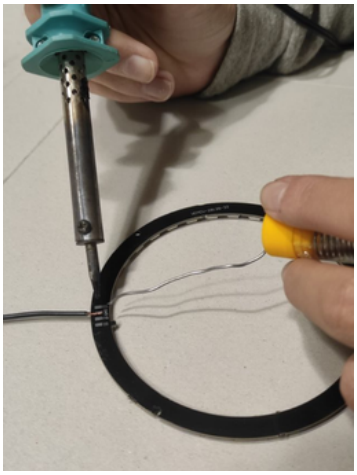
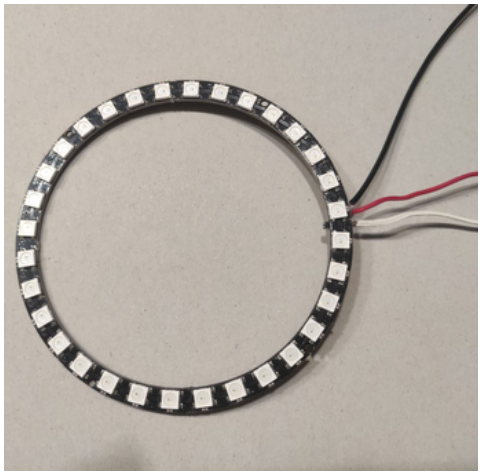
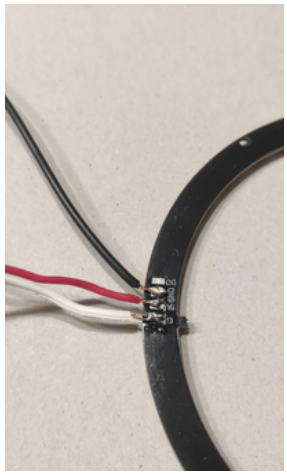
STEP 6 - BUILDING THE ELECTRONICS

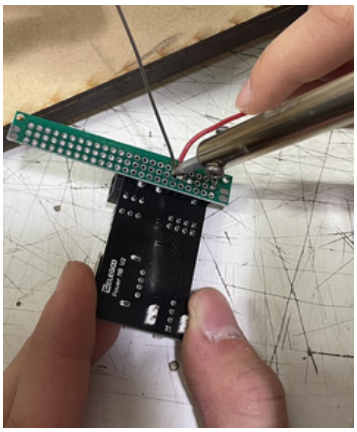
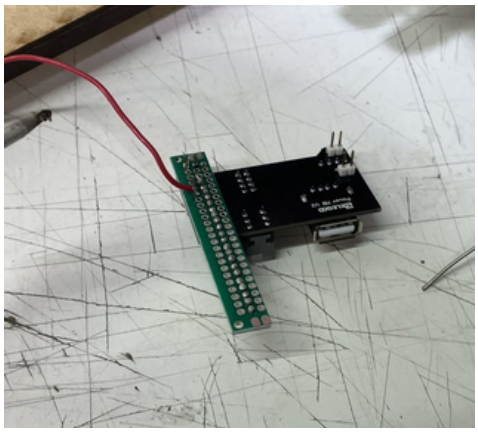
1

The first step was to solder the 32 LED ring with three wires, one for the ground, one for the power supply and one for the Arduino pin (pin 6).

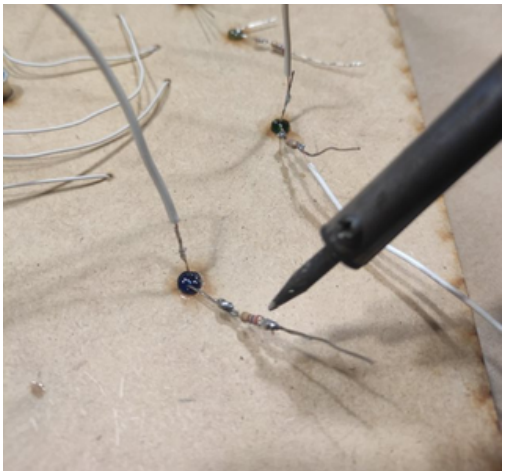
2

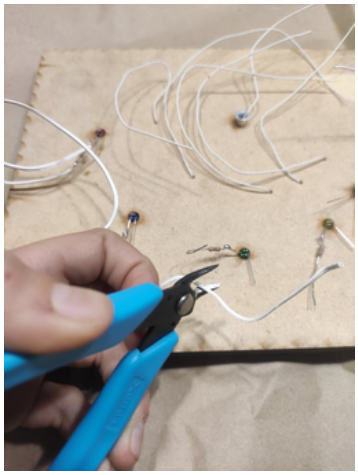
As it has 32 LEDs, it consumes a lot of current and that is why the Arduino needs an external 5V power supply. This power supply is soldered to a topoboard where there will be the ground socket that will go to the Arduino. The power cable from the led ring was soldered to the positive leg of the power supply.

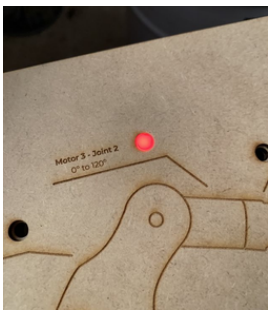
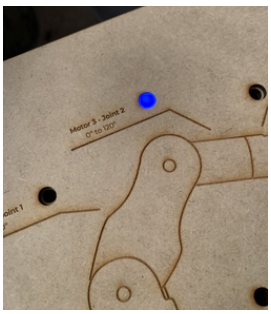
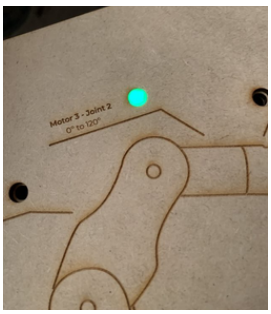
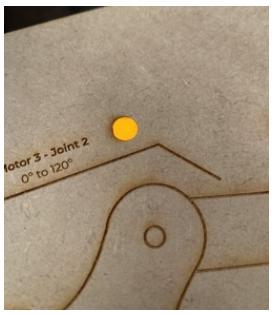
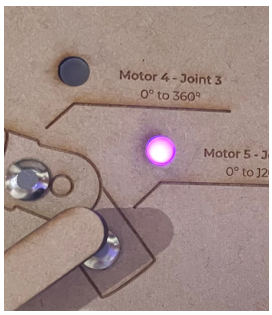
3

Next, we hooked the leds with superglue in the hole that corresponded to them and when they were already hooked we soldered the resistors to one leg with the cable that goes to the pin of the Arduino and the ground on the other leg, except for the RGB led that has 3 resistors and a ground.





The color of each LED corresponds to the programmed color of the LED ring, so the order in which the LEDs are hooked on the panel is important.

4

A wire was soldered to the end of each of the pins of the robotic arm underneath the panel.

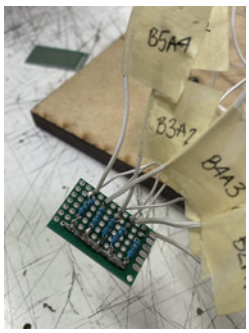
5

As explained in the problem section, if the person touches the thumbtack with his finger, the potential that runs from finger to finger is very variable, therefore, apart from the 3D part already explained, a selector lever of the robot arm has been added. This lever has an inverted thumbtack at the end so that when moving the lever, this thumbtack touches the pins of the panel. The other end of the lever is fixed by means of a shaft (cylinder).

The lever is made up of three laser cut pieces of 3mm MDF (two symmetrical pieces that are a coliso and one that is the same on the outside, but is flat on the inside to allow the cable that is connected to the pin to pass through. So first, the thumbtack was filled with solder, then it was joined to the first piece. After this, the central piece was glued and once dry, a wire (the same that was soldered inside the 3D piece) was soldered to the thumbtack, and finally the last piece was glued on top with superglue. The last step was to pass the shaft through the other end and glue it with superglue.

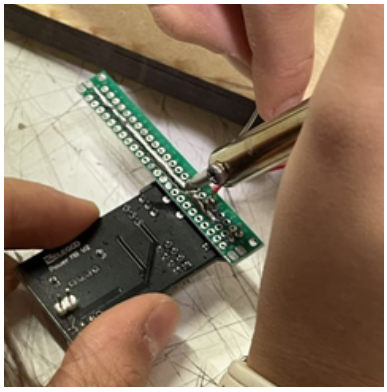

6

The next step was to solder the wire coming out of each pin (which we call buttons) to another breadboard, where we also soldered a wire that goes to the Arduino pins, a million ohms resistor and another wire that goes to ground.



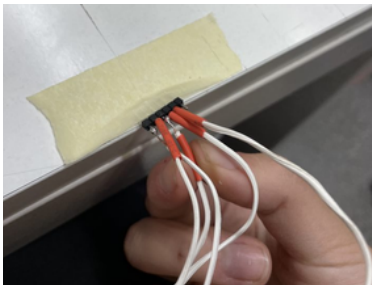
7

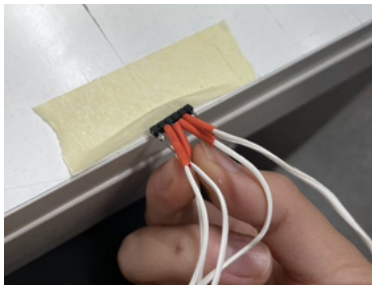
Once all the electronic components had their wires soldered, we soldered a common ground on the breadboard where the external power supply was, and added a wire that goes from the breadboard to the Arduino's groud.

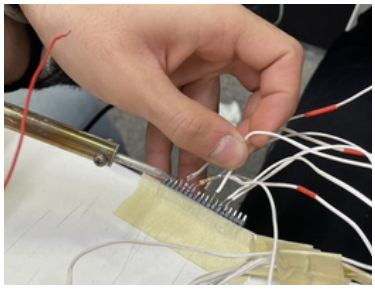


8

The next step was to arrange all the wires to be connected to the Arduino, using pieces that can easily fit on the pins and to which the component wires are soldered. It is very important that when soldering, there is no contact between wires. Therefore, we added some heat-shrinkable plastic tubes that we later heated to fix them.





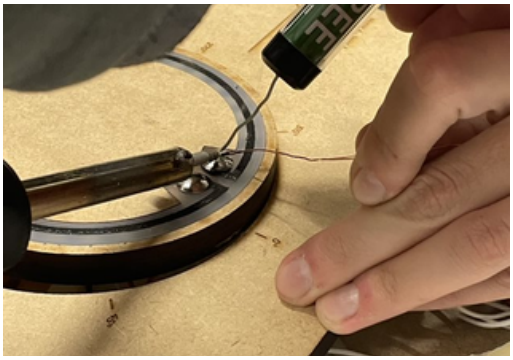


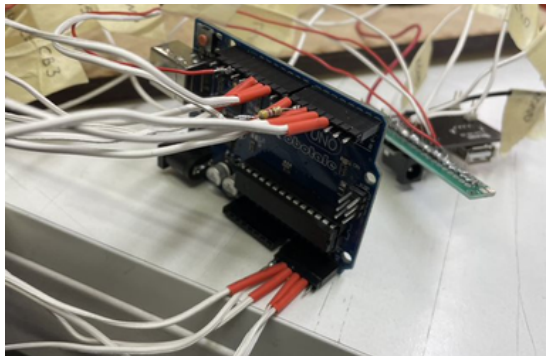
9

When we had the whole circuit soldered, we did some conductivity tests and realized that the system of two inverted pushpins touching each other, transmitted very little current, since it had too small a contact point. So we sanded the tips of all the pushpins to flatten them a bit. First we used coarser sandpaper and then finer sandpaper.

10

The next step was to calibrate the voltage at each point of the circuit. At that moment, after testing the circuit many times and varying the code parameters, we realized that in the paint circle, the two pins (since we had filled them with solder) were good conductors, since the 5V they received fell at their ends. However, in the case of the paint circle, this was not the case, since from one end of the circle to the other, only about 1.9V fell. This made it very difficult for us to calibrate the circle, as there was very little precision in the potential difference at each point. To solve this, the first step was to repaint the line near the pin, but after observing that nothing changed, we decided to add a small piece of copper wire (which is very conductive) to touch the pin and the start of the circle line. After seeing that it was effective, we added two more wires and soldered one end to the 5V pin, and the other paint end we taped to the pin.





11

One of the last steps was to fit the panel on top of the previously built and painted structure, putting all the electronics inside and pulling the Arduino cable and the external power supply cable through the back hole of the structure.

The support of the paint circle was hooked to a linston with the inclination of the panel that was fixed to the base (it is important to centre this circle well in the hole so that the 3D piece can rotate optimally).

And finally, to make the whole design work, the laptop (with the screen folded down) must be inserted through the slot on the right side of the structure. In this way, the virtual robotic arm can be visualised while it is being controlled.