Self-Driving Vehicle: Final Presentation

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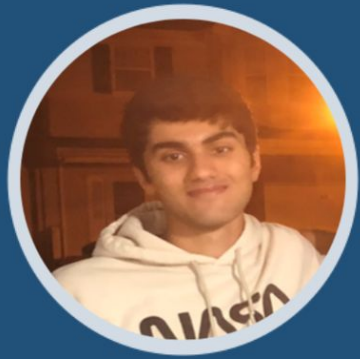

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Who we are

Useful Terms

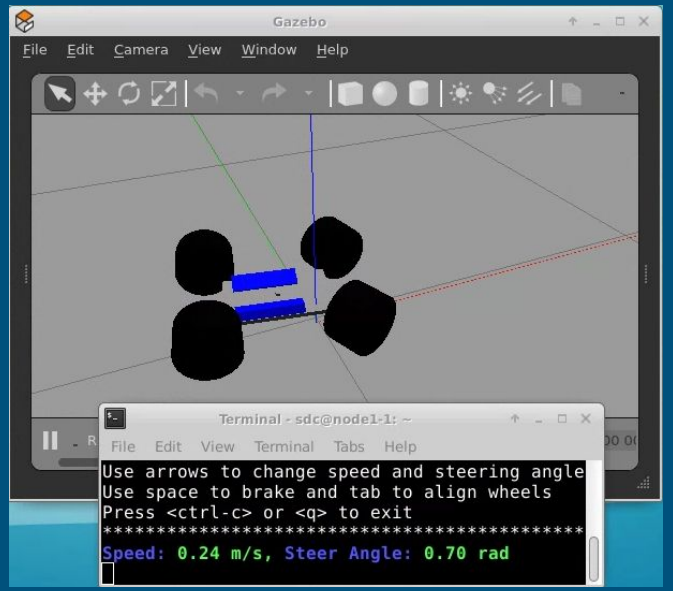
- ROS
  - Robot Operating System
  - Set of software libraries and tools used to build robot applications
- Chrome Remote Desktop
  - Allows a user to remotely access another computer
- Gazebo
  - 3D simulator that offers the ability to simulate robots operating in complex, digital environments
- Neural Network
  - Computational learning system that uses a network of different functions to understand and translate a data input of one form into a desired output

Project Objectives

- Build a fully functional self-driving vehicle
- Incorporate ROS control into simulated car software
- Write AI/machine learning algorithms for self-driving behavior
- Use Gazebo to map out simulations
- Build a physical model at WINLAB and test its autonomy in a real environment

Gazebo Simulator

- Created basic self-driving model in Gazebo
- Tested Ackermann steering
- Controlled digital model with keyop.py script
  - Adjustable speed and steering angle



Combining RealSense Point Clouds

- Accessed four RealSense camera positioned around model city intersection
- Created 3D image from each perspective and started to experiment with combining images by creating and transforming individual point clouds
  - Affine transform

Pioneer 3-DX

- The primary robot used to collect data
  - Contains onboard sensors, ROS compatibility, remote control
- Directly controlled using RosAria interface
- RealSense Depth Camera attached to top

```
**********************************************************************
*                    ROSARIA CLIENT INTERFACE                        *
*                                                                    *
*             Welcome to the RosAria client interface!               *
*                                                                    *
*        [1] go_three_second                                         *
*        [2] spin_clockwise                                          *
*        [3] spin_counterclockwise                                   *
*        [4] teleop                                                  *
*        [5] enable/disable print_state                              *
*        [6] enable_motors                                           *
*        Press [Q] to close the interface                            *
**********************************************************************
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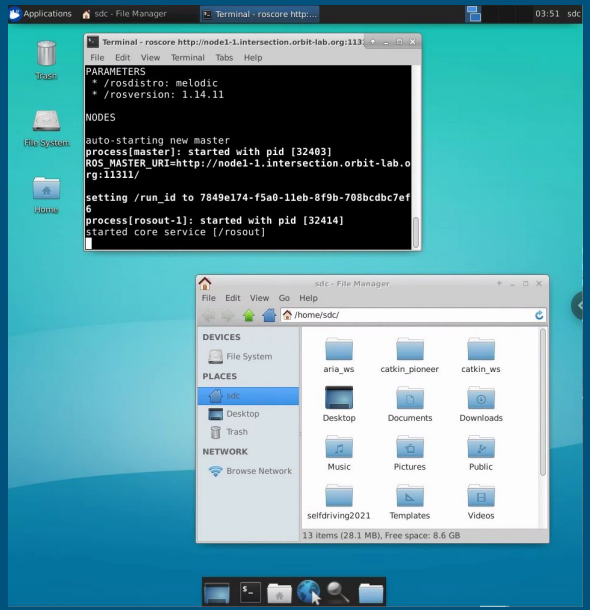
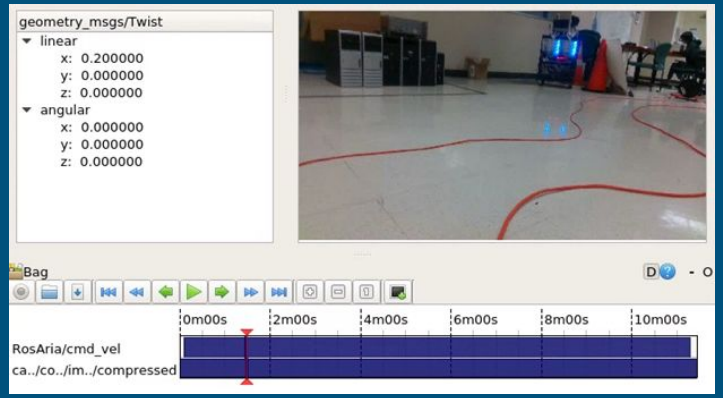
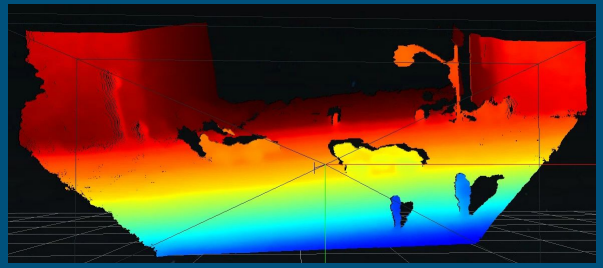


Recording Training Data

- Using RosAria to wirelessly drive Pioneer 3-DX
- Recording bag file using Rosbag package
- Subscribed to control and image topics
  - Rosaria/cmd_vel
  - camera/depth/image_raw/compressed
- Converted bag files to image (.ndz) files that were fed into 4 convolutional layers of neural network



Future Plans



- The depth sensor of the RealSense camera could provide additional training data
- Reduce the number of clients necessary to communicate between the user and the robot
- Allow for remote subscription to camera without sacrificing robot control security
- Configure RosAria onto smaller mobile robots and test self-driving behavior alongside Pioneer 3-DX in city intersection

Special Thanks

Project Advisor:

Jennifer Shane

Internship Supervisor:

Ivan Seskar

Any Questions?