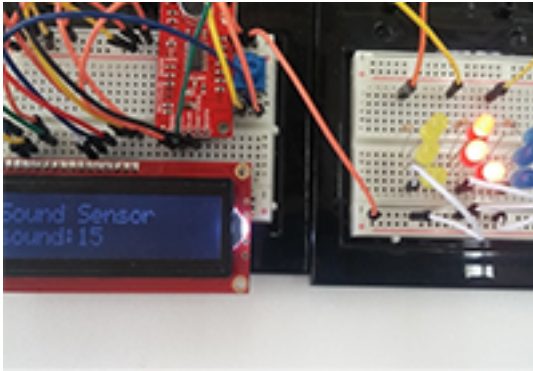


Making a Sound Detecting Device



Background

New York City is known as the city that never sleeps. Many New Yorkers experience a lot of noise day and night, from neighboring buildings, car horns, construction, sirens, the subway, airplanes, and more. In 2007, the City updated the Noise Code for the first time in 30 years to reflect the changing landscape and advances in acoustic technology. This code indicates the number of decibels allowed for types of noise in specific time frames during a 24-hour period. The decibel (dB) is the universal unit of sound measurement and is measured with a meter that registers sound pressure and displays these readings on a sound level scale. This project will have students create a noise detection device for measuring sound.

At a Glance

- **Age Level:** 12-18 years old
- **Subjects:** Science, Technology, Engineering
- **Time Needed:** 45-60 minutes

Learning Objectives

By the end of the lesson, students should be able to demonstrate:

- Coding
- Making
- Design thinking
- Types and uses of electronic components

Standards Alignment

This unit is related to the following areas in Korea, elementary science education.

Elementary school 3-4 grade group (8) the nature of sound.

- (4 Science 08-01) Observe the number of sounds in the developing object.
- (4 Science 08-02) Compare the intensity and pitch of the sound.
- (4 Science 08-03) Observe that the sound can be transmitted or reflected through a variety of objects and discuss ways to reduce the noise.

Prerequisite Skills

No prior knowledge or experiences necessary to complete the activities.

Modifications/Accommodations

We suggest student work in groups of 2-4.

- A USB cable (standard USB at one end, micro-USB at the other end)
- A Arduino 101/Genuino 101 SparkFun Inventor's Kit
- A PC (with the Genuino 101 IDE)

Inquiry Process

This unit encourages students to engage in scientific inquiry. Students will be challenged to figure out how the sketch (computer program) works and interacts with the input (sensor) and output (LCD and LED). They must figure out how the program works to be able to change the device's behavior. If things don't work out right, they must investigate why not and try another approach.

Technology and Resources

Introduce the Key Concepts

Introduce the concept of a sound detector board, how it works and its applications. Introduce the light-emitting diode (LED)--how it works and its applications. Introduce Serial Enabled 16x2 the light crystal display (LCD) white on black 3.3v--how it works and its applications. Explain that in this activity, we'll be using a sound detector board to sense the degree of sound, and an LED to simulate a lamp that we wish to turn on or off depending on the scale of sound.

Set-up for the Activity

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Note about set-up: You may elect to allow the students to connect their Genuino 101 boards, or you may elect to perform this set-up yourself prior to the start of class. The set-up involves connecting the Genuino 101 to the PCs the students will be using, as well as pre-loading the Arduino 101 (Genuino 101) IDE onto the PCs.

If the students will be performing the set-up themselves, add 15-20 minutes to the amount of time required for the unit. In addition, make sure the students are responsible and take care to follow the instructions below very carefully as performing the steps in the wrong order can result in permanent damage to the Genuino 101 board.

Step-by-step instructions for connecting Genuino 101 are found [here](#).

Within the step-by-step instructions, when prompted to choose a development environment, choose Arduino 101. Have the students proceed all the way through the "getting started" exercise to the point where they make the LED blink on the Genuino 101 board. This affirms the set-up has been done correctly. If they cannot make the LED blink, have them start over and/or seek your help.

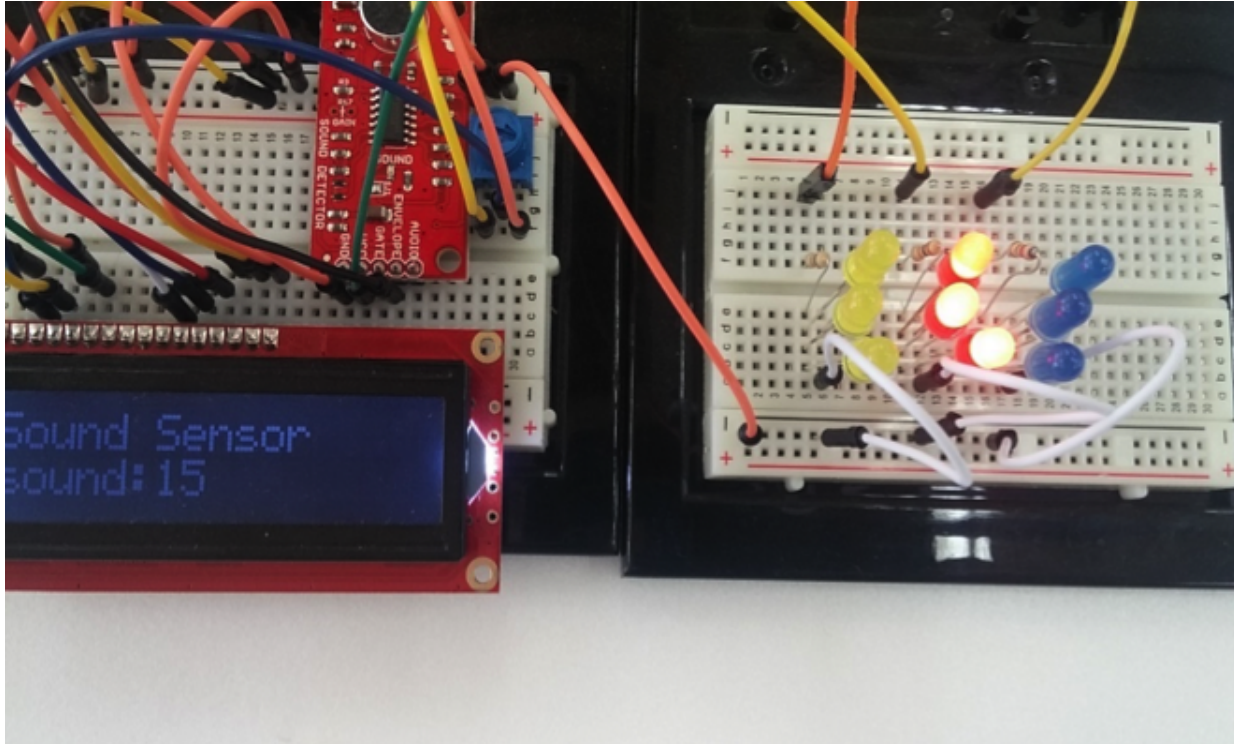
Activity

Now that the Genuino 101 board is connected to the computer and the computer running the Arduino 101 IDE, the students are ready to build the sound detecting device. Share with the class the photo in figure 2 of the teacher's presentation, illustrating the correct set-up.

Walk students through these steps:

- Carefully attach the 16*2 LCD to the Genuino 101 board.
- https://cdn.sparkfun.com/assets/learn_tutorials/4/9/2/Exp_21_LCD_bb.png
- https://cdn.sparkfun.com/assets/learn_tutorials/4/9/2/Arduino_101_SIK_Tutorial-16.jpg
- Using the jumper wires-connected, connect the sound detector board to the Genuino 101 at A0.
- Using the jumper wires-connected, the yellow LED to the Genuino 101 at D7, the red LED to the Genuino 101 at D8, the blue LED to the Genuino 101 at D9.

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- Turn on the shield using its switch.
- Open the Arduino 101 IDE software.
- Upload the SoundDetecting.ino from Github here:

<https://github.com/kfcman21/Genuino101Project/blob/master/SoundDetecting.ino>

- To simulate the changing of sound, change the blink of the yellow, red, and blue LED.
- <https://youtu.be/ciG9kq0iMD0>

Conclude the Unit

Lead the class in a discussion about the unit. Several directions are possible: What did we learn? Where else could this sensor system be used in the real world? Can you think of any interesting ideas for innovative smart devices for the home? What kinds of careers are available to people who enjoy these kinds of activities?

Assessment

An opening discussion about prior exposure to computers, electronics, and programming can be helpful in pacing the activity and grouping students who can provide leadership. Short wrap-up discussions after completing the unit is helpful to assess progress and revisit key learnings.

Differentiated Instruction

Resource Student

- Allow more time as needed.

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- Skip the challenge sections and focus on building the sensor and discussing how it works.

Gifted Student

- Give students additional challenges that force them to go deeper into modifying the sketch.
- Have students integrate the sound sensor into a broader science project.
- Have students learn the Arduino 101 programming language and try writing their own sketches to interact with the sensor input.

Source

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This project will have students create a noise detection device for measuring sound.