Shorts & Faulty Connections

IS YOUR BOARD HOT TO THE TOUCH? WHILE THE MICROCONTROLLER WILL GIVE OFF SOME HEAT, IT SHOULD NEVER BE UNCOMFORTABLE TO TOUCH. A SHORT BETWEEN POWER AND GROUND WILL PREVENT YOUR PROJECT FROM WORKING AND MAY EVEN CAUSE YOUR BATTERY TO HEAT UP WHICH CAN BE DANGEROUS.

DOUBLE CHECK STITCHES

LOOSE STITCHES, FRAYED THREADS, OR UNTRIMMED KNOT TAILS CAN CAUSE UNWANTED CONNECTIONS BETWEEN COMPONENTS. DOUBLE CHECK THAT YOU DO NOT HAVE ANY ACCIDENTAL CONNECTIONS DUE TO THESE PROBLEMS.

CHECK SOLDERED CONNECTION

AT TIMES THE CO2 SENSOR MAY COME UNSOLDERED FROM THE MICROCONTROLLER CHECK TO MAKE SURE THERE IS A STRONG CONNECTION BETWEEN THE SENSOR AND YOUR BOARD. IF NOT YOU WILL NEED TO MAKE A NEW CONNECTION BY REPAIRING THE SOLDER.

USE A MULTIMETER

USE A MULTIMETER'S CONTINUITY TESTER TO CHECK YOUR CIRCUIT FOR SHORTS. THE METER WILL BEEP ANY TIME THE TWO PROBES ARE ELECTRICALLY CONNECTED.

Bluetooth

CHECK YOUR CONNECTION

IF YOU'RE HAVING TROUBLE FINDING YOUR BLUEFRUIT DEVICE IN THE SCANNED PERIPHERALS LIST, ENSURE THE BOARD IS POWERED AND NOT PAIRED WITH ANY OTHER BLE DEVICES. IF THE PROBLEM PERSISTS, IT COULD BE DUE TO CACHING ISSUES IN THE IOS OR ANDROID OPERATING SYSTEM. FOR A FIX, TRY THE FOLLOWING:

CYCLE BLUETOOTH - TURN YOUR MOBILE DEVICE'S BLUETOOTH RADIO OFF AND ON AGAIN IN THE SETTINGS APP.
RELAUNCH APP - QUIT THE BLUETOOTH LE CONNECT APP AND RESTART IT. (INSTRUCTIONS FOR IOS & ANDROID)
CYCLE POWER - RESTART YOUR MOBILE DEVICE BY POWERING IT OFF AND RESTARTING.
DOING ONE OR BOTH OF THE ABOVE SOLVES MOST PERIPHERAL SCANNING ISSUES. IF YOU'RE STILL HAVING TROUBLE, TRY SEARCHING THE ADAFRUIT SUPPORT FORUM FOR YOUR ISSUE.

Sensor

STUCK AT 400 (PROBABLY A POWER ISSUE)
CRAZY READINGS - DID YOU GET YOUR SENSOR WET OR SPILL SOMETHING ON IT?
NOT FOUND (POWER OR CONNECTION ISSUE)

USE A MULTIMETER

USE A MULTIMETER'S CONTINUITY TESTER TO CHECK YOUR CIRCUIT FOR SHORTS. THE METER WILL BEEP ANY TIME THE TWO PROBES ARE ELECTRICALLY CONNECTED.

P@tch

In the aftermath of the 2016 election, I was feeling... well hungover mostly. But not just in like a literal sense, but figuratively as well. I became cynical.

I started to focus inward and decided to work on making my life more in line with causes I claimed to believe in as a way to take back control of something in the world.

I chose environmental issues as my main focus as there was a 0% chance the Trump administration would be doing anything constructive to save the only planet we have to live on. Where I live in the U.S. many people do not believe the changing Climate is due to Human activity. My hope for this iteration of the P@tch is to make a link to human activity and air quality.

As I began my endeavor, I realized there was no self tracking device for ethical behavior.

So I decided to make my own.

THIS HAND SEWN PATCH ALLOWS YOU TO TRACK YOUR ETHICAL BEHAVIOR.

This Co2 P@tch is all about creating self awareness by combining "hard data" and self reporting on your behavior to raise questions about our environmental values and our actions.

Can we use technology to shift political outrage into personal action?

Can we tackle large problems by breaking them down to smaller individual decisions?

Maybe... But it will take a lot of consumer pressure on large companies to use more
sustainable options. One way we can do this is by buying less plastic.

Supply list:

SPG30 GAS SENSOR
CANVAS/SCRAP FABRIC
CLEAR NAIL POLISH
ADAFRUIT BLUETOOTH LE MODULE
ADAFRUIT CIRCUIT PLAYGROUND
 (OR OTHER MICRO-CONTROLLER)
EMBROIDERY FLOSS
ADAFRUIT IO ACCOUNT (TO HOLD YOUR DATA)

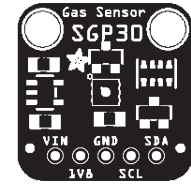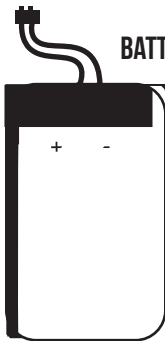ARDUINO SOFTWARE
MICRO USB CABLE
CONDUCTIVE THREAD
NEEDLE
BATTERY PACK
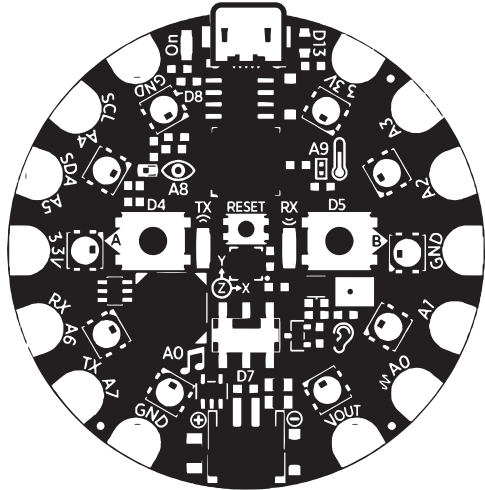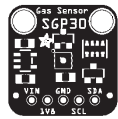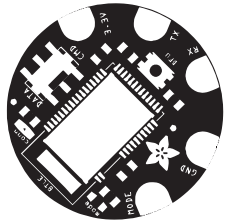
BATTERY CHARGER
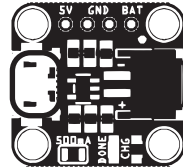
BATTERY

Sensor

THE SGP30 SENSOR

THE SENSOR WILL MEASURE ECO2 (EQUIVALENT CALCULATED CARBON-DIOXIDE) CONCENTRATION WITHIN A RANGE OF 400 TO 60,000 PARTS PER MILLION (PPM), AND TVOC (TOTAL VOLATILE ORGANIC COMPOUND) CONCENTRATION WITHIN A RANGE OF 0 TO 60,000 PARTS PER BILLION (PPB).
ECO2 IS CALCULATED BASED ON H2 (HYDROGEN GAS) CONCENTRATION, IT IS NOT A 'TRUE' CO2 SENSOR FOR LABORATORY USE. THIS SENSOR IS ALSO MOSTLY INTENDED FOR INDOOR USE...
SO WE WILL BE TESTING IT AT ITS LIMITS!

CO2
250-350 PPM: BACKGROUND (NORMAL) OUTDOOR AIR LEVEL
350-1,000 PPM: TYPICAL LEVEL FOUND IN OCCUPIED SPACES WITH GOOD AIR EXCHANGE
1,000-2,000 PPM: LEVEL ASSOCIATED WITH COMPLAINTS OF DROWSINESS & POOR AIR
2,000-5,000 PPM: LEVEL ASSOCIATED WITH HEADACHES, SLEEPINESS, LOSS OF ATTENTION,
                 INCREASED HEART RATE AND SLIGHT NAUSEA MAY ALSO BE PRESENT.
>5,000 PPM: THIS INDICATES UNUSUAL AIR CONDITIONS WHERE HIGH LEVELS OF OTHER GASES
            ALSO COULD BE PRESENT. TOXICITY OR OXYGEN DEPRIVATION COULD OCCUR. THIS IS
   THE PERMISSIBLE EXPOSURE LIMIT FOR DAILY WORKPLACE EXPOSURES.

TVOC
<300 NO IRRITATION
300-500 IRRITATION OR DISCOMFORT MAY BE POSSIBLE WITH SENSITIVE INDIVIDUALS
500-1000 IRRITATION LIKELY IN INDIVIDUALS
1000 - 3000 IRRITATION AND DISCOMFORT

Power
CHARGING THE BATTERY
THE LIPO CHARGER IS SMALL AND EASY TO USE.
JUST PLUG IT VIA ANY MICROUSB CABLE INTO A USB PORT AND A 3.7V/4.2V LITHIUM POLYMER OR LITHIUM ION RECHARGEABLE BATTERY INTO THE JST PLUG ON THE OTHER END.
THERE ARE TWO LEDS - ONE RED AND ONE GREEN. WHILE CHARGING, THE RED LED IS LIT.
WHEN THE BATTERY IS FULLY CHARGED AND READY FOR USE, THE GREEN LED TURNS ON.

BATTERY CHARGER

BATTERY
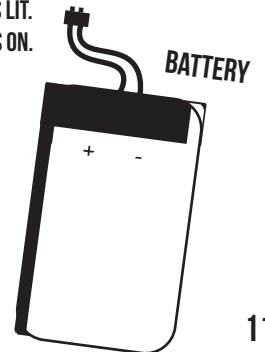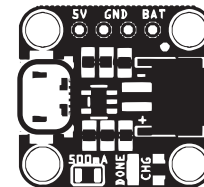
Bluetooth and Data

CONNECTING P@TCH TO YOUR PHONE
THE BLUEFRUIT CONNECT APP
THE IOS APP IS A FREE DOWNLOAD FROM APPLE'S APP STORE. IT REQUIRES IOS 9 OR LATER AND WORKS ON IPHONES, IPADS, AND IPOD TOUCHES. THE ANDROID APP IS A FREE DOWNLOAD FROM THE GOOGLE PLAY STORE. IT REQUIRES ANDROID 4.4 OR LATER.

ENABLE YOUR DEVICE'S BLUETOOTH: SETTINGS -> BLUETOOTH
CONNECT TO YOUR BLUEFRUIT LE MODULE
MAKE SURE YOUR BLUETOOTH MODULE'S SWITCH IT SET TO CMD
CLICK THE UART TERMINAL
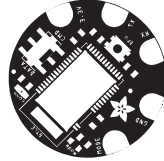
YOU ARE NOW CONNECTED TO YOUR P@TCH! NOW WE NEED TO CONNECT YOUR DATA WITH EVERYONE ELSE'S USING THE INTERNET OF THINGS.

UPLOADING YOUR DATA TO THE VISUALIZATION
SETTING UP MQTT
AFTER YOU HAVE ENTERED THE UART TERMINAL, CLICK THE MQTT BUTTON AT THE TOP RIGHT OF THE UART MENU

FIRSTLY, YOU WILL NEED TO CONFIGURE MQTT TO SEND YOUR DATA TO THE SHARED P@TCH ADAFRUIT.IO ACCOUNT IN ORDER TO LOG AND COLLECT YOUR DATA.
UNDER SERVER, ENTER "io.adafruit.com" AS THE SERVER ADDRESS AND "1883" AS THE PORT.

UNDER PUBLISH, ENTER IN <jahrndt>/f/<ec02> FOR BOTH UART RX AND TX.

FINALLY, UNDER ADVANCED, TYPE: jahrndt

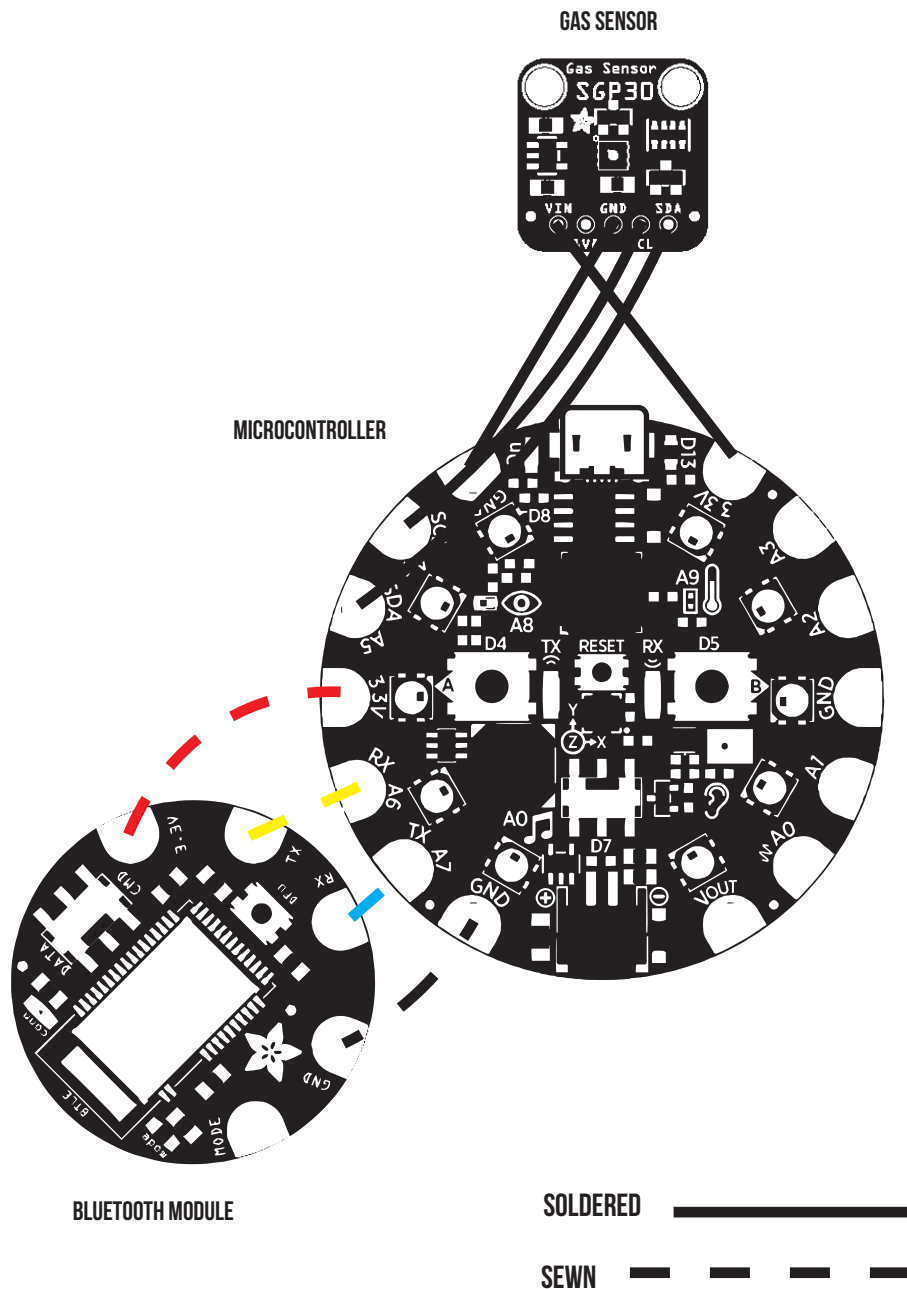UNDER PASSWORD, USE THE ADAFRUIT.IO ACCOUNT KEY.
YOU CAN OBTAIN THE KEY BY SCANNING THIS QR CODE
OR TYPING IN:
d1be172e5e714408808648a041f582fd

Contents

Circuit Diagram

GAS SENSOR

MICROCONTROLLER

BLUETOOTH MODULE

SOLDERED ————

SEWN — — — —

Coding P@tch

ARDUINO IDE

WHERE TO DOWNLOAD: **HTTPS://WWW.ARDUINO.CC/EN/MAIN/SOFTWARE**
THE OPEN-SOURCE ARDUINO SOFTWARE (IDE) MAKES IT EASY TO WRITE CODE AND UPLOAD IT TO THE BOARD.
IT RUNS ON WINDOWS, MAC OS X, AND LINUX.

ARDUINO FOR P@TCH

SELECT **CIRCUIT PLAYGROUND** FROM THE **TOOLS** -> **BOARD** DROP-DOWN MENU

LOADING LIBRARIES

THERE IS A DETAILED GUIDE HERE:
HTTPS://LEARN.ADAFRUIT.COM/ADAFRUIT-ALL-ABOUT-ARDUINO-LIBRARIES-INSTALL-USE
IN THE MENUBAR CLICK **"SKETCH"**, THEN **"INCLUDE LIBRARY"**
AT THE TOP, CLICK **"MANAGE LIBRARIES…"**
TYPE "**CIRCUIT**" IN THE SEARCH BOX. YOU SHOULD SEE ADAFRUIT CIRCUIT PLAYGROUND LISTED.
THEN CLICK UPDATE TO GET THE VERY LATEST VERSION & **INSTALL**.

WE WILL NEED THE FOLLOWING LIBRARIES TO RUN THE SKETCH FOR P@TCH:

ADAFRUIT_SGP30
ADAFRUIT_NEOPIXEL
ADAFRUIT_BLUEFRUITLE_NRF51

CONFIGURING FOR CIRCUIT PLAYGROUND
ADAFRUIT HAS A LOVELY GUIDE FOR THIS HERE:
HTTPS://LEARN.ADAFRUIT.COM/INTRODUCING-CIRCUIT-PLAYGROUND/ARDUINO

UPLOADING THE CODE
PLUGGING IN - USE A MICRO USB CABLE TO PLUG THE P@TCH INTO A USB PORT ON YOUR COMPUTER.
WAIT FOR IT TO BE RECOGNIZED BY THE OS (JUST TAKES A FEW SECONDS). IT WILL CREATE A SERIAL/COM PORT,
YOU CAN NOW SELECT IT FROM THE DROP-DOWN, IT'LL EVEN BE 'INDICATED' AS A CIRCUIT PLAYGROUND BOARD!

WHERE TO FIND THE CODE: HTTPS://JANNAVEVE.COM/PTCH/CO2/

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MAKE CONNECTIONS FOR ALL OF THE NEEDED BLUETOOTH TERMINALS

REPEAT THE PROCESS- KNOTTING OFF YOUR CONDUCTIVE THREAD AFTER EACH CONNECTION
!MAKE SURE NOT TO ACCIDENTALLY CROSS ANY CONNECTIONS!
KEEP THREADS FAR ENOUGH APART THAT YOUR DIFFERENT CONNECTIONS DO NOT TOUCH.
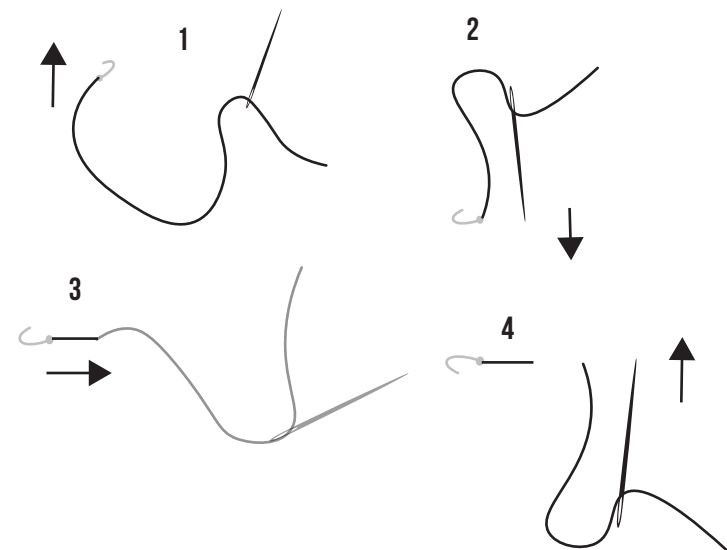
GND -> GND
3.3V -> 3.3V
TX -> RX
RX -> TX

MICROCONTROLLER

BLUETOOTH MODULE
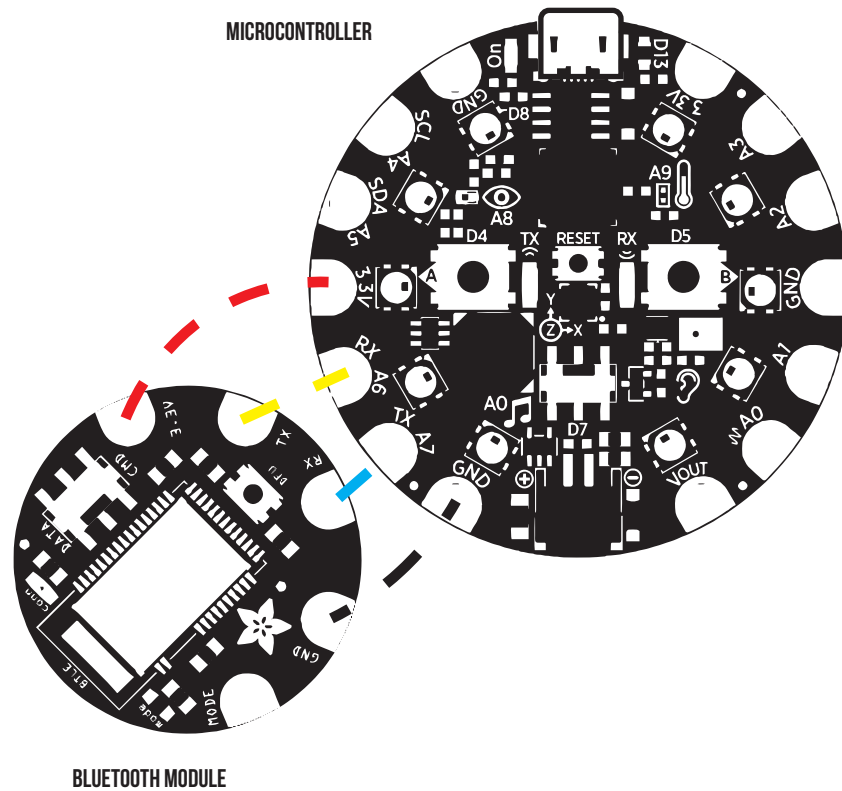
Sewing the Circuit

THREADING THE NEEDLE
CUT A LENGTH OF THREAD ROUGHLY THE LENGTH OF YOUR ARM.
LONGER THAN THIS AND THE THREAD WILL START TO BE DIFFICULT TO MANAGE.
USE ONLY ONE STRAND OF THREAD
THREAD THE NEEDLE WITH THE CONDUCTIVE THREAD.

STITCHES TO KNOW

RUNNING STITCH

1. COME UP FROM THE BACK OF THE FABRIC PULLING TIGHT SO THE KNOT STOPS THE THREAD
   FROM COMING ALL THE WAY THROUGH
2. 3-4 MM OR 1/8IN FROM WHERE YOU STARTED, PULL YOUR NEEDLE THROUGH FROM THE FRONT OF FABRIC
3. FROM THE BACK OF THE FABRIC, COME UP FROM THE BACK ABOUT 3-4 MM OR 1/8IN FROM
   WHERE YOU LAST CAME THROUGH
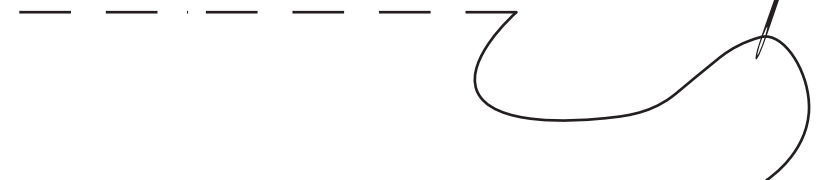
***THE MICROCONTROLLER AND BLUETOOTH MODULE BOTH HAVE UNUSED CONNECTORS. YOU CAN USE EMBROIDERY FLOSS TO CONNECT THESE COMPONENTS TO THE FABRIC PATCH BY SEWING THROUGH THESE HOLES. THIS WILL HELP KEEP THE BOARD FROM SLIDING AROUND WHILE WE USE OUR CONDUCTIVE THREAD TO SEW THE CIRCUIT.

Making connections

THE THREAD MUST TRAVEL BETWEEN COMPONENTS TO CONNECT THEM, WHILE AVOIDING OTHER PATHS OF CONDUCTIVE THREAD IN THE CIRCUIT. THE THREAD ACTS LIKE UNINSULATED WIRE. GET AN IDEA OF WHERE YOUR CIRCUIT WILL GO. YOU MAY WISH TO MARK TRACES WITH CHALK OR A WATER-SOLUBLE MARKER, OR WING IT. GET YOUR CIRCUIT BOARD ONTO YOUR FABRIC AND PICK UP YOUR FRESHLY THREADED NEEDLE.

STEP 1:
THREAD YOUR NEEDLE WITH THE CONDUCTIVE THREAD AND TIE A KNOT JUST AS YOU WOULD WITH NORMAL THREAD.
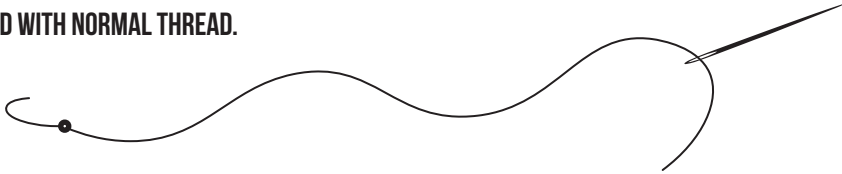
STEP 2:
BRING THE NEEDLE THROUGH THE FABRIC FROM BACK TO FRONT, RIGHT NEXT TO THE GROUND TERMINAL (GND) ON THE BLUETOOTH MODULE .
PULL THE NEEDLE ALL THE WAY THROUGH UNTIL IT IS STOPPED BY THE KNOT AT THE OTHER END.
BRING YOUR NEEDLE FROM FRONT TO BACK THROUGH THE HOLE MARKED GND.
PULL THE NEEDLE AND SLACK THREAD ALL THE WAY THROUGH UNTIL THE THREAD TIGHTLY MAKES CONTACT WITH THE CONDUCTIVE PAD AD THE EDGE OF THE BOARD.
REPEAT 4-5 TIMES THROUGH THE HOLE TO MAKE A SECURE ELECTRICAL CONNECTION.

STEP 3:
BEGIN A RUNNING STITCH TOWARDS THE GROUND TERMINAL ON THE MICRO CONTROLLER.
KEEP YOUR STITCHES SMALL (3-4 MM IN LENGTH) AND NEAT THROUGHOUT YOUR CIRCUIT.

STEP 4:
BRING YOUR NEEDLE FROM FRONT TO BACK THROUGH THE HOLE MARKED GND ON THE MICROCONTROLLER.
PULL THE NEEDLE AND SLACK THREAD ALL THE WAY THROUGH UNTIL THE THREAD TIGHTLY MAKES CONTACT WITH THE CONDUCTIVE PAD AD THE EDGE OF THE BOARD.
REPEAT 4-5 TIMES THROUGH THE HOLE TO MAKE A SECURE ELECTRICAL CONNECTION.

MICROCONTROLLER

BLUETOOTH MODULE
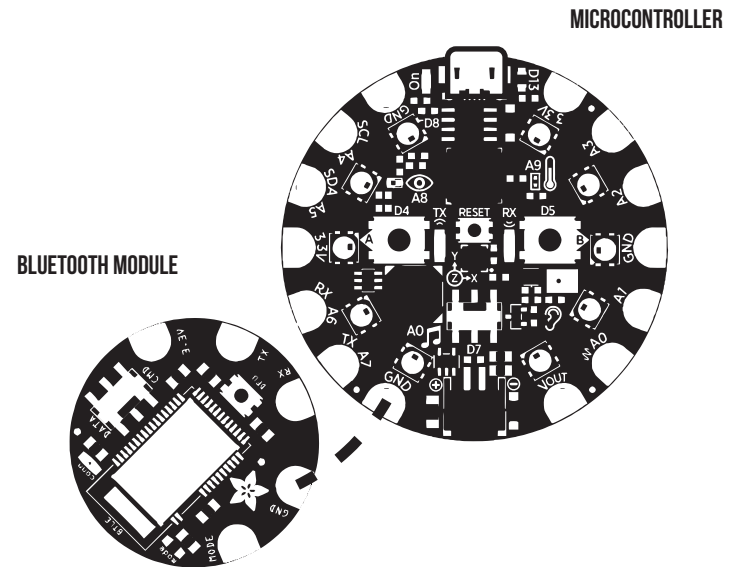
STEP 5: TYING OFF
YOU MUST TIE OFF YOUR THREAD EACH TIME YOU FINISH A CONNECTION TO CREATE A SUCCESSFUL CIRCUIT.

TIE A KNOT WITH A SEWING NEEDLE!
INSERT THE NEEDLE UNDER A PREVIOUS STITCH.
PULL THE THREAD ALMOST ALL THE WAY THROUGH, LEAVING A SMALL LOOP. PUT YOUR NEEDLE THROUGH THIS LOOP AND PULL THE THREAD THROUGH, CREATING A TIGHT KNOT.
DON'T FORGET TO SEAL THE KNOT WITH CLEAR NAIL POLISH BEFORE TRIMMING

THINGS BREAK.
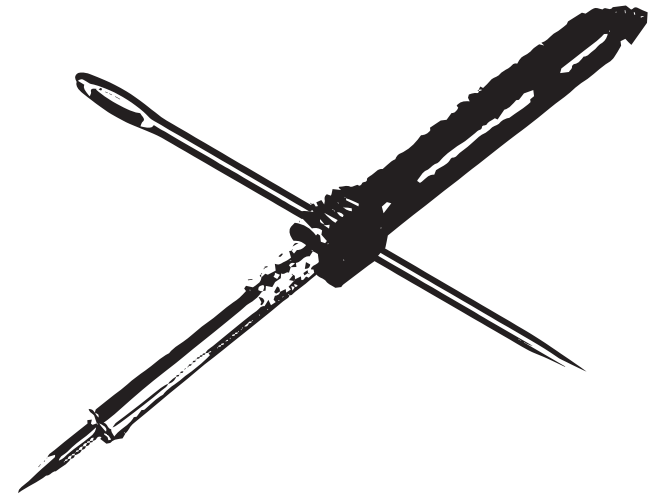ESPECIALLY HOMEMADE THINGS.
ESPECIALLY HOMEMADE ELECTRONICS.
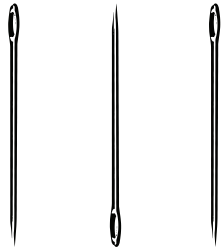
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📷 @jannaveve

#CO2Ptch

P@tch CO2