PROJECT REPORT

SafeDrive Vision

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Abstract

The SafeDrive Vision detection system employs advanced machine learning techniques to identify and locate objects in real time, enhancing road safety for both drivers and autonomous vehicles. The system is trained on diverse datasets to handle varying lighting and weather conditions. Upon detection, it activates visual and auditory alerts to assist drivers in adjusting speed and vehicle control, aiming to reduce accidents caused by unexpected road obstacles.

Introduction

Problem Statement: Speed breakers may become hazardous when poorly visible due to low light, rain, or fog, causing sudden braking or loss of vehicle control.

Objective: To enhance road safety by detecting speed breakers in real time with an accuracy of 97.14% under stable conditions.

Literature Review

Traditional road safety measures such as static signboards often fail in dynamic traffic conditions. Research indicates ultrasonic sensors are effective for short-range detection, while camera-based computer vision systems identify road features. LiDAR and radar technologies further enhance depth perception, especially in adverse weather.

System Architecture

The system consists of a Data Acquisition Layer using cameras and sensors, a Processing Layer utilizing edge computing and machine learning algorithms, an Alert Mechanism for visual and audio warnings, and an Integration Layer that interacts with vehicle systems such as suspension control.

Hardware Requirements

• ESP32 Microcontroller (Wi-Fi and Bluetooth enabled)
• Ultrasonic Distance Sensor
• Buzzer
• LCD Display

Software Requirements

• Programming Language: Python
• Development Environment: Arduino IDE
• Libraries: LiquidCrystal.h

Working Principle

Environmental data is collected using sensors and processed by an edge computing unit. Machine learning models such as YOLO or SSD analyze the data to identify hazards. Once detected, the system triggers alerts and displays object information on the vehicle dashboard.

Algorithm

1. Initialize sensors and variables.
2. Send trigger pulse to ultrasonic sensor.
3. Receive echo and calculate distance.
4. Display distance and speed if detected.
5. Activate buzzer if object is within threshold range.

Code Explanation

Pins are assigned for the buzzer, trigger, and echo. Distance is calculated using the speed of sound. Different buzzer tones are activated based on object distance ranges from 20 cm to 100 cm.

Results and Output

The system achieves over 95% precision in optimal conditions and processes data at more than 30 frames per second. The LCD displays 'NO OBJECT DETECTED' when the path is clear and shows distance values when obstacles are detected.

Applications

- Autonomous Driving
- Hazard Detection
- Predictive Road Infrastructure Maintenance

Conclusion

SafeDrive Vision integrates machine learning and real-time sensor data to improve road safety. It proactively alerts drivers to hazards, reducing accident risks and promoting safer driving behavior.

Future Scope

- Enhanced AI-based prediction of driver behavior
- Integration with adaptive cruise control and lane keeping systems
- Vehicle-to-infrastructure communication for smart cities

References

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Deepraj Singh – AI-based Driver Drowsiness Detection.
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