Designing an Autonomous Service Robot

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3rd Year Design Project

Synopsis

By now all teams should have designed a system to automate a **challenging task**.

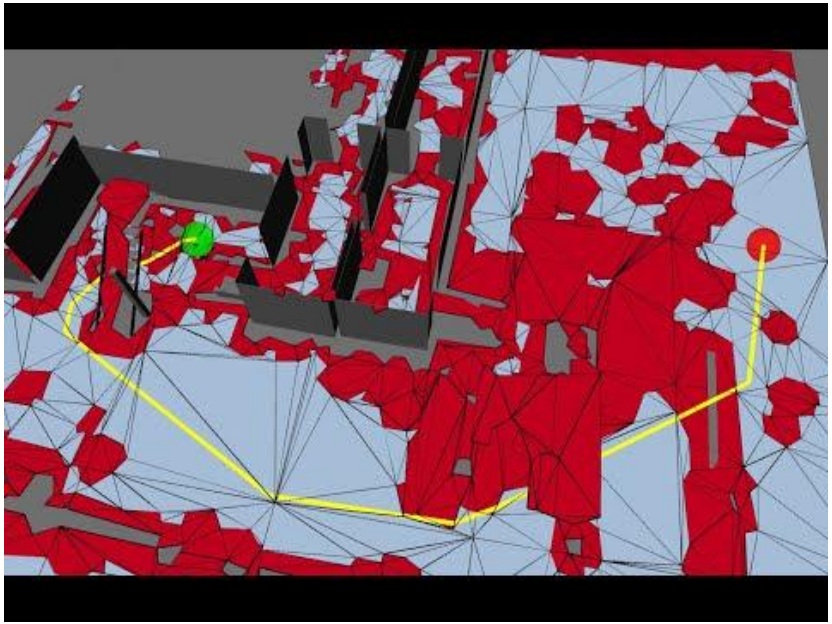
In this term we will focus on validation and verification of the **core aspects** the design using **modelling and simulation** tools.

The Challenge

Simulation and Evaluation of the **Perception** and **Motion Planning** capabilities of your system.

- Models
- Assumptions
- Algorithms

Examples

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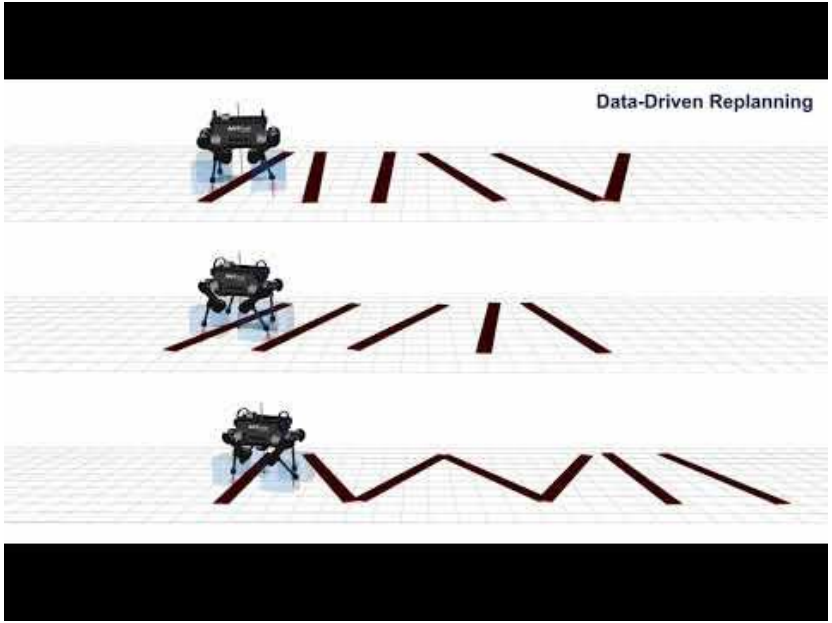
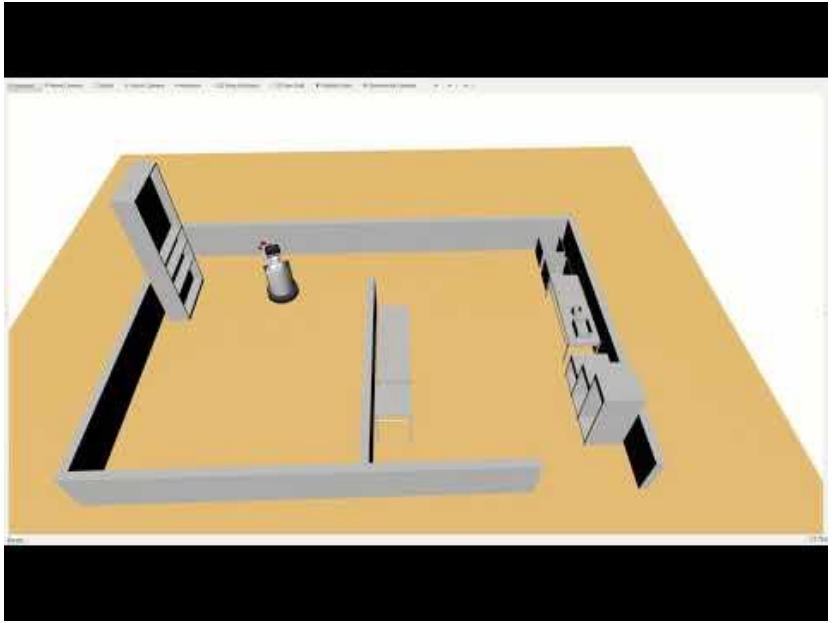
Examples





Open ended

Simulation Task

Pick-and-place task

- Scope
- Models
- Assumptions
- Conclusions

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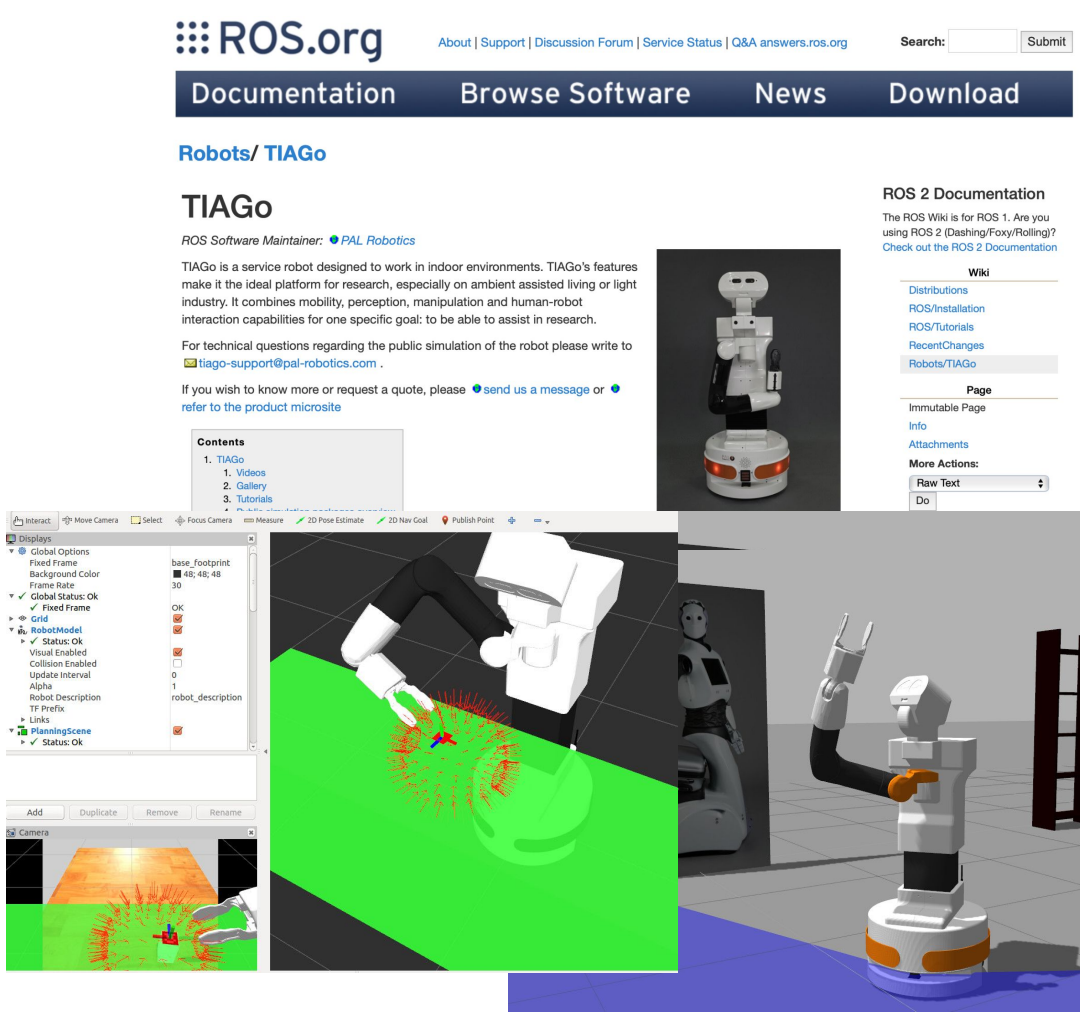


The Project

- Start from your designed system
  - Aims:
    - What are the core components you need to simulate
      - How do these interact
    - What will your system model show
      - E.g. motion planning based evaluation on capacity or coverage
    - How will you use the model to arrive to valuable conclusions

Organization

- Tools
  - ROS and Gazebo mainly – examples at **TiaGo Tutorials** webpage
- Scope
  - System components and interactions
- Experimental design
  - Structure and aim of simulation trials
- Workload planning
  - Distribute tasks and allocate work packages

Calendar

	Hilary Term	
Week 1		Challenge problem brief
Week 2	Log Books	Challenge Problem Progress Update 1 [Tools, assumptions, work division]
Week 3		Challenge Problem Progress Update 2 [Details on models and interactions]
Week 4		Challenge Problem Progress Update 3 [Focus on simulation and experimental design]
Week 5		Challenge Problem Progress Update 4 [Full system simulation and trial examples]
Week 6		Challenge Problem Progress Update 5 [Overview, evaluation and conclusions]
Week 7	Log Books	Practice Final Presentation #1
Week 8		Practice Final Presentation #2

Calendar

	Trinity Term	
Week 0		Draft of report
Week 1		A possible date for final presentation. (to be scheduled)
Week 2		A possible date for final presentation. (to be scheduled)
Week 4		Reports

Support

We will provide pointers and advice on

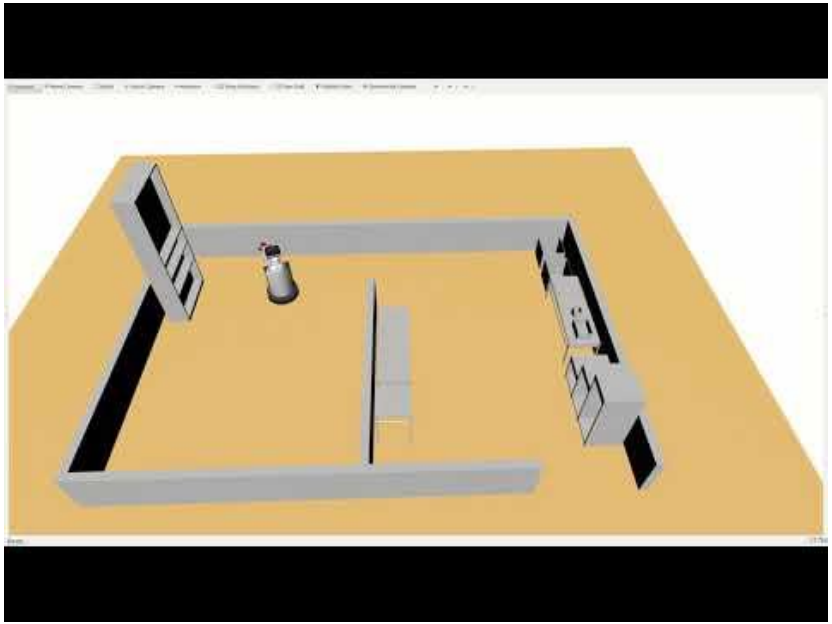
- Tools
- Modelling
- Approaches

More details

- Week 2 - Tools, assumptions, work division
  - Simulation strategy, subtasks and work packages
- Week 3 - Details on models and interactions
  - Specifics on acting components of the system and inputs/outputs
- Week 4 - Focus on simulation and experimental design
  - Evaluation of simulation performance and fidelity, sketch of experiments to support evaluations
- Week 5 - Full system simulation and trial examples
  - Examples of the system running and initial results of evaluations
- Week 6 - Overview, evaluation and conclusions
  - Presentation of the full pipeline and the conclusions drawn

Example

- Tidy-up a room
  - Robot navigates room
    - Localization
    - Path planning
  - Robot selects items
    - Perception and
    - Task planning/sequencing
  - How does this change with..
    - Size of room
    - Number of objects
    - Different bins



Final Result

An evaluation of the capabilities of the system supported by experimental **evidence** generated using a reasonable **simulation** pipeline.

Other Info

- Project website:

  https://ihavoutis.github.io/teaching/3YP_ASR/index.html

That's all! - Questions?