Course Kickoff

ECE 495/595 Lecture Slides

Winter 2017

Instructor: Micho Radovnikovich

Intelligent Ground Vehicle Competition

- International robotics competition held at Oakland University (www.igvc.org).
- Oakland has participated every single year since the first competition in 1993.

1996

2012

What is ROS?

- Robot Operating System (ROS) is designed to simplify the development of robust and complex robot software.
- Contains a large collection of software libraries and tools that provide the developer with a very flexible programming environment.
- Backed by an ever-growing open-source development community.
- Quickly becoming a widely-used standard in research and industrial applications.

What is ROS?

- The ROS website describes ROS as a combination of plumbing, tools, capabilities and ecosystem (http://www.ros.org/about-ros/).
  - **Plumbing** – Core functionality that enables the modularity and flexibility of ROS.
  - **Tools** – Built-in tools for 3D visualization, parameter adjustment, physics simulation, etc.
  - **Capability** – High level software packages that implement common robotics systems.
  - **Ecosystem** – The vast and rapidly growing community that maintains, develops and contributes to ROS.

ROS at Oakland

- Oakland won the IGVC in 2013 and 2014 using ROS-based software
  - Replicant on the 2013 IGVC basic course:
- I used ROS to implement the systems in my dissertation:
  - Simulation of a differential-drive vehicle navigating to a waypoint while avoiding obstacles:
  - Real-time experiment of waypoint navigation:
  - Simulation of multiple robots moving in formation:

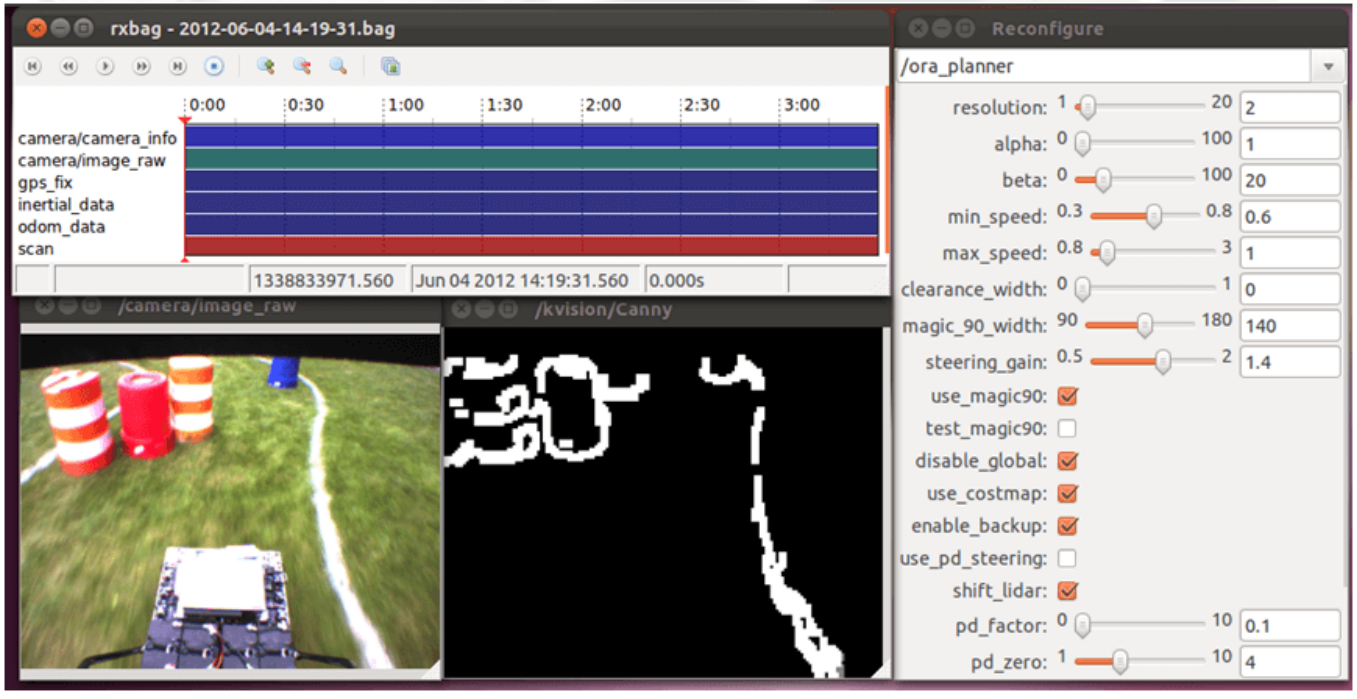
Overview of ROS Tools

- Discussion of the motivation behind developing ROS, and an overview of its capabilities:
- A nice, quick overview of the common ROS tools starts at the 10:18 point in the video:

Overview of ROS Tools

rosbag, dynamic_reconfigure and image_view

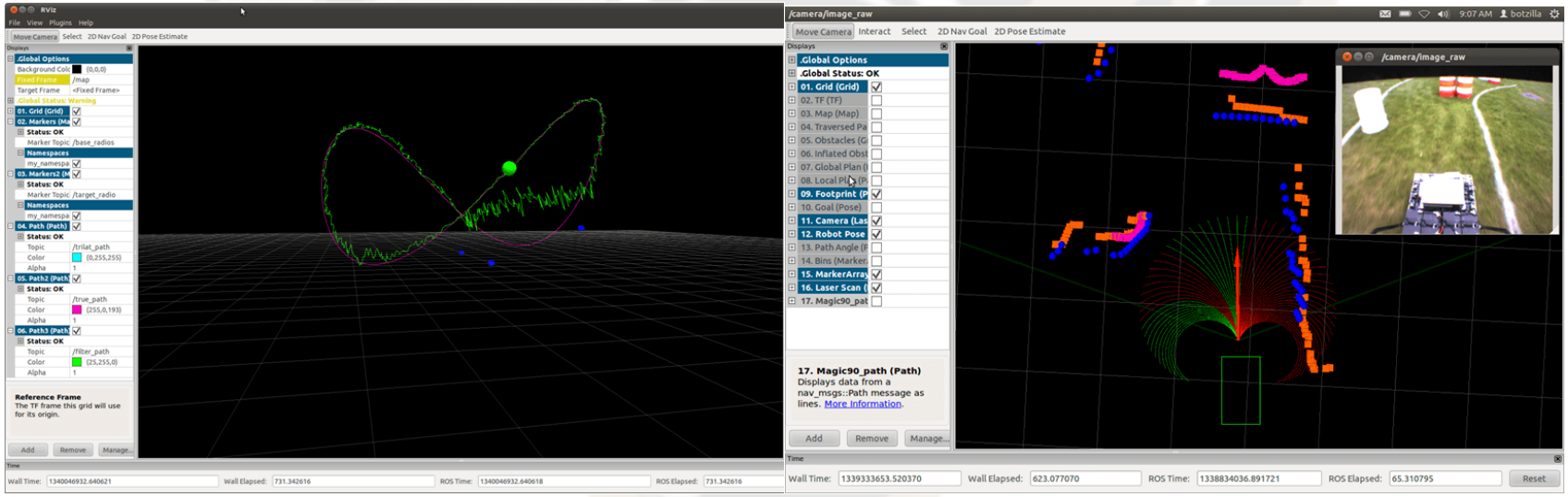
- Data can be easily recorded and played back.
- Parameters can be adjusted at run-time.
- Image processing output can be visualized in real-time.



Overview of ROS Tools

Rviz

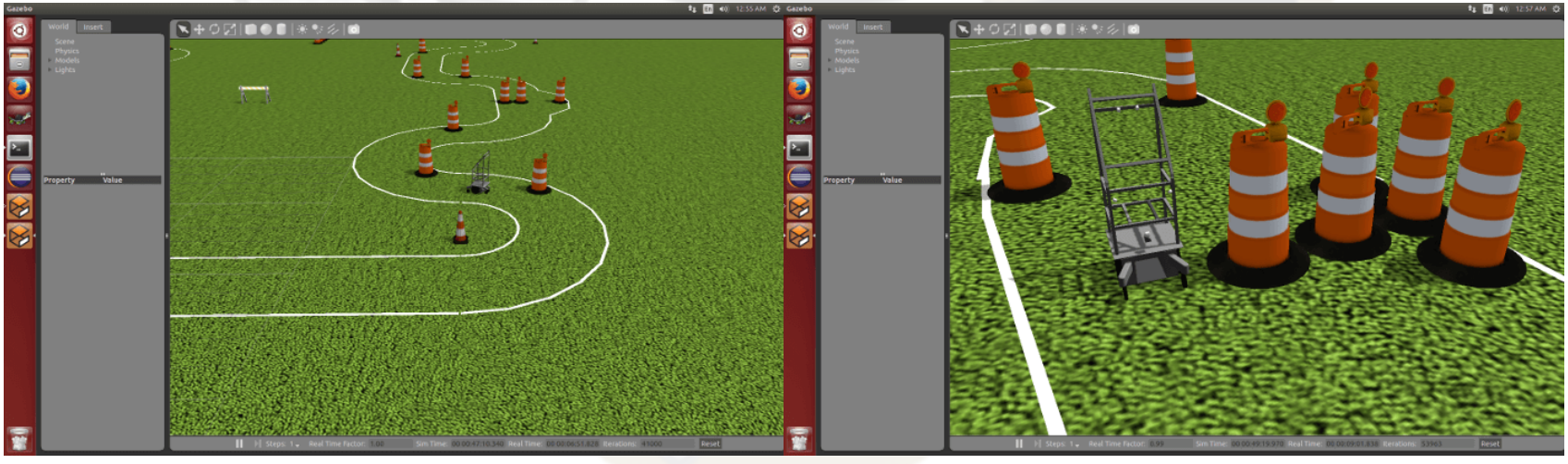
- 3-D visualization tool for both simulated and real-time systems.



Overview of ROS Tools

Gazebo

- Open-source physics simulator that can be used to construct realistic simulation environments and sensor data.



Companies Using ROS

- Fraunhofer IPA
- Clearpath Robotics
- Shadow Robot Company
- Southwest Research Institute (SwRI)
- Rethink Robotics
- . . . and several more!

ROS at Dataspeed Inc.

- Omnidirectional base for Baxter 
- First-person trainer for Baxter 
- Amazon Picking Challenge 
- 3-D mapping using a Velodyne LIDAR 
- ADAS development kit