Group #1

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Autonomous Driving System Simulation

project description

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Proposed To:

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1 Context

- The automotive industry is rapidly evolving with advancements in autonomous driving technology. Self-driving cars rely on computer vision, sensor fusion, localization, and motion planning to navigate safely and efficiently. This project taken from DSwithBappy on Youtube aims to develop self-driving car technology using computer vision techniques.

2 Problem Statement

- Traditional driving relies on human perception and decision-making, which can lead to accidents due to human errors. Autonomous vehicles aim to improve safety, reduce traffic congestion, and enhance mobility for people with disabilities. However, self-driving technology faces challenges such as accurate perception, real-time localization, and optimal motion planning in dynamic environments.

3 Objectives

- Understanding Self-Driving Car Fundamentals
- Mastering Computer Vision for Autonomous Driving
- Developing Perception & Sensor Fusion Techniques
- Implementing Path Planning & Navigation
- Hands-on Coding & Implementation
- Testing & Simulation of Autonomous Systems

4 Constraints

- **Real-time processing:** The system should work with minimal latency.
- **Computational efficiency:** Algorithms must run on available hardware without excessive resource consumption.
- **Data availability:** Simulated environments provide synthetic data, but real-world datasets may be needed for additional validation.
- **Simulation limitations:** Simulators may not fully replicate real-world conditions.

5 Users

- **AI/Robotics Engineers:** Develop and refine the autonomous driving model.
- **Researchers & Students:** Use the system for academic learning and research.
- **Automotive Companies:** Prototype and test AI models before real-world deployment.

6 Functional Needs

- **Planning:** Generate safe and efficient trajectories in dynamic environments.
- **Control:** Adjust vehicle speed and direction for smooth navigation.
- **Motion Control & Decision-Making** :Control vehicle acceleration, and steering and implement AI-driven decision-making for safe driving.

7 Non-Functional Needs

- **Real-time processing:** The system must respond within milliseconds.
- **Scalability:** Should be extendable for real-world implementation.

8 Hardware and Software Environment

Hardware:

- High-performance GPU (e.g., NVIDIA RTX 30xx) for deep learning models.
- High-speed processors for real-time execution.

Software:

- CARLA Simulator (for testing and validation).
- Python, OpenCV, PyTorch/TensorFlow (for AI models).
- ROS (Robot Operating System) for communication.
- Autoware/Apollo (optional) for real-world autonomous driving frameworks.

9 Project Planning

Phase	Tasks	Duration
sprint 1	-simulator download -data loading and processing	3 Weeks
sprint 2	-data balancing -training and validation split -applying data augmetation	3 Weeks
sprint 3	-image preprocessing -batch generator -implementing nvidia model	3 Weeks
sprint 4	-model training -environment and requirements setup -testing the model	3 Weeks

Thank You