Autonomous Vehicle AI System Documentation

Overview

Autonomous vehicles rely on artificial intelligence (AI) to navigate through complex environments, detect objects, avoid collisions, and ensure safety. While these systems perform well in well-structured environments (e.g., urban areas with clear roads), their performance degrades significantly in rural or unfamiliar environments. The following system is designed to enhance the robustness of autonomous vehicles by integrating object detection, novel object detection, and decision-making for collision avoidance.

System Capabilities

1. Known Object Detection: The system can detect objects that are predefined and recognized from training datasets (e.g., pedestrians, vehicles, traffic signs).
2. Novel Object Detection: The system can identify unfamiliar or unknown objects that it has not encountered before, which may be critical for environments with unforeseen obstacles, such as fallen trees, animals, or unusual debris.
3. Collision Avoidance: Based on the detection of both known and novel objects, the system can make real-time decisions to avoid collisions by steering, stopping, or decelerating.

System Architecture

1. Video Stream Input: A continuous video feed from onboard cameras that serves as the vehicle's primary sensory input.
2. Object Detection Module: This module uses deep learning models like YOLOv8 to detect known objects in the video stream.
3. Novel Object Detection Module: This module relies on techniques such as autoencoders detection algorithms to detect objects not previously seen by the system.
4. Decision-Making Module: Based on the object detection output, the decision-making module implements path-planning algorithms (e.g., A* algorithm or reinforcement learning) to avoid collisions.