Robogals Science Challenge

Minor Challenge Set #4
STEM Field: Electrical Engineering
Level: Junior
Challenge Name: Introduction to Arduino: Blink an LED
Materials required:
- Laptop/ Computer with Internet access
- An account on TinkerCAD (a free software)

Introduction:

Arduino is a platform to create interactive electronic projects. We can use Arduino boards to read input, for example, light on a sensor, and turn it into an output, such as turning on an LED. If you want to tinker with a project that involves both softwar e (coding) and hardware (building electrical circuits), Arduino is a great way to start.

To work on an Arduino project, you will need an Arduino board, wires, batteries, resistors, LEDs and more components, depending on the project you are working on. It may be difficult to gather all the required components, therefore, in this activity, we wi ll use TinkerCAD - a free software with tools to build electronic circuits and simulate them.

It may seem daunting as you attempt to build your first circuit, but fear not! Our activity is designed to help beginners navigate the software tools and build the first LED circuit. Upon completion of this activity, you may like to explore your own ideas and submit them as a Major Challenge.

Instructions:

1. Navigate to the website: https://www.tinkercad.com . It is recommended that you open this website on a browser such as Chrome. This software is free-to-use, and creating an account is necessary to save the progress of your project.

   If you have not registered, click "JOIN NOW", then select "Create a personal account".

   Alternatively, click "Sign In" to log into your TinkerCAD account.
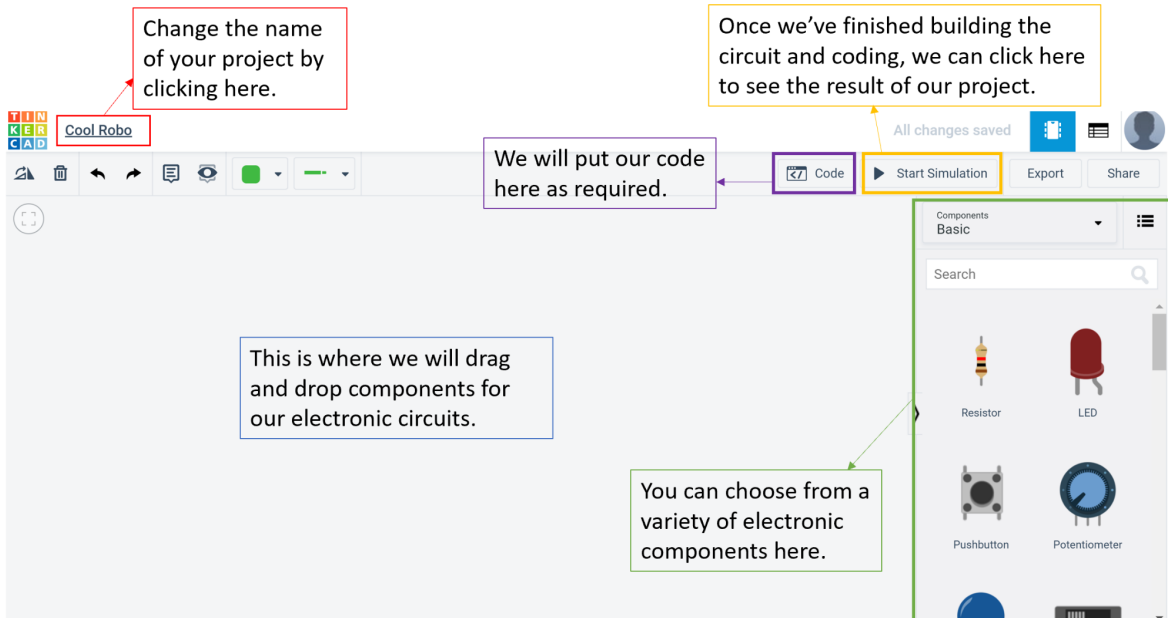
2. After you have logged in, you will see a dashboard with projects you are working on. TinkerCAD can be used to create 3D models or other software projects. In this activity, we will build our electronic circuit, so select "Circuits", then "Create new Circui t". (See the figure below)
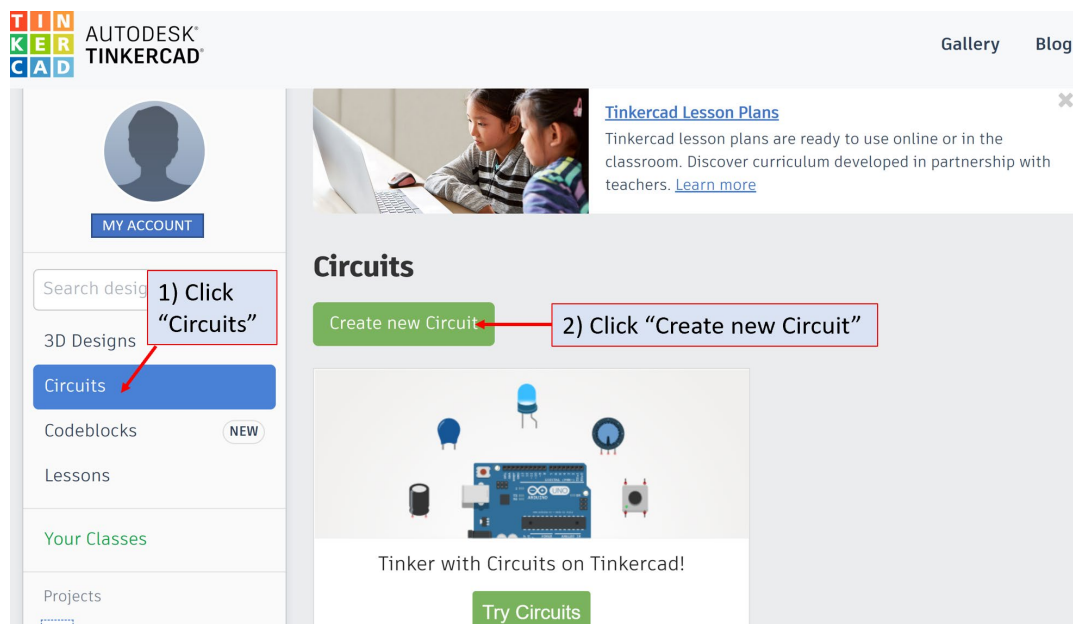
3. This is what your project dashboard will look like. The figure below shows the main functions you should be aware of before building your project.

Change the name of your project by clicking here.

Once we've finished building the circuit and coding, we can click here to see the result of our project.

We will put our code here as required.

This is where we will drag and drop components for our electronic circuits.

You can choose from a variety of electronic components here.

4. In this project, you will need 1x Arduino Uno board, 1x LED and 1x resistor. Drag and drop the components to the space provided.

5. Click on the resistor and change the resistance to 220Ω (as highlighted in the red box below).

Explanation: We need to use a resistor for our LED circuit. If there is too much current flowing through the LED, it may burn the LED out. A resistor is a component used to limit the current flow, and so helps prevent the LED from burning.
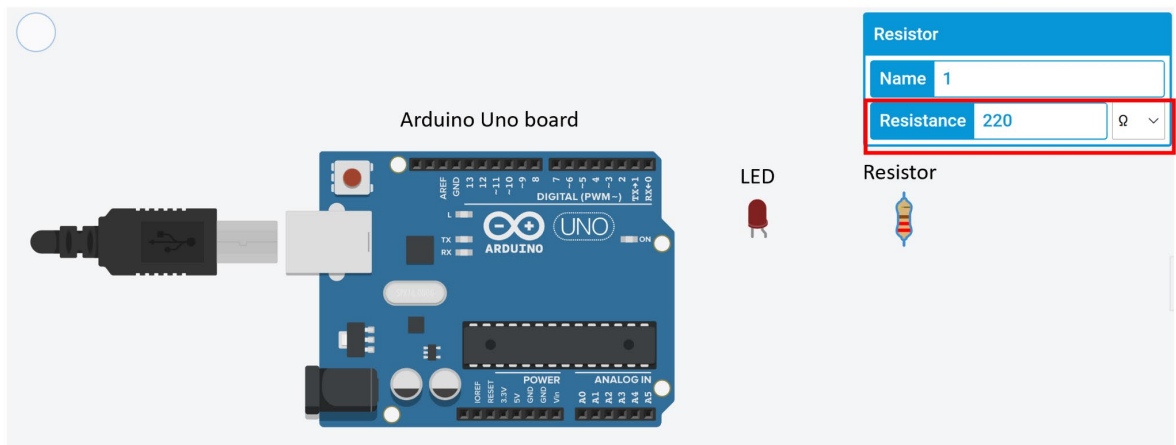
6. We will now connect the circuit as shown below. We will connect the negative leg (or the shorter, straight leg) of the LED to one side of the resistor.

   Explanation: By clicking and joining the components together, you are adding wires to build an electrical connection between them.

7. Click on the other side of the resistor and connect it to the GND (Ground) port.

8. Click on the positive leg (longer, bent leg) of the LED to the output 13 port. The figure below shows what your final electrical circuit should look like.

   Explanation: The LED only works when we connect it in a certain way. The negative leg of the LED is always connected to GND (Ground). The positive leg of the LED is always connected to an output port (in this case, we have chosen number 13).
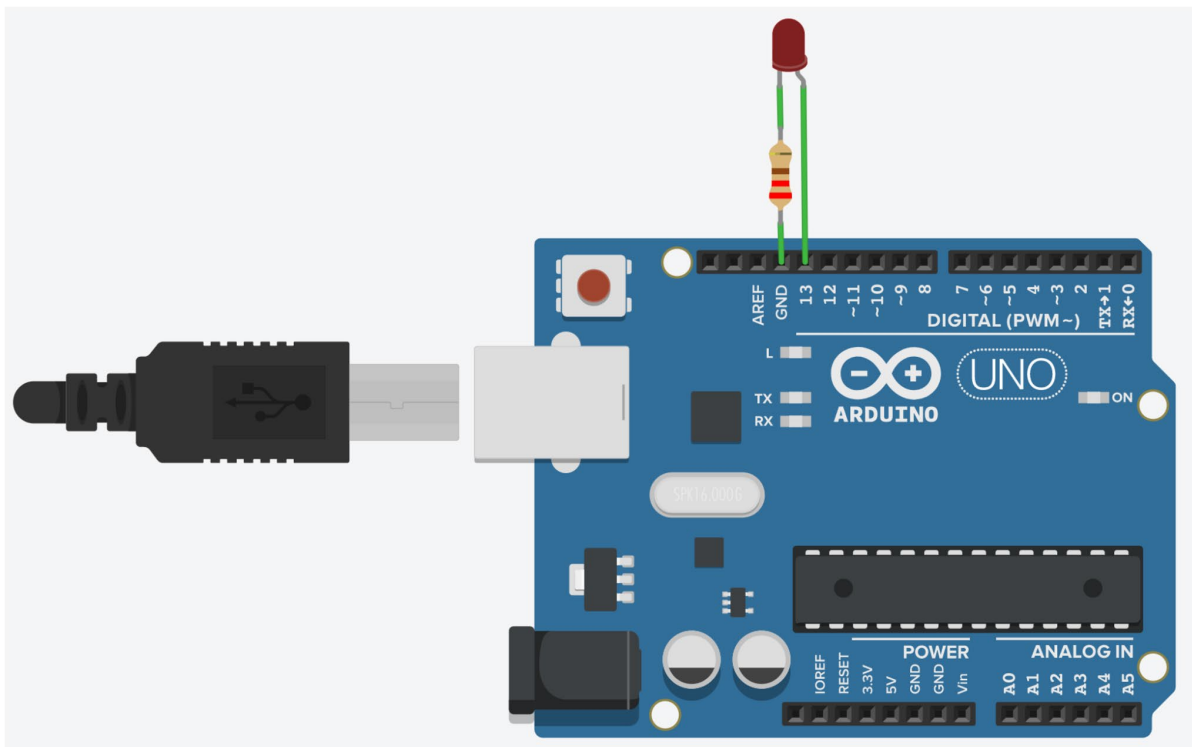
9. We will now add code to our electrical circuit by clicking on the ⟨/⟩ Code symbol. You will see the below code.
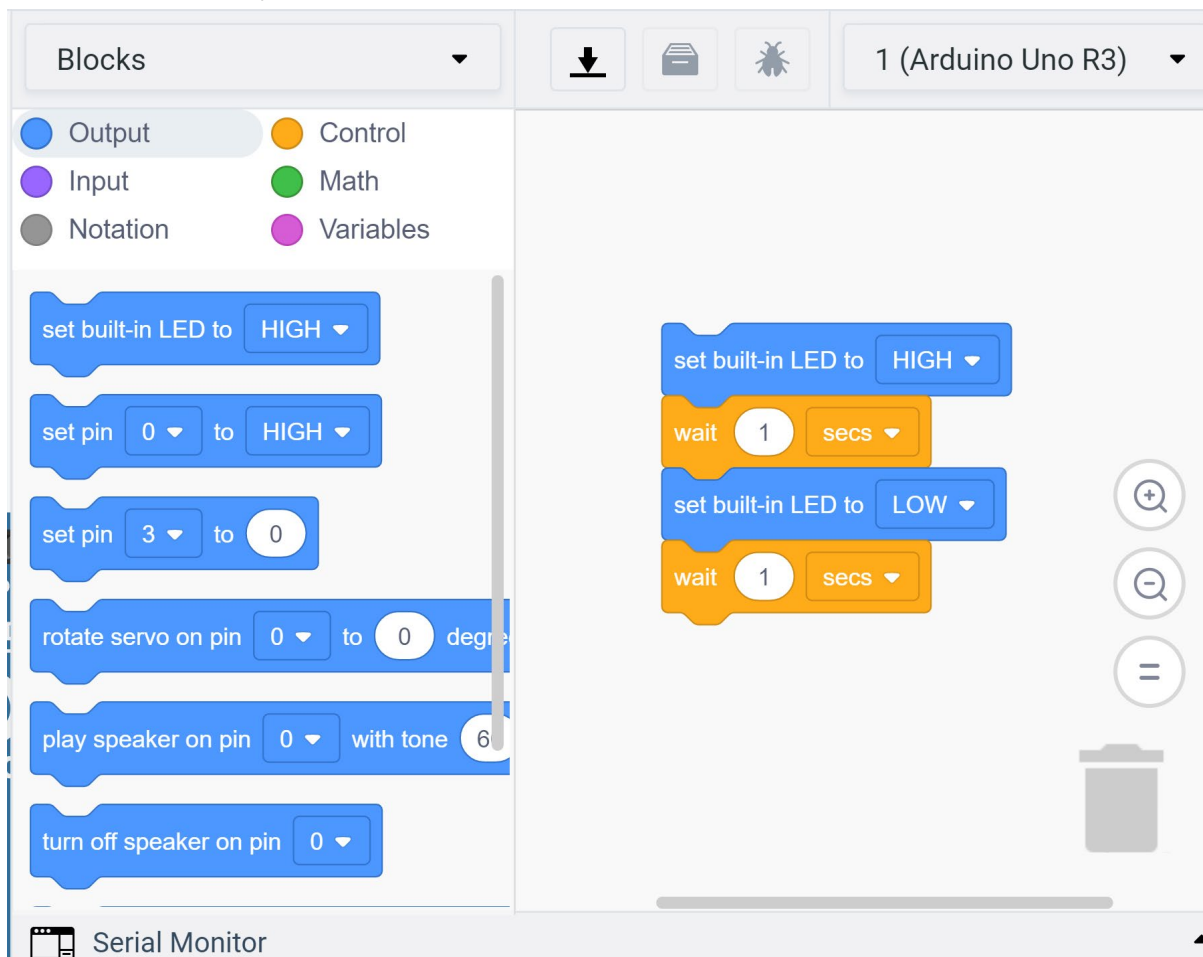
10. Here, we are telling our circuit to turn on the LED (by setting it to HIGH), then wait for 1 second, before turning off the LED (by setting it to LOW).

11. You can now click on "Start Simulation" and see how your circuit behaves.

Extension:

Research on how you would connect two LEDs in a circuit, then build it. If you attempt this task, please include a photo of your project as part of the submission for this Minor Challenge.

Reflection Questions:

- Are there any improvements you would make to this challenge?
- What real world application can you apply the challenge to?
- What are the key concepts of science and engineering that relate to this challenge?

- How would you change the time between when the LED is turned on and off?
- How would you change the colour of the LED? How would you change the colour of the wire?
- Remove the resistor from the circuit. Then connect the negative leg of the LED to GND (Ground). Did you get a notification as you simulate your circuit? In your own words, why do we need a resistor for this LED circuit?

Submission Guidelines:

- Submit photos of your code and circuit. Include a short summary that addresses the Reflection Questions.

> **Note:** When submitting this Minor Challenge, please upload pictures of your project or experimental setup. Remember, if you want to upload pictures of your Minor Challenge that also include you, please check if it is OK with your mentor first.

- There is a submission form directly on the Minor Challenge page here: https://sciencechallenge.org.au/index.php/minor_-challenges/.
- Fill out the details and make sure you upload your submission.

Learn More! Resources:

- This website has lots of projects and lessons for beginners - https://www.tinkercad.com/learn/circuits
- If you want to see what other people are building or tinkering with, have a look at the Gallery section of TinkerCAD - https://www.tinkercad.com/things