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ElevAid

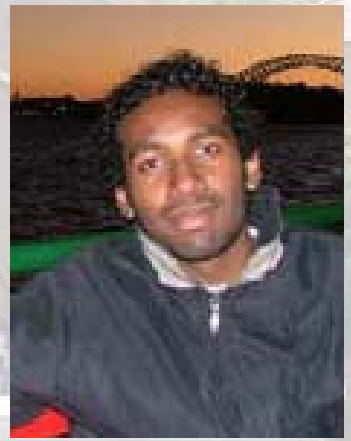
Engineering 210
Perspectives in Assistive Technology
Tuesday, March 11, 2008

Team

John Alabi is currently a second-year master's student in bioengineering. His area of concentration is medical device design and mechatronics. In addition to research and design work with orthopedic, laparoscopic, and cardiac rhythm management devices, he has done extensive work in the area of cardiovascular biomechanics.

Kent Anderson is a first year master's student in mechanical engineering, studying mechatronics and robotics. Prior to returning for graduate school, he spent 3 years in industry working on spinal implants and minimally invasive instruments, where he authored more than 50 patent applications.

Kevin Aberdeen is currently a second-year master's student in mechanical engineering with a concentration in design. Some of his past work included design projects with Deutsche Bahn, General Motors and Chevron.



David Quintero is a second-year master's student in mechanical engineering with a concentration in design and mechatronics. Some of his past work included design projects with DCI and Xerox.

Problem Statement

The goal of this project is to **improve elevator accessibility** for a Stanford student who is a powered wheelchair user. The solution must be cost effective and easy to implement

Video

Click to view video

Interviews

- Angelo – Wheelchair User
  - Has encountered many issues with elevators
  - Currently uses a custom table to slap buttons
    - Location of the buttons matters
  - Would prefer a solution that can be used for other purposes as well (light switches, etc)
  - Cannot void warranty on his current control system
  - Easy to use, not require much force or dexterity

Interviews

- Lisa – OAE administrator
  - 3 powered wheelchair users registered on campus (not including faculty or staff)
  - Most assistance programs not designed to change physical accessibility of classrooms
    - Taped lectures
    - Helpers
  - If cannot make classroom accessible, then they advise students to transfer credit from another institution
  - Growing population of wheelchair users will require better, more universal solutions

Design Needs

- Low cost
- Safe
- Not require modification to current elevator
- Easily attached to chair
- Capable of running off 12V or 24V car batteries
- Cannot increase the width of the chair, or interfere with getting in or out
- Simple to control
- Little maintenance

Existing Solutions

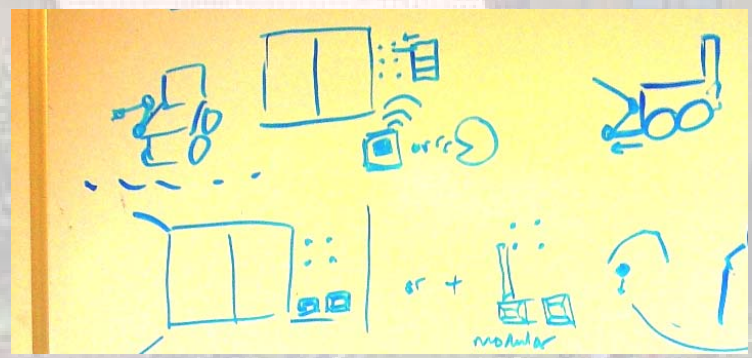
- Some new elevators equipped with floor pedal controls
- Custom table
- No other solutions available

Magnitude of the Problem

- Current campus powered wheelchair users have limited independence when navigating in and around the facilities
- This reduces their access to educational resources
- More than 100,000 people in the US use a powered wheelchair
- Growing number of campus users

Designs Considered

- Robotic arm
- Elevator modification
  - Voice activation
  - Improved floor pedal controls
  - Remote control interface
- Point and shoot device
  - Actuator
  - Projectile



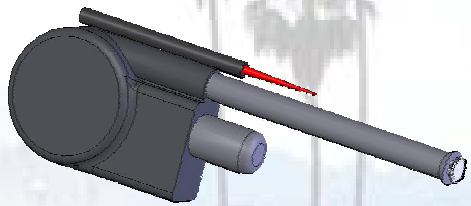
Design Analysis

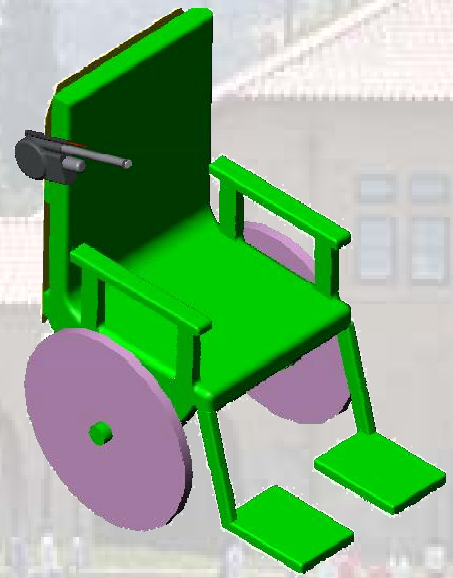
Concepts	Cost	Complexity	Time Frame	Ease of Use	Size	Aesthetics	Universality	Safety
Linear Actuator	4	4	4	3	3	4	2	3
Robotic Arm	2	1	2	2	1	2	3	3
Projectile	3	3	3	3	2	2	1	2
Modification to Elevator	1	3	2	5	5	4	4	4

1 = worst, 5 = best

Proposed Design

- Automatic car antenna controlled on a pivoting bracket
- 2 degrees of freedom
- 1 or 2 button control possible
- Laser pointer for target reference





Proposed Design

Click for animation

Proposed Action Items

- Perform design overview of the project
- Perform detailed design of the mechanical components
- Develop the electronics and control system
- Integration to the user's wheelchair
- Conduct field testing

Challenges

- User interface
- Making device modular, removable, secure
- Strength, reliability, maintenance of the antenna
- Learning curve
- Integration