DALHOUSIE UNIVERSITY
Department of Mechanical Engineering

Team 24 – Wheelchair to Vehicle Transfer Device

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harding medical
Delivering Independence

Background

- Conditions such as spinal cord injuries, cerebral palsy and muscular dystrophy can limit an individual's mobility.
- According to the World Health Organization, 1% of the human population needs an assistive mobility device.
- Caretakers are at a high risk of injury due to the strenuous patient transfer process.
- Devices that are currently being used in the market are either too expensive, too complex or are not mobile.

Project Scope

Create a transfer device to assist a wheelchair user, who has trunk function, when entering and exiting a motor vehicle.

Design Process

Defining Project Scope : meeting with clients to discuss project scope

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Data gathering and Interview: researched on existing devices in the current market and interviewed occupational therapist along with wheelchair user

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CAD modelling and stability analysis: Created a prototype model using SOLIDWORKS and calculated tipping analysis

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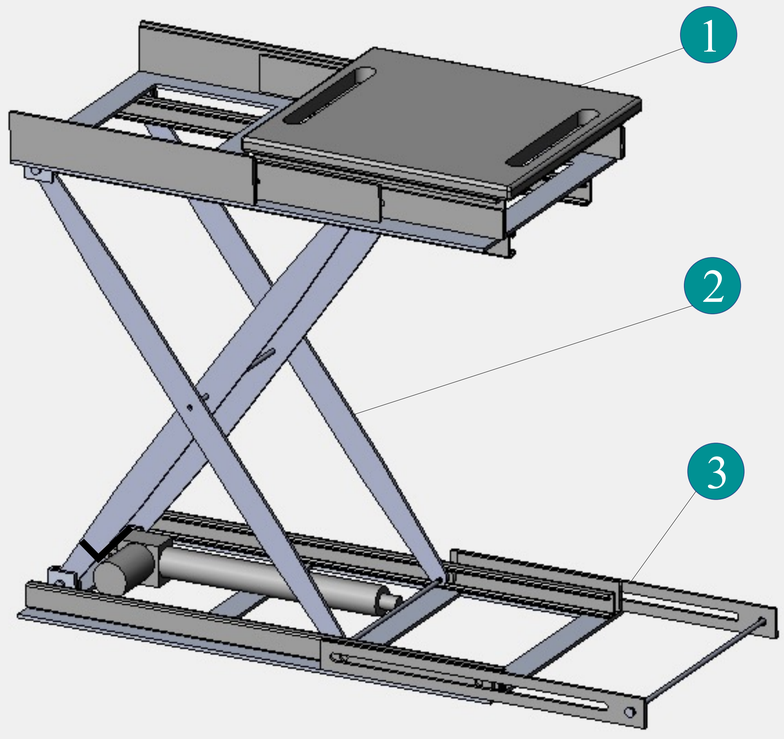
Prototyping and design iteration: Created a prototype and modified the device to improve performance and stability

Device Model



Design Features

1 - Sliding Mechanism:

- Side Mounted Drawer Slides: 3-part drawer slide extending to a total of 36". They have a built-in locking mechanism for both extremities and can support 400lbs.
- Seating Platform: The seat is a wooden board, sanded and finished with an epoxy for the comfort of the user.

2 - Scissors Lift:

- The scissor lift utilizes a 400lb linear actuator to raise the top platform.
- It is powered via 12V DC car outlet.
- The user can control the motion by a 2-way rocker switch.

3 - Extension Legs:

- Tipping of the device was a major concern in the beginning stages of the project.
- For this reason, contractible extension legs were installed to prevent this from happening.

Future Recommendations

- Increasing the number of legs would help stabilize the device and provide a larger range of motion.
- Using higher quality steel for the actuator through rod or shortening the moment arm to avoid distortion.
- Utilize high strength plastic in low stress areas to reduce weight.
- Reduce the frame width for better ergonomics and stability.
- Remove Extension legs.
- Add crossbars to the members to tie them together, decreasing wobble.
- Consider wheels to ease the mobility of the device.

Design Requirements

- The device shall support a static and dynamic load of 250 lbs. ✓
- The device shall cost less than 1500$ to manufacture. ✓
- The device shall not require more than one caretaker to operate. ✓
- The device shall weigh less than 50lbs. ✗
- The device shall fit in the trunk of a standard mid-sized SUV. ✓
- The device must be portable and can be stored in the vehicle. ✓
- The device shall be designed so that the user is not exposed to pinch points during transfer. ✓
- The device shall not have any components exceed 43˚C that are in contact with the user. ✓

Prototype and Testing

- Incrementally added weight to the transfer device until reaching 250lbs.
- Had a group member sit on the platform and slide across the device.
- Tested raising and lowering the device to find its full range of motion
- Stored inside an SUV trunk to see how well it fit.

Results

❖ **Performance**

- Able to support a static load of 250 lbs.
- Able to lift and slide a load of 150 lbs. Further testing was not possible due to the actuator rod plastically deforming .
- The device wobbled when the user was off centered or mounted too quickly.
- Technician manufacturing error caused extension leg bolts to get jammed on the roller tracks, so they had to be removed.
- Temperature limit was not exceeded on any of the parts in contact with the user.

❖ **Portability**

- The device exceeded the weight limit specified in the requirements.
- The device was able to fit in the trunk of a mid-sized SUV. However, it was not a practical solution since it was difficult to place inside.

References

All non referenced images are original content created by Team 24.

+ Med. "The History of Wheelchairs and Their Development." *MedPlus*, 8 July 2020, www.medplushealth.ca/blog/the-history-of-wheelchairs-and-their-development.

"Guidelines on the Provision of Manual Wheelchairs in Less Resourced Settings." *World Health Organization*, 12 May 2008, www.who.int/publications/i/item/guidelines-on-the-provision-of-manual-wheelchairs-in-less-resourced-settings.