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Video playlist:

<https://www.youtube.com/playlist?list=PL59nymGkZ9KuRvR-xONV86-UJgiKemQM8>

Robot parts

INSERT LABELED PHOTO

BEFORE YOU BEGIN!

Your robot is not a toy, if you force turn the wheels by hand or by rolling the robot along the ground the gears in the gearbox will break which will make your robot useless and replacement parts will not be provided.

Do not plug the Arduino into your computer with the switch turned 'ON' it must always be 'OFF'. Or you will overload the Arduino, burning the chip which will make your robot useless and replacement parts will not be provided.

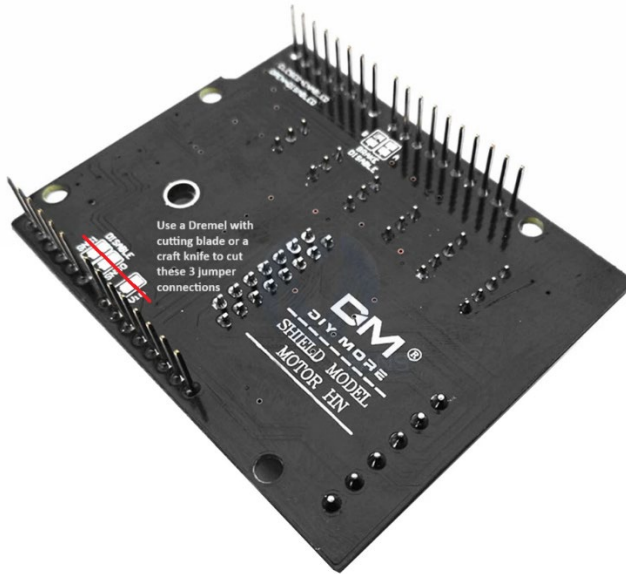
At the end of this unit, students who have paid fees may take their robot home (batteries not included). Students studying iSTEM or Computer Technology in year 9 will need to keep their robots as they will be used in the course.

At the end of EVERY lesson, you must remove the batteries and put them in the battery box.

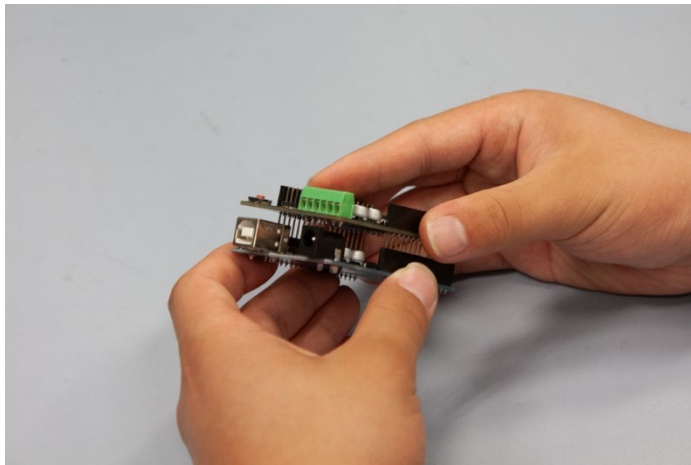
Prepare components

Note: These steps have been pre-done for Tempe HS students by the Software Engineering students.

1. Cut the jumpers on the underside of the L298NH Shield for the VIN, SNS0 and SNS1



2. Fit the pins of the L298NH Motor Shield to the headers of the Arduino Uno.



3. Solder the battery holder to the barrel jack

INSERT LABBLED PHOTO

Step 1: Attach the motors

Video:

https://www.youtube.com/watch?v=9ykH_hA3uK4

Parts:

1. Main chassis piece
2. 2x motors
3. 2x 40mm piece of wide double-sided tape

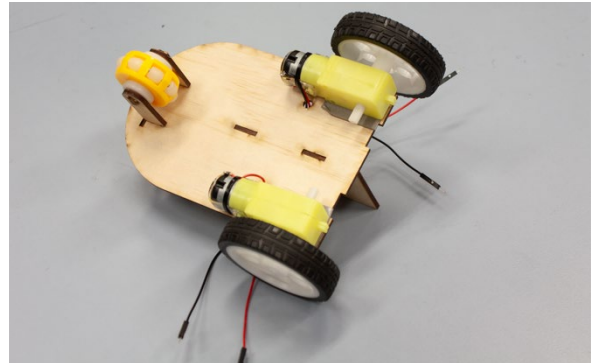
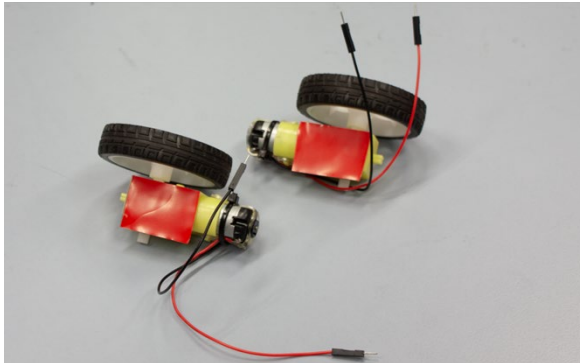
Tools:

1. Scissors

Procedure:

1. Place the double-sided tape on the square body of the motors
2. Ensure the cable tie is to the side
3. Make sure the motors correctly orientate themselves on the chassis, so the cables are inwards.
4. Peel red side of double-sided tape and carefully place motor on the chassis ensuring they are parallel to the side.
5. Firmly press the motors onto the chassis.
6. Pull the cables through the large hole next to the motors

Image:



Step 2: Assemble the chassis

Video:

https://www.youtube.com/watch?v=Z1Kt_OPkifM

Parts:

1. Partially assembled robot
2. Chassis centrepiece
3. Ultrasonic sensor holder
4. Superglue (your teacher may choose to dispense the superglue)

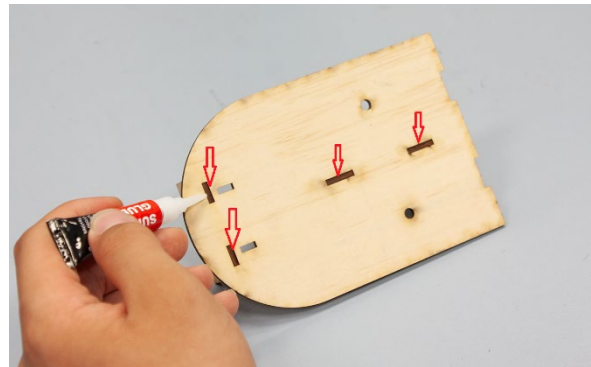
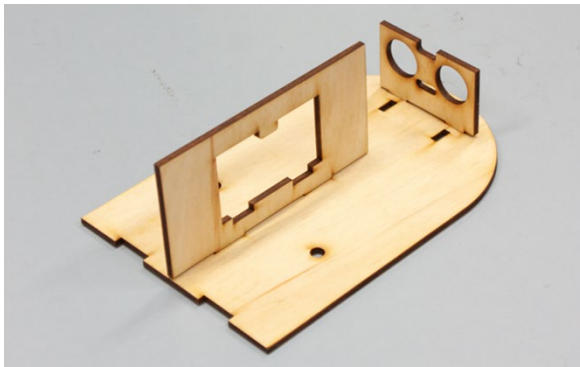
Tools:

1. None

Procedure:

1. Wiggle fit (do not force) both the centre piece and the ultrasonic sensor holder
2. Drop a small amount of superglue to the underside tabs

Picture:



Step 3: Assemble and attach the omni-wheel

Video:

<https://www.youtube.com/watch?v=OfzEexFeRfY>

Parts

1. Partially assembled robot
2. Two-part axel
3. 2x uprights
4. Omni-wheel
5. Superglue (your teacher may choose to dispense the superglue)

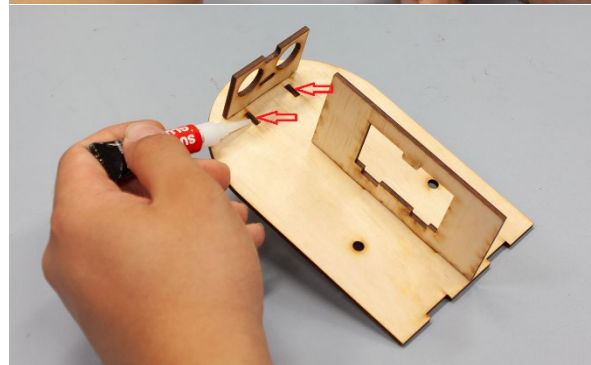
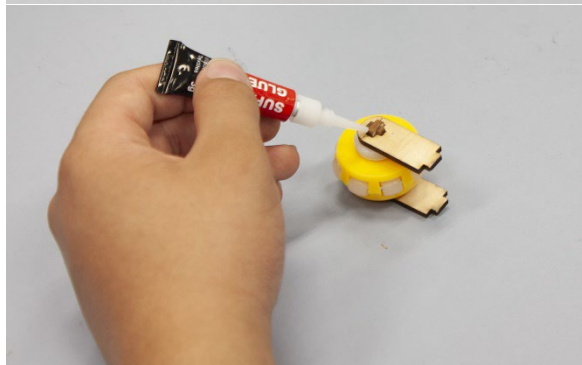
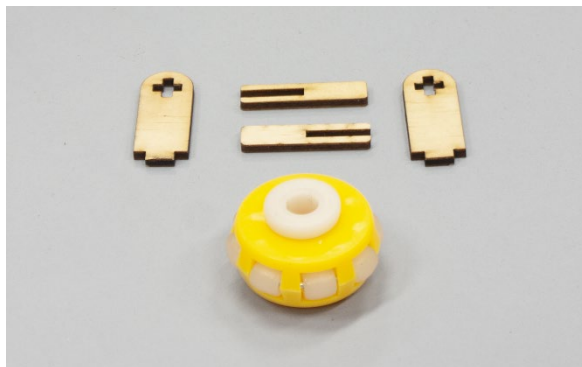
Tools

1. None

Procedure:

1. Push fit the two-part axel together and slide it through the omni-wheel
2. Push fit the two uprights onto the axel, so they are next to the omni-wheel both sides
3. Make sure the omni-wheel spins freely
4. Place a small drop of super glue on the end of the axel each side
5. Push fit the axel assembly into the chassis and apply a small drop of glue on the topside of each tab

Pictures:



Step 4: Attach the driving wheels

Video:

<https://www.youtube.com/watch?v=tTuZCgvmA4c>

Parts

1. Partially assembled robot
2. 2x Wheels

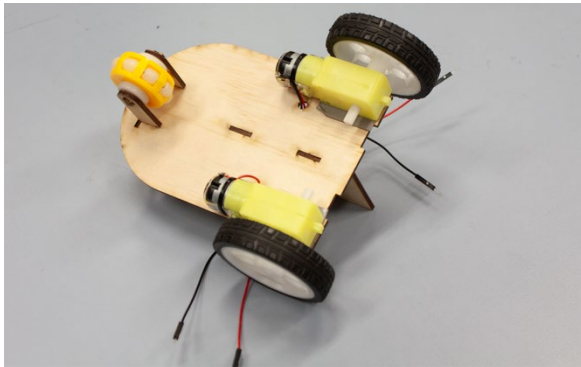
Tools

1. None

Procedure:

1. Make sure you are holding the motor firmly
2. Align the centre hole of the wheel to the motor axel
3. Push fit the wheel onto the axel

Pictures



Step 5: Attach the Arduino and battery holder

Video:

<https://www.youtube.com/watch?v=bePyt242HGU>

Parts:

1. Partially assembled robot
2. Arduino & Motor Controller
3. Battery holder
4. Double-sided tape

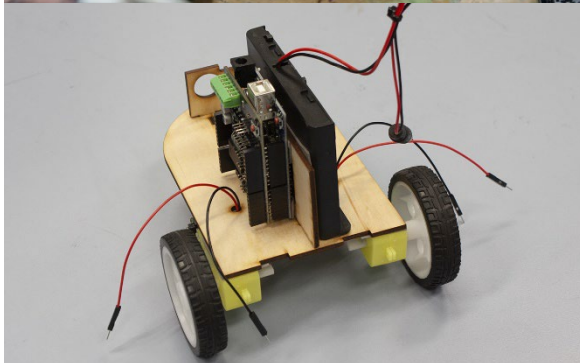
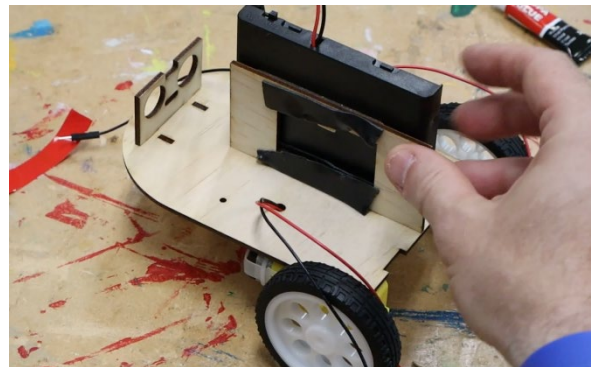
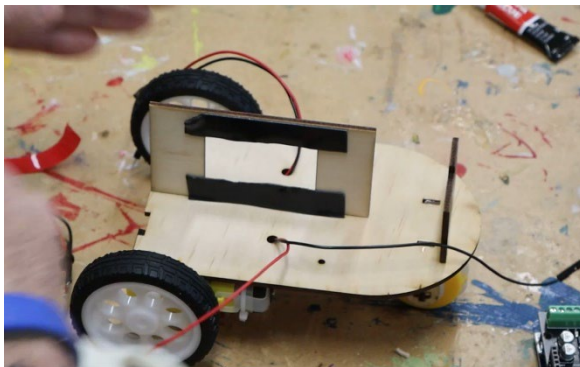
Tools:

1. Scissors

Procedure:

1. Cut 80mm of narrow double-sided tape then cut it in half down the length. Place the pieces on the top and bottom of the right-side centrepiece of the chassis.
2. Push the battery holder firmly into place
3. Cut 60mm of double-sided tape then cut it in half down the length. Place the pieces on the top and bottom of the left-side centrepiece of the chassis.
4. Push the Arduino firmly in place with the USB B connection pointing upwards

Pictures:



Step 6: Connect the power supply and motors

Video:

<https://www.youtube.com/watch?v=9kGzbvop4qE>

Parts

1. Partially assembled robot

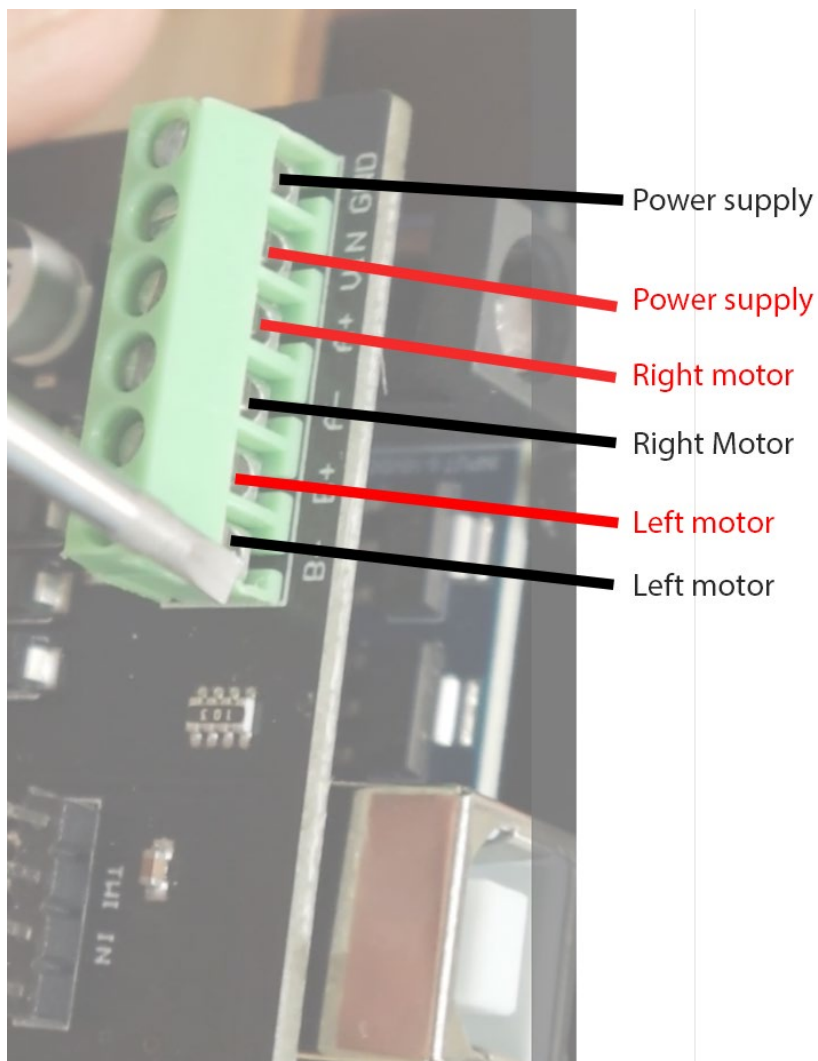
Tools

1. Precision flathead screwdriver

Procedure:

1. Unscrew all terminals $\frac{1}{2}$ a turn, be careful not to over unscrew as the screw will fall out
2. Connect each wire as per the below images and then gently tighten each screw terminal to hold the wire tight

Pictures:



Step 7: Connect ultrasonic sensor

Video:

<https://www.youtube.com/watch?v=OdE1rghmjQ>

Parts:

1. Partially assembled robot
2. Ultrasonic Sensor
3. 4x Dupont Cables

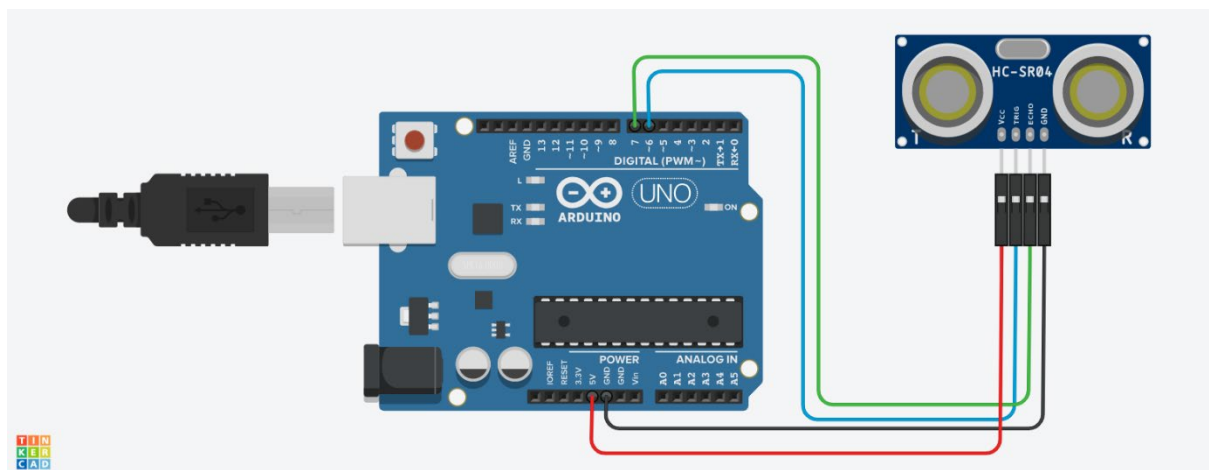
Tools:

1. None

Procedure:

1. Push fit the female end onto the ultrasonic sensor
2. Connect the male pins to the top of the shield as per the picture below

Pictures:



Step 8: Type test code

Video:

<https://www.youtube.com/watch?v=4qnntwJOTig>

Install (BYOD device only)

1. *DO NOT plugin the Arduino before completing all steps below*
2. Download the drivers and IDE here:
<https://drive.google.com/drive/folders/1E7SvlfkN71MPG1qPeB8lUVP195bzzzzz>
3. Install the drivers first
4. Install the IDE (accept all the dialog boxes)
5. Restart your computer

Type the test code

Procedure:

1. Download the files: https://github.com/TempeHS/AIDriver_Challenges
2. Extract the files and delete the zip file
3. Navigate to the testDebutestdebug.ino file and double click it, it with the Arduino IDE
4. Type the test code in the IDE

```
#include "AIDriver.h"

// Declare a pointer to a AIDriver object
AIDriver *mrJonesDriving;

void setup(){ // sets up once as the program starts
    // Instantiate a two wheeled to the pointer 'mrJonesDriving'
    mrJonesDriving = new AIDriver();
}

void loop(){ // loops continuously 50 times a second
    // Read the distanceRanger ultrasonic sensor and return the object
    distance in mm
    Serial.println(mrJonesDriving->read());

    // obj->doSomething(); in this case make the object mrJonesDriving
    rotate to the right at a speed of 200
    mrJonesDriving->rotateRight(125); // speed can be between 0-255
    // wait 2000 milliseconds or 2 seconds
    delay(2000);
    mrJonesDriving->rotateLeft(125);
    delay(2000);
    // Make mrJonesDriving drive forward left wheel speed 200 and right
    wheel speed 200
    mrJonesDriving->driveForward(125,125);
    delay(2000);
    mrJonesDriving->driveBackward(125,125);
    delay(2000);
}
```

Step 9: Upload the test code and debug

Video:

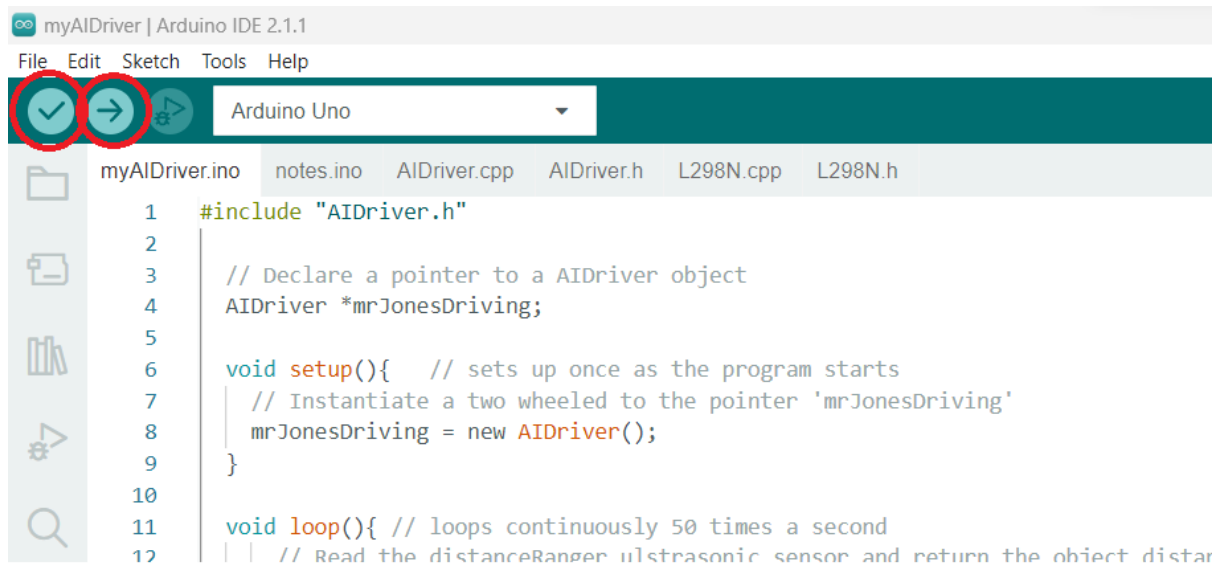
1. https://www.youtube.com/watch?v=IM-qIM_o73Y

Procedure:

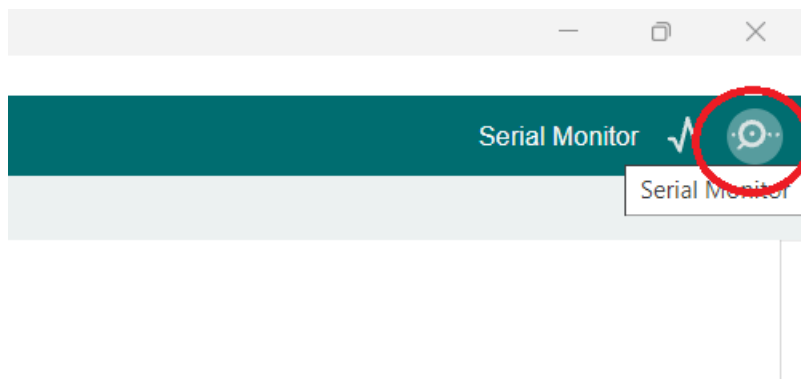
5. Make sure battery position is 'OFF'
6. Use the USB cable to connect the Arduino to your computer
7. NOTE the next steps will need to be repeated every time you open the IDE, don't forget them
 - a. Click the little arrow in the top menu box and choose 'Select other board and port'



- b. Type Uno into left search box and choose 'Arduino Uno'
 - c. Click the USB port on the right
 - d. Click 'OK'
8. Click the tick to compile then the arrow to upload



9. In the top right corner click the 'Serial Monitor'



10. The serial monitor should open, and you should see a reading in 'mm' of your ultrasonic sensor every 8 seconds
11. Disconnect the robot from the computer
12. Place your robot on the floor and turn the power switch to 'On'. Your robot should rotate to the right for 2 seconds, rotate to left for 2 seconds, drive forward for 2 seconds and drive backwards for 2 seconds then repeat until you turn it off

Debugging advice

Code does not compile	<p>Read the terminal feedback to assist your debug.</p> <p>Make sure you read the test code and very carefully type the code ensuring all lines that need to end with a ';' have a ';'.</p> <p>Make sure that uppercase and lowercase words match for example 'daviddriving' is different to 'davidDriving'.</p> <p>Make sure you have not deleted a '{' or '}' as the very last line should be a '}'.</p>
The code does not upload	Make sure only one window of the Arduino IDE is open
	If on a BYOD device make sure the drivers have been installed
	Make sure you have selected 'Uno' and the active port from the top menu
	Make sure the USB B cable is firmly connected to the Arduino
After uploading the code robot does not respond and red lights next to the green terminals do not flash	Check battery is switched on
	Check batteries have a charge
	Check batteries are correctly installed
	Check barrel jack is firmly inserted into the Arduino
	Check green terminals are screwed firm
	Check battery connections are correct, red to VIN and black to GND
After uploading the code robot does not respond but red lights next to the green terminals are flashing	Check motor connections are correctly wired to the green terminals
	Check green terminals are screwed firm
After loading the code motors work but they do not follow the correct pattern of: <ul style="list-style-type: none"> - Rotate right - Rotate left - Drive forward - Drive backward 	Check motor cables are correctly wired to the green terminals
	Check your code is written in the correct order
When the serial monitor is open the Ultrasonic Sensor reads	<p>Look carefully at the Arduino and make sure the Ultrasonic Sensor is wired correctly:</p> <ul style="list-style-type: none"> - GND to GND - VCC to +5V

1 or zero and does not respond to distance	<ul style="list-style-type: none">- Trig to 6- Echo to 7
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