IGV: Intelligent Ground Vehicle

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Team Introduction

Intelligent Ground Vehicle is a student led club at UCI which encompasses the very latest technologies impacting industrial development and taps tpas into core engineering subjects of high interests to students.

The concept of IGV relates to the upcoming future of the automotive industry that the top companies like **Zoox**, **Tesla**, and **Cruise** etc are leading towards, Self-Driving vehicles. Students at all levels of undergraduate can contribute to the team efforts, and those at lower levels (Freshmen, Sophomore) benefit greatly from the experience and mentorship of the seniors.

UCI IGV is an united team that welcomes all the engineering students who have the **passion to do something out of the box**, who are **accountable**, and willing to **learn and bring something new to the table**!

Project Objectives

The goal for students in IGV is to implement skills gained in classes while designing the vehicle and developing a method to allow it to navigate through the obstacle course. This includes usage of **Finite State Machines**, **Ultrasonic** and **GPS Sensors**, and **microcontrollers**.

The goal for Fall 2020 is to have a fully prepared design ready for manufacturing and modeled with the appropriate software. Our objective is to create a vehicle able to carry the necessary payload to complete any obstacle course it is put through. The goal for the year 2020-2021 is to compete at IGVC online under the **Auto-NAV Challenge**, **Design Competition**, **IOP Challenge**, **Self-Drive Challenge**, and **the Cyber Challenge**.

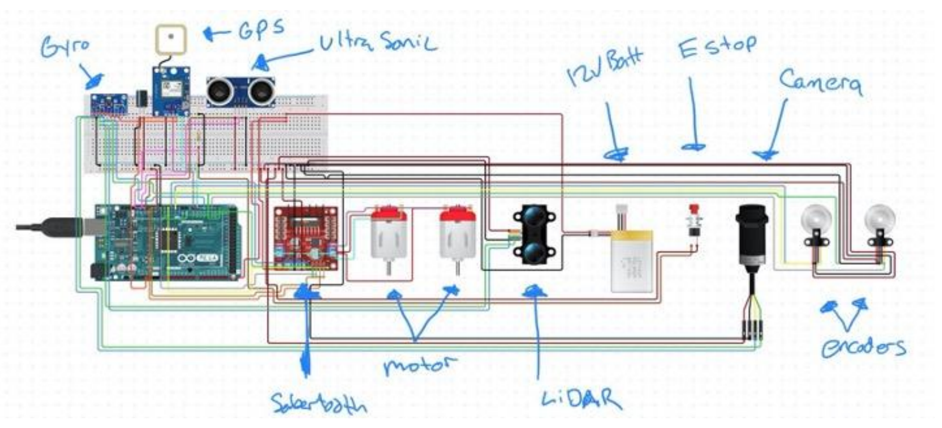
Mechanical

IGV aluminum 6061 frame is designed to reduce stresses over 50%, while minimizing weight(**~175 lbs**). With a low center of mass, this vehicle is designed to be compact and maneuverable. We believe this is will be a winning design for the IGV competition in 2021.

Figure 1: The Final CAD Assembly

Electrical

The circuitry was designed with efficiency and reliability in mind. Having all sensors powered by the Jetson Nano allows for easy debugging in case of failure. Two worm drive motors are controlled by the Sabertooth Dual 2x32A 6V-24V Regenerative Motor Driver, with rotary encoders to control speed and direction. There is a LIDAR scanner and ultrasonic sensor for lane and optical detection as well.



Controls

A turtlebot was used to simulate the vehicle's movement and obstacle avoidance in Gazebo in conjunction with the MATLAB ROS toolbox. The turtlebot uses vector field histograms to compute obstacle-free steering directions (Figure X).

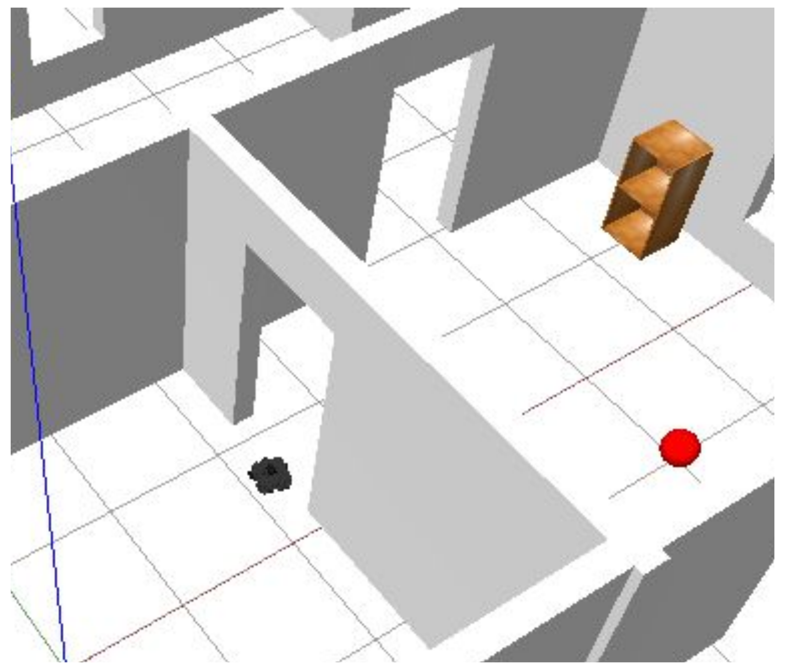


Figure 2: Turtlebot simulating obstacle avoidance in Gazebo

A Nvidia Jetson Nano is the brains of the vehicle. Using the OpenCV image and video processing modules we have written code in C++ to take camera input and find lanes as well as objects.

Figure 3 & 4: The black and white image is the processed output from the JetsoNano. The lines are drawn to match what the program output.

Future Goals

Future Design Tasks:
-Motors/shaft
-Weather-proofing material
-Manufacturing

Future Electrical Tasks:
- Run simulations with mechanical components in mind
- secure lab space for testing and debugging of circuits

Future Controls Tasks:
- Implement CAD model of the vehicle in Gazebo
- Make a model of the track in Gazebo