COURSE OVERVIEW

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Contents

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Introduction

Who is it for? What is it about?

▶ Course for **Bachelor Informatik Vollfach** students as part of the „Fachinformatik" module.

▶ Learn about basic concepts of autonomous mobility.

▶ Learn about software algorithms and hardware for mobile robots.

▶ Hands on programming with TurtleBot 3 robots.

▶ Gain basic knowledge in using Ubuntu, ROS2 and Python.

▶ Work in teams and collaborate with other students.

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The lectures and tutorials will be provided by:

▶ Prof. Dr. Dr. h.c. Frank Kirchner (Uni Bremen and DFKI)

▶ Dr. rer. nat. Teena Hassan (Uni Bremen, thassan@uni-bremen.de)

▶ Mihaela Popescu, M.Sc. (Uni Bremen, popescu@uni-bremen.de)

▶ A few others for specific sub-topics (Uni Bremen / DFKI)

Topics

Timetable of Lectures and Tutorials

w1	10/18/22	**Introduction to Robotics**
	10/20/22	Exercise 1 (Introduction to Robotics)
w2	10/25/22	**Robot Programming**
	10/27/22	Working/questions on ex.1
w3	11/01/22	**Sensors**
	11/03/22	Exercise 2 (Sensors and Odometry)
w4	11/08/22	**Robot Odometry**
	11/10/22	Working/questions on ex. 2
w5	11/15/22	**Mapping**
	11/17/22	Exercise 3 (Localization and Mapping)
w6	11/22/22	**Localisation**
	11/24/22	Working/questions on ex. 3
w7	11/29/22	**Path Planning**
	12/01/22	Exercise 4 (Path and Task Planning)
w8	12/06/22	**Task and Behaviour Planning**
	12/08/22	Working/questions on ex. 4

w9	12/13/22	**Robot Perception I**
	12/15/22	Exercise 5 (Robot Perception)
w9	12/20/22	**Robot Perception II**
	12/22/22	Working/questions on ex. 5
		Christmas Holidays
w11	01/10/23	**Mechanics**
	01/12/23	Exercise 6 (Mechanics, Actuators and Electronics)
w12	01/17/23	**Actuators**
	01/19/23	Working/questions on ex. 6
w13	01/24/23	**Electronics**
	01/26/23	Working/questions on ex. 6
w14	01/31/23	**Robotics and AI**
	02/02/23	Competition Day

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Frequency and Structure

▶ Worksheets will be uploaded in Stud.IP every second week of tutorials.

▶ Worksheets will include theoretical questions and practical tasks.

▶ There will be **12 groups of 3 students each**.

▶ Each group will work with one TurtleBot 3 robot.

Assistance

We will help you with the worksheets during the tutorials.

▶ Tutorial will take place every week on Thursdays onsite (see Schedule).

▶ We set up a Discord server so that you can interact with other participants and tutors, ask questions or get help.

▶ You can also use the Stud.IP forum to ask questions and feedback.

▶ You can also contact the lecturers and tutors via e-mail.

Software Requirements

In order to work with the TurtleBot 3 robots and solve the worksheets, you will need a laptop with:

- ▶ Ubuntu 22.04. (as standalone or as virtual machine).
- ▶ ROS 2 Humble.
- ▶ Python 3.

Remark: Please consult the Installation Guide we provided in StudIP.

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Worksheets

Competition

► At the end of the semester, you can try out what you learned in a competition.

► Your robot will compete against other teams in a predefined scenario.

► More details coming soon!

► For fun, not graded!

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Schedule

Lectures

- ▶ **Video lectures** uploaded on Tuesdays before 10:00 in StudIP (Opencast).
- ▶ **Q&A sessions** for lectures on **Wednesdays 10:00 - 12:00 in presence** in the seminar room B0.10 at DFKI building in Robert-Hooke-Str. 1.
  - ▶ Remark: It might also take place online depending on the pandemic situation.
- ▶ Language of instruction: **English** slides and videos.

Schedule of Robot Design Lab

Tutorials

▶ The tutorials will take place on **Thursdays 10:00 - 12:00** in the seminar room B0.10 at DFKI building in Robert-Hooke-Str. 1.

▶ The worksheets will be solved during tutorial sessions with TurtleBot robots.

▶ Tutors will be present during these sessions for assistance and guidance.

▶ Language of instruction: Tutorials and worksheets will be in English, but hand-ins can be provided by students **in English or in German**.

▶ *Remark:* Room for tutorials and Q&A sessions might vary during the semester. We will inform you via StudIP.

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Schedule of Robot Design Lab

Worksheets

- ▶ All worksheets should be solved in groups. But, every group member is expected to have a basic understanding of how to solve all tasks!

- ▶ Write your answers/solutions in the **provided LaTeX-Template**.

- ▶ Upload your answers as a PDF file, together with any source code files in Stud.IP **until 23:59 of the due date** specified for the exercise sheet.

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Grading

Requirements to pass

There will be **6 worksheets** to be solved ($\sim$ one worksheet every two weeks).
In order to pass this course:

- ▶ **All** worksheets must be attempted.
- ▶ Score at least **50%** on 4 worksheets.
- ▶ Score at least **60%** over all worksheets.
- ▶ Plagiarism: not acceptable, examination office (Prüfungsamt) will be informed!

Grading of Worksheets

Grade	From %	To %
1.0	97	100
1.3	93	96
1.7	89	92
2.0	85	88
2.3	81	84
2.7	77	80
3.0	73	76
3.3	69	72
3.7	65	68
4.0	60	64

You have two options:

1. Solve worksheets and participate in a group interview.
   - ▶ Pre-requisite: You should pass the worksheets.
   - ▶ You will get a pre-grade from the worksheets.
   - ▶ Group interview will help to improve individual grades.
2. Listen to video lectures and take an individual oral exam.
   - ▶ You can solve some exercises in simulation, but these will not be graded.
   - ▶ Note: Only Bachelor Informatik Vollfach students can appear for the oral exam.

Study Tips

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- ▶ Utilize the rich online resources e.g. online lectures from other universities.
- ▶ Take notes (on notepad or paper).
- ▶ Start organizing your study materials and notes, for future reference.

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Outlook

Courses

► Robot Design Lab (WiSe) → bachelor

► Modern Robot Control Architectures (SoSe) → bachelor/master

► Machine Learning for Autonomous Robots (WiSe) → master

► Reinforcement Learning (SoSe) → master

► Human-Centered Interaction in Robotics (SoSe) → master

► Project on Human-Robot Interaction (WiSe + SoSe) → bachelor/master

https://www.youtube.com/watch?v=-Ig7FDOMCNk

Next: Introduction to Robotics.