Sonar Calibration

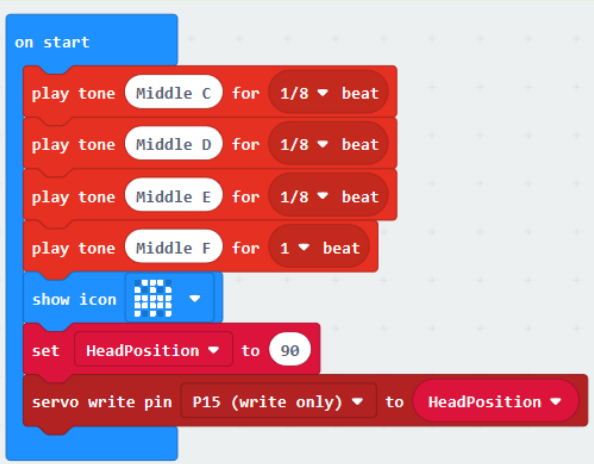
Objectives:

Determine the head straight position of the rover and create a LED representation of the calibration of the ultrasonic sensor (sonar) in the head straight position.

1. Open Microsoft MakeCode Editor https://makecode.microbit.org/#
2. Start a New Project +
3. Title the project: Sonar Calibration
4. Click on Extensions, search for sonar and add the Microsoft Sonar extension to the workspace.
5. Follow the **what** and **how** directions.

Did You Know?

Bats emit ultrasonic pulses that bounce back from surrounding objects, including prey. Bats use these reflected signals to navigate and to detect food. One food source of the bat, the Toxic Dogbane Tiger Moth, has evolved special bat-detecting ears that emit their own ultrasonic pulses that confuse bats and make them abort an attack on the moth.

What am I doing?	How will I do it?
Create code that will set the sonar facing forward when the rover is turned on. • The servo motor to which the sonar mount is connected has a rotating shaft that can be programmed to a particular angle or position. • This servo motor rotates within a scope of 0 to 180 degrees. For best functionality, the servo motor should not be set to its farthest measures (0 or 180). • The sonar should face straight forward when it is coded to approximately 90 degrees.	**Using the ON START block:** 1. Create one or more tones. 2. Create a startup image. 3. Create a variable called Head Position. 4. Set the head position to 90 degrees. 5. Add servo write pin P15 to head position. (servo write pin is in Pins) (servo must be plugged into I/O pin 15) 
Download to the micro:bit and test in rover.	When the rover is turned on, the sonar should face straight ahead. Does your sonar look straight? If not, what can you change in the code to correct it? (Change code and test.)

Create a graphical representation of the sonar measurement using the micro:bit LEDs.

- Use the sonar extension to set up the ultrasonic sensor to send and receive pulses.
- The ping trig should correspond with the trig wire connection on the motor:bit (P16).
- The echo should correspond with the echo wire connection on the motor:bit (P14).

On the FOREVER block:

1. Create a variable called Distance.
2. Set distance to ping trig P16, echo P14, and unit cm. (trig/echo block in Sonar)
3. Create variable called DistanceLED.
4. Compute the row number for the LEDs to be displayed as:
   a. set DistanceLED to Distance divided (/) by 5
   b. set DistanceLED to DistanceLED minus (-) 2
   c. set DistanceLED to round DistanceLED
5. Ensure the row number is always valid by using logic statements:
   a. if DisatnceLED is greater than (>) 4 then
   b. set DistanceLED to 4
   c. if DistanceLED is less than (<) 0 then
   d. set DistanceLED to 0
6. Set LEDs in columns 1,2, and 3 to display distance.
   a. plot x 1 y DistanceLED
   b. plot x 2 y DistanceLED
   c. plot x 3 y DistanceLED
7. Set LEDs in columns 0 and 4 to show when the distance is zero.
   a. if Distance equals (=) 0 then
   b. plot x 0 y DistanceLED
   c. plot x 4 y DistanceLED
8. Add a pause (500ms) and a clear screen.

Download to the micro:bit, insert into the rover, turn on the rover and test.

(Be sure to save (share) the link or download the hex file of this code as it will be imported to begin the next activity.)

Place and obstacle in front of the sonar sensor. Move the obstacle closer and farther away from the sensor.

- Can you see a change in the display as you move the obstacle?
- Using a yard stick, measure the distance that the obstacle moves each time the display changes. Create a table of this information.
- What happens when the obstacle and sensor are almost touching?