

Magic Music Carpet

What is a Step Sequencer?

A music sequencer is a device or application software that can record, edit, or play back music, by handling note and performance information in several forms. Basically it allows you to record a sequence of sound data to be played back at a later time. So what is a step sequencer? A step sequencer can record and playback a sequence or pattern of notes organized in a grid. This grid organization ensures that notes are always played in time. The most common use of step sequencers is with drum machines and groove boxes.



This is an example of an analogue drum machine. The Roland TR-808 used 16 steps to record drum patterns.

Foot Step Sequencer Components

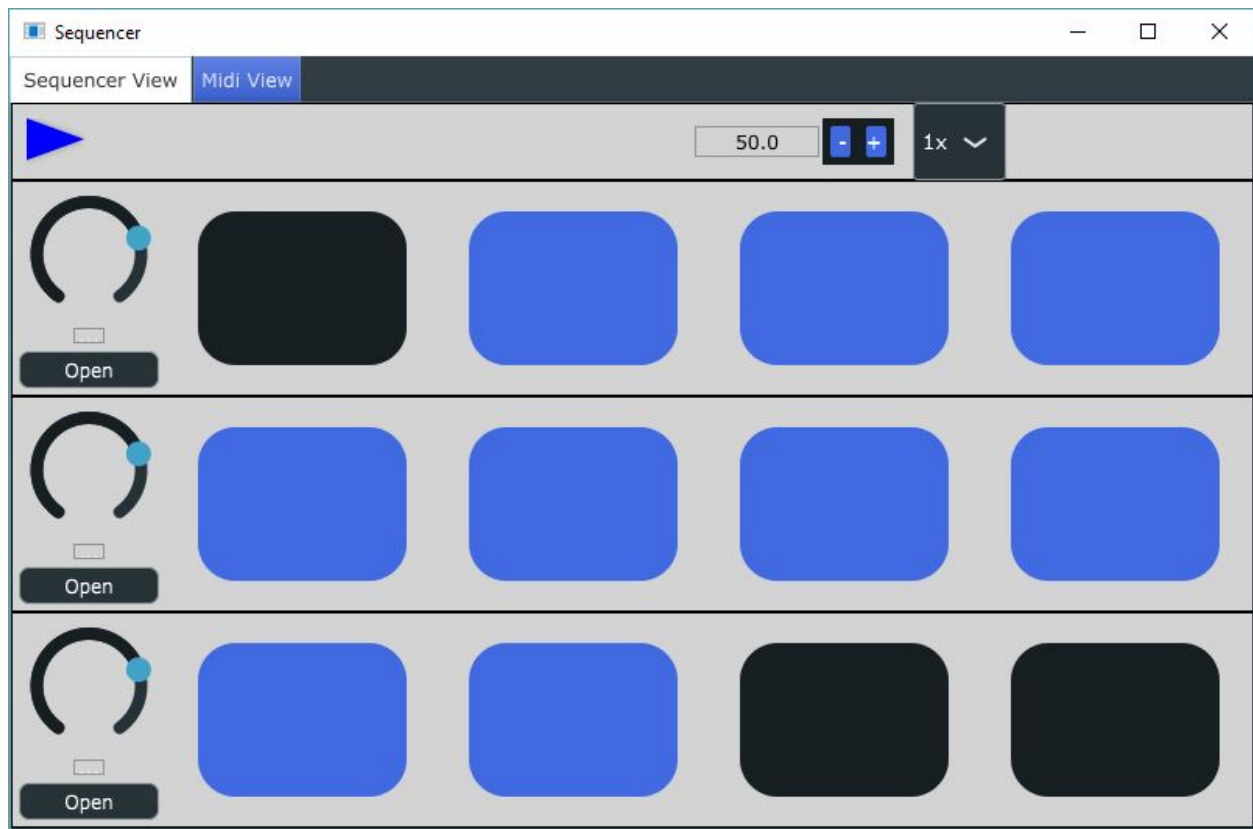
The foot Step Sequencer has three main components: Software, Microcontroller, Sensors.

Software

The purpose of the software is to receive MIDI input to model a sequence of drum hits in real time. The software runs on a PC (Windows in this case). The framework used was JUCE. JUCE is a framework for creating audio applications. The framework made it easy to quickly create a GUI and audio sequencer.

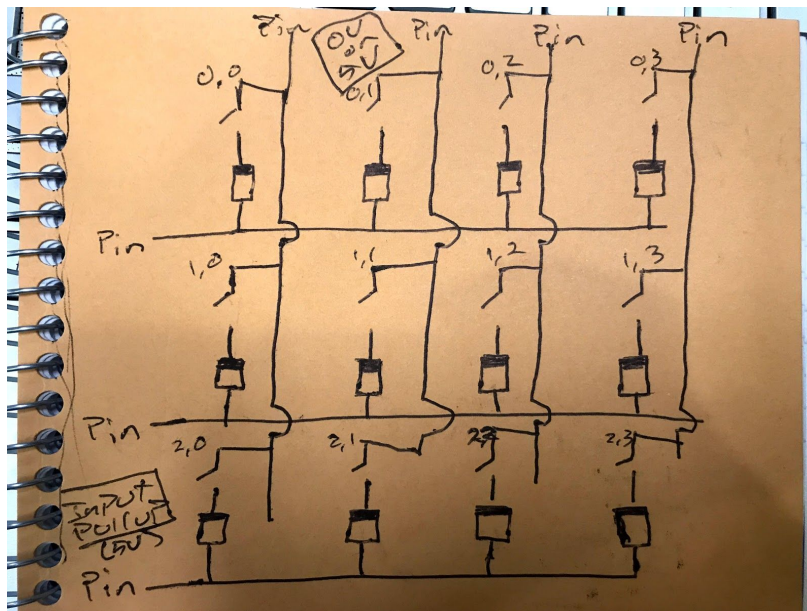
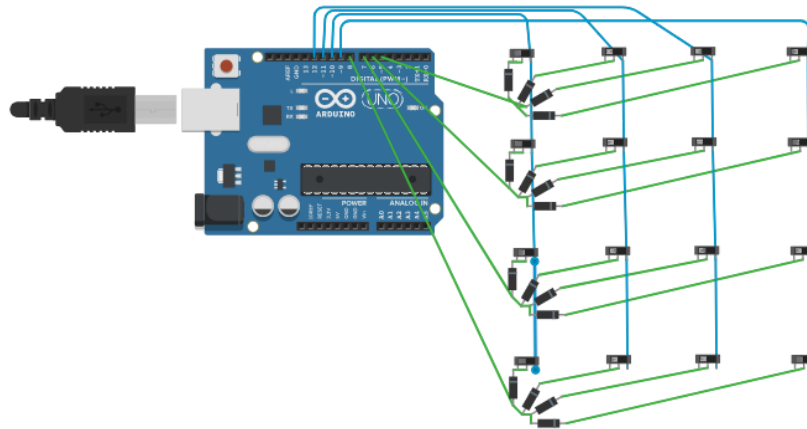
The application is a grid of 4 columns and 3 rows (This can be reconfigured easily). The columns represent steps and the rows represent sounds. At the slowest speed, each column represents one beat in a measure. A measure always has four beats. Each step in the sequence can be activated or not activated. An activated step means that the sound for that row will play on that beat. So if only the first step is activated then the sequencer will play the row's

sound on the first beat and stay silent for the three remaining beats. When the sequence finishes, it starts over creating a loop. The BPM and sound files can be configured via the GUI.



Microcontroller

The purpose of the microcontroller is to read the state of the physical sensors and transmit those states to the PC software via MIDI signals. The microcontroller used was an Arduino Micro. The following diagrams represent the wiring of the system.



The arduino uses a Keypad library to check the state of each of the sensors. In order to reduce the number of pins needed on the arduino, a multiplexing technique is used. One of the caveats of multiplexing is that the state of some sensors may not be accurate when too many sensors are activated near each other. In order to combat this issue, a diode was placed in series with each switch. The matrix is scanned thousands of times per second.

Physical Sensors

The physical sensors are based on a simple contacts between strips of charged copper tape. The sensors are about 9x9 inches. Each sensor has three layers made of felt. The top and bottom layers are identical. They have three strips of copper tape forming a capital letter H. The

middle layer has five square holes to allow the tape on the top and bottom layers to touch. When the two layers touch, current can flow through the sensor and this is detected by the microcontroller.

