



# 34755 Building dependable robots

- Today
- Introduction to
  - The course
  - The challenge
  - The Robot
  - Workshop
  - Facilities and support team
- Group forming
  - Group forming (we have 20 robots and 125 students)  
(see Learn: My course → groups and sign up for a group).
  - For each group there is one robot.
- Move to 330D ASTA (Autonomous Systems Test Arena)
  - DTU Robocup test setup
- Move back to 329A/120 and 325/047 for further group work.
- Course content → content → week 1 → group work

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PCAS (Perception and Cognition for Autonomous Systems)  
DTU Electro

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# Innovate a robot to compete in the DTU Robocup

## Objectives

- Formulate technical problems and solutions in writing (and orally)
- Analyse a challenge and design solutions with limited resources
- Use project planning
- Use project control for a team
- Remember characteristics of robot platform types
- Remember characteristics of sensors and actuators for mobile robots
- Use and programme mobile robots for demanding missions
- Build robust solutions for risky challenges
- Employ a reflective fault finding method

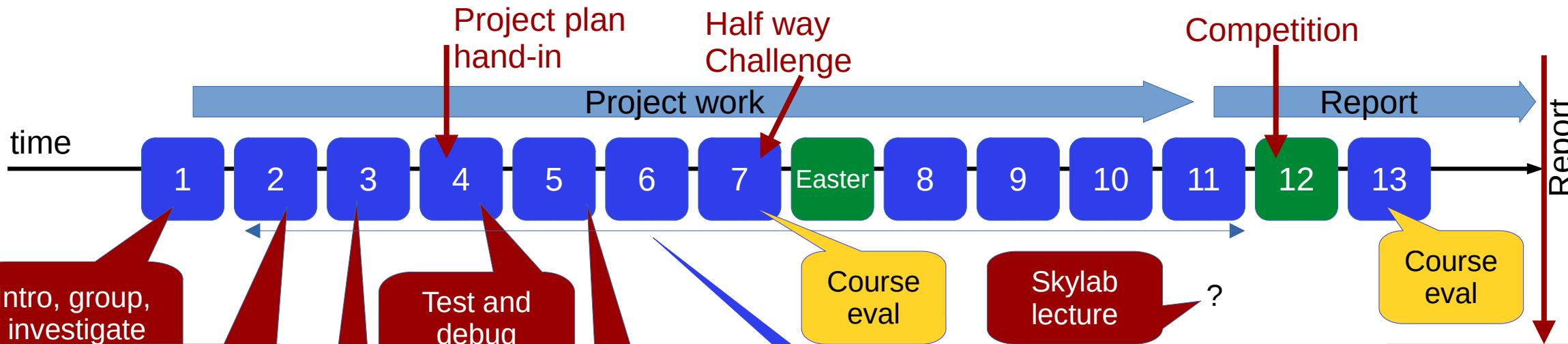
## Content

- Innovate an existing robot platform to meet the challenges of DTU Robocup in the context of a (large) team.
- Group-work, groups of 6-8 persons

## Evaluation

- Evaluation based quizzes, group performance, half-way challenge, competition, and a final report (7-scale).





Intro, group, investigate

More info.  
Project Analysis

Test and debug  
(1h lecture)

Reliability  
(1h lecture)

Course eval

Skylab lecture

Course eval

template

**Frontpage**  
Frontpage must include the course name, group name and name of participants.

**Introduction**

- Aims for performance
- Formal planning methods used like
  - Scrum and sprint (<https://www.justinmind.com/>)
  - Kanban (<https://www.linoxos.com/>)
  - Group work team contact (<https://www.georgebrown.ca/>)

**Cooperation plan**

- How to work in common on the project
- How to get in contact with other group members (e.g. the group on zoom, by otherwise)
- How to share data and documents (team file locker, teams, overleaf or other)
- How to build and test the robot
- The competition facilities include 3294/120, the lab in 325/047, the 326/131 and the test arena in building 3300 (ASTA)
- Who can be part of the final testing before DTU Robocup (in the Easter period competition (Wednesday and Thursday after Easter). Not all group members present).

**Project plan**

- Project tasks with a short description
  - including the main responsible person for the task. Each person must

Project planning  
Groupwork

**Week 2-10:**

- Groupwork
- Quiz (learn. Obj.)
- Fridays 13-17
  - Lecture
  - Support

template

**Report requirement:**

**Frontpage**

- with the course, date, group, robot and name

**Section 1: Introduction to the group**

- List of group members.
- Your role and responsibilities in the group.
- Your assessment of your role and the performance of the group as a whole.

**Section 2: Introduction to the selected challenge**

- Why this challenge
- Your assessment of the challenge

**Section 3: Description of challenge solution**

- The general approach, including how it fits with the other challenges.
- Solution description, including required hardware and software

**Section 4: Performance**

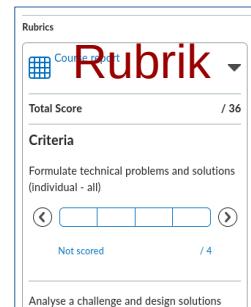
- An annotated path of the robot, pinpointing position or stretches of interest.
- An assessment of the performance along the path.
- An assessment of the risks for the competition performance associated with this challenge.
- A graph of some data recorded that can illustrate the performance or the associated risk. It could be, e.g. line position during line following, including robot velocity or tilt.
- It could be sample images and filtering performance if vision is relevant to the challenge.
- Reference to the team video.

**Section 5: Conclusion**

- Summary of the challenge performance.

**Section 6: Appendix**

- Relevant code



# Assignments

Each group of 6-8 persons Assignments:

- Project plan (for group)
- Weekly (info) quizzes / exercises
- Half way challenge (group)
- Final challenge (group)
- Project video (group - less than 5 minutes)
- Final report (individual)

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# Course assignment used to be DTU Robocup

See: <http://robocup.dtu.dk>

- Test track in ASTA  
Competition in ASTA

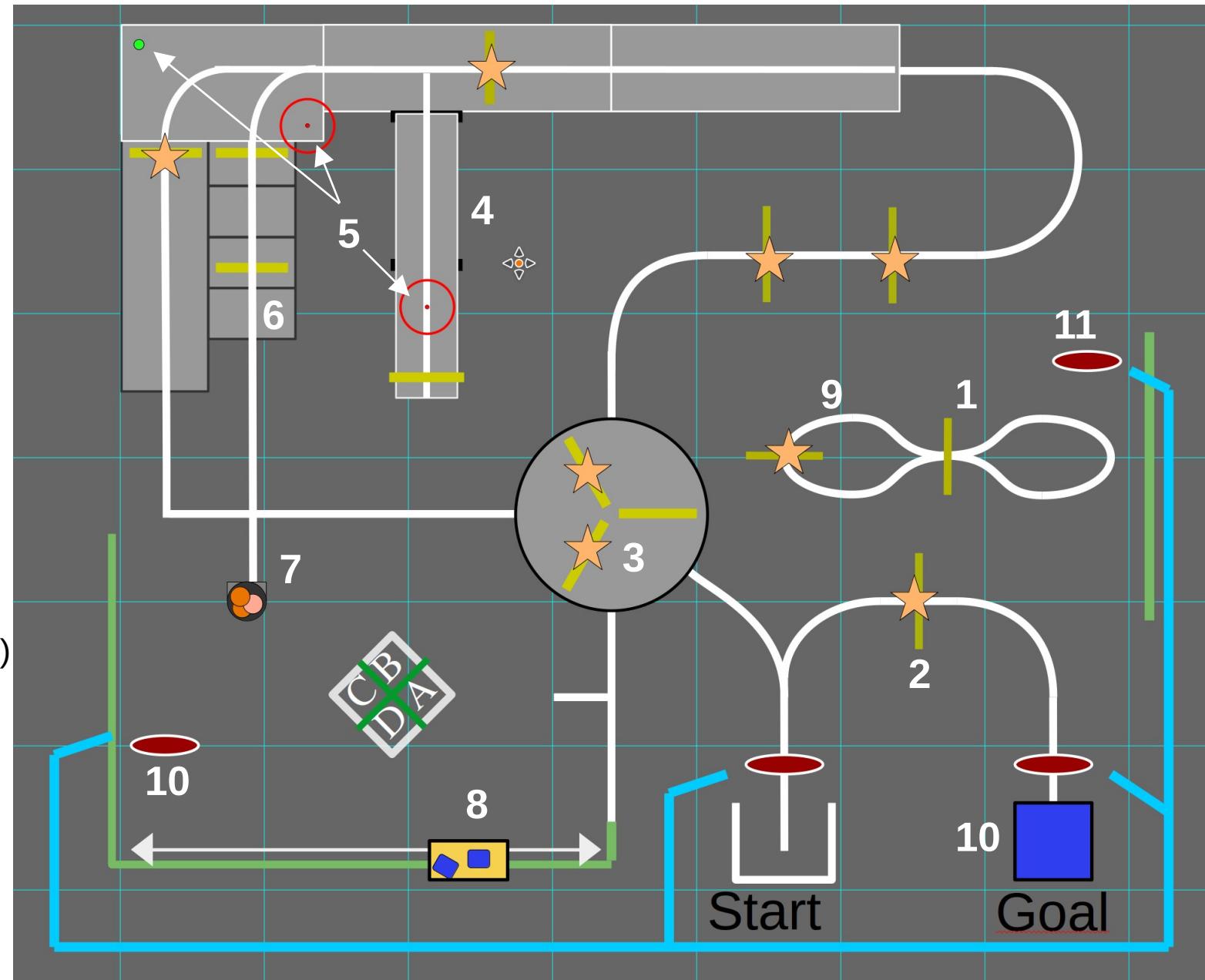


DTU finals 2023

# Course challenge

Points: (max 43 points)

- 1) Gate (yellow) passed: 1 point each
- 2) Gate with star: Has drone; bring blinking drone to goal 2 point each.
- 3) Roundabout (3 gates 2 drones)
- 4) See-saw: Gate point from see-saw only.
- 5) Golf-ball in hole gives 2 point each.
- 6) Stairs, going up gives double points (2x2).
- 7) Ball: bring blue ball to C 4 points  
Red ball to B 2 points
- 8) Luggage transport: Luggage 20 to A (4 points)  
Luggage 53 to D (2 points)
- 9) Guard robot: Touch gives -1 point (max -2)
- 10) Reaching goal: 2 points
- 11) Mission time limit 200 sec. These zones (2) trigger extra 90 seconds each.



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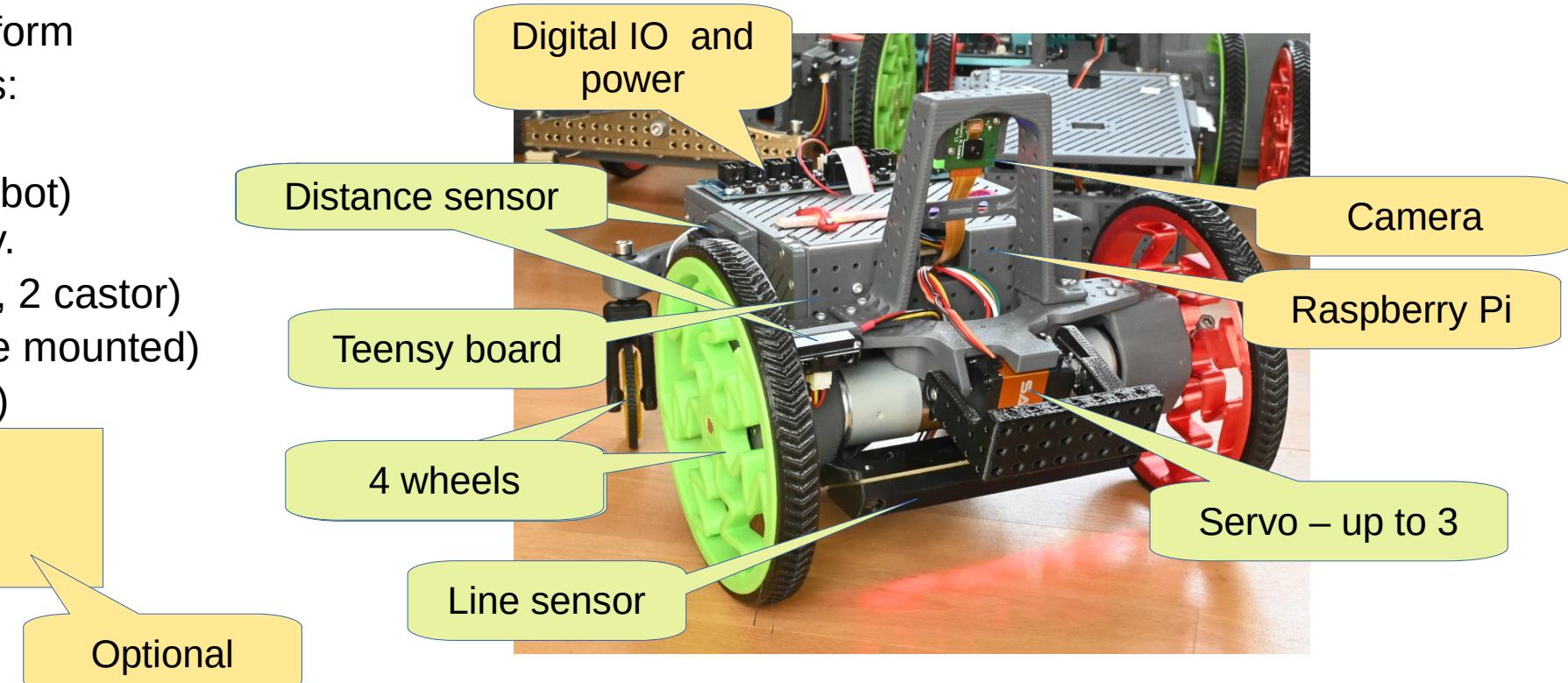
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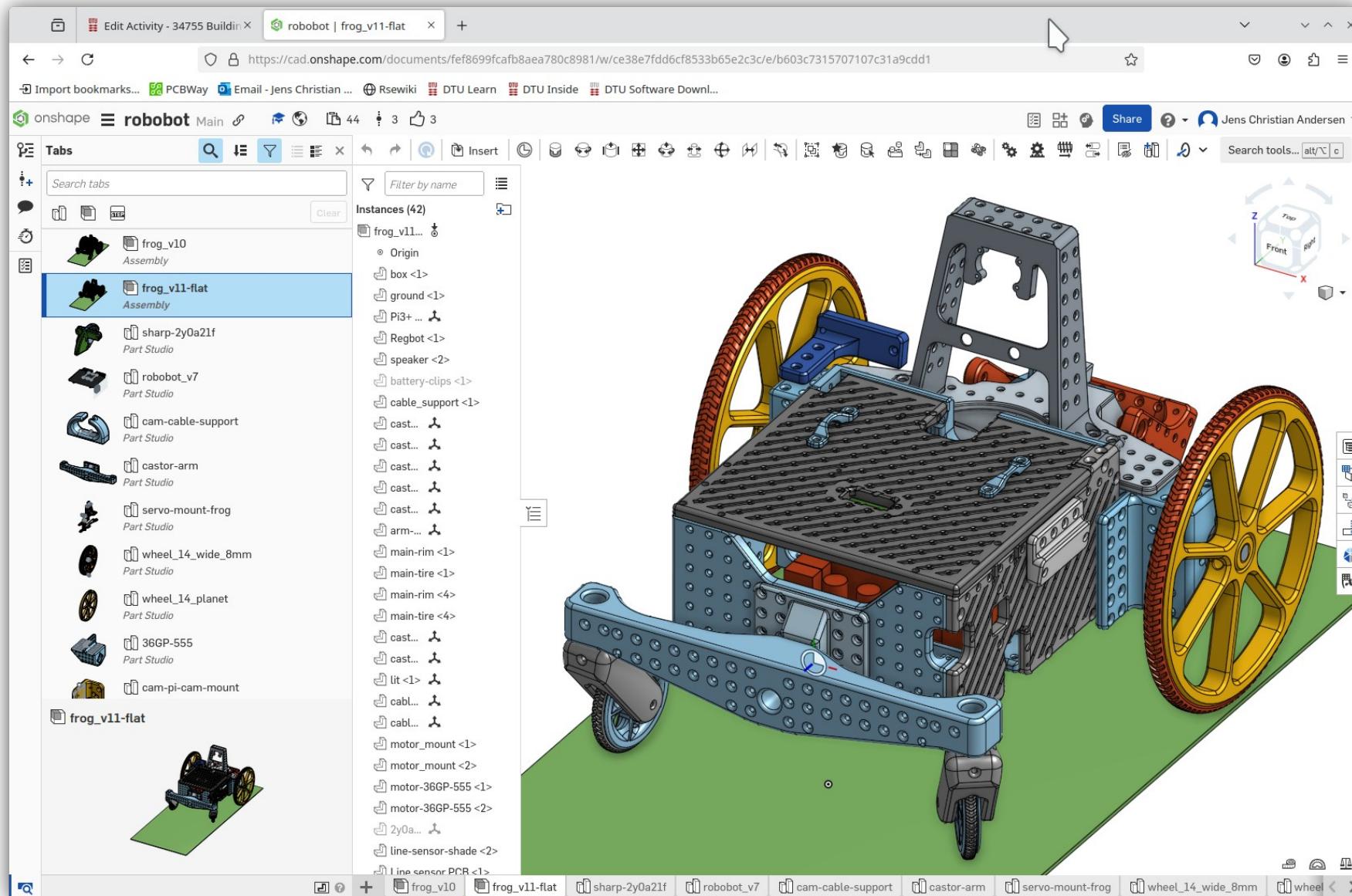
# Introduktion to Robobot

Robobot  
2025 version

- Robobot is a basis platform
- Main hardware features:
  - Linesensor
  - Teensy board (Regbot) with a small display.
  - 4 wheels (2 driving, 2 castor)
  - Up to 3 servos (one mounted)
  - Distance sensor (2)
  - Raspberry Pi
  - Camera
  - Digital IO board
- Software features
  - Coming
- Hardware demo



# Hardware plastic



Onshape

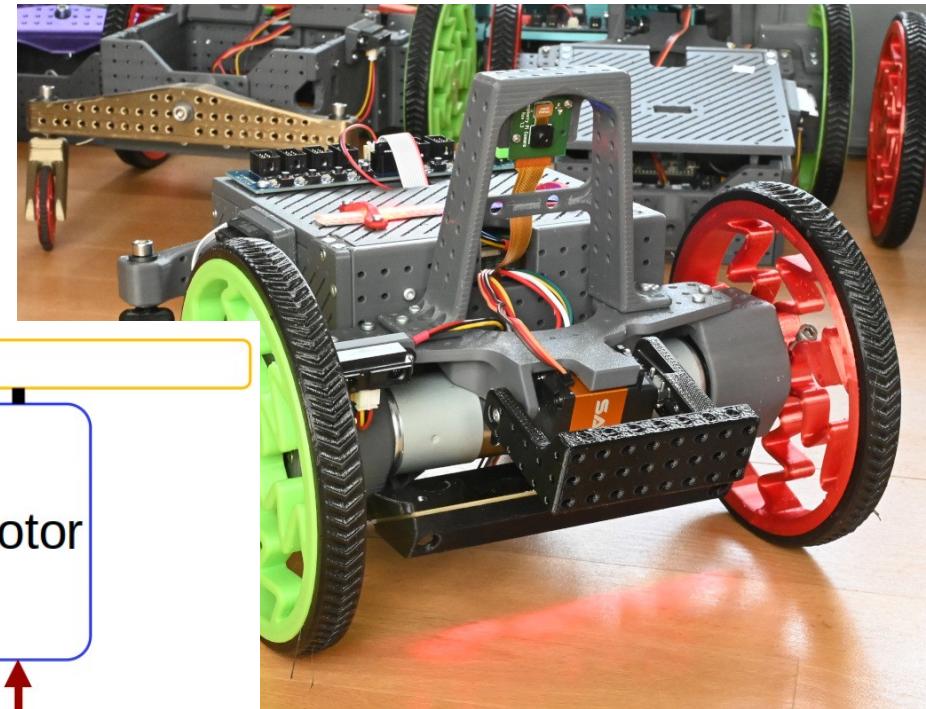
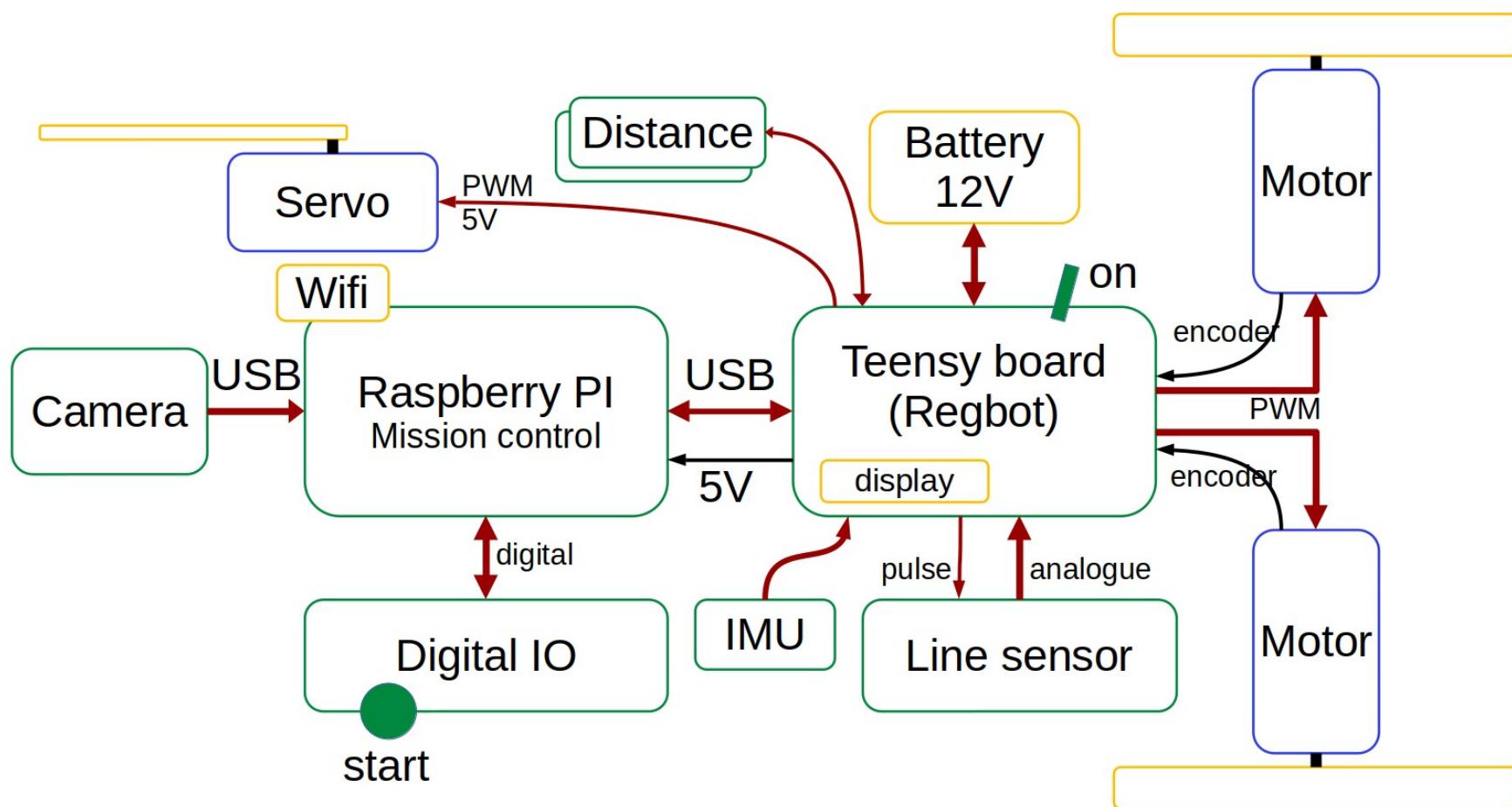
- free for Students
- cloud based
- (browser only)

<https://cad.onshape.com>  
Use link below, or search  
for ROBOT

<https://cad.onshape.com/documents/fef8699fcfb8aea780c8981/w/ce38e7fd6cf8533b65e2c3c/e/b603c7315707107c31a9cdd1>

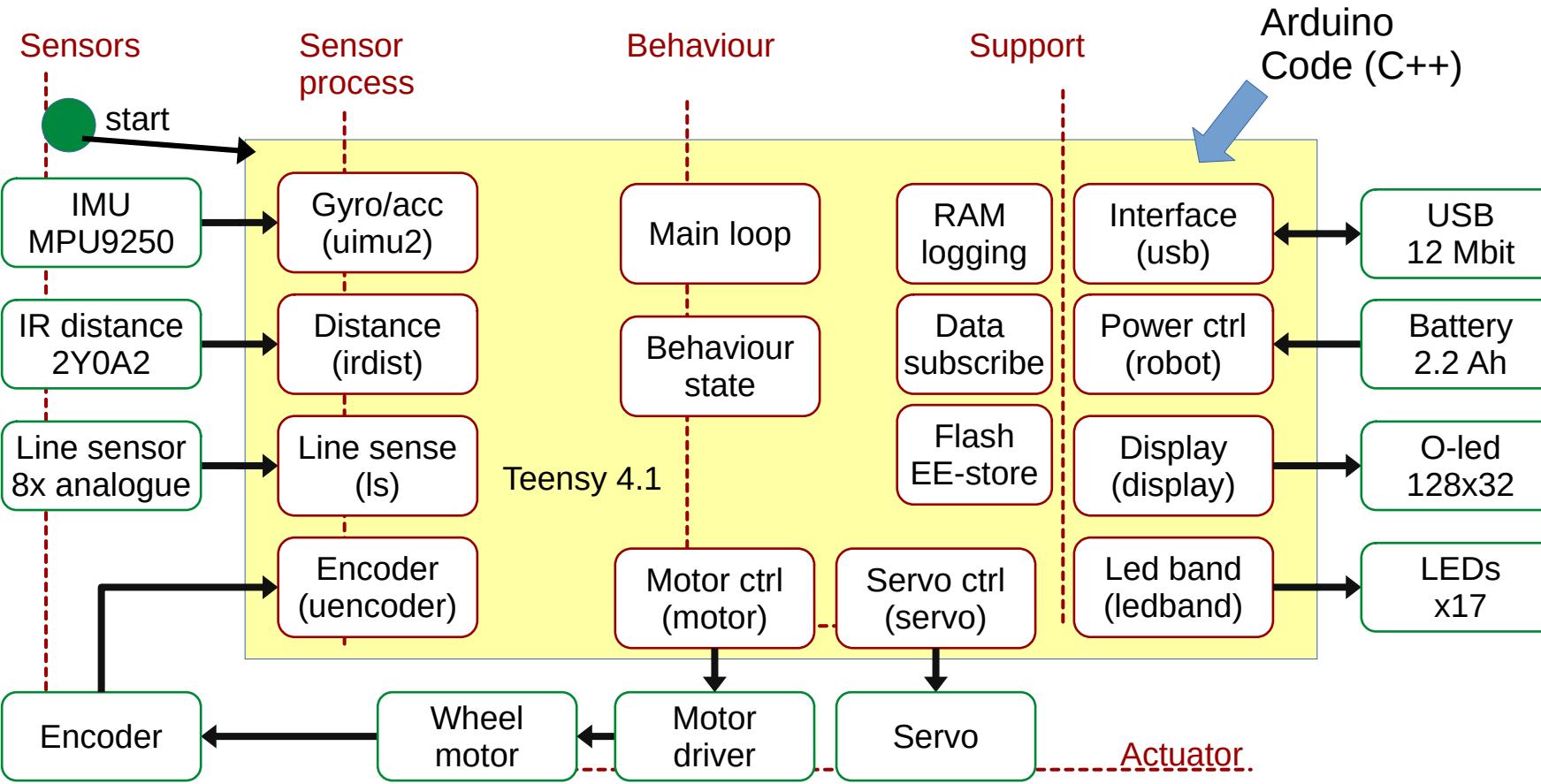
This, or any other tool,  
can be used to extend the  
robot.  
(and extension is needed).

# Robobot introduction - electrical

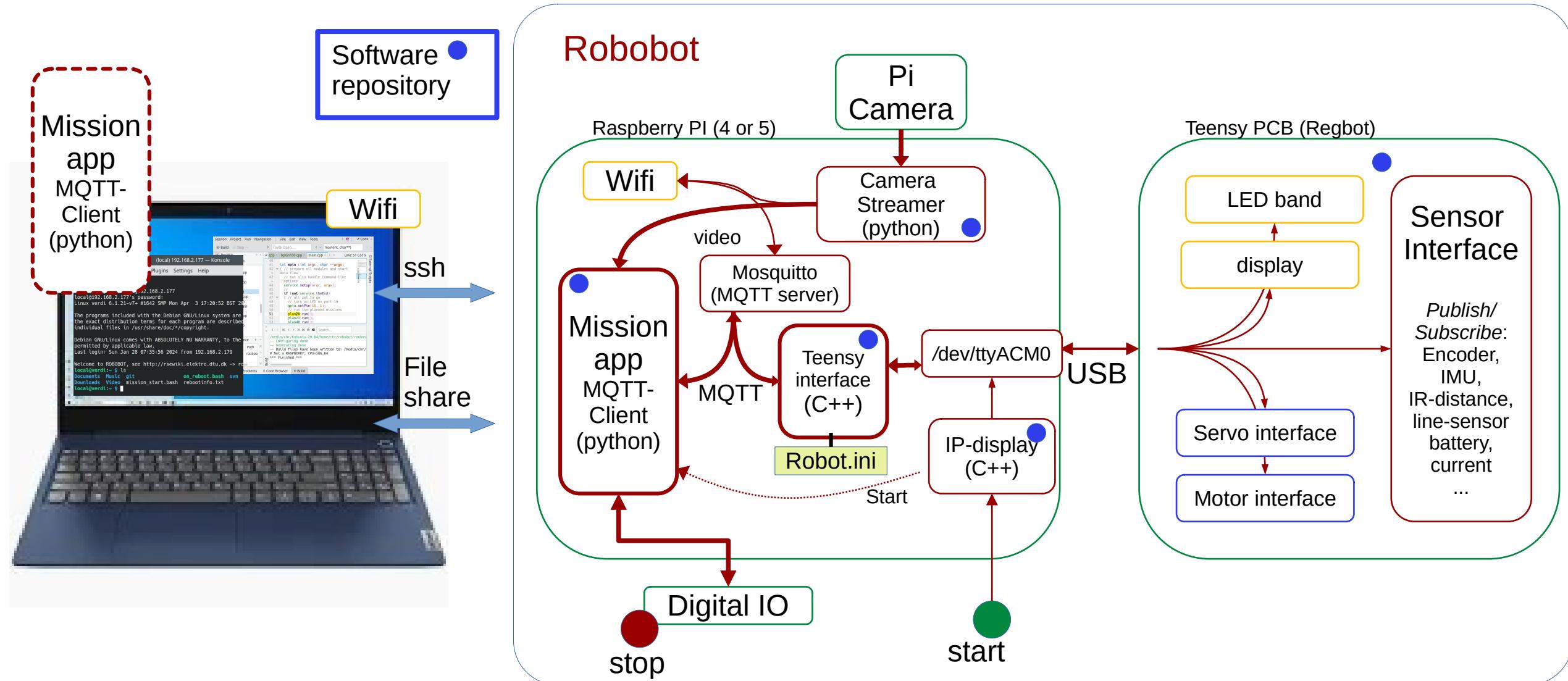


# Robobot introduction – No-Raspberry option

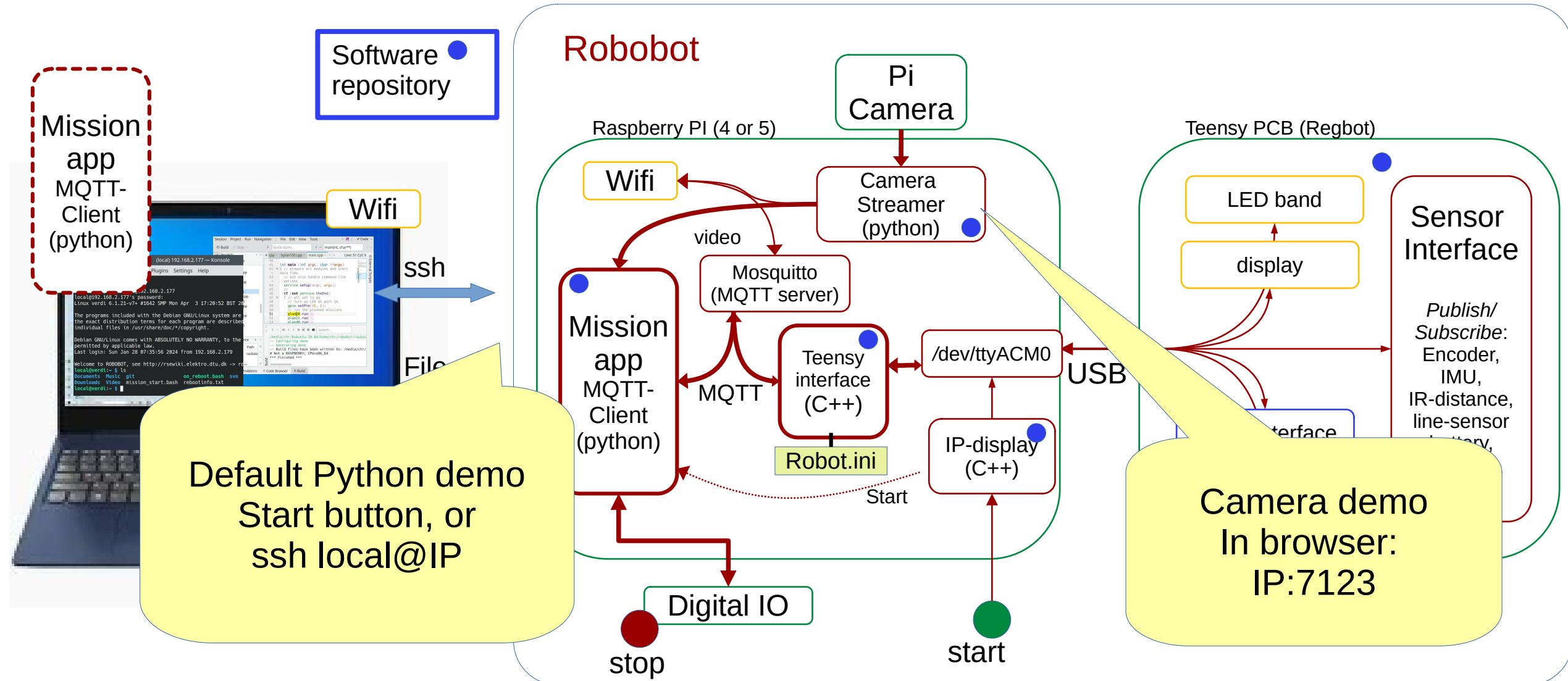
# Robobot base board



# Robobot introduction – Software elements (Raspberry option)



# Robobot introduction – Software elements (Raspberry option)



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# Facilities

## ASTA (Autonomous Systems Test Arena)

- A facility where
- drones, mobile robots, robots on or below water
- can be tested
- on its own or
- in any combination
- ~1000m<sup>2</sup> 14m to the ceiling
- Poor acoustics, not heated, Fine wifi
- The DTU Robocup track elements are available in ASTA
- You can leave the robot in ASTA (behind the track), in 329A 1<sup>st</sup> floor near 326, or take it along.
- 
- You should (soon) have card access to ASTA (Last person to leave must lock the door)
- 



## The supervisor team

- Help available on (most) Fridays 13:00 to 17:00.
- The aim is that two will be available each Friday.

Christian  
Andersen



Søren  
Hansen



Nils  
Andersen



Søren  
Beyer



Jakub  
Gregorek



Carles  
Trullén



Lars  
Dethlefsen



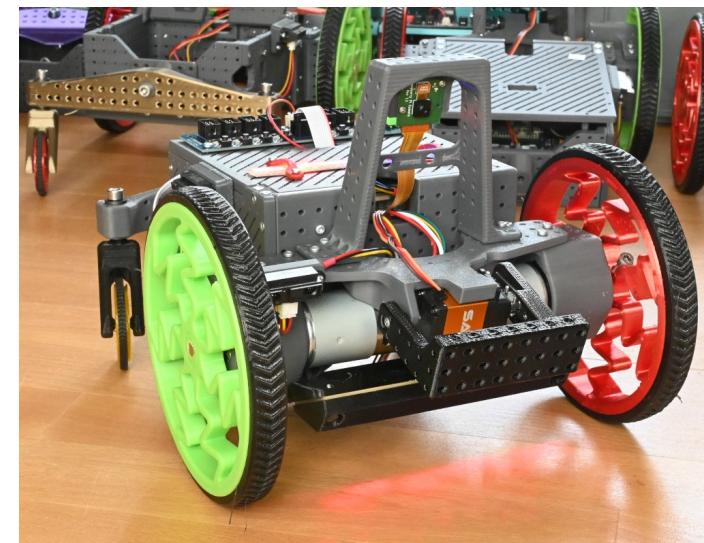
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# Today

- **Find your group robot**  
or  
**join a group with a robot**
- 6 to 8 persons per group.
- Find a group location (in the 329A/120 area or in the 325/047 area)
- In Learn, go to My course → Groups
- Enrol yourself into the group with the robot name
- Follow the 'Group work' plan for week 1.

Robots will be available outside 329A/120



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