**Lane Detection System for Autonomous Vehicles**

Abstract:

The development of self-driving cars and advanced driver-assistance systems (ADAS) heavily relies on lane detection algorithms for safe and efficient navigation. This project implements a Lane Detection System using computer vision and deep learning techniques, enabling vehicles to accurately detect and follow lane markings in real-time.

The system processes video footage from dashcams and applies image processing techniques such as edge detection (Canny), Hough Transform, and region-based segmentation to detect lane boundaries. Additionally, deep learning-based approaches (CNNs and segmentation models like U-Net or YOLO) can be used to improve robustness under various road conditions (rain, fog, night-time driving).

The project can be integrated into ADAS systems to assist human drivers in lane-keeping, reducing the risk of accidents caused by lane departures. Furthermore, it serves as a foundational component for fully autonomous navigation systems.

Pre-requisites:

Software & Libraries:

* Python (≥ 3.7)
* Jupyter Notebook / OpenCV (for image processing)
* Computer Vision Libraries:
  + OpenCV
  + PIL (Pillow)
* Deep Learning for Advanced Detection:
  + TensorFlow / Keras / PyTorch (for CNN-based lane detection)
  + U-Net / YOLO (for segmentation tasks)
* Image Processing Techniques:
  + Canny Edge Detection
  + Hough Transform
  + Gaussian Blur

Hardware Requirements:

* Minimum: 8GB RAM, Dedicated GPU for real-time processing
* Recommended: 16GB+ RAM, Nvidia GPU (for deep learning-based detection)