Power Wheelchair with Enhanced Safety Features and Automation

Bailey Armstrong, Mitchell Brough, Emily Schwab
Dr. Raman Paranjape, P.Eng. and Douglas Wagner, P.Eng.

University of Regina

FACULTY OF ENGINEERING & APPLIED SCIENCE

Background

Client Statement:
Equip multiple power wheelchairs to work as an automated transportation system in a pre-mapped building.

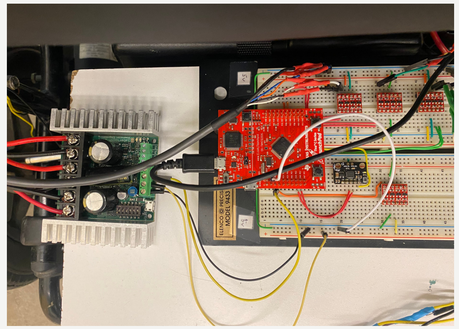
Previously Built:
Environment mapping using Light Detection and Ranging (LiDAR).

Our Goal:
Implement additional features to create a safe and reliable system that allows for both seamless integration with existing devices and future automation capabilities.

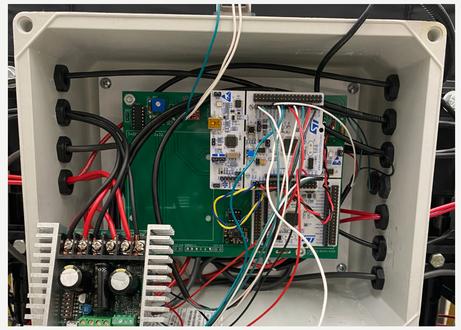
Objectives

1	**Manual Controls**	• Speed limitations • Direction constraints • System response time calculations
2	**Safety Features**	• Emergency stop • Chair occupancy sensor • Decrease speed around obstacles
3	**Spatial Awareness**	• Accurate wheel inputs • Distance sensors • Interface with existing system
4	**Autonomous Navigation**	• Environment mapping • Tracking capabilities • Ease of use

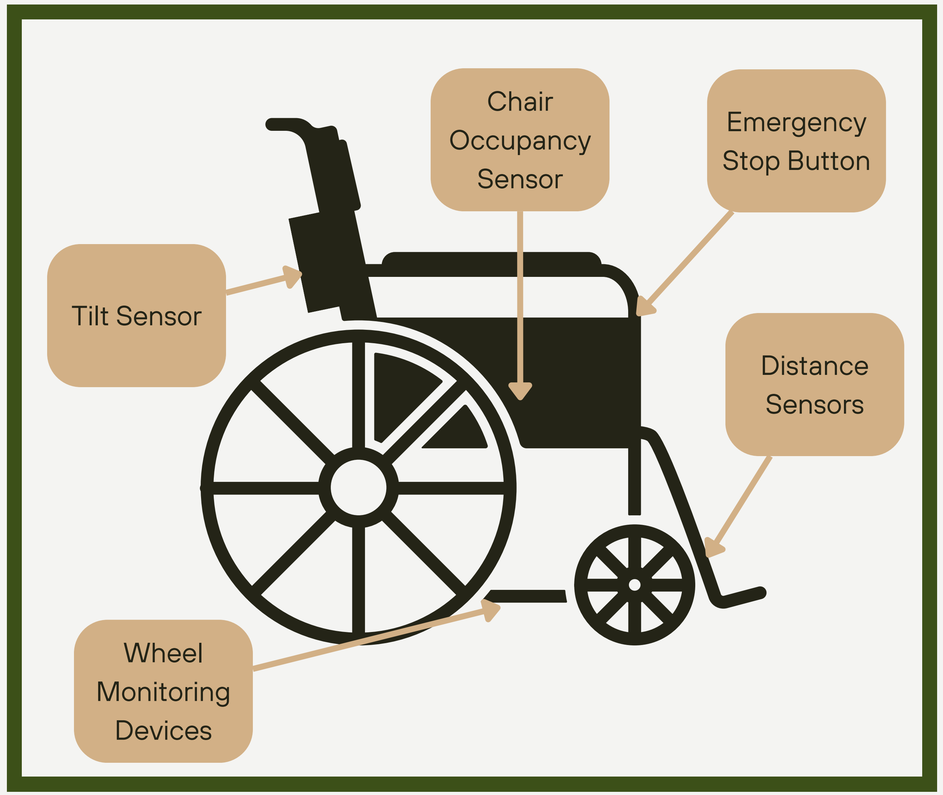
Design



Previous



Current



Results

Device Specifications

- 20ms response time for manual controls
- Reliably detect objects up to 1 foot away
- Indoor-use only
- Approximate weight 25 lbs (11 kg)
- Two 12 VDC batteries
- Two 350 W motors

Chair Specifications

- Ground clearance of 89 mm (3.5")
- Weight capacity of 250 lbs (112 kg), not including devices
- Maximum speed of 6.5 km/h (4 mph)
- Capable of driving up 10% grade ramps

Future Additions

- Improved user input, ex: number keypad
- Improved display, ex: liquid crystal display (LCD)
- Improved object detection, including drop-off (stairs)
- Audible alarm
- Integration with LiDAR environment mapping using Robot Operating System (ROS)
- Autonomous navigation
- Modular application on multiple wheelchairs

Acknowledgements:
- Monotosh Talukder, E.I.T.
- Dave Duguid
- Samuel Reddekop
- Faculty of Engineering and Applied Science

Want to see the wheelchair in action? Visit us at our booth in ED 114!