



ECE 484 FA24 MP1 Walkthrough Filtering & Perception

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Outline



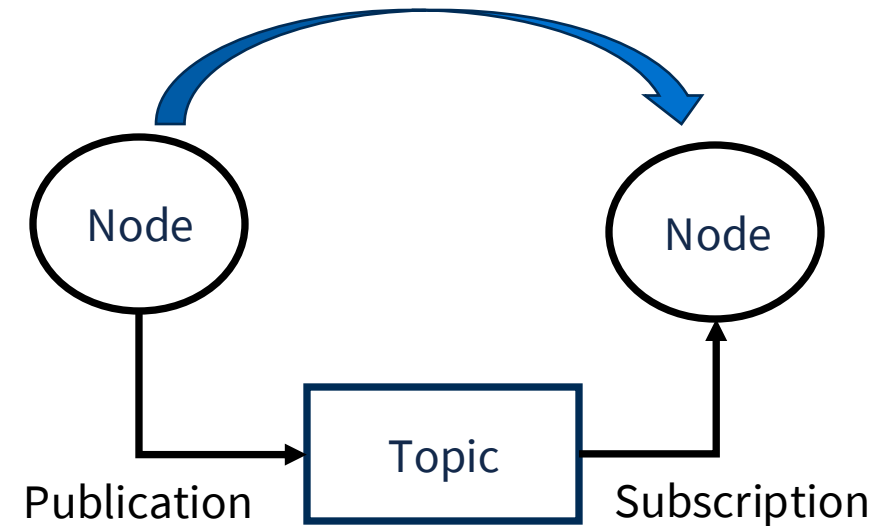
- HW1 (**Individual** work)
 - Convolution
 - Filters
 - Removing noise
- MP1 (**Group** work)
 - Lane Detection (OpenCV, ROS, Gazebo)

What is ROS?



Robot Operating System : a Publisher – Subscriber Model

- Nodes
- Master
- Messages
- Topics





This represents a (simple) self driving car. It has a few key systems – wheels, a steering wheel, and GPS sensor. It also has a program that makes all the navigation decisions. These are all nodes. They share data via messages and topics. You can think of a topic like a bulletin board – many people (nodes) can pin messages to a bulletin board (publish) and anyone (other nodes) can look at the messages (subscribe). Here we pass the needed data around and nodes get the data they need to do their job. The master then oversees all of this to ensure it works.

Node
GPS

Publish: Location

Topic
Location

Subscribe: Location

Node
Navigator

Topic
Directions

Publish: Directions to goal

Subscribe: Wheel Speeds

Node
Wheel
motors

Subscribe: Steering Info

Node
Steering
wheel

Master

Example prepared by Ben Walt

Gazebo, an opensource robotics simulator



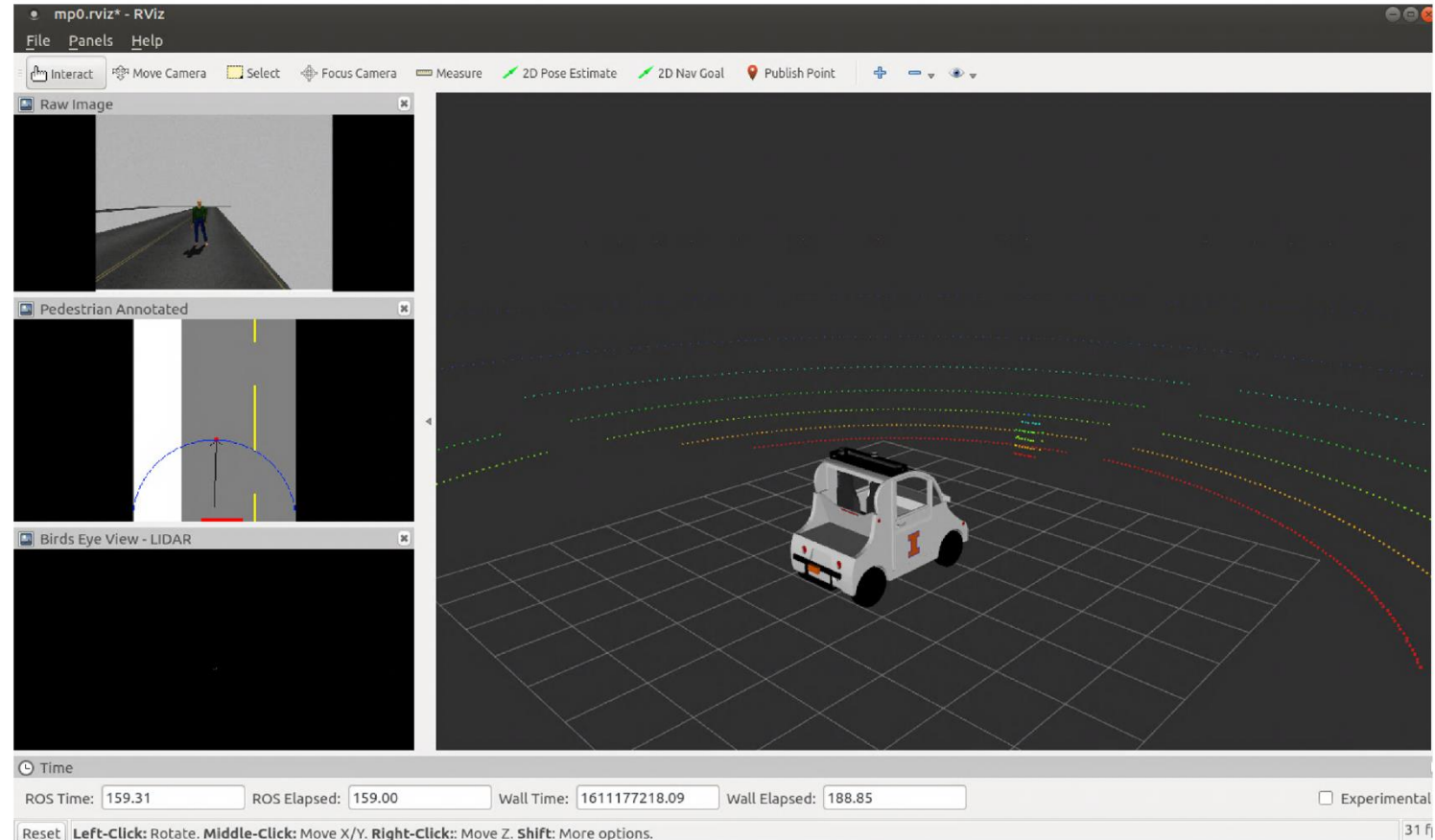
Simulates physics (like gravity, friction, etc.) and environment in which a robot operates.



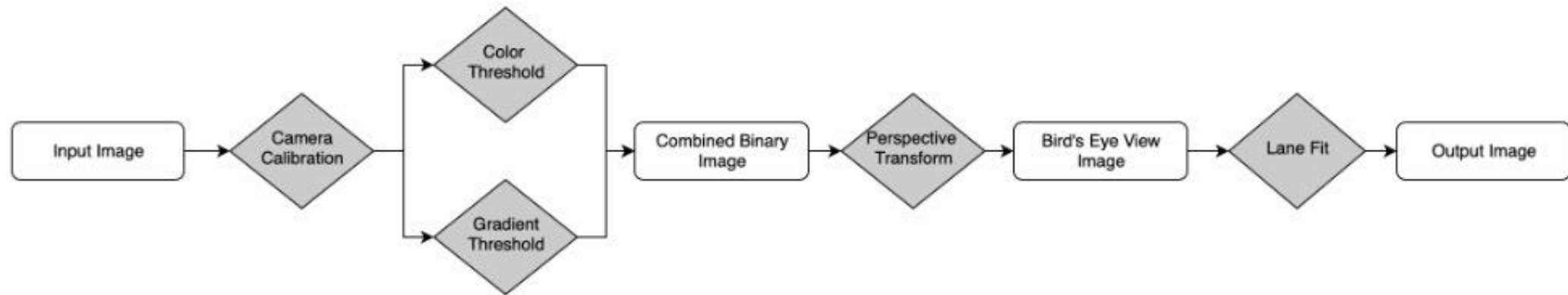
RVIZ, a ROS visualizer



- Visualizes data, including sensor data, the state of the robot, and planned actions.
- Subscribe to and visualize data from ROS topics in real-time.
- No physics engine.



Lane Detection Pipeline



Thresholding



Color Thresholding:



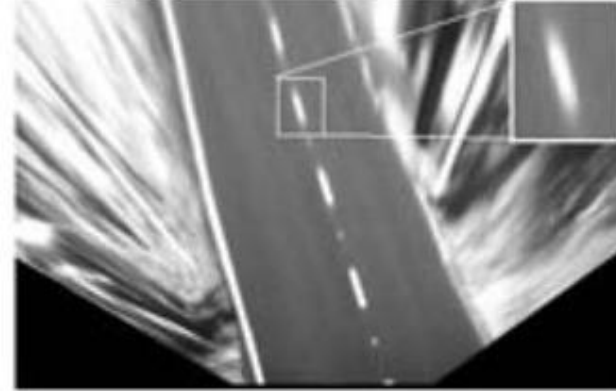
Gradient Thresholding:



Perspective Transform



Standard view through
windshield



Bird's Eye View
(computed via warp
perspective transform)

Testing your lane detection module

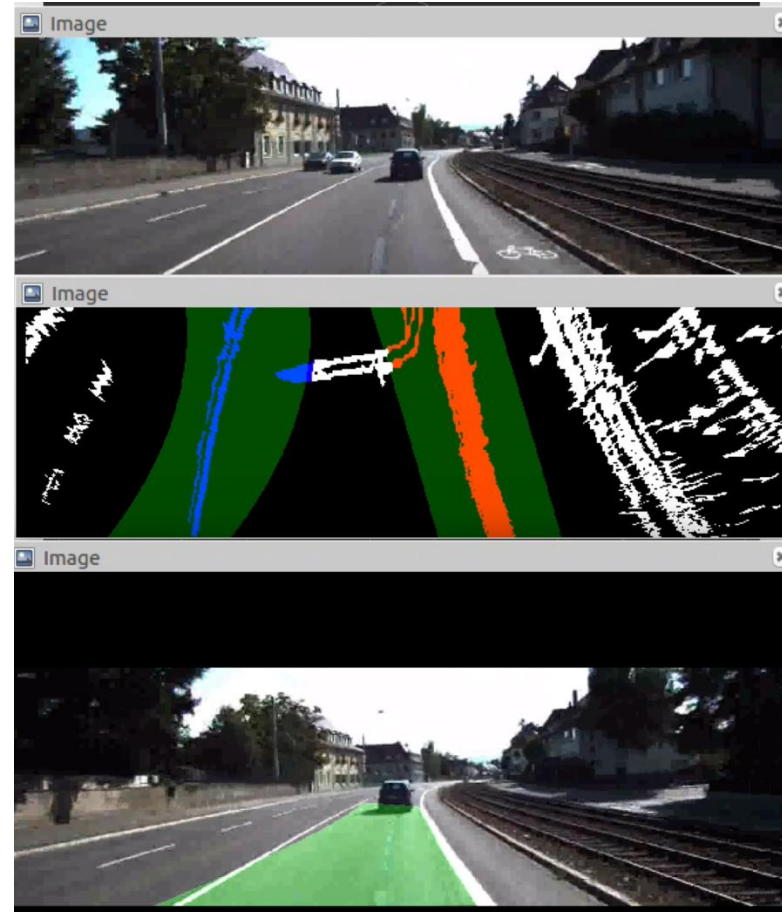


- Two validation frameworks
 - Gazebo (simulated environments with physics, etc..)
 - Rosbags (data collected from real world)
- Instructions on usage for both modalities is in the docs

Sample Demo



- Rosbag example



Grading



- HW1 (100 pts)
- MP1 (100pts)
 - Report 90 pts
 - Demo 10 pts

Logistics and Reminders



- Form MP groups and fill out survey by Sunday
 - Not necessarily the same group for final project
- MP0 and HW0 due next Friday 9/13
- MP0 demo will be in next lab session
 - Individual questions will be asked
- MP1 and HW1 will be due in three weeks 9/27
 - Start early as you can get stuck
 - Lab space may be limited outside of class



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