Introduction:
The goal of this project was to design and build a robot to mimic and replace a fencing opponent for fencers with various skill levels. We wanted to develop a robot that will help those who are unable to practice fencing with a live opponent to improve their skills. To effectively learn fencing, proper muscle memory must be developed. Currently, there are no interactive ways to develop proper muscle memory and sword tip control without interacting with another human being. There is need of a cost effective robot that can assist a single fencing athlete to learn basic saber fighting techniques.

Problem Statement:
Our objective was to develop a robot that can help fencing students practice at home without the need of a second person. The major user needs of the project are:

1. Speed
2. Durability
3. Accuracy
4. Ability to achieve specific movements (Parry 3, 4, & 5)

1. Speed:
When compared to a bullet, the tip of a fencing blade is the second fastest-moving object in Olympic sports. We aimed to have a robotic arm that could move within 80% of the movement speed of an average fencer (4.1 m/s). Using a cable driven arm and hoverboard motors to give us a high torque to price ratio we were able to create an arm with the agility required.

2. Durability:
A fairly robust robot is required for training purposes and repeated use. To accomplish this we used PETG 3D Printed parts to give us very high impact resistant part that could support the loads required.

3. Accuracy:
Our cable driven arm has lower inertial components than traditional designs. The cable design allows for larger motors to be used and located advantageously. The pulley system allows for weaker motors with high operating speeds. This results in a fast moving arm that can repeatedly move to the same positions.

4. Specific Movements:
The arm is able to move to parries 3, 4 and 5. This allows for a defensive practicing partner. The arm is capable of moving to other positions, and the wrist was designed with a unique flicking ability. This should lay the groundwork for future teams to explore the offensive capabilities of this design.

Key Results (Conclusion)
A robot was developed that encompassed the user needs of speed, durability, accuracy, and the required movements.