

ELEVATOR CONTROLLER FOR INDIVIDUAL WITH MULTIPLE SCLEROSIS

Product Design Specification

Team Members:

Sara Karle (Co-Team Leader)
Ashley Matsick (Co-Team Leader)
Michele Lorenz (Communicator)
Alison Boumeester (BSAC)
Peter Strohm (BWIG)

Primary Contact:

John O. Fleming, MD
Professor, Vice Chair, Neurology Professor, Medical Microbiology and Immunology,
University of Wisconsin Medical School - Department of Neurology, H6/564 CSC
Phone: 608-263-5421
Email: fleming@neurology.wisc.edu

Last update: December 12, 2006

Problem Statement/Function:

Our project involves the integration of adaptive controls into a prototype created in the spring of 2006. This device is capable of covering the distance from a wheelchair to an elevator call button, then exerting a horizontal force sufficient to push the call buttons in both the standard elevator car and the corresponding hallway. The controls to be integrated must be operable by stimulus generated by movement no lower than the user's neck. The device should be attached to the wheelchair in such a way that mobility and other wheelchair functions are not compromised. The final mounted prototype should be protected from physical and environmental damage by a weatherproof enclosure.

Client Requirements:

- The device must be attached on the left hand side of the wheelchair
- Adaptive controls must allow user to operate device using stimulus generated at the neck or above
- Device does not need to be universal with respect to the elevator controls in other buildings
- Device and controls must be weatherproof and protected
- Width added to the wheelchair cannot hinder maneuverability
- Must not obstruct user's ability to enter and exit the chair

Design Requirements:

1) Physical and Operational Characteristics

a) Performance

- Used multiple times daily
- Two unique sets of controls (one involving toggle options and the other a momentary contact switch) must move the actuator vertically and engage the solenoid, respectively
- Device should not draw an excessive amount of power from the wheelchair battery
- Docking of device on chair must not block rotation of chair's foot rests

b) Safety

- Can not alter normal wheelchair or elevator operations
- Device must be mounted in such a way that all elevator buttons can be reached
- Device controls should not compromise ease of use of current wheelchair controls
- Physical components should not endanger nearby people and objects
- Entire device should be removable from chair

c) Accuracy & Reliability

- Should be able to move to a specific button based on the input of the user
- Should provide visual feedback about the position of the pushing component
- Sensitivity of controls should allow for at least 90% success when the user attempts to engage the device
- Device should not engage without user input
- Device should not remain activated if accidental contact of controls occurs

d) Life in Service

- 10 years or until upgraded parts are available
- Individual parts should be easily serviceable as needed
- Each individual part should withstand use multiple times daily
- Weatherproof covering and all components of mounting arm must be removable to allow for maintenance

e) Operating Environment

- Weatherproof: temperature ranges from 20-90° Fahrenheit, humidity and rain
- Must withstand vibrations and dust upheaval caused by wheelchair motion, especially over uneven/bumpy terrain

f) Ergonomics

- Should not require physical interaction, with the exception of head/mouth movement
- Should not require unnecessary physical stress

g) Size

- Total width of chair and device may not exceed 35" and should be significantly less to avoid unnecessary maneuvering by the user
- Additional dimensions of device and mounting arm should not cause unnecessary adjustments to normal movement (turning corners, etc.)
- Size and location of manual controls should not obstruct vision but should be large enough for easy operation
- Components of mounting arm must not interfere with chair's normal operations (i.e. Rotation of footrests)

h) Weight

- Device should not compromise the existing stability of the wheelchair
- Controls and housing must not add excessive weight to existing control rod

i) Materials/Aesthetics & Appearance

- Exterior materials should be weatherproof
- Simple user interface
- Uncluttered components

2) Production Characteristics

a) Quantity

- One unit needed for individual client

b) Target Product Cost

- Minimize overall cost, preferably under \$500

3) Miscellaneous

a) Competition

- Patent searches returned no similar devices (but components may be individually patented)

b) User Preferences—Control

- User prefers device be controlled using preexisting infrared signaling so voice commands can be used, however this possibility may not be feasible