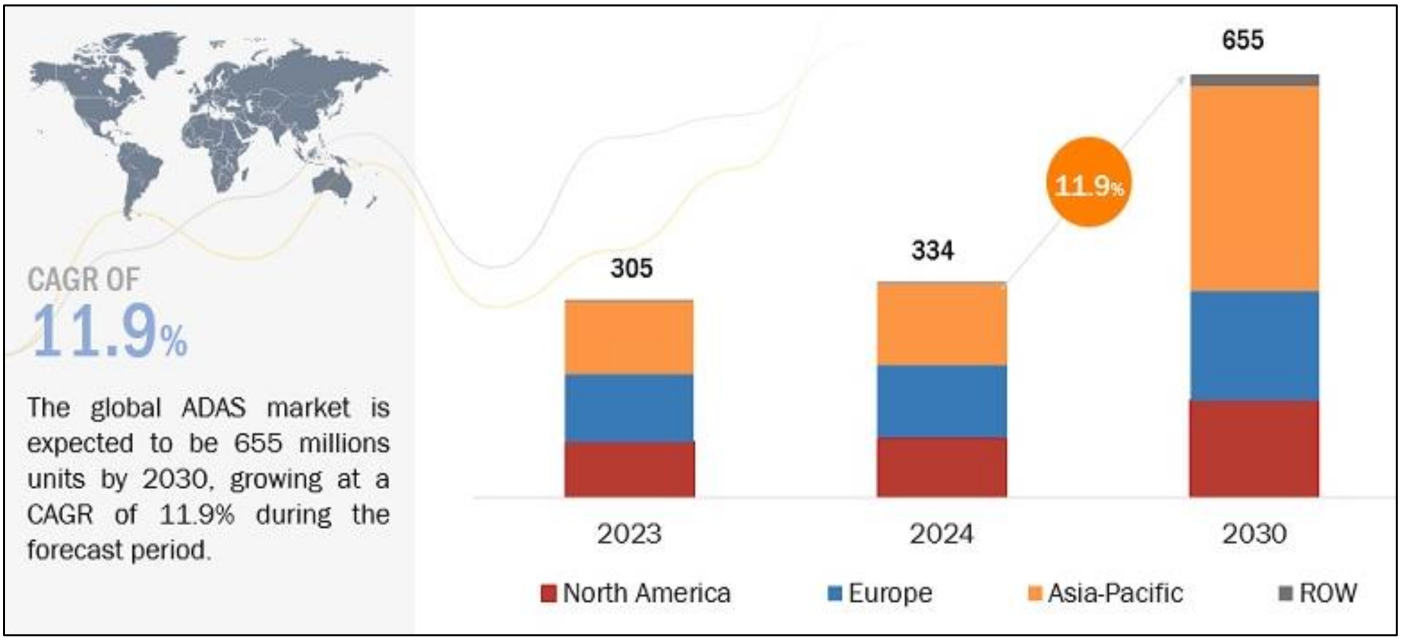

Fig 4 Advanced Driver Assistance Systems Market global forecast to 2030 (MILLION UNITS)

V. CHALLENGES AND FUTURE DIRECTIONS

Challenges of Implementing AI-Powered Digital Accident Prevention The three major challenges that need to be addressed for a successful implementation of our proposed model, AI-Powered Digital Accident Prevention (ADAP), which applies AI to address real-world problems through seamless interactions between humans, cyber entities, and physical systems, is how to provide explainability, seamlessly integrate the functions into vehicles, and consider both urban and remote areas. The explainability issue remains a major concern in the practical applications of AI technology. This becomes more challenging when deep learning models are used to model the relationship between driving behavior and traffic accidents. How to seamlessly integrate the functions into vehicles has yet to be explored. The final challenge is related to the driving experiences, which vary significantly in either urban or remote areas due to differing road and traffic conditions, with the former typically featuring lower vehicle speeds and higher vehicle density, and both conditions are highly correlated with traffic safety. It is a challenge to how we can learn and further enhance our performance.

Future Directions and Possible Applications The automotive industry is starting to embark on a critical developmental trajectory, since different vehicle models and driving characteristics must be considered in the development of a practical ADAP to achieve the goal of accident prevention, including the launches of advanced versions. The potential for an accident to occur is anticipated to be reduced or even eliminated with the principle of the ADAP, and this forms the foundation for the development of collision avoidance control within advanced models. More complex situations, such as how traffic lights are working and the position of pedestrians surrounding intersections, will be evaluated in the future. Improved real-time accident risk prediction models that can distinguish a variety of driving situations and conditions are expected to deliver a higher level of safety. Shortly, more appropriate countermeasures, such as restricting the number of top safety performers or avoiding the presence of low-performing cars on the roadways, may be employed. ADAP predicts the accident risk of individual vehicles, which makes our framework more effective in helping vehicle users manage traffic accidents.

- *Ethical Considerations in AI-Powered Systems*

In the era when artificial intelligence (AI) systems have immense potential to facilitate interaction with humans and diminish the risk and overhead of numerous daily aspects of life, including healthcare, resource and financial management, and transportation, we are also confronted with ethical questions that emerge from the utilization of AI in various fields, particularly regarding human-AI interaction. In this part, we will discuss the importance and ethical implications that arise during the development of AI-powered driver behavior analysis and accident prevention systems. Among others, these instances include the effect of behavior-oriented solutions in high-risk situations, the demonstration of the proper use of collected data and particularly videos in the context of information privacy, the risks of unexpected data usage by third parties, the question of explainability in AI reasoning, and the lack of human control over developed algorithms.

These ethical and societal difficulties lead to various legal challenges, particularly in the area of transportation. The delegation of tasks from real humans to machines powered by AI can become contentious, especially when the safety of a concentration of people is at stake. As soon as the opportunity arises for AI to provoke harm or infringe on human rights, political and public opinion becomes cautious and concerned. This difficulty is exacerbated in human-AI interactions when ethical considerations bypass globally accepted rules in favor of individual problems; this is particularly relevant to AI-powered systems that should be integrated into the transportation security framework. The more an AI system raises public concern, the more society will expect the design of a robust normative framework that includes all relevant elements and thorough certification before any approval.

- *Equation 3 : Fatigue Detection Using Blink Rate:*

$$F = \frac{N_{\text{blinks}}}{t}$$

Where:

F: Blink rate (blinks per second)

N_{blinks}: Number of blinks

t: Duration of the observation period

- *Future Trends in Driver Assistance Technology*

We believe that the recent developments in sensing and processing technology for driver monitoring and behavior analysis have significant potential for technology transfer to become the basis for future Advanced Driver Assistance Systems. Accurate vital sensing data has great potential to improve safety by preventing accidents. This is because many current ADAS technologies operate simply to mitigate damage after the onset of an accident and do not act as an early warning system to help prevent the accident entirely. To develop these systems, however, the appropriate sensors are needed to identify the onset of an accident. These sensors must be located on the vehicle itself or in a roadside environment and can monitor in real time a range of vital signs from the driver that can detect the onset of an adverse condition in real time.

Future trends will include technologies to assist the monitoring and commitment of drivers in smart cities. Currently, most intelligent transportation systems and content delivery to drivers through ADAS involve communication links through features of the infrastructure or other vehicles and the driver or vehicle. We believe that future driver monitoring approaches will use analyzed vital signs and facial images that ADAS can use to monitor the physical and mental state of drivers in situ, thus offering a broad range of new uses for ADAS technology that has traditionally been used for other purposes. Such technology use will also offer greater assistance functions on future vehicles.

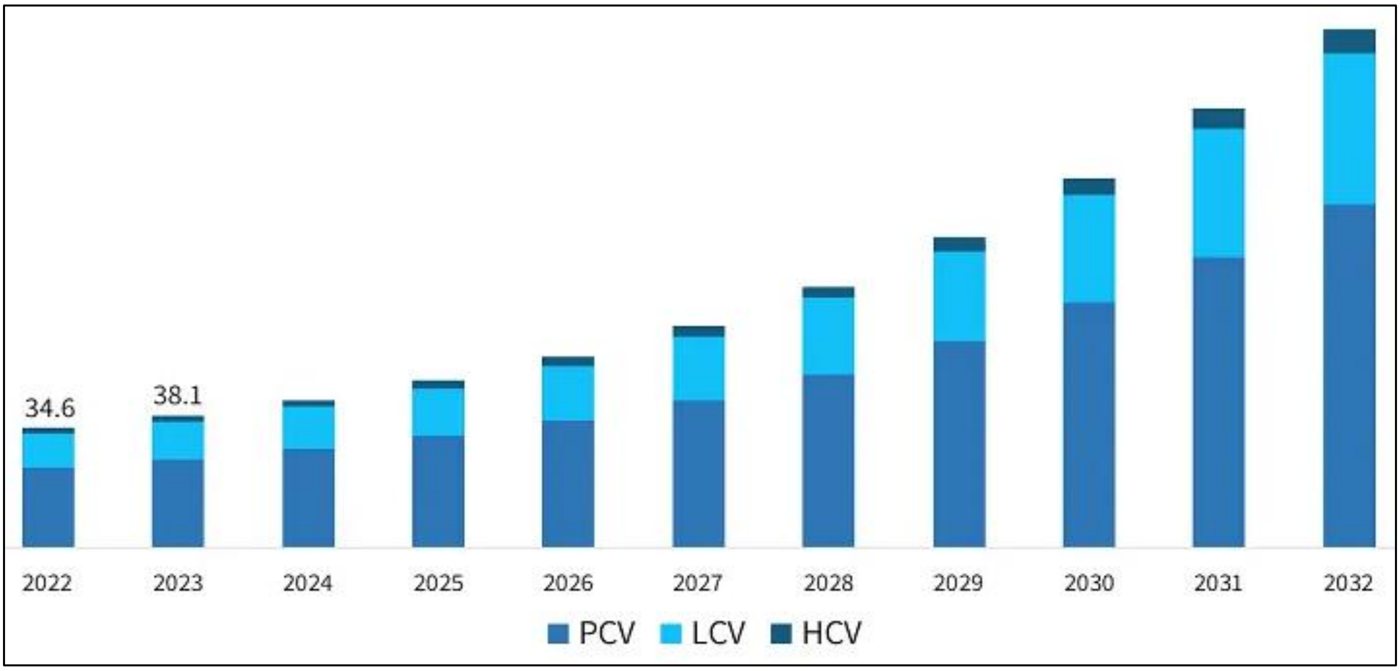

Fig 5 Advanced Driver Assistance System Market Size, by Vehicle, 2022-2032,(usd billion)

VI. CONCLUSION

Rollover accidents are known to have high fatality rates. Several studies have proposed some rollover conditions for the different types of vehicles and different conditions as driver, road characteristics, and even traffic conditions, and proposed a model to decide whether to roll or not by testing the vehicle performance against those rollover conditions. In this study, to collect data more realistically, buses are used in daily life. Each driving event contains not only the driving parameters but also prominent abnormal parameters which are recognized by advanced driver-assistance systems. These distinguished events, initially by a rough prediction tool, for further time history data separation, enable in-depth predicting of the separated events in transient, school bus rollovers are recognized by several artificial intelligence and machine learning techniques.

Vehicle rollovers are complex and need a dynamic model, but the priority in real-time applications is still classified by monitoring method and they are sent to a decision model and an affair which avoided the rollover accidents by evaluating the severity and time all those models may give warnings before crash if there are enough readers. The conclusion of this article, as a result of the first stage of this system, the warning message can save lives. In addition to passenger safety in buses, these real-time monitoring systems can also be used for relative safety and ease of driving. In these studies, the most important graduation criterion was to update the system by using runtime parameters without sacrificing time. They also basically were performed like driver windshield directions. After certification, a real-time warning is the priority.

➢ *Future Trends*

In summary, government authorities are becoming more aware of the importance of health and safety on the roads, both in Europe and elsewhere. This increasing focus on reducing the number of casualties on the roads will generate a shift in the ADAS and DMS fields, where collaboration between the two systems becomes a must in an attempt to reduce the number of accidents on the roads. This chapter presents an overview of the state of the art on concepts and technologies and focuses on the development process to be followed to integrate DMS and ADAS to activate an active safety system, proposing an architecture that will become mandatory in the transportation of cargo with important loads. The state of commercial products and the current challenges in linking these two sensorial techniques are discussed. Road safety has taken on greater importance in recent years as a key aspect of social security. The deployment of new technologies in vehicles that increasingly connect to their environment and users becomes an asset in the reduction of the accidents and casualties that occur every day on the world's roads.

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