College of Engineering, Design and Computing
UNIVERSITY OF COLORADO DENVER

Colorado's Most Accessible Urban Engineering University

CEDC CAPSTONE EXPERIENCES
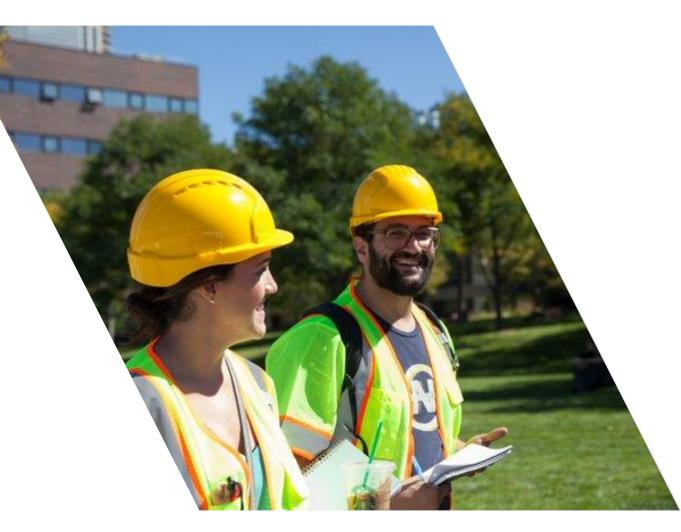
ABOUT CAPSTONE

The College of Engineering, Design and Computing (CEDC) Capstone Design Program is a signature program across all departments in the college. Each engineering student takes the Capstone Course during their senior year. In this course they design, build, analyze, prototype, test and provide documentation for a product that they have developed for their sponsor.

DESIGN

BUILD AND TEST

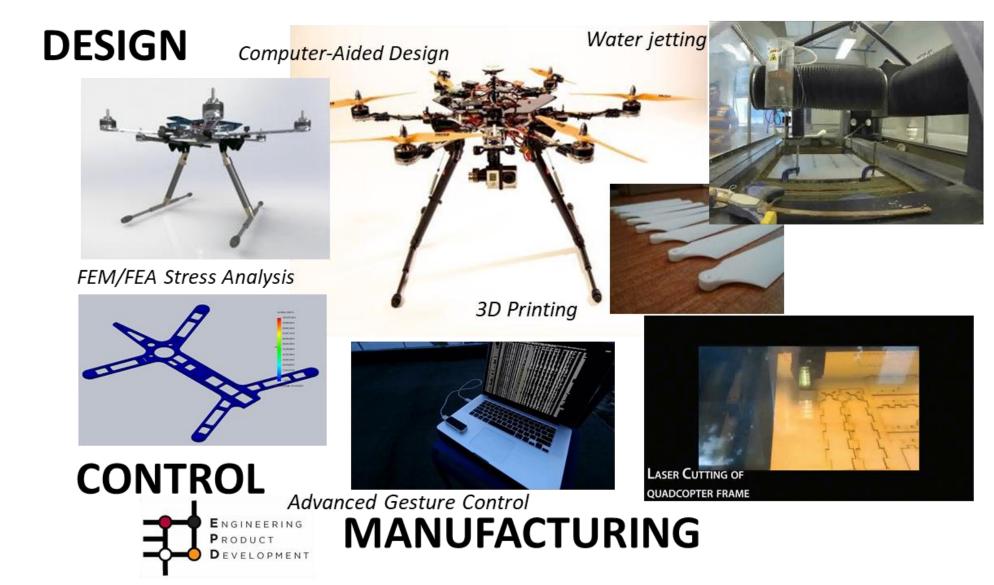**PROTOTYPE**

THE DIFFERENCE

- Culmination of a design-centered educational experience

- Teams of 3-5 students and a faculty mentor

- Interdisciplinary and Department specific

- Utilize state-of-the-art design processes

- Following project management best practices to enhance project deliverables

- Significant professional engagement with sponsors and stakeholders

- Projects utilize extensive engineering analysis and simulation

- Create prototypes to demonstrate feasibility

WHY THIS MATTERS TO **OUR STUDENTS** YOUR **FUTURE EMPLOYEES**

- Helps develop student professional skills

- Exposure to leading edge design and innovation processes

- Increases visibility for student work and outcomes

- Connects students and sponsors for employment opportunities

- Promotes cutting edge-design pedagogy

- Enables interdisciplinary projects

- Builds industry engagement across CEDC departments
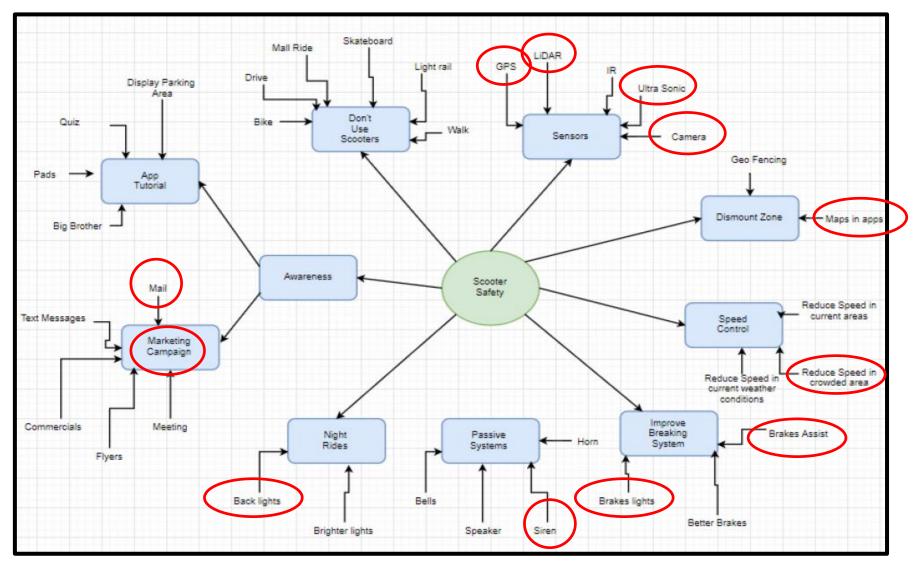
Example Project: Innovative Flying

DESIGN

Computer-Aided Design

Water jetting

FEM/FEA Stress Analysis

3D Printing

CONTROL

Advanced Gesture Control

MANUFACTURING

Laser Cutting of Quadcopter Frame

ENGINEERING PRODUCT DEVELOPMENT

Example Project: Nature (Bio) Inspired Flying

Current Project:
MIND MAP FOR SCOOTER SAFETY PROJECT
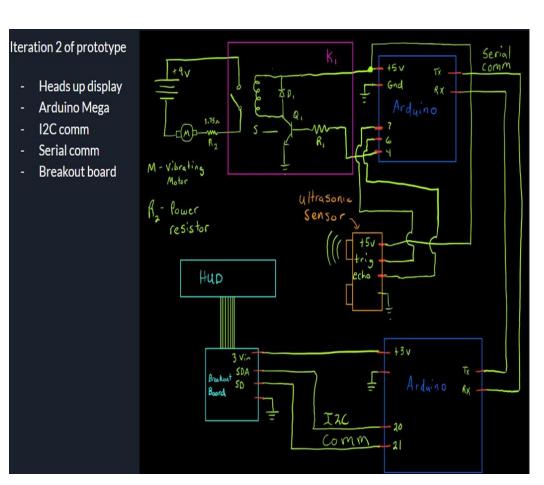
Current Project: SCOOTER SAFETY

Original Opportunity: How might we create technology to improve electric scooter safety?

Customer Co-Creation: "Device with sensors in helmet is a good idea – but I probably won't wear the helmet."

Pivoted (Reframed) Opportunity: How might we motivate the user to wear the helmet?

HEADS-UP DISPLAY + CAMERA WITH DOWNLOADS TO FACEBOOK (or other social media)

Iteration 2 of prototype
- Heads up display
- Arduino Mega
- I2C comm
- Serial comm
- Breakout board

Example Project:
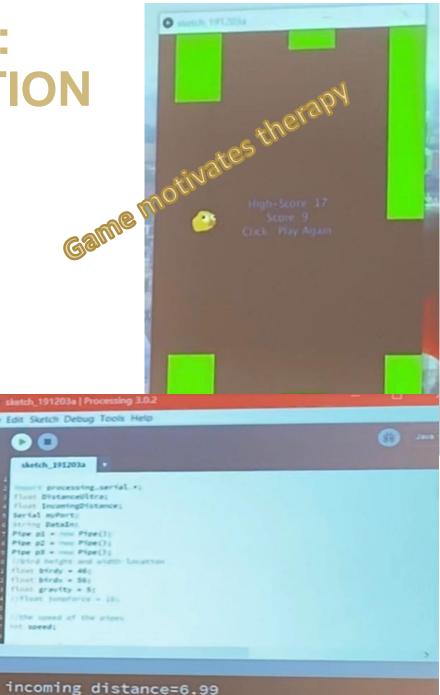# HAND REHABILITATION

Game motivates therapy

Original Opportunity: How might we create a feedback device for assisting in hand rehabilitation for those with arthritis?
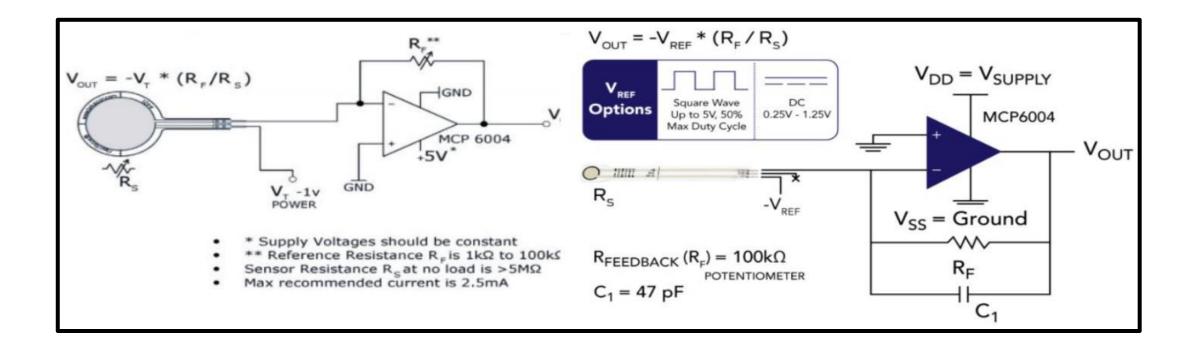
Customer Co-Creation: "Device works great – but not sure I'd use it for the amount of time prescribed by my physical therapist."

Pivoted (Reframed) Opportunity: How might we motivate the user to maintain their PT regiment for the needed time?
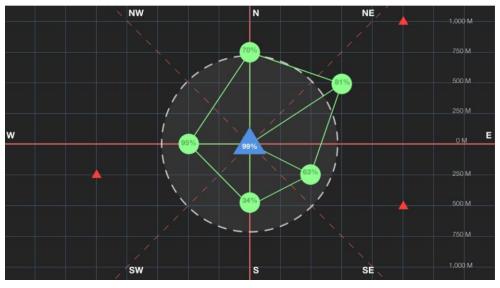
Being piloted at UC Medical. Patent(s) in the works.

incoming distance=6.99

ENGINEERING ANALYSIS MODEL FOR HAND REHABILITATION PROJECT

Current Capstone Project: Infrasound
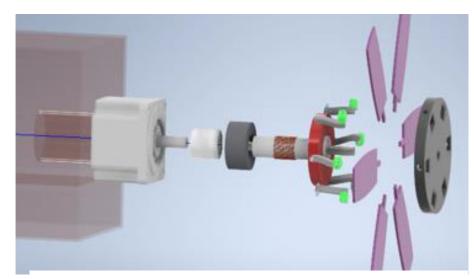

5 UAV-based sensors detect I-sound

Infrasound is < 20 Hz acoustic waves
- Travels huge distances with little attenuation
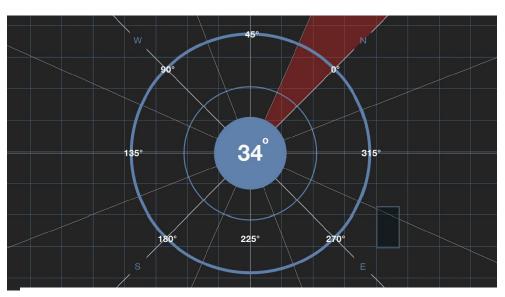- I-sound signals are created by nuclear detonation and missile launches (among other sources)

Original Opportunity: How might we locate sources of I-sound?

Pivoted (Reframed) Opportunity: How might we generate I-sound and use it for GPS denied navigation by measuring Doppler effect?

Being sponsored by AFRL

Matlab code detects direction of I-sound source

Rotary Sub-woofer for I-sound generation

BENEFITS FOR SPONSORS

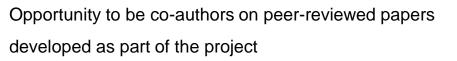✓ **Intellectual property generated belongs to the sponsor**

✓ Obtain a "feasibility demonstration level" prototype with documentation

✓ Generates approximately a person-years' worth of engineering design & analysis work

✓ Explore and expand variety of new ideas and approaches

✓ Facilitates pathways to collaboration in research or future design

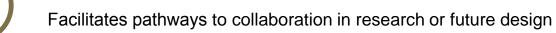✓ Opportunity to be co-authors on peer-reviewed papers developed as part of the project

✓ An opportunity for recruiting new graduates

✓ Opportunity of mentoring the next generation of technical leaders

LOGISTICS

Financial: Sponsors provide up to $15,000 per project to support the work.

Mentorship: Sponsors provide a point of contact (mentor) that works with the students' design team; interacting approximately monthly with the team and attending design briefs.

Technical Focus: Projects can be associated with a specific academic department (Civil, Mechanical, Biomedical, Electrical, and Computer Science) or the project can be interdisciplinary.

Sensitive Information: Teams can sign Non-disclosure Agreement's to protect sponsor's information when needed.

Number of Projects: 40-50 projects can be accepted by CEDC each year.

Project selection: Projects with a healthcare, urban focus, and an innovation orientation

PROJECT TIMELINE

SPRING SEMESTER Accepting Sponsor submissions throughout the year, finalizes in JUNE for the next academic year.

AUGUST Active sponsorships revealed, students submit preferences, and project teams are formed. Students meet with sponsor to clarify project scope. Sponsorship is funded.

FALL TERM Team co-creates with sponsors/stakeholders- refining project statement and generating multiple concepts to address the opportunity. Meeting/communication pattern with sponsor is set.

DECEMBER A major design review is held with the sponsor and stakeholders.

SPRING TERM Sponsors continue to meet with team and track progress during fabrication and testing. Team continues to collaborate closely with stakeholders.

MAY Sponsors are invited to attend a Final Design Review and Capstone Design Expo. Final report and any intellectual property, documentation or technical papers are produced.

DELIVERABLES

- Design teams objectives based on a process that increases success
- Extensive, well-documented understanding of the needs of the stakeholders
- Models that display user interface with the product, process, or service
- Exposure to a wide variety of innovative ideas to address the design and innovation opportunity
  - o Provide logical documented funneling of these ideas to stakeholder
- Initial low cost, simple prototypes to show feasibility
- Risk modeling and associated engineering analysis or simulation
- Prototypes that show the feasibility of the final solutions
- Design reviews with the sponsor and stakeholder
- Business case analysis provided from CU Denver's Smart Futures Lab
- Invention disclosures potentially leading to patents (when appropriate)
- Design briefs and design report
- Research paper(s) related to either the design or the educational experience (when appropriate)

FAST TRACK

YOUR DESIGN &

INNOVATION

SENIOR DESIGN EXPO

In May, all capstone teams showcase their designs at the CEDC Design Expo. Sponsors are also showcased at this event. Awards are given for innovation, quality of the new product and impact of the design.

Collaboration Opportunities

Capstone Projects

Training in Design Innovation
(1-3 day workshops)

Mentorship / Co-designing with you

Internships

Hiring streams for our top graduates

Research with Faculty or Graduate Students

Contact us

Where engineering meets innovation and prepares students to be leaders and societal change makers.

Lary Speakman

Director of Multidisciplinary Sponsorships

Phone: 303-315-7170

Email: lary.speakman@ucdenver.edu