Make Your Own AirCasting Luminescent Apparel

AirCasting is a platform for recording, mapping, and sharing health and environmental data using your smartphone. Each AirCasting session lets you capture real-world measurements, annotate the data to tell your story, and share it via the CrowdMap.

To start recording, mapping, and sharing sound level data for your neighborhood, simply download the AirCasting app to your Android device and press record. Don't have an Android device? Check out the AirCasting maps to see if someone has already contributed data for your area.

Zephyr HxM
Heart Rate Monitor

AirCasting
Air Monitor

AirCasting
Luminescent Vest

Your DIY
Sense Device

AirCasting App

Your DIY
Luminescent Accessory

Your
Server

AirCasting
Website

Other AirCasters
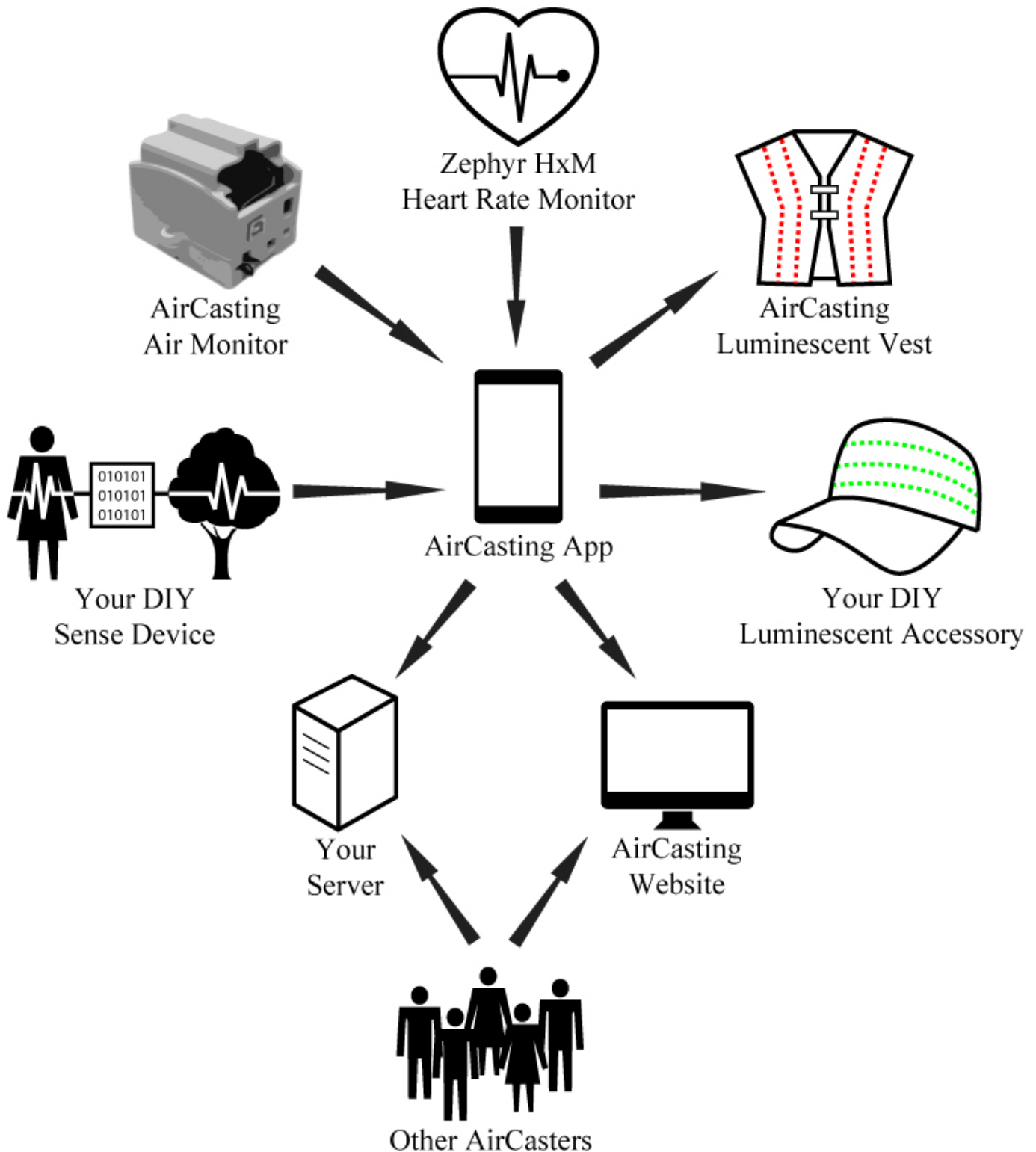
AirCasting Luminescence

AirCasting Luminescence uses a IOIO microcontroller connected to the AirCasting app over Bluetooth to illuminate LEDs in response to the sensor measurements received by the AirCasting app: green for low intensity, then yellow, then orange, and red for high intensity. AirCasting Luminescence was developed to communicate sensor measurements without the normally required reference to a screen interface and to spark interaction between AirCasters and people located in their immediate vicinity. AirCasting Luminescence . . . make a fashion statement with your sensor measurements!

Known Technical Difficulties

Many Android devices running Android 2.3.7 or below have a bug in the Broadcom Bluetooth stack that skips discovery of devices that report their class as 0x00, such as the IOIO. These Android devices will not be able to connect to the IOIO without upgrading to Android 3.0 or above.

When you purchase your IOIO make sure it has firmware version 3.11 or above or you will need to update the firmware yourself in order to use Bluetooth.

Not all Bluetooth dongles will work with the IOIO. The Bluetooth dongle included in our parts list has been proven to work with the IOIO, though it should be noted that almost half the dongles we ordered from the specified vendor were defective.

Monitor Air Quality with AirCasting

The AirCasting Air Monitor (ACAM) is equipped with carbon monoxide (CO), nitrogen dioxide (NO2), temperature, and relative humidity sensors. The ACAM connects to the AirCasting Android app over Bluetooth. When the ACAM is connected to the AirCasting app and an AirCasting session is initiated, the app begins receiving, mapping, graphing, and enumerating the data from the ACAM sensors. Download the AirCasting Air Monitor DIY guide, http://www.habitatmap.org/habitatmap_docs/HowToBuildAnAirCastingAirMonitor.pdf, and build your own Arduino-powered air monitor.

Monitor Your Heart Rate with AirCasting

Connect the Zephyr HxM heart rate monitor to the AirCasting app and measure how your heart rate responds to your activity level, location, and exposure to noise and air pollution.

ATTN Hardware Developers

It's simple to connect your own custom-designed sense device to the AirCasting app to display and record sensor measurements. Just do the following:

1. Download the AirCasting Arduino sketch, which controls the sensors and sends data to the app via Bluetooth, https://github.com/LunarLogicPolska/AirCastingAndroidClient/blob/master/arduino/aircasting/aircasting_tmp36.ino
2. Alter the Arduino sketch to communicate your sensor data
3. Use the AirCasting app to send your data to the AirCasting servers for display on the AirCasting website. Want to send the data to your own servers, just specify the URL in the AirCasting app settings, "Menu" > "Settings" > "Backend settings".

AirCasting is Open Source

AirCasting is an open source project. You can access the code repositories for the AirCasting Android app and the AirCasting web app through GitHub.

Thanks!

To Dr. Iem Heng and Raymond Yap for designing and programming the AirCasting Luminescence electronics with support from Dr. Andy Zhang; to Valentine Leung for designing and making the AirCasting Luminescent Vest garment; to Lunar Logic Polska for coding the AirCasting app and website; to Tim Dye for big ideas and constructive feedback; and to Brooke Singer for helping steer the project in the right direction.

AirCasting Partners

HabitatMap is a non-profit environmental health justice organization whose goal is to raise awareness about the impact the environment has on human health. Our online mapping and social networking platforms are designed to maximize the impact of community voices on city planning and strengthen ties between organizations and activists working to build greener, more sustainable cities. In addition to our online platforms, habitatmap.org & aircasting.org, HabitatMap conducts workshops that teach grassroots groups and their members how to leverage our online map making tools to strengthen their organizing and advocacy efforts.

City Tech's Mechatronics Technology Center provides a multidisciplinary platform for students to master the latest mechatronics and robotics technologies and gain experience through hands-on projects. The principle of hands-on education gives students an opportunity to experiment and understand why science, technology, engineering, and mathematics (STEM) are important in the context of solving real world problems.

The New York Hall of Science is New York City's hands-on science and technology center. Since 1986, NYSCI has served over seven million children, parents, and teachers. NYSCI's mission is to convey the excitement and understanding of science and technology to children, families, teachers, and others by galvanizing their curiosity and offering them creative, participatory ways to learn. NYSCI features the largest collection of hands-on science exhibits in New York City. Visitors of all ages can explore over 450 interactive exhibits.

Contact Us

Do you have questions, comments, or constructive feedback regarding our DIY guide? Contact Michael Heimbinder, Executive Director, HabitatMap: info@habitatmap.org, 347.410.9499
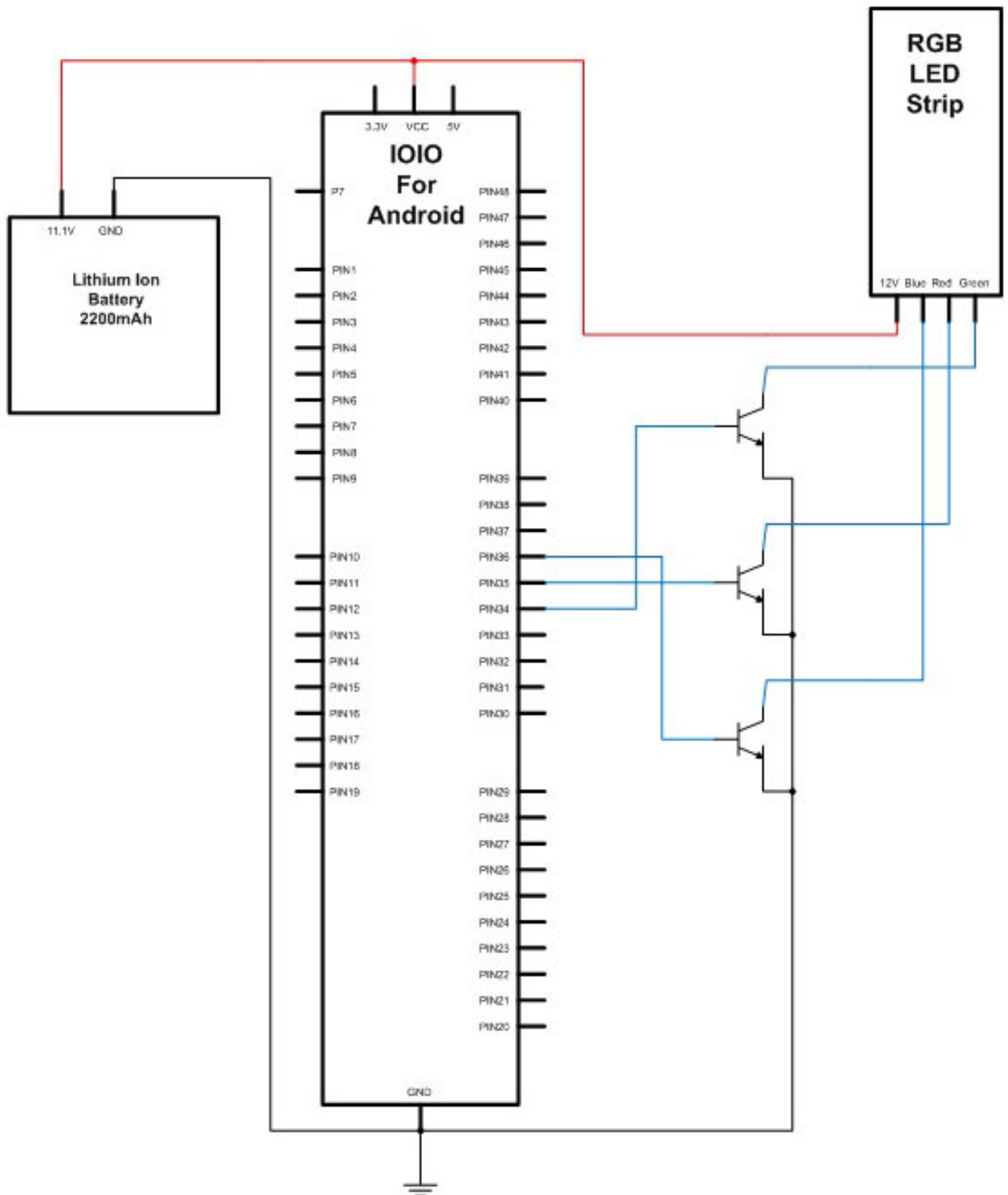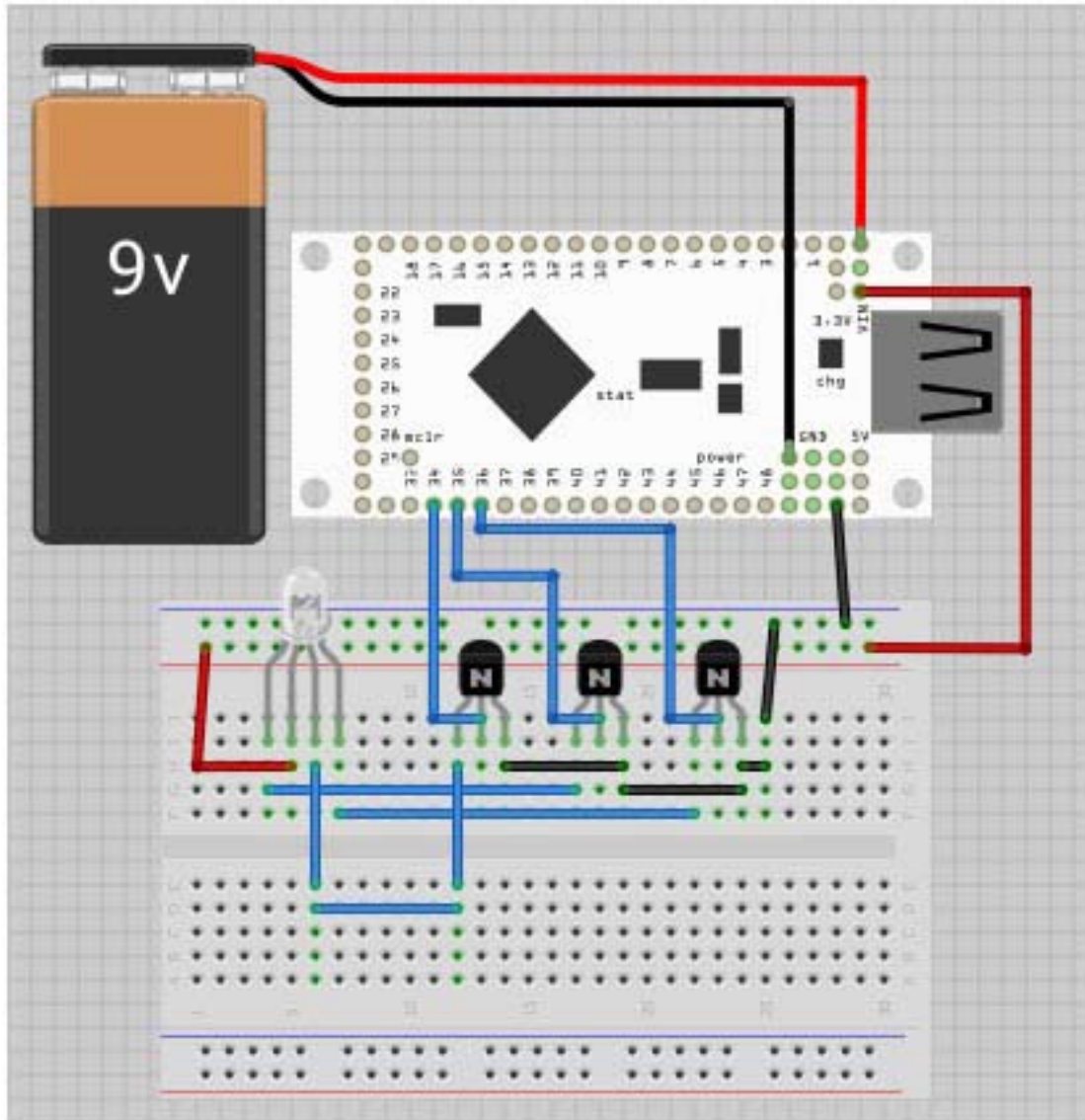
MAKE IT

&

GET ON THE MAP!

Parts & Tools

The electronic components for AirCasting Luminescence cost approximately $120 not including the battery charger. Vendors and vendor web links for these components are not an endorsement of the vendor; they are provided for convenience only. To make your own luminescent apparel you'll need a soldering iron, solder wire, a wire cutter/stripper, and long nose pliers.

| Item Name	Vendor	Vendor Web Link	Price/Unit
Dual Mini Board with 213 Holes	Radioshack	http://www.radioshack.com/product/index.jsp?productId=2104052	$2.19
IOIO for Android	Sparkfun	https://www.sparkfun.com/products/10748	$49.95
Bluetooth Dongle	Amazon	http://www.amazon.com/Bluetooth-USB-Micro-Adapter-Dongle/dp/B001EBE1LI/ (Buyer beware: often defective, but cheap)	$0.88
Tenergy Li-Ion 18650 11.1V 2200mAh Battery	Amazon	http://www.amazon.com/dp/B003BH8GVY/ref=pe_175190_21431760_M2T1_ST1_3p_dp_1	$26.99
2 XT60 Connectors - Male/Female Pair (the second female connector is used to adapt the charging cable)	Sparkfun	https://www.sparkfun.com/products/10474	$1.50
5 meter waterproof RGB LED strip, 300 LEDs, SMD 5050	Amazon	http://www.amazon.com/s/ref=nb_sb_noss_1?url=search-alias%3Delectronics&field-keywords=RGB+led+strip+5050+300 (Buyer beware: some LED strips advertised as 300 are only 150, others have defective connections within the strip)	$30.00
3 NPN Transistors	Jameco	www.jameco.com/webapp/wcs/stores/servlet/ProductDisplay?freeText=2N3053A&langId=-1&storeId=10001&productId=38295	$0.65
Stranded Breadboard Jumper Wire: 1 long black, 1 long red, 1 short red, 1 short green, 1 short blue, 1 short white	----	----	----
Solid Core Breadboard Jumper Wire: 2 gray, 1 red	----	----	----
Heat Shrink Tubing	----	----	----
TLP-2000 Tenergy Universal Smart Charger for Li-Ion/Polymer battery (not shown)	Amazon	http://www.amazon.com/gp/product/B001BEXDRQ/ref=oh_details_o06_s00_i00	$24.95
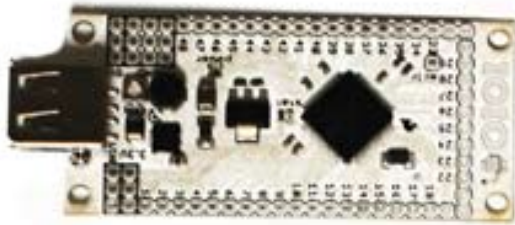
IOIO for Android

NPN Transistors

XT60 Connectors

Stranded Breadboard Jumper Wire
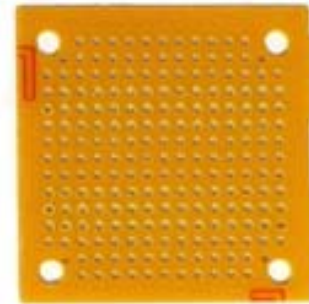
Dual Mini Board

11.1 V Lithium-Ion Battery

Solid Core Breadboard Jumper Wire


Bluetooth Dongle


Heat Shrink Tubing

RGB LED Strip

Step by Step Instructions

1 Snap the Mini Board in half. Take half the board, orient it top side up, and rotate it so the snapped side is facing right. Mark the lower left hand corner with a permamnent marker to orient yourself while building up the board. Then flip the board upside down and mark the same corner on the other side of the board.

2 Insert the three transistors into the board. Be sure to pull the transistor wires all the way through the board until the transistors are nearly flush with the top of the board. Bend the upper left legs up, the lower legs down, and the upper right leg to the right. Solder all the legs to the board. Be careful not to short the connections when soldering.
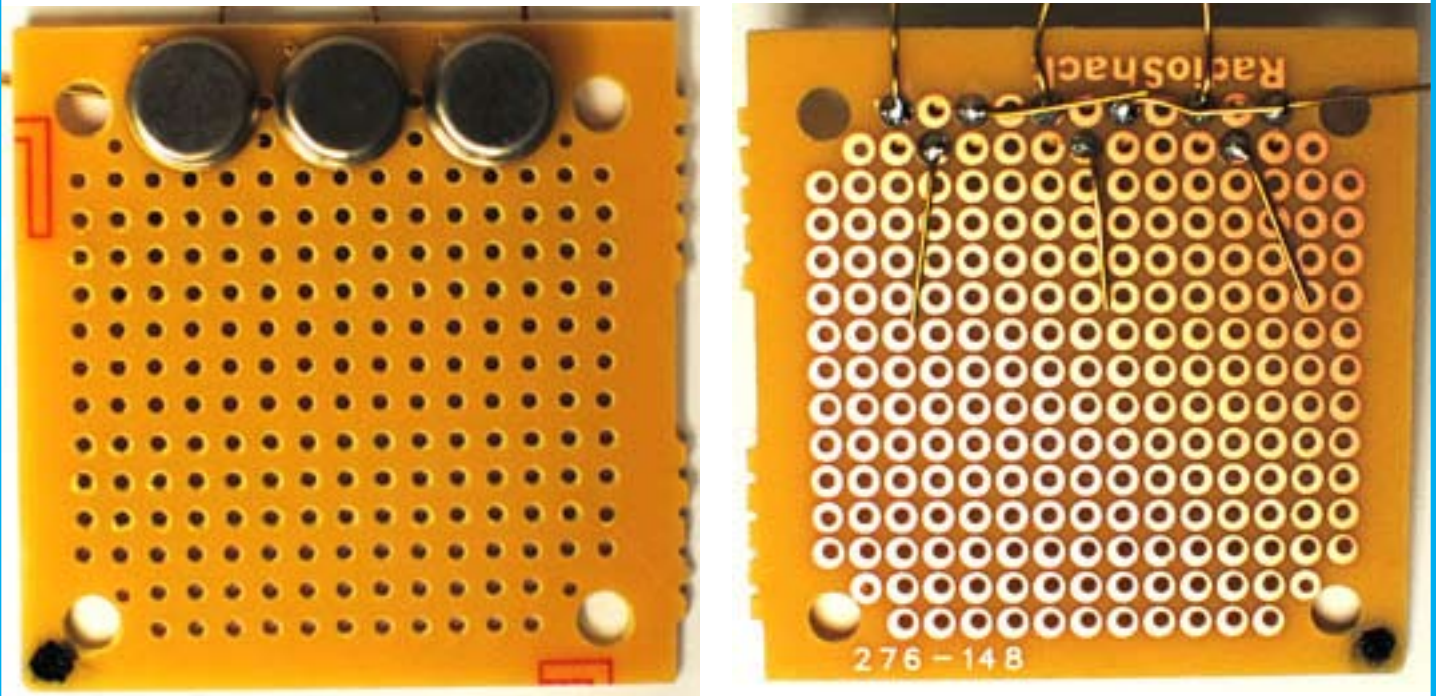

3 Insulate the right leg of each transistor to prevent the wires from shorting when they overlap. To insulate the wires, strip the plastic insulation from the grey solid core breadboard jumper wire. Then measure, cut to fit, and slide on to the upper right leg of each transistor. Solder the upper right leg of the transistor located on the left side of the board to the upper right leg of the transistor located in the middle of the board. Solder the upper right leg of the transistor located in the middle of the board to the upper right leg of the transistor located on the right side of the board.
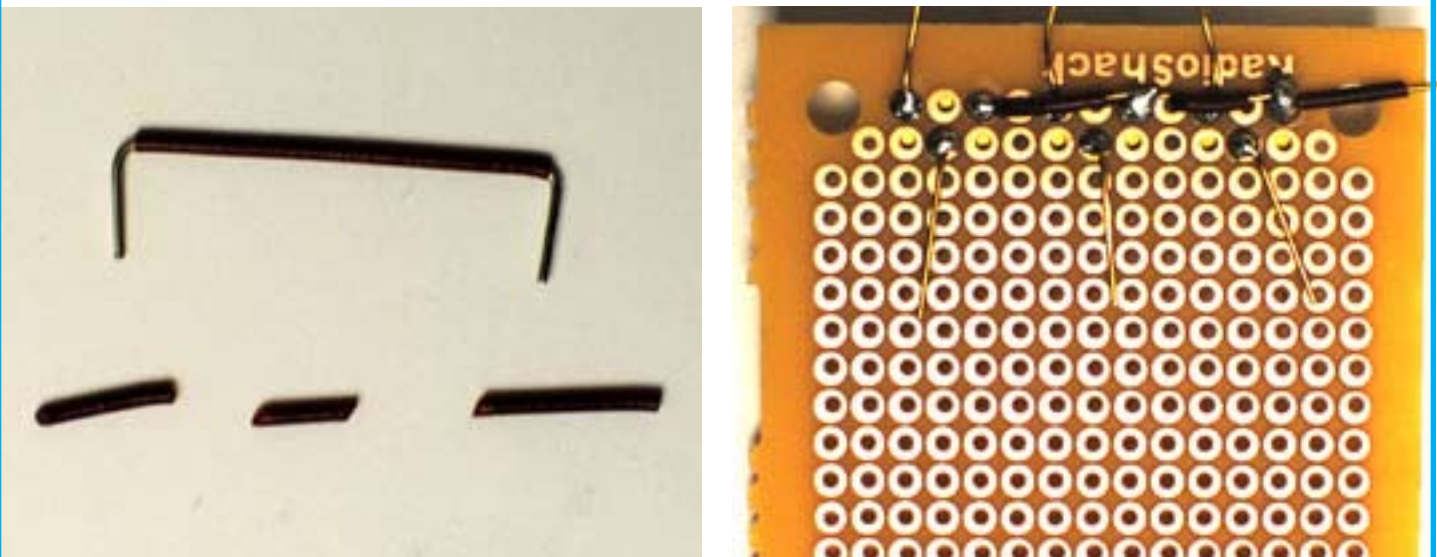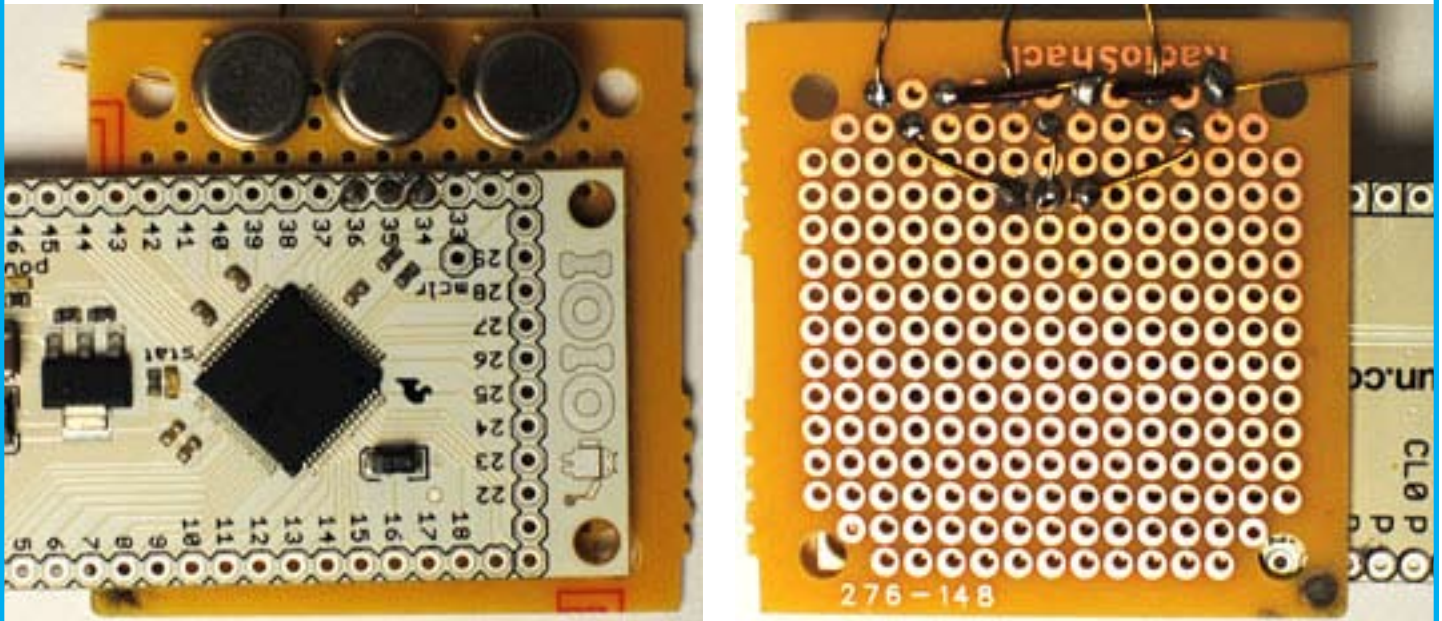
4 Place the IOIO on top of the board. Take the solid core wire from the stripped jumper cable, bend the tip, insert it through pin 35, and continue through the board. Make sure to align pin 35 with the lower leg of the middle transistor leaving one row between. Solder the solid core jumper wire to pin 35 from the top of the IOIO. Flip the board, then solder the solid core jumper wire to the lower leg of the middle transistor.
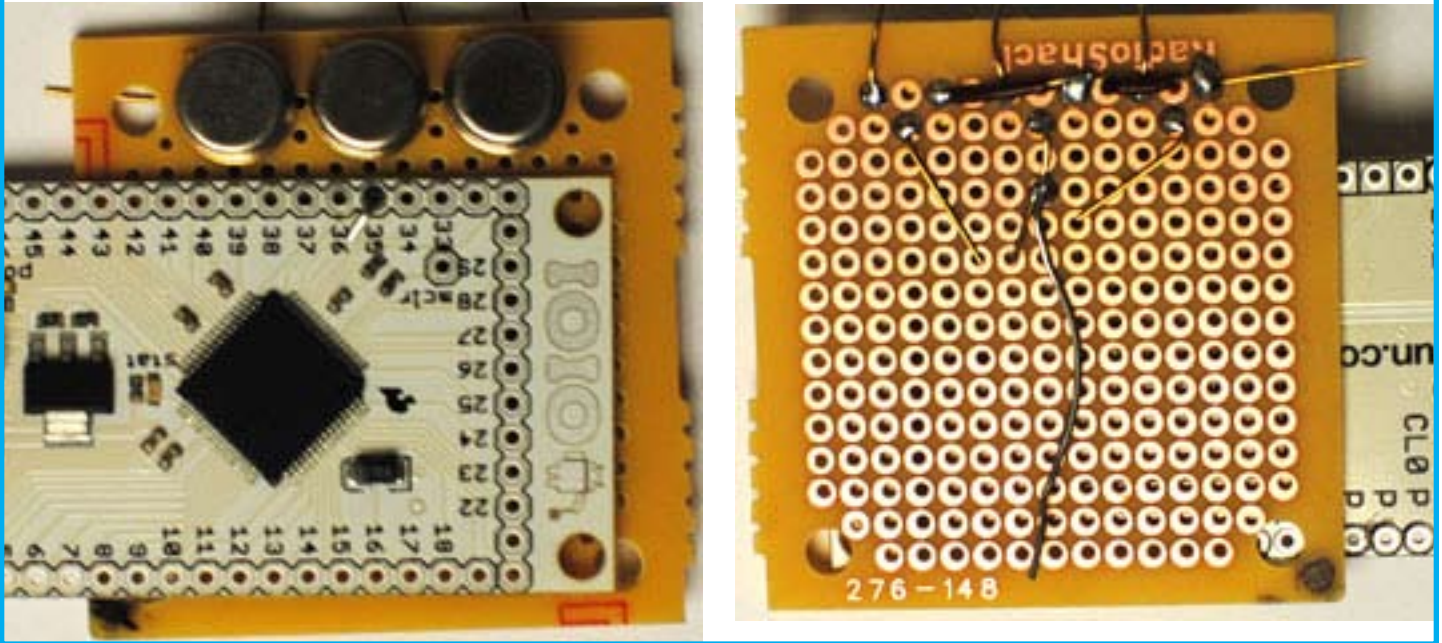

5 Cut the remainder of the solid core jumper wire from the board. Bend the tip then insert it through pin 34 and continue through the board. Solder the solid core jumper wire to pin 34 from the top of the IOIO. Flip the board, then solder the solid core jumper wire to the lower leg of the left transistor.
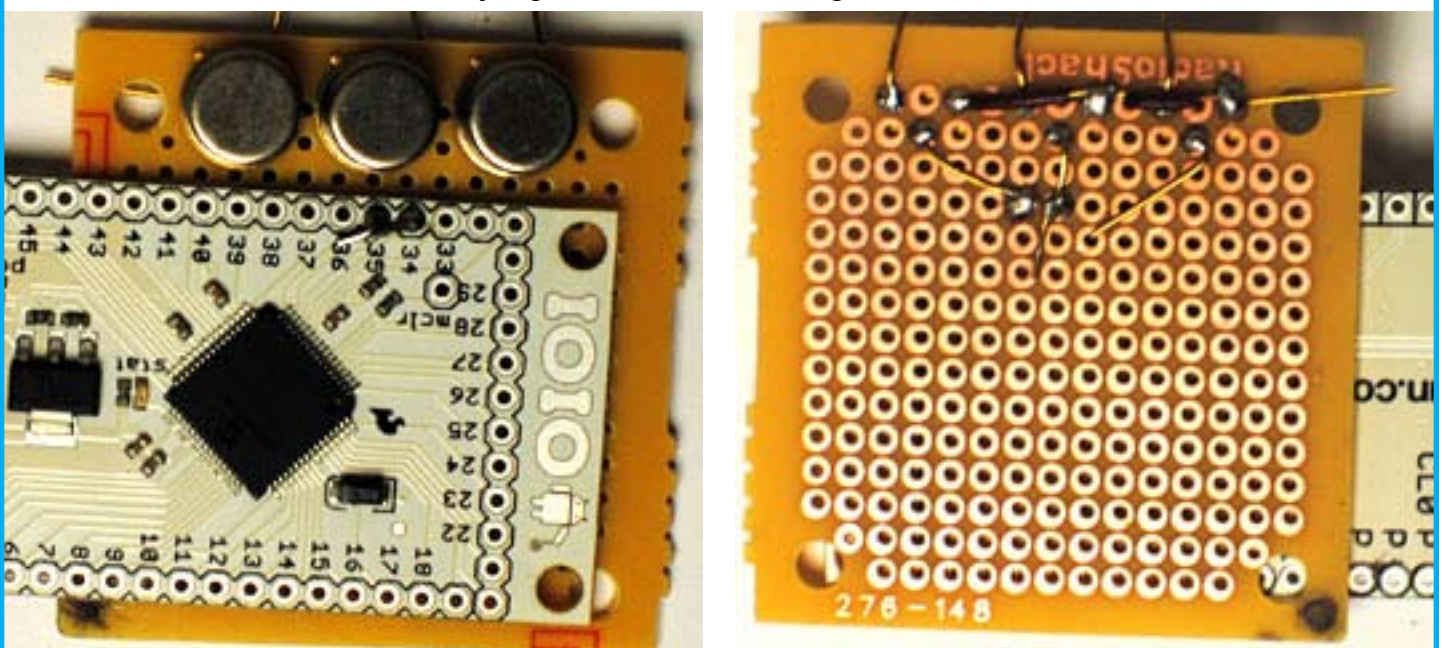
6 Cut the remainder of the solid core jumper wire from the board. Bend the tip then insert it through pin 36 and continue through the board. Solder the solid core jumper wire to pin 36 from the top of the IOIO. Flip the board, then solder the solid core jumper wire to the lower leg of the right transistor. Cut the remainder of the solid core wire from the board and discard.


7 Looking at the bottom of the board, take the grey solid core jumper wire, insert it through the IOIO GND, then flip the board and solder it in place. Take the other end of the grey solid core jumper wire and hook it around the upper right leg of the right transistor and solder in place.
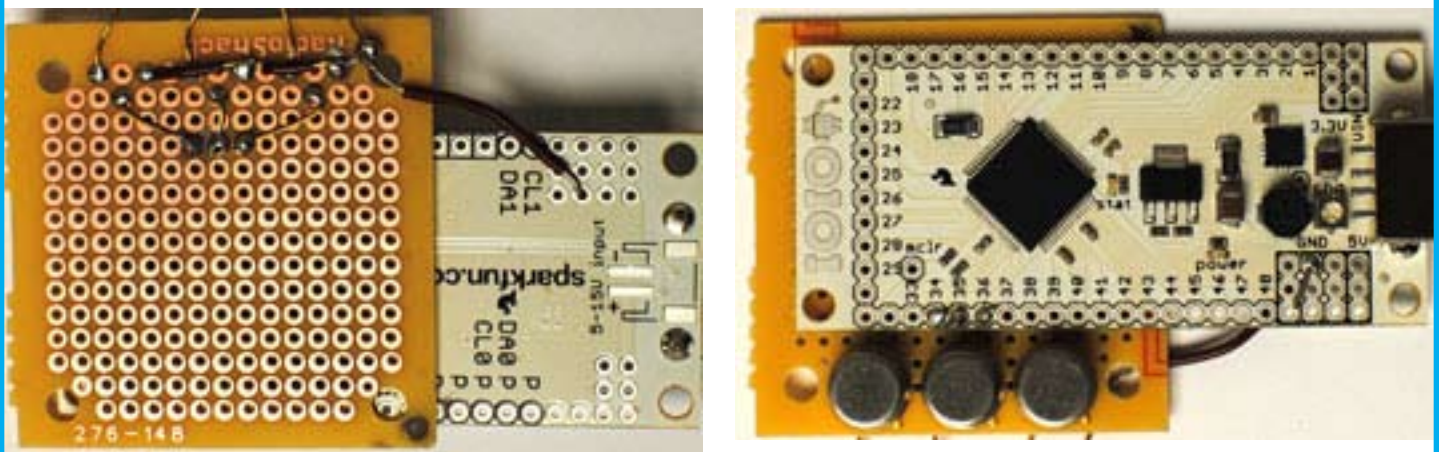
8 Looking at the bottom of the board, take the red solid core jumper wire, insert it through the IOIO Vin, then flip the board and solder in place. Hook the other end of the red solid core jumper cable and connect it to the hooked end of the white jumper cable then solder them together. Hook and solder the green jumper cable to the upper left leg of the right transistor. Hook and solder the orange jumper cable to the upper left leg of the middle transistor. Hook and solder the blue jumper cable to the upper left leg of the left transistor. Heat shrink the connection between the solid core jumper cable and the white jumper cable.
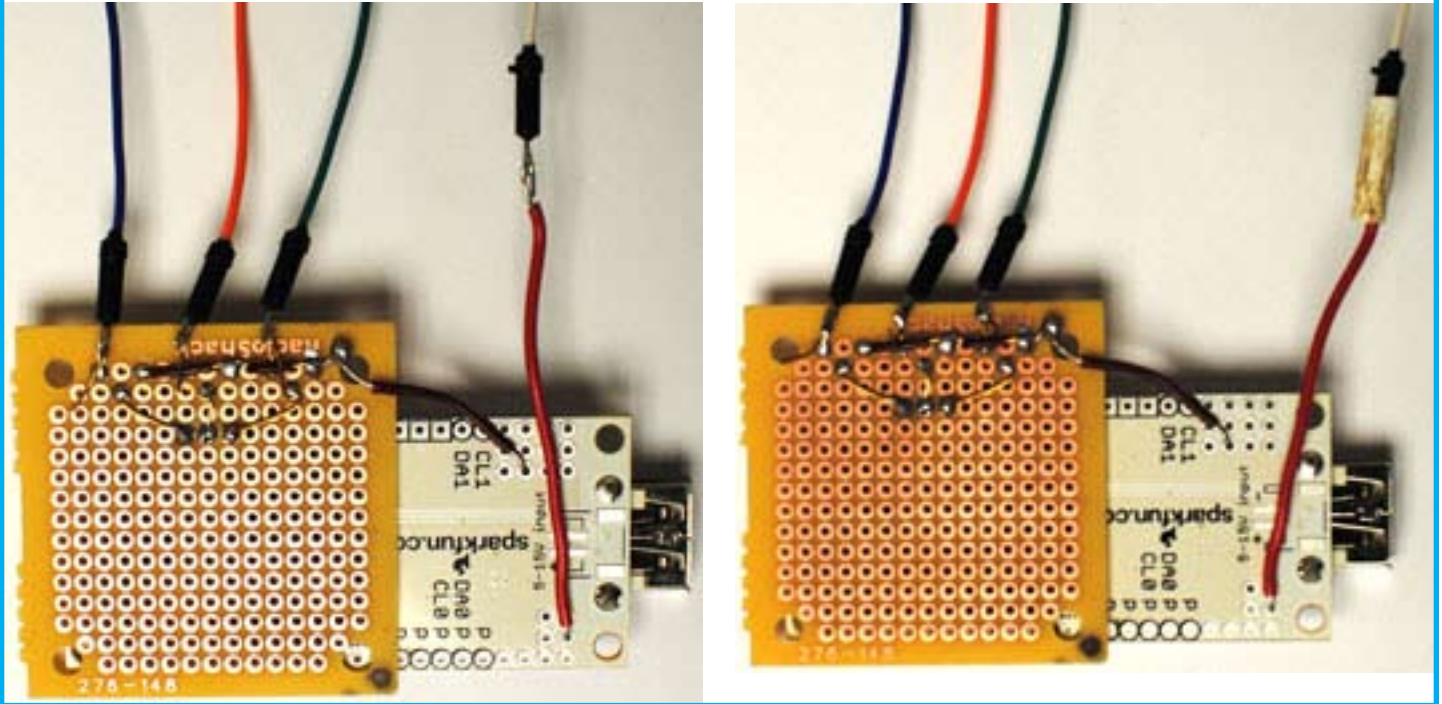
9 Fill the male half of the connector with solder. Heat the solder and insert the red jumper cable into the positive side. Heat the solder and insert the black jumper cable into the negative side. Heat shrink the jumper cables to the connector.
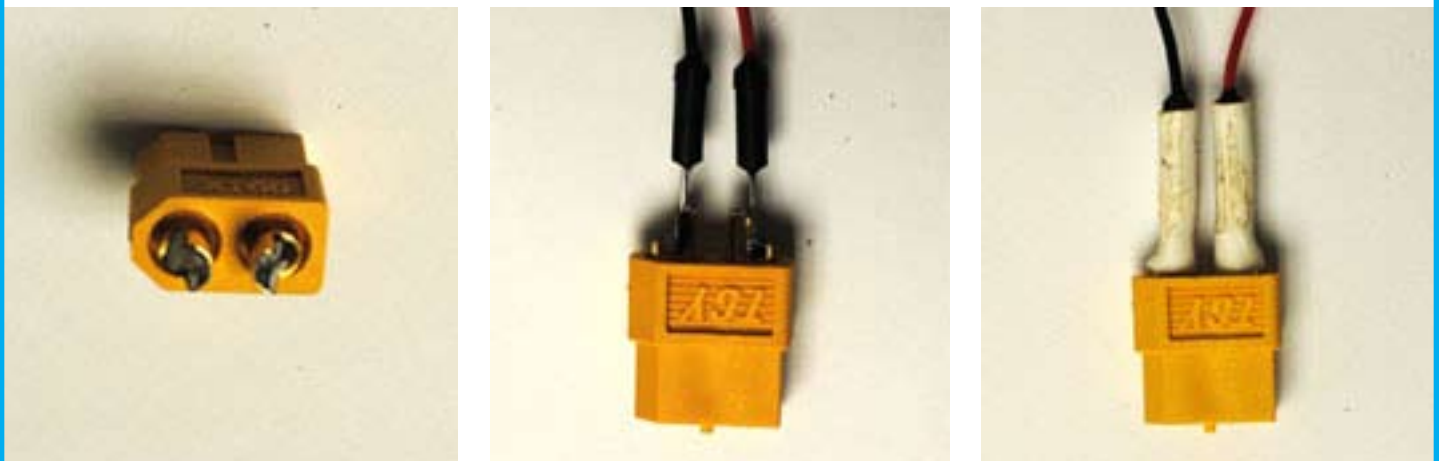
10 Connect and solder the red jumper cable to the IOIO Vin. Connect and solder the black jumper cable to the IOIO GND.
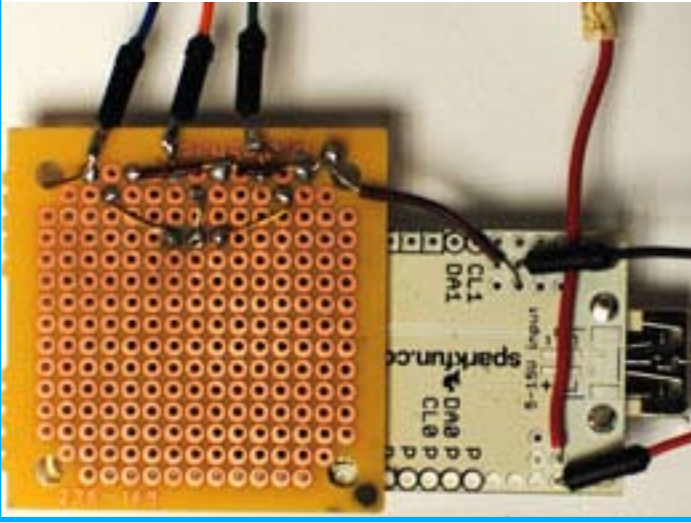
11 Fill the female half of the connector with solder. Slip a section of the heat shrink on to the red jumper cable from the battery and do the same for the black jumper cable. Heat the solder and insert the red jumper cable from the battery into the positive side. Heat the solder and insert the black jumper cable from the battery into the negative side. Heat shrink the battery jumper cables to the connector.

12 If your LED strip has a connector, connect the white jumper cable from the IOIO Vin to the 12V label on the LED strip. Connect the green jumper cable from the IOIO to the "G" label on the LED strip. Connect the orange jumper cable from the IOIO to the "R" label on the LED strip. Connect the blue jumper cable from the IOIO to the "B" label on the LED strip. Then shrink wrap (not shown). If your LED strip does not have a connector then follow the instructions here, www.ladyada.net/products/rgbledstrip/#wiring, to connect the IOIO and Li-Ion battery to the LED strip.
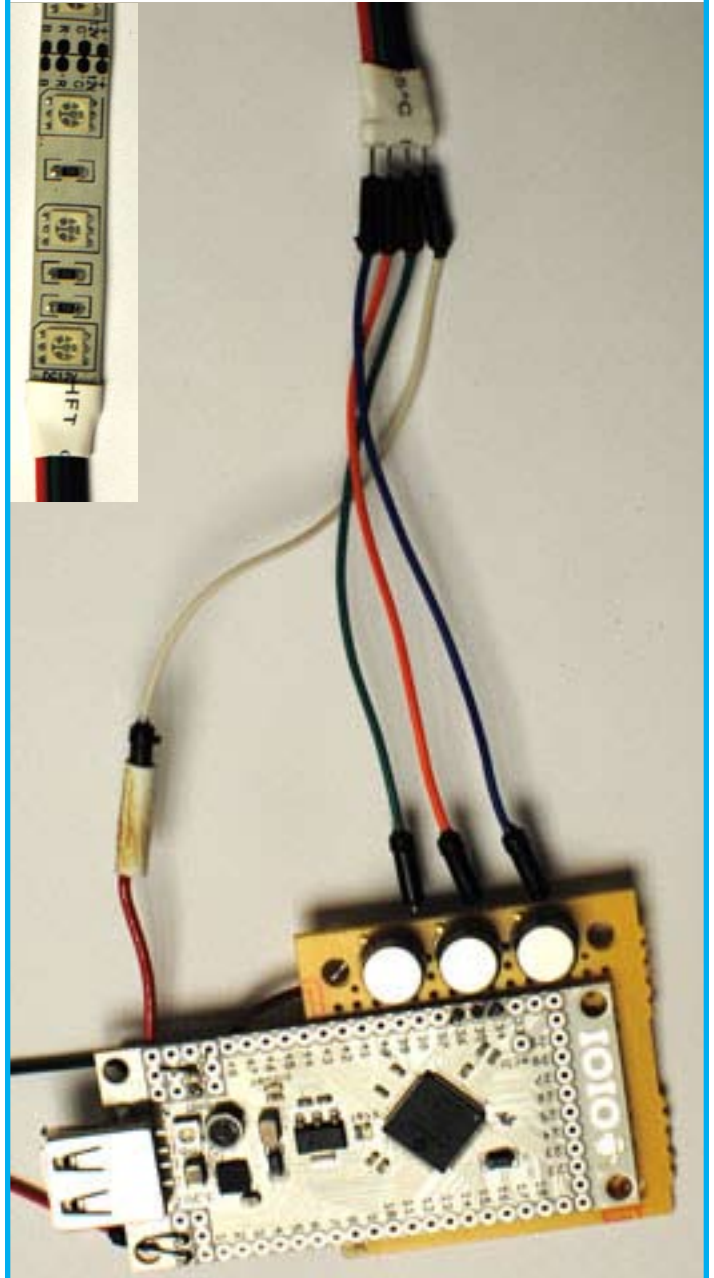
13 Now you're ready to connect your IOIO+LED strip to the AirCasting app and light it up. Plug the Bluetooth dongle into the IOIO. Then power on the IOIO by inserting the male side of the XT60 connector into the female side; this will illuminate the red LED on the IOIO.

Next, open the Play Store app and search for, download, and launch the AirCasting app. Then, press the menu button on your phone, select "Settings", select "External devices", select "pair with new devices", "search for devices", select the "IOIO", enter the pairing code "4545", return to the AirCasting app, select IOIO from the "External devices" dialog, and when prompted to connect press "Yes". You normally only need to pair with a device once, however, in the case of the IOIO you'll need to pair whenever prompted by pulling down the window shade, selecting the pairing request, and entering "4545". Once the AirCasting app is connected to the IOIO, the LED strip will light up in response to the sensor measurements - green for low intensity, then yellow, then orange, and red for high intensity.

Hint: to adjust the relationship between sensor measurements and display colors, tap the "Heat Legend" (the colored bar at the top of the screen).
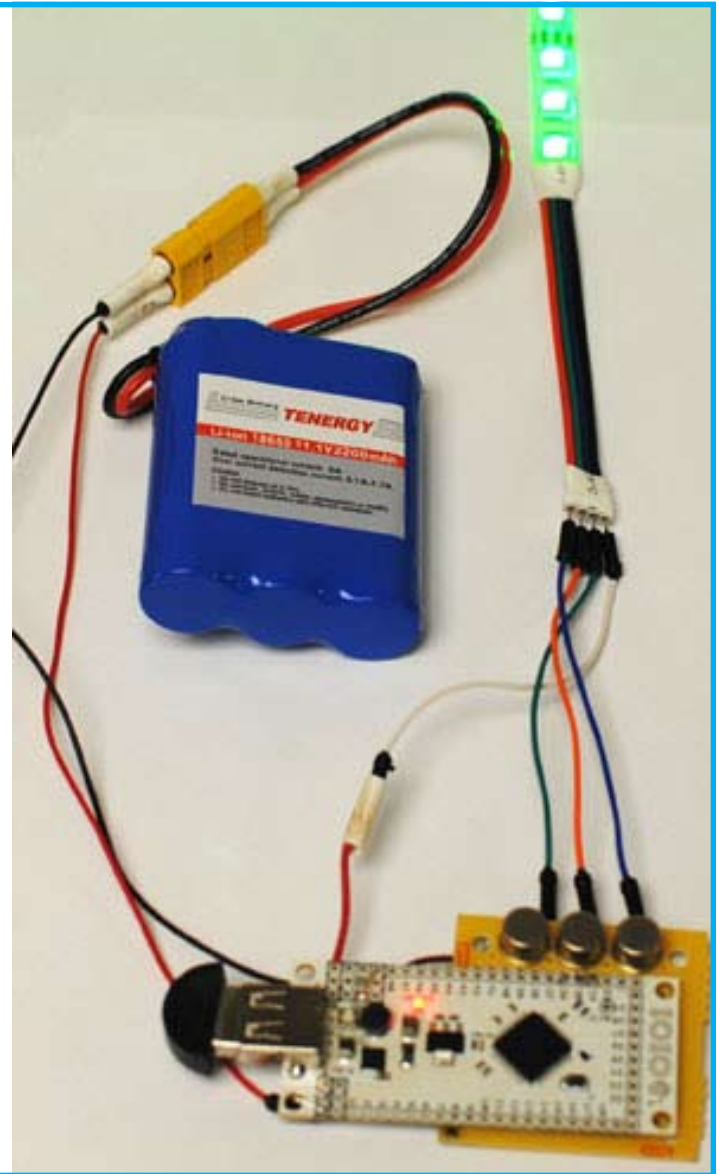
14 To protect the electronics and prevent the soldered connections from coming apart we put our IOIO, board, and battery inside of a 12 x 8 x 4 cm tupperware container, www.ikea.com/us/en/catalog/products/60149673/, that we cut holes in to accomodate wires and dissipate heat.

We also chopped the end off one of the charger cables and soldered a female XT60 connector to it so we wouldn't need to use the alligator clips when charging.
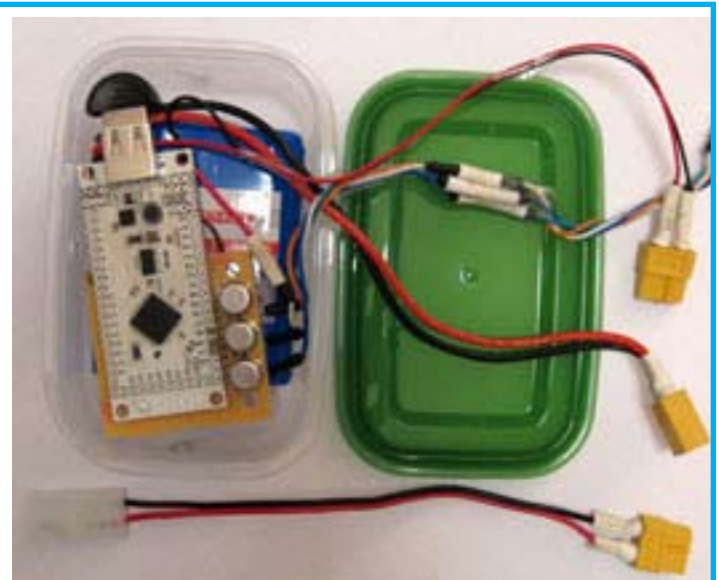
Now that you've succesfully assembled the Air-Casting Luminescence electronics it's time to make them wearable. We attached our LED strips to a modified American Apparel Dolman Sleeve Poncho using fabric sheaths made of white Ripstop nylon. You can make a vest like ours or let your imagination run wild and come up with something new.

15 Cut a strip of fabric to fit the garment and LED strip. Fold and sew together then turn inside out.

16 Cut velcro strips to match the width of the LED sheath. Make enough velcro strips to create an attachment point every 3-6 inches. Then sew one half of the velcro strip to the LED sheath.

17 Pin the sheath on the garment and mark where the velcro strip will attach to the garment. Then sew the other half of the velcro strip to the garment at the marked spots.

18 Velcro the LED sheaths to the garment and insert the LED strip. Now "lighten up", get outside, and go have some fun!