

Robotics

Erwin M. Bakker | LIACS Media Lab

28-2 2022



Universiteit
Leiden

Bij ons leer je de wereld kennen

Organization and Overview

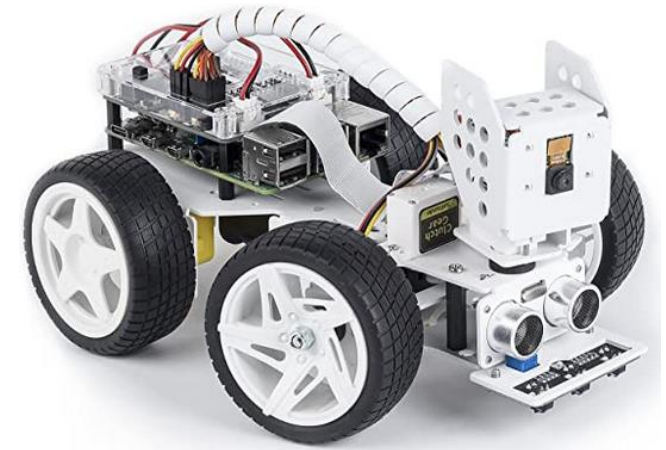
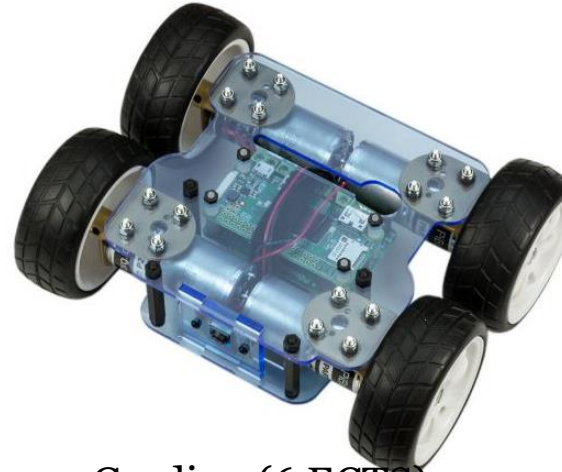
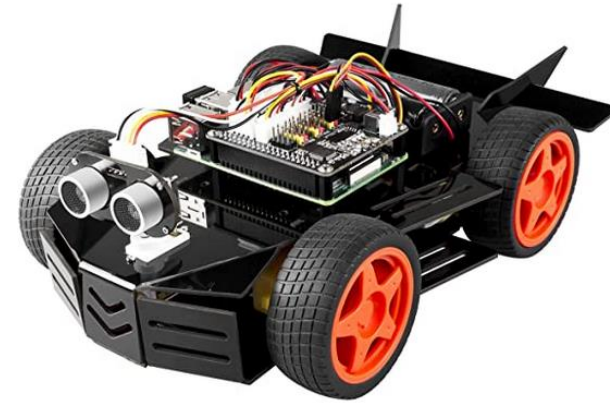
Period: February 7th – May 23rd 2022
Time: Monday 16.15 – 18.00
Place: Room 407 - 409
Lecturer: Erwin M. Bakker (erwin@liacs.nl)
Assistant: Hainan Yu (h.yu@liacs.leidenuniv.nl)

NB Register on Brightspace

Schedule:

7-2	Introduction and Overview
14-2	Locomotion and Inverse Kinematics
21-2	Robotics Sensors and Image Processing
28-2	SLAM + SLAM Workshop
7-3	Mobile Robot Challenge Introduction
14-3	Project Proposals I (presentation by students)
21-3	Project Proposals II (presentation by students)
28-3	Robotics Vision
4-4	Robotics Reinforcement Learning
11-4	Robotics Reinforcement Learning Workshop II
18-4	No Class (Eastern)
25-4	Project Progress I (presentations by students)
2-5	Project Progress II (presentations by students)
9-5	Mobile Robot Challenge
16-5	Project Demos I
23-5	Project Demos II

Website: <http://liacs.leidenuniv.nl/~bakkerem2/robotics/>



Grading (6 ECTS):

- Presentations and Robotics Project (60% of grade).
- Class discussions, attendance, workshops and assignments (40% of grade).
- It is necessary to be at every class and to complete every workshop and assignment.

List of Subjects

1. **Grading**
2. SLAM Workshop available on the web-site
3. Project Proposals (next 2 weeks)
4. Introduction Mobile Robot Challenge

1 Grading

Homework I	pass/no pass	
Homework II	(0-10)	5%
SLAM Workshop	(0-10)	10%
RL Workshop	(0-10)	5%
Mobile Robot Challenge	(0-10)	20%
Final Project	(0-10)	60%

2 SLAM Workshop

SLAM Workshop available on the web-site:
<https://liacs.leidenuniv.nl/~bakkerem2/robotics/>

Robotics Project Proposals Presentations

Monday 14-3 2022 and 21-3 2022

Present your Robotics Project Proposal during a **5 minute (max)** talk. Clearly state the title of your project, the team members, your goals, how you will pursue them, what are the challenges and what at least can and should be delivered on the demo days: **May 16th 2022 and May 23rd 2022.**

Note: Groups of 1-5 members are allowed.

The presentation should contain slides for:

1. Title and group members.
2. Goal of the project.
3. How will you pursue these goals.
4. What are the challenges.
5. What at least can and should be delivered on the demo days: **May 16th 2022 and May 23rd 2022.**

The LIACS Media Lab can support your project with some materials for your project. Please clearly state any materials that you would need for your proposal.

Please note that these materials are limited so project goals may need to be adjusted accordingly.

Each presentation will be followed by a short class discussion.

Robotics Project Proposals Presentations

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The presentation should contain slides for:

1. Title and group members.
2. Goal of the project.
3. How will you pursue these goals.
4. What are the challenges.
5. What at least can and should be delivered on the demo days: **May 16th 2022 and May 23rd 2022.**

Send your title, group-members and preference to present (e.g. on 1) March 14th 2) March 21st) to erwin@liacs.nl before the end of this week.

The LIACS Media Lab can support your project with some materials for your project. Please clearly state any materials that you would need for your proposal.

Please note that these materials are limited so project goals may need to be adjusted accordingly.

Each presentation will be followed by a short class discussion.

Previous Projects

1. Evolutionary Locomotion
 2. Nao plays Tic-Tac-Toe
 3. Slam Robot Project.
 4. Dolphin Drone: Drone Recognition and Maneuvering with Hoops.
 5. Delivery Drone.
 6. Programming a NAO to play a tune using a xylophone.
 7. Floor mapping with Swarm Robotics
 8. Tootballing Yetiborg
 9. Cat Flap Opening Based on Audio/Video/RFID
 10. DrawBot
 11. Traffic coordination (simulation).
 12. Plane filling curves (simulation).
1. AimBot
 2. Artificial Muscles
 3. Ball Tracking Car
 4. BorrelBot
 5. Fetch Bot
 6. Floor Mapping Robot
 7. Gesture Control Pachenko
 8. Hexapod
 9. Nao Pose
 10. Position Estimation
 11. Race Car Training
 12. Face Touch

List of Subjects

1. Grading
2. SLAM Workshop available on the web-site
3. Project Proposals (next 2 weeks)
4. **Introduction Mobile Robot Challenge (Due 9-5 2022)**

Teams Mobile Robot Challenge

Per team please send an email to erwin@liacs.nl with:

Team Name:

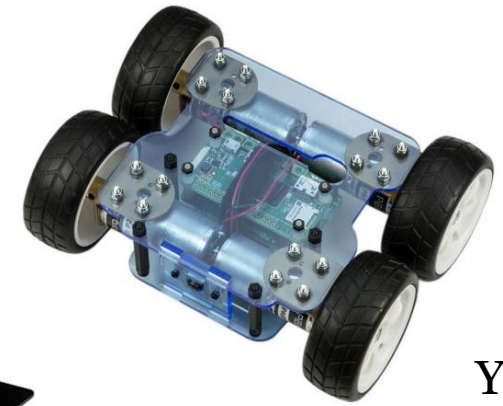
Contact Name (responsible for the robot):

Team Members:

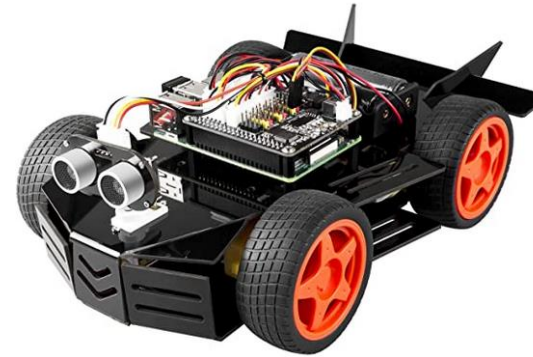
List of robots in order of preference, e.g.:

1. [YetiBorg v2](#)
2. [PiCar-4wd](#)
3. [PiCar-X](#)
4. [JetRacer \(2wd\)](#)

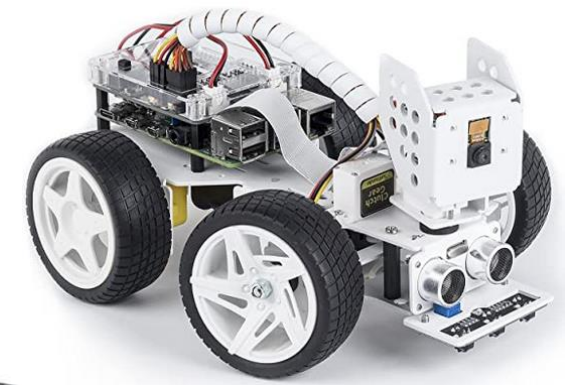
Website: <http://liacs.leidenuniv.nl/~bakkerem2/robotics/>



YetiBorg



PiCar-4wd



PiCar-X



JetRacer

References

SLAM

1. M. Sualeh, G.-W. Kim, Simultaneous Localization and Mapping in the Epoch of Semantics: A Survey, International Journal of Control, Automation and Systems 17(3) (2019) 729-742.
2. W. Hess, D. Kohler, H. Rapp, D. Andor, Real-Time Loop Closure in 2D LIDAR SLAM, Published in: 2016 IEEE International Conference on Robotics and Automation (ICRA).
3. X. Chen et al., OverlapNet: Loop Closing for Lidar-based SLAM, May 2021.
4. E.R. van der Zande, An Introduction to 2D Lidar SLAM, December 2021.
5. S. Sumikura et al., OpenVSLAM: A Versatile Visual SLAM Framework, 2019.
6. G. Liu et al. DMS-SLAM: A General Visual SLAM System for Dynamic Scenes with Multiple Sensors, Sensors, 2019.

Yetiborg Challenge

1. <https://navoshta.com/detecting-road-features/> by Alex Staravoitau
2. OpenCV.org