Robotics projects in the Autonomous Systems Lab
Kress-Gazit group

A variety of projects are available for **MAE, ECE,** and **CS** students in the Autonomous Systems lab. The lab focuses on all types of robotics, including theory, hardware, software, and networking for a variety of applications in the general area of autonomous/semi-autonomous robotic systems. All projects will have a long term goal of being integrated into our research goals, as demonstrated in autonomous/semi-autonomous robotic systems.

Lab wiki: http://cornell-asl.org/wiki

Application Instructions: Email the following to the Prof. Kress-Gazit (hadaskg@cornell.edu) :

1. Your CV
2. A short paragraph detailing which project you are interested in, why you are interested in it and a few words on your relevant experience
3. Level of effort (number of credits you are looking for). Note that we require all students to sign up for credit hours.

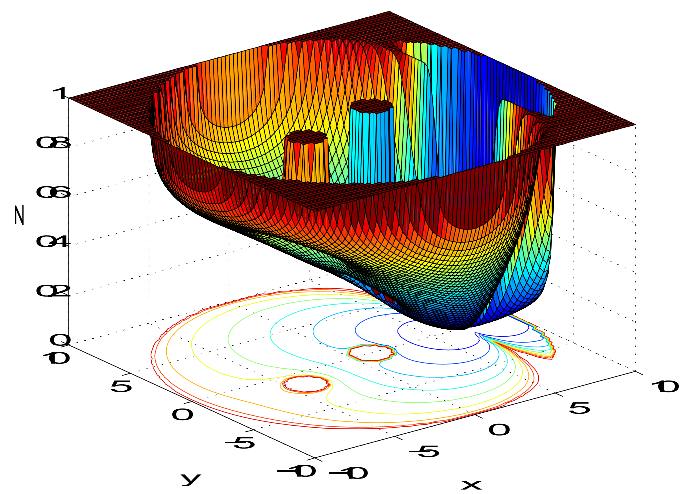
Projects:

1) Simulation and control of differential-drive robots by LTLMoP

The student's goal will be to enable the simulation of differential-drive robots in LTLMoP. The LTLMoP (Linear Temporal Logic MissiOn Planning) toolkit is a collection of Python applications for controlling robots using language (http://ltlmop.github.io/).

The project has three main components:

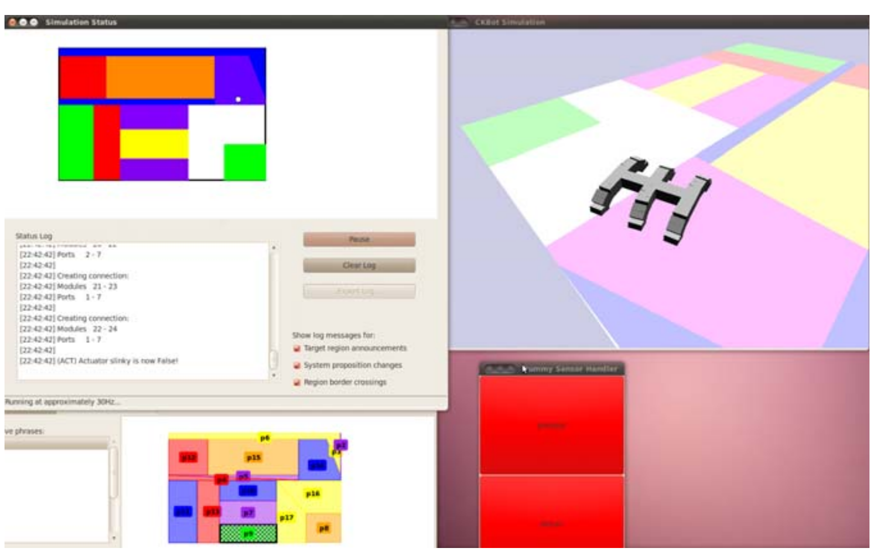
1. Implement a new RRT (Rapidly-exploring Random Tree) motion handler. For differential-robots and other applications, we are also interested in the robot's orientation. Therefore, the student will implement a version of RRT that operates in the robot's 3-dimensional configuration space (2D position + heading angle) and outputs such points (waypoints $[x\ y\ \theta]^T$). In addition, the student will implement the RRT* algorithm.
2. Implement a new drive handler that will steer the robot not only to a desired position, but force it to arrive there with a desired orientation. This way, the drive handler will take advantage of the new RRT's output (waypoints $[x\ y\ \theta]^T$). A first approach could be dipole-like reference vector fields. Another approach is dipolar Navigation Functions (NF). Dipolar NFs offer both collision avoidance (their main purpose) and convergence to a goal position with the desired orientation
3. Add a kinematic differential-drive robot to LTLMoP's simulator.



2) Web-based simulator

The goal of this project is to have a simulator for LTLMoP that runs in a browser and allows a user to:

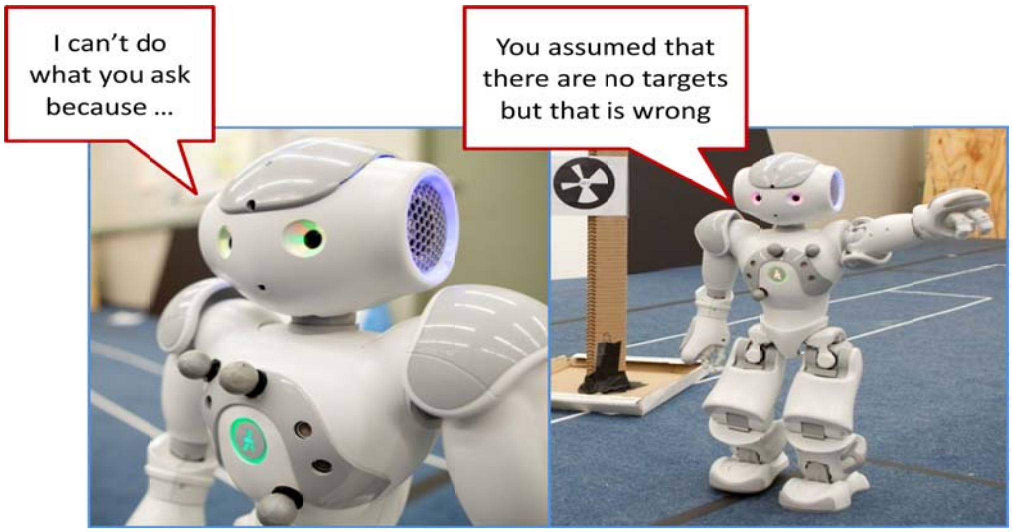
1. Control a simulated robot using English
2. Add objects dynamically to the simulated environment by clicking areas in the map
3. Receive feedback when added objects violate expected behavior



3) Speech interface for LTLMoP

The goal of this project is to design and implement a speech interface for LTLMoP. This interface will:

1. Transform spoken task specifications into text to be used by LTLMoP
2. Generate speech that will explain to the user possible problems with the specifications.



4) Localization using a Kinect and/or a smartphone

The goal of this project is to develop a localization solution, i.e. figure out where a robot is in a given map, using simple sensors such as a Kinect or a smartphone.

5) Integrating new robots with LTLMoP

The goal of this project is to demonstrate high-level control of different robots using LTLMoP. This project will require the student to create an interface between the robot’s sensing and control software and LTLMoP.