

Western Engineering Outreach

Makey Making Music

Grade 6-8

Meet Today's ENG HERO!

Katarina Grolinger –Assistant Professor with Western University



Dr. Katarina Grolinger is an Assistant Professor with the Department of Electrical and Computer Engineering at Western University and Vector Institute Faculty Affiliate. She received her Ph.D. and M.Eng. degrees in Software Engineering from Western University. Dr. Grolinger's work is largely carried out in collaboration with industry where she develops research to solve industry problems. Also, she has over ten years of industry experience in various roles including software engineer, Oracle certified database administrator, and technical team leader. To learn more about Dr. Katarina Grolinger please visit: https://www.eng.uwo.ca/electrical/faculty/grolinger_k/index.html

Learning Goal:

- The purpose of this project is to introduce drag-and-drop coding using Microbit
- Learning about software engineering
- Learning about coding terms (variables, if-statements, arrays, loops, etc.)
- Curriculum Connections: Grade 6- Electricity and Electrical Devices, Grade 7- Form and Function, Grade 8- Systems in Action

Materials Needed:

- Computer
- Wifi



Engineering and Science Connections

What is software engineering?

Software engineers create the programs you use daily such as (operating systems, Mozilla Firefox, Chrome, Safari, etc.). Software engineering uses programming languages to write instructions that computers need to execute a certain task.

What is block coding?

Block coding allows you to code with blocks of code rather than using complex coding language. Therefore, it's a great tool for beginners. Block coding includes many of the aspects of coding, some of which you will be learning today.

Variables

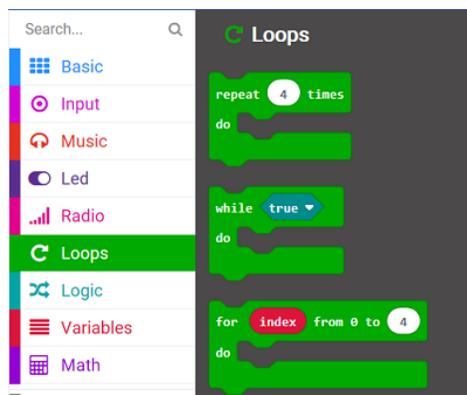
Variables are used to store values such as numbers in programming languages. Variables are essential so that values can easily be changed rather than each value being changed manually one by one.

```

int age = 20; ← value
  ^         ^
  |         |
datatype  variable_name
    
```

Loops

Loops are used to repeat lines of code rather than writing out those lines of code over and over. There many types of a loop (while loop, do-while loop, forever loop, etc.). The forever loop function repeats code an infinite amount of times.



What is an if-statement?

An if-statement is used to do execute specific lines of code only if a condition is true. If the condition is true it will go to the else if part and execute it if the condition is correct.

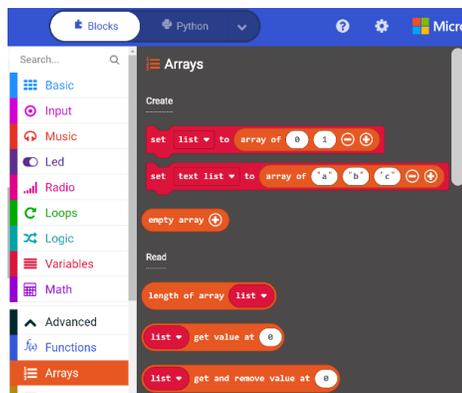
```

if RandomNum = 3 then
  show string "TRY AGAIN"
else
  if RandomNum = 2 then
    show string "YES"
  else
    if RandomNum = 1 then
      show string "NO"
    else

```

What is an array?

An array is simply a list of data elements. Arrays allow us to create a collection of values that are indexed. An array can store any type of data but only one type of data at a time.



Inputs

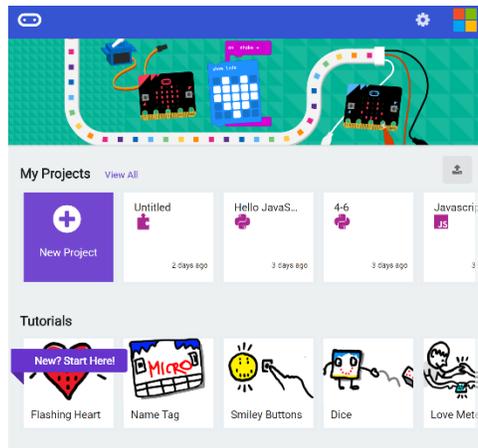
Inputs are something that you put into the computer which will be transformed by the system to produce an output. An input could be your entire code and the output is the result that you want your code to be able to accomplish.



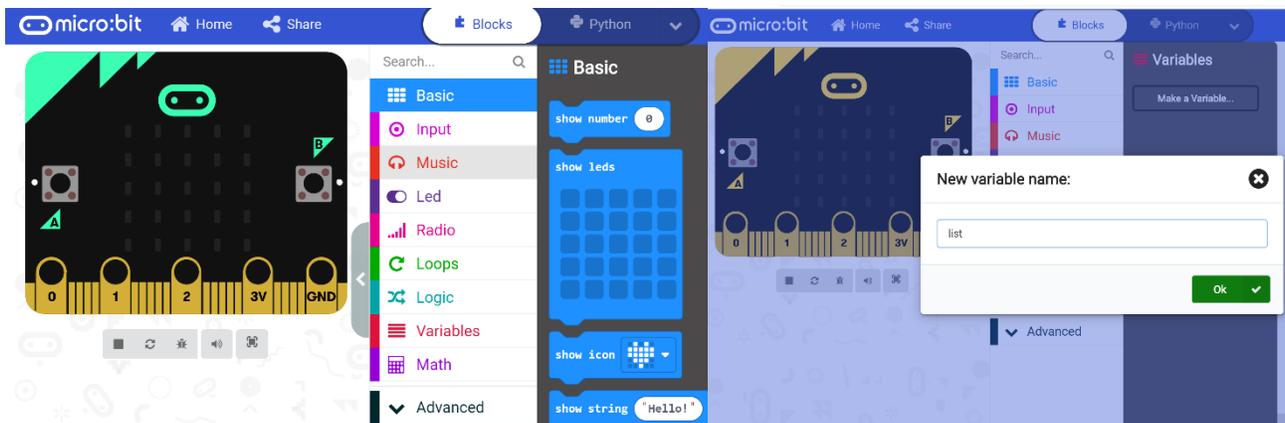
Activity

In today's activity, you will be creating your guitar with Microbit coding! You will get the chance to create an array with musical notes to be able to play many notes with your guitar. In this activity, you will be using Microbit's accelerometer (an instrument for measuring acceleration) to play different tones when the guitar is held and tilted while playing. Let's get started with our Song Maker.

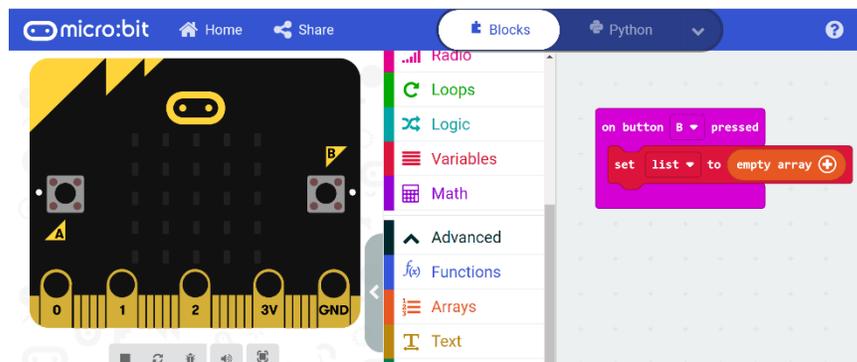
Step 1: Please go to <https://makecode.microbit.org/> to access Microbit Makecode. Please note that the colour of the block is coordinating with the colour of the sections.



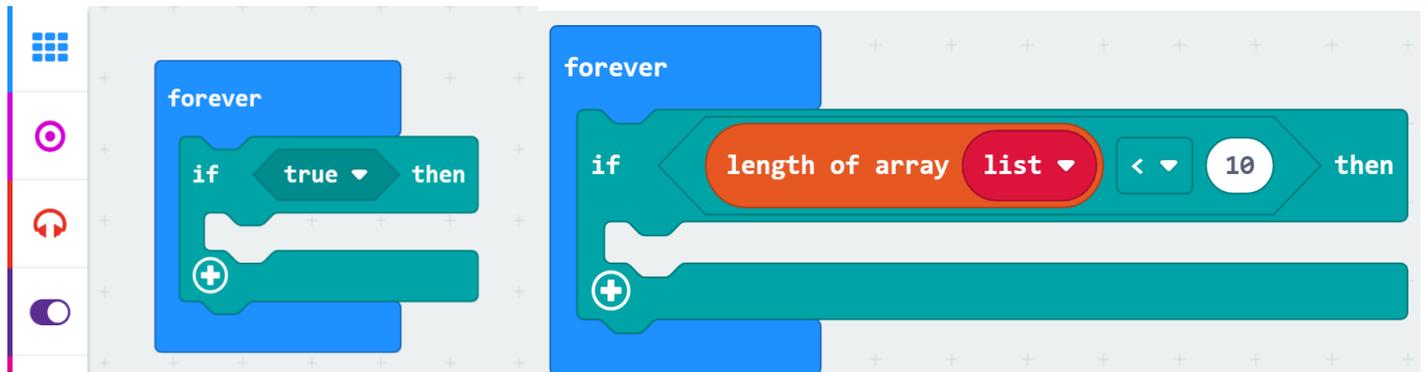
Step 2: Go to "Variables" in bright red from the menu on the left and click on "Make a Variable". Create a variable named list which is the array that will help us play notes on the guitar. Hint: If you hover over each block of code a description of what the block does will appear.



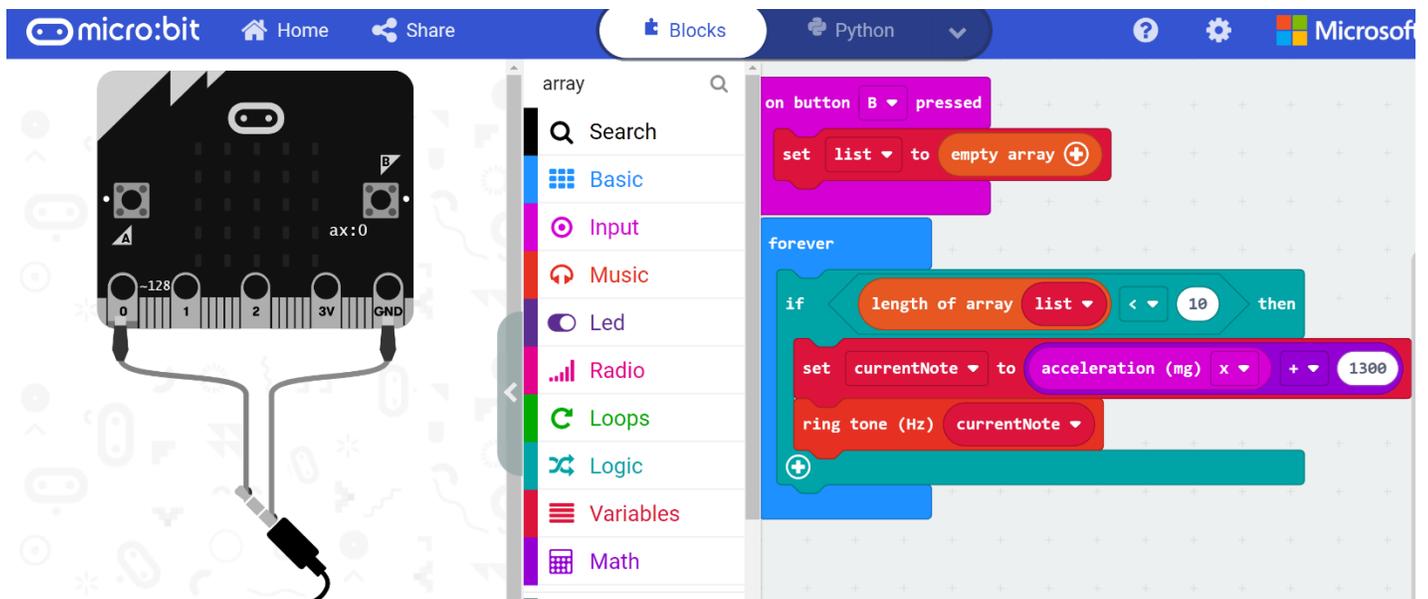
Step 3: From the input section of the menu grab the "on button A pressed" and change the button A to B by clicking on the letter A. Then grab from the variables section "Set list to 0" and place instead of the 0 "empty array" block from the arrays section in the menu which is in bright orange (to access the arrays section click on advanced). This will make you define your array before starting to code with arrays.



Step 4: Grab the forever block from basic in the menu on the left. Then drag from the logic section an if-statement and place it inside the forever block. From the logic, section grab from comparison the “=” sign. Click on the equal sign and change it to the smaller than sign. Afterwards, from the arrays section grab “length of array list” and place it inside the smaller block. Finally, change the 0 to 10.

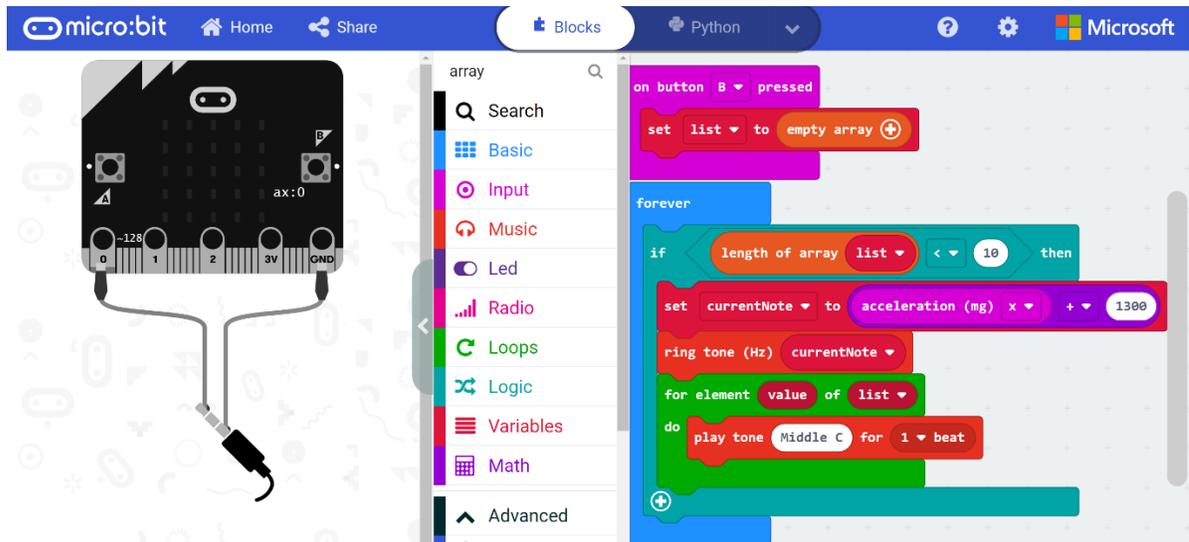


Step 5: From variables create a new variable called currentNote. Then grab the set “currentNote” block from variables and place inside it an additional block from math to make acceleration (form input) to 1300 (type it). Then from music grab the ringtone block and place inside it the variable “currentNote”.

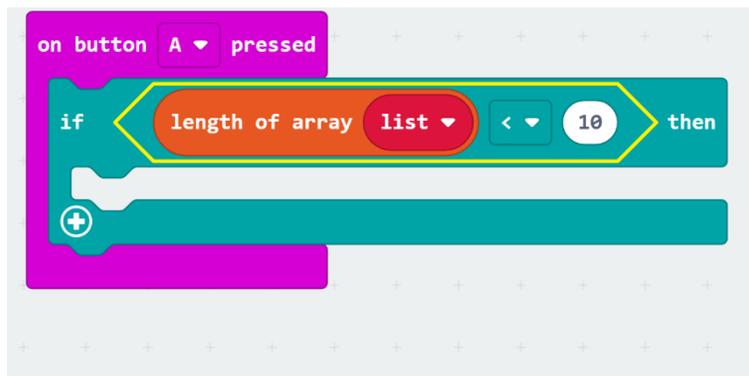


Step 6: Press on the plus sign of the if-else statement. Then grab from basics “ show LEDs” and make the following drawing that’s in the picture. Then from loops grab a for loop. Then place inside the block “play tone Middle C for” and set it to 1 beat.

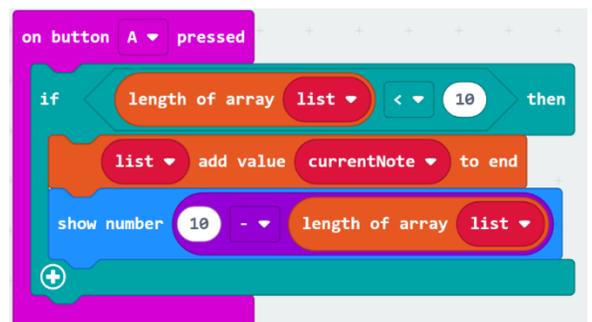
This is how your code should look like so far.



Step 7: From the input section grab the “on button A pressed” block. And from logic grab an if-statement and place it inside the block. Then from logic grab a smaller than block and make the length of array list smaller than 10.



Step 8: Place inside the if statement “list add value to end” block from arrays then add the variable currentNote. Then from basic grab the block “show number” and place inside it the subtraction operation from math. The operation should be 10 minus length of array list (from arrays). Now you have your guitar with Microbit, keep on playing notes with it.



What did you learn?



- Software engineering
- What is block coding?
- What are variables?
- What are loops?
- What are if-statements?
- Arrays
- Microbit coding

Future Learning



- You can turn this activity into a design challenge. Using what you have learned today about Microbit coding, you are challenged to design another code that will turn the Microbit into a musical instrument. Please go to the following link (<https://makecode.microbit.org/courses/csintro/arrays/project>) to get inspiration about future code to creating fun musical instruments with Microbit coding such as a piano.

Share your creations!

We would love to see what you made. Email us at discover@uwo.ca or tag us on social media.

Instagram: @westernueng

Twitter: @westernueng

Facebook: @westernueng

Thanks for discovering with us