

WEBCAM MICROSCOPE

DEAN WILSON

Up-cycle an old webcam into a super cool USB microscope with an easy to adjust focusing mechanism!

MATERIALS

SMALL PHILIPS SCREWDRIVER

LARGE PLIERS

SCALPEL AND TWO BLADES - 1 NEW AND 1 OLD BLADE

TOILET ROLL TUBE

PLASTIC 'TWIST PACK' CONTAINER. I USED A DP50 050, FROM ROSE PLASTICS, WHO SELL IN BULK. IF YOU CAN'T GET ONE OF THESE, OR MAKE ONE YOURSELF, CONTACT ME TO GET ONE AT COST PRICE: THEDEANOFWILSON@GMAIL.COM

BRIGHT WHITE LED

STEEL RULE

SOLDERING IRON AND SOLDER

150OHM RESISTOR

HOLE PUNCH

DOUBLE SIDED STICKY TAPE

ABOUT 20CM OF THIN, COATED WIRE

WIRE STRIPPERS

SMALL FLAT OR PINCH-NOSE PLIERS

CUTTING COMPASS (OR NORMAL COMPASS)

SMALL, FINE BLADED SAW, IDEALLY A JEWELLERS PIERCING SAW

THICK CARD, OR MOUNTING BOARD WITH AT LEAST ONE WHITE SIDE

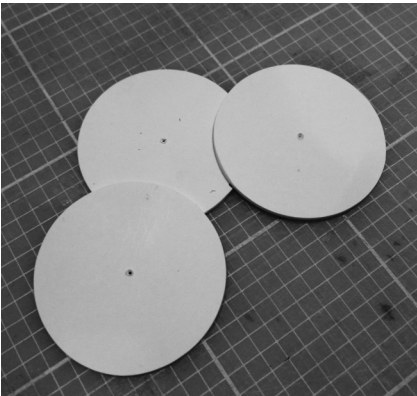
INSTRUCTIONS

STEP 1

PREPARE THE TWIST PACK AND CUT THE CARD

(1.1) Mark and cut a hole (about 35mm wide) in the top and bottom of the twist pack. (I heated an old scalpel blade and used it to gradually cut a hole by melting through the plastic, then smoothed the rough edges with a bit of sandpaper).

(1.2) Take your card and cut three circles of card about 51mm across.



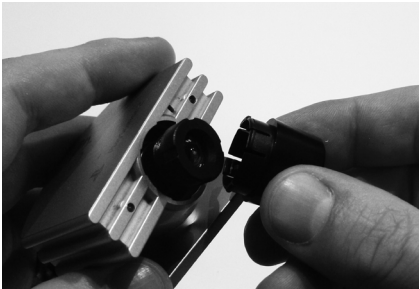
STEP 2

WEBCAM DISASSEMBLY

(2.1) Disassemble the webcam. First, unscrew the lens barrel (the black bit at the front) until it 'pops' out and keep unscrewing until the barrel comes out completely, then place to one side.

(2.2) Now open the case. Locate the screws situated underneath a sticker on the bottom of the case, close to where the USB cable leaves the case. Remove the screws and carefully pull the case apart and remove the circuit board.

(2.3) Use a pair of snips to remove the microphone from the board and place it out of the way.



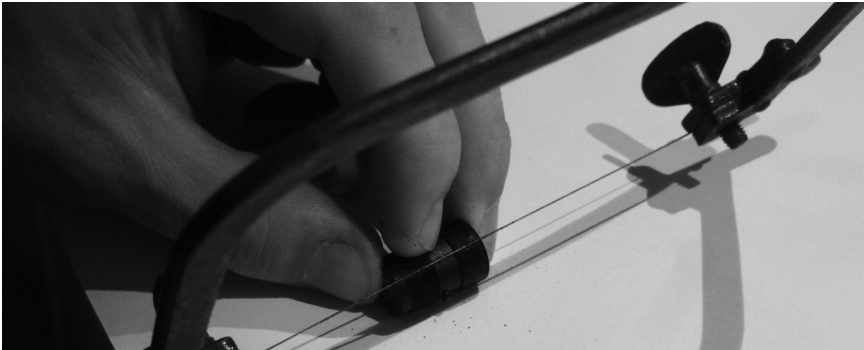
STEP 3

LENS BARREL DISASSEMBLY

(3.1) You now need to cut the lens barrel in half to access the lenses. First, remove the cap at the top of the barrel by gripping it with a pair of pliers (or gently in a vice) and then, with a second pair of pliers, twisting the cap. Remove the top lens and place this and the cap to one side – you will need the cap again in a few steps.

(3.2) Look for two thin lines (or seams) on the barrel, make sure one of these is facing up so you can use it as a guide. Hold the barrel tightly, or use a vice, then using a fine saw (I used a jeweller's piercing saw), carefully saw down the seam until you have cut through the barrel (you are trying to separate the two halves of the barrel without sawing into the lenses).

(3.3) Repeat on the other side being careful to keep the two halves together so that the lenses do not fall out. Remove the small ring of plastic stuck and the little glass square that sits beneath to make it easier to separate the two halves.



STEP 4

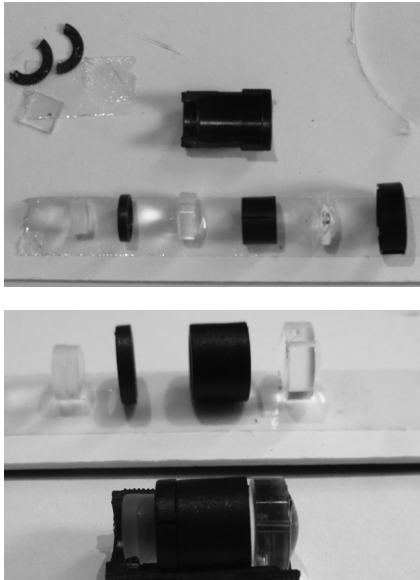
REORDER AND REASSEMBLE THE LENSES

(4.1) Carefully remove all the parts in the barrel and lay them out in order. Take a close look at the way the lenses are arranged (it may help to take a photograph so that you have a record of the order they are in). Pay particular attention to the curve of the lenses. You should see that one side appears more curved — or has a bigger bump — than the other; try to keep this bump to the front.

(4.2) Discard the front lens (the one directly behind the cap) and reassemble the parts in the barrel taking care to not to get fingerprints on the lenses and ensuring that the 'curviest' side of each lens faces

forwards (towards the cap). Now join the two halves and replace the cap you removed earlier (be patient with this and aim to keep the halves of the barrel aligned as you tighten the cap).

(4.3) Screw the barrel back on to the circuit board. Test your camera by plugging it in to your computer and using it to view the pixels on your screen or monitor (you'll need to hold the end of the barrel a few millimeters away from the surface if the screen). If you've configured the lenses correctly you should be able to see the red, green and blue components of individual pixels.

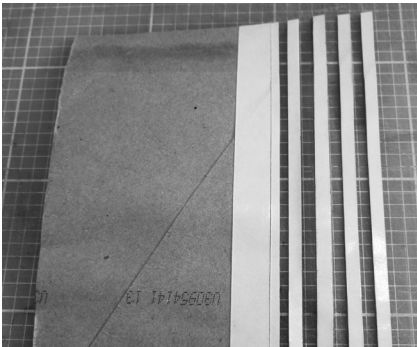


STEP 5

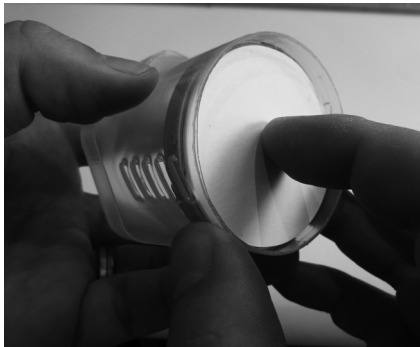
ADD A LEDGE TO INSIDE OF TWIST PACK

(5.1) Take your toilet roll and cut a straight line along its length with a pair of scissors, then flatten the tube out. Stick some double-sided tape along its length. Then trim at least four 5mm strips off the taped edge of the roll. Put these to one side.

(5.2) Take the top of your twist pack and, using a compass, mark a line 6mm from its bottom edge. Using this line as a guide, carefully stick one of the strips of card to the inside of the twist pack to create a 'ledge'. Then add one more strip on top of this.



(5.3) Take one of your cardboard discs and check that it will sit firmly on the 'ledge' you have just created. Build up the ledge with extra strips if you need to.



STEP 6

ADD AN LED TO YOUR WEBCAM (OPTIONAL BUT RECOMMENDED)

(6.1) Adding a light will help you to see specimens more clearly. Take an ultra bright LED (I got mine from an old LED torch) and solder a 130 ohm resistor to one of its legs. Then solder a length of wire, 50-60mm long, to the resistor. And solder another length of wire to the opposite leg of the LED so that you have two wires, a positive and a negative, that you can solder to your web cam (I used red and black wire so I could easily tell one from the other).

(6.2) Look for the five pins attaching the USB cable to one end of the camera circuit board. Identify the 'ground', or negative pin (this should

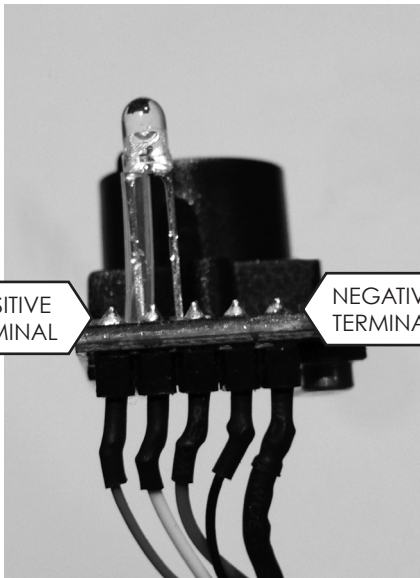


have a black wire attached to it) and solder the negative wire from your LED to this pin.

(6.3) Now identify the positive pin (this should have a red wire attached to it) and solder the positive wire from your LED to this pin. Now when you plug the web cam in to the USB port on your computer the LED should light. If it doesn't, check your wires to ensure you have the polarity correct.

POSITIVE TERMINAL

NEGATIVE TERMINAL



STEP 7

MOUNT THE CAMERA IN THE TWIST PACK

(7.1) Turn on your hot glue gun so that it has time to warm. Take one of your card discs and mark a point about 15mm from the centre of the disc then use a hole punch to create a small hole about 5mm in diameter. Now cut a hole in the centre of the disc just large enough for the widest end of the lens barrel (the 'capped' end) to pass through. You want this to be tight fit so try not to make it too large, about 12-13mm.

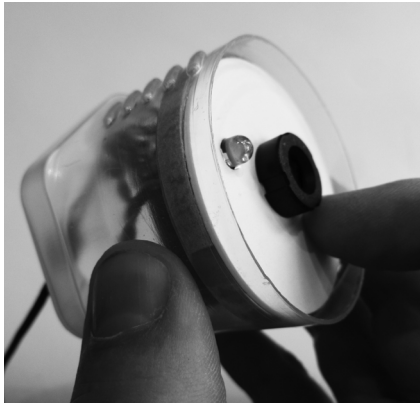
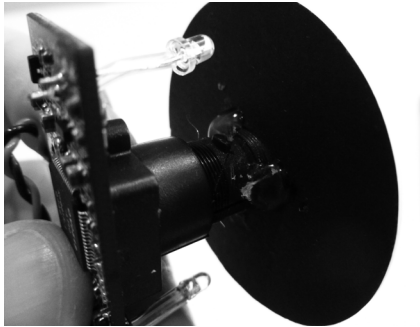
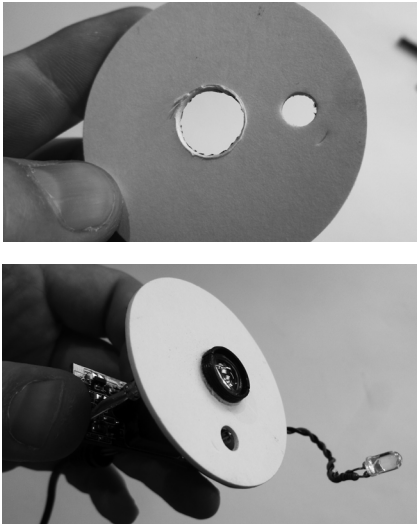
(7.2) Remove the cap from the lens barrel (but keep the barrel attached to the circuit board so that it doesn't fall apart) and carefully insert it through the center of the disc (if the card has only one white side make sure this is facing away from the circuit board).

(7.3) Replace the cap on the end of the barrel, and hold it flat to the card and secure with hot glue. Hold until everything is set, then pop the LED through the 5mm hole in the disc.

(7.4) Take the USB cable and feed it through the top of the twist pack. Pull

the cable through until the web cam sits in the tube and the card disc rests flat against the cardboard ledge on the inside of the tube. If the card feels loose you may want to add another strip of trimmed card.

(7.5) Once you are happy that the card disc is in place, secure with a couple of strips of card stuck to the inside edge of the tube.



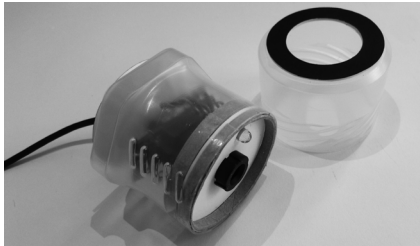
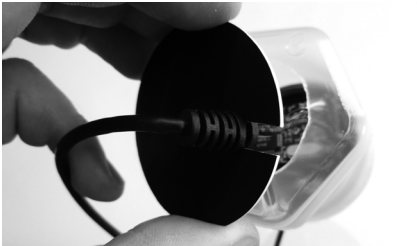
STEP 8

FINISH THINGS OFF

(8.1) You're almost done! Take another cardboard disc and draw a line through its center. Draw two more lines, 3mm above and below the centre line. Using these lines as a guide, cut a slot out of the disc about 15mm long from its edge. Use this to hold the USB cable in place by slotting the flexible rubber piece at the end of the cable in to it. Do this before the next step.

(8.2) Add some double sided tape or glue to the underside edge of the disc and fix it firmly to the top of the twist pack lid to seal it.

(8.3) Cut a hole in the centre of the remaining cardboard disc, just smaller than the hole you cut in the bottom of the twist pack. Then, using some double sided tape or glue, firmly fix the disc to the bottom of the pack. And that's it. You're done!



WHAT NEXT?

Go grab yourself some things you'd like to examine up close and get exploring!

Note: many computers will automatically recognise the EyeToy camera used in this project. If the computer you are using doesn't, there are a number of plug-ins and web-cam applications that can rectify this. If you use an Apple Mac, try MacCam webcam drivers (webcam-osx.sourceforge.net/cameras/index.php) and CamSpinner (www.optima-system.com/camspinner/) to capture images and record video.

Nearly 40, Dean still has trouble trying to explain what he does to his mum and dad. But he thinks that they understand that, first and foremost, he's a maker. When he's not working in his shed, he's working for a fantastic product and service innovation company called Fluxx. thedeanofwilson@gmail.com