# EXECUTIVE SUMMARY

The beach is fun and relaxing, but people must carry many heavy items, such as coolers and chairs, which can make going to the beach a struggle. The Beach Mule was created to solve this issue and will allow a person to enjoy the beach more by carrying their belongings. The Beach Mule is an innovative and advanced beach cart that has an array of features to set it apart from competitors. Firstly, it has autopilot capabilities that allow Beach Mule to follow the user wherever they go. While also being lightweight, it offers an extraordinary level of convenience and carrying capacity.
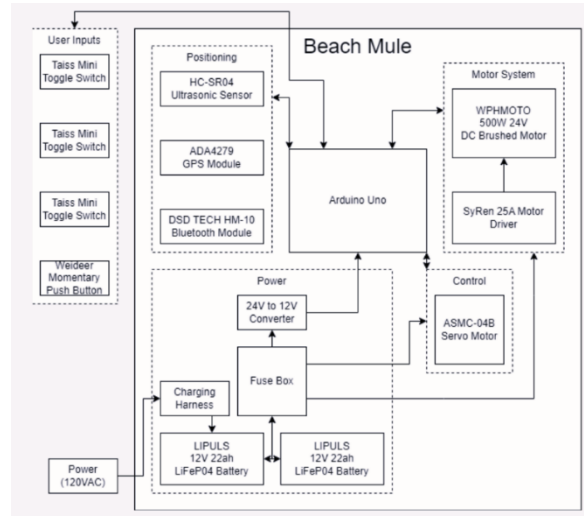
Figure 1. Beach Mule Design Overview

The design team had to meet multiple technical design constraints, including making the cart autonomous and making sure to have proper weight capacity (120 lbs.), size (able to fit SUV/truck), and functionality. The Beach Mule's functionality includes features such as battery life (1 hour of constant running power) and a proper stopping distance from the user (3-5 ft.). Secondly, practical design constraints dictated that the team is working to make it as cost-efficient as possible when compared to other competitors. The team chose the dimensions (38"x21"x12") to be able to fit in truck/SUV's trunk. The Beach Mule is also safe for the user to operate at any time. Lastly, the design followed applicable Engineering Standards including, IP-55 (components safe from foreign debris), GPS (get proper GPS locations), and UL (proper wire size for all components).

The Beach Mule is built rigid and sturdy for all beach terrains. The cart runs off two 12-volt batteries in series (24 V) that are wired to a fuse box to disperse power to all components needed. The motor used is a 500 brushed DC motor which has ample power to move the Beach Mule through all beach terrains. The microcontroller used is an Arduino Uno that can handle and control all the modules attached to the Beach Mule. The Bluetooth (iOS devices only), GPS module, and ultrasonic sensor all work together for the cart to be autonomous.

The Beach Mule can be improved in the future by adding an interface on a smartphone to use the different controls that are on the cart via buttons and switches. The Beach Mule does not have to be just for beaches, it can be used anytime anyone needs a helping hand.