

Senior Design Project – SDP20

Introduction

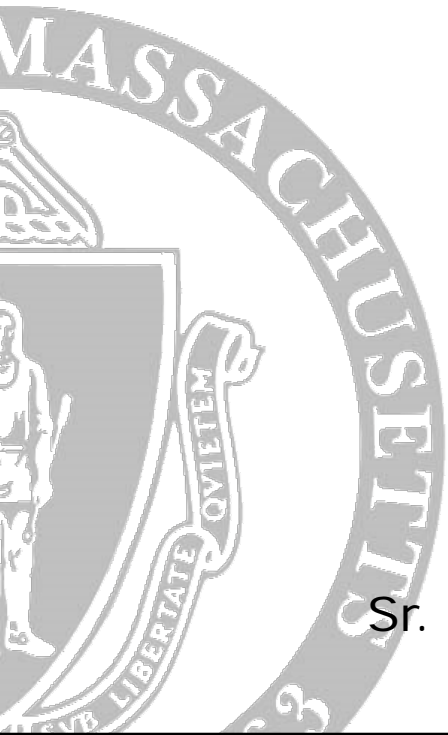
9 September 2019

C.V. Hollot

Professor and Head

Baird Soules

Sr. Lecturer and Director of Experiential Learning



Sally Darby

Director
Career Planning & Student Development

Senior Design Project – SDP20

Introduction

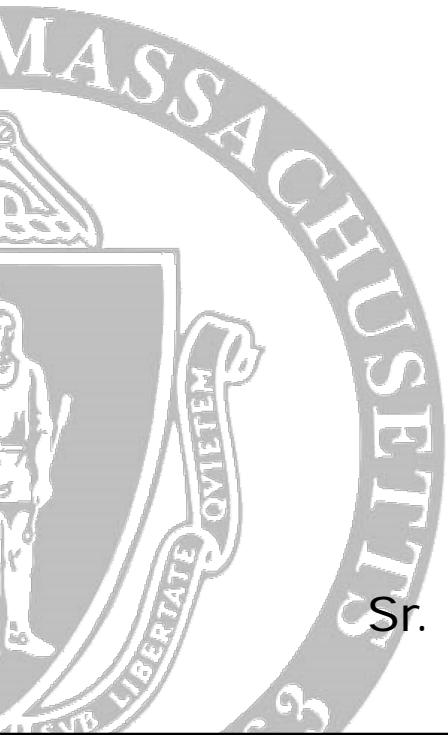
9 September 2019

C.V. Hollot

Professor and Head

Baird Soules

Sr. Lecturer and Director of Experiential Learning



SDP20 Clock Starts Ticking

SDP20 Demo Day
24th-25th April 2020

~~392 days~~

228 days

Students OWN SDP20

CSE 2020

Date: _____

Last Name _____ First Name _____

Curriculum Worksheet for the Computer Systems Engineering Class of 2020

FIRST YEAR		SECOND YEAR		THIRD YEAR			
Fall [18-19cr]	Spring [15-16cr]	Fall [18-19cr]	Spring [18-19cr]	Fall [15cr]	Spring [15cr]	Fall [13-15cr]	Spring [13-15cr]
ENGIN 112 Intro. to ECE [3 cr] [Note 1]	ECE 212 Intro. Programming for ECE [4 cr]	ECE 211 Circuit Analysis I [4 cr]	ECE 212 Circuit Analysis II [4 cr]	ECE 313 Signals & Systems [4 cr]	ECE 314 Intro. Prob. & Random Procs. [4 cr]	ECE 415 Senior Design Project I [3 cr] (GenEd-III)	ECE 416 Senior Design Project II [3 cr]
PHYSICS 151 Gen. Physics I – Mechanics [4 cr]	PHYSICS 152 Gen. Physics II – Thermo., E&M [4 cr]	ECE 221 Intro. Digital & Computer Systems [4 cr]	ECE 232 Hardware Organization & Design [4 cr]	ECE 323 Electronics I [4 cr]	ECE 374 Computer Networks & the Internet [3 cr]	Elective [3 or 4 cr] [Notes 6 & 7]	Elective [3 or 4 cr] [Notes 6 & 7]
MATH 131 Calculus I [4 cr]	MATH 132 Calculus II [4 cr]	ECE 242 Data Structures & Algorithms. (w/Java) [4 cr]	MATH 235 Linear Algebra [3 cr]	ECE 353 Computer Systems Lab I [3 cr]	ECE 354 Computer Systems Lab II [4 cr]	CSE Elective [3 or 4 cr] [Notes 6 & 7]	CSE Elective [3 or 4 cr] [Notes 6 & 7]
Social World Elective [4 cr] [Note 2]	Biological Sciences Elective [3 or 4 cr] [Note 4]	MATH 331 Differential Equations [3 cr]	COMPSOC 250 Intro. to Computation [4 cr]	ECE 373 Software Intensive Engineering [4 cr]	ECE 303 Junior Seminar [1 cr]	Social World Elective [4 cr] [Note 2]	Social World Elective [4 cr] [Note 2]
ENGLWRIT 112 College Writing [3 cr]	Social World Elective [4 cr] [Note 2]	Science Elective [3 or 4 cr] [Notes 5 & 6]			ENGIN 351 Writing in Engineering [3 cr]		
ENGIN 191 Freshman Seminar [1 cr] [Note 3]						5-yr B.S. / M.S. Graduate Course [3 or 4 cr] (Cannot be used for B.S. degree) [Note 8]	5-yr B.S. / M.S. Graduate Course [3 or 4 cr] (Cannot be used for B.S. degree) [Note 8]

The curriculum notes can be found on the reverse side of this worksheet.

UNIVERSITY OF MASSACHUSETTS AMHERST • DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
<http://ece.umass.edu/>

Updated July 2016

EE 2020

Date: _____

Last Name _____ First Name _____

Curriculum Worksheet for the Electrical Engineering Class of 2020

FIRST YEAR		SECOND YEAR		THIRD YEAR			
Fall [18-19cr]	Spring [15-16cr]	Fall [18-19cr]	Spring [18-19cr]	Fall [15cr]	Spring [15cr]	Fall [13-15cr]	Spring [13-15cr]
ENGIN 112 Intro. to ECE [3 cr] [Note 1]	ECE 222 Intro. Programming for ECE [4 cr]	ECE 211 Circuit Analysis I [4 cr]	ECE 212 Circuit Analysis II [4 cr]	ECE 313 Signals & Systems [4 cr]	ECE 314 Intro. Prob. & Random Procs. [4 cr]	ECE 415 Senior Design Project I [3 cr] (GenEd-III)	ECE 416 Senior Design Project II [3 cr]
PHYSICS 151 Gen. Physics I – Mechanics [4 cr]	PHYSICS 152 Gen. Physics II – Thermo., E&M [4 cr]	ECE 221 Intro. Digital & Computer Systems [4 cr]	ECE 232 Hardware Organization & Design [4 cr]	ECE 323 Electronics I [4 cr]	ECE 324 Electronics II [3 cr]	Elective [3 or 4 cr] [Notes 6 & 7]	Elective [3 or 4 cr] [Notes 6 & 7]
MATH 131 Calculus I [4 cr]	MATH 132 Calculus II [4 cr]	ECE 242 Data Structures & Algorithms. (w/Java) [4 cr]	MATH 235 Linear Algebra [3 cr]	ECE 353 Computer Systems Lab I [3 cr]	ECE 333 Fields & Waves [4 cr]	EE Elective [3 or 4 cr] [Notes 6 & 7]	EE Elective [3 or 4 cr] [Notes 6 & 7]
Social World Elective [4 cr] [Note 2]	Biological Sciences Elective [3 or 4 cr] [Note 4]	MATH 331 Differential Equations [3 cr]	MATH 233 Multivariate Calculus [3 cr]	ECE 344 Semiconductor Devices & Materials [1 cr]	ECE 303 Junior Seminar [1 cr]	Social World Elective [4 cr] [Note 2]	Social World Elective [4 cr] [Note 2]
ENGLWRIT 112 College Writing [3 cr]		Social World Elective [4 cr] [Note 2]	Science Elective [3 or 4 cr] [Notes 5 & 6]		ENGIN 351 Writing in Engineering [3 cr]		
ENGIN 191 Freshman Seminar [1 cr] [Note 3]						5-yr B.S. / M.S. Graduate Course [3 or 4 cr] (Cannot be used for B.S. degree) [Note 8]	5-yr B.S. / M.S. Graduate Course [3 or 4 cr] (Cannot be used for B.S. degree) [Note 8]

The curriculum notes can be found on the reverse side of this worksheet.

UNIVERSITY OF MASSACHUSETTS AMHERST • DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
<http://ece.umass.edu/>

Updated August 2016

Students Empowered (Responsible)

- Select your own team
- Select your own project
- Select your own advisor
- **Empowered**
- **Responsible**

Course attributes

- Teams self-form
- Ideas self-generated
 - Self-learning opportunities
 - Impact on society
 - Idea → prototype
- Pre-professional experience in engineering design
- **Teaming experience**
- **Minimal classroom interactions**
 - **Weekly team/advisor meetings**
 - **Reviews before faculty evaluators**

Takes a Department to do SDP



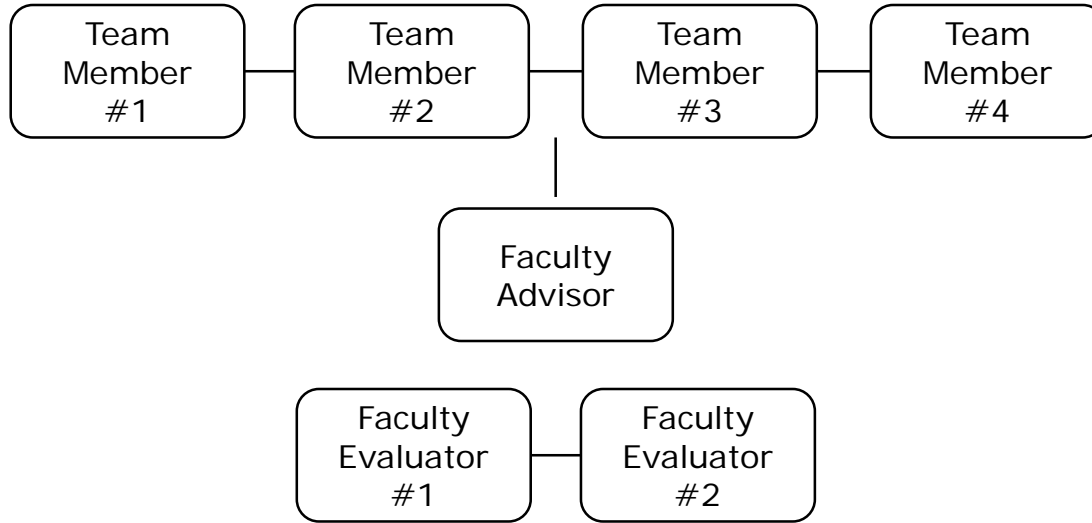
COO



CTO



CLT



Fran Caron (CLT)



Marcus Hall, Room 9A

Baird Soules (CTO)



M5, Room 5J



SDP20 Reviews

Problem Definition and Design

Preliminary
Design Review
(PDR)
Oct

Working Prototype

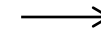
Midway Design
Review
(MDR)
Dec

Working Product

Comprehensive
Design Review
(CDR)
March

Final Product

Final Project
Review
(FPR)
April



SDP
Demo
Days
24th, 25th
April

SDP20 Course Deliverables

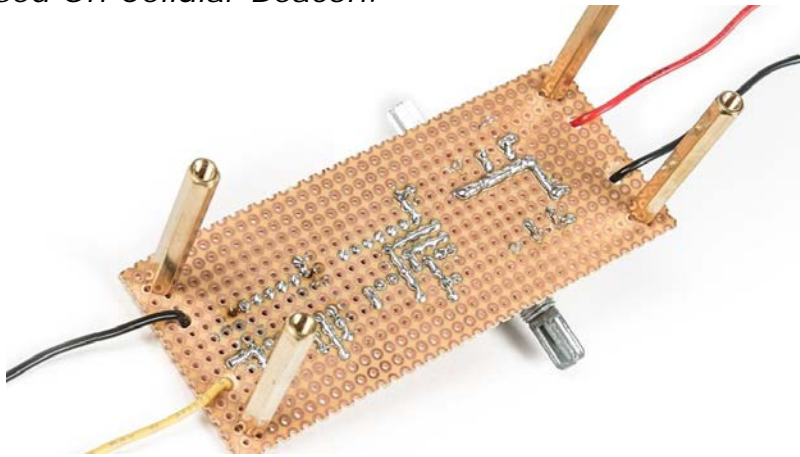
- Review Presentations
(PDR/MDR/CDR/FPR slide decks)
- Project Website
- Written report
- Demo Poster
- Final Product

Product must include custom PCBA (CDR, FPR)



At least one
PCBA required

Photo: UMassAmherst ECE SDP17, Team 4, *Autonomous Search and Rescue Based On Cellular Beacon*.



Only hand-soldered
protoboards allowed for
other circuits

Source: <https://makezine.com/2015/10/15/how-and-when-to-use-protoboard/>

Prototype Your Design Ideas Rapidly in Fall (MDR)

- For MDR, teams encouraged to use development boards and breakout boards.
- In many cases these boards will not be allowed at CDR, FPR and at the SDP20 demo days.
 - For example, Arduino, mbed and other no-operating-system 8-bit and 32-bit dev boards are not allowed after MDR.
 - Instead, you will migrate your design onto your custom PCB prior to CDR. In addition, you'll be required to migrate your Arduino code to ANSI C code prior to CDR.

SDP20 Process

- Teams of 4 students
 - Identify a team manager and PCB lead
- Advisor
 - Each team chooses its own ECE faculty advisor (**due 20th Sept**)
- Meetings
 - Weekly team meetings
 - Weekly advisor meetings
 - Course meetings
- Project budget: \$500
 - Some parts available in SDP lab or M5
 - We encourage students to secure outside support; e.g., free samples, sponsorships, competitions,


Review and Grading Process

- Reviews (PDR, MDR, CDR, FPR)
 - Two ECE faculty evaluators (different from advisor). **Teams nominate seven by 23rd Sept.**
 - 20/30 min presentation by team + 20 min Q&A
- The final grade for ECE 415 (and ECE 416):
 - Advisor grade (50%): Given at the discretion of the advisor
 - Review Board grade (30%): Average of review panel grades
 - Course Coordinator grade (20%): Based on project documents and performance
 - Each team member graded individually.

SDP20 website <http://www.ecs.umass.edu/ece/sdp/sdp20/>

Senior Design Project - SDP20

Home	Teams	Syllabus	Schedule	Lectures	Examples
----------------------	-----------------------	--------------------------	--------------------------	--------------------------	--------------------------



Welcome to Senior Design Project 2020 (SDP20)

Course Overview: The Senior Design Project provides a capstone experience for undergraduate students in the Department of Electrical and Computer Engineering. Students work in teams of 3-4 students in this year long course sequence to design and prototype a system of their choice. Past projects have included a variety of topics ranging from home automation systems to ultra wide band wireless links, assistive robots, and wireless drumsticks. Each team is advised by a faculty member in the department and projects undergo several formal reviews. The learning goals for the senior design project include technical design, team work, presentation skills, an understanding of realistic constraints, economics, and ethics.

News:

First Lecture: 4-5.15pm, Monday, 9th September'19, Hasbrouck Lab, Room 134

Advisors due: 20th September'19

PDR: 7th-11th October'19

**SDP20
Advisers**
Aksamija
Arbabi
Ciesielski
Duarte
Frasier

<http://www.ecs.umass.edu/ece/sdp/sdp20/>

To Do List

- Sign up for a lab bench (Marcus Hall, Rm 9A)
- Converge to a project idea
- Connect with a Faculty Adviser (due 20th Sept'19)
- Nominate 7 faculty members as your two evaluators (due 23rd Sept'19)
- Register for M5 membership (required)

Senior Design Project - SDP20

[Home](#)
[Teams](#)
[Syllabus](#)
[Schedule](#)
[Lectures](#)
[Examples](#)


Schedule

This schedule shows the main events for SDP20. Please note that the schedule is subject to change.

September 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2	3 First day of classes	4	5	6	7
8	9 Lecture 1: Introduction	10	11	12	13	14
15	16 Lecture 2: The Design Process	17	18	19	20 Advisors due	21
22	23 Benchsides (15min/team) 5.30-7.45pm seven nominations for evaluators due	24	25 Benchsides (15min/team) 5.30-7.45pm	26	27 Benchsides (15min/team) 5.30-7.45pm	28

October 2019

Sun	Mon	Tue	Wed	Thu	Fri	Sat
	30 Lecture 3 PDR	1	2	3	4	5
6	7 PDR	8 PDR	9 PDR	10 PDR	11 PDR	12
13	14	15	16	17	18	19

October 2019						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
	30 Lecture 3 PDR	1	2	3	4	5
6	7 PDR	8 PDR	9 PDR	10 PDR	11 PDR	12
13	14 Holiday	15 Lecture 4 Analyzing experiments Prof. Goeckel	16	17	18	19
20	21 Lecture 5 Teaming Dr. Peter Reinhart	22	23	24	25	26
27	28 Benchsides (10min/team) 4-5.30pm	29	30 Benchsides (10min/team) 4-5.30pm	31	1 Benchsides (10min/team) 4-5.30pm	2

November 2019						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
					1	2
3	4	5	6	7	8	9
10	11	12	13 Lecture 6 MDR, MDR report, website	14	15	16
17	18 Benchsides (10min/team) 4-5.30pm	19	20 Benchsides (10min/team) 4-5.30pm	21	22 Benchsides (10min/team) 4-5.30pm	23
24	25 Thansgiving Break	26 Thansgiving Break	27 Thansgiving Break	28 Thansgiving Break	29 Thansgiving Break	30

December 2019						
Sun	Mon	Tue	Wed	Thu	Fri	Sat
1	2 MDR	3 MDR	4 MDR	5 MDR	6 MDR	7
8	9	10	11	12	13	14

Working Prototype!

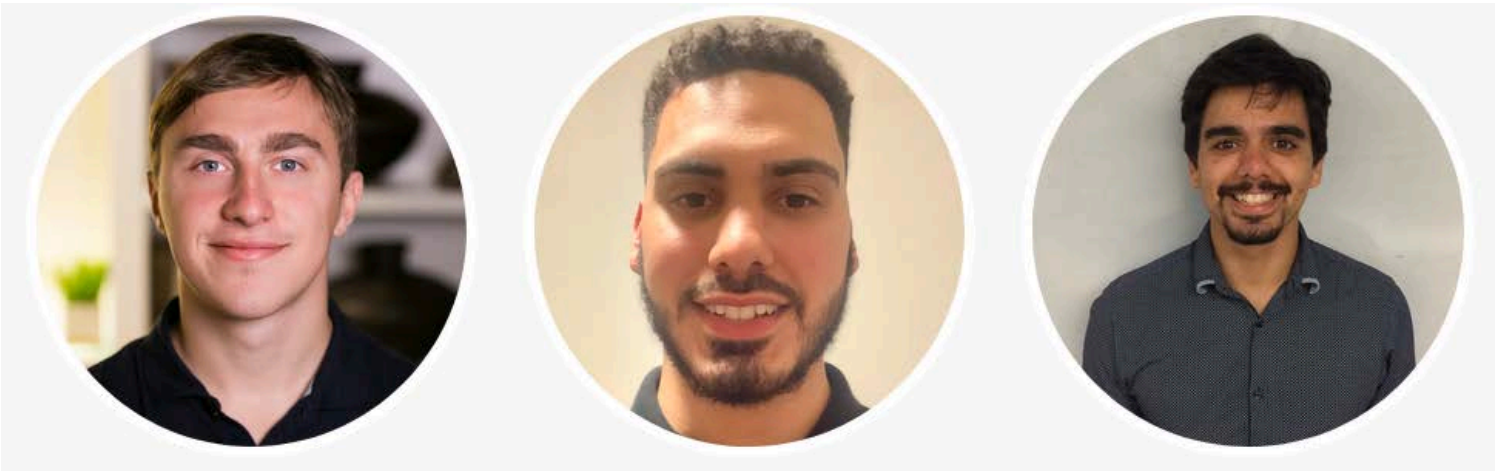
SDP19 Awards

ECE Senior Design Project 2019



SDP19 Third Place

Zipcart



Ryan Lagasse

Ricardo Henriquez

Jonathan Azevedo

Advisor: Tilman Wolf

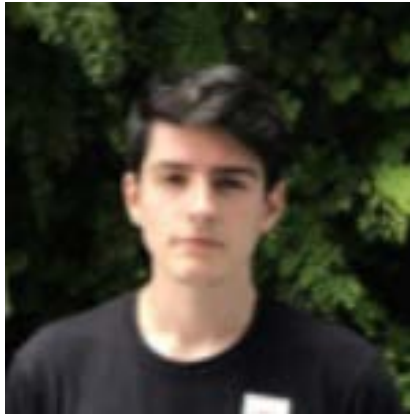
SDP19 Third Place

Zipcart



SDP19 Second Place

Electronic Piano Teacher

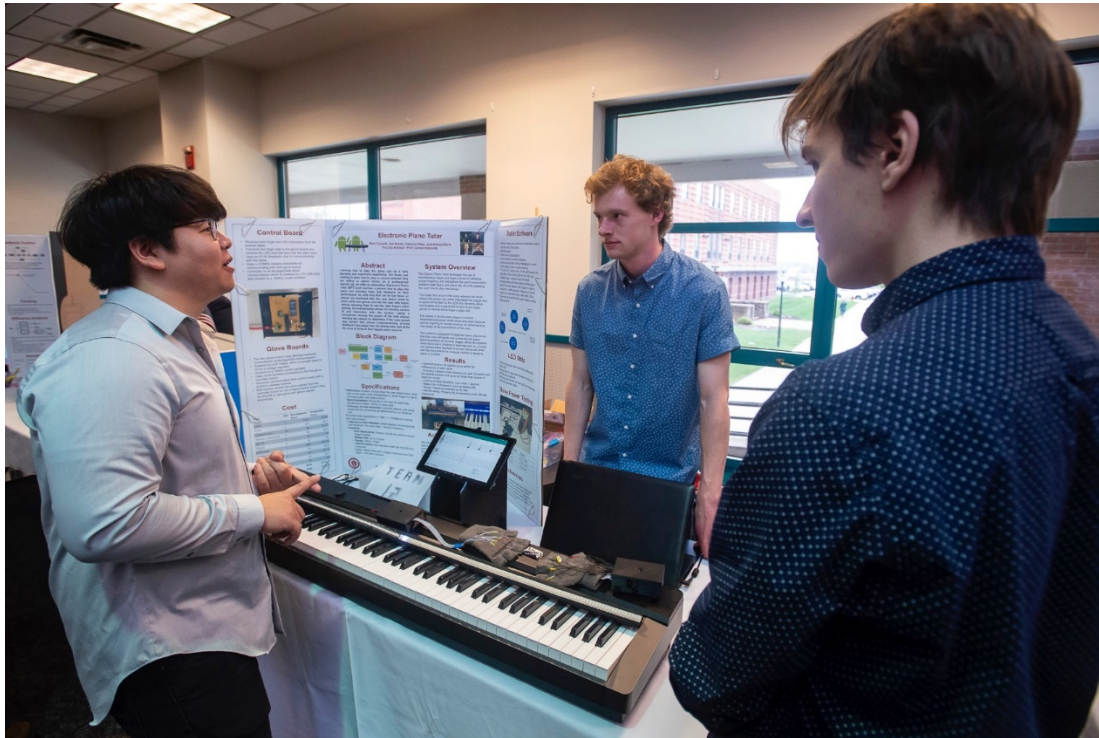


Joseph Breda Matthew Caswell Aleksa Deric Cassius Peter

Advisor: Dan Holcomb

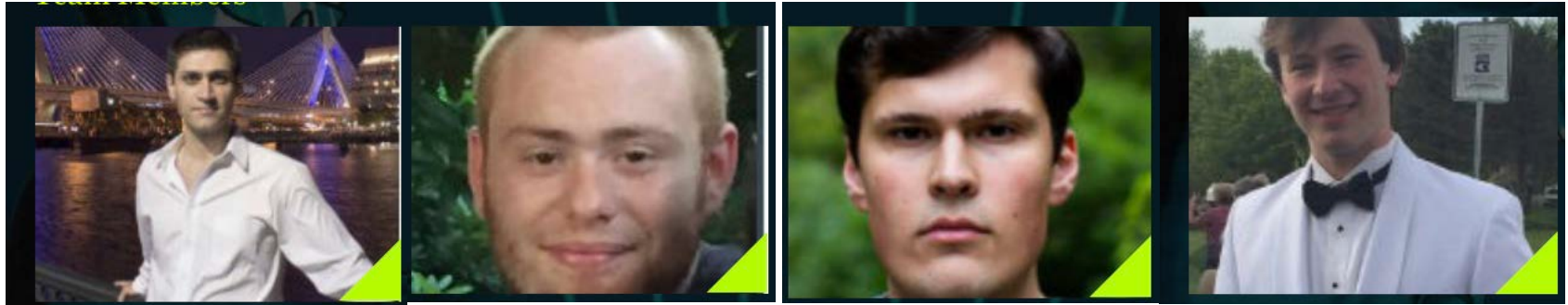
SDP19 Second Place

Electronic Piano Teacher



SDP19 First Place

IlluMiDi

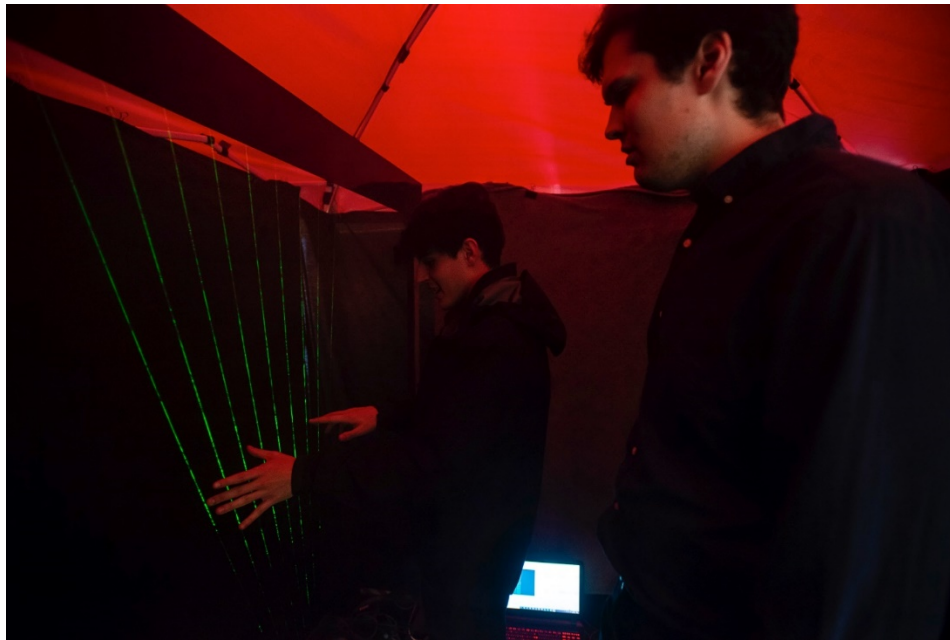


Liam Astrata Samuel Burgess Brandon Dester Elias Phillips

Advisor: Zlatan Aksamija

SDP19 First Place

IlluMiDi

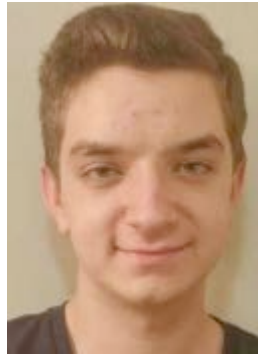


Coordinators' Choice Award

Lobster Assistant



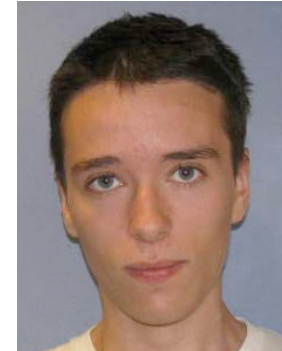
Shane Rizzotti



Nevan Shattuck



Joshua Shea



Noah Sheridan

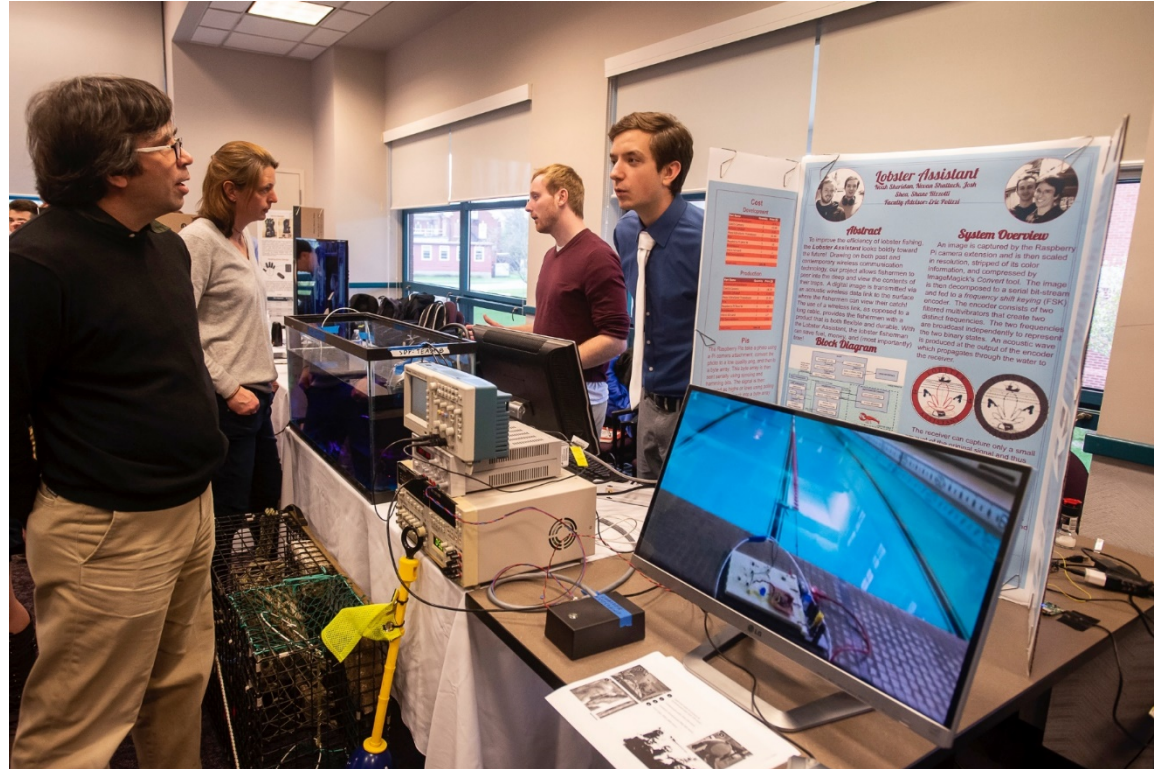
Advisor: Eric Polizzi

Coordinators' Choice Award

Lobster Assistant



Chancellor Subbaswamy



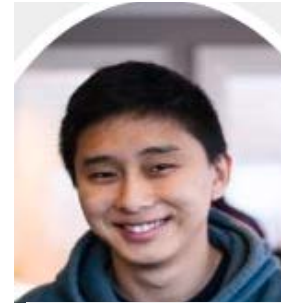
Advisor: Eric Polizzi

SDP19 People's Choice - Fifth Place

Intelligent Screw Sorter



Advisor: Yadi Eslami



Jordan Gyaltsen



Jordon Balskus



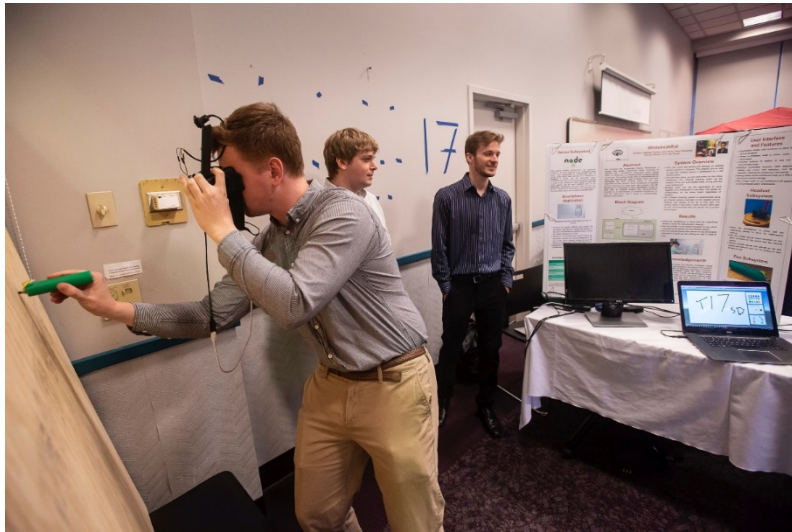
Andrew McGrath



Rajesh Shahi

SDP19 People's Choice - Fourth Place

AR Whiteboard



Jackson Perkins



Jeffrey Muri



John Shea

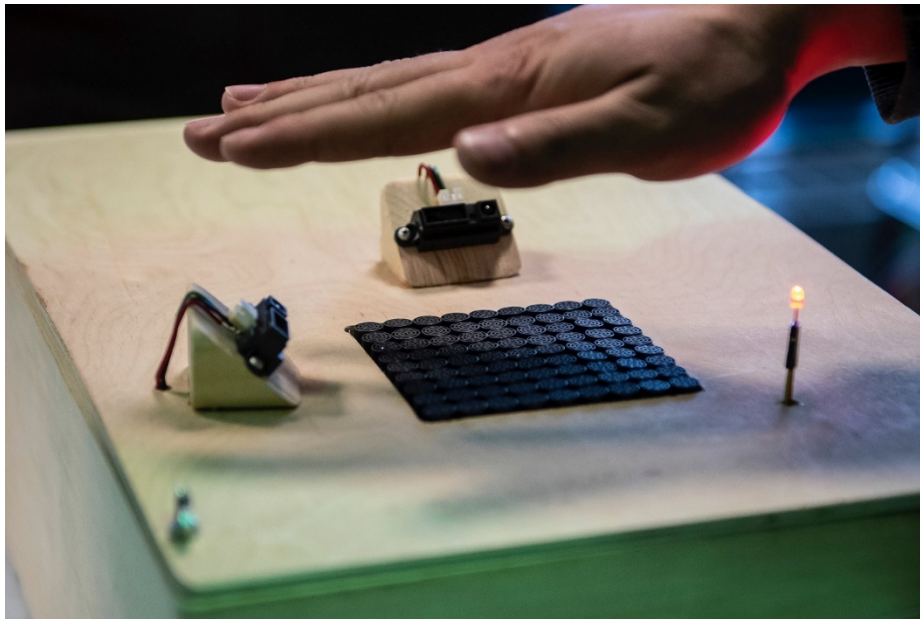


Peter Stanwicks

Advisor: Jau Taneja

SDP19 People's Choice - Third Place

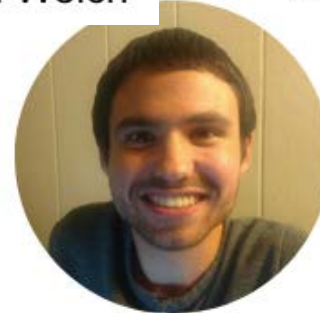
Mid-Air Haptics



David Welch



Andrew Kaluzny



Joe Weber



Zach Woods

Advisor: Maciej Ciesielski

SDP19 People's Choice - Second Place

Zipcart



Advisor: Tilman
Wolf



Ryan Lagasse



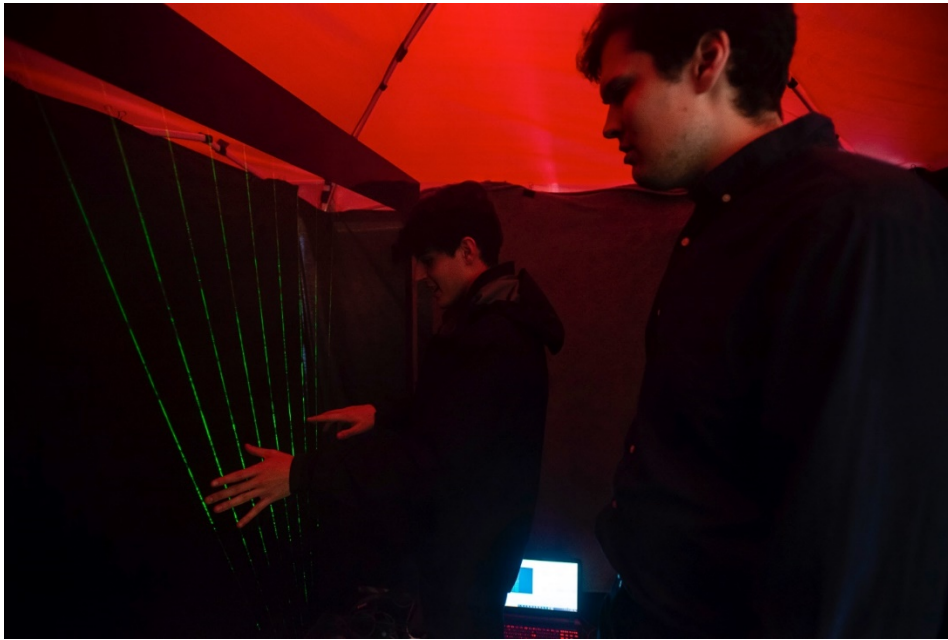
Jonathan Azevedo



Ricardo Henriquez

SDP19 People's Choice – First Place

IlluMiDi



Advisor: Zlatan Aksamija



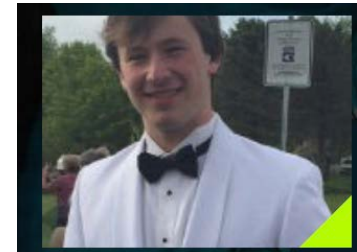
Liam Astrata



Samuel Burgess



Brandon Dester



Elias Phillips

SDP18 Awards

SDP18



SDP18 Third Place

SmartDesk



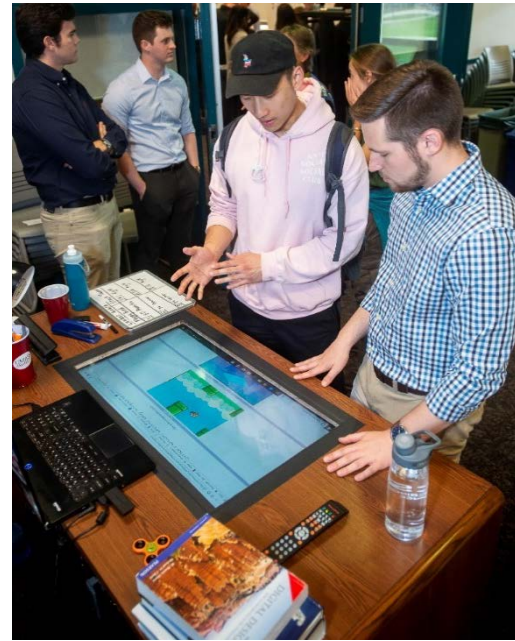
**John Melloni, Daniel Mathieu,
Tristan Koopman & Aidan Fitzpatrick**

Advisor: Paul Siqueira



SDP18 Third Place

SmartDesk



SDP18 Second Place

HELPING HAND



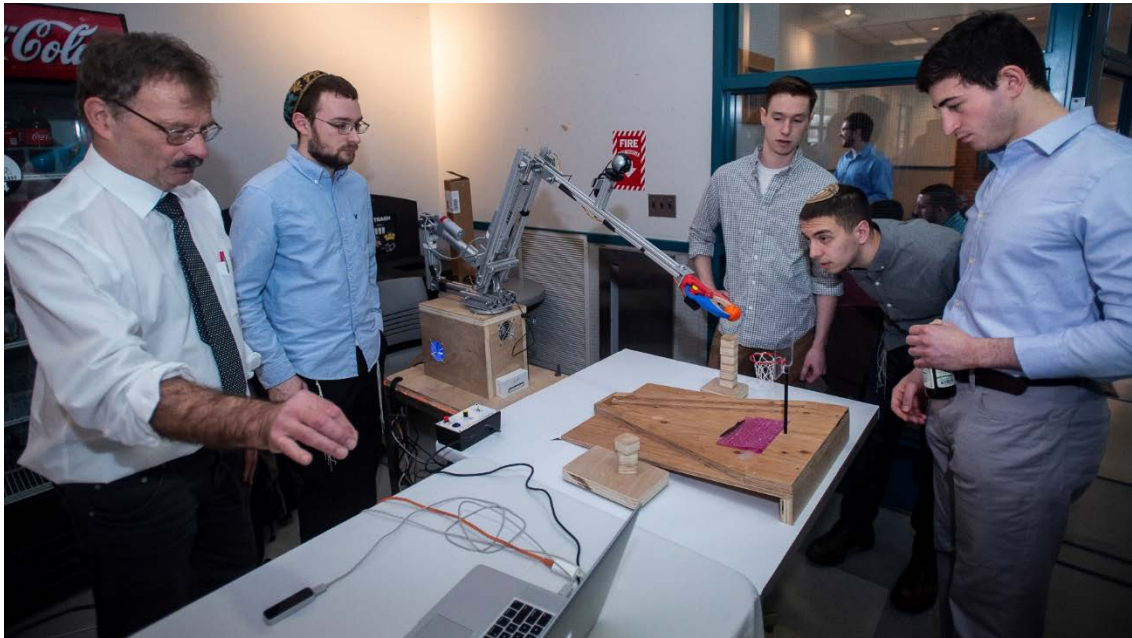
**Corey Ruderman, Dan Travis
Jacob Wyner & Joshua Girard**

Advisor: Marco Duarte



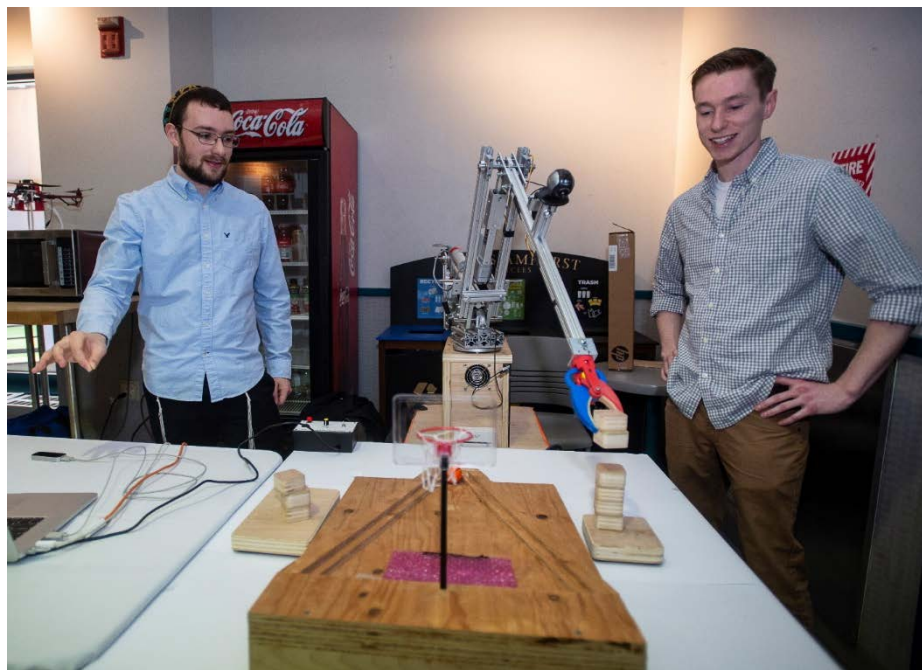
SDP18 Second Place

Helping Hand



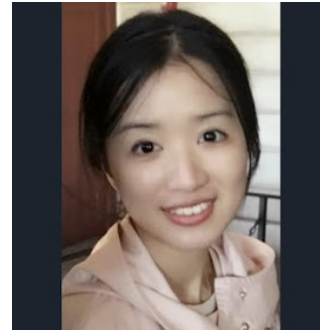
SDP18 Second Place

Helping Hand



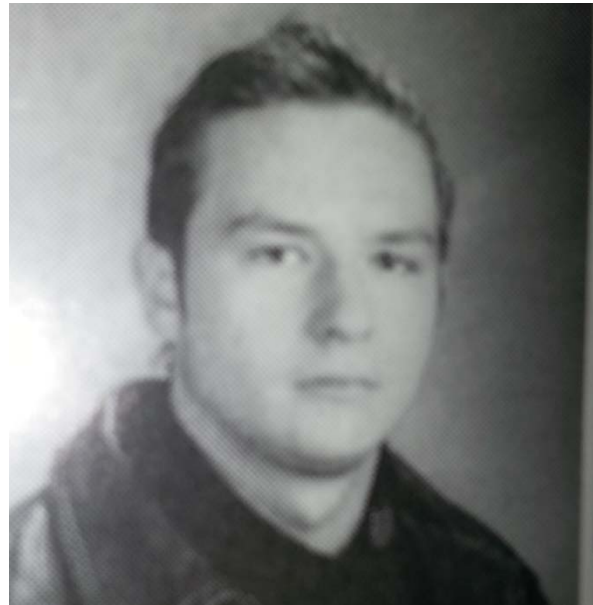
SDP18 First Place

DUAL PLAY



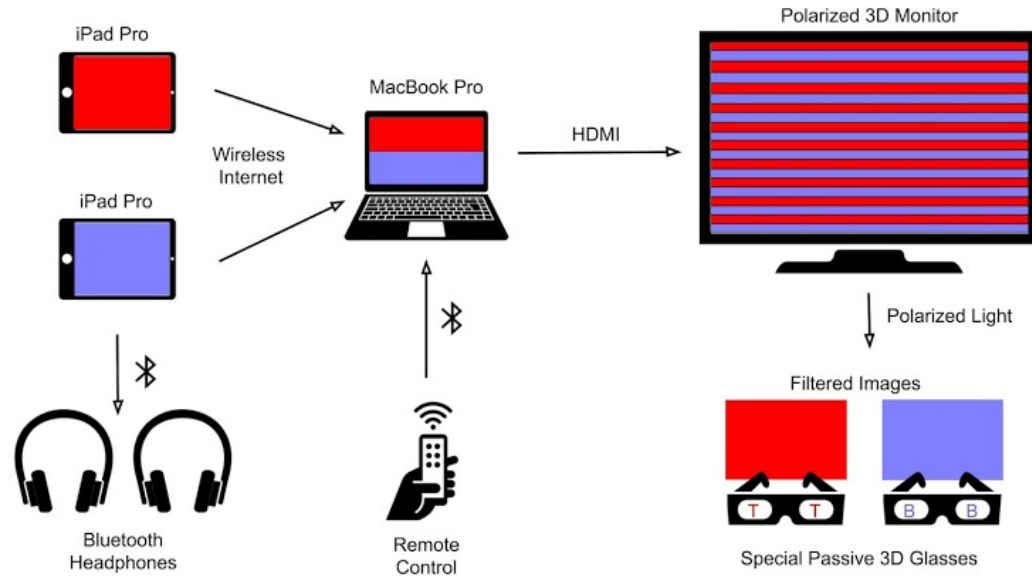
SuoAn Gao, Lina Wu, Yujia Huo & Siyu Wu

Advisor: Zlatan Aksamija



SDP18 First Place

Dual Play



SDP18 First Place

Dual Play



Coordinators' Choice Award

ACCESS

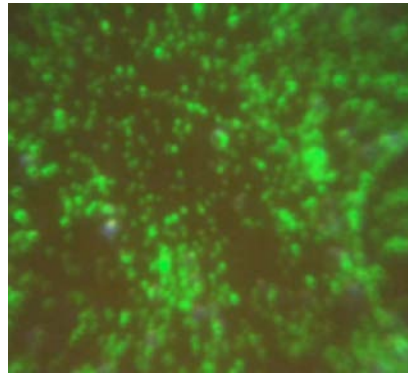


**Ivan Williams, Hassaan Khan,
David Downs & Victor Arango**

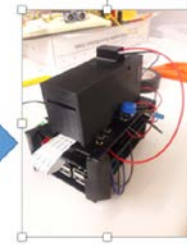
Advisor: Guangyu Xu

Coordinators' Choice Award

ACCESS



- Spin-coat polystyrene microspheres
- ID un-cloneable - complexity pattern.



- IDs loaded into reader
- Image sent to server for processing
- Result relayed back to user

SDP18 People's Choice - Third Place

ALFRED



Pat Barron, John Fouad, Ben Ivaldi & Chris Wong

Advisor: Andras Moritz

SDP18 People's Choice - Third Place

ALFRED



SDP18 People's Choice - Third Place

ALFRED



To Do List

- Sign up for a lab bench (Marcus Hall, Rm 9A)
- Converge to a project idea
- Connect with a Faculty Adviser (due 20th Sept'19)
- Nominate 7 faculty members as your two evaluators (due 23rd Sept'19)
- Register for M5 membership (required)

ECE Senior Design Project 2019



Assignment

- Converge on project (ok to consult with adviser)
- Reserve lab bench, Monday, 11th Sept'17
- Confirm faculty adviser by Tuesday, 19th September'17

Assignment

- Converge on project (ok to consult with adviser)
- Reserve lab bench, Monday, 11th Sept'17
- Confirm faculty adviser by Tuesday, 19th September'17

Honorable Mention

SAFE Drone

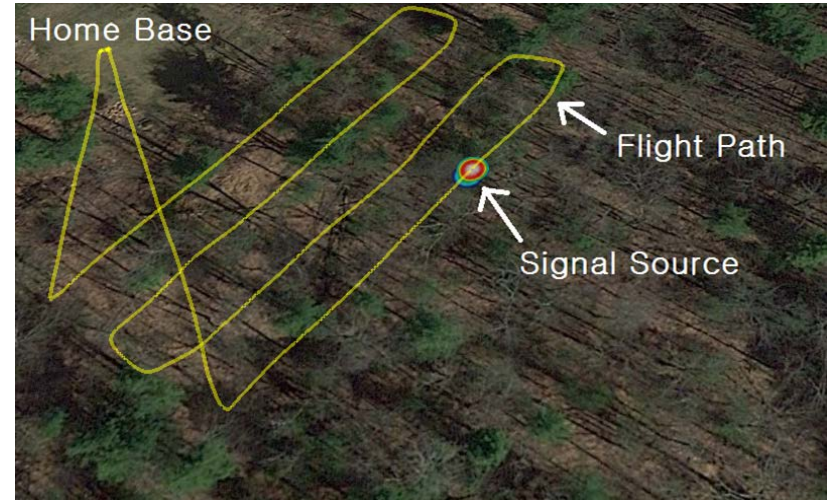


Bradley Marszalkowski, Jamie Kline & Serena Thomas

Advisor: Bill Leonard

Honorable Mention

SAFE Drone



Honorable Mention

AutoUmp

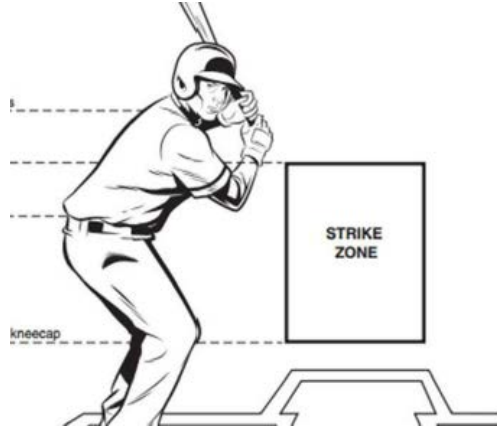


**Tim Adams, Justin Marple,
Jason Camiel & Matt Barnes**

Advisor: Tilman Wolf

Honorable Mention

AutoUmp



SDP17 Third Place

Pegasus-21



Trevor Berry, Istvan Kreiz & Keith Miller

Advisor: Zlatan Aksamija

SDP17 Third Place

Pegasus-21



SDP17 Second Place

Smart Hydroponic Greenhouse



**Michael D'Anna, Samantha De Groot,
Maxwell Joyce & Shaun Palmer**

Advisor: Bob Jackson

SDP17 Second Place

Smart Hydroponic Greenhouse



Sensor Array

- Moisture
- pH
- Humidity
- Temperature
- Water Level

Hydroponics

- Pump/Water Cycle Control
- Nutrient Dispersal System

Lighting

- Voltage Regulators and Power Management
- Light Cycle and Intensity Control

- Plant Database
- Notification Interface

Android Application

SDP17 First Place

Step

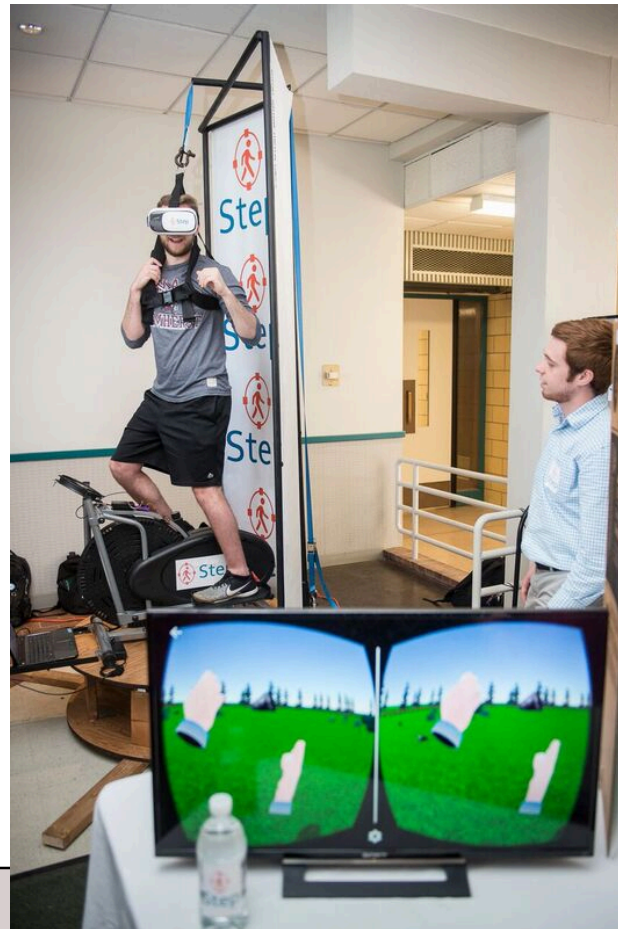


Joseph Roberts, Ryan Daly, Jared Ricci & Steven So

Advisor: Dennis Goeckel

SDP17 First Place

Step



Assignment

- Converge on project (ok to consult with adviser)
- Reserve lab bench, Monday, 11th Sept'17
- Confirm faculty adviser by Tuesday, 19th September'17

Career planning

- Engineering Career Development and Experiential Learning Center (Cheryl Brooks), Marston 112
 - Walk-in resume/cover letter help
 - Mock interviews (by appointment)

3	4	5	6	7	8	9
				10:00 - 3:00 Welcome Back for All Engineering Students		
10	11	12	13	14	15	16
11:00 - 2:00 Handshake Launch	9:00 - 12:00 Handshake Launch	9:00 - 1:00 Skanska Recruiting/Resu me Drop Table	11:00 - 2:00 Handshake Launch	2:00 - 5:00 Handshake Launch	2:00 - 5:00 Handshake Launch	
		2:00 - 5:00 Handshake Launch	5:30 - 6:30 Resume and Career Prep Workshop	5:30 - 6:30 Naval Nuclear Propulsion Lab Info Session		
17	18	19	20	21	22	23
5-STEM Workshop	5:30 - 6:30 ExxonMobil Info Session	3:30 - 5:00 Professional Communication Group	10:00 - 2:00 Entrepreneur-in- Residence Eric Crawley 9/21	5:30 - 6:30 Cavium Information Session		
	5:30 - 6:30 Resume and Career Prep Workshop					
24	25	26	27	28	29	30
5:00 - 8:00 Corporate Networking Night	10:00 - 3:00 Engineering & Computer Sciences Career Fair	11:00 - 4:00 Isenberg Career Fair	11:00 - 4:00 Isenberg Career Fair	10:00 - 2:00 Entrepreneur-in- Residence Eric Crawley 9/28		
		3:30 - 5:00 Professional Communication Group				
1	2	3	4	5	6	7
	5:30 - 6:30 Lockheed Martin Info Session	3:30 - 5:00 Professional Communication Group	10:00 - 2:00 American Plant Maintenance Recruiting/Resu	10:00 - 2:00 Entrepreneur-in- Residence Eric Crawley 10/05	10:00 - 3:00 Civil & Environmental Career Fair	
					10:00 - 3:00 Civil &	



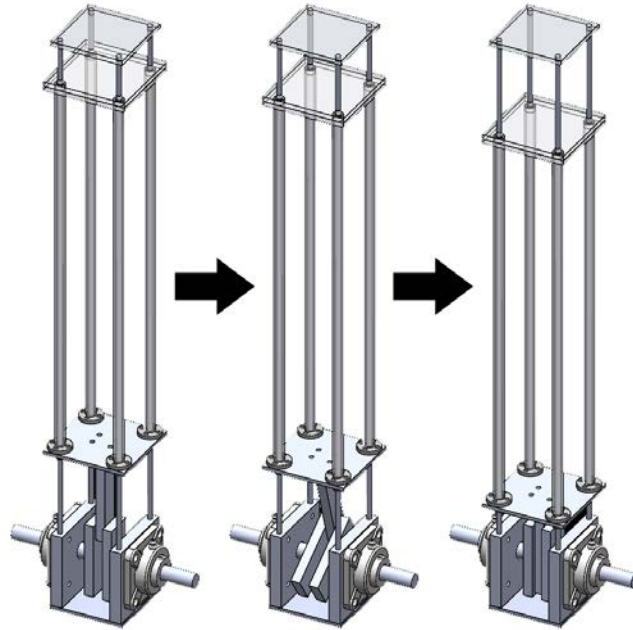
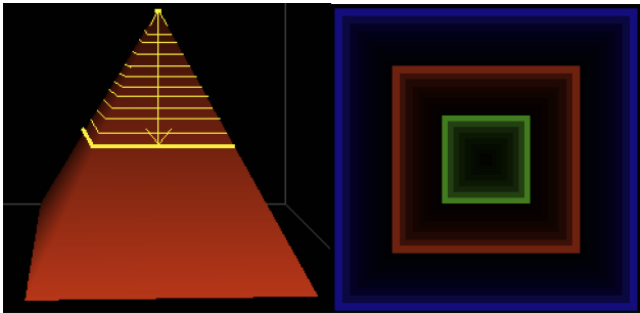
Projects

- What do you want to learn?
- Choose an area – become an expert
- Explore past SDP projects
 - UMass
 - Other ECE departments
- SDP projects are:
 - differentiators at job interviews
 - not PhD dissertations

Real-Time Concussion Analyzer (SDP13)

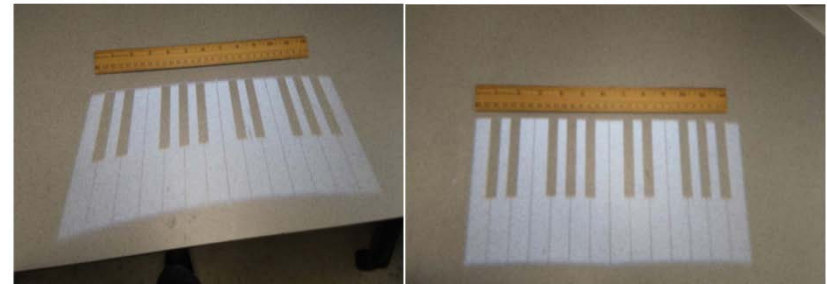
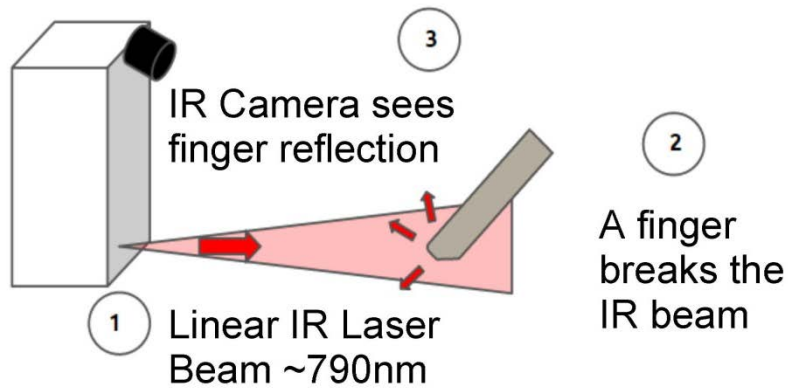


Hologram Machine (SDP14)



Viano (SDP15)

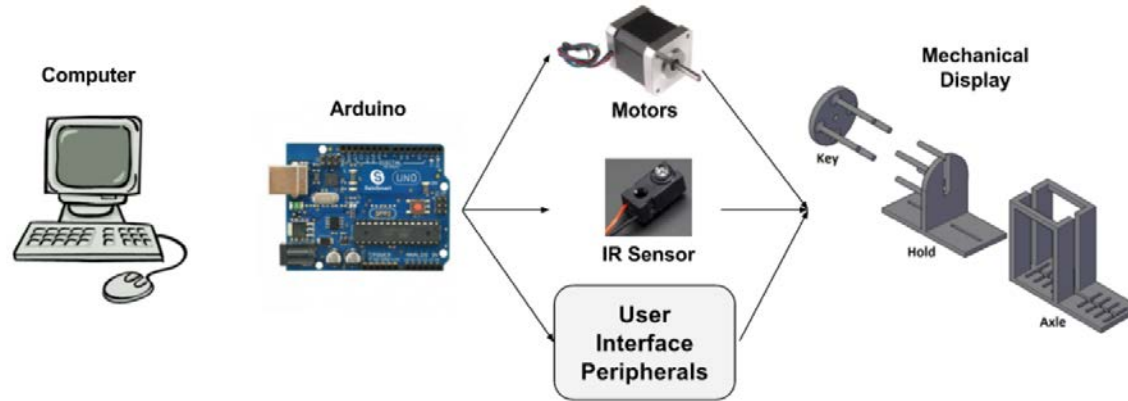
Finger Tracking



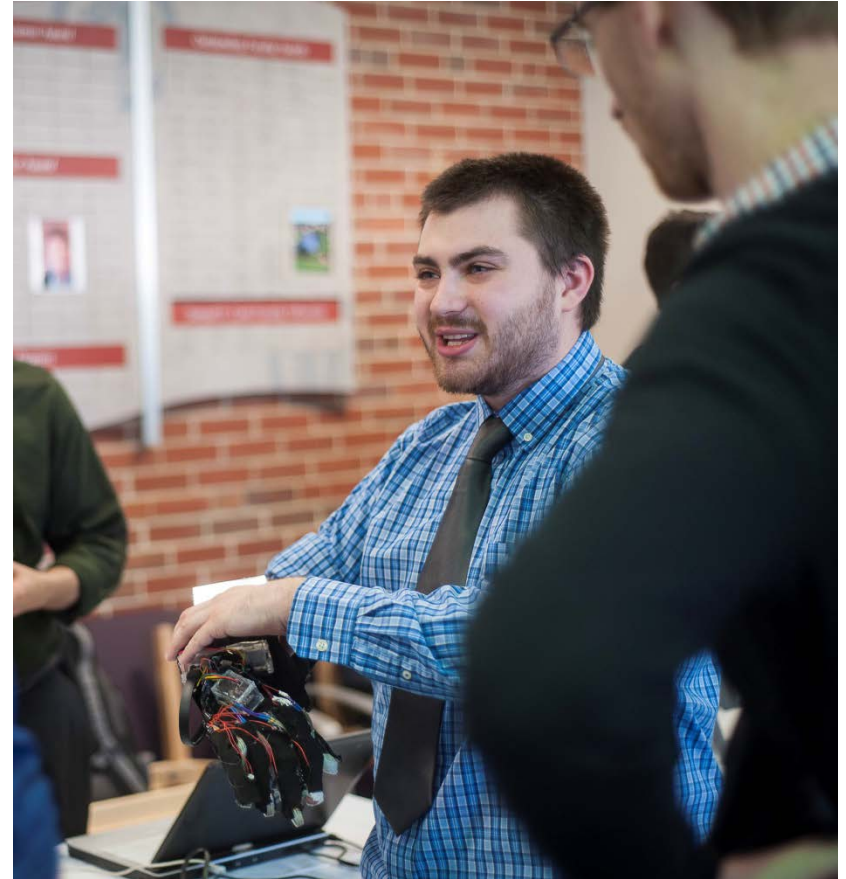
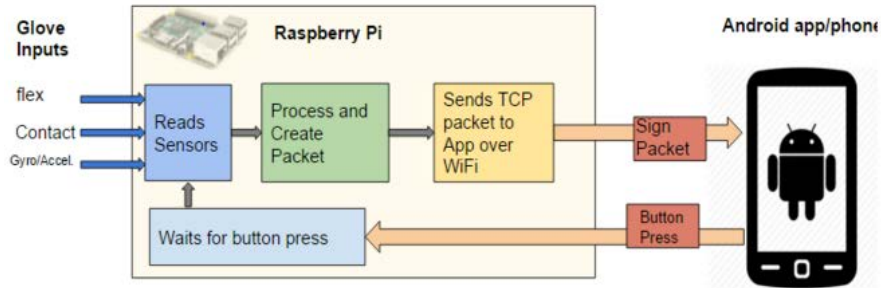
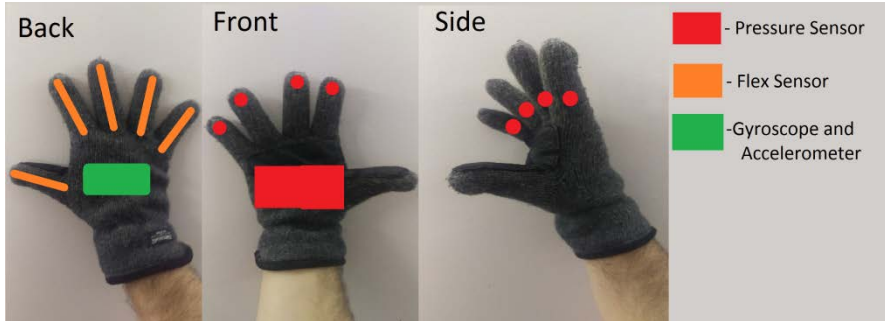
Before

After

braillebook (SDP16)



SigninGlove (SDP16)



ASPECTS (SDP16)

ECE Students Win First Place in FAA Design Competition By Creating Virtual Geofences to Protect Airports from Drones

The student team of UMass electrical engineering majors Alex Breger, Chris Boselli, Jason Danis, and Sandra McQueen received first place for the winning design in the "Runway Safety/Runway Incursions/Runway

