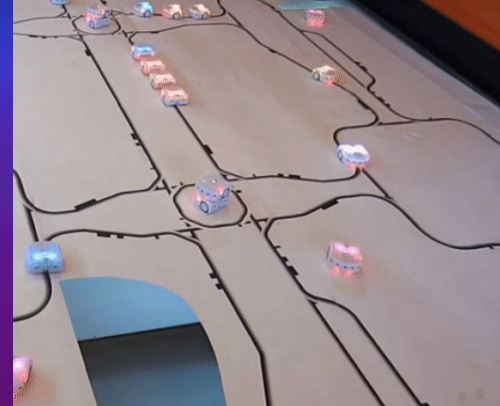
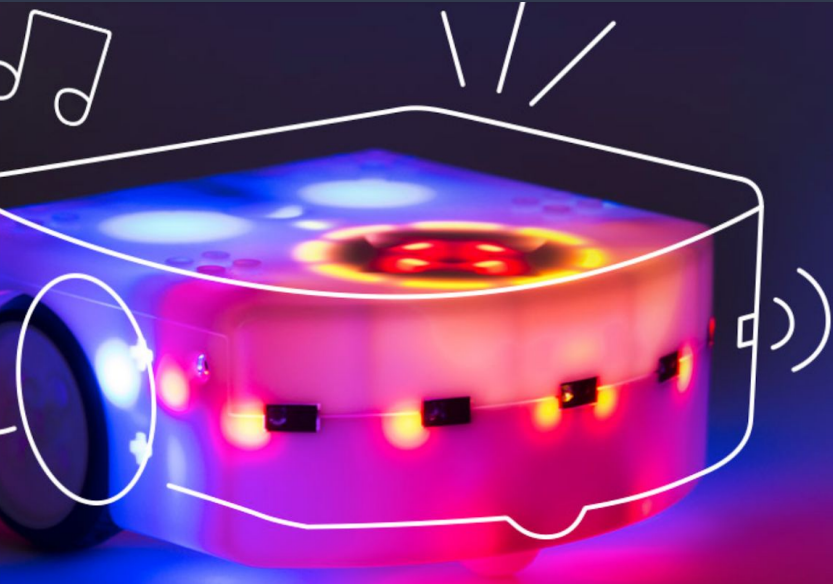
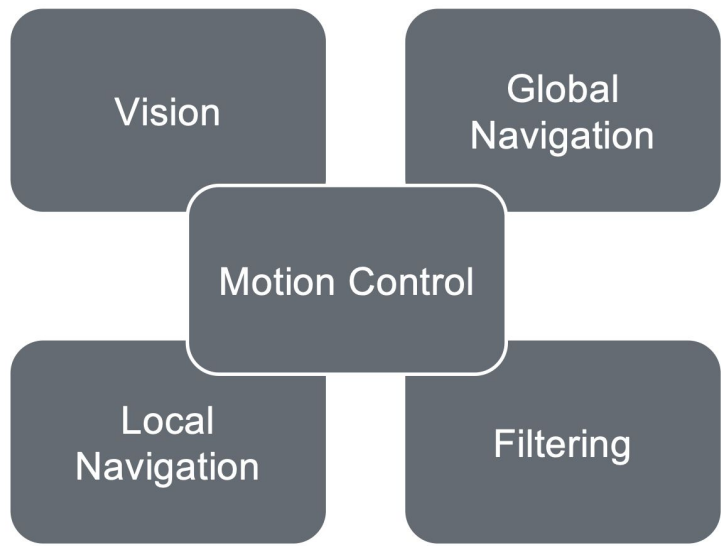


# Welcome to the exercise session !



# Implementing for better learning



*Better understand*

# Exercise sessions – why is it important ?

- **Dedicated TAs support** → Get help when stuck
- **Tips & Outline** → Guidance to approach each exercise
- **Quizzes + Corrections** → Practice, check, and learn



### Quiz

Implementing Kalman Filter for Robot Localization

The linear discrete-time state-space model is:

$x_{k+1} = A_k x_k + w_k = \begin{bmatrix} 1 & T s \\ 0 & 1 \end{bmatrix} x_k + w_k$

When there is a transition the measurement  $y^T$  is given by:

$y_k^T = H^T x_k + \nu_k^T = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} x_k + \nu_k^T$

When there is no transition  $y^{NT}$  is given by:

$y_k^{NT} = H^{NT} x_k + \nu_k^{NT} = \begin{bmatrix} 0 & 1 \end{bmatrix} x_k + \nu_k^{NT}$

### EPFL Key for the corrections

Particle filter Algorithm

- 1) **Initialize:** Randomly place particles across the map.
- 2) **Predict:** Move each particle based on control input and motion noise.
- 3) **Update:** Weigh each particle by how well it matches sensor data.
- 4) **Resample:** Select particles based on their weights to focus on high-probability areas.
- 5) **Repeat:** Iterate with new data for refined location tracking.

Algorithm Particle filter( $\mathcal{X}_{t-1}, u_t, z_t$ ):

```
 $\mathcal{X}_t = \mathcal{X}_t = \emptyset$ 
for  $m = 1$  to  $M$  do
  sample  $x_t^{(m)} \sim p(x_t | u_t, x_{t-1}^{(m)})$ 
   $w_t^{(m)} = p(z_t | x_t^{(m)})$ 
   $\mathcal{X}_t = \mathcal{X}_t + (x_t^{(m)}, w_t^{(m)})$ 
endfor
for  $m = 1$  to  $M$  do
  draw  $i$  with probability  $\propto w_t^{(i)}$ 
  add  $x_t^{(i)}$  to  $\mathcal{X}_t$ 
endfor
return  $\mathcal{X}_t$ 
```


# Welcome to the exercise session !

EPFL Home Dashboard My courses

Microengineering (MT) / MT - Master

## Basics of mobile robotics

Course Settings Participants Grades Reports More



Basics of mobile robotics

Objective

The objective of this course is to provide the basics required to develop autonomous mobile robots. Both hardware (energy, locomotion, sensors, embedded electronics, system integration) and software (control architectures, control theory, localization, trajectory planning, high-level control) aspects will be tackled. Theory will be deepened by exercises and application to simulated robots. Case studies will allow to make a more concrete.

Course organization

This course will start in hybrid mode with:

- lecture given in CE2 (Tuesday from 15:15 to 17:00)
- zoom live transmission of the lecture
- recording of the course
- exercices in Polydôme
- both local and remote answer to questions

The recording of the lecture will be made available on moodle, like the rest of material.

Exercises and project are made in groups and are based on a Thymio robot. Each student will be able to borrow one.

# How to ask questions



During the **session exercise**:

Open shared **Google form** (on Moodle)  
→ Wait an assistant

The screenshot shows the EPFL Moodle interface. At the top, the EPFL logo is on the left, and navigation links for Home, Dashboard, and My courses are on the right. A notification bell and a 'Student' profile icon are also visible. A sidebar menu on the left is open, showing a list of course-related items. A red arrow points from the text 'Open shared Google form (on Moodle)' to the 'Form to ask for assistants (...)' item in the sidebar. The main content area is titled 'Links to ask questions during the exercise sessions' and contains a list of links, each with a globe icon. The second link, 'Form to ask for assistants (access with EPFL account) - for the entire semester (updated 12/09/2023)', is highlighted with a light blue background. Below this link, there is a lock icon and the text 'Available from 10 September 2024, 7:00 PM'. The third link, 'Waiting list of the questions (access with EPFL account) - for the entire semester (updated 12/09/2023)', is also highlighted with a light blue background. The fourth link, 'Link to discord server (updated 12/09/2023)', is highlighted with a light blue background. The fifth link, 'Zoom link to speak with online TAs', is highlighted with a light blue background.

EPFL Home Dashboard My courses

Student

x

Basics of mobile robotics

- Announcements
- Forum for students
- Thymio / tdm client forum
- Resources for the course
- Robotacademy (online edu...

Links to ask questions duri...

Plan of Polydome places

Form to ask for assistants (...)

Waiting list of the question...

Link to discord server (...)

Zoom link to speak with on...

Links to borrow a robot / c...

Links to ask questions during the exercise sessions

Plan of Polydome places

Form to ask for assistants (access with EPFL account) - for the entire semester (updated 12/09/2023)

Waiting list of the questions (access with EPFL account) - for the entire semester (updated 12/09/2023)

Link to discord server (updated 12/09/2023)

Available from 10 September 2024, 7:00 PM

Zoom link to speak with online TAs

# How to ask questions

During the **session exercise**:

Open shared **Google form** (on Moodle)  
→ Wait an assistant

## Request for an assistant

Small form to request the help of an assistant during the practical sessions

[jerome.brender@epfl.ch](mailto:jerome.brender@epfl.ch) [Changer de compte](#)



\* Indique une question obligatoire

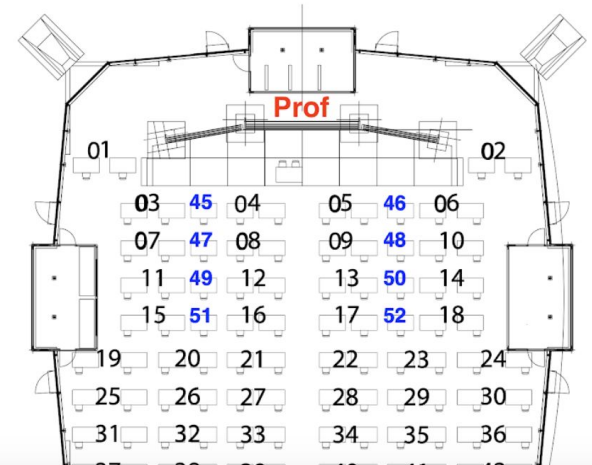
E-mail \*

Enregistrer [jerome.brender@epfl.ch](mailto:jerome.brender@epfl.ch) comme adresse e-mail à joindre à ma réponse

Small description of your problem/question (helps to choose the assistant :-)) \*

Votre réponse

Nbr of physical place where to join you (or zoom link) \*



# How to ask questions

During the **session exercise**:

Open shared [Google form](#) (on Moodle)  
→ Wait an assistant




Send on [Discord](#) for real-time  
→ Everyone can answer

Outside of the session exercise

Post on [FORUM](#) moodle  
→ Help everyone, no stupid question go on !



# Timeline for exercises

<b>Week 1</b>	Components of a mobile robot ( <b>get a robot</b> )	<b>Week 7</b> 	Uncertainties ( <b>using chatbot</b> )
<b>Week 2</b> 	Vision ( <b>using chatbot</b> )	<b>Week 8</b>	Uncertainties
<b>Week 3</b>	Vision & ANN & ML	<b>Week 9</b>	Localisation 2 + Project week 1 (+ <b>team building</b> )
<b>Week 4</b>	Navigation	<b>Week 10</b>	Project week 2
<b>Week 5</b> 	Navigation ( <b>using chatbot</b> )	<b>Week 11</b>	Project week 3 + group work check
<b>Week 6</b>	Localisation 1	<b>Week 12</b>	Project week 4 + Project presentations
Week vac	Vacation	<b>Week 13/14</b>	Project presentations + Conclusion + Dry Exam

## How can we design an AI tutor that actually helps you learn?

### Last year:

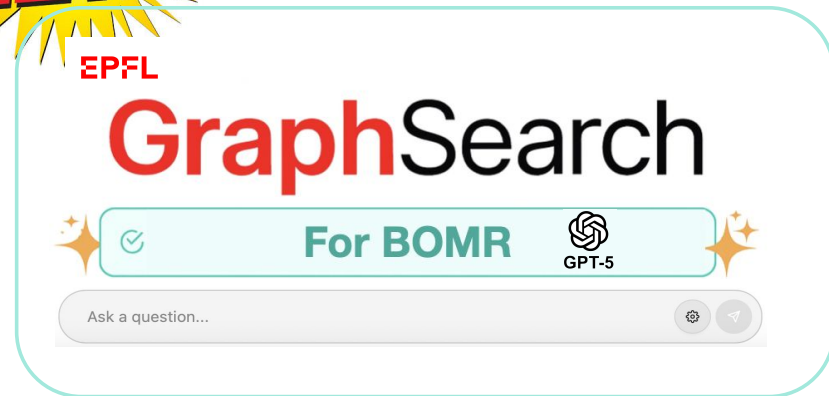
- V1 of a chatbot but low participation

### This year:

- Fully **reworked** chatbot with significantly improved performance and UI
- **Built for you** (fed with slides, exercises, solutions, datasheets, etc.)
- **Free** and powered with **GPT-5**

### WE NEED YOU!

- Help us by using the **AI Tutor** in **3 exercise sessions** and participating in the user study (**short quizzes & feedback**)
- And you can make **CHF 15** if you do all **3 sessions**.



Ready to participate?!

Let's start with this initial survey for the user study

Key word for the survey:

LLM = Large Language Model, here chatbot (ex: ChatGPT, Claude Ai, Bard...)

BOMR = Basics of Mobile Robotics (this course)


<https://tinyurl.com/bomr-survey>

Initial survey

 **Session dates for the experiment**

0) This initial survey (7 min)

- 1) September 16th (17h15-19h00)
- 2) October 7th (17h15-19h00)
- 3) October 28th (17h15-19h00)

 **15 CHF:** Each participant who participate and attend the **three** interactive\_sessions (with **survey**) will receive 15 CHF.

# Get a robot Today (for all the semester)



Thymio

1) Do the **queue**, and **leave** us your **camipro** (student card)



2) Go on **Moodle**, fill the **form** to borrow a Thymio



3) Once you have **sent the form**, come back to take back your camipro

A



B



C



# Installations

## Python

If you don't have a version on python 3 installed on your computer : go to <https://www.python.org/downloads/> and download the latest stable release of python 3 for your OS.

⚠ Don't forget to tick  "Add Python 3.8 to PATH"

## Pip

If pip was not installed at the same time as python, download <https://bootstrap.pypa.io/get-pip.py> and run in the terminal in the folder where you have downloaded the file : **python get-pip.py**

## Jupyter notebooks

Once pip has been installed, run in the terminal : **pip3 install notebook**



# Opening the first notebook

**Once you have installed python and Jupyter notebooks :**

1. In the terminal navigate to the folder where the notebook is located using `cd`
2. Type `jupyter notebook` in the terminal
3. Double click on the file of interest in the jupyter interface to open the notebook

**Alternative to the notebooks :**

if you do not want to use the notebooks, you can use the PyCharm Professional IDE (license available for EPFL students) to view the notebooks although it will not always work perfectly.

# Exercise session 1

All the files you will need are located on [moodle](#).

1. You should have installed everything, following the message in the announcements on moodle
2. Start with the notebook **Exercises Week 1 - Locomotion, Sensors and Architectures.ipynb**
3. When you are done you are encouraged to go over the notebook **Introduction to Python and Jupyter Notebooks.ipynb**
4. When you get access to your Thymio, you should go over the notebook **Control your Thymio in Python.ipynb**

# Final Remarks

## 1. Please do the exercise !

- The purpose of these sessions is to enhance your skills and understanding. Engage actively in the exercises !

## 2. Handle Robot Thymio Carefully

- These robots are sensitive and expensive equipment. Handle them with care.

## 3. Use Chatbots Responsibly

- If you use a chatbot, use it to LEARN, not to solve the exercise directly (we will look together soon).

## 4. Academic Integrity (especially for the project)

- You are in the Master's program at EPFL; we expect the highest level of integrity from you.
- Complete the work on your own or with your team.
- Cite **all your references**, libraries etc..

 **Warning:** Academic dishonesty is easily detectable and is embarrassing for both you and us !.