GRAVITY CRUISERS

TEAM 14 , Matthew Winkle, Eli Johnson, Jack Martinez, Dubem Nweke
Calvin University, Grand Rapids, Michigan

Introduction

The Gravity Cruisers' project was to produce a functioning prototype of an electrically powered longboard with some off-road capabilities. This project aims to provide a method of short-term commute and outdoor recreation.

The longboard was to function on various surfaces, including paved surfaces, grass, gravel, and dirt, while being able to traverse obstacles of up to two inches. The speed of the longboard was to be controlled remotely, capable of reaching up to 15 mph on flat paved surfaces.

This project sought to compete in the growing market of electrically-powered, off-road capable longboards by providing a simpler, less expensive solution. Current market solutions typically cost over $2,500. The product was also seen as a smaller, easy to transport alternative to electric scooters or mountain bikes.

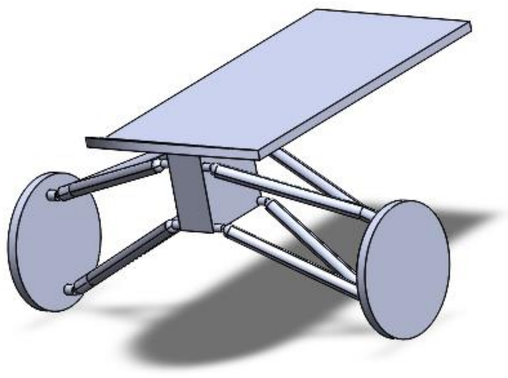

Figure 1. Initial suspension concept. The design did not feature independent suspension and turning.

Design Process

Research was performed into current market solutions, as well as other similar products, such as electric scooters, traditional longboards, and remote-control cars to gain an understanding of the systems required to achieve functionality.

An iterative design process was used to reach a final design. The first generation closely resembled traditional longboard trucks, and with every additional generation the design grew more complex and further from a traditional longboard.

Modelling of the components was done in SolidWorks and dynamic simulation of each design was performed in MSC Adams. Initial designs proved to not meet specifications for the maximum load or turning radius when simulated. The initial concept for suspension system may be seen in *Figure 1*. The final SolidWorks assembly for the prototype may be seen in *Figure 2*.

Final Design

Chassis

The chassis beneath the board supports the deck and suspension system. It is made of two pieces of angle aluminum and an aluminum plate.

Suspension System

The board features a modified A-arm suspension which is separated from the turning system, allowing for the board to handle obstacles without turning the wheels. The suspension features laser cut arms and springs to absorb shock.

Turning Mechanism

The deck rotates about an aluminum rod, allowing for traditional longboard steering. The tilt of the deck moves turning arms, which rotate the wheels, allowing them to turn.

Electronics

The longboard features a rechargeable 36 V 10 AH battery, two in-wheel motors, and a wireless, handheld speed controller.

Conclusion

The team found the concept of an electrically-powered, off-road longboard to be feasible technologically and financially. An iterative design process was used to model and simulate the longboard in SolidWorks and MSC Adams. A working prototype was constructed out of a combination of pre-fabricated components, custom laser cut parts, and in-house milled components. The prototype was constructed under budget.

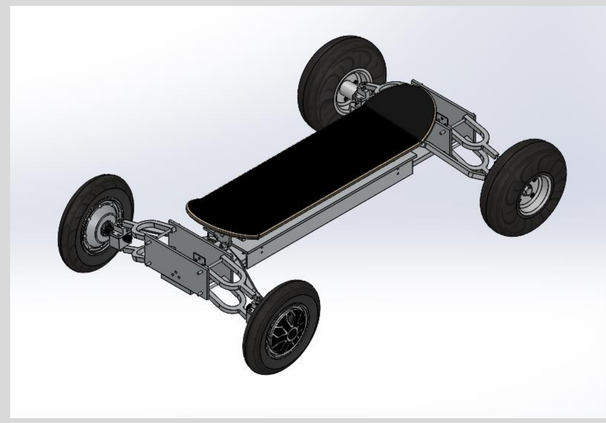

Figure 2. Final SolidWorks model for the prototype. The model excludes both the turning springs and the suspension springs, as these features were designed in MSC Adams.

The Team

From left to right: Dubem Nweke (M.E) , Eli Johnson (M.E), Matthew Winkle (M.E), Jack Martinez(M.E)

Resources

All 3D designs and dynamic simulations were done using Solid works and MSC Adams

Tubergen, Renard; Faculty Advisor

Sorensen, Chris; Wood and Machine Shop Tech

Laser cut parts provided by Wyser Inonvative Products

Team 14; 2022