Instructables: Making the Rickshaw

Materials
- A set of 2 20" diameter wheels
- Three 4ft by 4ft sheets of ½" plywood
- 2 sheets of leather, needle, and thread
- Seat cushion
- Hardware: 10 wood screws, 20 fender washers, and 8 bolts

Tools / Software
- A CAD program (e.g., Autocad, Rhino, etc.)
- CNC machine (e.g., Shopbot)

Design

Step 1:
Using a CAD program, design a rickshaw form taking into account the diameter of the wheels. Include handles at a comfortable height and distance from the seat and that the sides of the seat protects the passenger from the wheels.

Step 2:
Consider where the two wheels will be and cut out holes that match fender washers and a hole large enough for the shaft of the bicycle wheels.

Step 3:
Similar to those support boards, create 2 pieces at roughly 20" away from the edge of the seat and at an angle of 50 degrees as seen in the picture on the right. Also create tabs and holes as shown.

Step 4:
Duplicate this form and set the two sides 18" apart. Model a back board that is 14" high and 18" wide, a seat that is 18" by 18", and 3 support boards under the seat. Create tabs on the two ends of each of these pieces and cut out corresponding holes in each of the side pieces.
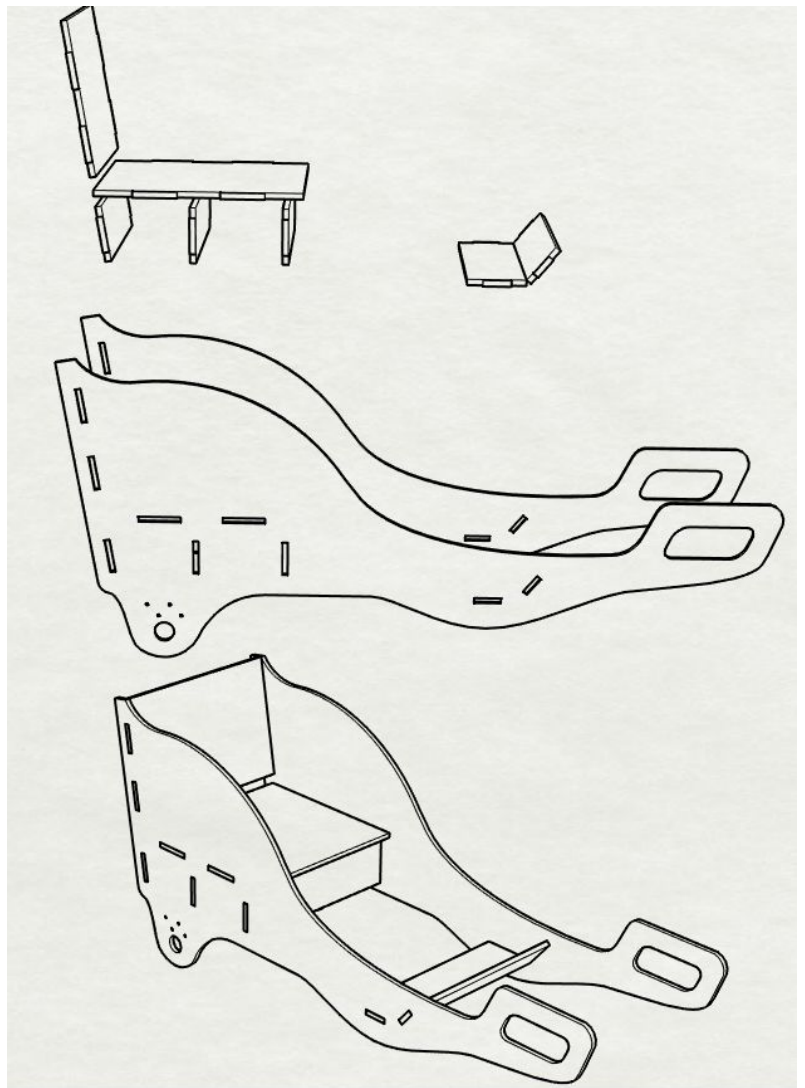
Assembly

Step 1:
Because the CNC drill bit cuts out circles, create dogbone cutouts as necessary around the tab insertions so that the rectangular tabs will fit. Export the file to a CAM program in the relevant format (e.g., .dfx). Go through each of the pieces that needs to be cut and create the profiles for the machine with appropriate settings. Taking into account that the drill bit will take away material the width of the bit's diameter, ensure that your cut profiles are on the inside or outside of the line accordingly to only take away material from the rest of the wood or the scraps. Load the plywood to the bed of the CNC machine and send the file to the machine for cutting. Arrange the pieces accordingly to the size of your plywood and repeat the process until you have all your pieces.
*Before cutting, you can include and arrange the logo as desired and create a cut/raster profile as desired.

Step 2:
Sand and smooth the edges as necessary. Assemble the wood as modeled (e.g., back board, seat board, support boards, footrest boards, etc.).

Step 3:
Secure the aluminum plates to the side wooden piece of the rickshaw with fender washers. Feed the shaft of the wheels into the aluminum plates and secure them with fender washers and nuts. Make sure that they are perpendicular to the rickshaw and won't tilt with weight.

Step 4:
Mount on the music player to the side of the rickshaw near the handles for the puller's access.

Embellishments
- Cut and sew the leather to wrap the handles for comfort of the rickshaw puller.
- Fasten a cushion to the seat.
- Paint the logo as desired.

Instructables: Making the Music Player

Materials

For the electronics:
- 3 arcade buttons with lights
- 1 on/off switch
- 1 Raspberry Pi 2 (all setup)
- 1 Adafruit Perma-Proto Half-sized Breadboard PCB
- 1 set of female headers
- Heat Shrink tubing for extra wire stability
- A portable power bar for the Pi
- Stranded wires in various colors

For the music player box:
- 2' x4' x ⅛" plywood
- 2 bolts and nuts
- Wood glue

Tools / Software
- Soldering iron and solder
- heat gun
- Power drill
- Wire stripper

Creating the Box

Step 1:

Measure the electronics and speaker and lay out the dimensions of a box necessary to hold them. Include holes correlating to the size of the screws. Laser cut the pieces of the box, glue 5 sides together, and then place the components inside. Close the box and fasten it to the side of the rickshaw with screws.

Assembling the Electronics

Step 1:

Count out and cut 11 strands of wire for the control panel. Strip them at both ends with a wire stripper.

Step 2:

Solder the stranded wires to the output pins of your arcade buttons and the switch. Make sure you know which pins are ground and power, and which pin corresponds to the built-in lights in the case of the arcade buttons. Color coding helps!

Step 3:

Slip heat shrink tubing onto the wires and use the heat gun to secure them to the input pins. This will prevent any wires from breaking or snapping off, and will ensure your music player is very sturdy!
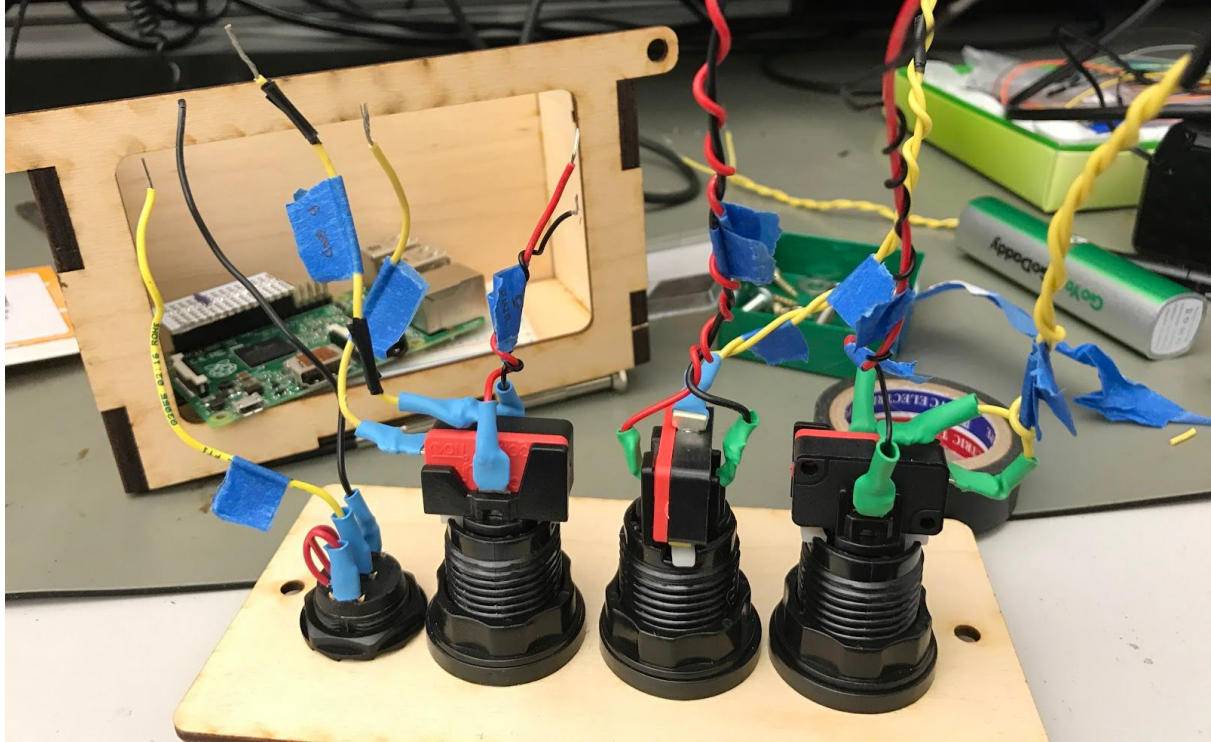
Step 4:
Attach the arcade buttons and the switch to the lid of the box. Set this aside for later.

Step 5:
Count out at least 10 rows of your protoboard and cut the the board (optional) if you'd like it to be a better fit for your box. In our prototype, we only used one fourth of a board. Solder at least 10 consecutive female headers to your protoboard, so that each header is attached to a row of its own. This row of headers will act as a shield to the leftmost set of pins on the Raspberry Pi.
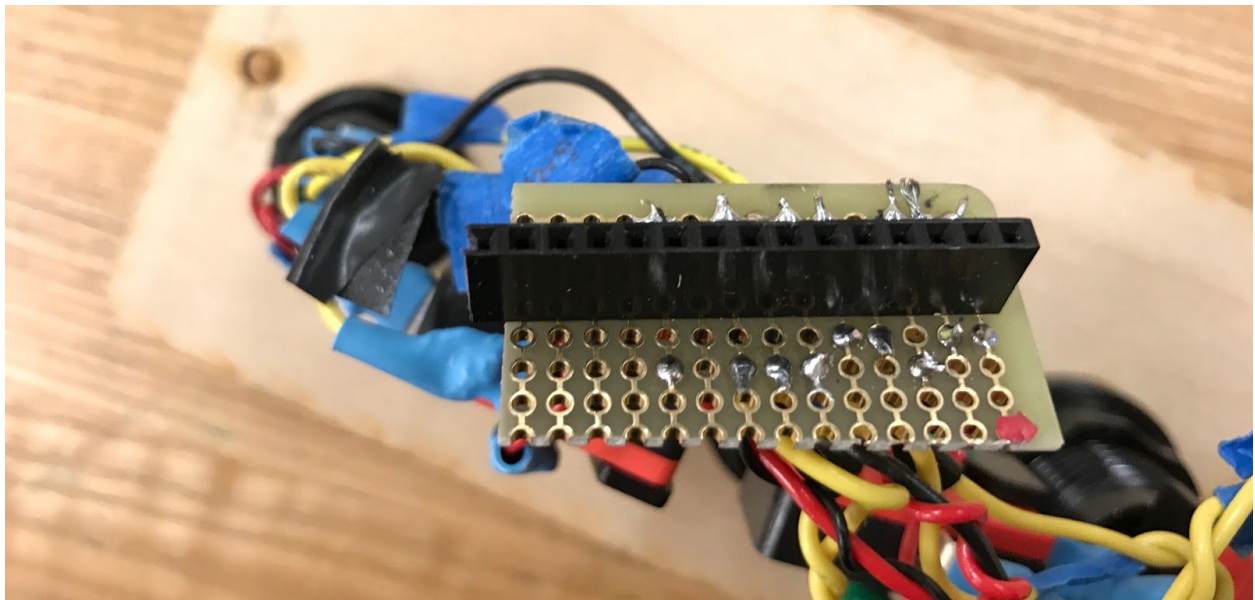
Step 6:
Solder the button wires to the protoboard in the following fashion (see diagram below). Pictured in the image is one fourth of a protoboard. The female headers are soldered to the opposite side (to be placed on top of the Raspberry Pi's GPIO pins) in rows 1 through 10, though you may have more if you wish. It is important that you solder the buttons exactly as pictured if you would like to use our provided code. However, if you have prior programming experience and wish to reorder the GPIO pins, please do so.
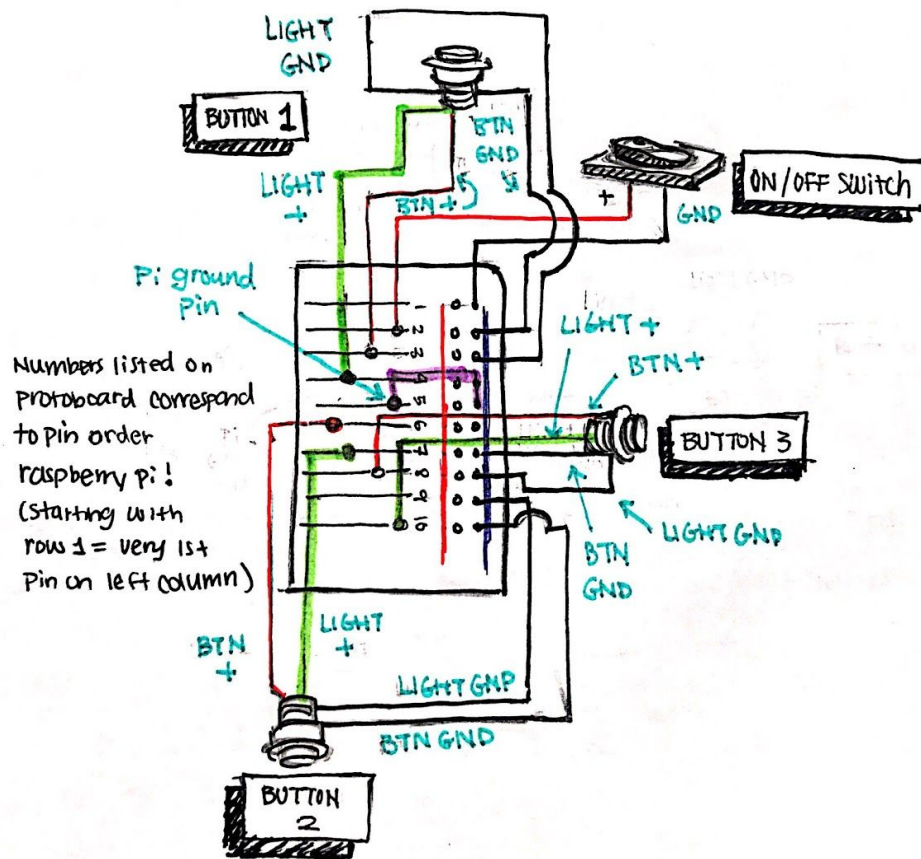
Step 7:
Place the protoboard, now connected to the buttons, on top of the Pi, making sure to fit the headers onto the leftmost row of the GPIO pins.

Step 8:
Go to the Uberick repository (https://github.com/mimilei/uberick) on GitHub and download the files under the folder "pi_code." Upload them to a folder in your Raspberry Pi and follow the instructions here

(http://www.instructables.com/id/Raspberry-Pi-Launch-Python-script-on-startup/?ALLSTEPS) to create a cronjob that runs the rickshaw_launcher.sh file on boot.

Step 9:
Arrange all your electronics inside your box and plug the power bar into your Raspberry Pi. Your music player should now be functional!
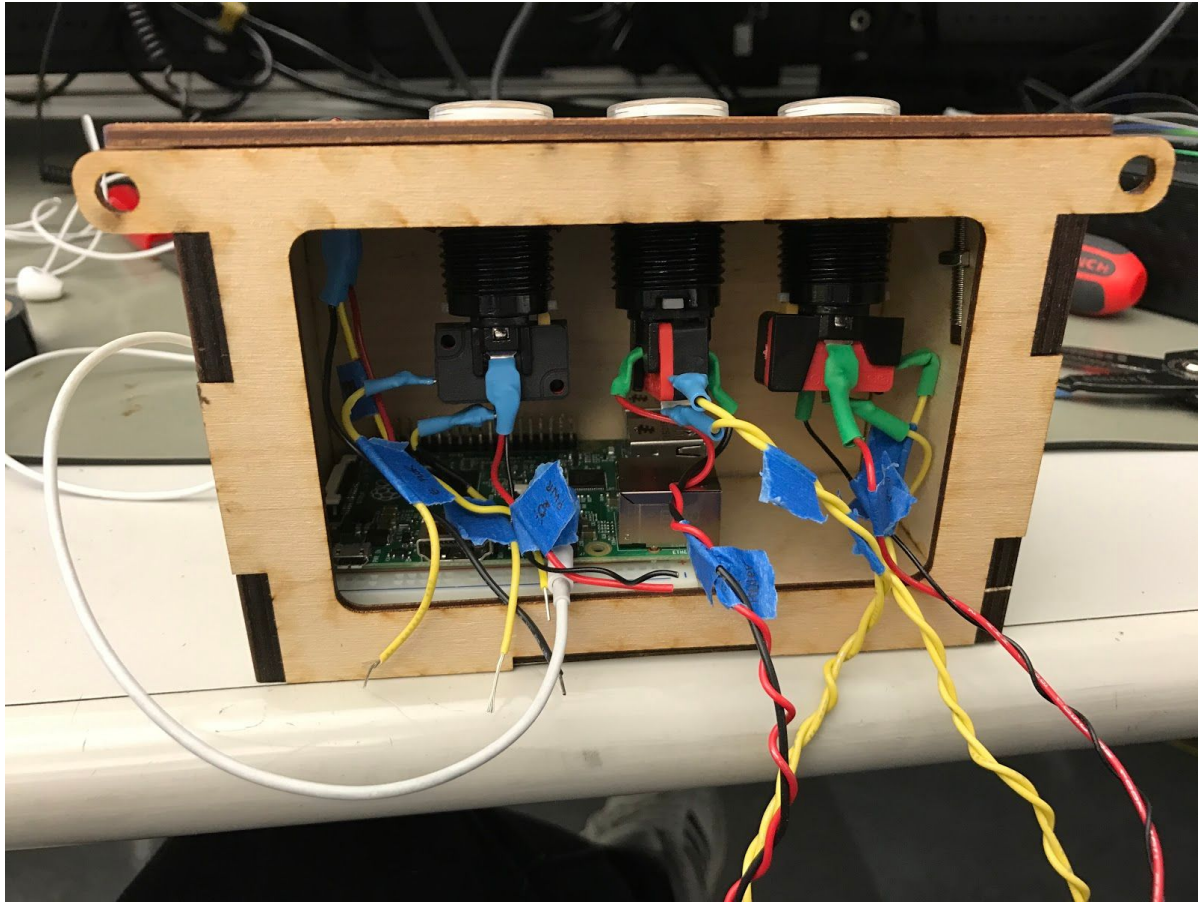
Instructables: Using the App

We created the Uberick Android application on Android Studio. You can modify it or download the zip file at our repository (https://github.com/mimilei/uberick). Simply clone the repo, unzip the Rickshaw.zip file, and open it in Android Studio. You can upload it to your Android device by plugging it into your laptop and specifying it as a testing device.

A demonstration of its user flow can be found here: https://youtu.be/CYYLr4HRV6o