All-Terrain Power Chair Fix
Project 1 for Annalee Hughes

All-Terrain Wheelchair Fix
Project 2 for Nathan Lamb

Beach Wheelchair
Project 23.1 for Danielle Giroux

Team 1
Stephen Elovetsky, Steven Rogers

Client Contact:

Susan Lucek
777 Tolland Stage Road
Tolland, CT
860-454-0448 (Home)
860-798-0402 (Mobile)
860-872-7000 (Office)
slucek@nerac.com

Janice M. Lamb
142 Barnes Road
Stonington, CT
860-535-3364 (Home)
860-460-1394 (Mobile)
860-245-5699 (Office/Fax)
janice.lamb@linde.com

David & Suzanne Giroux
53 Charlotte Drive
Tolland, CT
860-870-4249 (Home)
860-604-0893 (Mobile)
girouxs@sbcglobal.net
1 Statement of Need

1.1 Annalee

The all-terrain power chair that was built for Annalee Hughes did not function properly and needs to be fixed. The center of gravity mechanism that is used to keep the seat of the power chair level is not working correctly. As Annalee would traverse her yard, the seat would not adjust as it should, making the chair unsafe to use. Also, when Annalee would center the joystick to stop moving, the chair would continue to roll in the direction that she was moving before it would stop. This creates another safety issue in that if the chair doesn’t stop when necessary, it could cause damage to the chair, property, or worst of all to Annalee herself.

1.2 Nathan

The all-terrain power chair that was built for Nathan Lamb did not function properly and needs to be fixed. The seat does not respond properly to the movement of the joystick, thus making the power chair unsafe to use. The joystick is also a little flimsy for use by Nathan because he tends to be a little rough with things he uses because he does not fully understand that he is damaging them.

1.3 Danielle

The purpose of this design project is to create a wheelchair for Danielle Giroux that is specifically designed for sandy beach terrain crossing. Danielle is an eleven year old girl with Cerebral Palsy. She is very social and active both at home and at school. Her parents want to make it easy for her to go to the beach and be able to move freely and easily across the sand and even into the water. The wheelchair must be lightweight and able to go into establishments and restrooms. Danielle’s safety in this chair must also be addressed and safeguarded. The Giroux family will be able to spend many stress-free vacations at the beach with this durable wheelchair.

2 Introduction and Overview

2.1 Annalee

The programming that controls the center of gravity mechanism of the power chair is one of the major problems, thus it has to be analyzed and repaired accordingly. The issue with the brakes could be programming related or just a mechanical problem with the braking mechanism itself, thus both situations must be analyzed and fixed accordingly. The original code used to program the power chair will have to be obtained and analyzed for any mistakes or other bugs. If the original code cannot be obtained, the chair will have to be reprogramed from scratch to function properly. If the original code is found to have no noticeable errors, the wiring of the power chair will also have to be checked. Loose connections or miss wired pins on the microcontroller or other electrical component could be the true culprit behind the malfunctioning power chair.
The power chair was built for Annalee two years ago. Shortly after it was built and the problems were found, Annalee underwent surgery to correct the scoliosis that she developed. The surgery was successful and resulted in Annalee growing by a few inches. Being two years older, she is likely to have grown more as well. As a result, the seat of her power chair will need to be modified to fit Annalee.

The goal of this project is to get the power chair working correctly so that Annalee can use and enjoy it. She will be able to freely explore her yard independently and more safely.

2.2  Nathan

The goal of this project is to get the power chair working so that Nathan can use and enjoy it, allowing him to attend recreational activities with his family and being more independent while doing so.

The programming that controls the movement of the power chair via the joystick is one of the major problems. The power chair should move in the direction that the joystick is moved in. In its current state, the chair does not respond correctly, or at all, to the joystick movement, thus it has to be analyzed and repaired accordingly. Along with the programming fixes, the joystick that is used to control the chair needs to be upgraded to a nigger, more robust one that can withstand more aggressive handling.

The armrests of the seat do not recline with the back of the seat so if the seat is reclined, it is very uncomfortable for Nathan to use the chair. The seat for the power chair may have to be adjusted and/or modified to better fit Nathan, seen as he has grown since the chair was first built for him.

2.3  Danielle

The goal of this project is to design and build a wheelchair specially made for someone with Cerebral Palsy traveling across sandy beaches. This wheelchair does not need to be motorized as Danielle’s parents will primarily be pushing her across the sand. Due to the nature that wheels have to be to move across sand, Danielle will most likely not be able to reach the wheels, let alone push the wheelchair herself.

The wheelchair must be made out of a lightweight material for easy transport and use. The ideal material of choice for the framework would be PVC piping. Seeing as how Danielle’s parents don’t want a wheelchair that is made out of metal or that is overly flashy, the while PVC piping is ideal for aesthetic purposes as well.

The wheelchair must be able to collapse down to about 18 inches in order for it to be transported in the Giroux’s handicap accessible van. While in use, the wheelchair wheels must span out no longer than three feet in length so that Danielle has access to beach handicap restroom stalls. The chair seat has also been requested to be able to lower into the sand or water so that Danielle will be able to move back and forth between the wheelchair and sand/water.
Additional features that would like to be included are pockets on the sides or back of the wheelchair that would hold various beach supplies and toys. Other preliminary ideas for the wheelchair include an umbrella stand and emergency floatation devices.

3 Realistic Constraints

3.1 Annalee

Economic constraints for this project will mainly be the need to modify the seat and the possibility of having to replace the braking mechanism. The majority of the project will be programming related, thus the costs will be minimal.

In terms of sustainability, the chair should be adjustable enough to accommodate Annalee as he continues to grow. Once the power chair is functioning properly, it should need little maintenance while still lasting for many years to come.

3.2 Nathan

Economic constraints for this project will mainly be the need for a new joystick. The readjusting and/or modifying of the seat should not require too much in terms of new material so the overall cost of the project should be fairly low. In terms of costs for the client and his family, they will need to replace the batteries and maintain the functionality of the power chair after they receive it.

In terms of sustainability, the chair should be adjustable enough to accommodate Nathan as he continues to grow. Once the power chair is functioning properly, it should need little maintenance while still lasting for many years to come.

A primary environmental constraint is the proper disposal of the batteries. The batteries are rechargeable, however, even rechargeable batteries die eventually. The client and his family must know the proper way and proper place to dispose of the batteries when it comes time to replace them.

3.3 Danielle

An economic constraint in making this project is not knowing the budget provided to the group compared to the materials that is needed to build it. The basic framework should be relatively inexpensive; however costs of specialized wheels and seat elevation materials may be expensive.

The wheelchair must be made within certain specifications in order to be stored, transported conveniently in an automobile, and fit into a restroom at the beach. The size and width of the tires must also be factored into the rough overall dimensions of this wheelchair. The “accessories” to the wheelchair, like umbrella/umbrella stand and side pockets must be able to easily detach if the occasion calls for it.
The wheelchair must also have important safety features considered. It must have proper neck and body support for an individual with Cerebral Palsy, straps, and emergency floatation devices in case of getting swept out by rip tides.

4 Other Data

4.1 Danielle

Danielle’s parents requested that the wheelchair isn’t too flashy to attract too much unwanted attention so that other people don’t damage parts of the wheelchair. The Giroux family lives in Tolland, CT.

5 Questions

5.1 Annalee

1. What is our budget?
2. Can the programming problems be fixed? Does the chair have to be completely reprogrammed?
3. Do the brakes need to be replaced? If so, with what kind of brakes?
4. Can the tile mechanism be fixed through programming? If not can it be replaced, and if so by what?
5. Should the seat be made modular or more modular to accommodate the client’s growth?

5.2 Nathan

1. What is our budget?
2. Can the programming problems be fixed? Does the chair have to be completely reprogrammed?
3. What type of joystick should be used to best suit the needs of the client?
4. Should the seat be made modular or more modular to accommodate the client’s growth?

5.3 Danielle

1. What is our budget?
2. What will be the overall materials in the making of this wheelchair?
3. How will the wheelchair collapse?
4. What will be the properties of the specialized beach tires?
5. How will the wheelchair be able to raise and lower the occupant to the sand?
6. How will an emergency floatation device be implemented and deployed?
7. Does the chair need to be adaptable to Danielle’s continuing growth?
8. What should be the turning radius?
9. Will Danielle or her parents have any other additions modifications, and how will that affect the overall design of the wheelchair?