

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**.

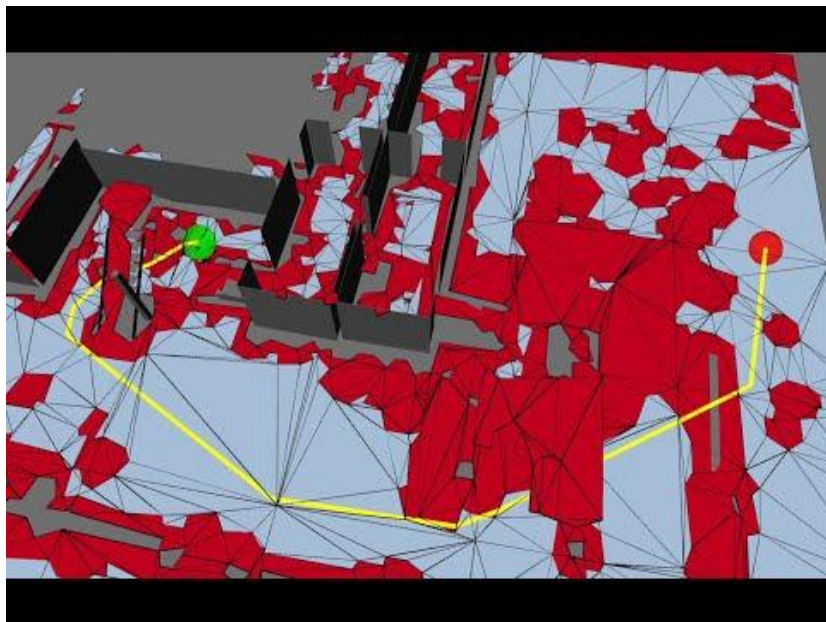
In this term we will focus on validation and verification of the **core aspects** the design using **modelling and simulation** tools.

The Challenge

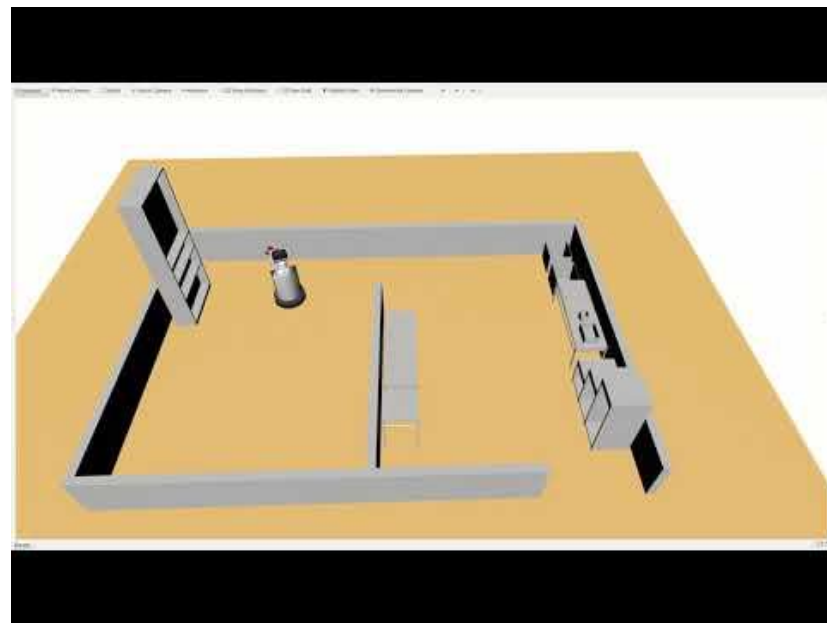
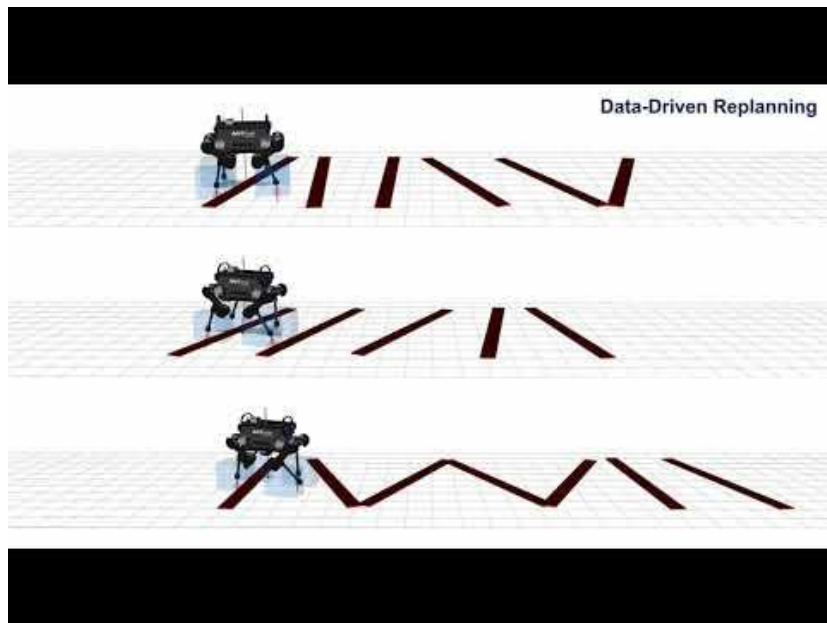
Simulation and Evaluation of the
Perception and **Motion Planning**
capabilities
of your system.

- Models
 - Assumptions
 - Algorithms
-

Examples



Examples



Open ended Simulation Task

Pick-and-place task

- Scope
- Models
- Assumptions
- Conclusions



Open ended Simulation Task

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Robots/ TIAGo

TIAGo

ROS Software Maintainer: [PAL Robotics](#)

TIAGo is a service robot designed to work in indoor environments. TIAGo's features make it the ideal platform for research, especially on ambient assisted living or light industry. It combines mobility, perception, manipulation and human-robot interaction capabilities for one specific goal: to be able to assist in research.

For technical questions regarding the public simulation of the robot please write to tiago-support@pal-robotics.com.

If you wish to know more or request a quote, please [send us a message](#) or [refer to the product microsite](#)



ROS 2 Documentation

The ROS Wiki is for ROS 1. Are you using ROS 2 (Dashing/Foxy/Rolling)? [Check out the ROS 2 Documentation](#)

Wiki

- [Distributions](#)
- [ROS/Installation](#)
- [ROS/Tutorials](#)
- [RecentChanges](#)
- [Robots/TIAGo](#)

Page

Immutable Page

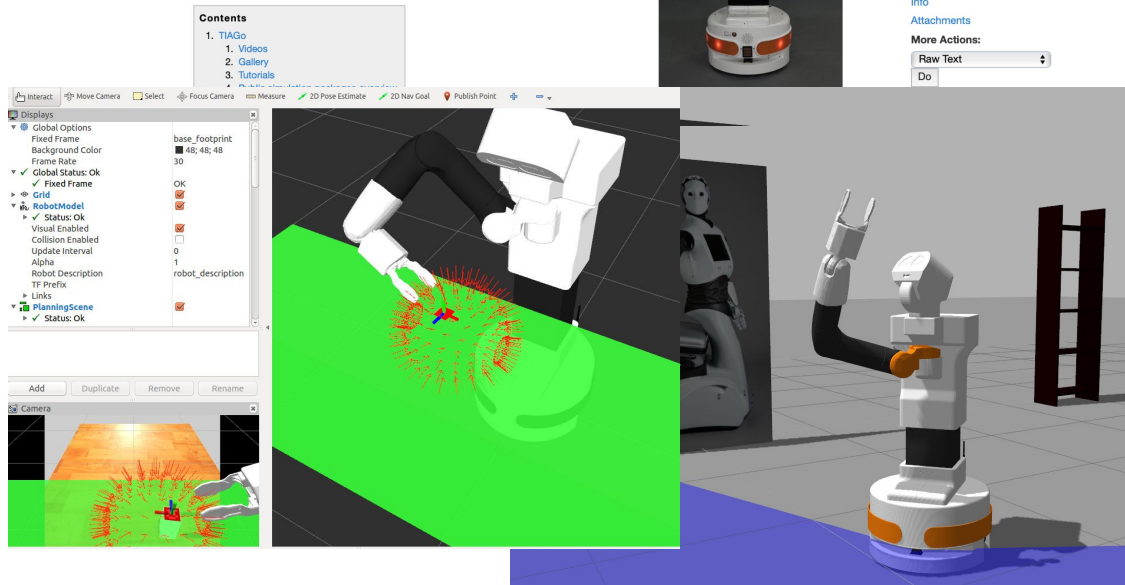
Info

[Attachments](#)

More Actions:

Raw Text

Do



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

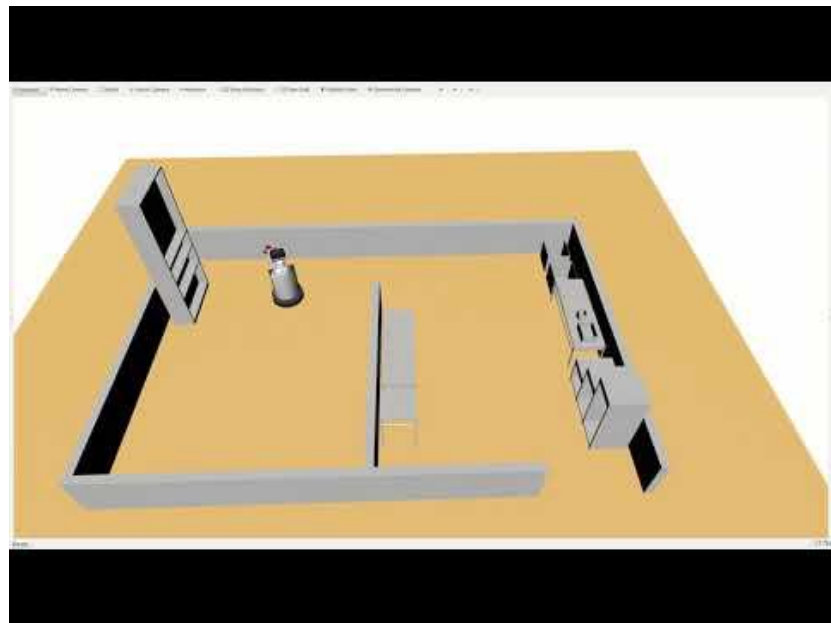
- Tools
- Modelling
- Approaches

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?