Manual Material Handling Lift Assist System for Occupational Exoskeletons

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Abstract

The manual material handling and lift-assist system for occupational exoskeletons will aid the operator in lifting heavy objects and handling bulk material. Its purpose is to protect workers from injury and ensure their health is intact as they age. Development relied on the use of SolidWorks to design components as well as run the necessary simulations. The team used a water jet cutting process to make the aluminum parts, and 3D printing for the end effector handles.

Introduction

How we protect our workers is always changing and this is the next step in doing that.
This system actively assists by using motors to actuate Kevlar cables and reduce the lift load on the muscles of the worker. The cables are attached to the load wherever the user is lifting from by the end effectors. Main parts of the system include the motors, end effectors (handles), and the shoulder brackets.

Methods and Materials

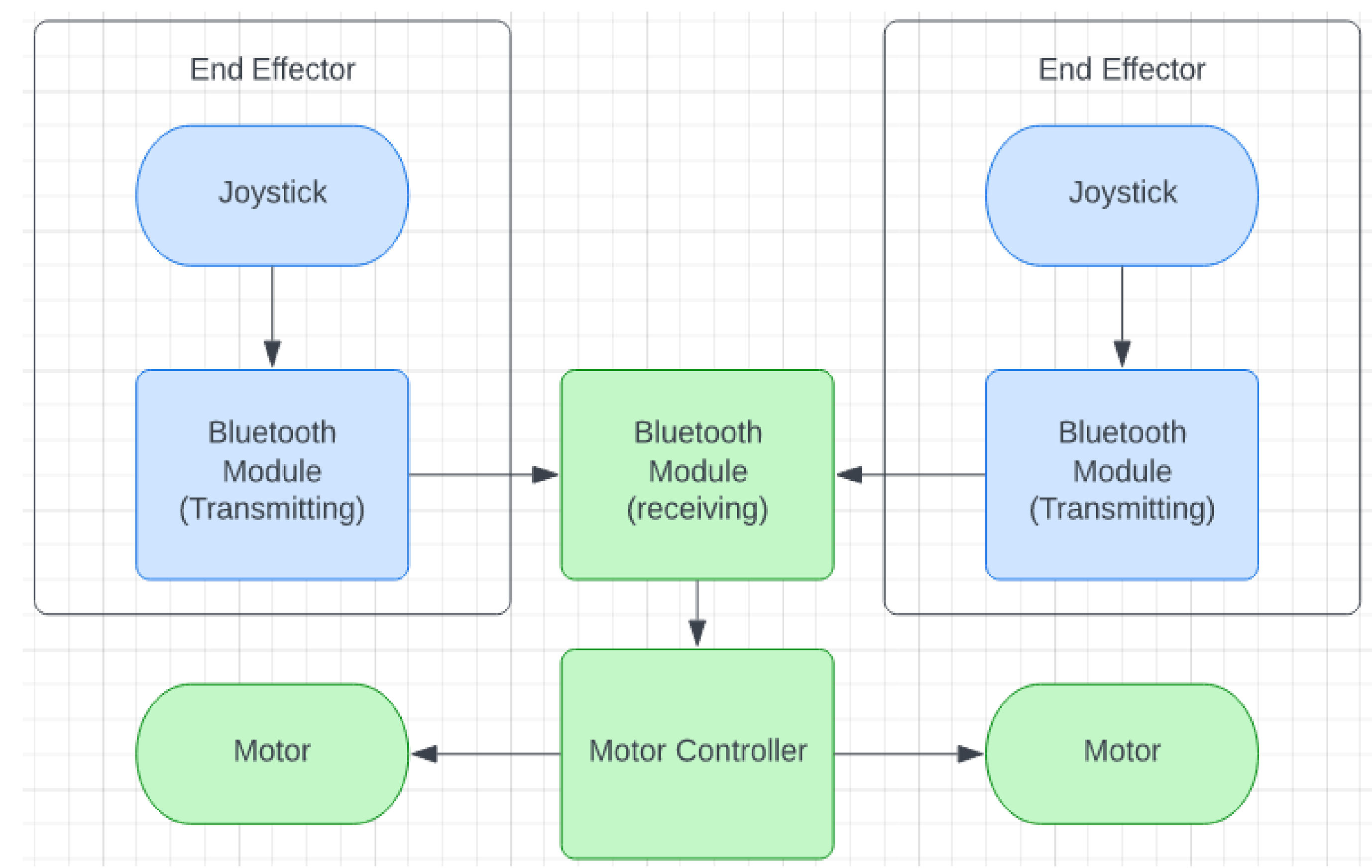
Methods
- Water jetting
- 3D Printing
- Soldering
- Milling
- Tapping

Materials
- PLA
- Aluminum

Various images of the end effector from the inside and outside.

Discussion

The motors to actuate the cables are controlled using joysticks on handles which the user holds. Movement of the joystick sends a wireless signal via Bluetooth to a receiving unit on the back of the device near the motors, telling the motor how fast to move. The speed and direction of movement is tied to the position of the joystick controls, giving the user full control of the load.



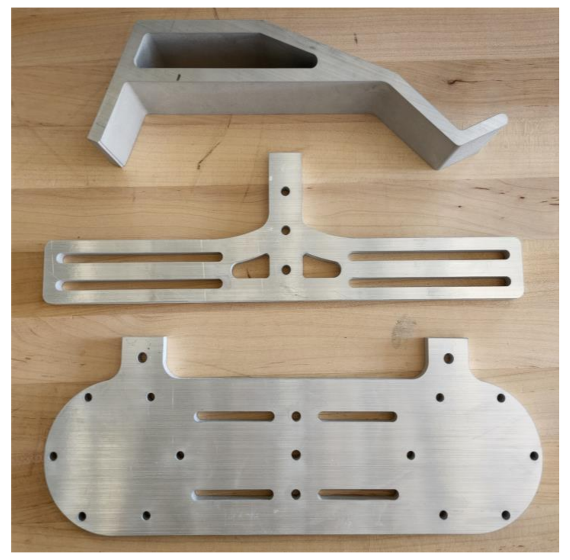
Flowchart visualization of circuitry.

Conclusions

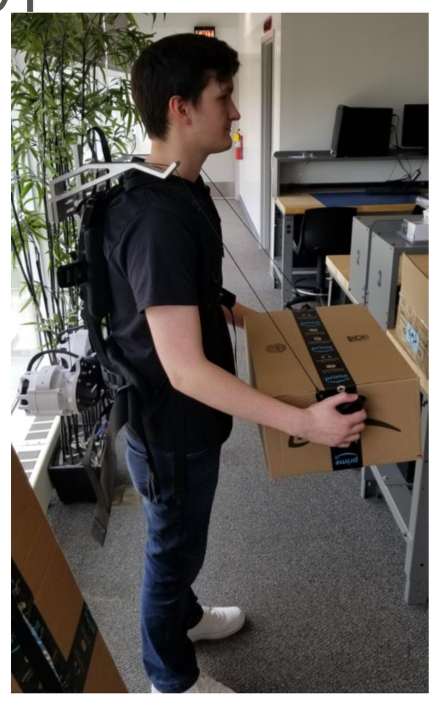
Some improvements to the system are necessary such as: the addition of a passive support system for the lower back and legs, further testing on the battery life and user comfort, overall weight optimization, and overall design durability improvements.

Results

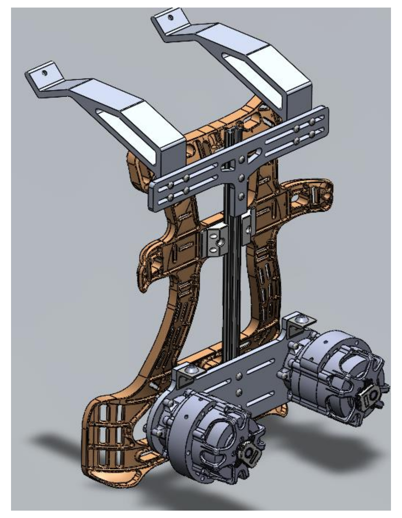
Simulations suggest the proposed solution will be more than capable of the intended use of lifting a 50-pound load. The team has constructed a physical prototype that is ready for testing.



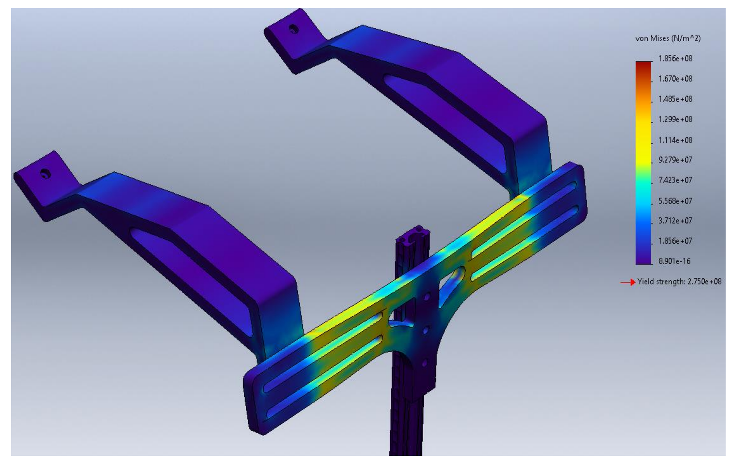
Freshly water jetted aluminum parts.



A team member using the prototype.



A visualization of the assembly in Solidworks.



Simulation results of a 50lb load being put on the shoulder brackets.

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