Vehicle and city simulation with Gazebo and ROS

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Background

Community interest in autonomous vehicle development

Resources for vehicle and city simulation

- Vehicle
- Environment
- Plugin
- Road network
- City
Prius Challenge

Compete for best Fuel Economy
20 teams, 9 laps, <45min
Goal: 100+ MPG (2.35 L/100km)

Prius Hybrid
Sonoma Raceway

http://priuschallenge.toyotaonramp.com/
Demo
Prius Hybrid Model

Ackerman steering

Rolling resistance
  - Modeled as joint friction torque

Aerodynamic drag
  - Modeled as force acting on CoM

Suspension
  - Allowed axle to roll for slopes and banked turns

Powertrain model
  - State machine determines combination of engine and electric motor

https://github.com/osrf/collaboration/blob/new_data/hyperdrive_json/hyperdrive_json.ipynb
ROS + Gazebo Car Demo

ROS Kinetic

Prius description URDF
- Planar Lidar
- Block Lidar
- Sonar
- Cameras

Control msg:
- Throttle, brake, steer, gear

Mcity test facility

https://github.com/osrf/car_demo
Deep Learning + Self Driving Car Demo

Nvidia End to End Learning Model

Two Nodes:

Driving

Object Detection

https://github.com/osrf/yolo_object_detector

https://github.com/osrf/tensorflow_object_detector
Ignition RNDF (Route Network Definition File)

C++ library for handling RNDF files

What is a road network definition?

Why do we need it?

Why RNDF (and not OpenDRIVE)?

Ignition RNDF features

- C++11, cross-platform, Apache 2
- In-memory representation of RNDF

https://bitbucket.org/ignitionrobotics/ign-rndf
Terminus

Generate or import simulated cities

Why is this useful?

Overview

- Procedural cities
- Import data from OpenStreetMap
- Roads + buildings
- Multiple formats
- Gazebo & Drake

https://github.com/ekumenlabs/terminus/wiki
Terminus
Summary

Vehicle model: Prius

Environment models: Mcity, Sonoma Raceway

Plugin: Powertrain model

Road networks: Ignition RNDF

Cities: Terminus
Future ideas

Vehicle models: bikes, trucks, sidecars, trailers, RVs

Environment models: curated environments with interesting features

Plugins: Traffic, pedestrians, weather

Sensors: Radar

Road networks: More formats, common API

Cities: More artificial cities
Thanks

Questions?