Product Design Capstone

MECHENG 4906.01 + 4906.02

Annie Abell & Dan Wisniewski
What is ME Product Design Capstone?

Students experience a human-centered design project that emphasizes understanding the users’ needs. Focus on user research to clearly understand a problem before tackling the design challenge.

Instructor permission is required to enroll
To take this capstone, you must be enrolled in 5682.01 Product Design Tech Elec!

*credit for 5682.01 in a prior semester is also ok*
<table>
<thead>
<tr>
<th></th>
<th>AU2023: ME 4906.01</th>
<th>SP2024: ME 4906.02</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Prof Abell</strong></td>
<td>M + W 12:45-2:05pm</td>
<td>TBD – likely similar</td>
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<td>W 3:00-4:50pm</td>
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<tr>
<td><strong>Prof Wisniewski</strong></td>
<td>T + R 12:45-3:00pm</td>
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<td><strong>pre- or corequisite: ME 5682.01</strong></td>
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What’s This Capstone’s Specialty?

Our focus is on the user-centered design process, we include topics that don't typically make it into engineering design classes:

**Conducting User Research:** go talk to real people! Understand them!

**Framing the Problem:** work with the people to define the opportunity at hand, and spend a significant amount of time framing the challenge

**Open-Ended Projects:** you define the project direction & solutions

**Entrepreneurial Mindset:** developing skills to share your work with non-technical audiences and making idea pitches
How are the Projects Structured?

Teams start by choosing a user group or project goal—**NOT** a specific product to design.

You get to choose many aspects of your project focus and suggest possible project topics.

Teams of 3-6 people.

Funded by department or industry sponsored.
This Course’s Design Intent

You will be able to understand the following, at a deep level:

The **problem** you're trying to solve

The **needs** of everyone who interacts with or depends on the potential solution for that problem

How the **design decisions** you make affect how the product is manufactured
Goals

Gain a better understanding of the product design process and how to balance constraints and user needs.

Focus on your visual communication skills. (presentations and portfolios)

Improve on storytelling and communicating your ideas.

Create a comfortable and safe speaking environment

Gain industry insights by learning prototyping, project management, presentation & testing skills

Help you grow as engineers, professionals and people.
Past Projects
Projects students have done in the past?

- **musicians** to improve transport and storage of fragile instruments
- **firefighters** to design a hose management system
- **beekeepers** to design a device to more effectively weigh beehives
- **The Cincinnati Zoo** to develop an enrichment device for Asian Elephants
- **Mid-Ohio Food Bank** to develop a rainwater collection system for urban farms

... many more!
Swimming Pace “Robot”

How can you visually show swimmers their pace during training?
Swimming Pace “Robot”
Hobbyist Coffee Roaster

Countertop coffee roaster for small batch home roasters
Hobbyist Coffee Roaster
Soccer Trainer

Soccer training aide with full spin and speed capability
Soccer Trainer
Automated Plant System

Self watering and nutrient delivery system to improve plan yield.
Automated Plant System
1,000,000,000,000 gallons of water are lost across the US due to pipe failure.

Borescope attachment to aide in residential pipe exploration
Pipe Crawling Robot

INITIAL CONCEPTS

Continuum Robot

Magnetic robot

Servo robot

FINAL PROTOTYPE

CAD
The Q-Collar helps protect the brain from the damage caused by repetitive head impacts that can alter brain tissue. Athletes who were not wearing the Q-Collar were three times more likely to have significant changes in their brain tissue.
**Q30**

**INTEGRATED BIOMETRICS**

**Collar Integration**

**Removable Accessory**

**Sleeve Integration**

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### Sensor Types

- Collar/Pad Pressure
- GPS/Position
- Non-GPS Location
- Accelerometer(s)
- Heart Rate
- Skin Galvanic
- Temp Sensor
- Hydration
- Breathing rate
- HRV (Heart Rate Variability)
- Communications (military)
- Misc. Attachments
- Biofeedback (auditory, vibratory)

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### Collar Function

Collection of sensors that provide data related to collar size, fit, function, performance, etc.

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**Brain Injury Prevention**

Collection of sensors that provide data related to detection or prevention of brain injury

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**Athlete Performance**

Collection of sensors that provide data related to athlete physical performance

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**Athlete Health**

Collection of sensors that provide data related to athlete health and biometrics

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### Table

<table>
<thead>
<tr>
<th>Sensor Type</th>
<th>Athletic Performance</th>
<th>Brain Injury Prevention</th>
<th>Athlete Health</th>
<th>Misc. Markets</th>
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</thead>
<tbody>
<tr>
<td>Collar Force/Pad Pressure</td>
<td>X</td>
<td></td>
<td></td>
<td>Head</td>
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<tr>
<td>Bioreadback (Light, audible, Vibratory)</td>
<td>X</td>
<td></td>
<td></td>
<td>Head</td>
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<tr>
<td>Temperature (ambient)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Optional</td>
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<tr>
<td>GPS/Position</td>
<td></td>
<td>X</td>
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<tr>
<td>Non-GPS Location (3 pt)</td>
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<tr>
<td>Accelerometer</td>
<td>X (body)</td>
<td>X</td>
<td>(head)</td>
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<tr>
<td>Gyroscope</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Barometric Pressure</td>
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<td>Barometric Altimeter</td>
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<tr>
<td>Heart Rate (optical, conductive)</td>
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<tr>
<td>Temperature (body)</td>
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<td>Hydration</td>
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<td>HRV (heart rate variability)</td>
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<td>ECG</td>
<td></td>
<td>X</td>
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<tr>
<td>Skin Galvanic</td>
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<tr>
<td>Breathing Rate</td>
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<tr>
<td>PO2 sensor (Oxygen level)</td>
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<td>Communications (military)</td>
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**Collar Function (military working)**

- X
- X
- X
- X
Example: On-the-scene shadowing of firefighters at a training exercise
Example: Visual Idea Generation

Solution: Grant: Develop a method for carrying heavy people that only requires two people and is less strenuous.

Nick Smith
No. 9

- Slide each leg through the arm, connect legs with rope.
- Note: build up hammock.
- Relaxing legs lift the person.
- Hammock unbuckles, mansto other end of carriage, and person lies in hammock/carrying system.
- Carriage takes weight of person to be carried off of the finisher, (carpenter stress off of person's body.)
Example: Low-Resolution Prototypes
What do past students say about 4906.01

"It takes a very wholistic approach to design. We start from the beginning!"

"YOU define the problems you are going to address"

"It gives us a better understanding of how to solve real world problems"

"You get to come up with your own project & explore your creativity"

"It challenges you to go out and figure things out for yourself"

"The independence is awesome!"

"You get to go very in depth with the product design process"
What do past students say is CHALLENGING?

"Not jumping ahead to solve the problem before you define it"

"You are responsible for your own fate. You must manage time to be successful"

"There are almost no constraints initially, so it can be daunting to figure out what you need to do to solve a problem"

"Keeping things on schedule- your own schedule"

"Being diligent about working & meeting with your teammates"

"Trying to figure out the true root cause of a user's problem"
This all sounds great! How do I proceed?

Enrollment is by permission of instructor

**Fill out Form** to express interest & request permission to enroll

https://forms.gle/oMj5q8YqiVDeBxeo9

Please share:
- why you want to join product design capstone
- which section you are interested in
- if you are enrolled in 5682.01
- your favorite personal project
When will enrollment be confirmed?

You will be notified of enrollment by April 7th.

Is your course registration window before April 7th?

Proactively enroll in the 5682.01 Product Design elective to hold your place.

Proactively enroll in your 2nd choice capstone to hold your second-choice place.

You will be notified of enrollment by April 7th.
Thanks...
Any Questions?

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