Music Synthesizer Experiments

O. Guy Morley

February 3, 2019

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The Beginning (1970s-1980s)

It was in the 1980s. For a teenager, buying anything that costed almost two thousand dollars (roughly equivalent to four thousand dollars in 2019) was more than a big deal. Roberto was ecstatic. It wasn't a car. It was a music synthesizer.

Roberto's interest in synthesized music started when he was a middle schooler. He listened to Isao Tomita's vinyl albums, filled with fascinating re-creation of classical music. Roberto also bought probably the first book on music synthesizers and learned its mechanisms and operations. Later, in a high school music class, his class was asked to do an individual project. Even though Roberto didn't have a synthesizer, he still wanted to create synthesized music. Luckily, he found out that a friend of his friend owned a synthesizer. So, he borrowed it and started a project.

At home, Roberto's family had a stereo system with a cassette deck. Roberto purchased another second-hand cassette deck; dual cassette decks were not readily available then. He used one deck for playing and the other for recording. The sound from the synthesizer was mixed during this process. He also made a passive mixer (just two potentiometers), so that the synthesizer sound can be "panned" at any position between the left and the right channels.

It was a very primitive and low-quality setup. Since the mixing process introduced significant noise each time, it was not very practical to repeat the process more than several times. But it worked. Roberto felt as if he was a little Isao Tomita.

For his school project, he chose a short piece “composed” by himself in his middle school music class. He used several different sounds along with dramatically-randomized introduction. At the end of the music, he added a short section of “Jupiter” from Holst’s *The Planets*, featuring four-part chorus simulation. Of course, he was very much influenced by Tomita’s synthesized performance of *The Planets*.

When Roberto’s recording was “premiered” in class, it was a hit. Many of his friends seemed to have been impressed. After that, he had to return the synthesizer to the owner. He was very sad.

Later, when Roberto became a college student, he decided to buy a music synthesizer. When he finally brought home his own synth made by Roland, he was really excited. Soon, he started to create his own music, still using the primitive recording setup. So, there was an inherent limit to what he was able to do. In order to minimize the number of mixing, he used a rhythm machine. In order to assist his poor keyboard technique, he also used a small sequencer. He spent a lot of time and recorded several pieces of music on a tape. By the end of his college years, though, his interest shifted. He sold the synthesizer and almost forgot about the whole experience until relatively recently.

Revival (2018-2019)

More than thirty years passed. Throughout these years, Roberto still enjoyed listening to music. However, a few years ago, he started to play a few musical instruments as well. Gradually, his family acquired several musical instruments and improved their audio system. Roberto also started to use free music-related programs including MuseScore and Audacity. MuseScore was extremely useful to edit available music scores. With Audacity, he was able to edit audio files in a variety of ways.

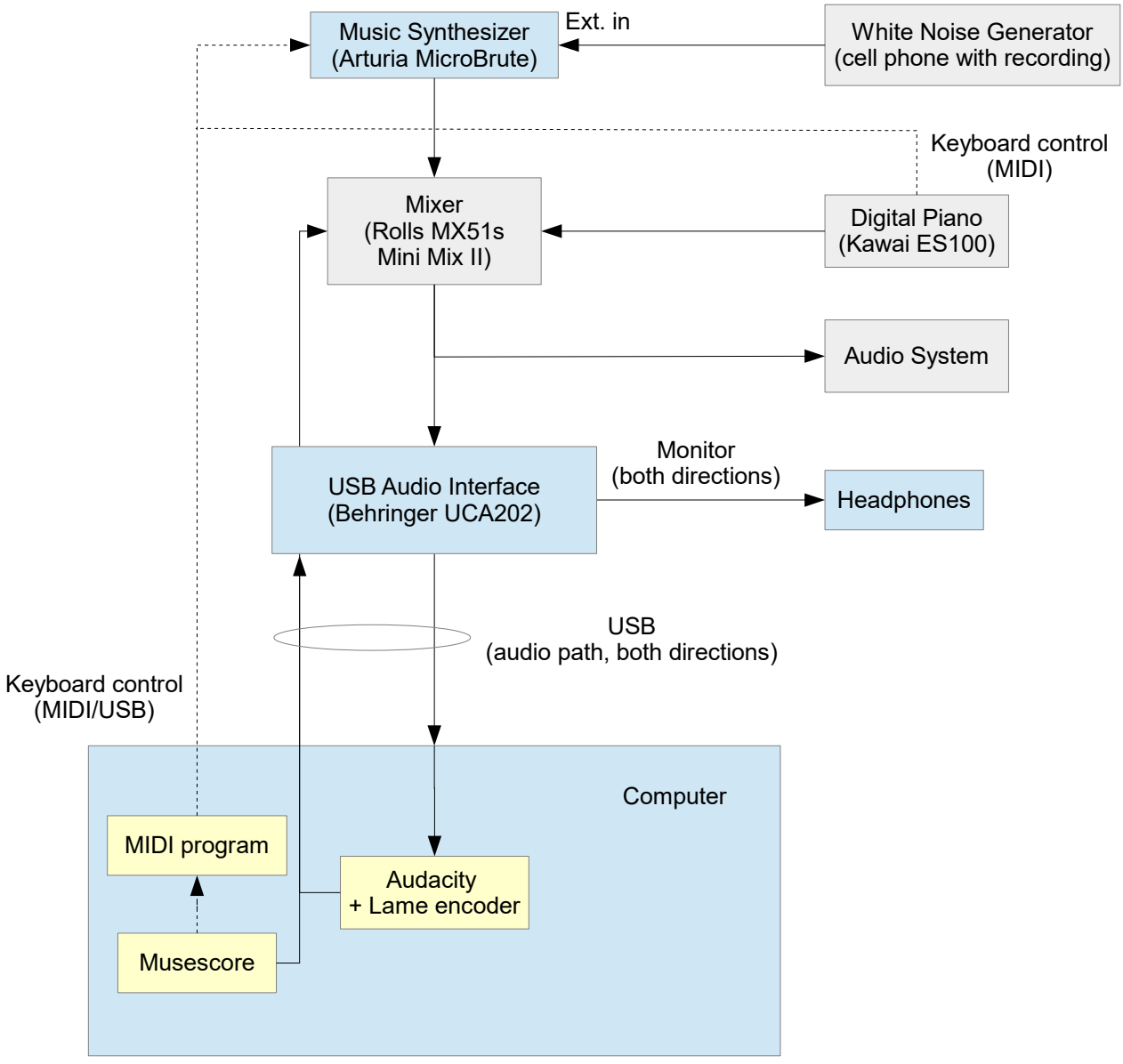
When Roberto was checking something on the Internet, he stumbled upon an online version of a music synthesizer simulator. It looked and sounded real. While that was fun, he also felt like turning dials and moving levers manually on a real device. He also realized that there are a lot of reasonably-priced musical synthesizers available these days. Things have changed.

Although Roberto had no intention of making synthesized music seriously, he still wanted to do some experiments. With an inexpensive synthesizer and Audacity, he thought that he could do what he couldn’t do many years ago. So, he bought the least expensive analog music synthesizer with decent control, which was Arturia Microbrute shown below.

Although Microbrute was really minimal in terms of functionality, it was quite affordable and still seemed to have a great potential. Roberto's focus this time was the ability to mix any number of sounds without sacrificing the sound quality. He was thinking about Audacity. So, as one of the first experiment, he chose Ravel's *Bolero*. He found a score on MuseScore and shortened it from about 15 minutes to about 9 minutes.

The first sound Roberto created was that of a snare drum. Since Microbrute doesn't have an on-board noise generator, he downloaded a white noise file to his phone, fed it to the external input of Microbrute, and played it continuously. The experiment configuration is shown below.

Music Synthesizer Experiement Diagram



Then, Roberto created all the necessary sounds one by one and recorded them on separate tracks. Initially, he started to play each part manually. However, he made so many mistakes and needed enormous amount of time to record even a single track. So, he decided to use MIDI control. MuseScore was used to create MID files. Then, these files were used to control Microbrute.

Roberto created various sounds including Violin1/2, Viola, Cello, Contrabass, Flute 1/2, Piccolo 1/2, Oboe d'amour, Oboe 1/2, English horn, E flat clarinet, Clarinet 1/2, Bass clarinet, Bassoon 1/2, F alto horn, C trumpet 1/2, Tenor saxophone, Timpani, Celesta, and Harp. Some parts, such as strings and harp, required multiple recordings corresponding to multiple notes.

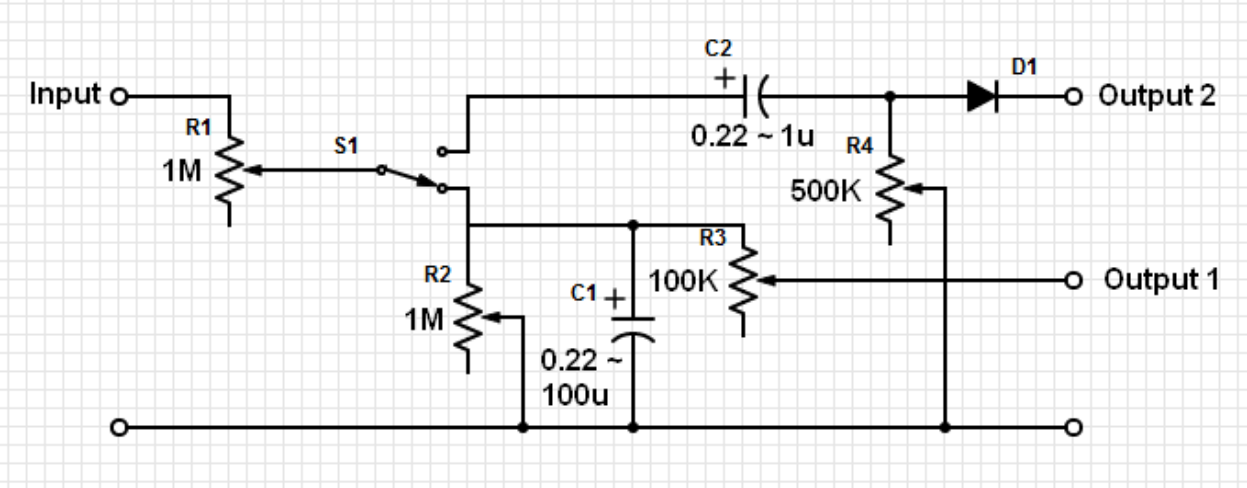
After all the tracks were recorded, the level was adjusted for each track and reverb was added to each track. While doing all these, Roberto named his Microbrute along with accompanying devices as "Synthetonix." If you search on-line with a word "synthetonix," you might still be able to find the mp3 files created by him. Roberto was not completely satisfied with the final recording. However, this experience of mixing so many tracks was exactly what he was unable to do before. So, he felt that his teen-age dream had come true.

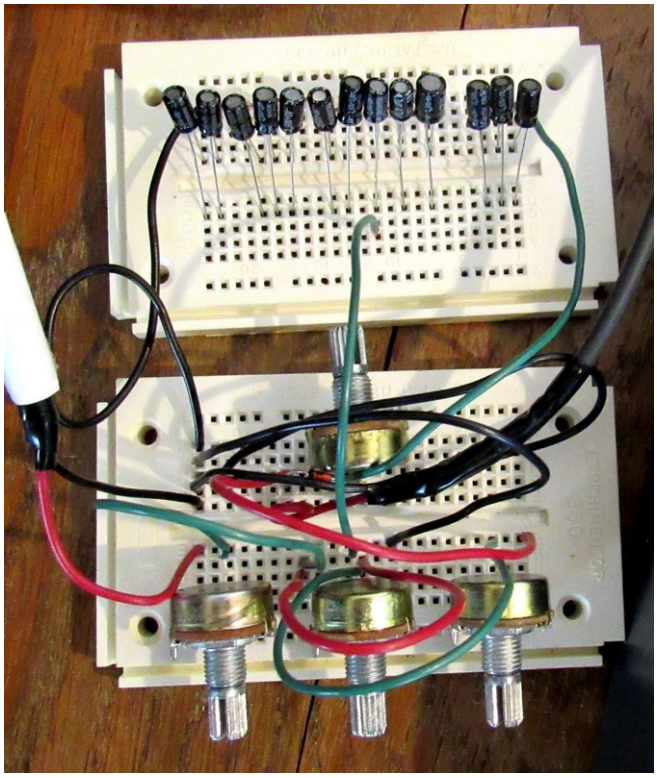
Cheap-Trick Envelope Generator

Before concluding his experiments, Robert wanted to one more thing. Although quite practical, Microbrute is still a small synthesizer and limited in many ways. For example, there were times he wanted to have two envelope generators. If there is another envelope generator in addition to the built-in envelope generator hardwired to the amp, he could use it to control the filter or the pitch independently. Since Microbrute has several modulation/control jacks, he decided to experiment a bit. He was an electrical engineer and had some electronic components at hand.

As a preliminary step, Roberto connected the CV out of Microbrute to a capacitor and a potentiometer so that CV out signal is initially absorbed by the capacitor and later delivered to the pitch input of the modulation matrix. Since the energy absorbed by the capacitor is released after the gate closes, this has an effect of a primitive AD (attack-decay) envelope generator. Using this contraption, he was able to control the pitch and/or filter with this new AD envelope independent of the built-in envelope.

Since Roberto had only a small stock of electronic components, he ordered dozens of potentiometers and dozens of capacitors. This costed about $10 in total including shipping (potentiometers were shipped directly from China and took about 10 days). After trial and error, he came up with the following design and assembly of a quasi-AD envelope generator controlled by either the gate (open and close) or trigger (open only).





This component can create a quasi-AD envelope (gate) at Output 1 or a quasi-D envelop (trigger) at Output 2. This can be selected by the connection represented by S1 in the diagram, realized as changing the jumper connection.

For Output 1 (gate), the timing of AD can be adjusted by C1 (choice of 10 capacitors) and the values of R1, R2, and R3. The choice of a larger capacitor and/or increasing R1 would increase

the AD timing. The value of R2 and R3 would also affect the timing in a complex way. In addition, the value of R3 would have more impact on the timing of D. The level can be adjusted by the combination of R1, R2, and R3. The ratio of R1 and R2 would be the main factor. But the value of R3 would also affect the result. For Output 2 (trigger), the timing of AD can be adjusted by C2 (choice of 3 capacitors) and the values of R1 and R4. The level can be adjusted by the combination of R1 and R4. The diode is added to eliminate (or reduce) the level shift when the gate closes.

It's rather tedious to adjust the multiple potentiometers and choose an appropriate capacitor. And the outcome can be a little unpredictable. Nevertheless, it really works and is fun.

If Roberto was more ambitious, he could have made a real envelope generator with a few OP amps. It wouldn't cost too much. He could also have made an additional LFO. But those things have not been accomplished. Currently, Roberto's focus is on playing musical instruments.

Epilogue

Roberto had long forgotten about his first, Roland synthesizer. Recently, when he was looking at vintage Roland synthesizer images on the Internet, he spotted what he used to own. It was SH-7 as shown below.

Now, Roberto clearly recalls that green panel with a good amount of control on it. It was fantastic.