Final Documentation - *Vasilis Fotopoulos, Mahin Salman, Tze Wei Tan, Adrian Tregonning*

The max patch *panner.maxpat* acts as the hub of the various sensor, audio and video components. It receives the distance measurements from the sonar sensors and calculates the person's coordinates in the space. The sound follows them around, and the flocking words fly away from them.

The soundscape consists of a low rumbling drone that is fed constantly to all the channels in the installation. This provides a constant, unsettling ambience. The sound design is divided into three parts: a drone, granular synthesis of a voice sample, and a whistle sample processed with the Doppler effect. The drone is a playback of a sound file created in Csound. It is a generative cross frequency modulation composition with randomized modulation frequencies, modulation indices, and panning.

The granular synthesis portion uses a sample of a female voice reciting a poem. The grain parameters are mapped to respond to the participant's position in the installation space. The participant's horizontal position is mapped to sample location: for example, when the participant is at the far left, the beginning of the sample will be granulized; when he is at the center, the center of the sample will be granulized, etc. The participant's vertical position is mapped to grain size: the further in front the participant, the smaller the grains; the further behind the participant, the larger the grains. Reverberation is added to both the drone and the granular synthesis parts.

The third portion of the sound design uses a sample of a person whistling. Using a Max example patch of the Doppler effect, the sample is triggered whenever the velocity of the participant goes below a set threshold. If the observer comes to a stop, a merry whistling person passes them by.

A total of 4 Arduino uno boards were used for mapping the audience's location. Each board consisted of a single Ultrasonic Ranging Module HC- Sr04 sensor. This model was deemed the best for the purpose of the project as it provides an optimal range of 2cm - 400 cm non-contact measurement. This model also includes ultrasonic transmitters and a receiver that controls the circuit. Additionally, the 4th circuit consists of a sonar, as well as an Adafruit - Bluefruit EZ Link Bluetooth serial link chip. The Bluetooth chip is a regular 'SPP' serial link client device that can pair with any computer and it appears as a serial/COM port. To power the circuit a 9V battery was used with an unassembled connector. This circuit required more effort as the Bluetooth components and the 9V battery connector required soldering. Ideally we would have preferred for all the circuits to be wireless but this was not possible due to time constraints.

In order to test the sensor code an LED light was attached directly to the Uno board. Using a simple Boolean expression the light turns on if it detects an object further than 20 cm and off when nothing is detected. This allowed for optimal testing and was a good indicator that the code had compiled properly during the presentation. During testing the sensor sketch was used until a final sketch was built for the sonar sensors. For coding in Arduino Ino, the newping library was added, this library was need in order to hardcode the sensor. Please note the files will not compile without this library and have been included in the Github repo. The circuit diagrams for the sensors and the uno board have also been included at the end of this document.

Using the distances received over serial connection from the Arduino sonar sensors, the JavaScript file *localizer.js* determines the observer's exact location in the room. It does this by calculating the intersection of overlapping circles, centered at the sensors, whose radius is the respective distance from each sensor. The person's angular position (with respect to the center of the room) determines the VBAP panning position of the granular voice, while the proximity to any speaker controls the volume. Pulkki's VBAP external is used. The Cartesian coordinates of the person determine the central flocking point of the word cloud – the flock is sent to the exact opposite spot on the opposite wall.

Before the patch can be used, the position of the sensors (distance and angle) and the azimuths of the loudspeakers used must be specified by sending configuration messages to localizer.js and the VBAP panner respectively. Additionally, a pictslider (i.e. x,y slider) can be used for testing the location detection and VBAP panner without physical sensors.

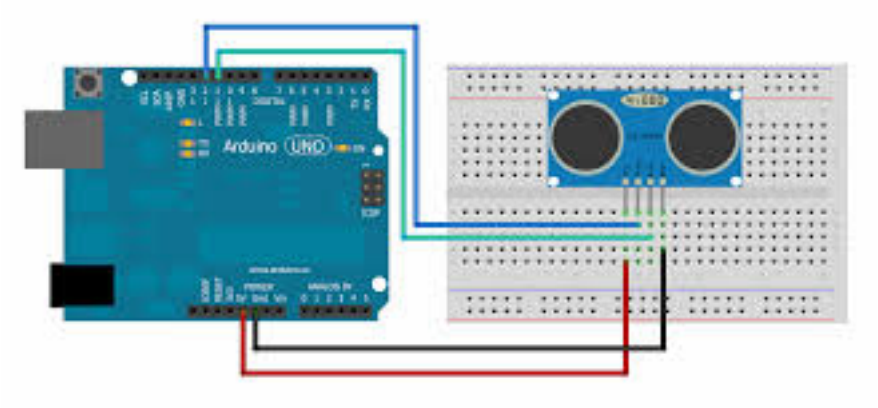
Dependencies/externals:

vbap
(www.maxobjects.com/?v=objects&id_objet=1197&requested=vbap&operateur=AND&id_plateforme=0&id_format=0)

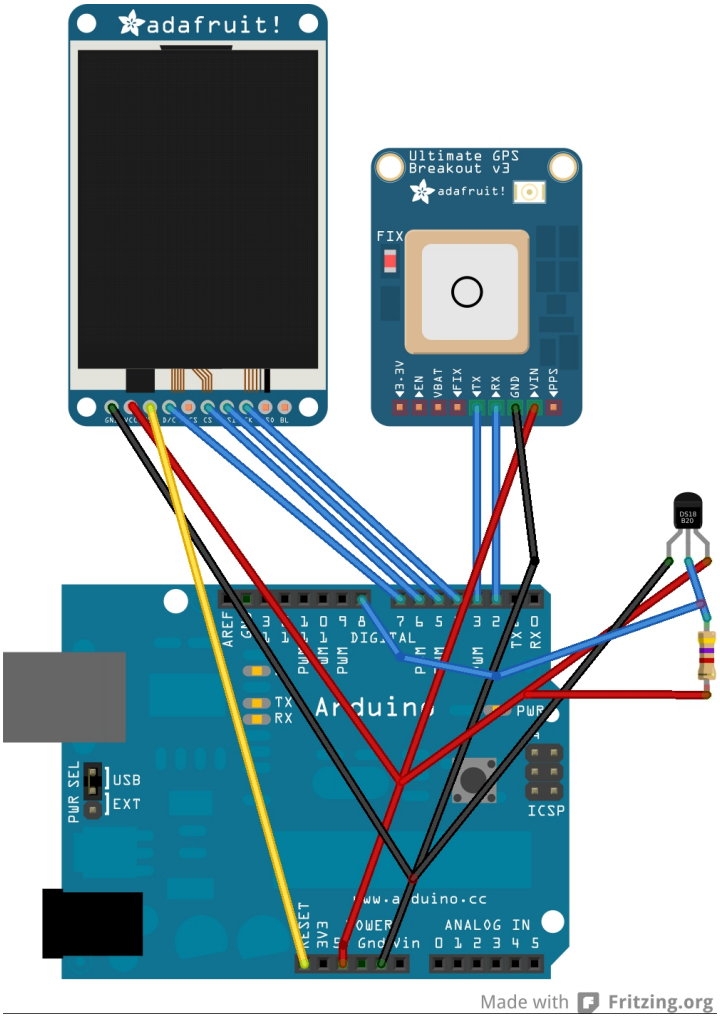
jit.boids3d
(www.maxobjects.com/?v=objects&id_objet=3979&requested=boids3d&operateur=AND&id_plateforme=0&id_format=0)

localizer.js

Circuit Diagrams:



Ultrasonic Ranging Module HC- Sr04 connection with Uno



Adafruit - Bluefruit EZ Link Bluetooth serial link with Uno