Software Design Document

Product: Final Project.

Status: Work in progress.

Description: Self-driving car RC car project.

Team Project:

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Introduction:

Autonomous vehicles are automobiles that can move without any intervention by detecting the road, traffic flow and surrounding objects with the help of the control system they have. These vehicles can detect objects around them by using technologies and techniques such as RADAR, GPS, Odometry, Computer Vision. The autopilot drive of autonomous vehicles starts briefly with the ultrasonic sensors on its wheels, detecting the positions of vehicles that are braking or parked, and data from a wide range of sensors(Cameras , GPS etc..) are analysed with a central computer system and events such as steering control, braking and acceleration are performed.

Purpose:

We are aiming to add emergency vehicle priority awareness feature to autonomous cars. In our project, we plan to use Artificial Intelligence, Machine Learning, Image Processing methods and test the results in simulation environment. The Autonomous Vehicle Drive Simulator that we will use need to provide us to simulate sensors such as GPS, radar and gives potential sensor outputs.

Tools to be used in this project:

1.OpenCv Library

2.Nvidia Jet Racer Interface

3.YoloV5 / RCNN / Mobile Net v2.

4.Deep Sort / Kalman filter for tracking purpose.

Hardware:

A Jetson nano micro-processor:

1.Collecting the frames of the Realtime video.

2.Navigating the vehicle.

3.Compassing information.

4.Running the AI models for e.g. YoloV5 & Deep Sort.

5. Running the Computer vision's algorithms (OpenCV library).

6.Andruav for Navigating.

7. Two android phones connected to transfer data.

Cameras:

1.Camera for lane detection.

2. Camera for object detection.

1.2 Scope

Approximately 1.35 million people die in car accidents each year, on average 3,700 people lose their lives every day on the roads. An additional 20-50 million suffer non-fatal injuries, often resulting in long-term disabilities. More than half of all road traffic deaths occur among vulnerable road users—pedestrians, cyclists, and motorcyclists. Road traffic injuries are the leading cause of death among young people aged 5-29. Young adults aged 15-44 account for more than half of all road deaths. More than 90% of all road fatalities occur in low- and middle-income countries, even though these countries have approximately 60% of the world’s vehicles. On average, car accidents cost countries 3% of their gross domestic product. Car accidents are the single greatest annual cause of death of healthy U.S. citizens traveling abroad.

1.4 Overview of document

This document is divided into several sections (see Table of Contents) with intended readers being developers and software managers. Sections have, however, been written in a manner that can be understood by anyone having basic knowledge about the software.

This Software Design Specification also includes:

1. System architecture description

2. A detailed description of components

3. Reuse and relationships with other products

4. Design decisions and tradeoffs

The design has been made clear using class diagrams and sequence diagrams.

2. Conceptual Architecture

2.1 Overview of models and component

1. Jetson-Nano

1. Camera: The camera module is responsible for capturing what is right in front of the car. This camera data is processed by the machine learning algorithm to judge the car's environment.

2. Compass (Andruav, Autopilot): The compass module provides the car's current heading direction and helps correct the car's direction of motion.

3. Machine Learning Algorithm: The machine learning algorithm is at the heart of this project. The model processes visual data from the Android device to judge the car's environment and control the car's motion.

2.2 Structure and relationships

The structure and hierarchy of the system can be understood from the following structural diagram

3. Logical Architecture

3.1 sequence Diagram

