
DTU

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

J. Christian Andersen
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).

34755 – Building dependable robot systems

2025

Project plan hand-in

Half way Challenge

Competition

Project work

Report

Report

time

1 2 3 4 5 6 7 Easter 8 9 10 11 12 13

Intro, group, investigate

More info. Project Analysis

Project planning Groupwork

Test and debug (1h lecture)

Reliability (1h lecture)

Course eval

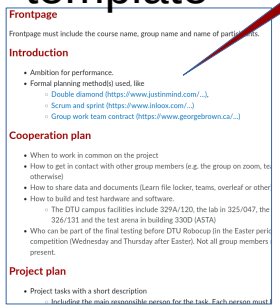
Skylab lecture ?

Course eval

Week 2-10:
- Groupwork
- Quiz (learn. Obj.)
- Fridays 13-17
  - Lecture
  - Support

Individual report -Strict requirements

template



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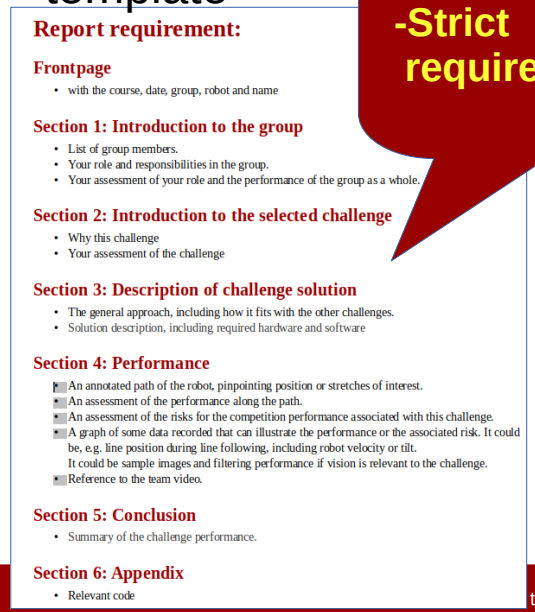

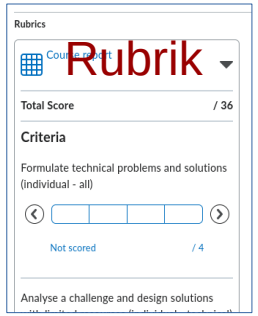

Assignments

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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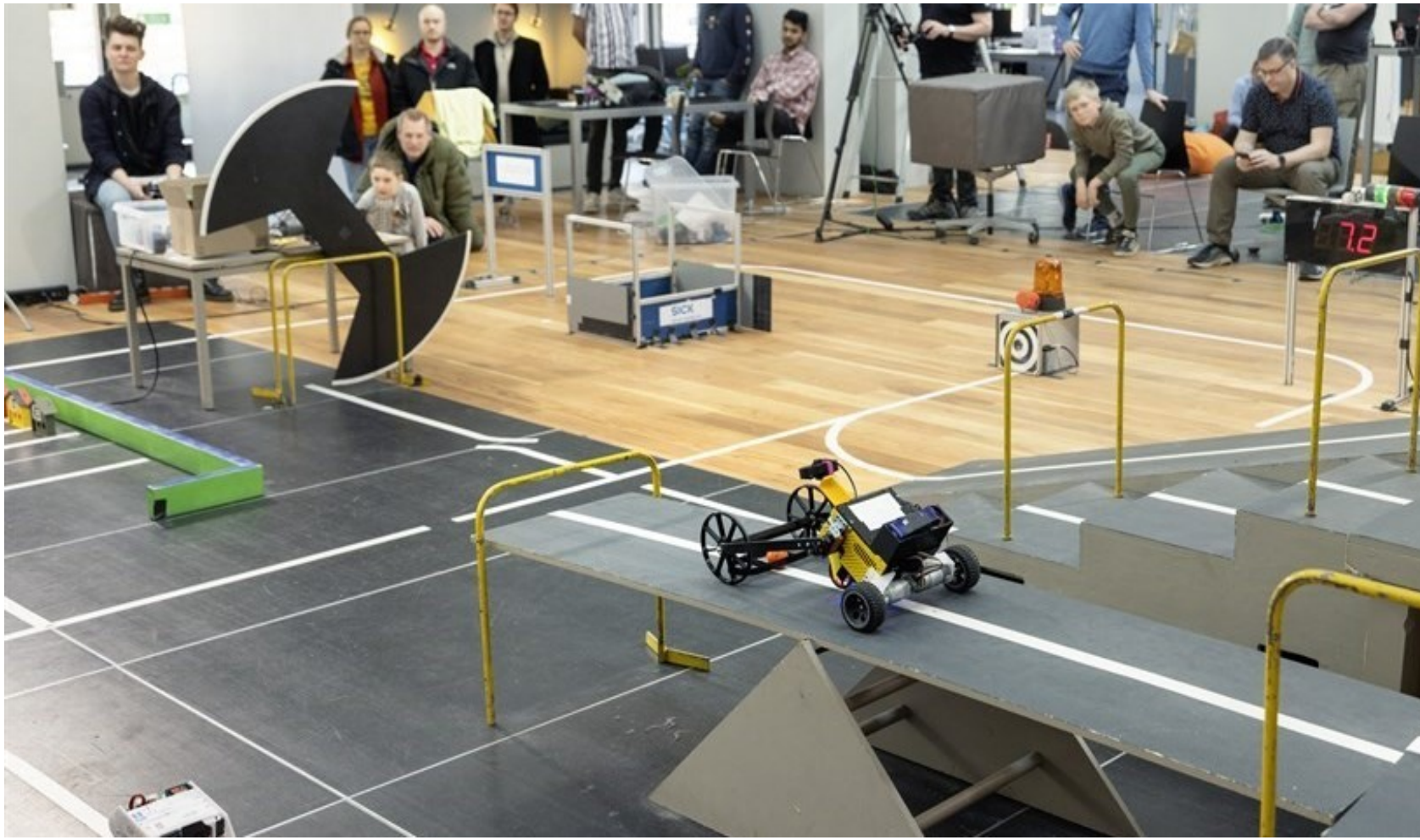
Course assignment used to be DTU Robocup

See: http://robocup.dtu.dk

- Test track in ASTA
  Competition in ASTA

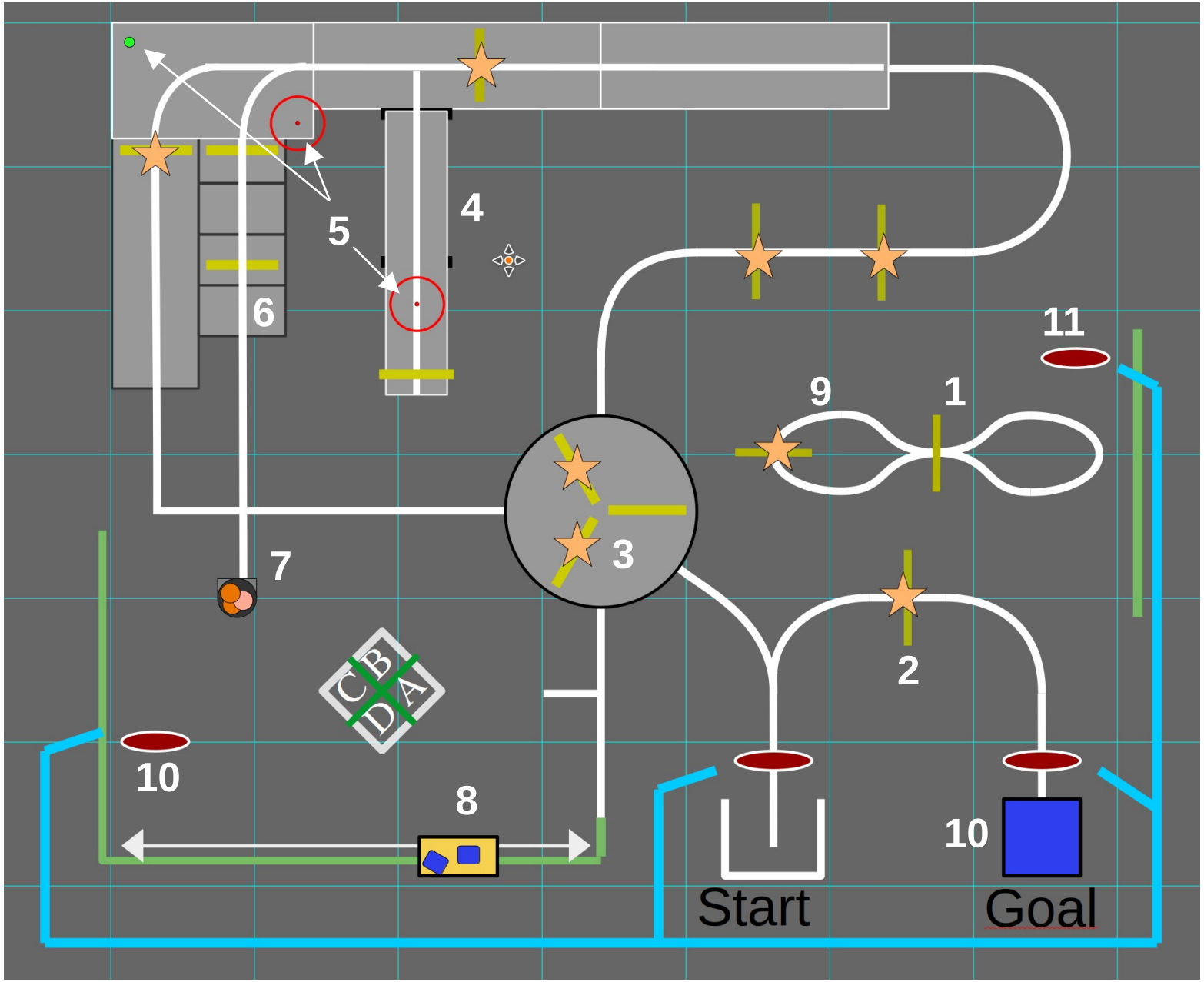


DTU finals 2023

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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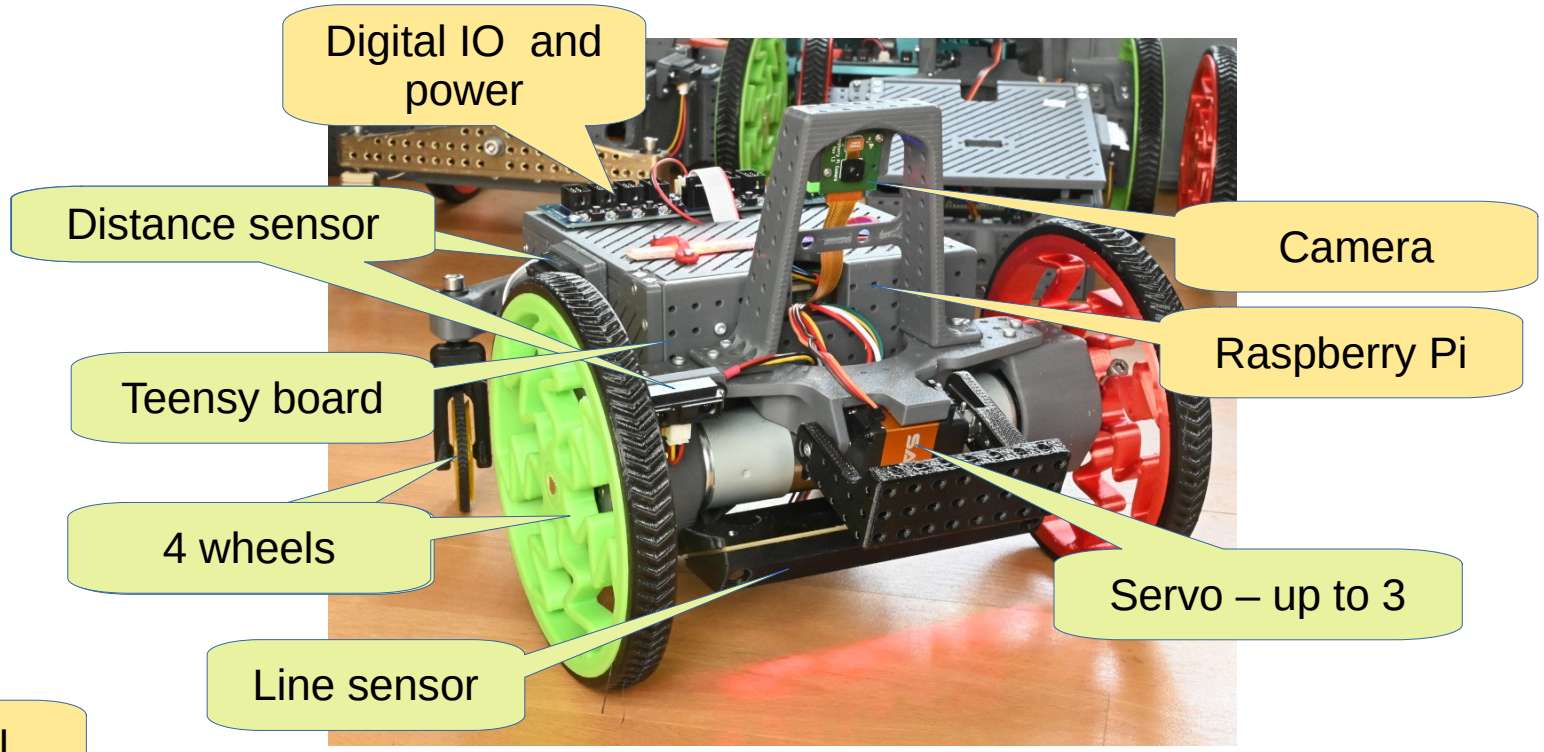
Introduktion to Robobot

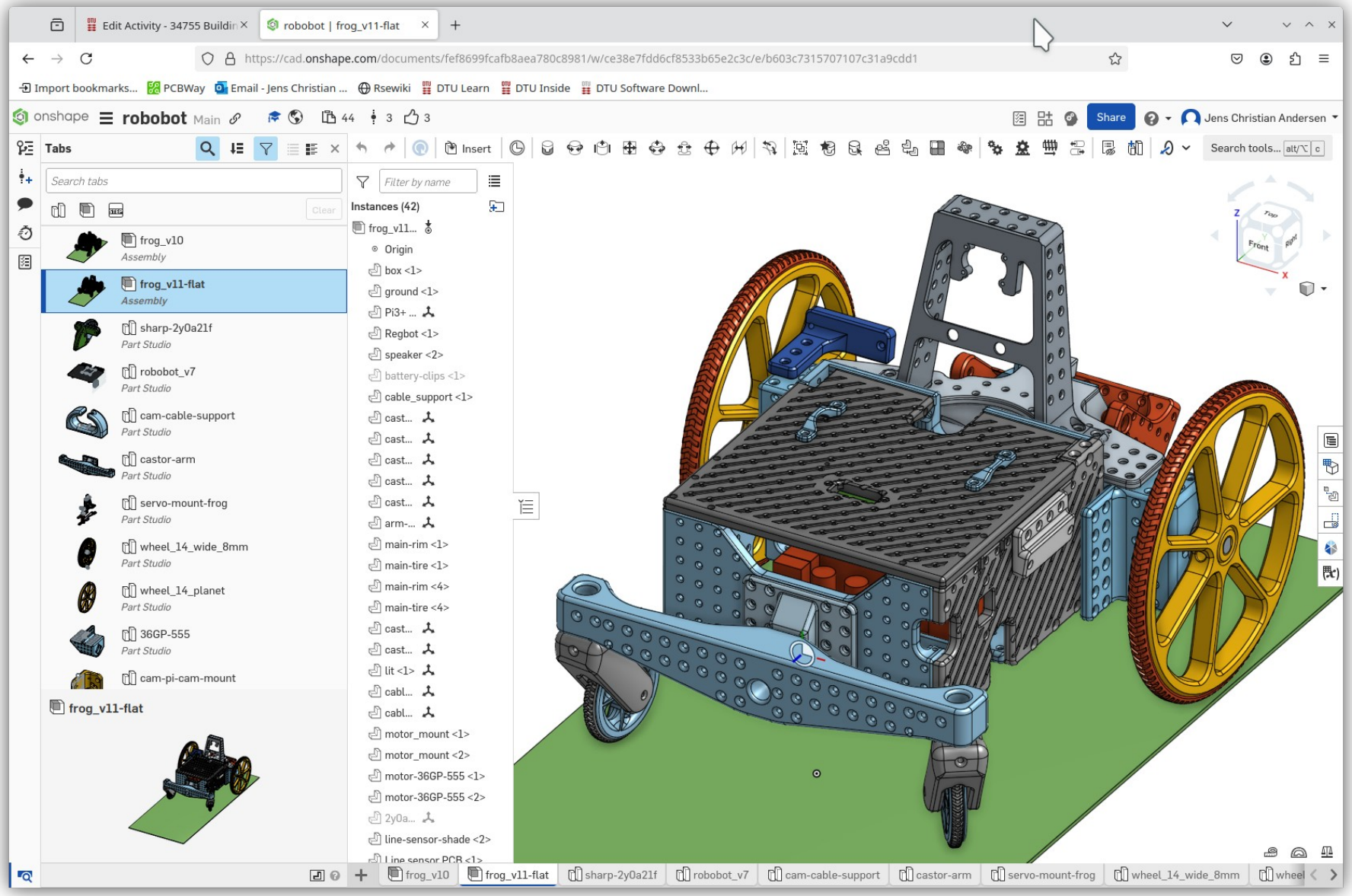
- Robobot is a basis platform
- Main hardware features:
  - Linesensor
  - Teensy board (Regbot) with a small display.
  - 4 wheels (2 driving, 2 castor)
  - Up to 3 servos (one mounted)
  - Distance sensor (2)
  - Raspberry Pi
  - Camera
  - Digital IO board
- Software features
  - Coming
- Hardware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

Optional

Robobot
2025 version



Hardware plastic



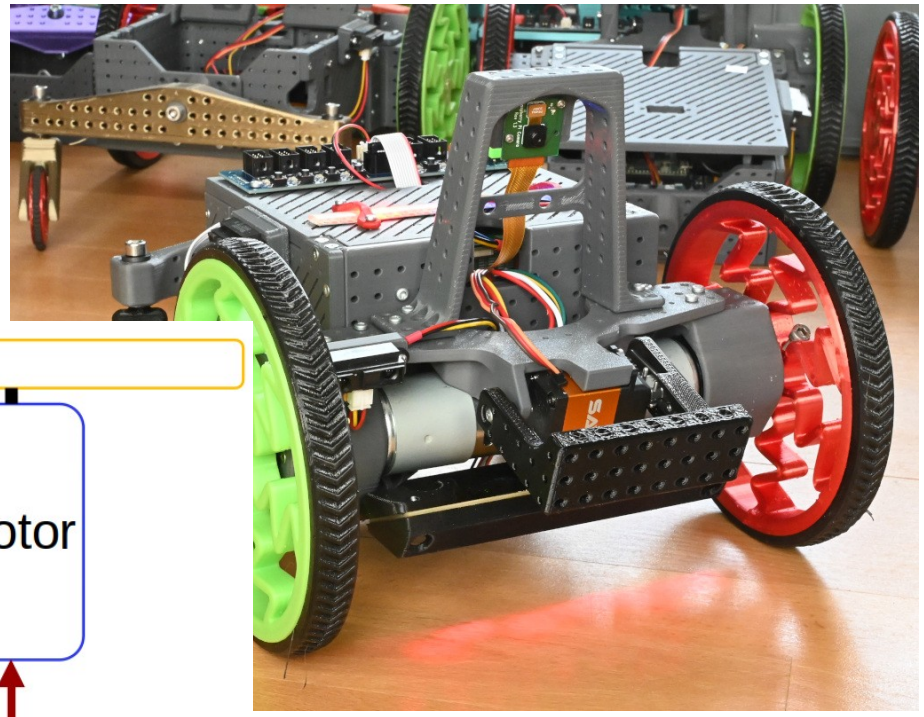
Onshape
- free for Students
- cloud based
  (browser only)

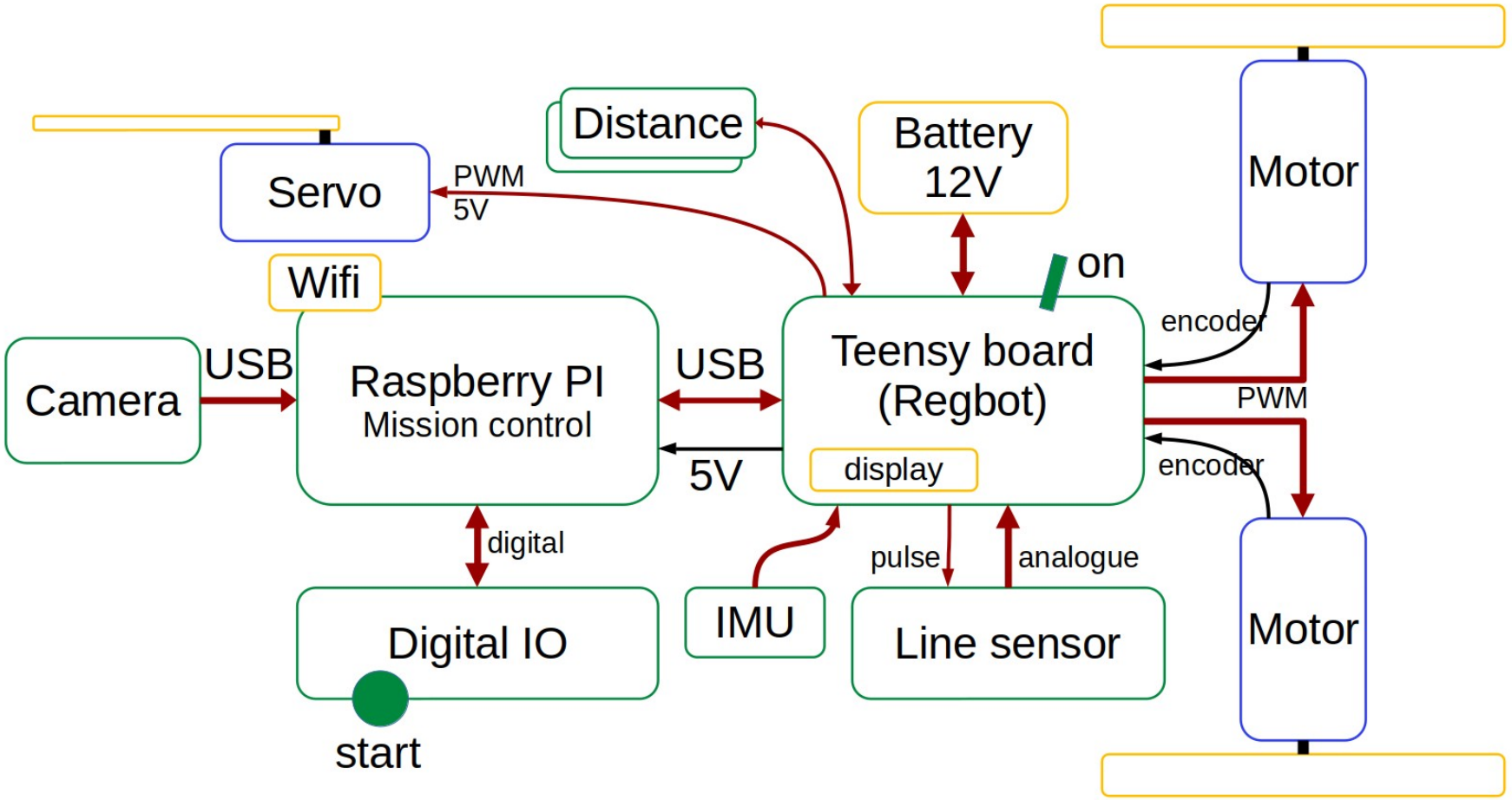
https://cad.onshape.com
Use link below, or search for ROBOBOT

https://cad.onshape.com/documents/fef8699fcafb8aea780c8981/w/ce38e7fdd6cf8533b65e2c3c/e/b603c7315707107c31a9cdd1

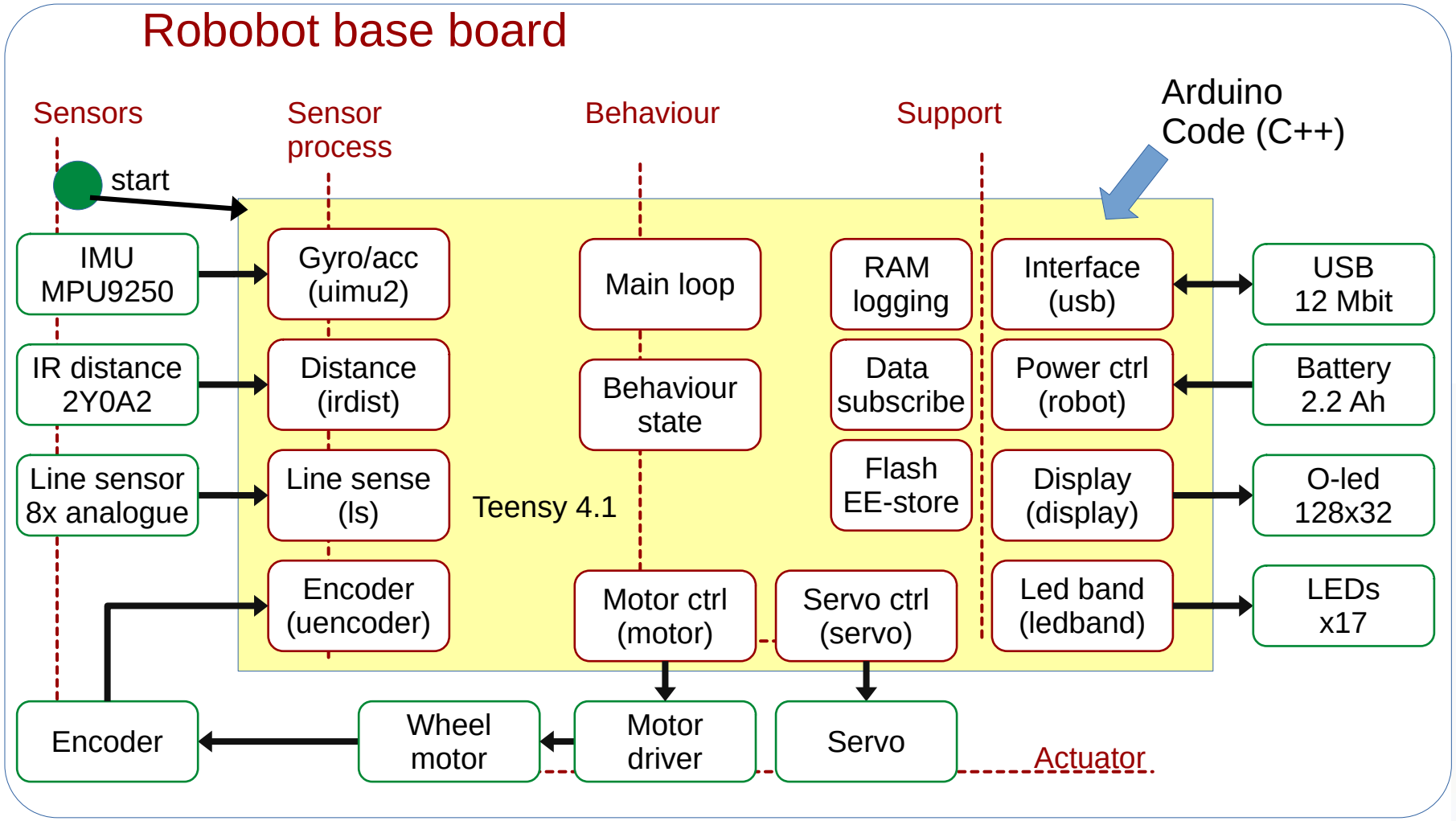
This, or any other tool, can be used to extend the robot.
(and extension is needed).

Robobot introduction - electrical





Robobot introduction – No-Raspberry option



Robobot introduction – Software elements (Raspberry option)

Software repository

Mission app MQTT-Client (python)

Robobot

Pi Camera

Raspberry PI (4 or 5)

Wifi

Camera Streamer (python)

video

Mosquitto (MQTT server)

Mission app MQTT-Client (python)

MQTT

Teensy interface (C++)

Robot.ini

/dev/ttyACM0

USB

IP-display (C++)

Start

Digital IO

stop

start

Teensy PCB (Regbot)

LED band

display

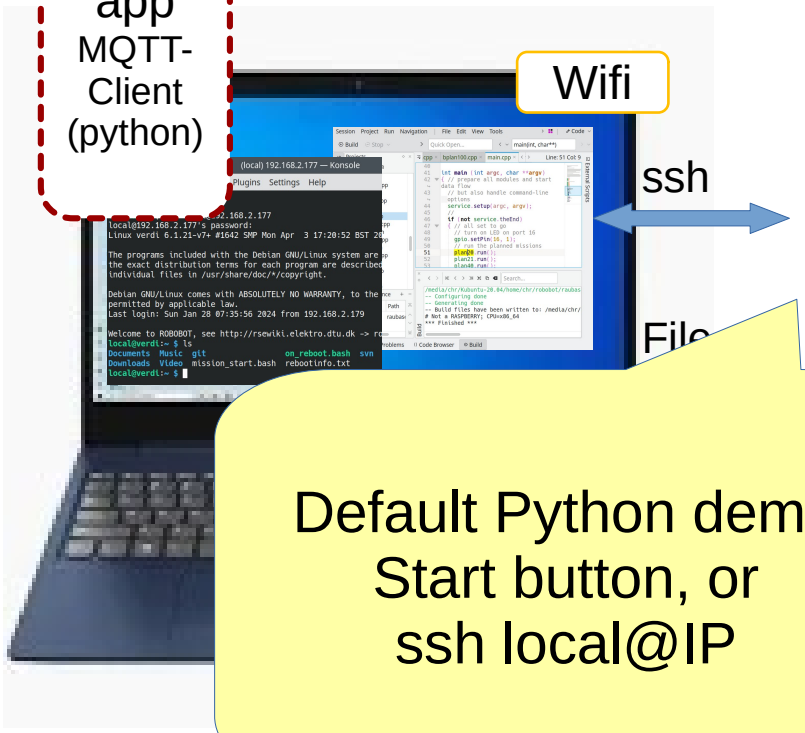
Servo interface

Motor interface

Sensor Interface

Publish/ Subscribe: Encoder, IMU, IR-distance, line-sensor battery, current ...

Robobot introduction – Software elements (Raspberry option)



Mission app MQTT-Client (python)

Software repository

Wifi

ssh

File

Default Python demo
Start button, or
ssh local@IP

Robobot

Pi Camera

Raspberry PI (4 or 5)

Wifi

Camera Streamer (python)

video

Mosquitto (MQTT server)

Mission app MQTT-Client (python)

MQTT

Teensy interface (C++)

/dev/ttyACM0

USB

Robot.ini

IP-display (C++)

Start

Digital IO

stop

start

Teensy PCB (Regbot)

LED band

display

Sensor Interface

Publish/ Subscribe: Encoder, IMU, IR-distance, line-sensor

Camera demo
In browser:
IP:7123

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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^2 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 1st floor near 326, or take it along.
-
- You should (soon) have card access to ASTA (Last person to leave must lock the door)
-

Support

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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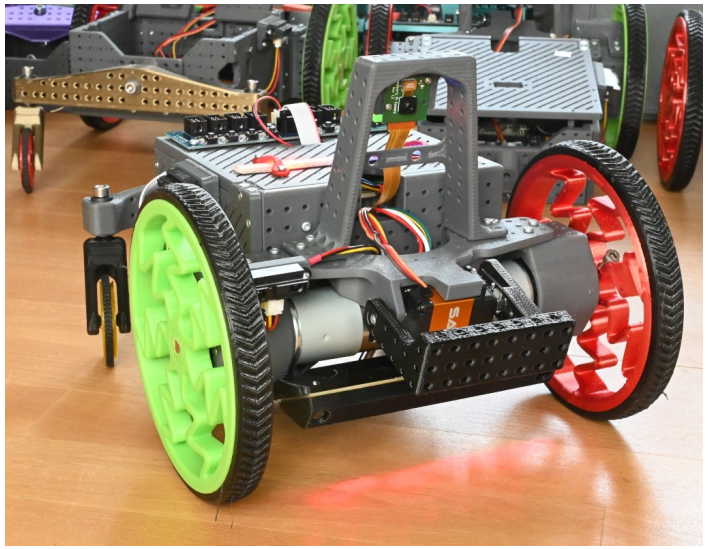
Today

- **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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