Accessible Easel

By

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Executive Summary:

This client is a 44 year-old man with cerebral palsy, dysarthria, moderate cognitive impairment (MR), visual acuity trouble, limited dexterity, and limited upper body movement. He requires the use of wheelchair and is an avid painter. His condition does limit his range of arm movement, which in turn limits the amount of area he can cover while painting. He desires a device that will allow him to expand his artistic talent by assisting him in covering larger canvases.

In order to satisfy this clients request, it has been determined that a movable easel will provide him with a better platform to paint from. The device will be electromechanical in nature and provide the movement of the canvas through linear actuators. The movement will be controlled by a joystick, and the entire easel will be small and lightweight in nature for easy storage. This devise will provide the client with the added canvas accessibility that he seeks.
Statement of Need:

My client requires a painting easel that will adjust its position in order to be more accessible. The client is a 44-year-old man with cerebral palsy, dysarthria, moderate cognitive impairment (MR), visual acuity trouble, limited dexterity, and limited upper body movement. His mobility is controlled by his wheelchair, which limits the height at which he can paint.

Although this client has lost much of his ability to move his upper body, he is a very talented painter. He specializes in painting large canvases in acrylic paint. Since he has been painting at the ATCO sheltered workshop his talents have been discovered and enriched. While his disability does not inhibit him from painting they have limited him to smaller canvases due to his limited arm movement.

Cerebral palsy is a condition caused by permanent brain injury occurring before, during, or shortly after birth. The effect of cerebral palsy, or CP, is characterized by lack of muscle control and body movement. While it is not a progressive disease of the brain, the effects of CP can change gradually over time resulting in sensory deficits and impairment to the intellect. There is no cure for CP, but it is possible to live a successful life with it. This client also lives with the effects of moderate cognitive impairment (MR) and dysarthria, which is a weakness or paralysis of the muscles used for speech. A person with dysarthria may speak in a whisper, have slurred speech, or “talk through their nose”.

Market research done for tables or easels designed for handicap people in wheelchairs produced many different options. Most of the options found were of the adjustable table format. Accessible Designs / Adjustable Systems Inc offer two models of a rehab dining table that adjust their height accommodating between two and four people. The smaller of the two versions is adjusted by a manual hand crank and is priced around $900, while the larger table is adjusted mechanically and costs around $1700.

A similar table is offered by G E Miller Inc., this model can accommodate up to four wheelchairs and adjusts between heights of 24 and 30 inches in height. The up and down movement of the table is produced by hydraulics, and controlled by the simple use of a handle. This table is a valid solution for larger studios and sells for around $1500.

Market research into the easel format did not produce as many valid solutions to this problem. While many easels are produced, there are a limited number that will adjust or conform to a person in a wheelchair. Most easels have obstructions regarding to the amount of leg room underneath the easel. The most common solution to this problem is a table top version of the easel, which did little to aid the user in the amount of area that could be covered.

One easel manufactured by Extensions for Independence can tilt up to 15 degrees towards the user and 45 degrees away from the user. This proves beneficial in aiding the user in moving the canvas front to back, but does little to aid in the up or down, and side to side movements. This model is called “The Dreamer” and can be purchased by the manufacturer for around $3000.

A search of the National Science Foundation website revealed several different projects that have been designed to aid people in wheelchairs. In 1995 there were two different tables designed that allowed the user to
adjust the height to suit their capabilities. Both the tables moved up and down while one of them also adjusted its tilt to provide the user with a better angle of tilt.

In 1995, there was a tilting easel designed at Manhattan College that placed the easel on a swivel mechanism that provided up to 45 degrees of tilt. Another moving easel was designed at the University of Connecticut, this project was designed to move a canvas up and down while also providing a range of tilt. The easel was produced in 2000 and produced the movement through a moving frames design that adjusted to the size of the canvas. One problem with this design was the lack of leg room that was needed by the client.

Project Description:

Objective:

The objective of this design is to provide the client with a easel that will allow him to paint larger works of art. The devise will move the canvas horizontally to enable the client to stay in a stationary position. It will also tilt the canvas towards and away from him, giving him the ability to paint at an angle that best suits him. The angle of tilt will also allow the client to see his canvas from different perspectives, which can be important when creating larger works of art.

The easel will consist a electromechanically driven easel mounted onto four detachable legs. A linear actuator with a 12-inch stroke length will power the horizontal movement, while the degree of tilt will be driven by a linear actuator with a 8-inch stroke length. The user will control the motions via a joystick, which will be mounted on the easel.

Methods:

A joystick will control the easel, which will move in a horizontal motion, while providing a degree of tilt. The joystick will relay the signals to a microcontroller, which will process the signal and produce and output that will control the two linear actuators. These two actuators will move the painting easel to the desired location and will stop when the input signal is terminated. The actuators have internal limit switches that will stop the movement once they have reached a maximum distance. This will be used as a safety precaution as to not damage the easel or anything in close proximity.

The linear actuators are going to produce the power and movement for the easel frame. The movement will be produced horizontally across two linear slide rails, which will support the weight of the easel frame and the
components for its tilting motion. A linear actuator placed at the base of the easel frame will directly produce the vertical tilt of the frame. The range of motion of the horizontal movement will be controlled directly by the range of the actuator, while the degree of tilt of the frame will be controlled both by the range of the actuator used and the geometry at which it is attached.

The power supply for these components will come directly from a 120VAC wall outlet, and will be converted via power supply to the necessary DC voltages. This will ensure that the user will have a constant power supply without worrying about battery life.
Figure 2: Front view
Easel Frame

Linear actuator
(8" stroke length)

Moving Platform

Bearing Pillow Blocks
Guide Rails

Figure 3: Side view

3'

Range of motion
12"

1'6"

Actuator Stage

Linear actuator
3"
Figure 4: Top View without easel frame

Budget:

2 Support Rails $300.00
2 Bearing Pillow Blocks $100.00
2 Linear Actuators $300.00
Machine Shop Costs $100.00
Microcontroller $20.00
Joystick $50.00
Amplifiers / Electrical Components $50.00
PCB Board $60.00
Total $980.00

Timeline:
Conclusion:

The “Accessible Easel” painting easel system will provide the client with the ability to access large works of art by positioning the canvas at more accessible locations. The easel will move the canvas horizontally as well as tilt it about a vertical axis. The control for the easel will be simple, and the position of the easel will be monitored by limit switches. Since similar devices to this easel exist on the market today, there is a very high possibility that this product will be successful. The cost of this project will be considerably less than the retail products, allowing us to believe that this project could prove successful on the open market. The amount of movement that this easel provides will prove enough for the client to better access his works of art and in turn improve his quality of life by allowing him to participate in an activity that he enjoys.