

# GML Recording Machine HOW TO

A step by step guide for how to build yours

This guide is based on workshop held in  
Constant Association for Art and Media, Brussels, Belgium  
on November 30, 2011  
In collaboration with Muharrem Yildirim  
Evan Roth  
Wendy Van Wynsberghe

All photos are taken by Evan Roth

# PARTS

	Quantity	Price	
<b>Electronic components</b>			
Arduino	1	29.95	<a href="http://www.sparkfun.com/products/9950">http://www.sparkfun.com/products/9950</a>
Arduino microSD Shield	1	14.95	<a href="http://www.sparkfun.com/products/9802">http://www.sparkfun.com/products/9802</a>
Arduino Stackable Header - 6 Pin	2	1	<a href="http://www.sparkfun.com/products/9280">http://www.sparkfun.com/products/9280</a>
Arduino Stackable Header - 5 Pin	2	1	<a href="http://www.sparkfun.com/products/9279">http://www.sparkfun.com/products/9279</a>
microSD card	1	4	Any microSD card should work. No need for more than 1 GB.
PS2 Ball Mouse	1	10	Any ball mouse should work in theory
RGB LED	1	1.95	<a href="http://www.sparkfun.com/products/9264">http://www.sparkfun.com/products/9264</a>
Momentary Push Button	1	0.35	<a href="http://www.sparkfun.com/products/97">http://www.sparkfun.com/products/97</a>
9V Battery	1	1.95	<a href="http://www.sparkfun.com/products/10218">http://www.sparkfun.com/products/10218</a>
Battery holder	1	2.95	<a href="http://www.sparkfun.com/products/10512">http://www.sparkfun.com/products/10512</a>
10K Resistor	1	0.25	
220 Ohm Resistor	3	0.75	
<b>Non Electronic Components</b>			
String	20 ft / 6 m	3	Should be durable to being rubbed. Any string which has a texture should work
Retractable Tape Measure	2	6	3 ft / 3 m each
Snap Fastener Kit	1	5	
Washers	4	3	
Masking tape	1	2	
Electrical tape	1	2	
Steel wire / Paperclip		2	Long enough to create two small hooks
Piece of plexiglass / wood		2	Should be big enough to cover bottom of the mouse
Spray can	1	4	Any spray paint
Spray cap	1	0.5	Any kind of cap
	Total	98.6	USD
<b>Tools</b>			
USB cable for Arduino			
microSD card reader			
Glue gun / glue			
Super glue			
Dremmel with cutting and drilling bid			
Soldering iron / solder			
Wire stripper, Diagonal cutter, Needle nose pliers, Box Cutter			



# SOFTWARE

Arduino

<http://www.arduino.cc/>

Arduino Ps2mouse Library

<http://arduino.cc/playground/ComponentLib/Ps2mouse>

sdfatlib Library

<http://code.google.com/p/sdfatlib/>

Custom Arduino/Processing Programs

Can be downloaded from:

[http://muharrem-yildirim.com/GMLRM\\_howto/HOWTO\\_Software.zip](http://muharrem-yildirim.com/GMLRM_howto/HOWTO_Software.zip)

# STEPS

Modify the tape measures

- Replace the tapes with strings

- Repeat the steps using 6 ft/3 m string and a retractable tape measure

Modify the mouse inner and outer components

- Modify the inner parts of the mouse

- Modify the discs

- Modify the washers

- Attach the piece of plexiglass or a wood to the bottom

- Drill holes that strings will come through

Bring together all the electronics

- Extend the mouse button with wires and external buttons

- Solder button and LED to the microSD shield

- Solder mouse's wires to the microSD shield

Attach everything together

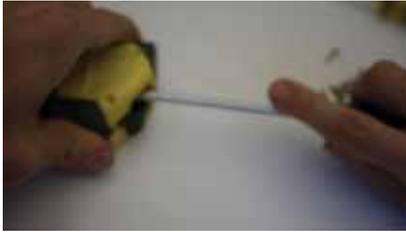
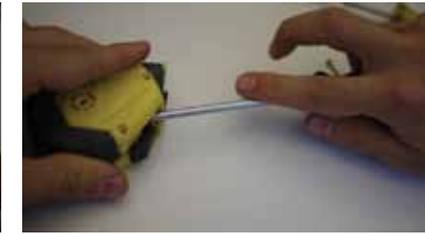
- Glue the mouse to the bottom

- Glue / tape the tape measures to the spray can

- Glue the button to the spray cap

Make hooks for the feet

Unscrew the tape measure  
Don't let the inside  
mechanism pop up



Pull till the end



Cut the end



Glue the end



Attach a piece of metal to  
string and glue it to plastic



Glue a snap fastener  
piece to where the  
string comes out

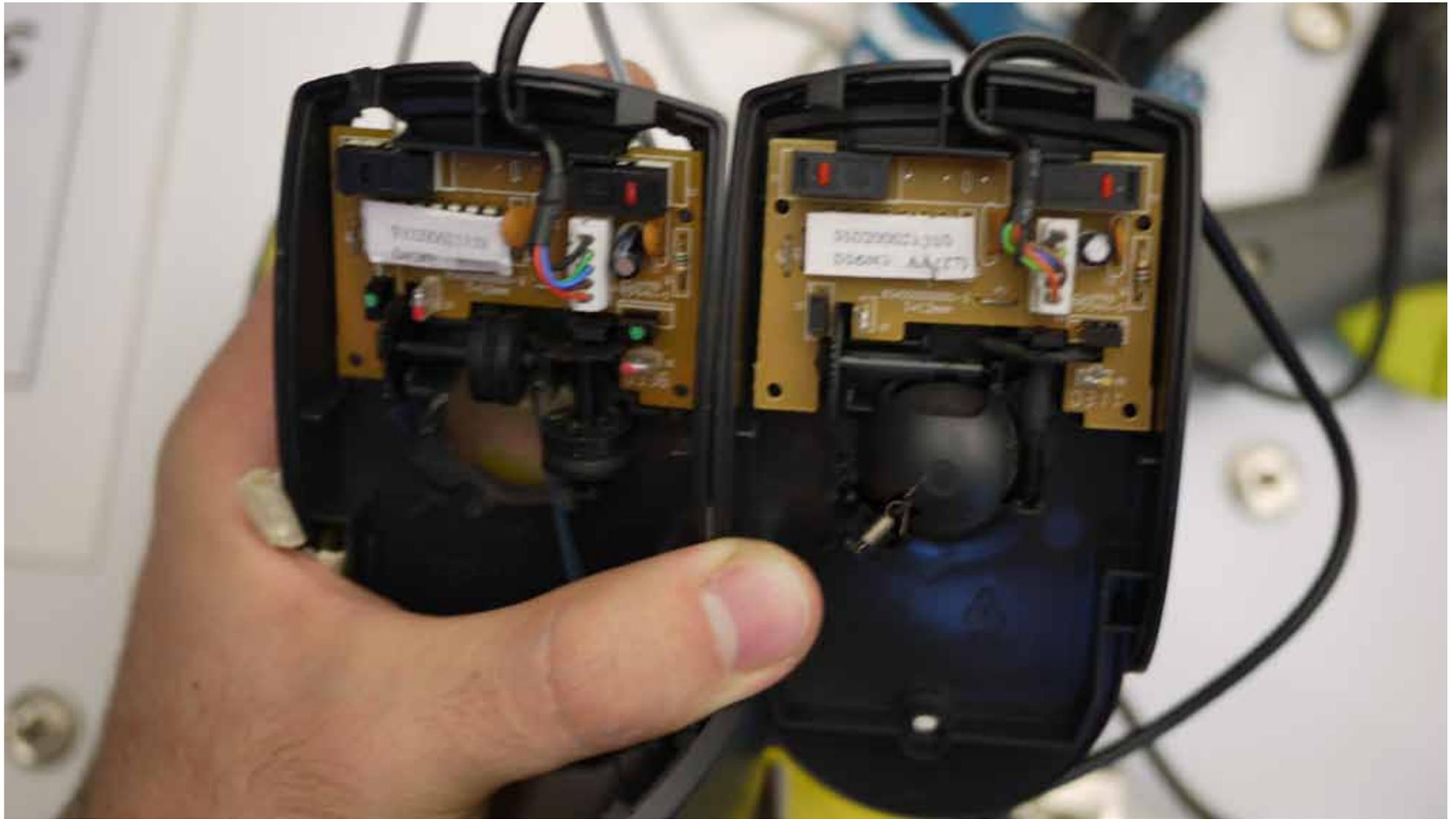


Take the string through  
the hole and rewind



Repeat these steps for  
the other tape measure

Mouse on the right will look like mouse on the left at the end



Take out the ball,  
electronic parts and  
the discs



Cut the extra parts  
to leave enough space  
for washers.  
Don't cut holder parts  
of the discs.

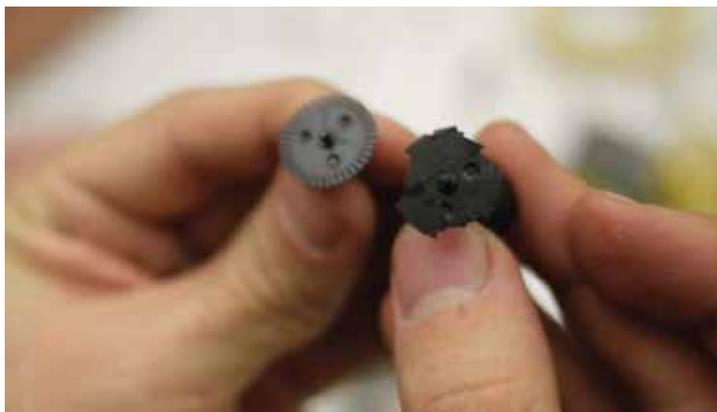


Make sure you can mount the  
discs again



Drill holes to extend the  
button's to outside later





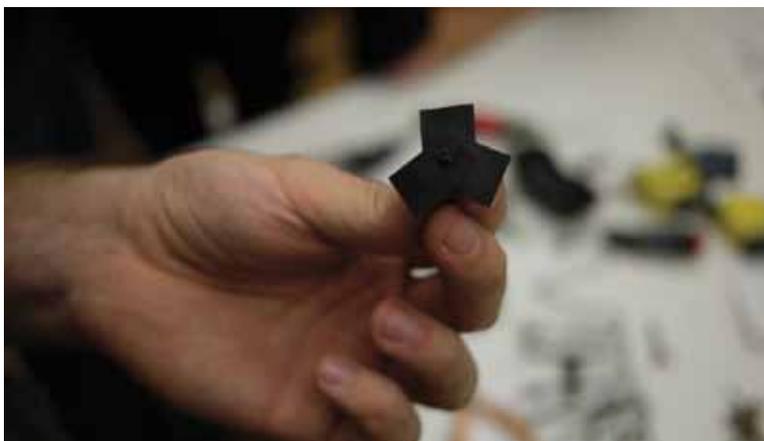
Disc on the left will look like one on the right



Cut sides of the disc to make it look like the one on the right.



Tape the teeth so the disc has three teeth in total in the end



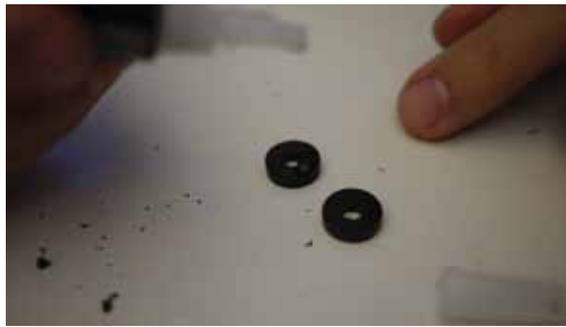
We are doing this since the mouse cannot handle the speed so we're decreasing the resolution of the mouse

Cut the extra parts of the tape. Do that for both discs



If you want, you can try this step at the very end after seeing if it works or not

Glue two washers to each other



After it gets dry, put it onto a Dremmel bit



Run the Dremmel on high speed and create a groove with a sharp object



Glue the washer on the disc



Repeat this for both discs

Glue the piece of plexiglass to the bottom of mouse



Drill the corresponding button holes



Mark the holes that strings will come through the mouse



Drill and glue the snap fastener pieces



Cut a part of cover to see what's going on inside



Drill top of the cover that string will come out from the mouse.



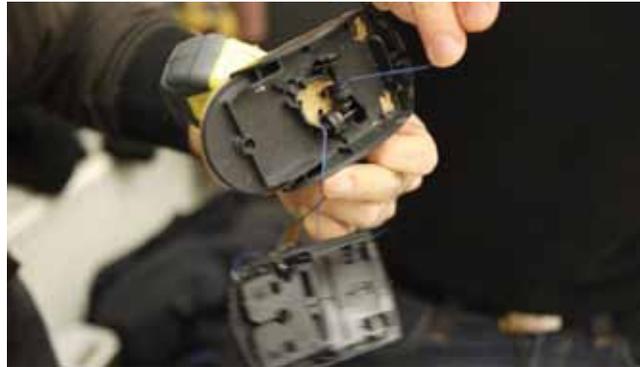
Glue snap fastener piece to prevent cover from getting cut by the string.



Do that for both axis.



Glue the tape measures to each other

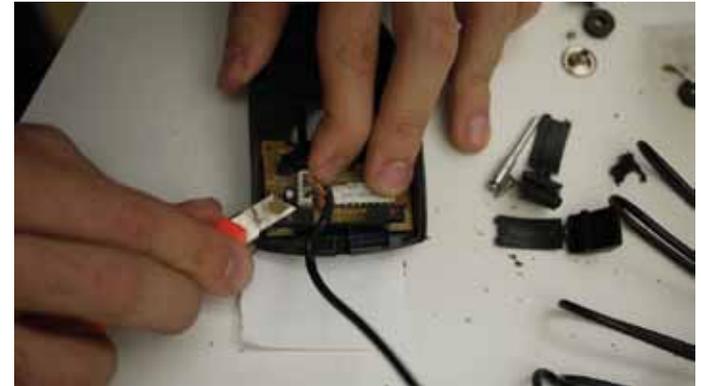


Take the strings through the mouse.  
Strings need to match the groove on the washers  
to be able to turn the mechanism inside the mouse.



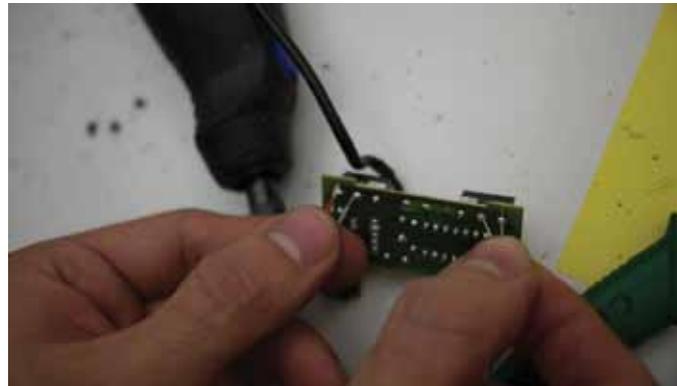
Cut the buttons on the mouse

This is because we'll attach buttons and wires to extend the buttons. We don't want to press the buttons on the mouse accidentally.

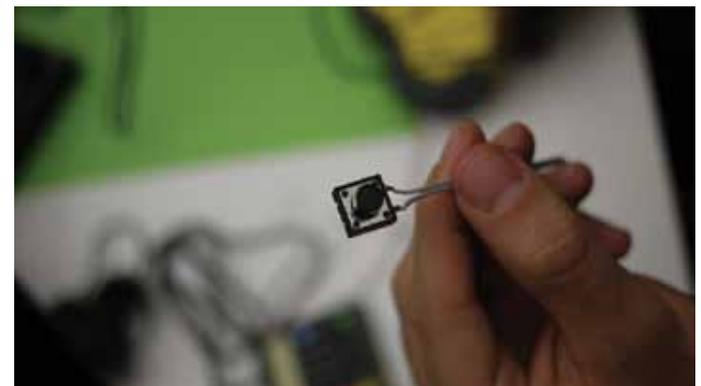
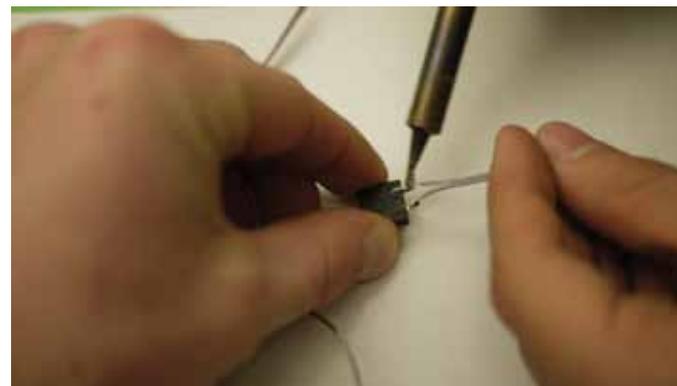


Solder wires and a button to extend the mouse buttons outside the mouse for both right and left click

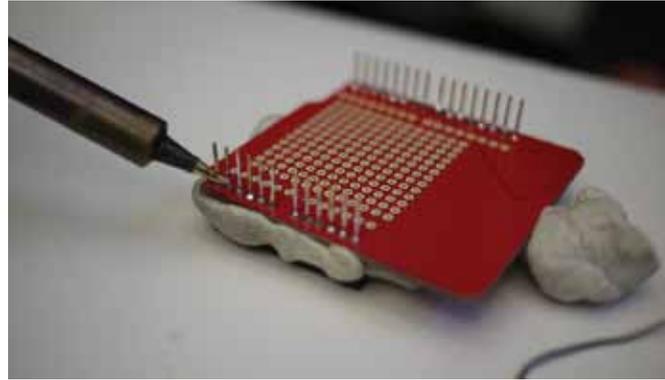
Left click will be attached to the spray cap.



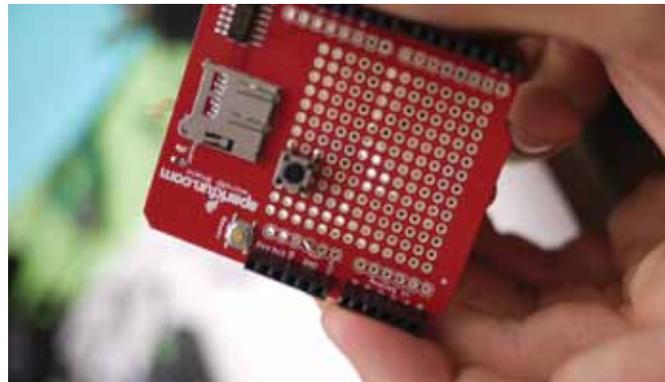
Right click can be attached to anywhere. It'll be used to calibrate the device.  
(Will set all the values to zero)



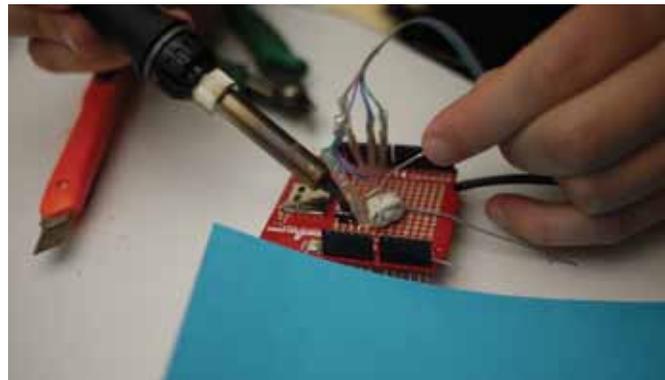
Solder the stackable headers to Arduino



We will also connect the button and the RGB LED to Arduino directly.



See the next page for details



These steps are from different tutorials/howtos available online.  
LED and extra button and the mouse will be connected to microSD shield in the en.d

#### LED - Debugging purposes

Connect the LED as it is shown on this instructable

<http://www.instructables.com/id/Controlling-an-RGB-Led-with-Arduino-and-Processing/step2/Setting-Up-the-Hardware/>

#### Button - For starting and ending a tag (Other buttons are not directly connected to Arduino)

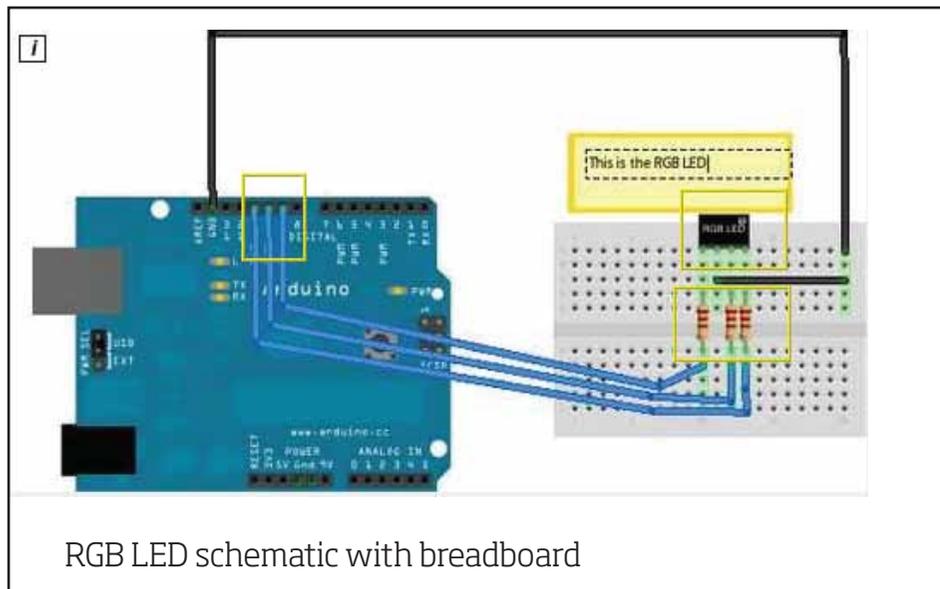
Connect the button for start/stop as it is shown in this tutorial

<http://www.arduino.cc/en/Tutorial/button>

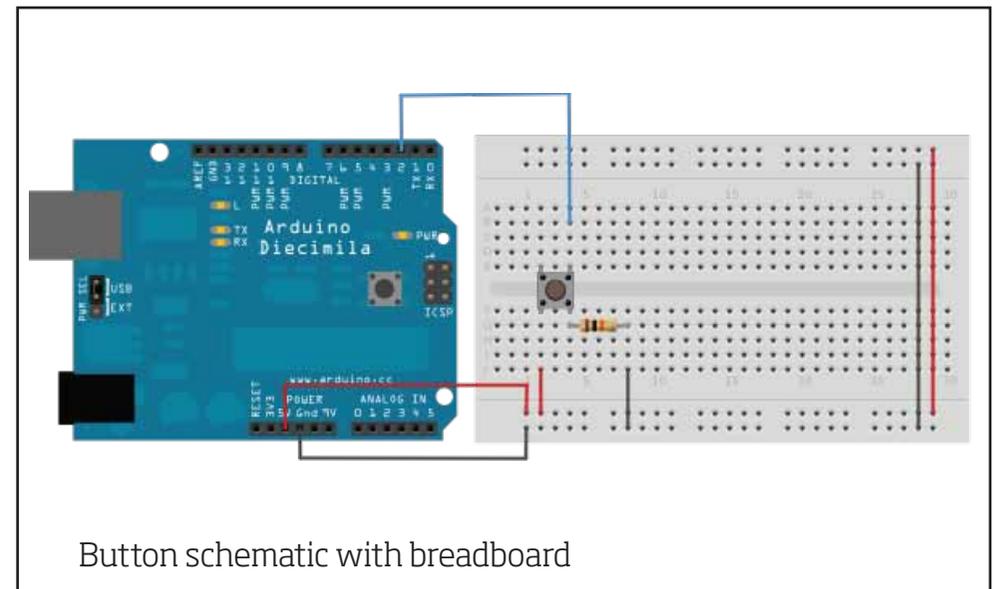
#### Mouse

Follow these steps for figuring out which wire from mouse is which.

<http://arduino.cc/playground/ComponentLib/Ps2mouse>



RGB LED schematic with breadboard



Button schematic with breadboard

All the wires will end up at these inputs of Arduino

PS2 Ground to Arduino Ground, VCC to Arduino 3.3 V  
PS2 Clock pin - D7  
PS2 Data pin - D6  
Extra button pin - D2  
RGB LED - D9, D10, D11 (9 blue, 10 green, 11 red)

Glue the left click button to spray can and all other stuff to the spray can itself.



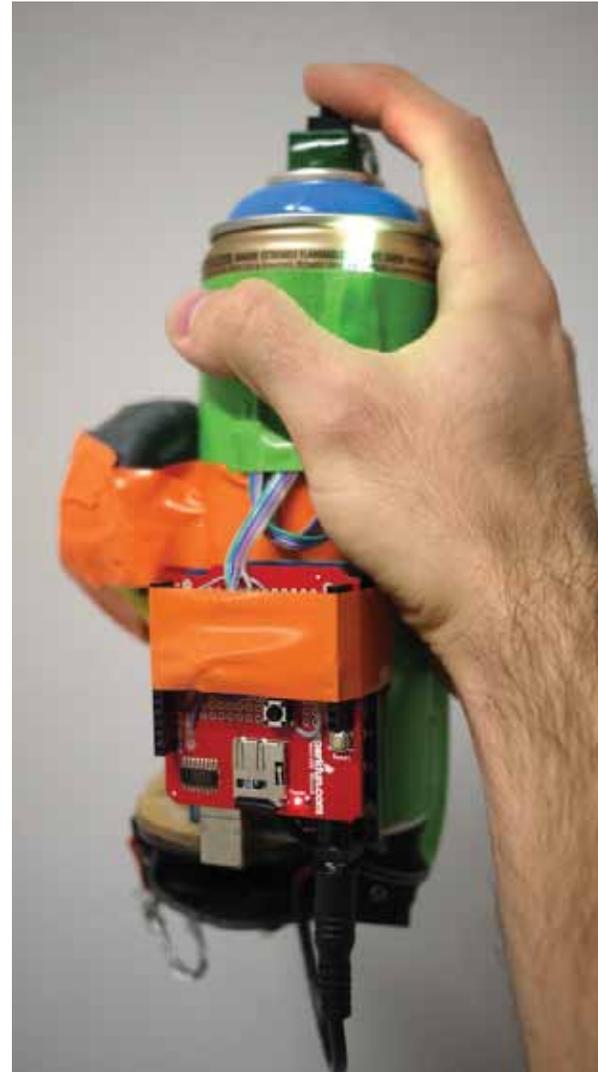
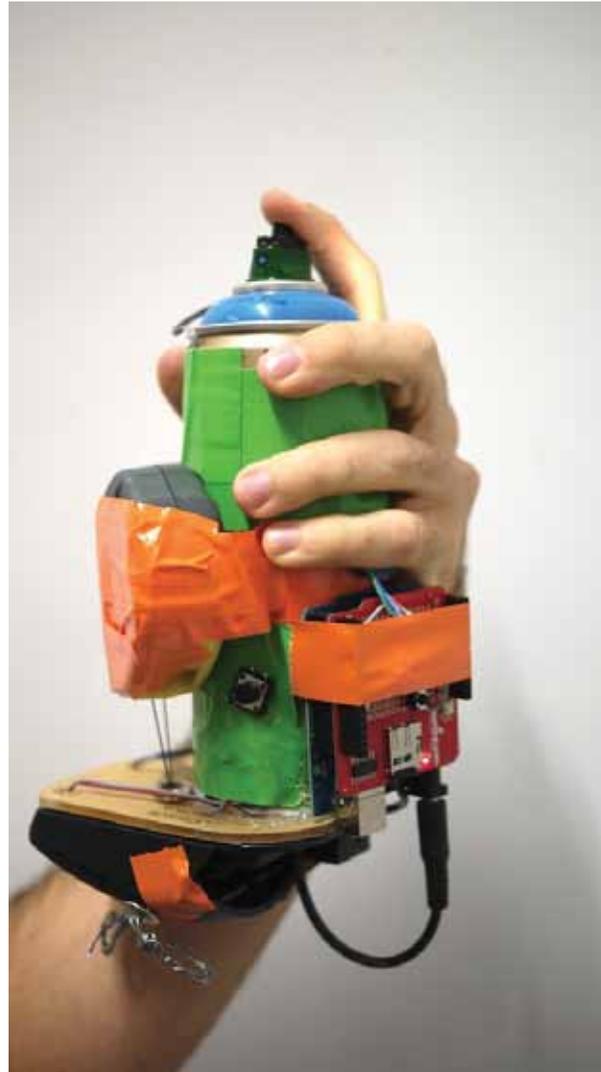


Make hooks for the strings and make a piece for each foot to attach the hooks to your feet.

WE'RE DONE!



Completed version of the device (with hooks and more tape)



## LIVE TEST

Plug the device to computer to test in real time

Upload **GMLRM\_to\_Processing\_ARDUINO** sketch to test in real time

Check through Serial Monitor if the values are right

Run **GMLRM\_to\_Processing\_PROCESSING** on Processing

You should be able to see the circles getting bigger and smaller as you pull and release the strings

You can also draw when you push the button attached to the spray cap.

## microSD TEST

To try the device with microSD, not real time:

Upload **GMLRM\_to\_microSD\_ARDUINO** sketch to be able to record to microSD card.

(Plug the microSD card to the shield of course)

Plug the battery cap to be able to use the device stand alone.

After recording tags, each file stored on the microSD card should be converted to GML format using **pointsToGML.py**

You can do it on the command line

```
> python pointsToGML.py 20123.gml > test.gml
```

Where 20123.gml is a data file from microSD (just points) and test.gml is the output as an actual GML format file.