Metronome:

What is a Metronome?

A metronome is a device or tool used in music to help musicians maintain a consistent tempo or beat while playing or practicing. It produces a regular, steady sound at a specific rate, usually measured in beats per minute (BPM). The metronome's primary purpose is to provide a rhythmic reference point for musicians to stay in time and develop a sense of timing and rhythm.

Assignment: We need to make a metronome which can generate regular steady sound at a specific BPM provided an audio beat that we want to repeat.

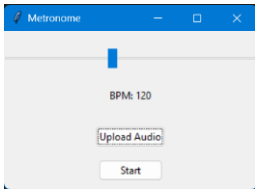

Fig1. UI of metronome

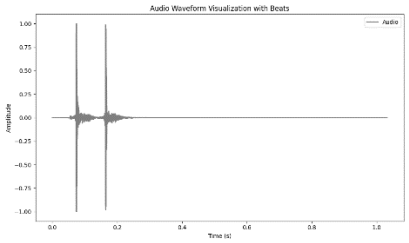

Fig2. Waveform of mouse click sound.

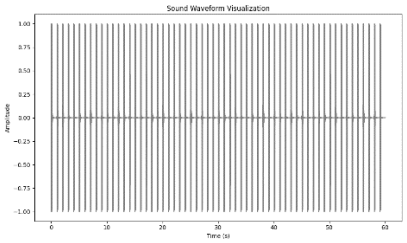

Fig3. Waveform of sound of mouse click at 60 BPM.

Solution:

1. We find out the time gap between two consecutive beats by using the formula.

Time_gap = 60/BPM seconds

2. We play the beat on **interval of Time_gap** and we get the required sound at that specific BPM.

But there are some issues that we need to handle to make it practical.

a. If the provided audio has a silence period at the start for t_1 time. Then the first beat will be delayed by t_1 time and so the bpm we will notice might be lower than the BPM we provided to the metronome.
Solution: We can easily solve the problem by simply trimming the audio up to the point where the beat actually starts.

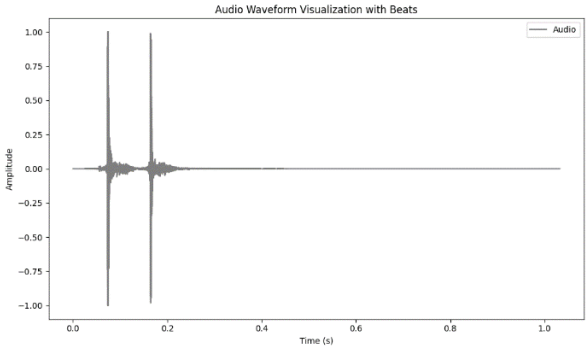

Fig4. Audio of a delayed beat.

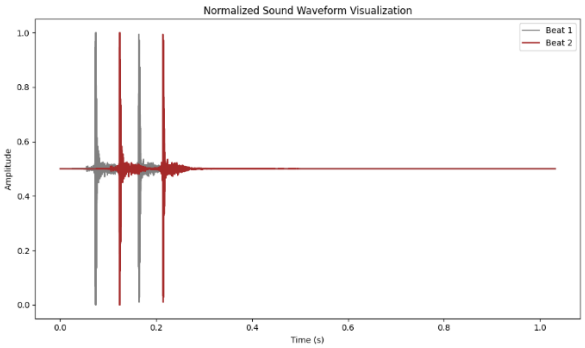

Fig5. Overlapping of beats on higher BPM.

b. Suppose if the provided audio has length of the beat to be 0.3 seconds. Then we need to have a minimum Time_gap of 0.3 seconds between two consecutive beats to hear them distinctly. Otherwise, the beats will overlap and may be on higher BPM we might not be able to tell them apart as distinct beats.
Solution: Limit the number of BPMs by some upper bounds.