

Syllabus*

EENG350: Systems Exploration, Engineering, and Design Laboratory

Tyrone Vincent

Department of Electrical Engineering
Colorado School of Mines

Fall 2022

Syllabus

EENG350 Course Info

- Class meeting schedule
 - section A: 11:00AM - 12:00PM, MWF
 - section B: 1:00PM - 2:00PM, MWF
 - section C: 2:00PM - 3:00PM, MWF
- Class location: Brown Building 304.
- Course Webpages:
 - Canvas (<http://elearning.mines.edu/>). All current CSM students should have a Canvas account, and students registered for this course will be automatically enrolled. Check with CCIT if you do not have a Canvas account.

Instructors

- Instructor: Tyrone Vincent (he/him)
 - Office: BB327D
 - Zoom office hours: see Canvas Syllabus Page
 - Zoom link: <https://mines.zoom.us/j/7531940773>
 - Email: tvincent@mines.edu
 - Phone: (303) 733 8501
- Lab support: Darren McSweeney (he/him)
 - Office: BB317
 - Email: dmcsweeney@mines.edu
 - Phone: 303 384 2064

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Teaching Assistants

- Alexander Curtis Email: curtis@mines.edu
- Paul Sampson Email: psampson@mines.edu
- Gerard Abiassaf Email: abiassaf@mines.edu

Instructional Activity: 3 hours lab, 2 semester hours.

Course designation: Elective/Major Requirement (EE)

Course description

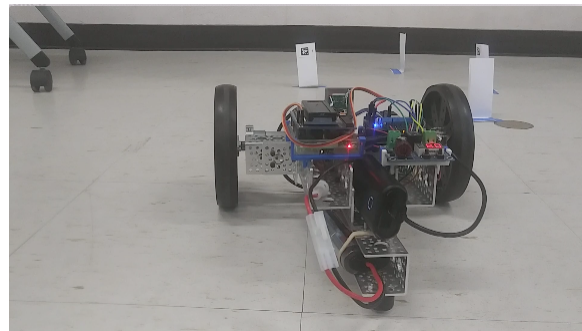
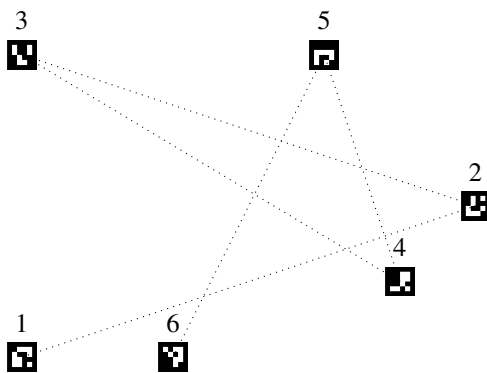
This laboratory is a semester-long design and build activity centered around a challenge problem that varies from year to year. Solving this problem requires the design and prototyping of a complex system and utilizes concepts from multiple electrical engineering courses. Students work in intra-disciplinary teams, with students focusing a particular subsystem.

Objectives**Students will be able to:**

- Design and debug integrated systems as an intra-disciplinary team.
- Design experiments and gather data to solve engineering problems and/or demonstrate performance of sub-systems or systems.
- Predict the performance of a designed system and verify their predictions experimentally.
- Work effectively in intra-disciplinary teams to solve engineering problems.
- Engage in reflective learning and demonstrate an ability to engage in life-long learning.

Project Description

A mobile robot is an example of an integrated system that requires the development and integration of several different subsystems in order to be successful. As such, it is an excellent testbed for you to practice and develop your skills as an engineer, working in a team environment of distributed expertise. To provide a focus for the project, a specific task for the robot to achieve is defined. This semester, your robot should traverse a specific path that will be defined by patterned markers (called Aurco markers). Six markers will be placed on the floor, with each marker corresponding to a different stage in the path (You will be given the mapping from marker pattern to stage). Your robot will traverse the path from 1 to 6 in the correct order, coming to a stop directly over each marker for at least 5 seconds before going on to the next marker. The performance will be judged on the number of trials it takes to run the path correctly, and the speed at which the robot completes the path.



For convenience, some aspects of the design have been fixed: the motors, wheels, battery size, available sensors, and available embedded processors. However, you are free to choose all other elements of the design, including the construction of the robot frame (within the available Actobotics elements) placement of elements on the frame, and of course, all control systems, signal processing, and embedded system implementation.

Course Outline

- Pre-project prep
 - 1 week: First Week Exercise: Python
 - 2 weeks: Exercise 1 - Individual exercise to learn to program either an Arduino or a Raspberry Pi
 - 2 weeks: Exercise 2 - Individual exercise to learn one potentially useful subsystem for the project
 - 2 weeks: Mini project - Team project to build a small system
- Main Project
 - 3 weeks: Demo 1 - subsystem demonstration
 - 3 weeks: Demo 2 - complete system demonstration
 - 2 weeks: Final Demo - demonstration of main project

Group Work

You will be working in groups to complete the activities in this lab. This is done for several reasons. Researchers have shown that students working in small groups tend to learn more of what is taught and retain it longer than when the same content is presented in other instructional formats. In addition, the ability to work in a diverse group is an educational objective in itself, and one of the student outcomes that we are required to measure for accreditation of the electrical engineering degree is the ability to function on multidisciplinary teams.

We will model a multidisciplinary team by having members concentration on different aspects of the system. Even though you are all electrical engineers, you will need to learn how to cooperate and communicate with team members whose expertise is different from yours.

Team Composition

Each team will consist of 4 people. Each of the team members will go through different introductory exercises. The roles are

- Simulation and Control
- Localization
- System Integration
- Computer Vision

Although you have chosen specific initial roles, these are just to provide a reasonable starting point and are not fixed. You may find that members of the team will have learn other roles as needs become apparent.

Work Process

- The class lab space is available for you to work, but the kits are portable, so much of the work can be done outside of the laboratory as well.
- Although your section is scheduled in the lab for 3 hours a week, it is expected that you will be working at least 3 hours of work per week outside of these designated lab hours. The labs BB304 and BB305 are open labs, and you can use a bench whenever it is available, although priority is for the scheduled course at that time.
- Once you start the mini-project, you will have regular team meetings. These meetings can be in lab, or using conferencing software. [Zoom](#) is available, but you are free to use others as well. During this meeting, you will review the progress towards the goals from last week, discuss design and process decisions that need to be made, decide on goals for the current week, and assign responsibilities for the current week.
- In order to collaborate as a team, you will need to have a common area to save files, work on software, work on reports. etc. Once you start the mini-project, you will use github as a software repository and for project management.

Maintaining an inclusive workspace

- Everyone has the right to utilize the EE labs and a shared responsibility to make the labs an inclusive environment where everyone is comfortable working
- You can help make this happen by
 - Using professional behavior in the labs. (e.g. no shouting, no foul language, no aggressive behavior)
 - Observing all safety and covid related policies
 - Keeping the laboratory clean and neat
 - **Reporting unprofessional behavior to an instructor**

Grading Scale

Teams earn points up to the total listed in the grading scale below.

Available Points		
Stage	Assignment	Points
First Week	First Week Assignments	50 points
Exercise 1	Documentation/Demo	50 points
Exercise 2	Documentation/Demo	50 points
Mini-project	Documentation/Demo	100 points
Demo 1	Documentation	75 points
	Performance	100 points
Demo 2	Documentation	75 points
	Performance	150 points
Final Demo	Documentation	20 points
	Performance	200 points
	Presentation	80 points
Checkout	Equipment Return	50 points
Total		1000 points

Letter Grades

Letter grades will be assigned according to the following scale:

- $A \geq 90\%$
- $B+ \geq 87\%$
- $B \geq 83\%$
- $B- \geq 80\%$
- $C+ \geq 77\%$
- $C \geq 73\%$
- $C- \geq 70\%$
- $D+ \geq 67\%$
- $D \geq 63\%$
- $D- \geq 60\%$
- $F < 60\%$

Demo Day

- For the assignments, mini-project and project, you should plan to finish your assignment *before* the day of the demo.
- To encourage this, no questions are answered by the TAs and Instructors on the day of the demo.
- Teams must also submit a video of their robot operating correctly before each demo.

Late Assignment Policy

- Demonstrations: Students or groups that miss a deadline for a demonstration will receive 90% of their score if the demonstration occurs by the next scheduled lab time, 70% if the demonstration is delayed by an additional scheduled lab, and 0% after that.
 - Example: Demo is scheduled for Wednesday. 90% for demonstrating on Friday, 70% for demonstrating on the following Monday.

The exception is the final Demo, which must be completed on the assigned day.

- Assignments turned in on Canvas: Assignments that are 24 hours late are graded out of 90%, up to one week late is 50%, and 0 after that.

Demos

For the challenge project, there will be three demonstrations during the semester, and the robots will be judged in their performance in several categories at this time.

The demonstrations times are listed in the schedule at the end of the syllabus, and on Canvas. For Demo 1 and 2, if a group gives a demonstration before the deadline, they will receive full points. The points are reduced each class period after that, with 10% reduction for one class period and 30% reduction for two class periods. For example, if the demonstration deadline is a Wednesday, groups receive full points that day, 90% of points if they demo on Friday, and 70% of the points the next Monday. After this point, the demonstration period will close and the team will score 0 for performance for that demo.

Performance Scoring

The performance will be judged in certain criteria. The score for each category is determined as follows:

- Let B be the target metric, which is the third best score over all sections (for example: an angle error of 1 degree.) Best scores in categories are established on the first day at least one team participates.
- Let S be your teams achieved performance metric (e.g. error of 2 degrees):
 - Time and distance: $\frac{B}{S} \times 50$ (e.g. $(1/2) \times 50 = 25$ points)
 - Failures: $50 - (S - B) \times 10$

Teams earn the sum over all available categories, up to the maximum listed above.

Weights for Performance Scoring

The performance score will be weighted according to the effort and contribution to the team as judged by your teammates. Each member of the team will fill out a form similar to the following.

Your name:	Joe Smith		
Other group members:	John Doe	Mary Public	Robert Roe
% Effort	25	41.6	33.3
Reason for weighting:	Missed 3 group work days	Had to work extra to finish system integration	

The information you provide will not be given out to anyone, including your other group members.

The following grid will be set up for each group:

	Joe Smith	John Doe	Mary Public	Robert Roe
Joe Smith	x	25%	41.6%	33.3%
John Doe	33.3%	x	33.3%	33.3%
Mary Public	33.3%	33.3%	x	33.3%
Robert Roe	33.3%	33.3%	33.3%	x
Total (max 110%)	100%	91.6%	108.3%	100%
Performance Score: 140				
Weighted Score	140	128	152	140

In this case, one group member thought that John Doe was not pulling his weight, thus his share of the grade is lower. Notice, however, that you cannot affect your own grade. Mary Public distributed the weight evenly between her partners, but she ended up with the highest grade. Also, the weighting cannot exceed 110%.

Reflection Logs

It is common practice to **assign meaning to experiences**. Our decisions in daily life are based on how we interpret or make meaning of experiences. We will be using reflection logs to bridge connections between specific experiences you go through during the design process and how it contributes to your learning or positively impacted what you decide to do in the future. These logs will be used as a means to develop your life-long learning skills.

Purpose of the reflection logs

1. Help you articulate what you have learned. This will eventually help you talk about your experiences to future prospective employers in a meaningful way.
2. Provide you with an opportunity to identify the valuable lessons learned from sometimes frustrating experiences while working on the project. We tend to get so caught up in the negativity that we forget to realize what the negative experience taught you and the role it played in making you a better engineer and a better individual.

Reflection Logs for Assignments 1 and 2

These allow reflection on your learning when you are first getting familiar with tools (hardware/software). This has been designed so you fill it out in three phases

1. Reflect on what you already know before you start working on the introductory exercises. This will help you recognize what you gained from doing the exercises later.
2. Record critical pieces such as resources that helped you succeed so you can refer to them in the future.
3. Reflect on what you learned from those exercises. These could be technical things as well as subtle/abstract skills or knowledge you might have gained.

Reflection Logs for Group Projects

These are used when working in a team. This has been designed to help you

1. recollect and articulate assumptions that you might have made when you first started with the tasks assigned to you, and how those assumptions changed after working on the task. From this you can understand the value of the experience and specifically recognize what you learnt. As instructors we also want to get to know how you applied your engineering knowledge to develop experiments to get over obstacles.
2. reflect on your team and team work. As engineers you will be expected to work in a team in a professional environment. What did you learn about team dynamics and critical lessons learned when integrating parts of the project together?

On the day the reflection logs for group projects are due, we will break up into sections for a group discussion on the logs. The reflection logs should be submitted to Canvas before class starts.

Lab and Equipment Safety

The equipment you will be working with is sensitive electronic equipment, and you are responsible for knowing the limitations and proper handling of this equipment. The equipment that you will be provided must be returned in good working condition. The team is jointly responsible for damaged equipment. An updated inventory of your teams equipment will be provided.



- When wiring external circuits and equipment to the the Arduino, care is needed to avoid damaging over-voltage or shorting conditions. You are responsible for reading and understanding the following documents:
 - <http://www.ruggedcircuits.com/10-ways-to-destroy-an-arduino/>
 - <http://playground.arduino.cc/Main/ArduinoPinCurrentLimitations>

After studying this material, you should take the quiz on Canvas. A score above 70% is required in order to begin work in the lab.

- The robots are fairly lightweight, but the motors are strong enough to move the robot around at high speed. Take care and be aware any time you are operating the robot. Also, the motor gears are can be damaged if the motors shaft is hit (say, by dropping it) or if excessive weight is applied to the robot, or if the motors are repeatedly cycled back and forth at maximum torque.
- You will be working with batteries with significant energy storage. If the batteries are shorted, a large current can occur, causing heat and perhaps fire. Be aware of potential short circuits.

Lab and Equipment Safety

On the EE Student Portal Canvas page, under Modules/Seminars/Tech Talks/Workshops, there is a Lab Usage and Safety Quiz. You must pass this quiz to have access to the labs.

▼ Seminars/Tech Talks/Workshops	
	Introduction to EE Labs: Safety and Access
	Lab Usage and Safety Quiz 20 pts

Connect with the Dean of Students Office

If you're struggling to stay engaged or facing other issues you can't seem to surmount, raise your hand. This form is here for you to help you stop searching and get the assistance you need.

- <https://www.mines.edu/student-life/raise-your-hand/>

Guidelines for Posting & Sharing in Online Discussions

The general rule for a discussion board is to remember that this is a venue for the group to learn together as professionals. Language should be kept appropriate for professionals and to ensure that it encourages learning. This means that we need to be thoughtful in our word choices, which is why we are using a forum and not a chat format. You can draft your text in your favorite word processing program and then paste them into the forum. Below are some general norms for discussions to get us started.

- Do...
 - Ask questions and engage in conversations as often as possible. Feel free to contact the instructor via the discussion forum for questions or via email or other communication.
 - Be patient and respectful of others and their ideas and opinions they post online.
 - Remember to be thoughtful and use professional language. Keep in mind that things often come across differently in written text, so review your writing before posting.
 - Be prepared for some delays in response time, as virtual communication tends to be slower than face-to-face communication.
 - Contact the instructor if you feel that inappropriate content or behavior has occurred as part of the course.
 - Check the syllabus and course policies stated by your instructor to know what to expect about your instructor's turnaround time for responding.
- Do Not...
 - Use inappropriate language—this includes, but is not limited to, the use of curse words, swearing, or language that is derogatory.
 - Post inappropriate materials—for example, accidentally posting/showing a picture that is not appropriate for the course content.
 - Post in ALL CAPS, as this is perceived as shouting and avoid abbreviations and informal language ("I'll C U L8R").
 - Send heated messages even if you are provoked. Likewise, if you should happen to receive a heated message, do not respond to it.
 - Send an email or post to the entire class, unless you feel that everyone must read it.

Diversity and Inclusion:

At Colorado School of Mines, we understand that a diverse and inclusive learning environment inspires creativity and innovation, which are essential to the engineering process. We also know that in order to address current and emerging national and global challenges, it is important to learn with and from people who have different backgrounds, thoughts, and experiences. Our students represent every state in the nation and more than 90 countries around the world, and we continue to make progress in the areas of diversity and inclusion by providing [Diversity and Inclusion programs](#) and services to support these efforts.

Students with Disabilities:

The Colorado School of Mines is committed to ensuring the full participation of all students in its programs, including students with disabilities. If you anticipate or experience any barriers to learning in this course, please feel welcome to discuss your concerns with me. Students with disabilities may also wish to contact Disability Support Services (DSS) to discuss options to removing barriers in this course, including how to register and request official accommodations. Please visit their website at disabilities.mines.edu for contact and additional information. If you have already been approved for accommodations through DSS, please meet with me at your earliest convenience so we can discuss your needs in this course.

Accessibility within Canvas:

Read the [Accessibility Statement](#) from Canvas to see how the learning management system at the Colorado School of Mines is committed to providing a system that is usable by everyone. The Canvas platform was built using the most modern HTML and CSS technologies, and is committed to W3C's Web Accessibility Initiative and Section 508 guidelines.

Discrimination, Harassment, and Title IX:

All learning opportunities at Mines, including this course, require a safe environment for everyone to be productive and able to share and learn without fear of discrimination or harassment. Mines' core values of respect, diversity, compassion, and collaboration will be honored in this course, and the standards in this class are the same as those expected in any professional work environment. (More information can be [found here](#).) **Discrimination or harassment of any type will not be tolerated.** As a participant in this course, we expect you to respect your instructor and your classmates. As your instructor, it is my responsibility to foster a learning environment that supports diversity of thoughts, perspectives and experiences, and honors your identities. To help accomplish this:

- Course rosters are provided to the instructor with the student's legal name. I will honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records.
- If something is said or done in this course (by anyone, including myself) that made you or others feel uncomfortable, or if your performance in the course is being impacted by your experiences outside of the course, please report it to:
 - Me (if you are comfortable doing so)
 - Wellness Center- Counseling (<https://www.mines.edu/counseling-center/>)
 - Speak Up (<https://www.mines.edu/speak-up/>) - Anonymous Option

In this course, we will cultivate a community that supports survivors, prevents interpersonal violence, and promotes a harassment free environment. Title IX and Colorado State law protects individuals from discrimination based on sex and gender in educational programs and activities. Mines takes this obligation seriously and is committed to providing a campus community free from gender and sex-based discrimination. Discrimination, including sexual harassment, sexual violence, stalking, and domestic violence, is prohibited and will not be tolerated within the Mines campus community. If these issues have affected you or someone you know, you can access the appropriate resources on the [Mines Title IX website](#). You can also contact the Mines Title IX Coordinator, Camille Torres, at 303.384.2124 or titleix@mines.edu for more information.

It's on us, all of the Mines community, to engineer a culture of respect.

CARE @ Mines:

If you feel overwhelmed, anxious, depressed, distressed, mentally or physically unhealthy, or concerned about your wellbeing overall, there are resources both on- and off-campus available to you. If you need assistance, please ask for help from a trusted faculty or staff member, fellow student, or any of the resources below. As a community of care, we can help one another get through difficult times. If you need help, reach out. If you are concerned for another student, offer assistance and/or ask for help on their behalf. Students seeking resources for themselves or others should visit care.mines.edu.

Additional suggestions for referrals for support, depending on comfort level and needs include:

- CARE at Mines (<http://care.mines.edu>) - for various resources and options, or to submit an online "CARE report" about someone you're concerned about (email care@mines.edu)
- CASA (<https://www.mines.edu/casa>) - for academic advising, tutoring, academic support, and academic workshops

- Counseling Center (<https://www.mines.edu/counseling-center/>)- for students to call 303-273-3377 for an appointment. There are also online resources for students on the website. Located in the Wellness Center 2nd floor at 1770 Elm St.
- Health Center (<https://www.mines.edu/student-health/>) - students may call 303-273-3381 for appointment. Located in Wellness Center 1st floor at 1770 Elm St.
- Colorado Crisis Services (<http://coloradocrisiservices.org>) - for crisis support 24/7, either by phone, text, or in person. Colorado Crisis Services is a great confidential resource, available to anyone by calling 1-844-493-8255, or texting “TALK” to 38255. Walk-in location addresses are posted on the website.

All of these options are available for free for students. The Counseling Center, Health Center, and Colorado Crisis Services are confidential resources. The Counseling Center will also make referrals to off-campus counselors, if preferred.

In an emergency, you should call 911, and they will dispatch a Mines or Golden PD officer to assist.

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify your professor if you are comfortable in doing so. This will enable your professor to provide resources that may be available.

Absence Policy

The [Student Absences](#) webpage outlines CSM’s policy regarding student absences. It contains information and documents to obtain excused absences.

Note: All absences that are not documented as excused absences are considered unexcused absences. Faculty members may deny a student the opportunity to make up some or all of the work missed due to unexcused absence(s). However, the faculty members do have the discretion to grant a student permission to make up any missed academic work for an unexcused absence. The faculty member may consider the student’s class performance, as well as their attendance, in the decision.

In the case of an absence, the student is responsible for determining what work was missed and for putting forth a good faith effort to review the material on their own.

Policy on Academic Integrity/Misconduct:

The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining and fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student’s academic achievements, and giving credence to the university’s educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times. Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete policy can be found in the [Mines’ Policy Library](#).

1 Schedule

Part	Date	Topic
	Mon, August 22	Course Orientation
	Wed, August 24	Project Group Assignment and Equipment Checkout
Assign. #1	Fri, August 26	Lab Work
	Mon, August 29	Lab Work
	Wed, August 31	Discussion: Learning Software
	Fri, September 2	Lab Work
	Mon, September 5	Labor Day - no class
	Wed, September 7	Assignment 1 Demos
Assign. #2	Fri, September 9	Lab Work
	Mon, September 12	Lab work
	Wed, September 14	Discussion: Help Desk
	Fri, September 16	Lab work
	Mon, September 19	Assignment 2 Demos
Mini Project	Wed, September 21	Discussion: Working in Groups
	Fri, September 23	Lab work
	Mon, September 26 through	Lab work
	Fri, September 30	
	Mon, October 3	Mini Project Demos

Part	Date	Topic
Demo 1	Wed, October 5	Start work towards Demo 1
	Fri, October 7	Lab work
	Mon, October 10 through Fri, October 14	Lab work
	Mon, October 17 through Tue, October 18	Fall Break - no classes
	Wed, October 19	Lab Work
	Fri, October 21	Demo 1 Demonstration
	Mon, October 24 through Fri, October 28	Lab Work
	Mon, October 31 through Fri, November 4	Lab Work
Demo 2	Mon, November 7	Lab work
	Wed, November 9	Demo 2 Demonstration
	Fri, November 11	Lab Work
	Mon, November 14 through Fri, November 18	Lab work
Final Demo	Mon, November 21	Lab Work
	Wed, November 23 through Fri, November 25	Thanksgiving Break - no classes
	Mon, November 28 through Fri, December 2	Lab Work
	Mon, December 5	Final Demo
	Wed, December 7	Equipment Return