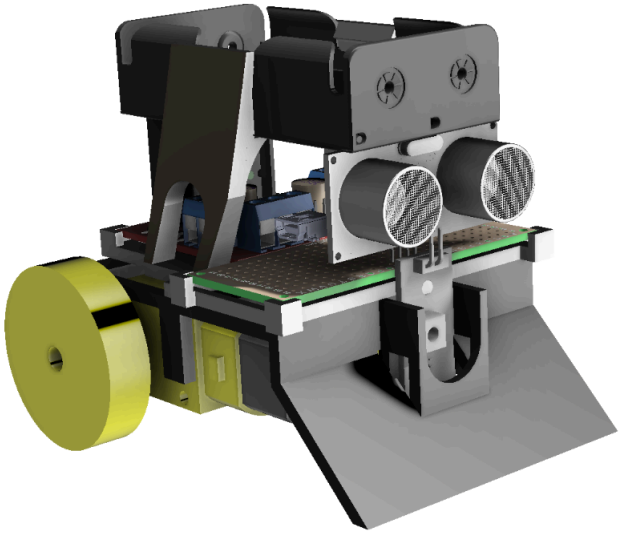
CRF Sumo-bot



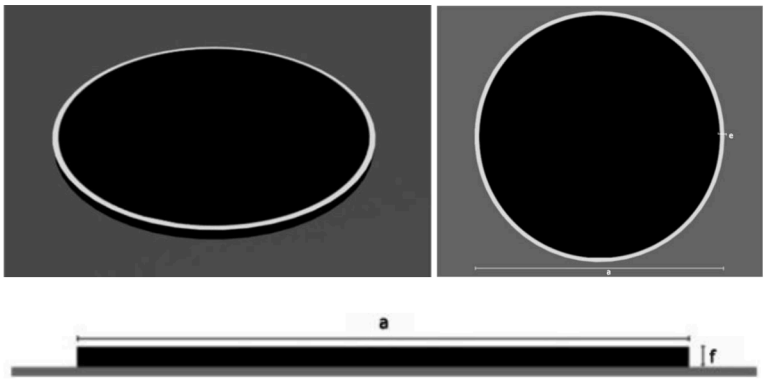
Background

The name ”sumo” is from an old Japanese sport consisting of two opponents fighting in a ring where the goal is to push each other out. In robot sumo, two robots are competing against each other trying to do the same thing.

Sumo is divided into several classes with specific weight and measurements. This kit is for a “mini” sumo. With rules:

1. Maximum outer dimensions: 10x10 cm
2. Maximum weight: 500g
3. The robot shape could be changed after start.
4. Must be self-controlling.

The contest ring is designed in a certain way for each class and have two colours. Black with a white frame. Contest ring, also called “The Doyho”



Link to Robot SM rules

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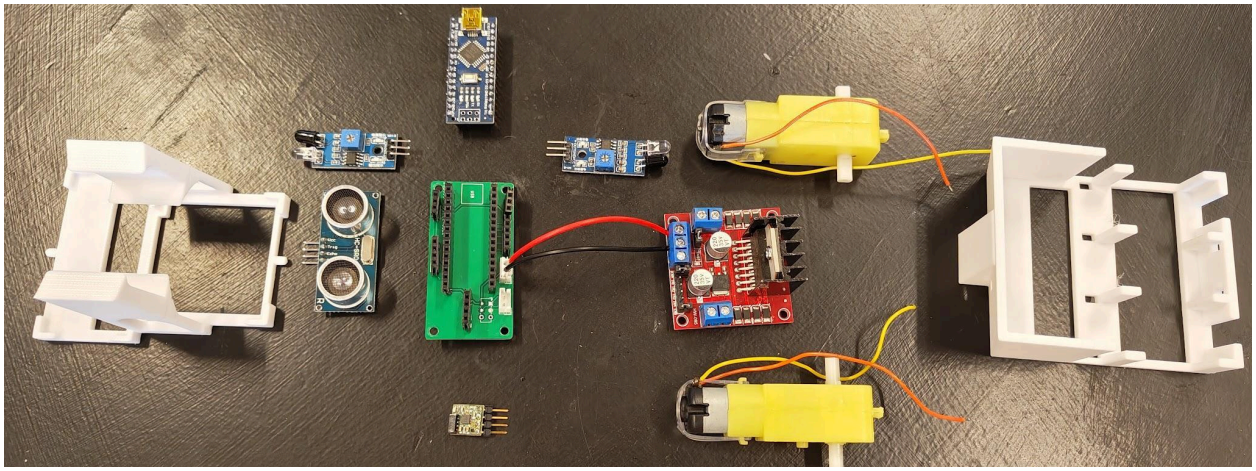
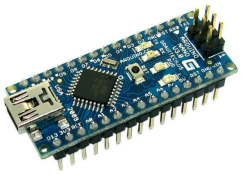
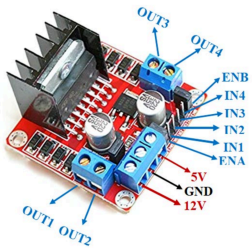
Build guide - Components

Overview of components:



Arduino Nano (copy) Main board micro processor which is controlling all parts with code.	
DC motor with wheel x2	
Motor driver L298N Dual H bridge Provides constant voltage to the motors and can be controlled with the Arduino	
Ultrasonic sensor HC-SR04 Measuring distance with sound and is used to locate the opponent.	

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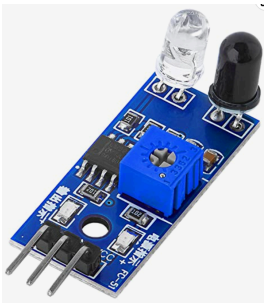
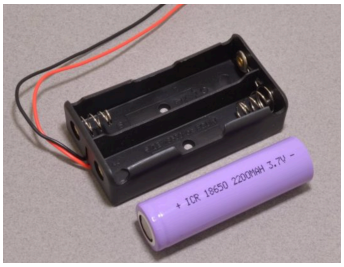
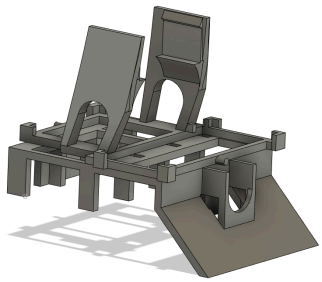
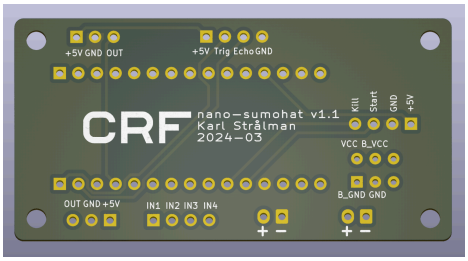
IR sensor TCRT5000 Makes the robot able to spot if it is on the black or white part of the contest ring.	
Lithium battery 18650 x2 Supplies Arduino and motor driver with voltage.	
Jumper wires (Dupont) Some wires between different parts of the robot.	
3D-printed frame Holds the sumo-bot together	
PCB / breakout circuit board	
Wheels	<Insert image of wheel here>

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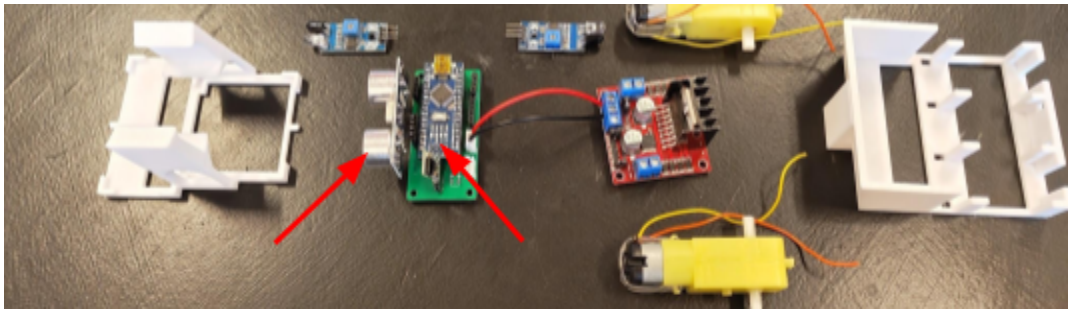
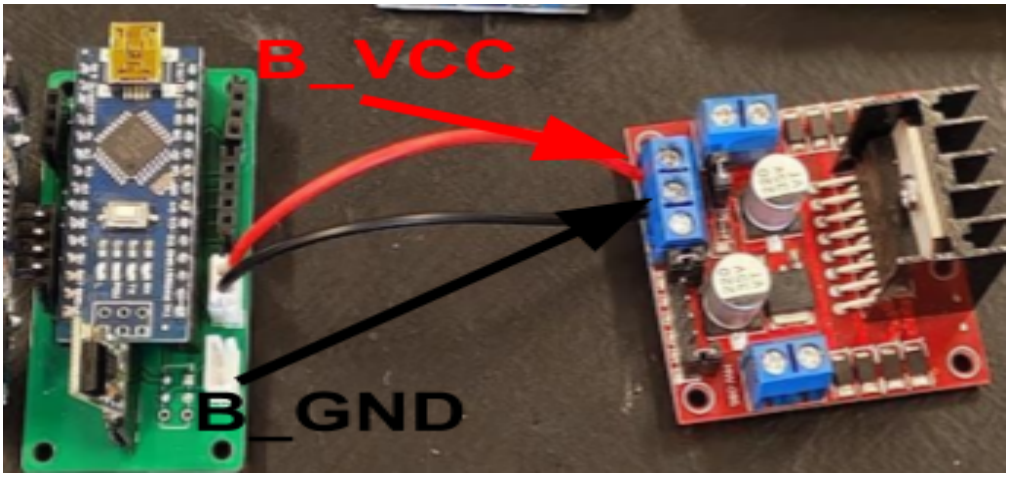
Building guide - step-by-step

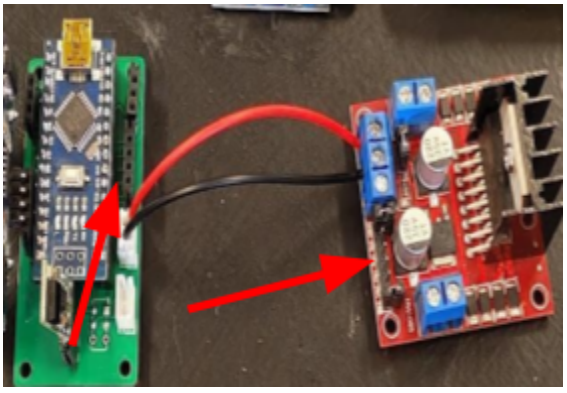
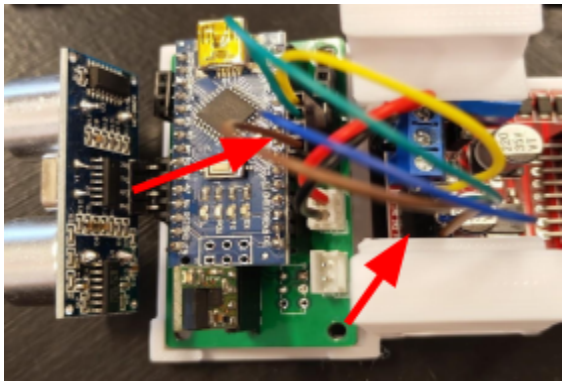
1. **Install the Ultrasonic sensor and Arduino Nano (Blue microprocessor board)**



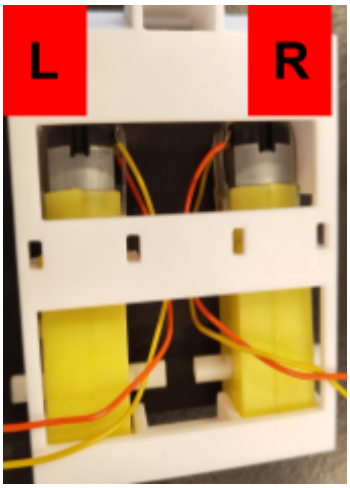
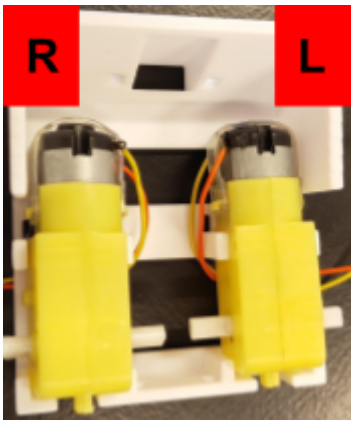
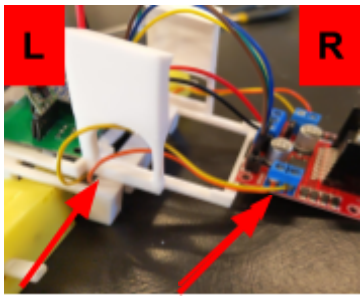
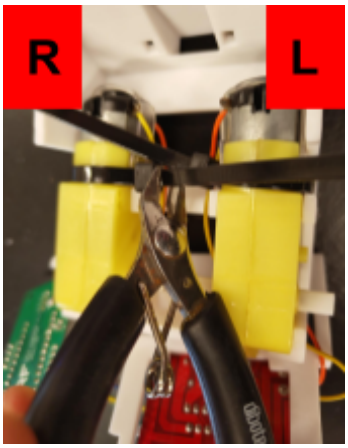
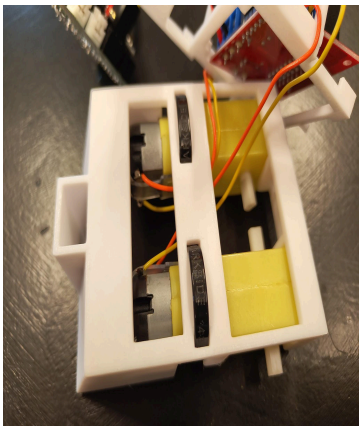
2. **Install Battery power wires from breakout board(Green PCB) to H-bridge (Red PCB)**



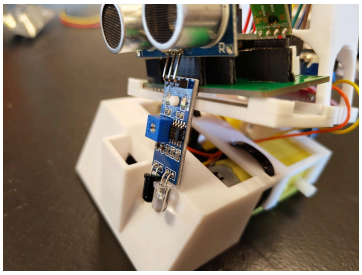
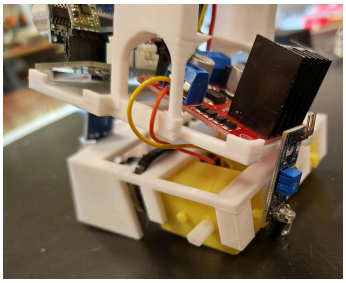
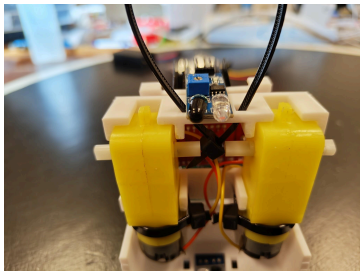
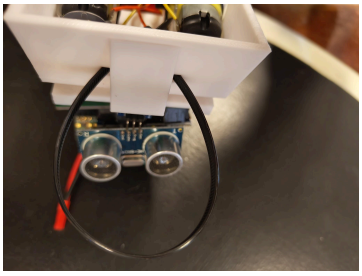
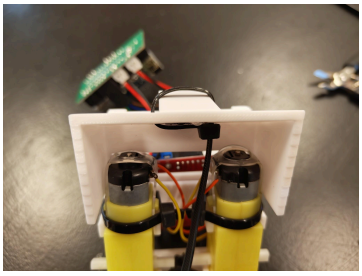
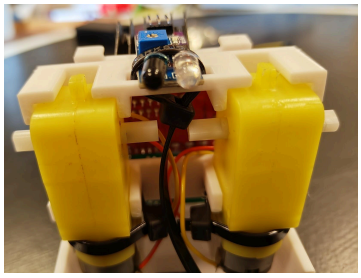
3. **Install jumper wires between H-bridge and Arduino nano.**

	
IN1 on Arduino should connect to H-bridge IN1 and so on	IN1 - IN1 IN2 - IN2 IN3 - IN3 IN4 - IN4

4. **Install motors to H-bridge.**
(Motors are labelled with left (L) and right (R) to make it easier to follow 🙂)

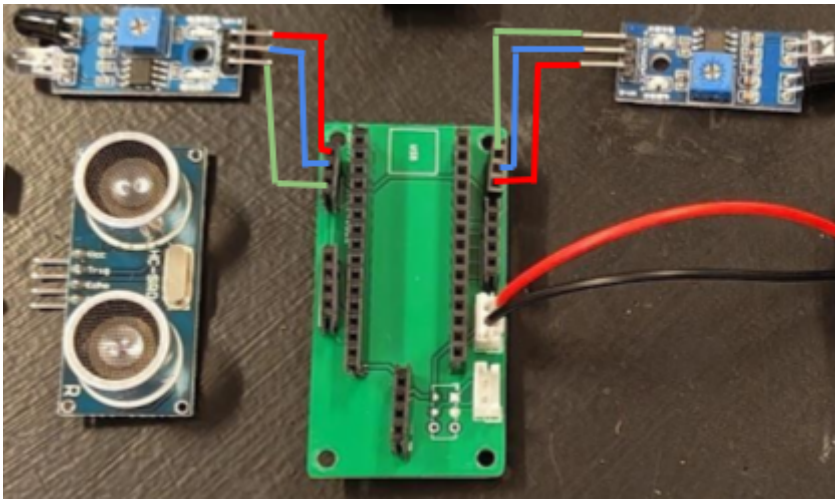
		
1. Top side view	2. Bottom side view	3. Make sure cables go through top frame's hole and is inserted and tightened in the screw terminal on the H-bridge
		*This table cell is intentionally left blank*
4. (Bottom side view) There are holes for zip ties to go through to fasten the motors to the bottom part of the case.	5. Installed and fastened motors should look like this.	*This table cell is intentionally left blank*

5. Install IR sensors

		
1. Insert the IR sensor on the front like this, friction fit	2. The back sensor is inserted similarly	3. Fasten the back IR sensor with a zip tie using the frames dedicated holes
		
4. Fasten the front IR sensor with a zip tie in the dedicated holes	5. Make sure the zip tie lock is placed on the inside of the frame	6. The zip tie lock for the back sensor should also be placed on the inside

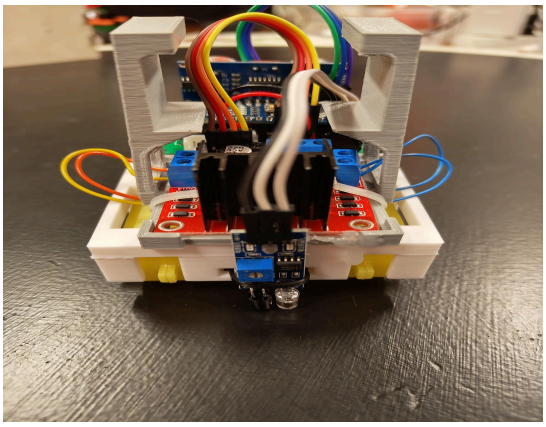
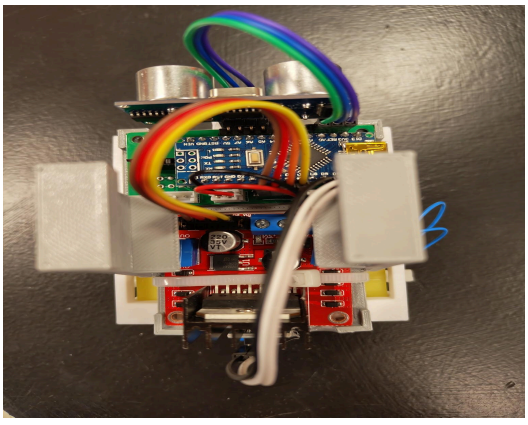
6. **Install the jumper wires between the Arduino and IR sensor**

Jumper wires should be installed according to the following image & table:

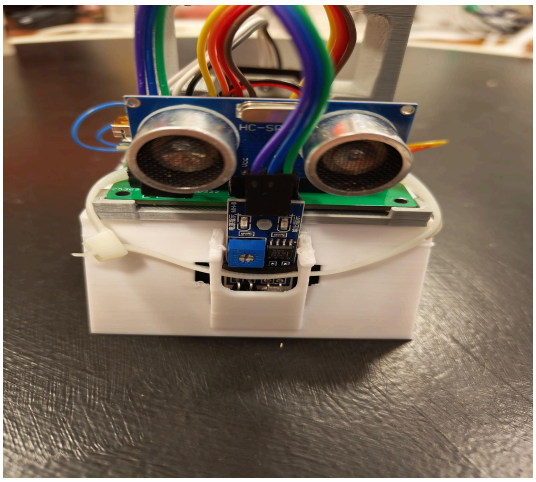
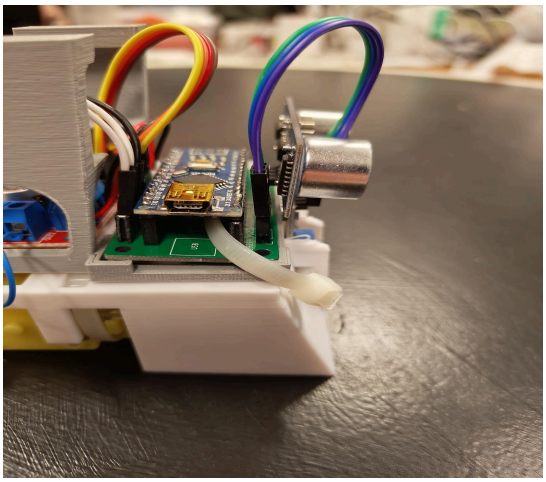


IR Sensor	Arduino pin
VCC	+5V
GND	GND
OUT	OUT

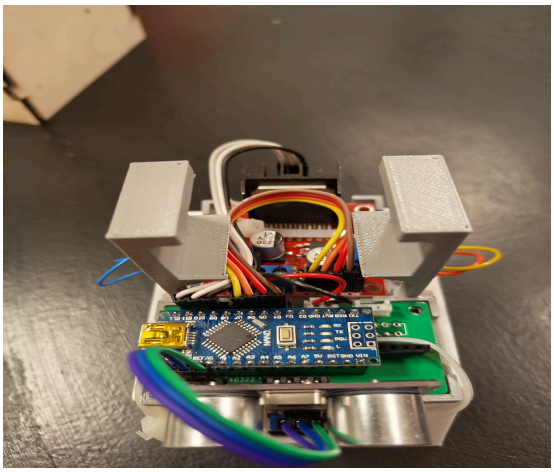
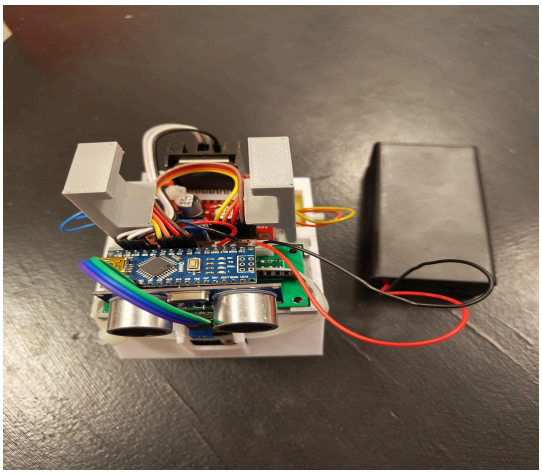
7. **Fasten the H-bridge with a zip tie.**

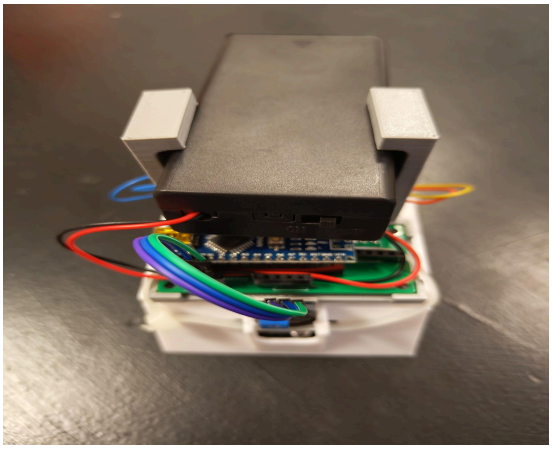
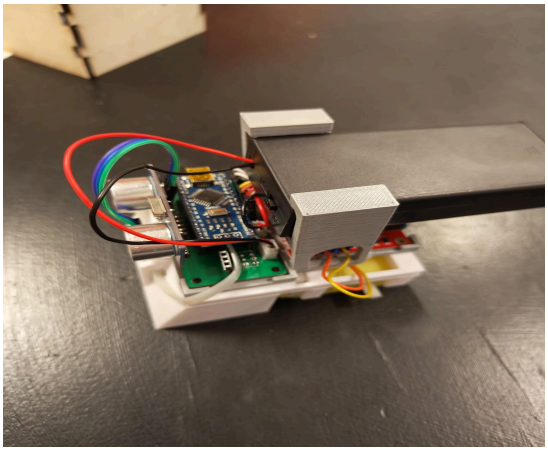
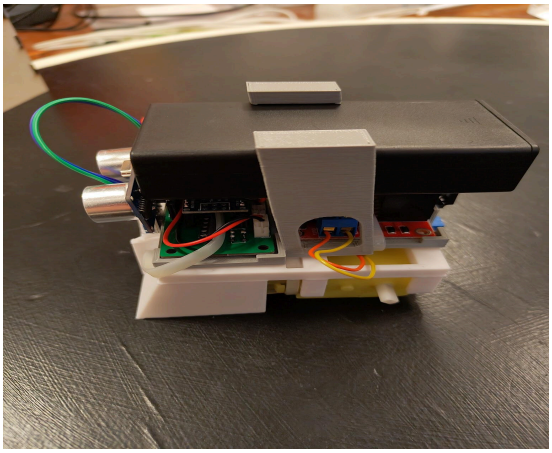
	
Make sure the zip ties do not cover the motors	

8. **Fasten the breakout board with a zip tie**

	
Front view	Side view

9. **Add battery & battery holder**

	
Make space for battery holder by hiding the jumper wires	Plug in power cables from battery holder

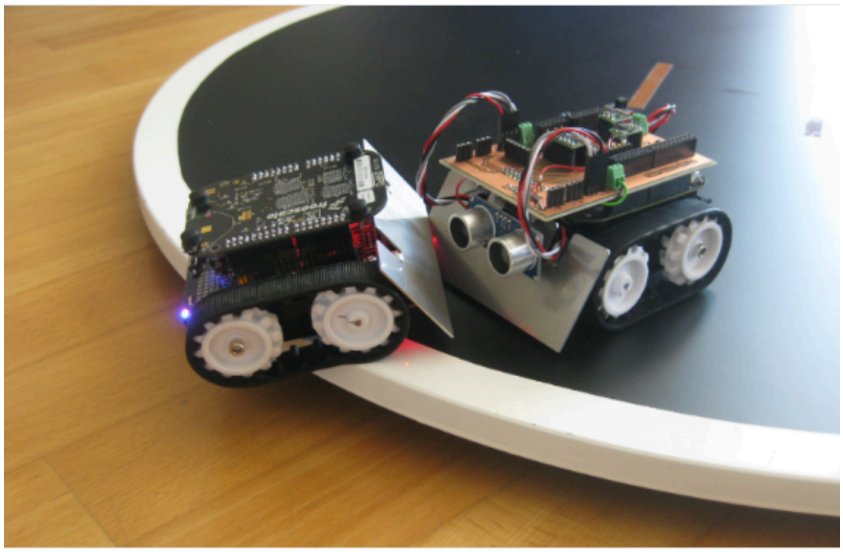
	
Hide power cables behind ultrasonic sensor	Slide in battery holder from the back of the robot
	*This table cell is intentionally left blank*
It should look like this from the side when the battery holder is fully inserted	*This table cell is intentionally left blank*

10. Install the wheels

Simple plug them into the motors and install the included screws

11. The robot kit is now finished! 🥳🎉

Continue reading on next page for a guide on how to calibrate the robot

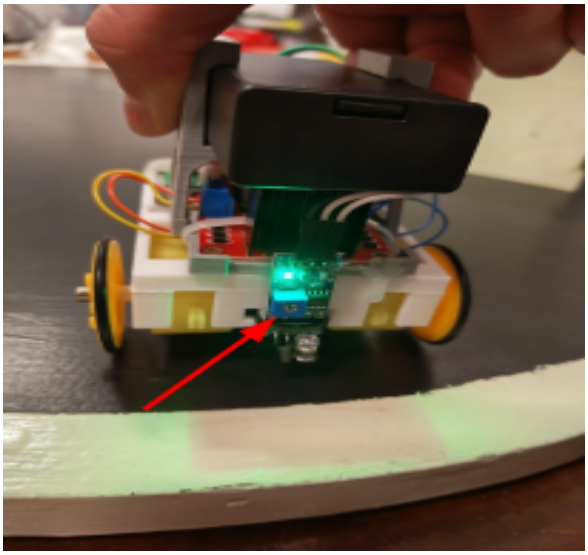
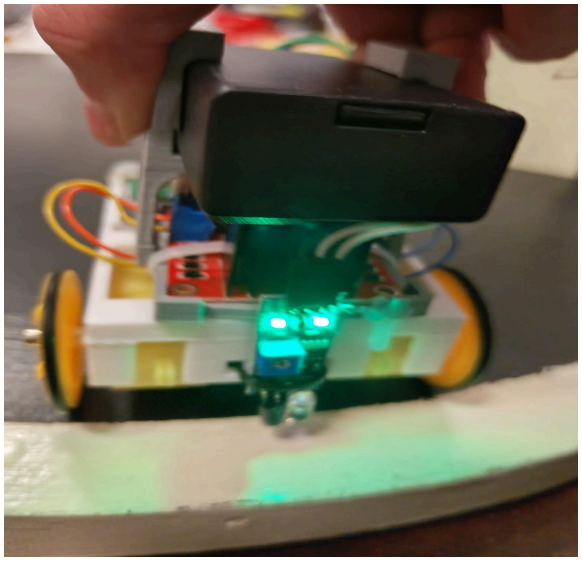


(Not the robot from this kit but you get the picture)

CRF Sumo-bot

Calibrate the sensors

Before competing, the IR sensors need to be calibrated on the contest ring.

	
Calibrate the IR sensor by screwing clockwise or counter clockwise until (red arrow). One led should be lit when the bot is on the black area	Two leds should be lit when placing the started sumo bot on the white line area

CRF Sumo-bot

Robot Strategy (Firmware)

There are loads of different strategies. The example code of this robot kit is one of the most basic:

- Five seconds after connecting power cables, the robot will start rotating.
- If the opponent is found in a given range found by the ultrasonic sensor it will attack. Which means stop rotating and going forward against the opponent and try to push it off the contest ring. If
- If the opponent moves out of the way, rotating will be applied.
- If the IR sensor in the back discovers a white line go forward, and backward if the front IR sensor detects white line.

Link to CRF-Sumo Github repository

Example code, STLs and PCB project files can be found in our github repository

CRF Sumo-bot

Making the robot competition ready

To participate in a CRF competition (for example Robot SM) you will need to install a start module. CRF will lend this out during competition. But for testing purposes use a 5 second delay in the code.

- Code with start module

```
void waitStartSignal()
{
  while (digitalRead(pin[SIG_START]) != HIGH)
  {
        Serial.println("Waiting for start signal");
  }
}
```

- Code without start module

```
void waitStartSignal()
{
   // Comment intentionally added
}
```

There is also an alternative to changing the code. Connect “+5V” directly to “Start” to bypass the need of having a start module.