A PARTICULAR MIDI SYNTHETISER

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ABSTRACT

In contemporary times, musicians have access to a variety of musical instruments.However, the fundamental of any musical note remain constant. Our objective is twofold:

- Firstly, to identify MIDI notes based on their fundamental frequency
- Secondly, to synthesize these notes with an alternative instrument. Following the creation of their music, users can choose their desired instrument through a frequency recognition system.

FREQUENCY RECOGNITION

OBJECTIVE

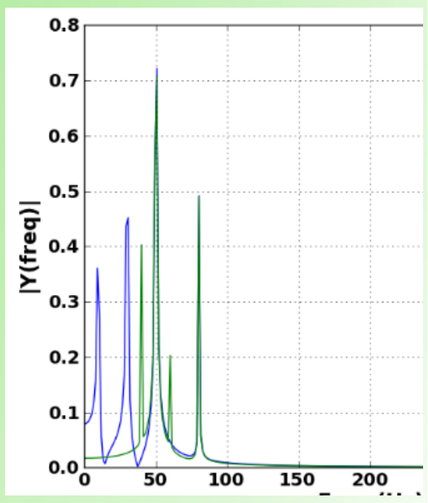
- Recognize a user-played MIDI note
- Find out the fundamental despite the existence of noise and harmonics
- Make a comparison of existing frequency recognition algorithms in order to choose the most suitable.

METHOD: FFT ALGORITHM

- In order to find the fundamental, we can use the FFt recognition method
- Let x(t) be a signal composed with multiple sine waves. fft or fourier transform associates to x(t) a unique x(f), where:

$$X(f) = \int_{-\infty}^{\infty} x(t) \cdot e^{-j2\pi ft}\, dt$$

- So by finding x(f) ,we can easily find out the fundamental as it is the lowest frequency.
- However, because of the noise and pollutant signals, we cannot be sure of the result.
- We can calculate the probability of efficiency of this algorithm and in our case it is around 90 %.



RESULTS

- The fundamental is recognized 90 per cent of the time
- The recognition is less effective the more external noise there is.
- In our project it is largely sufficient
- However we want to precise that there are more powerful algorithms like the YIN's algorithm that are more effective even with noise presence.

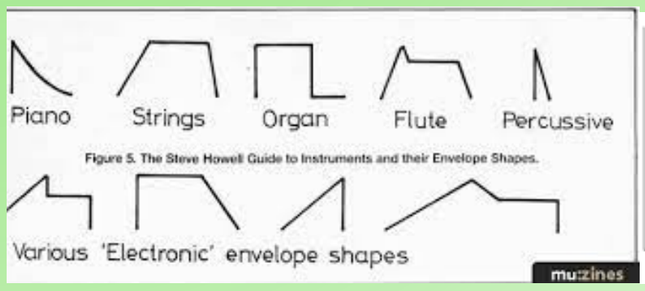
SOUND SYNTHESIS

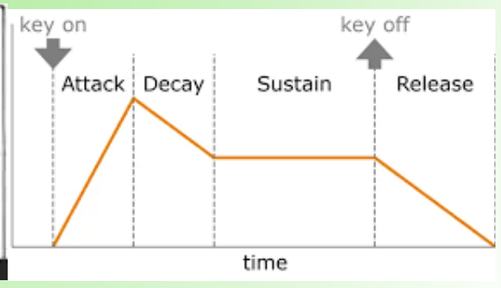
OBJECTIVE

- Synthesize a note using faust language
- Altering this note by shaping the amplitude with an envelop to make it sound like a particular musical intrument
- Improve the sound quality

METHOD: ADSR ENVELOP FOR FLUTE

- We can create an envelope that shapes the amplitude of a sound over time, allowing for the creation of dynamic and expressive musical tones. Every shape characterizes an instrument.
- For example, adsr shape can be used to mimic the flute sound.adsr stands for attack(ramp), decay(anti-ramp), sustain(constant), realase(anti-ramp).





RESULT

- The result is mixed as despite the fact that the sound is somewhat similar to the one that would be emitted by an instrument, the volume was so low because it saturates when we increase it.
- Also, while guitar sound is very resembling, it is not the case for wind instruments for example.

CONCLUSION

Our goal of making a "particular MIDI synthesizer" has been successful.The teensy recognizes the user-played serie of notes and replay it according to the chosen instrument. Nevertheless, as a perspective of improvement,

- We could on one hand replace the fft algorithm with the yin's one which is more effcient.
- And for the synthesis part, there is a saturation problem that needs to be fixed.

This project can be useful in the musical community as it changes the user's personal composition into another instrument.

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