ECE 445 Lecture 1 Fall Semester 2025

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Lecture-1 Layout

- Course Overview and RFA submission – A. Fliflet
- Conflict Management Workshop – Prof. Mironenko
- Pitched Projects
  - Maggie Li – Sound Sleep
  - Varum Gopal – DSED
  - Meenakshi Singhal – Neuroguard
  - Shrey Patel – FadeX
  - Paul Kwiat
  - Shiyuan Duan – 2 pitches
  - Manuel Hernandez – Exercise system for MS
- Brainstorming exercise

Introduction

- Welcome to ECE 445, Senior Design Project Laboratory, the department's capstone course

- We expect you to carry out projects that are **unique**, **technically challenging**, and **completable** within the semester.
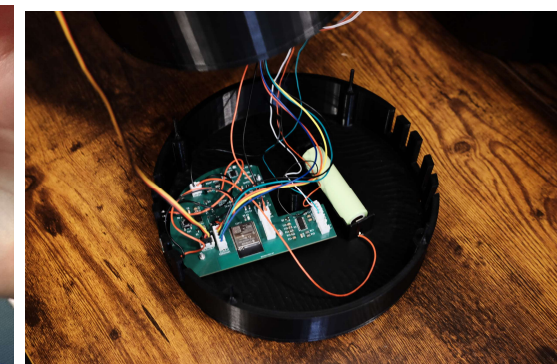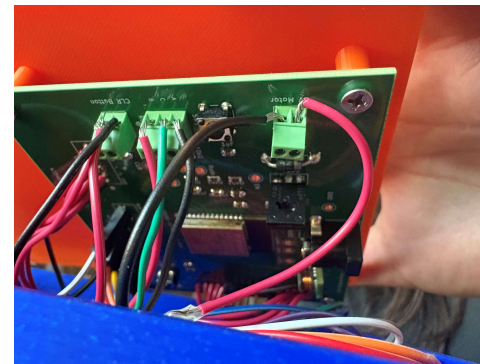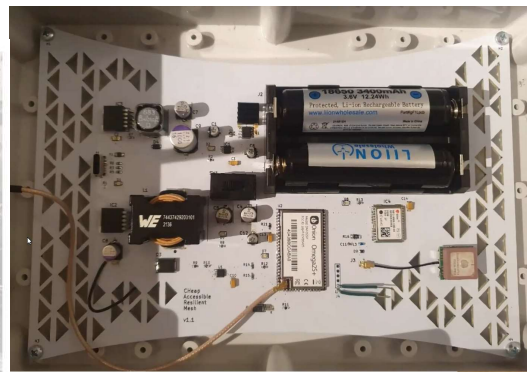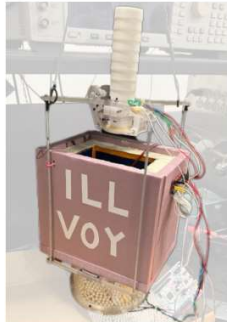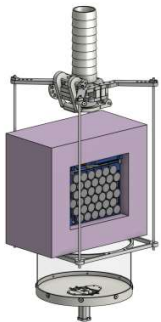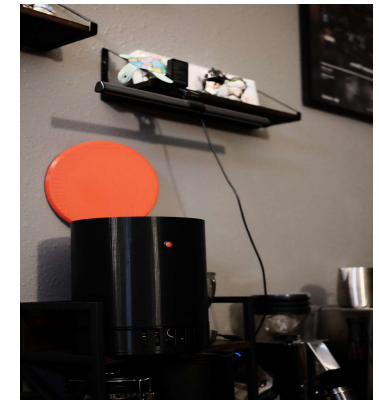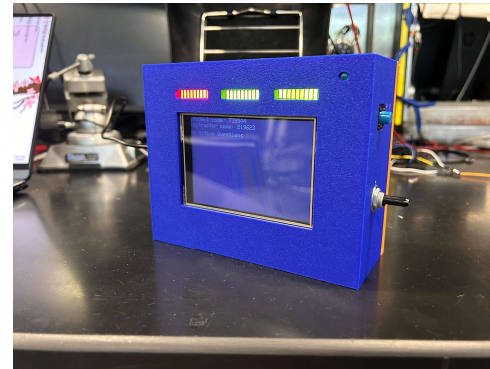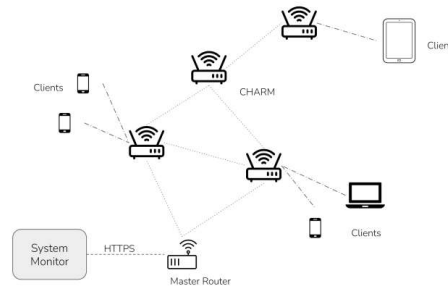
Illini Voyager (SP23)   CHARM (FA22)   Classroom Clarity (SP25)   CO2ffee(Sp25)

Course Outline (weeks 1-5)

- **Introductory lectures, Q&A sessions, and class exercises** (weeks 1-4)
- **Project identification, team formation, and project approval** (weeks 1-3)
  - Propose a project idea or respond to a project pitch on the class **web board**
  - Form a project team
  - Prepare a **Request For Approval** (**RFA**)
  - Approved projects are assigned a TA and instructor
- **PCB training assignments** (weeks 1-3)
  - Learn to use KICAD to design a microprocessor-based PCB ready for fabrication
  - Solder components onto this PCB, download software, and demo operation
- **Team project proposal and Proposal Review** (weeks 3-5)
  - The proposal is a plan for your project, and its prescribed structure basically determines how you will describe and characterize your project.
  - The proposal is presented by the teams to the instructors and TAs at the **Proposal Review**.

Course Outline (weeks 6-15)

- **Project fabrication, testing and analysis** (weeks 6-13)
  - Circuit design, breadboard tests, PCB design and tests, software development, subsystem tests and integration
- **Breadboard Demos** (weeks 7 and 10))
  - Team presents breadboard-stage project to instructor and TA
- **Design Document adds design and project information** (week 8)
  - Tolerance analysis, R&V tables, design calculations and simulations, control software, BOM, cost and schedule.
- All students document project in **Lab notebook** (10% of grade)
- **Demo**, **Final Presentation** and **Final Report** (weeks 14-15)
  - Team demonstrates fully functioning, finished device with working PCB
  - Final presentation gives project overview, highlights and conclusions
  - Final Report provides complete project documentation

Course Grading

- Students receive a **team grade** for major assignments (Proposal, Design Doc, Demo, Presentation, Final Report)

- Students receive an **individual grade** for individual assignments (initial post, lab notebook, IPR, peer reviews)

- Demo scores are used to determine A-level projects.

- Both individual and team scores impact final grade

- Total point percentages tend to be high and do not correspond to letter grades, i.e., a 95% point-percentage may not be an A.

Staff and Support Structure

- Each project will have three students, one TA, and one instructor
- Project teams meet weekly with their TA – the TA is the primary guide and point of contact for your project. Several projects may be mentored by Jack Blevins.
- **Instructors**
  - Arne Fliflet, Rakesh Kumar, Cunjiang Yu

- **TAs**
  - Gayatri Chandran, Shiyuan Duan, Lukas Dumasius, Jason Jung, Shengyan Liu, Wesley Pang, Wenjin Song, Eric Tang, Weiman Yan, Bill Yang, Jason Zhang, Zhuoer Zhang

- **Mentor:** Jack Blevins – ECE alumnus with 50 years industry experience [217-390-1734, jacklouisblevins@gmail.com]
- **Course Directors**
  - Professors Rakesh Kumar and Michael Oelze

The PCB, the heart of your project

- Contains a microprocessor
  - ATmega328. ESP32, STM32, ...
- Not based on a development board or SBC.
- Common components
  - Linear regulator or buck/boost converter
  - External oscillator for internet
  - H-Bridge, motor driver
  - USB and/or JTAG/UART port
  - Amplifiers, switches, voltage level shifters
  - IMU
  - RF transmitter, receiver, antenna for Wifi, Bluetooth
- Required for a successful project

PCB Training (weeks 1-3)

- To help you have a successful PCB experience, you will have a two-part PCB training assignment during the first three weeks of the course.

- **CAD Assignment**: Use KiCAD software to design a simple PCB for a "Microencabulator". A tutorial is provided. End results are the Gerber files used in PCB fabrication

- **Soldering Assignment:** You are given the microencabulator PCB and solder the circuit components onto the board. You then download the microencabulator program to the MCU, do the final assembly and demonstrate the device function

- Course **Wiki page** has info on more advanced PCBs

How to succeed in ECE 445

- Get familiar with the course web site and watch the videos
  - RFA, project proposal, lab notebook, modular design, ethics, …
- Use the **PCB assignment** and course **Wiki page** to prepare for designing and soldering your project PCB
- Use course calendar to anticipate deadlines
- Understand the grading process – 21 grades large and small
  - Proposal Review, lab book, demo, final presentation & report
  - Idea post and PCB assignments
  - Team evaluation, individual progress report, peer review assignments
- **Focus initially on getting a project approved**
- Participate in web board discussions, go to office hours.
- Can't find a project?
  - Respond to project pitches
  - Look for teams needing complementary expertise

How to succeed in ECE 445, continued

- Work with your teammates to build a strong team
    - Hold regular meetings
    - Communicate and be transparent with your teammates and TA
    - Discuss problems as soon as they arise
- Spend time frequently documenting your work in your lab notebook
- Get help solving problems - a lot of expertise is available
- Keep the project moving during the build and test phases

Important Approaching Deadlines

- **First Web Board Posting: Thursday, August 28, 11:59 PM**

  - This is an **individual** assignment

- **Project approval: Thursday, September 11, 11:59 PM**

  - This is a **team** assignment

- Laboratory safety training and CAD assignment are also due during this time period

Submit an RFA

In about Five Visualized Steps

Step 1 in RFA: Post Ideas (Initial Post Deadline August 28)

- All projects start on the Web Board
  - Each idea must first be presented on the web board
  - Pitch and sell your ideas and form your team
  - Professors, TA's, and other students critique and discuss each idea
  - The first student to pitch an idea is the owner of that idea (does not apply to pitched projects)
  - After sufficient discussion, an idea becomes recommended for an RFA by the staff

Step 1: Post an idea to the Web Board

Step 2: Respond to feedback (keep an eye regularly on your thread)

Step 3: Submit the RFA

RFA Template for project description

- Problem

- Solution Overview

- Solution Subsystems
  - Subsystems 1
  - Subsystems 2
  - Etc.

- Criterion for Success

Step 4: Submit the RFA

Step 5: Incorporate Feedback

- The staff may give you feedback
  - Update your RFA from the [My Project page](#)
  - Check your feedback frequently
  - Respond to your feedback early

- Please submit one RFA at a time for most promising idea
  - You can have multiple ideas under discussion

- Project Rejected
  - Try, try again…

- Project Approved
  - Start working on your [Proposal Immediately](#)

Initial Post Deadline
Thursday August 28 11:59pm

RFA Early Approval Deadline
(5 pts extra credit)
Thursday September 3 4:45pm

RFA Final Approval Deadline

Thursday September 11 11:59pm

Consequences of Lagging Behind and Resources for Seeking Help

- If you haven't got project approved by the 3rd week...
  - Although you seems to only have lost 5 / ~500 points
  - You will have a tight time getting RFA approved, and proposal finished in the 4th week, when 25 / ~500 points at stake
  - The effect is cumulative, all other times will be shortened

- If you haven't got project approved by the 3rd week...
  - Talk to TA and professors to clarify the scope
  - Talk to project sponsors
  - Join approved teams
  - We will help you succeed but don't wait until the last minute

Brainstorming Exercise

- Based on Brainstorming and Ideation pre-lecture materials
- Good opportunity to meet other students
- Recent project topics have included
    - Food and drink preparation
    - Trash disposal
    - Exercise assists
    - Disability aids
    - Music
    - Pet feeders and pet exercise aids
    - Security and locks
    - Bicycle assists
    - Climate control
    - Emergency situation assists
    - Remote exploration
    - Satellites
    - Balloons