UNIVERSITY of WASHINGTON

PortaBoard

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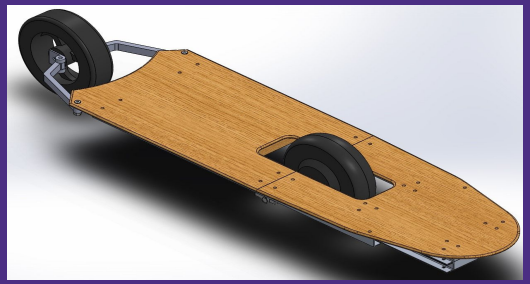
Problem/Constraints

We wanted to build an affordable, foldable, and powerful electric skateboard for use of urban travelers and commuters. We saw that a lot of the electric vehicles that were heavy and powerful on the market so we wanted to create something more light and portable. 40% of users that we asked said that they would purchase a board of this kind if it was priced from between $200-$400. 70% of users we asked were willing to purchase any sort of electric skateboard of this kind. So we took it upon ourselves to design something affordable and unique. The unique foldable design would allow for the user to easily store the board while riding the bus or while at work, allowing for more convenience. Some design constraints we had are a foldable board and a two wheel design. The board must be lightweight for portability and powerful enough to handle common obstacles.



Full Model View

Experiments

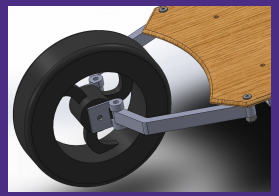
The board will not break as the yield strength is 56.5 MPa for oak. The overall max stress was around 210 MPa at the red sections as seen below. Those are where the hinges will be, so the force will be more distributed. But either way the aluminum bars will be fine as the yield strength is around 276 MPa. To improve our FEA results we could model them in ANSYS or ABAQUS for more complex dynamic studies

BASIC COMPONENTS

- Front wheel & rear hub-motor
- Steering arms
- Front & rear deck
- Support rails & block
- Hinges
- Electronics speed controller
- Battery management system
- Lithium-ion batteries
- Controller for motor

Steering

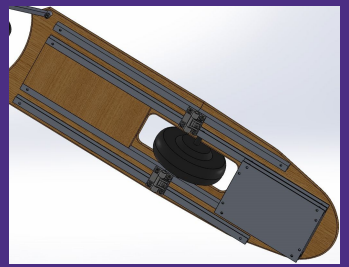
Since there's only one wheel is the front, we have to come up with a unique mechanism that allows the board to turn when the user leans. We used a 4 bar linkage that allows for the turning motion and the grip from the tire helps it turn when the user leans. In the future we can add a spring to help the wheel recenter easier.



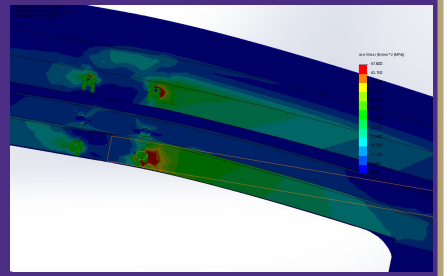
Model of the Steering Mechanism

Deck/Supports

Our board is made of a classic layering design of multiple pieces of laminate. Specifically, layers of 1mm oak laminate and fiberglass layers to provide the sufficient flexibility and strength. We added aluminum rails to provide extra support in case of obstacles and the stresses around the hinges as shown in the analysis. There are many areas we can improve on with an increase budget and access to more resources. Some of these include: carbon fiber layering, custom stronger hinges, different sizings of board for different types of riders.

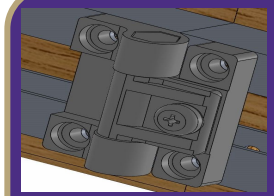


Model of the Deck/Supports



FEA Analysis

Folding



Model of the Hinge

Part of the goal of the board was to make it portable. To address this, we designed the board to be able to fold in half using two adjustable friction hinges from McMaster. To address the collected stress at these points, we decided to machine these hinges using steel. We also mounted these hinges to the supports for additional stress relief. In the future, custom made hinges that are embedded into the board could replace these to give the board a sleeker look.

References/Resources: Solidworks, McMaster-Carr, UW Bothell Faculty & Staff

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