COMPUTER VISION SYSTEM FOR AUTONOMOUS VEHICLE NAVIGATION

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ABSTRACT

An advanced Computer Vision (CV) system for autonomous vehicle navigation using deep neural networks. The system employs Convolutional Neural Networks (CNN) for real-time object detection and classification. Integration with Global Positioning System (GPS) and Light Detection and Ranging (LiDAR) sensors provides robust environmental perception. The invention includes Graphics Processing Unit (GPU) acceleration for processing High-Definition (HD) video streams at 60 frames per second. Machine Learning (ML) algorithms enable adaptive behavior in varying weather conditions. The system achieves 99.2% accuracy in pedestrian detection and obstacle avoidance using Artificial Intelligence (AI).

BACKGROUND

Autonomous vehicles require sophisticated Computer Vision systems to navigate safely. Existing systems using traditional image processing struggle with complex scenarios such as adverse weather, low-light conditions, and crowded urban environments. Radio Frequency Identification (RFID) and basic camera systems (see US 9,234,567) provide limited functionality. Recent developments in Deep Learning have enabled better object recognition, but real-time processing remains challenging. Prior art includes lane detection systems (US 9,345,678) and basic obstacle detection (US 9,456,789), but these lack the comprehensive environmental understanding needed for full autonomy.

DETAILED DESCRIPTION

The system architecture comprises multiple neural network modules operating in parallel. The primary CNN processes camera inputs through a series of convolutional layers with Rectified Linear Unit (ReLU) activation functions. Feature extraction utilizes a modified ResNet architecture pre-trained on ImageNet dataset. Sensor fusion combines data from camera, LiDAR, Radio Detection and Ranging (RADAR), and GPS modules. The Central Processing Unit (CPU) coordinates data flow while the GPU handles intensive neural network computations. Results are transmitted via Controller Area Network (CAN) bus to the vehicle's Electronic Control Unit (ECU). The User Interface displays processed data on a Liquid Crystal Display (LCD) screen, providing real-time visualization of detected objects. System diagnostics are accessible via Universal Serial Bus (USB) connection for maintenance purposes.

REFERENCES CITED

U.S. Patent Documents:
US 9,234,567 - Basic vehicle camera system (2019)
US 9,345,678 - Lane detection system (2020)
US 9,456,789 - Obstacle detection method (2021)
US 9,567,890 - Sensor fusion for vehicles (2022)

Foreign Patent Documents:
EP 3567890 - Autonomous navigation system (2023)
WO 2023/098765 - Deep learning for vehicles (2023)