AUTONOMOUS RC CAR

A platform for rapid Autonomous prototyping and development.

INTRODUCTION

The purpose of this project is to produce an autonomous driving RC car that is able to solve many of the same problems full-scale autonomous vehicles are currently having to work on such as classifying objects, detecting static and dynamic obstacles, and making the proper movement based on the determined situation.

PROJECT GOAL

Our main goal is to implement a fully autonomous RC car that can navigate a busy room without collisions; functionality-wise, it should be similar to a full-sized autonomous vehicle.

REQUIREMENTS

The car is equipped with LiDAR, and optical sensors in order to provide the proper data. The car will need to travel between predetermined points A and B safely. It will also need to avoid static objects, as well as to predict and avoid moving obstacles. This car should also be able to navigate extreme circumstances such as quickly appearing obstacles. The testing criteria will be to instruct the car to drive down a road and return back to the starting point.

Oregon State University

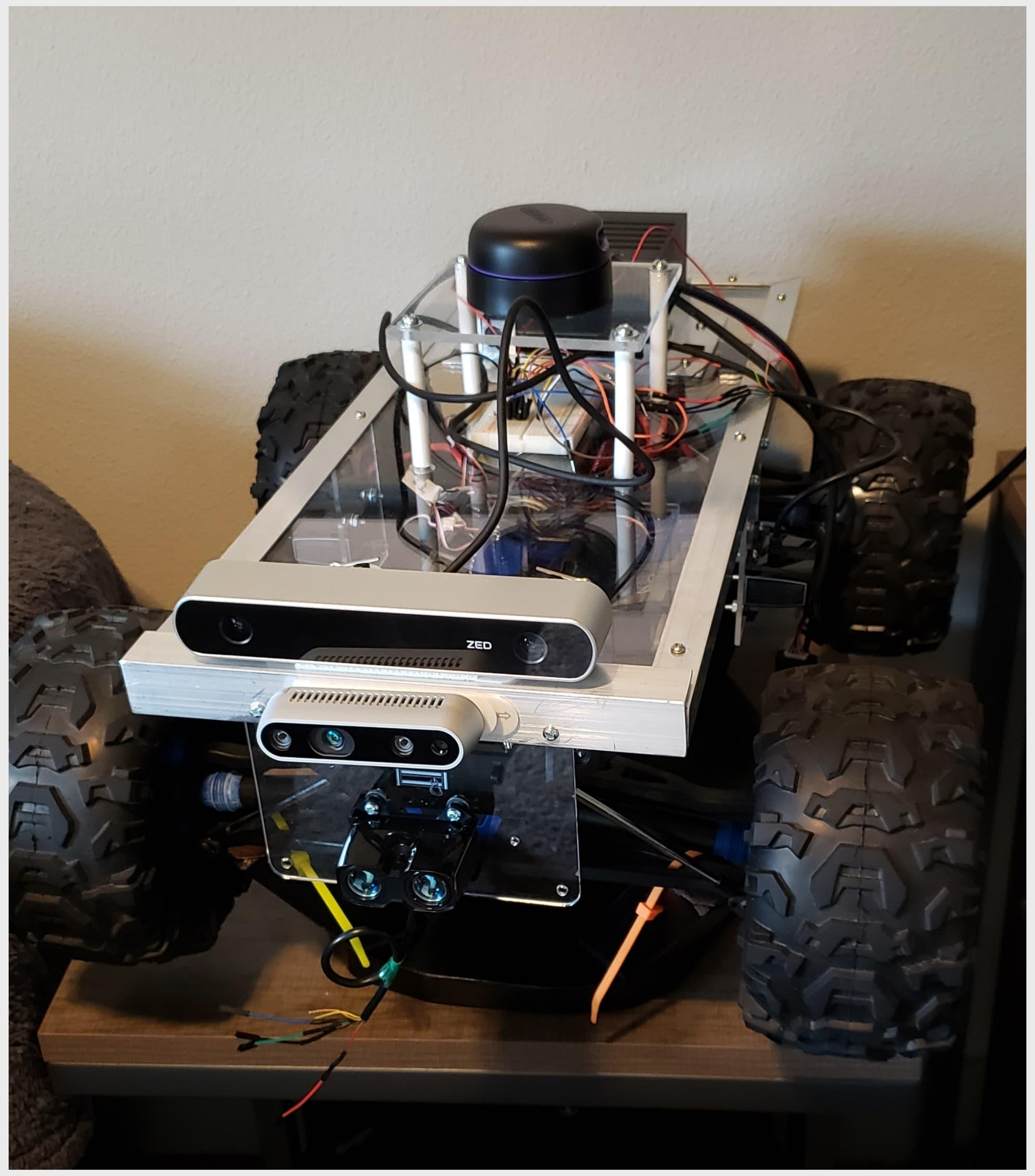

Figure 1: R/C car with all the components.

DESIGN SOLUTION

The RC car utilizes various sensors, as well as a Jetson AGX Xavier and Pixhawk 4, all mounted on top of a Traxxas car body.

The design solution includes intelligent positioning of the sensors to receive optimal sensory data.

Using ROS (Robot Operating System) and the RPLIDAR laser data, we are then able to construct a 2-dimensional grid map of the car's surroundings, a procedure known as simultaneous localization and mapping.

COMPONENTS

Our car utilizes 8 different sensors to reach full autonomy.

- 4 Garmin LIDAR-Lite v3HP sensors are positioned on each side of our car to provide distance readings of up to 40 meters.
- 1 Intel realsense D435i depth tracking camera is positioned on the front of the vehicle.
- 1 ZED camera for long range 3D sensing of up to 20 meters.
- 1 slamtec RPLIDAR A3 360 degree sensor. This provides us with a 360 degree model of objects within ~ 25 meters of the sensor.

CONCLUSIONS

- Development of self-driving vehicles has a wide variety of autonomous capabilities and recognition
- Basic obstacle avoidance is rather simple given sufficiently frequent sensor scans, but doesn't take into account the reasons for avoidance
- Tesla's all-optical solution provides optimal object recognition capabilities at the price of more difficult processing.
- A combination of laser scans and optical scans provides a good balance of object detection and identification, useful for prioritization.
- Technologies such as SLAM produce mostly-accurate representations of an environment that allow for pathing decisions to be made but risks fast-moving environmental changes disrupting what might be considered "normal" behavior

NVIDIA Jetson AGX Xavier - Control Computer

ACKNOWLEDGEMENTS

- BURTON MICHAEL, KULKARNI RAJAT, SASO LOGAN, ZHOU MIAO
- burtomic@oregonstate.edu, kulkarnr@oregonstate.edu, sasol@oregonstate.edu, zhuom@oregonstate.edu

- D. Kevin McGrath, Client

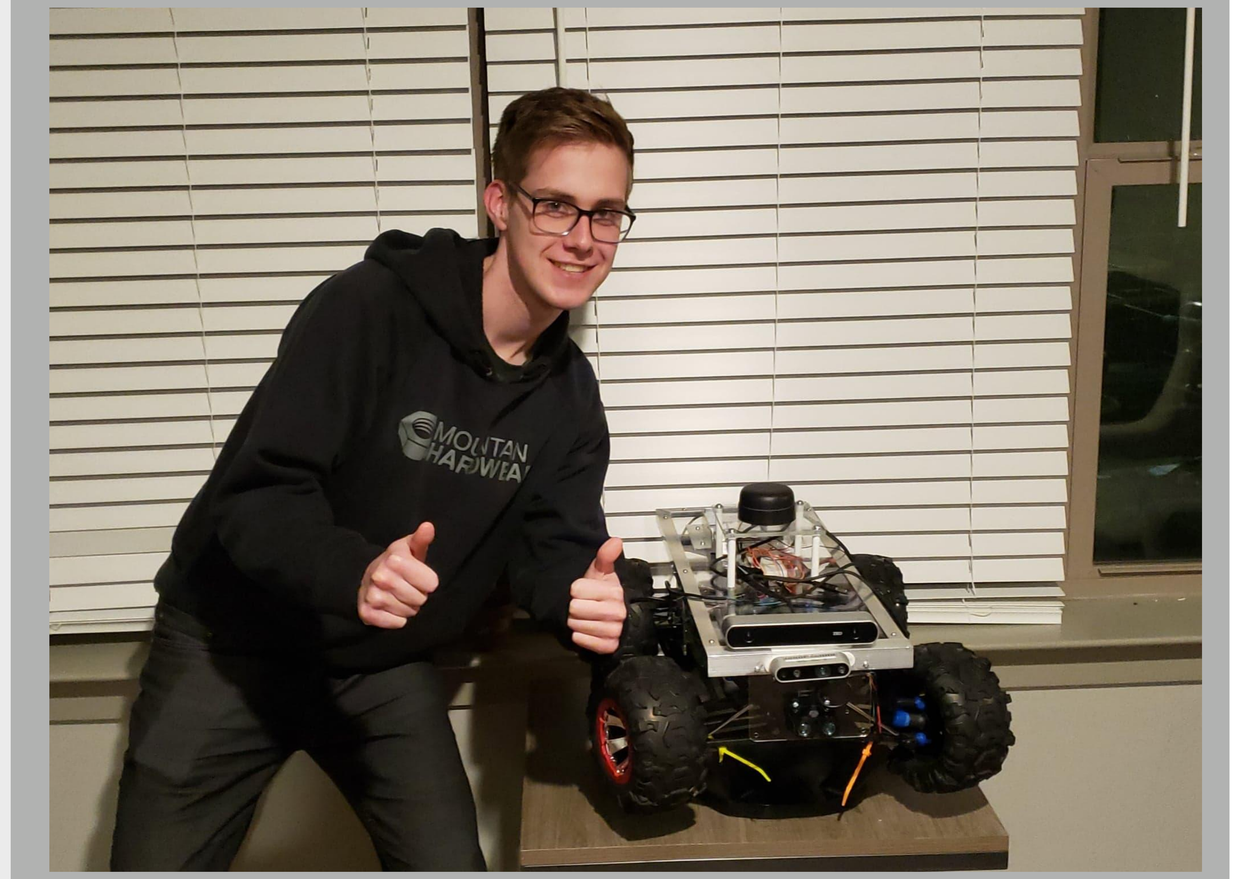

Figure 2: Michael next to the car.