QL+ Student Association
Quarterly Newsletter: Fall 2017
QL+ Student Association Mission:
QL+ is a multidisciplinary student association on a mission to improve the quality of life of
community members and those who have served through innovation in prostheses, medical
devices, and assistive technologies.

Spring Quarter Summary:
During Spring Quarter, the QL+ Student Association hosted a second Quarterly Design Project
(QDP). Students were tasked to design an innovative lower limb prosthesis that could assist in a
specific activity. This QDP was formatted as a competition and we were honored to have a guest
judge panel which included; our club advisor Dr. Lily Laiho, Stephen Mohr from Varian
Medical, and Leo Labra from Southern California Edison. The officers and judges were
incredibly impressed with the creativity and professionalism of the club during the presentations.
The Swimming Fin for a Child took first place with an innovative design for a swimming fin for
a single or double below the knee amputee. The most exciting part of this design is the
“mermaid-like” quality, allowing the child to feel special rather than left out during a day at the
pool. We also held workshops in 3D printing, circuit filters and building fidget spinners using the
Mustang 60 wood shop. Finally, we hosted our first annual QL+ SA end of the year banquet. All
of our formal design teams had the opportunity to present their projects, we thanked all our
supporters, and introduced a few of our projects for next year.
Spring Quarterly Design Project

The QL+ SA spring quarterly design project is a competition project. The officers presented the club with the following prompt *design an innovative lower limb prosthesis to assist with a specific activity.* We worked with 10 groups of 6 students throughout the quarter to develop their ideas and prototype them with our in house 3D printers. We then heard design presentations from all 10 teams at a special two hour meeting in the advanced technologies laboratory Keck Lab. We would like to offer special congratulations to group five for receiving first place. Our judges were very impressed with the quality of designs of all our teams and we look forward to running another QDP in Fall 2017.
Formal Design Projects

Five new formal design projects began in Fall 2016, and one project continued from last year. Formal design projects are centered around a community member with a specific challenge, referred to as a challenger. These in-depth, year-long projects culminate with a presentation of a final product from the formal design team to the challenger.
Arm for Luke

About Luke:
The team enjoyed working with Luke, a sixteen year old boy who is learning how to drive. Luke experienced amniotic banding and, as a result, his right arm did not grow past his bicep. He came to us with the challenges he faced while driving using only his left hand, such as making turns and shifting gears. Our team created a prosthetic arm to allow Luke to drive more safely by gripping the steering wheel.

Project Update:
The body of our final product was 3D printed for cost and weight efficiency, except for the elbow lock which was Computer Numerical Control machined aluminum to assure function of the sliding parts that allow Luke to turn the arm into and away from his body. The arm uses a motor attached with a spool that controls a whipple tree mechanism to close his four fingers apart from the thumb. We designed a stationary thumb so Luke would have the freedom to move the two thumb joints with his other hand and still put pressure against the thumb when firmly grasping objects. The circuitry team created a Particle Circuit Board to reduce the wiring and updated the arm’s function with two modes: automatic and manual. Automatic mode keeps the hand closed for a determined amount of time so the arm can be used without other interface and manual mode lets the hand close as long as a button and pressed and remain there indefinitely. The socket team met with a local prosthetist for advice and decided to use a BOA closure system so that lacing can be tightened around the body of the pin-lock prosthetic.
Myoelectric Hand for Dr. Bratcher

About Dr. Bratcher:

Dr. Chris Bratcher is a winemaker in Lompoc, California. Two years ago, he suffered a winery accident that cost him his right hand. He currently uses a body-powered hook prosthesis that is difficult to strap on and use, especially for his tasks as a winemaker. He has always wanted a myoelectric hand prosthesis, and our team’s goal is to design and build a myoelectric hand that will help him better conduct his everyday wine-making routines.

Project Update:

Our team consists of seven well-qualified engineering students with mechanical, electrical and programming backgrounds. During the spring quarter 2017, our team finalized design decisions and moved on to building every component of our hand. We fabricated a carbon fiber socket with the help of Matt Robinson, a local prosthetist from Hanger Clinic. We assembled the fingers, worked on the electrical hardware and even ran some tests with Dr. Bratcher, to make sure our electrodes picked up signals from his limb. The electrical and software part of the project still proves to be the most challenging, but we continue to work on and improve on those aspects and expect to have a finished product by mid September.
Cycling Leg for Francis

About Francis:

Mr. Foo is a transtibial amputee and is an active road cyclist. Up until this point, he has been frustrated with the discomfort and lack of power that comes from using his walking prosthesis for cycling. He’s looking for our team to create a cycling clip-in foot, and a more rigid ankle optimized for road cycling.

Project Update:

Entering our final quarter of this project, we designed and manufactured an adjustable prosthetic prototype. With this prototype, Mr. Foo will be able to have a custom bike fit to find the best prosthesis dimensions for maximum power and comfort. The prosthesis is adjustable in overall height, angle of the ankle, and placement cleat on the bottom of the foot (under the toes versus under the heel). The new prototype will connect to his existing socket via a standard prosthetic connection. A working aluminum prototype was sent to Mr. Foo at the beginning of spring quarter 2017. After going through a successful remote fitting process, Mr. Foo sent us back the specifications that we needed to create a final design for his prosthesis. The final build was a simple, stable straight leg design made entirely out of anodized aluminum. Our team consists of 5 motivated undergraduates; Lauren Jensen, Matt Whitman, Erik Stafford, Veera Panova, and Tyler McDonough. This diverse group ranges from 1st to 3rd years and includes mechanical, biomedical, and manufacturing engineers as well a biochemistry major.
Transportation System for Terra

About Terra:

The goal with this project is to improve the quality of life for our challenger, Terra. Terra has cerebral palsy, which impairs her fine motor skills as well as large muscular function. She is primarily affected beneath the waist, hindering her ability to walk independently without the assistance of crutches or a wheelchair. As a result, she has challenged our team to engineer a solution that will help her carry and transport items that are crucial to everyday life.

Project Update:

Our team of seven engineers has designed an electric remote controlled cart with an elevating tray using CAD (Computer Aided Design) programs. After undergoing intensive analysis and inspection, we manufactured our cart design with attachments to assist Terra by carrying grocery bags, laundry, dishware, etc. The cart is operated by a remote control attached to Terra’s crutch, and should be able to traverse any corner of Terra’s home (further testing is necessary). Additionally, we have designed an attachment for one of Terra’s crutches that will allow her to carry beverages hands free. This attachment will be connected to the side of the crutch and is capable of swinging freely in a front to back motion, allowing the drink to remain upright as Terra moves the crutches. Our team has worked very hard on these designs and are very pleased to deliver the finished product to Terra.
Dexterity Enhancing Toolset for David

About David:

The goal of this project is to provide our challenger, David, with the means to dress himself despite having Multiple Sclerosis. The devices currently available are single-handed tools that aid in buttoning pants. However, these tools only work with loose, lightweight fabric and are not optimal for those who prefer to wear jeans. We worked to develop a two-handed product to allow David to dress himself even when wearing thick fabric, such as jeans. Another goal of this project is to have the tool be collapsible so that it may fit into a pocket or leather pouch to make carrying it around easier and more discreet.

Project Update:

This project began at the beginning of Winter Quarter 2017 and was completed at end of Spring Quarter 2017. The team has done a great job turning our ideas into well thought-out designs and models and building our final product from those designs. With the tool completed, we were happy to hand off the final product to David at the annual QL+SA Banquet.
Hand for Levi

About Levi:
We have been given the opportunity to change the life of a local seven year old boy. He was born with a partial left hand and is in need of a multifunctional prosthetic hand. We have now been working with him for over a year and our designs have gone through many iterations to support his needs of doing everyday activities, and most recently riding a bike.

Project Update:
The project officially began the last week of November 2015, and concluded with the first functional prototype hand off in June of 2016. Due to the unique requirements to meet the needs of a growing client, we have extended the project into this year to make further improvements and advancements. We were able to receive more feedback on our last prototype of the hand, and have started to make more improvements for that everyday prototype. However, we have realized that Levi would prefer to have a prosthesis that allows him to do something exciting, like ride a bike. After this realization we were able to work incredibly hard to produce a functional prototype that we delivered to Levi within two weeks. We were lucky enough to try this out and watch Levi successfully ride a bike for the first time ever. During Winter Quarter, we continued to work on our hand prototype by updating the thumb design, locking mechanism, as well as optimizing the socket. We also submitted our bike attachment design to the Summer Biomechanics, Bioengineering and Biotransport Conference and we were selected as finalists!
Looking Ahead: Fall 2017

We are so excited to get started with a new school year! We have seven new formal design projects getting started as well as a Quarterly Design Project for this Fall. In addition we have workshops in solidworks and ANSYS, and great community building socials to acclimate all our new members!

Thank you for your interest in the QL+ Student Association! If you would like more information about what we do, or would like to get involved in our mission, please contact our faculty advisor, Dr. Lily Laiho, or our president, Berkeley Davis.

Dr. Lily Laiho
llaiho@calpoly.edu

Berkeley Davis
bdavis35@calpoly.edu