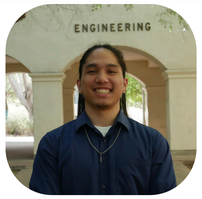
SDSU College of Engineering

Adaptive E-Bike Pedal System

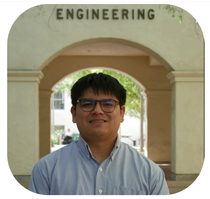
PROJECT S.E.R.V.E.

The Team



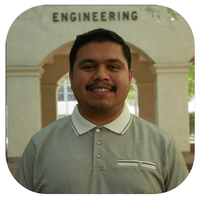
Rolan Luis Abubo
Design Lead

Will Brandenberger
Team Lead



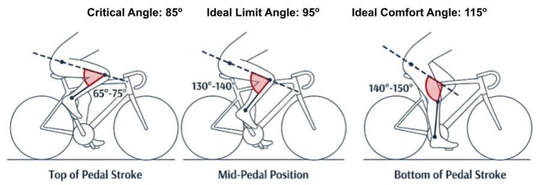
Caleb Ezure
Manufacturing Lead

Nikhil Maharaj
Analysis Lead

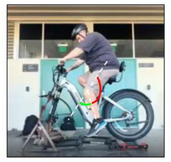


Luis Quiñones Segura
Safety Lead

Range of Motion

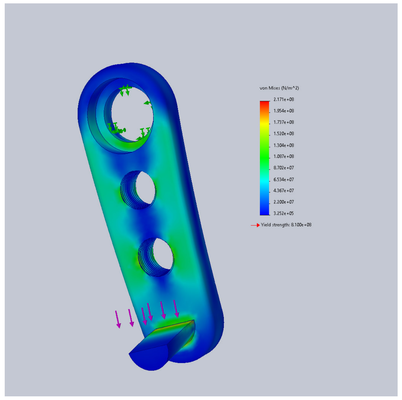


This angle is **impossible** for Josh to reach with his left leg



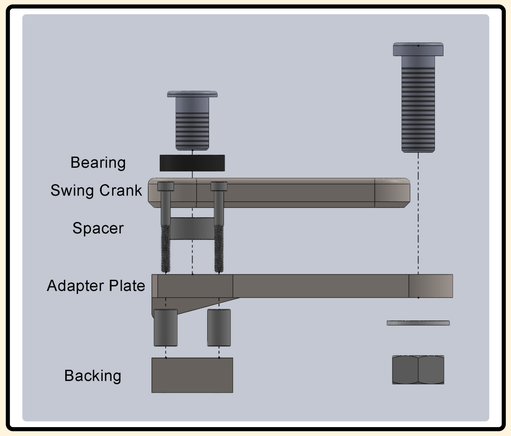
Minimizing proximity to the critical angle is paramount in the design approach.

Finite Element Analysis



The pendulum arm is the most prone to failure due to localized stress arising from loading on the pedal; as such, it has been evaluated for Von-Mises stress iteratively using FEA in SolidWorks.

Exploded View



Project Overview

Problem: Design and create an adaptive pedal system for an electric bicycle, to reduce the angle required to pedal for Josh, a US Marine Corps Veteran. Josh's left leg is limited to a maximum bend of 95°, but standard bicycles require up to 140°.

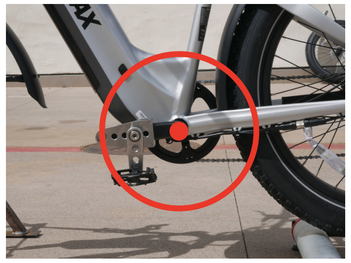
Project Objectives

Reduce the maximum bend requirement of the stroke cycle down to 85° while ensuring that Josh can ride without discomfort or pain. With this design, Josh can ride a bicycle for the first time in 22 years.

Final Result

Design Principle

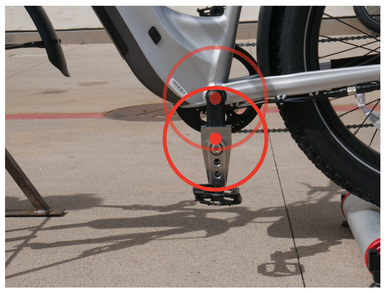
Original Stroke Path



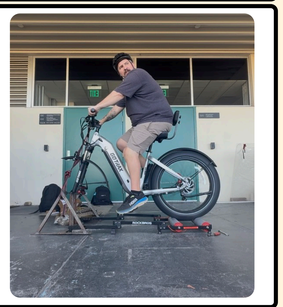
Crank Shortener

Pendulum Crank

By combining the effects of shortening the bike crank and attaching a pendulum crank to the pedal, we are able to reduce the size of the pedal pathway while moving it downward to minimize leg RoM required to ride a bicycle.



Test & Evaluation



The Sponsor

Project S.E.R.V.E. is a 501(c)(3) nonprofit that partners student engineers with veterans and emergency responders living with limiting disabilities to design solutions that improve their quality of life.

Acknowledgments

The team would like to thank Dr. Shaffar and Project SERVE for arranging and advising the project. The team also appreciates Scott Huyvaert and Ryan Liu for their mentorship throughout the program, and would like to acknowledge Chris Ketcham and Adrian Hernandez Sr. and Jr. for their support as well.

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