# EMPOWER

## Cal Poly Student Association

# FALL NEWSLETTER 2022

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LEARN BY DOING

CAL POLY

**E**NDEAVORS TO
**M**OVE
**P**EOPLE
**O**WARD
**W**ITH
**E**NGINEERED
**R**ESULTS

## FALL QUARTER IN REVIEW

The EMPOWER Student Association had a wonderful fall quarter and hosted a variety of opportunities for learning & collaboration. Between workshops, information sessions, and a Quarterly Design Project, it was quite busy! In total, we hosted info sessions with both Edwards Lifesciences and Gore, a seminar by Brooke Wheeler, a club social to Architecture Graveyard, a resume workshop, two SolidWorks workshops, and a 3D printing workshop! Additionally, Formal Design Project teams were finalized at the end of the quarter, so we are eager to see where each project goes in the rest of the academic year. LLEAP has also had a busy quarter as they continue to engineer an exoskeleton, which you can read about in detail on pages 4 and 5.

We couldn't have done any of the awesome events mentioned above without our officer board, who is pictured below. Thank you for putting your time & efforts into making EMPOWER what it is!


President


Senior Vice President


Vice President of Operations


Treasurer


LLEAP CEO


LLEAP COO


Technical Director


Quartermaster


Corporate Ambassador


Manufacturing Director

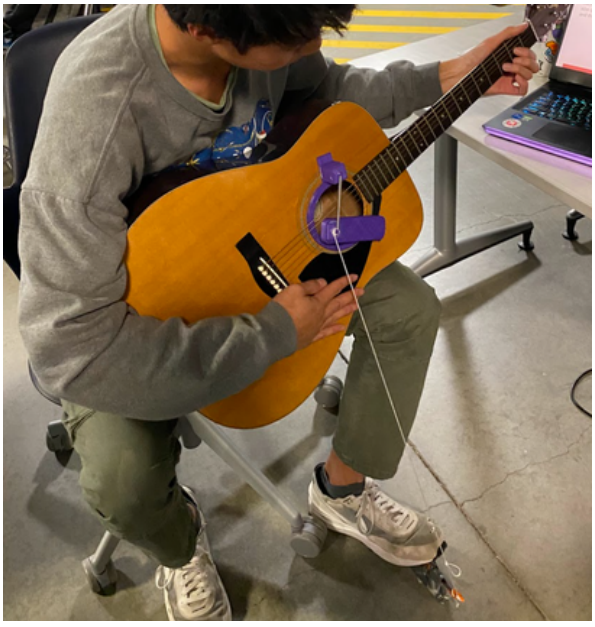

Community Outreach

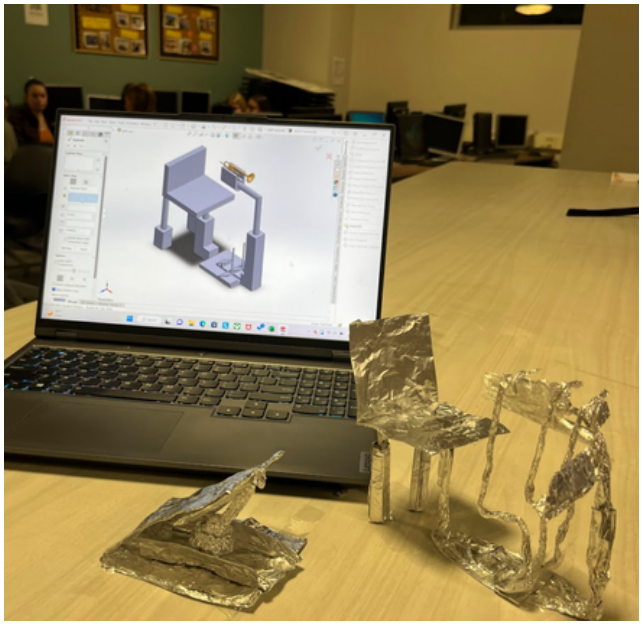
# QUARTERLY DESIGN PROJECT

## MUSICAL INSTRUMENT MODIFICATIONS

Fall 2022's quarterly design challenge involves creating instruments that can be used by individuals with limited mobility. The designs can be traditional instruments with added modifications, or teams can let their imagination run wild and come up with brand new musical creations. Teams were judged on their idea's creativity, manufacturability, usability, and cost.

After every team presented their ideas, two teams have been selected to continue as Formal Design Projects. These two teams are named "Fuitar" and "The Triumphant". The Fuitar, or Foot Guitar, allows a guitar to be strummed by using a foot pedal. It is shown being used below on the left. This allows people with limited arm and finger mobility to be able to play the guitar! The Triumphant helps those with little to no hand/finger mobility to be able to play the trumpet by using foot pedals. The CAD and aluminum foil concept model are shown below on the right. We are excited to see where each team takes these projects in the coming months!





# LLEAP

## LOWER-LIMB EXOSKELETON ASSIST PROJECT

During the Fall 2022 quarter, LLEAP has been hard at work! LLEAP is creating a lower limb exoskeleton for an individual with no function of their lower body so they can walk. LLEAP's first single-leg prototype was built in the 2021-22 school year. It has an adjustable height and weight design, allowing for physical testing this year. A new refined prototype will be completed this year. This year, LLEAP has 5 interdisciplinary teams: Prototyping, Software and Simulation, Mechatronics, Kinesiology, and Sensing and User Interface.

The prototyping team has three sub-teams: ankle, hip, and structures. Each team has been working on refining last year's design and creating new and improved components. The hip team has designed a cycloidal gearbox, the ankle team has designed a leaf-spring joint, and the structural team has designed the back shell and connections points. The sub-teams will gain professor feedback early winter quarter, perform analysis, and begin manufacturing at the end of winter quarter. The knee joint is being designed and manufactured through ME senior project and will be a four-bar linkage powered by a linear actuator.

The mechatronics team works to control the motors on the suit. They have been working towards their year-end goal of testing the 2022 prototype, having precise motor position and velocity trajectories at the knee and the hip motors. This quarter, they worked on getting controlled movement through PID, which allows precise motion from one point to another.

# LLEAP CONTINUED

The sensing and user interface team works for the user to have complete control of the suit and feedback on the status of the exoskeleton. This includes buttons on the crutches, the display of data, and helping the user learn the operation of the suit. This quarter, the team got wireless communication working, inertial measurement units (IMUs) working, and created a python script to capture data from all of the sensors on the suit. They plan to create a java app for the user and interface the IMU sensors to ROS2 by the end of the year.

The software and simulation team works to have all the different components of the suit talk to each other through a middleware called the Robot Operating System (ROS). This allows the organization and compartmentalization of all LLEAP components. The team is finishing up the simulation of the suit and has migrated all of their data to ROS2. They plan to communicate the sensor data to the motors and transform it into a usable format by year-end.

A new addition to LLEAP is the kinesiology team. This research-based team works to optimize the suit for the user, ensuring the user is safe and comfortable. They have researched topics such as potential clinical concerns, a safe fall system, user preparation for using the suit, and much more. From this, they have created a set of design requirements for each team to ensure LLEAP is designing around the user. They will work with the teams to integrate all chosen requirements for the remainder of the year.

LLEAP has made a significant amount of progress this quarter, and we look forward to continuing our club into the new year. In addition to the technical advancements made, students of all experience levels and backgrounds have been able to positively contribute to our project, and most of all, have fun doing it!

# FORMAL DESIGN PROJECTS

2022-2023

## FALL QUARTER PROGRESS

Our Formal Design Projects (FDPs) are the cornerstone of our organization. Each FDP team works with a "challenger" who presents a given challenge as an opportunity to create an innovative solution. These challengers can be individuals with disabilities, organizations, and, in past years, even pets! Three projects from the 2021-2022 school year will be continuing and coming to completion at the end of the year. Additionally, four new projects are starting. Two of the new projects are sponsored by EnCompass, and will allow two teams to get involved with stent inspection and testing. In the past few weeks, teams have been solidified and are already working hard on their projects. We look forward to the innovation and discoveries that are to come from these teams for the remainder of the academic year.

**2022-2023 FDP TEAMS:**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# FORMAL DESIGN PROJECTS

**2022-2023**

## HAND FOR MAGGIE

### PROBLEM STATEMENT:

Maggie is a 3rd year biomedical engineering student at Cal Poly who is in need of a prosthetic hand that would help her grab objects. She wants to be able to turn door knobs and lift weights in the gym. Because she is a Cal Poly student, she would like to be involved in designing her prosthetic and would play a big role in the team.

### TEAM MEMBERS:

Rachel Rowe*
Aidan Geurts
Jeffrey Wisoff
Natalie Adamson
Ruth Abigail Rodriguez
Skylar Rose
Maggie Collier

*indicates Team Lead

# FORMAL DESIGN PROJECTS

**2022-2023**

## PORTABLE LIFT FOR ALEX

### PROBLEM STATEMENT:

Alex is an Aerospace Engineering student at Cal Poly. In 2012, he fell from a cliff and was paralyzed. While traveling used to be a hobby of Alex's, he now feels as though he's lost much of his independence. Alex uses a motorized lift to move from his bed to his wheelchair and vice versa. In a home setting, this works fine but getting in and out of bed proves to be a hurdle which keeps Alex from staying at hotels. Hotel rooms vary drastically in size and layout and often don't have the necessary space for the industry's idea of a portable lift to operate.

This project has been on-going for two years now and needs new members and a new team to help finish manufacturing as well as assembly and testing. This next year Alex is hopeful that EMPOWER can improve upon the previous team's design and manufacture a final product so he is able to travel again. Alex looks forward to finally visiting family overseas after 10 years apart.

### TEAM MEMBERS:

Brooke Ellis*
Christianna Altamura
Colin Cook
Elliott Tanovan
Anna Smith
Lina Boukhateb

*indicates Team Lead

# FORMAL DESIGN PROJECTS

**2022-2023**

## ENCOMPASS - F2 IN-VITRO STENT FATIGUE TESTING

### PROBLEM STATEMENT:

Braided structures, and stents, are used in the medical device industry for stroke treatment. Based on the specific treatment and location - stents can be used in arterial, venous vasculatures, neurovascular, cardiovascular, and peripheral anatomical structures. When these devices are deployed they are subjected to stresses and strains due to the pulsatory motion of the arterial wall. Regulations and guidance are provided by the FDA for any intravascular stents and associated delivery systems. FDA requires stent durability and fatigue testing and recommends that you “test the durability of your stent to the equivalent of ten years of real-time use under pulsatile flow and physiologic loading that simulates blood pressure conditions in the human body.” A standard has been created by the American Society for Testing and Materials (ASTM F2477) that the FDA recognizes for its regulation and will be used as a guide for this project.

### TEAM MEMBERS:

Zander Sadorra*
Erica Singh
Katie Kellum
Maliha Hossain
Will Stauffer
Emily Mendyke
Heather Erickson
Kyu Rhee Han

*indicates Team Lead

# FORMAL DESIGN PROJECTS

**2022-2023**

## ENCOMPASS - STENT WELD INSPECTION

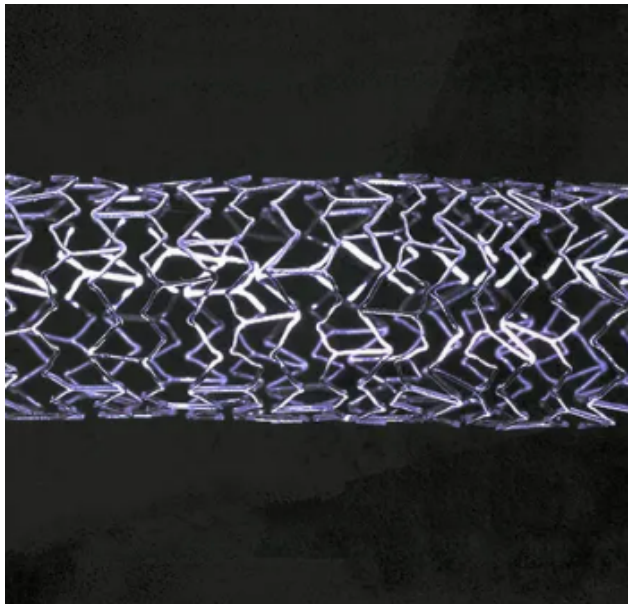
### PROBLEM STATEMENT:

The EnCompass F2 device is used to filter embolic particles shed after an aortic valve replacement that could cause a stroke. The device is composed of a super-elastic braided nitinol frame that supports a polyurethane filter membrane. During the stent manufacturing process, multiple wires are braided and joined together using stainless steel sleeves and laser welding. The quality of these welds determines the strength of the joints and is critical to the device's overall strength and life cycle. If welds are cracked, non-continuous, or otherwise not to spec, they are subject to failure. Our job is to help create a more repeatable measurement system that removes variability in the lot.

### TEAM MEMBERS:

Akanksha Maddi*
Allie McAuliffe
Adam Gish
Annie, Larson
Pouya Behdinan
Sydney Dedrick
Josh Gottschalk
Natsumi Shudo

*indicates Team Lead



# FORMAL DESIGN PROJECTS

**2022-2023**

## HAND FOR BETH

### PROBLEM STATEMENT:

After facing sepsis in 2016 and losing parts of each of her limbs, Beth Parrish wants a device that will give her left hand the basic dexterity and strength required to hold objects like clothing, a dish, or a piece of fruit. Such a device could also provide Beth with the ability to type on a keyboard.

This is an ongoing project that started in 2020. The previous team has finished the finger design (linkage system) and just needs help with manufacturing as well as a better attachment mechanism to Beth's hand.

### TEAM MEMBERS:

Michael Grandi*
Kelsea Clays
Lucas Rambo
Jamey Farin
Samantha Gonzales
Jessica Schmok

*indicates Team Lead

# FORMAL DESIGN PROJECTS

**2022-2023**

## EDWARDS - VARIABLE SYSTEM MEASUREMENT

### PROBLEM STATEMENT:

Coatings are used extensively on medical devices to serve a variety of functions such as hydrophobicity, electrical isolation, and corrosion resistance. The integrity of these coatings is meticulously monitored by means of inspection throughout the design process. Edwards Lifesciences currently has a validated inspection method that produces attribute data (pass or fail), but it is not without hurdles since operator subjectivity is often present in manual, visual inspections. The creation of a variable inspection system, whether fully automated or camera-assisted, is an avenue to mitigate operator subjectivity, monitor product stability, and produce better component yields.

### TEAM MEMBERS:


Jadon Bradford**
Jack Foxcroft**
Daniel Kim
Ethan Hemmerlin
Izabella Parga
Brandon Nguyen
Paige Read


**indicates co-Team Lead

Edwards

# FORMAL DESIGN PROJECTS

**2022-2023**

## SPASM ALGORITHM FOR TAMAR

### PROBLEM STATEMENT:

Tamar is a local student in San Luis Obispo and was born with quadriplegic cerebral palsy. This team has the goal is to construct a Machine Learning model that can recognize muscle spasms and/or seizures by training it with EEG data.

The team has already made some progress and has acquired an EEG headset, and set up our method of data collection using a Muse 2 EEG headset and a supporting app, MindMonitor. They also narrowed down their options for training our ML model, and additionally have started playing around with EEG readings and are still in the process of learning how to interpret EEG signals. The biggest challenge is collecting, organizing, and cleaning the data. So, their next task is to build an organized, clean dataset and experiment with training the ML model. Then, the goal for Spring quarter is to then apply the trained model to Tamar's EEG readings, and hopefully "calibrate" it to his personal EEG readings. This way, they can build a "framework" ML model, that can generally be applied to Tamar's, and any other person's, EEG readings by just readjusting/calibrating the model to fit that person's specific EEG.

### TEAM MEMBERS:

Noah Nguyen*
Grace Romero
Asa Levine

*indicates Team Lead

# LOOKING FORWARD

We are looking forward to Winter Quarter 2023, as we have many workshops and information sessions planned. If you would like to attend our meetings this upcoming quarter, they will be in the TECHE Lab from 6:10 to 7 pm every Tuesday night. Finally, our Formal Design Project teams are preparing for a Preliminary Design Review, which will allow each team to get feedback on their designs from the officers, faculty, and other professionals. We are excited to see where the rest of the year takes us!

Thank you for taking the opportunity to learn more about EMPOWER. If you would like more information about what we do, how to get involved, or past projects, please check out our website https://www.cpempower.com/ or email us at cpempowerops@gmail.com.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