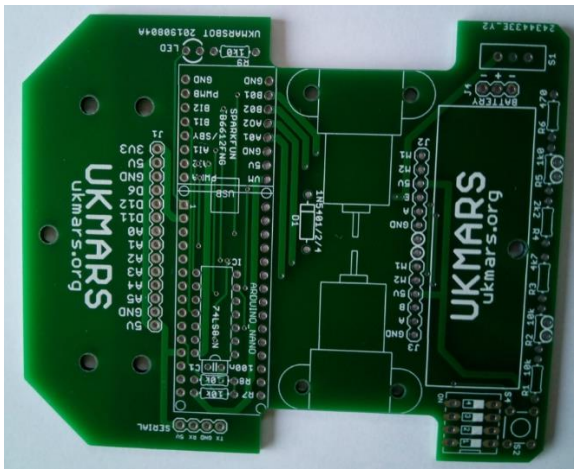
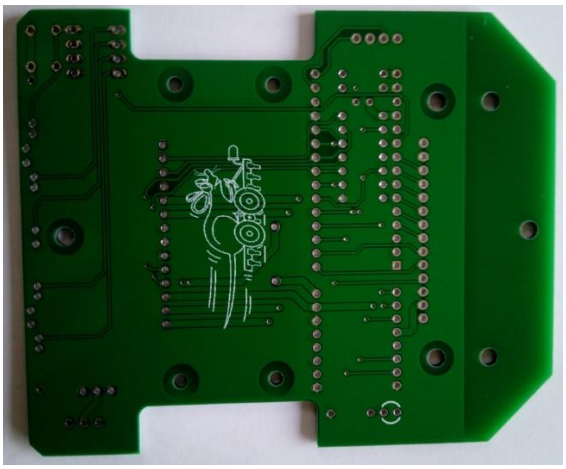
UKMARSBOT assembly details:

Main PCB assembly

This is the main printed circuit board top and bottom:



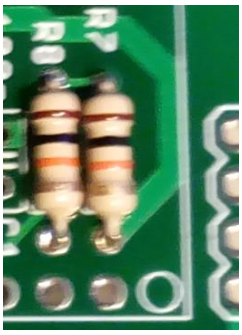


BUILD SEQUENCE

1. Solder in resistors R1 to R6 –

Do not worry if the ends of the resistors at the back edge of the board short out together e.g. between R1 and R2 or R2 and R3 etc up to R5 and R6, as they are connected anyway in the circuit. Clip off all the excess leads for each device as soon as you have soldered it in so that it does not get in the way of further soldering.

2. Solder in R7 and R8 making sure that these 10KΩ resistors which are mounted below the Arduino are close to the board.



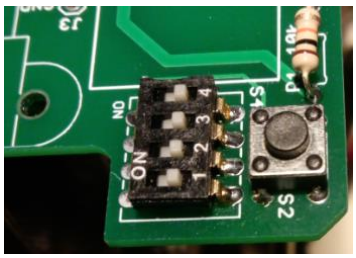
3. Solder in the single row 15-way Arduino socket on the side of the motors – take care to connect all 15 pins and inspect it after soldering. A good tip is to solder just the 2 end pins first then check that it is fully seated and upright before soldering in the other 13 pins.

4. Solder in the IC 74LS86N checking that the dot in the plastic by pin 1 and the notch at the end of the IC are at the end closest to resistors R7 and R8. You may need to bend the pins slightly inwards before it will go in smoothly

5. Put ceramic disc capacitor c1 in between the IC and resistor R8. You may need to allow enough length in the leads so that it can bend partly over R7 and R8 so that it stays below the level of the top of the Arduino connector.

6. Solder in the other 15 pin Arduino connector making sure it is fully seated and upright.

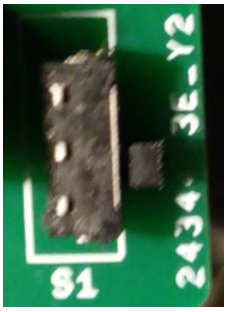
7. Solder in the tactile switch S2 – It should only fit one way – and then the 4-way DIPs switch S4



8. Add the two 6-way pin header connectors for the motors and the 14-way connector for the sensors. Placing the PCB down on a flat surface will help to get them seated fully while you solder these and the next ones in. You can either use pin headers (cut to length from a 36-way strip) or single row sockets as used for the Arduino (also cut to length from a 15-way item)

9. Add the 4 way pin header connector for the serial connection. and then solder the battery connector lead into the main PCB, with the negative red lead into the centre one of the 3 holes available and the negative black lead into either of the two side ones..

10. Add the miniature 3 pin slide switch used to switch the robot on and off – Yours may look slightly different to the one I have used.

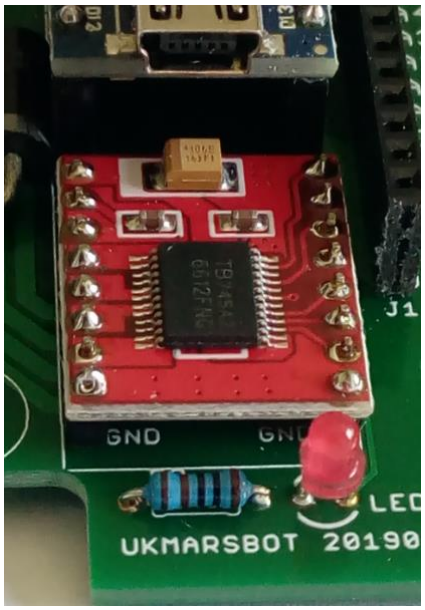


11. If your moto driver board or Arduino Nano does not have the headers soldered onto them do this now. Make sure that the short side of the pins are soldered onto the top side of the boards so that the black spacer and long pins are on the rear side of the board where there are no components.

12. Solder the motor driver board onto the main PCB so that the yellow tantalum capacitor on the motor driver board is at the end closest to the Arduino

13. Solder in R9 1kΩ resistor next to the motor driver board

14. Add a 2 or 3mm indicator LED next to R9. The long lead (+) should be the one furthest away from R9 and closest to the word LED on the board

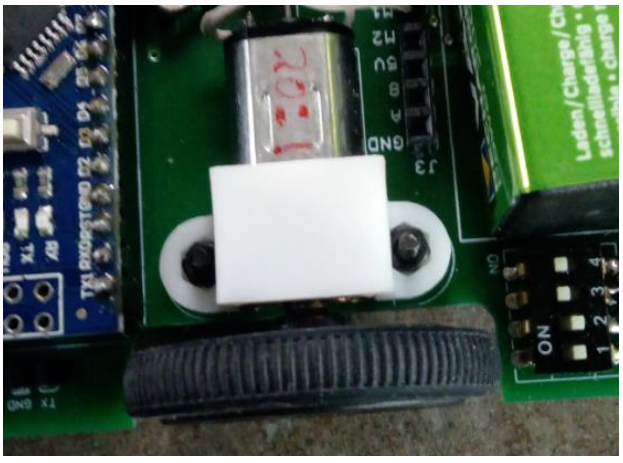


15. Make up a PP6 battery connector lead with a 3 pin connector at the end with positive going to the middle pin and negative to the two end pins.

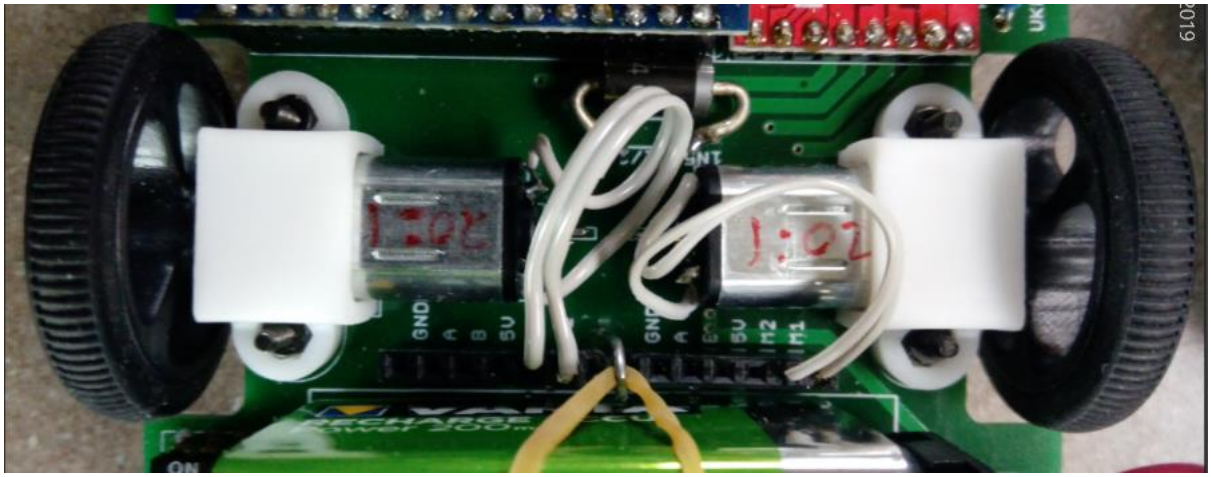
16. Plug your Arduino Nano into the two 15 pin sockets so that the USB mini connector is at the end closest to the motor driver board

Motors and wheels assembly

For wheels of up to 32mm diameter the motors are mounted so that the wheel on the motor's D shaft fits into the cut out at the side of the man board. Two screws are inserted in the holes from the bottom of the board to connect with the nuts in the motor mounting brackets. Depending on the source of the brackets these may use M2, M2,5 or M3 screws. If your bracket uses M3 screws you will need to slightly enlarge the holes in the main PCB to make them fit. The motor bracket goes over the gearbox part of the motor as shown here.

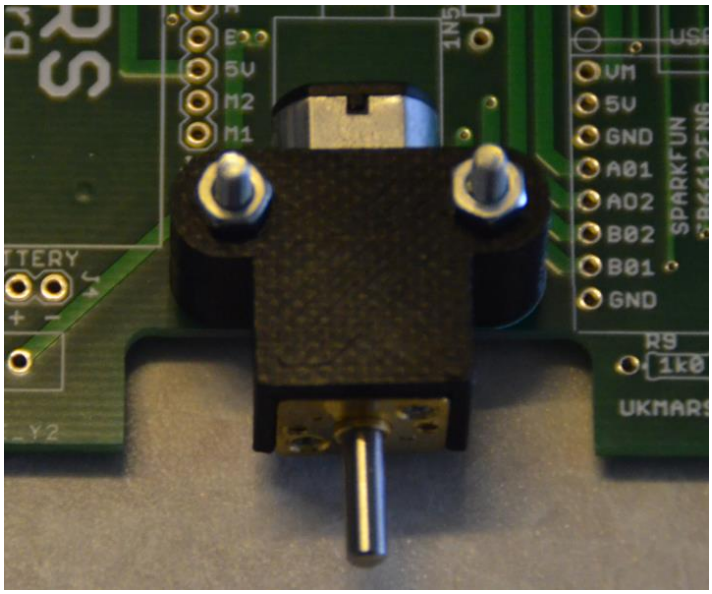


If using motors with extended shafts, there should still be a few millimetres between the extended shafts of the 2 motors. This allows enough space for magnetic encoders to be fitted to the shafts.

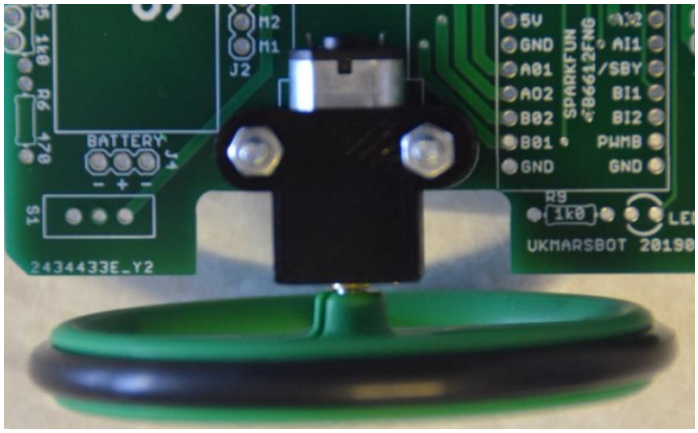


Note: When removing the wheels from the shafts DO NOT just try to pull them off as you may pull the gearbox off from the motor. Use a small screwdriver inserted between the gearbox and the wheel hub, and lever the wheel off the shaft this way.

If using larger wheels than 32mm, you will need to use the extended motor brackets which will be fitted over the gearbox part of the motor as shown.



This will bring the motor D shafts further out so that the wheels extend beyond the edge of the main PCB.

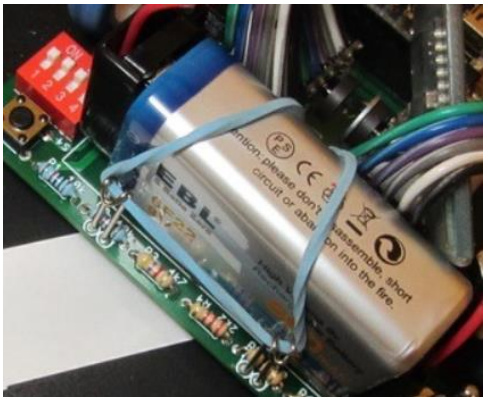


The power leads to the motor connect to M1 and M2 on each of the connectors. If using encoders the other 4 leads 5v, Gnd, A and B also need to be connected to the encoders on each motor.

Other parts assembly

Battery holder clips

The 3 battery holder clips are made from metal paper clips by cutting off the inner loop of the paper clip, then bending the ends in towards each other and then folding the end over to make a hook. For 2 of them the ends are soldered into the two holes at the edge of the board, and the 3rd one goes into the 2 holes at the other side of the battery space. An elastic band is looped over all 3 as shown to hold the battery in place.



Front skid

For wheels around 32mm in size, a front skid can be made with a 12mm long M3 screw, a 5mm long M3 plastic spacer and two M3 nuts. Put the 5mm spacer on the screw then an M3 nut on it. Then put this through the middle hole at the front of the main PCB and put the other nut on the other side of the PCB. Adjust the length of the spacer between the head of the screw and the bottom of the main PCB so that with the wheels in place, the main PCB is level with the ground. It is easier to put this in place before the sensor board is put in place so that you can get to the nut without hitting the front LED and phototransistors on the line sensor board.

Rear skid

The rear skid needs to locate into the hole at the back of the main PCB, but cannot go right through or it will get in the way of the battery. A small piece of domed plastic or wood with a short 3mm spigot on it should be glued into place. The height of the skid will depend on the size of the wheels being used. If you have the facilities to 3D print a part this will be ideal.

Once both skids are in place, the robot should just be able to rock up and down only by a millimetre or so. If this is not the case, adjust the front skid to get this clearance.