

Project Overview

This project is a **self-driving car** using **Raspberry Pi 4**, capable of:

- **Lane Following** 🚦 : Detects and follows a **white lane on a black road**.
- **Traffic Light Detection** 🔴 : Stops at **red lights**, moves at **green lights**.
- **Obstacle Avoidance** 🚧 : Uses an **ultrasonic sensor** to stop if obstacles are within **15 cm**.
- **Adaptive Cruise Control (ACC)** 🚗 : Adjusts speed based on **distance from objects** ahead.
- **Object Detection & Text Recognition** 📷 : Identifies objects and reads text using **YOLOv4 & OCR**.

Hardware Components

Component	Description
Raspberry Pi 4	Main controller
Pi Camera	Vision-based lane detection & object recognition
L298N Motor Driver	Controls DC motors
DC Motors (x2)	Left and right wheels
HC-SR04 Ultrasonic Sensor	Detects obstacles
Battery Pack	Power supply

🔧 Features & Functionality

1️⃣ Lane Following

- Uses **OpenCV** to detect **white lane lines**.
- Adjusts **steering** dynamically to stay centered.

2️⃣ Traffic Light Detection

- **Red Light** → Stop 🚦
- **Green Light** → Move 🚗
- Uses **HSV color filtering** to detect signals.

3️⃣ Obstacle Avoidance

- **Ultrasonic sensor** detects obstacles **within 15 cm**.
- Car **stops automatically** to prevent collisions.

4️⃣ Adaptive Cruise Control (ACC)

- Adjusts speed based on **distance from the front vehicle**.
 - **>50 cm → Speed up**
 - **30-50 cm → Maintain speed**
 - **<30 cm → Slow down**
 - **<15 cm → Stop**

5 Object Detection & Text Recognition

- Uses **YOLOv4-Tiny** to detect objects (cars, people, traffic signs, etc.).
- Uses **Tesseract OCR** to recognize text in images.

Code Structure

```
├── cruise_control.py    # Adjusts car speed based on distance
├── lane_tracking.py     # Detects and follows lane
├── traffic_light.py     # Stops/moves based on traffic lights
├── obstacle_avoidance.py # Stops car if an obstacle is detected
├── object_detection_text.py # Detects objects and recognizes text
└── README.md           # Project documentation
```

Installation & Setup

Install Dependencies

```
sudo apt update
```

```
sudo apt install tesseract-ocr
```

```
pip install pytesseract opencv-python numpy
```

Download YOLO Model Files

```
wget https://raw.githubusercontent.com/pjreddie/darknet/master/cfg/yolov4-tiny.cfg
```





```
wget https://pjreddie.com/media/files/yolov4-tiny.weights
```

```
wget https://raw.githubusercontent.com/pjreddie/darknet/master/data/coco.names
```

Running the Scripts

- **Lane Tracking:** `python3 lane_tracking.py`
- **Traffic Light Detection:** `python3 traffic_light.py`
- **Obstacle Avoidance:** `python3 obstacle_avoidance.py`
- **Object Detection:** `python3 object_detection_text.py`
- **Cruise Control:** `python3 cruise_control.py`

Future Enhancements

- Stop Sign Detection 
- GPS Navigation 
- Voice Commands 
- LIDAR-based Collision Avoidance 

License

This project is **open-source** under the **MIT License**.

Contact

For questions or contributions, open an issue on GitHub or reach out via email.

 Built with Raspberry Pi & OpenCV - Let's Drive into the Future! 