Detection of Lane and Speed Breaker Using Machine Learning Algorithm

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***Abstract*—With the rapid advancement of autonomous vehicle technologies, ensuring the safety of these vehicles on roads has become a paramount concern. One of the critical aspects of safe autonomous driving is the accurate detection of lanes and potential road hazards, such as speed breakers. In this study, we propose a Lane and Speed Breaker Warning System (LSBWS) that employs machine learning algorithms to enhance the perception capabilities of autonomous vehicles. The LSBWS utilizes a combination of computer vision and machine learning techniques to detect and analyse road lanes and speed breakers in real-time. The system utilizes a camera sensor to capture the road scene ahead and then employs image processing algorithms to identify lane markings and speed breakers. A convolutional neural network (CNN) is employed to accurately detect and classify these features within the captured images. Keywords: Lane detection, Speed breaker detection, Autonomous vehicles, Machine learning algorithms, Convolutional neural network, Road safety**

***Index Terms*—Autonomous Vehicles, Lane Detection, Speed Breaker Warning, Machine Learning, Convolutional Neural Network, Computer Vision, Road Safety.**

I. INTRODUCTION

In recent years, the advancement of autonomous vehicle technology has been at the forefront of innovation in the automotive industry. One of the critical challenges in the development of autonomous vehicles is the creation of reliable and robust perception systems. The ability of autonomous vehicles to accurately detect and respond to dynamic elements in their environment, such as lanes and speed breakers, is paramount to ensuring the safety and efficiency of these vehicles on the road. This research focuses on the implementation of a Lane Detection and Speed Breaker Warning System for autonomous vehicles, leveraging the power of machine learning algorithms. The primary objective is to enhance the perception capabilities of autonomous vehicles, enabling them to navigate through complex road scenarios with a high level of accuracy and safety.

II. LITERATURESURVEY

1. Paper Name: Speed Breaker Detection and Mapping using IoT
Author: Rahul Ramakrishnan; Ayusha Pendse; Chetna Sharma; Priya Chimurkar
Abstract: With an increasing road accidents due to improper and non-standard speed breakers, it is the need of the hour to address this issue appropriately, and due to this although speed breakers are built for safety, they are posing to be more of a danger. This is mainly due to building illegal speed breakers and not maintaining existing ones. The existing solutions are largely dependent on the user or the surrounding, both of which do not provide immediate accuracy and dependability. This paper presents a self-improving system with minimal user involvement and aims to cover nearly all the drawbacks of the current solutions. It suggests speed breaker detection by measuring the difference in the height between the road level and the vehicle. In this approach, GPS coordinates are stored in an online database system that is available to the public through a portal. When the vehicle is at a predefined distance away from the speed breaker, the user is notified resulting in improved accuracy with every usage.

2.Paper Name: Detection of Potholes and Speed Breaker on Road
Author: Gurpreet Singh; Rajeev Kumar; Poonam Kashtriya
Abstract: In this paper, earlier potholes detection systems that have been developed and introduces a worthwhile solution to recognize humps, potholes and speed breakers on road surface and give up-to-date signals to drivers to avoid vehicle damages or accidents, by giving him earlier warnings. To identify of humps, speed breaker and potholes,

ultrasonic sensors are used and also to estimate their height and depth, respectively. In our proposed system, we are using global positioning system receiver (GPS receiver) for identification of geographical location coordinates of the detected potholes and speed breaker. The data which are sensed by the ultrasonic sensors includes geographical location, the height of speed breakers and depth of potholes, which is saved in the local and cloud database. This paper also considers updating the database on the regular basis so that potholes can be repaired regularly by concerned authorities.

3.Paper Name: Pothole and Speed Breaker Detection Using Smartphone Cameras and Convolutional Neural Networks

Author: Zahid Hasan; Samsoon Nahar Shampa; Tasmia Rahman Shahidi; Shahnewaz Siddique

Abstract : Poor road conditions are one of the major causes for road accidents. Developing countries in particular are witnessing increased accident rates due to these poor road conditions. Potholes, deep ridges, missing pitches, improper speed breakers, poorly constructed manhole covers and slabs all combine to greatly increase the probability of serious accidents thus transforming roads into obstacle courses. In this study we have developed a model to detect unwanted potholes, deep ridges and speed breakers using computer vision and machine learning tools. We have developed a customized dataset (called Bumpy) that we use to train our machine learning algorithms. In this paper we propose a method where we use the Tensorflow pre-trained model to detect the potholes, deep ridges and speed breakers. Our experimental results demonstrate high accuracy although there are many obstacles on the road.

4. Paper Name: Real-time detection of speed breakers and warning system for on road drivers

Author: Mahbuba Afrin; Md. Redowan Mahmud; Md. Abdur Razzaque

Abstract: The excessive use of speed breakers on national highways distracts vehicle drivers. In addition to that, drivers often can't recognize the appearance of unmarked speed breakers and lose control of the vehicle, causing serious accidents and loss of lives. In the literature, there exist a few methods to warn on-road drivers about the upcoming speed breakers which are highly error-prone and time consuming. Moreover, none of them pay any heed to track the information of infringing speed breakers. In this paper, we come forward with a system that facilitates autonomous speed breaker data collection, dynamic speed breaker detection and warning generation for the onroad drivers. Our system also incorporates real-time tracking of driver, vehicle and timing information for speed breaker rule violations. The proposed system outperforms the state-of-the-art works with which it is compared to in terms of response time and accuracy.

5.Paper Name: Speed detection using image processing

Author: Pranith Kumar Thadagoppula; Vikas Upadhyaya

Abstract: With the increase in automobile use, the highway traffic have only surged. At the current rate of increasing automobiles, speed determination has become a major concern in avoiding fatal accidents. Radar technology is the current productive way used for speed detection. In this paper we have come up with an alternative method of using image and video processing which can overcome the drawbacks of radar guns. It uses the live video stream from the surveillance cameras for calculating the speed of the vehicle. The speed of vehicle is updated every half a second, hence keeping a track on acceleration and deceleration of vehicle in the field of view of the camera. Any violation in the speed laws can be observed and notified to the officer of law. This helps in keeping track of the speed violators and saves the effort of an officer holding a radar gun on the highways. The video can also be saved for future use. The speed calculated shows an error of only 3.

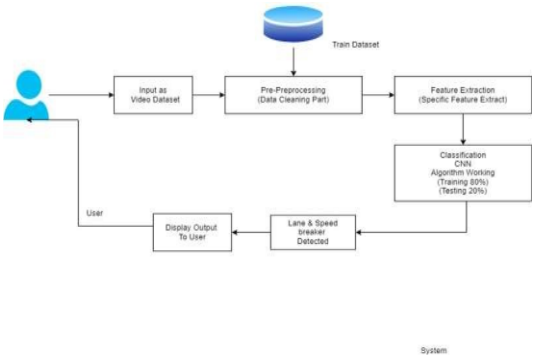
III. OBJECTIVE

The objective of detecting lanes and speed breakers using machine learning algorithms can be broken down into key points:

1. Safety Improvement Accident Prevention: Enhance driver safety by providing early warnings about lanes and speed breakers, reducing the risk of accidents. Road Hazard Detection: Identify speed breakers, which can be potential road hazards if not noticed in time, especially in poor visibility conditions.

2. Driver Assistance Lane Departure Warning: Assist drivers in maintaining lane discipline by alerting them if they unintentionally drift out of their lane. Speed Breaker Alert: Inform drivers about upcoming speed breakers, allowing them to adjust speed accordingly and avoid sudden jolts.

IV. METHODOLOGY



Using visual input, a lane and speed breaker warning system for cars usually consists of the following steps and components:

1. Input Dataset**:** Input as Video Dataset

2. Video Preprocessing: To guarantee a consistent and clean input for analysis, preprocessing may involve tasks like frame extraction and stabilization before feeding the movies into the system.

3. Feature Extraction: This technique looks for pertinent information in the video frames by evaluating them. Some of the features for lane and speed break detection could be object tracking, color analysis, and edge identification. In essence, features are the aspects of the video frames that can be utilized for categorization.

4. CNN Classification Algorithm: Convolutional neural networks, or CNNs, are frequently employed in the study of images and videos. At this point, the features that were taken out of the video frames are classified using a CNN model. It may be able to detect lane markers for lane detection and imperfections in the road for speed breaker detection.

5. Detection of Lanes and Speed Breakers: After analyzing the features, CNN can determine whether a video frame provides pertinent information about lanes or speed breakers. This classification may sound an alert when a speed limit is nearing or lanes are broken.

VI. RESULT AND MODEL

1. Lane detection: Using video footage, machine learning algorithms are able to precisely identify lane lines on roads. The outcomes might include the capacity to detect lane deviations, track lane curvature, and discern between various lane kinds (such as solid, dashed, and double lines).

2. Speed Breaker Detection: From video footage, machine learning algorithms can be trained to identify speed bumps and breakers. Accurately locating speed breakers, calculating their size, and forecasting how they will affect vehicle speed are some possible outcomes.

CONCLUSION

While speed breaker detection helps notify the driver of impending speed limit violations so they can reduce their speed, lane detection helps to keep the car in its lane. Because they lessen the chance of accidents, both of these methods can contribute to increased road safety.

The sophistication of lane and speed breaker detecting systems is growing, and a greater variety of cars are using them. These technologies are making driving more pleasurable and contributing to increased road safety.

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