Road Safety Implementation by Preventing Accident Using AI

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ABSTRACT - One of the difficult issues in autonomous vehicle navigation is the detection and avoidance of obstacles. Currently, a variety of sensors, including RGB cameras, radar, and lidar, are utilized to scan the area around the car for obstacles. The practice of utilizing supervised learning techniques for environment analysis has shown to be costly because different obstacles need to be trained for different scenarios. This work uses Reinforcement Learning (RL) techniques to understand the unpredictable environment based on sensor input and make decisions in order to overcome this issue. The multi-layer perception neural network (MLP-NN), a model-free, policy-free Q-learning based reinforcement learning method, is used and trained to forecast the best course of action for the vehicle based on its current condition. Additionally, the suggested Q-Learning with MLP-NN based approach is compared with the state-of-the-art, namely, Qlearning.A simulated urban area obstacles scenario is considered with the different number of ultra-sonic radar sensors in detecting obstacles. The experimental result shows that Q-learning with MLP-NN along with the ultrasonic sensors is proven to be more accurate than conventional Q-learning technique with the ultra-sonic sensors. Hence it is demonstrated that combining Q-learning
with MLP-NN will improve in predicting obstacles for autonomous vehicle navigation.

***Index Terms*— Vehicle Detection, Camera, Haarfeature-Based Cascade Classifiers, Opencv, Python.**

I. INTRODUCTION

The introduction of artificial intelligence (AI) has transformed a number of industries, and one crucial area it has greatly affected is transportation safety. Because there are more and more cars on the road globally, there is a growing concern about road accidents. governments, decision-makers, and general public alike. Our project, "Road Safety Implementation by Preventing Accidents Using AI," aims to use artificial intelligence (AI) to reduce the likelihood of accidents and improve road safety in general in response to this problem. The principal aim of this project is to create an intelligent system that can anticipate and avert collisions by evaluating multiple variables in real-time, including traffic patterns, meteorological conditions, vehicle velocity, and driver conduct. Beyond conventional reactive measures, we aim to develop a proactive approach to road safety by utilizing AI algorithms and machine learning approaches. The startling global data on traffic accidents, which not only claim lives but also have a substantial financial and social toll, is what spurred our research. The World Health Organization (WHO) states that millions of people die or suffer serious injuries from traffic-related injuries every year, making it one of the major causes of death globally. Furthermore, the financial toll that traffic accidents take in terms of lost productivity, property damage, and medical costs is astounding. Our research uses a multifaceted strategy that integrates a number of technologies, including sensors, cameras, GPS, and advanced analytics, to address these issues. Our artificial intelligence system is able to identify possible road dangers and promptly notify drivers, authorities, and other relevant parties to take preventive measures by gathering and evaluating data from various sources real-time.

II. RELATED STUDY

Due to the fact that road accidents claim millions of lives each year and cause enormous financial losses, road safety has become a top priority on a global scale. Increasingly, people are interested in using artificial intelligence (AI) to improve road safety protocols and prevent accidents as technology advances.

Several research works have investigated the use of AI in traffic safety programs. Using machine learning algorithms for predictive analysis of accident-prone locations and times is one popular field of research. These algorithms can detect patterns and risk factors by evaluating previous accident data coupled with different environmental and traffic conditions. This allows authorities to put preventive and targeted interventions into place.

In addition, studies have looked into how computer vision methods might be used to improve traffic monitoring and surveillance. Modern cameras with AI algorithms built in can monitor and assess traffic conditions in real time, spot possible dangers like distracted driving or pedestrian crossings, and notify authorities and other drivers of such events. These technologies have the capacity to drastically lower the number of accidents by issuing prompt alerts and taking appropriate action.
Furthermore, a viable strategy to improve road safety is the integration of AI-powered systems with linked automobiles and smart infrastructure. These technologies facilitate the real-time sharing of vital information about road conditions, traffic congestion, and approaching threats by enabling seamless connection between vehicles, infrastructure, and pedestrians. AI plays a role in allowing cars to make judgments on their own by using this data.
In addition to accident prevention, AI-driven technologies are also being explored for post-accident analysis and investigation. Machine learning algorithms can analyze accident data to identify root causes, contributing factors, and common trends, thereby guiding policymakers in formulating more effective road safety policies and regulations.

Overall, the literature on AI-based road safety initiatives demonstrates the immense potential of technology in mitigating the risks associated with road travel. However, challenges such as data privacy, algorithm bias, and infrastructure limitations need to be addressed to ensure the widespread adoption and effectiveness of these solutions. Continued research and collaboration between academia, industry, and government stakeholders are essential to realizing the vision of safer roads for all..

III. METHODOLOGY

EXSITING SYSTEM

To solve road safety difficulties in the current system, conventional techniques like manual monitoring or simple driver aid technologies are employed.These techniques frequently have accuracy and dependability issues, which increases the chance of accidents, particularly when there are unanticipated roadblocks or driver weariness..

PROPOSED SYSTEM

The suggested method overcomes the shortcomings of the current system by utilizing computer vision and artificial intelligence approaches. The system can precisely detect a vehicle's position in the road and identify potential obstructions by tracking the lanes and processing real-time photos from the car's front camera. After that, it gives the driver timely alerts so they can take the appropriate safety measures and prevent collisions.

IV. MODULES DESCRIPTION

To ensure the efficacy and efficiency of the suggested solution, the system design for the application of artificial intelligence (AI) in road safety measures is essential. The main elements, architecture, and development and implementation processes of the AI-based road safety system are described in this section.

4.1 DATA COLLECTION

The quality and quantity of data that an AI-driven system can use as a basis is essential. When it comes to implementing road safety, data collecting entails obtaining information from a variety of sources, including sensors, GPS units, traffic cameras, and accident reports from the past. After that, the raw data is analyzed to extract pertinent features including traffic density, vehicle speed, weather, and road infrastructure.

4.2 MACHINE LEARNING MODELS:

Algorithms for machine learning (ML) are essential for assessing and forecasting the risks associated with road safety. Models can be trained using supervised learning techniques using labeled databases to identify trends suggestive of possible mishaps. A variety of methods, such as decision trees, random forests, support vector machines, and neural networks, can be included in these models. Furthermore, unsupervised learning methods like clustering can be used to find unusual activity or accident-prone locations.

4.3 ANALYSIS OF REAL-TIME MONITORING:

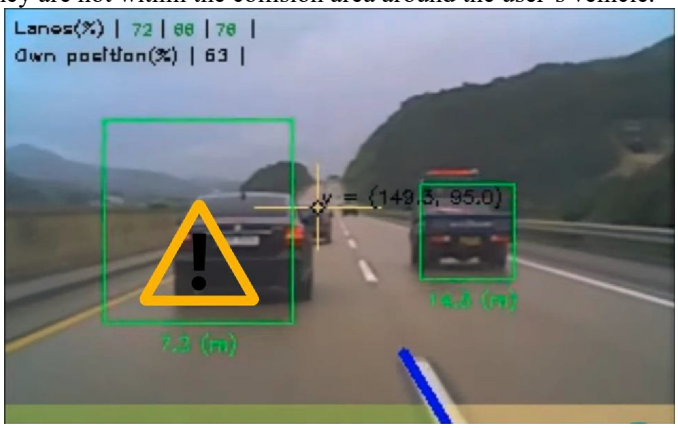
The AI system should be able to track traffic patterns in real-time and spot possible dangers on the road. This is the ongoing examination of incoming data streams in order to identify any anomalies in typical traffic patterns or circumstances that heighten the probability of collisions. Advanced methods that can be used to give authorities and drivers early warnings include anomaly detection and predictive analytics.

4.4 INTEGRATION WITH TRAFFIC MONITORING SYSTEMS:

The AI system must operate in harmony with the current traffic management infrastructure in order to optimize the benefits of road safety initiatives. This entails coordinating with emergency response agencies, dynamic message signs, and traffic signal management systems. Traffic flow can be managed and preventative action taken to lessen the likelihood of accidents by utilizing real-time data and predictive insights.

V. RESULTS AND DISCUSSIONS

The system is firstly applied on the images captured on the Yangon-Mandalay Highway Road before applying in the real-time application. The system only focuses on the vehicles in the same lane line on highway road in which the driver is driving. The system can detect vehicle within the range of around 10 meters. The vehicles beyond 10 meters can be ignored as they are not within the collision area around the user's vehicle.



VI. CONCLUSION AND FUTURE SCOPE

In conclusion, the system study conducted provides valuable insights into the complexities surrounding road safety and the need for innovative solutions to address them. By leveraging AI technologies, we aspire to create a safer and more efficient transportation ecosystem that prioritizes the well-being of road users. In the subsequent sections of this report, we will delve deeper into the technical aspects of our proposed solution and outline the implementation strategy to realize our objectives.

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