

Winter Project Proposal

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Description:

I would like to control a turtlebot using hand gestures recognized from computer vision. I would like to start with basic controls, telling the turtlebot what direction to move in and at what speed. Then I would like to add other commands, such as telling the turtlebot to try and find a goal, or to do a trick like spin around in a circle.

Technical Objectives:

Fallback:

- Able to recognize simple hand gestures, even if I must be stationary for it to work.
- Turn these gestures into moving the Turtlebot around manually

Core:

- Create a shoulder mount for the camera.
- Ideally, this would simply sit on my shoulder and look down at my hands, but I'm expecting there to be issues with me moving around and the background changing.
- If this will be a problem, I will design a shoulder mount that extends forward enough so that the camera looks at my hands with my shirt as a constant background.

Reach:

- I'd like to learn more and show off the turtlebots object detection and avoidance by giving it a command to reach a goal on its own. This may require some knowledge of SWARM robotics that I'll need to learn.
- You can create basic gesture recognition with OpenCV, but I'd like to try and use Machine Learning to solve this more thoroughly if I have time.
- Adding voice recognition for other commands would be a natural extension to this project.

Learning Objectives:

- Hand recognition using OpenCv and perhaps using an Intel Realsense camera.
- Learn to control an actual turtlebot and how to pipe hand gestures to actual controls.
- SWARM robotic using Turtlebot
- Machine Learning techniques for learning hand gestures.

Tasks:

1. Research hand gesture recognition - 1 week
2. Implement code to find possible gestures to use - 1 week
3. Work through turtlebot tutorial to control an actual turtlebot - 2 weeks
4. Integrate hand gestures to turtlebot commands - 2 weeks
5. Create shoulder mount for camera - 1 week
6. Research SWARM techniques for turtlebot and integrate with hand gesture - 2 weeks
7. Research Machine Learning and use for more robust gestures - 2 weeks

Risks, Challenges, and Uncertainties:

- Turning hand gestures into turtlebot commands may prove more difficult than anticipated. Especially controlling the turning of the turtlebot based on where my hand is pointing relative to my body.. From what I've seen online, this is not a commonly used hand gesture.
- I have not seen hand gestures used with someone who is moving around. This may cause a problem with the computer vision, which is why I may need to extend the camera forward so it uses my shirt as a constant background.
- I am not familiar with SWARM techniques and this may be more complicated than I have time for.
- Same goes for Machine Learning.

Hardware:

- Turtlebot (exact kind is not important)
- Camera, whether webcam or Intel Realsense
- Micro Controller for camera to turtlebot communication (like Raspberry Pi)
- 3D printed shoulder mount for camera