LED Zeppelins II - Space Synth
Multiple target sound localising wavetable synthesizer

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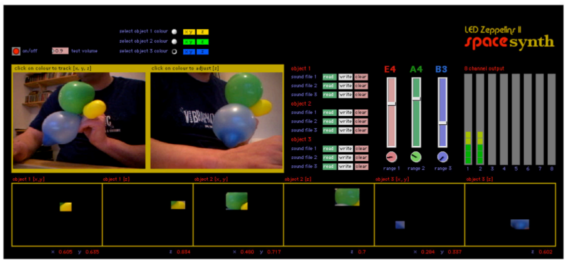
Abstract

LED Zeppelins II Space Synth is a generative / interactive soundscape synthesizer that uses computer vision (colour tracking) to track the 3-dimentional coordinates of up to three separate objects - in this case helium filled balloons - moving in 3D space, via feeds from two live camera inputs. Using wavetable synthesis the software synth can be used to attribute each tracked balloon up to three sound file loops that can then be altered and mixed on-the-fly. The synth then uses sound localisation to target the sounds to the position of the balloons.

Keywords

Computer vision, sound installation, interactive sound, generative sound, colour tracking, wavetable synthesis, 8-channel sound, sound localisation.



LED Zeppelins II – Space Synth interface testing

Introduction

Rather than targeting the listener, this project concentrates on the localisation of sound targeting multiple tracked objects in a 3-dimensional space, in this case up to three helium filled balloons. The use of a spatially distributed 8-speaker system allows the amplitude of sounds output from each speaker to be adjusted to correspond to the positional data of each balloon's physical position within the space.
The interface allows the user to load up to three sound files for each balloon at any time (.wav format). These sound bites are stored in individual buffers, which loop using wavetable synthesis initially in synch at a cycle length of 500ms. The user can then adjust the start and end points of the each looped buffer from 0 to 500ms, allowing them to generate even more complex waveforms and produce a richer variety of sounds. Just as the x, y and z coordinate data of each object adjusts the amplitude of its allocated mix of sounds to each of the 8 speakers, each tracked balloon's y coordinate value also alters the speed of playback of the mixed sound clips up and down a musical scale. As the data from the y axis value of an object is received as a continuous scale, it converted to distinct values graduated to correspond to notes in a musical scale, A1, B1b, B1, C2, C2#, etc. This generates a more audibly pleasing / musical output. The user is also given control over the range of each of the three separate musical scales to allow a wider spectrum of sounds to be produced.

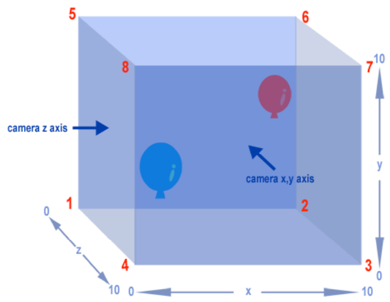
Demonstration of project in BGB212

The viewer engages in the project by controlling the input and mixing of the audio clips and moving by the balloons around in the space whilst listening to the resulting 8-channel playback. There is also a high level of visual feedback available when viewing the interface.

Computer Vision

Computer vision is a constantly developing field that offers a multitude of possibilities both for digital artists as well as having a wide range of physical applications in areas such as surveillance, medical (sight replacement), entertainment systems, etc. As digital camera technology improves and computer processing power increases, accessibility and the possibilities that come with it increase. The chosen method for recognition of movement for this project is colour tracking using feeds from two Apple isight webcams, although these could be replaced with any means of live firewire based colour video feed.
The first camera is positioned on one side of the to track the x and y coordinates of the balloons' movement and the second is positioned on an adjacent side of the space to track the z coordinate. The sub-patches '2videosin' and the colourtrack sub-patches use adapted source from TapTools

tap.jit.colortrack by Timothy Place. The user can click on any coloured object in each of the two video feeds ('x,y' and 'z') which will set the hue, saturation and luminosity values to be tracked for that object. They can then select another object and repeat the process for that objects colour. The two original video feeds are displayed in the two larger screens of the interface while the six smaller screens show just the objects being tracked object 1 (x,y), object 1 (z), etc.



Sound Localisation

Sound localisation in the context of this project is the practice of simulating the placement of a sound within a 3-dimensional space by controlling the output levels from each of the eight spatially distributed speakers surrounding the space. There are many more complex models within psychoacoustics that could be implemented to adjust the way the waveforms are perceived by the listener. Considering the simplicity of the method used the results are surprisingly effective. This does alter however depending on the sounds location in relation to the listener and also the makeup of the waveform itself. It seems harder to identify the location of lower tones for example.

Synthasis

The initial sound bite read into each buffer is 500ms in length. In most cases this allows enough time to get some reasonable variance of sound producing a good looping effect whilst also providing enough scope for adjustment of the beginning and end points to generate a decent range of complex sound waves from.

Conclusion

The tracking of the balloons in the space and adjusting of the output sounds as a result of their free movement can be considered as generative sound synthasis, however, given the amount of control given to the user over the wavetable synthesizer and in reality over the movement of the balloons, the Space Synth can easily become more of an instrument and has a high level of 'playability'. The visual feedback from the interface adds to the interactivity and with the right sounds loaded the piece can offer entertainment over long periods of playing by holding the objects in front of the cameras and controlling the interface through both their movement and adjustment of the various controls. Alternatively when left to generate sound based on colour movement alone can achieve some amazing results. Because of the diversity of sounds that can be loaded and adjustments that can be made to them the complexity of sounds output is endless. To progress the project, the balloons could easily be replaced by using the cameras to track movement of any coloured objects e.g. dancers.

Acknowledgements

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