My topic of the ID301 project is “looper with live audio effects, helping the real-time looping and music production”. Let me briefly introduce what it is mainly about.

In modern music production, trackmakers are encouraged to use various kinds of features. One of the most fundamental features of music production is Looping and Sampling the audio.

In music, a loop is a repeating section of sound material. Short sections can be repeated to create patterns which is appropriate for looping. For example, a instrument player might loop what they play on an entire verse of a song in order to reduce the effort for the session. The representative audios for looping are drum breaks in breakbeat songs, chord synth loops in pop or house musics. The first trying to loop the audio to make music was the loop on Magentic tape in 1960s, and then people moved to hardware to record and perform a loop in around 1980s. Finally, with the rapid development of software, modern music producers are able to easliy loop the audio with mouse and keyboard in DAW softwares. ///

Sampling is the fundamental building block of modern music-making, which is the use of a piece of recorded or synthesized audio for the loop. This piece of audio could be anything from a tiny drum break snippet of sound to a full section of music. Not only just being looped, it can be manipulated in all kinds of ways: it might be chopped into some small “audio chunks” and sticked so that we can create a new loop or pattern from it. Also, we can use various kinds of sampling skills like retriggering, gate, stretch, reverse playing. Let me show how the each part sounds like within the video. ///

A "looper", as a musical device, is a piece of equipment used by musicians to loop the audio sample in real-time. It allows the user to create layers of sound by recording passages of music and then playing them back in a continuous loop. I've planned to just build something like looper mainly related to editting the audio (not only looping it) and done many amount of research. Due to the 5 min time limit, let me briefly introduce just 3 essential products in them.

The representative product of Looper is Boss RC-505, which has 5 internal stereo channel to record and loop the audio sample. It can deliver most of the fundamental features of looper and even includes the FX to add some spices to sound. Let me show how it could be used. ///

Another one, a quite simple but really impressing product is called “Ball Beats”. It doesn't seem to be sold these days since the website domain is changed to other topic, but I think this is a really creative one. Let me show this simple Youtube video. ///

In this video, the drum break sample is chopped into several pieces with the same time interval, and user can set up which chopped one should be played in each time section. As you can see, if the user modifies the position of the ball, the other part will be played at that time. This cut-and-paste method is the most fundamental part in electronic music production and sequencing. ///

The another one I was impressed is Lo-Fi tape looper made by a japanese person. In conjunction with the playback of the sample, the main idea of this looper is to add a playback speed control

stuff, like a scratch plate on a DJ device. When sound is playing, you can speed up or slow down the playback speed by turning the knob potentiometer clockwise or counterclockwise. This is called a tape effect in music production, because when playing sound with analog equipment such as a cassette tape, the tape is stretched, giving the vibes that the pitch of the sound moves back and forth. ///

Referring to many of the ideas including these three, I've set the main purpose of the product to make a loop with editing the sample or recorded audio with the hardware conveniently. But due to the rapid development of music software, it can be actually done within only software-ish aspect(we have many DAWs like FL Studio, ableton Live, Cubase, etc). Therefore, I decided to focus on the usage of real-time loop editting, such as editting the drum break pattern in electronic music live, and add some sampling skills like tape effect, retrigger, reverse effect to give variations. Like most of the loopers, I would like to put a external recording feature so that I can directly push and edit the recorded sound to the device like this(**show yt video**) ///

-〉 Now I'll show you the outline of my product (explain the image) ///

-〉 I've designed the blueprint with this outline, let me briefly explain about this.

1) USB Cable – connection with Laptop, uses UART protocol

2) LCD Display – to display an entire waveform of loaded sample

3) Play / Pause / Record button – can play and loop the samples, or pause them in the forward / reverse direction, up to 4. can record the audio from computer's stereo mix or external input.

4) volume slider – can control the overall volume of current sample

5) position slider – can control the time position of sample, that indicates which chopped audio chunk will be played at that time (most important part)

6) randomizer – when this is on, the value of position slider wold be randomized from 1 to 8. can be toggled by pressing.

7) tape effect disk – modifies the play speed of sample, from 0.5x to 1.5x (= tape effect). can be controlled with human finger

8) track switch – changes the sample to edit. up to 4.

9) effect button – apply the effect (retrigger / stretch / reverse / downsampling) to each chopped sample piece, can be enabled or disabled

10) display LED – when the corresponding section is played, the LED lights turn on red

11) external input cable – TS cable for reading external audio input. single or double. ///

I made a simple sketch based on the design, let me explain the mechanism. To simplify, the sample will be chopped into 4 pieces not 8 in this time. I could only get 3 slider knobs in Audi lab, so the 4th one is actually absent in this time but the number of chunks will be 4 anyway. As I explained, changing the slider allows us to modify the pattern of concatenating the chunks. Unfortunately, I'm really struggling at dealing with python audio library so I couldn't implemented actual looping this time, but changing the slider value would change the loop pattern. I'll show you how it works. (show the loop changes) Also, I've implemented the reverse, retrigger and gated effect for the audio. By pressing the button, the effect is applyed only to the corresponding chunk. Let me show these efffects one by one. Additionally, I added a joystick temporarily for the tape loop, because I haven't find an appropriate disk for the finger moving. The device reads X, Y movement of it and send it to computer. ///

The next step is divided into 3 categories. First, I would replace the arduino board to Raspberry Pi, in order to unite the signal sending and receiving process to Python. The structure of circuit board will remain unchanged though. Second, I should figure out updating the audio loop within real-time. In current state, my process is just only a repetition of Modifying the loop array and playing it as one by one, so I should make it to be played as real-time loop, additionally to be editted from the device control. Third, I should find out the algorithm of implementing a tape loop. As I mentioned, tape loop is based on real-time modification of playing speed but I'm still ignorant about how to edit the audio array to implement it. I would ask my acquintances about if they have an answer, or get rid of tape effect and assign other effect on the disk for it.

Thank you for listening. Any questions?