

Sound Display - NXT

Overview

Challenge

Collect and display sound data from the NXT sound sensor in real time on the LCD display of the NXT. Also include the ability to pause the data collection by bumping a button to view a particular screen of data until another button is bumped.

Age Range

15 - 18

Topics

Sound Sensors

Subjects

Math & Science

Programming Themes

Switches
Counters
Loops
Mathematical Manipulation of Data
Displaying Data within Constraints
Wait For time

Related Math & Science Concepts

Sound Waves

Building and Programming

Materials

- NXT brick
- Sound Sensor
- Noise to read levels from

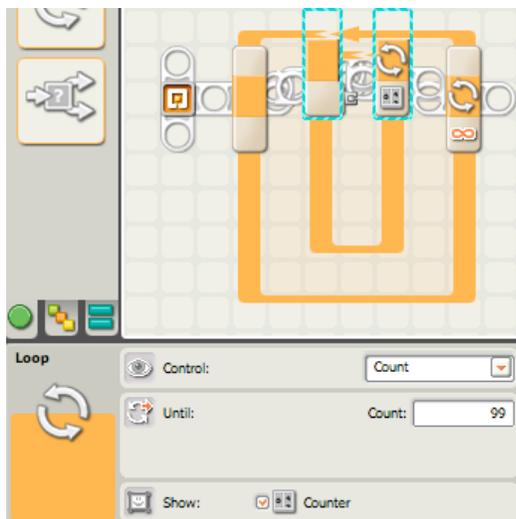
Building Instructions

1. Wire a sound sensor to port 2 of an NXT brick with a connector cable.

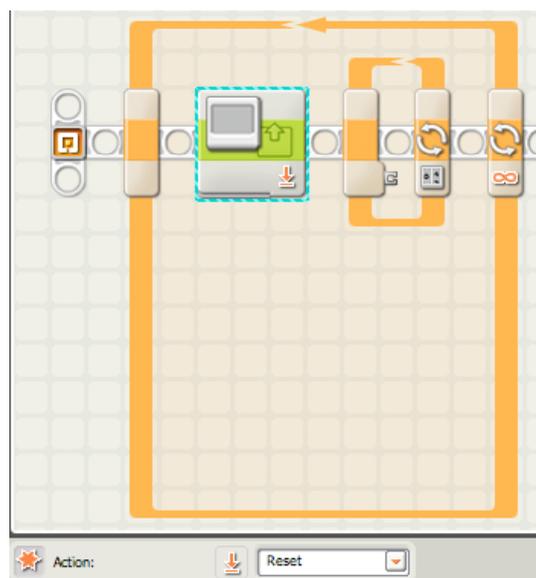
Programming Instructions

Using Mindstorms NXT-G, program the NXT to read data from the sound sensor and to display the data continuously in discrete passes (in this program, the passes take about 1 second each to complete). The display will need to be cleared before each pass. Include the ability to pause the data display when a button (Enter) is bumped, and resume displaying when another button (Right) is bumped.

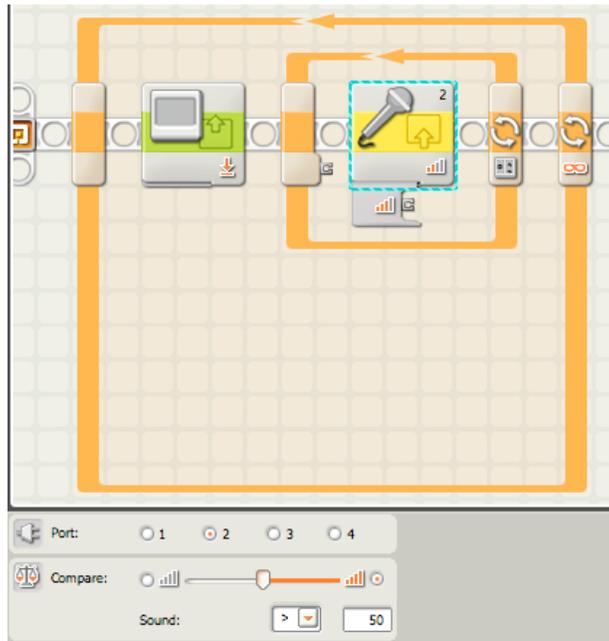
1. Start with an infinite loop. Inside the infinite loop, add another loop set to Count until the count is 99. Check the Show Counter box so that the count can eventually be wired to another block.



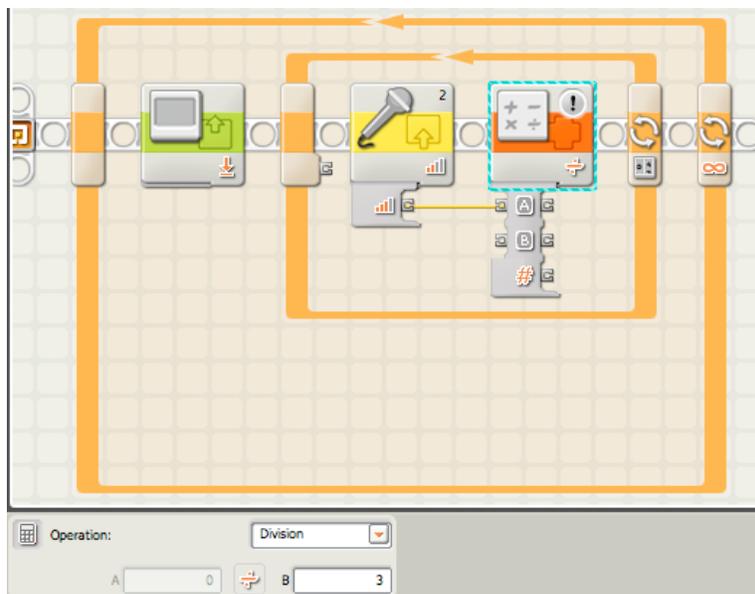
2. Add a “Display” block, setting it to reset the display to clear it before each pass.



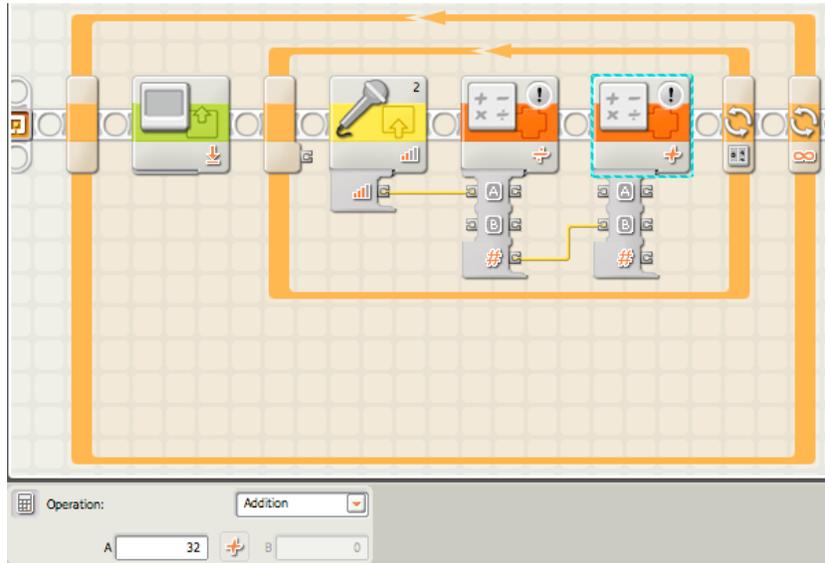
3. Add a "Sound" block inside the counter block, setting it to port 2.



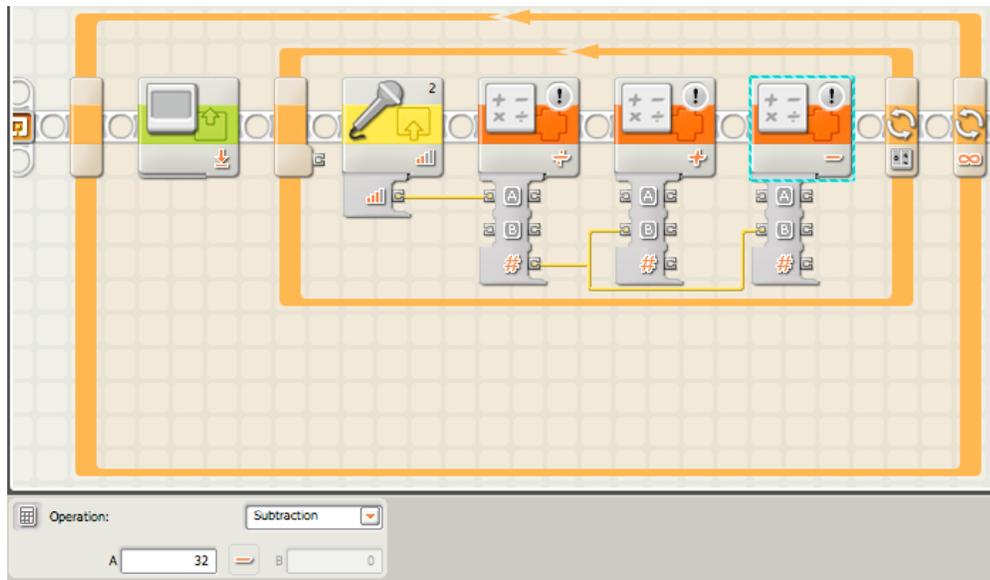
4. Add a "Math" block set to Division mode, wiring in the Sound Level output from the "Sound" block to input A of the "Math" block. Set value B = 3.



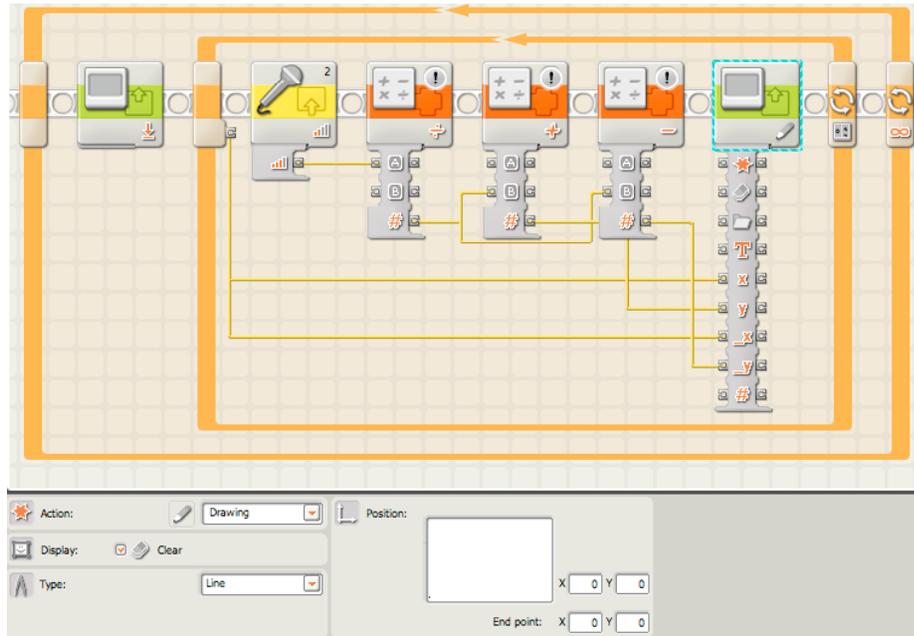
5. Add a second “Math” block, setting it to Addition mode, value A = 32. Wire the result from the first “Math” block to input B of this “Math” block.



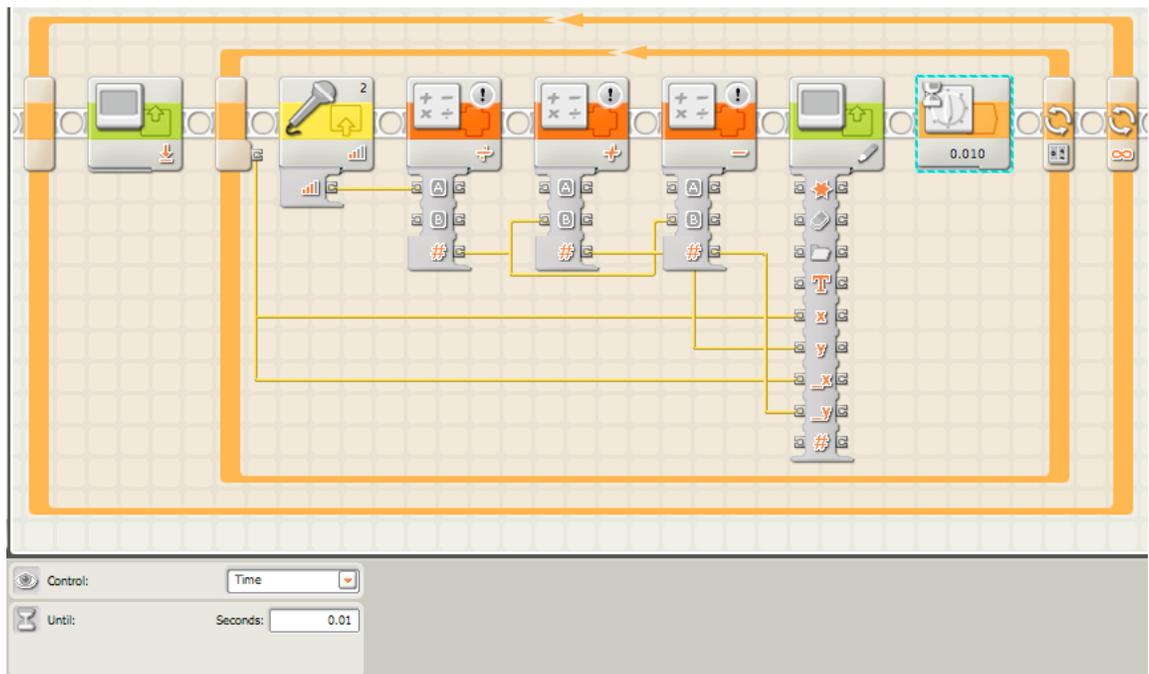
6. Add a third “Math” block in Subtraction mode, value A = 32. Wire the result from the first “Math” block to input B of this “Math” block.



7. Add a “Display” block, setting it to Drawing. Check the Clear Display box and set Type to Line. Wire the result from the second “Math” block to the Y input on the “Display” block. Wire the result from the third “Math” block to the $_Y$ input on the “Display” block. Wire the Loop Count of the counter Loop to both X and $_X$ inputs of the “Display” block.



8. Add a “Wait For” block, set to Time, until 0.01 seconds have passed.



In Action

Hold the NXT brick in one hand and the sound sensor in the other. Run the Sound_Display.rbt program, and watch the display change as noise levels change in the location you are in. Try playing some music, holding a conversation, and having someone clap, snap, and make noise. Walk around outside and watch the noise levels of cars, wind, and bird calls appear on the LCD display. Try pausing and resuming the display to get a better look at what the levels are during a particular pass.

Resources/Help

Related Activities

- Clap On
- Fan-Tastic – NXT
- Crane

Building & Programming References

- The NXT
- Sound_Display.rbt

Knowledge Base

- How do I create a loop in NXT-G so that I can repeat one sequence of events over and over?
- What is the NXT-G switch block for?
- What is the NXT-G math block for?

Classroom Management

Procedure

1. Begin the lesson with a description of how sound sensing works. Microphones are a great example, and many people can relate to having seen or used them in the real world.
2. Each NXT brick should be programmed in Mindstorms NXT, either by the students if time permits or before the activity starts.
3. Each student or group of students should have an NXT brick with an attached sound sensor.
4. Have each student or group of students read the sound levels of various environments. For example, play music in one corner of the room, open the window to read ambient noise levels or play ambient noise in one corner of the room, have students hold conversations while reading the noise levels, and have students make noises such as clapping and snapping. Observe the patterns of sounds. Do claps and snaps resemble the sounds of other objects, such as a guitar pluck or a bird call? The waveforms of the sounds can be looked at if the display is paused after a pass. With several NXTs paused after observing different sounds, the students can compare which sounds look like what on the display. Each sound environment can be paused and drawn on a graph as the students rotate around the room, for comparison at the end of class.
5. Collaborate as a class and work out which sounds were similar and which sounds were different.
6. Wrap up by talking about the activity and additional uses of sound-sensing systems. Also discuss why certain sounds have certain waveforms and similarities due to volume level, decay, and so on.