Arduino Basics 101

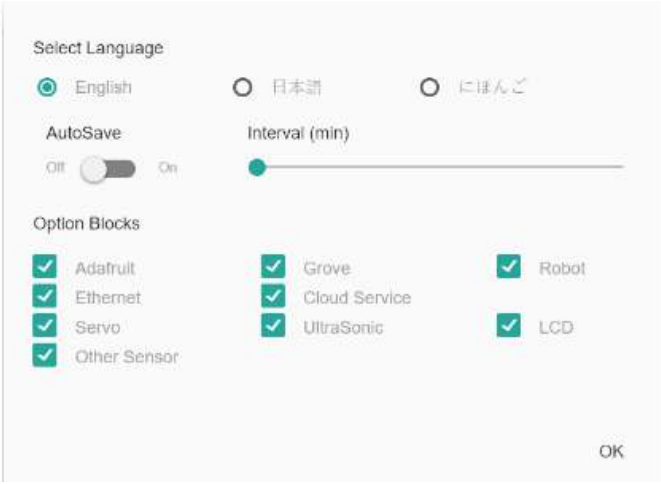
Programs for Arduino Projects

In order for us to build and create robotics that respond to our instructions we have to learn how to communicate with it. The **Arduino** is a unique computer-based language. It will receive instructions from the computer using a USB and then pass the message to the robotic parts.

1. Click on the link below. The **BlocklyDuino** Editor app allows you to click, drag and combine block code/instructions. Add the link to your desktop by going to the website in Google Chrome and click the three-dot icon in the top-right corner of your browser window. Then, go to "More tools" > "Create shortcut."
   https://code.makewitharduino.com/#

In BlocklyDuino go to the **settings menu**

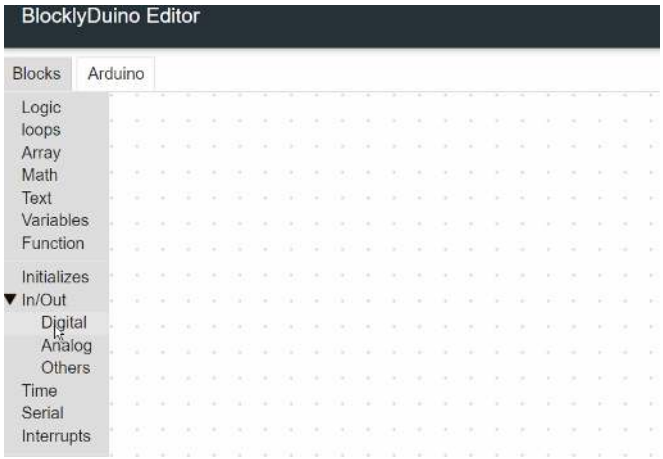
Click on the settings button. This will open the blocks menu. Check all the boxes so that you have access to all the menu blocks. Then, press "OK."



How to Navigate the BlockyDuino

Green: Block-bank is the area where all the blocks can be used to construct a program.
Purple: Building platform is the area where we construct our program by dragging and connecting our blocks.
Red: Code selection is the area that allows the switch between block-based coding and text-based conversion.
Orange: Settings and saving area. This is where we can select different settings and save/open our programs.

Finding and using a block:

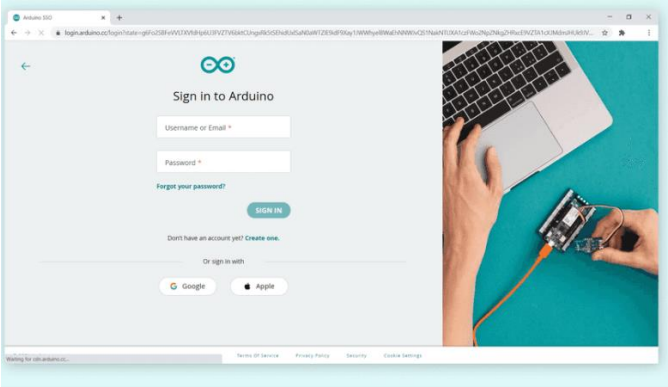


Locate the block in the Block-bank. The specific blocks to use for different things will be explored during the activities/lessons.

Click and drag it onto the Building platform. Arranging them into the desired configuration will be discussed and explored throughout the activities/lessons.

2. Arduino cannot understand the block coding instructions. To translate it into a text-based language download a “translator” called **Arduino Editor IDE.**

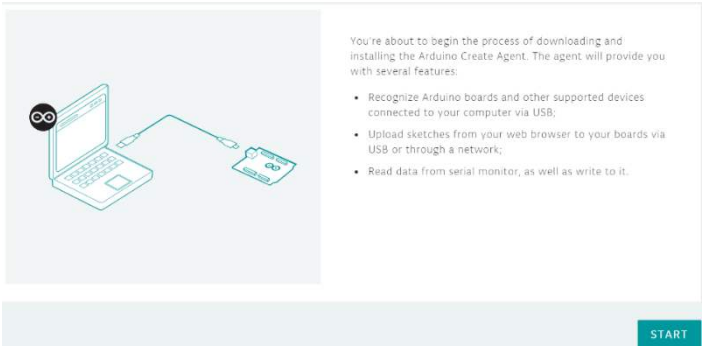
Note – The Arduino software might be already pre-installed on school division computers. In some school divisions you are not allowed to download outside software, so ask your IT department for assistance. Also, for **Chromebook** instead use Arduino Create for Education in the App Store.



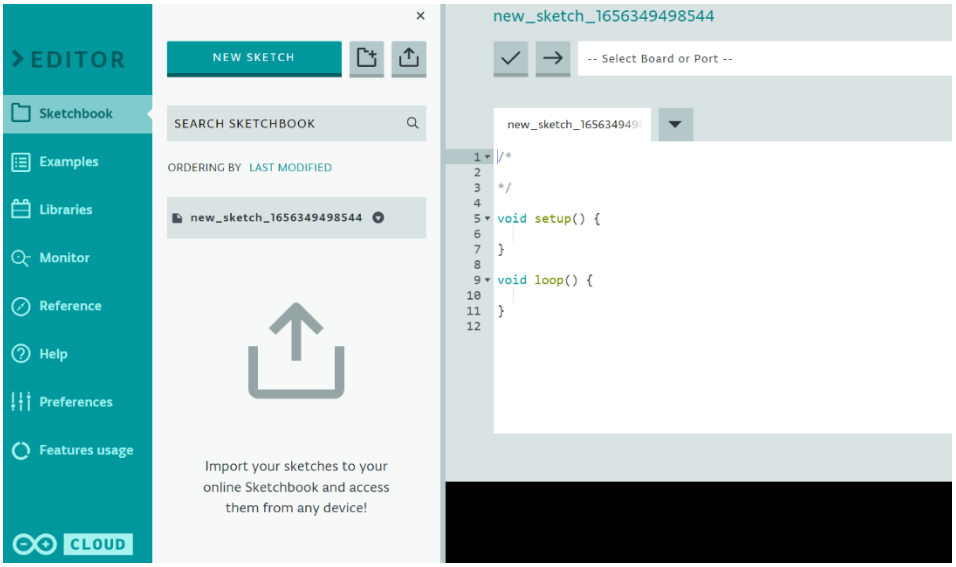
Log in to your Arduino account.

a) The first step is to create an account. This is done by navigating to login.arduino.cc/login. Here, you can either manually create an account, or login using for example Google. Once you login, it will ask you to create a username.

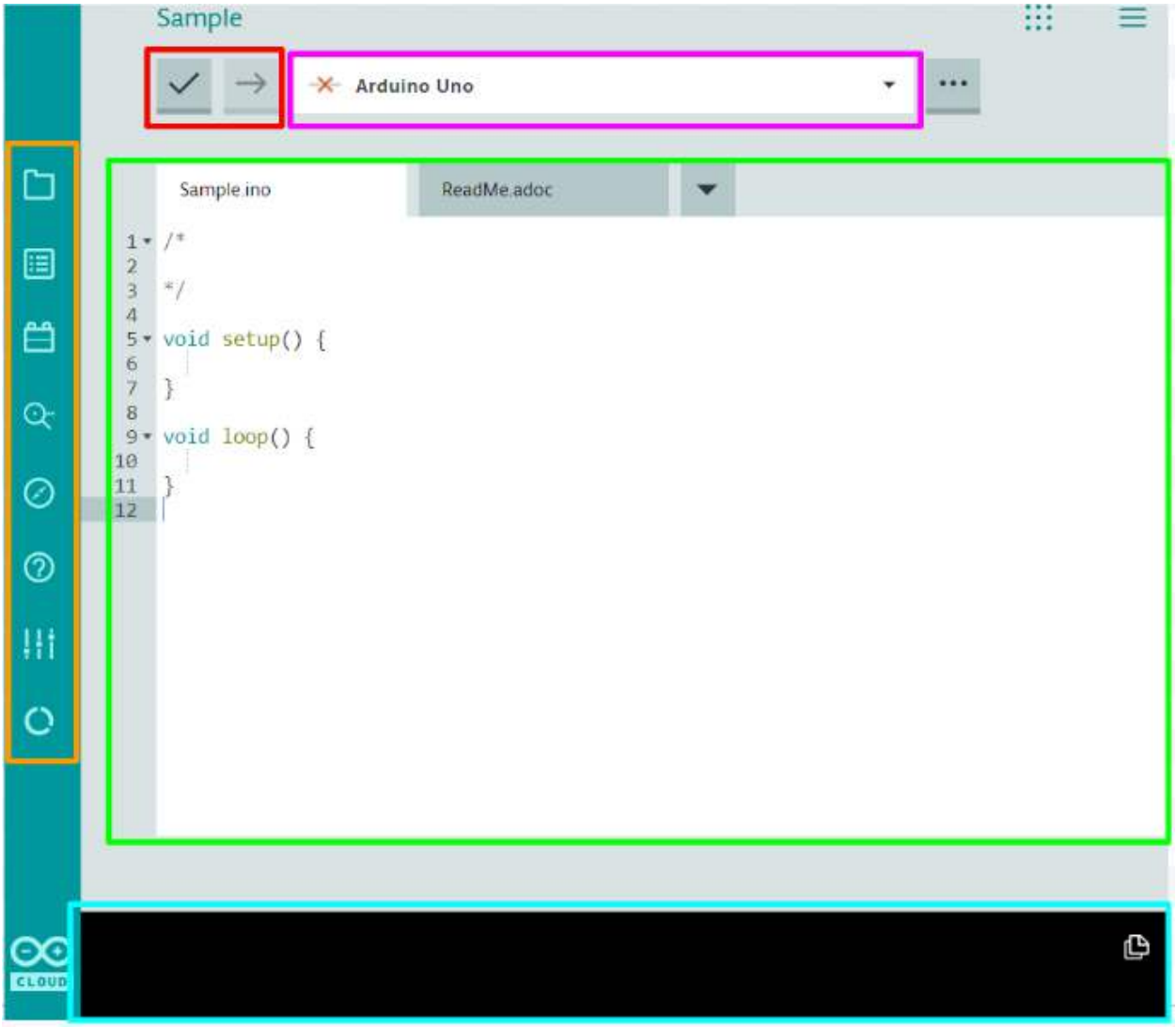
b) Once you have created and activated your account, we need to install the Arduino Create for Education app. This is done by navigating to the [Create Agent Installation page]. Here, you simply need to click on "Start" to begin the installation. Follow the instructions on this page to complete the installation.



c) Then login to your account. Click on the Web Editor to open Arduino Editor IDE.



How to Navigate the Arduino IDE



Green: Sketch Editor. This is the area where we will type our code, and edit our sketch.

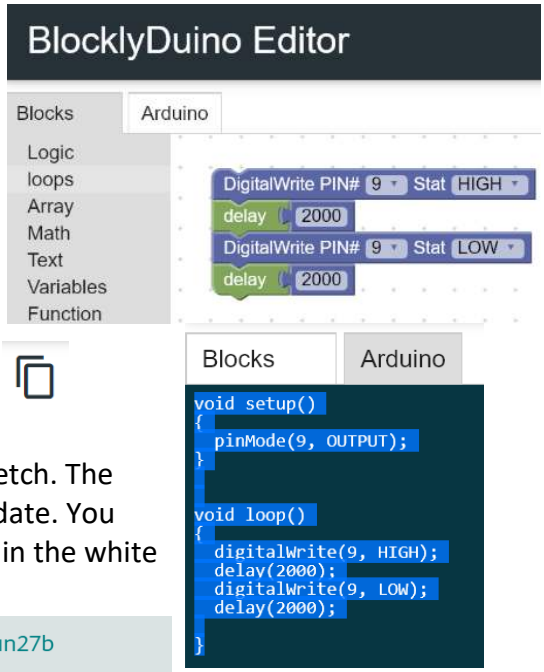
Purple: Board Selector. This is where we select which board (which type of Arduino board) and which port (computer communication port) we are using.

Red: Verify/Upload buttons. These buttons allow us to check our sketch for syntax, and upload the sketch to the Arduino.

Orange: Toolbar. In this area we find a number of options that we can use, including file manager, example sketches, libraries, Serial monitor, reference material, and preferences.

Teal: Message area. This is where we will see messages from the Arduino Create program.

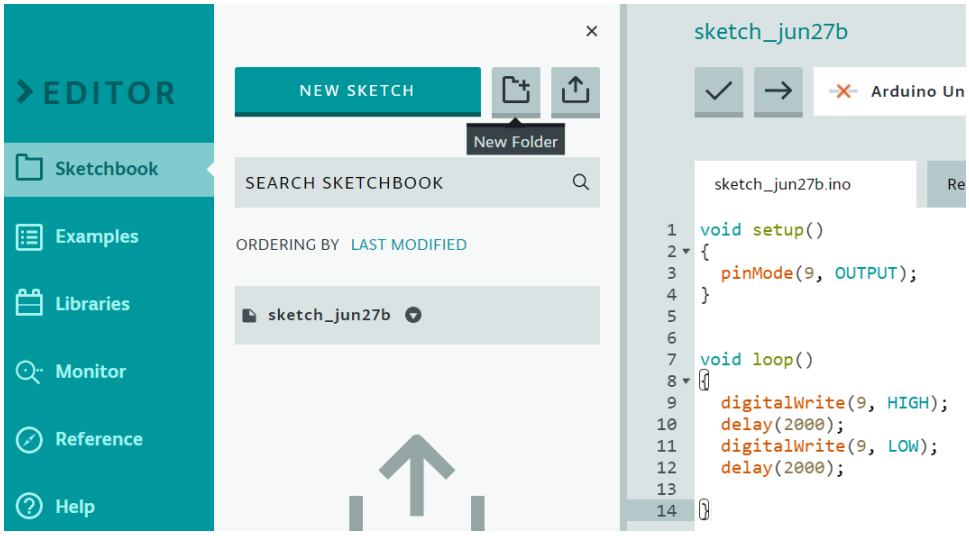
Using USB to Send Translated Instructions to Arduino



a) **Create your set of instructions using BlockyDuino Editor**. Click on the left panel to find the different blocks. Click and drag the blocks to the white dotted grid pattern. Connect them together like puzzle pieces to create your instructions. Also, you can change the values in blocks by clicking and selecting from the drop-down menu.

b) Click the **Arduino tab**. Copy the instructions by clicking

c) Go to the **Arduino Editor IDE**. Create a New Sketch. The Sketch will be automatically named based on the date. You may want to rename it. Delete anything that is already in the white box. Press "ctrl v" to paste the instructions.



d) Hook up your Arduino to your computer using the USB cable. You will need to select a board and port by clicking on the drop-down bar below. The board is Arduino Uno and the port should appear. The port might have USB or COM in the name.

e) The button on the left "→" will send your code to the Arduino. The checkmark will verify that your program is valid.

<SaskCode> ARDUINO KIT CONETENTS

15 x Arduino UNO W/ Cables	15 x Large Breadboards	15 x LCD Displays	15 x Keypads
15 x 16 Button Matrix	15 x Neo Pixel LED Rings	Red Yellow Green LEDs	RGB LEDs
Resistors	Jumper Wires (M to M)	Jumper Wires (M to F)	15 x Servo Motors
15 x 9V Battery Adapters	15 x Ultrasonic Sensors	15 x Joysticks	15 x Speakers
60 x Buttons (Random Colors)	15 x Potentiometers	30 x Buzzers	15 x Water Sensors
15 x Temp/ Humidity Sensors	30 x Switches	30 x Photo Resistors	15 x Seven Segment Display

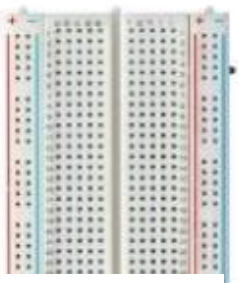
Components

Review the organization of the kit, and how each component is used. Remind to handle the components carefully and the importance of returning each item.

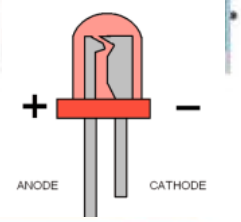
Arduino Uno Board: The Arduino is a microcontroller that will communicate the code to the components of your program.

Resistors: Resist the flow of electricity. The strength of a resistor (measured in ohms) is marked on the body of the resistor using small colored bands. Each color stands for a number, which you can look up using a resistor chart.

Breadboard: is an electronic circuit used by inserting wire leads or terminals into the holes and making connections. The holes that run vertically along the edges between the coloured line are connected vertically. The red + is known as the power rail. The blue – is known as the ground rail. The holes that have the alphabet are connected horizontally with the middle bridge dividing the two sides. So, holes a, b, c, d, and e are connected vertically. Holes f, g, h, I, and j are connected vertically.



LEDs: (Light Emitting Diodes) are small lights made from a silicon diode. They come in different colors, brightness and sizes. LEDs have a positive (+) leg and a negative (-) leg, and they will only let electricity flow through them in one direction. The (+) leg is the longer of the legs on the LED. Also, the longer leg will have a bend in the build diagram.



Ultrasonic Distance Sensor: Distance sensors work by sending pulses of light or sound out from a transmitter, then timing how long it takes for the signals to bounce off an object and return to a receiver (just like sonar). This sensor, the HC-SR04, provides 2 cm - 400 cm measurement, and the ranging accuracy is 3mm. There are only four pins that you need to worry about on the HC-SR04: VCC (Power), Trig (Trigger), Echo (Receive), and GND (Ground).

Servo Motor: Servo motors have three wires: one for power, one for ground and one for signal. When you send the right signal through the signal wire, the servo will move to a specific angle and stay there. Common servos rotate over a range of about 0° to 180°.

- BROWN is GROUND (Diagrams = Black)
- RED is POSITIVE
- ORANGE is DATA (assigned to a pin on the Arduino)

Note: To avoid damaging the motor a range of 20-170 works best.

Included with your servo motor you will find a variety of motor mounts that connect to the shaft of your servo.

Piezo Speaker: Uses a small magnetic coil to vibrate a metal disc inside a plastic housing. By pulsing electricity through the coil at different rates, different frequencies (pitches) of sound can be produced.

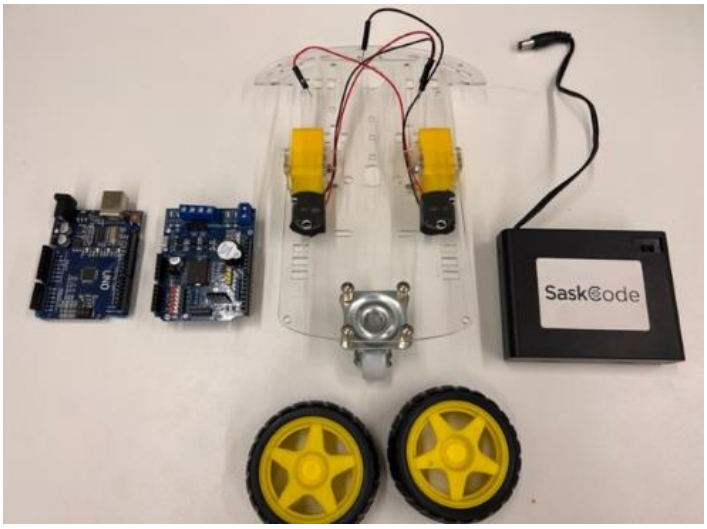
Note	Freq.	Note	Freq.	Note	Freq.	Note	Freq.
B0	31	**AS2**	117	**A4**	440	**GS6**	1661
C1	33	**B2**	123	**AS4**	466	**A6**	1760
CS1	35	**C3**	131	**B4**	494	**AS6**	1865
D1	37	**CS3**	139	**C5**	523	**B6**	1976
DS1	39	**D3**	147	**CS5**	554	**C7**	2093
E1	41	**DS3**	156	**D5**	587	**CS7**	2217
F1	44	**E3**	165	**DS5**	622	**D7**	2349
FS1	46	**F3**	175	**E5**	659	**DS7**	2489
G1	49	**FS3**	185	**F5**	698	**E7**	2637
GS1	52	**G3**	196	**FS5**	740	**F7**	2794
A1	55	**GS3**	208	**G5**	784	**FS7**	2960
AS1	58	**A3**	220	**GS5**	831	**G7**	3136
B1	62	**AS3**	233	**A5**	880	**GS7**	3322
C2	65	**B3**	247	**AS5**	932	**A7**	3520
CS2	69	**C4**	262	**B5**	988	**AS7**	3729
D2	73	**CS4**	277	**C6**	1047	**B7**	3951
DS2	78	**D4**	294	**CS6**	1109	**C8**	4186
E2	82	**DS4**	311	**D6**	1175	**CS8**	4435
F2	87	**E4**	330	**DS6**	1245	**D8**	4699
FS2	93	**F4**	349	**E6**	1319	**DS8**	4978
G2	98	**FS4**	370	**F6**	1397		
GS2	104	**G4**	392	**FS6**	1480		
A2	110	**GS4**	415	**G6**	1568		

Other components may be introduced in the related lessons.

Arduino Robotic Car

The Robot Car Kit is a versatile and safe kit that allows students to learn the necessary skills to control a robot autonomously or with an operator. The Robot Car Kit allows graduated levels of difficulty, starting with basic movement to advanced applications, where students are adding various sensors to increase the capabilities of the robot.

Materials:
Robot Car Kit (frame/wheels, Arduino Uno, L298P Motor Shield, 6 AA battery pack, small screwdriver. Get to know the components! These components come pre-assembled. Each wheel is powered by one DC motor.



Build & Troubleshoot:

Add in 6 AA batteries to the pack and connect to the Uno. Secure the battery pack on-top of robotic car using sticky tack, elastic bands or Velcro.

The wires coming from the motors are soldered into the back of the headers marked MA and MB. **No additional wires are needed to connect to the pins!**

Use the blue USB cable to transfer the Arduino IDE code on the computer to the Uno of the robotic car.

Note, some troubleshooting may be done in the lesson/activity. Additional sensors and wires may be used depending on the lesson/activity, but it is explained with pictures.

***SAFETY: The combination of voltage and current can be dangerous. Do not use a car battery or any type of wall outlet to supply voltage.**

***SAFETY: Do not short circuit batteries, as they will get dangerously hot and possible pressurized**. A short circuit is created when the positive and negative leads of a battery are directly connected without going through a load (i.e., light, motor, etc.). If you notice heat, unplug power supply.