ISEN | école d'ingénieurs

Orchestra Hero

Include computers in your orchestra using sensors

Team MT1

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ABSTRACT

Orchestra Hero is a system allowing the conductor to direct with the same gestures either musicians and computers (which plays a tune).

What are our objectives ?

- Tempo control based on the beats, the tempo has its values between 60 and 180 bpm (beats per minute).
- Input/Output of the instrument considering the gesture : Circle, TapScreen, Swipe.
- Control of musical dynamics of the music played on each computer based on the intensity and direction of the hand beating the tempo.

CHALLENGES AND DIFFICULTIES

CHALLENGES :

- Apprehend Kinect and LeapMotion interfaces
- Interpret, translate, and give the movements a meaning

DIFFICULTIES :

- Find generic movements for the conductor
- Questioning the use of PureData and/or C#
- Non-existence of similar projects which forced us to imagine our own solution

SENSORS

LEAP MOTION

The Leap Motion is using two cameras and three infrared LEDs, the device observes a roughly hemispherical area, to a distance of about 1 meter (3 feet). It is designed to track fingers (or similar items such as a pen) which cross into the observed area, to a spatial precision of about 0.01 mm.

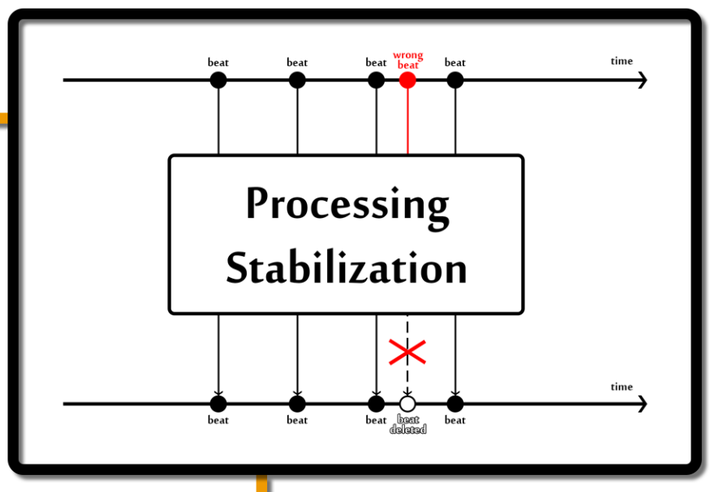
Using the infrared (IR) camera, Kinect can recognize up to six users in the field of view of the sensor. Of these, up to two users can be tracked in detail. An application can locate the joints of the tracked users in space and track their movements over time.

KINECT™

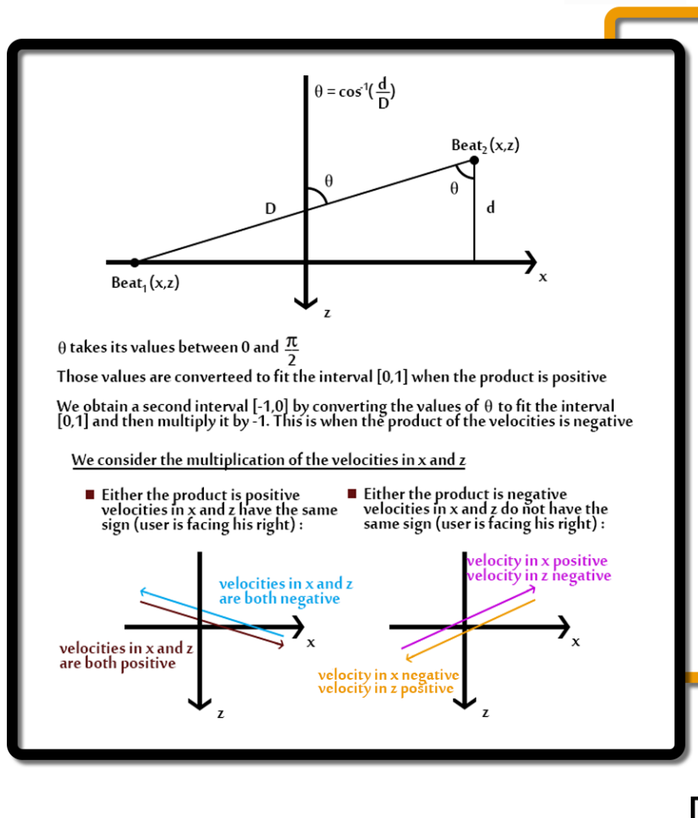
PROGRAMMING

PureData is a real-time graphical pogramming environment for audio processing.

C# is a real-time programming langage encompassing object-oriented (class based) and component-oriented programming disciplines.



ANALYSIS



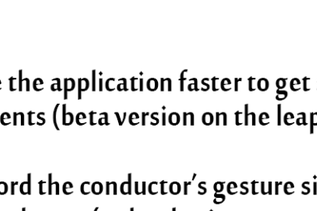
θ takes its values between 0 and $\frac{\pi}{2}$

Those values are converteed to fit the interval [0,1] when the product is positive

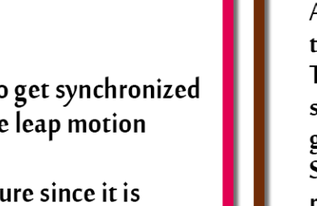
We obtain a second interval [-1,0] by converting the values of θ to fit the interval [0,1] and then multiply it by -1. This is when the product of the velocities is negative

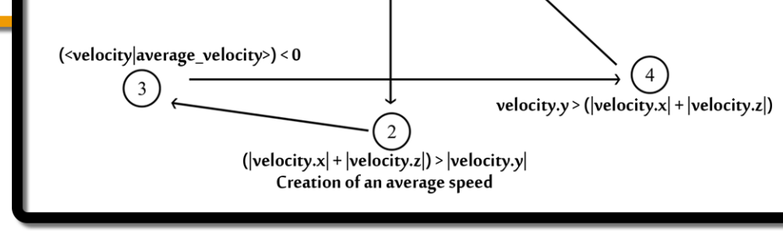
We consider the multiplication of the velocities in x and z

- Either the product is positive velocities in x and z have the same sign (user is facing his right) :



- Either the product is negative velocities in x and z do not have the same sign (user is facing his right) :





PLAYBACK

MIDI (Musical Instruments Digital Interface) is basically an interface with, for instance, an instruments library (tone). In it, there are the informations about the tempo, the notes to play or not, the instruments used for each track, the track numbers, the volume, the effects, the signature (number of times in a division).

Principle : We read a MIDI file and we send notes to a MIDI output synchronized with the gesture of the conductor in the right moments.

RESULTS

Successes :

- Conception of a patch in pure data in order to modify the tempo with the leap motion and select an instrument following the orientation of a hand with the leap motion.
- Reading a MIDI file using the MIDI protocol
- Reading synchronization using beats with the Leap motion or/and the Kinect
- Receving OSC signals in order to get the orientation and the step of the beat pattern
- Multi-tasking application
- Granular synthesis in PureData

Failures :

- Difficulties to make the application faster to get synchronized on the user's movements (beta version on the leap motion kinect less accurate)
- Impossibility to record the conductor's gesture since it is changing for each conductor (only a basic gesture, the swipe).

OUTLOOK

Using the program to help a DJ to mix using only his fingers in the air.
Accumulate a lot of different gestures of a conductor in order to optimize the program.
Turn the application into a video game. Analyzing the gestures to play a specific instrument or to conduct them all. The game would allow the gamer to play an « air instrument » or to be a conductor.
Synchronization of the spotlights with the tempo (For shows or representations)

REFERENCES

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