Joshua’s Jumper
Project Proposal

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Project for Joshua Bouchard
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Executive Summary

The client has expressed a need for a motorized device which will allow for a child with cerebral palsy to be free to remain in a standing position and jump for an extended period of time. The client, Joshua Bouchard, is a nine year old male with cerebral palsy and has difficulty maintaining his balance and standing under his own power. The device will be an adaptation of a popular baby-bouncing apparatus, and will be motorized to allow for easy transportation of Joshua. By allowing him to remain in a standing position for an extended amount of time, Joshua will be able to strengthen the muscles in his legs and aid him in learning how to maintain his own balance.

The device will be constructed out of a lightweight, yet stable, metal, allowing for ample support of Joshua, without compromising the safety and structure of the device. The harness will provide support to Joshua, particularly in the torso and pelvic regions to promote a proper standing position and allow him to strengthen his legs without having to support his entire body weight. The motorized portion of the device will have two sets of controls. One set will be used primarily by Joshua’s parents, where they will be able to remotely control the device. The other set of controls will be available for Joshua to use. These controls will ultimately help to adjust Joshua to those of a motorized wheelchair, which his parents hope to have him using in the future. There will be a safety switch on Joshua’s controls to ensure that they will remain inactive until he is ready to use them.

The projected budget for Joshua’s Jumper has been determined to be between $2600 and $2800. There are multiple components to this project, and the desire to have the device remotely controlled and motorized has increased the price dramatically. While the project may be costly, the effect it will have on Joshua’s quality of life will be greatly beneficial to both Joshua and his family. By including the motorized components into the design, it will allow Joshua’s family more freedom to move him about the house and other family outings. Also, by providing Joshua with his own set of controls, he will be able to improve his fine motor skills, with the goal of one day controlling his own motorized wheelchair. Both the controls and the adjustable, portable nature of the device will be incredibly beneficial to the client and well worth the time and effort required to manufacture it.
1 Introduction

1.1 Background

This project is for the client, Joshua Bouchard, a nine year old male with Cerebral Palsy. His medical condition stemmed from a brain injury at birth and has therefore made him completely dependent on assistance from his parents and caregivers. As is the case with many children with Cerebral Palsy, Joshua has both mental and physical limitations. He is unable to talk, and therefore has a more difficult time expressing his thoughts and emotions. It is clear, though, that he thoroughly enjoys being in a standing position and being able to use his legs to jump, when he is assisted by his parents.

Due to his physical limitations, Joshua is wheelchair bound and unable to support his own weight or maintain balance when placed into a standing position. Because he spends a vast majority of his time in the wheelchair, his core and leg muscles, which are required to stand and maintain balance, are not as developed. Aside from affecting his ability to stand and jump without assistance, Joshua’s condition also affects his fine motor skills and ability to manipulate controls with his hands. His therapist and parents have indicated that, ideally, Joshua would be transferred to a motorized wheelchair in the future. This would require a great deal of therapy and practice, but could be accomplished over time.

1.2 Purpose of the Project

The purpose of this project is to provide Joshua with a means to have more freedom to do what he loves, while keeping him safe and allowing for muscular development and coordination. The client has expressed a desire for Joshua to have the ability to remain unassisted in a standing position, while providing him with enough support to allow him to jump and bounce on his own. The client has also stated that it would be beneficial if the device were motorized to allow for easier transport both around the house and wherever the device is taken. Therefore, a device that is both remotely controlled and easy to transport will make things easier on the parents and caregivers. This machine could make Joshua at ease with the idea of using a motorized wheelchair in the future. The device must be strong enough to fully support Joshua and...
adjust to any growth in height or weight, while remaining lightweight and portable. In this way, both Joshua and his entire family will have more freedom.

1.3 Previous Work Done by Others

1.3.1 Products / 1.3.2 Patent Search Results

There are several products that facilitate the jumping and standing of babies, while keeping them secure. One of these is made by Amby and it consists of a frame with a spring and attached harness. However, products like these do not support weights over 29lbs and are intended for children under one year of age. Joshua’s length and build are much different from the younger children who use these products. Similar to this, there are baby bumpers that are fastened in doorways. Evenflo has created models such as “Johnny Jump Up”, which is a portable device that clamps onto doorways, utilizes springs, and has a seat frame that completely surrounds the baby. It is complete with a removable, washable seat pad, and adjustable straps to account for growth. Again, this product could not be used for Joshua because it has a maximum weight of 24lbs and is intended for babies 4 months old to walking age.

Figure 1: Amby Baby Bed Accessory with Metal Cross Strut Frame.

Figure 2: Evenflo Johnny Jump Up
For the standing, motorized part of the device that will be created, there are some previous inventions that have aspects desirable for this project. AbleData was used to search through these products, where the Rifton Large Dynamic Stander, model K170 (Figure 3), was found. It is a mobile device that fully supports the individual with body supports, straps, fleece, and a seat pad. The idea of the platform underneath the individual with a frame with four wheels is a concept that may be used in the production of Joshua’s Jumper. The Rifton is a stander that can be used with fully dependant individuals and also with ones that have some weight bearing abilities. A difference in this product and the one that will be created is that Joshua’s legs need freedom to strengthen them, rather than restrictive braces. This device can also carry a larger amount of weight (much greater than Joshua, in fact) which would allow him to grow into it. The price is $2147.00 for the Rifton.

![The Rifton Large Dynamic Stander](image)

Figure 3: The Rifton Large Dynamic Stander.

The Lifestand Compact, LSC, is a motorized wheelchair that allows the user to sit or stand (with power operated changes), and can be for children or adults. A stiff back frame provides the supine support for the rear wheel drive machine. This is a very expensive product, at about $22995.00, because of its compactness, power, and ability to change positions of the user. Mobility4kids makes a product called “The Go-Bot”, which is another motorized device that is specifically for children and allows them to sit or stand. It can be operated by children from 1 year of age or older, but under 43 inches tall or 100lbs. It can be used both indoors and outdoors on flat surfaces and has front wheel drive. A joystick or series of switches are used to operate the Go-Bot, with an
emergency remote for an adult to use to shut off the power. This device has many of the features necessary for Joshua’s Jumper, except that he would be too tall and too restricted (unable to jump). Additionally, it is not necessary for him to be able to sit in the device, which will allow for the design to permit jumping motions. The Go-Bot is priced at about $5315.00.

Figure 4: Mobility4kids' Go-Bot.

There are no patents equivalent to what this group is trying to design. The closest that could be found were for infants to toddlers, and they were not motorized. Walkers are similar instruments; however, they do not provide the ability to jump that Joshua will have with this powered jumper. PatentStorm shows that Mattel, Inc. holds the patent on a free-standing jumping design that is somewhat similar to the group’s design. The Mattel design includes an unattached frame that supports a seat and resilient members and sleeves at the front and back sections of the device to maintain stability. The position of the seat is adjustable with the resilient members that attach to it and the support frame. This design is similar to the team’s design in that it provides a supporting frame, thus making it independent of being mounted on a door frame like other baby jumpers. However, this design by Mattel is very different from what the team is creating. This senior design project differs in the replacement of the seat with a harness, which will secure Josh better than a seat and provide his legs with more degrees of motion. Josh’s Jumper will be much larger in size compared to Mattel’s
design because Mattel’s device is meant for infants. Josh’s jumper will also be motorized with a platform that helps to keep Josh from any debris he may step on in the different environmental surfaces his jumper may be placed on. Unlike an infant who may not be able to support his/her weight, Josh can support his body with his legs therefore the team’s device will also allow Josh to perhaps exercise his lower limbs as well as provide him with entertainment.

2 Project Description
2.1 Objective

The primary objective of this project is to design and create a device that will allow the client, Joshua, to have the freedom to remain in the standing position to jump and bounce for an extended period of time, without assistance from anyone else. As his legs and core muscles develop and strengthen, Joshua will be able to rely more on his own strength to remain upright and allow him to gradually increase his level of coordination. As his fine motor skills develop, a secondary objective is to provide Joshua with the opportunity to control his own movement through the use of a joystick. By allowing him to have control over the device, Joshua will be able to experience more freedom to move around his environment. This practice will also prepare him for the use of a motorized wheelchair which the family hopes to eventually have for his use.

The design team has determined that the device will model popular baby-bouncing designs, similar to the Amby and Evenflo products. This design will be modified to account for Joshua’s height and weight. A full torso and pelvic harness will be used to support Joshua in an upright position while he remains in the device. This harness will be made adjustable to account for any growth Joshua may experience over the next few years. From this harness, adjustable, elastic straps will be suspended from the lightweight, metal frame. Ideally, the frame will be constructed in the most stable, yet efficient way possible. It will not exceed the dimensions of standard doorways, and will be stable enough to withstand the stress caused by Joshua’s jumping. The frame will then be made easily adjustable and portable for easy transport by the family. The entire apparatus will then have the option to be placed on a movable platform. When secured to this platform, either Joshua or his parents will be able to control the movement of the
device and give him the freedom he desires. It has also been noted that the client desired a way in which Joshua's brother could accompany him on the motorized device, through the use of an attachment similar to a sidecar. By designing the device in this manner, Joshua and his family will be able to use and enjoy the jumper for many years into the future and use it for both Joshua’s enjoyment and physical and psychological development.

To complete the project, it will be divided into various segments from which it will be easier to manage and complete. The design, budgeting, construction, troubleshooting and testing will administered between the team members to better allocate time and resources to each member’s strengths. The design team will implement these steps to take this project from a collection of ideas, to a finalized device that will provide Joshua with more freedom to jump and move about his environment.

2.2 Methods

2.2.1. Determining Joshua’s Needs and Limitations:

The design team will contact and arrange a meeting with the client as soon as possible. During this meeting, the extent of Josh’s disability will be determined and documented. Everything from his height and weight, to the dimensions and features of the client’s house will be discussed. The team will also be able to determine Josh’s level of muscular control and coordination, which will help in the designing of the device. It is important to obtain a good understanding of Josh’s physical and mental limitations to ensure that the design will account for each and help to keep him safe while using the device. This will also be an excellent opportunity to discuss and see any devices that Josh currently uses, and gain an understanding of which aspects the clients like and dislike about each device. From this meeting, the design team will determine what the client’s expectations and desires are for the final project. These desires will be taken into consideration and every effort will be made to exceed the expectations of the client.

2.2.2. Composing the Project Statements and Specifications

The team will compose the Project Statement and Specifications using the information gathered during the meeting with the client. The project statement will
outline the purpose of the project, potential design ideas, constraints and other considerations to be examined as the project progresses. The specifications will give a general picture of the design team’s ideas and approach toward designing the device. Both the project statement specification may be subjected to updates when necessary to present a better overview.

2.2.3. Research Optimal Building Materials and Create CAD Drawings

The team will research different building materials for each component to deduce the most optimal material combination for the device. SolidWorks 3-dimensional CAD drawings or similar programs will be used to assist the group as they design the most optimal build that fits the specifications provided by the client. Stainless steel or aluminum rods shall be used to build the framework for the device and the harness will be purchased. Wheels, motors, and circuits will be purchased from commercial sources to ensure better quality of the finished product. The materials in direct contact with Josh’s skin will be carefully chosen to avoid causing any discomfort to Josh. The client has no known allergies but the team will take extra precautions to ensure that the device will provide the most comfort to the user.

2.2.4. Consult the Client, Faculty, and Other Advisers

The team will frequently consult the client to keep the family updated on the proceedings of this project and the frequent communications will also allow the team to provide the most satisfaction to the client. During the troubleshooting phase of the prototype, the team will increase the amount of meetings with the client, if possible, to provide more opportunities to make the essential changes to the device to produce more satisfaction. The senior design group will consult faculties and advisers whenever needed to get the necessary information and to improve the effectiveness of the device. Additional research will be done to ensure that the best job has been done for the client. If necessary the team will consult with Josh’s doctors and physical therapists for more information that may help produce a device most suitable for Joshua.

2.2.5. Construct Individual Components

The team will construct the device from commercial parts and materials, but most of the connections between the parts will be done manually. Adjustments and
Modification of the commercially purchased products will also be hand done by the team if deemed necessary (for example, the harness).

**Frame:** The frame of the device will have either a pyramid or rectangular shape that will support both the harness and Josh. Because Josh is around 4 feet tall and weighs approximately 32 lbs, the dimensions of the device will be around 33 x 33 x 64 inches (L x W x H). This dimension will satisfy the space constraints in Josh’s home as well, including doorways and other obstacles. The device will weigh around 100 lbs, the framework should be able to support upwards of 110 lbs, and the harness straps shall support up to 50 lbs. The fifty pounds takes into account just Josh’s current and future weights. The framework will support an increased weight in order to provide for the possibility of adding on Josh’s younger brother. The device shall have either a removable or permanently attached platform above the wheels for Josh to stand and jump from regardless of environmental surfaces. The platform should add more stability to the device to lessen the chances that the device will topple over or sway. Additionally, weights may be applied to the frame when needed to improve the stability of the device. The edges of the device and the platform shall be rounded off or padded to ensure that Josh’s family, especially his little brother, and the family pets will not get hurt being around the device, which will be fairly large in size. Handle bars may be another addition to help Josh maintain proper posture and stability. The team has considered constructing the platform from an elastic material that should help Josh jump better and cushion him as he lands.

**Harness:** The harness will be adjustable in length to prolong the useful period of the device as Joshua continues to grow. The harness will encompass Josh’s torso with addition leg straps to fully support him and help Joshua to maintain an erect posture while he uses the device. The supporting straps will hook to the harness and the device’s frame at multiple places to ensure maximum stability and safety for Joshua while he is using the device. At least 2 straps will always be connected to the harness at all times with the option for more or less as Joshua’s physical abilities improve. The rear section of the harness that supports Joshua’s back may be stiffened to help Josh maintain a straight back posture. Joshua’s parents have expressed how he is able to support his own head and neck, but the team may develop a detachable neck support
that can be attached to the harness to provide increase comfort during long sessions of usage.

-Other: The device will be motorized to allow easier movement of the device from one place to another. The motor and its components will most likely be attached to the bottom of the platform and in a protective case to avoid accidental tampering. The device can be used on grass as well as sand depending on the environment. The wheels will need to be modified for them to work on multiple surfaces or there may be multiple sets of detachable wheels where each set is for a specific surface. A remote control and supporting technology will be purchased to permit the emergency operation of the device by the parents. Some sort of joystick control will be bought, attached, and wired to allow Josh to control the machine once he is physical and mentally capable.

2.2.6. Construct Prototype

The team will construct the prototype based on the most optimal design that will be selected from at least four possibilities. The prototype will be constructed as soon as the major components are ordered and the project has been approved. Trouble-shooting will take place during the construction of the prototype and adjustments and improvements will be made as necessary. The prototype may lack some comforts such as extra padding or rounded edges due to its temporary usage time for testing and trouble shoots reasons. The components and accessories of the design will be subjected to change as problems or unforeseen difficulties arise. The prototype will become the final device when all problems and issues have been dealt with and properly fixed.

2.2.7. Construct Final Project

The team will use the prototype as the final device if it survives the testing and trouble-shooting phase unscathed. However, if the prototype is damaged or destroyed during trouble-shooting, then a brand new device will be constructed for the final product. The final device will also be properly tested once again to ensure that everything is in order before it will be presented to the client.
### 3 Budget

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Table 1: Complete Budget Estimates Including Applicable Shipping Costs.
This budget includes researched materials and parts found on the internet. The choices made for these were the best that were found at this time; however, other products that are cheaper or better may be later purchased. Because we have several design ideas, some of these materials may be found unnecessary in the final prototype. The total price was scaled down to 35% of the total because the prototype is more expensive than the product would be to produce again. The final product could cost less than $1000, which could be attractive to the market. This product does not appear to exist explicitly, and there could be a need from the disabled community. Other families who have children with Cerebral Palsy that also have leg strength and movements but limited upper body function may want a product that is transportable and will allow their child to be comfortable and preoccupied while surrounded by their family.

### 4 Conclusion

The goal of this project is to provide Joshua with the ability to stand and jump on his own once his parents assist him into the device. He will be able to use the product over long bouts of time throughout the day, as he desires, due to its comfort and fit to his body. This will allow his parents to spend time with him while he is doing what he loves and also while preventing physical strain on the bodies of his mother and father. Ideally, the device will have a way in which Joshua’s younger brother can ride along, to provide something the boys can do together. This idea was suggested by Josh’s physical therapist, who believes it will be nice for the brothers to have some common ground. The device will have functionality both inside and outdoors so as to give Josh more exposure to elements besides his home. The family has indicated that they have the space for this device in the house, including storage when it is not being used. They would like it to be able to travel with them, and do not mind if this means it will require some assembly. These are other qualities of the device that make it unique, in addition to the fact that there are currently no jumping devices for disabled children.

The bulk of the budget will be spent on the motor, frame components, wheels, and controls. Having to purchase and wire both a joystick and a remote control will add greatly to the cost of building this prototype. However, the overall cost is predicted to be in an acceptable limit while taking into account that unknown problems can occur with
the design in the future testing. This product could be desired by other families with children who have disabilities that do not limit their leg movements. Because the market tends to only have products for sale for younger children, a piece of equipment that would suit a larger, older child with Cerebral Palsy or other disorders could be valuable.