Self-Driving Vehicle: Final Presentation

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Who we are
Useful Terms

❖ **ROS**
  ➢ Robot Operating System
  ➢ Set of software libraries and tools used to build robot applications

❖ **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
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
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Any Questions?