Race of D.O.O.M

Driving Obediently On the Motorway

Team 8

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Project Overview

Main Objectives:

- *Developing an autonomous RC car prototype for future groups to expand upon*

- *This autonomous vehicle will be required to safely navigate around certain obstacles*

Project Overview

Obstacles:

- *Construction*
- *Crosswalks*
- *Stop signs*

Requirements – Functionality

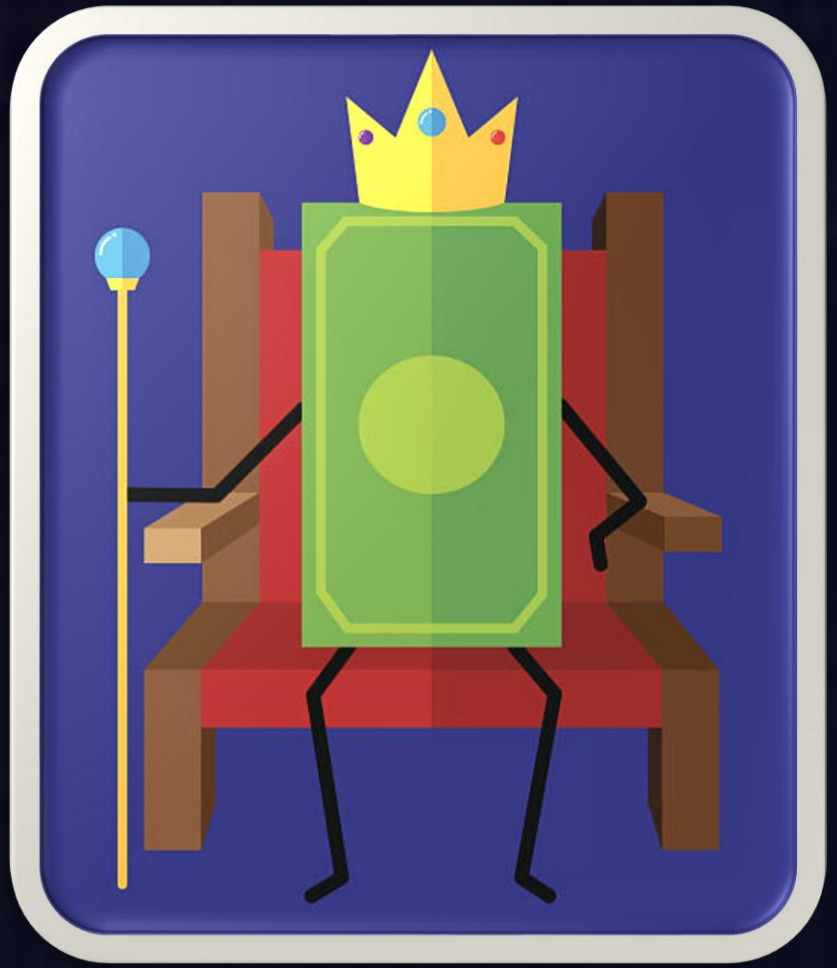
- *Vehicle can move in every direction autonomously*
- *Using sensors and cameras as its eyes and ears to make human-like decisions*
- *Camera detection and reaction to signs*
- *Using sensors to stay in the lanes and avoid walls*

User

- *Autonomous Vehicle Enthusiast*
- *Unsafe Drivers*
- *Driving Haters*

Constraints

- *$500 budget*
- *Processing Power*



Milestones – Semester 1

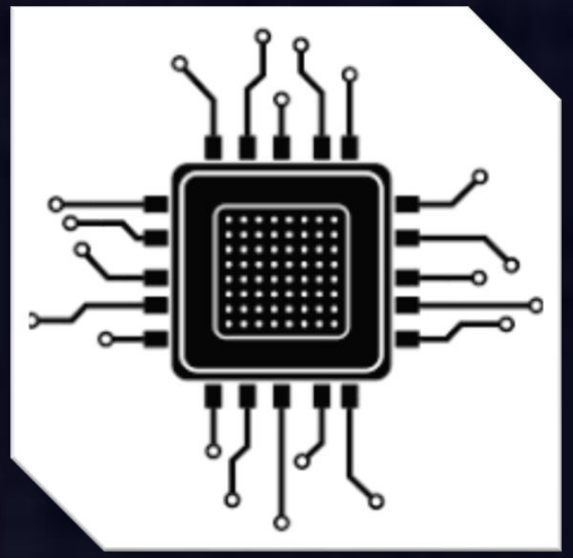
- *Analyze Previous group's project(s)*
- *Decide direction/ reason for our project*
- *Gather Components - Research*
- *Deconstruct Car*
- *Component Integration*
- *Basic Movement*

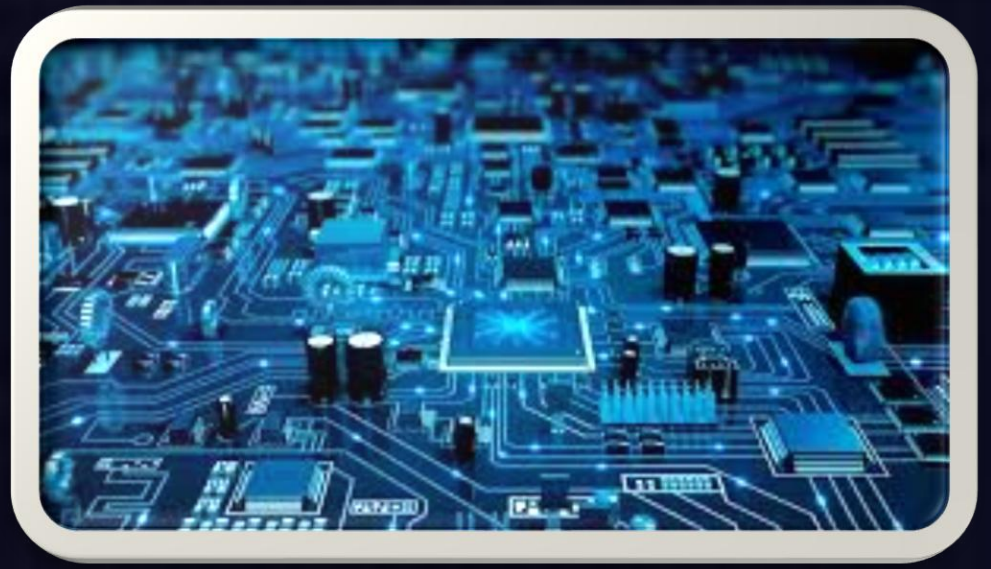
Milestones – Semester 2

- *Autonomous Movement*
- *Component Communication*
- *Sign Identification*
- *Obstacle Avoidance*
- *Quality Documentation*

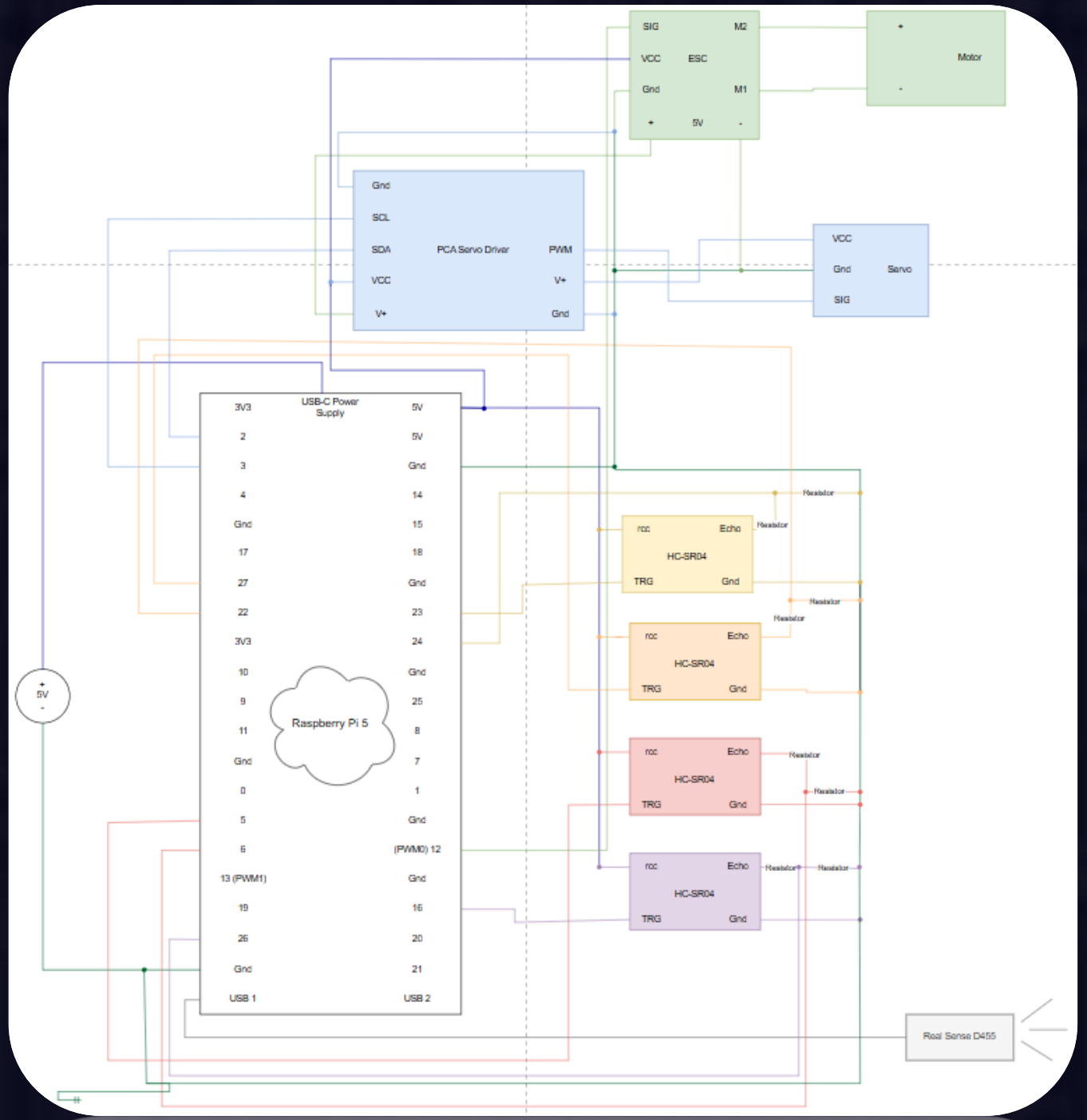
Hardware Resources

- *Traxxas Slash*
- *Servos*
- *Motor/ESC*
- *PWM/Servo Driver*
- *Raspberry Pi 5*
- *RealSense D455 Depth Camera*
- *HC-SRO4 Ultrasonic Sensors*

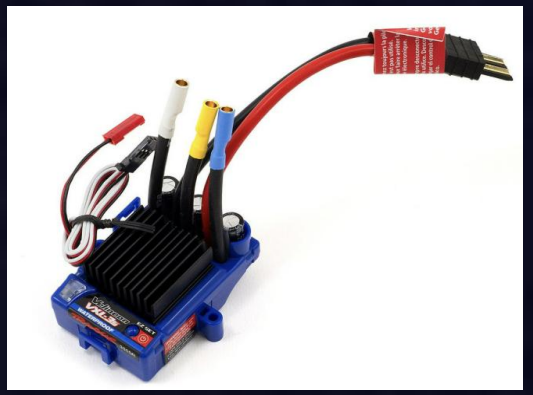




Hardware Design

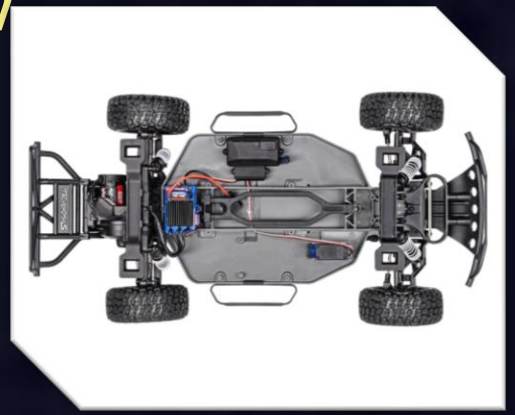


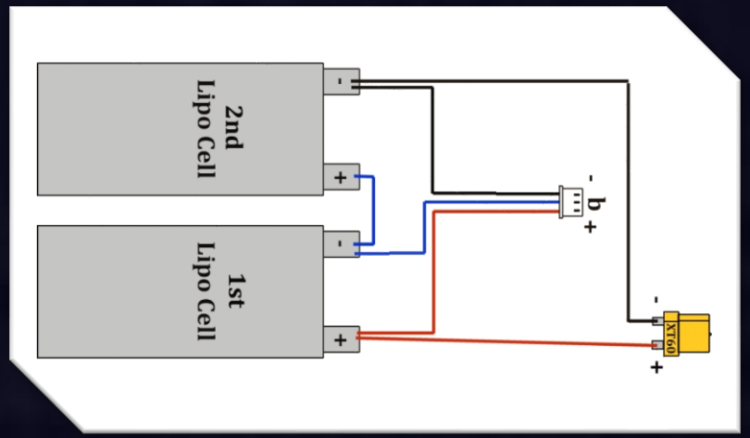
Traxxas Slash



Components

- *Traxxas Velineon VXL-3s Brushless Power System*
  - *Motor Controller with internal programming (ESC)*
  - *Brushless motor directly connects to ESC*
- *Adafruit PCA 9865 16-Channel PWM Driver*
  - *Utilized for servo steering control*
  - *Interface is precise for making turns*
- *7.4V Lipo Battery*

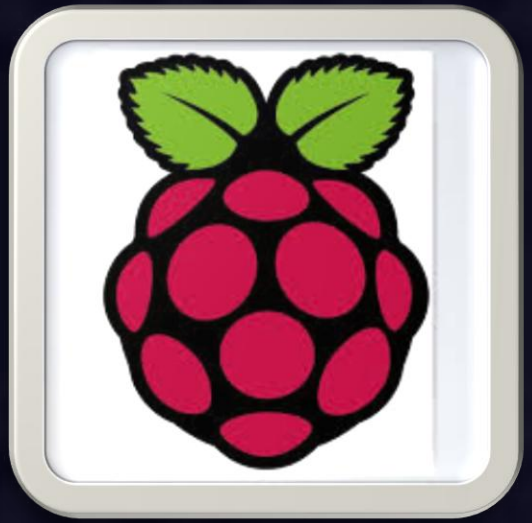




Raspberry Pi 5

- *Strengths:*
  - *Central processing controlling all peripherals of the car*
  - *GPIO Interface to communicate between components*

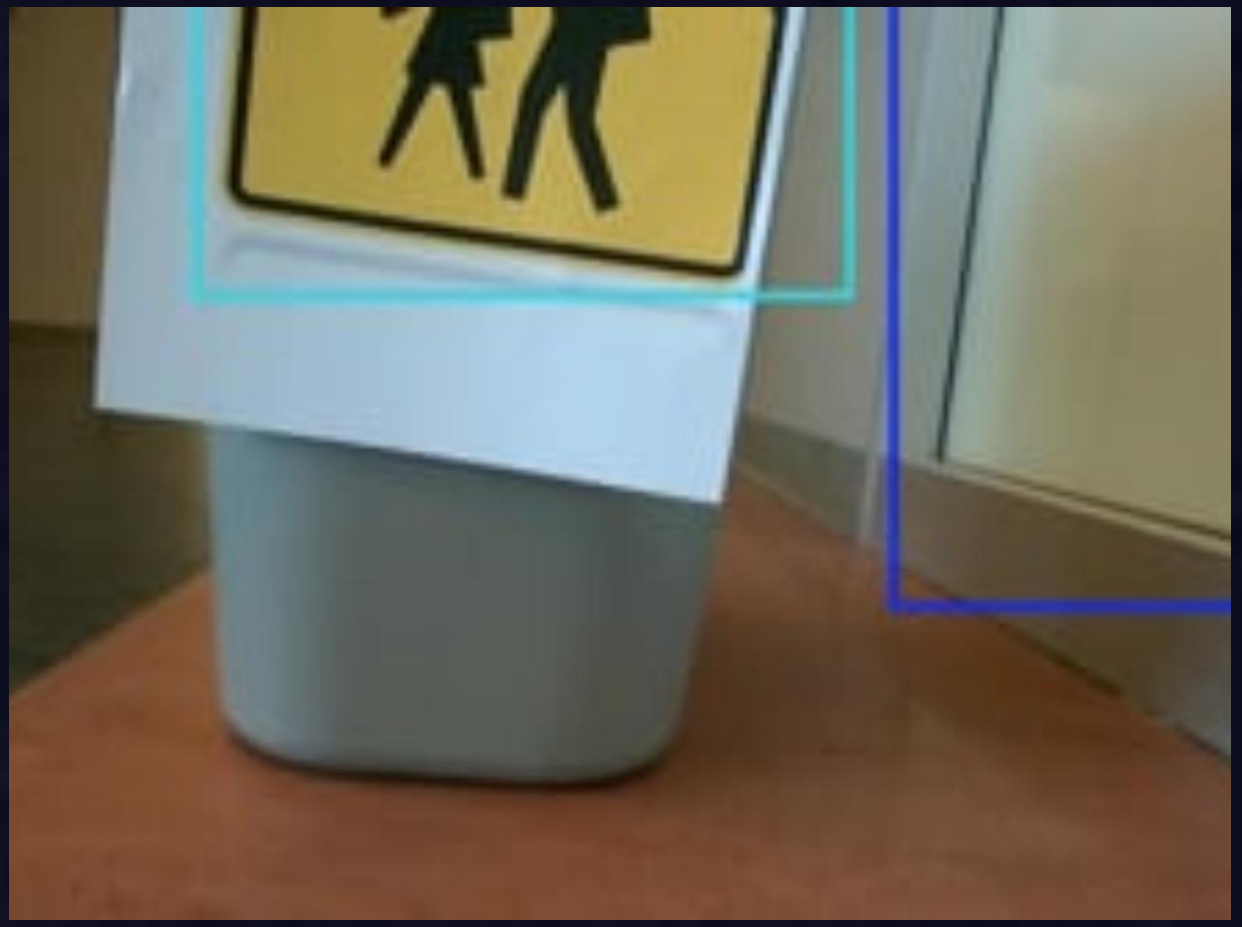
- *Weaknesses:*
  - *Processing power*



RealSense Camera

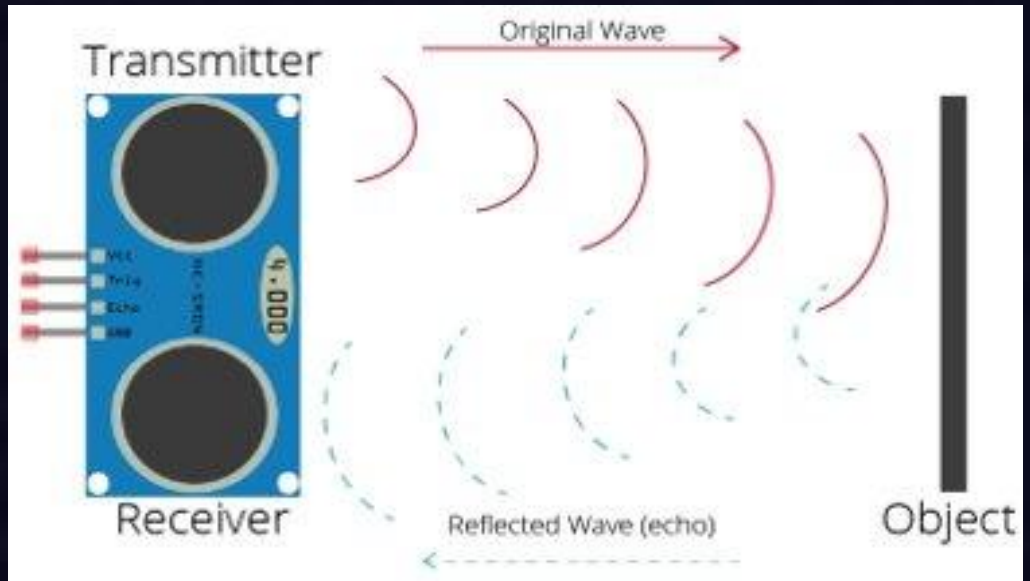
- *Real time visual display*
- *RGB display for color and pattern recognition*
- *Working on current RealSense SDK*
- *Mounted on the front of the car as the eyes*
- *Object Detection model trained from roboflow*

RealSense Camera



Ultra-Sonic Sensors

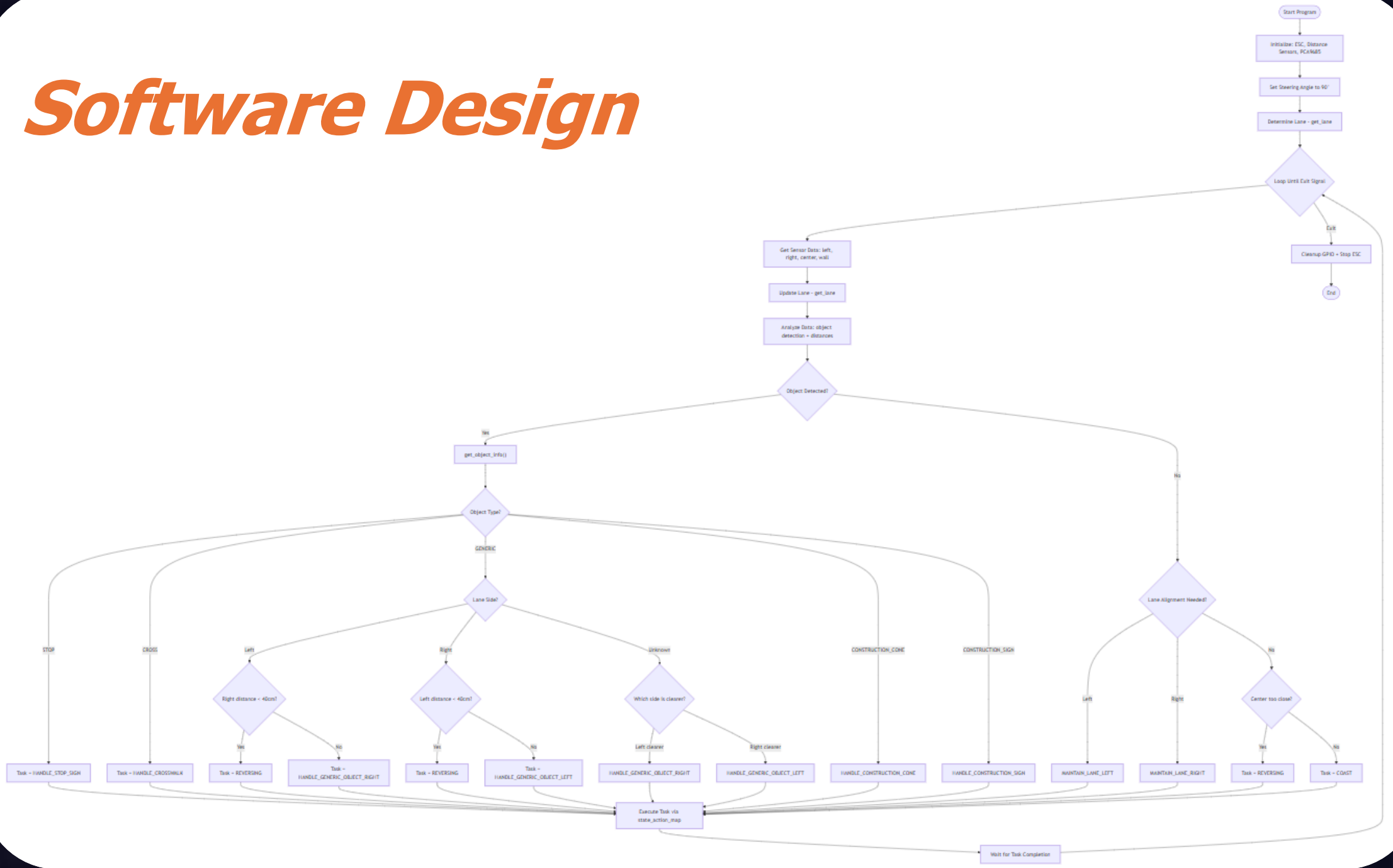
- *Strengths:*
  - *Cost effective*
  - *Ease of Use*
- *Weaknesses:*
  - *Limited Range (2m)*
  - *Occasional inaccurate Readings*



Software Design Components

- *Frontend*
  - *Language - python*
    - *Gpiozero – Controlling peripherals*
    - *Asyncio – Non-blocking sensor operations*
    - *I2C Interfacing – Communication with Adafruit PCA 9685*
    - *State Machine Based Approach – Intuitive Decision Making and Task Execution*
- *Backend*
  - *Language - Python*
    - *Flask – To allow clients to make requests*
    - *Pyrealsense2 – For reading depth/color frames*
    - *Roboflow – Object Detection dataset generation for training*
    - *Ultralytics – AI computer vision training*

Software Design



Future of the Project

- *Algorithm based Navigation*
- *Smoother flow of the car with a fully designed motor*

Demo

Thank You!