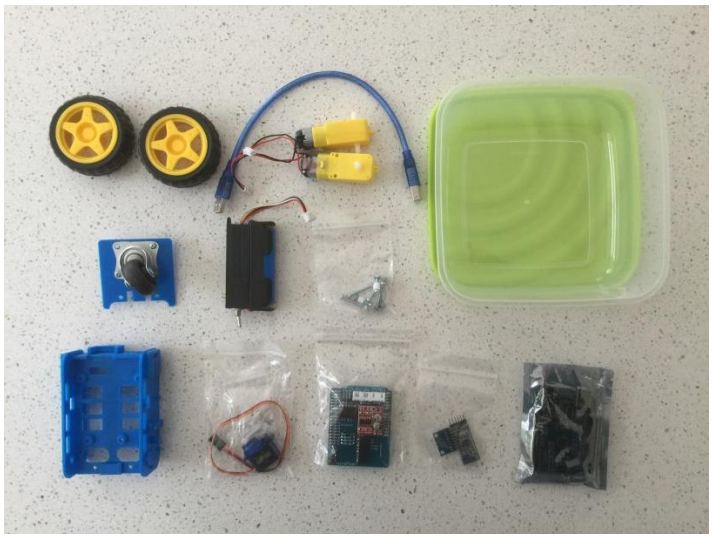
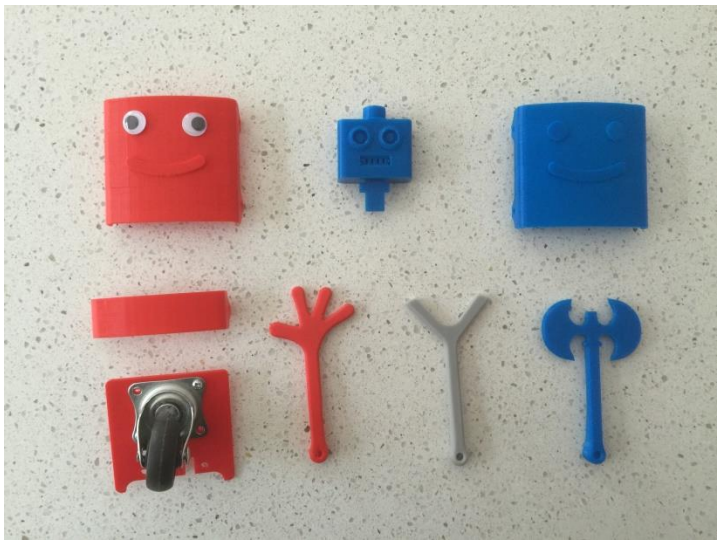
Parts List



These are the parts for the base robot.

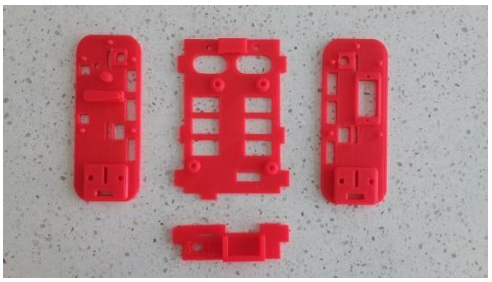
Note the container in the top right corner was used for the after school program where kits were made up for the children and supplied to them in the container.

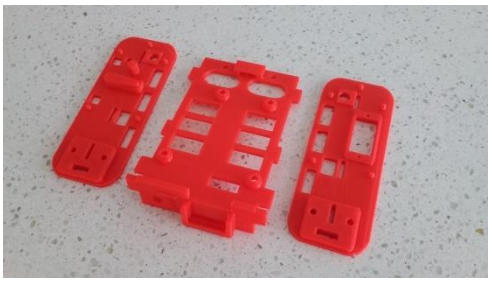


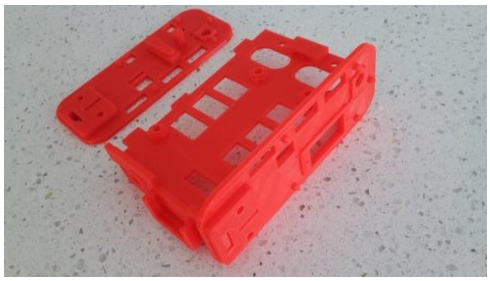
The great thing is, it is easy to make accessories for the robot – these are available in TinkerCAD for you to 3D print or you can create your own.

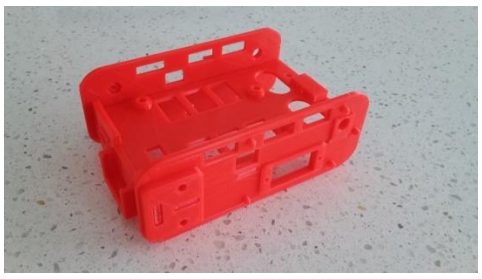
Parts List for Robot

Note: links to suppliers in this list are provided to give more information about the part – however I do not endorse or otherwise recommend the supplier - the parts are widely available from many suppliers.









Robot Chassis

3D print the chassis. The 3D printed chassis (PLA filament) is made up of four pieces clipped together by slots and tabs - the pieces are available in TinkerCAD :

https://www.tinkercad.com/

Search in “3D designs” for “balrobot” in the tinkerCAD gallery.

Step 1: Once all the pieces are printed, push the bottom piece into the tab on the centre piece.

Step 2: Push the right hand side into the tabs on the attached bottom and centre pieces. Note, the right hand and left hand sides are different, make sure you get these the correct way round – carefully look at the photos.

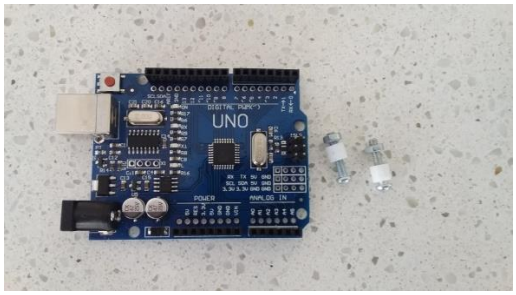
Step 3: Push the left hand side into the tabs on the tabs on the bottom and centre pieces.

Depending on the supplier of PLA filament, you may find it difficult to push the tabs into the slots - the slots may need to be eased – e.g. you could push a flat blade screw driver into the slots to ease the slots a little bit wider if you need to.

3 wheel caster extension .

3D print the caster extension piece. This is available from TinkerCAD gallery (as detailed above). The caster wheel is bolted to the 3D printed extension piece. Ideal bolts are 3M x 6mm length. But other sizes can be used.

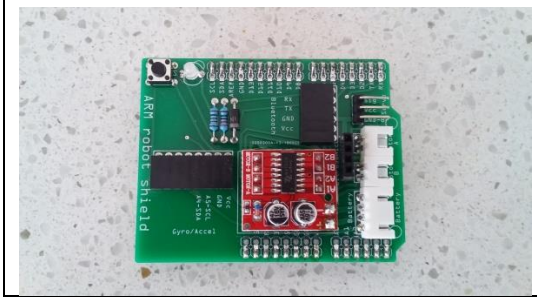
32x24mm caster wheel e.g. https://www.aliexpress.com/item/Smart-car-an-inch-small-robot-omnidirectional-wheel-guide-wheel-caster-Smart-Car-Robot-DIY-Toy/32706433155.html?spm=a2g0s.9042311.0.0.27424c4d4HMcLc



Arduino Uno + plus mounting bolts.

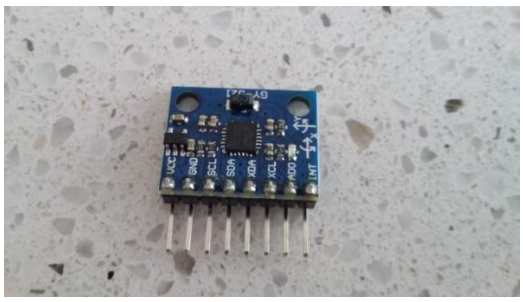
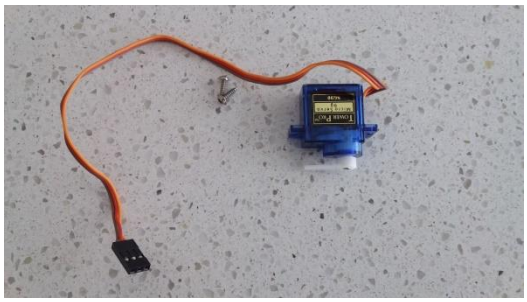
The mounting bolts are 3mm diameter and can be any length from 12-16mm.

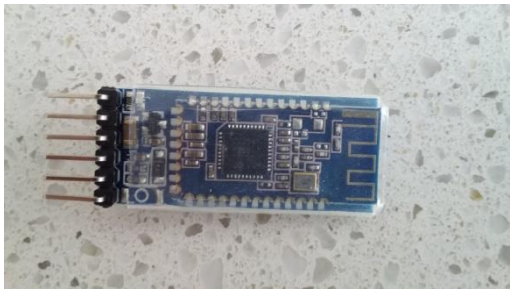
Also note the white stand off washers, these can also be 3D printed - available from the TinkerCAD gallery (as detailed above)

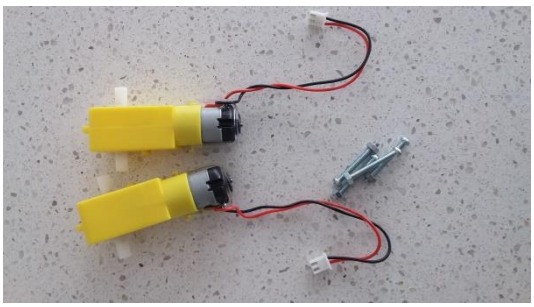


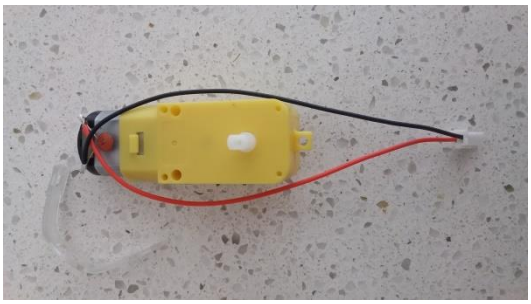
Robot shield – the details on how to make this are included elsewhere in this Instructables.

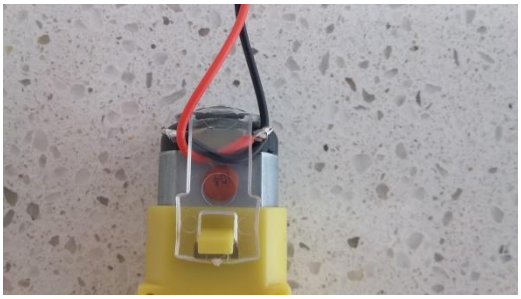
The PCB design is done in Fritzing.
The Fritzing design and gerber files are available.

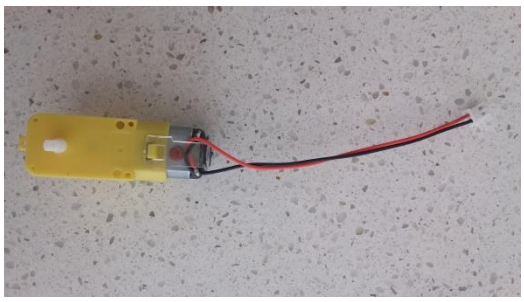
	MPU 6050. The MPU 6050 generally is supplied with straight and right angled header pins which need to be soldered on. Solder on the right angled header pins oriented as showed in the photo. https://www.aliexpress.com/item/1PCS-GY-521-MPU-6050-MPU6050-Module-3-Axis-analog-gyro-sensors-3-Axis-Accelerometer-Module/32787390733.html?spm=a2g0s.9042311.0.0.27424c4d6eBzKU
	HC-SR04 Ultrasonic sensor (optional).
	SG90 servo (for the movable arm) – not required if you don't wish to have a movable arm. The servo lever is fitted so that it is pointing as shown in the photo when the servo is set to 90 degrees. The easiest way to do this is after the robot is constructed and after power up for the first time – position the lever pointing directly upwards. https://www.aliexpress.com/item/Smart-Electronics-1Pcs-Rc-Mini-Micro-9g-1-6KG-Servo-SG90-for-RC-250-450-Helicopter/32948858235.html?spm=a2g0s.9042311.0.0.27424c4d6eBzKU

	AT09 BLE bluetooth module. You need to configure the baud rate to 115200 (default is 9600). Also you may wish to configure a unique Bluetooth name. https://medium.com/@yostane/using-the-at-09-ble-module-with-the-arduino-3bc7d5cb0ac2 https://www.aliexpress.com/item/AT-09-BLE-Bluetooth-4-0-Uart-Transceiver-Module-CC2541-Central-Switching-compatible-HM-10/32461170479.html?spm=a2g0s.9042311.0.0.27424c4d6eBzKU Notes: The firmware version on the AT09 is important – the version "MLT-BT05" works well (in my experience this is the sw version you usually get). However if you get a AT09 with a firmware version of "BT05", you can try to see if it works with the phone apps, if not you will need to upgrade the firmware – see below link (this link shows you how to upgrade the sw to HM10 software – the AT09 can run HM10 sw): https://forum.arduino.cc/index.php?topic=393655.0 The HM10 Bluetooth module also works fine, however the pins are reversed on the HM10 module – so either you can de-solder the header pins from the HM10 and solder them on the other side of the module or you could change the PCB board layout using fritzing to reverse the pins. The HC05 Bluetooth module (BT 2.0 – the older Bluetooth standard) also works fine on Android phones (not iPhones) – need to configure the baud rate to 115200. The reason for using the AT09 is because it has the same pinout order as the HC05 and because it is cheaper than the HM10 module.









TT motor

TT motors spec:

- 1:48 gearbox reduction (this is the usual gearbox ratio for TT motors).
- 3V to 12V DC (recommended operating voltage of about 6 to 8V)

4 bolts are used to mount the motors – 3M x 25mm

You should solder a 0.1uF ceramic capacitor across the terminals of the motor (to reduce interference).

You also need to solder 2 pin JST-XH 2.54mm leads with plugs on them to the motor terminals. 2 pin JST-XH 2.54mm plugs with leads can for example be obtained here:

https://www.aliexpress.com/store/product/10Sets-JST-XH2-54-XH-2-54mm-Wire-Cable-Connector-2-3-4-5-6-7/1980395_32875429112.html?spm=2114.12010615.8148356.4.1de77714ocMeDv

Step 1: remove the plastic motor holding strap carefully with pliers.

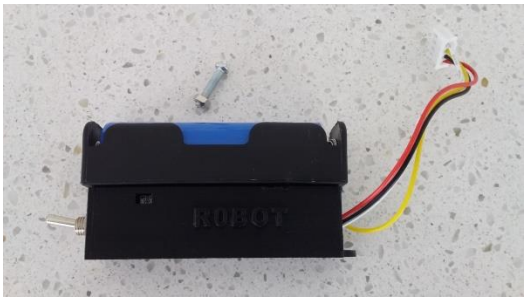
Step 2: solder a 0.1uF capacitor between the motor terminals, and solder on the power leaders. Note, the red wire is soldered onto the right hand motor terminal. Note also that the wires are soldered so they cross over the motor.

Step 3: replace the plastic motor holding strap. Note that the wires crossing over the motor prevent tension on the motor terminals and reduces the possibility of the motor terminals breaking.

Wheels - usually buy these with the motors, although they can be purchased separately.

https://www.aliexpress.com/item/TT-Motor-Smart-Car-Robot-Gear-Motor-for-arduino/32826863185.html?spm=a2g0s.9042311.0.0.27424c4dkSxCOE

https://www.aliexpress.com/item/10PCS-65-27mm-TT-Motor-Tires-Mini-Rubber-Wheel-Tire-Shock-absorbing-Tyre-with-Plastic-Wheel/32878624935.html?spm=a2g0s.9042311.0.0.27424c4dAEnqAU



18650 Li Ion battery pack.

I show elsewhere in these Instructables how to make this.

Note also the bolt required to mount that battery pack – same as for mounting the Arduino Uno.

3D Printing the Robot Pieces

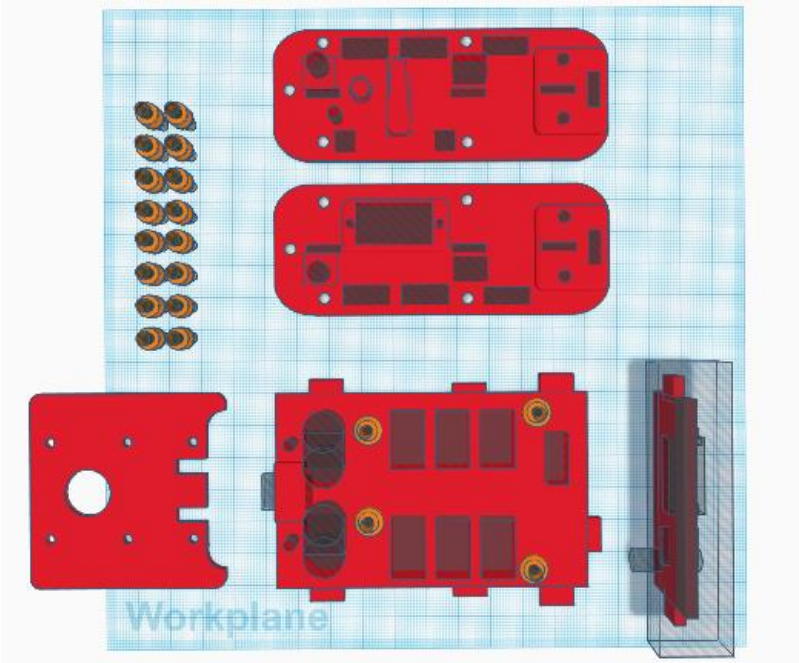
The balancing robot chassis and accessories have been designed in TinkerCAD
https://www.tinkercad.com/

The chassis and accessories are public and can be obtained by searching in “3D design” for “balrobot” in the tinkerCAD gallery - use 1.75mm PLA filament.

The following pictures show what is available in the tinkerCAD gallery.

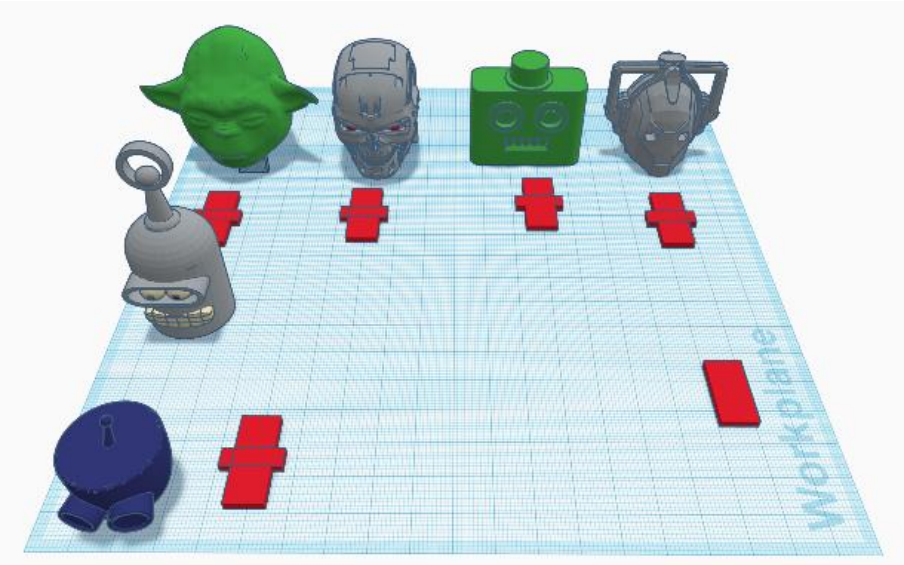
The chassis consists of four main parts: the centre, two sides and the bottom. There are tabs on the centre piece which push into slots on the sides and bottom pieces. The slots can be quite tight and sometimes need to be widened, for example by pushing a flat screw driver blade into the slot to ease it slightly wider.

Also included are the cylinder shaped standoffs and the 3rd wheel extension piece.

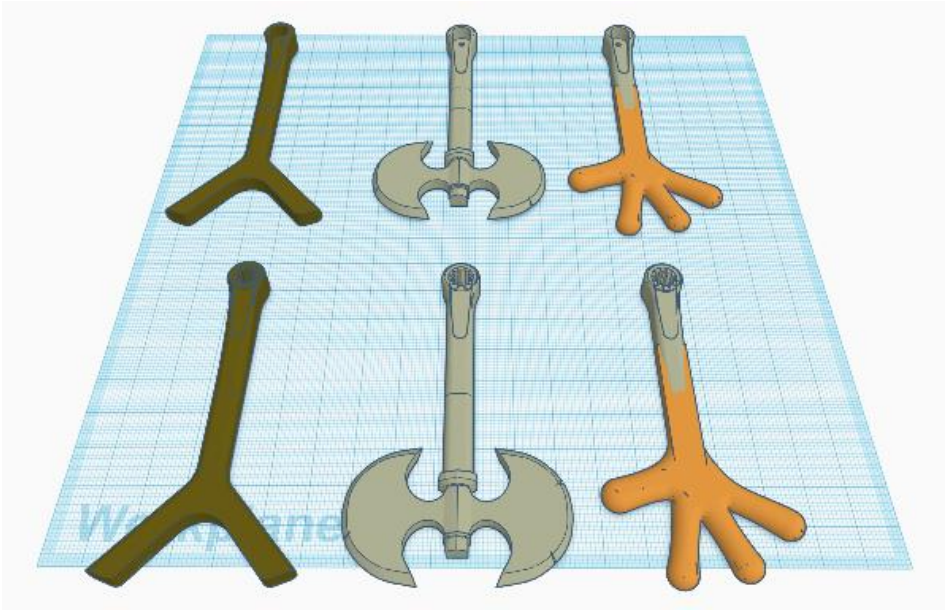


A number of heads are included. These heads can slot into the top of the robot.

To mount the head, the cross shaped pieces slide into the bottom of the head and into the slot at the top of the robot.



A number of arms are included. Note there are two types of arm fittings: the servo style fitting and the spline (toothed) type fittings.



A number of covers and faces are included. There are two plain covers (small and large) and a number of faces.