Project Statement

Assisted Walking Device

Team 3:
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Project for Annalee Hughes
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Statement of Needs:

In the case of ten year old Annalee Hughes, there is a need for a device which allows her to remain in the standing position for an extended period of time and trains her to walk despite her disabilities. Annalee is suffering from Cerebral Palsy and the client has expressed that the standing position is beneficial for her. Her ability to stand and walk unassisted is inadequate and she must lean on a stationary object to remain on her feet. Her lack of muscle control prevents her from maintaining the posture necessary for walking. After doing some research into existing devices such as the Great Strides Walker, the design group came to the conclusion that cost and functionality were major issues involved in the development of the device. Another issue that must be solved is the adaptability of the device to her changing body structure. Annalee is a young girl and her height and weight will be changing. The client has expressed the need for this device to last through this growth period while maintaining its safety and durability.

Another consideration is the propulsion method of the device. Since Annalee has a limited ability to propel herself, the device may have the option to assist her. She must lean on something while standing, therefore, her ability to move in all directions is limited. The client has explained that Annalee tends to lean in a forward direction and must use a stationary object to lean on. This makes moving backwards more difficult since the majority of the weight on the device will be on the front wheels. After meeting with the client and Annalee, the design team discovered that she tends to scissor her legs when attempting to walk. This tendency must be altered for her to achieve the ability to walk. The goal of this project is for Annalee to gain the ability to walk short distances without the assistance of others. Annalee’s condition requires many safety precautions for the device and will be a challenge for the design team.

Introduction & Overview:

Cerebral palsy can severely affect a person’s muscular control and coordination, making it difficult to perform basic tasks including fine motor skills, walking, and general balance (Cerebral Palsy). Thus, children with cerebral palsy are often mentally and emotionally developed, but cerebral palsy prevents them from physically responding. Annalee Hughes
reflects this condition—she can read and learn, and is adventurous. However, her body limits her from living to the fullest. The purpose of this device will be to give Annalee greater mobility and support in the standing position and train her to walk unassisted. This will increase her independency and ultimately improve her quality of life.

Currently available devices can support a walking child with cerebral palsy, but we have not come across a device that can offer easy mounting and independence from others (MKII Hart Walker; see Fig. 1). Also, the Great Strides walker is quite inelegant, with many exposed metal plates and harnesses that are both unattractive and may pose risks in case of tipping. The Assisted Walking Device will help meet these demands. It will support her body in the standing position, particularly her torso, align her legs in a more natural walking position, and give her the ability to get into the device unassisted. The Assisted Walking Device aims to be far more elegant and cleanly packaged, so it will allow Annalee to move about on her own.

![Image of Annalee with device](image)

Figure 1. The MKII Hart Walker

More specifically, the Assisted Walking Device will be easy to operate, and must have balance features suited to her body and her muscular control. For example, the device must be very stable to avoid tipping while simultaneously supporting her whole body, and needs to have simple controls that she can manipulate in a natural manner. Since this will not be a mass-produced device, it must be durable and easy to fix, using off-the-shelf components (harnesses,
structural pieces, etc.), and splash resistance will be required. Finally, since the Hughes family lives in Tolland in a hilly, rocky area, the client has expressed that the device only be used indoors. It must be transportable to other homes that may not be handicap friendly.

**Realistic Constraints:**

Because of the unique needs of children with cerebral palsy, the Assisted Walking Device must be suited to Annalee’s body and physical capabilities. In addition, as students we are constrained to fairly simple materials and manufacturing capabilities. While some of our designs may require design compromises based on the available resources, we feel that we can achieve the ultimate goal of making Annalee’s life easier.

Annalee is 56” tall, weighs 62lbs, and is 10 years old. She has a weak trunk, so she has difficulty sitting and standing upright. However, having a relatively normal walking ability will be important for her overall development and quality of life. Therefore, our device needs to accommodate her body and unnatural tendencies.

The Assisted Walking Device must be ergonomic for Annalee. Ingress and egress must be fairly simple and require a minimum of assistance. The controls need to be tailored to her level of motor control. For example, if a motor is incorporated, bicycle-type brake levers may be useful since they only require gross muscular movement, as opposed to buttons of joysticks. Most importantly, it must be safe for her to use. Critical parameters include: center of gravity, distribution of weight at the base, quality of the harness, and a sound electrical design. The materials will need to be strong and lightweight from a usability standpoint. They must be easy to work with and inexpensive from a manufacturing standpoint. Since children are exposed to many different environments, ability of the material to be sterilized is also important.

Mechanically, the Assisted Walking Device must be inexpensive and easy to maintain, with a modular design that can easily accept replacement parts. Finally, the layout and dimensions of her home will need to be carefully considered, so the final product is usable indoors. It must fit through doorways, be able to turn in small spaces, and take a minimum amount of storage space.
Other Data:

Annalee currently uses a specialized power chair. It is heavy, large, restricts her from many activities, and is difficult to use when going visiting grandparents and non-accessible homes. The power chair is controlled by Annalee using a large joystick. It was modified particularly for Annalee to support her upper body and neck. She is able to put minimal effort towards moving in and out of her chair and requires assistance to complete the transfer.

As characteristic of Cerebral Palsy, Annalee has poor trunk strength. She cannot walk unassisted, and tends to lean forward and scissor her legs. She can stand while leaning on something stationary, so our device must be designed around her specific size and the degree of lean. It must also be stable enough to support her without her exerting too much work.

Annalee lives on a hillside rocky farm in Tolland Connecticut. This limits her to her home, which contains some tight spaces and sharp corners. There is a variety of flooring in the home including carpet, hardwood, and tile, which the device must be able to negotiate.

There are devices on the market, such as the MKII Hart Walker and other Medical Walkers, but they would need to be modified for Annalee’s specifications and a power source would need to be added.

Annalee is a bright and happy young girl. The Assisted Walking Device would give her freedom to see and do things that are currently being restricted by her large specialized chair. She is an adventurous, willing to learn, and can read, write and respond appropriately.

Question:

Some questions regarding the Assited Walking Device include:

- What are the family’s expectations of the final product?
- What are Annalee’s expectations, what does she want to be able to do with the device?
- How will she get into and out of the device?
- What is the terrain of her house, both inside and outside?
- Where will the device be used?
- How will the device be designed for easy transport?
- How much is Annalee expected to grow in height and weight?
- How will Annalee be safely harnessed into the device?
- How long can Annalee stand for leaning on the device?
- How much weight can she support?
- Is there a need for a mechanical interface she can use; a joystick, lever, or twisting grip?
- What types of material are ideal to produce a lightweight, sturdy device that is able to be sterilized?
- What type of driving force will be used to power the device; a battery powered motor?
References:

    <http://www.mayoclinic.com/health/cerebral-palsy/DS00302>

    <http://www.greatstridesforcp.com/>