

technocamps

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S4A - Scratch for Arduino Workbook

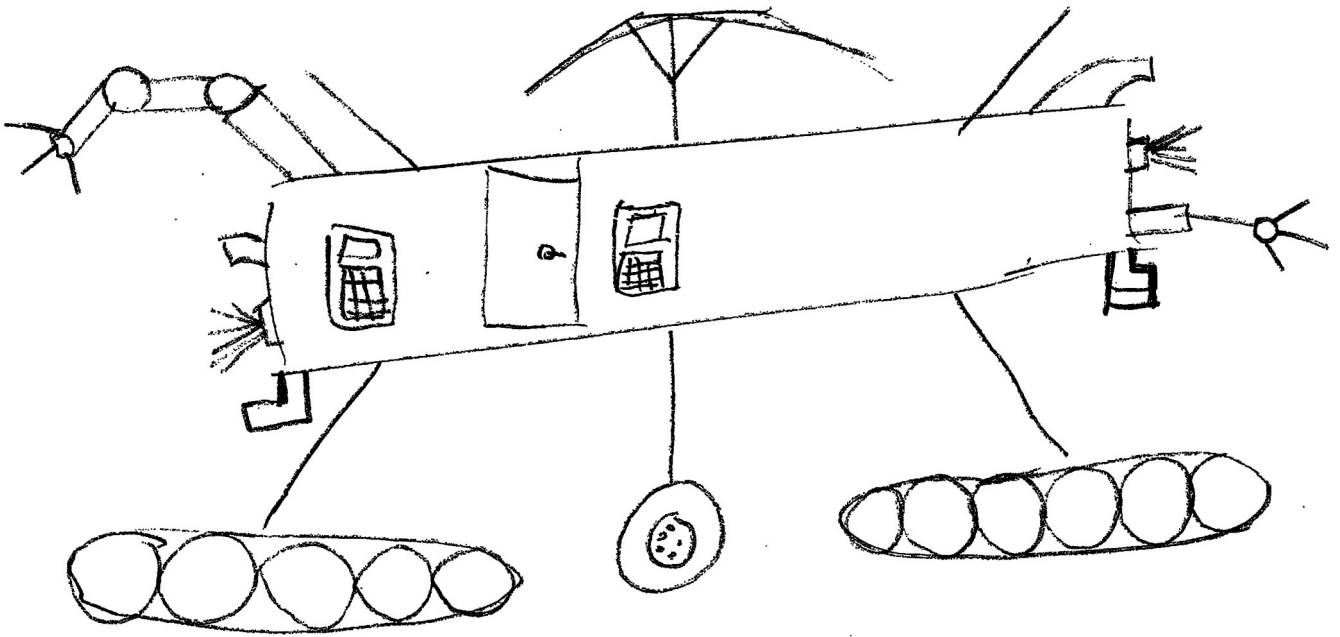


S4A- Scratch for Arduino

1) Robotics

Draw a robot. Consider the following and annotate:

- What will it look like?
- What will it do?
- How will you as a user interact with it?



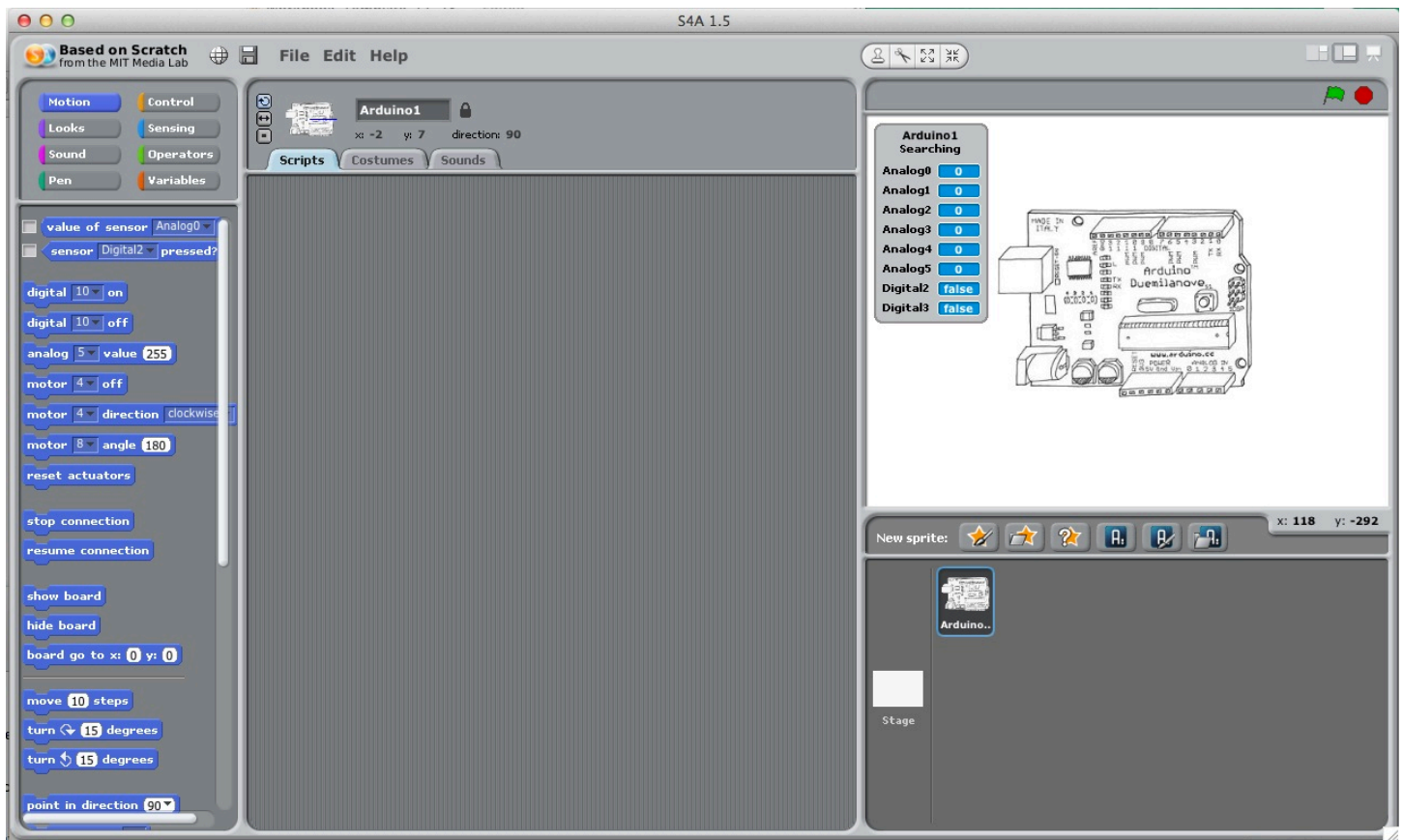
Robots are devices, sometimes they can be programmable. Some robots can sense and interact with their environment, perhaps even begin to learn with the incorporation of Artificial Intelligence. Some robots may be created for a certain purpose such as factory robots, repeating the same tasks in potentially dangerous environments.

Within this activity book you will be developing your own Arduino Project. Arduino is a micro-controller, which is a small computer that you can use to send and receive messages to and from other electrical components. It is used similar to a motherboard, inside your computer - you can connect various components to it and build up your electrical circuits. Usually Arduinos are programmed using a programming language called C, this is a language commonly used within industry but can be initially complex to grasp, particularly for beginners. Alternatively, you can use drag and drop programming environments where the focus is on the concepts behind the build of code blocks rather than worrying about syntax errors. Scratch for Arduino is a good example of this.

S4A (Scratch for Arduino) is a drag and drop programming environment based on the MIT creation "Scratch". It has been modified to connect to an Arduino plugged in via USB, offering a variety of additional code blocks to implement and create scripts to control the Arduino and attached components.

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S4A can be downloaded onto the following operating systems: Mac, Linux and Windows. Make sure this is installed correctly and opened before continuing.



Scratch has 5 main sections, firstly starting from the top left you have a list of categories to choose from. As you select each one you can see in the box below different instructions appear in the box directly below (colour co-ordinated), these can be used to create your game by dragging them across to the right where the scripts can be used for your project. On the right of the screen, you can see the white box with the Arduino drawing inside, this is your project. As you begin developing your project, you can play and stop it using the green flag and red circle buttons above. There is one last section, this is your library below the project screen. As you begin connecting more boards, these can be added as sprites, you can see them all being stored in your project library here.

2) S4A

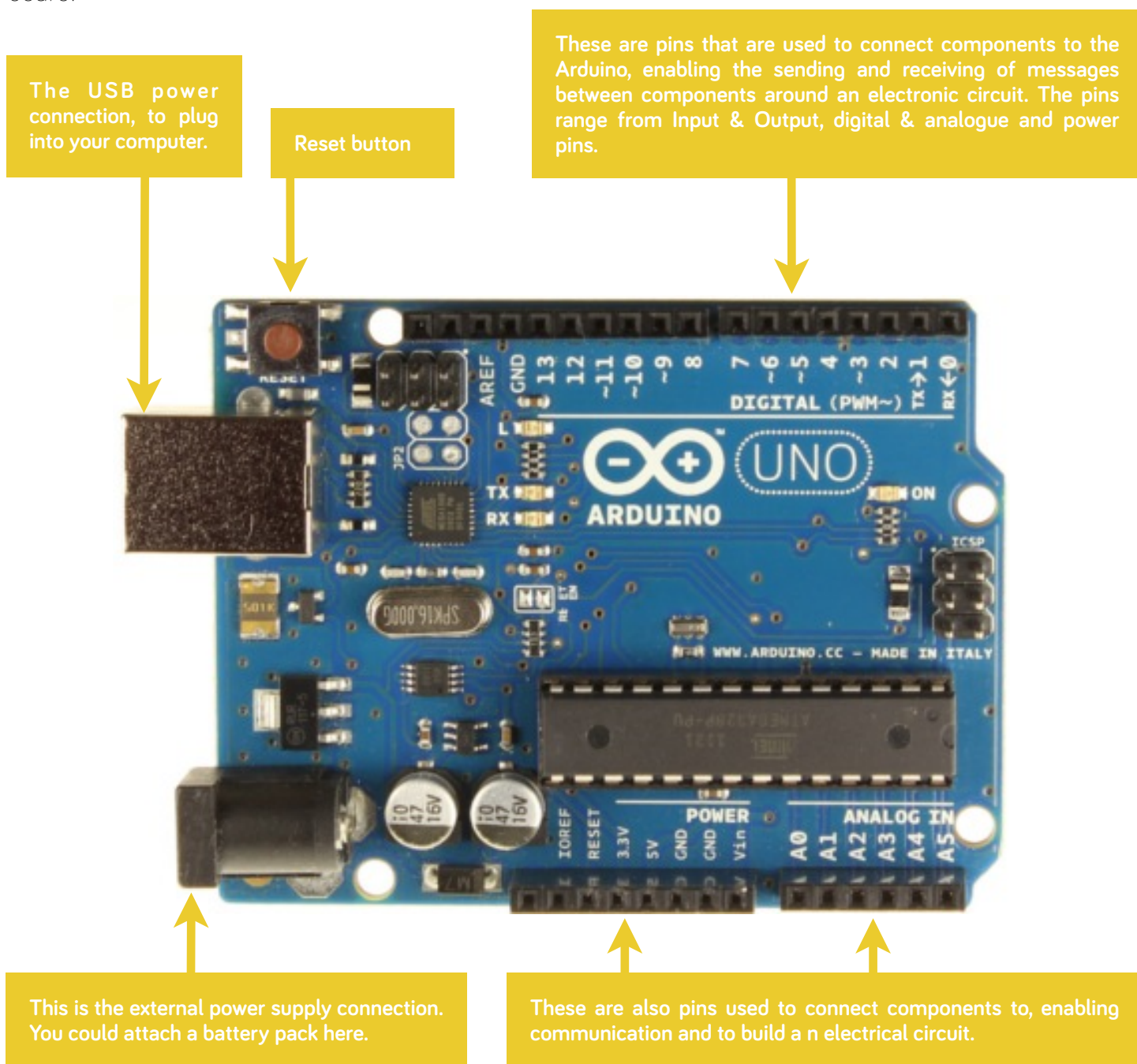
Start combining blocks of code and dragging on pieces to build up practice scripts. Note how certain blocks connect and see that all blocks need to begin with a “Control” block - colour coded in yellow. Most of the blocks appropriate to an Arduino project are available in the “Motion” category (colour coded in the darker blue), see the Top Tips for a breakdown of the purpose of each of the code blocks.

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2) Scratch vs S4A

If you already have a familiarity with the Scratch interface or are able to download Scratch onto your computer, what are the biggest differences you notice between the software? Can you see how the new code block additions can be implemented into your scripts to build up an Arduino project, rather than a game or animation?

Now that you are familiar with the S4A interface, let's have a look at the micro-controller you will be using throughout this activity book. Below is an explanation of some of the elements of the Arduino board:

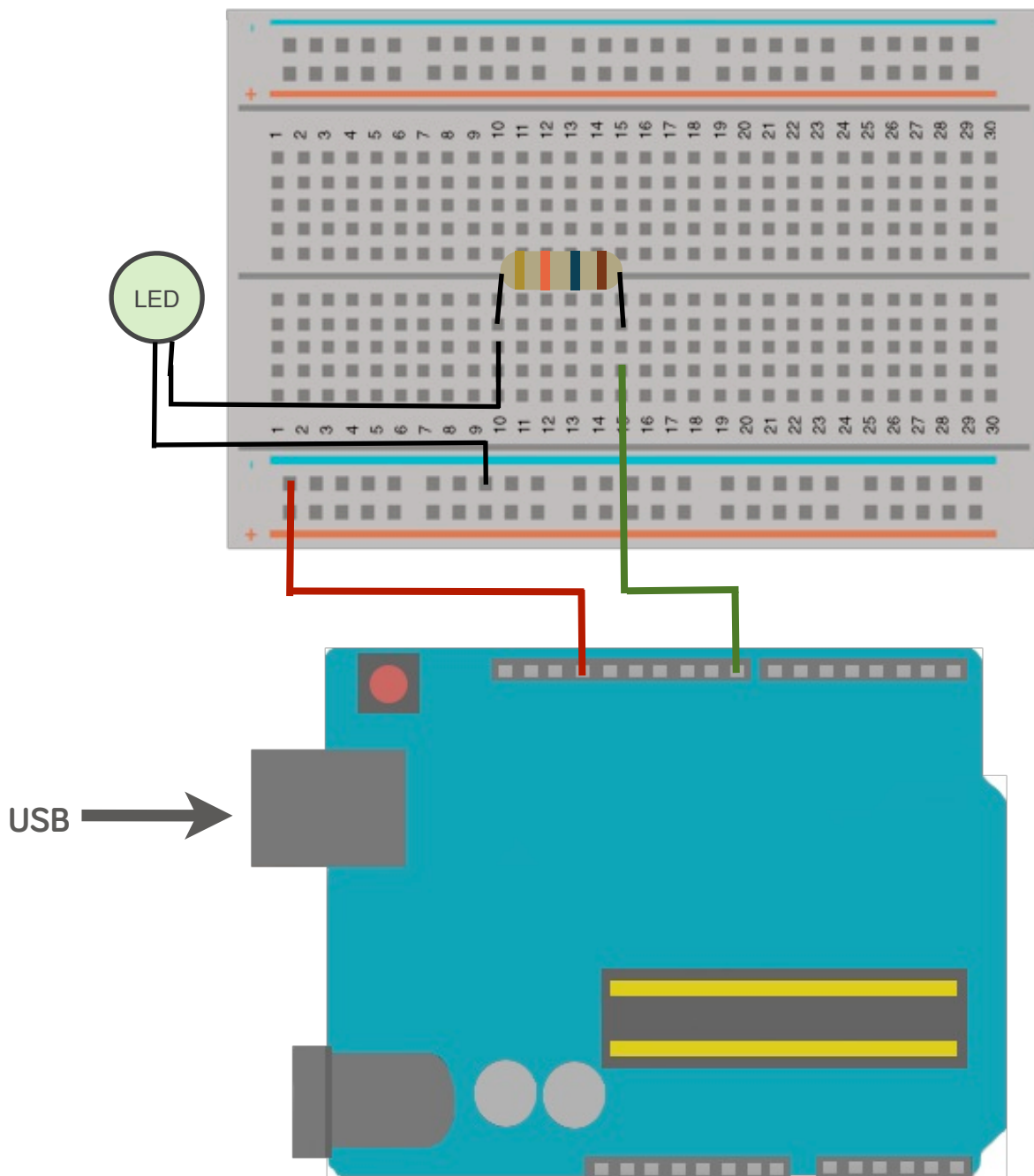


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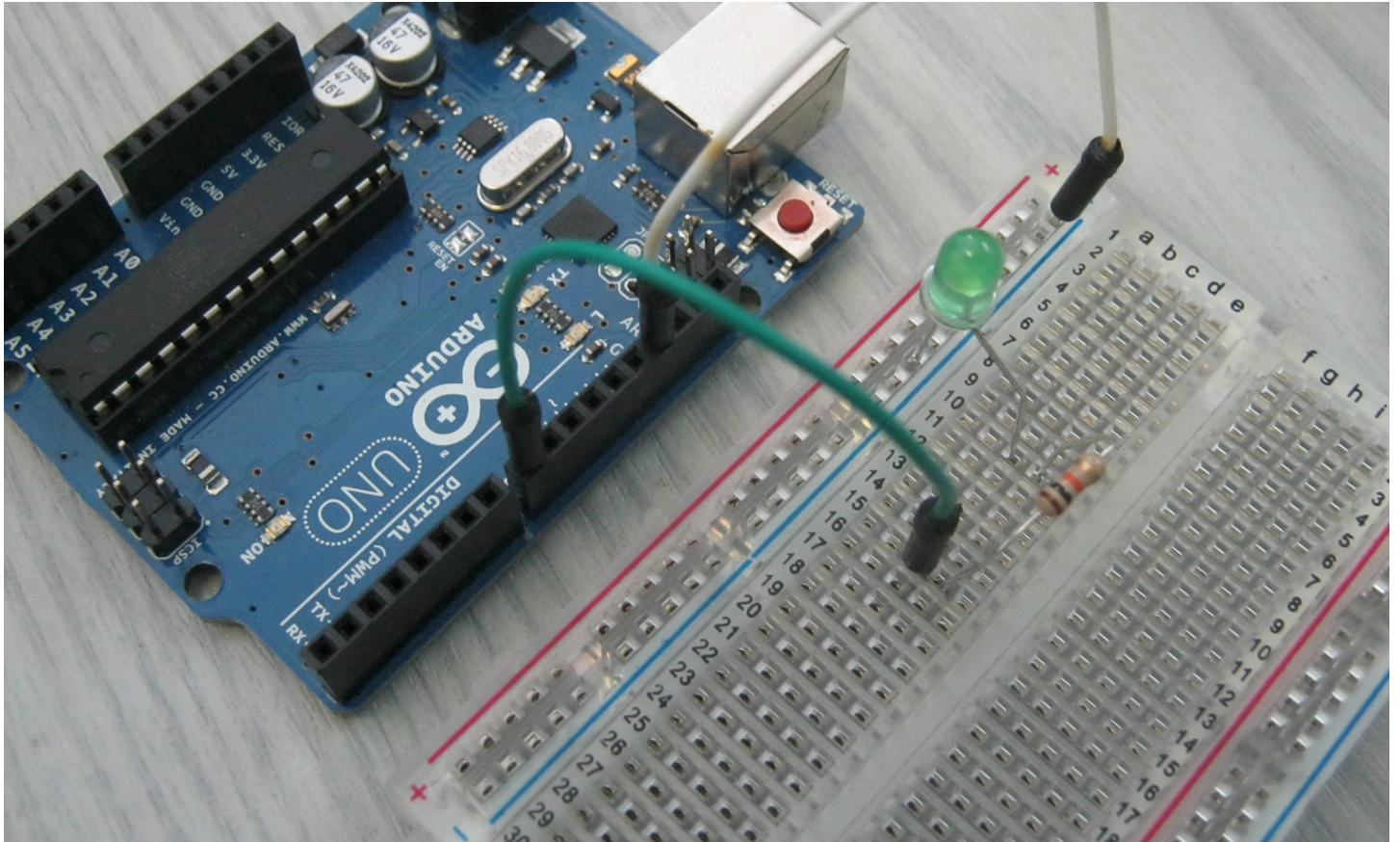
3) LED circuit

In an workshop environment there will be a pre-made “LED” circuit to connect to the Arduino, although if you wish to build your own follow the instructions and diagram below:

- Attach the jumper wires to the Arduino and the breadboard.
- Next, insert the appropriate resistor.
- Finally insert the LED and ensure the USB connection is attached to the computer as a power source.



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Here is where you begin more confidently using the code blocks on S4A. So far you have got your LED to shine successfully once power has been supplied via USB. But how could you get the LED to shine on, then off and repeat this continuously?

As you know all commands on S4A/Scratch must begin with a “Control” block. There is also some code in the “Control” category that will allow you to repeat the embedded instructions...forever. Referring back to the “Motion” category will enable you to specify which digital pin to reference.

If you are using the LED circuit issued within a Technocamps workshop, the LED should be plugged into Pin 13, double check this just in case.

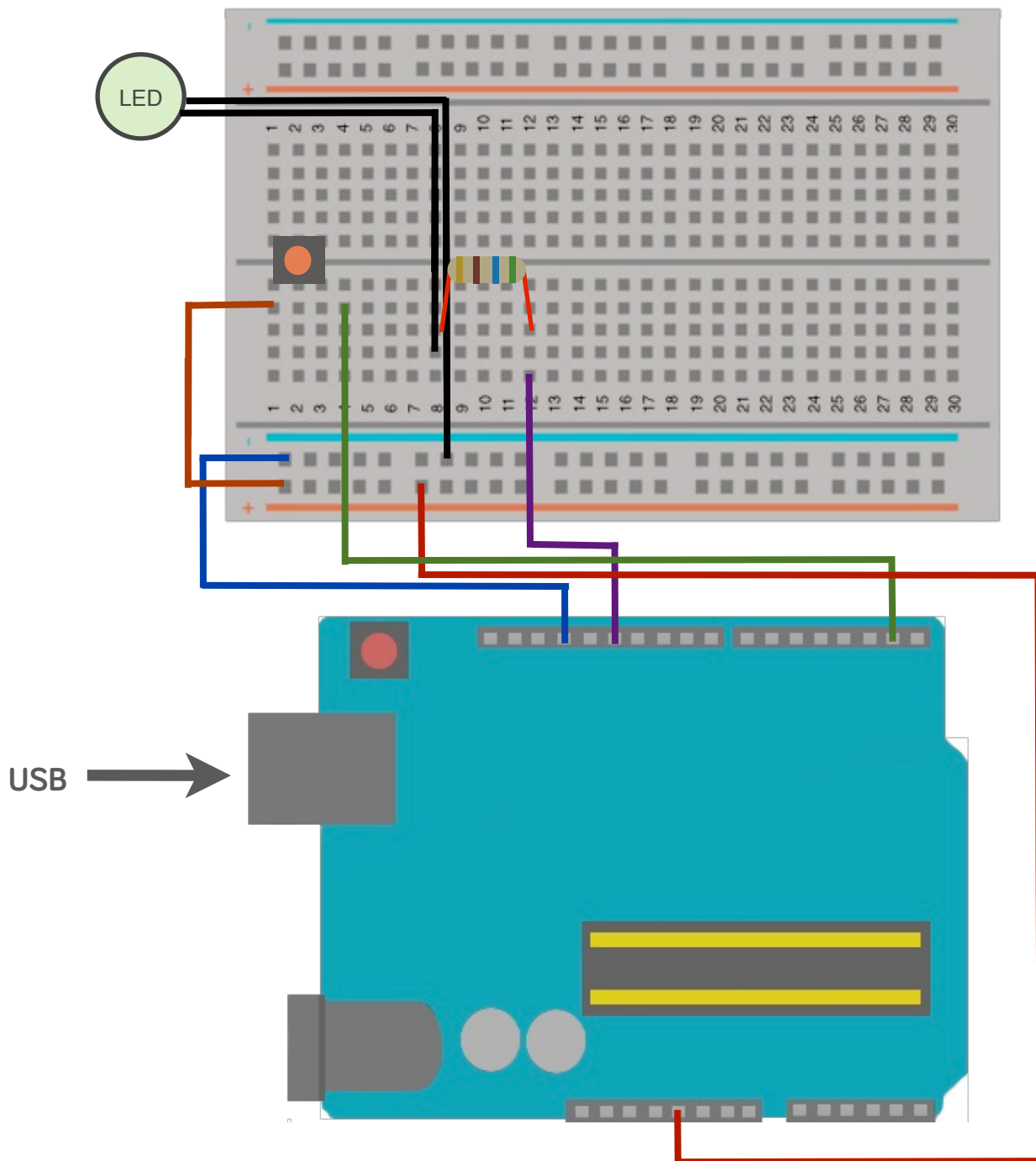
4) Flashing LED

Add instructions on S4A to tell the LED to turn on, then off again. Don't forget to check which pin you have your LED plugged into to reference correctly in your code blocks. Also, if you wish to slow down the speed of the on and off flashes, you could use a “Wait” command from the “Control” category and set your chosen time to pause.

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5) Flashing LED with a button

Add a switch (button) to your Arduino circuitry. This will control the flashing of the Arduino, you will need to alter the circuit from the previous task to a circuit similar to below. When the button is pressed down the circuit is completed so power is supplied to the LED, when it is released the circuit is incomplete.



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Next you will be using 2 new elements of your Arduino kit: Magician Chassis and the Motor Controller. The motor controller lets you move 2 motors controlled by your Arduino board, it can control the speed, the brakes and direction of each independently. The Magician Chassis has 2 gear-motors and enables you to attached the Arduino and Motor controller on-top of it so the entire robot can maneuver around.

6) Change over

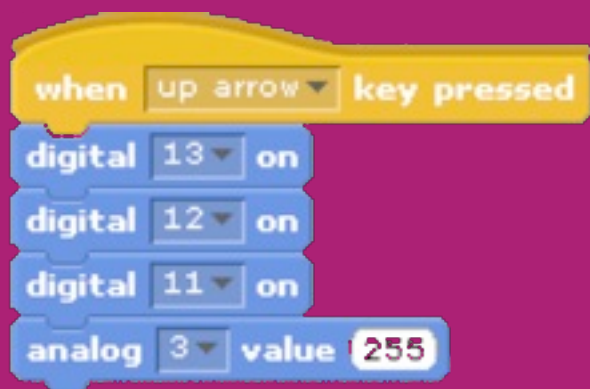
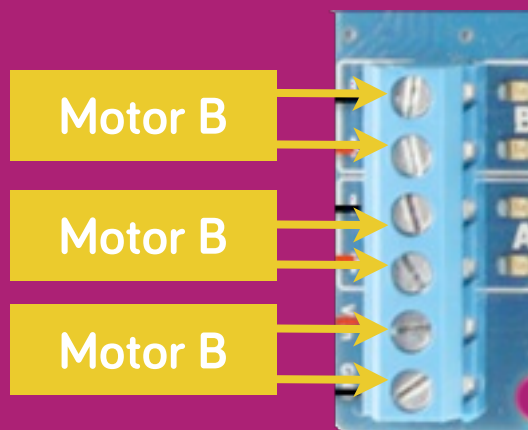
Unplug the LED circuit and connect the Arduino to the motor controller and the magician chassis.

7) Motor Controller

As you can see, the motors are both wired onto the shield, in the ports A and B. A battery pack will also be needed here (if not provided) which should be wired into the over port of the shield.

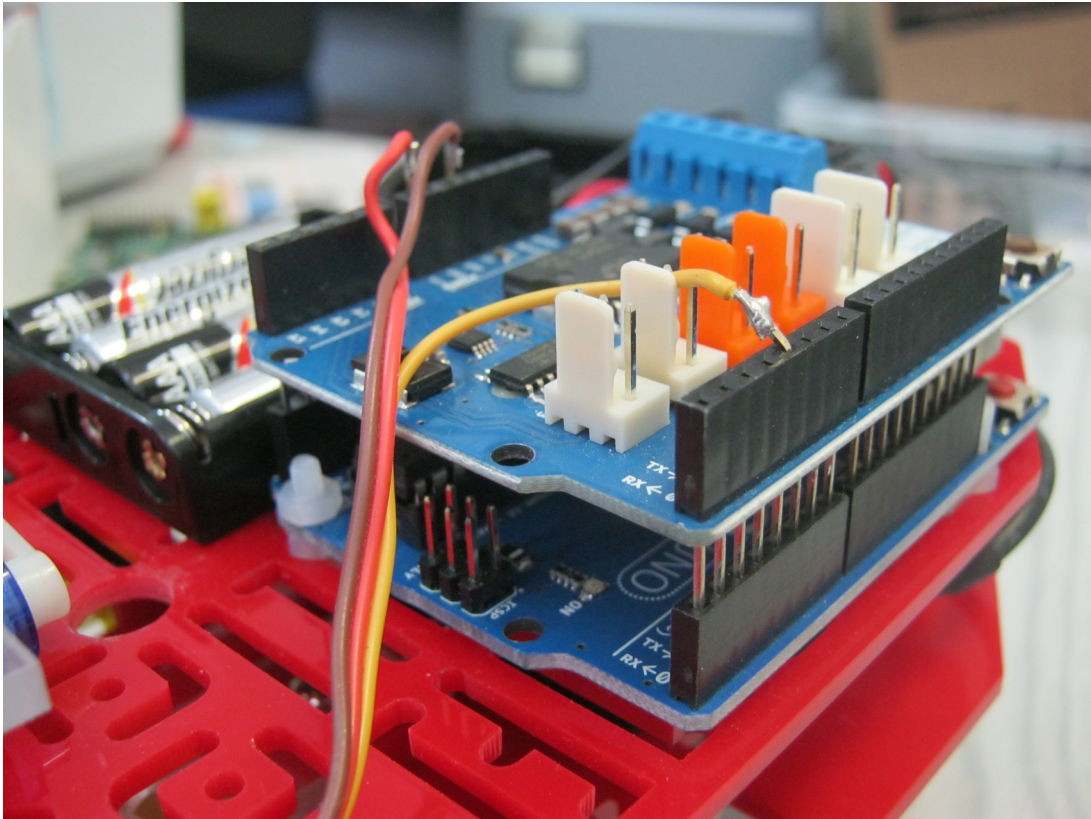
Each motor has a direction that it spins in, and a power for how fast they are spinning. The direction of the motors initially need to be set, using S4A. You can see the required directions and powers in the table below.

Use your knowledge and familiarity of S4A to do the commands for "When up is pressed", "When down is pressed", "When Left is pressed", "When Right is pressed" and "When Space is pressed". Up has been done as an example below:

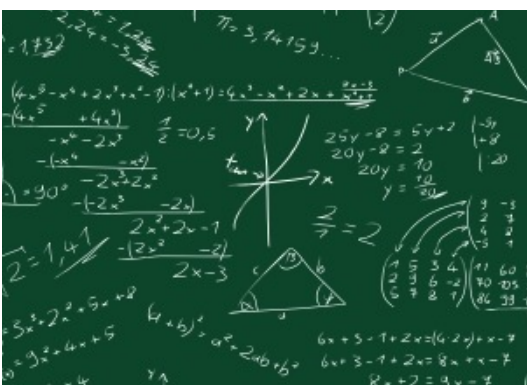
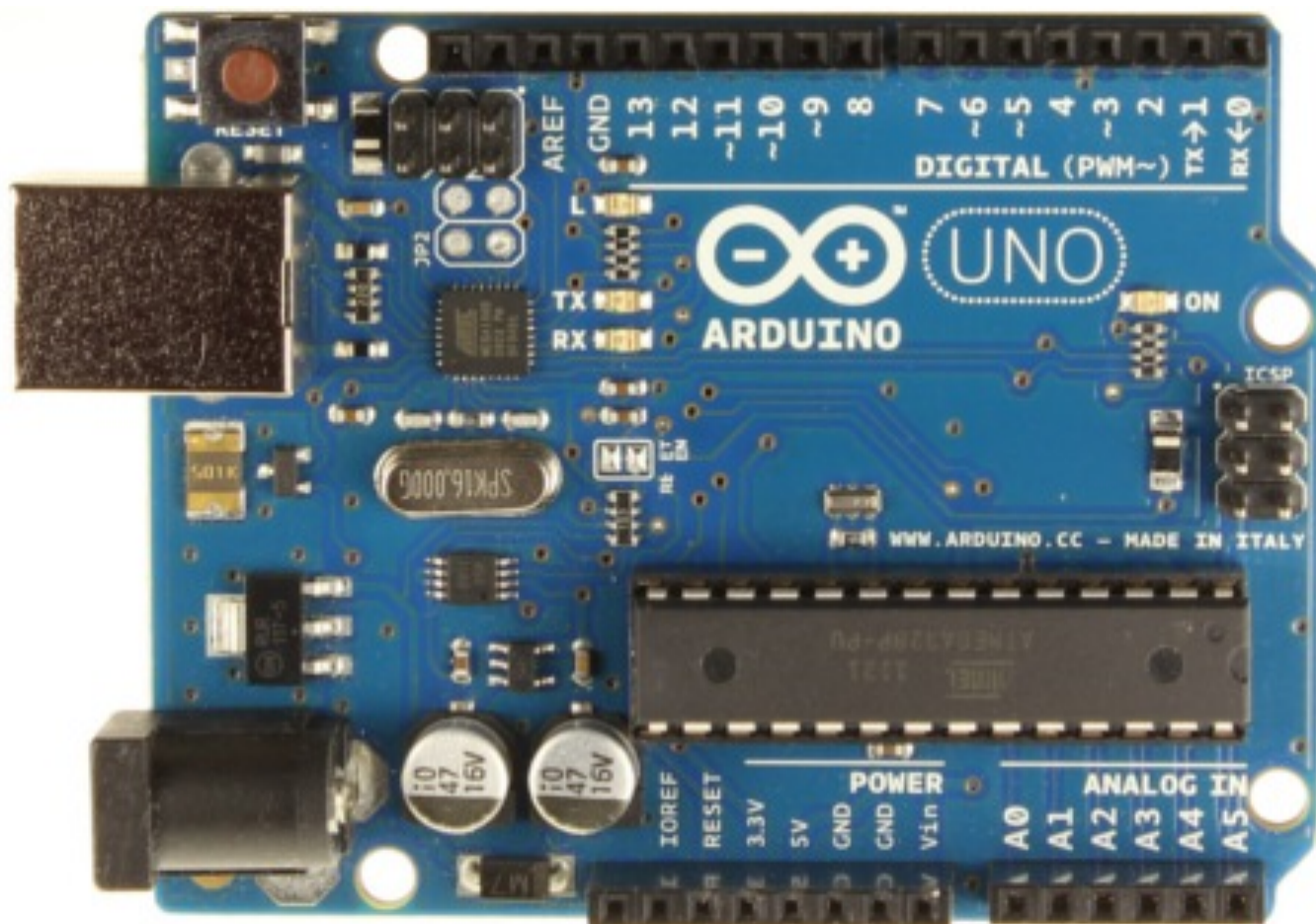


DIRA	Direction of A (Pin 12)
DIRB	Direction of B (Pin 13)
PWMA	Power of A (Pin 3)
PWMB	Power of B (Pin 11)

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Congratulations you have successfully built an Arduino robot, commanded to move using the S4A interface.



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