Upper Body Exoskeleton System

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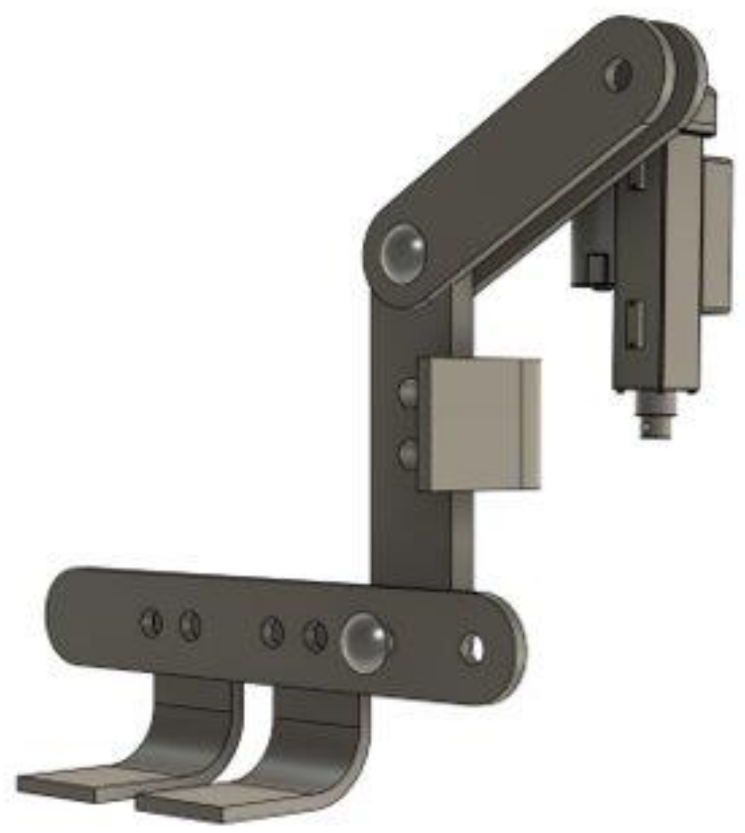
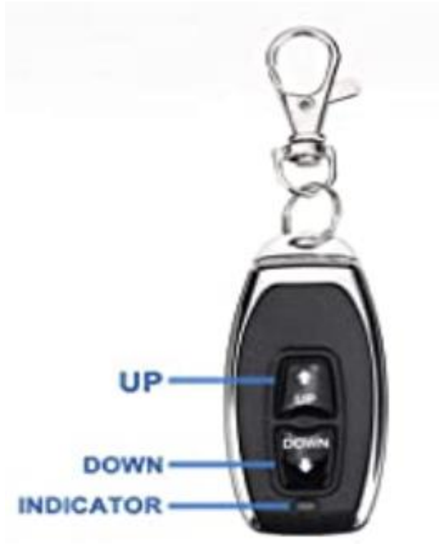
Introduction: Initial Research and Design

In our first semester, the goal of our exoskeleton design was to assist individuals with degenerative muscular conditions or physical limitations. During this time, we toggled between single-arm designs of a wheelchair-attached or physically-fitted device. This semester, the project deviated towards a more robust, upper body, Iron Man-esque design after realizing the oversimplicity of our original design. This system is now capable of dynamic and static load-lifting with the options of dual-arm or individual arm control. The wholistic design and the specific solutions realized to make this project possible have great potential for both industrial and personal use.

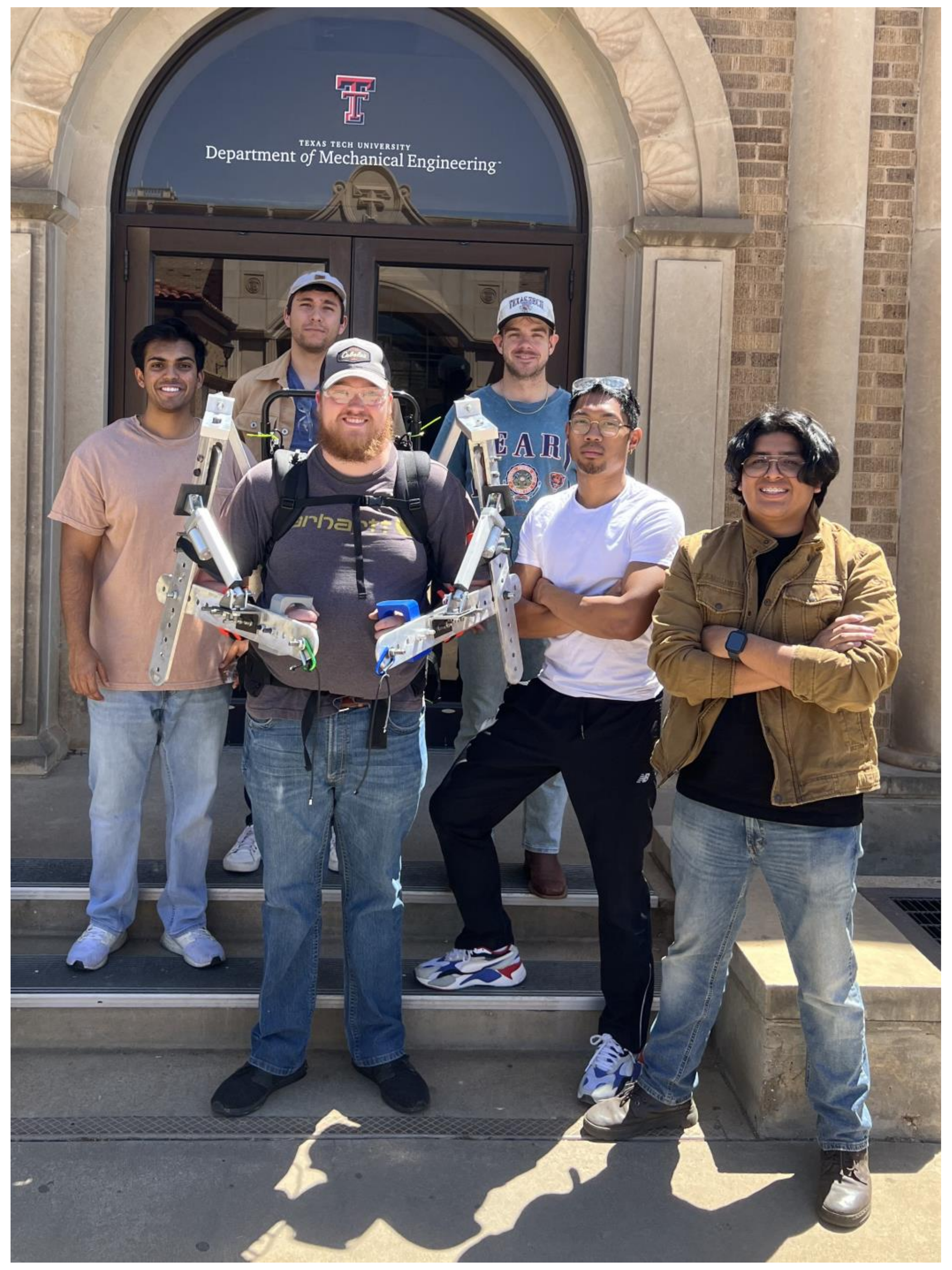
Arm Prototype

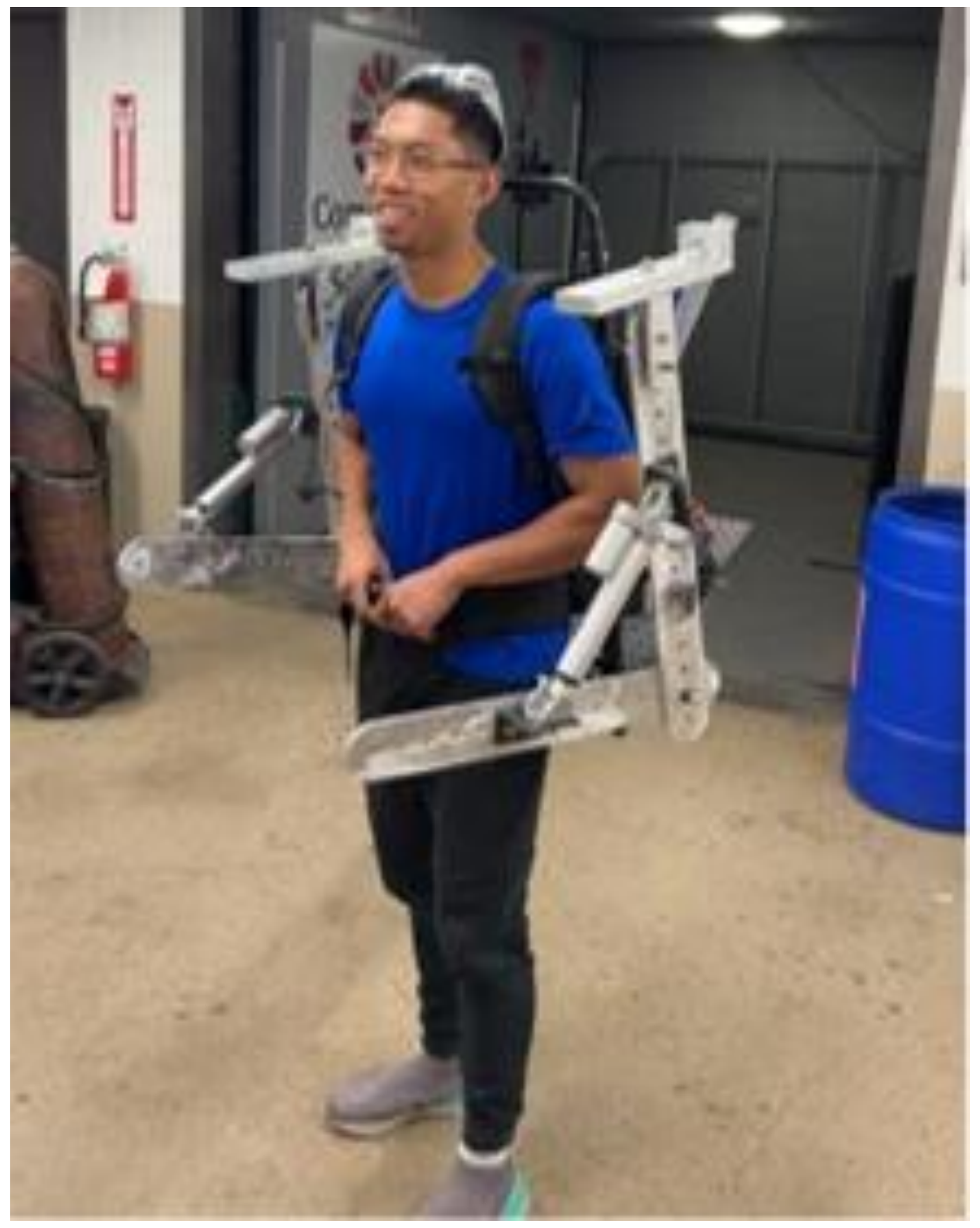


The arm's curling motion is driven using a linear actuator rated for ~200 lbf. The user controls the actuator via key fob held by the user (shown below).



Final Design





Conclusion

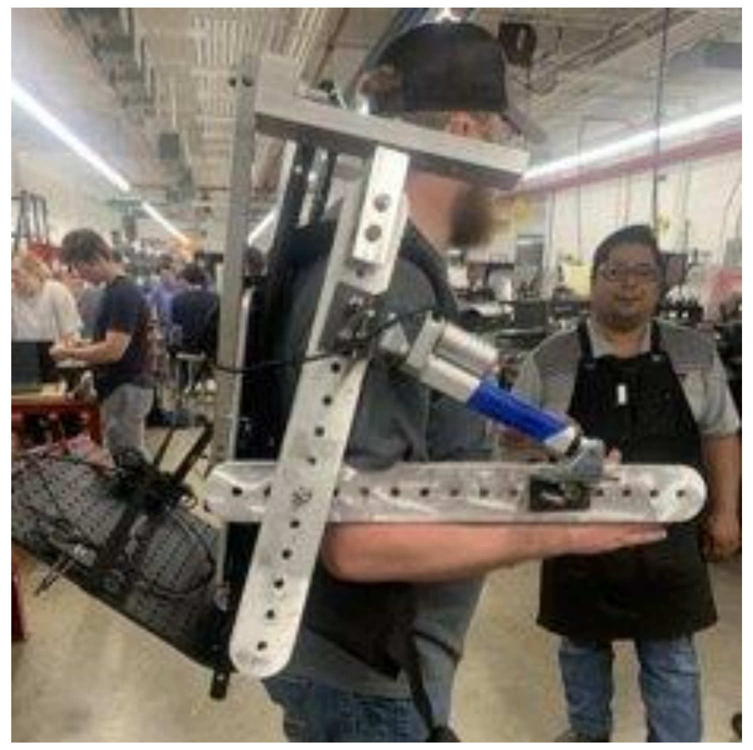
Our original mission was to lift more than 40 lbs. but our tests have proven its capability of easily lifting over 100 lbs (no max-load test; the human body is fragile). The use of linear actuators make it extremely strong and powerful and allow the arms to self-lock with no power input. A highlight of this design is its exceptional sizeablility and modularity, allowing almost anyone to fit it and use any attachments designed for it.

Manufacturing

Subtractive manufacturing with a manual mill and CNC plasma cutting were utilized for manufacturing the main structures of our device.

3D printing was also utilized to make parts such as the handles, arm brackets and a battery casing.

A Modular Mechanical Assembly



The Final Controls System