

Wheelson build guide

Introduction

The beginning

Welcome to CircuitMess Wheelson build guide!

By following this build guide, you'll learn how to assemble your very own AI self-driving car. Autonomous cars are the future and we'll show you how they work. With Wheelson you'll learn about microcomputers, autonomous driving, computer vision, and much more.



Age group

Like it says on the box, Wheelson is designed for anyone who's at least **11 years old**.

Some of the assembly steps should be approached carefully, so make sure to have an adult jump in if you need some help with soldering or tightening the bolts later in the process. It's okay to ask for help.

Don't worry though! We'll go through the assembly step by step and provide some useful tips along the way. We'll give you a heads-up if there's something important to keep in mind while assembling.

Assembly time

It should take you approximately 4 hours to fully assemble your Wheelson.

Of course, the assembly time depends on your previous knowledge and experience. If you don't have any experience yet, don't worry! It just might take

you a little longer to get into the groove and overcome the challenges in the beginning.

Skills

You don't need to have any specific skills before getting your hands dirty with this DIY project.

The main objective here is to have fun and learn something new.

So hold on tight, read all the instructions, and get ready to have fun! This is a great opportunity and your first step in your big engineering career.

Learning with Wheelson

As previously mentioned, Wheelson will teach you a few useful things along the way.

Here's what you will learn:

- How to assemble a small 4-wheeled robot (that's Wheelson!)
- How to control an electromotor using a microcomputer
- How computer vision works
- How to calibrate your robot's camera
- How autonomous cars work and how they navigate a road autonomously
- How to recognize and scan a QR code using your robot's camera
- How to recognize different simple objects using a camera and image processing algorithms
- That Tesla's engineers are not some crazy magicians

What's in the box?

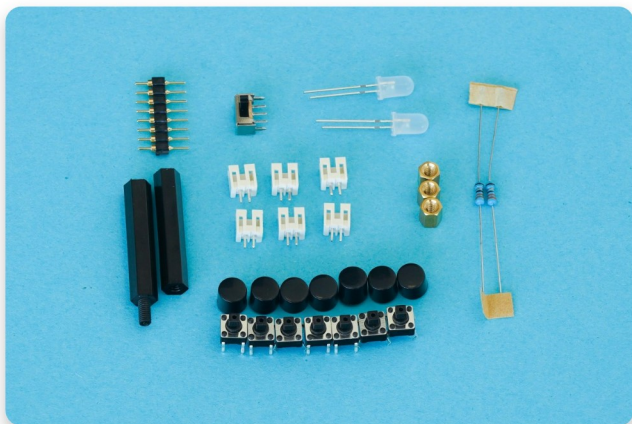
Let's get to know all the components that come in the box!



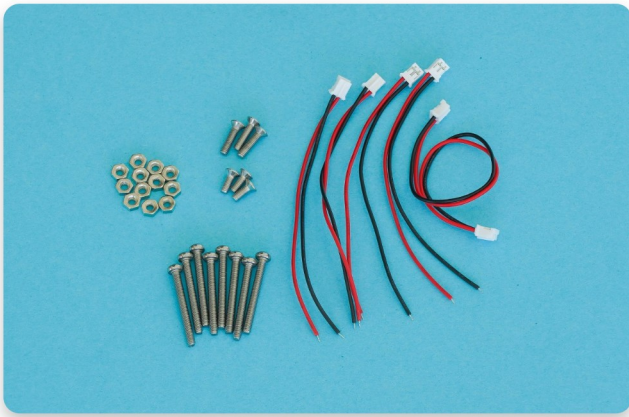
Here's the list of components:

1. **Main circuit board – connects everything together, has a dual-core processor with Wi-Fi & Bluetooth, and a battery charging circuit**
2. **Camera and headlights board**
3. **Display board – 128*160 TFT color display**
4. **Li-Po battery**
5. **Four electromotors**
6. **Four Wheels**
7. **Robot’s plastic chassis**
8. **Two bags of other small components such as pushbuttons, nuts, and bolts**
9. **USB-C cable for charging and programming the device**

Check all the small components



1. Male pin header
2. Black nylon spacers (x2)
3. Switch button
4. White LEDs (x2)
5. JST connector (x6)
6. Small black pushbuttons (x7)
7. Small black button caps (x7)
8. Brass spacers (x3)
9. Resistors (x2)



1. Metal nuts (x12)
2. Medium metal bolts (x3)
3. Small metal bolts (x3)
4. Big metal bolts (x8)
5. JST cables (x4)
6. JST cable male/male

Meet the tools

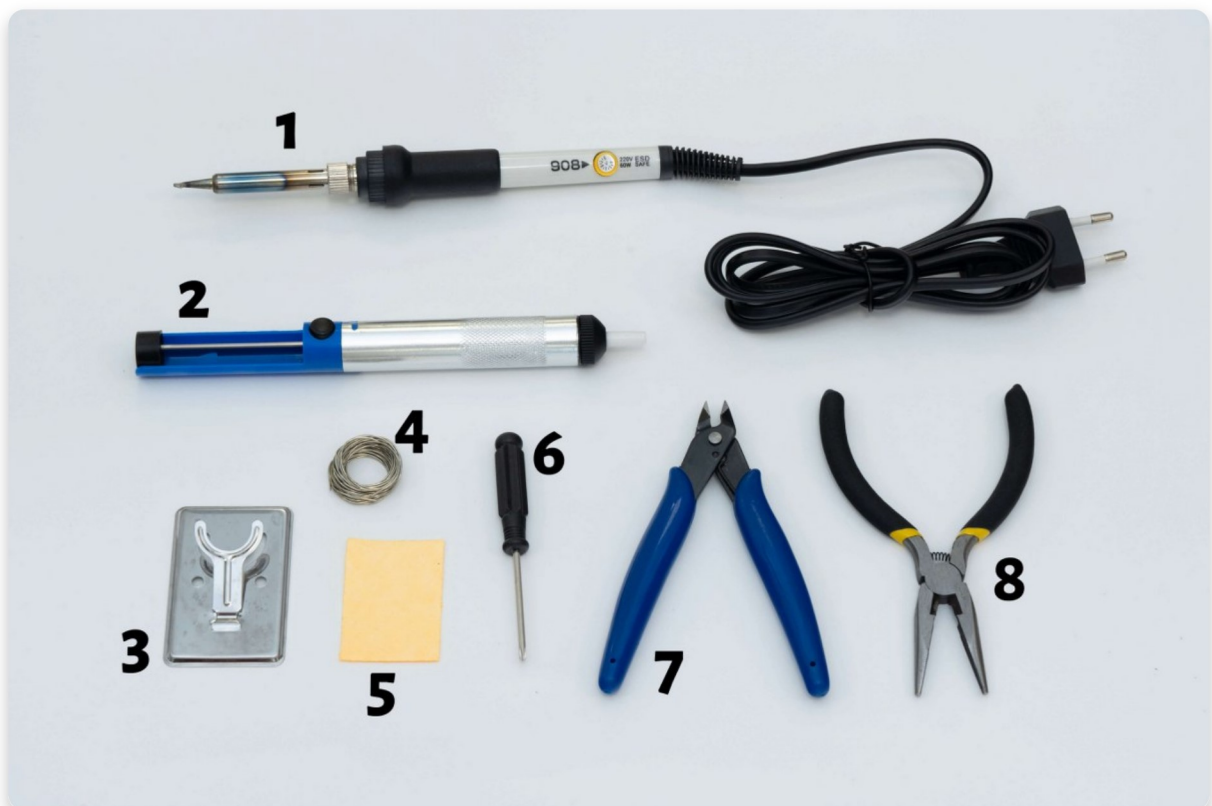
Mandatory tools

In this chapter, we'll explain what tools you'll need to assemble your Wheelson!

If you have your **CircuitMess Tools pack** in front of you, you should be all set.

In case you got the Wheelson kit without the Tools pack, this is a good time to borrow some of the tools or purchase them.

The tools required are essential when assembling, fixing, or modifying electronic devices! These are the tools of the trade for every maker/hardware hacker/modder/electrician.



1. **Soldering iron**
2. **Desoldering vacuum tool (solder sucker)**
3. **Soldering iron stand**
4. **A small reel of rosin-cored solder**
5. **Cleaning sponge**
6. **Phillips screwdriver**
7. **Diagonal cutter pliers**
8. **Wire cutters**

8. Needle-nose pliers

Soldering iron

A soldering iron is the most important tool in a maker's arsenal. For Wheelsons assembly, any entry-level soldering iron will suffice.

If you plan to dive into the world of DIY, you should maybe consider getting a more expensive soldering station with temperature regulation.

There are also many soldering irons with interchangeable tips that can be particularly useful when working with much smaller components.

You will find the instructions on how to properly solder and take care of your soldering iron in the next chapter.



The soldering iron from the Tools pack

Soldering sponge



This small piece doesn't seem like much until you soak it in some water. It then turns into a super solder-cleaning sponge! Use it after soldering a couple of joints to remove the excess solder from the tip of your iron. Make sure that the sponge isn't dripping wet or bone dry – it should be damp.

Diagonal cutter pliers

With pliers like these, you'll be able to trim the legs of soldered components and cut wires!

We prefer this type shown in the picture (Plato, model 170), but any other type will do.

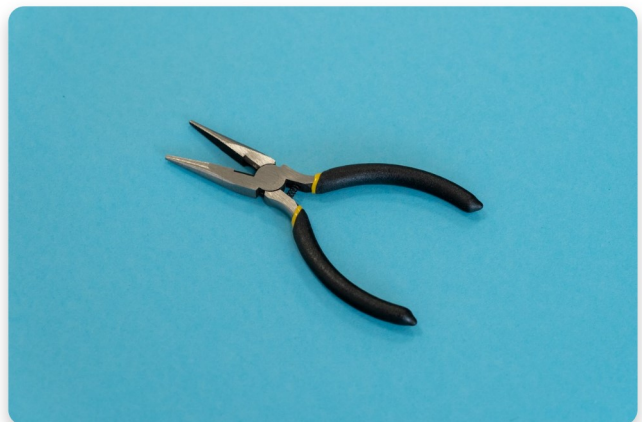


Diagonal cutter pliers

Needle-nose pliers

You're going to need pliers like these when assembling the casing, or when plugging in some tricky connectors!

They're generally useful when doing some fine mechanical work.



Needle-nose pliers

Standard cross screwdriver

You'll need this cross (Phillips) screwdriver to assemble the casing together.

A standard 2.0mm cross screwdriver should do the trick.



Standard cross screwdriver

Desoldering vacuum tool (solder sucker)

This tool is useful when cleaning up soldering mistakes, but it isn't necessary for assembly.

If you plan on doing some hacking, modding, or hardware repairs in the future, having this is always a good idea.



Desoldering vacuum tool

Additional useful tools

Helping third hand with magnifier

This could make your soldering experience a little more enjoyable, especially when doing some more complicated projects.



Helping hand with a lot of additional tools

Multimeter

A multimeter can be used for many things: testing tricky connections, measuring battery voltage, testing resistors & capacitors, measuring the current consumption, and more.

It's a useful tool when you're trying to figure out what went wrong with any electronics kit.



Multimeter

Solder wick

You can use solder wick along with the desoldering vacuum tool to clean up any soldering mistakes. Just put it on the wrongly soldered joint and press on it with a hot soldering iron, then it will soak up the excess solder like a sponge!

Useful for fixing solder joints when they cannot be easily reached with a solder sucker.



Solder wick

Assembly

Soldering introduction

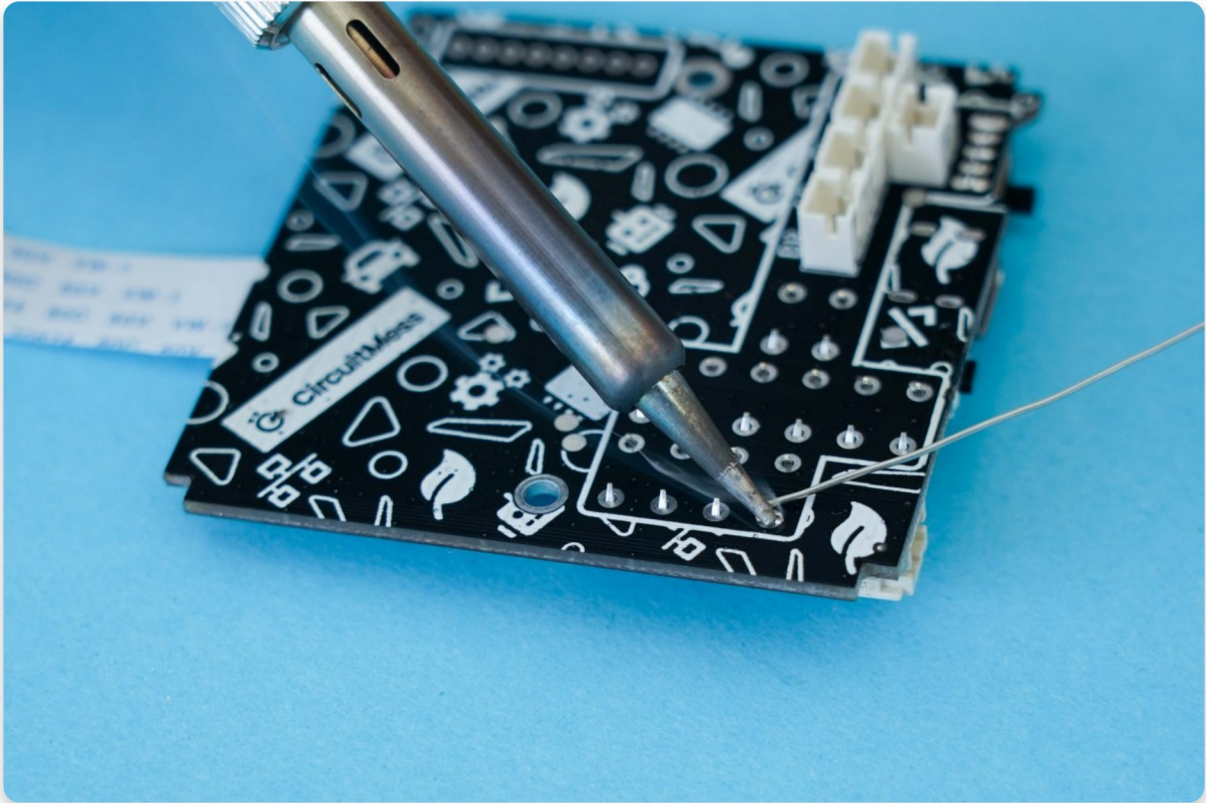
The first thing that you'll do as a part of the Wheelson assembly process is soldering!

Have you ever done that before? If your answer is no, we suggest you look at the following few links where you'll find useful tutorials and blogs about soldering. It will only take you 10 minutes to get into the zone and understand how it's done. Here are the links:

- [Adafruit's video tutorial featuring Collin Cunningham](#) – A tutorial featuring Collin Cunningham, a super charismatic electronics guru.
- [Adafruit's standard soldering tutorial](#) – A great and thorough video tutorial.

An absolute must-read, even if you know how to solder. Make sure to check the “common soldering mistakes” section at the end.

- [Sparkfun's video soldering tutorial](#) – Another well-made how-to-solder video tutorial.
- [Sparkfun's standard soldering tutorial](#) – A detailed tutorial made by Sparkfun.



A little bit of heat + some solder = a connection!

There are several rules of soldering that everybody, regardless of their skill level, should follow at all times.

- **Never inhale the dust and the fumes that can be produced by the soldering iron!** These can be hazardous, so please don't inhale them.
- **Never touch the tip of the soldering iron!** Even if the soldering iron is turned off or completely disconnected from the power source, there is still a possibility that it's very hot and, therefore, can cause very uncomfortable pain if touched. Always keep it facing away from your hands. If you're finished with the soldering iron, unplug it from the power source and leave it to cool off for at least five minutes before putting it back in the box.
- **Clean the soldering iron!** The sponge is your best friend while soldering. Make sure to use it often and clean your soldering iron if you wish to have an easy and simple soldering experience. Carefully hold one part of the sponge with one hand and wipe the tip of the soldering iron on the other part of the sponge to remove the extra solder. Repeat the process until the tip of the iron is nice and clean from the old solder.
- **Check your solder joints twice (at least)!** Most of the malfunctions in the world of electronics are due to bad solder joints, so regardless if this is your first or 100th soldering project, always make sure to inspect your joints multiple times before proceeding to the next step.

- **Keep the soldering iron on the stand when you're not using it.**
- **Know how much solder is needed!** Make sure to put just enough solder, not too much, and not too little, since both can cause the device to malfunction.
- **Don't leave any residual solder on the board!** The solder should only be on the parts where the pins connect to the board. Everything else should be clean. Little pieces of solder all over the board are a big no-no!

Now go over these rules a couple of times so you don't forget them!

If you follow these rules, your soldering experience should be easy peasy.

Using the soldering iron

The soldering iron is very easy to use but only when used properly.

If you have purchased the CircuitMess tools pack with your Wheelson kit, you have a white soldering iron with a temperature regulator.

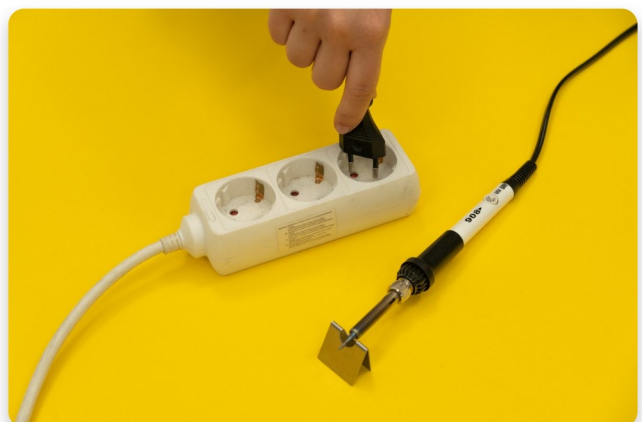
Remember the rules mentioned previously? Good! Let's go over the instructions on how to use the soldering iron now...

Soldering iron instructions



Step 1

Set up your soldering iron so it stands on the stand – as shown in the photo. After that, plug it into a power outlet.



Step 2

Set the temperature to **250°** by turning the regulator. There is a small black arrow next to the regulator wheel, so make sure that it points to the right temperature, like in the photo.

Your soldering iron is now ready to use, but give it a minute or two, so it can heat up. The safest way to let it heat up is to leave it on the stand while you wait!



Set the temperature to 250°

Step 3

Once you're done with soldering (don't worry, we'll let you know when that time comes), you'll unplug the iron from the power outlet to turn it off.

Please use the soldering iron stand every time you are not using the soldering iron to make sure you don't burn the surface or the circuit board!

Make sure to not touch the soldering iron tip for at least five minutes after you have turned it off.

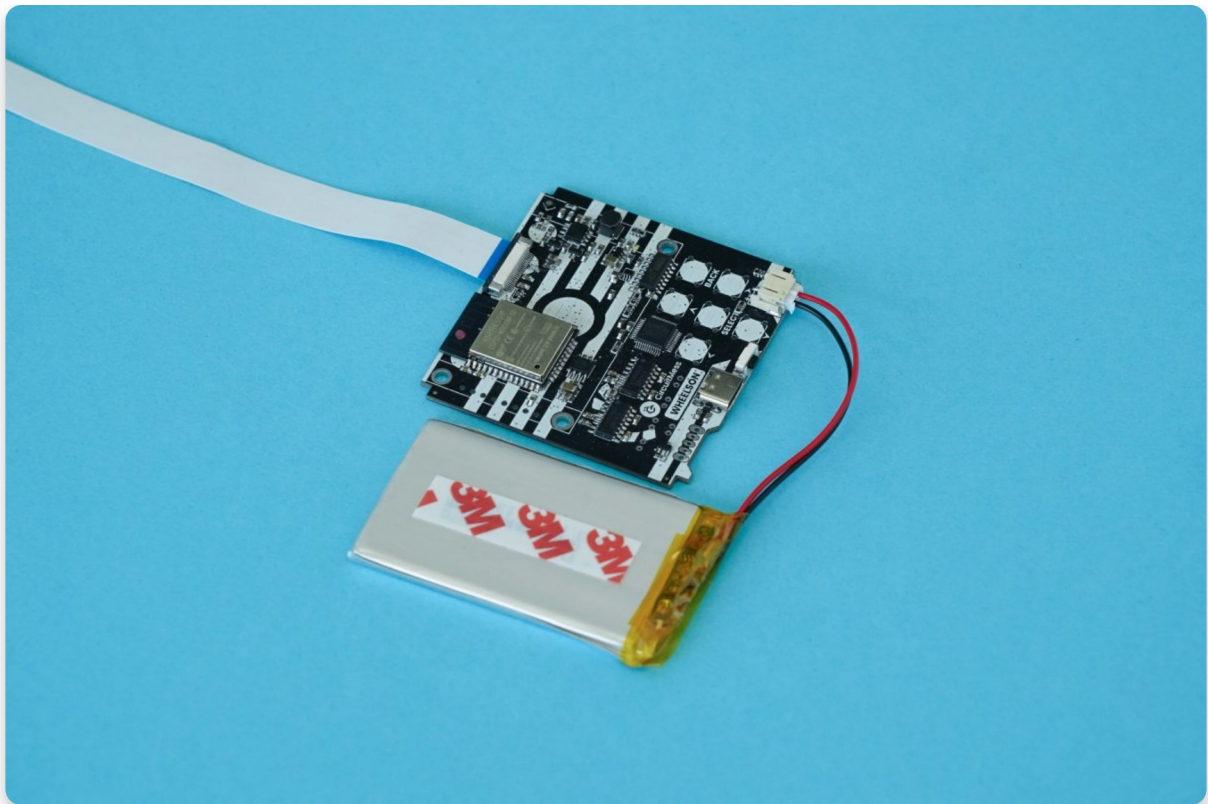


Chapter One – Soldering the components

Now you know how to solder, let's put it to the test. Ready?

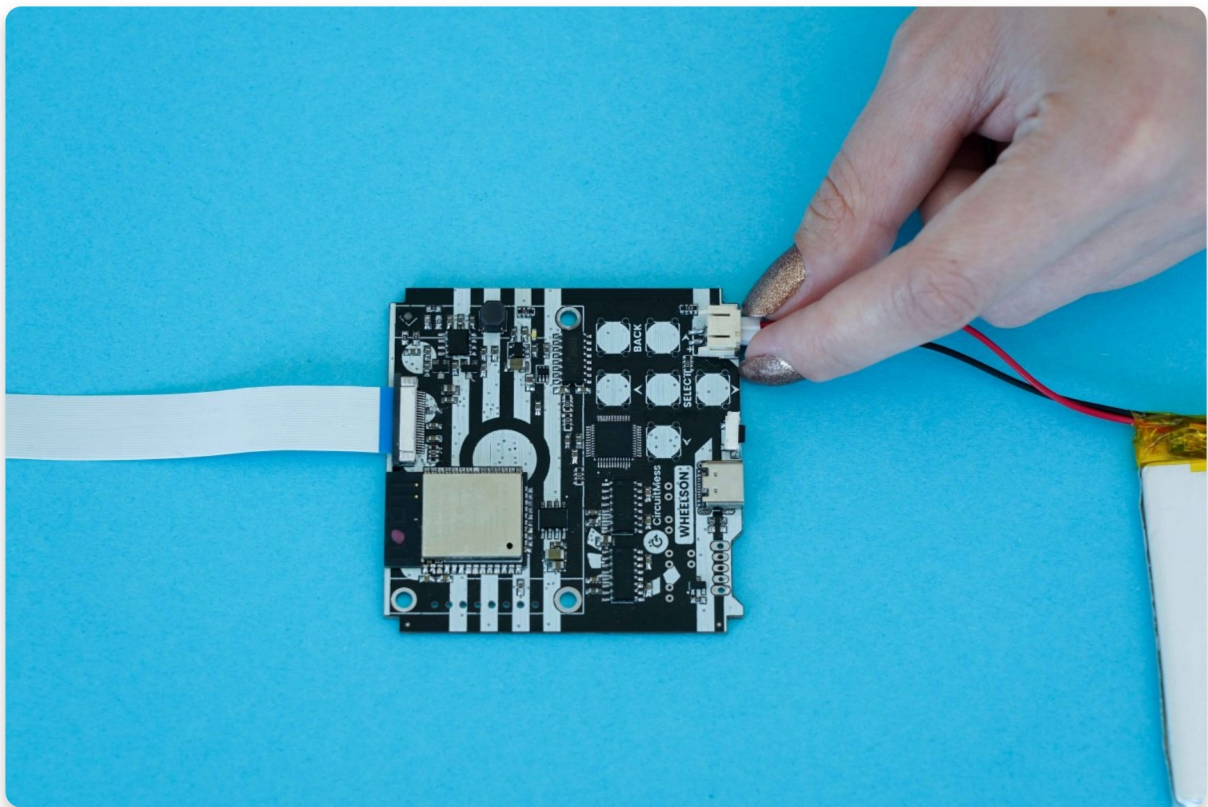
Part one – Soldering the components

Let's begin! Here are the parts necessary for this step – the main board with the connected Li-Po battery.



The first thing you have to do is **unplug the Li-Po battery from the board**. You do that by pulling on the white plastic connector at the end of the RED and BLACK cable until the battery disconnects. **Make sure you don't pull on the wire itself but rather the white connector.**

This is a crucial step that has to be done before you do any soldering at all!

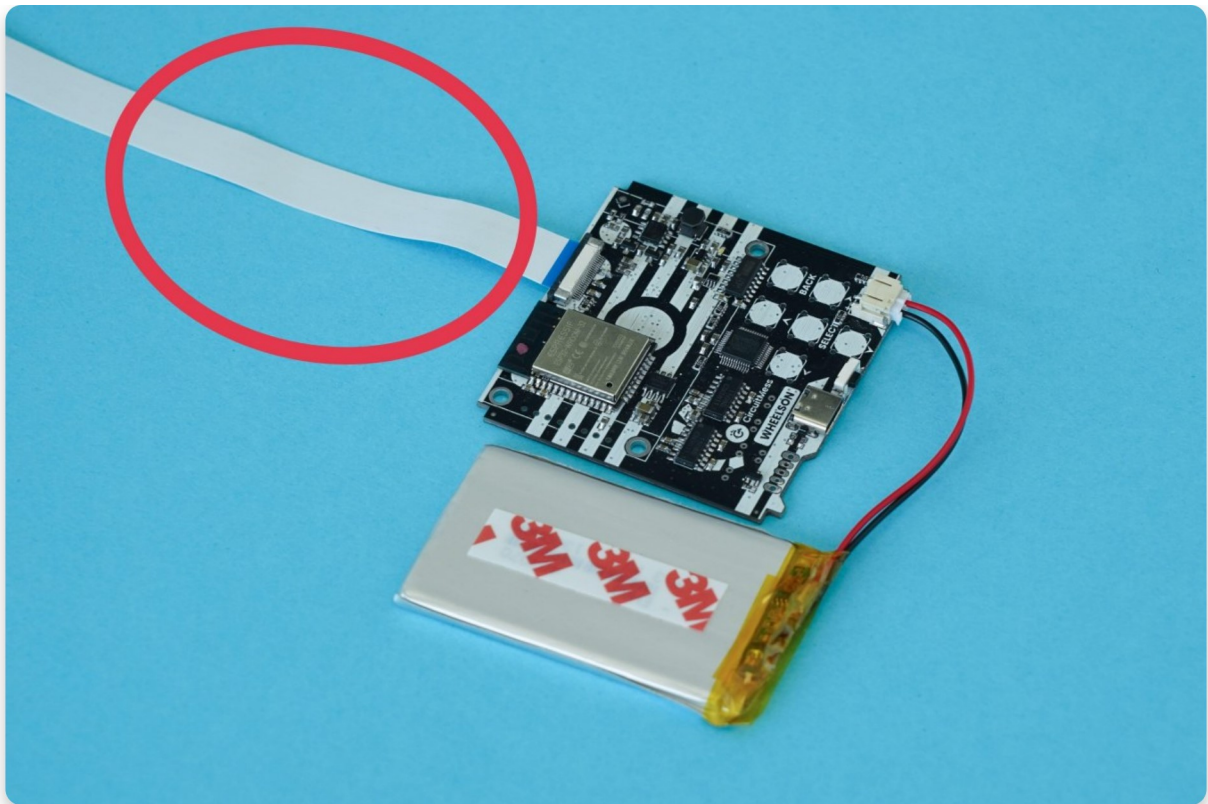


Unplug the battery from the board



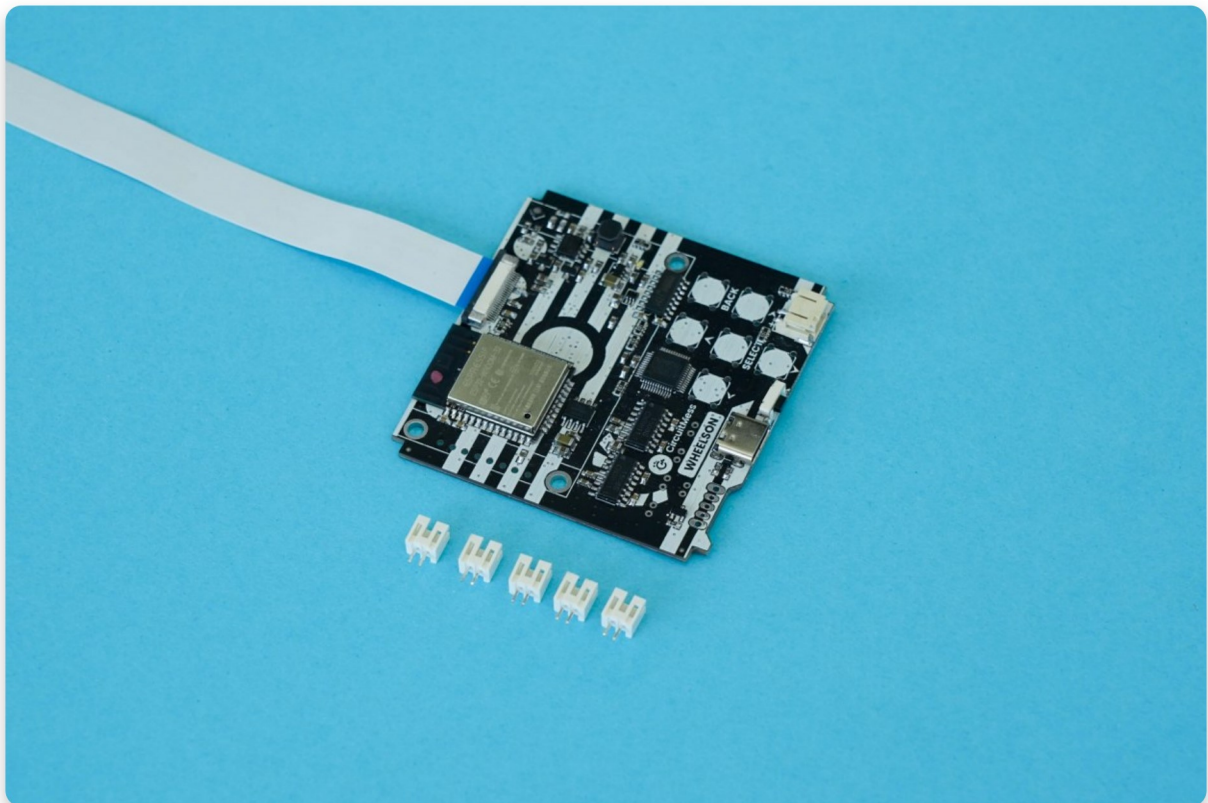
Do not skip this step, you must unplug the battery before beginning the soldering process.

You'll see that the main board has a cable with a camera on the end of it. This cable is very delicate so please be careful when you are soldering and handling the board to not damage it!

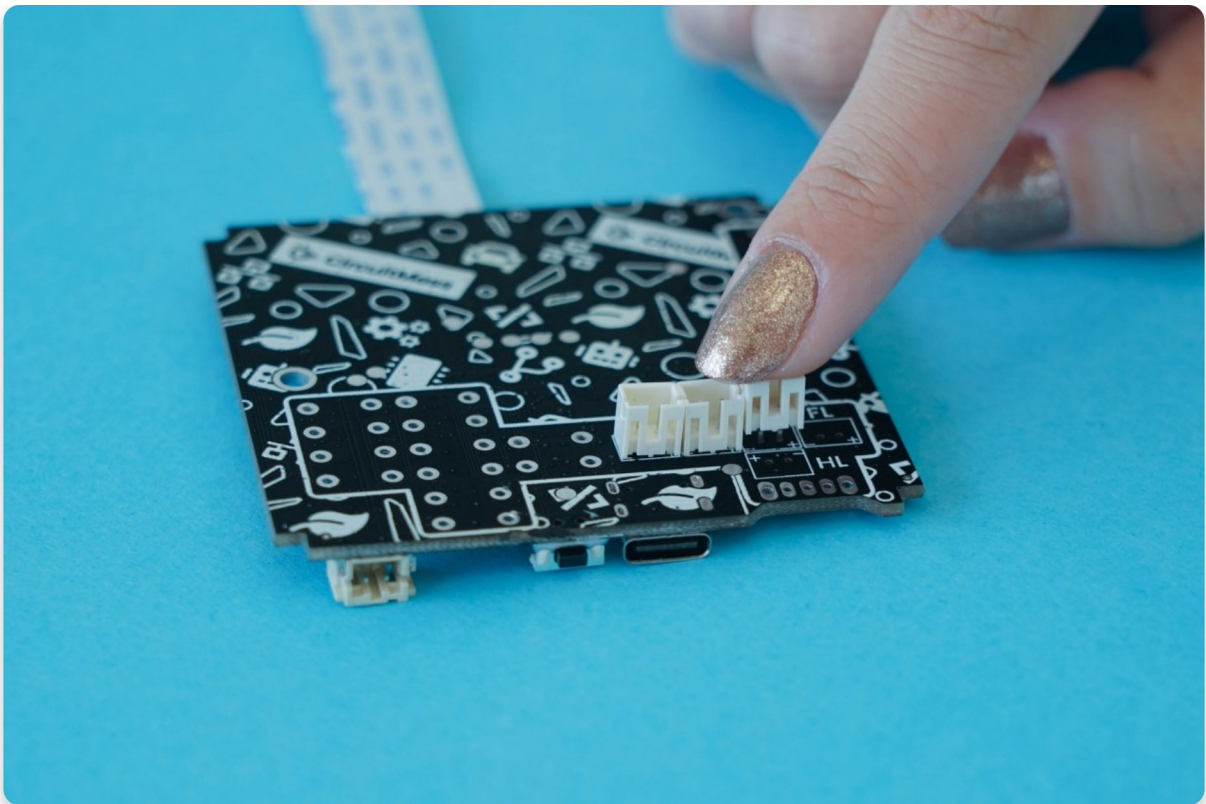


Be gentle with this cable!

Now that you've unplugged the battery we can move on to the next step. Here's what you'll need - the main board and 5 white connectors, called "JST connectors".



Flip over the board, while being careful not to make sudden movements with the camera cable hanging from the board, and position the 5 JST connectors on the board like so



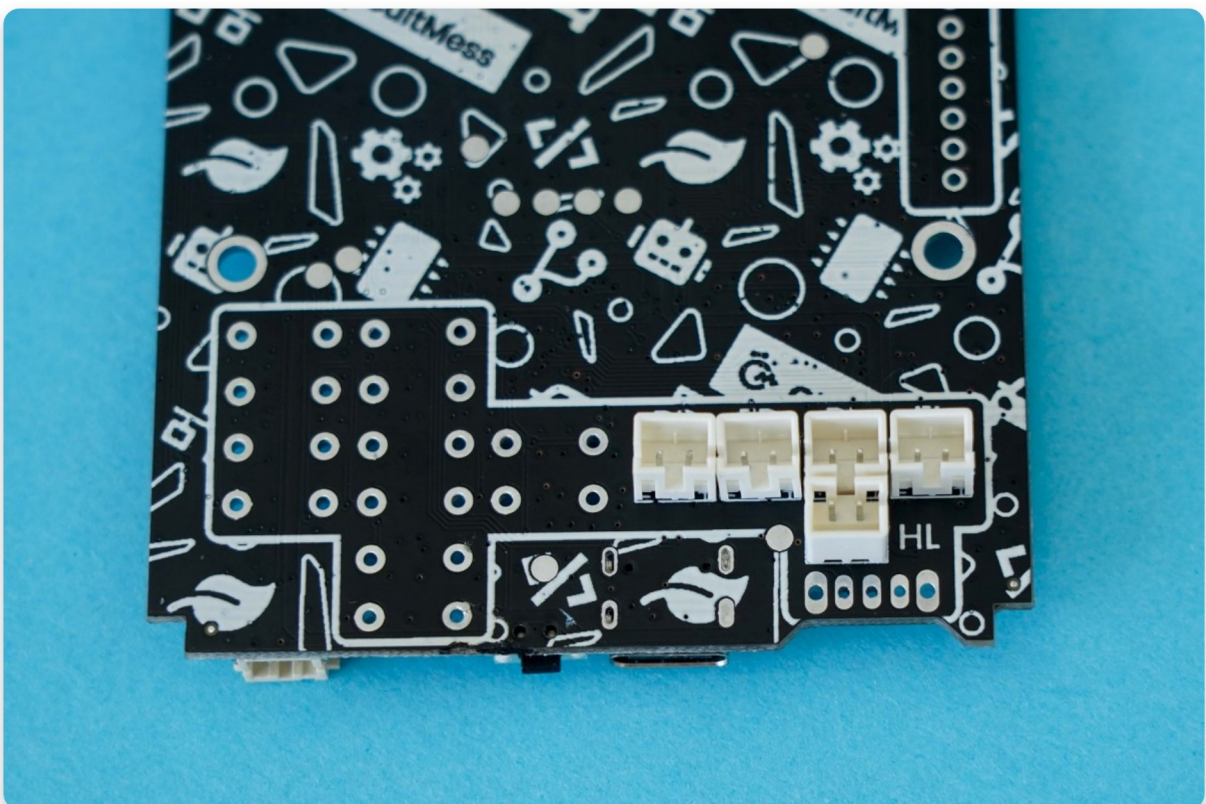
Insert the JST connectors all the way in

It's important that the JST connectors are inserted in the right way.

You'll see that one side of the JST connector has holes on it. Make sure that **those holes are facing away from the camera and the camera connector on the other side of the board!** Place four JST connectors next to each other on the board in that way.

The fifth and last JST connector should be placed in the opposite direction with the holes facing towards the camera, camera connector, and the other connectors.

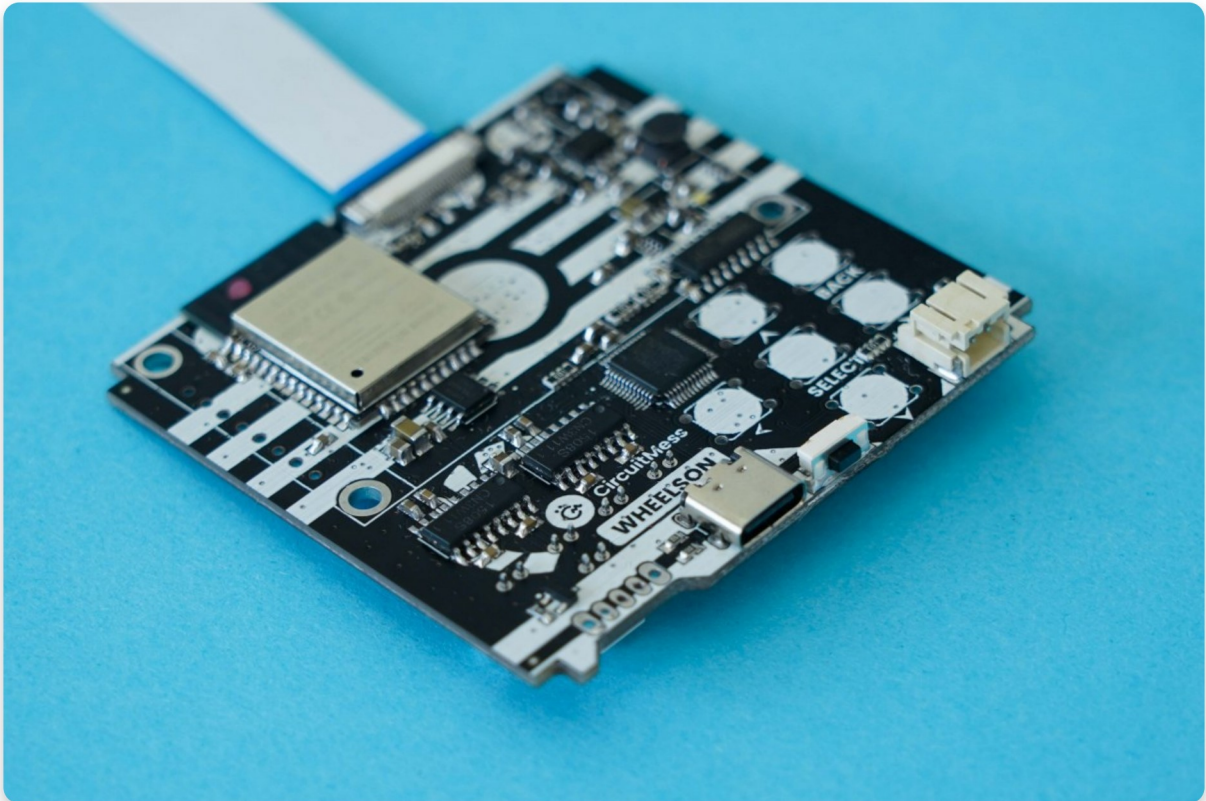
Here's a photo of how they should be placed:



Your JST connectors should be positioned on the board like this

Next, turn over the board - making sure none of the connectors falls out - and check the pins.

You'll see where the connectors' pins are sticking out of the board next to the CircuitMess Wheelson logo. There are ten soldering connections in total you have to make here.

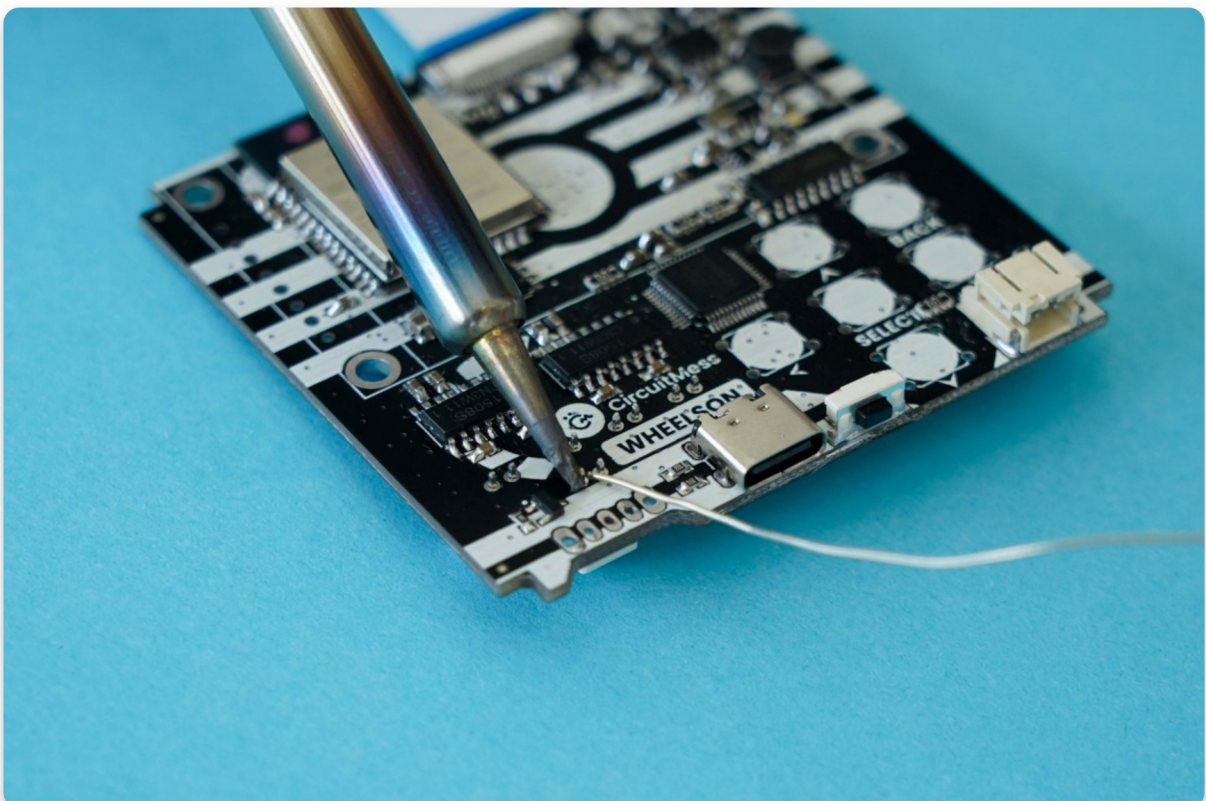


Turn over the board and get ready to solder the first pin

It's time to solder the first pin!

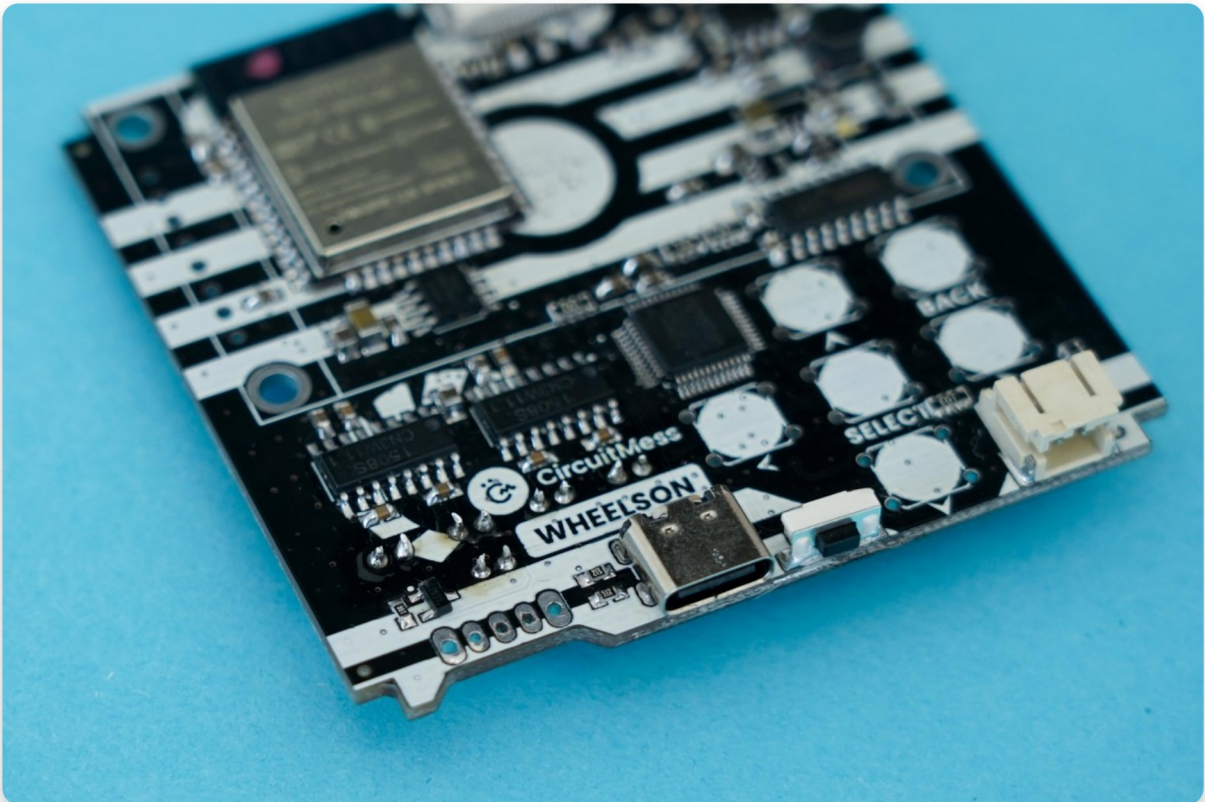
First, carefully place the soldering iron on the first pin so that it's touching both the pin and the little plated area around the hole that the pin is going through.

Leave it like that for about 5 to 10 seconds, so it heats up, and then apply the tip of the solder to pin/pad. The solder should easily melt and spread evenly around the joint.



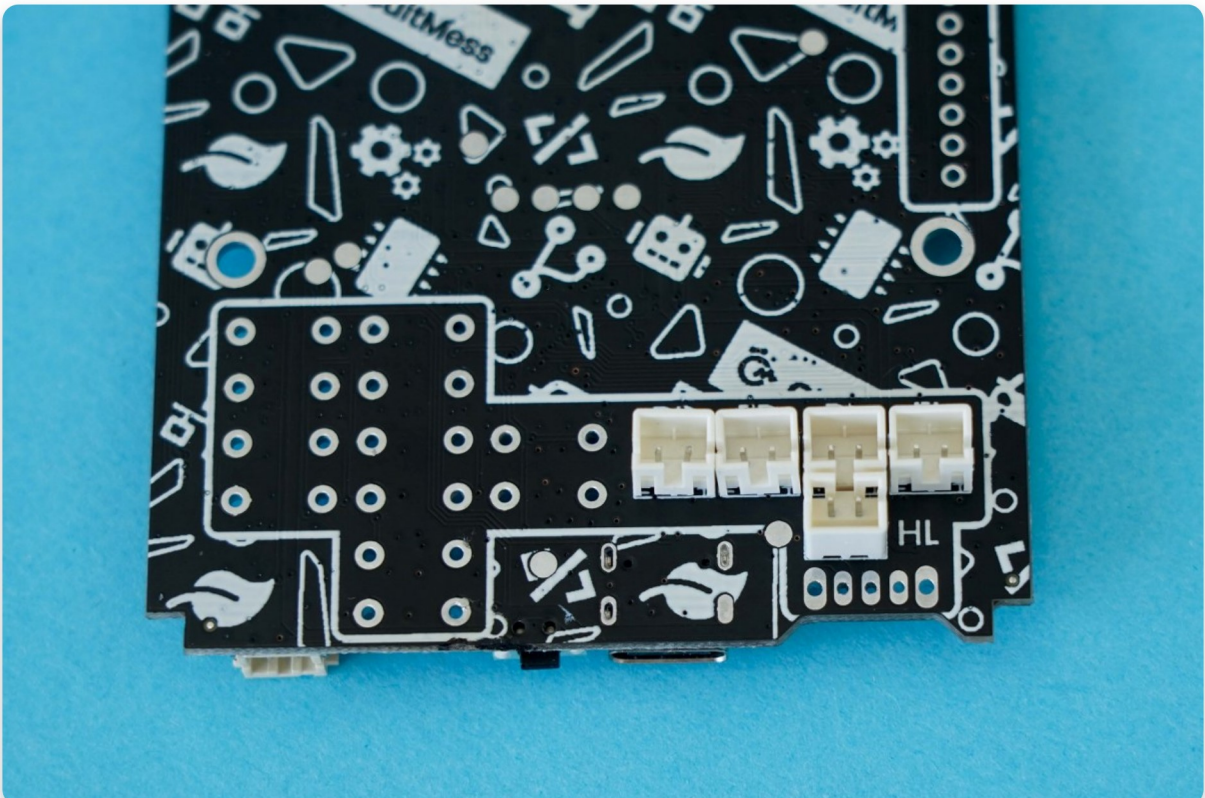
Make the first connection

Repeat this process nine more times until all ten pins are soldered to the board.



This is how your soldering connections should look

Once you finish soldering, turn the board over to check whether all connectors are securely connected to the board.

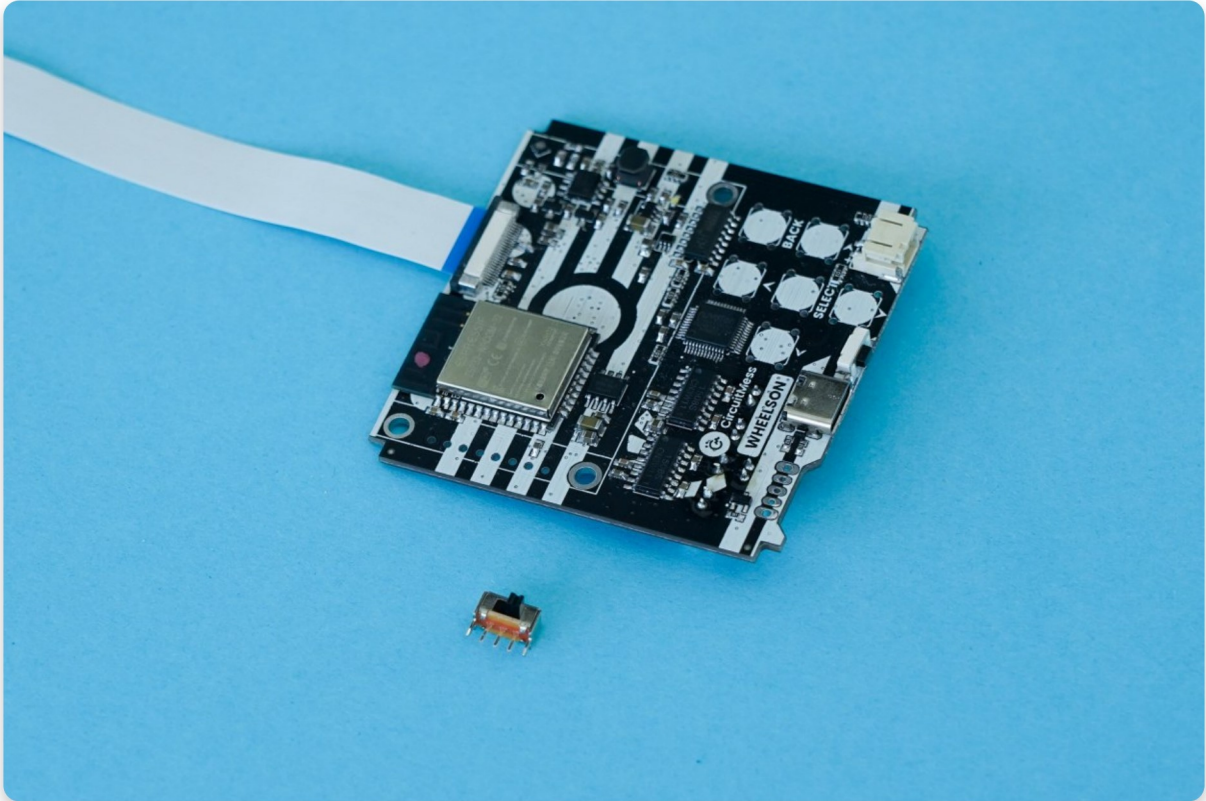


Great job! You soldered the first components to the board.

Part two – Soldering the switch button

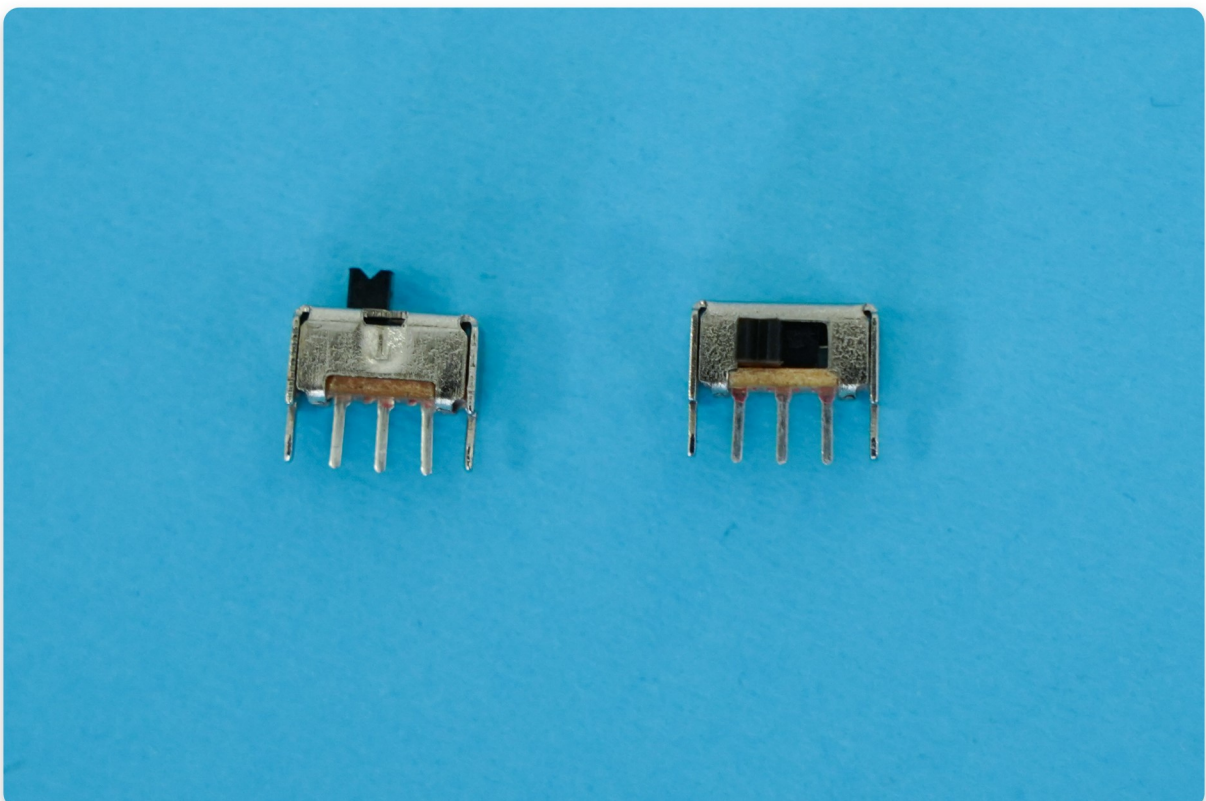
In this step, you'll solder the switch button to the board. This button will be used to turn Wheelson on or off. Here are the components you'll need:

- Main circuit board
- Switch button



Circuit board and the switch button

A quick side note: you can get one of the **two versions of the switch button**. One version has the switch on the top, and the other has the switch on its side. Regardless of which version of the switch button you get, they will both work completely fine.

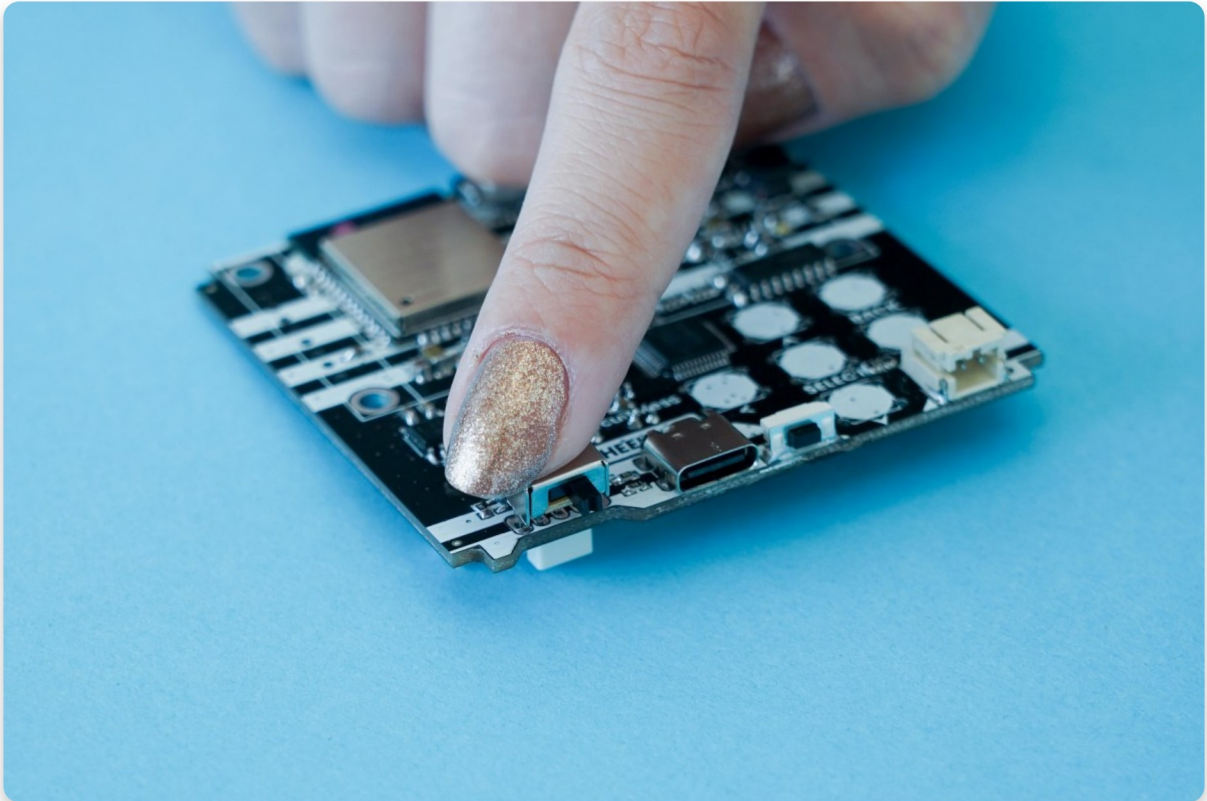


The two versions of the switch button

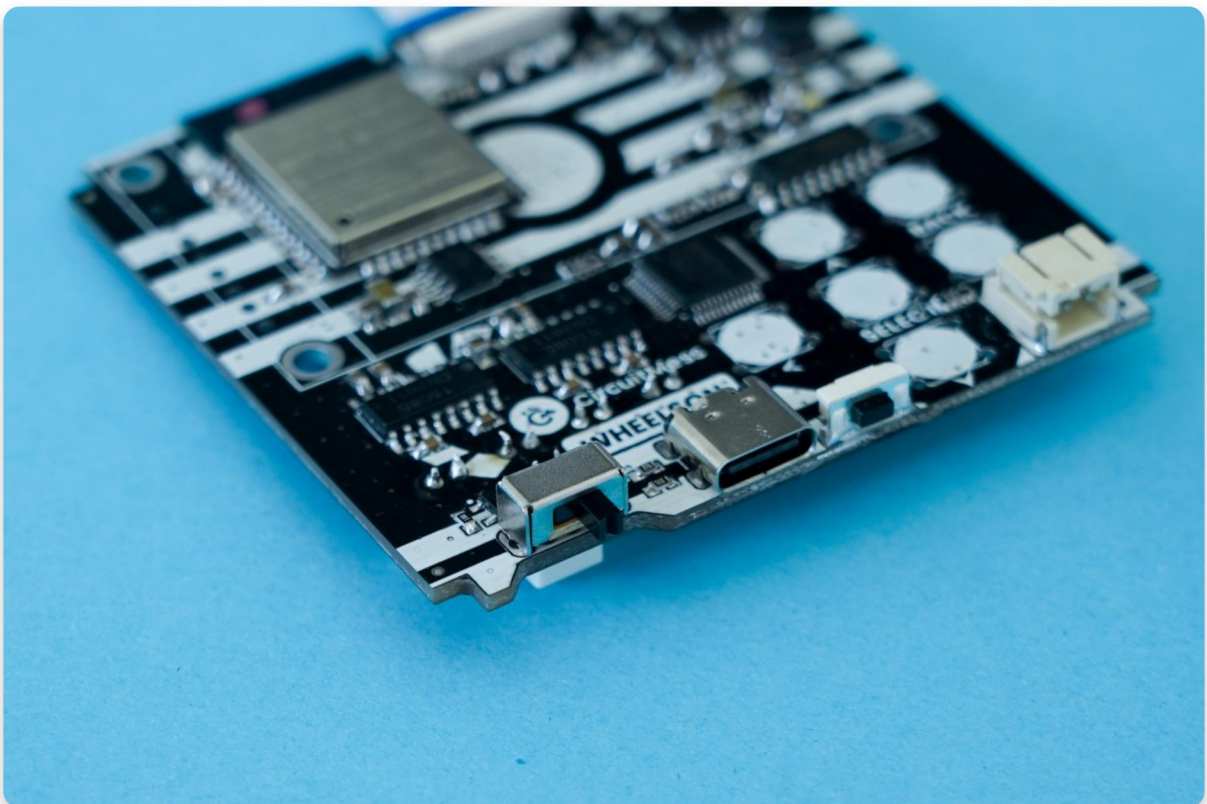
Now we need to find its place on the board.

First, find the CircuitMess Wheelson logo on the board. On the left of the logo, right near the bottom of the board, there should be five holes. This is where you

should place your switch. Make sure to push it all the way in.



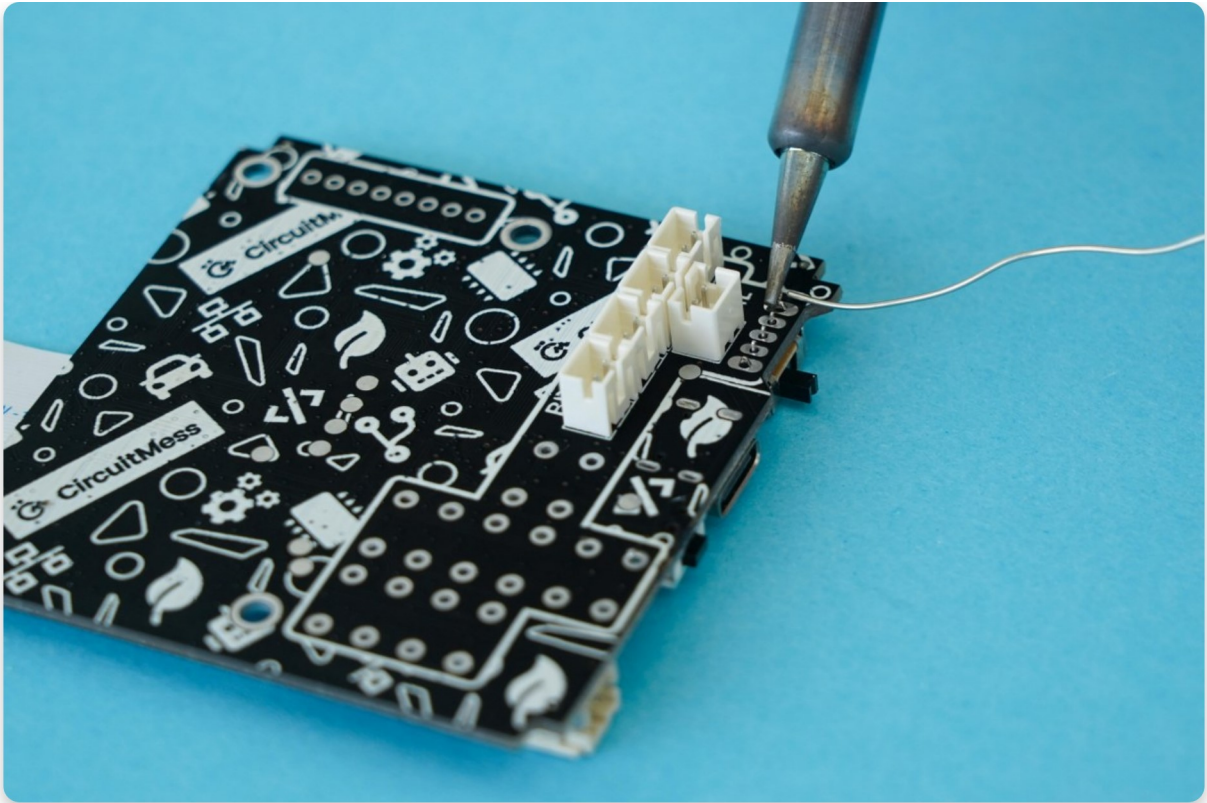
Push the switch button into the holes on the board



This is how the switch button should look after it's inserted

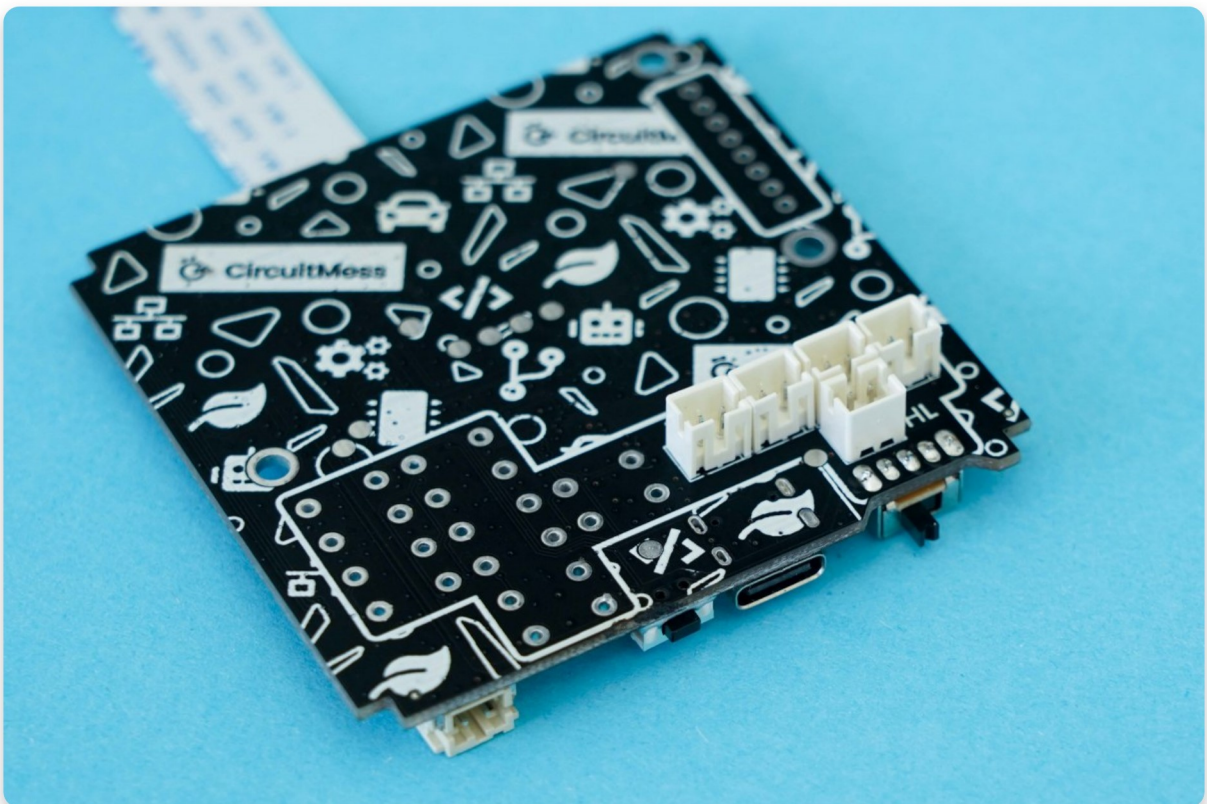
After inserting the switch it's time to connect it to the board. Get ready to make some more soldering connections!

Turn the board over and start by soldering the first pin. Repeat the procedure for the rest of the pins.



Soldering the switch button to the board

Check if all five pins have been soldered to the board correctly.



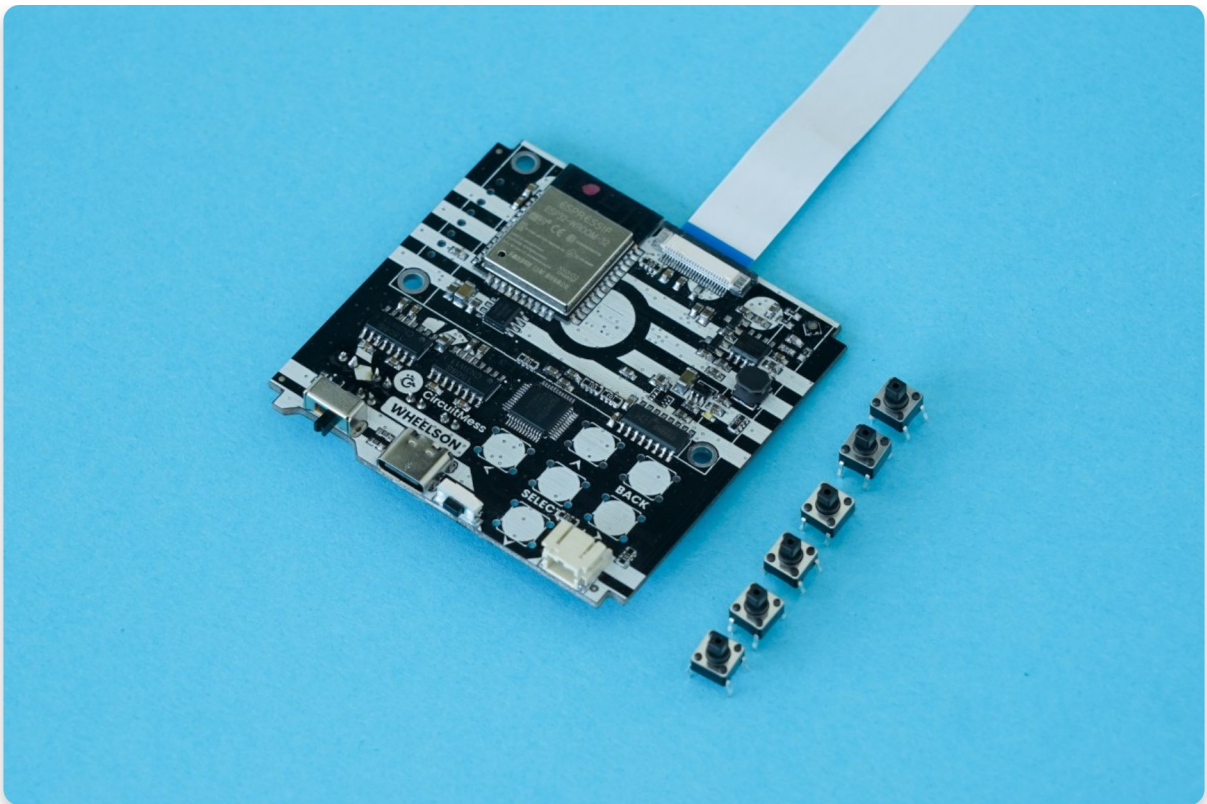
This is what the soldering connections should look like

Awesome! Another component is now soldered to the board. Pretty cool, right?

Part three – Soldering the buttons

Let's move on to soldering the buttons to the board. Here are the components you'll need for this step:

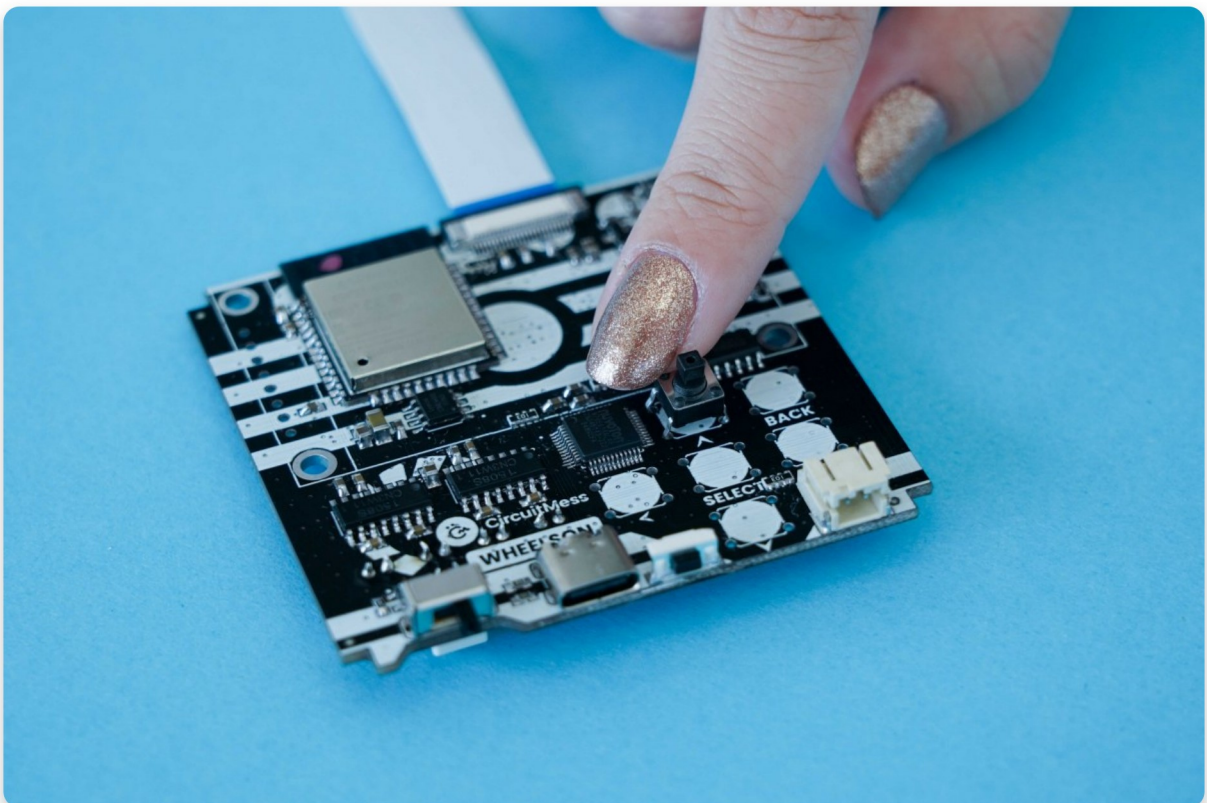
- The main board
- Six Pushbuttons



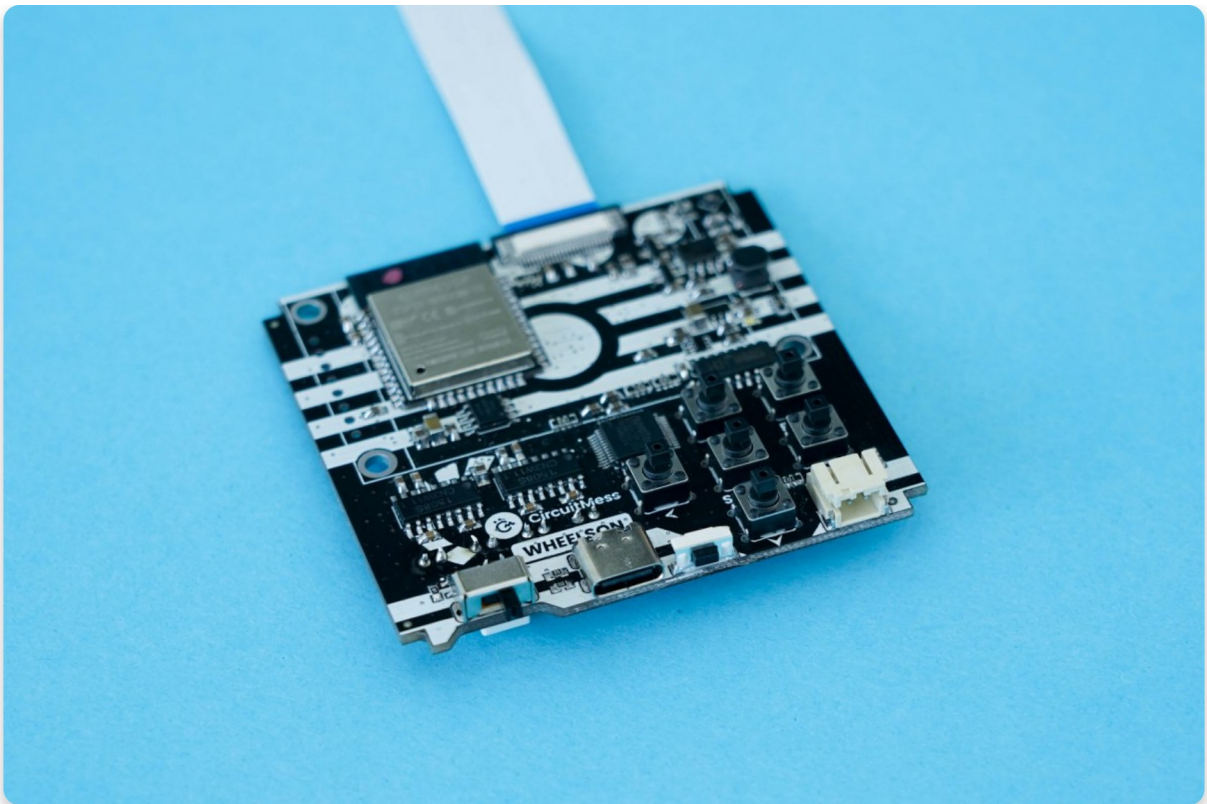
The circuit board and six pushbuttons

It's time to find where the pushbuttons go. Let's use the CircuitMess Wheelson logo as an orientation point once again. You'll see six white circles on the right side of the logo - this is where the pushbuttons go.

Heads up - the pushbutton pins are shaped like a rectangle, so make sure to fit them accordingly. Also, ensure that the pins go all the way through the board - you might have to push a bit harder in order for them to go all the way through the board and sit flat.



Insert the pushbuttons

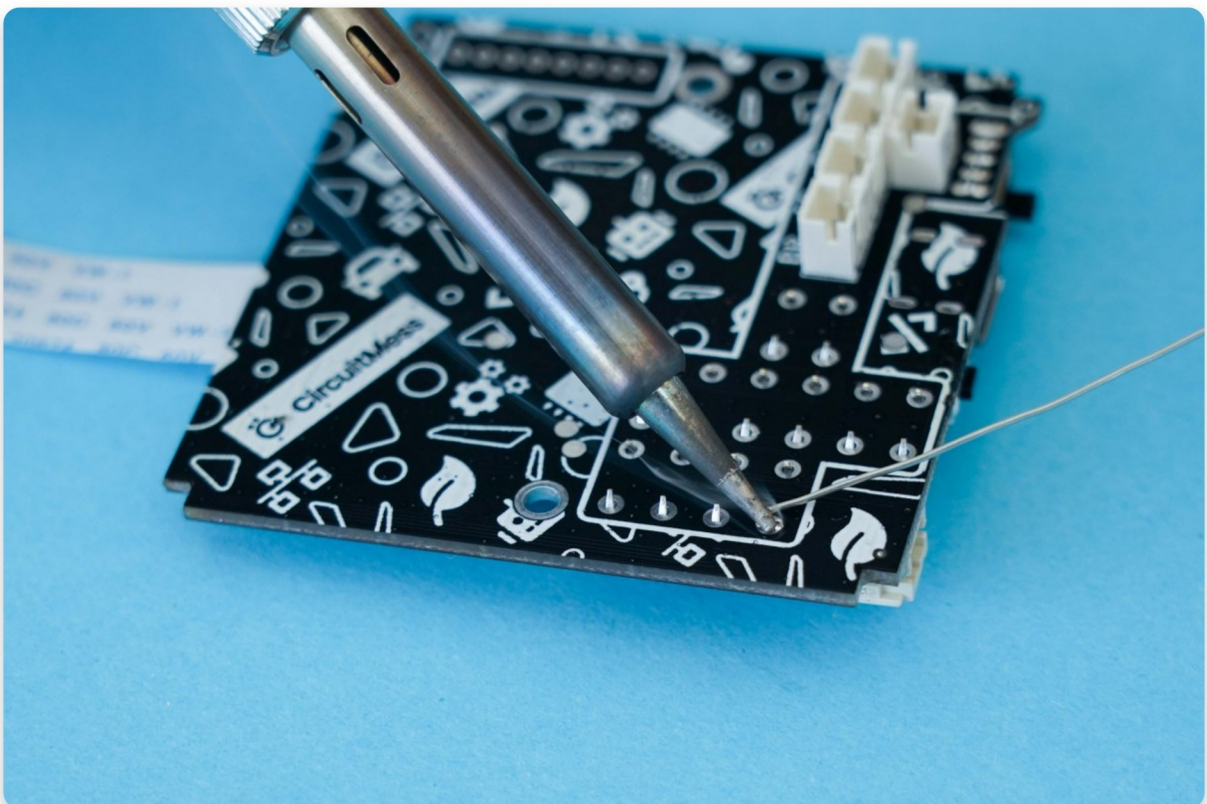


Insert all six pushbuttons

Let's do some more soldering! Turn the board over and solder the pushbuttons to the board.

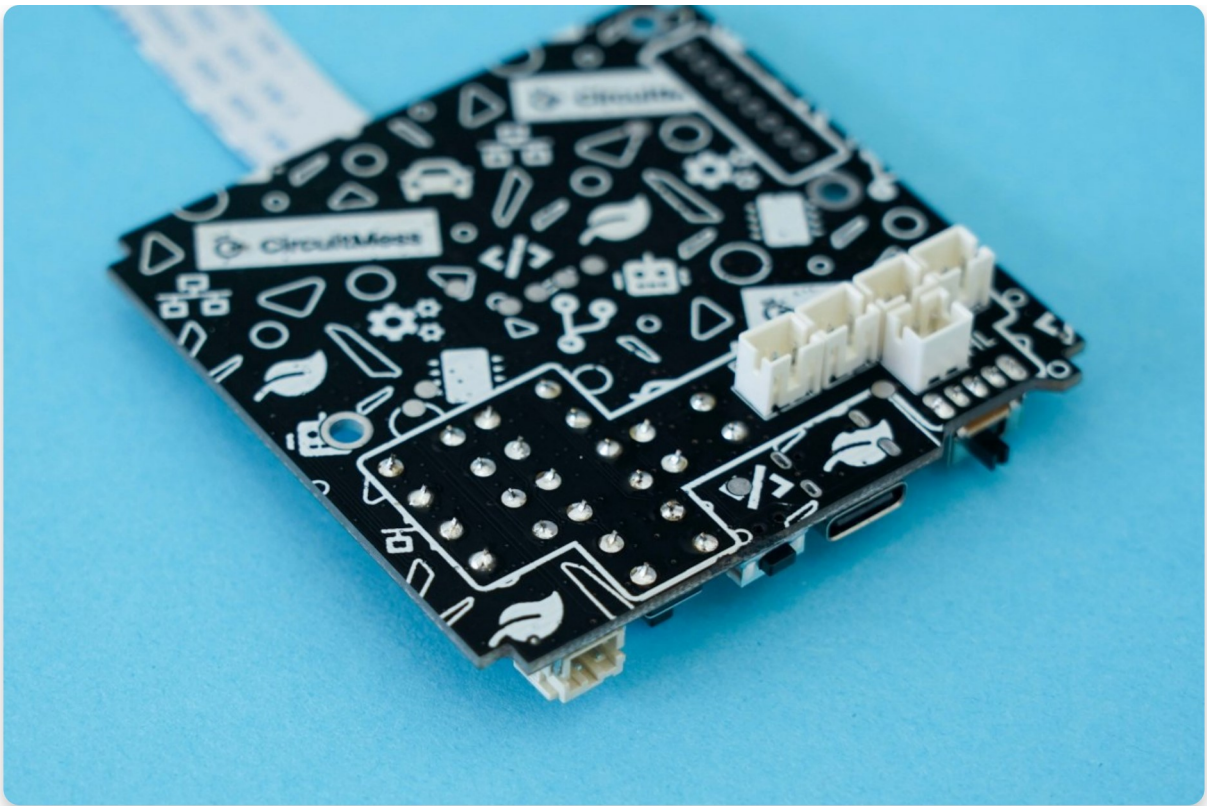
There are quite a few soldering connections to be made here so take your time.

Make sure that all the buttons sit flat, you may have to press the buttons a couple of times to make sure they are fitted securely in place.



Solder the pushbuttons

Check if all pins have been soldered to the board. Here's how the connections should look:



Pushbuttons soldered to the board

Part three – Putting on the button caps

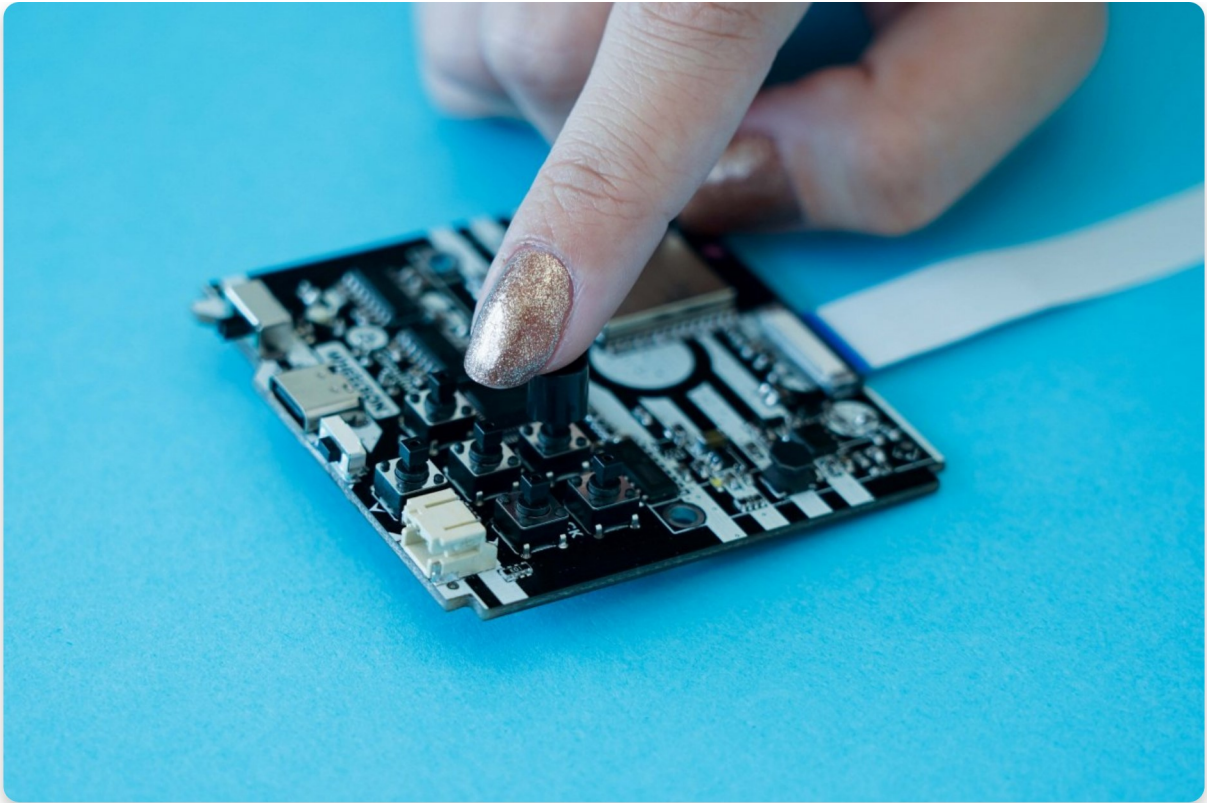
The pushbuttons are rather small and aren't the most comfortable thing to press. So, we included some more comfortable button caps that will solve this issue. It's time to add them on. Here's what you need:

- The main board
- Six button caps



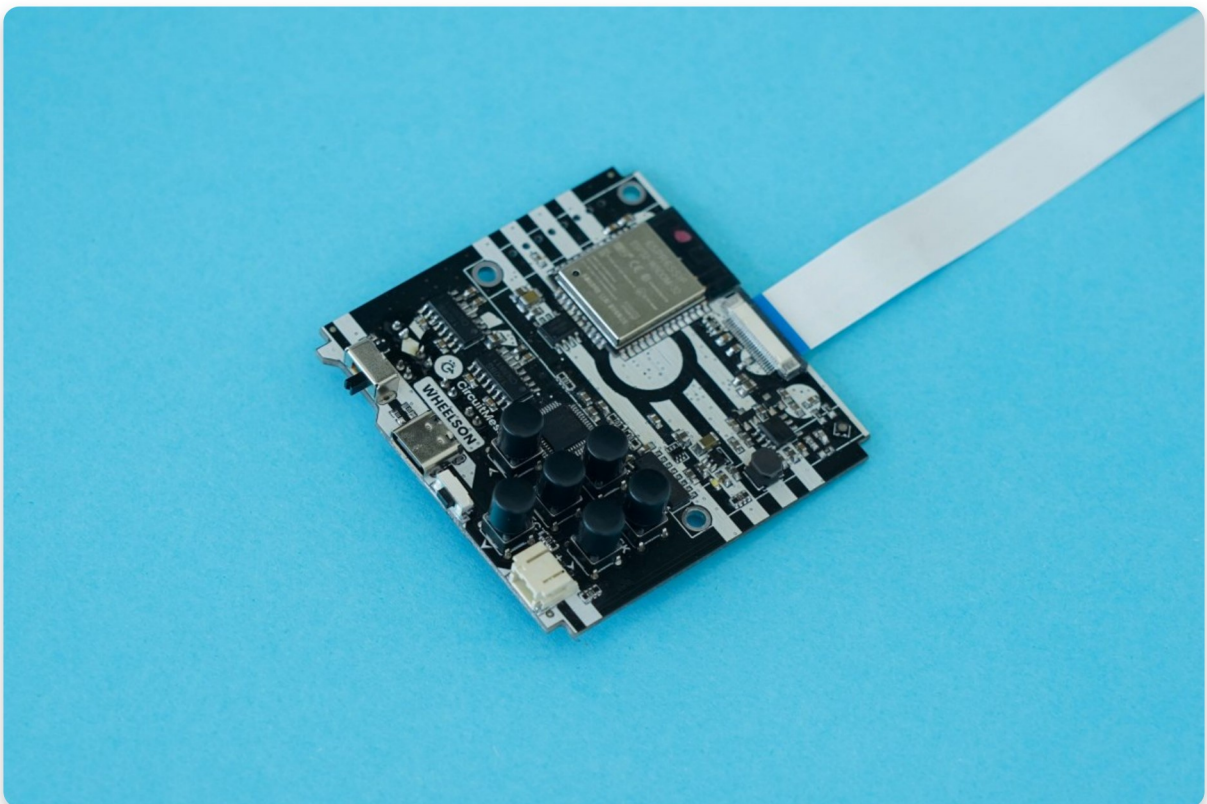
The main board and six button caps

Just like in the photo below, place the button caps on the pushbutton and push until they *click* into place.



Push the button cap until it clicks into place

Repeat this process for the remaining five buttons/caps. This is how your board should look with all the button caps on:



You're doing great! Ready for the next step?

Step five – Soldering the screen

Soldering the screen is a pretty big step, so you should treat it with care.

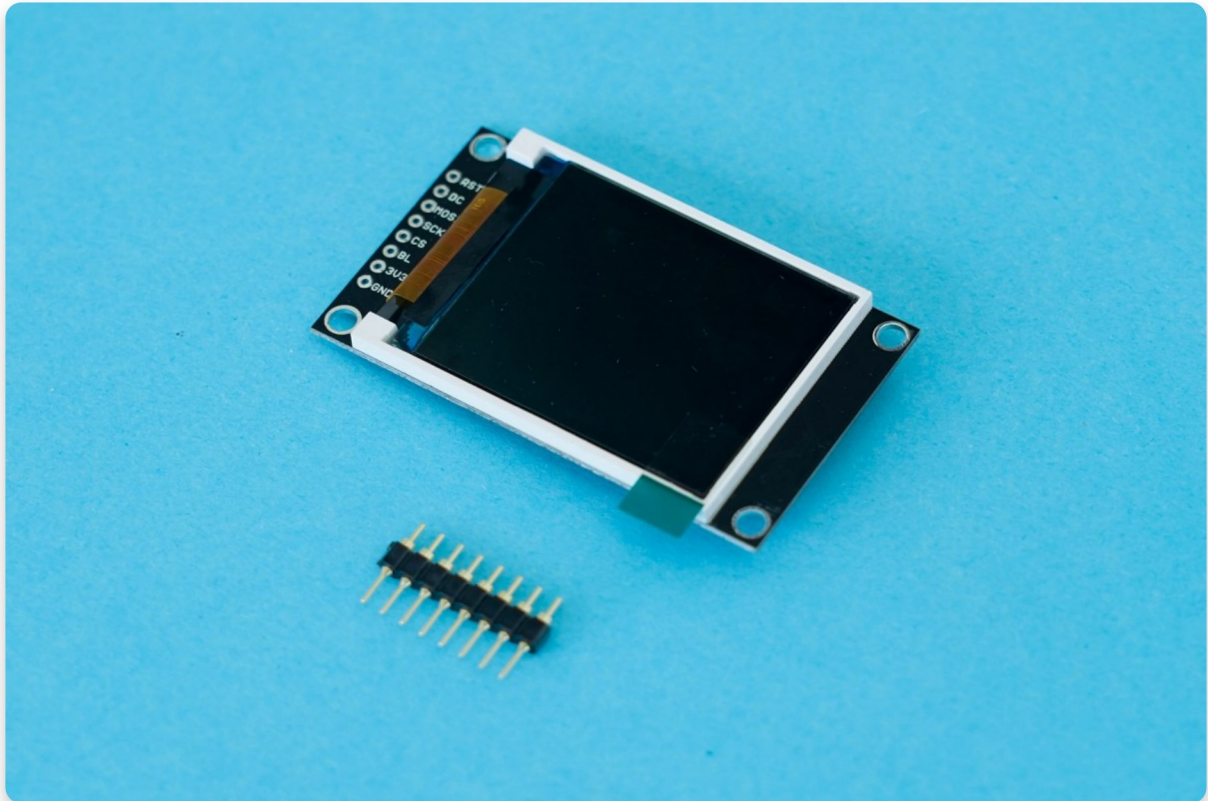
You'll notice a little protective layer on top of the screen, which you can take off by pulling the little green tab. Don't do that just yet though! This just ensures that the screen stays protected all the way through the soldering part.

After you've done your soldering, you can take it off; this will make your screen really shine. Everything will work just as well even if the protector remains on, so don't worry too much about it. Let's just jump right in!

You'll need the following parts to begin with:

- The screen
- The header pins.

Look at the picture below to see what they look like:

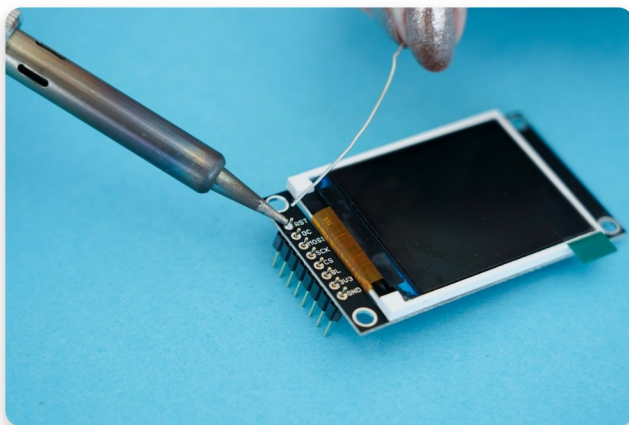


Insert the pins into the board with the screen.

Be careful in how you insert the header pins since the top and bottom parts are slightly different. **The part you want to insert into the screen is the shorter side (in the picture above, it will be the top part of the header pins).**

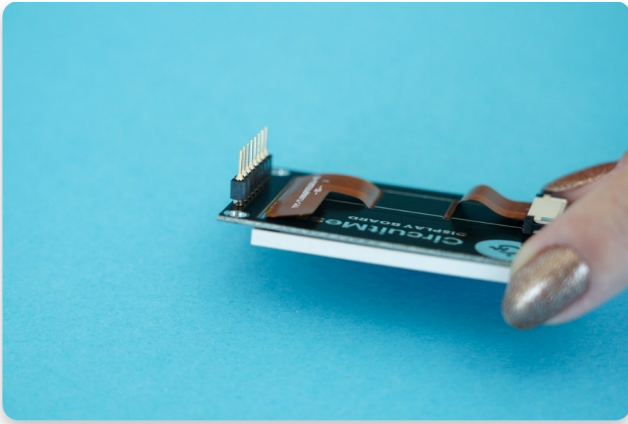
It's soldering time! Now, bear with us, this is important.

Pins should be soldered **perpendicular** to the screen. There is a useful tip that you can use for this so keep reading.



1) Solder just the first pin of one row of headers

Solder the first pin



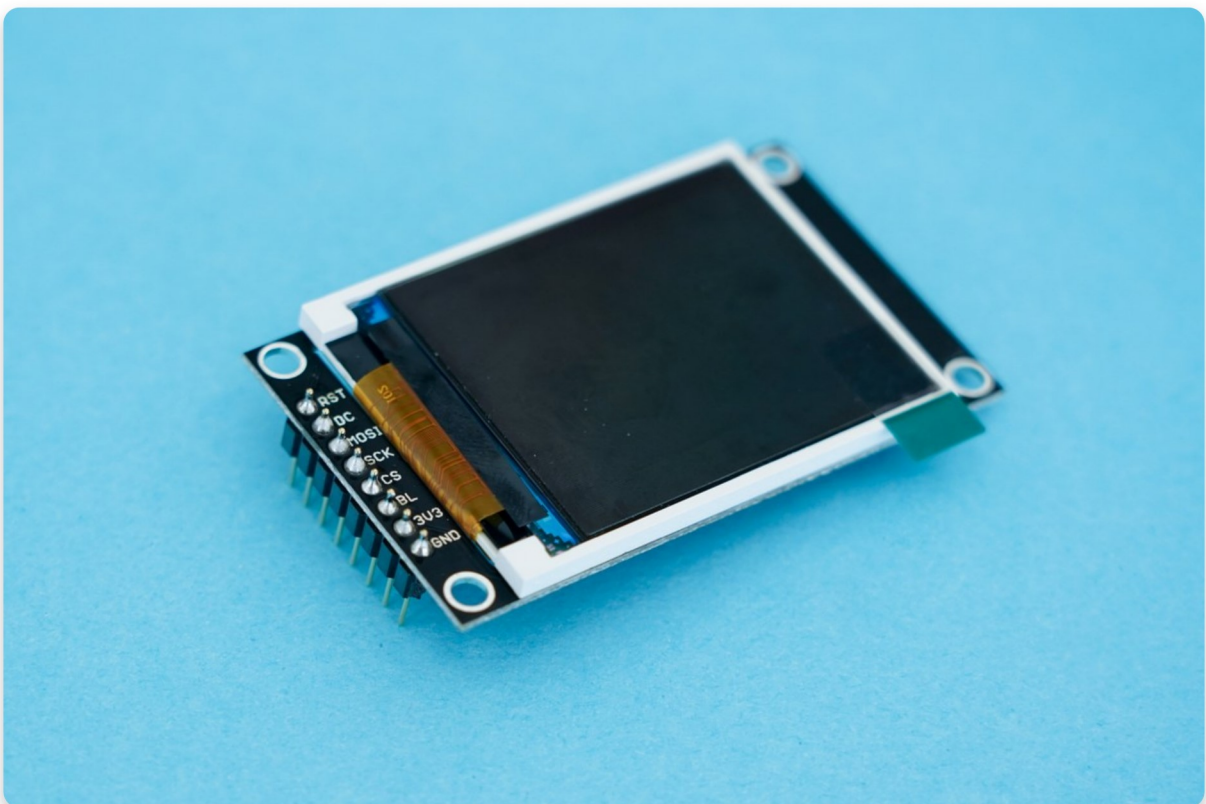
2) When the first pin is soldered, check if the header pin is perpendicular to the board



3) If the header is slightly skewed and needs adjusting, melt the solder and tilt the headers with your fingers.

(Watch out not to burn yourself! When you are doing this, make sure you do not touch the pin that you soldered/are heating up as this will be hot!)

When you're confident that the pin header is perpendicular, continue soldering all the remaining pins, just like in the photo below.



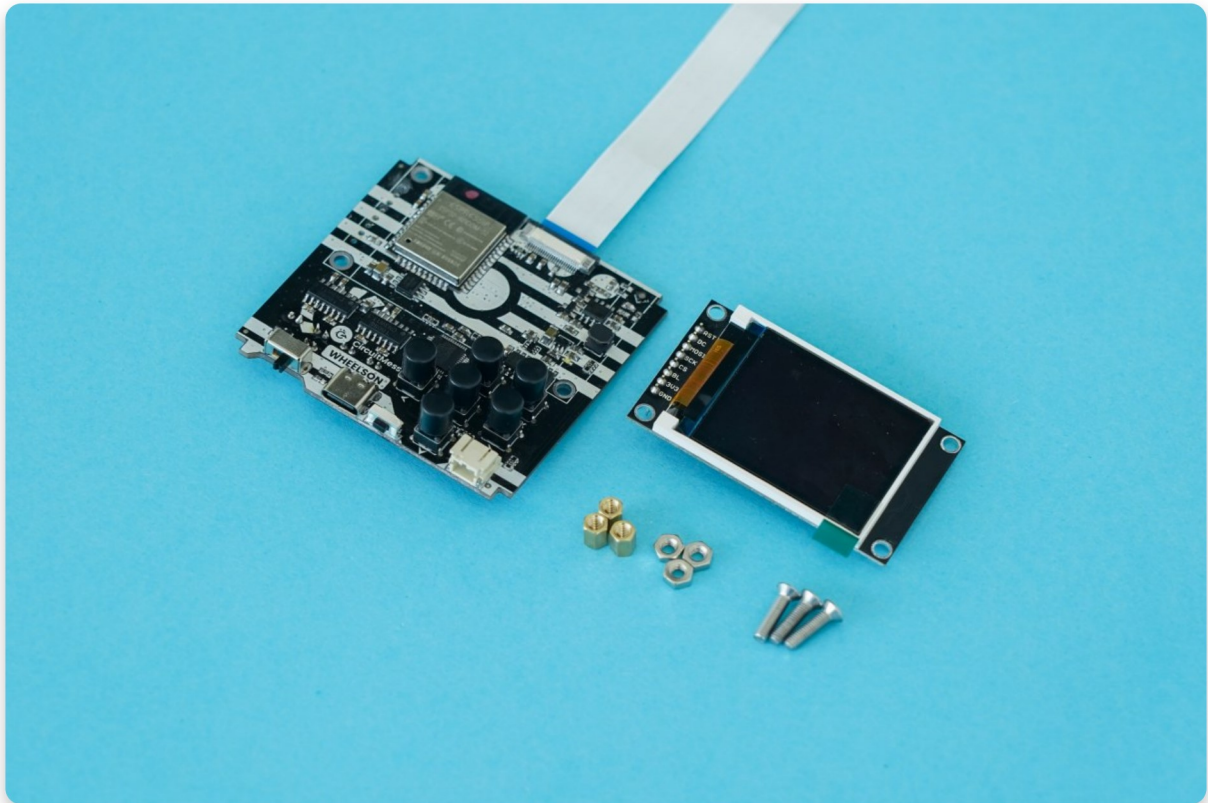
All the pins are soldered

You have now successfully soldered the header pins that will connect the screen with the main board. Great job!

We'll move on now to connecting the screen to the main board. Here's what you need for this step:

- The main board
- The display board
- Three brass spacers
- Three metal nuts

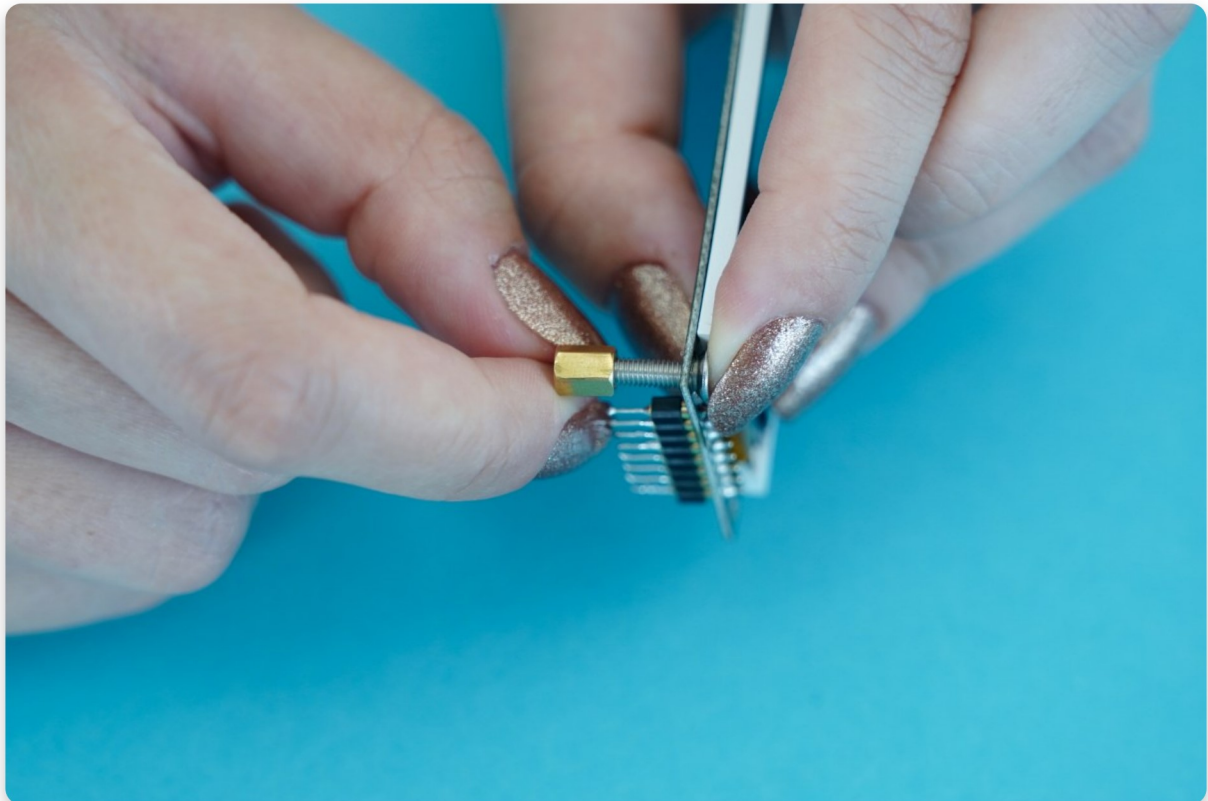
- Three metal bolts



The components you need

Take the display board (screen) and turn it so that the display is facing you. Start by inserting medium metal bolts into the top left hole of the display board.

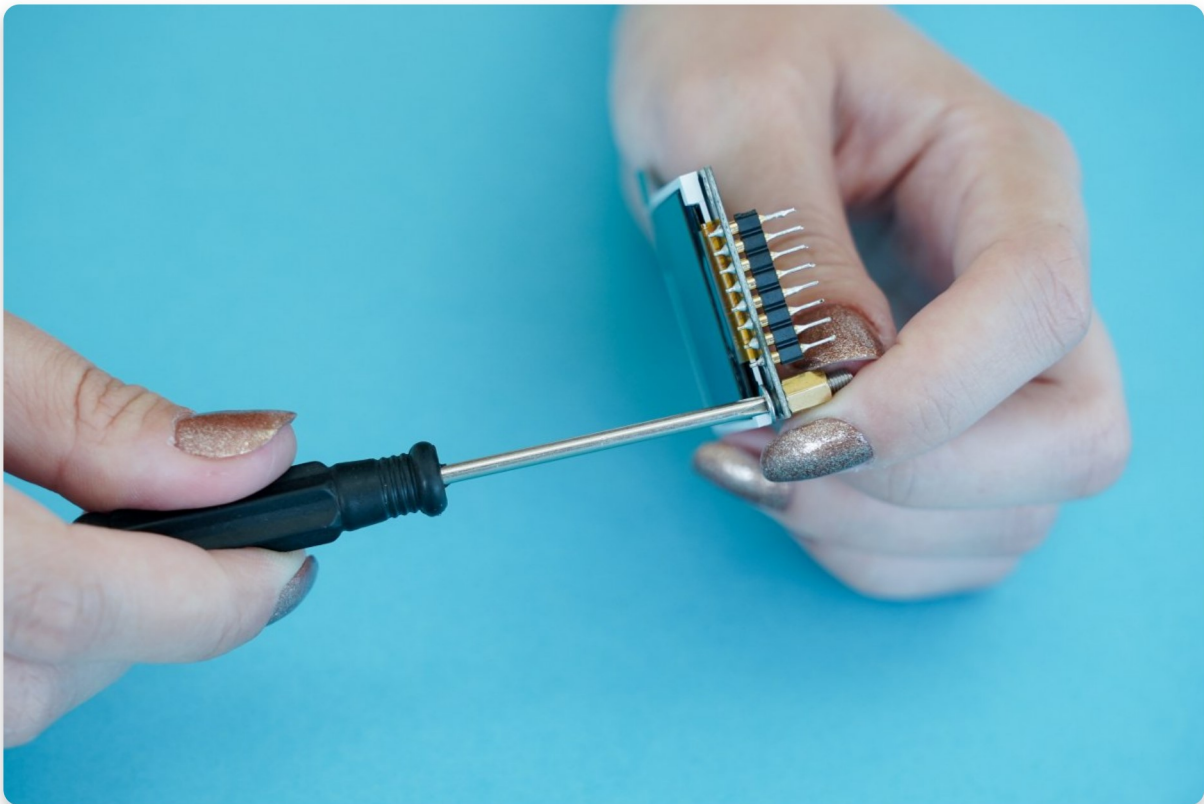
Take one golden brass spacer and place it on the opposite side of the display board and screw the bolt in at the same time so that the spacer and bolt are secured tightly! You can do this with your hand but don't be afraid to ask for help from an adult to make sure the bolt is tightened correctly.



Twist on the brass spacer onto the end of the metal bolt

We don't want the screen to move or slide so let's double-check that the bolt is tightened to the brass spacer! Using a small Phillips screwdriver, twist the metal

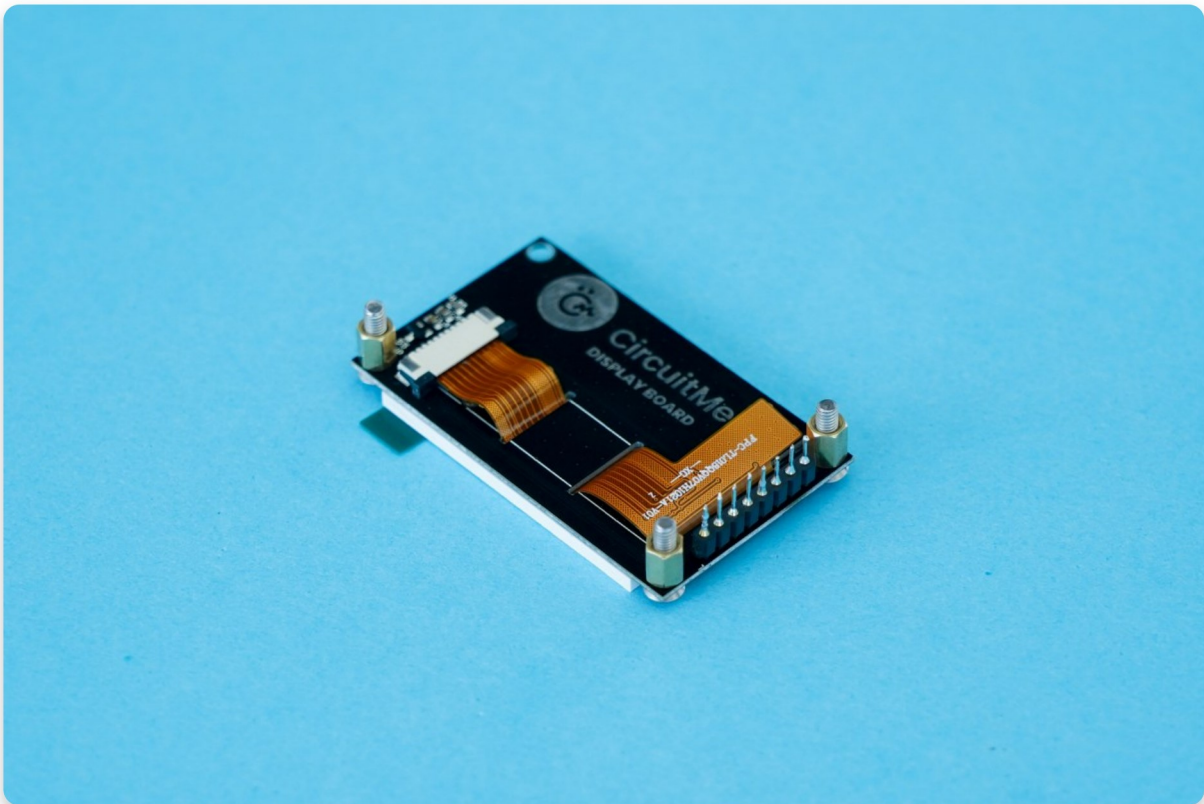
bolt until it is securely connected to the display board



Tighten the bolt

Repeat the same steps on the bottom left and right corners. secure one big metal bolt and one golden spacer per corner, making sure they are secured tight enough.

When looking at the display board from the back, the upper left corner should remain empty.



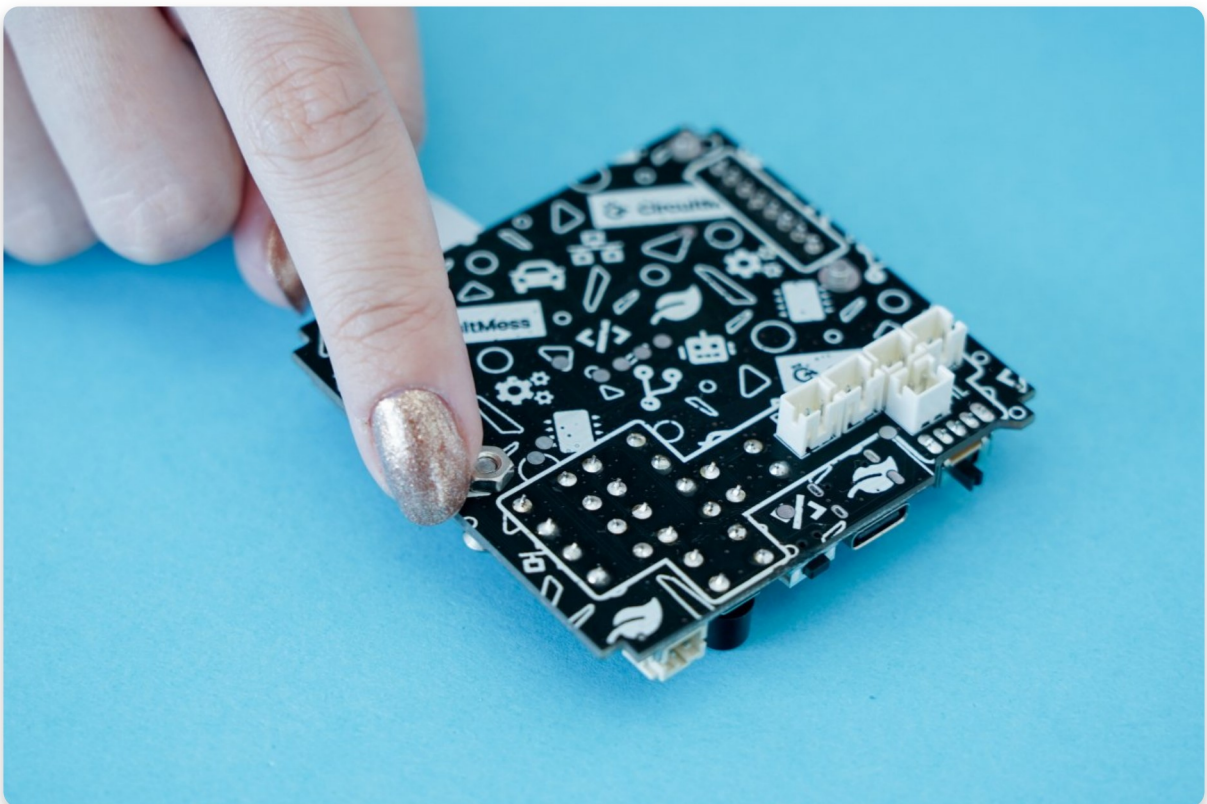
You can now place the screen on the board. Make sure to place the screen on top of the main board, as seen in the below photo (so that the pins go on the left side of the board).



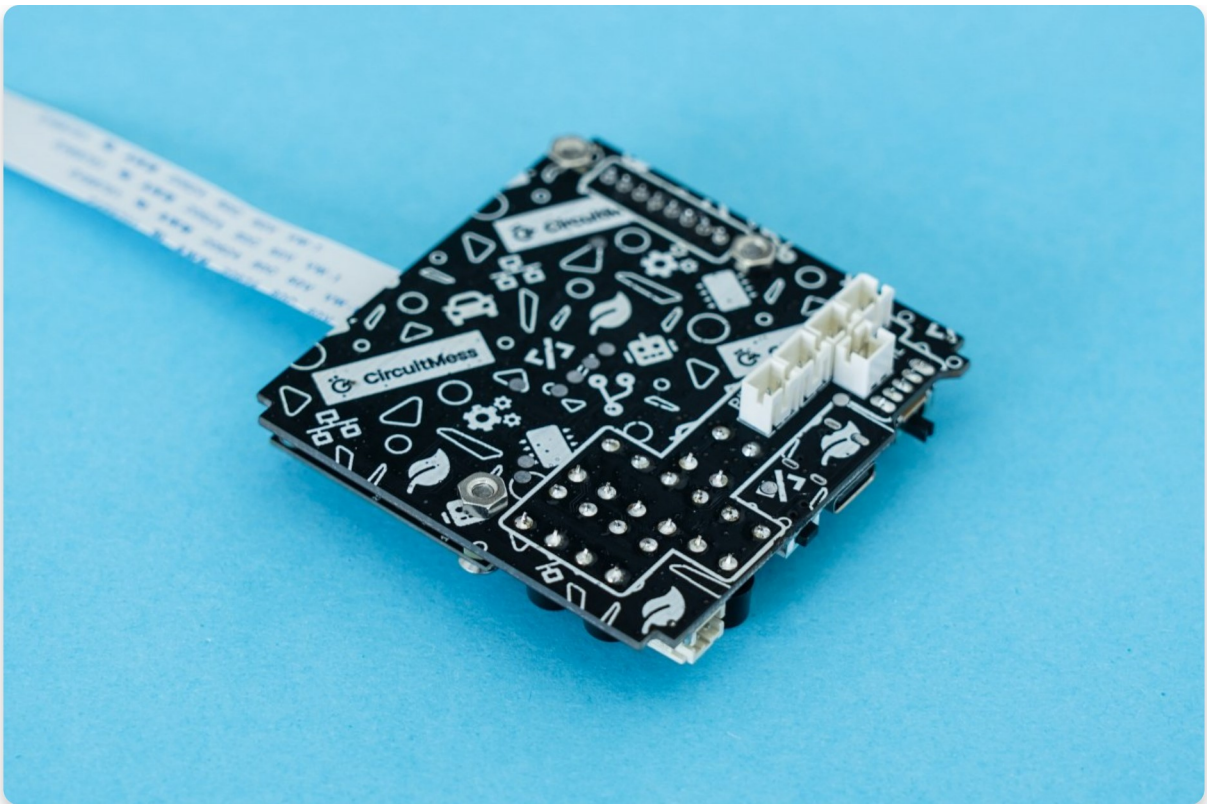
Let's tighten and secure the screen to the board.

Turn the main board upside down while holding the screen so it doesn't fall out. Take one metal nut and place it on the bottom of the bolt poking through. Tighten it with your fingers, so it holds the screen in place.

Repeat that for all three bolts.



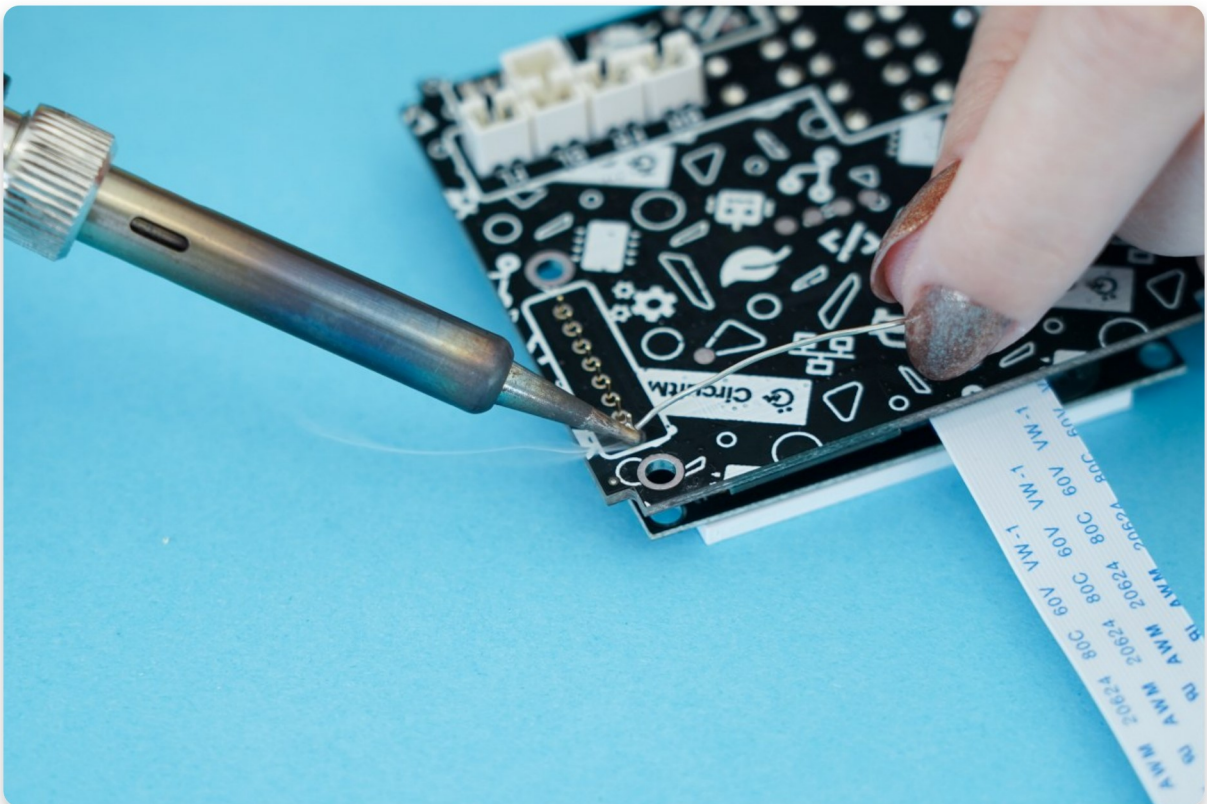
Tighten the nut so that it holds the screen in place



Repeat until all three bolts are tightened

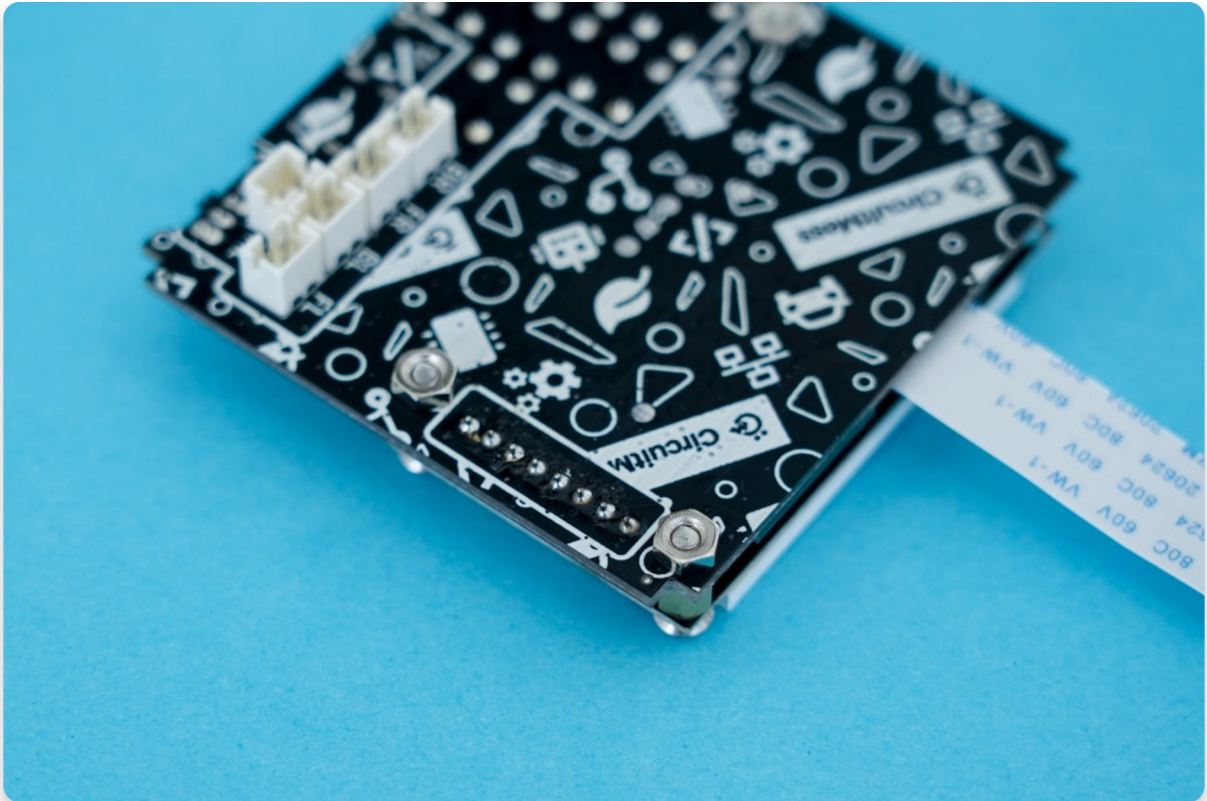
Alright, everyone, it's time to solder the screen to the board!

Making sure the board is upside down, find the pins that will connect the screen. They're located between the two bottom spacers that you were just tightening in the previous step.



Solder the pins to connect the screen

Solder all 8 pins in place until they look like this:



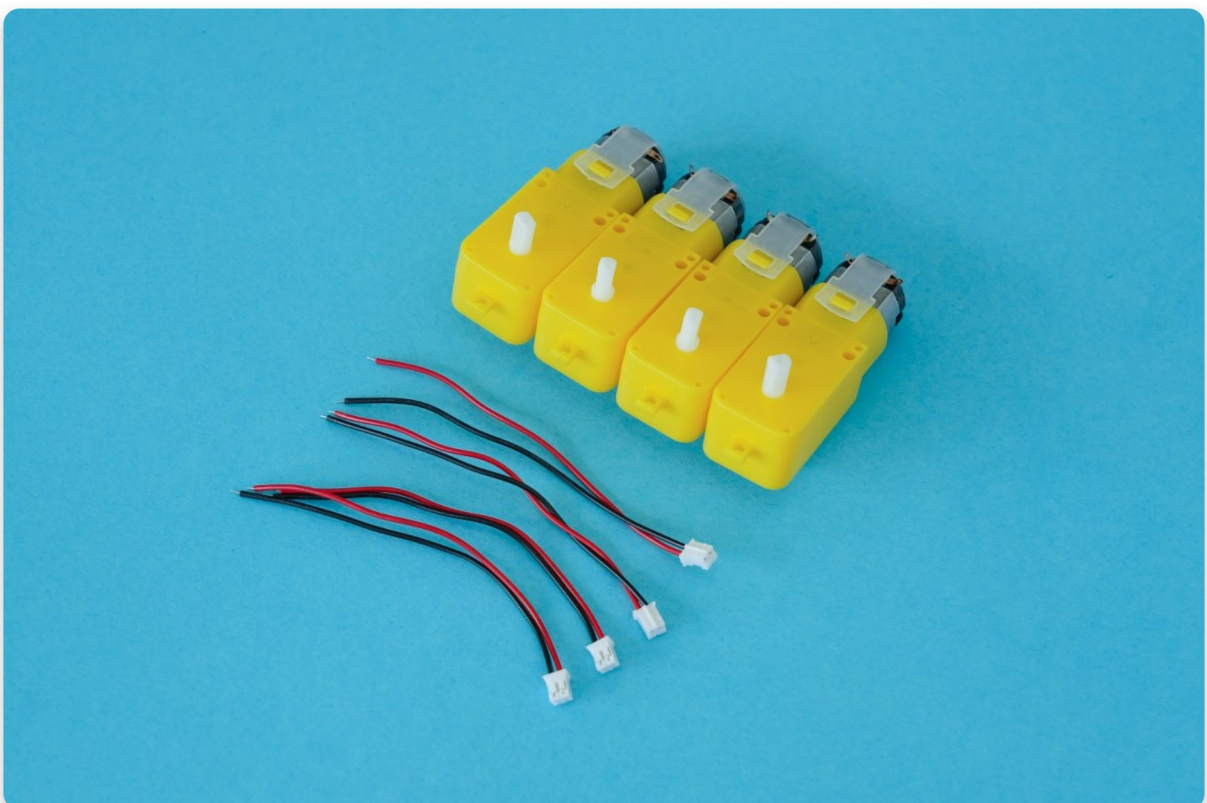
All the pins soldered

Step six – Soldering the electromotors

How are you holding up? If you need it, feel free to take a little break – you deserve it.

When you're ready, let's move on to connecting the electromotors to the board. Here are the components you'll need for this:

- Four electromotors
- Four JST cables



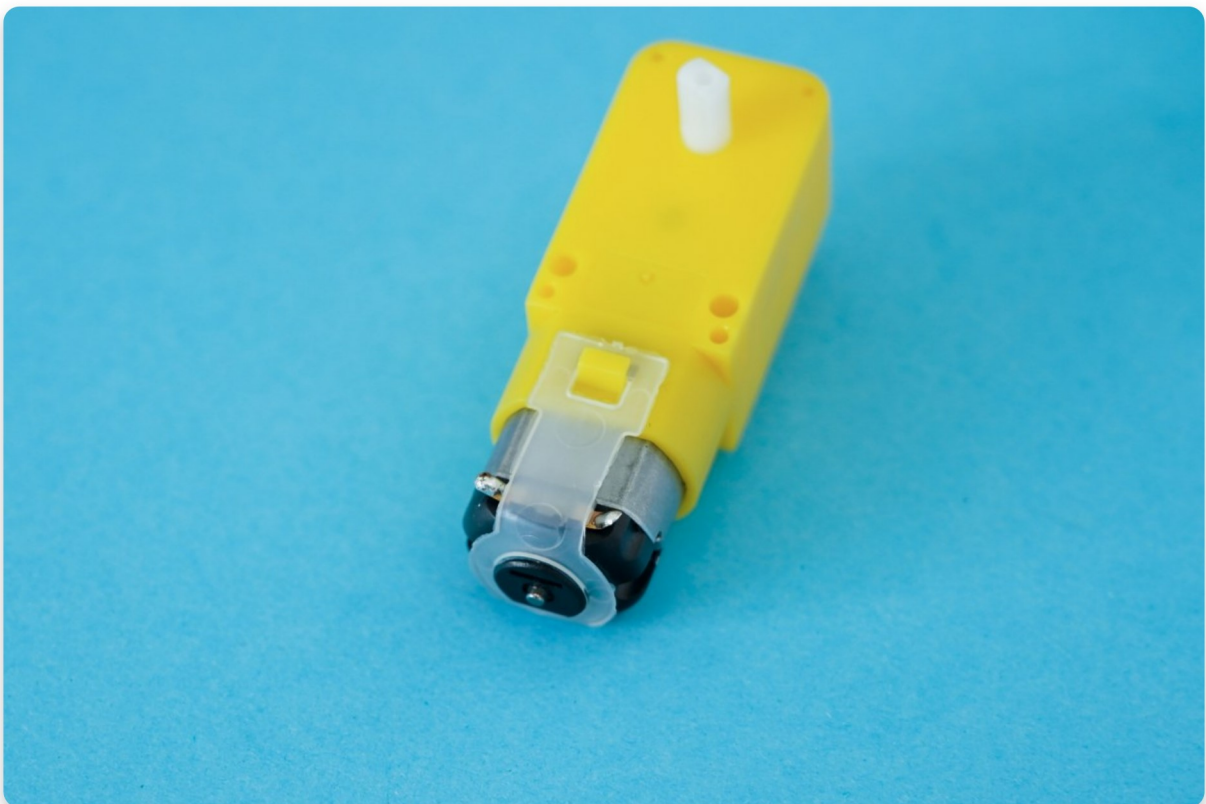
Pick up one of the electromotors. Here you'll see that each motor has two small metal pieces with a hole on the bottom. We need to put some solder in the hole to fill it in.

Use your soldering iron and some solder, melt a generous amount of solder into

the hole. Repeat this for all four electromotors.



Put a generous amount of solder into the hole



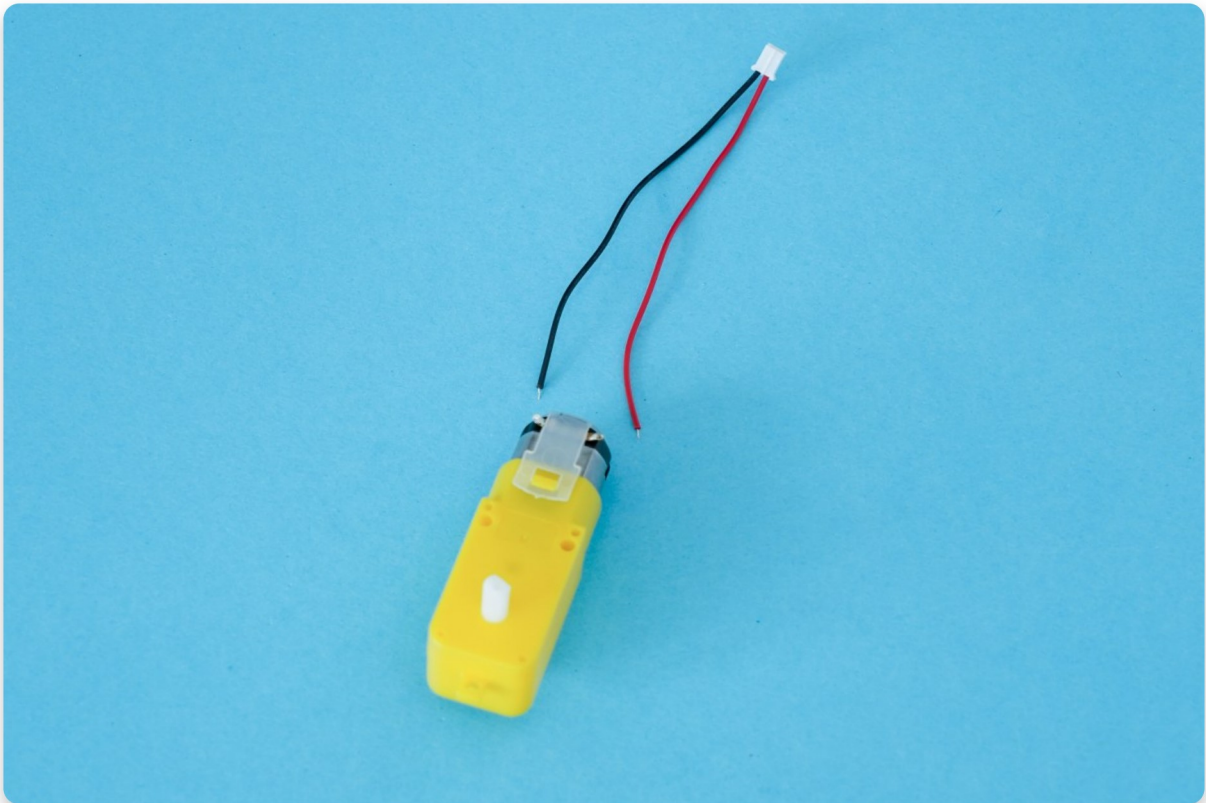
Holes filled with solder

Let's connect the JST cables to the electromotors now. You'll notice that **one cable is coloured red (positive) and the other black (negative)**. This is so that you know which cable goes onto which side.

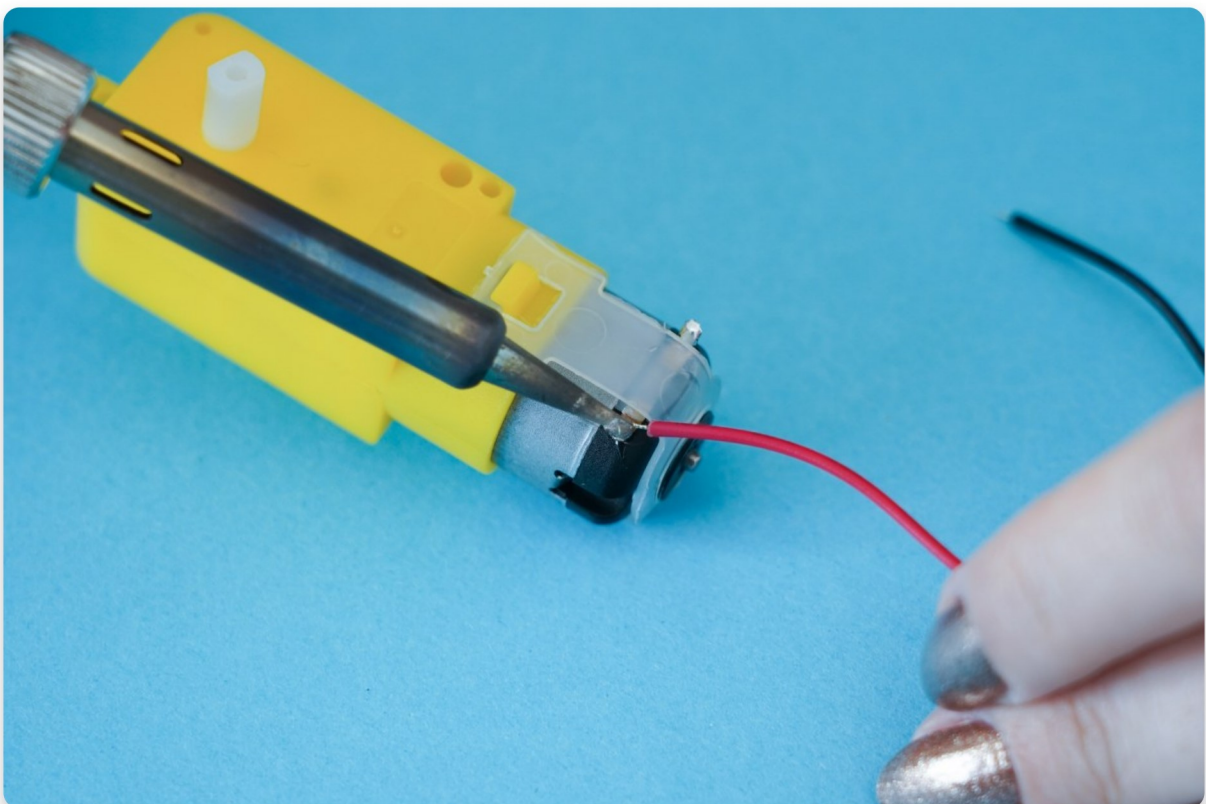
Be careful to connect the correct cable to the correct side. Here's a tip on how to do that:

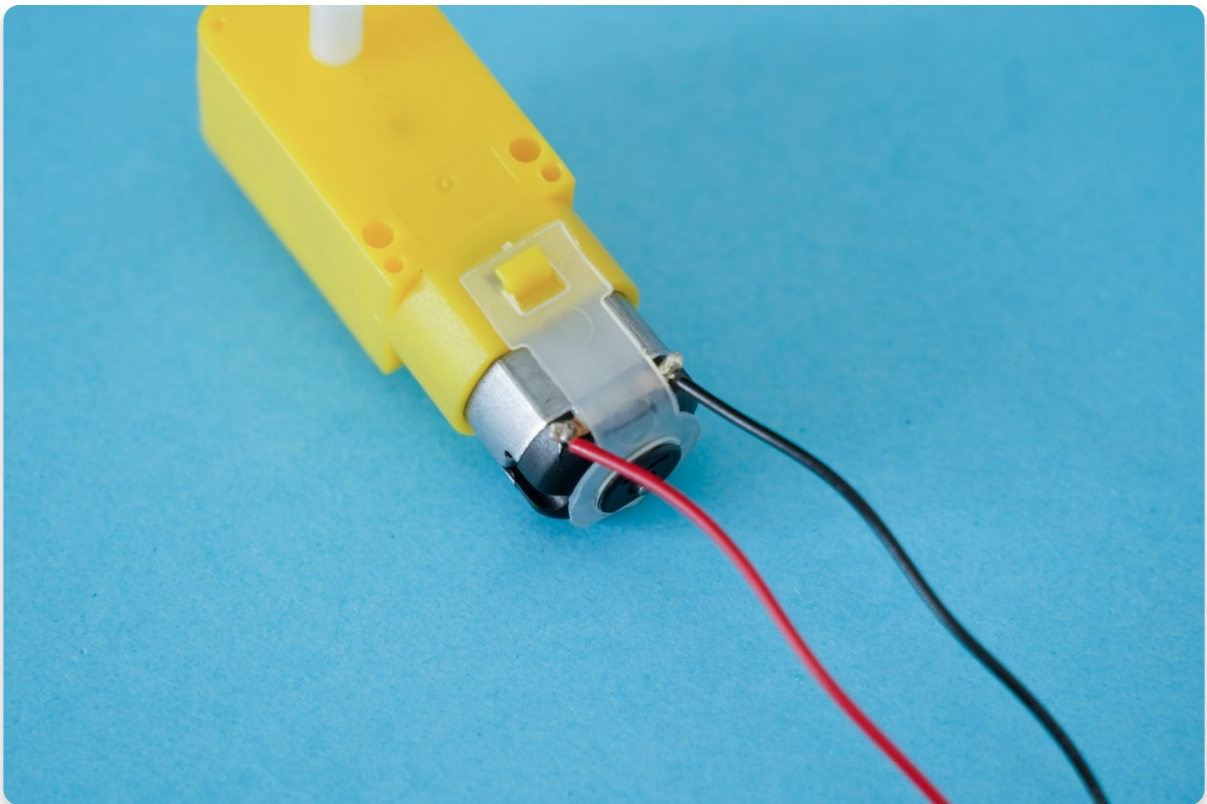
- Turn the electromotor so that the white plastic tube is on the top and the metal bottom part is facing you - see the below picture.
- Solder the **red wire** to the **left side** and the **black wire** to the **right side of the**

electromotor.



You'll solder these wires into the holes you just filled with solder. Using your soldering iron, melt the solder and simply stick the tip of the wire in.





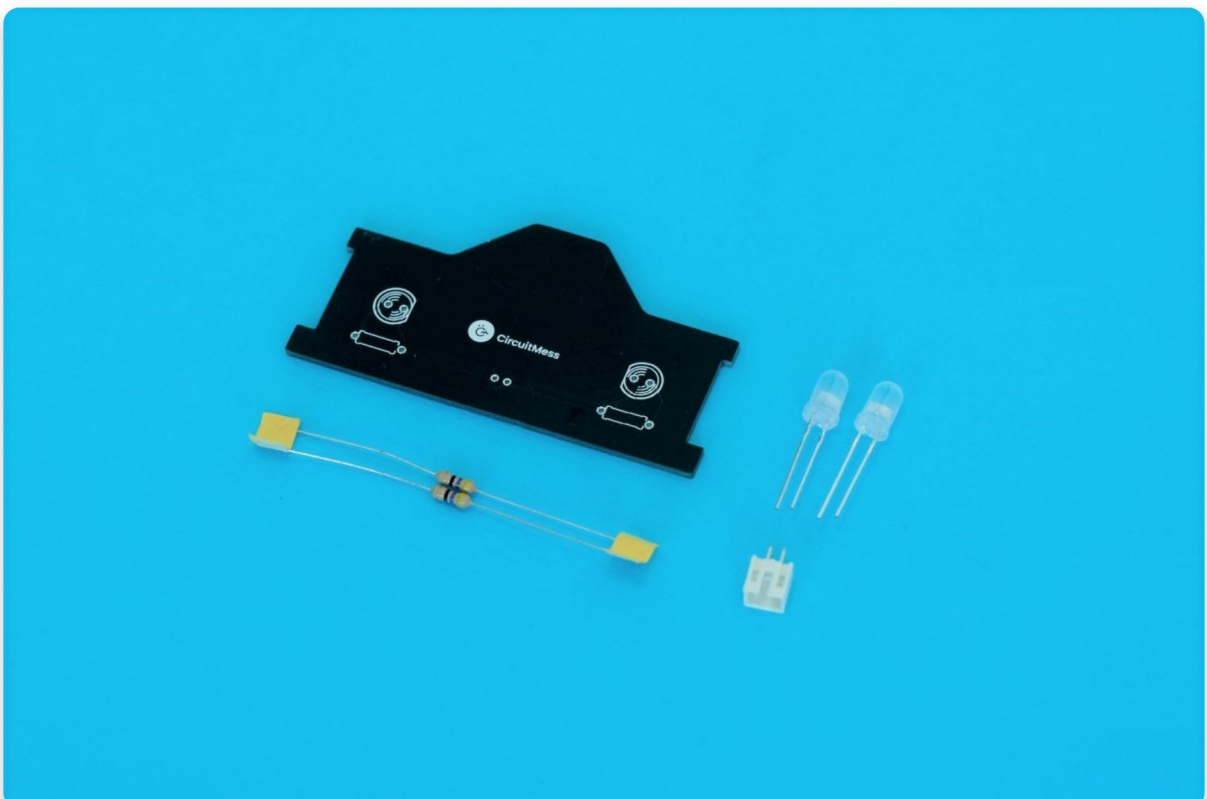
Connect the red wire to the left side of the electromotor and the black to the right side.

Repeat this step for the remaining three motors.

Step seven – Soldering the camera and headlights board

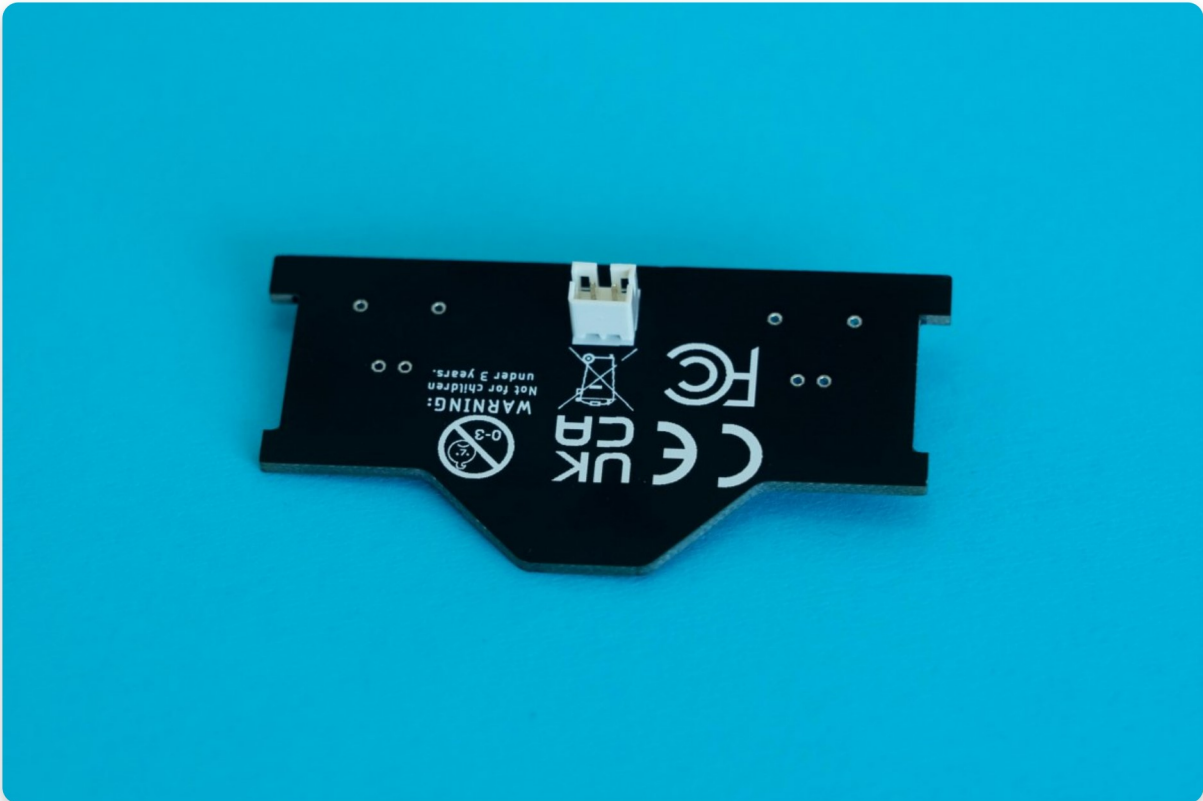
Awesome work so far! It's time to solder components to the camera and headlights board. These are the components you'll need:

- Camera and headlights board
- Two resistors
- Two LEDs
- One JST connector

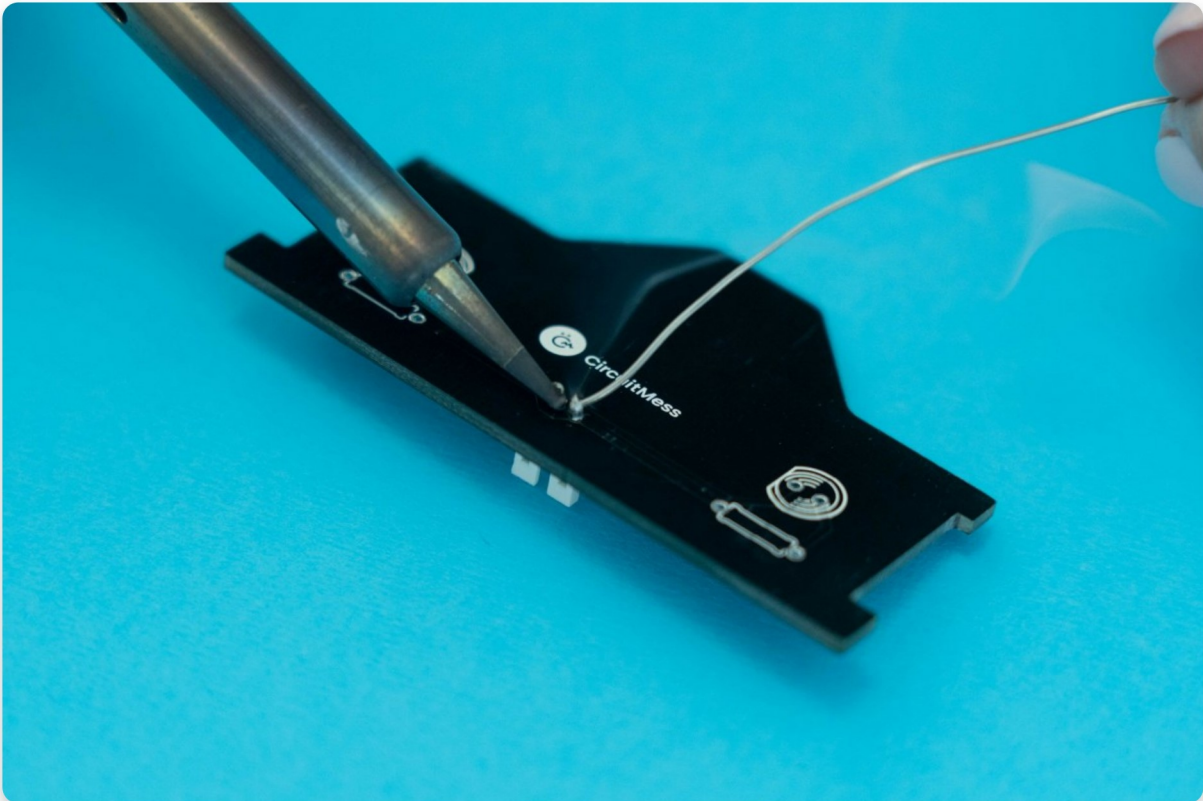


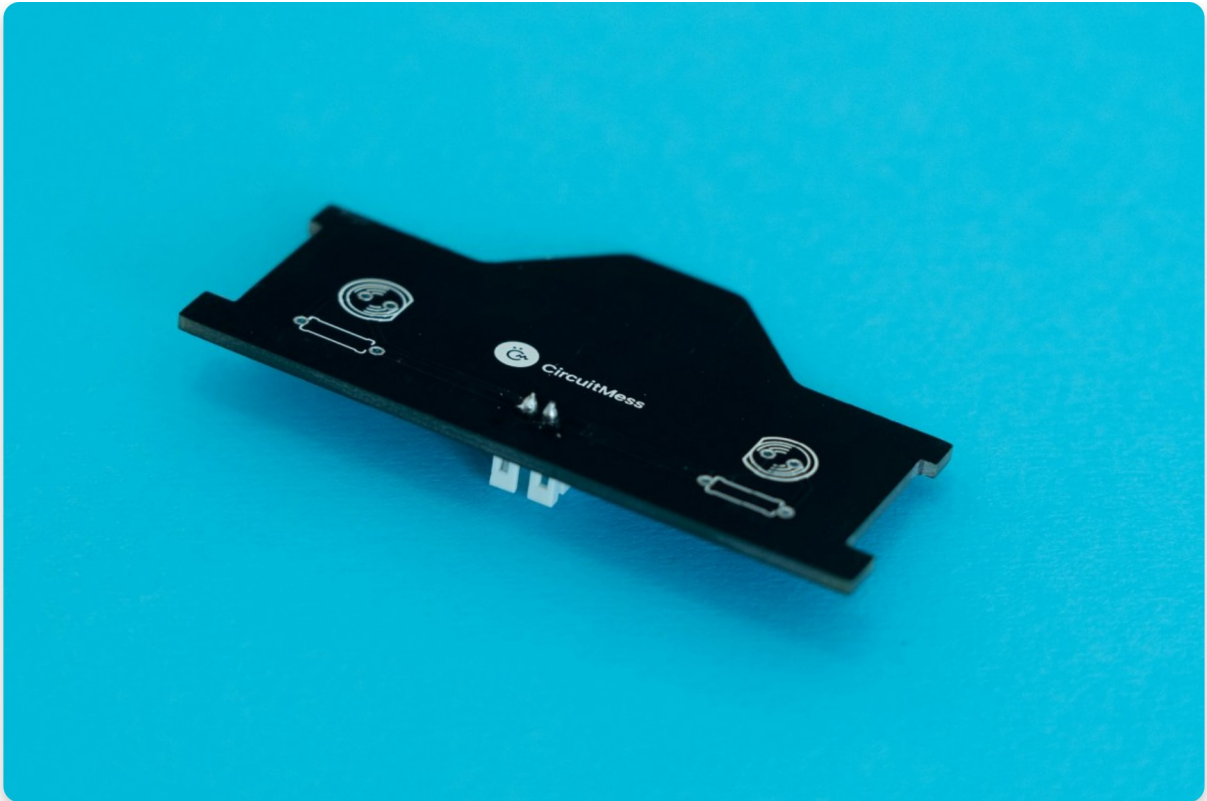
First, turn the board upside down and fit the JST connector into the two holes on the back. Again, look for the part of the connector that has holes in it, and make sure to turn it so that it's facing away from the angled part of the top of the board.

Use the below photo as a reference:



Turn the board back around - making sure the connector doesn't fall out - and solder the two pins to the board.





Pins soldered to the board

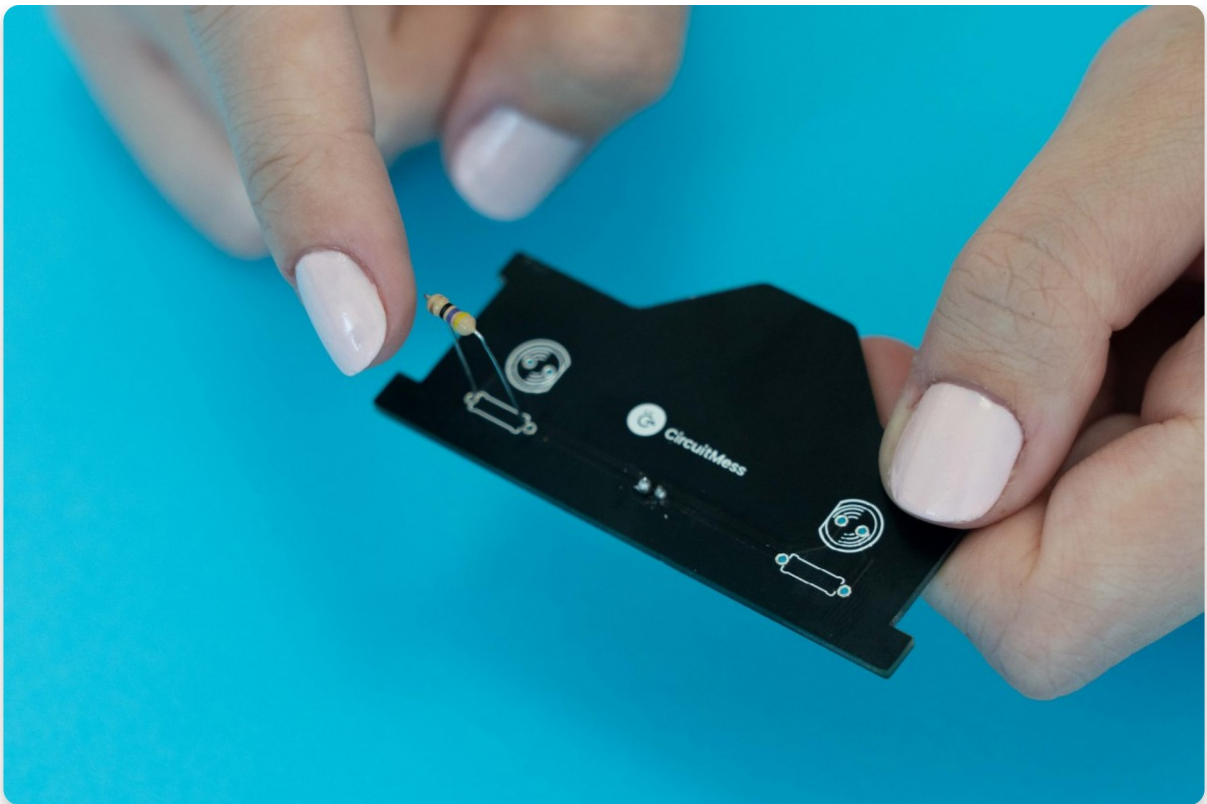
Now, pick up one of the resistors and bend it to fit into the two holes on the front of the board. There's a quick way of doing this:

1. Pinch the resistors with your thumb and index finger.
2. Using your other hand, bend the two pins down in the same direction.
3. Make sure that each side of the resistor is bent at a 90-degree angle.

The two holes it should fit through are on either side of the board on the front of the board – see the below photos for reference!

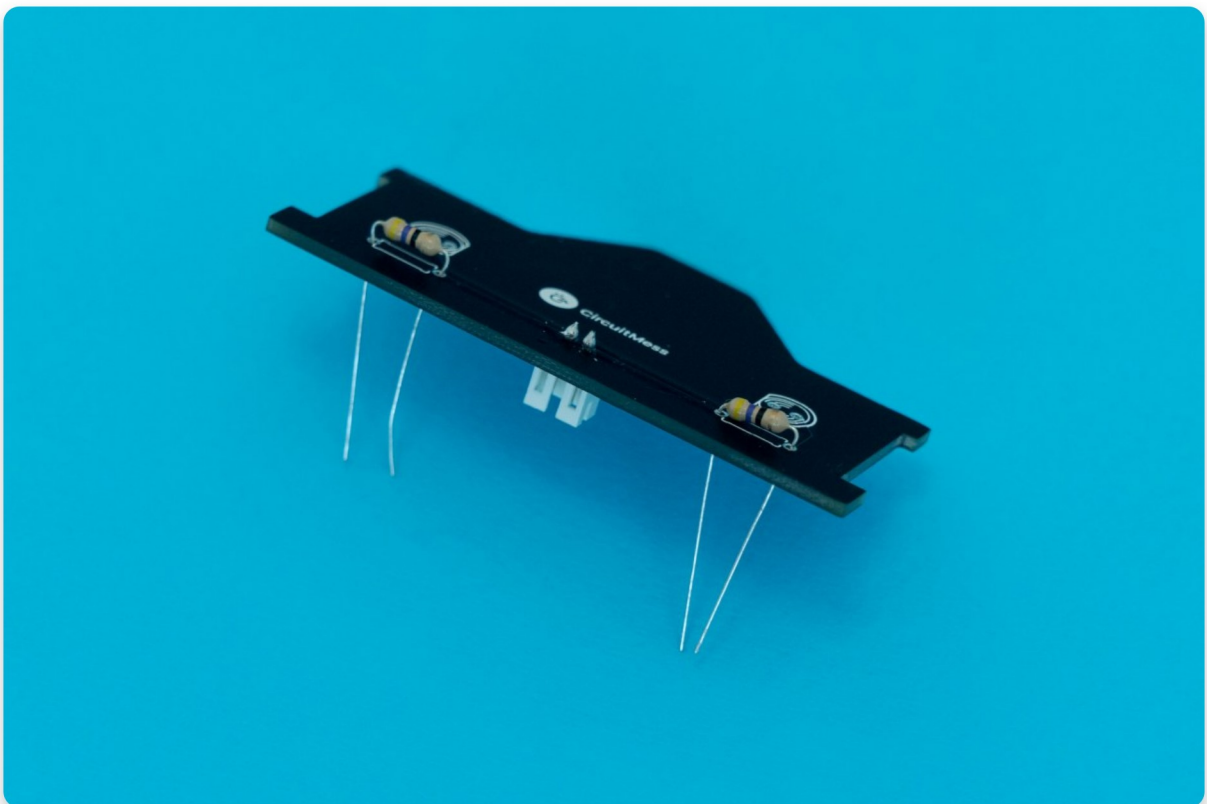


Bend the resistor



Fit the resistor to the board

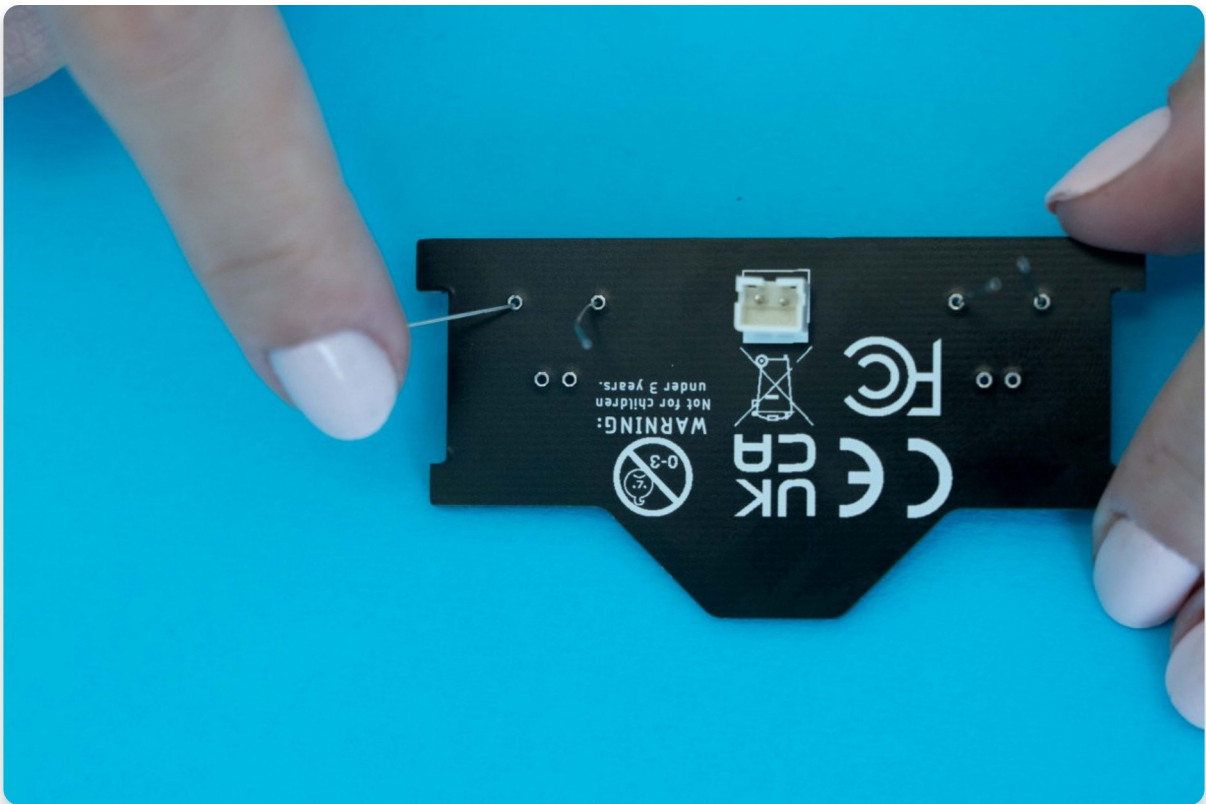
Repeat the same process for the second resistor.



Both resistors inserted through the board

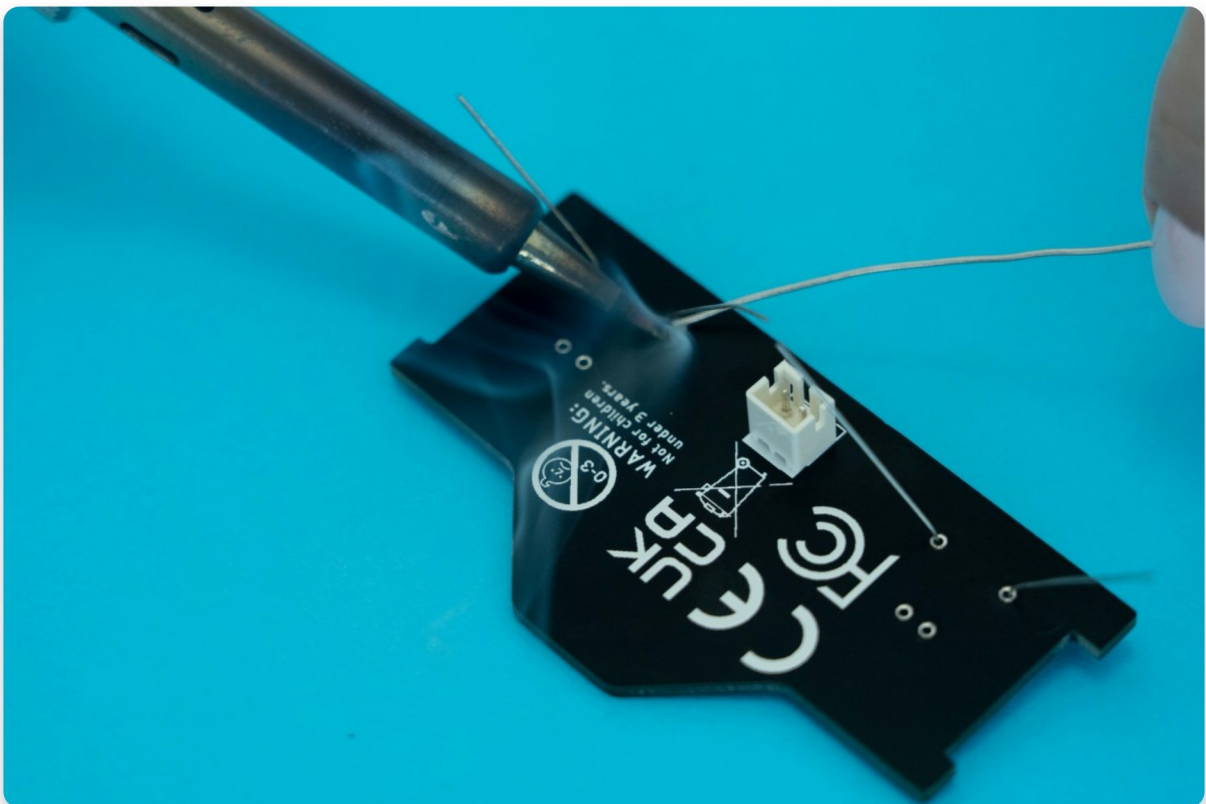
Okay, let's solder the resistors to the board now!

Here's a pro tip for you: bend the resistors' pins outwards, as shown below, so that they don't fall out or move around when you're soldering.



Bend the resistors' pins outwards

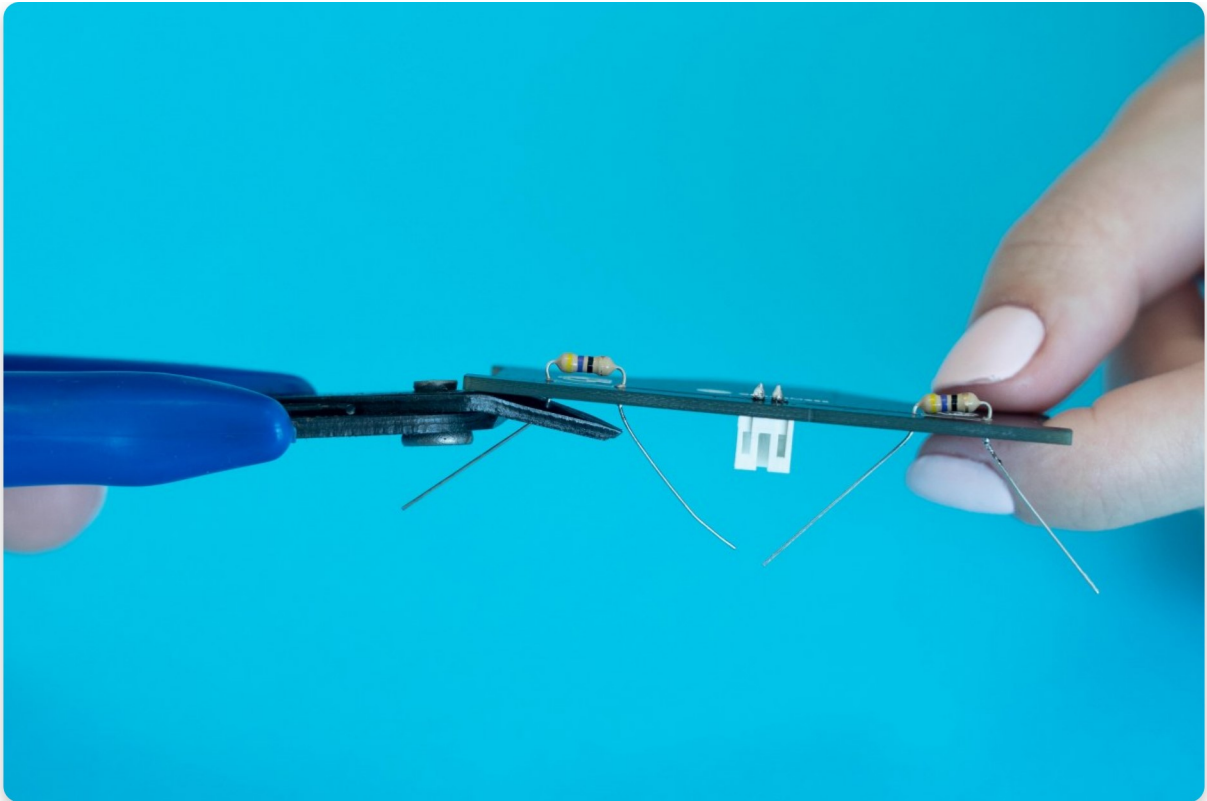
Solder both resistors to the board.



Once the resistors have been soldered to the board, it's time to cut off the excess pins. Grab your diagonal cutters and cut off the excess.



Turn the board around so that the wires are facing away from your face and eyes. Make sure that you do not scratch the PCB as this could cause some issues in the future.

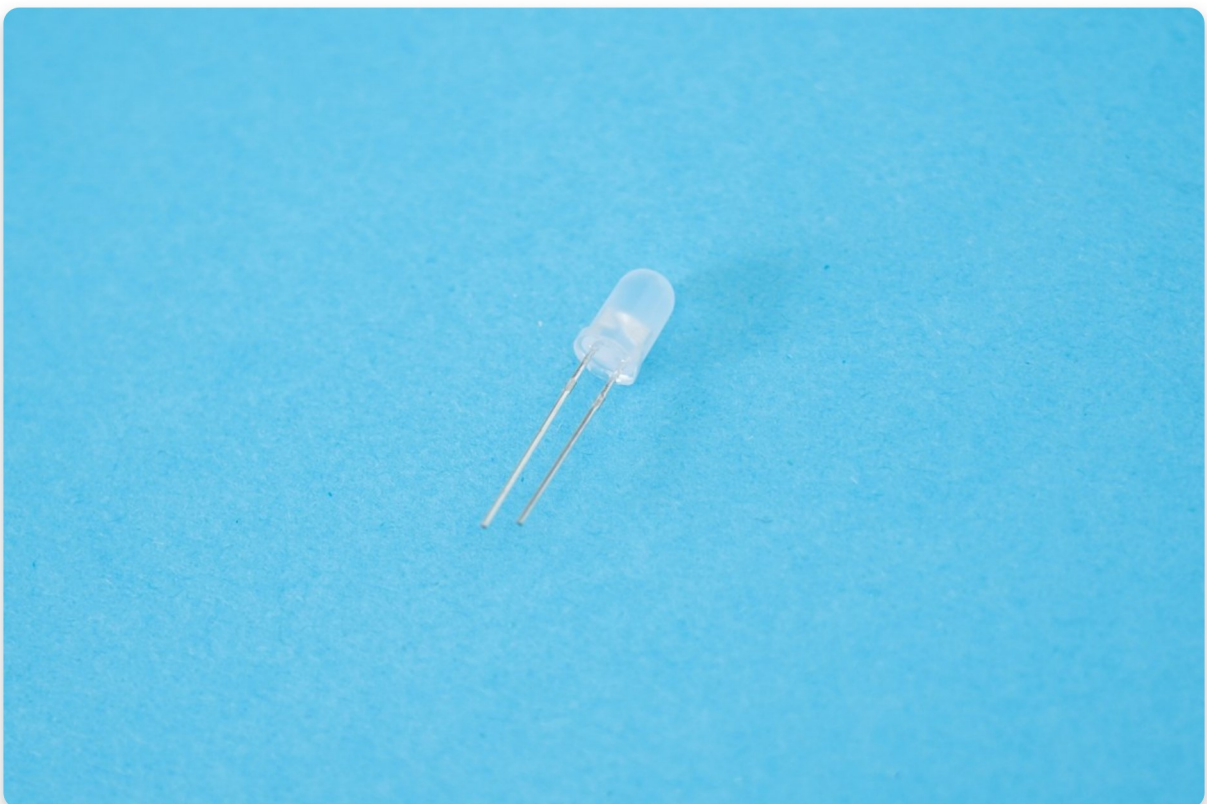


Turn the board away from your face and eyes and cut off the excess.

We'll now connect the two white LEDs to the board. First, take one of the white LEDs.

It's important to note how you insert the LED into the board. So take some time to inspect the LED first!.

You'll see that one of the LED's legs is shorter than the other, and if you look closely, you'll notice that one side of the LED is straight while the other is round.

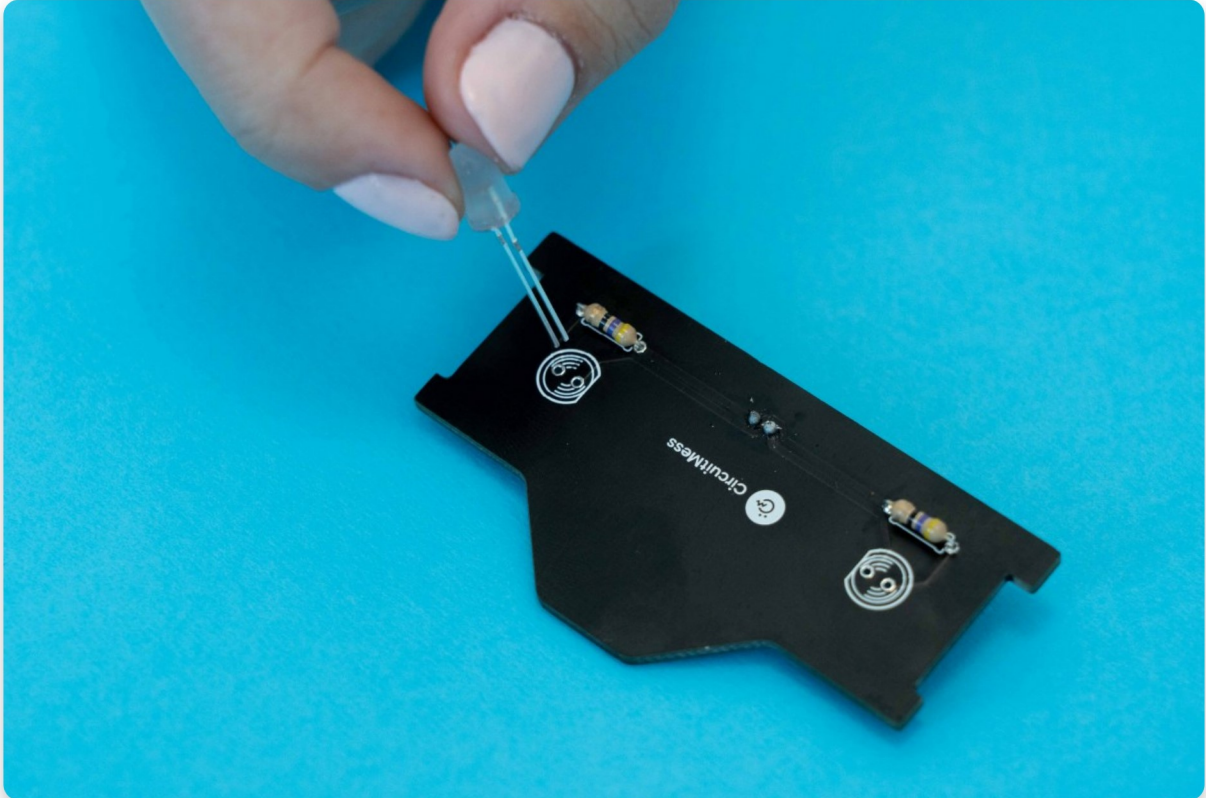


White LED

Now take a look at your board. You'll see that the circle illustration on the board has followed this same principle. One side of the circle is round while the other has a straight edge. This should give you an idea on how to correctly place your

LED.

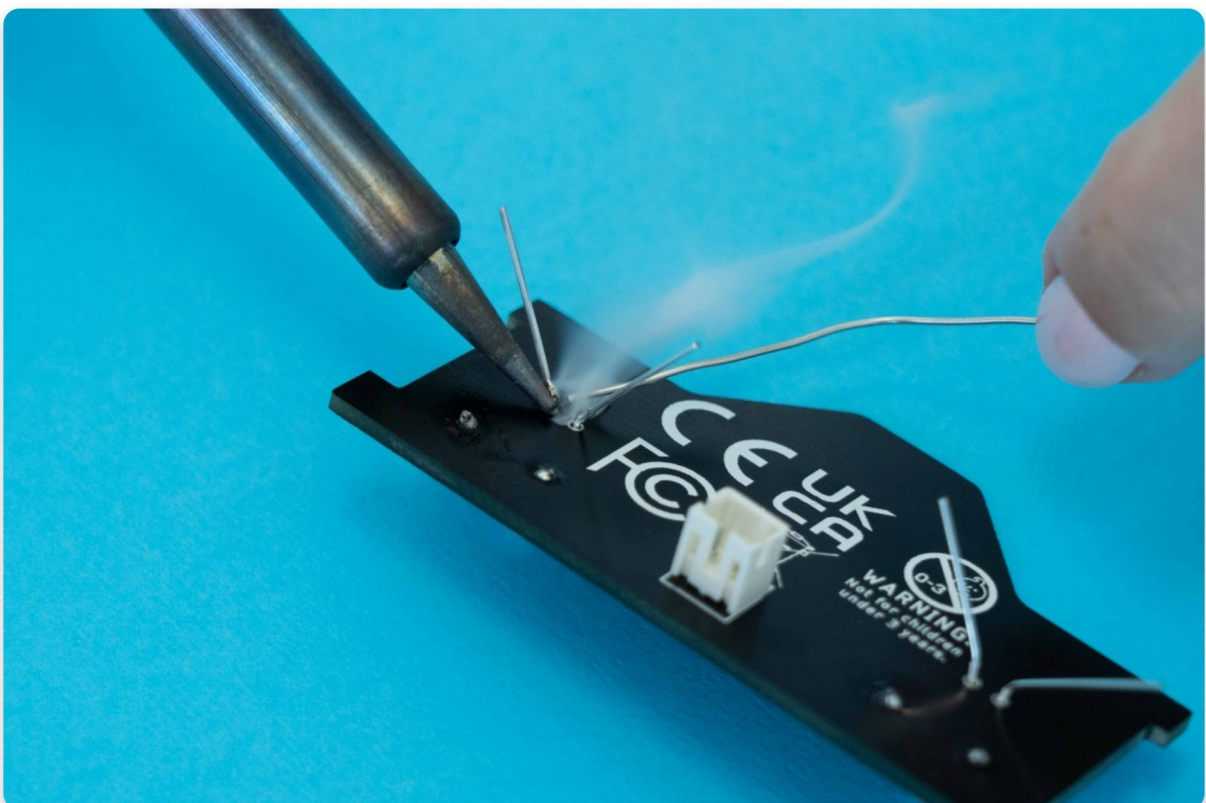
The straight edge of the LED should line up with the straight edge drawn on the board. Another reference you can use is that the LED's shorter leg should go through the hole right next to the straight edge.



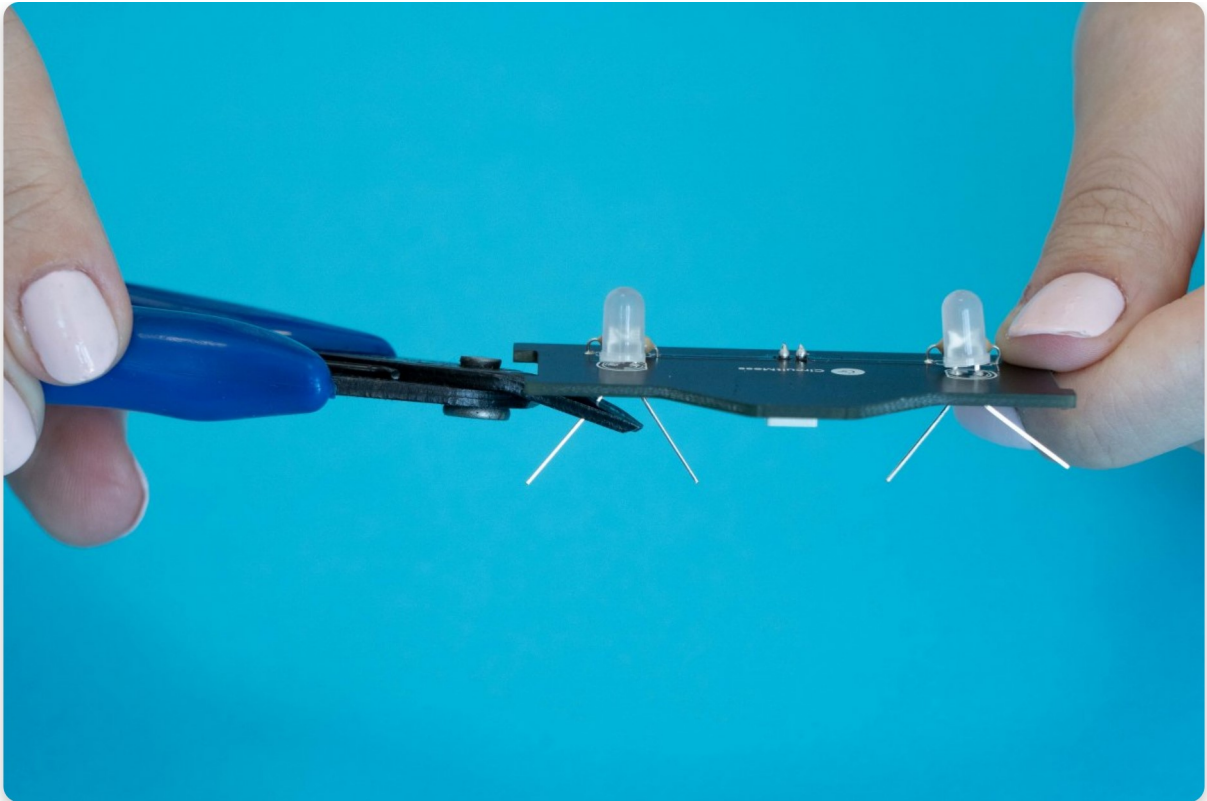
Insert the LEDs

You can use the same trick from before and bend the LED's pins so that it doesn't fall out while you're placing the second LED in.

Alright, everyone, this is the last time you're going to use your soldering iron in this project. It's time to solder the LEDs to the board!



Once the LEDs are soldered, cut away the excess wires with diagonal cutters. Be careful to **cut away from your face and eyes.**



You have now successfully soldered the LEDs to the circuit board.



LEDs soldered to the board

Remember



We hope you had a great time soldering the components. Sadly, you'll have to turn off your soldering iron now! But there are fun steps ahead, and we're not quite done yet! Please turn off your soldering iron by unplugging it from the power outlet. Leave it on the soldering iron stand for at least five minutes, so it cools off before you put it away.

Ready to continue?

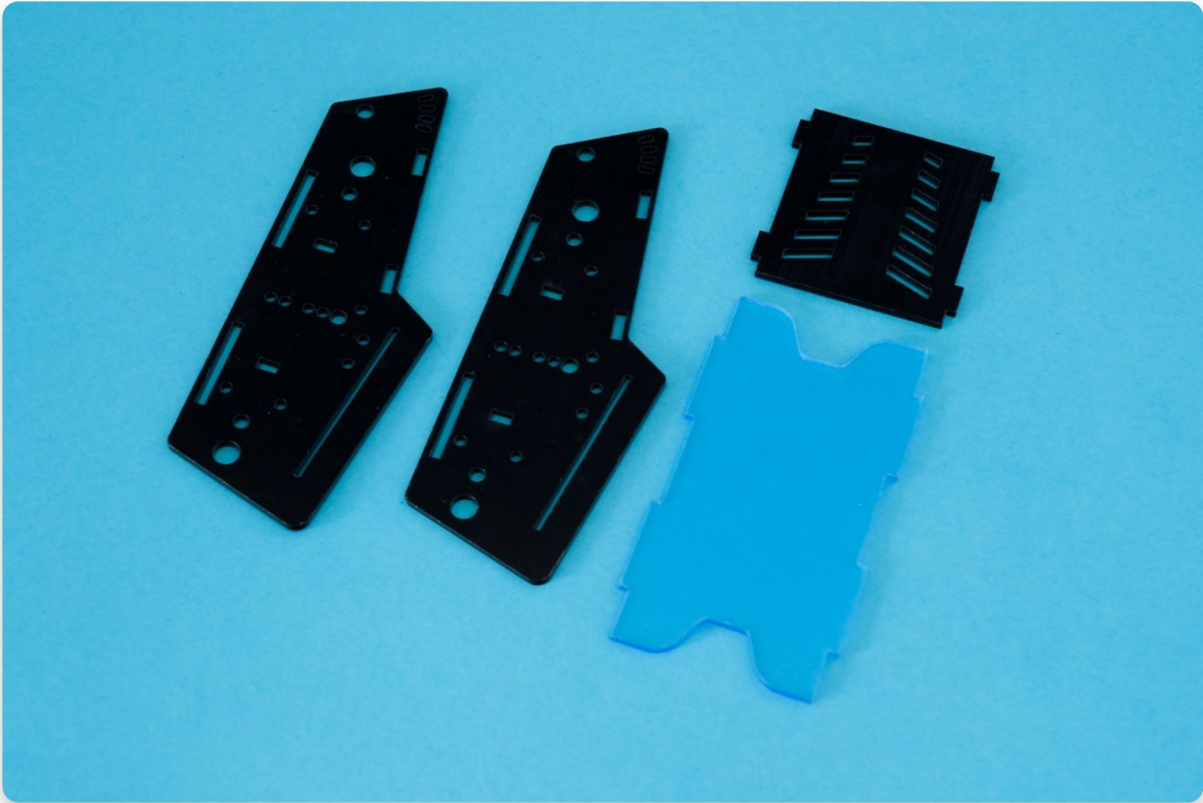
Chapter Two – Putting it together

In this chapter, we'll explain how to assemble the casings.

This might be the most satisfying part of the whole process! Peeling off the protective layers.

Each acrylic casing has a protective layer on both sides that needs to be peeled off; even the black casings have a protective layer on them.

The transparent acrylic casing is not transparent yet but it will be once you peel off the blue protective layer.



All the casing layers.

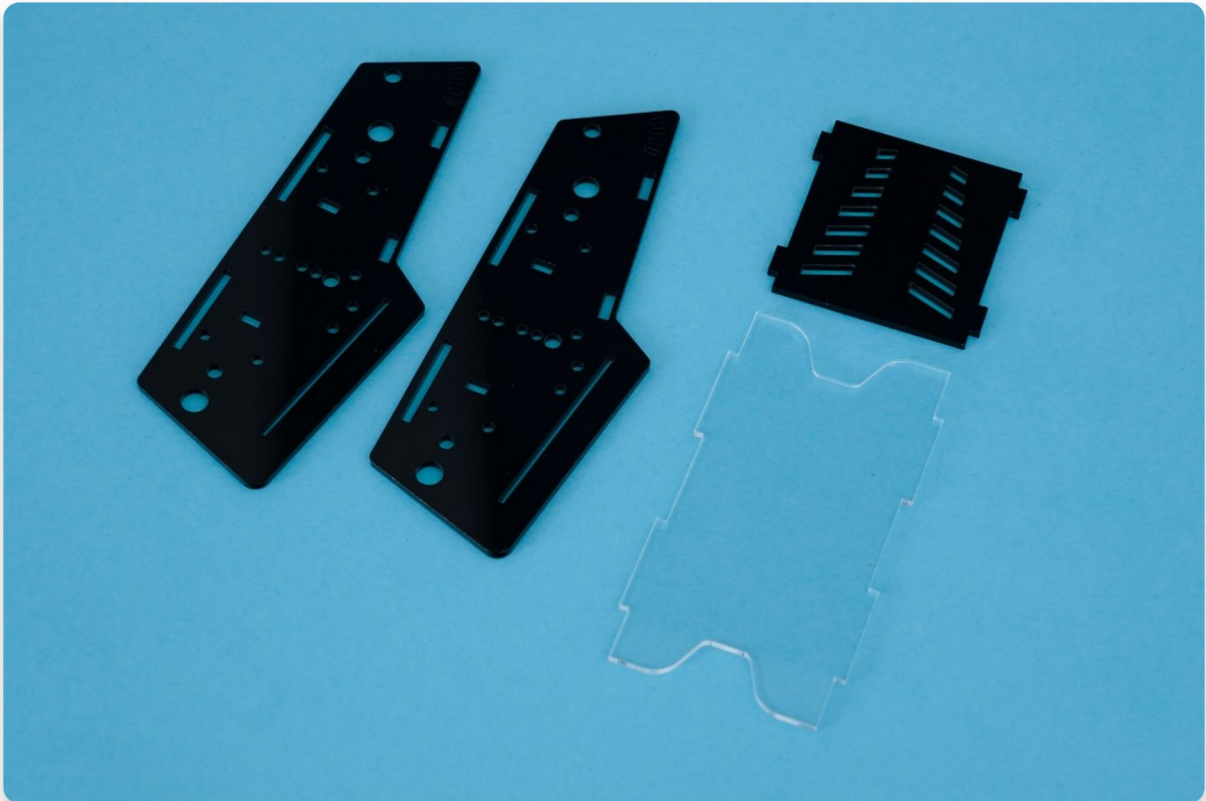


Peel off the protective layer from both sides of all the casing panels.

Remember



Peel off the protective layer on both sides of the acrylic casing. Even the black casings have a protective layer on them!

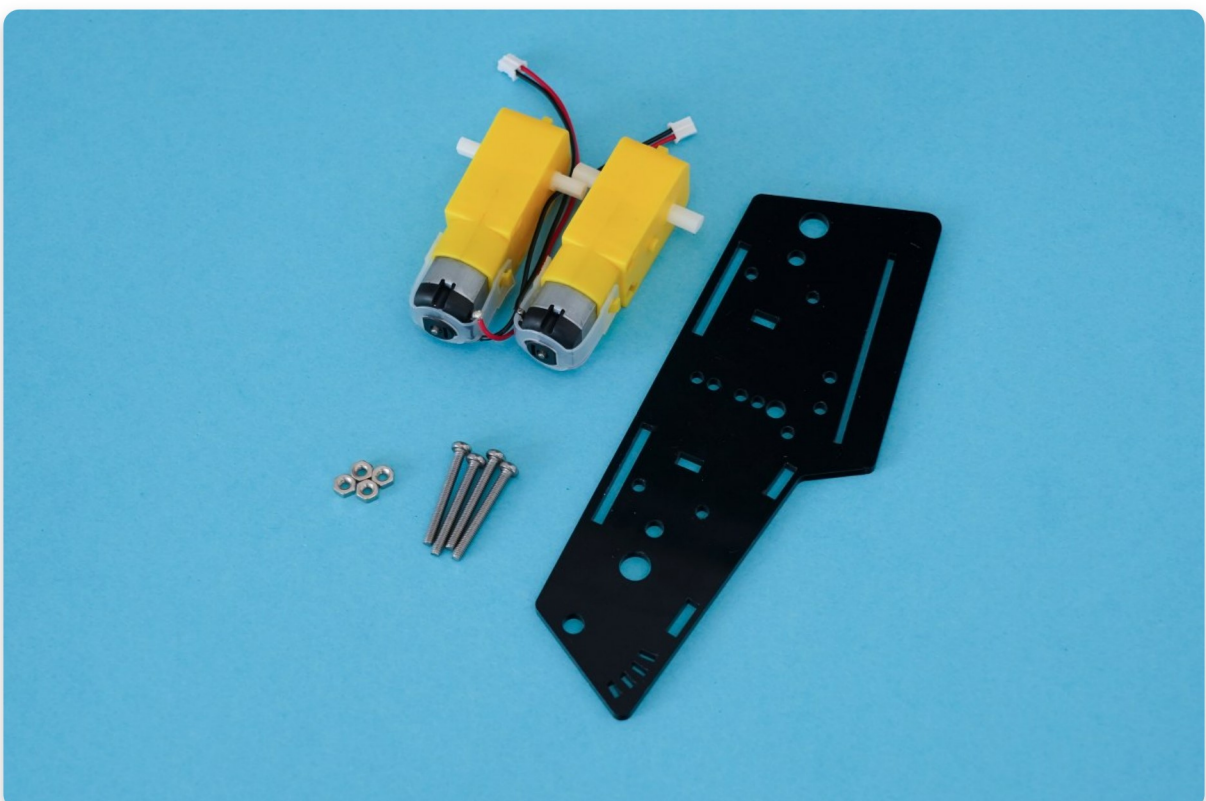


This is how your casings should look like after removing the protective layer.

Step one – Attaching the electromotors

Let's start by attaching the first two electromotors to Wheelson's casing. Here are the components you'll need for this:

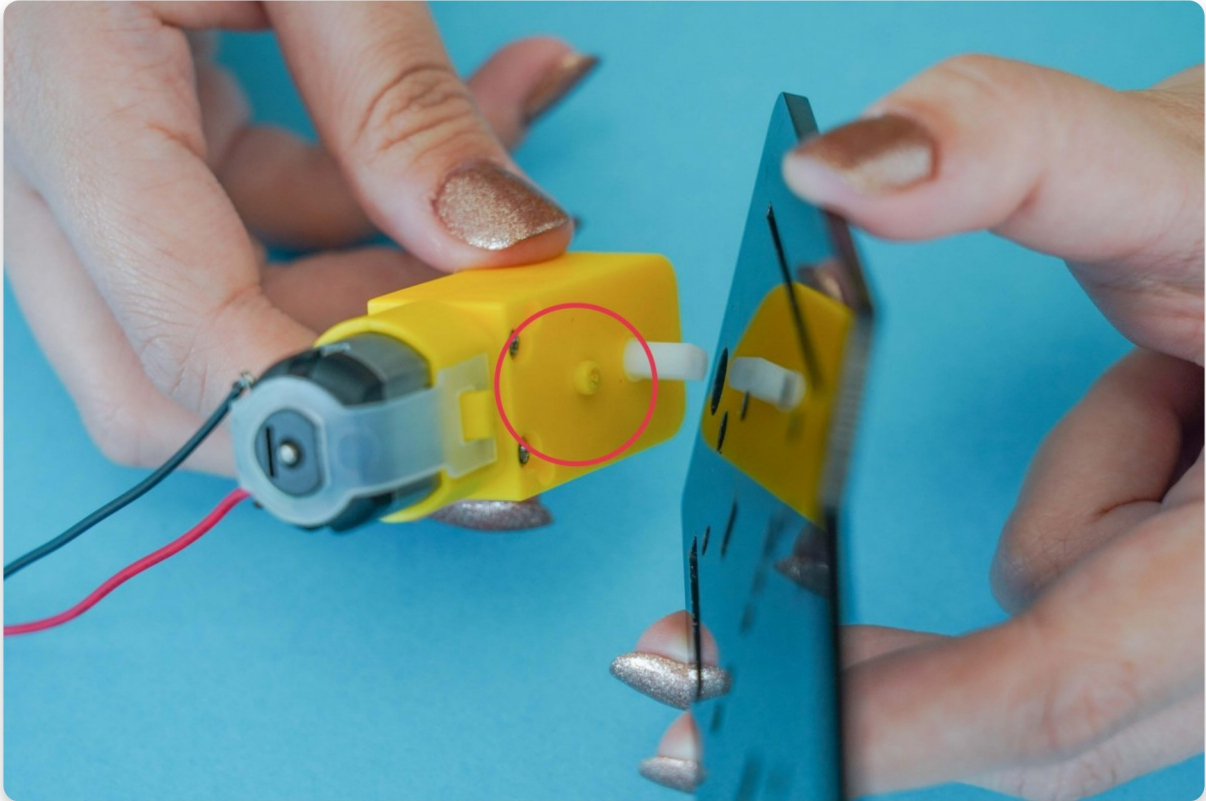
- Two electromotors
- Four big metal bolts
- Four metal nuts
- One long, black acrylic casing



You'll notice that the black acrylic casing has holes all over it. Look for the two biggest circular holes on each end of the casing. Then, grab one of your electromotors.

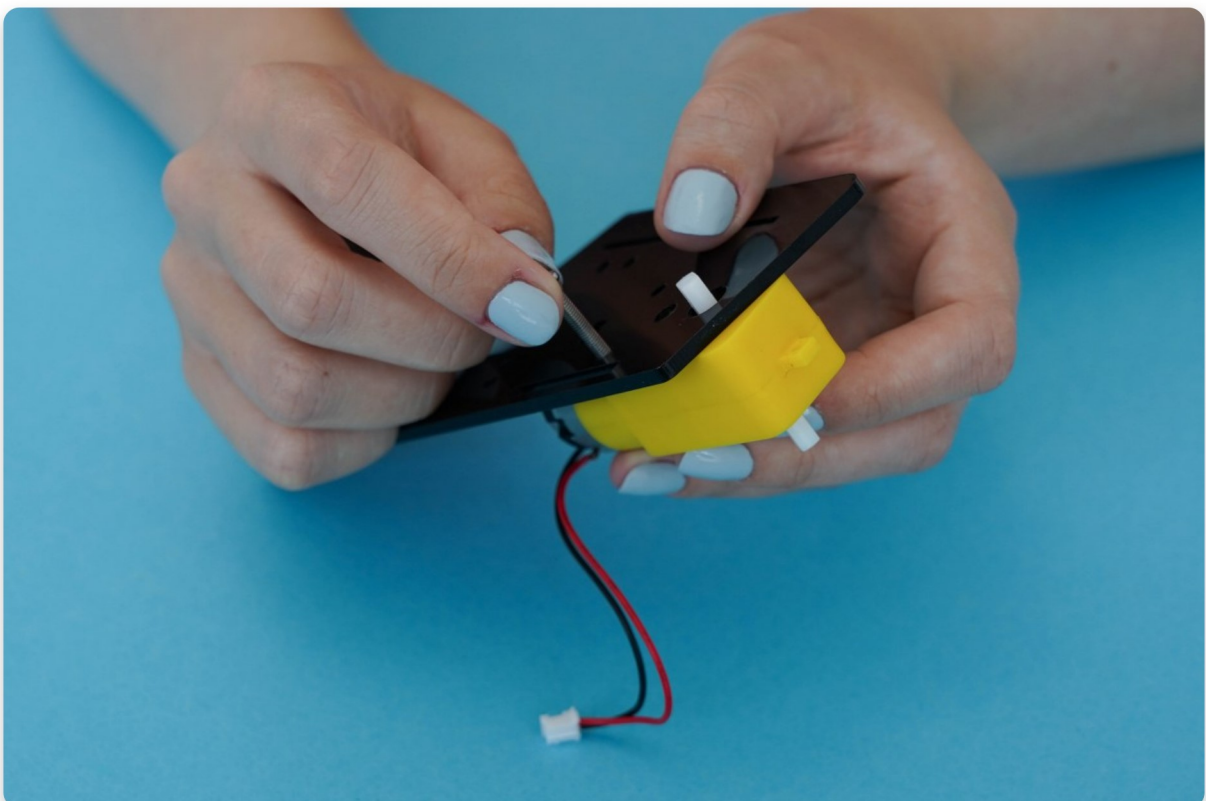
Take a closer look at the electromotor and you'll see that one side of it has a yellow bulge on it. **Use the below photo for reference.**

Using this, align the white plastic tube through the bigger hole and align the bulge through the smaller hole right above the bigger one. Confusing but take a look at the below pictures for a visual reference on how to do this.



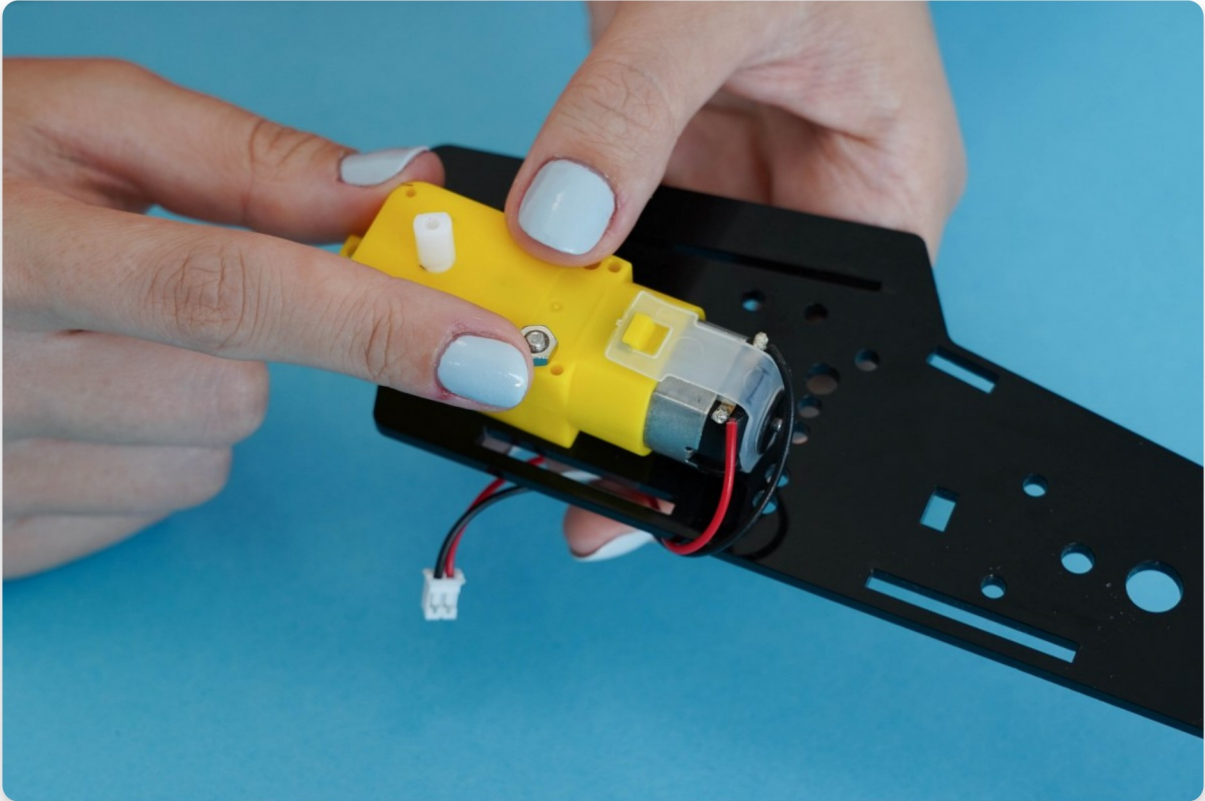
Align the electromotor with the casing.

While holding the electromotor in place, grab one of the big metal bolts. There are two holes on the bottom of the electromotor so insert the metal bolt through one of those holes. These will secure the motors in place.



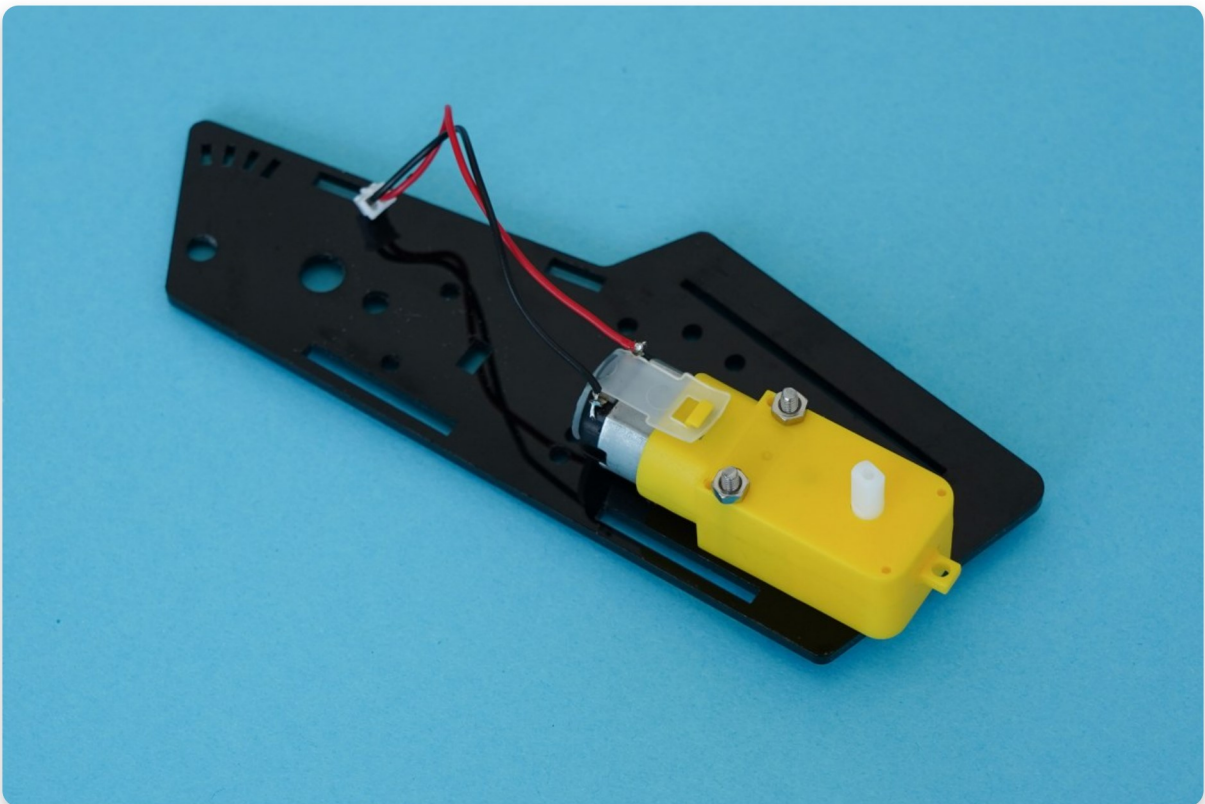
Insert the metal bolt.

Use a metal nut to secure the motor in place on the opposite side of the casing. You can use your finger to twist the nut on and tighten it.



Twist the metal nut to the metal bolt.

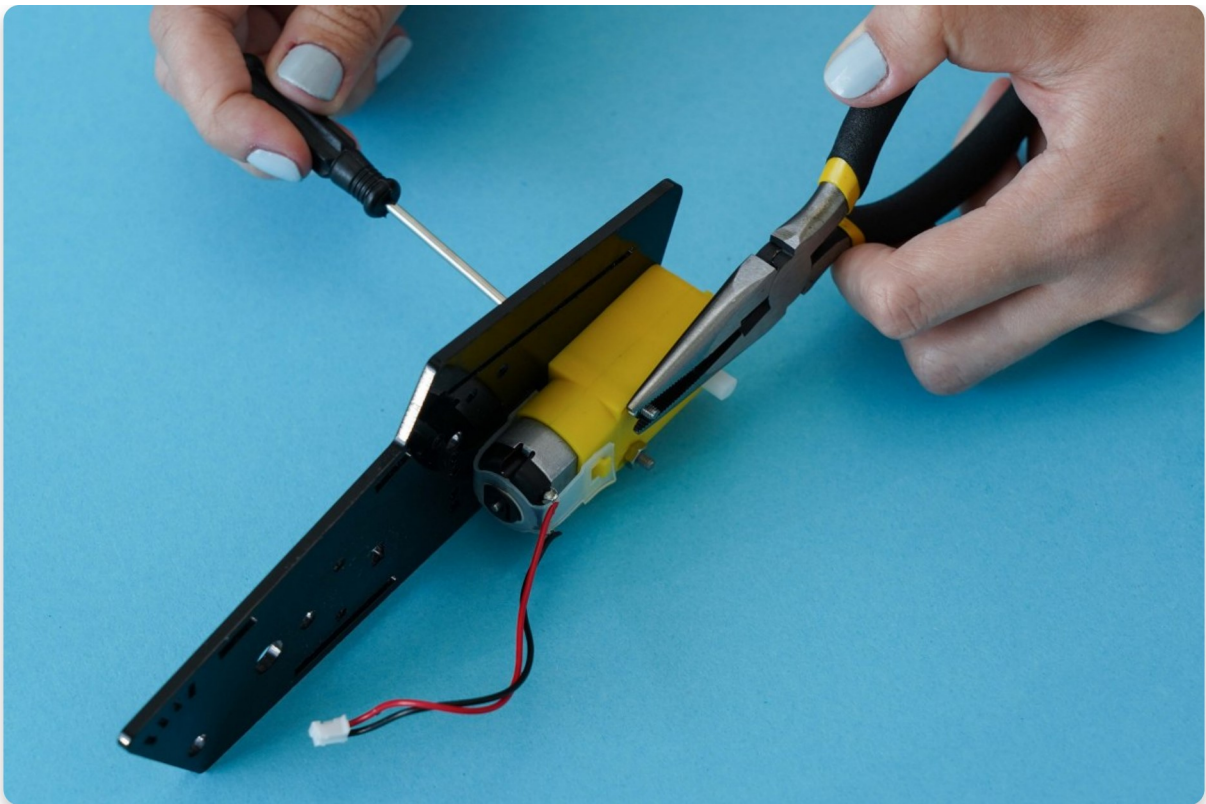
Repeat this step with the second metal bolt and nut. It should look like this:



A view of the electromotor attached to the casing.

Since the electromotor will be connected with Wheelson's wheels **we have to ensure it is screwed on tightly**. So, using a Phillips screwdriver and needle-nose pliers we will tighten the bolts to avoid any unwanted movement.

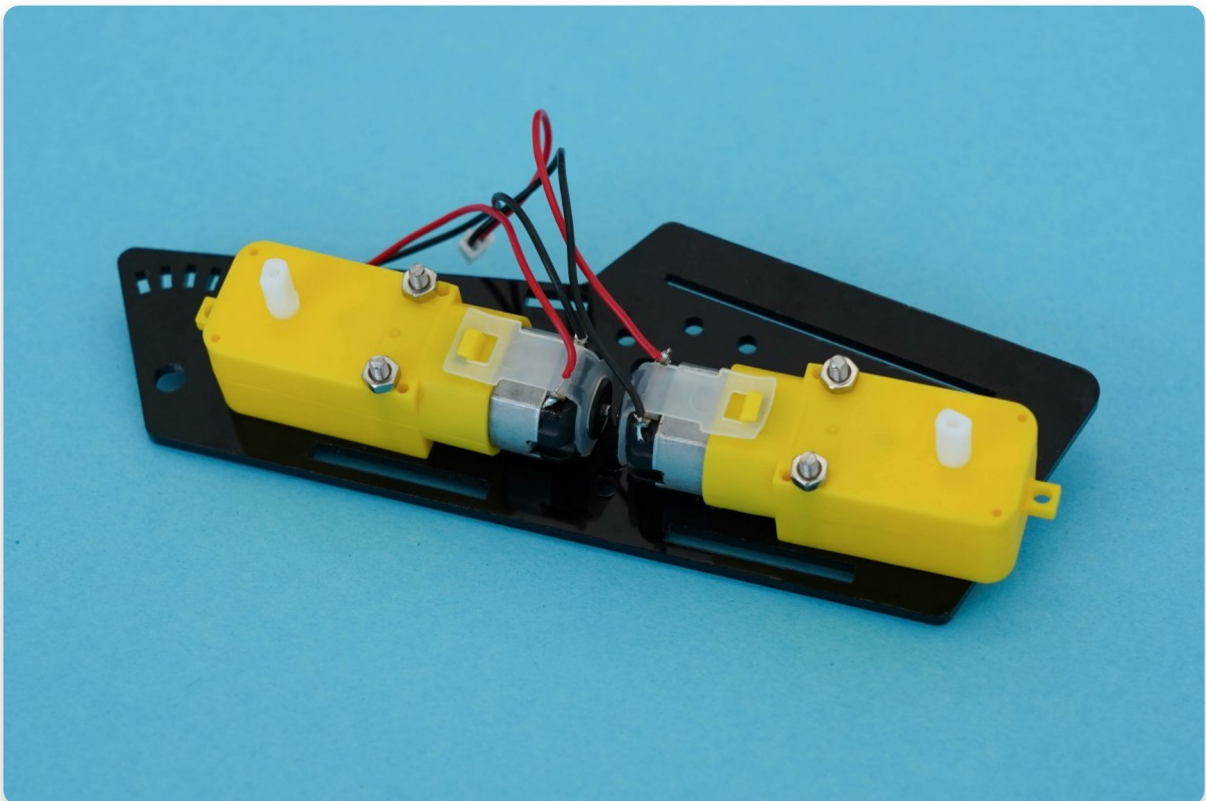
Use the needle-nose pliers to hold the nut in place while you use the screwdriver to **tighten the bolt**. If you need an extra pair of hands, you can always ask for help.



Make sure that the bolt is tightened completely otherwise the wheels could move around unnecessarily.

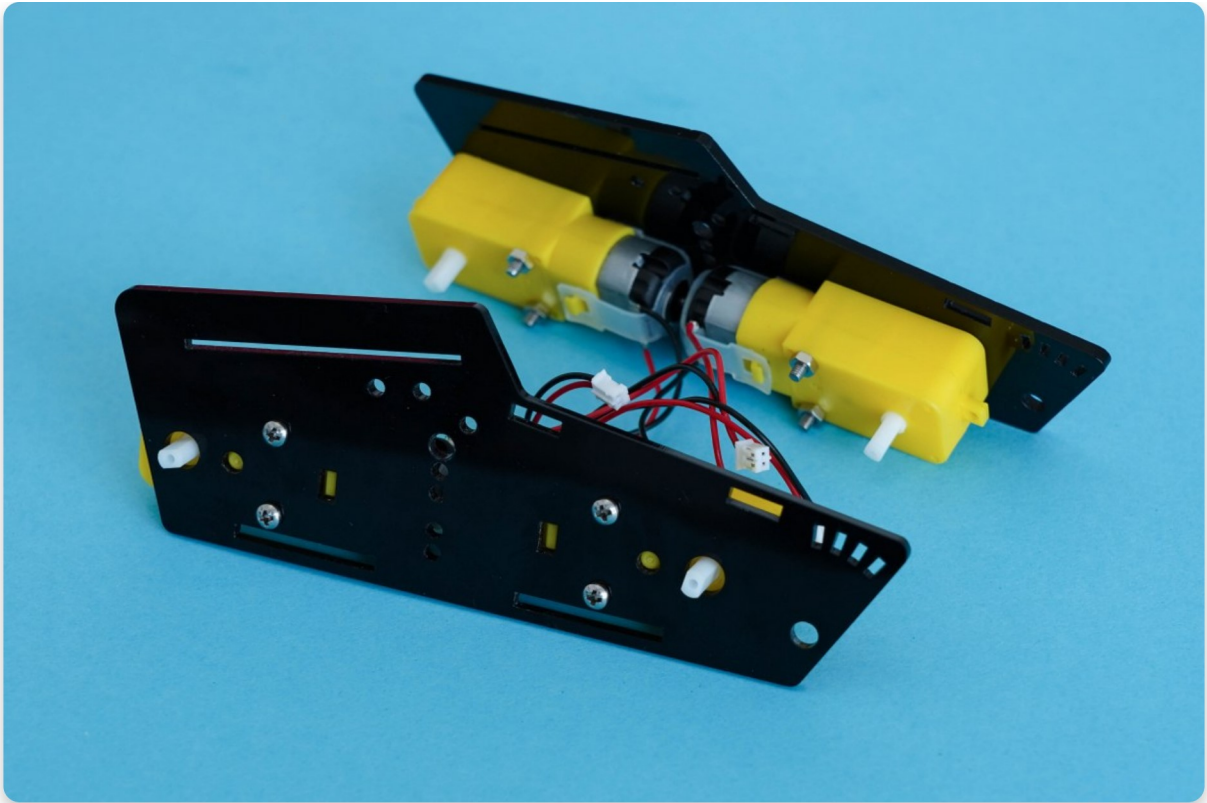
Repeat the same step for the second electromotor on the narrow side of the casing.

This is how the side panel should look with two electromotors attached.



Now grab the second black acrylic casing and repeat the same steps. Be careful to attach the electromotors to the **correct, opposite, side of the acrylic casing**.

Here's a tip on how to do that. Align the two acrylic casings so that the wider top parts of the casings are facing each other, as seen below. Then, attach the electromotors so that they're on the inner side of the two casings. Use the below photo for reference.



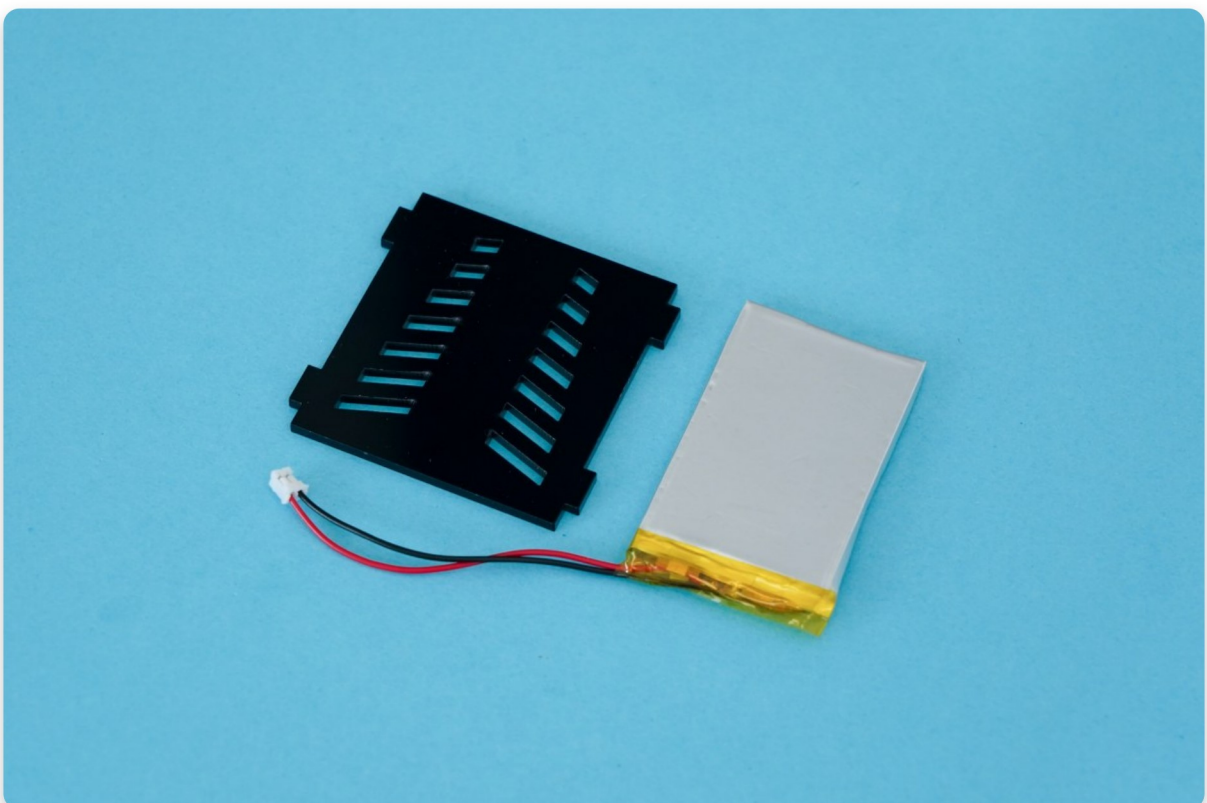
All four electromotors attached and properly aligned.

Step two – Attaching the battery to the casing

Remember the battery we disconnected at the very beginning? It's now time to connect it to the casing. Here's what you'll need:

- The Battery we disconnected from earlier
- The front acrylic plate

See the below photos to see what each part looks like.

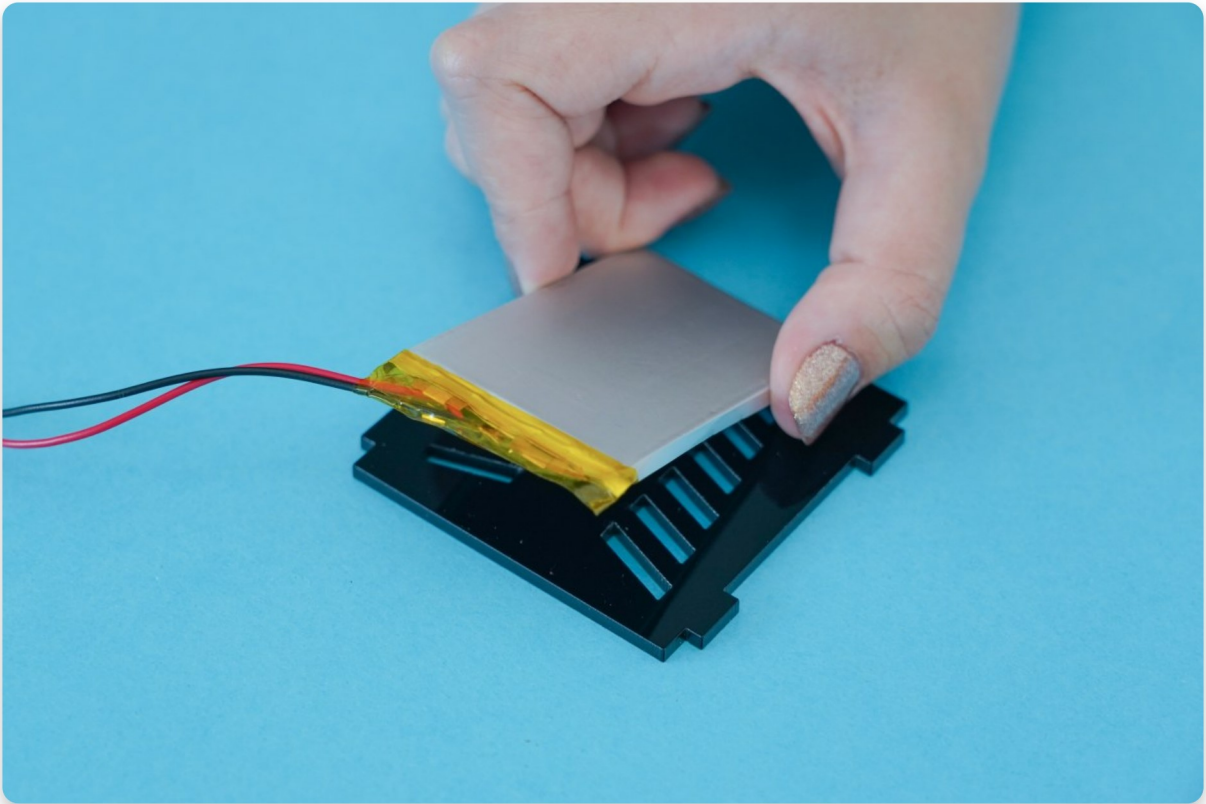


Small black acrylic casing and Li-Po battery

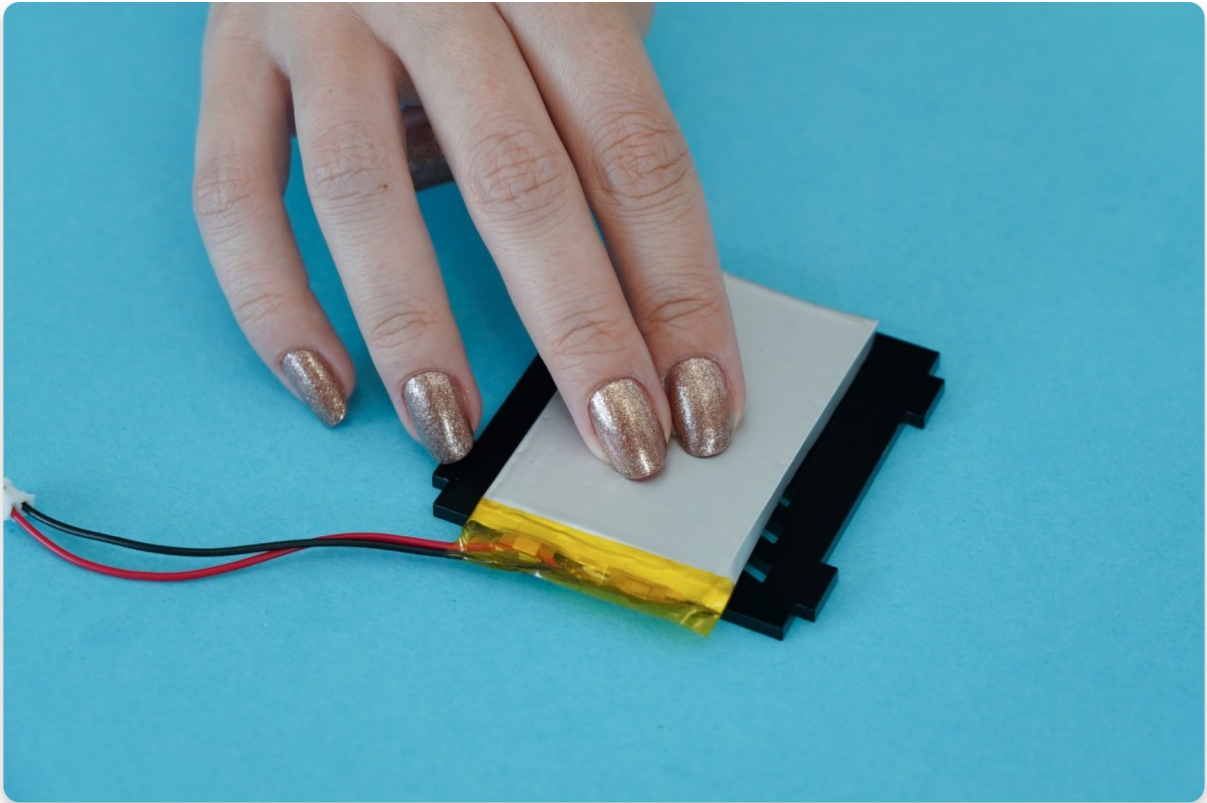
Turn over the Li-po battery and peel off the protective layer from the sticker.



Align the battery within the middle of the black acrylic casing and press it firmly in place. See the below photos if you're not sure.



Align the battery with the middle of the casing.



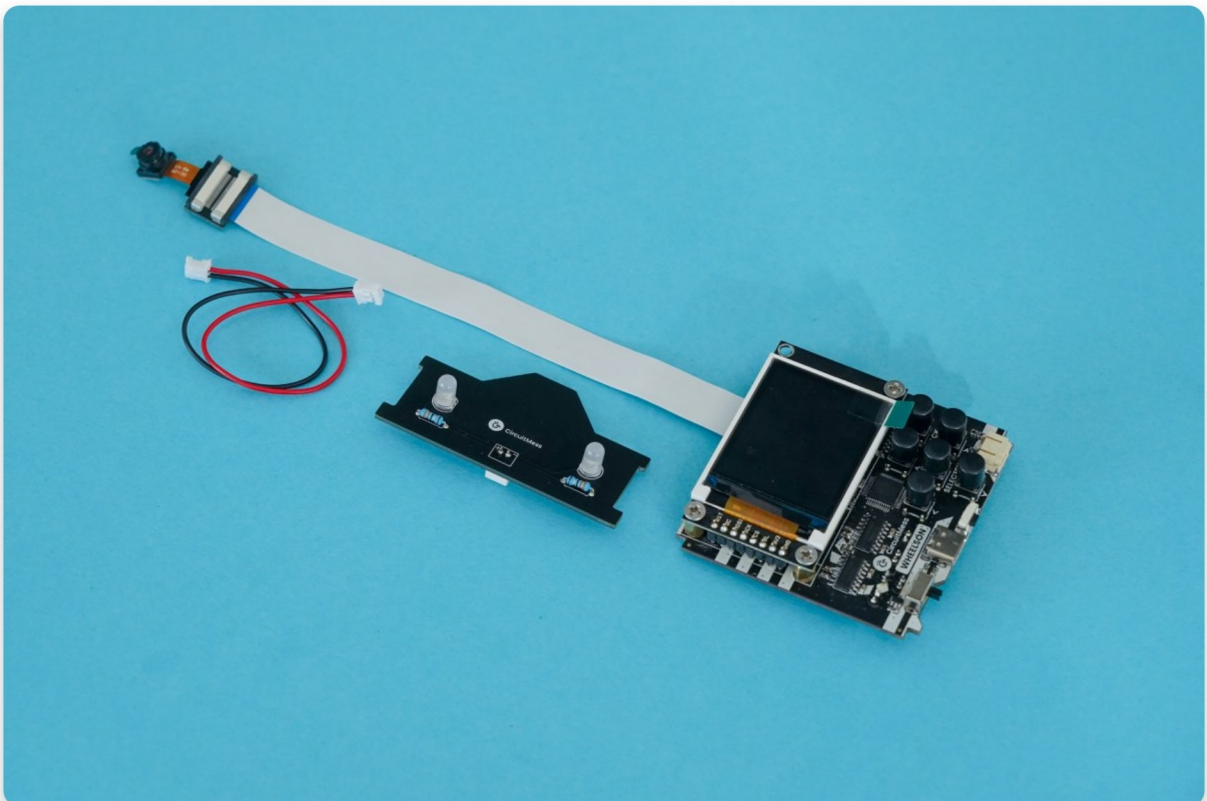
Make sure the battery is firmly attached by pressing it in place.

Step three - Connecting the main board with the camera and headlights board

Let's connect the main board to the camera and headlights board. Grab these components:

1. Main board
2. Camera and headlights board
3. Male to Male JST cable

If you're not sure about any of the parts, check the below photo.

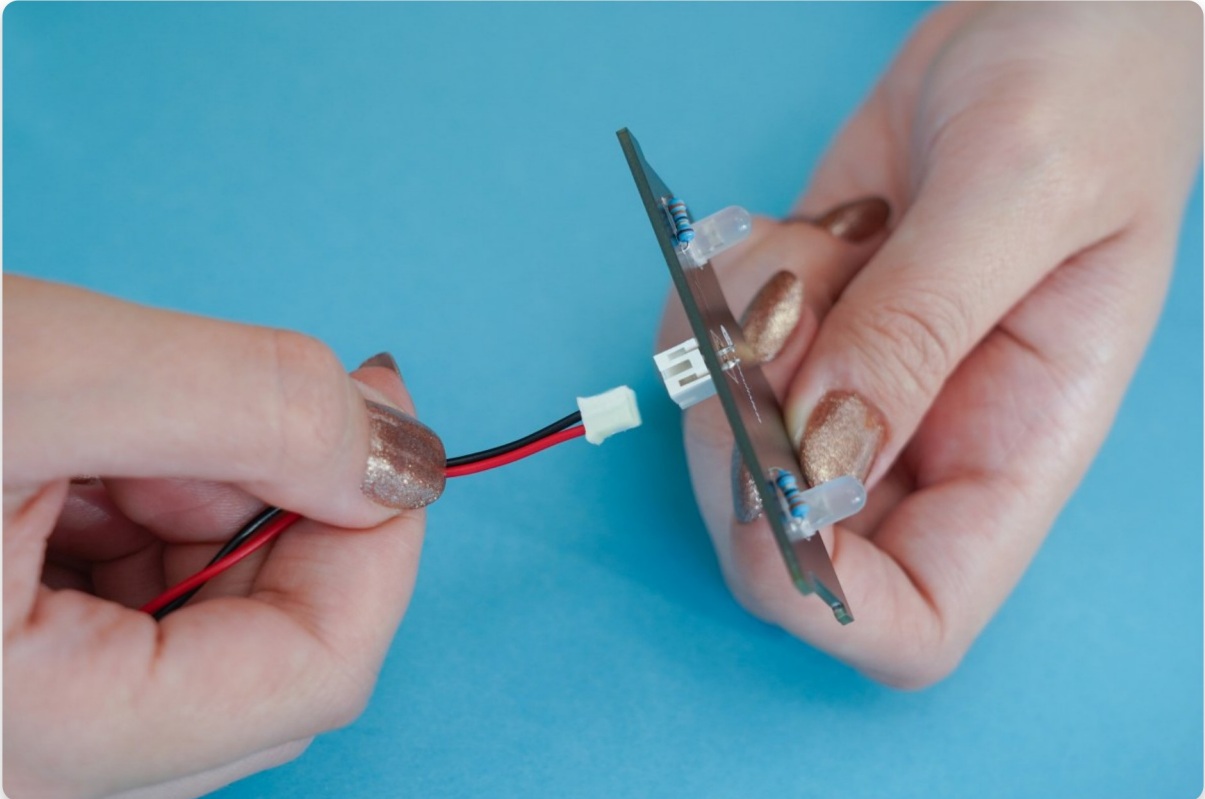


Take the male to male JST cable and insert it into the JST connector on the back of the Camera and headlights board.

Make sure to push it all the way in!



If it doesn't go in the first time, check that you're plugging it in the right way round - you may find that you need to turn the cable around and try again.

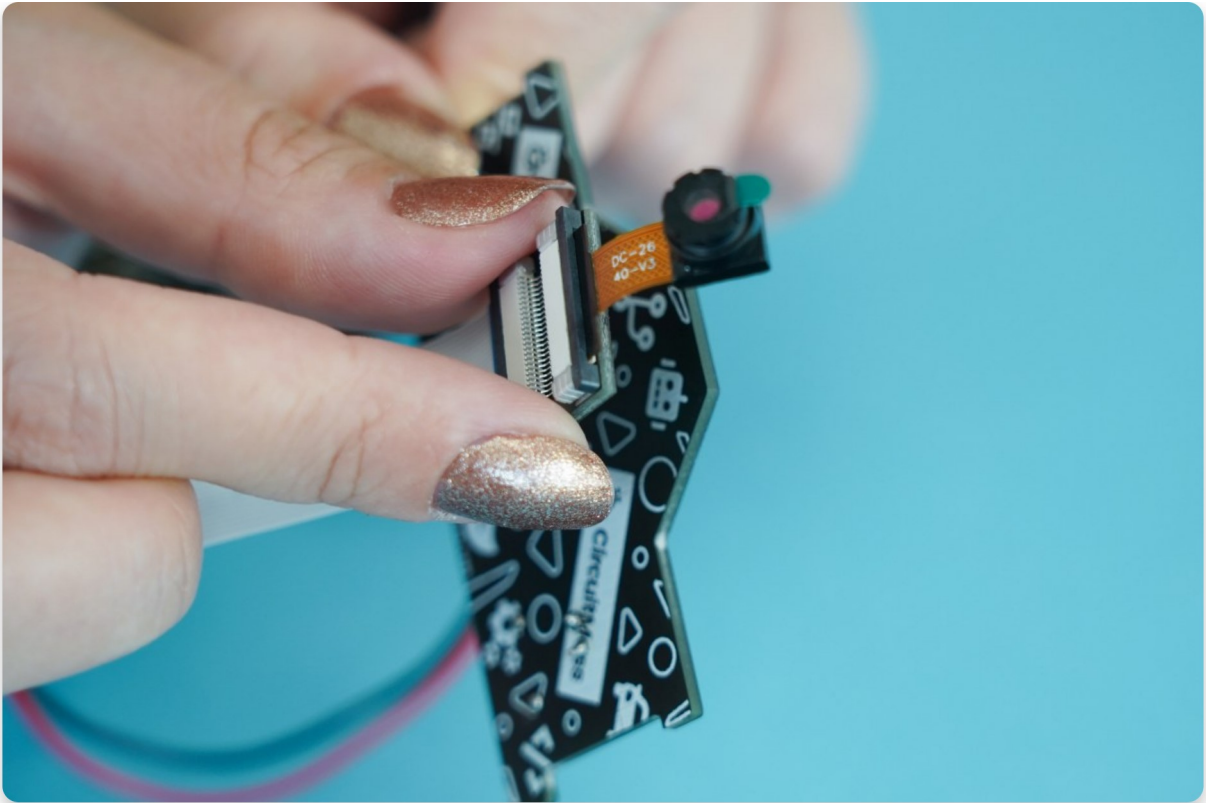


Connect the JST cable with the JST connector.

Next, find the camera on the end of the long, white cable that is connected to the main board. Then find the sticker on the back of the small board right below the camera. Peel off the backing to reveal the sticky part; this will allow us to stick it onto the camera and headlights board!



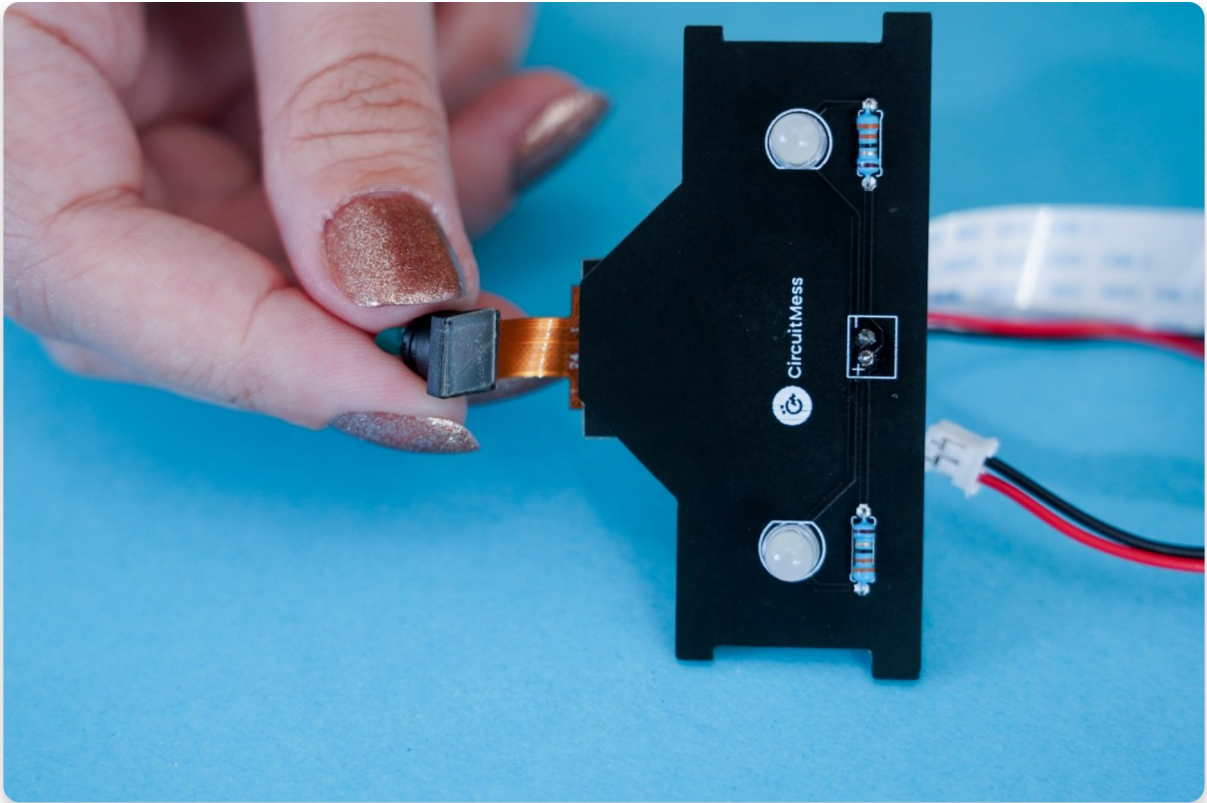
Take the camera and headlights board and turn in upsidedown. Then, stick the small camera board onto the shorter part of the camera and headlights board, as shown in the photo:



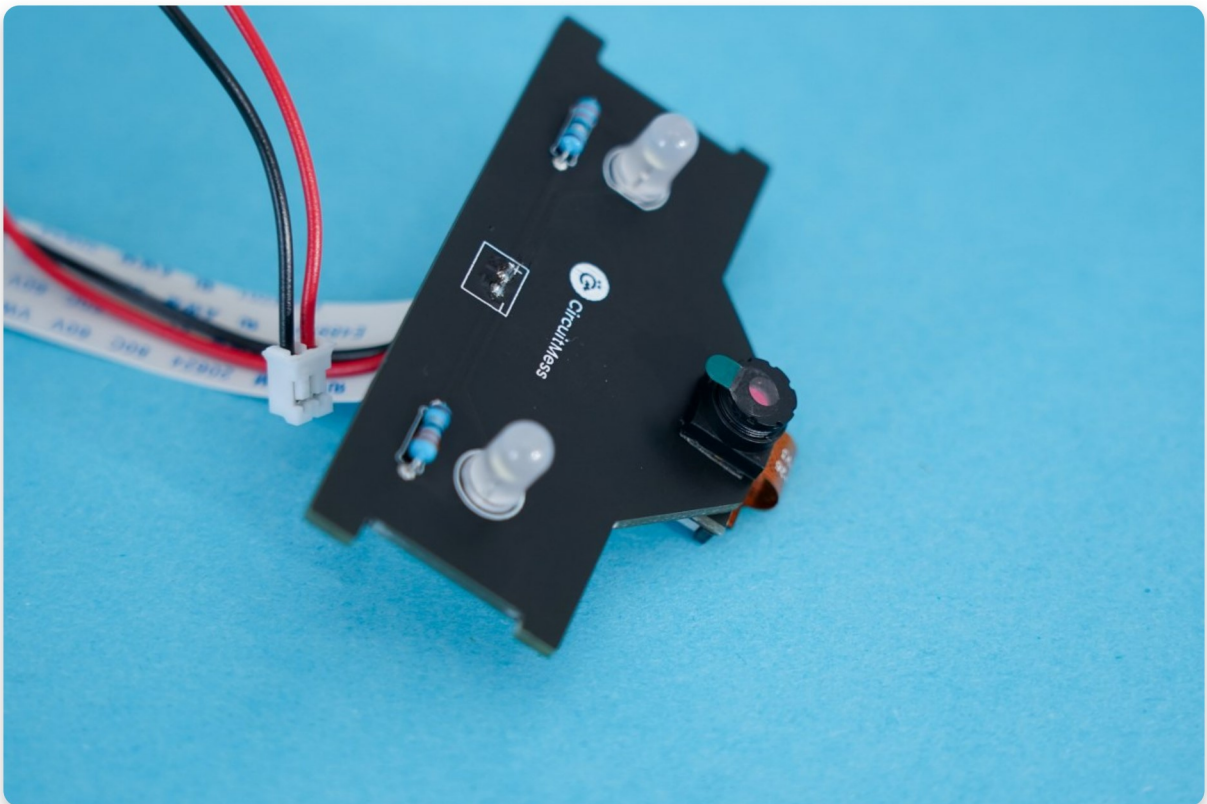
Next, take off the backing from the camera.



Stick the camera to the front of the board. Make sure to keep the camera centre!



Here's how it should look like:



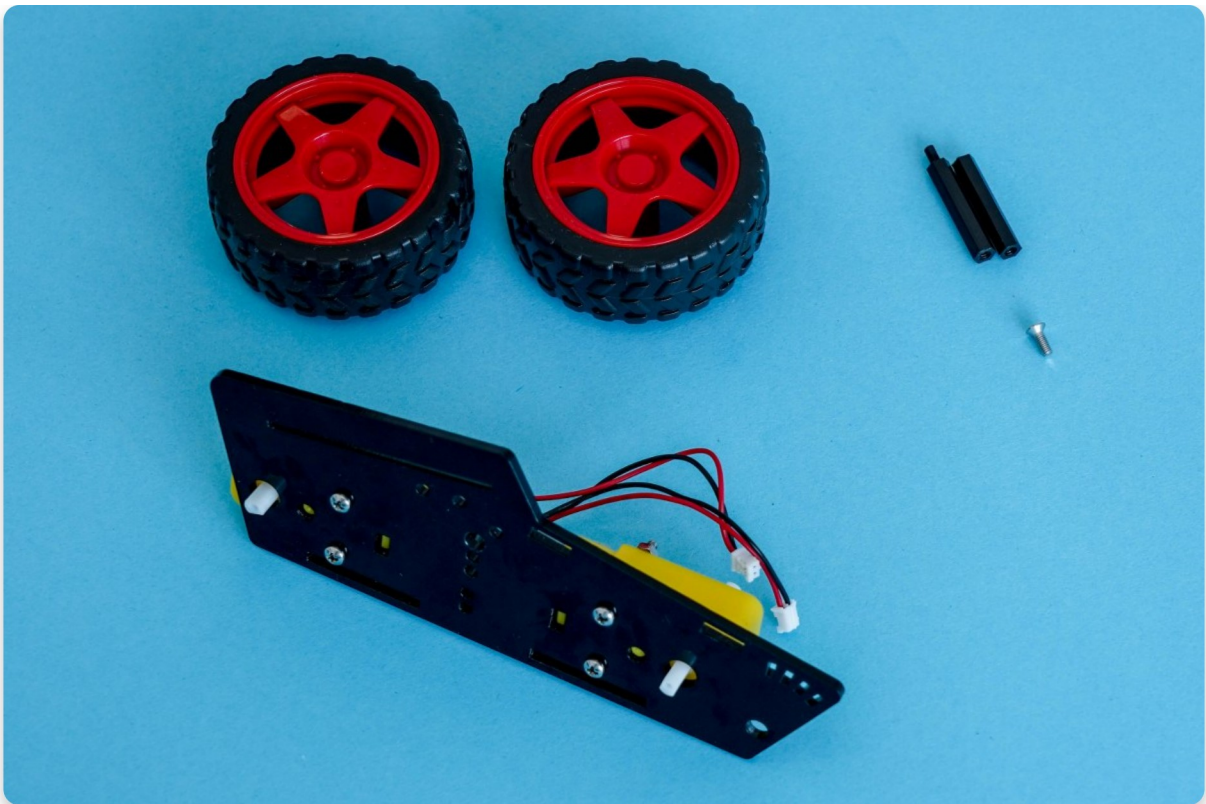
Camera glued to the board.

Step four – Connecting the first two wheels

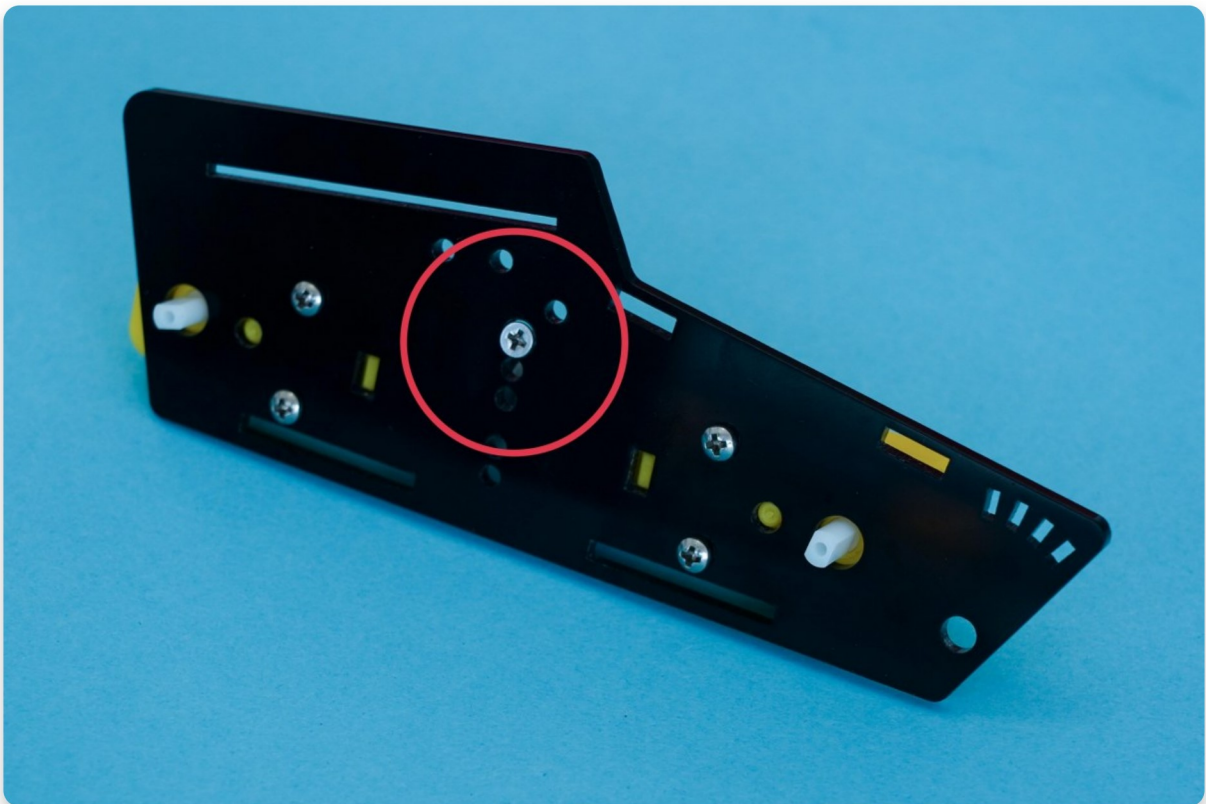
Okay, I'm excited now! We're getting close to the end. Let's connect the first two wheels onto the electromotors. You'll need these components:

- Two wheels
- One large black acrylic casing with electromotors attached
- A small metal bolt
- Two nylon spacers

If you're not sure what these look like, take a look below!



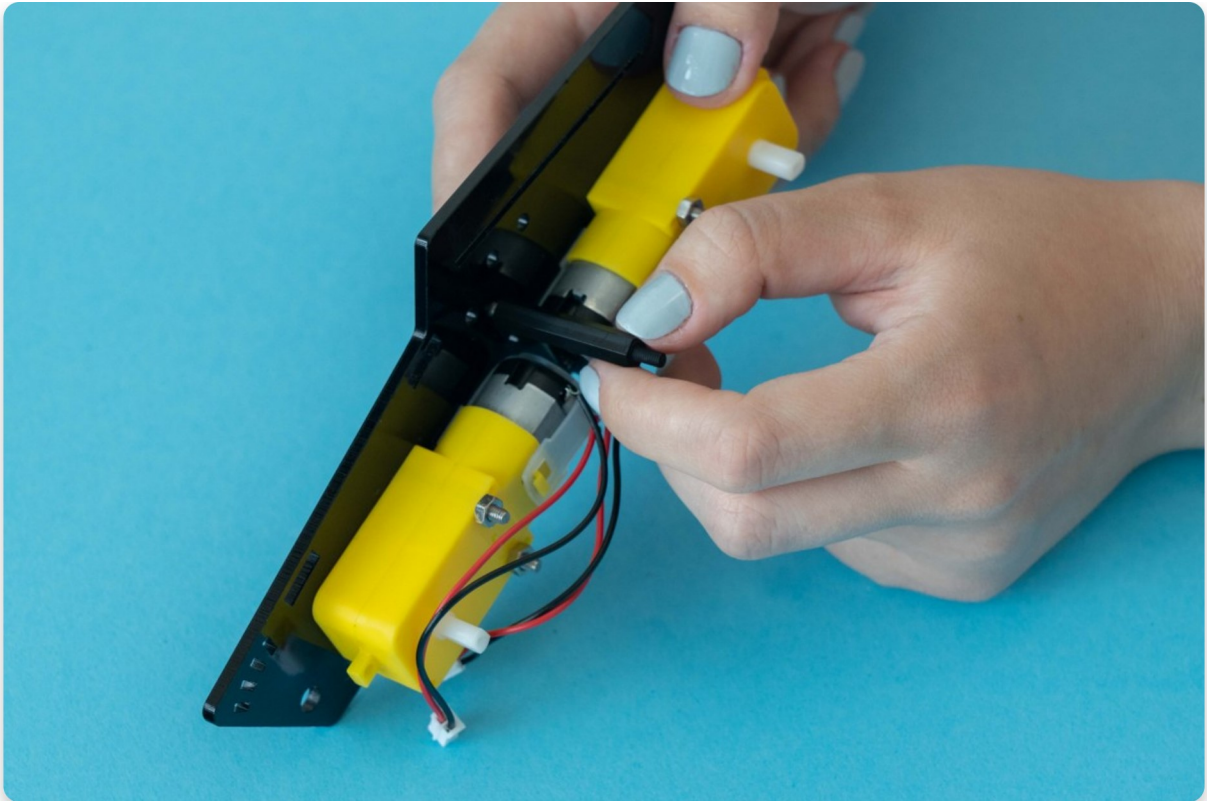
Start by inserting the small metal bolt through the hole in the casing on the opposite side of the motors.



Insert the metal bolt through the casing.

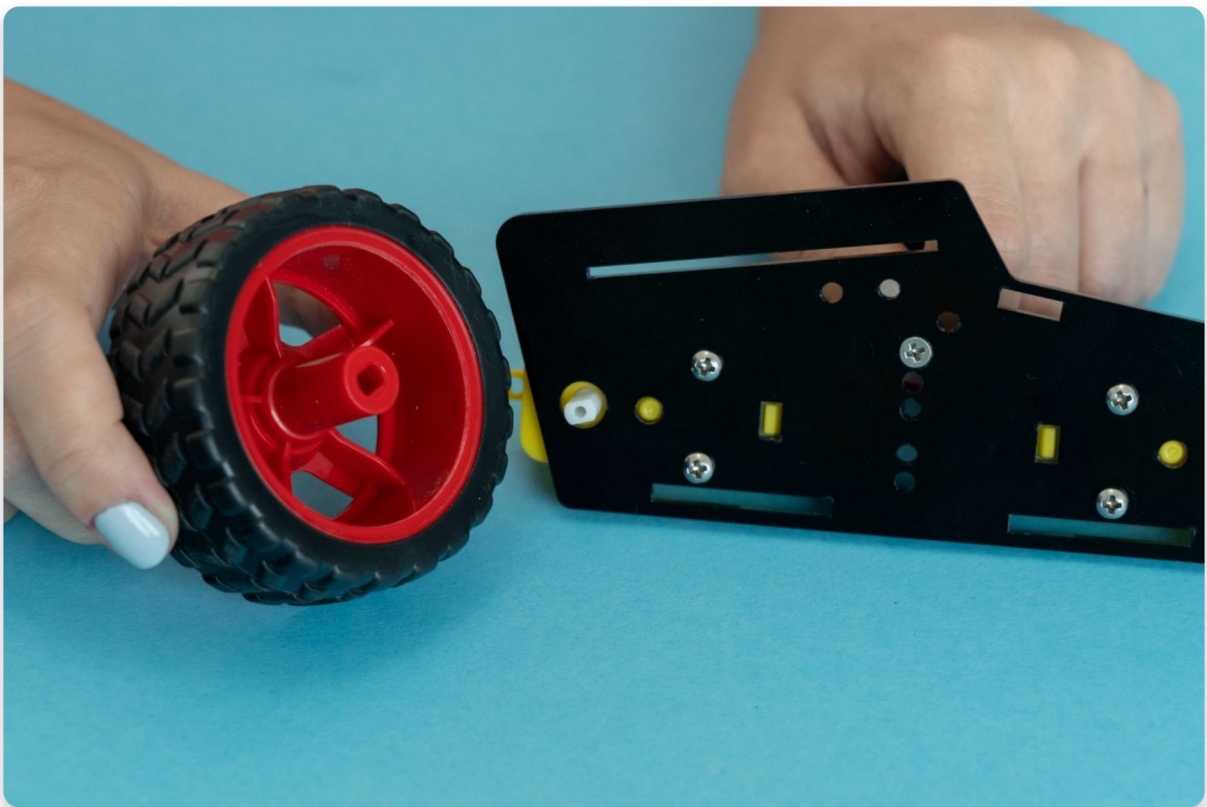
Next, grab the nylon spacer that has a thin plastic part sticking out from one end. Screw it onto the bolt you just inserted. You can use your hand to twist the spacer onto the bolt.

Then, take the other black nylon spacer and screw it on until it is tightened to the spacer we previously connected with the metal bolt.



It's time to attach the wheels now. Pick up one of the wheels and the casing we just connected the nylon spacer to.

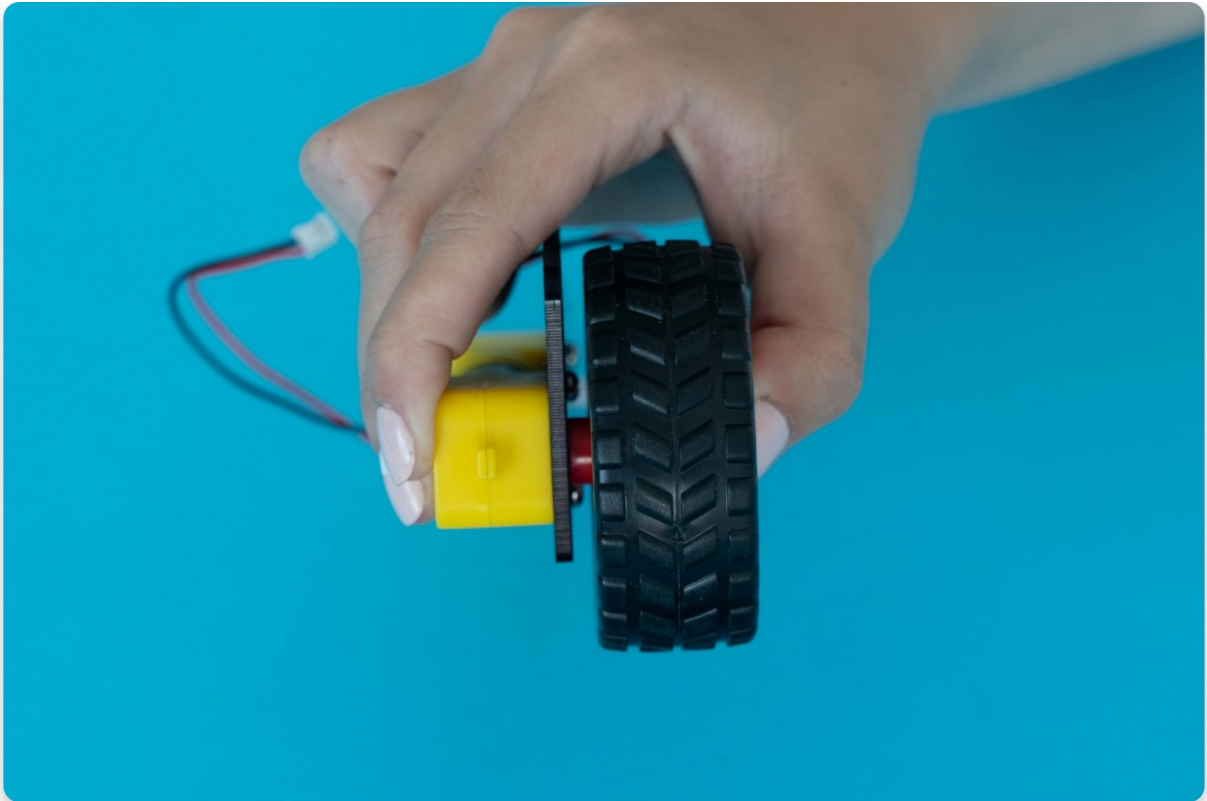
You'll notice that the white plastic tube on the electromotor has the same shape as the wheel. Make sure to align the wheel with this tube and push it into place. It's as easy as that!



Push the wheel into place.

Make sure to **push the wheel all the way in**. This will ensure that your wheels are placed securely and do not move around.

There should be no space left between the acrylic casing and the wheel – push it in as far as it goes. Use the below photo for reference:



Push the wheel in as far as it goes

Repeat the same process to connect the second wheel.



Wheels connected to the casing.

You don't have to connect the other two wheels just yet. We'll let you know when it's time to do that.

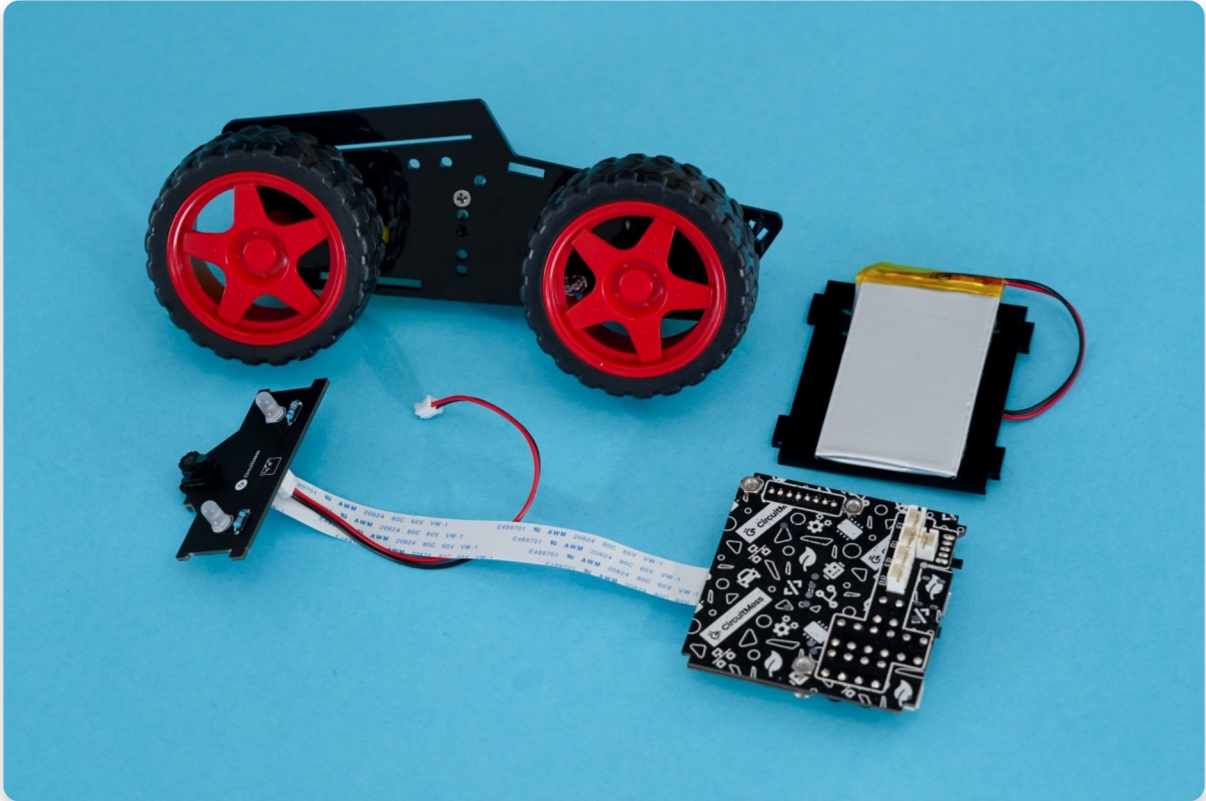
Step five – Connecting the parts

Wheelson is slowly starting to come together! Let's assemble the last few pieces. Here's what you'll need:

- The casing with the wheels attached
- The main board connected to the camera and headlights board

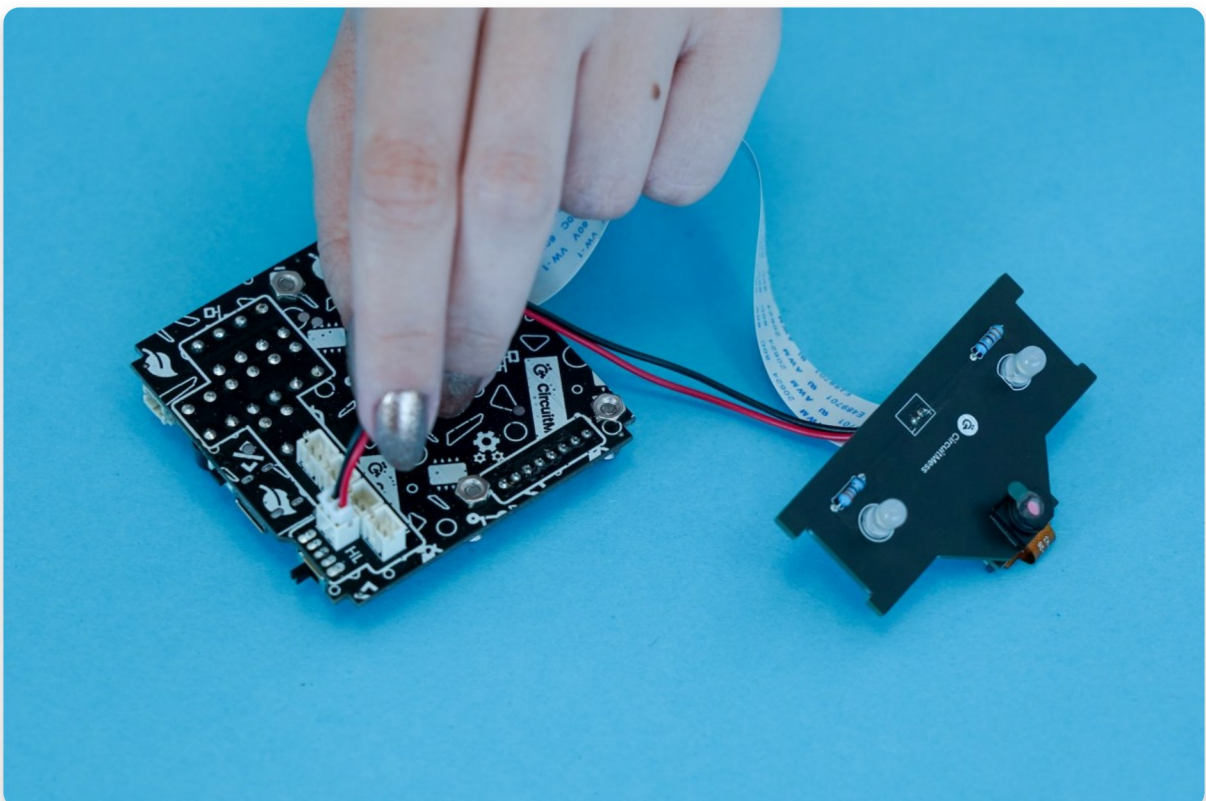
- The casing with the connected Li-Po battery

Not sure? Check the photo below.



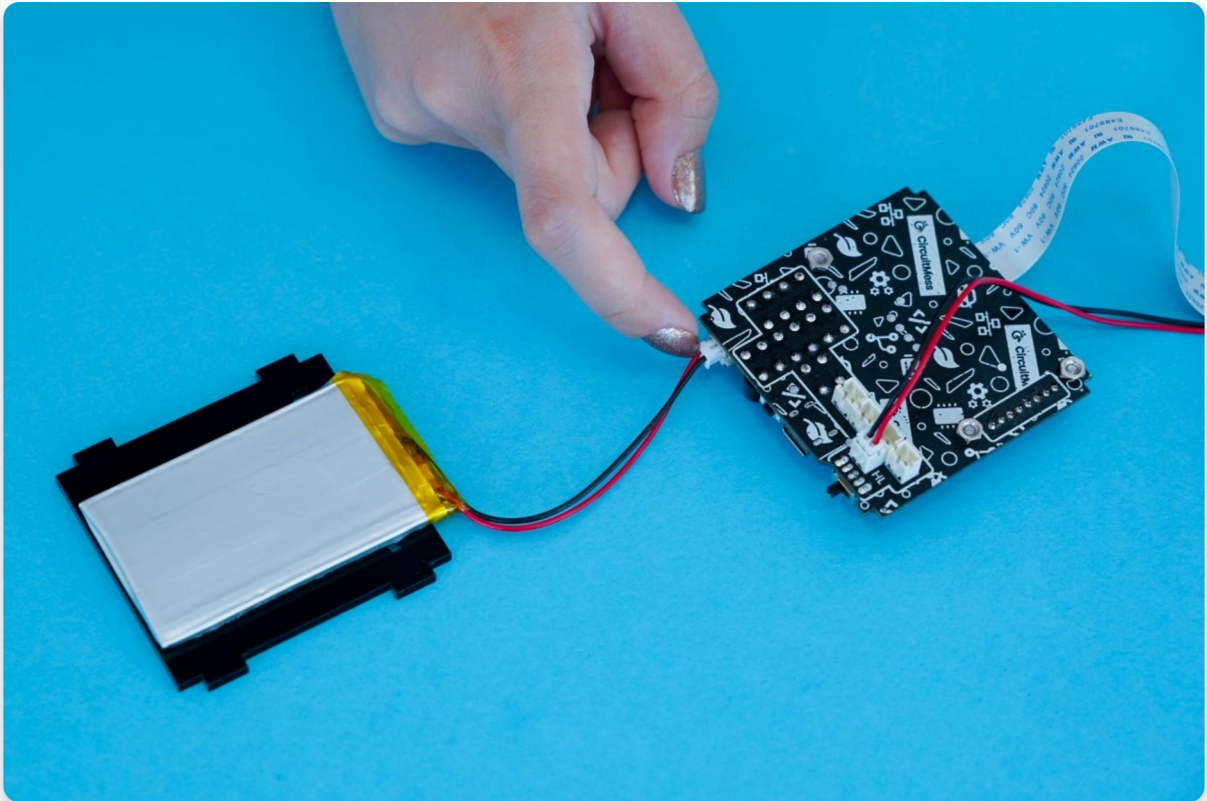
The first step is to connect the camera and the headlights board to the main board. Turn the mainboard upside down (so the JST connectors are facing up) and take the male to male JST cable that's connected to the camera and headlights board.

You'll see that there are letters next to each JST connector on the main board. Find the JST connector that has '**HL**' (for headlights) written next to it. This is where you should insert the cable.



Insert the JST cable

Next, grab the casing with the Li-Po battery. Connect it to the main board, as shown on the photo below:



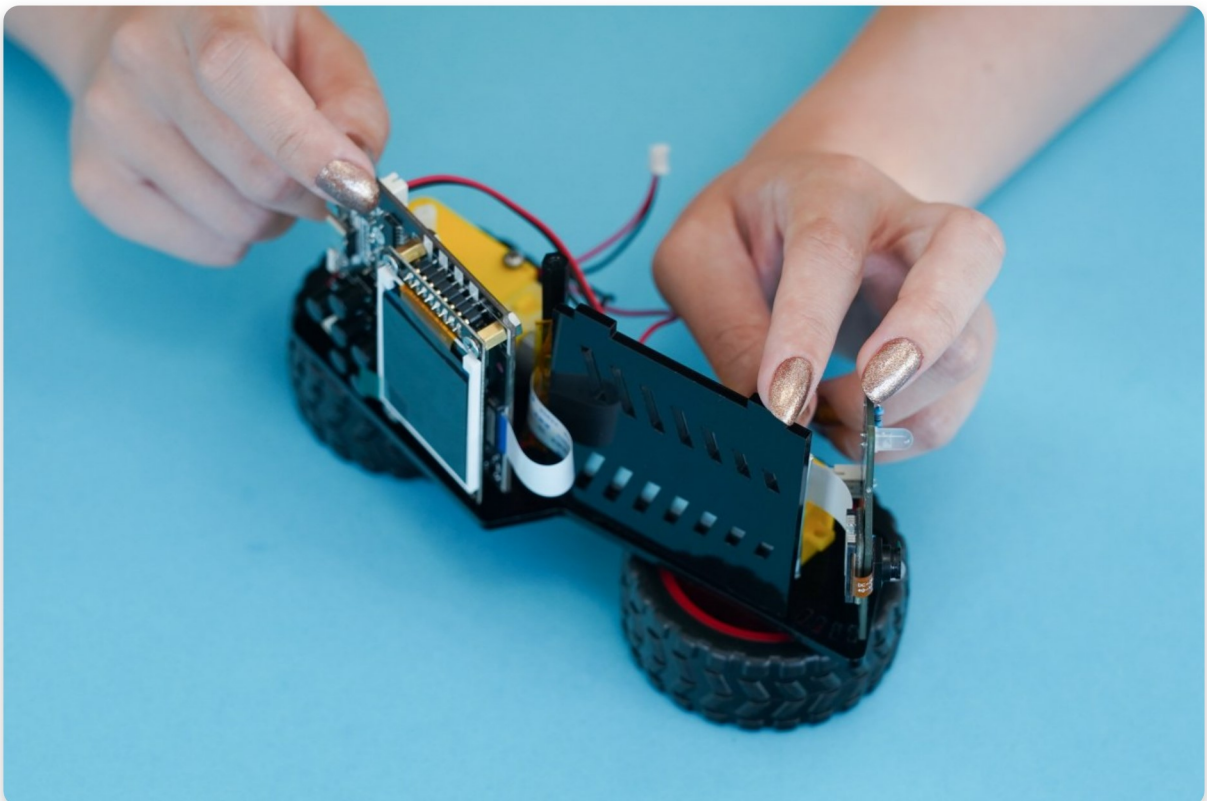
Connecting the battery with the main board.

Now place the large black acrylic casing with the wheels connected, onto a flat surface with the wheels placed on the surface.

Then, take all the parts you just connected; the main board, Camera and headlights board, and the casing with the Li-Po battery glued to it and get ready to assemble them.

You'll see that the large black acrylic casing has holes that these pieces fit into, like a puzzle!

With that said, insert the boards and casings into their designated places. Use the photo below as a reference:

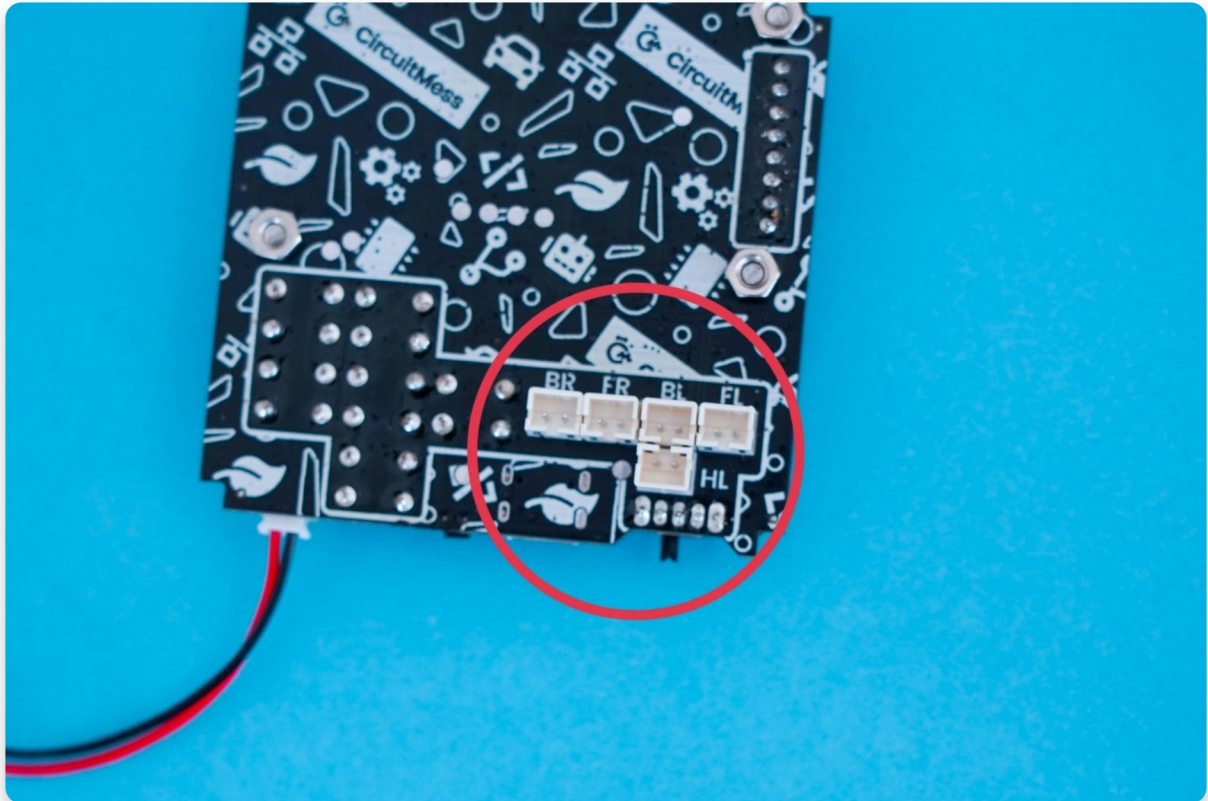


Fit the the pieces into the side panel and push them into place

You're doing great! In this step, we'll connect the electromotors with the main board. This part might be a little bit hectic but if you follow our instructions closely, you should be fine.

Remember us mentioning that each **JST connector has some letters written next to it on the board?** These letters will help you identify how to connect the right electromotors with the right JST connectors. Here's what they stand for:

1. **BR = back right**
2. **FR = front right**
3. **BL = back left**
4. **FR = back right**

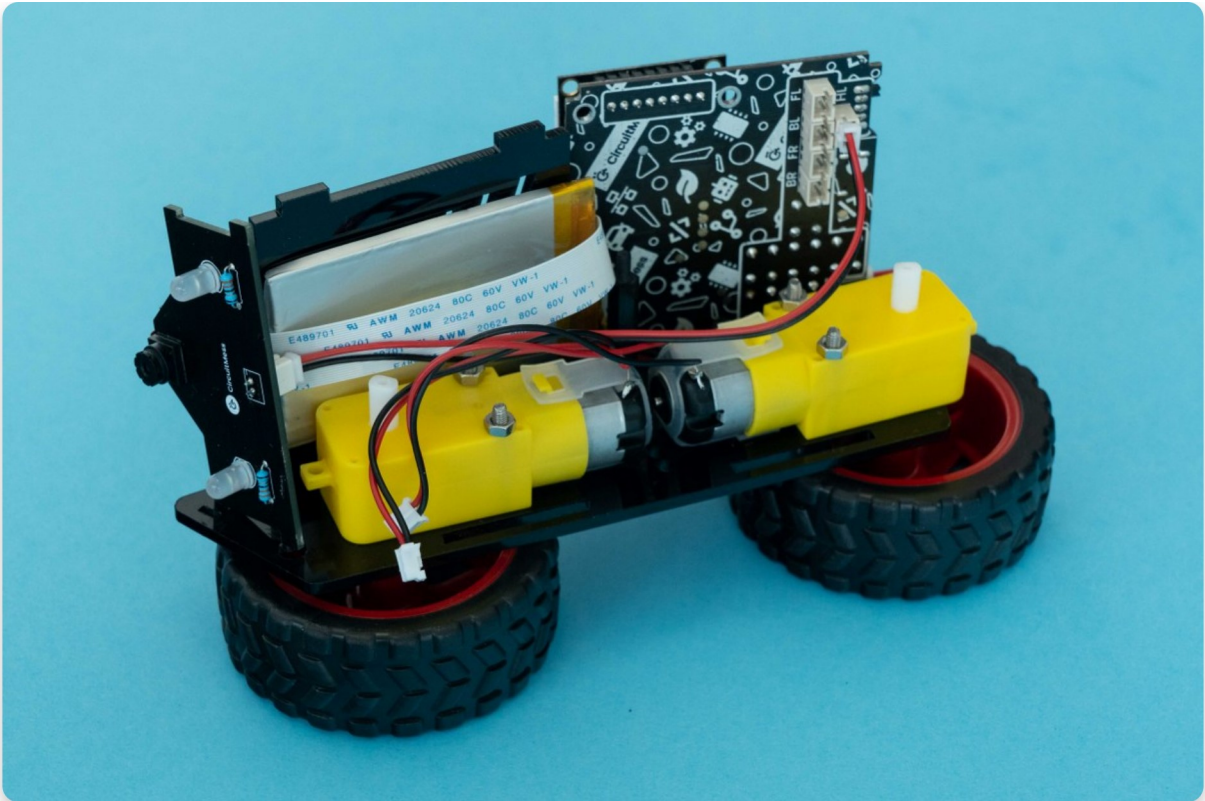


Letters on the board

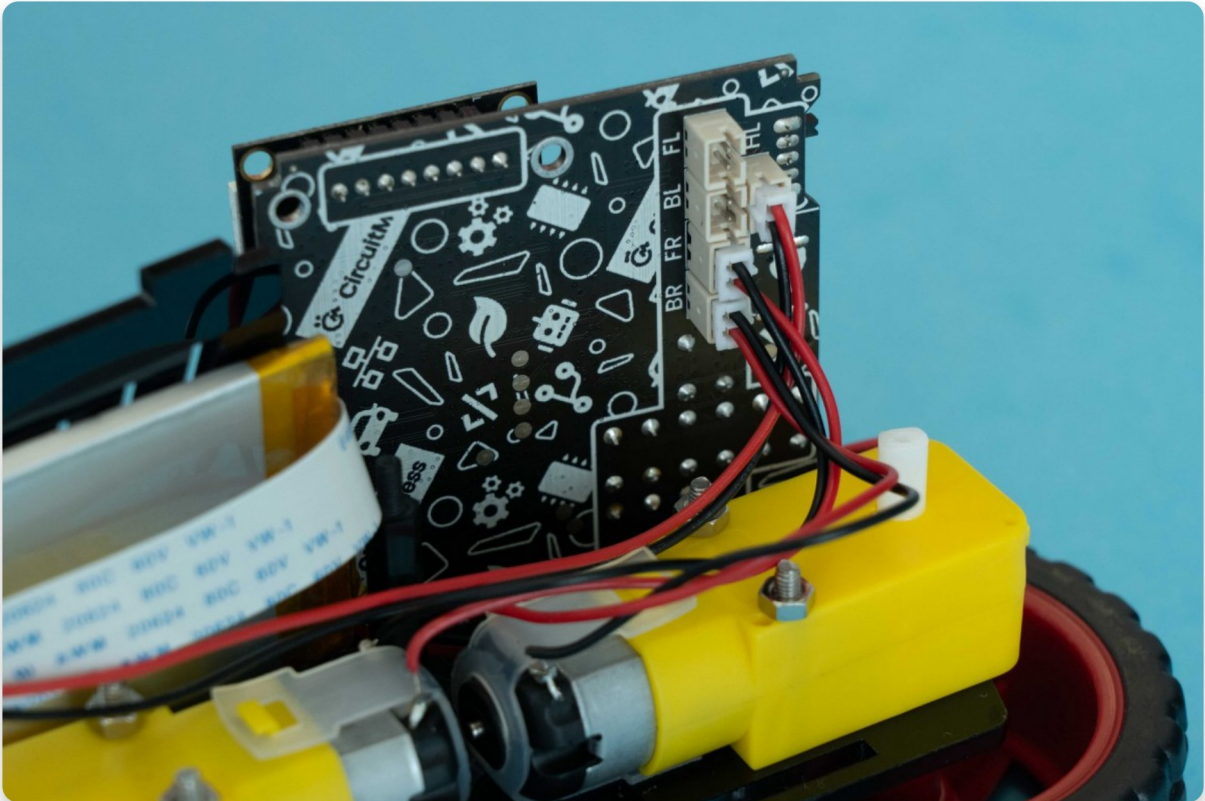
When looking at Wheelson from the top, the casing with the wheels attached to it is on Wheelson's right side.

- This means the first motor (on the left in the photo below) should connect to Wheelson's Front Right connector.
- The second motor (on the right in the photo below) should connect to Wheelson's Back Right connector.

We'll now connect Wheelson's front and back right electromotors with the main board.

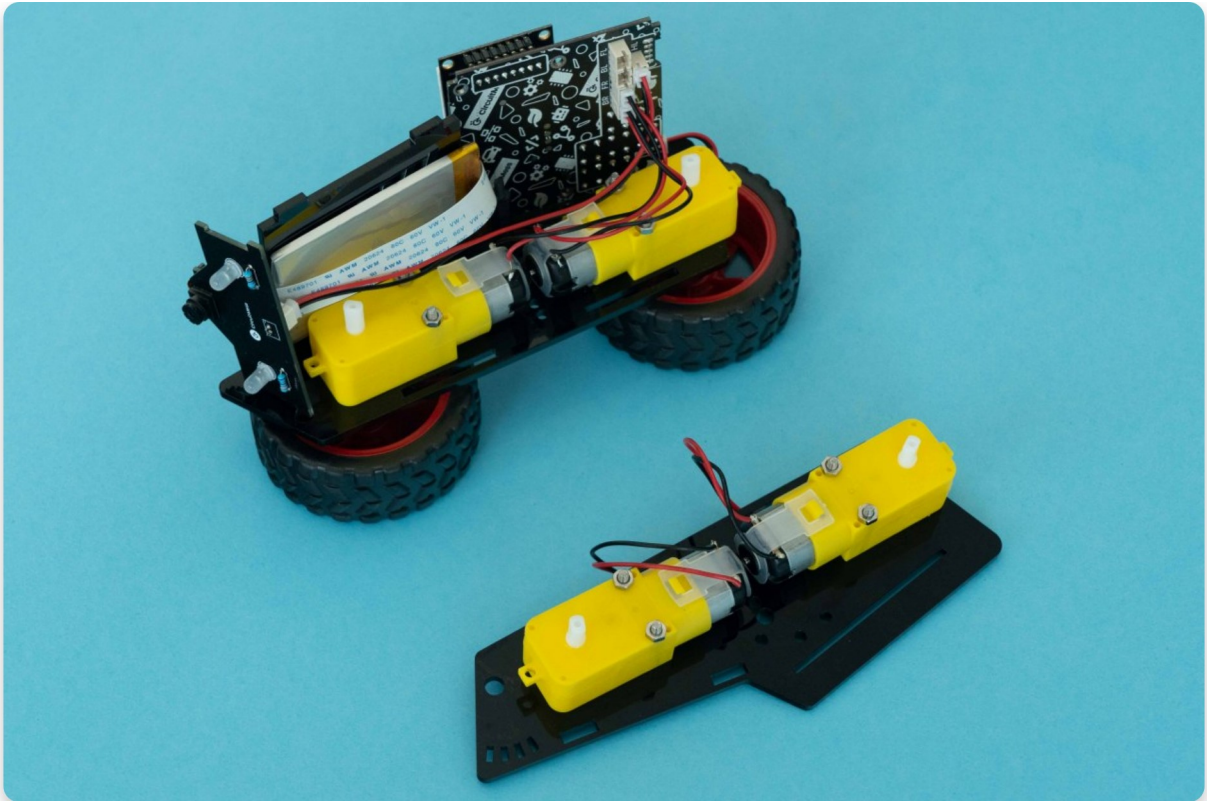


Take the **JST cable connected with the electromotor in the front** and connect it with the **JST connector labeled 'FR' (front right)**. Then, take **the other JST cable** and connect it with the **connector labeled 'BR' (back right)**.

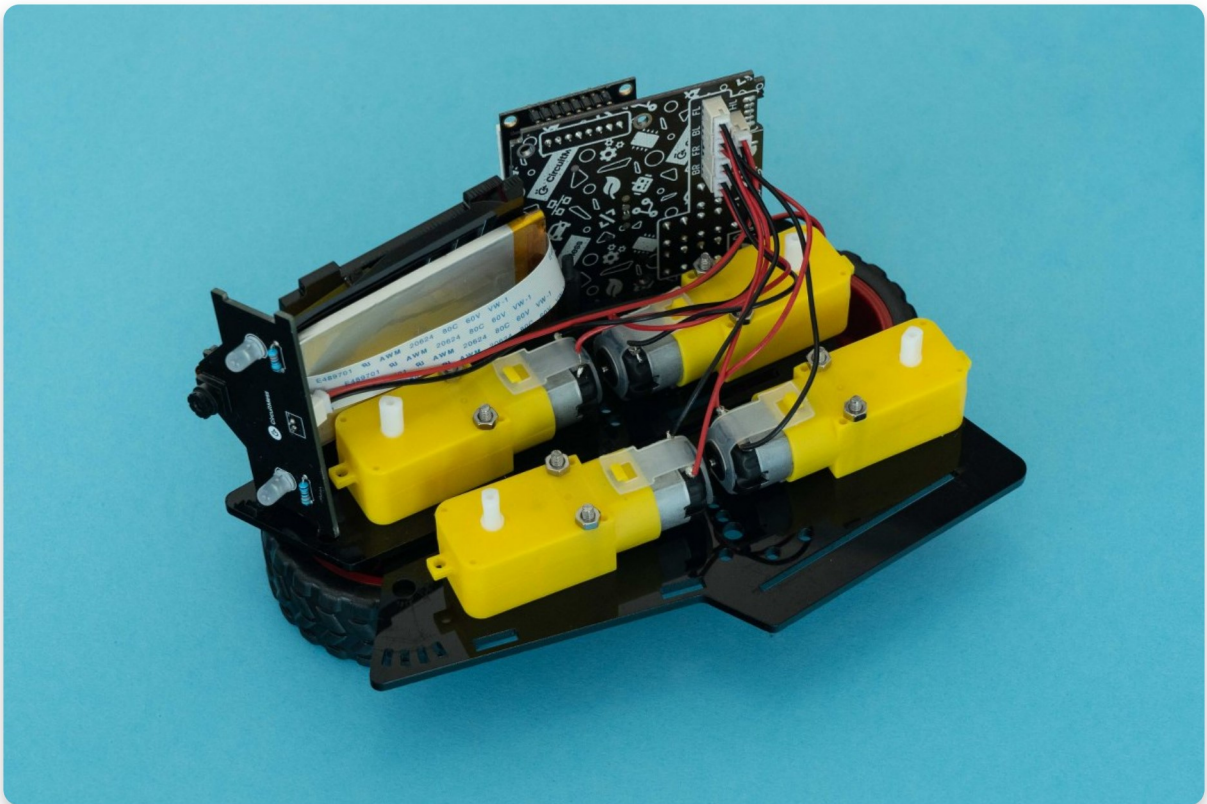


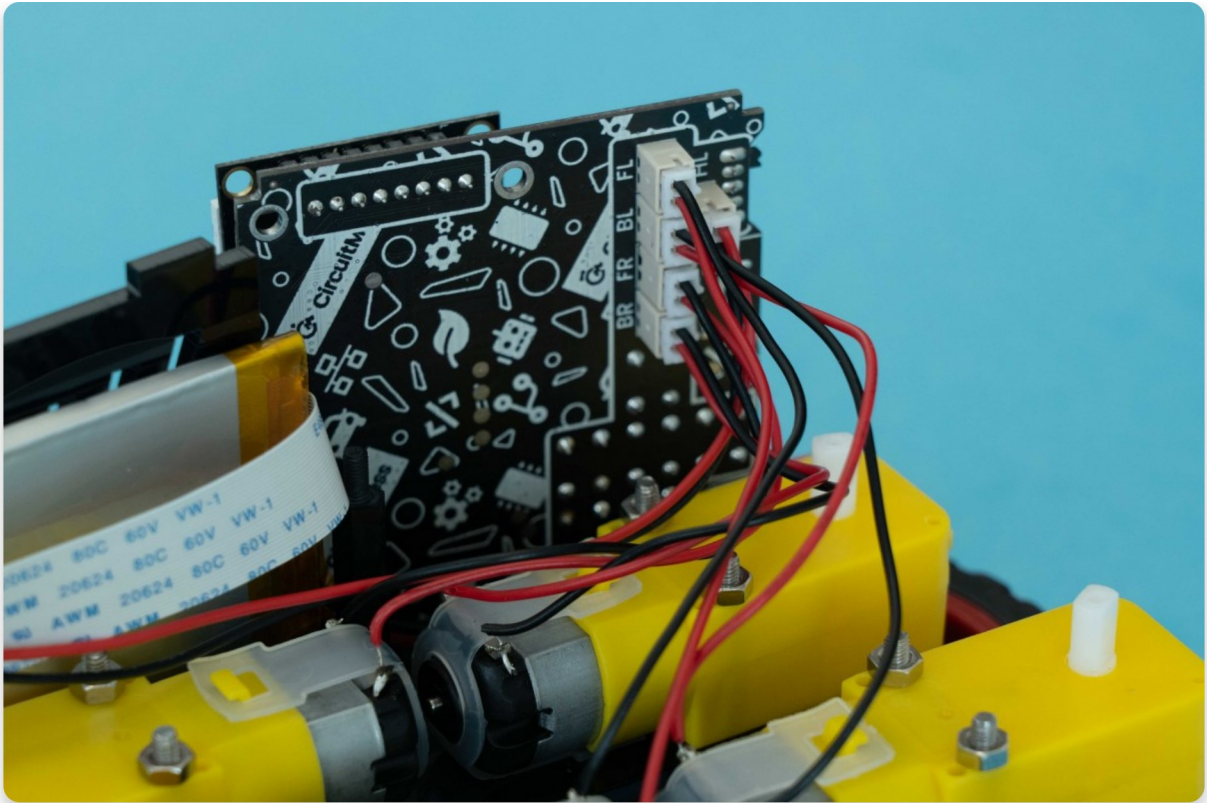
Let's connect the remaining two electromotors.

We've connected the electromotors on Wheelson's right side so it's now time to connect the ones on his left! Grab the other remaining side panel.



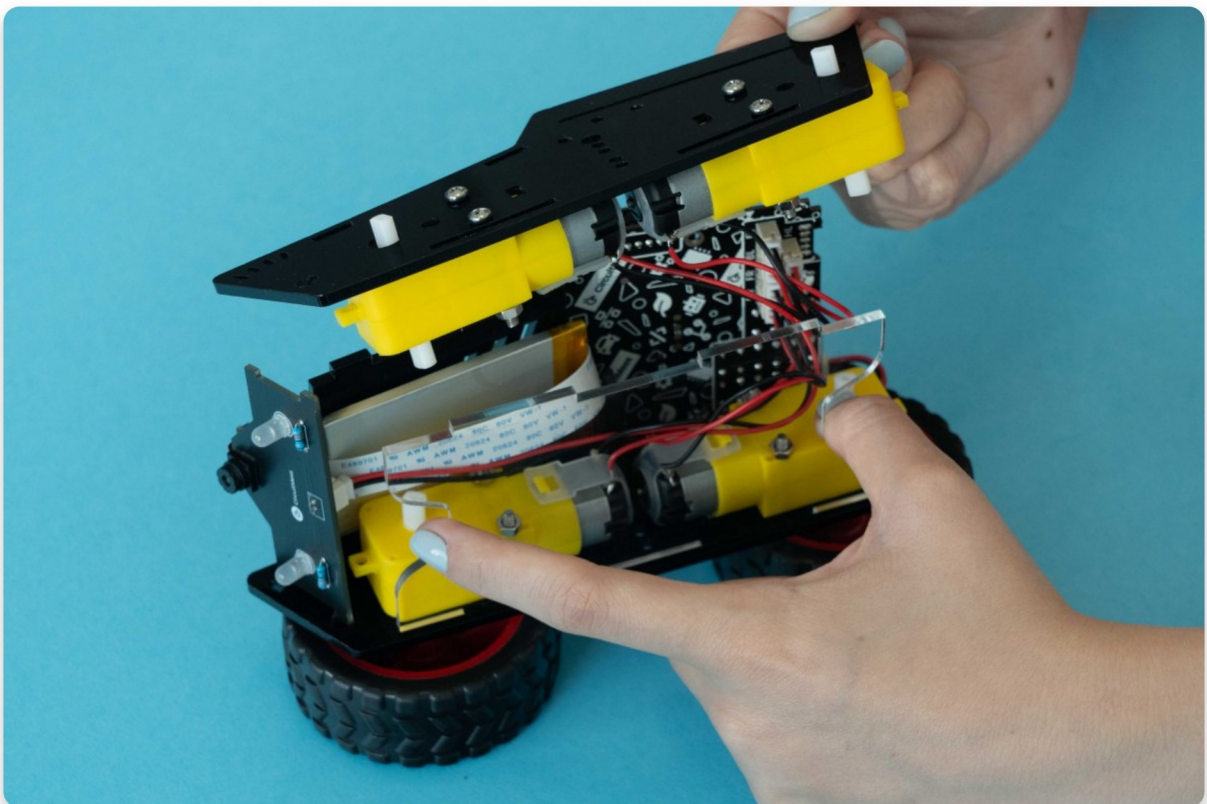
Take the JST cable connected to the **electromotor on the front** and **connect it with the JST connector labeled 'FL' (front left)**. Then, take the other JST cable and connect it with the **connector labelled 'BL' (back left)**.
This is how it should look like.





A closer look at the connections.

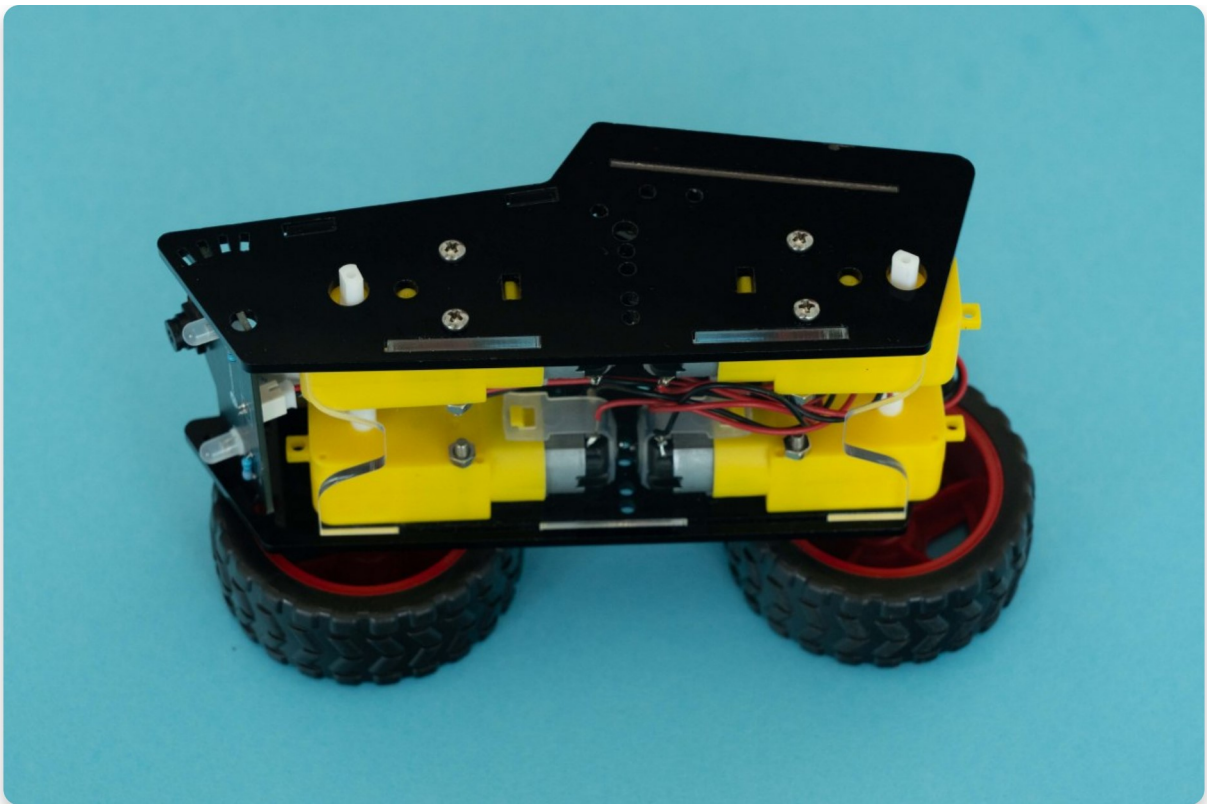
Congratulations! You're done with all the finicky parts. The only thing that's left now is to assemble Wheelson into his final form. I can't wait!



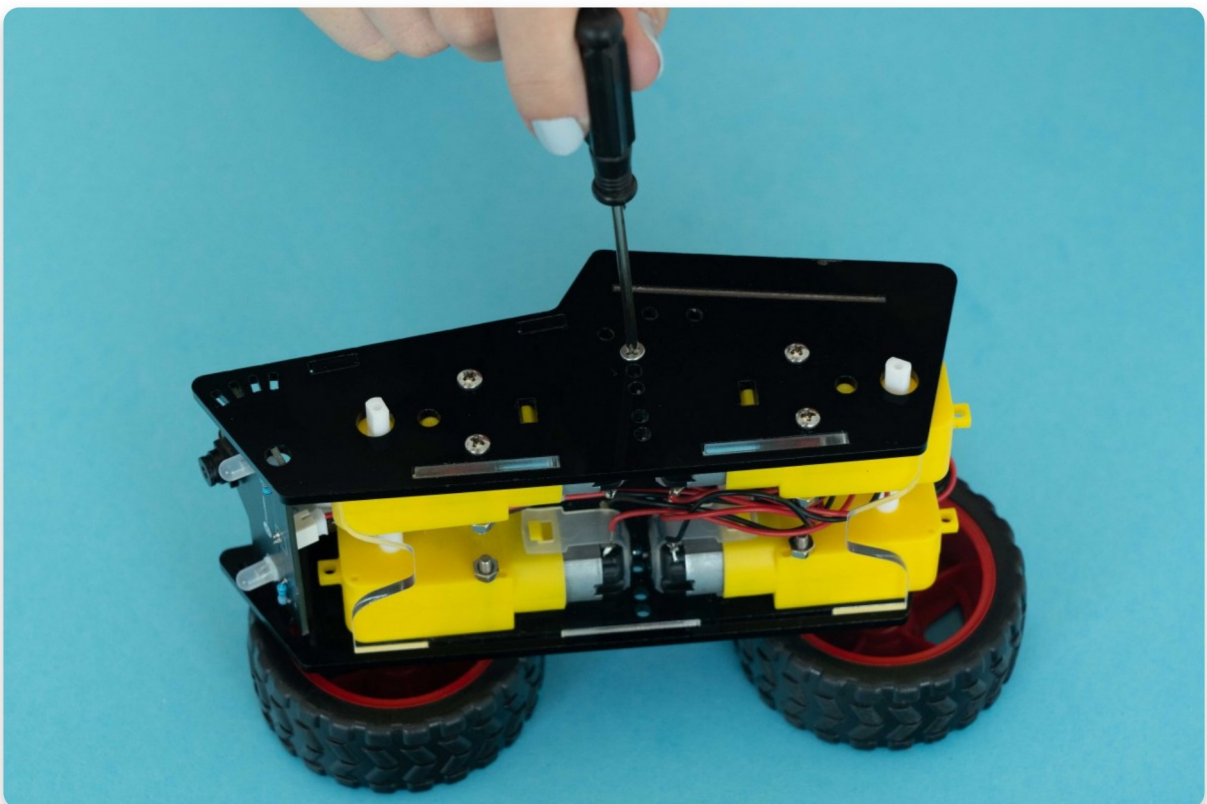
Grab the clear acrylic casing and place it right under the electromotors. You'll see two slots at the bottom of the side panels that will fit the casing perfectly – that's where the clear casing should go.

Then, take Wheelson's left side casing and place it on the top, so all the boards and pieces should fit like a puzzle. This may take some fiddling around so be patient until it all slots into place.

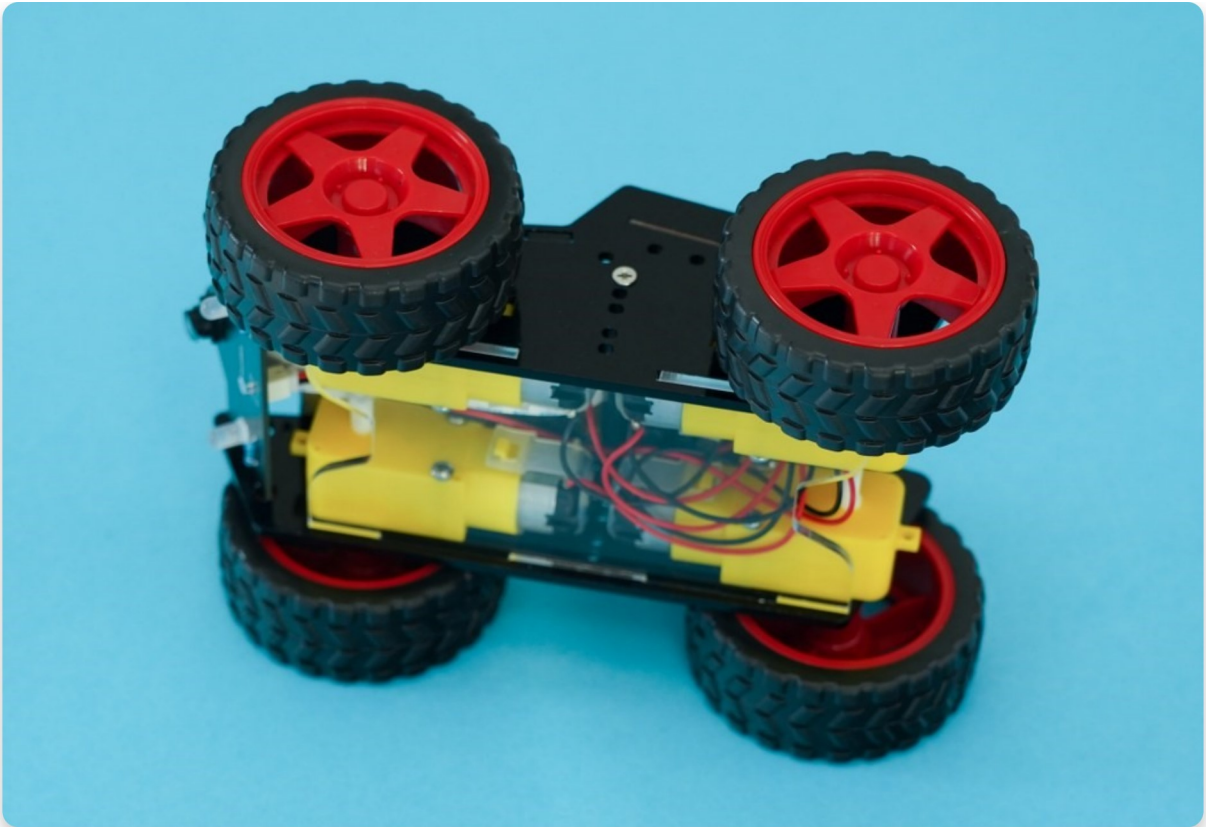
This is how it should look like:



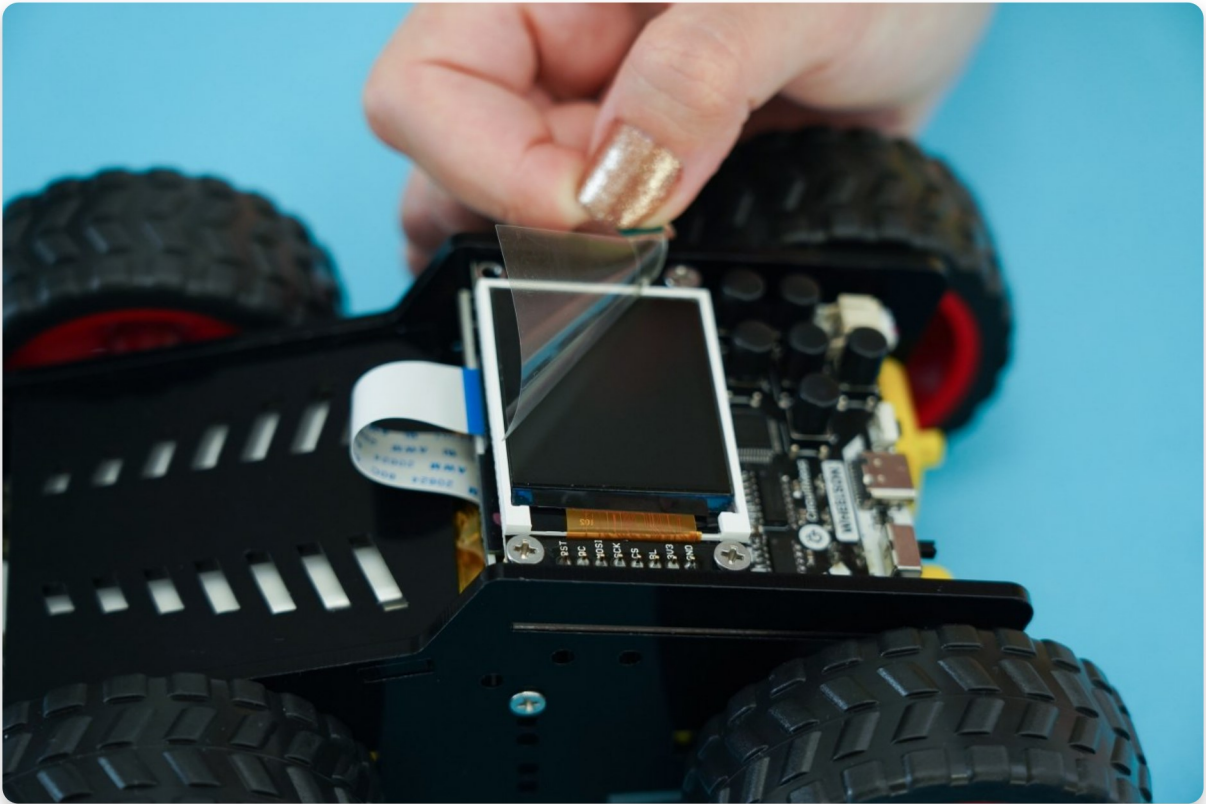
Let's secure everything in place now! Take the final small metal bolt and put it into the hole that aligns with the black nylon spacer we connected with the casing previously. Tighten it into place using a screwdriver.



We've come to the last step in the assembly process - attaching the remaining two wheels. Repeat the same process that we used before - align the wheels with the white plastic tubes and push until the wheels click into place.



Now, there's only one thing left to do. Remove the protective layer from the screen and the camera. The fun part!



Remove the protective layer from the screen.



Remove the protective layer from the camera.

And that's it – you've reached the end of the build guide. Your Wheelson is now fully assembled and ready to go!

Remember!



Make sure you turned off your soldering iron! Unplug it from the power source, place it on the soldering iron stand and let it cool off for at least 5 minutes before you put it away in your tool box.

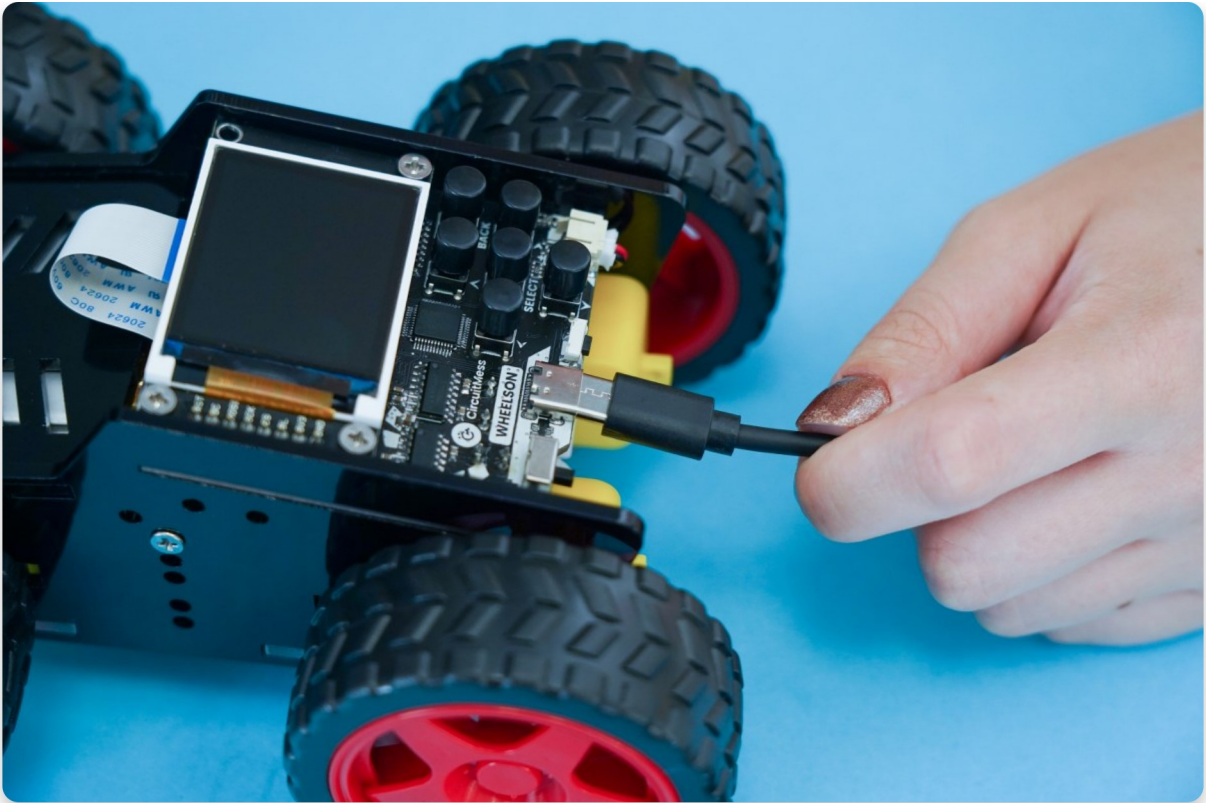
What's next?

How to charge Wheelson

You did an amazing job assembling your Wheelson and putting all the components together! Let's find out how to charge Wheelson's battery.

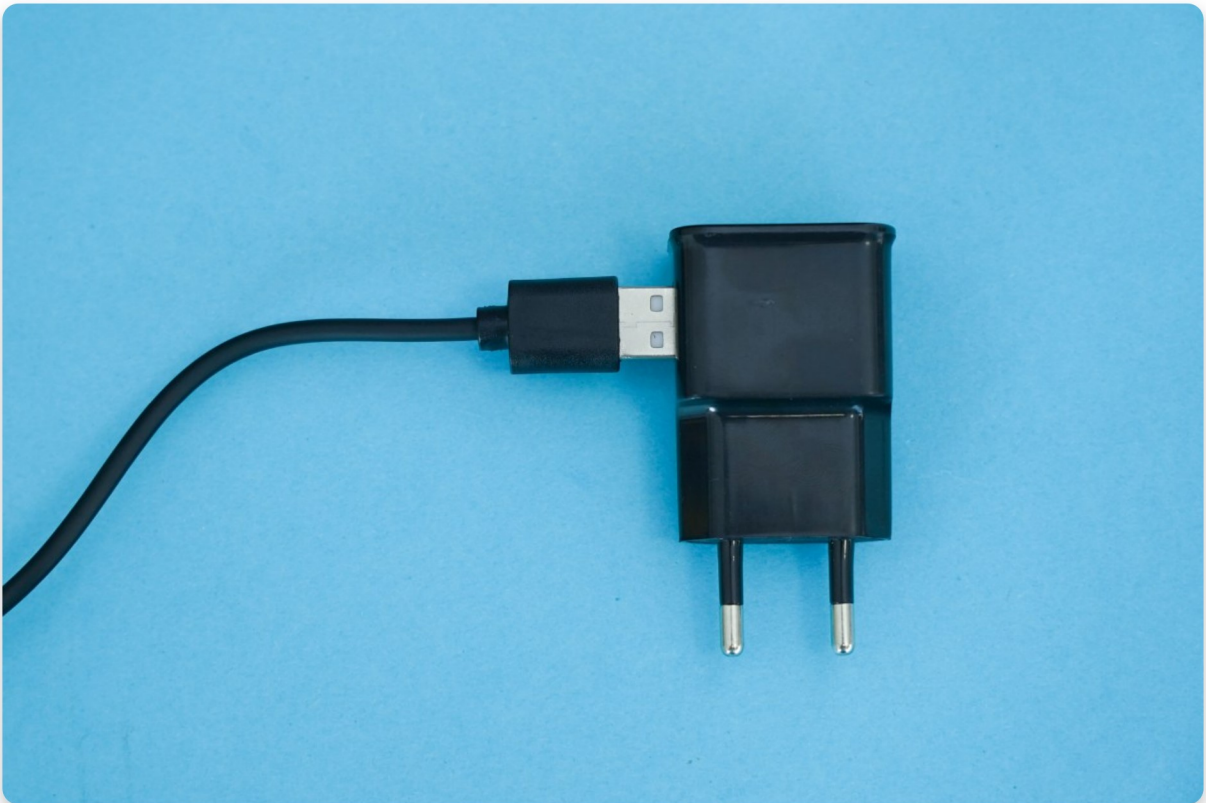
In this chapter, we'll show you how to charge your Wheelson – he needs fuel, right?

1. Connect the USB micro cable to your Wheelson.



Connect the USB micro cable to Wheelson

2. Connect the USB end of the cable to a power adapter.



3. Plug the power adapter into a power source like a power socket.

That's it, you're done - nothing too complicated. Your Wheelson is now charging and he'll be ready to drive in no time.