98-012 Fun with Robots - Course Syllabus

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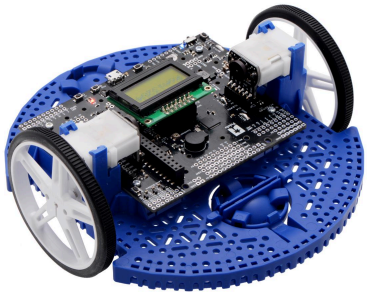

Location and Times

This class will be held with an In-Person Expectation (IPE) in Baker 140A from 7:00 - 8:50 PM on Mondays.

Course Description

In this course, students will learn the basics of programming, sensors, motors, and controls. Students will learn how to program a Romi robot. Students will also build a basic breadboard circuit and use real sensor data to navigate. The course lecture format will include instructional slides and teaching at the beginning of each lecture, along with a brief lecture on how what we do in class connects to “real-world” robotics. This is then followed by supervised programming time where the instructors will answer questions and advise students working on labs.

There is a $10 lab fee. If your financial situation makes this fee an obstacle to your participation in the class, please talk to the instructors.

Skill Expectations

No programming, engineering, or robotics experience is needed to take this course; we teach everyone the basics of Arduino programming. However, we can offer additional projects for students who have experience in programming or robotics and want to learn more.

Learning Objectives

Our goal in teaching this course is to teach students about the main aspects of robotics; programming, circuitry, actuation, and control. We also want to teach students how to connect what they are learning to "real-world" robotics.

Upon completion of this course, the student will be able to:

- Formulate an Arduino program that controls their robot in response to inputs when given a simple task.
- Construct a circuit to connect a resistive sensor to a robot, and explain why a sensor circuit allows their robot to read a sensor.
- Utilize existing parts to create an assembly that completes a given task.
- Explain the purpose of each aspect of a PID control and write a basic PID control algorithm so the robot can complete a task effectively and efficiently.
- Combine aspects of programming, sensing, control, and actuation to create a robot that autonomously completes a complex task.
- Describe different areas of robotics and how they are used to create functional robots.

Labs

Labs will be assigned approximately every two or three weeks. They will be graded pass/fail based on whether the robot completes all the task requirements. Students are encouraged to collaborate with one another, when possible, to optimize their robots. **Four of the five labs must be passed in order to pass the class**. Completed labs are accepted on a rolling basis, with the **final due date being the last day of the course**. Some labs will also have a competition among the class for the fastest time/best performance.

There will be four main labs over the course of the semester:

- *Square Lab*: have your robot drive in a square
- *Photovore Lab:* have your robot drive from a specific spot toward a light source
- *Control Lab:* have your robot follow a looped black line twice under a given time period
- *Servo Lab:* have your robot make art
- *Pathfinder Lab:* have your robot autonomously navigate an obstacle course

Feedback Methodology

Students will receive feedback on their learning primarily through how successfully their robot completes the lab tasks as they are developing their solution. Additionally, feedback will be given through informal questions and answers posed during lectures.

Grading and Attendance

Labs will be graded pass/fail based on whether the robot completes all the task requirements. Completed labs are accepted on a rolling basis, with the final due date being the last day of the course; however, lectures follow a schedule of roughly two to three weeks between each lab.

This is a three-unit course. As such, we will do our very best to minimize the amount of work that must be done outside of class, and history shows that students are capable of finishing everything within three hours per week, which includes the two-hour lecture. We expect everyone to attend class on time and actively participate. If you are not able to attend a class, we ask that you please inform us prior to lecture, as **we are required by StuCo policy to fail any student with more than two unexcused absences.**

The passing criteria are as follows:

- Attend all class sessions (with the exception of excused absences and a maximum of two unexcused absences).
- Make an honest effort on every assigned lab.
- Successfully complete (pass) four labs including the final lab.

Class Materials

We encourage you to play with and work on your robots outside of class, but please remember to bring them to class each week. We will provide a box to store your robot and hardware, but you will need to store this box on your own and bring it back and forth to class. Don’t worry, the robot and box are relatively light and small. You do not need to bring your own laptop computer to class, though you can if you want to.

Extra Help

We try to make the class accessible for students from any background with any experience level, but still interesting and fun for students with experience in robotics, programming, or related fields. If you feel like you are struggling, please let the instructors know: we want everyone to pass. You are welcome to email us anytime, using the email addresses near the top of the first page of this document.

Collaboration

Each student is expected to write their own code for each lab. However, we encourage general discussion of strategies, troubleshooting, and debugging, with other students and instructors.

Academic Integrity & Collaboration

From CMU's Policy on Academic Integrity:
In any manner of presentation, it is the responsibility of each student to produce her/his own original academic work. Collaboration or assistance on academic work to be graded is not permitted unless explicitly authorized by the course instructor(s). Students may utilize the assistance provided by Academic Development, the Global Communication Center, and the Academic Resource Center (CMU-Q) unless specifically prohibited by the course instructor(s). Any other sources of collaboration or assistance must be specifically authorized by the course instructor(s).

In all academic work to be graded, the citation of all sources is required. When collaboration or assistance is permitted by the course instructor(s) or when a student utilizes the services provided by Academic Development, the Global Communication Center, and the Academic Resource Center (CMU-Q), the acknowledgement of any collaboration or assistance is likewise required. This citation and acknowledgement must be incorporated into the work submitted and not separately or at a later point in time. Failure to do so is dishonest and is subject to disciplinary action.

Instructors have a duty to communicate their expectations including those specific to collaboration, assistance, citation and acknowledgement within each course. Students likewise have a duty to ensure that they understand and abide by the standards that apply in any course or academic activity. In the absence of such understanding, it is the student's responsibility to seek additional information and clarification.

Policy on Generative AI

Generative AI is rapidly becoming a large part of our everyday lives as university students. However, we value the learning process and think that most uses of GenAI for writing code do not assist in your learning. That being said, we have chosen **not to allow the use of GenAI tools** (such as ChatGPT) **for any lab assignments**. If you find yourself considering using GenAI on an assignment, *please* reach out to the instructors. We are here to help you!

Accommodations for students with disabilities

If you have a disability and have an accommodations letter from the Disability Resources office, I encourage you to discuss your accommodations and needs with me as early in the semester as possible. I will work with you to ensure that accommodations are provided as appropriate. If you suspect that you may have a disability and would benefit from accommodations but are not yet registered with the Office of Disability Resources, I encourage you to contact them at access@andrew.cmu.edu.

Statement on student wellness:

As a student, you may experience a range of challenges that can interfere with learning, such as strained relationships, increased anxiety, substance use, feeling down, difficulty concentrating and/or lack of motivation. All of us benefit from support during times of struggle. You are not alone. There are many helpful resources available on campus and an important part of the college experience is learning how to ask for help. Asking for support sooner rather than later is often helpful. If you or anyone you know experiences any academic stress, difficult life events, or feelings of anxiety or depression, I strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help call 412-268-2922 and visit their website at http://www.cmu.edu/counseling. Do not hesitate to ask me for help in getting support.

Statement on Diversity, Equity, and Inclusion

We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment.

Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- Center for Student Diversity and Inclusion: csdi@andrew.cmu.edu, (412) 268-2150
- Report-It online anonymous reporting platform: reportit.net username: tartans password: plaid

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.

Acknowledgments

Thank you to the Robotics Institute for providing funding for this course, and to the CMU Robotics Club for developing the curriculum over the past several years.

Instructors in this class are often officers and project leaders in the Robotics Club, and if you are interested in the course we encourage you to join us! The Robotics Club is located in the basement of the Cohon Center, just beyond the package pickup center.

If you are interested in working in the Robotics Institute, we encourage you to check it out! Please email one of us and we can give you more information!

Schedule

This schedule is tentative and may be modified, although any changes to the schedule will be announced during class. Once introduced, all labs can be worked on until the end of the last class.

Date	Lecture	Lab
01/12	Introduction, Roboclub Tour	
01/19	**(No class, MLK Day)**	
01/26	**(No class, Snow Day)**	
02/02	Square Lab Intro	Square Lab
02/09	Photovore Intro, Robot Assembly	Photovore Lab Introduced, Square Lab Demo/Dance
02/16	Sensors Lecture	Photovore Lab Cont.
02/23	Control Lab Intro + Algorithms Lecture	Control Lab Introduced, Photovore Lab Checkoff
03/02	**(No class, Spring Break)**	
03/09	Filtering Lecture	Control Lab Cont.
03/16	Computer Vision Lecture	Control Lab Cont.
03/23	Servo Lab Intro + Actuator Lecture Pt. 1	Actuation Lab Introduced, Control Lab Checkoff/Race
03/30	Actuator Lecture Pt. 2	Actuation Lab Cont.
04/06	Pathfinder Intro	Pathfinder Lab Introduced, Actuation Lab Checkoff
04/13		Pathfinder Lab Cont.
04/20	The Last Lecture	All Labs Due, Pathfinder Lab Demo