Universität Bremen

Institute for Artificial Intelligence

Faculty 03

Mathematics &

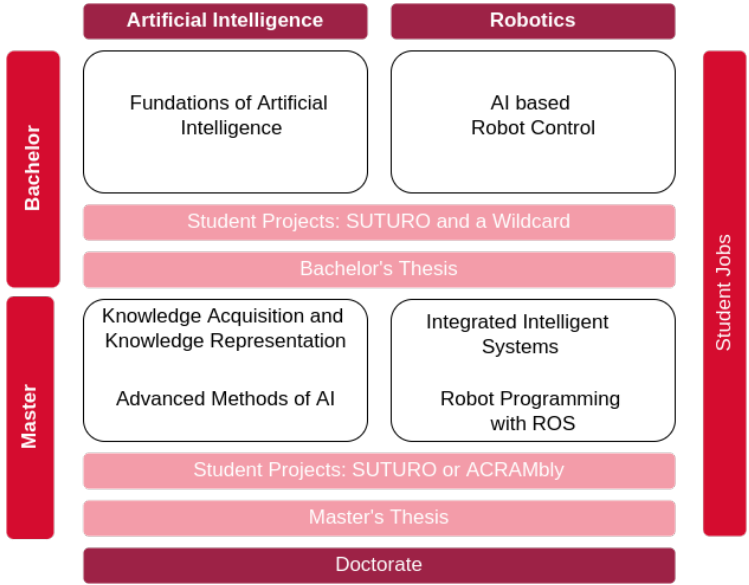
Computer Science

Robot Programming with ROS

1. Introduction, Overview

Arthur Niedźwiecki

16th Apr. 2025


Artificial Intelligence
Robotics
Bachelor
Fundations of Artificial Intelligence
AI based Robot Control
Student Projects: SUTURO and a Wildcard
Bachelor's Thesis
Master
Knowledge Acquisition and Knowledge Representation
Advanced Methods of AI
Integrated Intelligent Systems
Robot Programming with ROS
Student Projects: SUTURO or ACRAMbly
Master's Thesis
Doctorate
Student Jobs

Plan

General Info

- Lecturers: Arthur Niedźwiecki
- Correspondence: `aniedz@cs.uni-bremen.de`
- Dates: Wednesdays, 12:15 - 13:45, 14:15 - 15:45
- Language: English and German
- Credits: 6 ECTS (4 SWS)
- Profile: KIKR
- Course number: 03-IMVP-RPROS
- Location: TAB Building, Room 0.30

Plan

Course Goals

Intended Learning Outcomes

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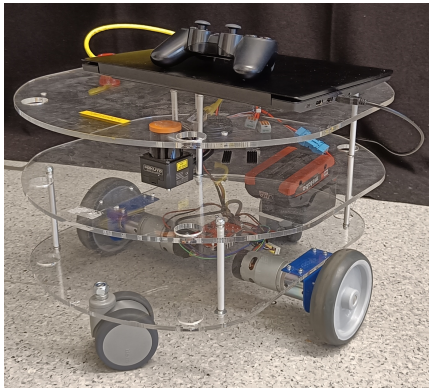
- You can set up a distributed system with ROS
- You can describe the components of a cognitive robot.
- You can describe how a robot perceives the world.
- You understand how an autonomous driving robot navigates.

TortugaBot

- 2 controllable wheels
- 2D laser scanner
- Thinkpad E485 PC with Bluetooth
- PlayStation controller
- OS: Linux Ubuntu 24.04
- with ROS2 Jazzy Jalisco



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ROS2 Page
`https://www.ros.org/`

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- *De facto* standard in modern robotics

ROS 1 to ROS 2

ROS 1: Ubuntu 20.04
released May 2020, EOL May 2025

ROS 2: Ubuntu 24.04
released May 2023, EOL May 2029

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...and get to play with a real little robot!

Plan

Topics

16.04.25 - 02.07.25: 12 Lectures
12:15 - 13:45 Lecture, 14:15 - 15:45 Tutorium
Assignments in simulation and on the real robot

- Install Ubuntu 24.04 and ROS 2 Jazzy Jalisco
- TF & coordinates
- ROS communication
- Kinematics
- Sensors
- Navigation
- Project

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- $Grade = \frac{(100 - P_{your})}{(100 - 50)} * 3 + 1$

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- Solutions are discussed in the tutorium.

Code of conduct

Me

- I answer your questions by mail (& StudIP) on the same day until 4pm (aniedz@cs.uni-bremen.de)
- The depth of my feedback and grading depends on the course size
- I am on time and grade fairly
- I want to let you pass the course, but you need to work for it

You

- You raise technical issues early so we can fix them
- You bring a laptop so you can work together
- You submit your assignments timely so I can grade you
- You use all tools available to you (e.g. Copilot, ChatGPT, Google) to help with your assignments.
  Use **ROS 2 Jazzy Jalisco** in searches

Links

- This lectures website:
  `https://ai.uni-bremen.de/teaching/cs-ros-ss25`
- Git reference book:
  `https://git-scm.com/docs/gittutorial`
- Assignments repository:
  `https://github.com/artnie/rpwr-assignments`

Info summary

Next class:

- Date: 23.04.
- Time: 12:15
- Place: same room (TAB 0.30)

Plan

Try out ROS Online

on our Server: `https://binder.intel4coro.de/v2/gh/IntEL4CoRo/jupyter-ros2.git/HEAD`
or locally with Docker: `https://github.com/artnie/rpwr-assignments/`
Docker with ROS2+Jupyterhub:

- cons: upload and download files to & from jupyter
- cons: no native UI display
- pro: platform-independent web-interface for quick tutorials

This is not a permanent setup solution.

Assignment goals

Prep your Laptop to communicate with the robot.

Install/Navigate a Linux terminal

Install ROS

Set up your workspace

Set up your Git repository

Poll

What OS do you currently use?

Task 1: Get Linux Ubuntu 24.04

Use Linux Ubuntu 24.04!

- TortugaBots run Ubuntu 24.04 with ROS2 Jazzy Jalisco
- 24.04 is the latest LTS distribution of Ubuntu
- Latest ROS2 (Jazzy Jalisco) runs on Ubuntu 24.04

Task 1: Install Ubuntu 24.04

Dual-Boot Windows and Linux:

- Install Ubuntu from a USB Drive
- `https://ubuntu.com/download/desktop`
- `https://www.youtube.com/watch?v=qq-7X8zLP7g`

VirtualBox VM:

- Use a virtual machine on top of your host
- `https://www.oracle.com/virtualization/technologies/vm/downloads/virtualbox-downloads.html`
- `https://www.youtube.com/watch?v=DhVjgI57Ino`

Why not WSL? Ports are closed in LAN, so no robot communication.

Task 2: Install ROS 2 Jazzy Jalisco on Ubuntu 24.04

ROS2 Jazzy Jalisco Install Guide
`https://docs.ros.org/en/jazzy/Installation/Ubuntu-Install-Debs.html`
Youtube walkthrough
`https://www.youtube.com/watch?v=aQeirEM59zg`

Task 3: Set up your repository

All assignments are as Jupyter Notebooks on GitHub.
`https://github.com/artnie/rpwr-assignments/`

- Follow the instructions of the first assignment on Bash and Git.

Q & A

Thanks for your attention!