LeapLoop  
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**Abstract**: Loop based music composition system where the user records loops using the instruments built in the system, applies effects to the audio generated and controls everything using hand gestures.

**Overview:**  LeapLoop is a web based music creation system controlled by the Leap Motion which has 4 built in instruments which can be used to create music: 1. Drum Pad/Sampler 2. Synthesizer 3. Oscillators 4. Microphone audio input. The idea is to record multiple instruments over one bar to create a song. These instruments are played gesturally using the Leap Motion. Audio effects can be added to individual instruments or the master track which are also controlled by gestures and can be recorded. The different audio effects available are filters, reverb, delay (normal and ping-pong), chorus, flanger, spatialization and pitch shift.

**Technology:** The LeapLoop is to be built using web based technologies and is controlled using the Leap Motion Controller.

1. **Web Audio API:** Powerful and versatile system for controlling audio on the web allowing developers to choose audio sources, add audio effects, create audio visualizations, apply spatial effects, etc.
2. **p5.js:** JavaScript client-side library for creating graphic and interactive experiences, based on the core principles of Processing, a creative coding environment.
3. **Leap Motion (LeapJS):** JavaScript framework to use and control the Leap Motion.

**Gestures and Mappings:** The Leap Motion recognizes four main gestures – circle, swipe, key tap and screen tap. The web based interface also provides additional gesture capabilities to interact with the system reducing the restrictions of the Leap Motion. Gestures to create music differ in each instrument. These are the proposed gestural interactions with the system –

Instrumental Interactions

1. Drum pad/ Sampler: Use the key tap gesture to play virtual drums/sampler. The Leap Motion allows the use of both hands simultaneously, allowing the player to play to be extremely expressive with the drums.
2. Synthesizer: Screen tap gestures will be used to play a virtual synthesizer visualized on the screen. The right hand will be able to play the synth normally or hold a chord and let the system arpeggiate the notes held. The left hand will use pointing gesture to change the scale of the synthesizer.
3. Continuous controlled oscillator (Generative): This is an oscillator group (or a generative music system) which is controlled by the fingers of the right hand. Each finger will be mapped to a different oscillator and the addition/removal of each finger can give rise to a new continuous tone. The X-position will control the pitch and the Y-position will control the volume and the Z-position will control the vibrato (or any other) effect.
4. Audio Input using mics: This does not need any gestures.  
     
     
   System Interactions
5. Recording: Done over one bar, the recording of an instrument will be started by the creation of a “fist” using the left hand which will prompt the recording to start after the end of the current bar.
6. Switch between instruments: the swipe gesture will be used to change the instruments which will also be displayed on the browser graphically.
7. Effects: These are controlled by waving the left hand in the vertical direction. The amount of the applied effect will be inversely proportional to the distance of the hand from the Leap Motion. Spatialization/Panning will have a continuous control gesture.
8. User Interaction with the System UI: A finger based mouse like interaction with the web UI to control the system (macro parameters) easily.
9. Recording Effects (automation): After recording audio, on the same instrument, a fist gesture can be used to start recording the changes induced by the movement of the left hand on the effect values. More than one effect can be controlled by the hand movement and recorded together.

**Salient Features:**

1. Multiple instrument instances give endless musical possibilities.
2. Web Audio API is a very versatile audio framework.
3. Instruments are easy to play with – low floor.
4. Recording loops over one another with different instruments and effects increases complexity but also musical potential – high ceiling.

**Challenges:**

1. Too many gestures can make the system difficult to interact with.
2. Web based interactions tend not to be smooth, particularly with a leap motion.