LANDJE ROBOT KIT PREPARATION

Introduction

This guide documents the parts and tools to be purchased to create a complete Landje robot kit. Part of the preparation is assembling the wiring looms and preparation of the led and its wiring. If you have completed this guide the kit will assemble the picture below.

Part list

Hardware

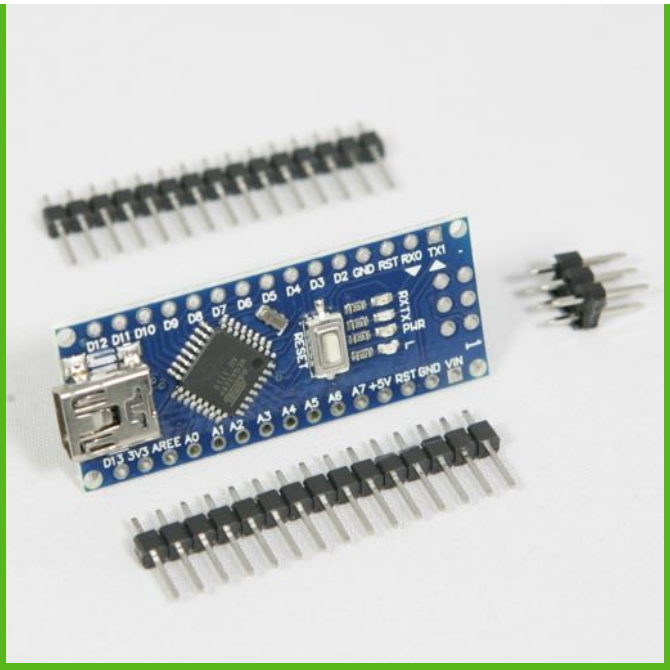
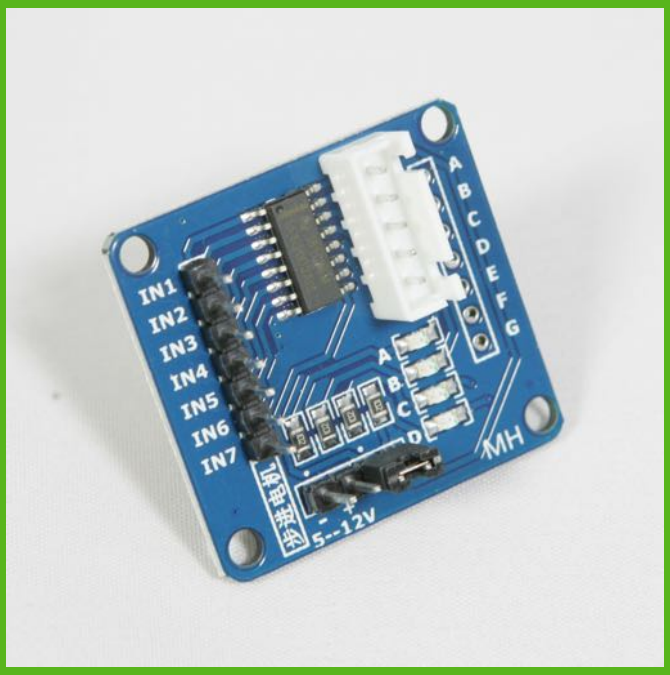
Qty	Article	Details	Est. price
4	Philips head self-tapping micro screws. M3.5x6	 AliExpress	€ 0,13

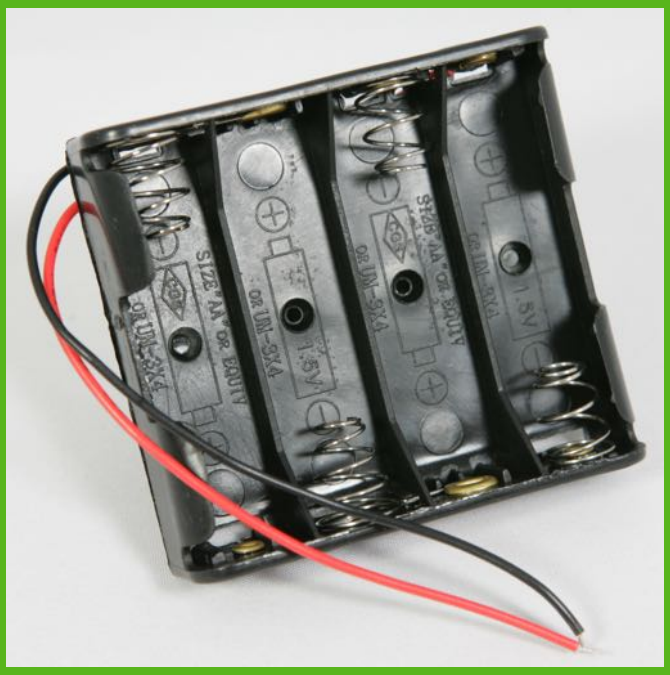
10	Philips head self-tapping micro screws. M2.6x4	 AliExpress	€ 0,28
4	Philips head self-tapping micro screws. M1.7x8	 AliExpress	€ 0,14
4	Philips head self-tapping micro screws. M1.7x4		€ 0,12

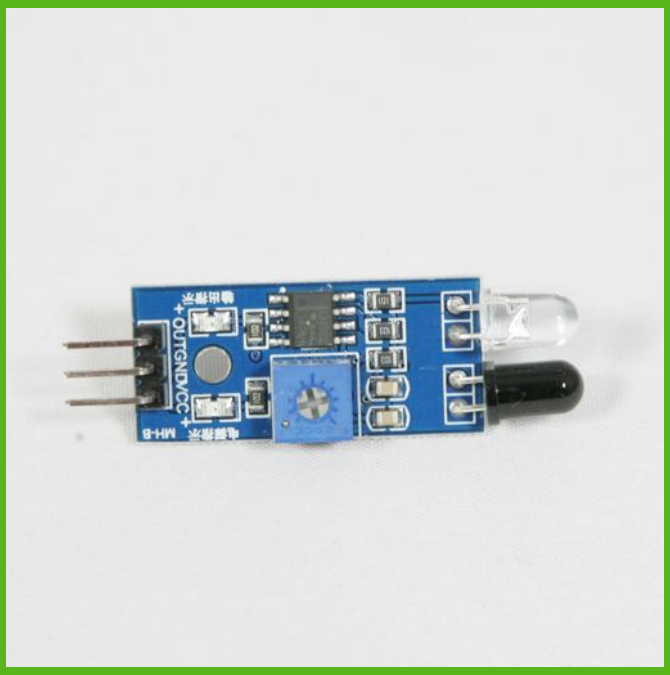
		 AliExpress	

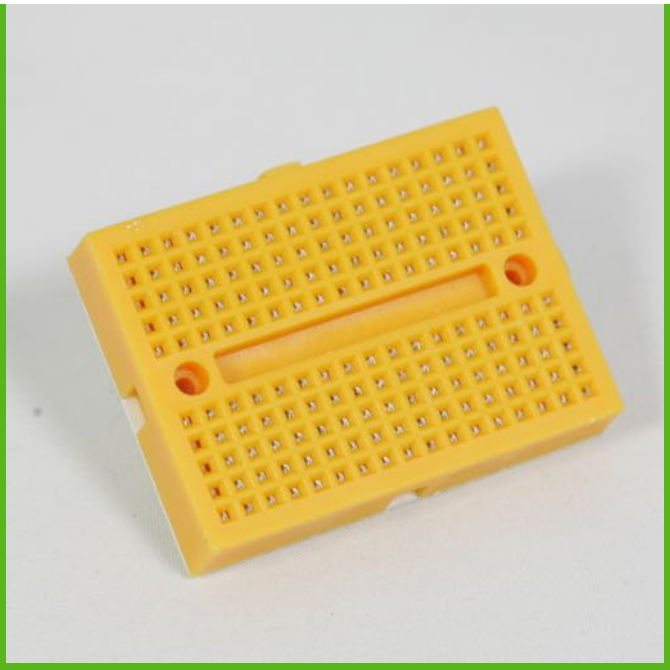
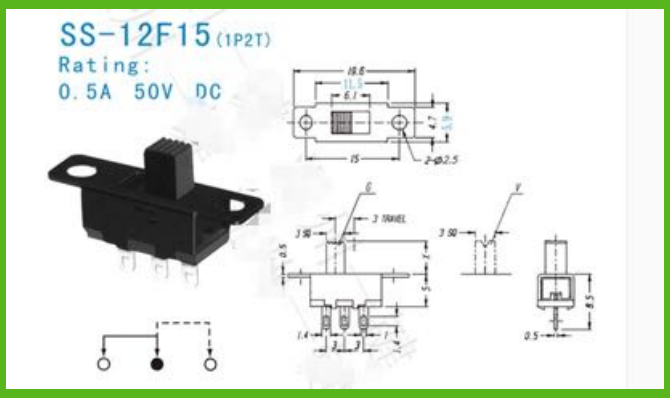
Electronics

Qty	Article	Details	Est. price
1	Tower pro SG90 RC Micro Servo 9g	 AliExpress	€ 1.05

1	Arduino Nano 3.0 CH340 USB driver 16 Mhz	 AliExpress	€ 2,00
2	ULN2003 Stepper Motor Driver Board SMD	 AliExpress	€ 1,16
2	28BYJ-48-5V Stepper motors		€ 2,28

		 AliExpress	
1	AA Power Battery Storage Case Plastic Box Holder With 4 Slots	 AliExpress	€ 0,40

1	1/6W Metal Film Resistor 220Ω	 AliExpress	€ 0,01
2	IR Infrared Obstacle Avoidance Sensor Module	 AliExpress	€ 0,90

1	SYB-170 Mini Solderless Prototype Breadboard	 AliExpress	€ 0,45
2	5mm Height Knob 3 Pin 2 Position 1P2T SPDT Panel Slide Switch 0.5A	 	€ 0,16

		AliExpress	
2	Dupont connector 3 pin single row 2.54 mm	 AliExpress	€ 0,03
5	Dupont connector 4 pin single row 2.54 mm	 AliExpress	€ 0,08

26	Dupont connector 1 pin single row 2.54 mm	 AliExpress	€ 0,31
22	Dupont connector reed 2.54 mm metal terminal female	 AliExpress	€ 0,30

29	Dupont connector reed 2.54 mm metal terminal male	 AliExpress	€ 0,50
6	Different colors of 26AWG Silicone Wire Red, Black, Blue, Green, Yellow, Purple	Buy 2 boxes of Striveday 26AWG Silicone Wire. Sufficient to build a colony of robots Each robot requires about 1.5m wire.	€ 0,50

		 AliExpress	
1	Ultrasonic Module HC-SR04 Distance Measuring Transducer Sensor	AliExpress	€ 0,80
1	5mm(4.8mm) Red straw hat LED	 AliExpress	€ 0,02

1	USB Cable		

Miscelleanous parts

Qty	Article	Details	Est. price
2	O-Ring 36mm	Buy some Plastic Robot Chassis Wheels with Rubber Band and discard the wheel.  AliExpress	€ 0,59
1	2cm length 4MM heat shrink tube	 AliExpress	€ 0,01

8	100mm x 2mm wire zip ties	 AliExpress	€ 0,11
1	12mmx2mm Stainless Steel Round Rod Axle Bars for RC Toys	 AliExpress	€ 0,01

3D printed parts

I developed the 3D printed parts using Tinkercad and an Ultimaker 3 printer. Because results of the printed parts may slightly differ per printer and the used parts may change over time you may need to adopt the design of the parts. Therefore the designs are freely available on Tinkercad in the project TinkercadProjectName. The STL files can be directly downloaded from the STL folder in the Github repository. An optimal Curaprofile can be dowloaded also from the UM3 folder when printing on an UM3 with PLA and PVA as support material.

Qty	Article	Details	Est. price

1	Frame	Requires about 77g PLA and 86g PVA	€ 16,03
1	Head	 Requires about 14g PLA and 13g PVA	€ 2,69
2	Wheel	 Requires about 6g PLA and 2g PVA	€ 0,72
1	Tail wheel		€ 0,07

		 Requires about <1g PLA and 0g PVA	
1	Tail wheel steering arm	 Requires about <1g PLA and 0g PVA	€ 0,07
1	Screw organizer		€ 0,24

		 Requires about 3g PLA and 0g PVA		

Tools

Qty	Article	Details	Est. price
1	PH00 1.5	Philips PH00 1.5 screwdriver	€
1	PH1	Philips PH1 screwdriver	€

Assembly tools

For the kit preparation some more and some less general available tools are required

- A small side cutter
- A heavy duty side cutter
- A pair of small straight pliers
- Solder station
- Tin/Lead 40/60 solder
- 3D Printer

KIT PREPARATION INSTRUCTIONS

Cables

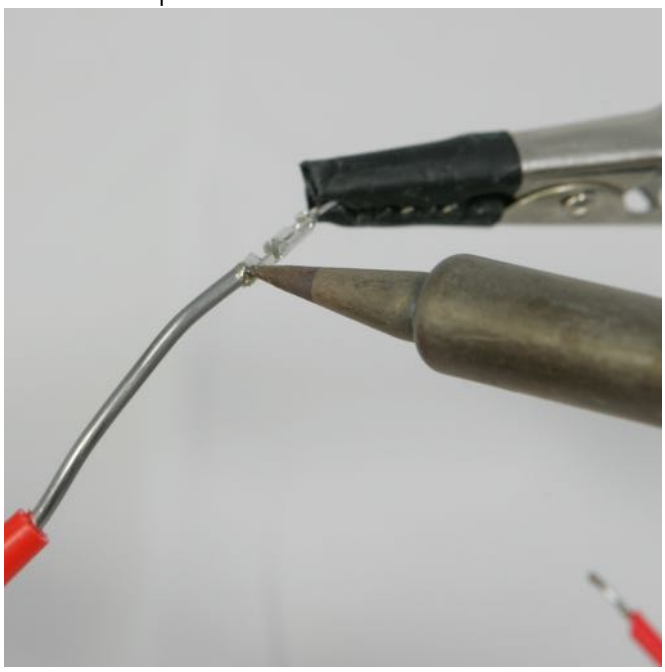
In the next images all wiring looms which need to be assembled are documented. I do personally have bad experience with Dupont crimping pliers and prefer to solder to wires to the Dupont connectors. Soldering, although it requires a steady hand, is not heard and needs a little bit of practice.

Soldering Dupont wires

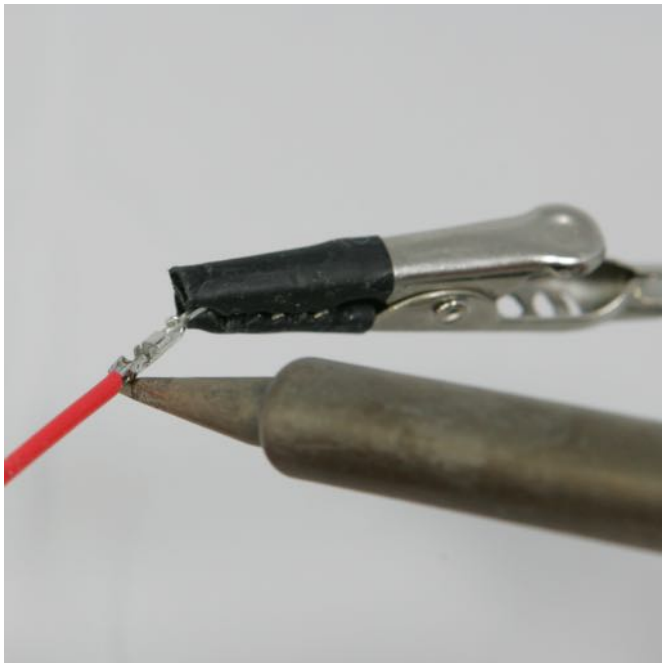
Cut of the fold-over wings

Strip the cable-end about 2mm and tin it

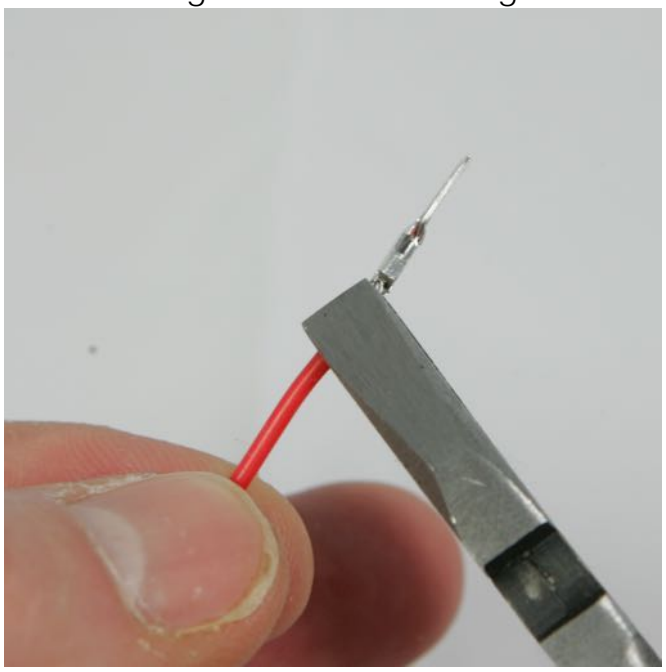
Tin the Dupont connector

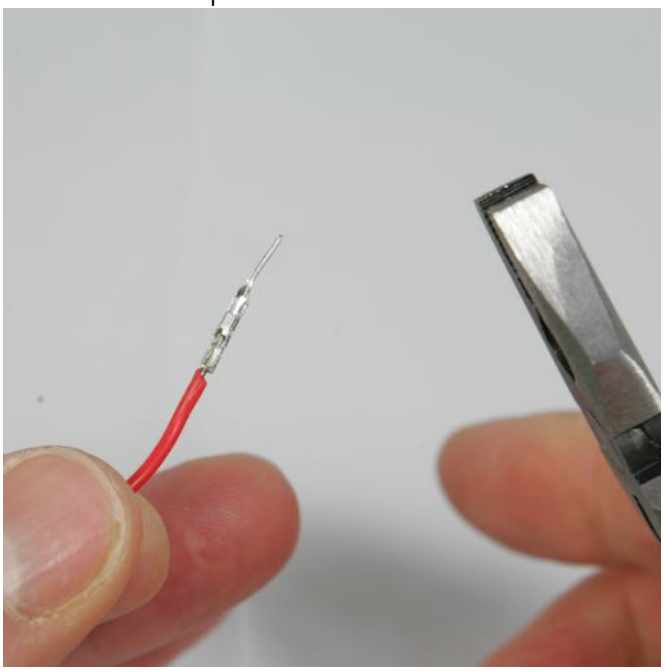


Solder the wire to the connector.



Fold the wings over the wire using a combination or radio plier

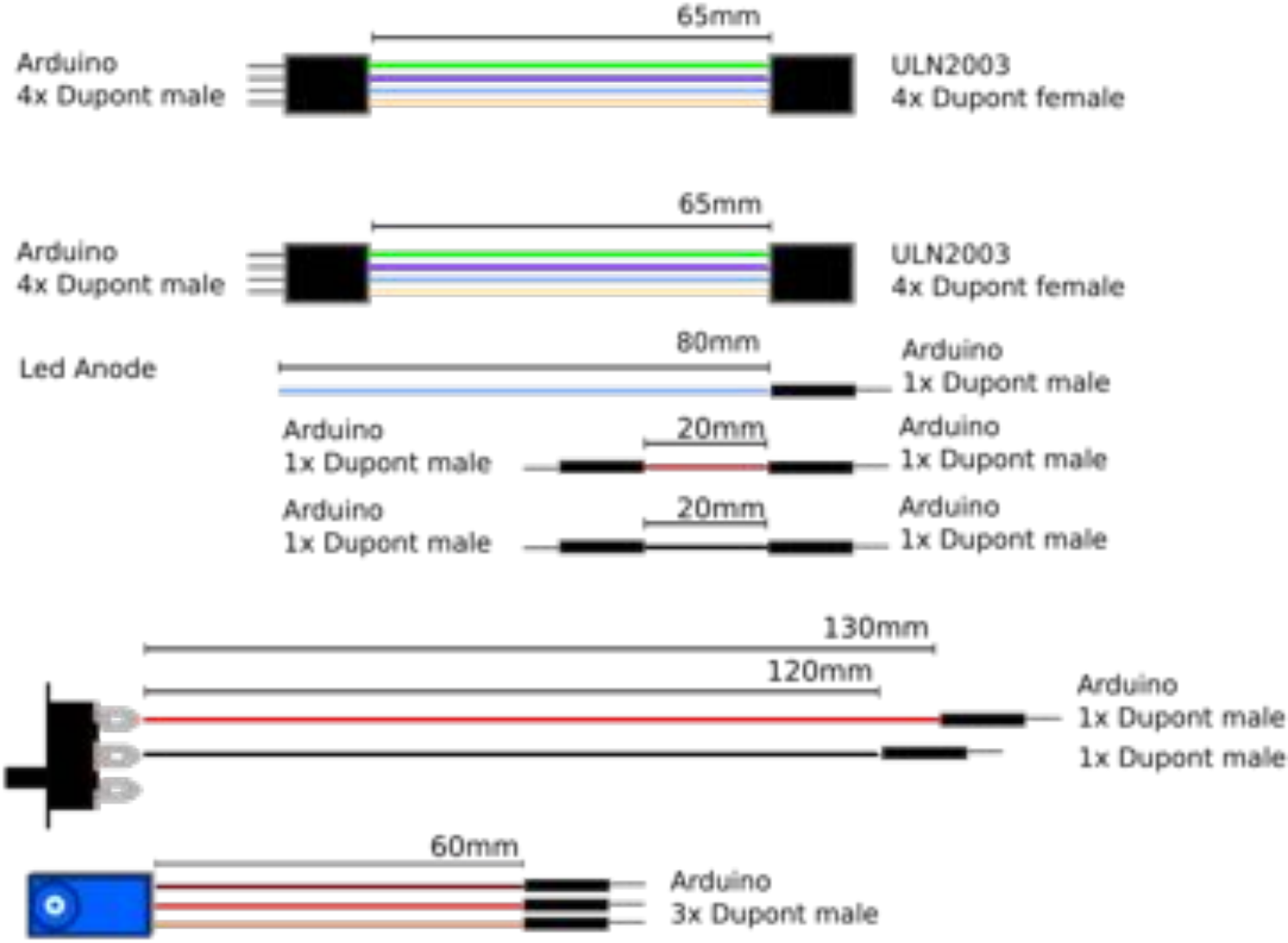


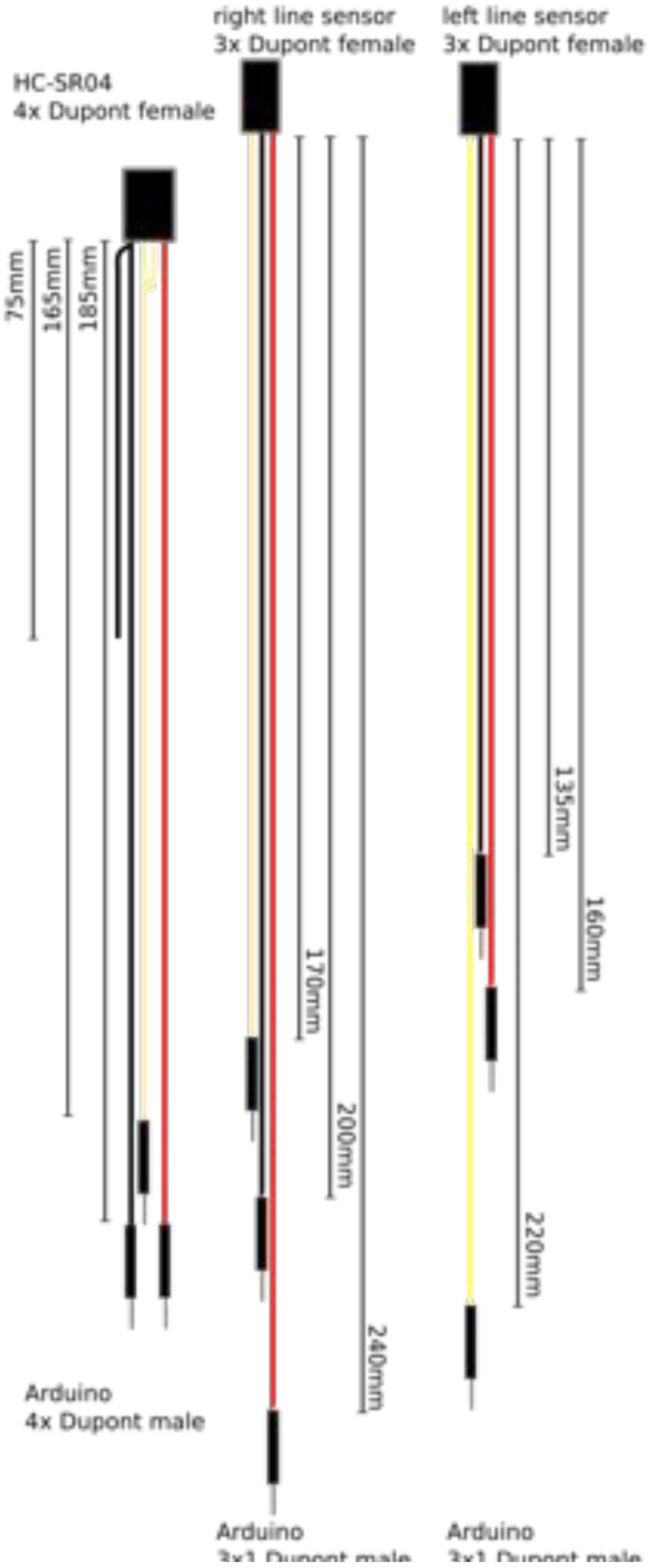


Wiring loom set

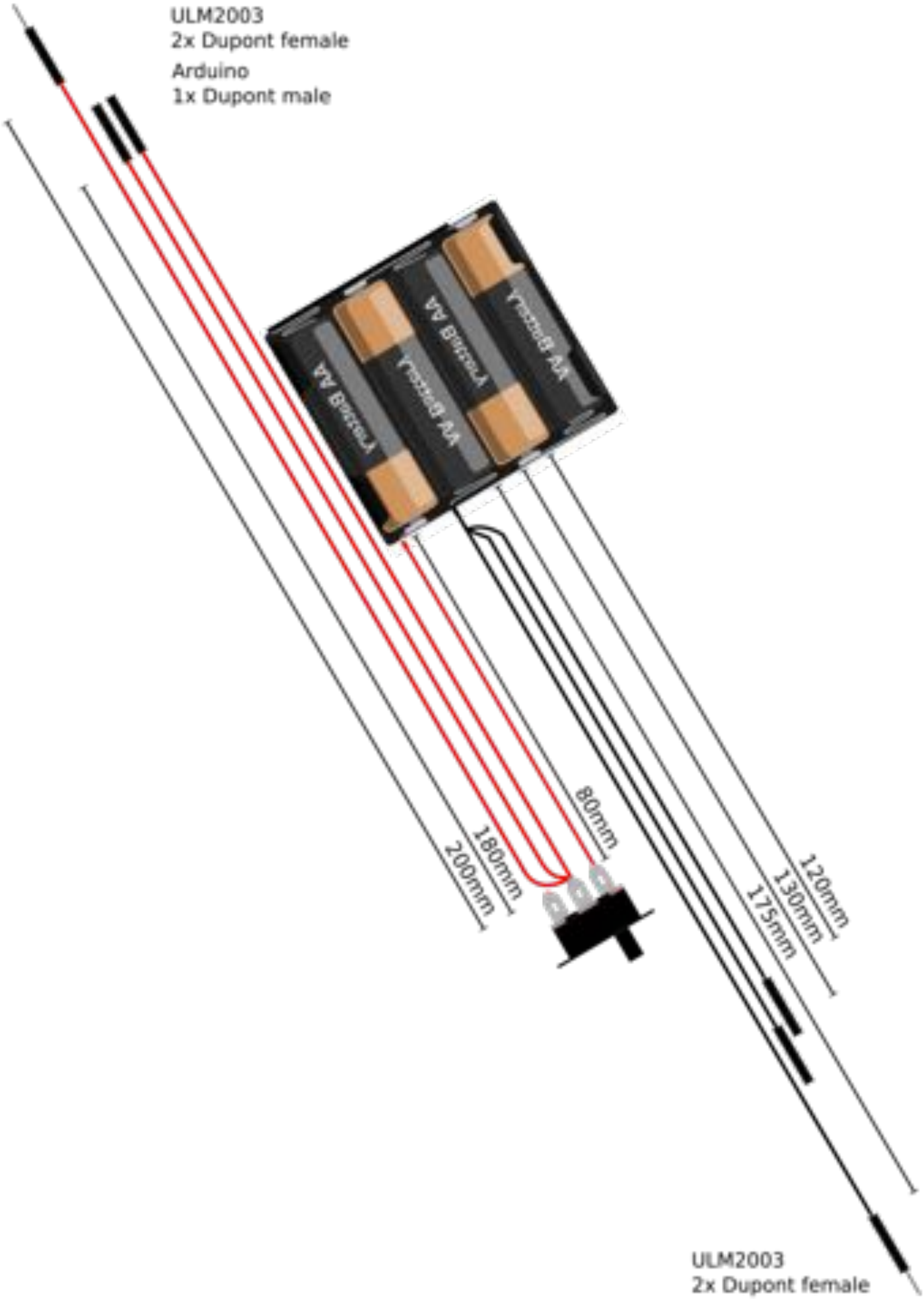
Create the wiring looms shown below. Please be aware that the images may not scale right. If you want to print them on the right scale, download the file wiring diagram.svg and use Inkscape to open and print the file without borders (no-slug). Alternatively you can download the “wiring diagram_*.png” files from the Landje robot Kit preparation folder and print the files border-less (no-slug) on A4 paper.

Servo wires Servos by default have a 3-pin female dupont connector. Cut the servo cable to the desired length and replace the 3-pin female dupont connector by 3 1-pin male dupont


65mm
Arduino
4x Dupont male
ULN2003
4x Dupont female
65mm
Arduino
4x Dupont male
ULN2003
4x Dupont female
Led Anode
80mm
Arduino
1x Dupont male
Arduino
1x Dupont male
20mm
Arduino
1x Dupont male
Arduino
1x Dupont male
20mm
Arduino
1x Dupont male
130mm
120mm
Arduino
1x Dupont male
1x Dupont male
60mm
Arduino
3x Dupont male


right line sensor
3x Dupont female
left line sensor
3x Dupont female
HC-SR04
4x Dupont female
75mm
165mm
185mm
135mm
160mm
170mm
200mm
220mm
240mm
Arduino
4x Dupont male
Arduino
3x1 Dupont male
Arduino
3x1 Dupont male

3X1 Duplex Male 3X1 Duplex Male


ULM2003
2x Dupont female
Arduino
1x Dupont male
AA Battery
AA Battery
AA Battery
80mm
180mm
200mm
120mm
130mm
175mm
ULM2003
2x Dupont female
Arduino
1x Dupont male

Robo head

Depending on the (motoric) skills of the students, you can prepare the robot head or let the students assemble and solder the parts themselves. For 8th grade primary school students i did the preparation.

Parts

First gather the necessary parts to assemble the robot head.

- 1/6w metal filmm resistor 220Ω
- HC-SR04
- 5mm Led
- 2 wire zip ties
- 3d printed head
- Led Anode wire
- HC-SR04 wiring loom

Assembly

Hold the 3d printed head so the back faces towards you. Push the resistor in the outer brackets.

Bend both end of the resistor wires 90° and push the wires in the center brackets.

Bend the right wire of the resistor 90º and push it in the right middle bracket.

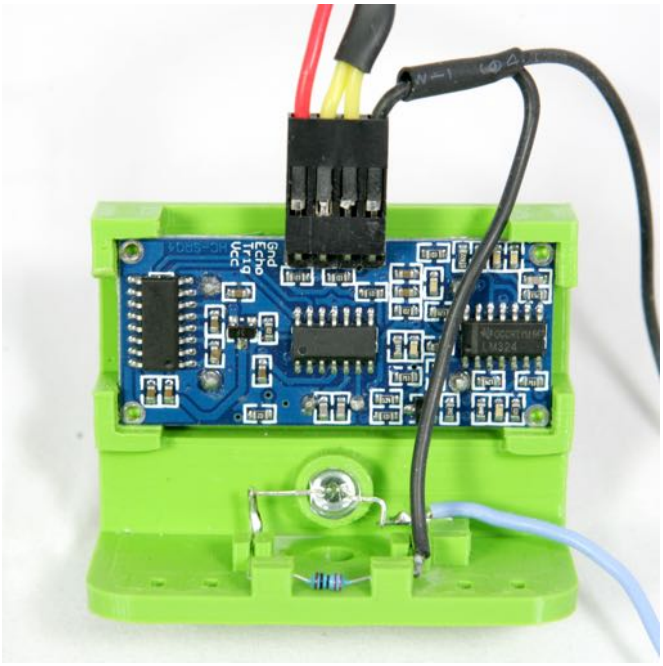
Place the led into the recess. Make sure the kathode, the shorter pin, is on your left. Push the led into the recess of the mouth until it clicks. If you need to apply to much pressure, slightly warm the head using a hot airgun. Make sure no to heat it to much to prevent deformation. When printed in PLA a temperature of 35 degrees is sufficient to soften the plastic.

Take the led bend both wires 90º, then make two bends 90º in the left wire till it connects to the resistor. Make three 90º bends in the right wire until it can be pushed into the last unused bracket.

Solder the kathode of the led to the resistor lead and the blue 80mm wire to the anode.

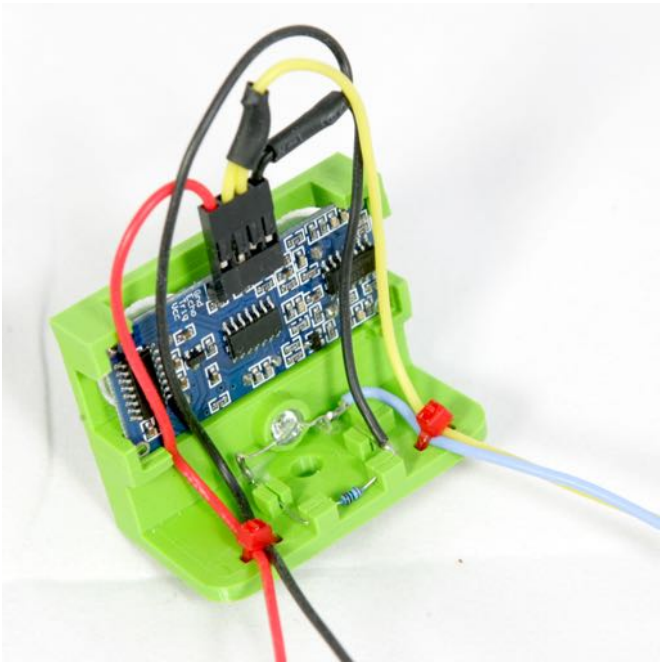
Take the HC-SR04 loom and solder the black lead without the dupont connector to the other lead of the resistor.

Push the HC-SR03 ultrasonic sensor gently into the socket until it clicks



Fasten the black and red wire on the left by threading a cable-ties through an eyelet and fastening it. Repeat the process for the other side for the blue and yellow wire.

Cut of the leads of the cable-ties and the assembly of the head is finished.

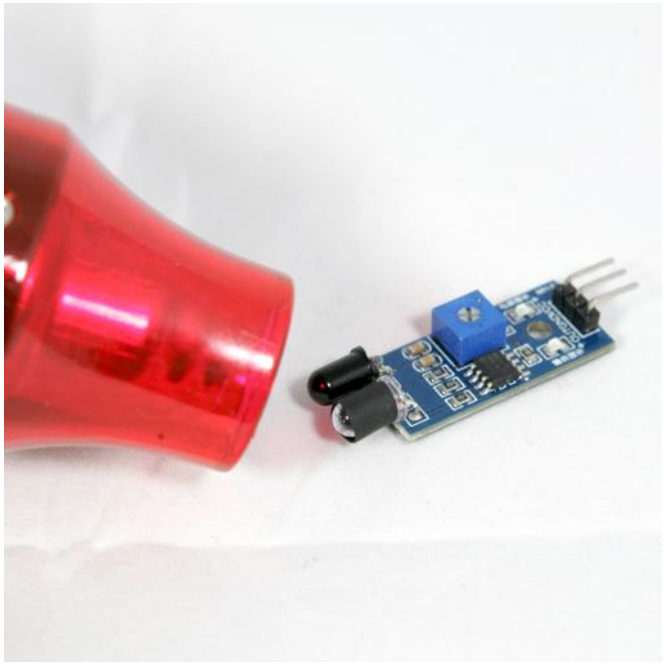


IR Sensor module

The IR Sensor module has an IR light emitter and receiver. Depending on the print material and colour of the frame it may more or less conduct the IR light shine through. When conducting to much light the sensor will not able detect lines. Therefore a piece of 6mm black heat shrink tube has to be put on the IT light emitter.

Slide the heat shrink tube ove rthe IR light emitter. The emitter led is the translucent led.

Carefully head the shrink tube, making sure the other compontents do not get overheated. The heat shrink tube must be tight enough so you cannot slide it of the led after it has been cooled down



Tail wheel

To assemble the tail wheel, cut a piece of 12mm from the 2mm Stainless Steel Round Rod.

Place the wheel in the boom so the axle of the wheel is aligned with the holes in the boom. Push the rod through a hole in one side of the boom.

Gently push the rod untill it comes out of the hole on the other side of the boom.