AUTONOMOUS ROBOTIC EXPLORATION OF DYNAMIC ENVIRONMENTS

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PROBLEM STATEMENT

• How can we build exploratory behaviors for robotic agents to autonomously respond to objects of interest?

• How can we interpret an agent’s reasoning in a difficult environment?

HOW WE THINK OF NAVIGATION

It’s simple. Move towards* the objective!

Why wouldn’t we try to go through this wall and take a shorter path?

*The selected route is generally determined by a combination of factors, such as proximity, safety, and time.
HIERARCHICAL BEHAVIOR DESIGN

Overall Objective: Get to the Goal

Current Behavior: Approaching the goal
THE AGENT: ROVER EQUIPPED WITH 2D LIDAR

2D Lidar Module, taken from
OVERALL OBJECTIVE: EXPLORE (ROAM) AREAS
**Hierarchical Design in Practice**

**Object Avoidance**

1. Retrieve array of Lidar data
2. Remove measurement errors
3. Segment different regions
4. Retrieve the radial with the closest distance reading
   - **High**: What is the retrieved object's threat level?
     - Yes: Go straight. Object is in close proximity to agent, but not directly in front of it
     - No: Turn away from the object (in place) to lower the threat level on the next iteration
   - **Low**: Retrieve the object containing the closest radial
5. **No**: Back away to make space
6. **Yes**: Does the agent have space to pivot?
   - Yes: Back away to make space
   - No: Pivot to center it

**Exploration**

1. Is the path centered?
   - Yes: Select ratio dependent path of interest
   - No: Pivot to center it
2. Any paths deep enough to be of interest?
   - Yes: Drive towards the path angle
   - No: Turn around (pivot right)
3. Calculate radial path lengths
4. Update saved Lidar data
**PROBLEM:** TILTING MEANS CHANGING LINE OF SIGHT!
**Problem:** Tilting means changing line of sight!
HOW CAN WE UNDERSTAND AN AGENT’S ACTIONS IN AN UNFAMILIAR ENVIRONMENT?

• Structuring the code as independent entities in a hierarchy is convenient for rapidly prototyping new behaviors.

• If the agent behaves unexpectedly, how do we know why it took the steps that it did?

Visualization!
HOW VISUALIZATIONS LOOK – A BIRD’S EYE VIEW
ROVER LIDAR VISUALIZER
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