Tower of Hanoi
ECE 470 Lab 2 Intro

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Announcement

- You can find this document and any others that I share in my Box Share Folder
- You can also find it on my Website

Lab 2 Goal

- Our goal is to use ROS to solve the Tower of Hanoi puzzle
- The robot should accept input from the user to select the starting and ending tower locations.
- Suction feedback should be implemented and detect if a block is missing.
- Prep for Next Lab:
  - Continue to work on Lab 2 during your off week
  - Prepare for Lab 3 - Forward Kinematics (out soon I hope)
  - Write your lab report

Demonstration

A demonstration of your working code is required for this lab.

- Show me (your TA) your working program
- Online students will demo their simulation over Zoom
- In-person students can demo in-person or via Zoom
- All demos will be live (no recordings), so please plan ahead to see me in office hours or during lab time - prior to the due date.
- **Please read the requirements carefully. Every semester people want to demo without completing the lab properly.**
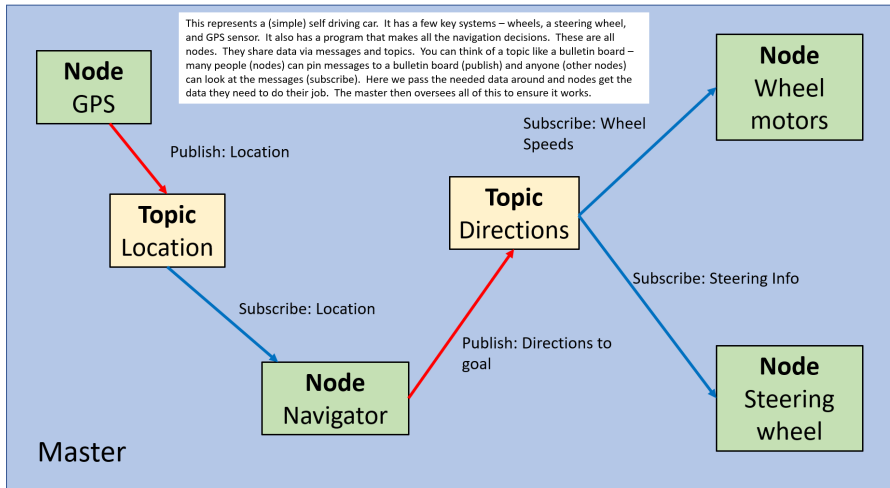
ROS (Robot Operating System) is a program that allows for easy integration of many systems in a robot. A vital aspect is how it passes information between processes.

- Nodes – These are processes and there will be many of them
- Master – This knows about all the nodes and helps connect them
- Messages – (Data structures) Nodes communicate with each other via messages
- Topics – Nodes publish and subscribe to topics via messages

Graph of a Self Driving Car in ROS

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

Publish: Directions to goal

Topic
Directions

Subscribe: Wheel Speeds

Subscribe: Steering Info

Node
Wheel motors

Node
Steering wheel

Master

Lab Reports

- Lab reports will be due according to the schedule in GradeScope.
  - Group A - Week of 12 October
  - Group B - Week of 19 October
- Please look closely at the lab report guidelines document - How to Write a Lab Report
- Read Section 2.8 carefully and ensure that you answer all the questions there.

How to Write a Lab Report

- I have created a simple example of a lab report based on Lab 1 - Lab 1 Report
- You can use the How to Write a Lab Report document as a Word template to write yours or a Latex template is provided.
- Google Docs is not really adequate to write the report. If you choose to use it, you need to figure out how to match the format requirements.

How to Write a Lab Report Tips

Please note the following:

- Section headers are numbered
- The report is written in full sentences and paragraphs - not just a set of bullet points
- Figures require captions and should be referred to by number - e.g. Figure 2
- Only include figures that you discuss in the text
- No screenshots of text, no hand drawn figures and don't take pictures of a screen with your cellphone.
- Read the requirements carefully - if asked to discuss a topic, do so.

Lab 2 - Hints and Help

Lab 2 Details

- Read the code carefully. There are only a few sections that you need to work on.
- Solve the Towers of Hanoi yourself or read about the solution. What changes when you change start and end locations?
- Make use of the Adding Suction Feedback document.
  - Using ROS commands needs to be discussed in your report.
- Make sure you understand the **Q** matrix and how it works with the **move_block()** function. See Figure 2.5 in the manual.

Lab 2 Report Details

- Ask yourself "What were the most important things we did in this lab?" This should be the focus of your report.
- Use code snippits to help explain what you did
- Include your code (**lab2_exec.py** only) as an appendix in your report
- **Figures, Figures, Figures** - I love figures and expect you to make good use of them in every report!
- Follow the How to Write a Lab Report Guidelines!

For Next Lab

- Do the pre-lab and reading for Lab 3 (Out soon)
- Finish your Lab 2 solution before the demo due date.
- Start writing your lab report following the lab report guidelines.