

Kieron McGeever returns this issue with yet another low cost robotic winner with

Mecha-Socca-Bot

How to make and play Robot Soccer

A great deal of interest and fun can be generated with a couple of teams of robot soccer players and the Mechasocca Bot really is low cost and quick to make. All else that is needed is a table top playing surface with a pair of goals. This can be made from a thin sheet of MDF with edging boards to stop the ping pong football from rolling onto the floor. The game can be played one on one, two on two or teams of three, one in goal and two out players. The robots are fast (especially if you use 3 volts instead of 1.5 volts) and highly manoeuvrable requiring a lot of skill to control them. The rules of play are based on standard football rules, but can be adapted to suit your situation.

As a project it can be aimed at the top end of Key Stage 2 or for Key Stage 3 work. The designs shown here are based around the TEP robot disc with a scoop taken out of the front so that the ball can be easily dribbled. The curved horns on the outside edge of the disc make good toe-ends for taking shots with. For ease of construction the top and bottom plates (as shown here) can be easily manufactured by hand out of thin plastic sheet, such as rigid polystyrene, man-made board or foam PVC to any shape you want them to be. If you have a CNC machine available then the job becomes even easier as the shapes can be drawn in 2D and then accurately manufactured on your machine (please note; if you are lucky enough to have a Laser cutter DO NOT use foam PVC as this will ruin your filters - very expensive). If you are making a number of them on the bench rather than milling them out, marking out can prove particularly challenging so making drilling jigs would be a good idea for each of the three discs.

How it Works

The Mechasocca Bot works by using two motors without gear boxes mounted almost vertically to move the robot about. Rubber tubes are fitted to the ends of the drive shafts, which are tilted at an angle, to provide friction for the motion. The motors have to run in opposite directions for it to work and are held in place with two plates, a bottom plate and a top plate fixed in place with three 40mm machine screws. A control plate holds the two push to make switches, used to turn the motors on and off, and the battery box. Four

strands of coloured ribbon cable can be split from a forty way cable is used to connect the control plate to the robot. All connections to the terminals are done with the usual TEP rubber sleeve method, except for the connector block which is screwed together (this is more suitable for KS 2), but a more robust robot would be achieved if the connections can be soldered (suitable for KS 3). Also by only using push to make switches means that the robot does not have any reverse gear and can not spin round on its own axis, which is not a big problem, but an advanced version could be made using the forward and reversing Motor Control Switchboard out of the Teaching Resources catalogue, but it does make the project a lot more expensive and requires a lot more soldering.

Building the Mechasocca Bot Construction Part 1

Start by fixing a nut to one of the long 40mm machine screws and screw it all the way to the end (this is to make the drag leg for the robot).

Fit it into the back 4mm hole in the Bottom Plate and screw it down tightly with a second nut.

Fit two more 40mm screws into the front two 4mm holes this time with only one nut.

Put a second nut on each of the three screws about 20mm above the first nut (see assembly picture).

Making the Wiring Harness

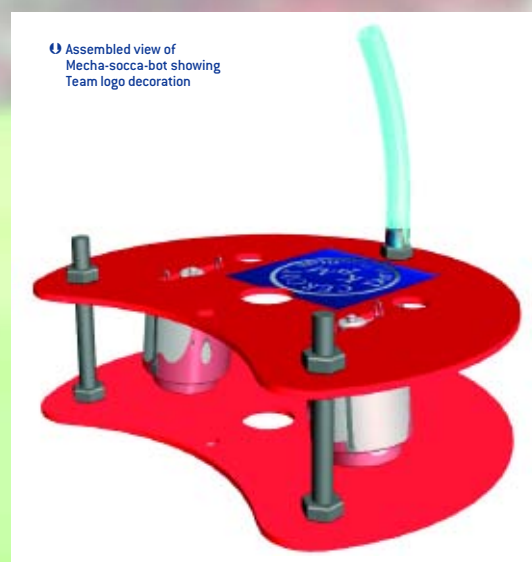
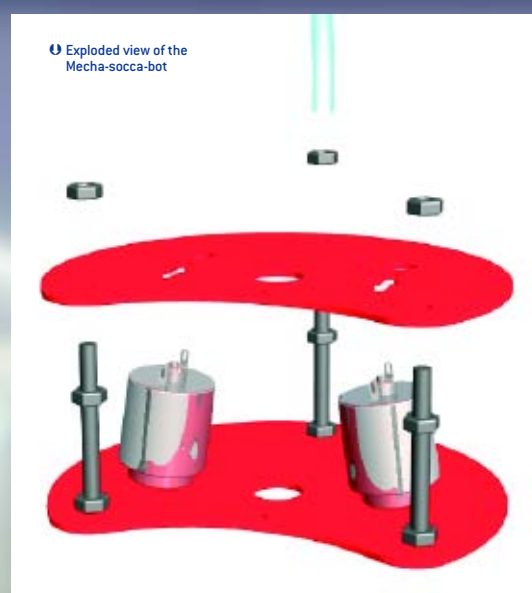
Now make the wiring harness by taking the four strands of coloured ribbon cable and stripping the ends.

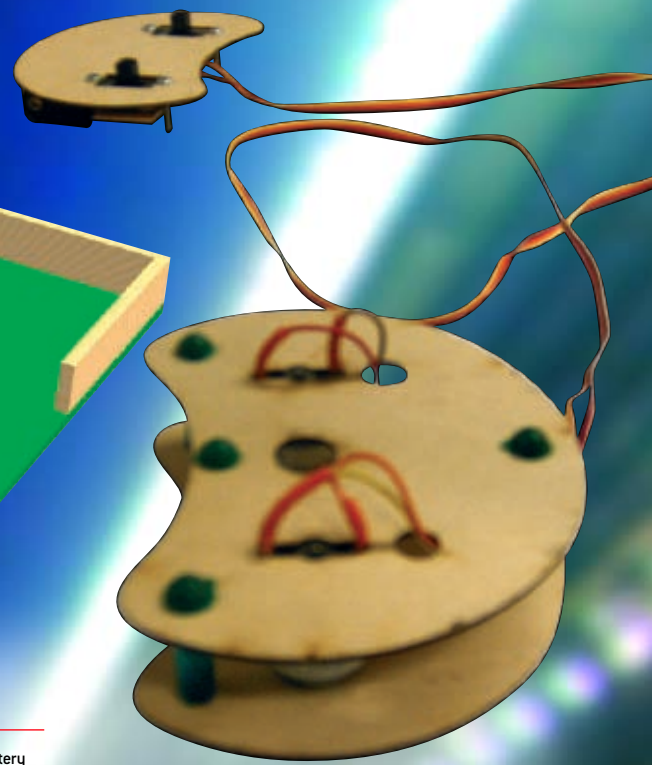
Split one end of it into two pairs for about 150mm along its length.

Then split the end of each pair to allow it to be connected to a motor.

At the other end of the cable split one wire off each side for about 100mm leaving a pair in the middle and two single strands.

Twist the stripped ends of the centre two strands together to make a common line which will be connected to the negative terminal block on the control plate.





Wiring up the Motors

Take the two pair end of the wiring harness and the Top Plate

Pass one pair of wires up through the 6mm diameter hole on the right hand side of the plate.

Then pass them down through the slotted hole that holds the motor terminals.

Fit a rubber sleeve over each wire.

Attached one wire to each terminal on the motor, making sure it is twisted on tightly DO NOT SOLDER at this point and slide the sleeve across.

Now do the same to the left hand side of the plate.

Push the back of the motors into the slotted holes making sure they are both twisted in the same direction (use markings on the end or side of the case to help you with this as it is important when you come to wire up the Control Plate).



Construction Part 2

Take the Bottom Plate and line it up with the Top Plate. Put the front of the motors into the 6mm holes. This will cause the motors to lean towards each other.

Screw the Top Plate down tight to the motors using the second nut and a third new nut (see pictures) on each screw.

Fit the plastic tubing to the rear machine screw. Now fit the two push switches into the 12.5mm holes on the Control Plate.

Fit the battery holder and connector block with sticky pads (see picture).



Wiring up the Control Plate

Now connect the Red and Black wires from the battery box to the connector block.

At the other end of the wiring harness take the common pair of wires in the middle, the ones you twisted together, and connect them to the BLACK side (negative side) of the terminal block.

The motors are turned on by the two push switches. Connect each one to the RED wire coming out of the battery box via the connector block (see picture).

The remaining two wires of the wiring harness are connected to each push switch (it helps to connect the left switch to the left motor and the right switch to the right motor) to do this check the colours of the wires to see which is connected to which motor.

The motors have to turn in opposite directions to each other. To do this the right hand motor should have positive to positive, negative to negative connections (clockwise rotation) and the left motor should have positive to negative and negative to positive (anti-clockwise rotation). Experiment with the wiring to achieve this or check the colouring of the wires to see which is connected to what on the motors.

When you are satisfied that the motors run correctly, tighten up all the joints or solder them if this is appropriate.

Finish off your Mechasocca Bot by taping the Wiring harness to the top of the plastic tubing and decorating with your favourite club colours.

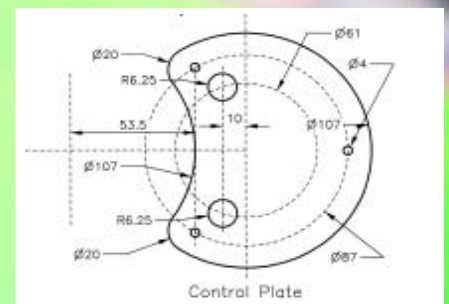
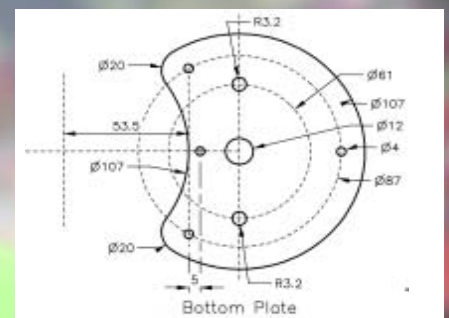
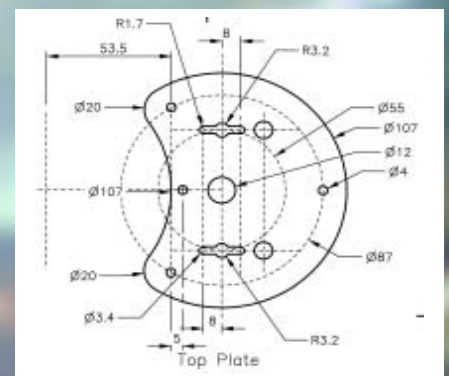
You are now ready to play Mechasocca!



Parts list to build a Mecha-Socca-Bot:

- 1 off each of 3 Plates as drawn
- 1m plus of 4 strands of insulated ribbon cable
- 2 off push to make switches
- 1 off 1AA (or 2AA for high power) battery holder with wire or battery snap
- 1 off AA battery (or 2 see above)
- 2 off MM12 motors
- Short length of heat shrink sleeving
- 1 off 3amp terminal block
- 4 off M4 x40mm machine screws
- 12 off M4 hex nuts
- Short length of 4mm bore PVC tubing

An alternative method of fastening the top and bottom plates is PVC tubing and TEP rivets CODE IT8 006 or plastic axle pins CODE CS7 030



Supporting drawings can be downloaded from the TEP website