# Sonic Pi: MIDI Synthesizer

**Focus of Project/Unit**

The goal of this project is to provide students the opportunity to create electronic music using Sonic Pi and MIDI keyboards.

**Rationale for Project/Unit**

Most commercial music produced today involves the use of synthesized and sampled sounds. MIDI (musical instrument digital interface) is the standard language used for electronic musical instruments and computers to communicate with one another. Sonic Pi is capable of producing a wide variety of synthesized sounds which can be controlled via MIDI.

**Standards and/or Learning Goals Addressed**

Wyoming Fine & Performing Arts

- FPA4.1.M.3: Students improvise simple rhythms, melodies and accompaniments using a variety of traditional and nontraditional sounds
- FPA 4.1.M.4: Students create music using a variety of traditional and nontraditional sound sources

Wyoming Computer Science

- 2.AP.C.01 With guidance, independently and collaboratively create programs to accomplish tasks using a programming language, robot device, or unplugged activity that includes sequencing, conditionals, and repetition.
- 2.IC.C.01 Describe how people use different types of technologies in their daily work and personal lives.

**Time Span Involved**

I anticipate being able to cover this material in about two 35 minute class periods. However, this project could easily be extended, depending on student interest and available time, to involve a deeper look at how to manipulate the code in order to create a wide variety of additional synthesized sounds in Sonic Pi.

**Materials Needed**

- For Teacher
    - Raspberry Pi (display projected for class to see)
    - MIDI controller

    - Sound system

- For Students
    - Macbook computers
    - MIDI controllers
    - Optional: headphones

**Plan for Implementing the Unit**

Day 1: Getting started with MIDI

- Teacher demonstration and introduction
    - Sonic Pi
        - Demonstration of some of its capabilities, including live looping and MIDI controlled events.
    - MIDI (musical instrument digital interface)
        - Purpose, brief history
- Hand out equipment
    - Computer assignments
    - MIDI keyboards (USB cables)
- Making music with Sonic Pi and MIDI controller
    - How to open project and load code
    - 'run' command
    - Explore music creating using MIDI keyboard

Day 2: Sonic Pi Code

- Review concepts from previous class
    - Address any issues, questions, or problems that arose
- Keyboard synth demonstration
    - Discuss the ability of keyboard to change sounds
- How to change synthesizer selection within Sonic Pi code
    - Demonstrate a few examples sounds
    - Display list of all available synth sounds
    - How to change code within live loop to select a new synthesizer
        - Don't forget to click 'run' after any changes

**Differentiation**

I have observed that generally all students tend to enjoy "cause and effect" and making sounds. Regardless of their previous individual musical skills and knowledge, I believe all students will enjoy playing around with the MIDI keyboard and exploring the sounds they can create via Sonic Pi. Students with more musical ability and keyboard skills will obviously be able to make more sophisticated music.

**Unit Extension as Time Allows**

Students could be given the opportunity to alter the project code in order to manipulate the synthesizer parameters and to select other synthesizers to produce a wider variety of sounds.

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MIDI synthesizer

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```
#experiment with [synth :piano] to change to other synthesizer sounds

live_loop :synth do
  use_real_time
  note, velocity = sync "/midi/nanokey2_keyboard/0/1/note_on"
  synth :piano, note: note, amp: velocity/127.0
end
```

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MIDI synthesizer with drum loop

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```
# experiment with [use_bpm] value

live_loop :midi_piano do
  use_real_time
  note, velocity = sync "/midi/nanokey2_keyboard/0/1/note_on"
  synth :prophet, note: note, amp: velocity / 127.0
end

live_loop :drums do
  use_bpm 100
  sample :drum_heavy_kick
  sleep 0.5
  sample :drum_cymbal_closed
  sleep 0.5
  sample :drum_cymbal_closed
  sample :drum_snare_hard
  sleep 0.5
  sample :drum_cymbal_closed
  sleep 0.5
end
```

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Extension activity: exploring synth parameters

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```
# midi controller with randomized filter and panning
```

```
# experiment with different ADSR values (attack, decay, sustain, release)
# experimented with cutoff, res, wave, and pan values

live_loop :synth do
  use_real_time
  note, velocity = sync "/midi/nanokey2_keyboard/0/1/note_on"
  synth :prophet, note: note,
    amp: velocity/127.0,
    attack: 0, decay: 0,  sustain: 0,  release: 0.4,
    cutoff: rrand_i(70, 130), res: rrand(0.1, 1), pan: rrand(-1, 1), wave: rrand_i(0,2)
end
```

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Sonic Pi Synths

| | | | | | | |
|---|---|---|---|---|---|---|
| beep | dark_ambience | fm | mod_beep | noise | rodeo | tb303 |
| blade | dpulse | gnoise | mod_dsaw | piano | saw | tech_saws |
| bnoise | dsaw | growl | mod_fm | pluck | sine | tri |
| chipbass | dtri | hollow | mod_pulse | pnoise | square | zawa |
| chiplead | dull_bell | hoover | mod_saw | pretty_bell | subpulse | |
| cnoise | | kalimba | mod_sine | prophet | supersaw | |
| | | | mod_tri | pulse | | |