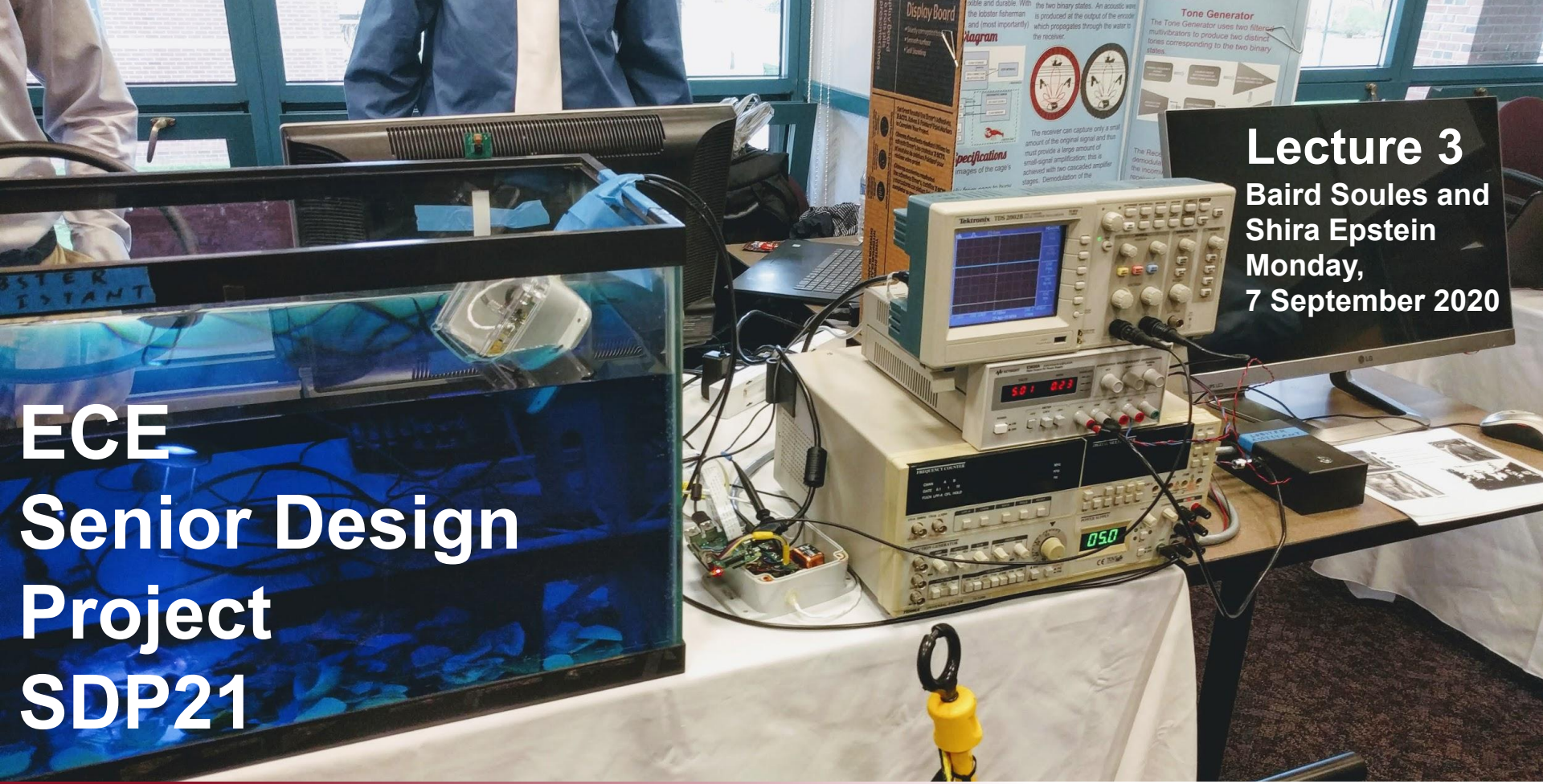


ECE Senior Design Project SDP21

Lecture 3

Baird Soules and Shira Epstein

Monday, 7 September 2020

Outline of Lecture 3, 7 September 2020

- Administrative Matters
- Continued from last time:
  - Suggested reading
  - Reaching out to people to get feedback and ideas
- New PDR Evaluation Sheet
- Preparing for Check-ins
- Project Management
- PDR Proposal of MDR Deliverables
- Cost Estimate
- Presentation

An Important Reminder

4 days until advisor choice due

14 days until PDR Week

70 days until MDR Week

229 days until SDP21 demo days
(Friday, April 24 and Saturday, April 25, 2021)

We are here

August/September 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
23	24 Lecture 1	25	26	27	28	29
30	31 Lecture 2	1	2	3	4	5
6	7 Lecture 3	8	9	10	11 Advisors due	12
13	14 Check-in #2 Evaluators due	15 Check-in #2	16 Check-in #2	17 Check-in #2	18	19
20	21 PDR	22 PDR	23 PDR	24 PDR	25 PDR	26
27	28 Lecture 4	29	30			

November 2020						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2 Lecture 6	3	4	5	6	7
8	9 Check-in #4	10 Check-in #4	11 Check-in #4	12 Check-in #4	13	14
15	16 MDR	17 MDR	18 MDR	19 MDR	20 MDR	21
22	23	24	25	26	27 Reading Day	28 Reading Day
29	30 Exams begin					

Course Communication Infrastructure

Moodle (private)

- Links to the lecture slides (.pdf files) and
- videos (.mp4 files).

Course Communication Infrastructure

Official course slack: sdp21.slack.com

Each team will set up their

own slack workspace for team

communications.

SDP21 Slack Profiles

Jack DeGuglielmo CompE

Jackie Chan CompE

Jacob Colapietro CompE

SDP21 Slack Profiles

Course Communication Infrastructure

Google Drive

It is recommended that each team

have a shared Google Drive folder

for team documents (presentations, etc.)

Course Communication Infrastructure

Github

Each team will set up their

own github repository for team

code and documents.

We'll offer a Github workshop soon.

Picking up your face shield

Students should show up to **Marcus 8** between **9AM and 3:45PM, Monday through Friday**

Keith's office is in 8A; students will locate Keith to obtain a face shield and use the computer stationed in the back to enter their info into the face shield checkout spreadsheet.

Students receive one face shield for the semester and must wear it in all laboratory settings along with their face mask.

Signage with instructions is on the door of 8C & on the computer to right of the door.

Logistics… updates coming soon…

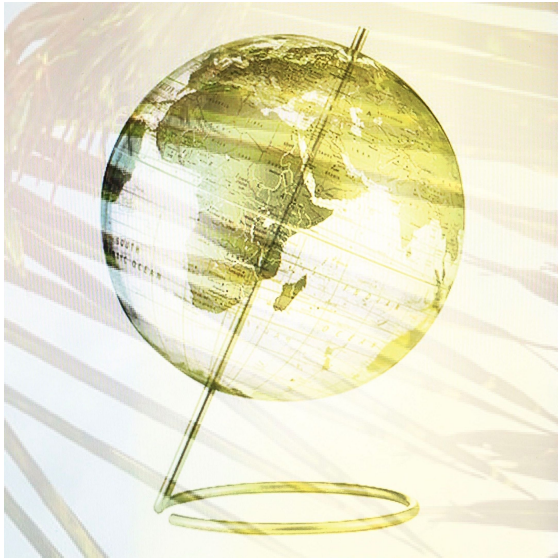
How to order parts

Picking up team tool kits

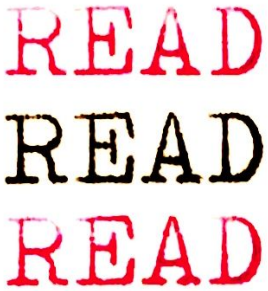
Reservation system for benches and tables
M5 + SDP Lab (Marcus 10 & 12)
will go live on Monday, Sep 14

Logistics: Remote Students

- teams work to distribute tasks within the team
- you may work on a part of the project
  that involves needing parts and equipment
- think about the logistics, what you would
  need, and then reach out to Shira to come up with a plan



Where we left off -- how to read and reach out to people to do your research



Search for the O'Reilly Safari Learning Platform at the UMass library site and then search for these three ebooks. All three are by Charles Platt.

Link to the playlist of O'Reilly Safari ebooks recommended for SDP21:

tinyurl.com/sdp21aad

Please feel free to suggest additions to the playlist on the #safariplaylist slack channel.

Documents, publications for ideas, etc.:

- Data Sheets
- Application Notes
- Reference Designs (see ti.com)
- White Papers
- Case Studies (example: see case study at particle.io)
- Magazine articles (see Circuit Cellar, etc)
- New York Times
- Blogs
- Podcasts (see embedded.fm and the Amp Hour)
- eBooks (Safari and others)
- IEEE journals (see IEEE Xplore at UMass library)(IEEE Potentials)

YouTube - Page 1

Destin Sandlin - SmarterEveryDay

Andreas Spiess - "the guy with the Swiss accent" -> ESP8266, ESP32, LoRa

Mehdi Sadaghar - ElectroBoom

Ben Krasnow - Applied Science

David Jones - EEVblog

YouTube - Page 2

Fran Blanche - FranLabs

Colin Furze

Engineer Guy

SparkFun

Adafruit

YouTube - Page 3

Simone Giertz

Jeri Ellsworth

Mr. Carlson's Lab

Digi-Key

Element14 presents

Mouser Electronics

YouTube - Page 4

Computer History Museum

The Centre for Computing History

Hackster.io

Hackaday

Make:

Reach out to people for feedback, ideas, etc.:

- SDP21 Slack
- M5 Discord Join the M5 Discord https://discord.gg/tbvGBJ
- ECE Faculty
- ECE Alums (via Prof. Hollot's UMass Amherst ECE LinkedIn group and via ECE faculty)
- Application Engineers (at chip companies and vendors like Digikey)

UMass Amherst SDP21 PDR

Summary of evaluation sheet

Presentation	10%
Problem Statement	5%
Preliminary System Specifications	10%
Survey of Competing Solutions in Marketplace	5%
Preliminary Design	40%
Significant Custom Hardware Design	5%
Proposed MDR Deliverables	10%
Cost Estimate	5%
Project Management	10%

UMass Amherst SDP21 PDR

What was covered last week in Lecture 2

Presentation	10%
Problem Statement	5%
Preliminary System Specifications	10%
Survey of Competing Solutions in Marketplace	5%
Preliminary Design	40%
Significant Custom Hardware Design	5%
Proposed MDR Deliverables	10%
Cost Estimate	5%
Project Management	10%

Problem Statement	
5%	Rubric
• Background • High-level description of product	**(4.0)** The problem statement is described concisely and in layperson's terms. **(3.0)** Either the problem statement is a little confusing or the problem statement is overly technical. **(2.0)** The problem statement is confusing. **(1.0)** The problem statement is unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

Preliminary System Specifications	
10%	Rubric
• Quantitative • Design-agnostic	**(4.0)** Preliminary system specifications are clear, complete, quantitative, and design-agnostic. **(3.0)** One or two necessary characteristics of the specifications are unclear and/or missing. **(2.0)** More than two necessary characteristics are unclear and/or missing. **(1.0)** The preliminary system specifications are unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

Survey of Competing Solutions in Marketplace	
5%	Rubric
	(4.0) A sufficient survey of competing solutions in the marketplace. **(3.0)** An obvious competing solution is missing. **(2.0)** Numerous obvious competing solutions are missing. **(1.0)** Survey of competing solutions is unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

Preliminary Design	
40%	Rubric
• System Block Diagram • Software Diagram(s)	**(4.0)** A clear and compelling preliminary design was presented via the diagrams. **(3.0)** One major aspect of the preliminary design is unclear or missing. **(2.0)** More than one major aspect of the preliminary design is unclear or missing. **(1.0)** Preliminary design is unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

Significant Custom Hardware Design	
5%	Rubric
• Meaningful to project • Appropriate complexity	**(4.0)** The proposed hardware design is meaningful to the project and is of appropriate complexity. **(3.0)** The proposed hardware design is not appropriately complex. **(2.0)** The proposed hardware design is not meaningful to the project. **(1.0)** The proposed hardware design is unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

Deliverables for check-in (next week!) [drafts of]

Presentation	10%
Problem Statement	5%
Preliminary System Specifications	10%
Survey of Competing Solutions in Marketplace	5%
Preliminary Design	40%
Significant Custom Hardware Design	5%
Proposed MDR Deliverables	10%
Cost Estimate	5%
Project Management	10%

Check-ins start next week
Deliverables are due: No later than Sunday September 13th (11:59pm)
What are check-ins?

15 minute meeting with course coordinators to help you prepare for PDR

Not formally graded, but remember:
Course coordinators assign a grade based on overall performance for the semester (20% of your grade)

Course coordinators will review your deliverables ahead of time to prepare for the check-in meeting

Check-ins start next week
Deliverables are due: No later than Sunday September 13th (11:59pm)
How to submit deliverables for check-in:

Shira will share a folder with your team on Google Drive.

You will get a notification shortly that will let you know where the folder can be found.

All team members can edit, add files, etc.

You can keep editing until deadline.

Course coordinators will need
the final versions by the deadline.

Deliverables for Check-in	% of PDR
Problem Statement	5%
Preliminary System Specifications	10%
Preliminary Design	40%
Significant Custom Hardware Design	5%

UMass Amherst SDP21 PDR

Summary of evaluation sheet

Presentation	10%
Problem Statement	5%
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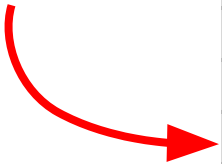
Up next:



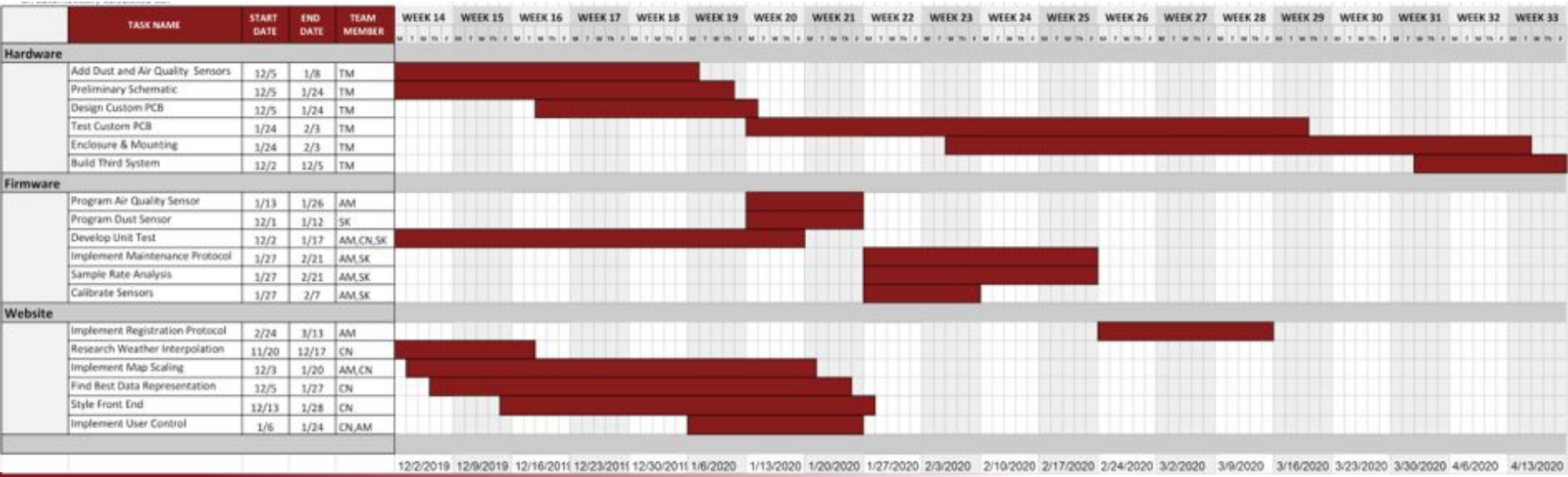
Project Management

Project Management	
10%	Rubric
• Gantt Chart • Team Responsibilities ◦ Team coordinator ◦ Altium Lead ◦ Budget Management Lead ◦ Technical responsibilities	**(4.0)** The team has created a comprehensive plan specifying milestones and primary responsibilities. **(3.0)** The team's plan is missing some detail on milestones and/or responsibilities. **(2.0)** The team's plan is missing significant details on milestones and/or responsibilities. **(1.0)** The team's plan is unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

Gantt Chart Example

You know when things are due. Work backwards from there.

Ask yourself: What are the dependencies? What is mission critical?



	TASK NAME	START DATE	END DATE	TEAM MEMBER
Hardware				
	Add Dust and Air Quality Sensors	12/5	1/8	TM
	Preliminary Schematic	12/5	1/24	TM
	Design Custom PCB	12/5	1/24	TM
	Test Custom PCB	1/24	2/3	TM
	Enclosure & Mounting	1/24	2/3	TM
	Build Third System	12/2	12/5	TM
Firmware				
	Program Air Quality Sensor	1/13	1/26	AM
	Program Dust Sensor	12/1	1/12	SK
	Develop Unit Test	12/2	1/17	AM,CN,SK
	Implement Maintenance Protocol	1/27	2/21	AM,SK
	Sample Rate Analysis	1/27	2/21	AM,SK
	Calibrate Sensors	1/27	2/7	AM,SK
Website				
	Implement Registration Protocol	2/24	3/13	AM
	Research Weather Interpolation	11/20	12/17	CN
	Implement Map Scaling	12/3	1/20	AM,CN
	Find Best Data Representation	12/5	1/27	CN
	Style Front End	12/13	1/28	CN
	Implement User Control	1/6	1/24	CN,AM

Gantt Chart Example

You know when things are due. Work backwards from there.

Ask yourself: What are the dependencies? What is mission critical?

Task	Engineers	21-Jan	28-Jan	4-Feb	11-Feb	18-Feb	25-Feb	3-Mar	10-Mar	17-Mar	24-Mar	31-Mar	7-Apr	14-Apr
Network Latency within 0.1 s	Anamitra													
Mobile User Interface	Max													
Long Distance Data Transmission	Minting													
Battery Monitoring System	Xiaoyang													
Scalable System Test	All													
Outdoor Implementation Test	Xiaoyang													
User Manual	All													
3D reconstruction	Max													
Hardware Intergration	Minting													
Software Integration	Anamitra													
Project refinement	All													

Project Management

Breaking down team responsibilities

All teams have identified a:

- Team coordinator
- Altium lead
- Budget management lead

And assigned leads to major (“mission critical”) technical responsibilities.

Project Management

Overall performance of the team affects grades of individuals on the team

Even if you are a superstar, if your team falls apart:

- It is unlikely you will impress your evaluators at presentations
- Your prototype and final design will probably work as planned

Each and every member has a strong personal interest in successful teamwork

Individual course grades, but most graded items are collective endeavours by the team (presentations, final product)

Project Management

Grading

The final grade for ECE 415 and ECE 416 will be a weighted average of the following three grade components:

- Advisor grade (50%): Given at the discretion of the advisor.
- Review Board grade (30%): Average of PDR and MDR (for ECE 415) or CDR and FPR (for ECE 416) grades.
- Course Coordinator grade (20%): Based on attendance, project documents, and performance:

Each Team member is graded individually.

Project Management - Planning the timeline

Parallelization

“I can’t do this until…” is almost always rationalization for procrastination.

We can always find a way to do something that advances our work significantly.

Freebies:

- More reading
- More research
- Run simulations
- Virtual shopping (preparing bills of materials, researching parts)

Project Management

VoxCaliper1 examples:

Recordings of spoken numbers aren’t ready -- so we use any old files we find online to start.

Code isn’t properly interpreting caliper data, but we can still write the rest of the code while one team member debugs that (provide an example reading, such as “1.23 mm” and work from that)

Project Management

VoxCaliper1 examples:

I need an enclosure for my PCB that I intend to 3d print but my PCB isn't ready.

I don't know the dimensions. So I don't begin the design process at all until my teammate finishes the PCB, and for some reason I also decide I don't need to start until the physical PCB arrives in the mail.

That's wasted time! I could design most of my enclosure based only on a rough estimate of the PCB size, and modify it later.

Project Management

‘[N+1] brains are better than [N] brains’

More confidence in your solution if multiple members reach same conclusion

Candid communication, compromises on creative vision for the project (not always easy)

Going over things multiple times helps catch missing pieces

Project Management

Ordering **exact quantities** of **exactly what you need, exactly before you need it leaves no room for error!**

Murphy's law &"Two is one and one is none"

Find out what lead times are and incorporate this thinking into Gantt chart as needed.

- Digikey shipping options https://www.digikey.com/en/help/same-day-shipping
- PCB Manufacturing turnarounds https://docs.oshpark.com/services/

Be careful not to order things that are backordered/not available in domestic warehouses.
Factory lead times are usually prohibitively long.
Usually an alternate source can be found.

UMass Amherst SDP21 PDR

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Up next:

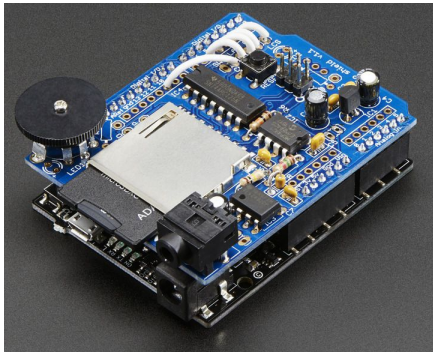
Proposed MDR Deliverables	
10%	Rubric
• Demonstration of essential portions of project • Feasible to complete by MDR	**(4.0)** Deliverables demonstrate essential, technically challenging portions of the project. Working subsystems feasible by MDR. **(3.0)** Deliverables are overly ambitious and therefore are unlikely to be successfully completed by MDR. **(2.0)** Deliverables do not demonstrate essential, technically challenging portions of the project. **(1.0)** Proposed MDR deliverables are unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

Subsystems don't need to talk to each other; you can demonstrate independently

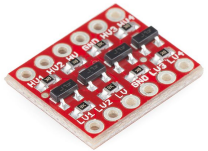
If you can integrate them, excellent, but not required

Obviously how separable things are will be specific to the project/implementation/other details

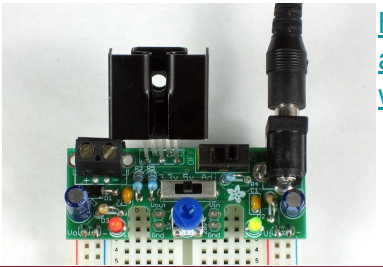
Our **2 person team!** MDR Deliverables for VoxCaliper1



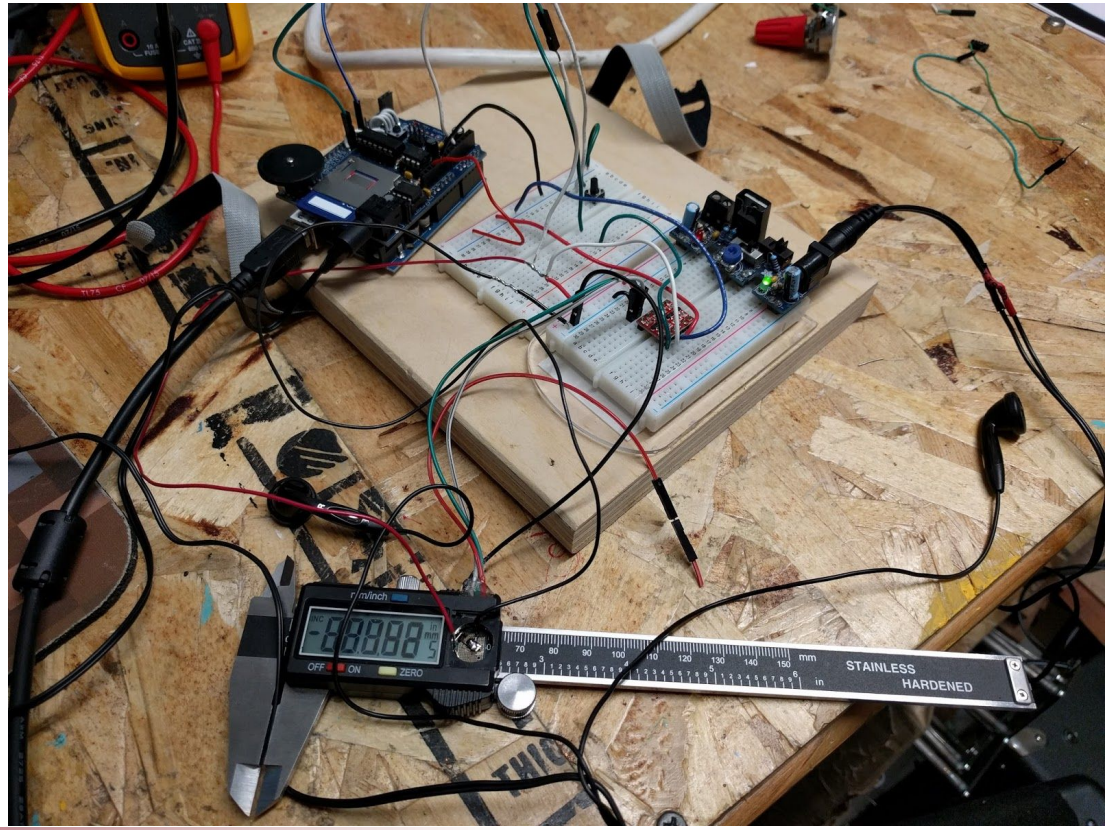
https://www.adafruit.com/product/94



https://www.sparkfun.com/products/12009



https://learn.adafruit.com/adjustable-breadboard-power-supply-kit/overview



VoxCaliper1 MDR Deliverables (2 person team)

Baird's MDR Deliverable portion

- Arduino Uno
- Level shifter
- Voltage regulator
- Calipers
- Button/Switch

Baird will write the code that will allow the Arduino Uno to read the value from the calipers and print it out correctly to the serial monitor.

Baird will focus on metric units for now, and tackle imperial units only if time allows.

Shira's MDR Deliverable Portion

- Arduino Uno (a second one)
- Adafruit Wave Shield
- SD Card and sound files

Shira will review the Adafruit Wave Shield Guide and figure out how to get the sound files into the appropriate format so that the WaveHC Library can successfully use them. She will write sample code that will call the functions of the WaveHC Library. She will prepare sound files for playback in this manner

Buy the battery, buy the charger, and run system on the battery (Arduino Uno Vin / GND pins)

Stretch goals:
Imperial unit packet parsing works
Implement Arduino on a breadboard using DIP package ATMEGA328P
Re-learn the ATMEL ICE
Drop the Arduino bootloader and try programming "outside" the Arduino environment

UMass Amherst SDP21 PDR

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Up next:

Cost Estimate	
5%	Rubric
• Prototyping costs ◦ Breakout boards/single board computers ◦ PCB order/revisions ◦ Components ◦ Contingencies	**(4.0)** The cost estimate is well-described and complete. **(3.0)** The cost estimate is missing some detail. **(2.0)** The cost estimate is missing significant detail. **(1.0)** The cost estimate is unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

How You Will Spend Your $500 (plan)

Up next:

UMass Amherst SDP21 PDR

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Presentation	
10%	Rubric
• Begins on time • Rehearsed • Teamliness	**(4.0)** A professional presentation that demonstrates knowledge and practice. **(3.0)** The presentation should have been practiced more. **(2.0)** The presentation was confusing. **(1.0)** The presentation was unsatisfactory.
Score [1.0 - 4.0]:	
Written comments:	

How to prepare for an excellent presentation

- **You have to practice with your advisor**
- Practice
- Practice
  - In front of your family. Your friends. Your classmates. Via Zoom.
- Rework your presentation text. Do multiples drafts. Keep on polishing the content as you practice the presentation

Questions?