

Project Name: Arduino Electronic Drumkit

shared by Michelle Kornberg, MIT 2020

Specialized tools/technology used:	Experience level required:
piezo sensors, Arduino Uno, microcontrollers	familiarity with Arduino
electric circuits	beginner, intermediate
soldering iron, wire cutters/strippers	beginner but not first-timer, intermediate
Software, Mac: Arduino, Ardumo, Java 6 Software, PC: Arduino, Hairless MIDI/Serial Bridge, loopMIDI, and LMMS (a music software similar to GarageBand)	beginner

Grade Level (of this example): 9th grade and up

Content Standards (of this example): electrical circuits, energy transformation, soundwaves

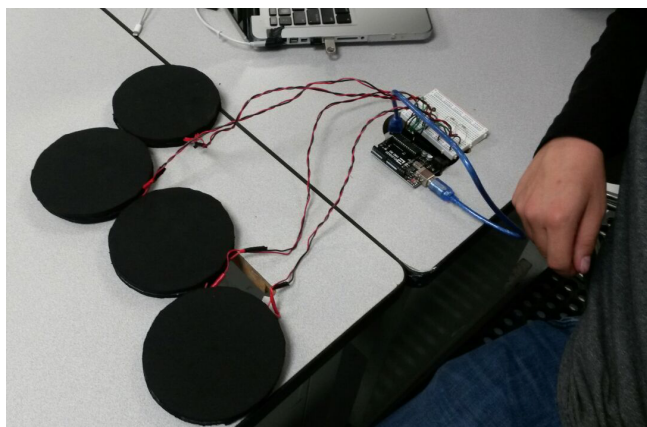
Summary of Project: Students build a fairly simple electronic drum kit. Students work in groups of two or three to make the drum pads, build the circuit, and write the Arduino program for their project.

Before working independently, students should know or learn some basics on:

- electric circuits (series vs. parallel, what is voltage, piezoelectric effect)
- how digital computers and microcontrollers work together
- loop rules

Expect the project to take about 20 hours, including pre-teaching. See below for more details on managing the project.

Images of finished student work





Possible content explorations / expansions

STEM - Energy transformation

- Each major content topic (electricity, circuits, energy transformation, etc.) can be explored in more depth before or after
- Use project as an entry point for independent, open-ended research on applications of energy transformation (gathering energy from roadways, solar power, etc.)
- Place output speakers on/in different objects to find unique acoustic effects
- Design a piezo-triggered electric instrument or invention suited to particular environments/users

ELA/Social Studies

- Expand the palette of playable objects beyond drums - consider placing piezo triggers on furniture or theatrical set-pieces to create an interactive exhibit that tells a story
 - Design exhibit for a museum, public event, or elementary classroom
 - Design simulator of rare, delicate, or hard-to-find instrument

More details on the original project pictured above:

This project is based on [this "Midi Arduino Drums" tutorial from Instructables](#) with modifications by Michelle Kornberg, MIT 2020. The project was tested with high school seniors and college freshmen, most with some background in Java or in C++, some with circuitry experience. They completed the project in 16 total hours of work, so 4 hours have been added to the time estimate above to account for difference in age and experience.

The original tutorial is written for Mac users - PC users' actual written code will vary from what is seen in the original. Some things to note about coding for the Hairless MIDI/Serial Bridge:

- Takes three bytes of information, so you must use the Serial.write() command
- Defining piezos with arrays and storing their values in an array allows students to use a for loop to iterate through them
- Can be a good opportunity to learn about helper functions
- You cannot simultaneously interface with your Arduino and Hairless, so you must disable the bridge to upload more code,
- loopMIDI should be designated as the output port in Hairless. The input should be your Arduino

In addition to the tools above, students were provided with the following materials:

- Piezo elements (x4), from [dx.com](#)
- CD (x4)
- Rubber (enough for 8 circles) - can reuse old mouse pads, carpet liner, bike tubes, etc.
- 1 MOhm resistor (x4), from [sparkfun.com](#)
- Arduino + USB connector, from [sparkfun.com](#)
- Breadboard, from [sparkfun.com](#)
- 22 gauge wire (red, black, green)