602 South Trenton St.
Ruston, LA 71270

7 October 2011

Shared Light Foundation
April Honaker, Executive Director
3693 Baltimore Avenue
Delta, PA 20456

Dear Mrs. Honaker:

I have enclosed my proposal so as to seek funds from your organization and carry out research to find alternative methods to operate wheelchairs for physically disabled people. The proposal contains the current situation of the problem, stepwise description of my project plan with a Gantt chart, costs and benefits analysis, and the qualifications that prove me worthy of this research.

SLF has a history of providing financial support to researchers with potentially brilliant ideas that may help a large community in the future. It is for this reason that I have addressed these documents to you, and I am confident that, if given a chance, my research will be able to help hundreds of motor-disabled people.

My research will focus on three potential methods to operate an automated wheelchair: an eye tracking system, brain-computer interface technology, and voice-commands. These methods will allow freedom to their movements and reduce the risk of danger when left unattended in the wheelchair.

I would like to request that you look over my proposal and contact me if you have any questions. With your help and support, we can work together to make this world a better place to live in for disabled people around the globe.

Thank you for allowing me to present this proposal. You can contact me by phone at (443)232-5432 or email at sbk006@latech.edu. I look forward to hearing an affirmative response from you.

Sincerely,

Sanjog Bikram KC
Student Researcher

Proposal to Find the Best Method to Operate Automated Wheelchairs for the Physically Disabled

Introduction

The purpose of this proposal is to request financial support of $2800 to conduct research to find the best method for operating automated wheelchairs for physically disabled people. The idea of this research is to provide freedom to disabled people in the field of locomotion. Success in this research would mean a revolution in the field of medicine and engineering, and a step to help the thousands of disabled around the world.

Upon acceptance of this proposal, I plan to use carefully selected criteria (mentioned later in the proposal) to compare three methods to operate the wheelchairs: an eye tracking system, brain-computer interface technology, and voice commands. In the end, I will determine the best method to operate the wheelchair. This proposal will provide the background of the current situation, and present a project plan along with a timeline in the form of a Gantt chart. I will also provide an estimated budget for this research and my personal qualifications.

Current Situation

According to the disability statistics report of 2010, 6.5 million Americans were reported to have a severe disability out of which 12.9% of the population had ambulatory disabilities ("ABA Disability"). To aid in the movement of disabled people, engineers have been trying to develop efficient wheelchairs for years. Today, with the use of advanced technologies, wheelchairs can be operated through the use of joysticks. However, these wheelchairs are limited to those who can use their upper extremities. Wheelchairs are still non-advantageous to people with severe physical disabilities (such as loss of ability to control movement), and mobility disabilities (such as arthritis and osteoporosis). In addition, people who have acquired disabilities (such as multiple sclerosis and spinal cord injury) that have resulted in no upper extremity movement are unable to make use of wheelchairs unless provided assistance. It is therefore necessary to develop a method to allow those groups of disabled people to use wheelchairs on their own.

Efforts have been made in the past to develop wheelchairs mounted with robotic arms, but these showed very little commercial success due to poor usability (Alqasem). Another project included the use of tongue motion to operate the wheelchair. However, the navigation time was three times longer than using a joystick (Huo). My research will consider the eye-tracking system, brain-computer interface technology, and voice commands to operate the wheelchair. This research attempts to evaluate three innovative designs, ultimately providing an intelligent system to improve performance and usability while maintaining the cost. Figure 1 shows a bar diagram indicating disabled people requiring assistance in 2005. My research will also aid in lowering these numbers as it opens the door for self-sufficiency and reduces reliance on caregivers.

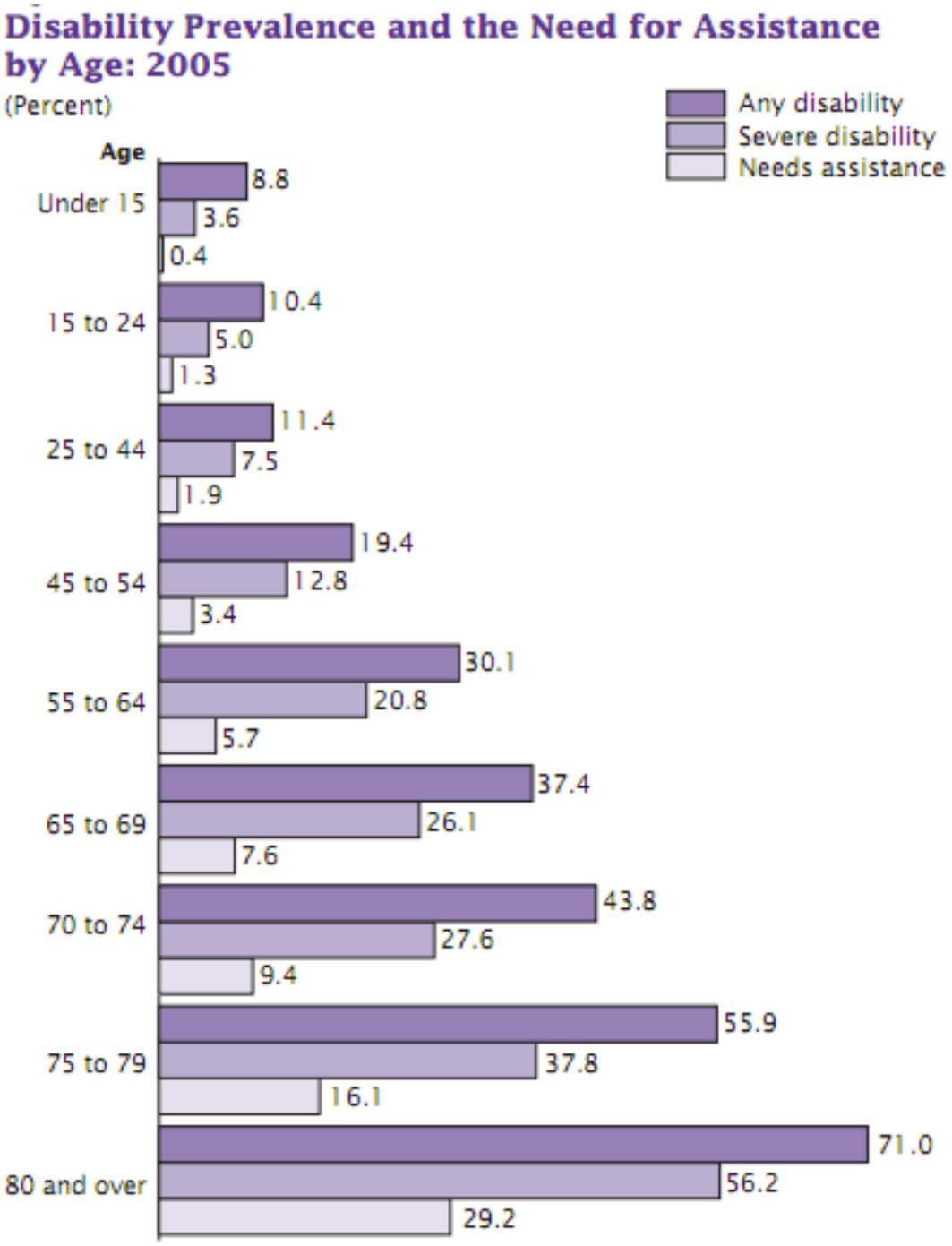

Figure 1

Source: U.S. Census Bureau, Survey of Income and Program Participation, June–September 2005

Figure 1, clearly shows that the age has a remarkable impact on the health of an individual. With age, more people are prone to disabilities. This means that at one point in our lives, we can expect to suffer from some form of disability or know someone who does. It is almost impractical to have someone at all times to assist the disabled, and it

sure is a burden at times. My research also aims to reduce the burden of providing care by providing an insight to a better life for the disabled and those who care for them.

Project Plan

Below is the list of tasks that I will follow to complete my research and find the best method to operate an automated wheel chair for the physically disabled.

Task 1: Identify the proposal topic and the problem through research

During the course of developing low cost prosthetic arms in the Center for Biomedical Engineering and Rehabilitation Science (CBERS), I came across an idea to help not only those who require an artificial organ, but also the disabled who can barely make use of their body. I researched on the development of the wheelchair from the early 1500s and quickly generated ideas to use existing highly advanced technologies to change the way wheelchairs work today.

Task 2: Identify and describe the three potential methods

My research will evaluate an eye-tracking system, brain-computer interface technology, and voice commands to operate the wheelchair. The eye-tracking system tracks the movement and the size of the pupil to locate the exact viewpoint of the user (Tabaoda). The brain-computer interface is comprised of Electroencephalograph (EEG) sensor electrodes that pick up neural activity from the scalp and send electrical signals to the computer to determine the exact location of the initiation of brain impulses (Sullivan et al). In other words, the computer translates the brain's activity into usable directions. Voice commands will involve the use of microphone to send digital signals of certain wavelength and frequency to input a specific command. The three methods show similarity as they operate through signal processing. The signals generated from these devices will be processed and programmed to control the movement of the automated wheelchair. I will do further research to better understand the intricate workings of each.

Task 3: Establish the criteria by which to compare methods

The methods to operate the wheelchair will be compared using the following criteria:

- **Cost**
  How affordable is the method? The goal is to identify an innovative technology that has the potential to be affordable to most of the citizens in United States. In the long term, it should be affordable globally**.** The affordability of the technologies shall be determined by comparing each of the methods to the others under consideration and the existing commercial technologies in the market.

- **Ease of use**
  How easy is each method to use? People should be able to use the method to operate the wheelchair without any difficulty. The wheelchair is designed for people with complete motor disabilities. The easier it is to operate, the more

effective will it be. To evaluate this criterion, I will consider usability tests and compare the results to each of the potential methods.

- **Ease of implementation**
  How well can it be implemented on a large scale? The product should be available to people around the globe in the long run and the degree of accessibility to people around the world will depend on the implementation of the product. Therefore, to determine this criterion system integration, scope analysis, requirement analysis, user policies, and delivery shall be taken into account and evaluated to each of the potential methods.

Task 4: Submit the Proposal

After completing the proposal, it will be submitted to Ms. Honaker, executive director of the Shared Light Foundation on 7 October 2011.

Task 5: Compare methods using the criteria

A weighted decision matrix will be used to compare the proposed methods. The methods will be compared to each of the 3 criteria, and the best method will be determined. The cost of operating the wheelchair using each of the methods will be given a top priority because the research is not targeted to a specific group of people, but disabled people from different backgrounds. If the method I ultimately recommend is not accessible to the intended users, this research will have little value. Second priority will be given to the ease of use of the method to operate the wheelchair. Any method not able to meet the desired degree of user-friendliness may not be suitable to use. Third priority will be based on implementation of the method on a large scale. The technology should be able to flourish at a large scale so as to help millions of disabled around the globe.

Task 6: Develop the analytical report

Various sources from the Louisiana Tech Prescott Memorial Library and credible online materials will be used to develop the report. The report will also contain personal opinion and interviews of Biomedical engineers and professors of Louisiana Tech University. I will visit the writing center for assistance related to writing and compiling the materials for the report.

Task 7: Submit Rough draft of the technical report

In order to ensure professionalism in the report, a rough draft will be submitted to Ms. Honaker through turnitin.com on 7 October 2011.

Task 8: Submit Final Report

After the review of my rough draft, any existing errors will be eliminated and corrected. I will ensure that the best information on the topic is available for the reader. All the findings will be documented and submitted to Ms. Honaker on 26 October 2011.

Gantt Chart

Figure 2 below is a Gantt chart that illustrates my project schedule.

	Project Schedule						
	19 Sep	25 Sep	1 Oct	7 Oct	17 Oct	24 Oct	26 Oct
Task 1: Identify proposal topic and problem through research							
Task 2: Identify & describe three potential methods							
Task 3: Establish Criteria by which to compare the methods							
Task 4: Submit Proposal							
Task 5: Explain how to compare methods using the criteria							
Task 6: Develop Analytical Report							
Task 7: Submit Rough Draft of Technical Report							
Task 8: Submit Final Technical Report							

Figure 2: Gantt Chart

I will make sure that I complete all my tasks in the schedule mentioned. Should there be a need to make any changes, I will request approval from SLF with detailed information on the necessary changes.

Costs and Benefits

Upon acceptance of my proposal, the monetary funding that I will receive from your organization will be spent as described in Table 1 below. Based on the previous researches that I have conducted, I think 50 hours should be dedicated for this research. I will require a laptop, printer, and a few other supplies to conduct this research. Further, a small amount of capital will be used to print and bind the hard copies of the outcome of this research.

Project Budget			
	Cost/Hour	**Quantity**	**Total Cost**
Labor	$36.82	50	$1,841
Computer		1	$750
Paper		1	$26
Binding		1	$3
Printer		1	$200
Ink		2	$180
Total Cost of the Project			**$3000**

Table 1: Project Budget

The hourly wage that has been mentioned in the table is the average pay for an entry level researcher in the field of Biomedical engineering. To ensure quality real-time feedback when using huge engineering programs such as LabVIEW, MatLAB, MathCAD a computer of higher processor (preferably 2.0GHz or higher) is needed. So, a computer in the above mentioned price range would be fit for the project. A high quality laser printer (price ranging from $150- $200) and a few refill inks will be required to print out the results of the research, and papers and binders will be required to present the final hard copy of the report. The total cost of the project would be $3000, which is a reasonable cost for this type of highly advanced research.

Qualifications

I am a junior Biomedical Engineering student at Louisiana Tech University, which is one of the best schools in United States. I have also been awarded the Tech's Best Scholar award for the year 2011- 2012 for my fine academic record. I currently work as a research assistant at the Center for Biomedical engineering and Rehabilitation Science (CBERS) under one of the reputed professors of the university – Dr. Alan Chiu. We are currently working on developing low cost prosthetic device for underdeveloped countries. I have also worked with professors and students from overseas to make use of sustainable energy to meet the demand of energy in the underdeveloped areas of the world. In addition, I did an internship last summer with Purdue University in the area of neural signal processing, which will be very helpful in this research. I'm confident that I'm qualified to carry out this research successfully.

Conclusion

As I have mentioned in the current situation section of this proposal, there are a great deal of disabled people unable to perform tasks as simple as locomotion. It is very important that we take this step to uplift their quality of life so that they feel worthy of living. This is a small step for a better future. With your help and support, we can make a difference and provide information to the industries around the world so that they can help the disabled in every way possible.

I appreciate your organization taking time to look at my proposal. If you have any questions, please contact me by phone at (443)232-5432, or by email at sbk006@latech.edu.

Work Cited

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