F25-EE483: Intro to Robotics

You can start setting up your computer for the class exercises and labs

1. **Go to the Modules Page and thr Guide to setup your computer module**
2. **Download either the Mac with M processors or the Windows guide**
3. **Follow the instructions detailed there.**
4. **Your computer setup must be done by the end of the first week of classes**

Instructors information

Instructor - Rômulo Meira-Góes

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Office: 316 EE East
Office Hours: Weds from 1 to 3 p.m. at 101 N. Atherton building

TA - Shih-Jie Shih

Email: sfs6681@psu.edu
Office Hours:
Tuesdays 4 to 5:30 p.m. at 101 N. Atherton building
Fridays 10:30 am to 12 p.m. at 101 N. Atherton building

Communications:

Class Teams Channel: In this class, we will all learn from each other. In that spirit, please **post questions about the class material in Teams** so you can benefit from the knowledge of your classmates (and they can benefit from yours). Expect to get a reply from me, the TA, or the LA within a day (depending on the time you have posted the question).

If **you have a private matter to discuss** (e.g., the need to miss class), you can email me and the TA.

Class information

Class Schedule: Tuesday and Thursday - 9:05 to 10:20 am - 101 N. Atherton Building
Prerequisites: MATH220, MATH250, and CMPSC 131 or 200 or 201

Course Goals and Objectives

Learning robotics by building and programming a robot. Short lectures followed by lab where students work on the robots and activities.

Goals:

- Introduce with experiential learning basics concepts of robotics – hands-on robotics with autonomous vehicle robots
- Use robotics topics – perception, kinematics, control, planning - to demonstrate mathematical concepts – linear algebra, ODE, programming
- Explore advanced topics in EE that are related to robotics – control theory, computer vision, machine learning, sensing and actuating
- Discuss the ethical principles and social impacts in the field of robotics

Objectives and Outcomes: When a student successfully completes the course, they will have demonstrated:

- Describe and analyze robotic systems architecture
- Develop complex robotic systems using the Robotic Operating System (ROS)
- Apply coordinate transformations and robot kinematics to 2D and 3D systems
- Explain and demonstrate standard perception and control algorithms
- Apply best programming practices and principles
- Recognize and identify ethical principles for robotics and social impacts of the field of robotics

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Course Outline

1. Programming basics in Robot Operating System (ROS) - 4 weeks (Exs1 to 4 and Lab 1)
2. Robot Sensing - 4 weeks (Exs 5 to 7and Lab 2)
3. Robot Acting - 3 weeks (Exs 8 to 9 and Lab 3)
4. Robot Reasoning - 2 weeks (Final Project)
5. Advanced Topics - 2 weeks (Final Project)

Grading

1. Exercises (9 in total - lowest score dropped)- 30%
2. Labs (3 in total) - 30 %
3. Class Project - 35%
4. Participation - 5%

Final course grades are awarded using the following scale:

A	95% - 100%
A-	92% - 95%
B+	90% - 92%
B	87% - 90%
B-	84% - 87%
C+	82% - 84%
C	80% - 82%
D	70% - 80%
F	<= 70%

Exercises and Lab Policy

Exercises are due every Friday at 11:59 pm. See the detailed schedule for the due dates of each assignment.

Lab assignments are due every Thursday at noon. The lab demos must be shown by the end of the class at the deadline date. See the detailed schedule for the due dates of each assignment.

Exercises

We will use Canvas to collect your exercise reports and GitHub for testing your code. You may discuss problems with fellow students, and I encourage you to do so. However, each student must submit individual assignments, representing your own work. Exercise assignments will be posted on Canvas with their description.
Students are allowed **two grace periods** of **three days each** that can be used at any time (but no more than one grace period per exercise). Note that if you submit your homework five minutes after the due date, this counts as using one grace period. Late exercises beyond the grace period will not be accepted.

Labs

Labs are going to be developed in groups of three. The instructor will form the groups by the second week of class. Similar to exercises, we will use Canvas to collect your lab

reports and GitHub for testing your code. Groups may discuss problems with other groups, but each group submits their assignments, representing their work.

Lab assignments will be posted on Canvas. Labs have a demonstration part where the robot will perform some tasks. These demonstrations must be shown to the instructor or TA in class or during office hours anytime before the due date. The lab reports must be submitted via Canvas by the due date.

Lab assignments will be graded individually based on the effort of each team member. **A majority of the lab assignments are performed during class time. Missing classes without justification can reduce your lab assignment grade.**

Lab groups are allowed one late lab report and demonstration submission without having a grade deduction. The late lab work must be submitted by the class immediately after the lab due date. After using the one late submission, late lab submissions will be accepted with a penalty of 5% per late day. We encourage you to stay on schedule.

Final Project

The final project will be developed throughout the class. It will be developed by the same lab groups. Each group will select a possible final project topic to develop. The idea is that you are pitching a new feature to be implemented in the robot. We want to get enough preliminary results such that the company decides to move forward with implementing your project feature in the next semester.

There will be four stages of the final project development: (1) Project selection; (2) Initial report; (2) Mid-semester report; and, (3) Final presentation and report. Each report will have at least one page but not more than 2 pages.

Project selection: Each group will select one project among 7 of the possible choices. Project topics are on a first-come first-serve basis. Each project topic can only be chosen by at most two groups. If a third group decides to select a topic that already has two groups, they will need to select a different one. The selection phase will be open by the second week of class. It will be informed together when the lab groups are formed.

Initial report: Groups will describe which project they have selected with a plan of how they will approach their project. It needs to contain: a description of the project goals with a basic background on the project topic, ROS packages, and nodes architecture with an explanation of their future functionalities, a timeline of the project, and a collaboration plan among the group.

Mid-semester report: Groups will describe their preliminary implementation results as well as describe any difficulty with the project. The report will contain: a description of what has been developed and what is missing, a description of the participation of each member in the project, an updated timeline, and a description of any difficulties faced.

Final presentation and report: Groups will present their results to the rest of the class. Presentations must have videos of the project, e.g., the robot moving with the new

feature, the screen of the computer showing objects being detected, etc. The final report will contain: a description of the project, a description of the participation of each member in the project, a discussion on the preliminary results of the project, the difficulties faced in the project, and the future of this project (what's next?).

Participation

Students will be evaluated on the following rubric (Teams channel and Office hours count towards participation). Total points are capped at 5 points.

Preparation for class:

Exceeds expectation: 2 points	Meets expectation: 1 point	Below expectations: 0 points
Completes all the material, readings before classes.	Completes all the material readings far enough before classes.	Does not complete reading assignments before classes.

Frequency of class participation:

Exceeds expectation: 2 points	Meets expectation: 1 point	Below expectations: 0 points
Initiates contributions, helps other students, or asks for help more than once every week.	Initiates contributions, helps other students, or asks for help every week.	Initiates contributions, helps other students, or asks for help in at least half of the total class sessions.

Listening skills:

Exceeds expectation: 2 points	Meets expectation: 1 point	Below expectations: 0 points
Listens attentively when others present materials.	Mostly attentive when others present materials.	Often inattentive. Occasionally makes disruptive comments when others are speaking.

Forms of Address: Names and Pronouns

Many people might go by a name in daily life that is different from their legal name. In this classroom, we seek to refer to people by the names that they go by. Pronouns can be a way to affirm someone's gender identity, but they can also be unrelated to a person's identity. They are simply a public way in which people are referred to in place of their name (e.g. "he" or "she" or "they" or "ze" or something else). In this classroom, you are invited (if you want to) to share what pronouns you go by, and we seek to refer to people using the pronouns that they share. The pronouns someone indicates are not necessarily indicative of their gender identity. Visit Trans and Non-Binary Penn StateLinks to an external site. to learn more.

Academic Integrity

Academic integrity is the pursuit of scholarly activity in an open, honest, and responsible manner. Academic integrity is a basic guiding principle for all academic activity at The Pennsylvania State University, and all members of the University community are expected to act in accordance with this principle. Consistent with this expectation, the University's Code of Conduct states that all students should act with personal integrity, respect other students' dignity, rights, and property, and help create and maintain an environment in which all can succeed through the fruits of their efforts.

Academic integrity includes a commitment by all members of the University community not to engage in or tolerate acts of falsification, misrepresentation, or deception. Such acts of dishonesty violate the fundamental ethical principles of the University community and compromise the worth of work completed by others.

Disability Accommodation

Penn State welcomes students with disabilities into the University's educational programs. Every Penn State campus has an office for students with disabilities. Student Disability Resources (SDR) website provides contact information for every Penn State campusLinks to an external site. (https://equity.psu.edu/offices/student-disability-resources/campus-offices). For further information, please visit Student Disability Resources websiteLinks to an external site. (http://equity.psu.edu/sdr/).

In order to receive consideration for reasonable accommodations, you must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentation: See documentation guidelinesLinks to an external site. (http://equity.psu.edu/sdr/guidelines). If the documentation supports your request for reasonable accommodations, your campus disability services office will provide you with an accommodation letter. Please share this letter with your instructors and discuss the accommodations with them as early as possible. You must follow this process for every semester that you request accommodations.

Counseling and Psychological Services

Many students at Penn State face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious

backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

[Counseling and Psychological Services at University Park (CAPS)Links to an external site.](http://studentaffairs.psu.edu/counseling/): 814-863-0395

Penn State Crisis Line (24 hours/7 days/week): 877-229-6400
Crisis Text Line (24 hours/7 days/week): Text LIONS to 741741

Educational Equity and Reporting Bias

Penn State takes great pride to foster a diverse and inclusive environment for students, faculty, and staff. Acts of intolerance, discrimination, or harassment due to age, ancestry, color, disability, gender, gender identity, national origin, race, religious belief, sexual orientation, or veteran status are not tolerated and can be reported through Educational Equity via the Report Bias webpageLinks to an external site. .

Reporting Sexual Misconduct

Sexual misconduct is never tolerated at Penn State. Prohibited conduct includes sexual and gender-based harassment, stalking, sexual assault, and dating violence. These behaviors are not allowed in the classroom, the campus community, labs, or anywhere students, staff, and faculty are located. Prohibited behaviors can include degrading comments such as belittling female-identified students, LGBTQ+ individuals, and gender-diverse students. It can also include harassment, touching someone without their consent, following someone without consent, repeated calls or messaging, physical acts of violence, and more. In other words, professional and appropriate behavior is always expected, and inappropriate or unprofessional behavior is never tolerated. For more information, please refer to the Student Code of Conduct and Penn State Policies AD85 and AD91. (Title IX Sexual Harassment | Penn State Policies (psu.edu)Links to an external site. and Discrimination and Harassment and Related Inappropriate Conduct | Penn State Policies (psu.edu)Links to an external site.)
If you or anyone you know has experienced or is concerned about inappropriate or unprofessional behavior, you can talk with College, or School leadership, your instructor, academic advisor, or another trusted faculty/staff member, report to police or the Office of Sexual Misconduct Reporting & Response (titleix.psu.eduLinks to an external site.), or you can seek confidential support and assistance from the Gender Equity Center. The Gender Equity Center supports any student who has had negative relationship experiences including those impacted by sexual violence, relationship violence, stalking, harassment, and other campus climate issues. Services include one on one crisis intervention/support, advocacy, exploring options, accommodations, safety planning, and referrals. They also promote awareness, build support for survivors, and conduct

educational programs and events. All services are free and confidential. [Gender Equity Center | Penn State Student Affairs (psu.edu)](Links to an external site.)Links to an external site.

The syllabus is an agreement between us about the course. However, "stuff happens" and it might be necessary to make some changes. If this happens, I will let you all know in advance about these changes.