AMPLFY Mini DIY Portable Speaker - Solar / Bluetooth / Flash Light / Phone Charger

by **Baclair** on November 19, 2016

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Intro: AMPLFY Mini DIY Portable Speaker - Solar / Bluetooth / Flash Light / Phone Charger

Hello!

Today, I am going to teach you how to build your very own portable AMPLFY mini Bluetooth speaker, which is unlike any other speaker sold on the market today.

What makes this speaker so different?

It features 2 x 200 mA 5v solar panels, 8 lithium-ion 18650 cells (20 Ah), a phone charger and a flashlight.

The purpose of this Instructable was to create a relatively cheap ($30), powerful portable speaker, which looks great, is convenient to use and can be taken almost anywhere.

Whats more, you don't have to be an electronics wizard to build one your self; so long as you have access to a drill, a saw (either a jigsaw or coping saw) and a soldering iron, you can build it yourself. I have provided step-by-step instructions with videos, detailing everything down to the very last wire.

Specs and Features:

· 5W per channel output

· Bluetooth 4.0 with APT-X codec

· 5V micro USB charging - with charging (red) / full charge (Green) indicator LED's.

· 5V output Phone Charger (IPhone and Android compatible)

· LED Flash Light with on/off switch

· 2 x 5V 200 mA Solar Panels (400 mA)

· 2 x 2.5" 10 Watt RMS Drivers

· 2 x 70mm Passive Radiators

· 8 x 18650 Lithium Batteries (20Ah) over 100 hours playtime. Can fully charge an iPhone up to 10 times.

Step 1: Design Rationale

Cheap:

I wanted to create something as cheap as possible, whilst using high quality components. In order to do so – I hacked some of the components, and up cycled as many components as possible. Luckily, I was able to recycle speakers, batteries, switches and LED's (more information about this later). For those who couldn't recycle all of these parts, I have posted the links to buy them brand new in the next step.

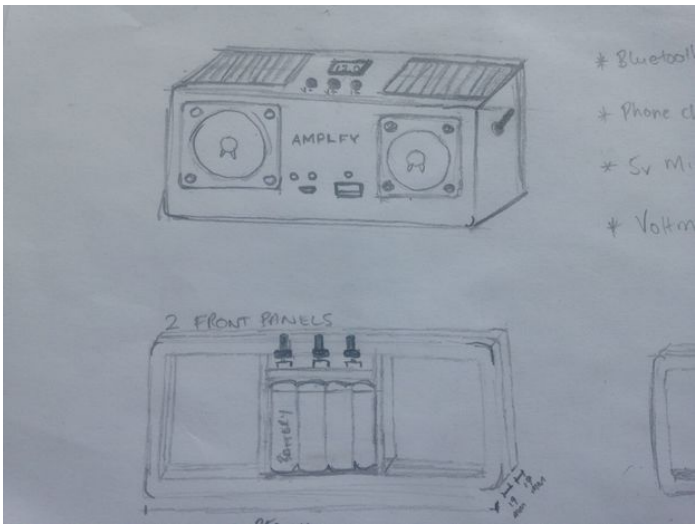
Convenience, Portability and Size:

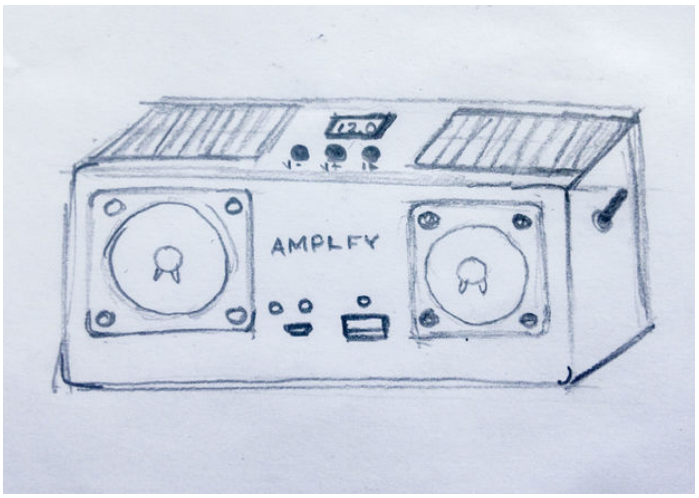
The primary focus of this build was to create a solar powered power bank inside of a small portable speaker, which I could take camping/fishing/beach and use to charge up other electronic devices. In order to get the highest capacity, 8 lithium-ion cells were wired in parallel. In doing so, this created a 3.7v (low voltage) 20Ah (high capacity) battery, which could easily be charged via two small solar panels, and the speaker could conveniently fit into either a backpack, or a handbag. The 3.7v battery can also be charged using a common phone charger, which means you don't have to take a phone charger with you wherever you go (as everybody has a phone charger).

Sound Quality:

In order to get the highest quality sound, both the left and right channels have been isolated into cylindrical chambers, and each driver is paired with a passive radiator.

The cylindrical chambers reduce the internal reflections in the box, which often causes spikes in the frequency response of the system. The downside of the cylindrical design means there is less volume inside of the box, which can be useful in such a small design. In terms of isolating both left and right channels, I have noticed a significant improvement in sound quality from previous builds.





Step 2: Parts and Materials

Below is a link to where you can buy all of the components:

To save money I recycled LED's, Speaker Drivers, Batteries and Switches. However, I have provided a link to where you can purchase all of these components.

Electronics:

1) 5V Bluetooth / Amplifier

2) Voltage Step Up Module

3) Micro USB 18650 Battery Charge Controller

4) 5V Solar Panels 200 mA (Buy 2)

5) Phone Charger Module

6) 18650 Battery x 4

7) Speaker Drivers

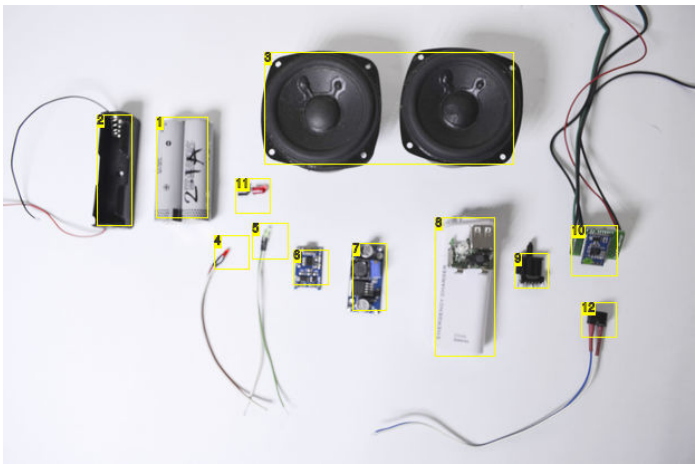
8) Passive Radiators 70mm (Buy 2)

Optional:

1) Voltmeter (Make sure you buy a voltmeter that has a range of at least 3 - 4.2 volts.)

2) Microphone for Bluetooth Module

3) LED's multiple colours



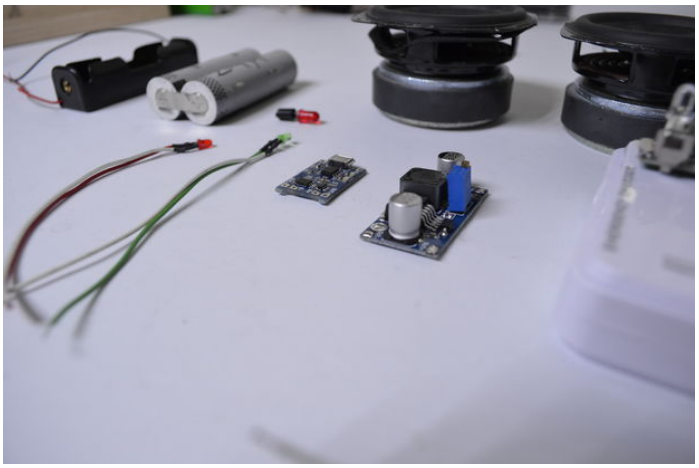
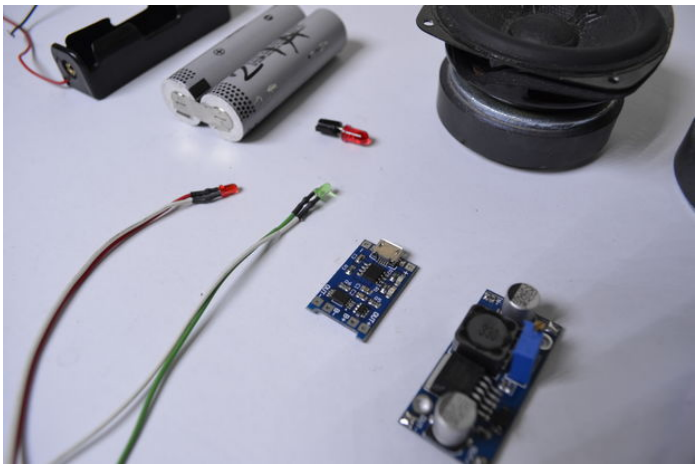


Image Notes
1. 3.7V 18650 Battery
2. 18650 Battery Holder
3. 2.5" Speaker Drivers
4. Red Battery Charging LED indicator
5. Green LED 'Full Charge' indicator
6. Battery Charging Module
7. Voltage Step Up Module
8. 5V phone Charger and LED flash Light
9. Slide Switch
10. Bluetooth Amplifier
11. Red on/off LED
12. Microphone (optional)



Step 3: Speaker Drivers

In my speaker I am using two x 2.5" speaker drivers, which were recycled from an old sound system and are rated at 10 Watt, 8 Ohm.

Note: There are plenty of variables to consider, when designing and building a speaker. However, if you are a beginner, pay attention to the following.

Watts: Refers to the power handling of a speaker. You will want to find a speaker with a Watt RMS rating near the RMS of the amplifier. The amplifier used in this tutorial is rated at 6 Watts at 4 Ohms.

Ohms: Ohms refers to the resistance of the speaker. Lower Ohms means less resistance and more power; however this also means that more power is being consumed, therefore will drain the battery faster.

I would recommend searching for speakers rated between 4 and 8 Ohms.

To add more speakers to your design, you can wire them in either parallel or series depending on their ohm rating.

Step 4: Batteries

I am using 8 recycled Panasonic NCR18650 batteries, rated at 2700 mAh each. All of these cells are wired in parallel (positive to positive, negative to negative – keeping the voltage the same, but doubling the capacity). This is definitely overkill, and 2 – 4 cells should be sufficient.

For some of you, the most expensive part of this build will be purchasing batteries. I am lucky enough to have access to a lot of old laptop batteries, which is where I source my cells from.

Note: If you don't have experience recycling old laptop batteries I would recommend purchasing them brand new, as it is worth an entire instructable itself getting batteries prepped and ready to be used safely.

Tips:

- Stay away from cheap Chinese (insert name here)-fire batteries and stick to quality brands such as Panasonic, Sanyo and Samsung.
- mAh – refers to the capacity of the cell - the higher the capacity the more expensive the cell (usually). Anything over 3500 mAh is likely to be false.
- Don't purchase a cell with battery protection, as the charging module will protect the battery from over charge and over discharge.

Below is a link to 4 high quality lithium ion cells (currently on sale) NCR-18650B 3400 mAH battery = 13AH. Which would give around 50 – 60 hours playtime and will charge a phone battery several times.

http://www.banggood.com/4pcs-NCR18650B-3400mAH-3_7...

Make sure you buy a battery holder, as it can be difficult to solder directly to batteries. Make sure the battery holder is parallel. Below is a link to a 4 P 18650 Battery Holder from Ebay.

http://www.ebay.com.au/itm/Rectangle-In-Parallel-2...

Step 5: Building the Box

The box consists of three sections, two of which are speaker chambers and the middle section for electronics. The idea behind this is to isolate the electronics from the two speaker chambers, in order to make it airtight.

To build the box I used the following pieces of wood;

1) 19mm x 89mm x 2.4m pine, which I picked up from Bunnings for about $4.

2) 3mm Pine Plywood

3) 3mm MDF wood (optional)

The 19mm x 89mm pine was cut into four equal pieces at 25cm each. The box will be consisting of these four pieces of pine glued together, with each section cut out individually. To cut the wood into equal 25cm sections I used a jigsaw.

The size of the middle section was roughly the size of four 18650 batteries side by side.

Cutting out each chamber:

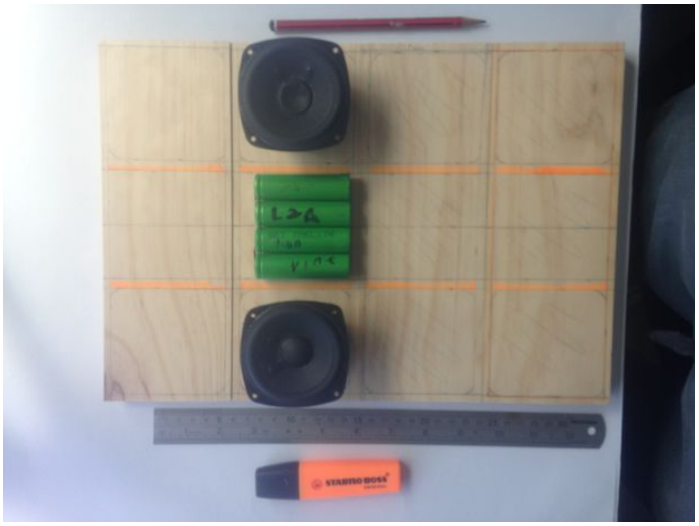
To cut out each speaker chamber, I temporarily clamped two pieces of pine together and used a 2.5” hole saw to cut out each hole.

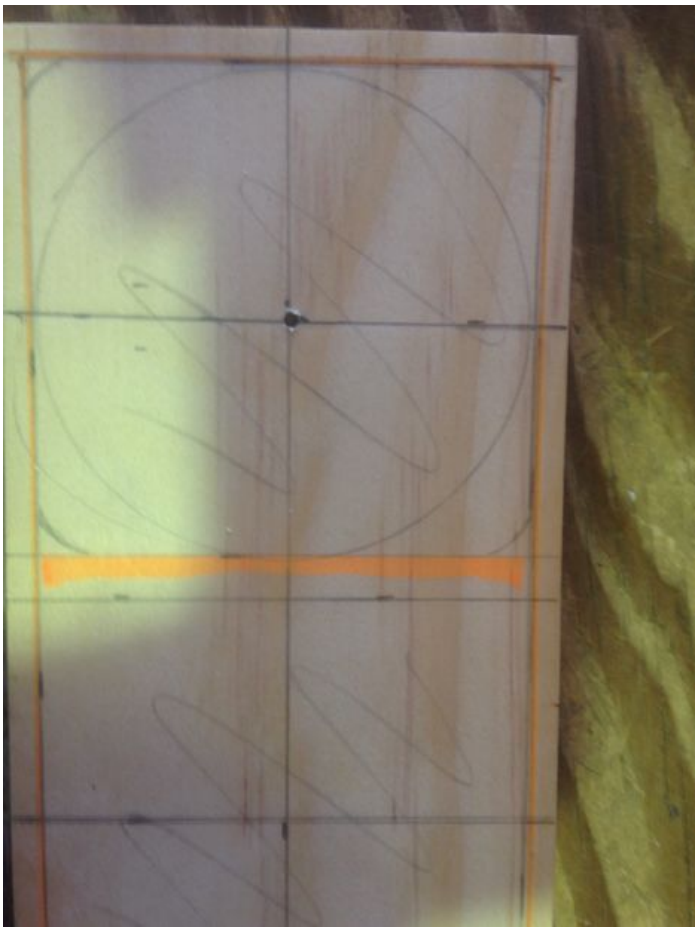
To cut out the middle section, I used a drill and a jigsaw. To cut out the middle square, first drill a hole big enough for the blade of the jigsaw to fit into and follow the line.

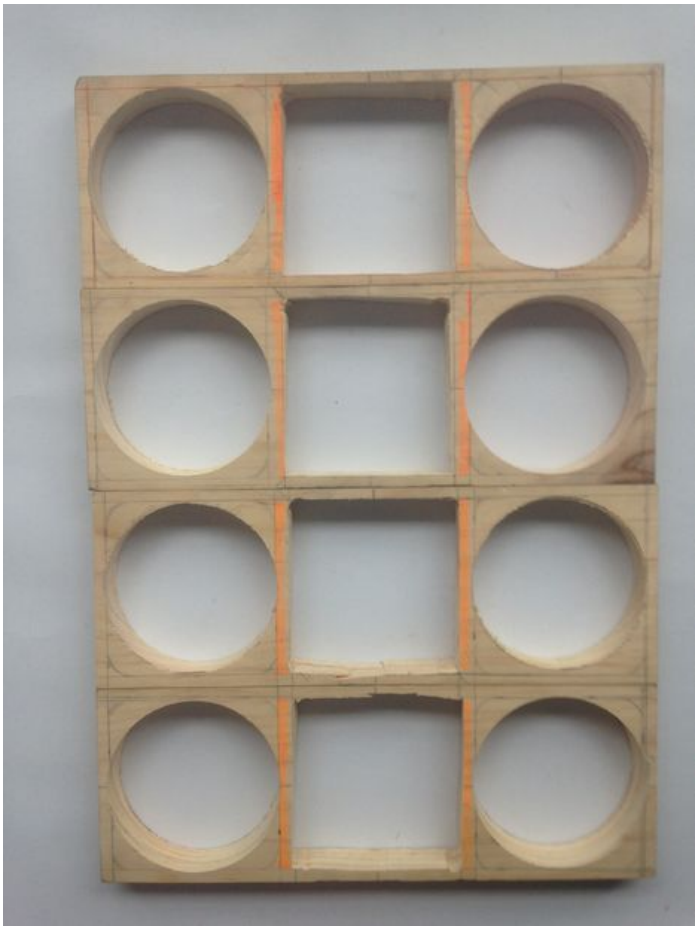
Once each section is cut in all four pieces of wood, clamp all of the wood together and use a metal file to clean up all of the sections.

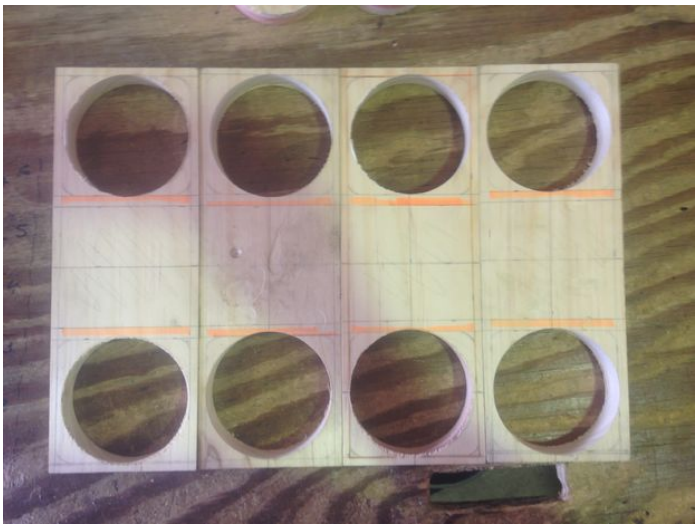
Cut out the front and back panel

To do this I traced around, the existing pine and cut it out with a jigsaw. I then sanded down the panels to the size of the pine.









Step 6: Cutting out Holes for Components

The most difficult and time consuming part of this build, was cutting out the holes for the battery charger, phone charger, and switch on the back panel.

I have manually cut out all of these pieces on a piece of 3mm MDF wood. In the near future, I will be upgrading to 3mm pine, which will be laser cut. I will upload the files once they are ready.

Cut out the holes for on the Back Panel:

a) Micro USB port

b) USB Port

c) Slide Switch (on/off) for the LED flash Light

d) 2 Small holes for the charging and full charge LED's (Only if you decide to hack the charging module).

e) A small hole for the LED flash light.

To get the correct sizes for each component, I placed each module into its position and traced around it, from the inside the box. This gave me a general idea about where each module would be. I then measured the size of the USB ports and switch, to make up smaller rectangles. I used a small drill bit, to drill cut out the corners of each rectangle and then a larger drill bit, which took up the majority of the rectangle, and used the fine metal file to make the holes the right size and shape.

When positioning the battery charger, and the phone charger, I wanted to make sure that they would be resting on the bottom panel, and not “floating” so as they would have more support, and I would be able to use smaller bits of MDF wood as a bracket for each component.

To mount the Micro USB battery charger flush, I filed about 1.5mm into the wood so that the charger would sit into the back panel, to make it easier to plug in the charging cable.

Depending on your build, you may need to drill a small hole for the LED charge indicator lights, and the LED flash light. When drilling these holes, use a drill bit slightly smaller than the circumference of the LED, so that you can squeeze the LED into the wood.

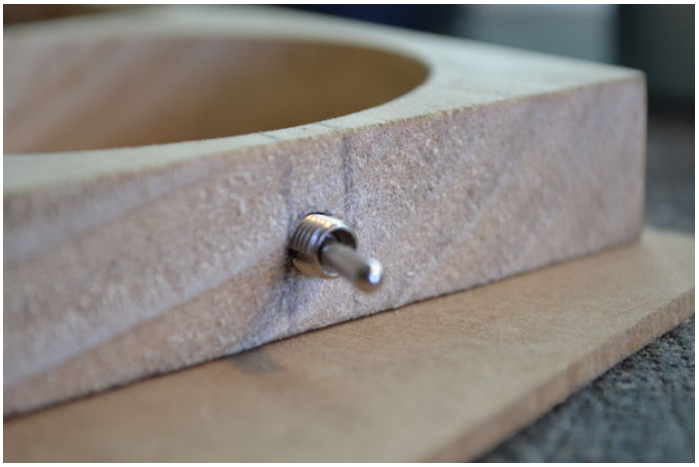
Tools Used:

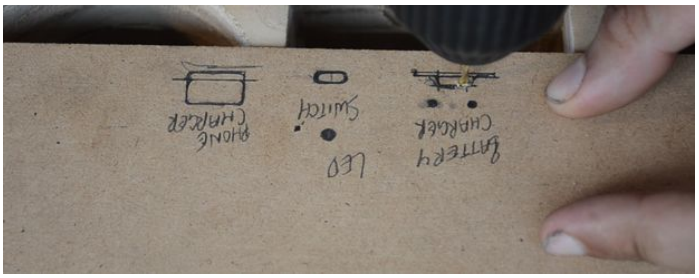
- Very small Metal File (very useful tool when making small holes to a particular size and shape).
- Drill

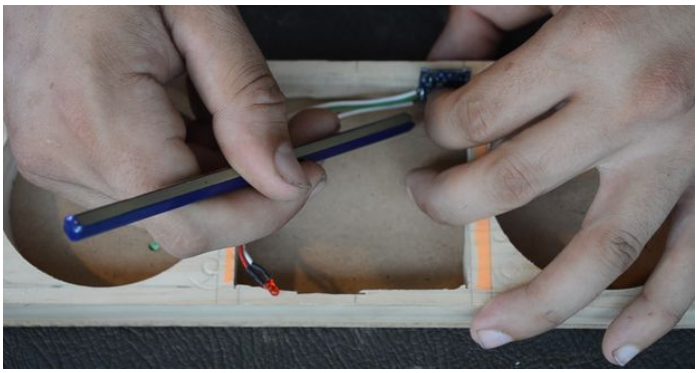
Drill Holes in Pine Wood: Switch, and Speaker Chamber Wires.

You will need to drill three small holes in one piece of 19mm Pine wood. The holes are for the speakers wires to get into the electronics chamber, and a hole for the main on/off switch.

Drill a small hole for the on/off LED indicator light on the front panel.







Step 7: Glue 2 pieces of Pine

Glue two pieces of pine together, to make up two halves of the enclosure.

To do so, apply PVA wood glue to both pieces of pine liberally and clamp together for 24 hours.

After I glued the two pieces of wood together, I applied wood filler to any gaps, and sanded it down.

Step 8: Stain and Varnish or Painting

Prior to staining / painting, I would strongly recommend sanding down all of the exposed panels to a smooth consistency. If you are using MDF wood, I would recommend painting it rather than staining, as staining is better on woods with a natural grain.

Tips:

- Do a couple of test coats to see if you are happy with the colour
- Less is more, apply very light coats.
- Try to apply coats evenly, and stain with the grain.
- Sand in between each coat, I used 1800 grit sand paper.
- Not too much stain on the brush

You can use either a brush or a piece of foam.

Step 9: Hacking the Phone Charger

To charge a phone from the speaker, I have hacked a cheap phone charger module.

You will need to dismantle the phone charger and take out the phone charging module. This module will be good to use, as it has an LED flash light function, and a red LED indicator. Which we will use as for our flash light, and the red LED can be used as a ‘power on’ LED for our speaker box.

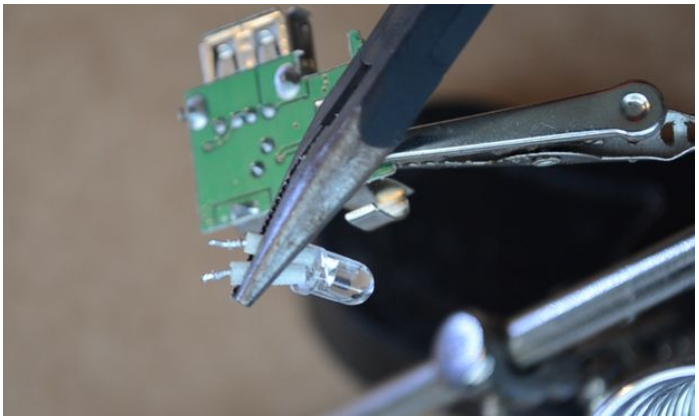
For our Flash Light, we will pull out the LED light from the charger, and wire another switch to turn it on and off. To pull out the LED, you will need something to hold the module, whilst you heat up the solder tabs and pull it out with some pliers. I have uploaded a short video of me doing this. The good thing about this LED is that it runs off 3.7 volts, and you do not need a resistor.

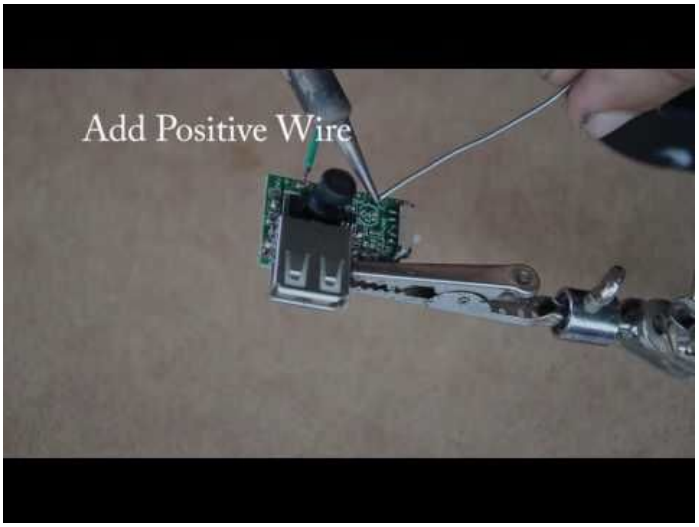
Whilst you’re at it, you might as well remove the Red LED as well. I used this LED as the ‘charging indicator’ light for the Battery Charging module - it can be used for that purpose, or as the on/off indicator LED. Once again, this LED runs of 3.7V so you won’t need a resistor.

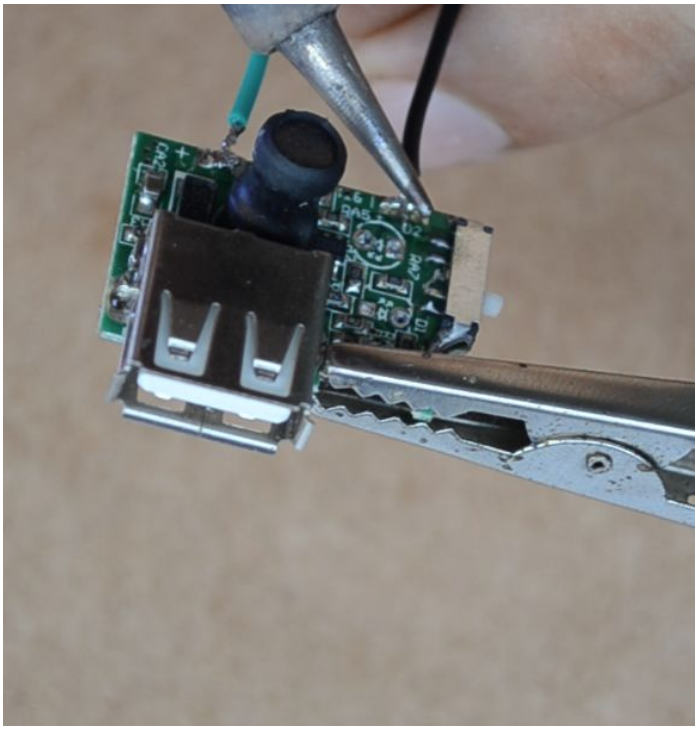
Note: In order to free up some more room, I also removed the Positive and Negative terminals which contacted the batteries.

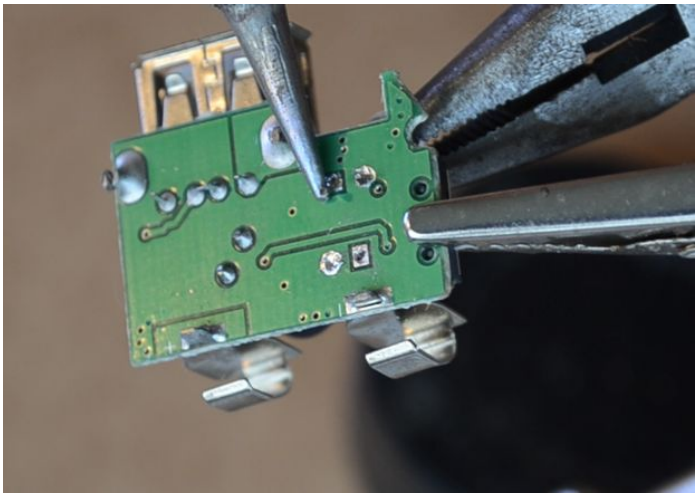
Solder Wires onto the Positive and Negative Terminal of the Phone Charger.

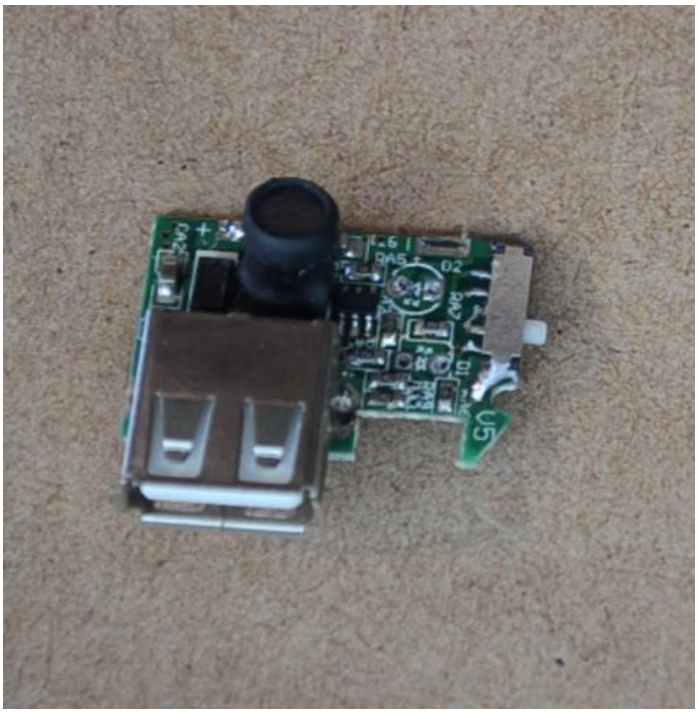
The positive and negative terminals are identified with a + and - on the charging module. Simply solder two wires onto these contacts. I used a green wire for positive, and a black wire for the negative terminal. You will also need to make sure when you use the charging module, that you the phone charging switch to the 'on' position.











Step 10: Wiring the LED Flash Light

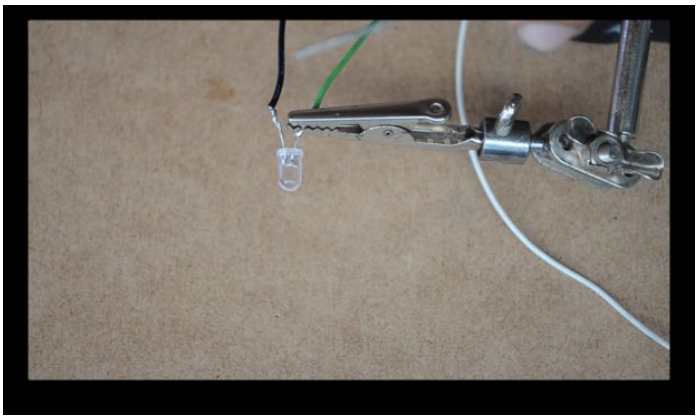
Once you have removed the LED Flash Light from the Charging module, you will need to add a positive and negative wire.

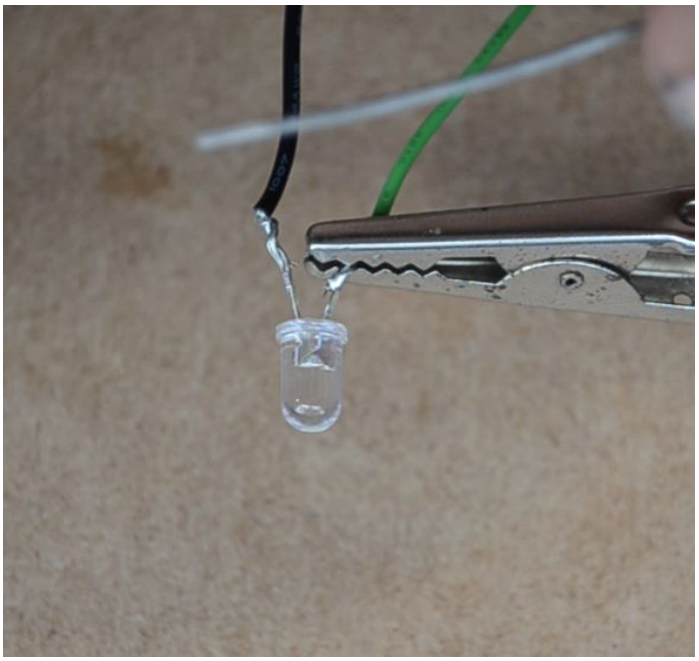
To find the positive and negative pole of the LED wire it temporarily to the battery. As the LED is a diode, it will only allow electricity to flow in one direction, if the polarity is reversed it will not light up.

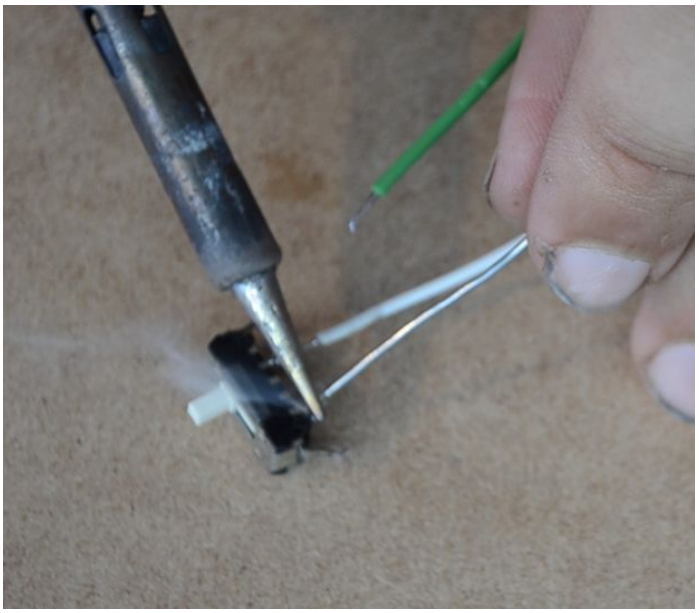
The positive wire will be connected to the switch, which will then be connected to the battery output on the charging module. To test the circuit, wire it temporarily to the battery, and use the switch to turn the LED on and off.

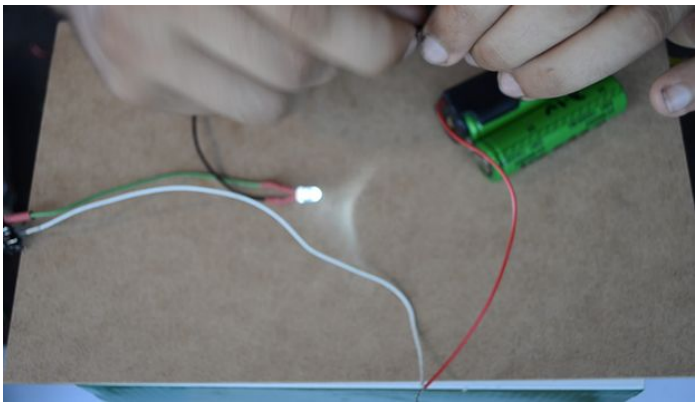
To find out which poles to use on the switch I wired a temporary circuit together, and it was a bit of trial and error as I had recycled the switch from an old Video Cassette Player, and I wasn't sure how it was configured.

Make sure you add some heat shrink to the wires on the switch to give it more support, and prevent any short-circuiting.









Step 11: Hacking the Micro USB battery Charger.

This little module is great at charging 18650 batteries. You can wire as many batteries in parallel, and this module will charge it. It features battery over charge and discharge protection, meaning the voltage of the battery will not go over 4.2 volts, and will not discharge below 3 volts. Voltages outside of this range will damage the battery.

The module features two LED's soldered into the circuit, which identify when the battery is charging, and when the battery is completely charged. The red LED indicates the battery is being charged, and the green LED indicates a full battery.

As the module would be inside the enclosure it would have been impossible to see if the battery was charging, or whether it was fully charged. Therefore I wanted to add two LED's, which I could mount into the back panel, which would indicate the charging status. This would be great to use with the Solar Panels to ensure that the enough sunlight was penetrating the solar cells to charge the battery.

The first thing to do is to identify, which LED is used for which purpose. You can do this by simply plugging in the Micro USB cable into the USB port on the module. The LED's should light up - I found that the LED closest to the Micro USB port was used for the 'charging' status and the one beside was a 'full charge' LED.

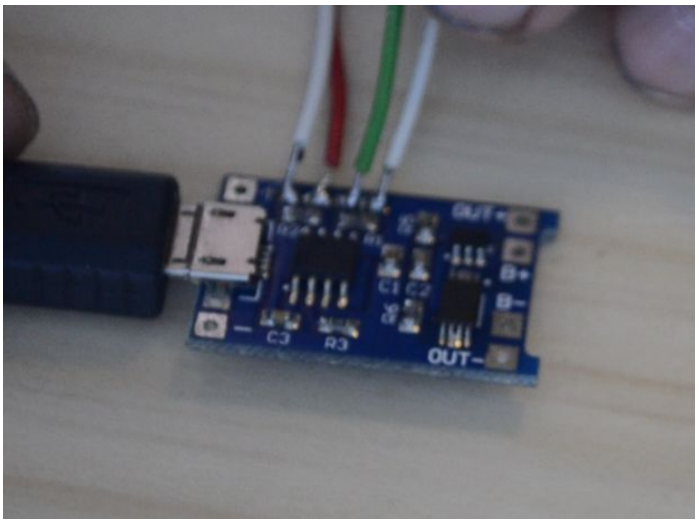
Once you have identified the LED, remove the LED by heating up the soldering pads, which are holding the LED to the PCB board. Once the pads are in liquid form you can remove the LED's.

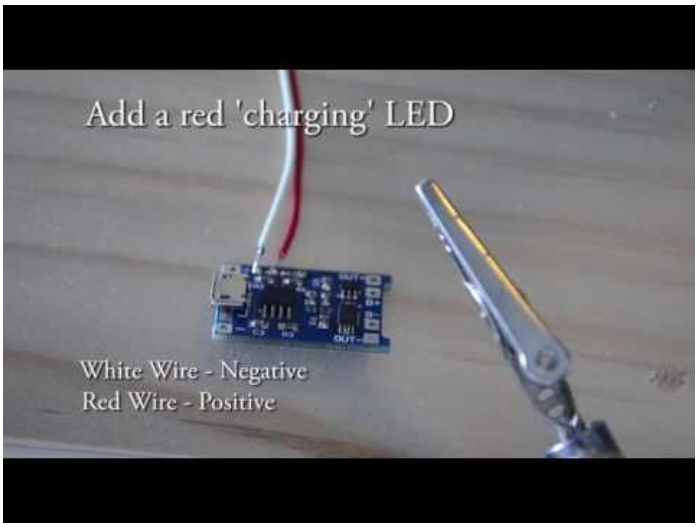
Only remove the 'Full Charge' LED if you have another LED to replace it. I used the RED LED from the phone-charging module as the charging indicator LED on the battery charger, and a spare green LED for the 'full charge' indicator.

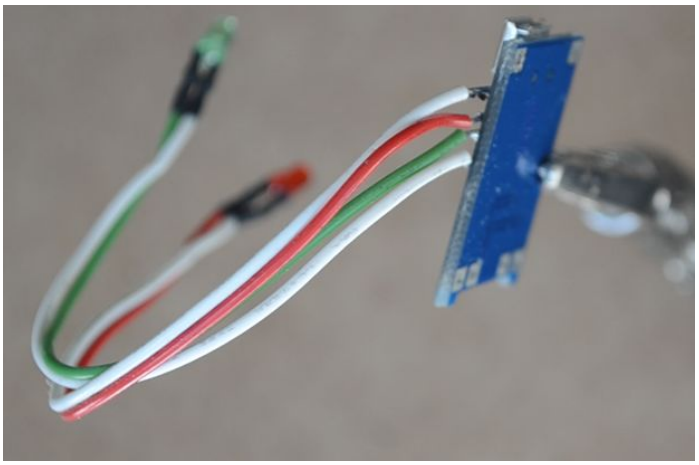
When soldering onto the circuit, I would recommend applying flux to the solder pads – this will make it easier to solder the wires to the pads. Once again to test the polarity of the pads and the LEDs – Plug in the charging module and temporarily place LED wires onto the pads to see if the LED's light up. Be careful not join any of the pads, as you will short circuit the module.

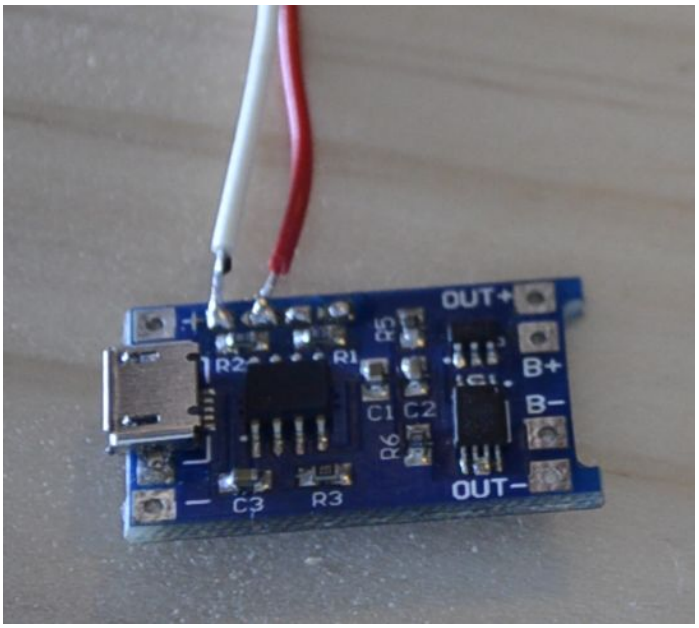
After you have soldered the LED wires onto the battery charger correctly, I would recommend going over those pads and wires with some hot glue, to prevent them from short-circuiting. I did this when I was mounting the board in the box.

I have uploaded a short video of me removing the LED's and soldering on two new LED's.





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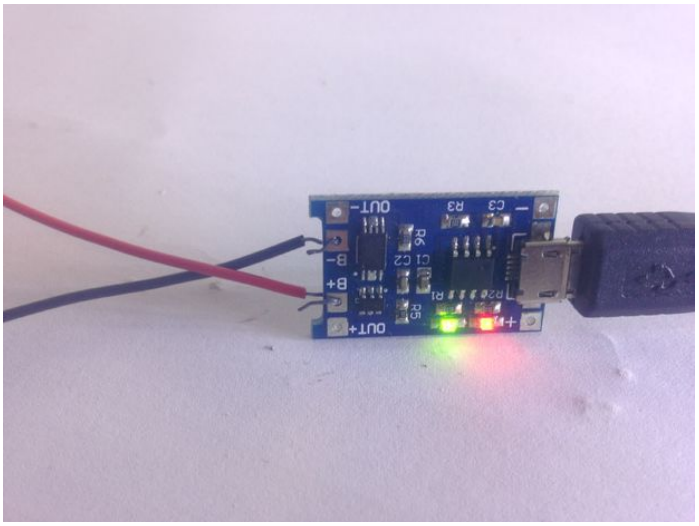

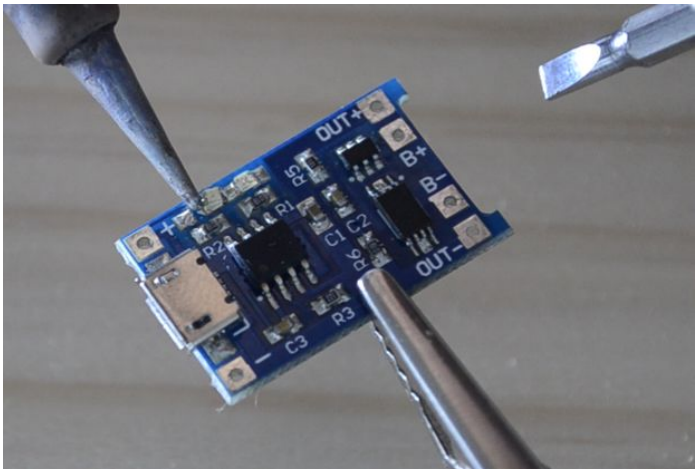
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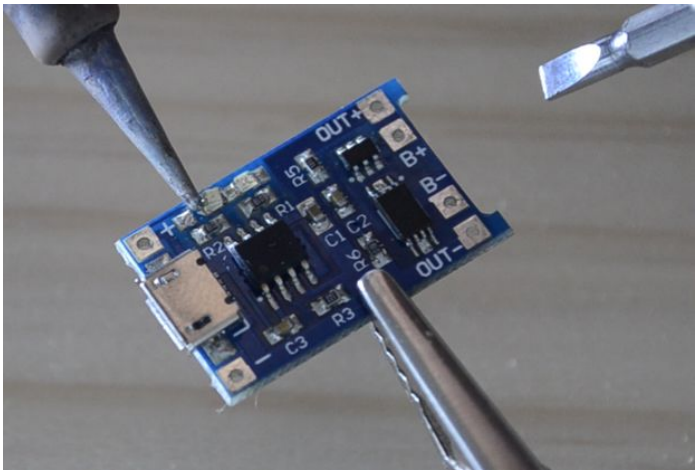
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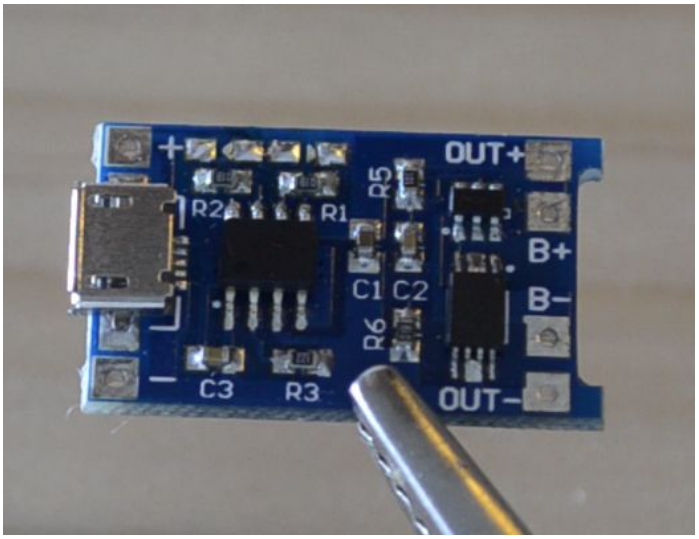
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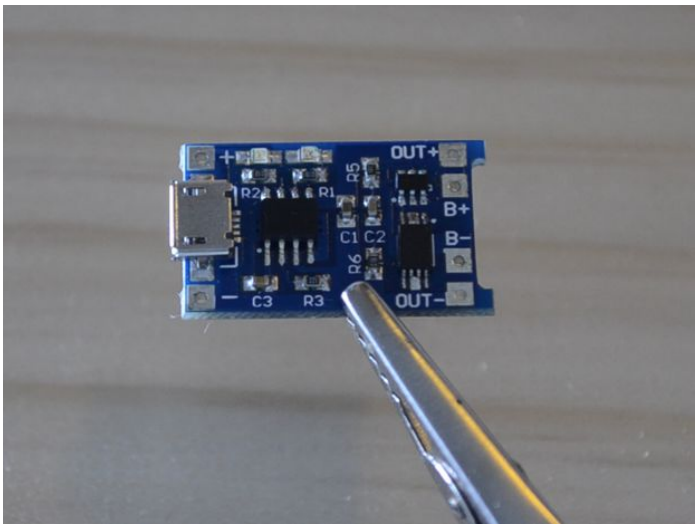
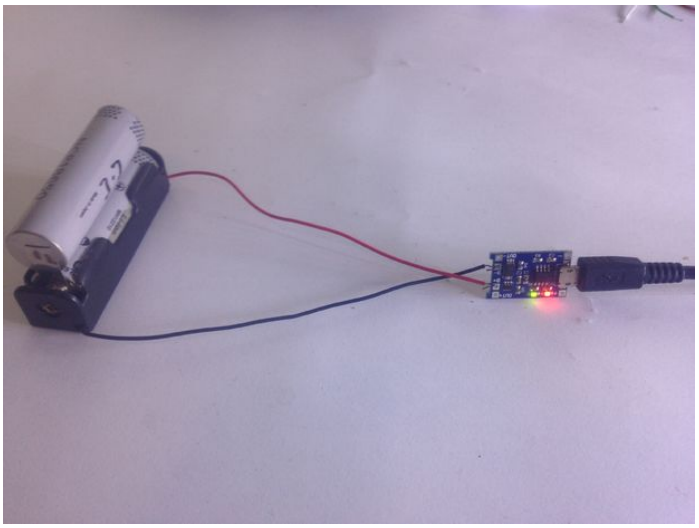
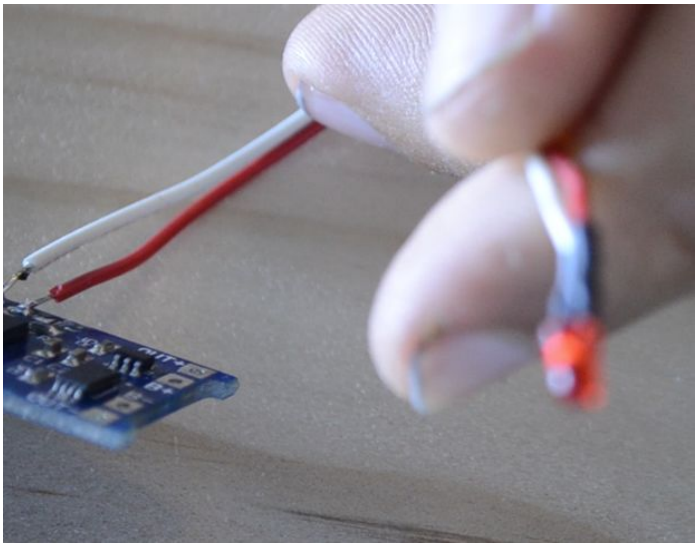






Step 12: Building the Battery Pack

Building the Battery Pack:

This step may be different to your battery pack depending on the batteries you have. Because my batteries have been spot welded together in pairs, I was able to solder directly onto the tabs.

My battery pack consists of 8 lithium-ion 18650 batteries joined together in parallel (Positive to Positive, and Negative to Negative).

To build the pack I joined all of the batteries together, using black duct tape. As the batteries are all in parallel, it is okay to have the batteries side by side (without any other insulation between cells).

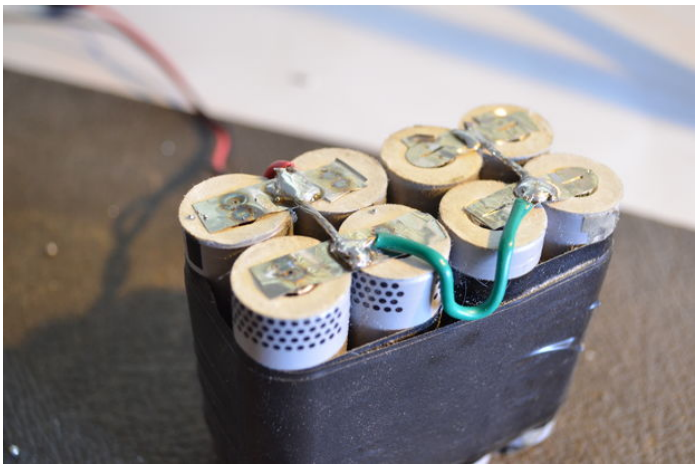
The pack was roughly the same size as the middle section of the box, and was about 38mm deep, meaning that it would fit nicely into one half of the enclosure, leaving the back half for components.

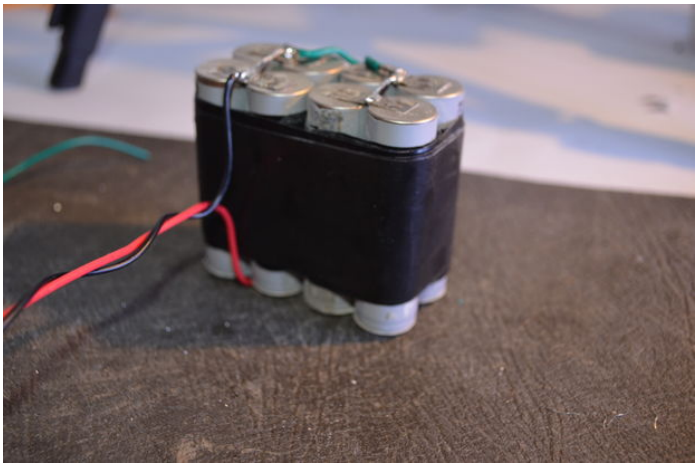
To solder directly onto the spot-weld tabs, I used a dremel rotary tool to remove the coating, which prevented the solder from sticking to the tabs. I then dabbed a small bit of solder directly to the tabs (with flux), 'tinned' a wire roughly the size of 2 cells and soldered the wire onto the tabs.

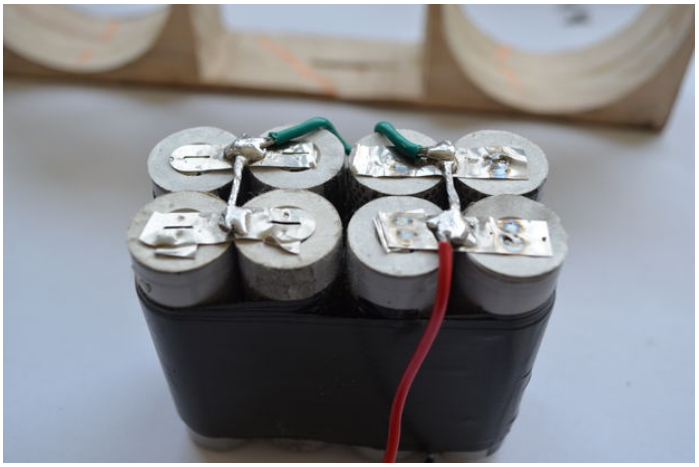
All of the wires were soldered onto the center of the tabs (between two cells) to prevent any exposed wire from accidentally short circuiting the battery.

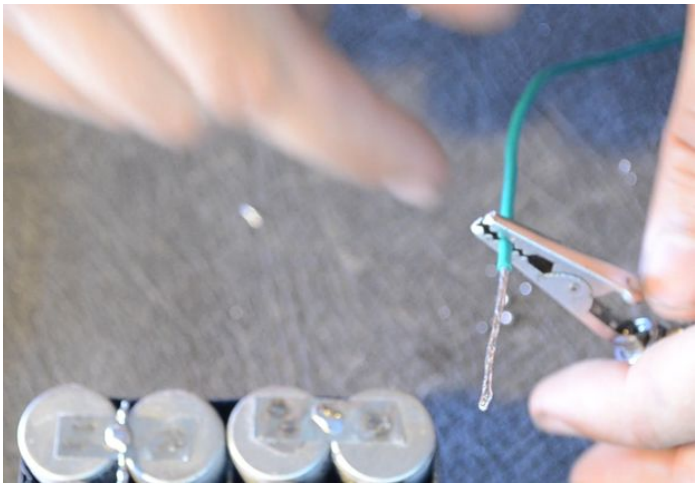
Tip: When soldering the batteries, be careful not to touch the soldering iron onto the battery for too long, as it will damage the battery.

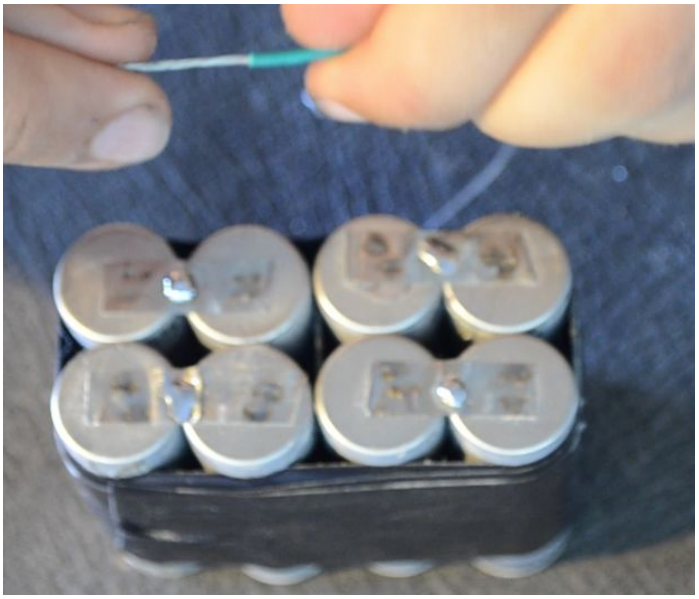
Check out the video to see how the battery pack was put together!





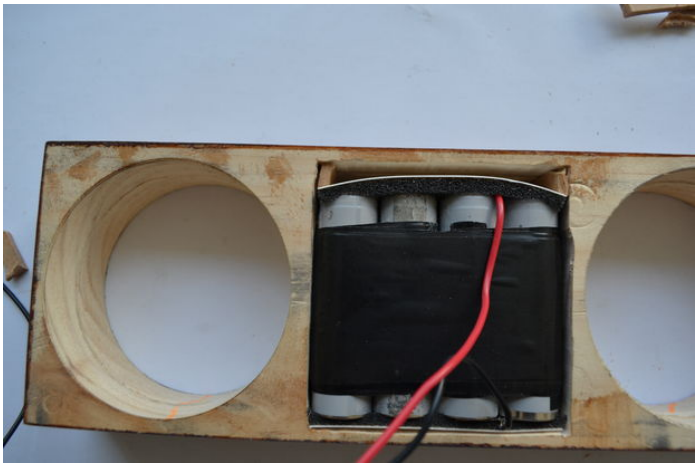


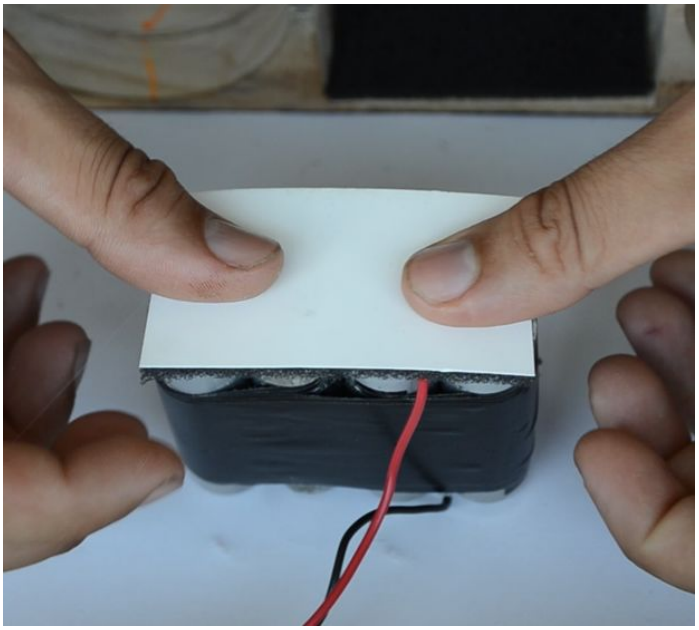


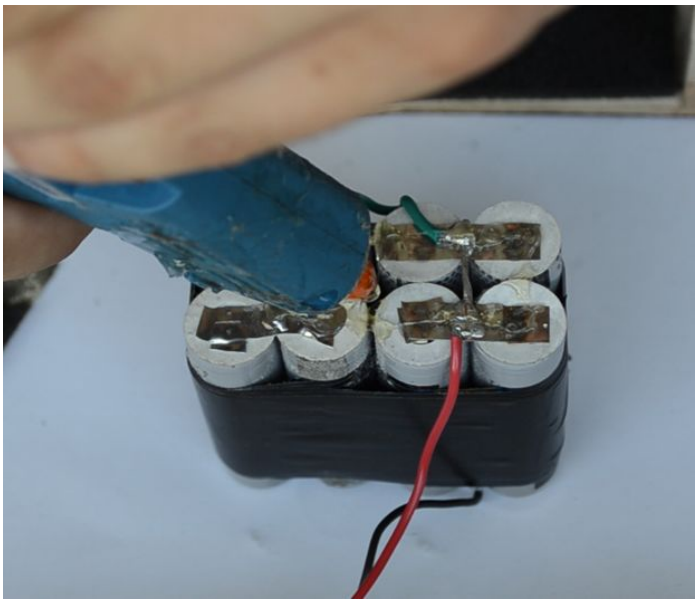


Step 13: Mounting the Battery:

To mount the battery into the box, I insulated the positive and negative terminals of the battery, with foam salvaged from an old scanner. I used hot glue to mount the battery to the box, and glued a small piece of MDF wood between the battery and the top panel, to secure the battery firmly in place.





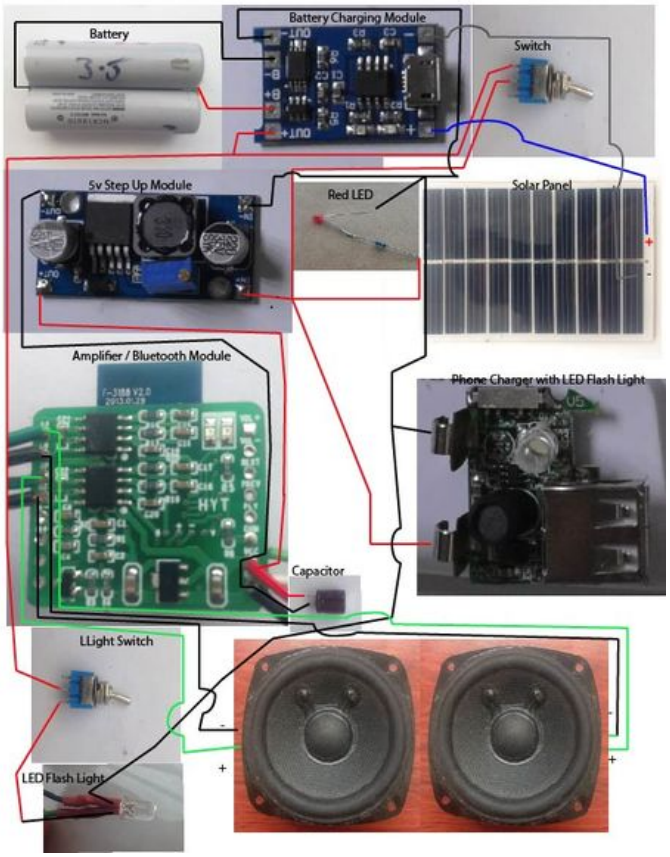


Step 14: Wiring Schmetic

There are few different ways to wire the components together. I decided to wire a main switch, which will provide power to everything. This means in order to use the Flash Light or the Phone Charger, you will need to turn the speaker on first.

Alternatively, you could wire the phone charger and the LED Flash light switch before the main power switch, and connect it directly to the battery output + terminals on the battery charger. This means you can use the Flash l?Light, and the phone charge, without having to turn the speaker on. In order to do this with the phone charger, you will need to remove the LED's as they will drain the battery.

The wiring schematic I have uploaded has the LED flash light switch wired before the main on/off power switch. This means you can use the LED on/off slide switch to control the light, without having turn on the main power switch.



Step 15: Wiring the Micro USB Battery Charger

In this step we will be soldering onto four terminals on the Micro USB Battery Charger. ;

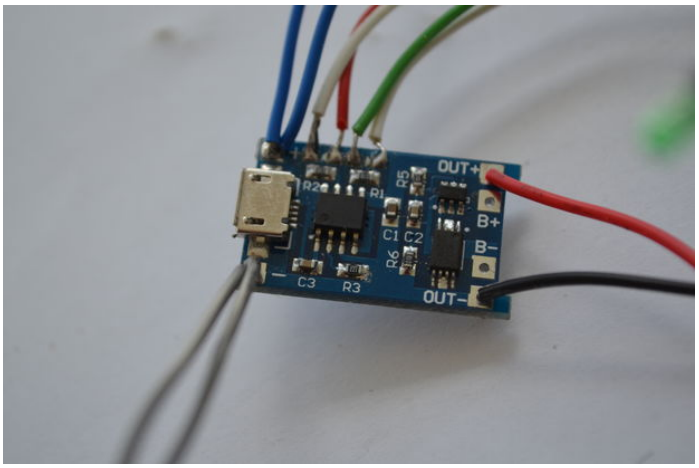
1) The 'In +' terminal will have two wires (blue), which will be connected to the positive terminal on the solar panel. Each wire will go to a separate solar panel.

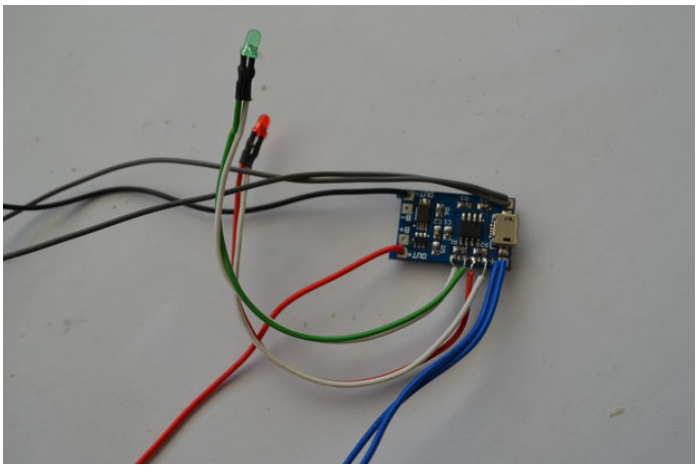
2) The 'In -' Terminal will have two wires (grey), which will be connected to the negative terminal on the solar panel. Each wire will go to a separate solar panel.

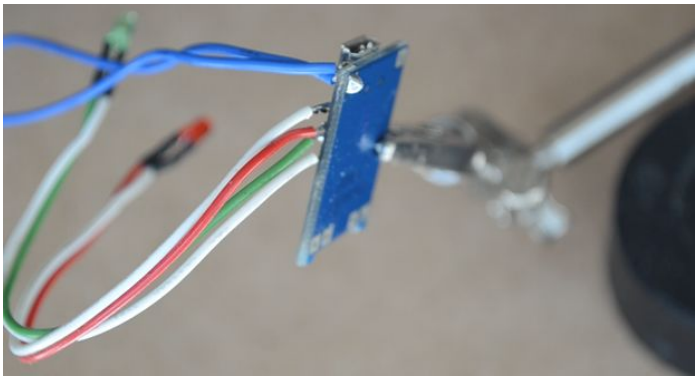
3) The 'out +' terminal will have one wire (red) which will be connected to the top pole of the main on/off switch.

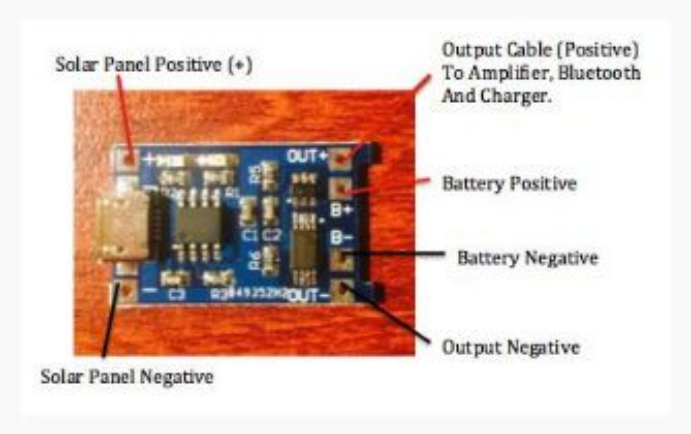
4) The 'out -' terminal will have one wire (black) which will be connected to the ground cables of the following components; Phone Charger, LED indicator Light, LED Flash Light and Step-Up Module.

The Bat -, and Bat + terminals will be connected towards the end of the instructable, directly to the battery pack.









Step 16: Wiring the Amplifier

In this step we will be adding positive and negative wires to the amplifier, and the left and right (+,-) speaker driver wires. We will also add a capacitor to the input of the amplifier, in parallel to the positive and negative terminals. I have uploaded a video, which explains what happens when you add/remove capacitors.

Firstly, solder a positive and negative wire onto the amplifier board; I used a red for positive and black for negative. These wires will then be soldered onto a Step-Up Module boosting the voltage from 3.7v up to 6.5 volts, in the next step.

Using a Capacitor:

As I was using a 6.3V capacitor, I only increased the voltage up to 6.3V, as you shouldn't exceed the limits of the capacitor.

The capacitor acts like a small battery, which temporarily stores charge. The capacitor was used to prevent fluctuations in the voltage. Without a capacitor, in certain songs with a lot of bass (and at high volume), the speakers/amplifier will draw a lot of current causing fluctuations in the voltage and the amplifier would shut off.

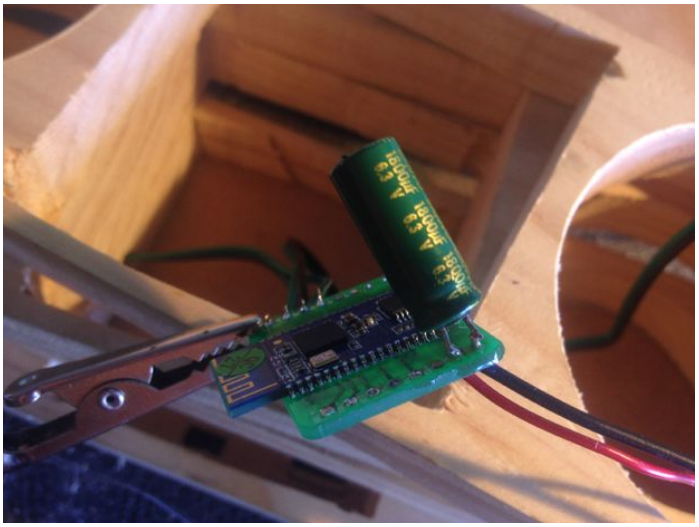
I used two capacitors in parallel, rated at 6.3v, 1000uf and 1800uf. When I was testing the speakers with two battery cells, it was still cutting out with one 1800uf capacitor, therefore I added an extra capacitor. The more batteries you use the less the voltage will fluctuate, depending on the amp rating (current) of the battery cells.

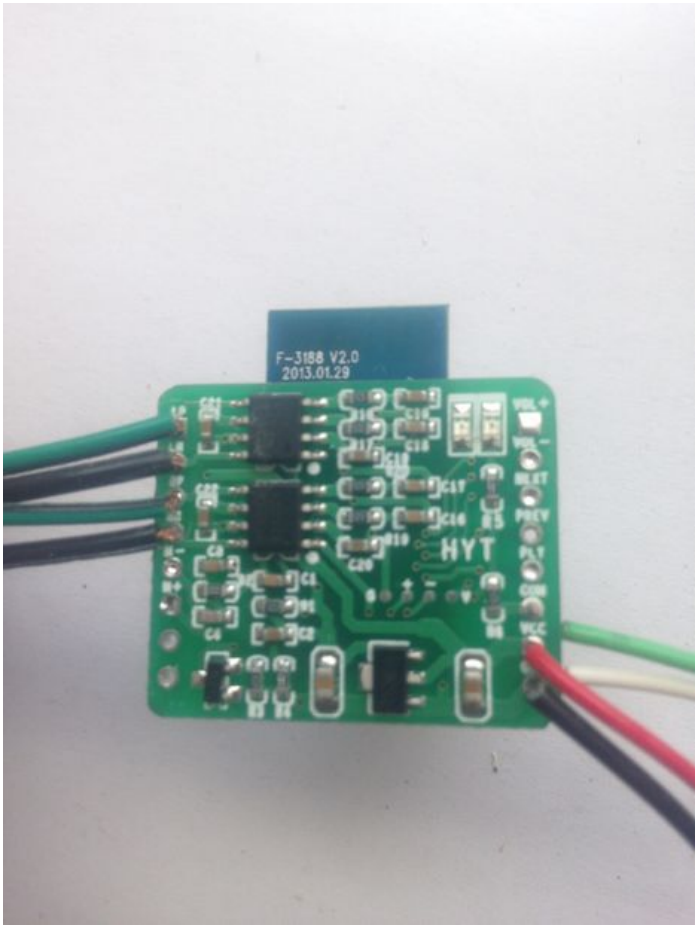
I tested the amplifier with and without capacitors, to see the results check out the video!

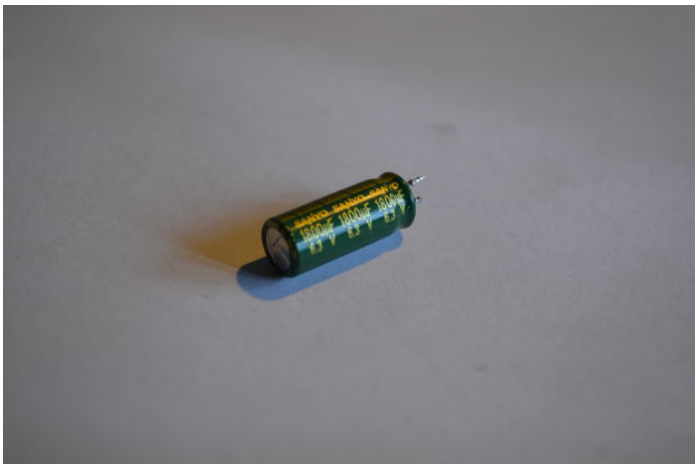
Adding buttons:

This amplifier is great because it gives you the option to add buttons or switches, you will need to use 'push to make' switches. I decided not to use any buttons, as I prefer my speaker with fewer buttons. Have a look at the wiring schematic when you purchase the amplifier for details about how to wire the buttons.

You also have the option to use a mic for the speakerphone.





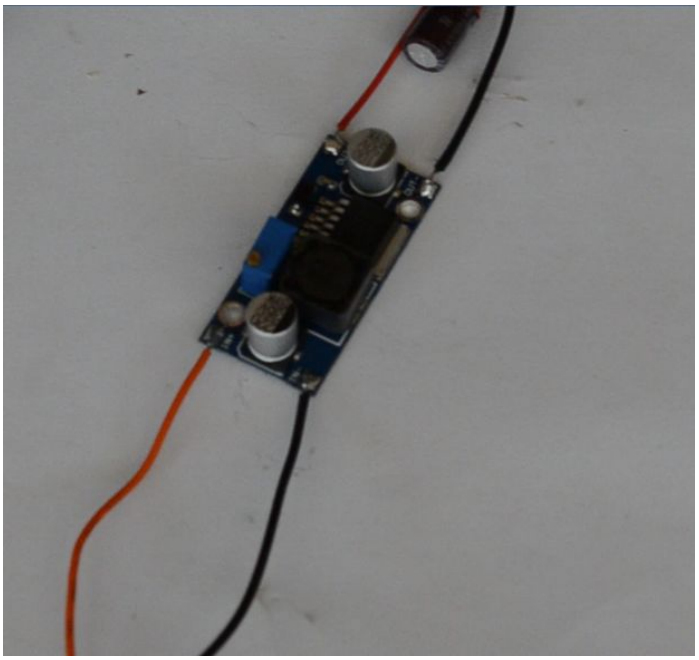


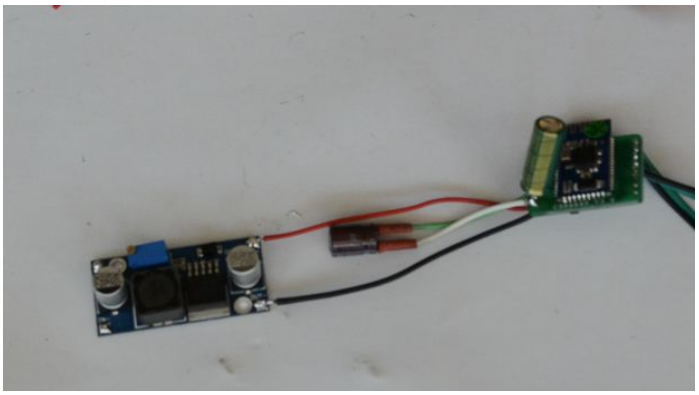
Step 17: Boosting the Voltage!

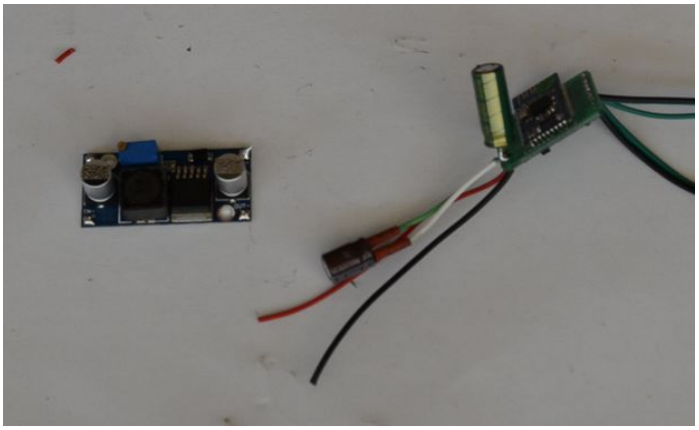
In order to get more power from our amplifier, we will need to step the voltage up to 6.5 volts. This Step-Up module will do the trick – you will need a multi meter to check the voltage, as you adjust the potentiometer. Turn the potentiometer clockwise to boost the voltage, and anti-clockwise to step-down the voltage.

The input (+) will be connected to the main on/off switch, and the input (-) will be connected to the output (-) on the battery charging module.

The output (+) and (-) of the Voltage Booster (Step-Up Module), will be connected to the positive and negative of the amplifier.







Step 18: Adding an LED indicator Light.

Adding an LED indicator Light:

In order to know when the speaker is switched on/off, we will be using a red 3mm LED as an indicator light.

The LED will light up only when the speaker is turned on.

For educational purposes, I decided to use an LED with a resistor, to show how it could be wired together. I picked up a 2.3v 15ma resistor from Jay car electronics, and used a 90-ohm resistor.

To calculate the resistor you will need for your LED, you will need to do the following calculation.

The formula for resistance is R=V/I

R = Resistance

V = Voltage

I = Current

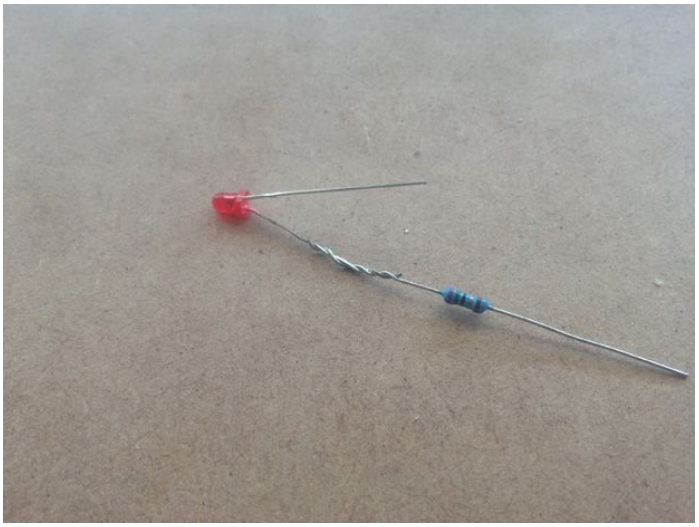
The voltage of the LED I am using is 2.3 Volts, and the current is 15ma. Therefore to use the LED, we will need to bring 3.7V (the nominal voltage of our battery), down to 2.3V at 15ma.

To do this we will do the following calculation:

(Battery Voltage – LED Voltage) / (Current / 1000) = Resistance

(3.7 Volts – 2.3 Volts) / (15 / 1000) = 93.33

Therefore we will need a **90-Ohm resistor**. Simply wire the resistor the positive leg of the LED, which will be connected to the output of the main on/off switch. The other leg (cathode) (-) will be connected the negative of the battery output (-).



Step 19: Mounting the Passive Radiators

Now is the time to mount the Passive Radiators to the back panel of the speaker.

The passive radiators, I will be using for my speaker have not arrived in the mail. I will update this instructable when they have arrived.

Step 20: Mounting the Electronics

In this step, mount all of the electronics to the middle compartment of the speaker.

To mount the Micro USB Battery Charger, and the Phone Charger, I glued a piece of MDF wood, behind the module to provide support when plugging in the USB cables. See the Pictures above to get a better idea about how to do this.

the rest of the components were mounted with hot glue, around the sides of the box.

Mount the Following Components:

1) Mount the on/off switch

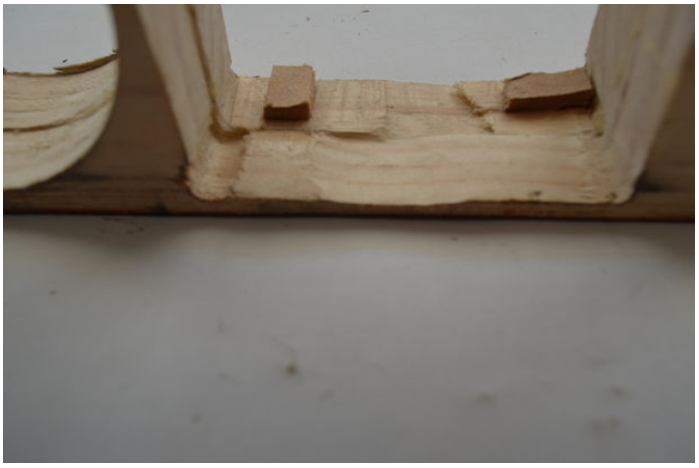
2) Mount the Micro USB charging Module

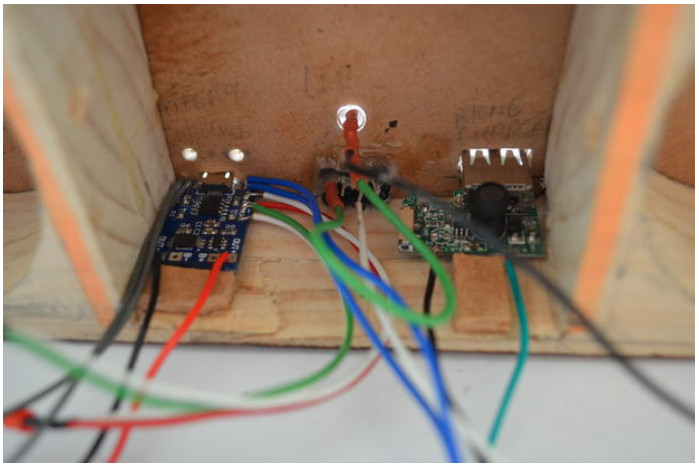
3) Mount the USB phone Charging Module

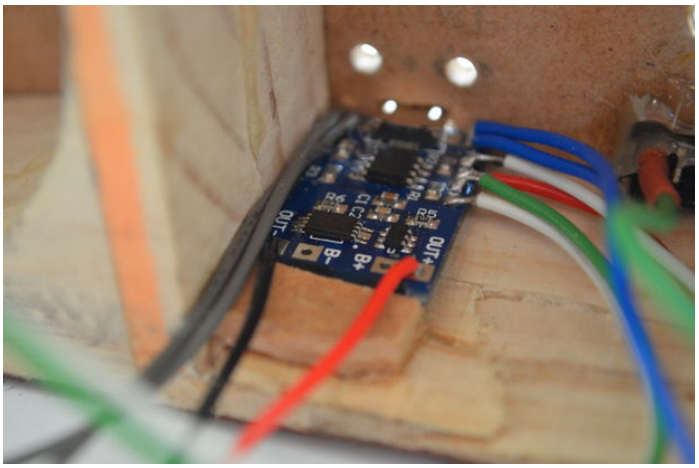
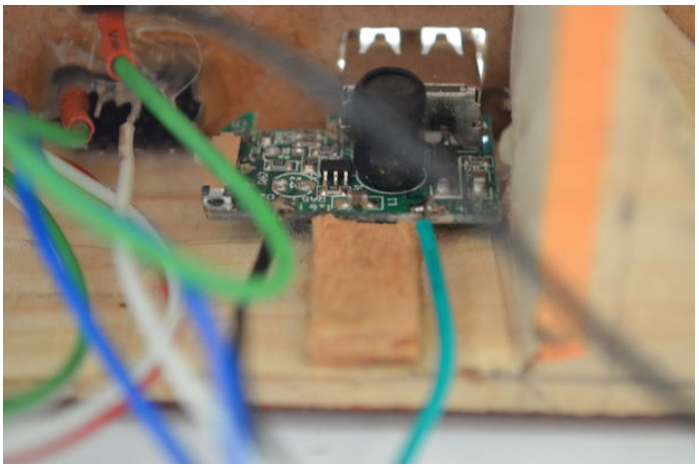
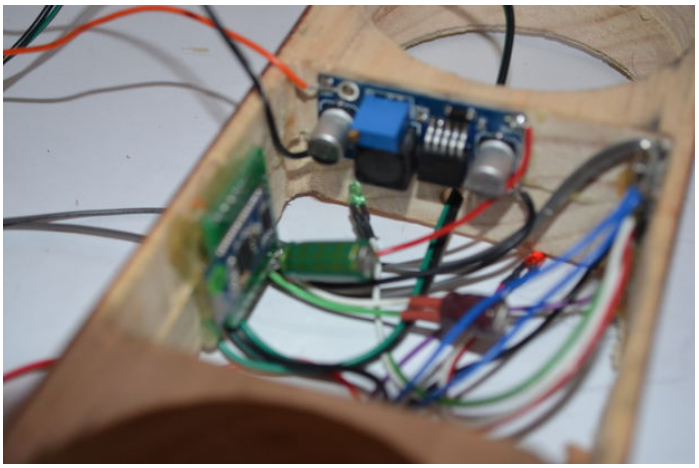
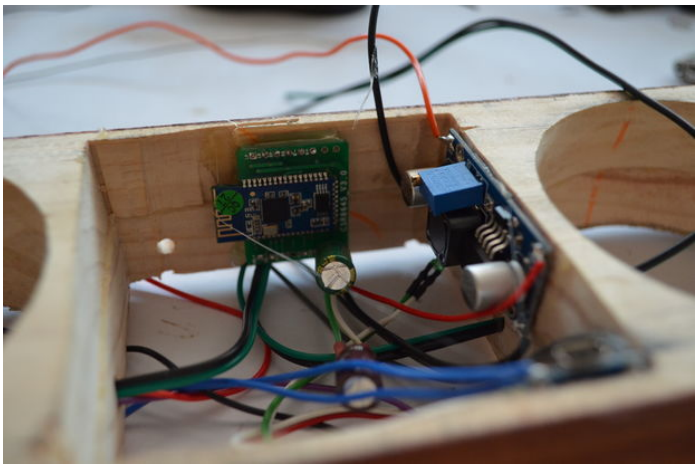
4) Mount the Amplifier / bluetooth module

5) Mount the Voltage Booster

6) Mount LED flash Light Switch and LED





Step 21: Connecting the remaining wires

Next step is to wire all of the remaining components together.

To do this, refer back the wiring schematic you have drawn up, or use the one we have provided.

In this step, I wired the 'Bat out (+)' on the battery charger, to the top pole of the switch. The second pole of the switch was then connected to all of the Positives of the following components;

Wiring the Positives (+)

1) Step Up Voltage Booster (Orange Wire)

2) Phone Charger (Green)

3) LED Flash Light Switch (White)

4) LED on / off Indicator Light (Yellow)

Wiring the Grounds (-)

The grounds (-) of all of the components (apart from the ground of the amplifier which is connected to the voltage booster) are connected to the 'Out (-)' wire on the Battery Charging Module. This includes;

1) Step Up Voltage Booster

2) The Phone Charger

3) The LED Flash Light (not the switch)

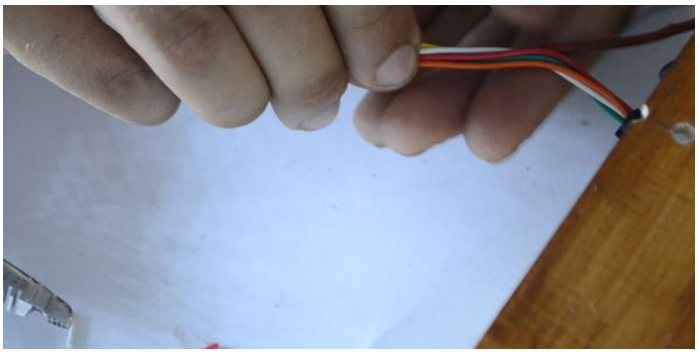
4) LED on/off Indicator Light.

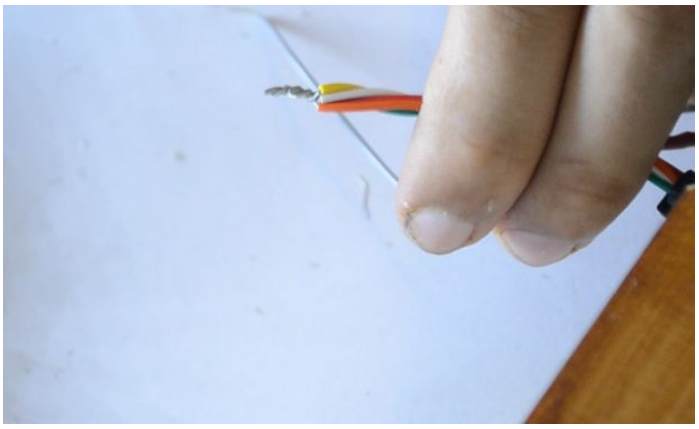
Wire the Battery to the Battery Charging Module

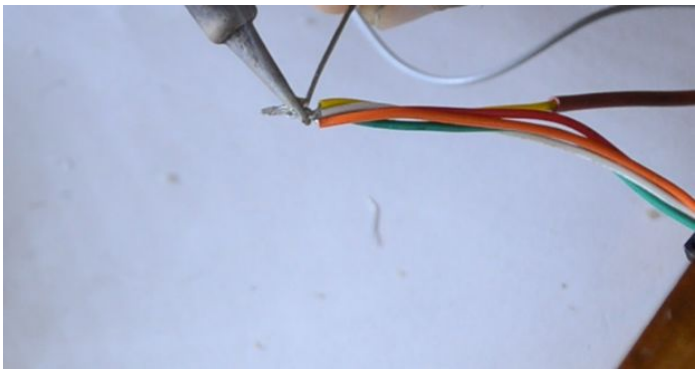
Finally wire the positive wire (red) from the Battery to the 'Bat +' on the battery charging module. Next, wire the the negative (black) wire from the Battery to the 'Bat -' on the battery charging module.

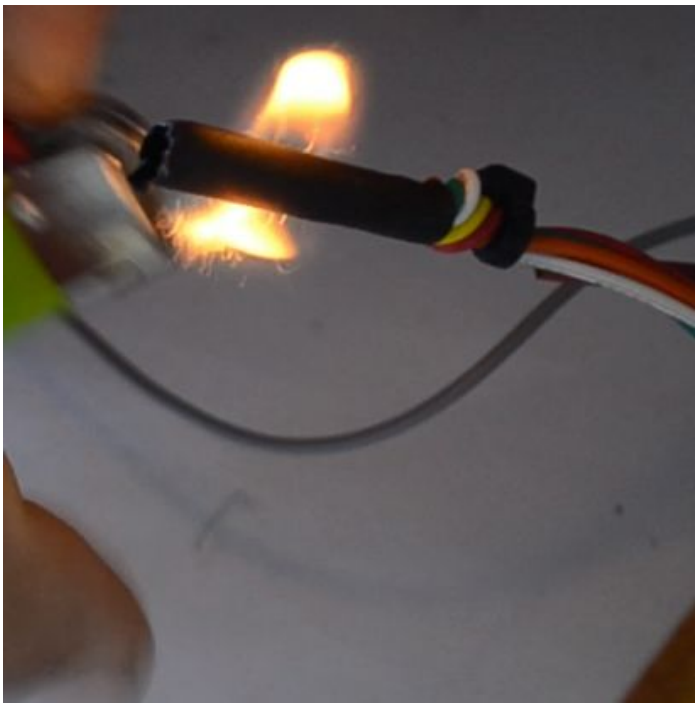
All of the components should now be connected. Test all of the components to see if they work.

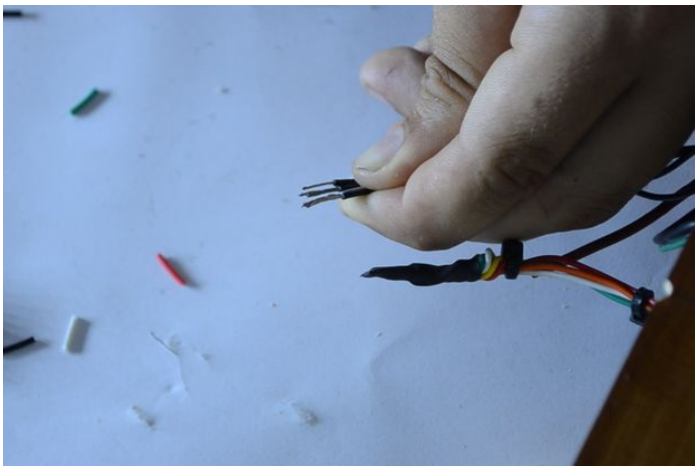
Make sure you add heat shrink to all exposed wires.

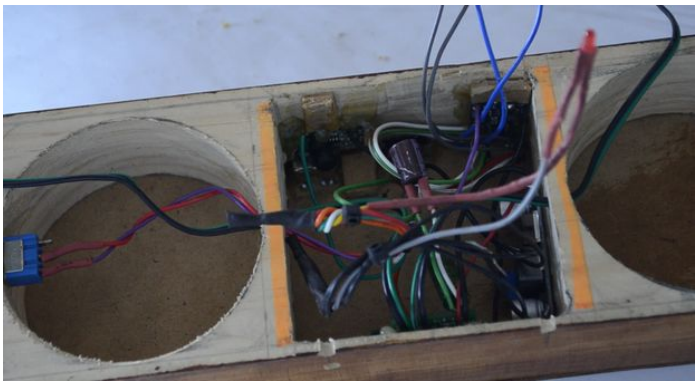












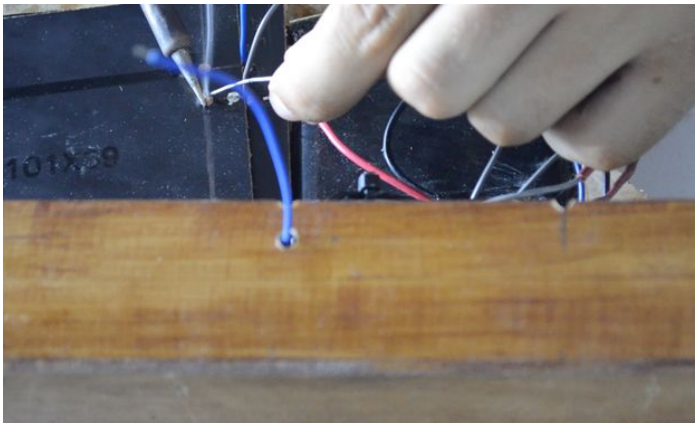
Step 22: Wiring Solar Panels

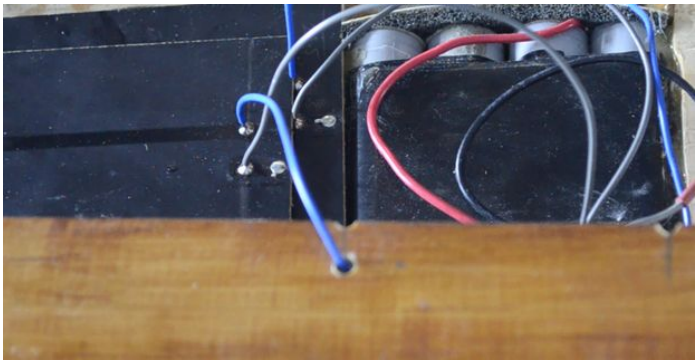
Each solar panel is rated at 5V 200 ma. To double the capacity we will need to join them in parallel. This means wiring the positive to positive, and the negative to negative of each solar panel. This will give a total of 400 ma in direct sunlight.

Alternatively, you can wire both positives from the solar panel to the input (+) on the Micro USB Battery Charger (which is what I have done). You can do the same with both of the negatives.

In order to mount the solar panels flush on the top panel, I soldered the wires at a 90 degree angle. Make sure you thread the wires through the holes in the enclosure prior to soldering.

Note: There is no need to add a blocking diode, as the charge controller will stop the panels from drawing energy. Also, there is no need for a voltage regulator.





Step 23: Mounting the Speakers

Making Rubber Sealants:

In order to make the speaker chambers completely airtight, I made rings out of 1.5mm of rubber to squeeze in-between the speakers and the wooden panel.

To make the rubber sealants, I traced the circumference of the speaker hole in the front panel with a thick marker, and cut a circle roughly 7mm from the traced circle to make a ring.

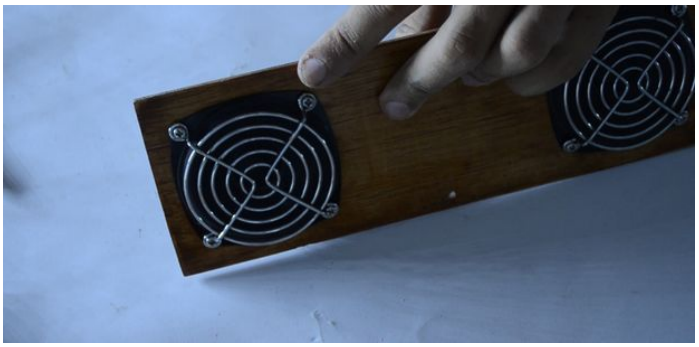
I then mounted the speakers to the front wooden panel with M3 (3mm) nuts and bolts, which applied pressure onto the rubber sealant to eliminate any air from escaping. Doing this will dramatically improve the sound quality, and improve the performance of the passive radiators to replicate the low bass frequencies.

Metal Speaker Grills

The metal speaker grills I am using are recycled from old computer fans. I am using 70 mm grills, in which I bent the legs with some pliers so that they could be mounted to the speakers.

To purchase the grills, click on the following link;

http://www.ebay.com.au/itm/2-Pieces-Metal-Wire-Fin...



Step 24: Upgrades

Here are a couple of tips to improve your speaker!

Add a Voltage Meter

This is a great way to tell the battery voltage of the speaker. A fully charged battery will read between 4.1 - 4.2 volts. A low battery will read near 3 volts.

Upgrade the LED Flash Light

The LED Flash Light was not very powerful, instead I will be replacing it with a PCB LED salvaged from an old LED TV. One of these LED lights will run off 3 - 4 volts. Try searching for high 3 - 5V luminescent PCB LED's on eBay.

Acoustic Foam

Depending your speaker drivers, try experimenting by adding acoustic foam / poly fill to the enclosure.

Step 25: Finished!

Thanks Folks,

That concludes this tutorial!

We are a small Social Enterprise based in Brisbane, Australia called AMPLFY. We teach people with disabilities and people seeking employment how to build cool products out of recycled electronics!

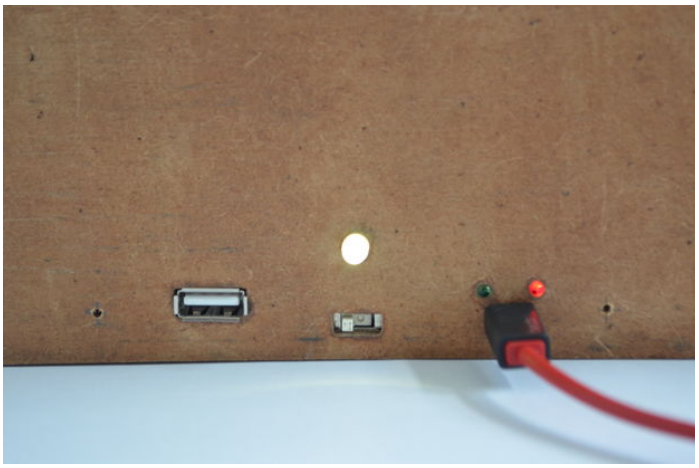
If you enjoyed this Instructable and learnt something, here are a couple of things you can do to support us;

1) Vote for this instructable in the **AMPS and Speaker Contest**

2) Like our Facebook Page and Instagram Page.

3) To find out more about the work we do, and the other awesome speakers we have created check out www.amplfy.com.au.

4) We will also be starting up a Youtube channel - so make sure you subscribe!



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