

CamJam EduKit Robotics – Building a Robot

Project Building the Robot

Description Building the chassis, connecting the EduKit Robotics Motor Controller Board, motors and batteries.

Equipment Required

For this worksheet you will require, from the CamJam EduKit:

- The CamJam EduKit Motor Controller Board
- Two motors (with wires already attached)
- Two wheels (red, for extra speed!)
- The battery box
- The roller ball (castor)
- Double sided tape to stick parts to chassis – cut as required

Equipment you will need to supply yourself:

- A Raspberry Pi
- An SD card to fit your version of the Pi
- Monitor & cable to connect to the HDMI or composite output of your Pi
- A keyboard and mouse
- A Raspberry Pi power supply, or a phone charger-type battery
- 4 AA batteries. You should get good batteries, as some cheaper ones cannot supply the current required to run the motors.
- A chassis (not supplied) - use your imagination (also not supplied!)
- A small cross-head screwdriver

Building the 'Bot

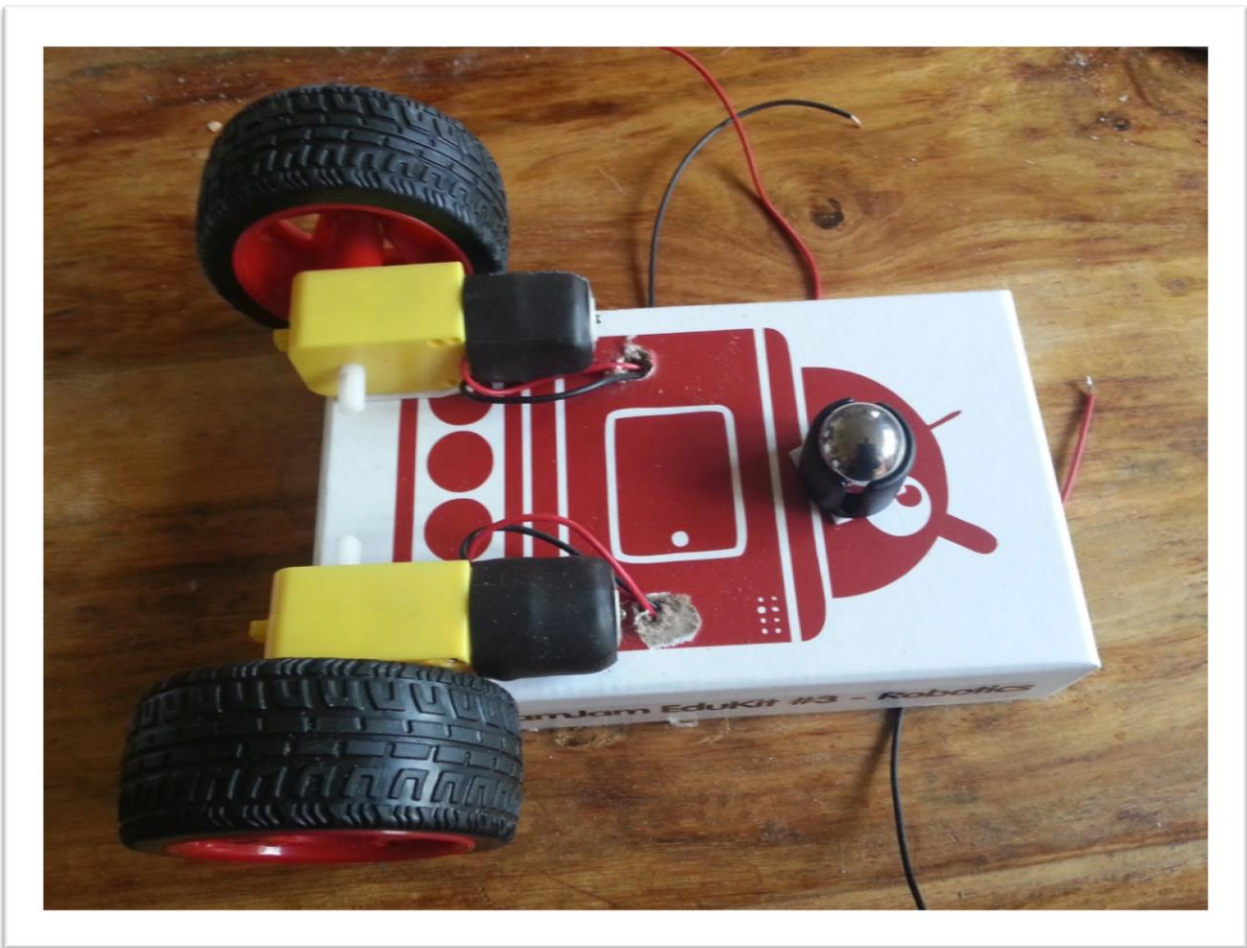
In this first worksheet, you are going to bring the basic parts together and build your robot. Almost everything you need has been supplied, apart from the four AA batteries, which are easily obtainable. A chassis is also not supplied, because that would take the fun away from making the robot to your own design. The box your EduKit 3 came in, however, may come in handy!

If you do not have a battery to power your Raspberry Pi, your robot is going to be 'tethered', meaning that you will only be able to drive as far as the power lead you are using to power your Pi.

Building the Chassis

Find something that will be the body, or chassis, of your robot. Decide which is the top, and which is the bottom, and turn it over with the bottom up. Fix the motors onto one end and the roller ball on the other. Some double-sided sticky tape is supplied with your kit but *remember to cut it to size before using it*. The roller ball comes with screws so you may be able to bolt that to your chassis. You may find mounting putty works well for you and allows you to move the motors and roller ball around.

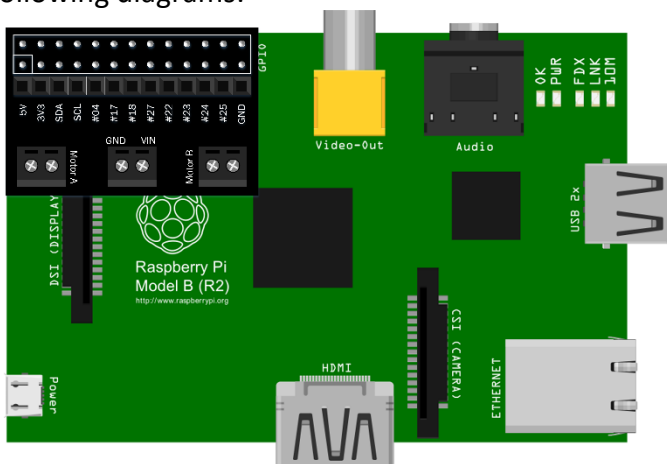
Note: Your robot wheels will move better with most of the weight of the Pi and batteries over the driving wheels. Therefore, build the chassis so that most of the weight is over them.



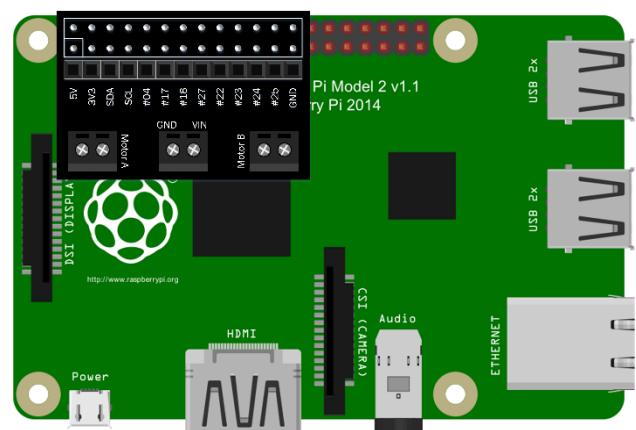
The underside of a Robot

Connecting the EduKit Motor Controller to your Pi

Make sure your Raspberry Pi is turned off before connecting anything to it. Plug the EduKit Motor Controller Board onto the GPIO pins of your Pi, with the main part of the controller board hanging over the Pi, as in the following diagrams:



Raspberry Pi Model A and B



Raspberry Pi Model B+/Pi2/Pi3

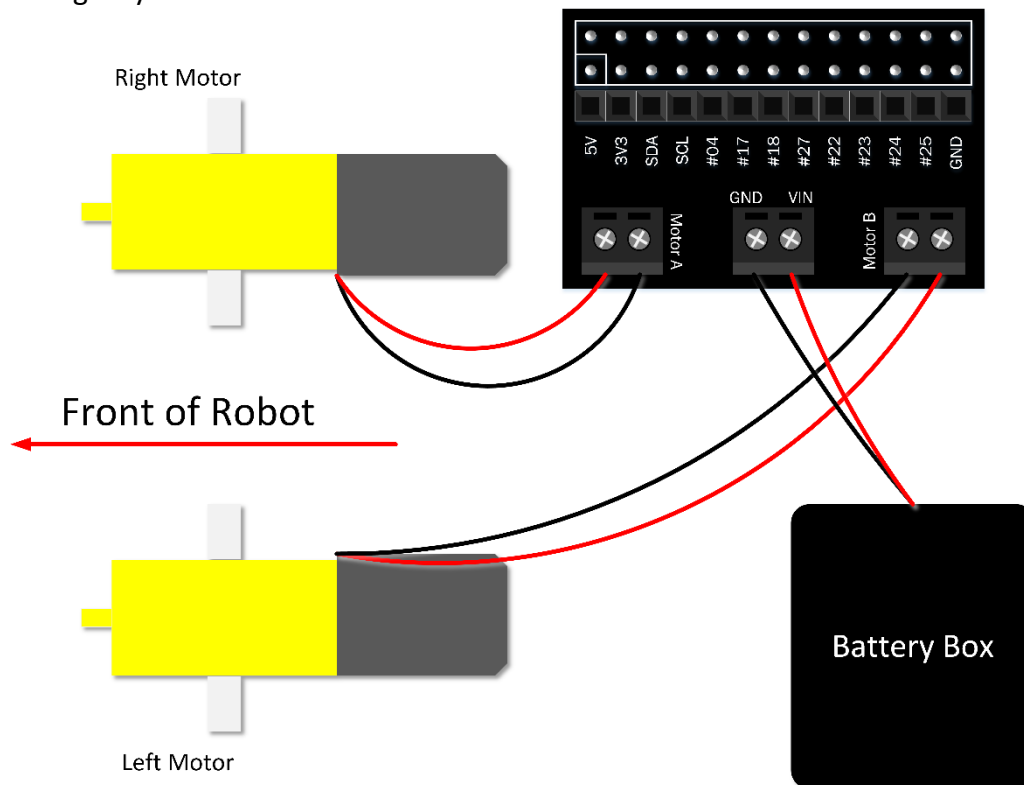
Once you are sure you know how it fits onto your Pi, you should remove the board to make connecting the wires for the motors and battery easier.

Connecting the Motors and Battery Box to the EduKit Motor Controller Board

Turn the robot over onto its wheels. Fix your Pi and the battery box (with batteries inserted and *turned off*) onto the top of the chassis with double sided tape or mounting putty. Now connect the battery box and motors to the controller screw terminals as shown in the diagram below (the Pi is not shown for clarity). The black wire goes to the terminal marked GND (ground) and the red wire goes to the terminal marked VCC (Voltage). **Please note:** *It is important which way round the battery box wires go. You risk damaging your EduKit Motor Controller board if you connect it the wrong way around, so double check the wiring before turning anything on.*

The robot you are going to build following these instructions has the driver motors at the front, with the single ball-wheel at the back. However, your robot may be different.

Connect the motor on the right of the robot to the terminal block marked Motor A, and the left-hand motor to the terminal block marked Motor B. It is not important which motor wires go into which of the terminals at this stage, as the red/black wiring is not guaranteed to be the same way around on the motors, so they may turn the wrong way. You will fix that in the next worksheet.



Connecting the Motors and Battery Box to the EduKit Motor Controller Board (looking from the top)

Choosing a Battery for your Pi (optional)

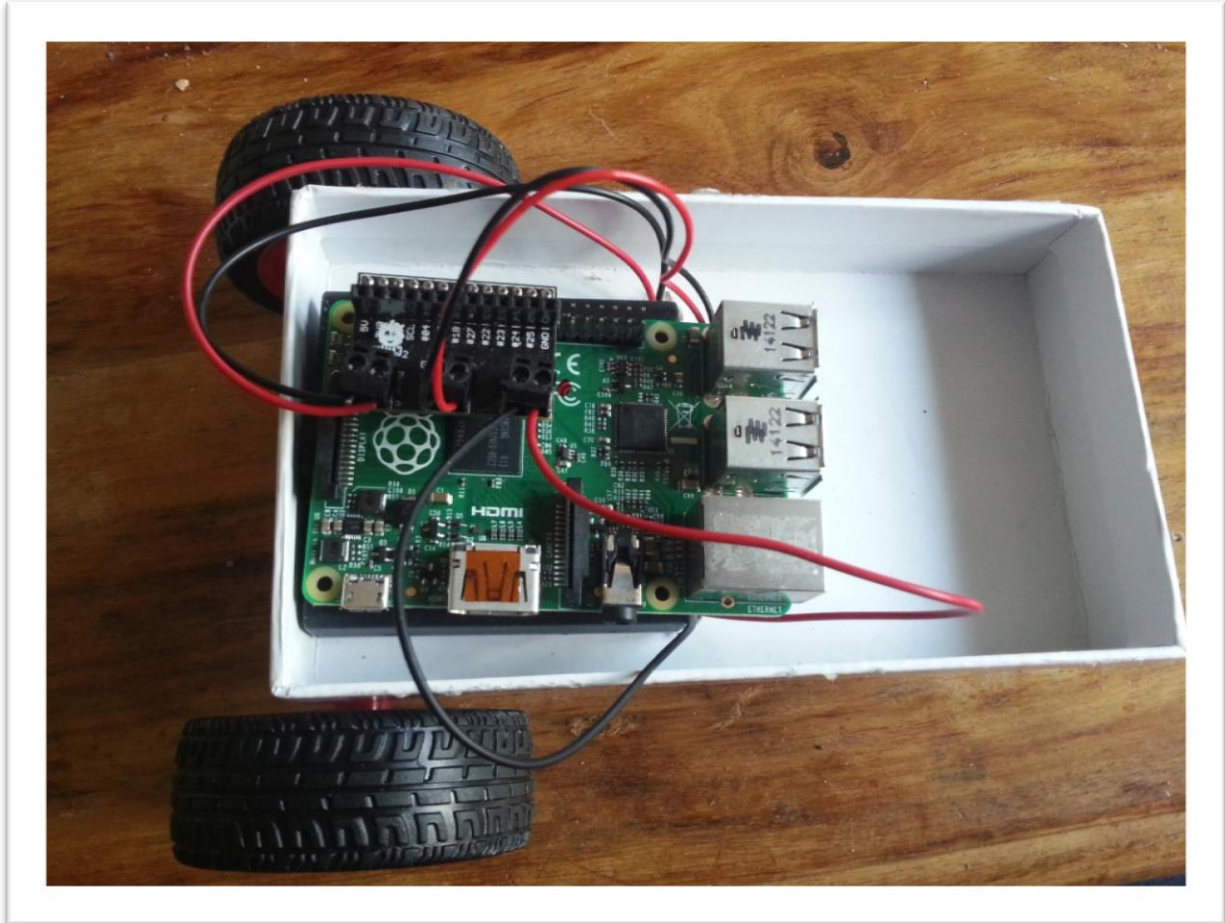
In order to make your Raspberry Pi mobile, you need to power it with a portable battery pack. There are various battery options you could use, but the easiest way is to use a battery pack that is used to charge mobile phones. They need to be able to supply enough current for the Pi (at least 1A is recommended) and have enough power to last a reasonable amount of time before running out. An example of a battery pack can be found on the 4tronix website: <http://bit.ly/EduKitBattery>. Use a standard USB to microUSB cable to connect the battery to your Pi.

Completed Robot

If you have not yet done so, re-connect the motor controller board to the Raspberry Pi.

The basic robot is now complete.

In the next worksheet you will learn how to make the wheels turn *and* make them turn in the same direction at the same time.



A completed robot

Summary

You now possess a Robot!

Challenge

One of the friends of CamJam, Daniel Bull, has designed a 3D printed chassis especially for the CamJam EduKit Robotics kit. If you have a 3D printer you may download it from Thingiverse, thing 1113796 (<https://www.thingiverse.com/thing:1113796>). This is a wonderful design, and he has made it available to be modified by anyone who can use Autodesk Design123 (<http://www.123dapp.com/>), a free web application for 3D designers.