Vehicle and city simulation with Gazebo and ROS

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ROSCon 2017, Vancouver

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

Demo

Prius Hybrid Model

Ackerman steering

Rolling resistance

- Modeled as joint friction torque
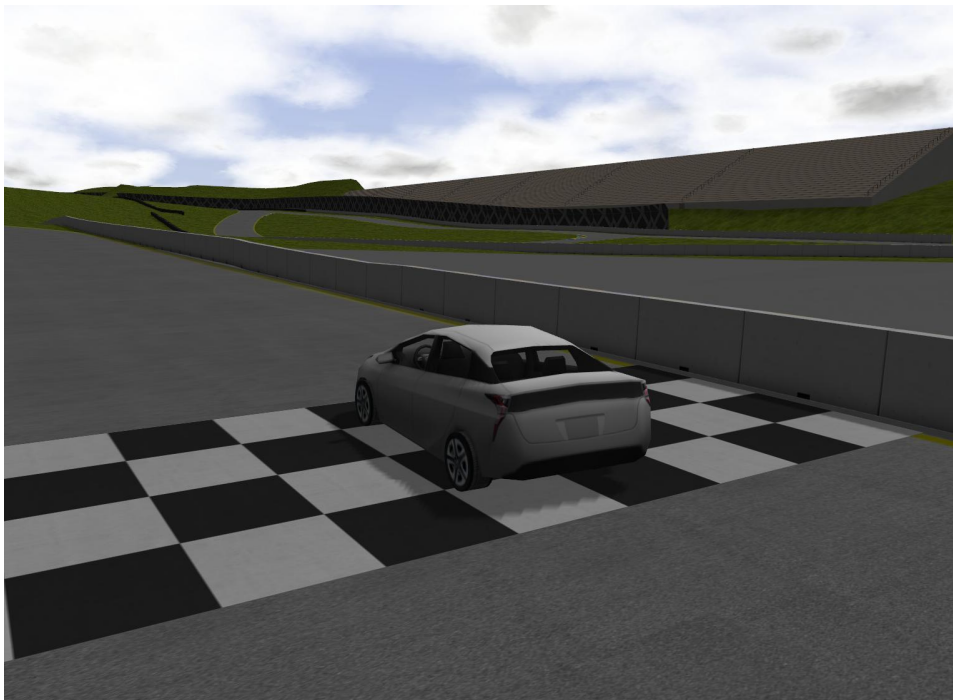
Aerodynamic drag

- 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
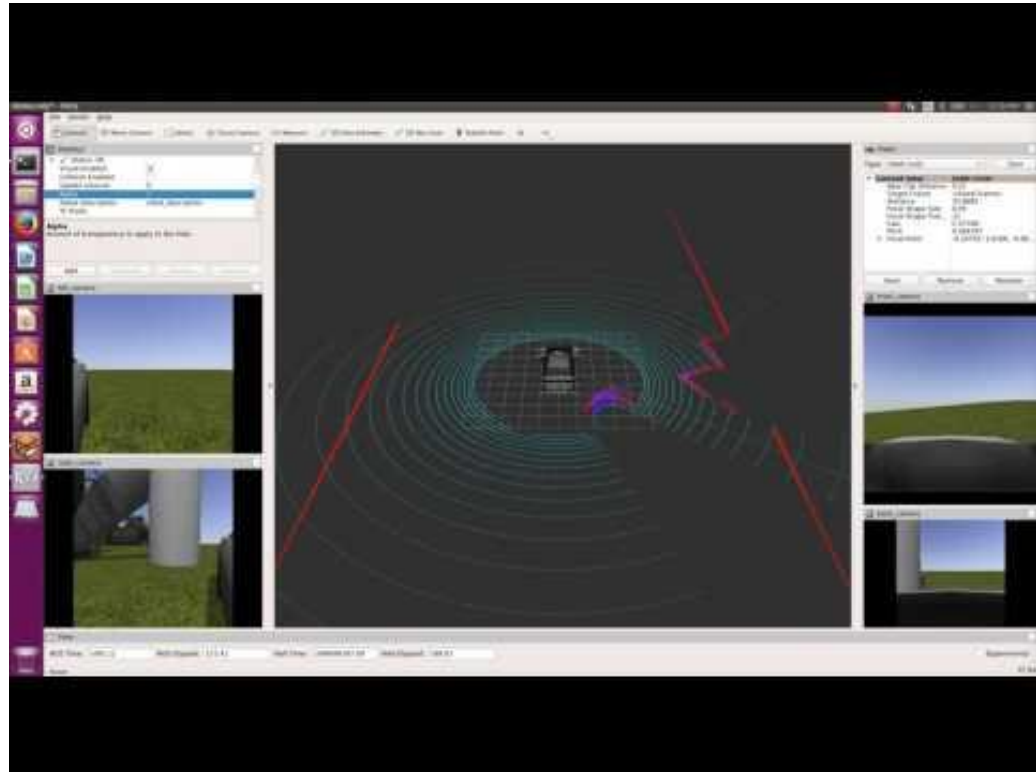
ROS + Gazebo Car Demo

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

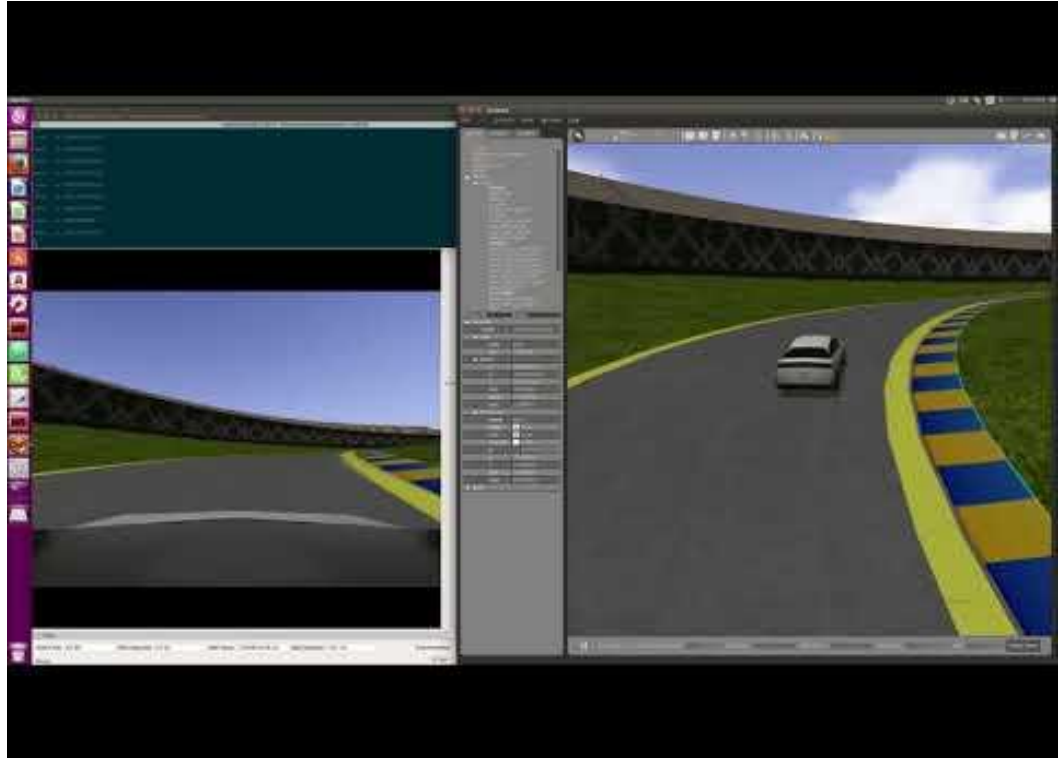Nvidia End to End Learning Model

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) 🛣️
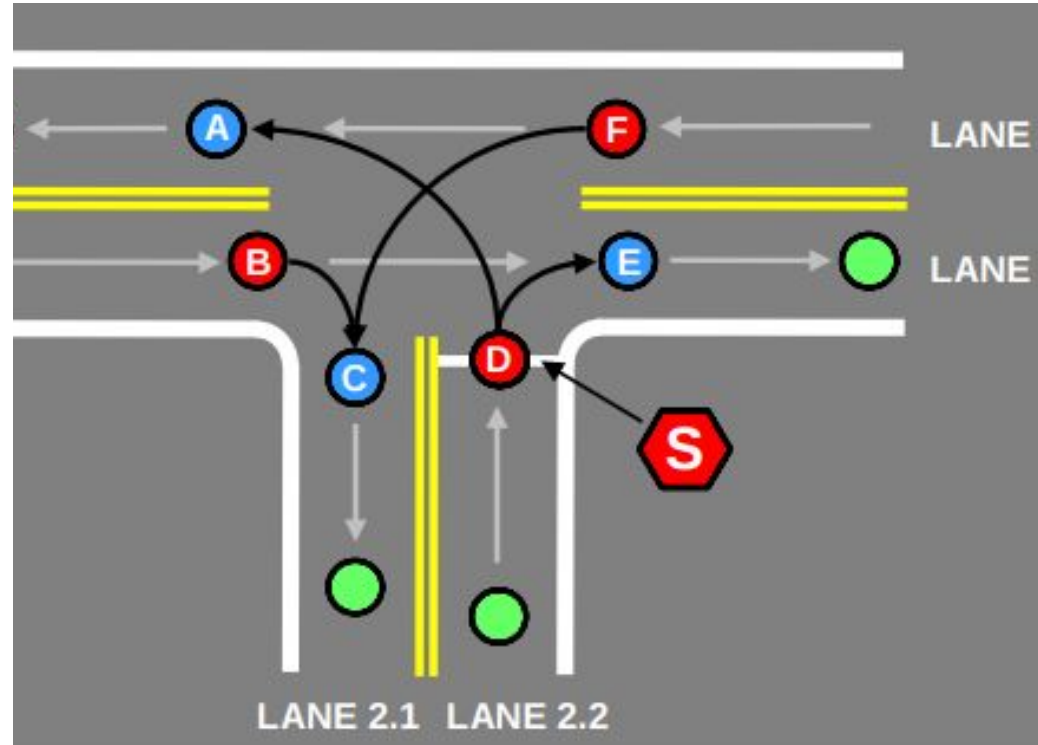
C++ library for handling RNDF files

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
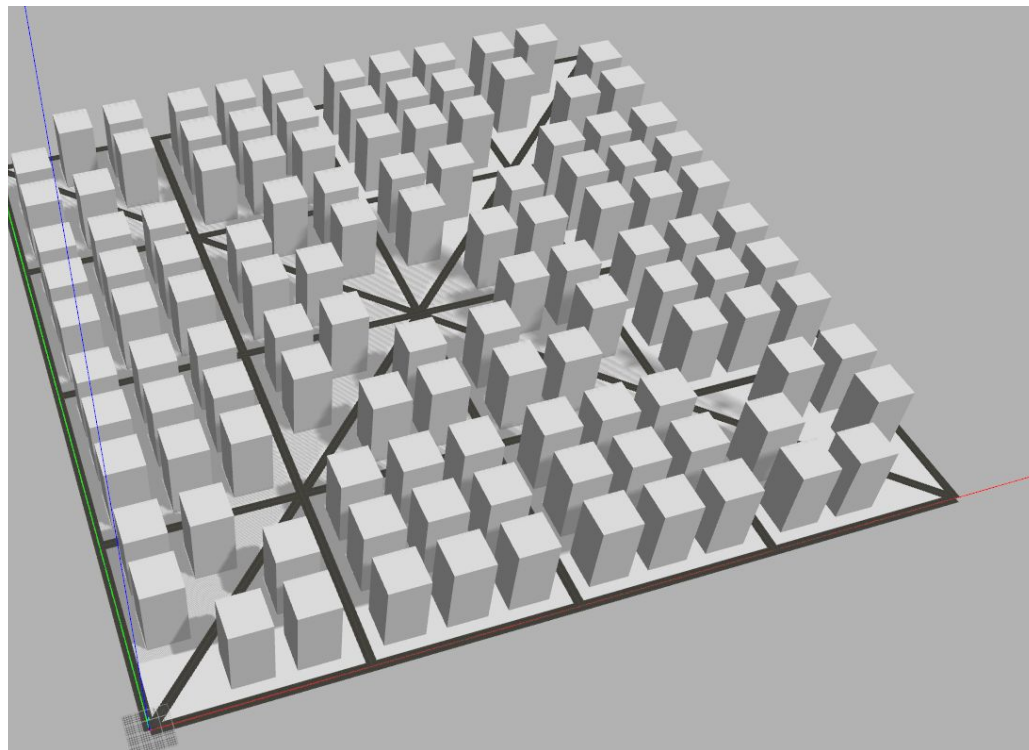- In-memory representation of RNDF
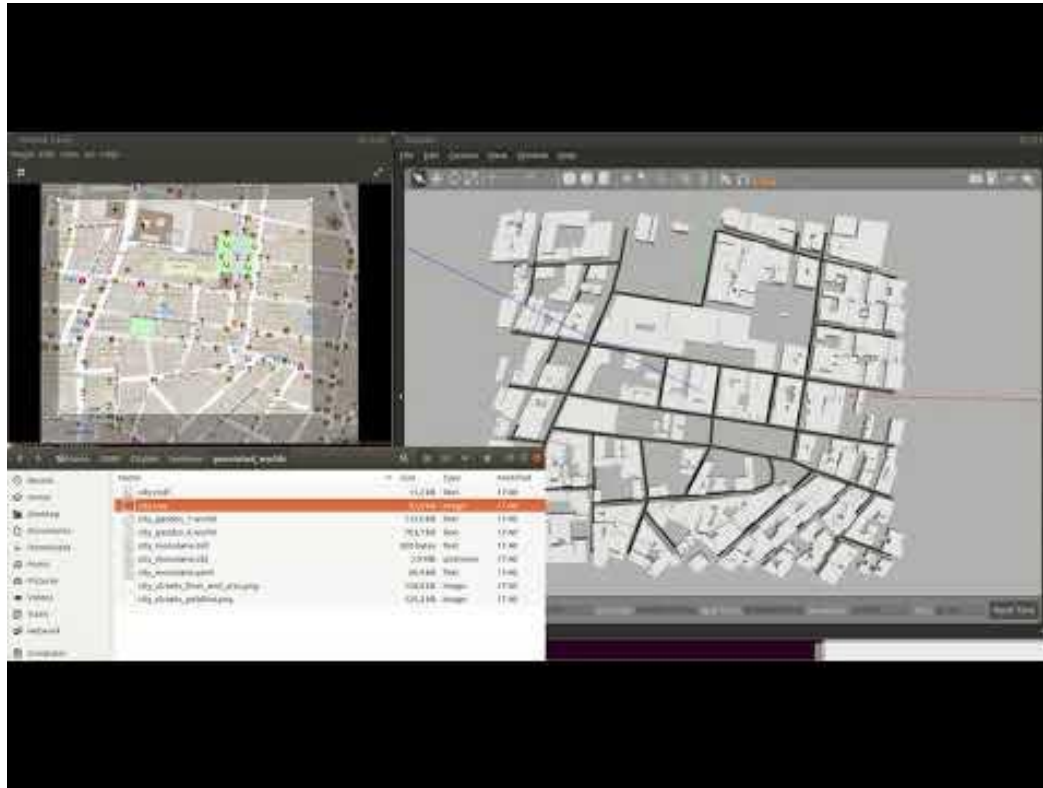
Terminus

Generate or import simulated cities

Why is this useful?

Overview

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

EKUMEN

Terminus

Summary

Vehicle model: Prius

Environment models: Mcity, Sonoma Raceway

Plugin: Powertrain model

Road networks: Ignition RNDF

Cities: Terminus

open robotics

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

open
robotics

Thanks

Questions?

open
robotics