Directions for Arduino Nano Snowflake

Supplies:

- Arduino Nano (comes with 3 and you only need one for each snowflake) - https://www.amazon.com/gp/product/B0713XK923/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1
- WS2812 (LEDs) (comes with 420 LEDs and you need 36 for each snowflake) - https://www.amazon.com/gp/product/B00K7UHPEC/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1
- 9 Volt battery - https://www.amazon.com/gp/product/B00MH4QM1S/ref=oh_aui_detailpage_o00_s00?ie=UTF8&psc=1
- 22 AWG stranded hook-up wire (I would recommend getting three spools with a different color each. One for power lines, the second for ground, and the third for data lines - https://www.amazon.com/gp/product/B00NB3SQJU/ref=oh_aui_detailpage_o02_s00?ie=UTF8&psc=1
- eSUN 3 mm Cool White PLA (I have about enough to print 10 or so of these on one spool so one should be totally cool) - https://www.amazon.com/gp/product/B01EKFV60S/ref=oh_aui_detailpage_o04_s00?ie=UTF8&psc=1
- Push button (comes with 20 and you need 2 per snowflake) - https://www.amazon.com/gp/product/B01ER729Y6/ref=oh_aui_detailpage_o03_s00?ie=UTF8&psc=1
- SPDT switches (comes with 10 and you need 1 per snowflake) - https://www.amazon.com/gp/product/B01N7NCW8N/ref=oh_aui_detailpage_o03_s00?ie=UTF8&psc=1
- 9V battery snap connector (comes with 10 and you need 1 per snowflake) - https://www.amazon.com/BBTO-Battery-Connector-Cable-Connection/dp/B0779ZSNS3/ref=sr_1_1_sspa?s=electronics&ie=UTF8&qid=1545063395&sr=1-1-spons&keywords=9v+battery+snap+connector&psc=1

Other things you will need:

- Access to 3D printer
- Access to soldering equipment
- Wire stripper/wire cutter
- Hot Glue Gun
- Velcro

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Directions:

Get Case Ready for Soldering:

1. Using the 3D printing materials available to you, print out the full design which includes:
    a. Base Plate
    b. Backing Plate
    c. Half Box with wire cutout
    d. Cover with switch and push button cutouts
    e. Battery Cover
2. Cut 6 strips of LEDs with 4 LEDs per strip
3. Glue the LED strips to the Base Plate for the snowflakes with the data line pointing in towards the center of the piece (obviously make sure these are upside down meaning that the LEDs are pointing outwards and fit into the squares. This seems obvious…but just make sure)
    a. Start gluing from the furthest most LED from the center and continue on to the center
    b. Bend the top of the LED strip (furthest away from the center) back so that the lettering on the copper strips are exposed. The reason for doing this is because I've found that the top of the copper pads for the DI/DO traces tend to be a lot more reliable than the underside of the WS2812s.
    c. Get rid of all the excess glue by cutting it away or just ripping it out. Make sure that the LED strip is laying as flat as possible against the base plate.

Prepare Wires for Soldering:

1. Cut wires to appropriate lengths
    a. 6 (1 ½'') wires for connecting DI/DO
    b. 5 (1/2'') wires for connecting power
    c. 5 (1/2'') wires for connecting ground
    d. 1 (1 ½'') wire for connecting power
    e. 1 (1 ½'') wire for connecting ground
    f. 2 (3/4'') wire for connecting buttons to Arduino
    g. 1 (1 ¼'') wire for connecting grounds of buttons
    h. 1 (3/4'') wire for connecting button ground to Arduino ground
2. Strip both ends of all the wires
3. Tin all of the wires
    a. Since we went with shredded wires, you're going to have to "tin" the wires. Be leery to tin the ends that are going into the Arduino with extreme care. These will have to fit in incredibly small pockets so if your tinning isn't the best, you might want to leave these ends without any solder so that you might have a better chance of getting a good soldering joint at the connection with the Arduino.

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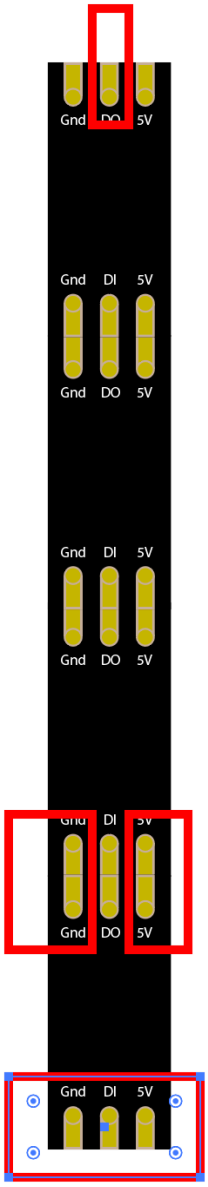
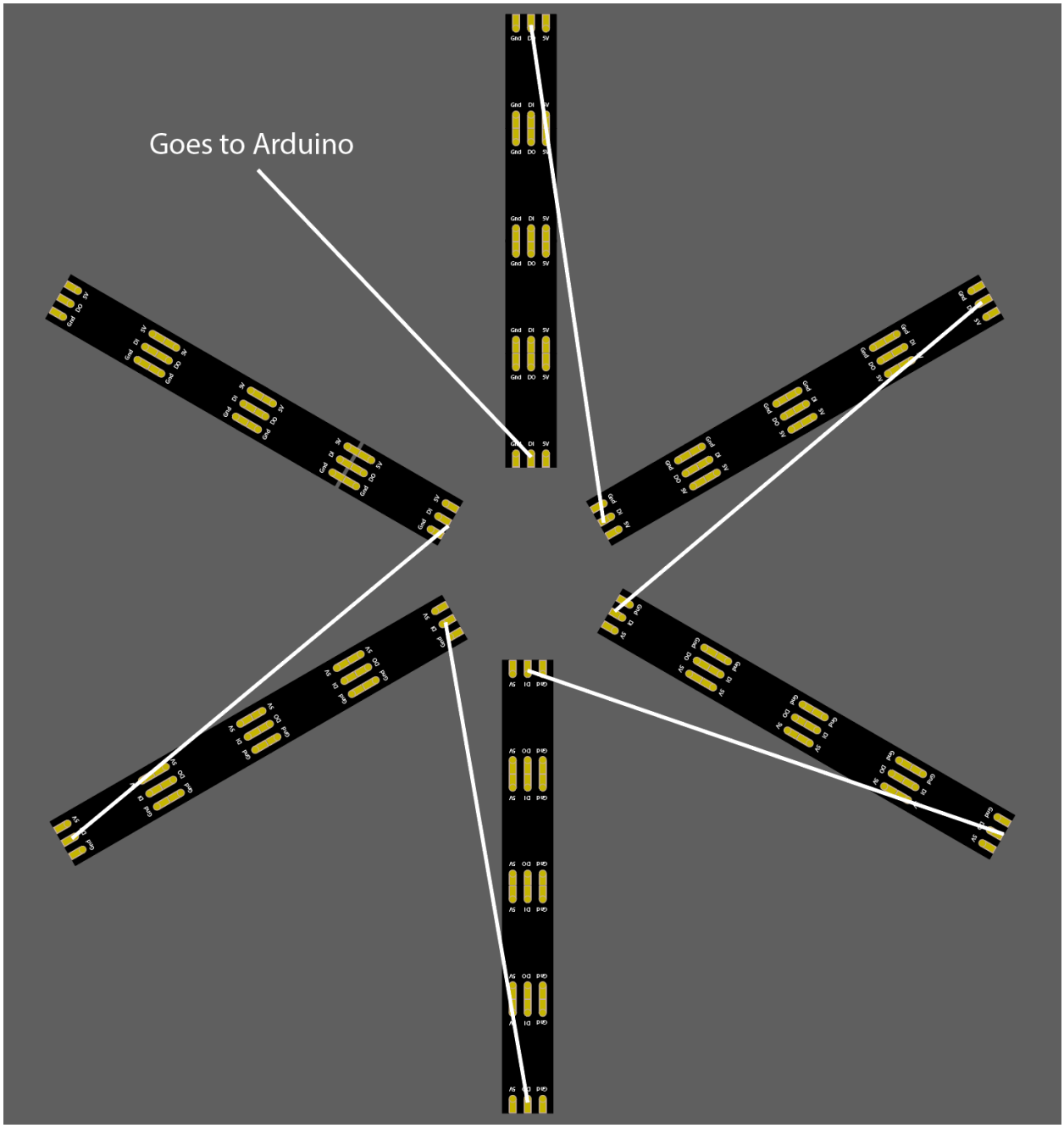
Prepare LED strips for Soldering:

1. You will need to "tin" all of the copper pads that are going to be soldered too. If you forget this step, it becomes nearly impossible to solder to these LED strips. They definitely aren't the easiest things to solder, so all of the tinning will help in the long run for ensuring a solid solder joint. Follow the diagram below to know what parts of the strip to solder. Remember that at the outmost part of the LED strip you are going to be soldering the top of the LED strip for DO rather than the underside which is what you normally will see.

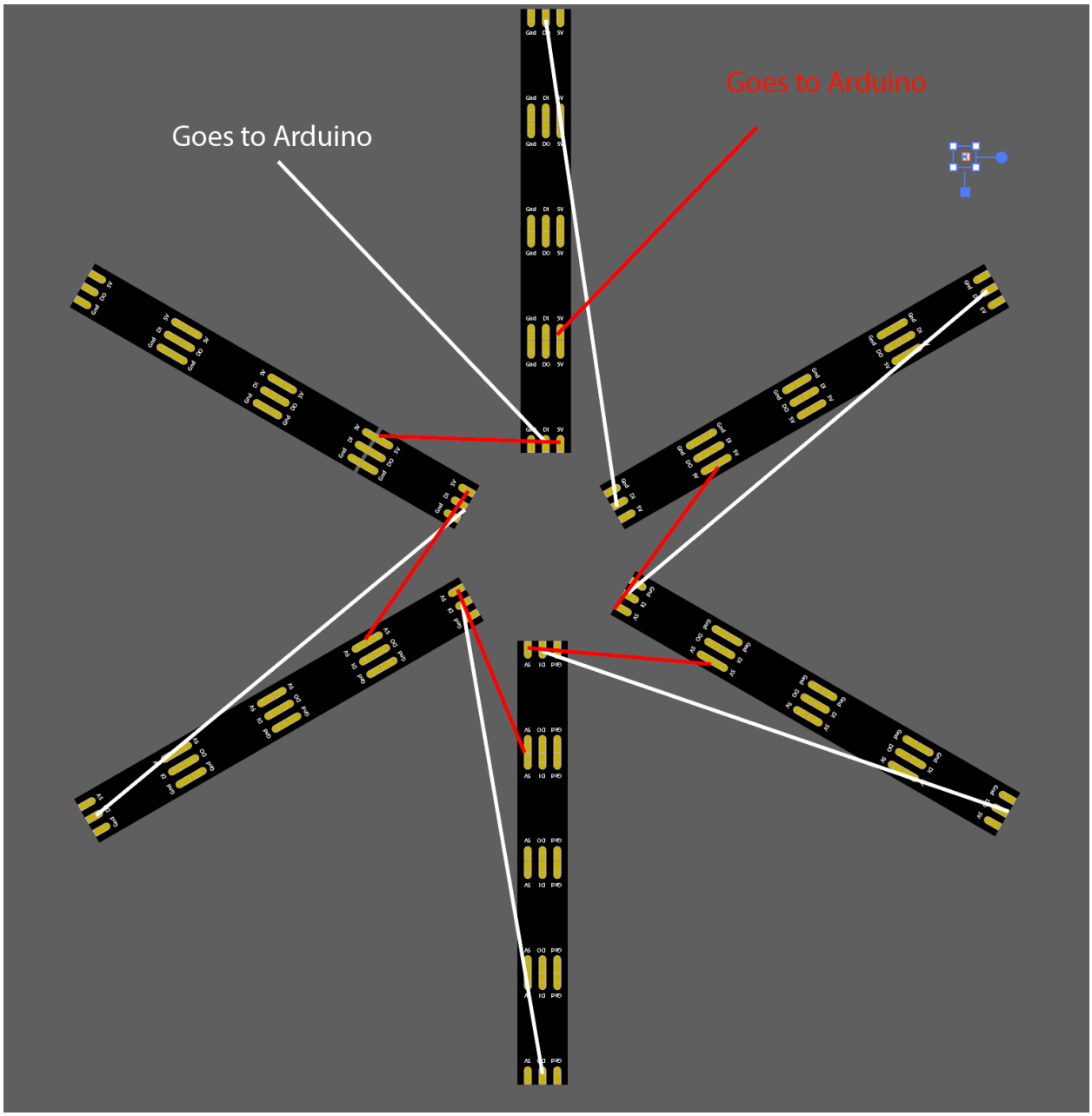


Solder up the Base Plate:

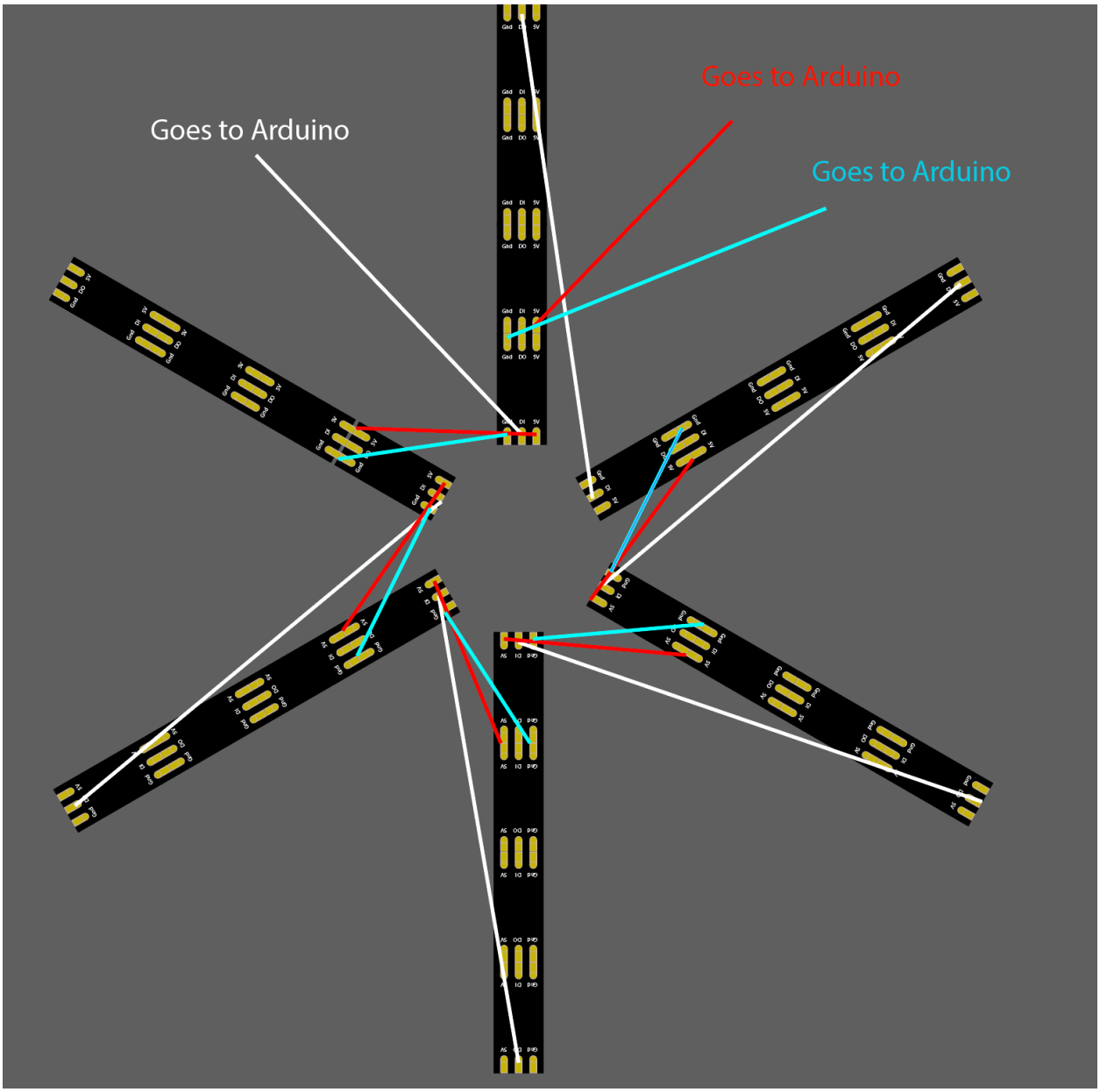
1. You will be using the wires from the list up above highlighted in orange in order to accomplish this part of the directions. I would start by soldering all of the DO/DIs together first. The diagram for that will look like this:



2. Next, you will be wiring up the power on the same strips. The diagram will look something like this:



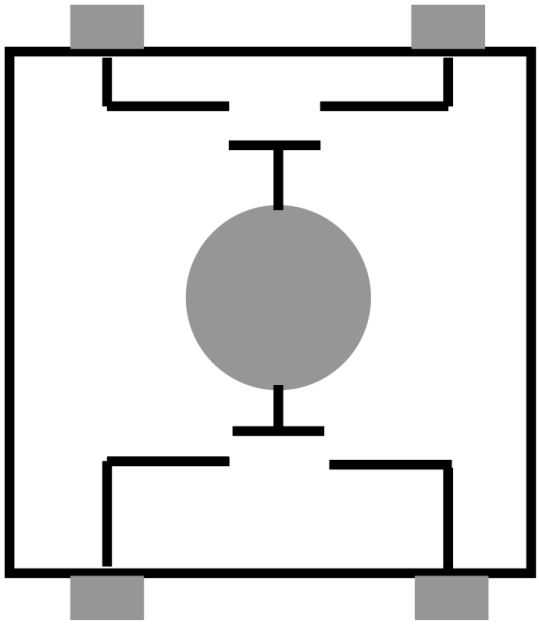
3. Now for the ground wires. Same deal as the power lines. I would use black wires to hook up the ground wires, but in the image, I used an aqua color so that it would be easier to see.



4. Now for the wires that say, “Goes to Arduino”, make sure those are the long wires, not the shorter ones that you’re using. These will in fact go to the Arduino through the back plate…that’s why they need the extra length…in order to actually make it to the Arduino.

Prepare the Controller:

1.) Grab the plate with the slits for the push buttons and switches and glue the push buttons and the switch into place. Ensure that you have the orientation of the push buttons correct. If you look closely at the push buttons, there are 4 prongs: 2 sets of 2 that are electrically connected. The diagram for this looks something like this:



The two silver blocks on the sides of the square are the pins for the push button. These are the ones that are electronically connected to one another. I drew the circuit diagram essentially to show that when you depress the push button, there is a little metal piece that comes down and connects the two sides together…. thus, electrically connecting them. Make sure whatever way you glue the push buttons together you are VERY AWARE of this. If you don't know what you're doing here, the push buttons simply won't work…and we definitely don't want that. I'll try to be as explicit as possible about the orientation from here on out…but make sure you are taking heed as well.

2.) Solder this baby up, but not the entire thing yet. We are going to just do the main controller part that doesn't have to do with the Arduino. So, grab the 9V snap connector along with some wires (the rest of the ones we haven't used) and away we go! Here's what the connections should look like current on the controller part from underneath. This part is tricky so heads up:

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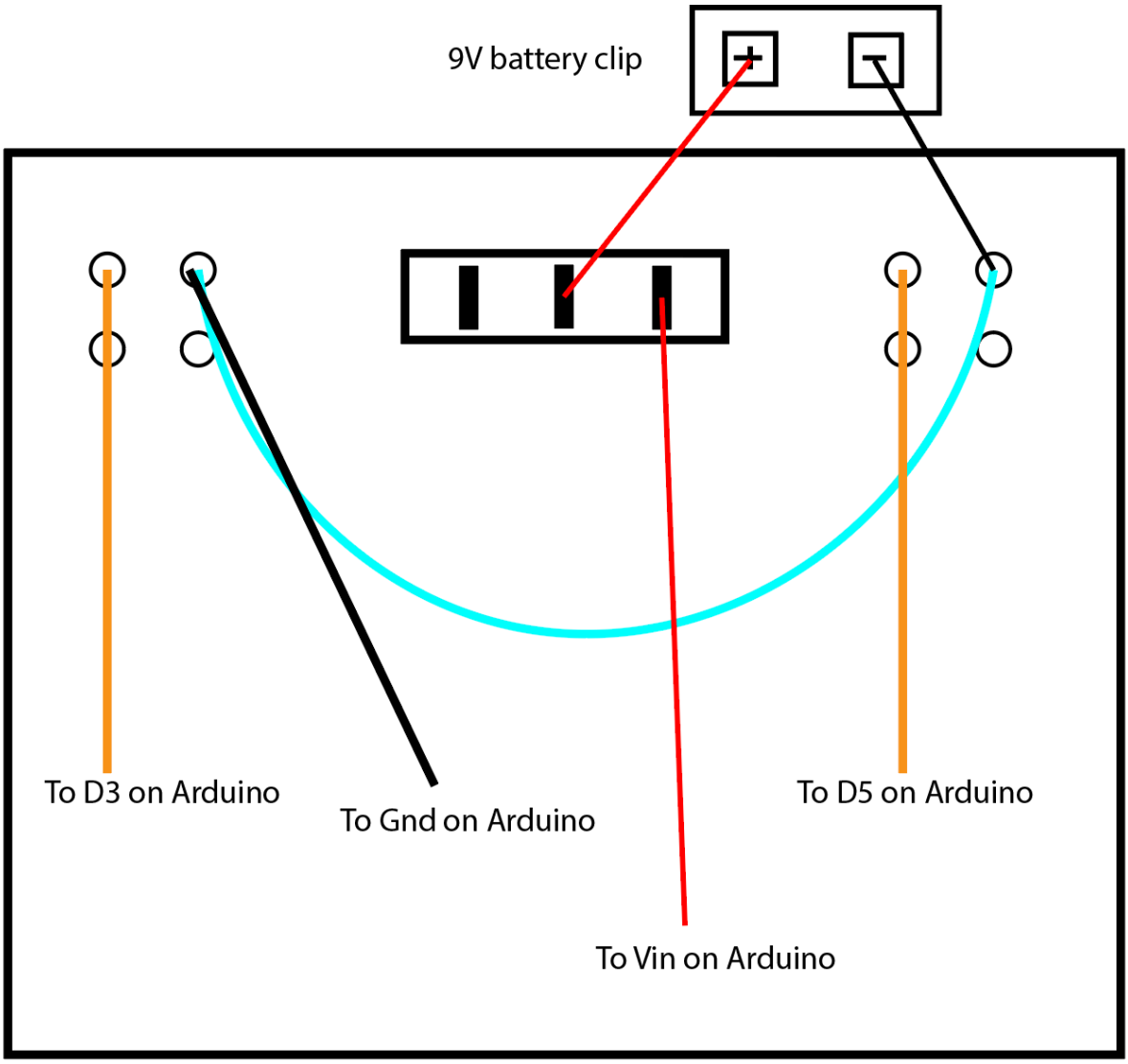

Prepare the Arduino:

Kyli should have this code, but you're going to want to flash the Arduino with the code provided. Make sure you do this step before soldering to the Arduino…otherwise with all the wires, doing this becomes incredibly tedious.

Finish the Soldering Work:

Now for everything where I donated: "To … on Arduino", you're going to want to solder all of those connections now. From the LED strips take the 3 wires (one data, one power, and one ground) and feed them through the back plate and then the box that will house all the wires. Once that's done, solder those wires up as follows:

Arduino ----->	LED Strip
D12	Data
5V	Power
Gnd	Ground

Make it Look Pretty:

You should now be done with the electronic part of the project (objectively the most difficulty aspect of the project). Make sure all of it works with the switch, push buttons, etc. If it doesn't work now…it's not going to work after this step…SO BE SURE THE THING ACTUALLY WORKS!

Now, what you want to do is glue the backing to the LED strips. I would just put some hot glue on the end of the DO solder joints from the strips and press the backing plate down until it stays there securely. Next would be to glue the box to the backing plate. Again, just make sure you have enough hot glue to make it stationary, and then you should be good to go! After that, glue the controller plate onto the box, again with hot glue. Last part is the plain cover (this will be used for getting the 9V battery in and out). What I ended up doing was using Velcro on the 4 corners so that you can just peel the plate away when needed. Make sure that however the orient the snowflake, that plate is on top, otherwise gravity will take hold and most likely rip the battery out of the snowflake and destroy some of your perfectly crafted solder joints D:

Celebrate:

YOU DONE DID IT! CONGRATULATIONS! (Make sure it still works after all the glue…it should…but I've definitely worked on projects where the last step caused everything to fail miserably)