



3D PRINTED OTOSCOPE

Abstract

1. An otoscope is simple device used in the diagnosis of ear, nose, and throat diseases. It is essentially a magnification lens with a light and speculum to help open orifices and direct the light. It is commonly used to examine the eardrum, which as the border separating the external ear canal from the middle ear, often has characteristics indicative of various diseases of the middle ear space.
2. The design work was inspired from the initial work done by Andrew Wallis. Here is a detailed link: http://www.appropedia.org/3D_Printed_Otoscope

Bill of Materials

Printed Parts:

Note: Price of 1kg filament assumed to be \$30

Bill of Material					
S.No.	Name of Parts	Qty.	Material(Gram)	Cost(US dollar)	Time(mins)
1	Otoscope Body	1	18.9	0.567	94
2	Threaded nut	1	6.3	0.189	30
3	Battery lid	1	1.4	0.042	7
4	LED case body	1	2.8	0.084	19
5	LED case lid	1	1.1	0.033	6
6	T-Mounting	1	8.3	0.249	46
7	Lens Assy.	1	2.3	0.069	11
8	Pin	1	0.6	0.018	4
9	Specula 5mm	1	2.7	0.081	17
	Total	9	44.4	1.332	234

Other Electrical components:

S.No.	Components	Qty.	Price (\$)
1	Push button switch	1	0.1
2	Plus 7 power 24mm magnifying lens	1	3
3	Electrical wire (22 gauge solid core)	1	0.05

Total cost to manufacture is \$4.482

Tools needed for fabrication of the OSAT

1. Depending on print quality, a knife may be needed to shave away plastic on the edges of the parts that come together.
2. A soldering iron and solder is needed to securely attach the electrical components together
3. Wire strippers and/or diagonals are needed to trim the wiring

Skills and Knowledge Necessary to Make the OSAT

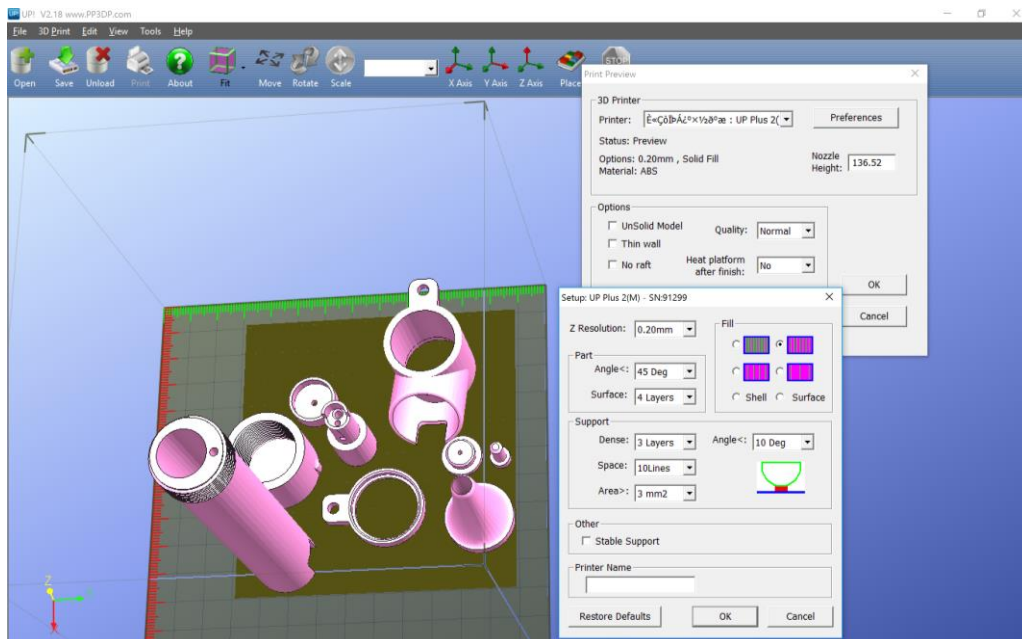
1. You will need to know how to solder [\[1\]](#)

Technical Specifications and Assembly Instructions



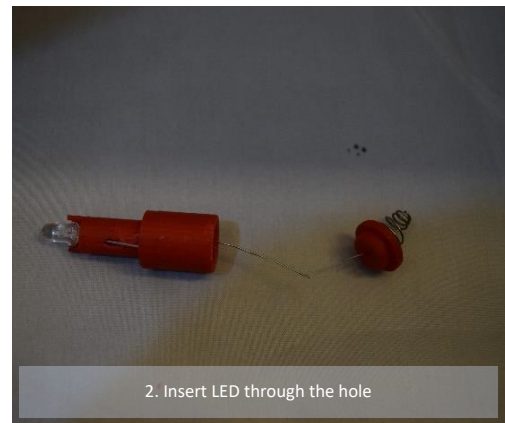
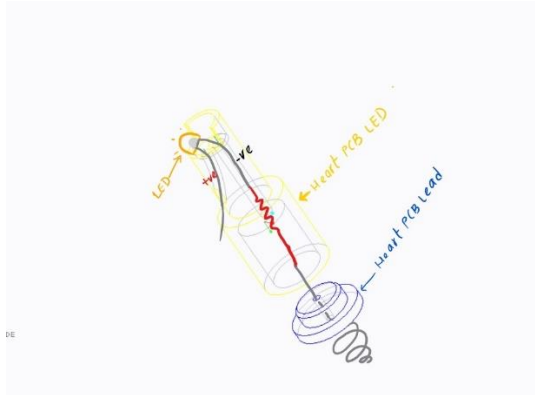
Different components of a 3D Printed otoscope

1. Build Instructions



Orientation of components for 3D Printing

1. Print the otoscope parts as shown in the picture above with light fill (20% fill) and support angle less than 10 degree. It is good to print 'specula and pin' with solid fill(above 80%). While the all other parts can be printed in ABS, Specula performs well with black colored PLA filament. Then cut two wire, one about 180 mm long for the positive connection and one about 70 mm long for the negative. After the print is completed, carefully remove the support. Insert 2mm thin nail or smallest screw driver from the hole of PCB LED case to remove support inside it.

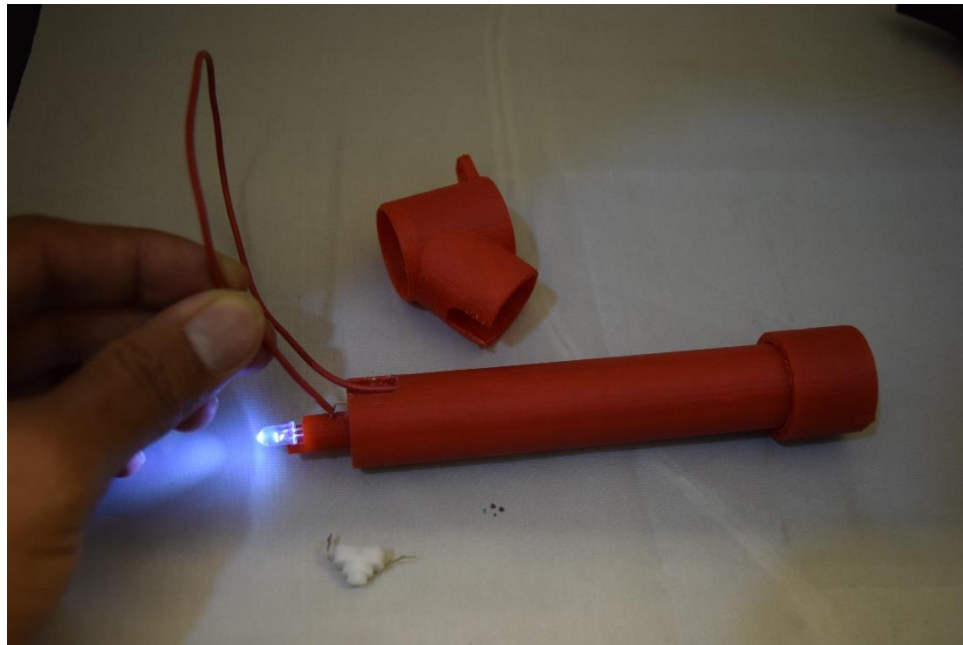


2. Start with a LED circuit. Solder a 220 Ohm resistor to the negative terminal of a LED bulb. The shorter pin is negative and the longer pin is positive terminal. Trim LED pin and resistor

to adjust its length properly. Now insert the two terminals of LED into two holes. Positive terminal pin should come out to the side of the case. Insert a small helical spring into the lid and solder its end to the other end of resistor. Then, close the lid.



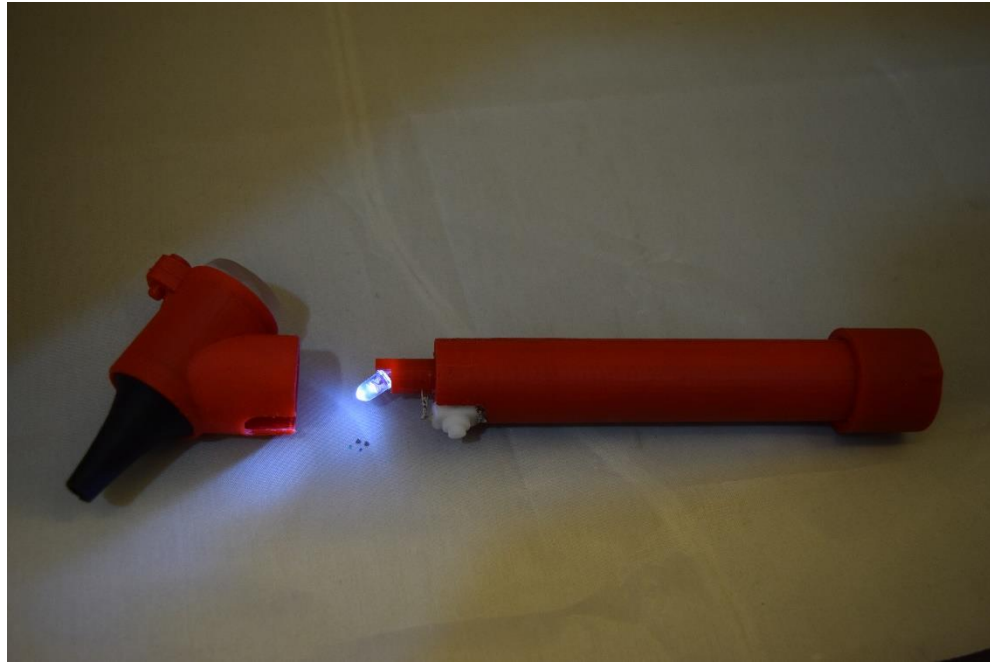
Insert the LED case into the otoscope body



Making sure that the electrical connections are okay

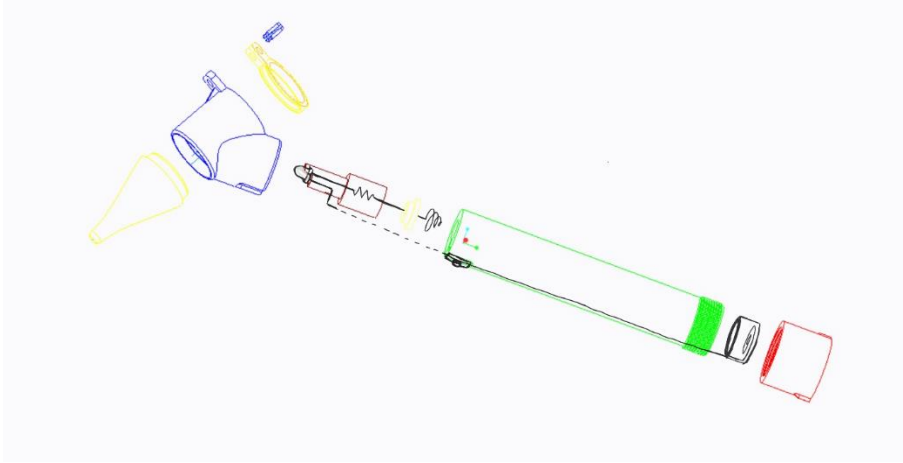
3. Insert the 'LED case' into the 'otoscope body' and push it with two AA size battery. Insert 22-gauge solid core wire of a length around 160mm into the hole that extends the entire otoscope

length. Using the tip of the wire strippers, strip 30mm of insulation off the end and curl the exposed wire to create a spring-like shape inside the 'Battery-Lid' and close the battery lid. Close the 'body lock nut' in the otoscope body.

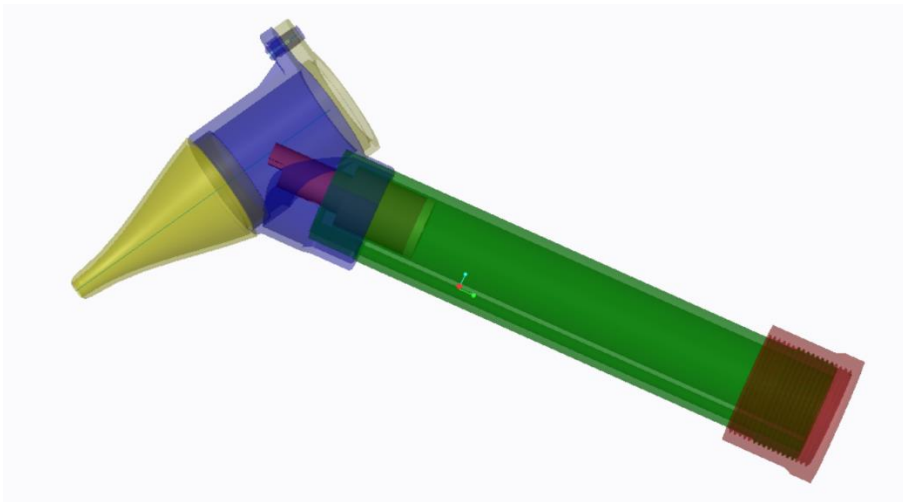


Solder the push button switch to the wire and LED terminal and bend it towards specula slightly

4. Solder the end of positive terminal wire that comes out of the otoscope body hole to the bottom of the pushbutton and the other end of pushbutton to the positive terminal of LED.
 5. Insert the printed 'T-mounting' onto the otoscope head without damaging the LED and pushbutton. The slot on the T-mounting should face towards the pushbutton switch.
 6. Snap the 24mm lens into the 'lens assembly'. Apply some glue to make it more rigid and fix it on the T-mounting with the printed pin.
1. Total print time estimate is 234 minutes and the material consumed is 44gram.
 2. Assembly time will take around 10 minute.



Schematic drawing of otoscope assembly



CAD visualization of Otoscope Components

Place for Improvement:

1. Make Lens assy. more robust.
2. Increase the height of lens assy rest.
3. Update new specula and make it customizable