

# Nik Albarran, Angela Ha, Abby Rice, Audrey Sedal MIT Course 6.811 (Principles & Practices of Assistive Technology) Project How-To

## Project Summary:

Our client battles quadriplegia and multiple sclerosis. She is unable to move her body below her neck and lives in a single family house in the boston area. A professional, daily personal care assistant and her family and friends help our client conquer each day. Additionally, she utilizes many assistive technologies to control her household things such as her computer, windows, doors, and lights.

Our client's enthusiasm for these technologies emanated the first time we met her; however, there was help missing in a particular area of her life--her hobbies! Before her disabilities, she enjoyed bird watching on a weekly basis. Presently, neither her help from others nor her power wheelchair and voice controlled Environmental Control Unit allows her to hold and adjust binoculars. This semester, we tackled this problem of our client's inability to bird watch with a level of control and independence.

## Design Overview:

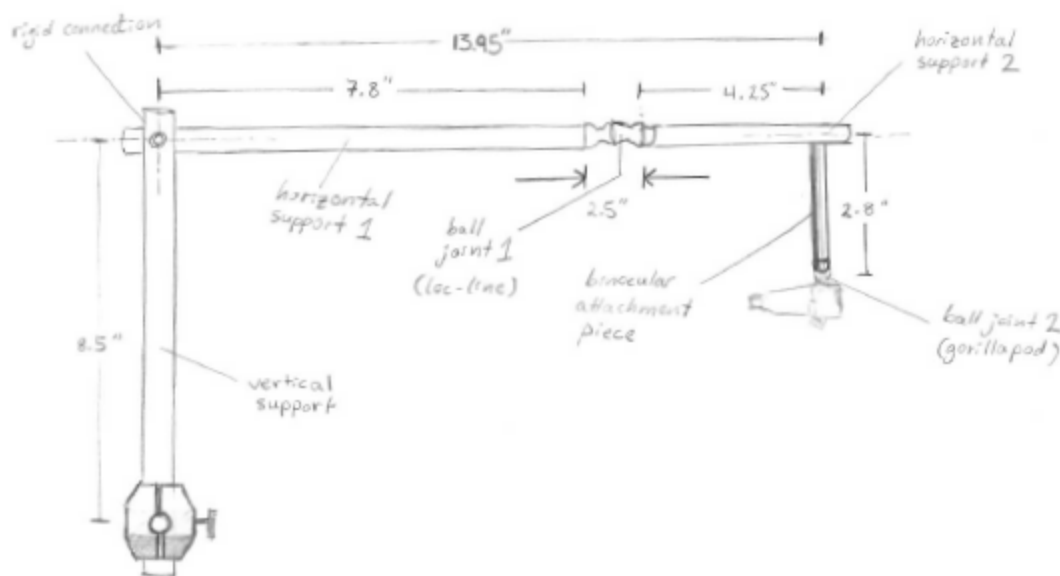


Fig. 1: Dimensioned sketch of final prototype

The binocular holder was designed with adjustability, portability and ease-of-use in mind. It is comprised of dimensioned supports made out of PVC pipes and reinforced with wood, and 2

differently sized high friction ball joints for coarse and fine control respectively. The system mounts to the user's headrest using an easily adjustable clamp. An optional, adjustable mouth stick (Fig.2) mountable to horizontal support 2 allows greater control range of the device, and a way to return the binoculars to the eyes should the piece exit the desired viewing range.

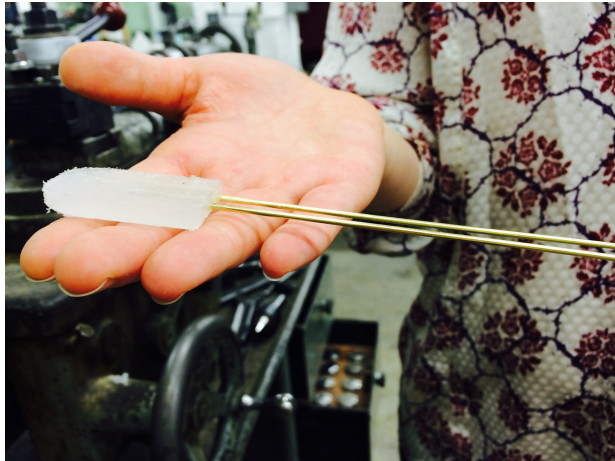


Fig. 2: Mouth stick for extra control

The following video: <http://www.youtube.com/watch?v=EOImqYnPthQ&feature=youtu.be> depicts the range of motion of the system.

## Materials:

- 1 in. outer diameter PVC pipe (4+ ft.)
- 0.85 in. outer diameter cylindrical wood pieces: trim to appropriate width with a lathe if needed (4+ ft.)
- ¼ in. diam. by 1.5 in. bolts (2)
- Epoxy
- ½ in. inner diameter Snap-Loc (3 links, available from McMaster-Carr with Product #5307K96)
- Gorillapod "Original" (1, available at <http://joby.com/gorillapod>)
- Binoculars, self-focussing recommended (1)
- Sand paper
- Clamp, 1in. diameter (1) (we used: <http://www.amazon.com/Gibraltar-SC-GRSRA-Series-Right-Angle/dp/B0002F78QC>)
- Rubber padding, hard plastic, and brass rods for mouthstick

## Procedure:

**1. Make measurements.** The chair should have a headrest with a bar upon which you can clamp the device. (use picture)

- a) Measure the distance between the center of the headrest's horizontal bar and the center of the user's head to get the length of horizontal support 1.
- b) Measure the distance from the center of the user's head to the desired center of the binoculars to get the length of horizontal support 2.
- c) Measure the distance between the headrest bar and ~3in above the user's head for the length of the vertical support.

**2. Assemble PVC support system.**

- a) Cut PVC pipe to the dimensions measured.
- b) Insert the wood pieces into the PVC pipes for added support. The wood should be wide enough to be held by the pipe from friction alone.
- c) Using a mill, cut a notch on the outside of horizontal support 1 as depicted.
- d) Use the epoxy to stick the vertical support to the horizontal support.
- e) When the epoxy dries, drill and tap a ¼ in bolt hole and bolt into the connection for added stability.

**3. Assemble the flexible link**

- a) Sand down 2 individual Snap-Loc links until desired amount of friction is reached.
- b) Using epoxy, attach each end of the Snap-loc segment to the PVC horizontal support 1 and 2.

**4. Assemble the binocular attachment.**

- a) Drill M4 hole into small hexagonal aluminium piece and tap it for an M4 bolt on both sides. This will be the binocular attachment piece.
- b) Place the screw through horizontal support 2 and into the binocular attachment piece.
- c) Screw the gorillapod into the bottom end of the binocular attachment piece.
- d) Wrap the arms of the gorillapod around the binoculars you wish to use.

**5. Create Mouthstick**

- a) Cut desired mouthstick shape out of hard plastic.
- b) Wrap hard plastic with soft rubber for mouth comfort.
- c) Drill holes in plastic and attach brass rods with epoxy.
- c) Rigidly attach ends of brass rod to PVC in desired position.



## Operating Guide

**1. Clamp system onto headrest of wheelchair.** This step will be completed by our client's personal care assistant. Our simple adjustable clamp will make it easy for the PCA to attach and detach the system to the back of our client's wheelchair.



**2. Appropriately match binocular attachment end of PVC pipe to client's eyes.** The PCA will also have to help with this step. Initially, our binocular system will be needed to adjusted a bit so that the binoculars rest gently on Liz's eyes in its "zero" position (binoculars completely parallel to ground, loc-line in straight position).





**3. Move head accordingly with location of bird!** Our client will be able to perform this step on her own. The only external help needed were completed in the first two steps. Our client should be able to control the pan, tilt, and depth of sight through her binoculars using our PVC system. The loc-line and gorillapod have the right amount of friction to move in sync with our client's head movements. These parts will allow our client to control tilt (vertical) and pan (horizontal) of the binoculars, as well as allow her to move the binoculars forward. The mouthstick will allow our client to pull the binoculars towards her if needed. Once our client has finished bird watching, she can also simply use her head to move our system out of the way and drive her wheelchair back home.