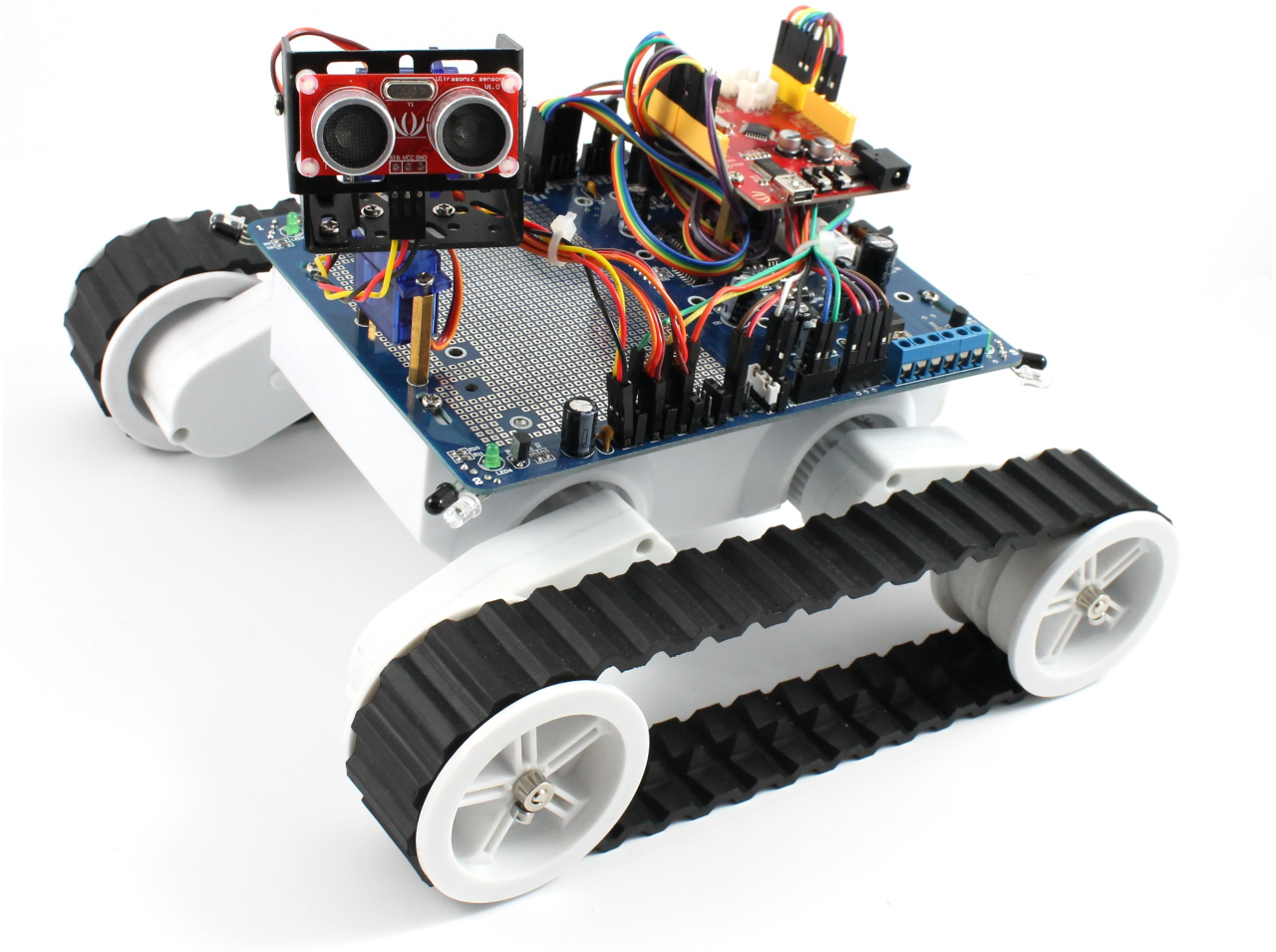
Rover 5
Seeeduino/Arduino
Robot Kit



DAWN ROBOTICS

Version 1.01

Welcome

The Rover 5 Seeeduino/Arduino Robot Kit is a robot kit that combines the powerful Rover 5 chassis, with a Seeeduino (an Arduino compatible controller board) to give you a complete robot with loads of great features. The kit is easy to assemble, and accessible for beginners, whilst providing the flexibility that more experienced robot builders need to build advanced robotic projects.

Features

- Rugged Tank chassis with 2 powerful motors
- Encoders with 1000 pulses every 3 wheel revolutions
- Motor current sensing
- 4 corner mounted Infra Red sensors
- Ultrasonic Range Sensor mounted on a pan/tilt head
- 6xAA battery holder (batteries not included)
- NiMh batteries can be trickle charged using a 9-12V DC Power Adaptor (not included)

Kit Contents

Please carefully check the contents of your kit against this list before you begin assembly. If anything is missing, please contact sales@dawnrobotics.co.uk.

1 x Dagu Rover 5 Robot Chassis - (2 Motors and 2 Encoders)
1 x Dagu Explorer PCB for Rover 5
1 x Seeeduino V3.0 (Atmega 328P) - Arduino Compatible Board
1 x 40 Pin Dual Male Splittable Jumper Wire - 300mm
2 x Jumpers
1 x Jumper Cable - 200mm Female to Female - 3 Pin
1 x Dagu Sensor Pan/Tilt Kit
1 x SeeedStudio - Ultrasonic Range Measurement Sensor Module
1 x Sensor Fixing Set
4 x Cable ties
1 x USB to mini-USB cable

Extra Requirements

- A computer
- 6xAA Rechargeable batteries NiMh or NiCd. These should ideally be high capacity batteries i.e. 2400mAh

Note: It is possible to run this robot with Alkaline (non-rechargeable) batteries. However you may find that they are unable to supply the current that the robot needs for extended periods of time. Also, if you do use Alkaline batteries do **NOT** attempt to use the trickle charge feature by attaching a power adaptor to the barrel jack on the Explorer PCB. Attempting to charge Alkaline batteries in this way can result in fire/carnage etc.

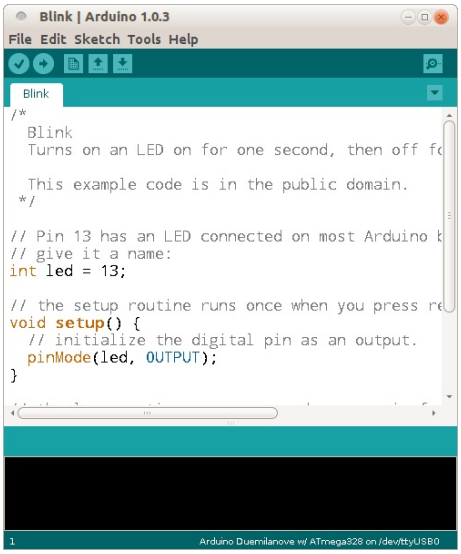
Testing the Seeeduino

Before we dive into assembling the robot, we're going to put a simple test program on the Seeeduino. This will confirm that the Seeeduino is working, and provide a useful way of testing that the robot power wires have been attached correctly later on.

1. Download and install the Arduino IDE - Select the appropriate package for your operating system at http://arduino.cc/en/Main/Software. Depending upon your platform, it may also help if you have a look at the getting started guide for your platform at http://arduino.cc/en/Guide/HomePage.

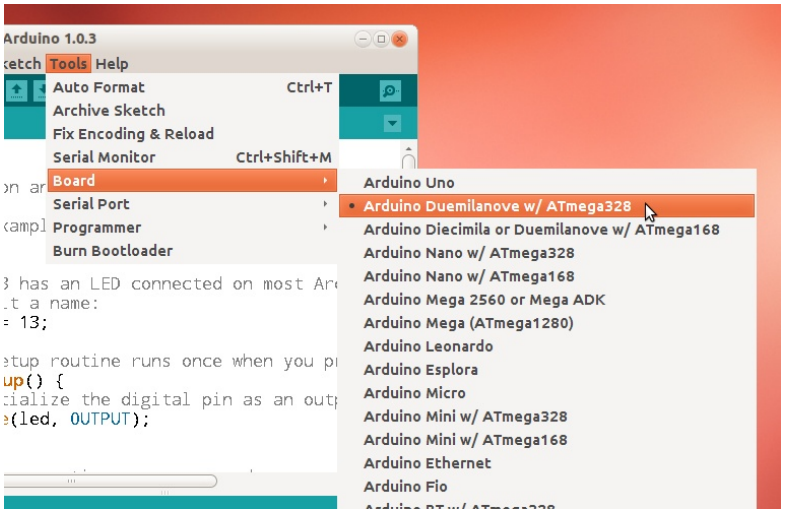
2. Connect the Seeeduino to your computer with the supplied USB cable.

3. Select the Blink example sketch. **File > Examples > 1.Basics > Blink**.



4. Select the serial port for your Seeeduino from the **Tools > Serial Port** menu.

5. Select the correct board type. From the **Tools > Board** menu. The Seeeduino corresponds to a 'Arduino Demilanove w/ ATmega328'.



6. Program the Seeeduino by pressing the 'Upload' button.

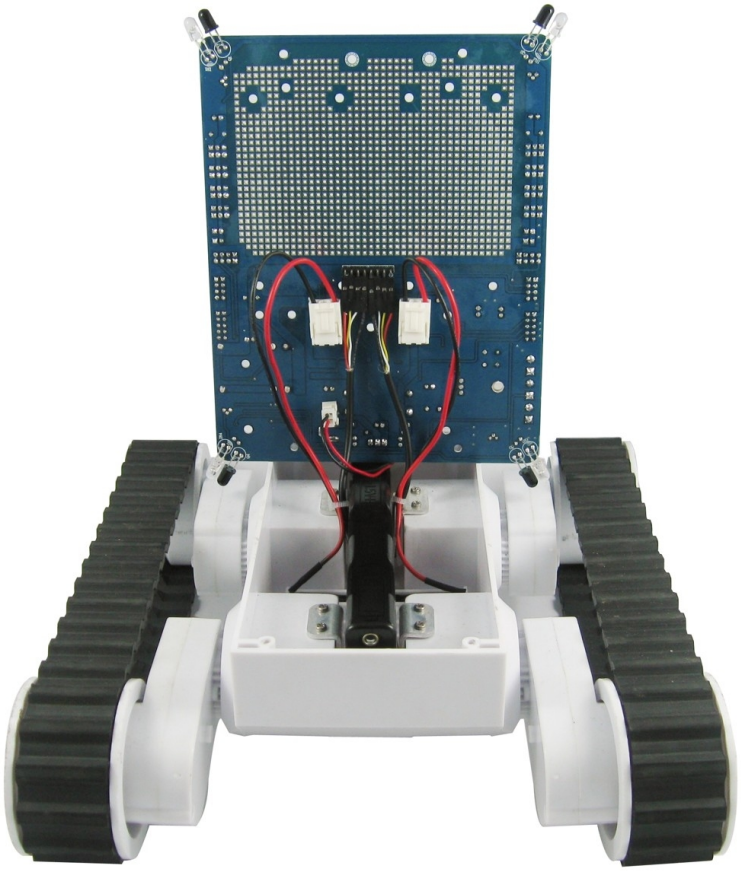
If all goes well, you should now see a blinking LED on your Seeeduino. Congratulations! Moreover, because the program is programmed into the Seeeduino's memory, the blink program remains even if you unplug the Seeeduino, and will run whenever it's powered on.

Assembling and Wiring the Robot

We're now ready to assemble the robot. Take things slowly, and check the wiring carefully as you go. In most situations, getting wires the wrong way round will not have any bad effects, apart from the robot not working correctly. However, if you get the power lines on your Seeeduino, Servos or Ultrasonic Sensor the wrong way round they are **likely to be destroyed**. With that dire warning out of the way, lets begin.

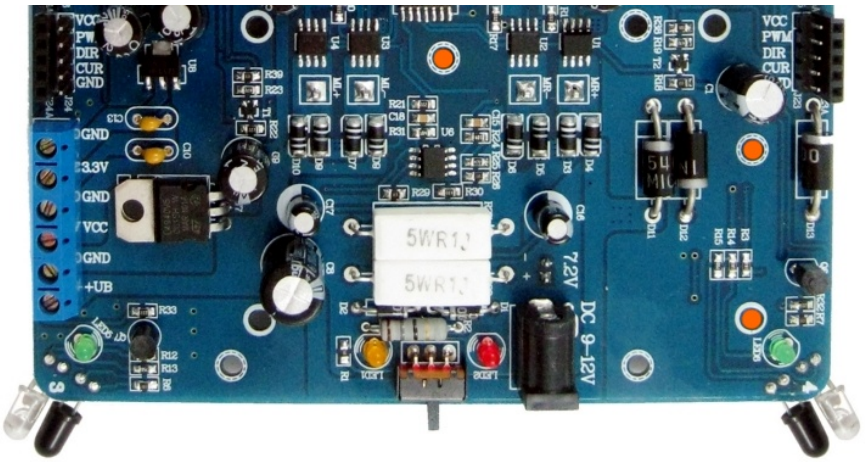
1. Attach the encoder wires and motor wires of the Rover 5 chassis to the base of the Explorer PCB. Pay attention to the polarity of the power connections for the encoders. Red wires are +V, Black wires are ground. Don't worry about the polarity of the motor wires as they should only connect in one orientation, and it only affects the direction the motors turn,

It doesn't matter if you swap the yellow and white wires of the encoders. This will only reverse the sense of direction and can be easily corrected either in the software or with the wiring on the upper side of the board.



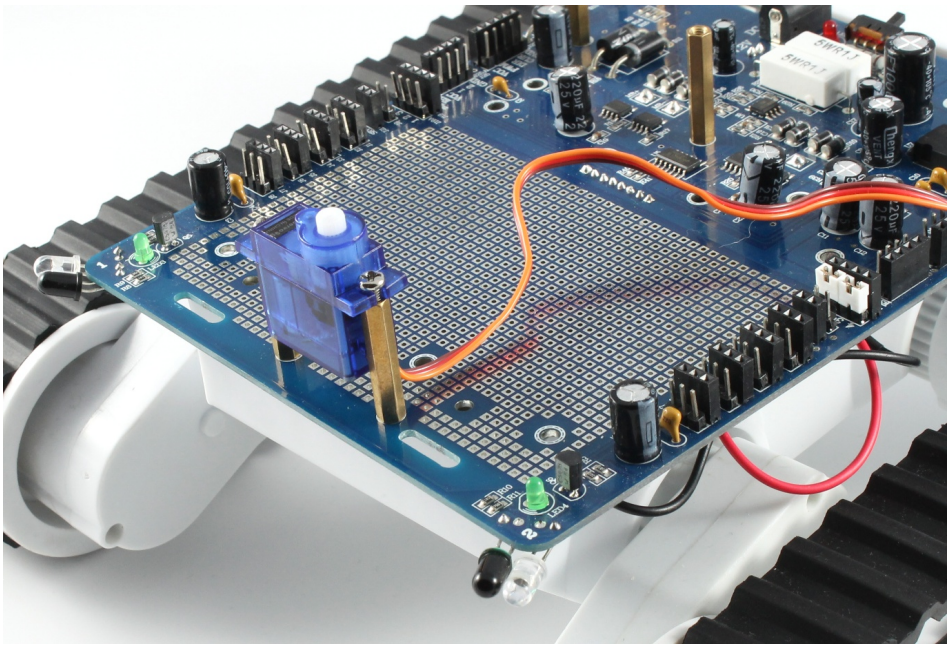
2. Put batteries in the battery holder and attach the battery holder to the base of the Explorer PCB. The connector should only go in one way round.

3. Attach 3 brass standoffs for the Seeeduino to the holes marked in orange.

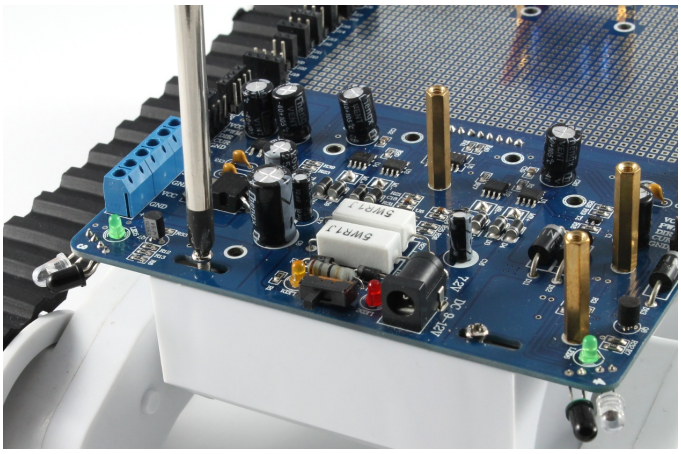


4. Attach brass standoffs to one of the mini servos of the pan/tilt kit. The holes on the servos are a bit small, so you may need to widen the holes before the screws will fit. This can be done fairly easily by using a small flat headed screwdriver.

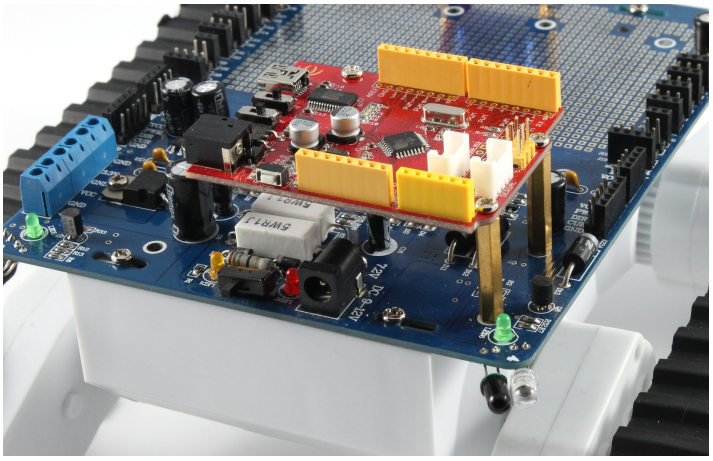
5. Now attach the servo standoffs to the Explorer PCB.



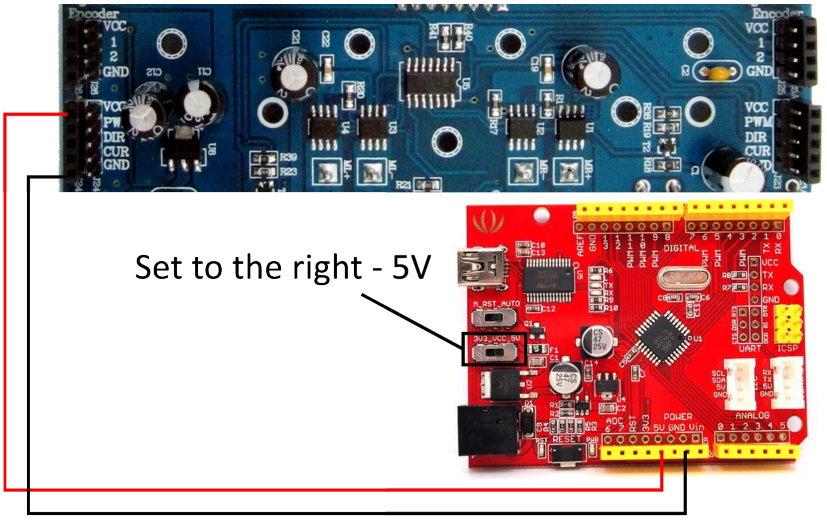
6. Put the motor wires and the battery holder into the Rover 5 chassis, and use then the long self tapping screws to attach the Explorer PCB to the Rover 5 chassis. **Tip:** It can be tough to cram all of the wires into the base, a bit of blu-tak and/or sellotape can be very useful here to hold wires in place.



7. Attach the Seeeduino to the brass standoffs

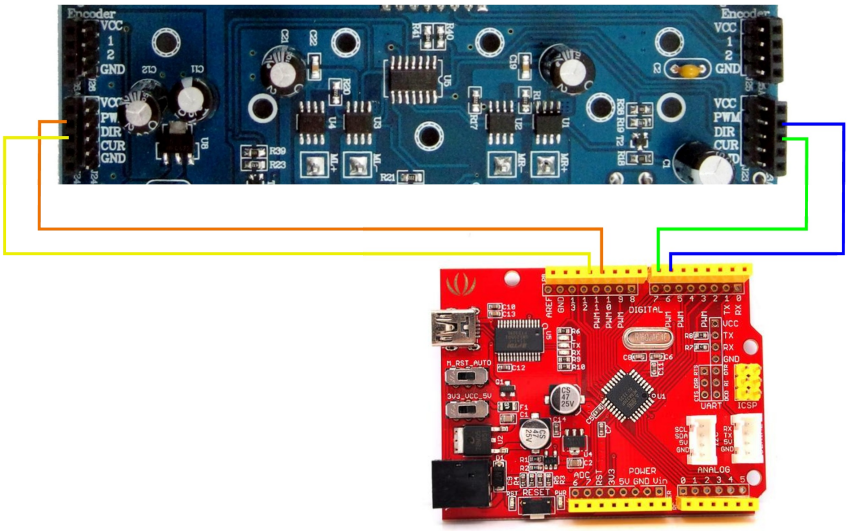


8. Connect power to Seeeduino using 2 wires (Brown and Red are good) from the set of 40 male to male jumper wires, as shown on the diagram below. Things can be kept tidy by wrapping excess wire length around the brass standoffs. The connections to make are VCC to 5V and GND to GND. **Note:** Ensure that the Seeeduino voltage is set to 5V.

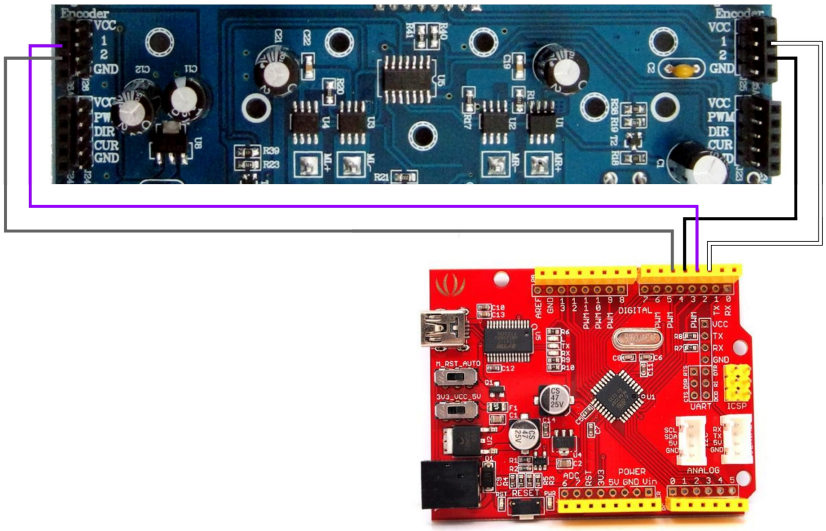


9. Test the Seeeduino by turning on the power switch at the back of the Explorer PCB, if all is well you should see a flashing LED on the Seeeduino. If you don't see a flashing LED then test the Seeeduino on its own by reconnecting it to the PC with the USB cable. Also, check the wiring.

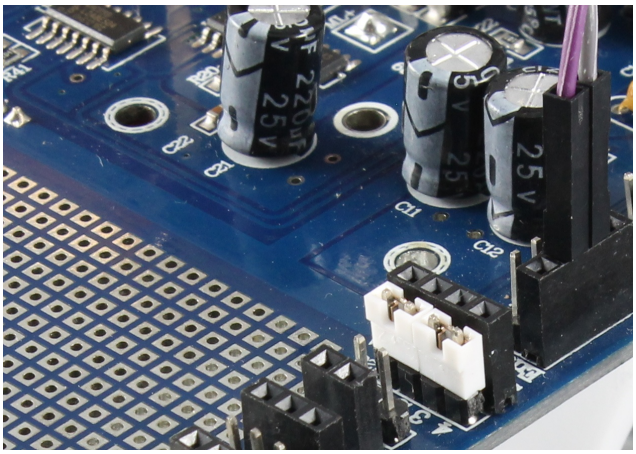
10. Wire up the motors. The connections to make are, Digital 11 to Left PWM, Digital 12 to Left DIR, Digital 6 to Right PWM, Digital 7 to Right DIR.



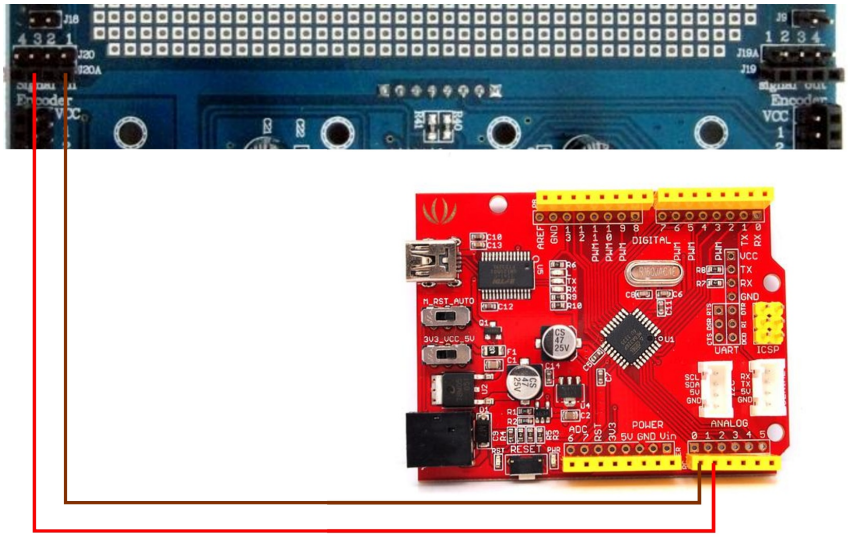
11. Wire up the encoders. The connections to make are Digital 2 to Right Encoder 1, Digital 4 to Right Encoder 2, Digital 3 to Left Encoder 1, Digital 5 to Left Encoder 2.



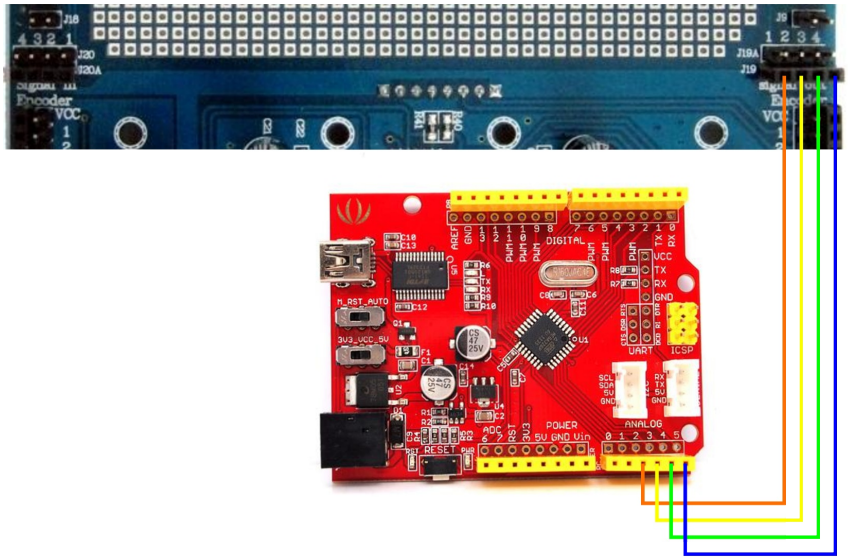
12. Use the supplied jumpers to connect IR LEDs 1 and 2, and IR LEDs 3 and 4 together.



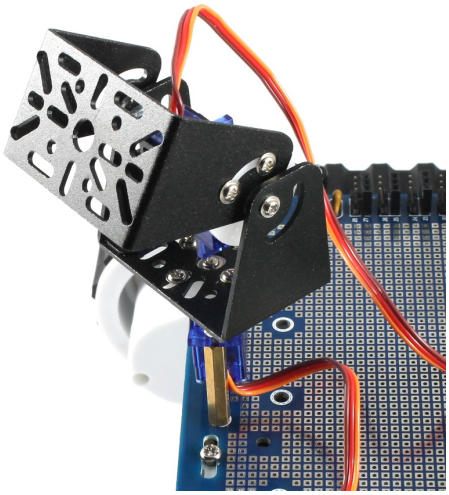
13. Wire up the corner mounted IR LEDs. The connections to make are Analog 0 to Signal In 1, and Analog 1 to Signal In 3.



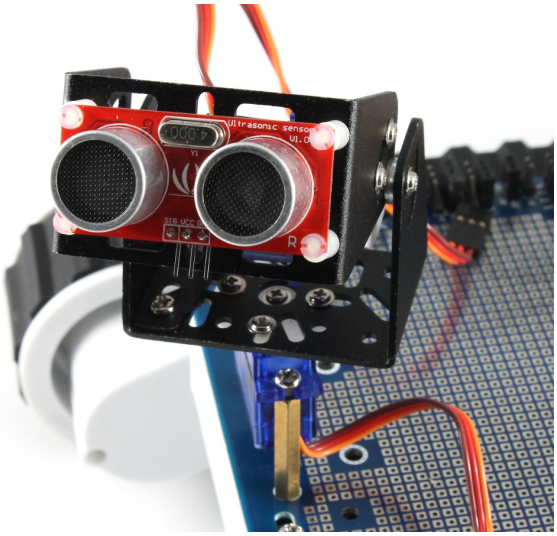
14. Wire up the corner mounted IR sensors. The connections to make are Analog 2 to Signal Out 1, Analog 3 to Signal Out 2, Analog 4 to Signal Out 3, and Analog 5 to Signal Out 4.



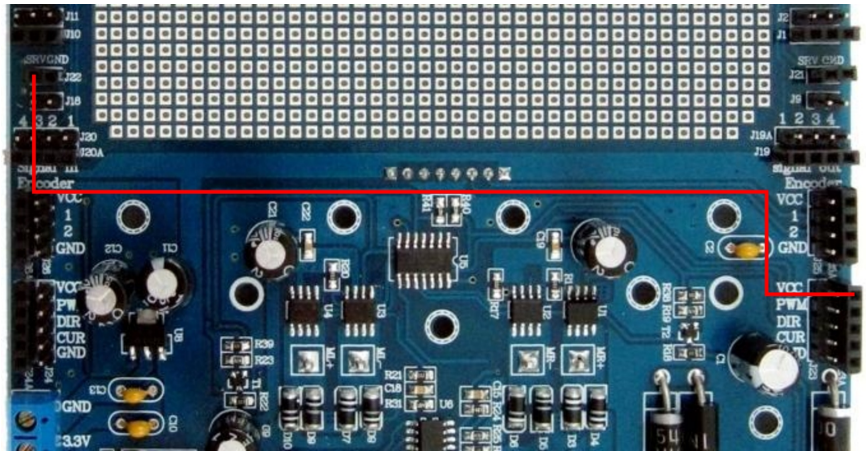
15. Assemble the pan/tilt head and attach it to the brass standoffs



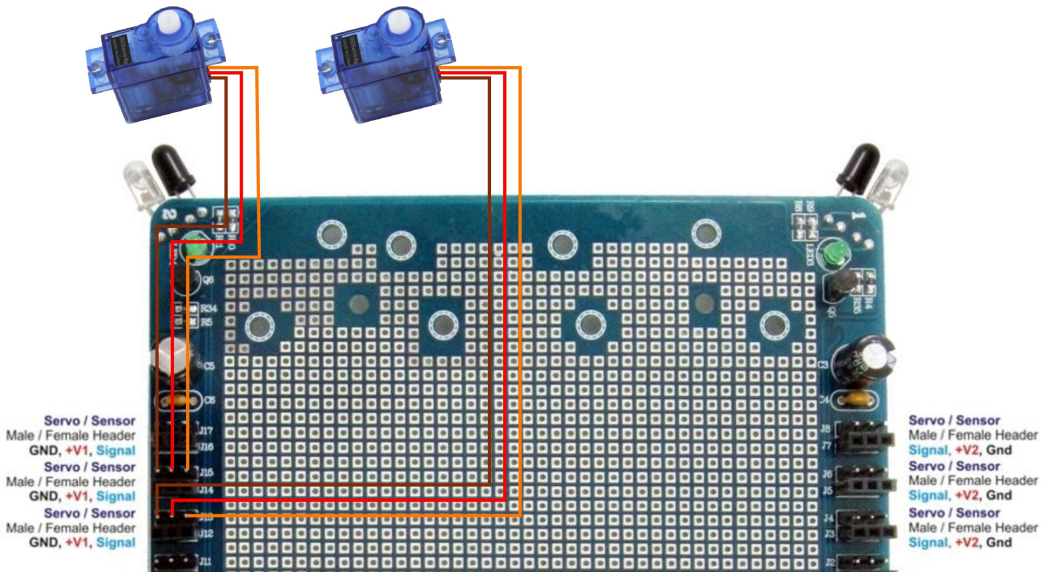
16. Use the sensor fixing set to attach the ultrasonic sensor to the pan/tilt head



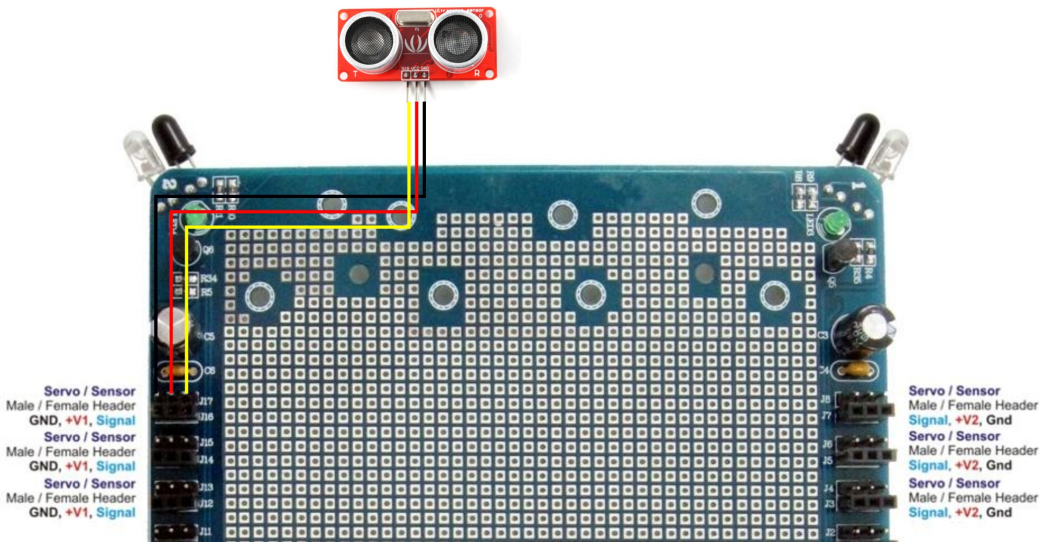
17. Now connect 5V power to the left hand power line. The connection to make is VCC to J22 SRV.



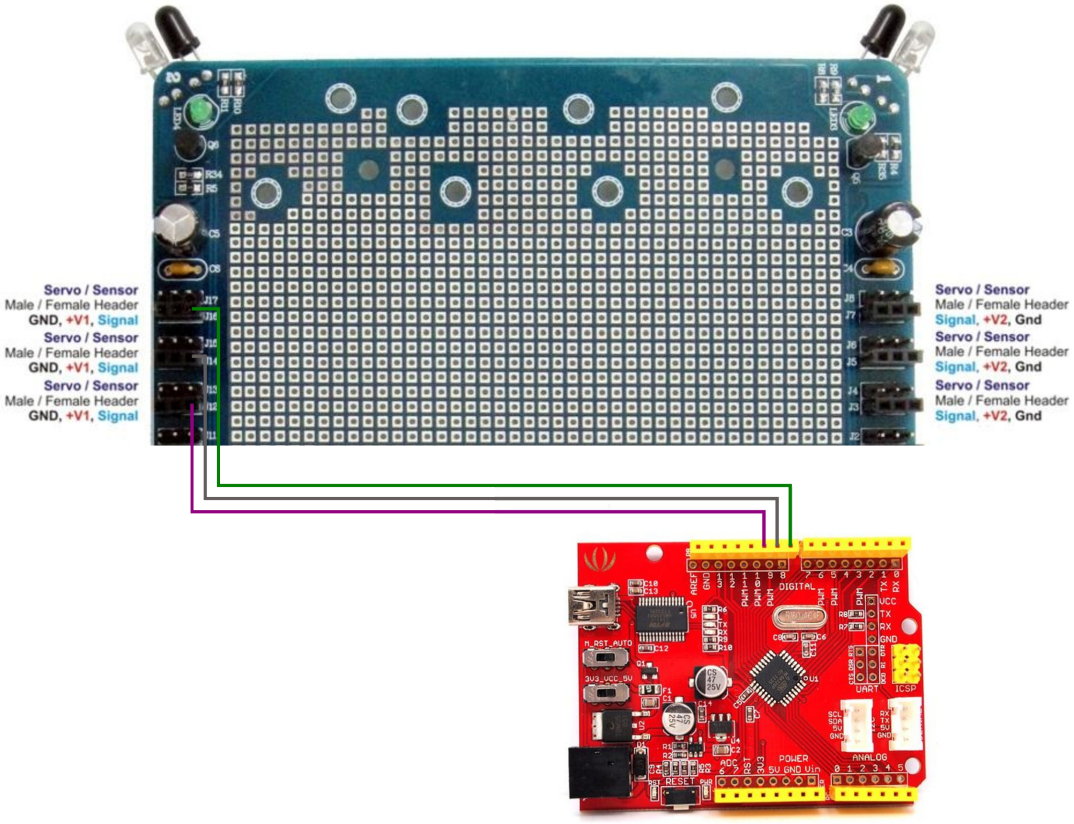
18. Connect the servos for the pan/tilt neck to the Explorer PCB. The servo wires are coloured as follows; Ground is **brown**, VCC is **red** (and in the centre), and the Signal wire is **orange**. The connections to make for the pan servo are Ground to J15 GND, VCC to J15 +V1, and Signal to J15 Signal. The connections to make for the tilt servo are Ground to J13 GND, VCC to J13 +V1, and Signal to J13 Signal.



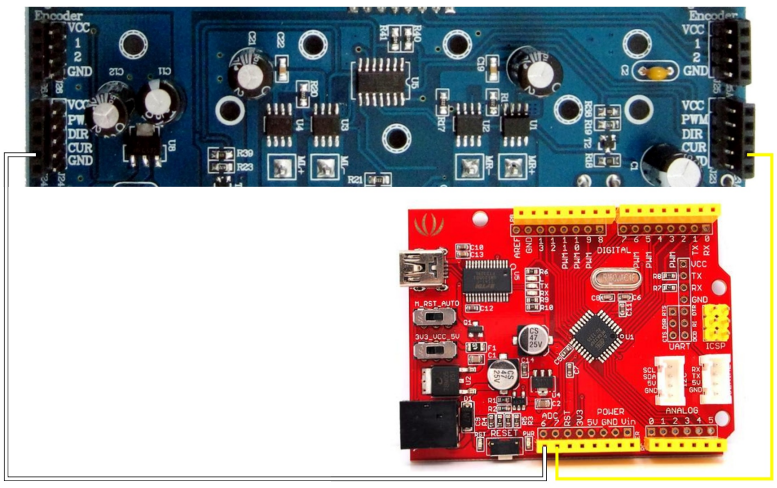
19. Connect the ultrasonic sensor to the Explorer PCB using the 3 wire female to female jumper cable. The connections to make are GND to J17 GND, VCC to J17 +V1, and SIG to J17 Signal.



20. Now connect signal wires for the pan/tilt servo motors, and for the ultrasonic sensor to the Seeeduino. The connections to make are Digital 8 to J16 Signal, Digital 9 to J14 Signal, and Digital 10 to J12 Signal.



21. Wire up the motor current sensors to the Seeeduino. This will let the Seeeduino sense when a motor has stalled. The connections to make are ADC6 to left CUR and ADC7 to right CUR.



21. Finally, keep the robot's wires tidy by using some of the provided cable ties to bind them together

Programming your Robot

In order to program your robot, you connect the Seeeduino to the PC using the USB cable, and then upload a program from the Arduino IDE as we did earlier. You can find an example program at http://www.dawnrobotics.co.uk/content/rover_5_wall_follower.zip. Unzip the program on your computer and navigate to it with the Arduino IDE. You should then be able to upload it to your Rover 5 (make sure that the power switch at the back of the Rover is off at this point). Once the program is uploaded put the robot down on the floor and turn it on. You should find that it drives forwards until it finds a wall, it then turns left and attempts to follow the wall, keeping the wall on its right hand side.

If the head of the robot doesn't face forwards when it first starts looking for a wall, or doesn't look to the right properly when following the wall, then you may need to modify the constants called LOOK_FORWARD_PAN/TILT_ANGLE and LOOK_RIGHT_PAN/TILT_ANGLE in the main program file (called rover_5_wall_follower).

Warning: The Rover 5 robot should **not** be left to run on its own, as it can quite easily drive off the edge of stairs, become stuck or otherwise damage itself if left unattended. The Rover 5 kit is not a polished consumer product but rather a platform for research, education and experimentation. If nothing else, watching the Rover 5 drive around, and experimenting with making changes to its software for a while should convince you of the challenges involved with equipping a robot for fully autonomous operation!

Troubleshooting

If you have any problems with the assembly and/or programming of this robot kit, then you can look for answers on our support forum at http://forum.dawnrobotics.co.uk.

Taking Things Further

With any luck, you should now have a complete robot which drives round trying to follow the walls. This is just the beginning though, there's lots to learn and do with your new robot. For a start, you can get a greater understanding of the parts that make up the kit. More information about each of the robot's components, such as the Explorer PCB and Ultrasonic sensor can be found on the Dawn Robotics website, along with links to manuals and sample code.

The Artificial Intelligence (AI) of the robot can be improved a lot, and you can re-program the robot to perform a number of different actions in response to the information it gets from its sensors. You could program the robot to solve a maze, or to explore the rooms of your house. Extra sensors can also be added onto the robot to give it more information about the environment it's exploring. Many interesting behaviours can be achieved by adding a light sensor to the robot and getting it to seek out light source for example.

Wireless communications can be added to the robot using either a Bluetooth shield or a WiFi shield, and once this is done you can control the robot from an external computer or smartphone.

So, the possibilities are many and varied. Have fun!