ENERGY DESIGN

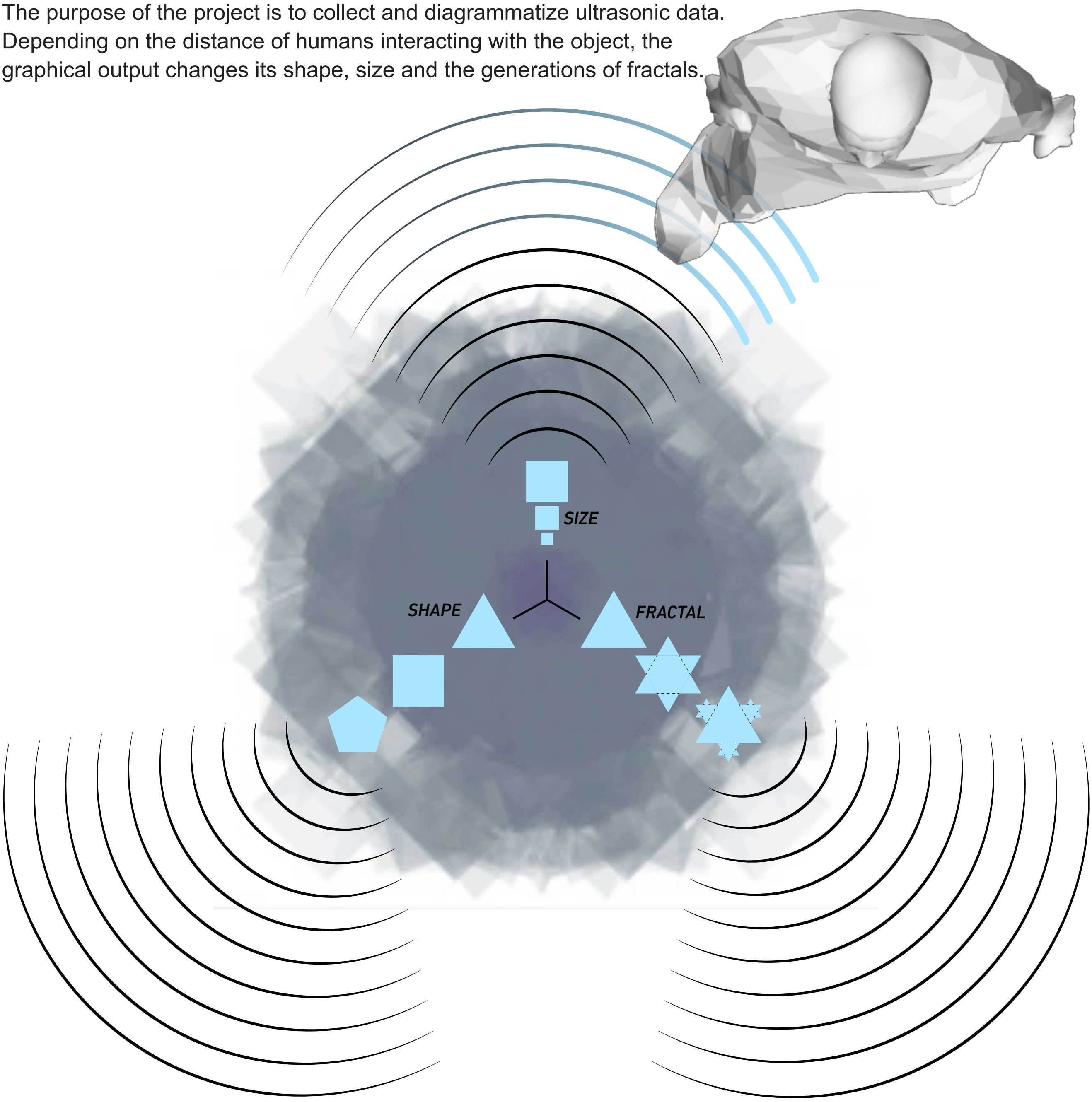
FFG

Ultrasonic Platonic

Luca MELCHIORI
Barbara SCHICKERMUELLER

CONCEPTUAL DIAGRAM

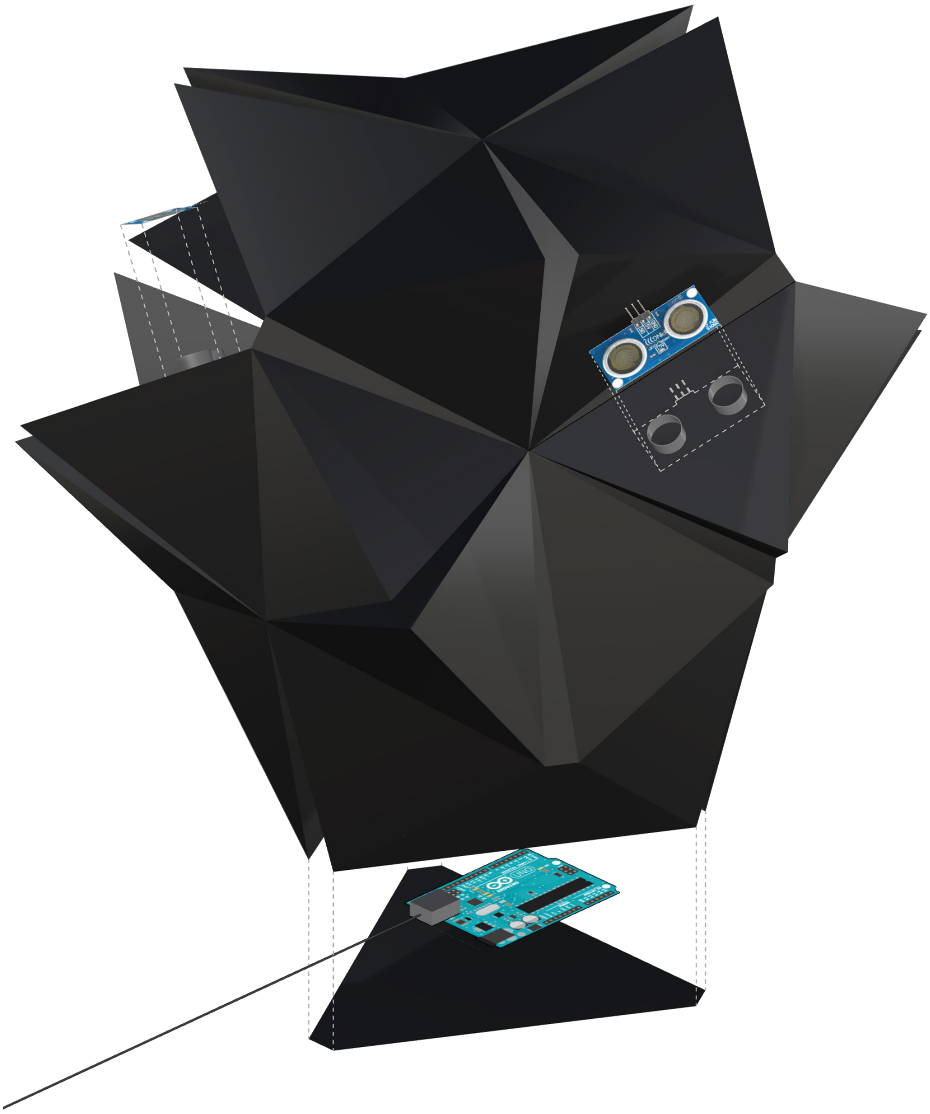
The purpose of the project is to collect and diagrammatize ultrasonic data. Depending on the distance of humans interacting with the object, the graphical output changes its shape, size and the generations of fractals.



Ultrasonic Platonic
Luca MELCHIORI
Barbara SCHICKERMUELLER

SENSOR CASE

We proposed a sensor case inspired by the fractal shapes of the project's graphical output.
The three sensors are mounted into three different faces on the top side of the polyeder, whereas the Arduino board is placed at the bottom. The Sensor Case is situated on a table, where people can use their hands and bodies to interact with the object and influence its graphical outcome.



Ultrasonic Platonic
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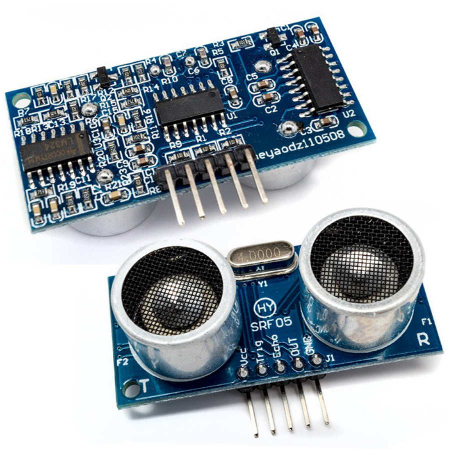
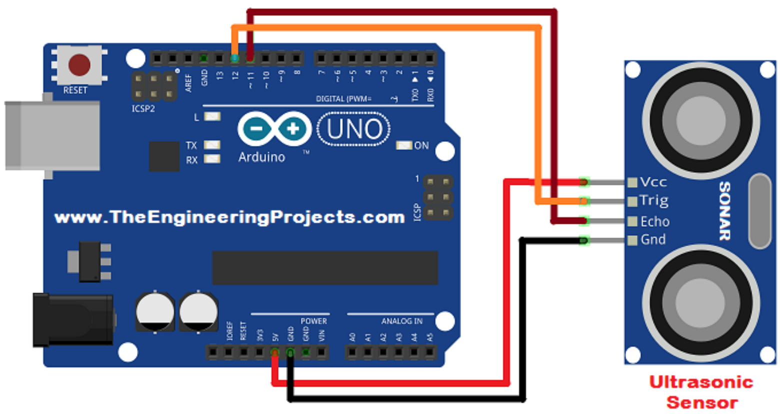
HARDWARE INFORMATION

Ultrasonic Sensor - HC-SR04

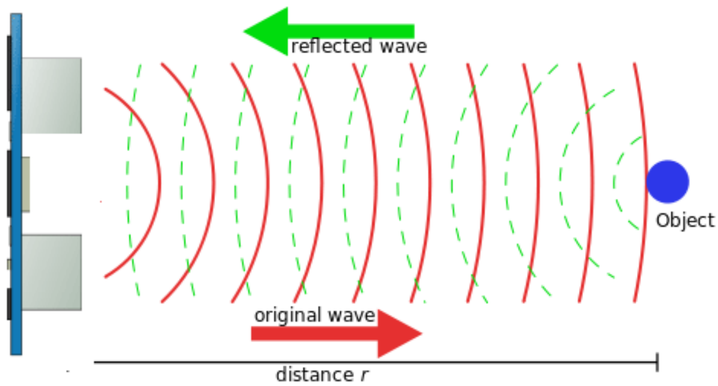
This is the HC-SR04 ultrasonic ranging sensor. This economical sensor provides 2cm to 400cm of non-contact measurement functionality with a ranging accuracy that can reach up to 3mm. Each HC-SR04 module includes an ultrasonic transmitter, a receiver and a control circuit.



Ultrasonic Sensor - HC-SR04



Ultrasonic Sensor Arduino Interfacing



Theory

Speed of sound = 0.334µs

Time = distance/speed = 294µs

Distance = (time * 0.034) / 2

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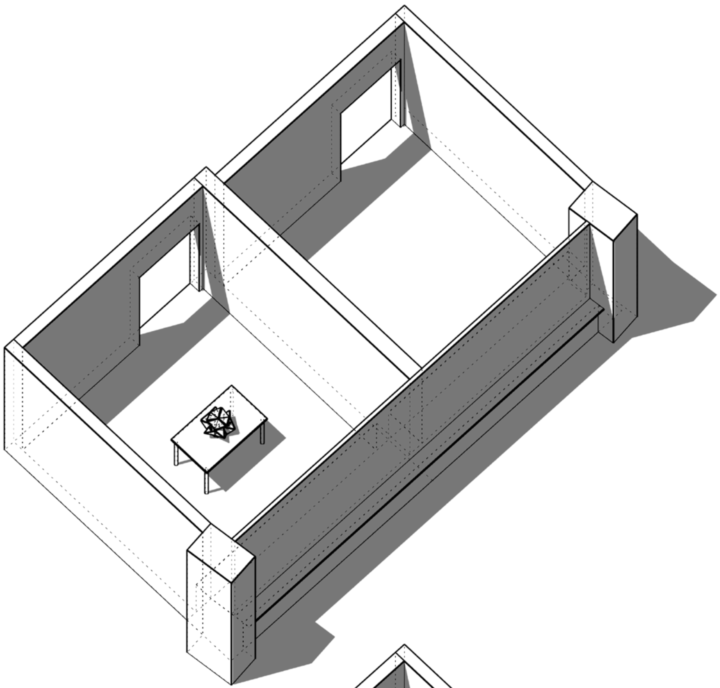
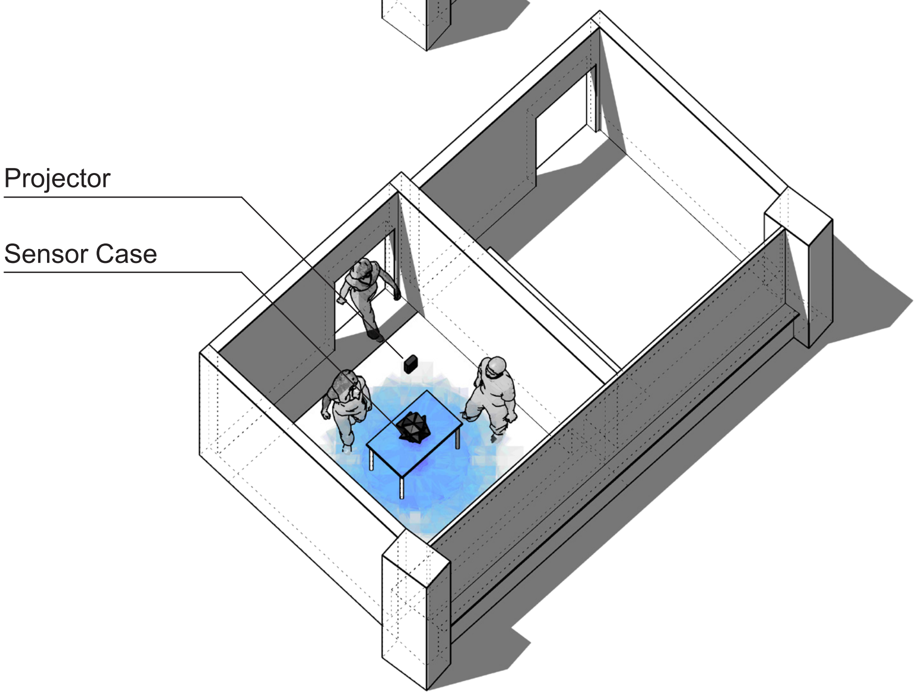
INSTALLATION PLAN

The object is standing on a table in the center of the room, in order to be accessible from all sides. People can interact with the sensor case and depending on the distance to the sensors, which are situated on the top, the graphical output of these fractals changes, varying in size, numer of fractals and shape.

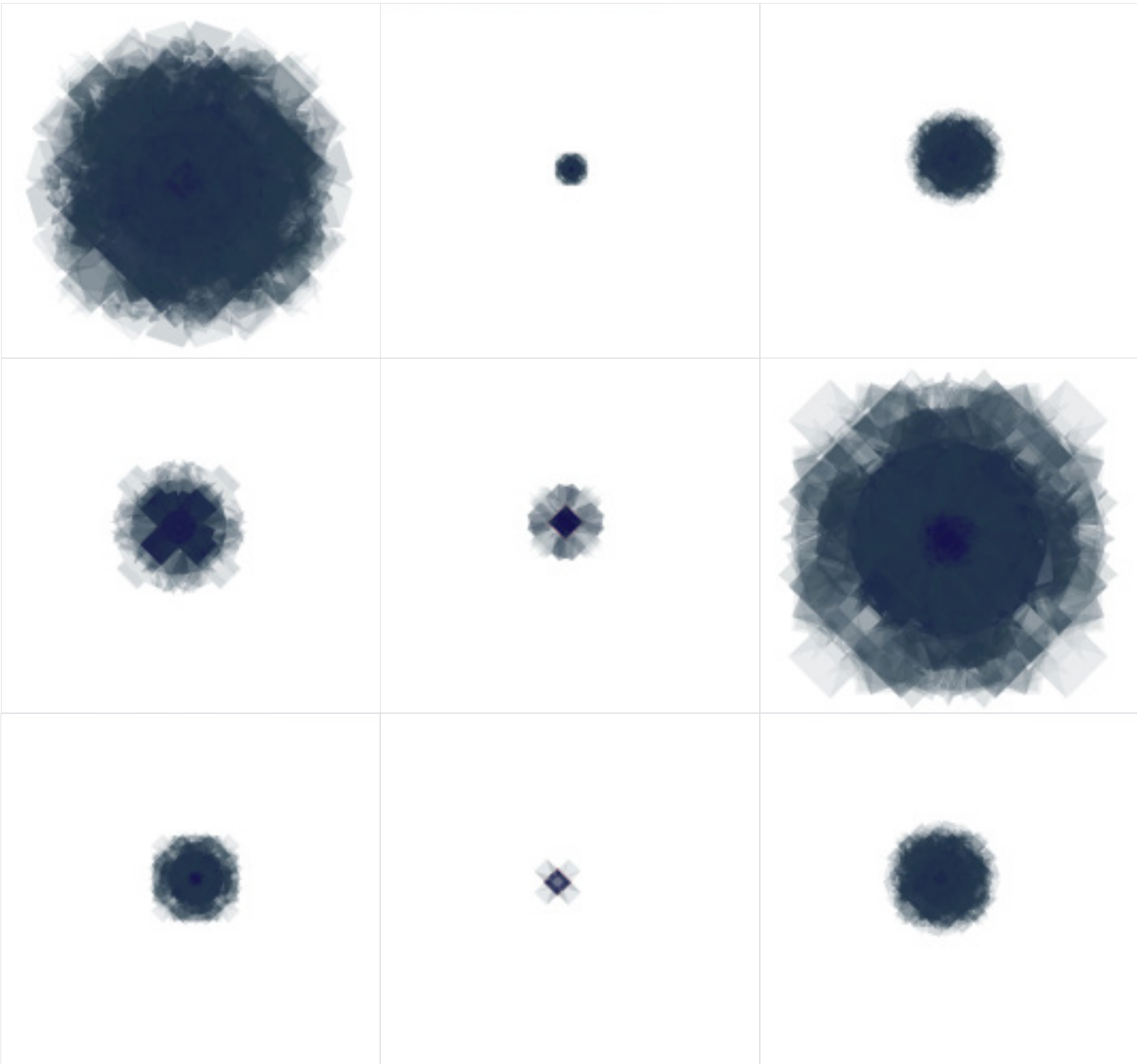




Ultrasonic Platonic
Luca MELCHIORI
Barbara SCHICKERMUELLER

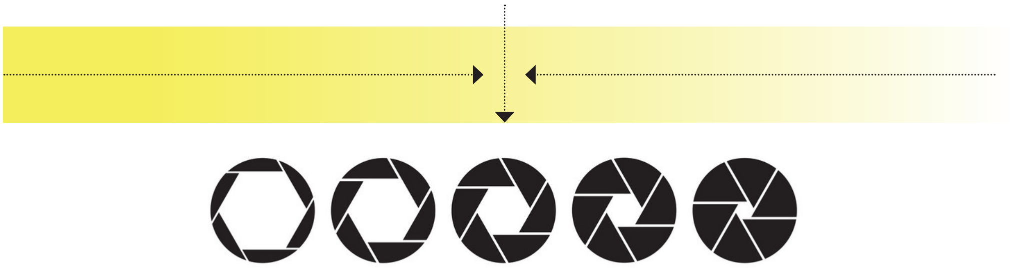
DATA VISUALISATION

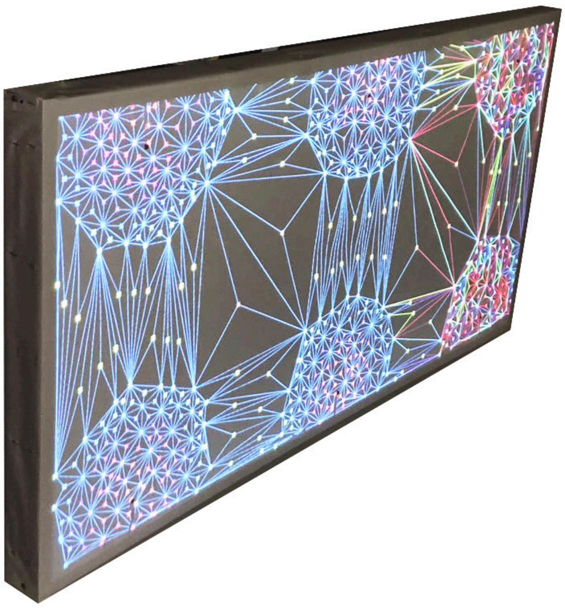
The Ultrasonic Sensors sends a signal which gets reflected by objects. Depending on the time intervall and therefore also the distance of the objects, it calculates the distance which then gets translated into a three-dimensional fractal system. One sensor is controlling the shape of the primitive, one is controlling the size and the other one the generations of fractals.



Light adaptable facade

Alexandra Moisi
Garvin Goepel

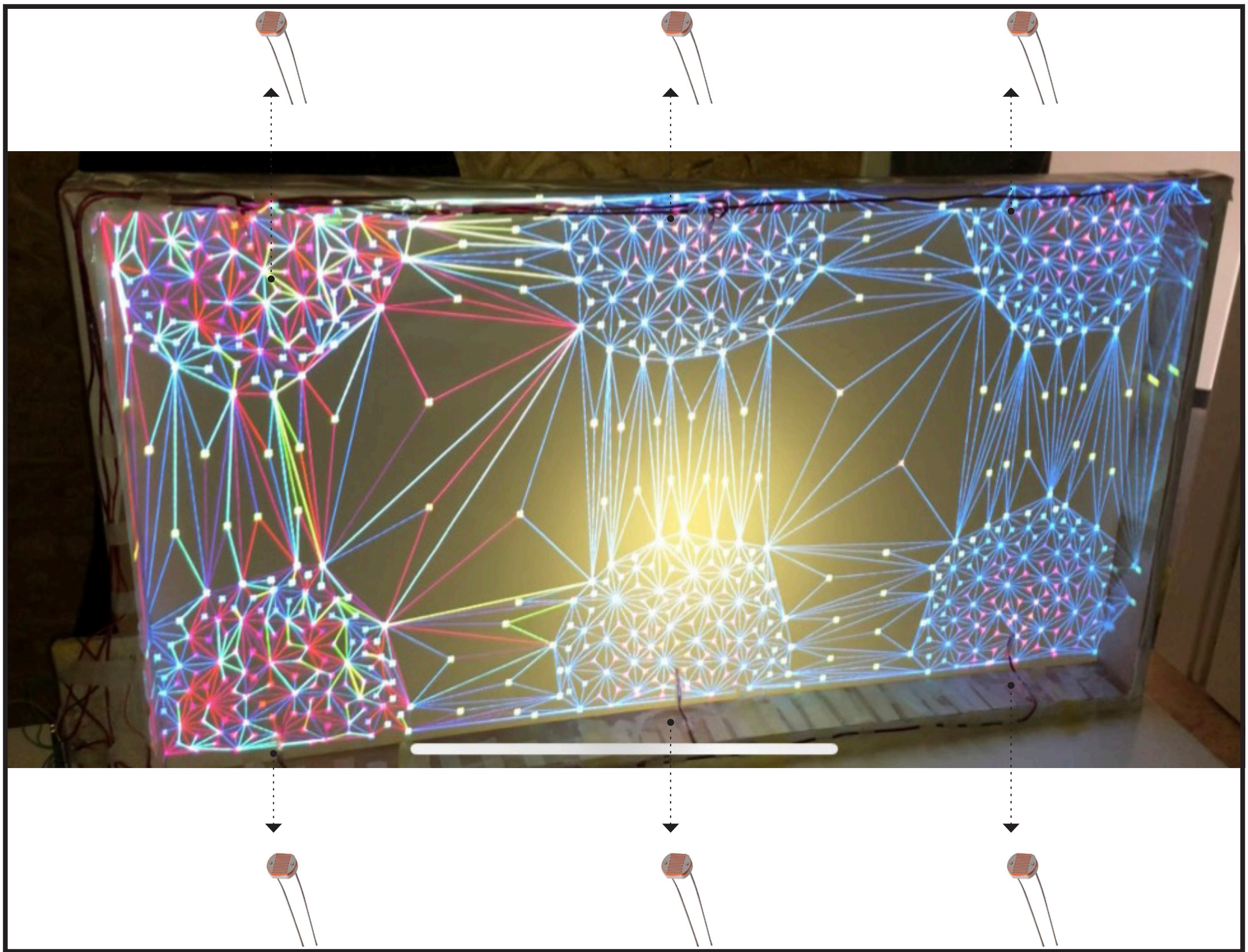




The concept of our interface is to define a diagrammatic facade which responds to the intensity of light throughout the day, to achieve a better environmental performance of light in a room.
Dynamic facades have the potential to add to the architectural expression of a building by visualizing the changeable aspects of the environment, in our case of light.
The facade reacts accordingly, either opening up or closing down on the corresponding regions to the light sensors.
The program will always try to achieve the optimal amount the light throughout the space. It can be particularly useful in extreme climates where it can either offer protection from the extensive sun and heat or on the opposite let as much light in as possible.

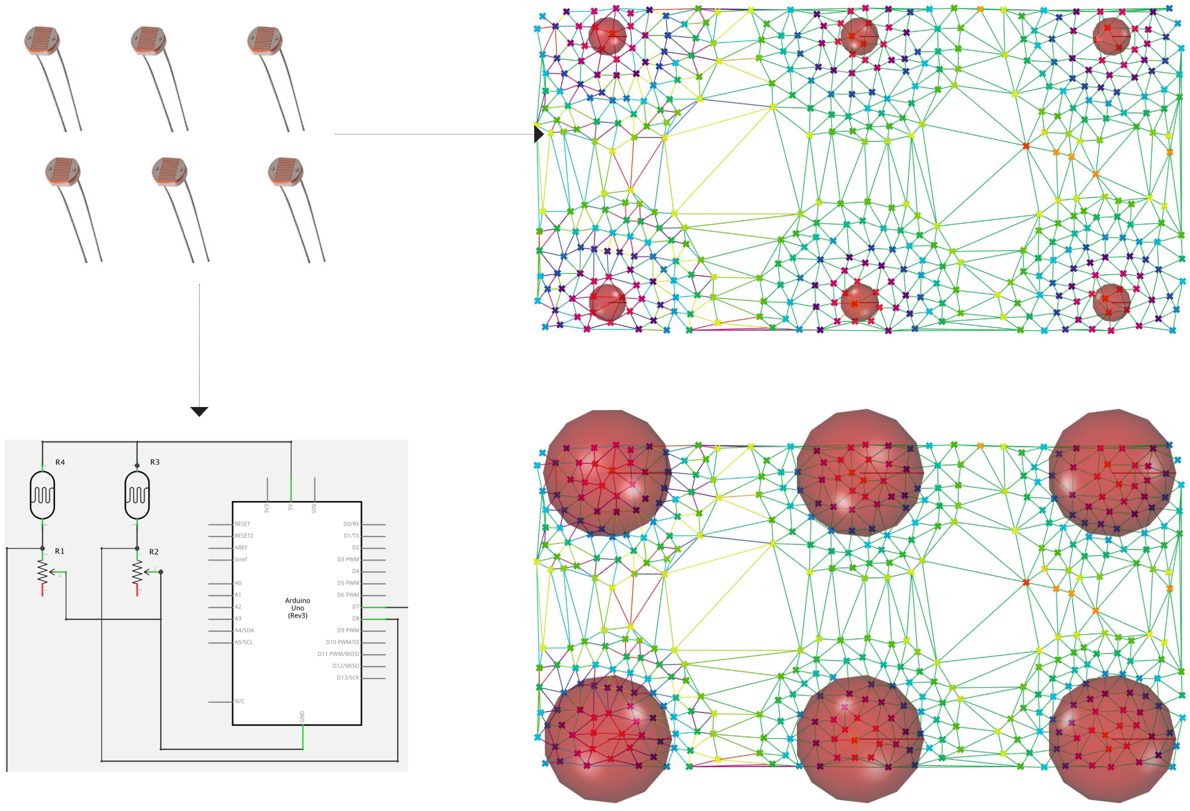
Light adaptable facade

Alexandra Moisi
Garvin Goepel



The adaptable facade prototype is a surface resembling the proportions of the window to be transformed and it is large enough for the sensors to be zoned and to react to the flashlight of a mobile phone and generate openings/ enclosures. The design is at this stage a diagrammatic field of points that are connected by lines. According to the six light sensors, we have six fields of dense points, which will spread out/ open, when light is coming towards the sensor. When the light is removed, the points will come back to its dense cluster/ close.

Light adaptable facade
Alexandra Moisi
Garvin Goepel



What sensors are used?
The system is composed of 6 photoresistors distributed across the ceiling of the room in order to collect light data and light intensities from different zones of the space.

What is being measured?
We are measuring the intensity of light with the light sensors.

What information do you get from the data (eg spatial distribution of sound...)?
We are remapping the resulting numbers of the light sensors to give the system information, weather to open or close the system.

Light adaptable facade
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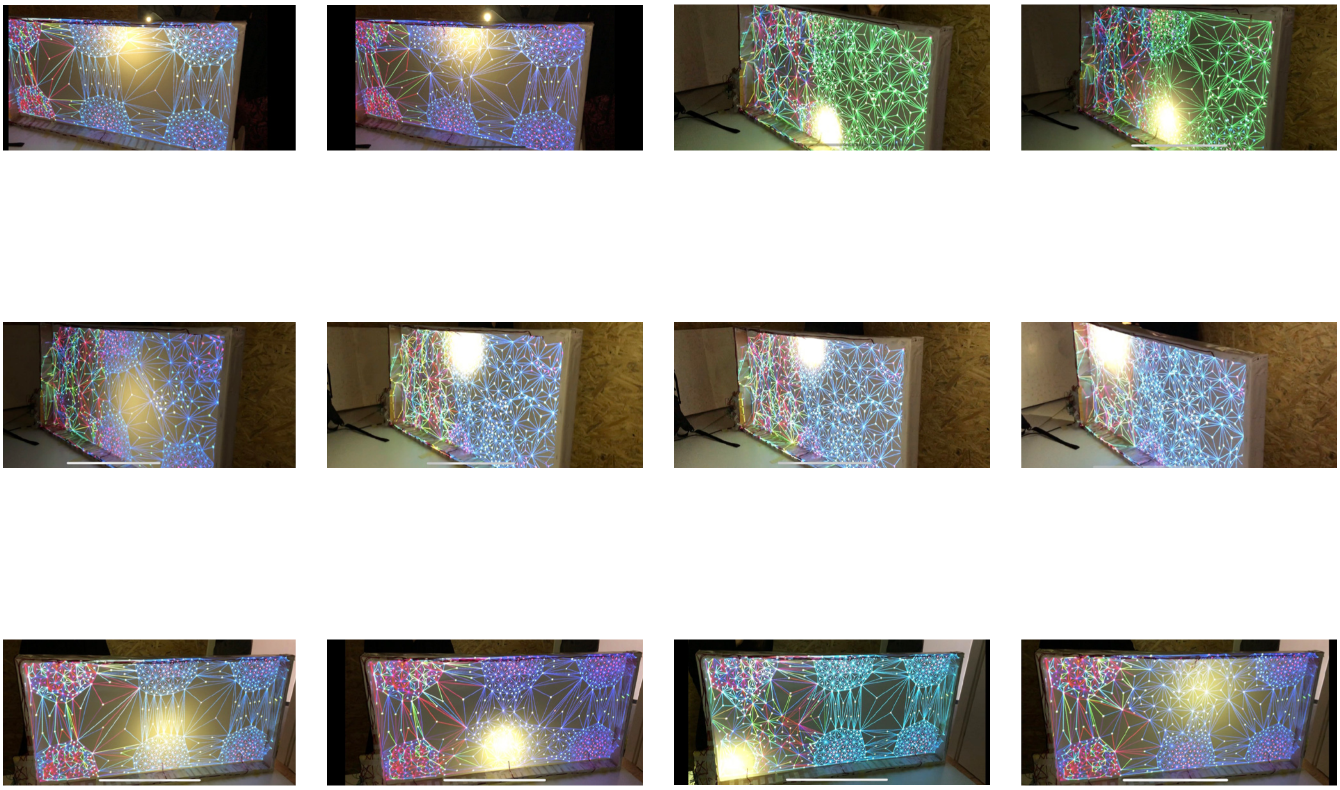

The interface consists of photo resistor sensors positioned strategically along a surface. It's a prototype of a facade that opens or closes during the day depending on the light conditions. The interface is a projection of a mesh-field, which points are interacting with the same position of the light sensors. The mesh-field changes in density, according to different light conditions. The complexity of the system is generated through its behavior rather than through non-standard components. Even with a simple mesh pattern many potential variations are possible.

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Light adaptable facade
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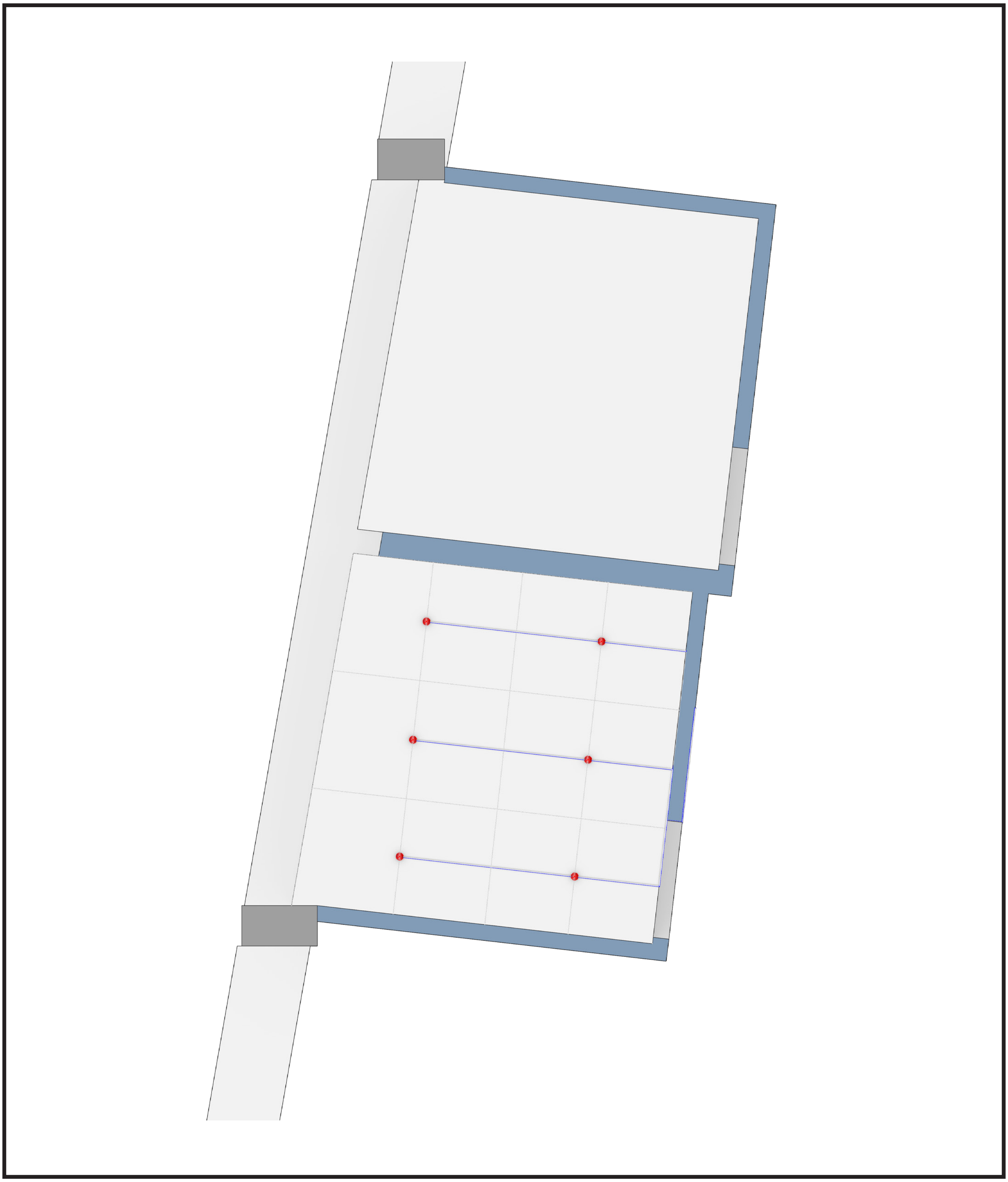

Light adaptable facade
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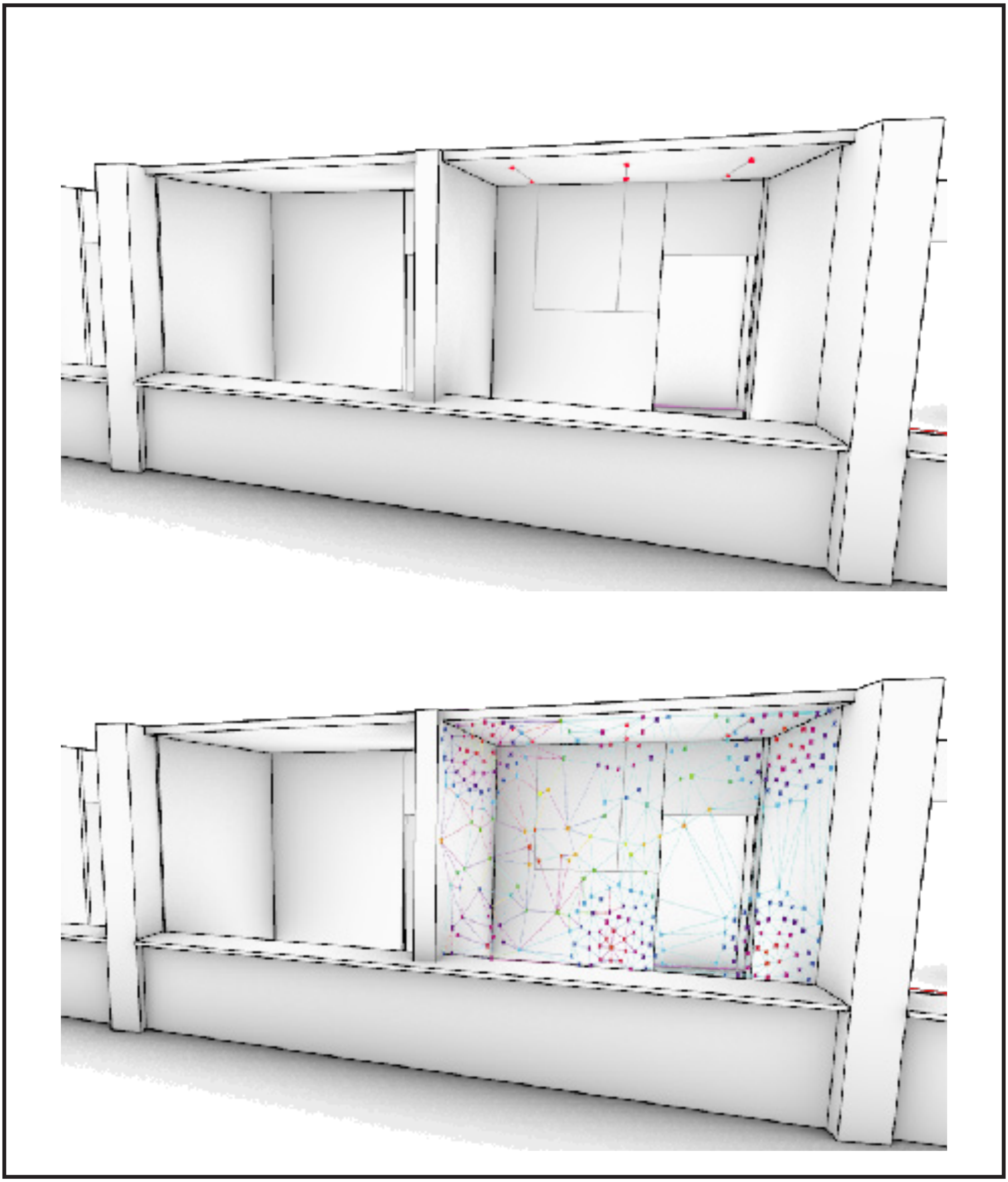

Light adaptable facade
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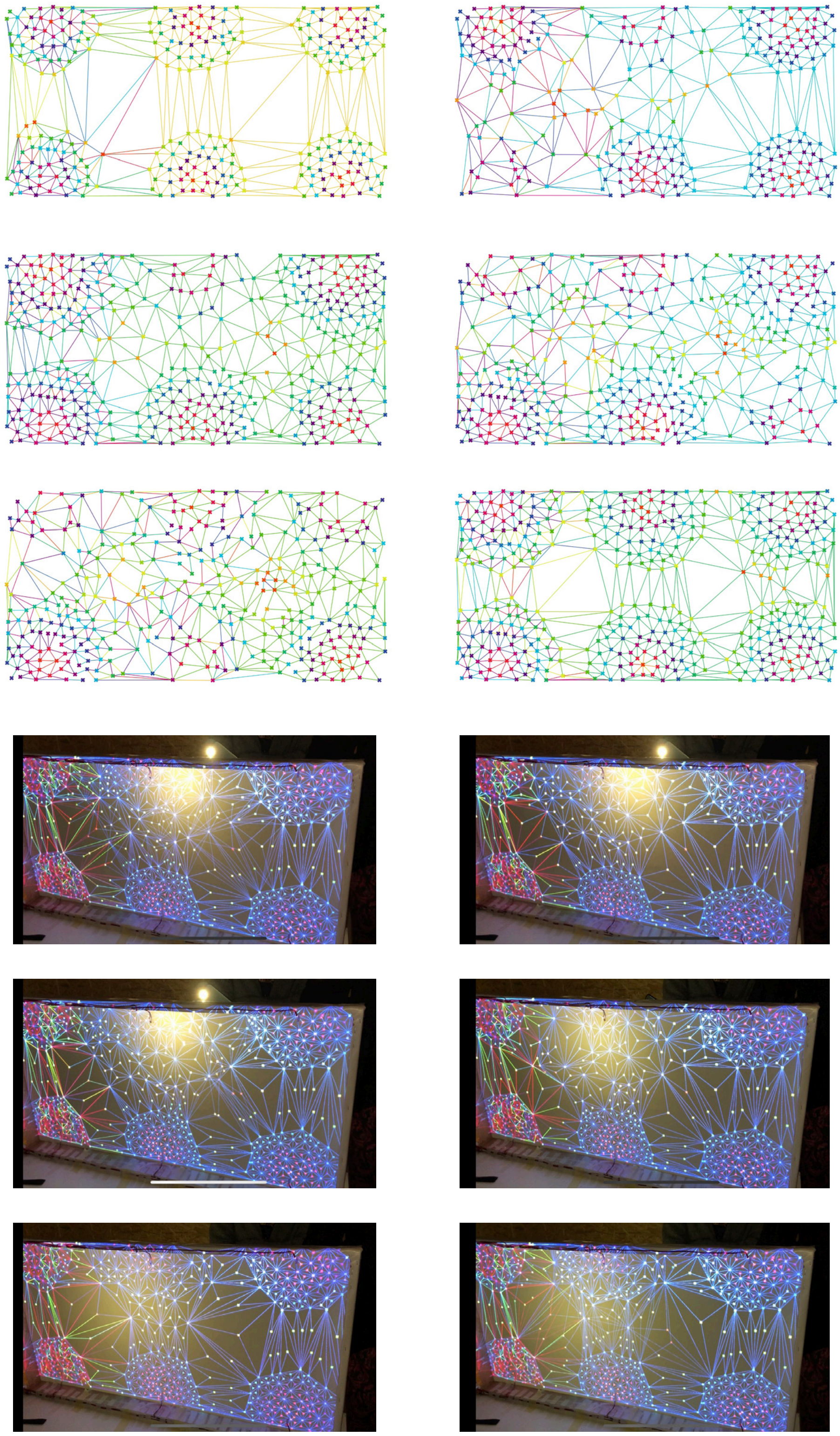
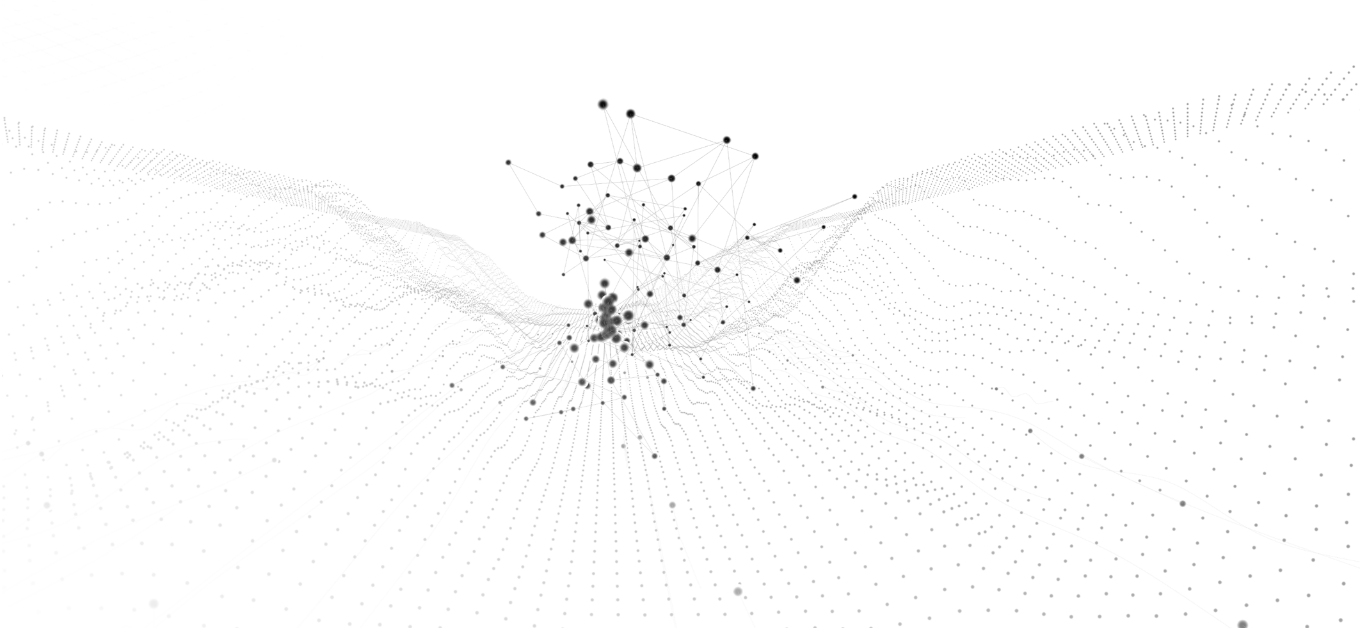


Soundscape
Ka Wai (Godwin) Cheung,
Michael Tingen, Anastasia Shesterikova



PROPOSAL & SETUP

This project aims to understand the basic principles of room acoustics using arduino sound sensors to detect sources and reverberations. Using frequency and amplitude analysis, the sources could then be categorized to inform us later on how to design an appropriate adaptive facade that responds to different noise types. The focus of the project's task 1 is to first record and visualize the sound sources and reverberations.

ENERGY DESIGN

FFG

Soundscape

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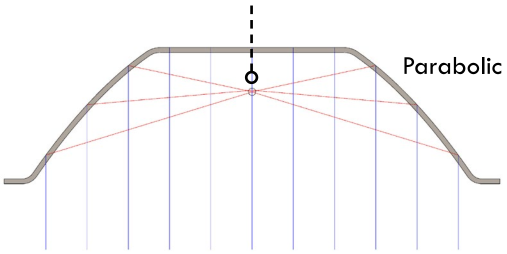

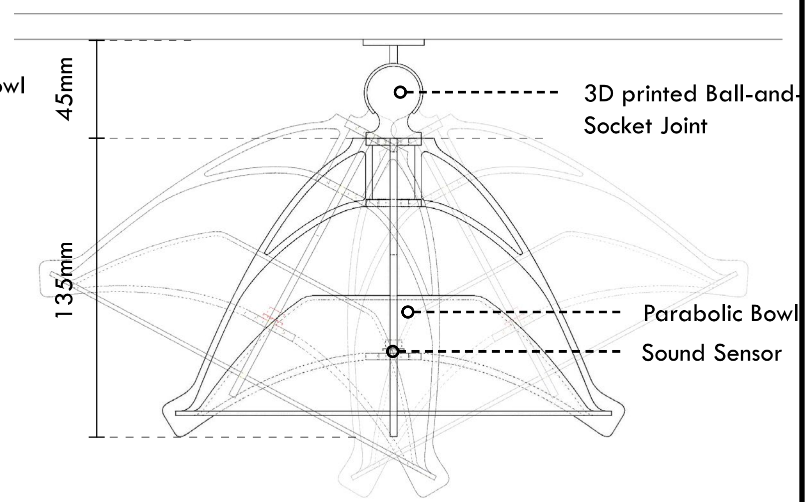

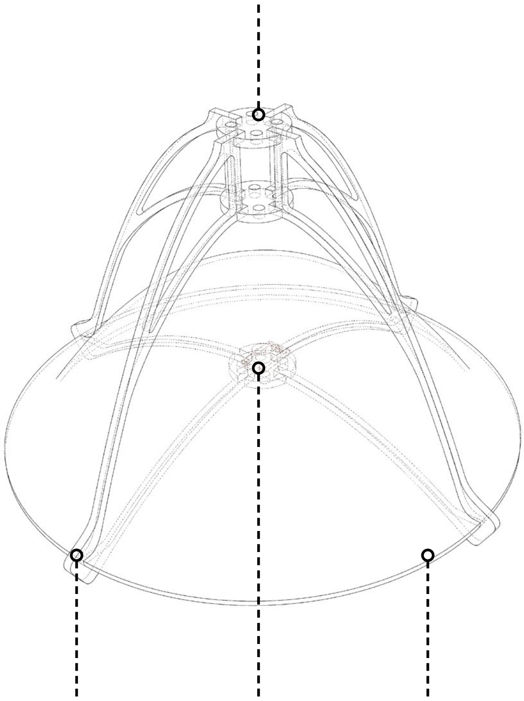

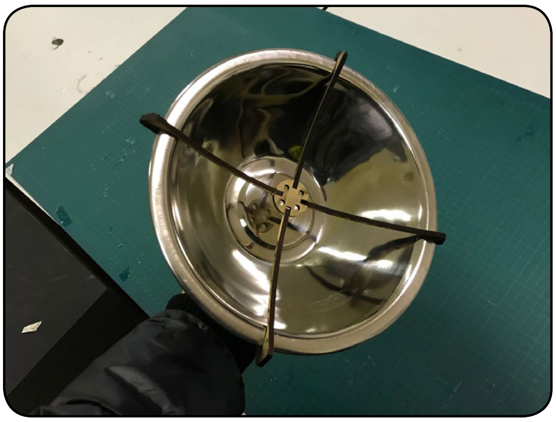

PARABOLIC SOUND SENSOR HOLDER

A parabolic shaped reflector could drastically improve the readings for the sound sensors without the need to adjust the sensitivity too high. This way the sensor error readings could be decreased. Additionally, parabolic reflectors could isolate directional readings and shield off reverberations that are bounced off walls.

Soundscape

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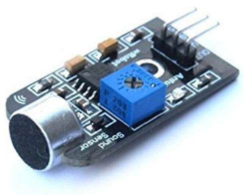
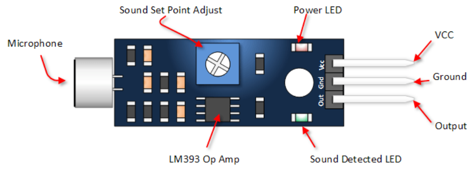
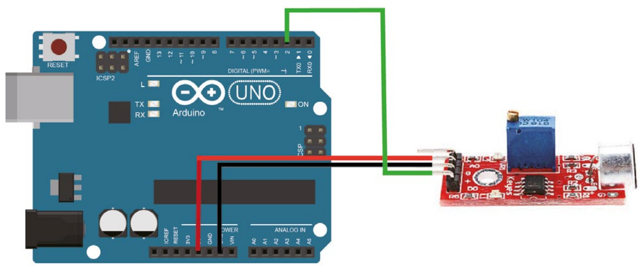


GaoXing Tech Sound Detection Sensor Module x5





Arduino Setup with Analog Outputs plugged into 5 sensors

SENSORS

This project aims to understand the basic principles of room acoustics using arduino sound sensors to detect sources and reverberations. Using frequency and amplitude analysis, the sources could then be categorized to inform us later on how to design an appropriate adaptive facade that responds to different noise types. The focus of the project's task 1 is to first record and visualize the sound sources and reverberations.

ENERGY DESIGN FFG

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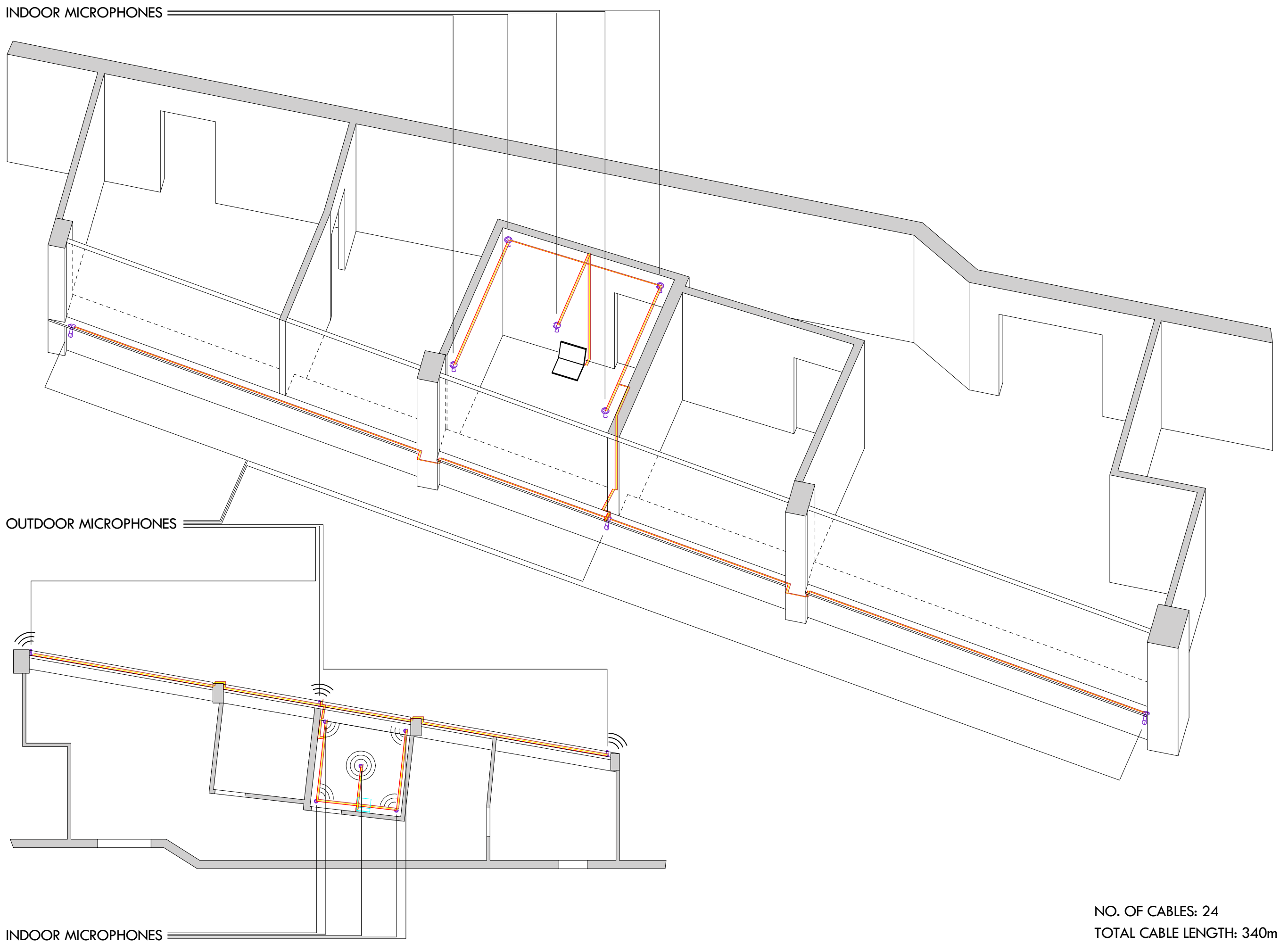
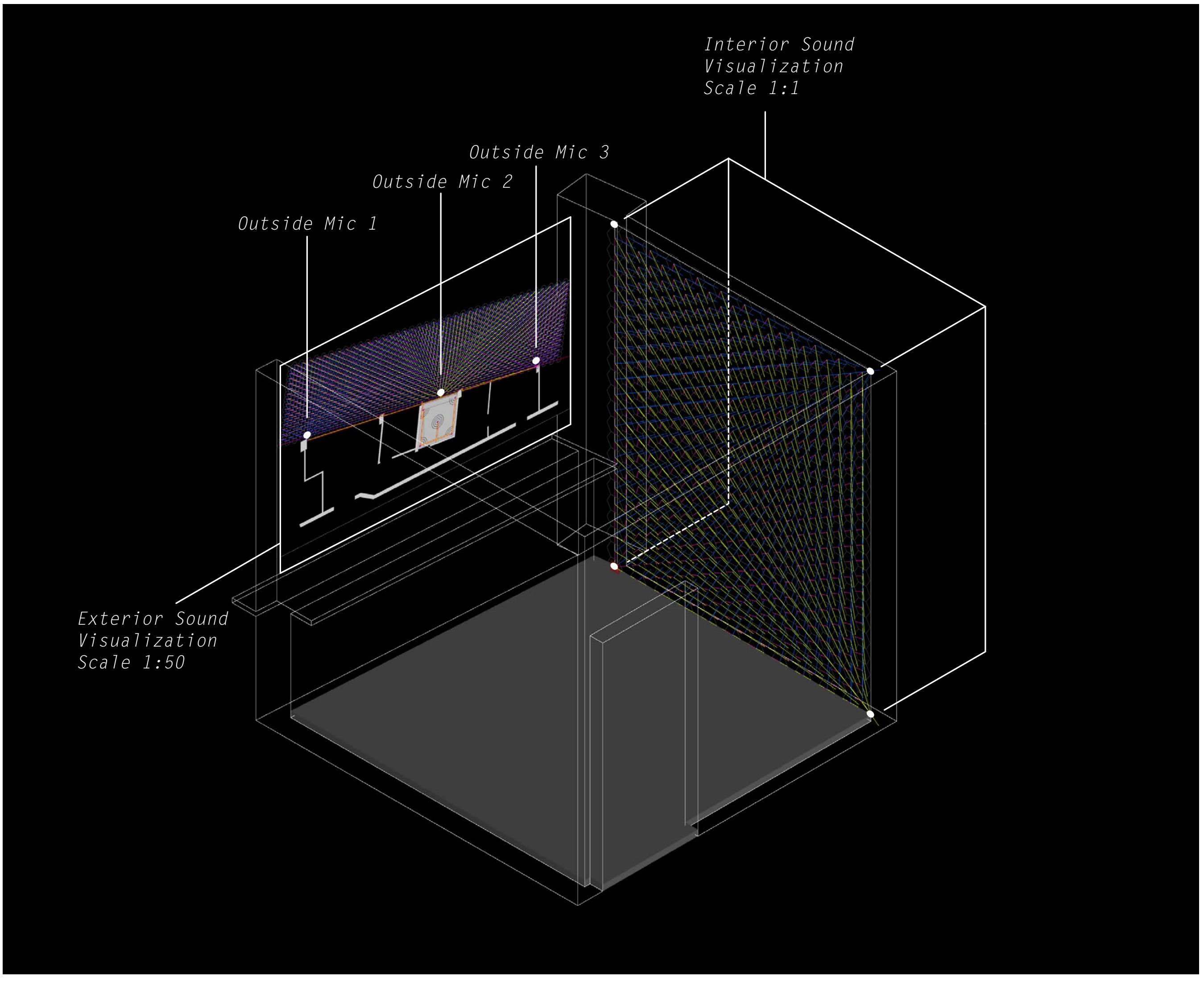


SENSORS SETUP

To futher elaborate the scheme, we could set up the sensors also outside of the apartment to record incoming traffic from both directions. By capturing sound of vehicles earlier it would give time for the adaptive facade to respond and shield off the noise.

Soundscape

Ka Wai (Godwin) Cheung,
Michael Tingen, Anastasia Shesterikova



VISUALIZATION IN ROOM

Direction intensity, pitch and source of sound is mapped 1:1 within the space. The same visualization is projected on the window at 1: 50 scale representing the sounds entering the interior. These visual representations will correspond to real time augmentations of the interior soundscape. Example: car sounds morphing into soft ocean waves.

Soundscape

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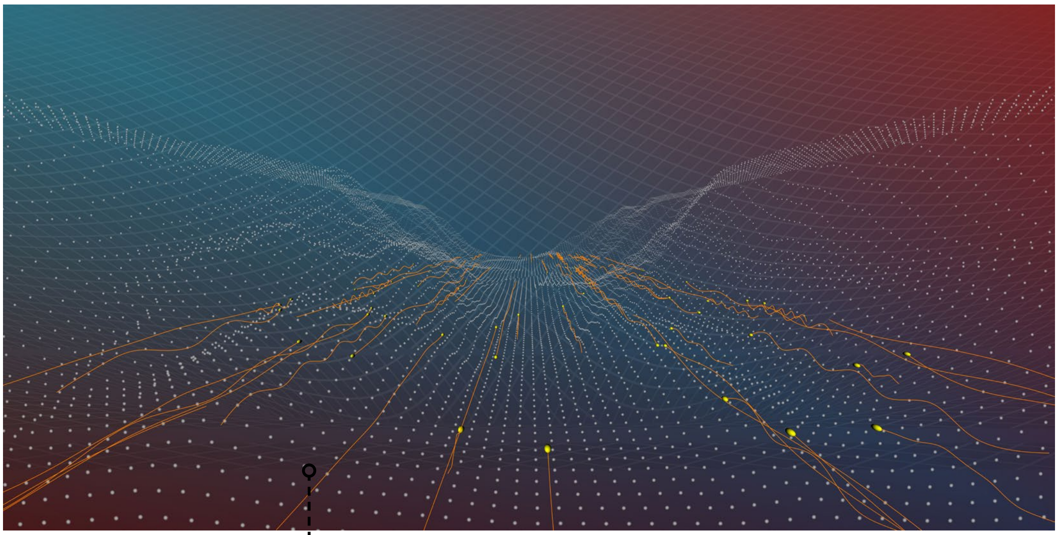
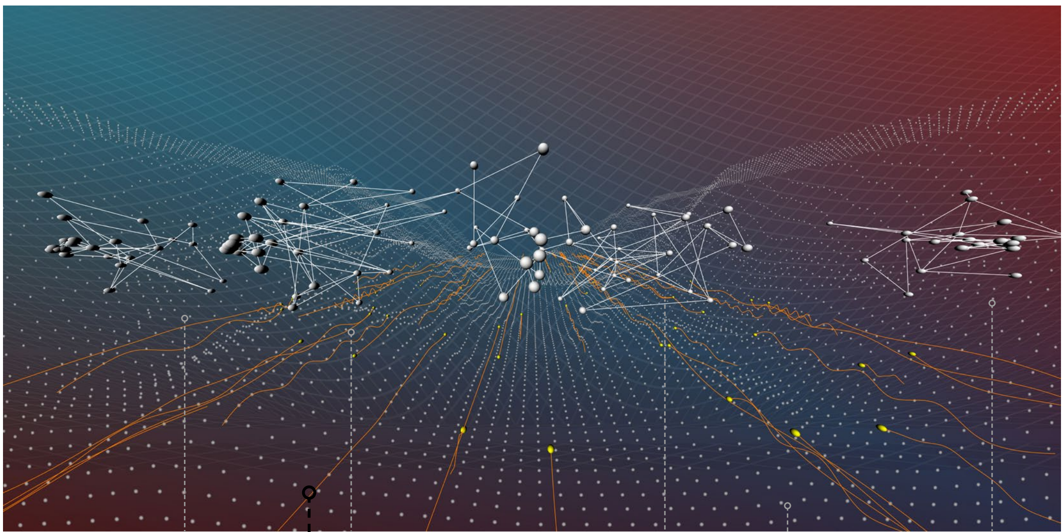
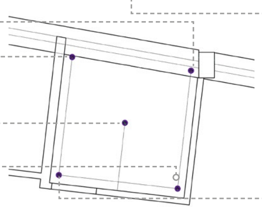
Michael Tingen, Anastasia Shesterikova



Ambient Noise
30 - 800 Hz
0 - 20dB





Vocal Range
30 - 800 Hz
0 - 20dB

VISUALIZATIONS

The initial visualization strategy was to abstractify the room into a soundscape in which readings could be represented through the distortion of the landscape at the relative position in the room. However, since the sound sensors used were not able to distinguish too well the amplitude (captured as on-off conditions only), the visualization strategy was changed to categorize between ambient noise levels and other louder ranges such as vocal or clapping.

Soundscape
Ka Wai (Godwin) Cheung,
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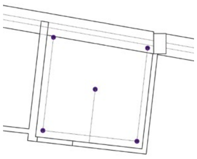

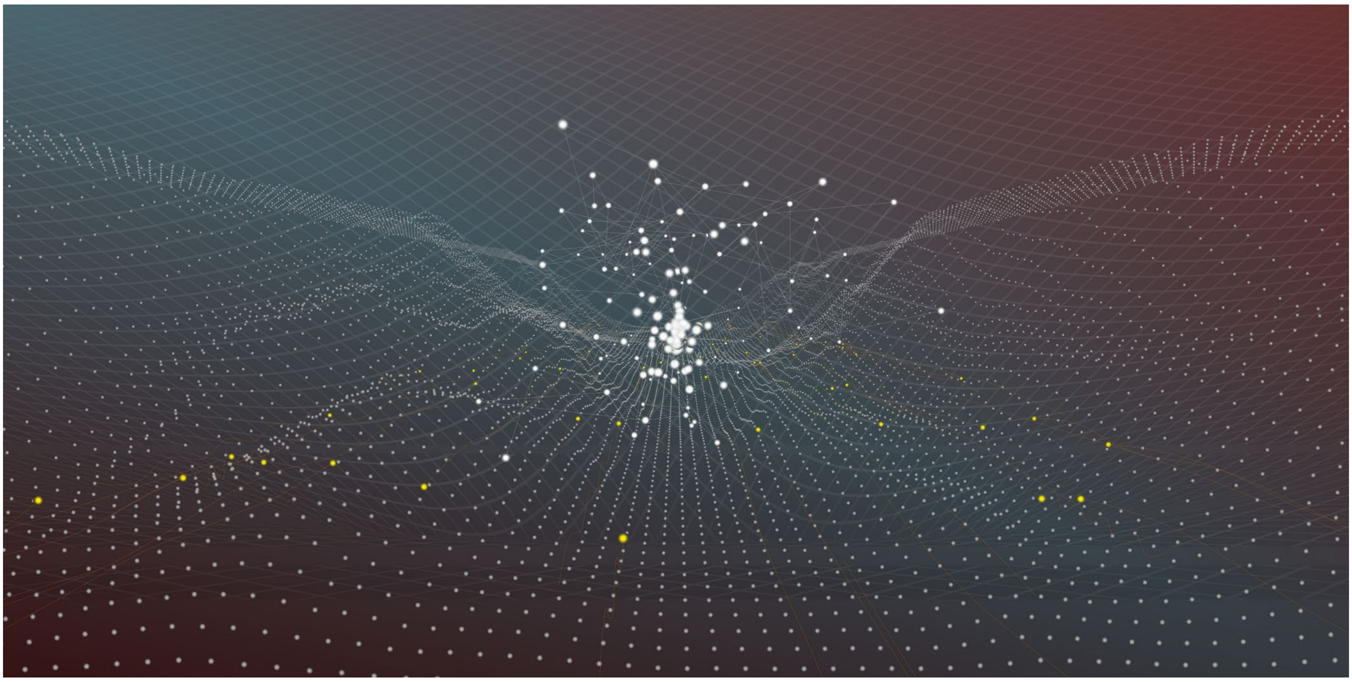

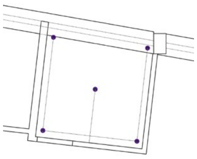

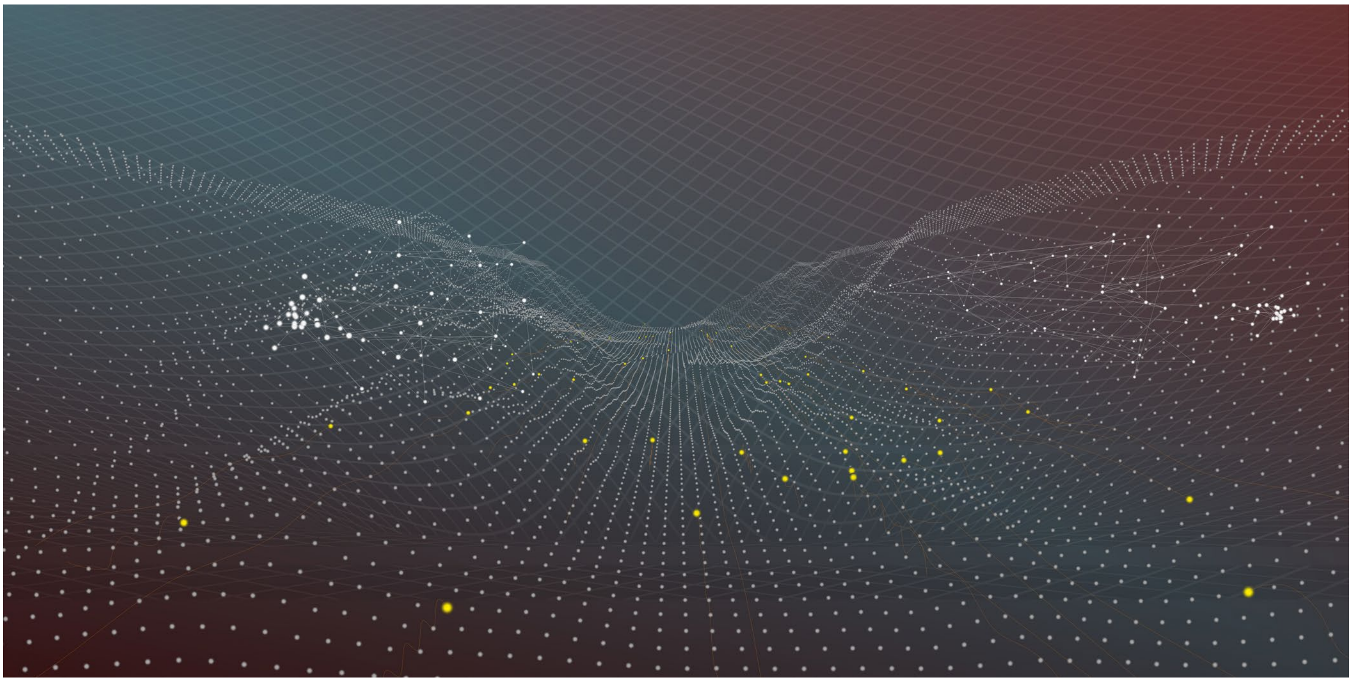

Soundscape

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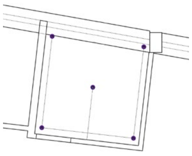
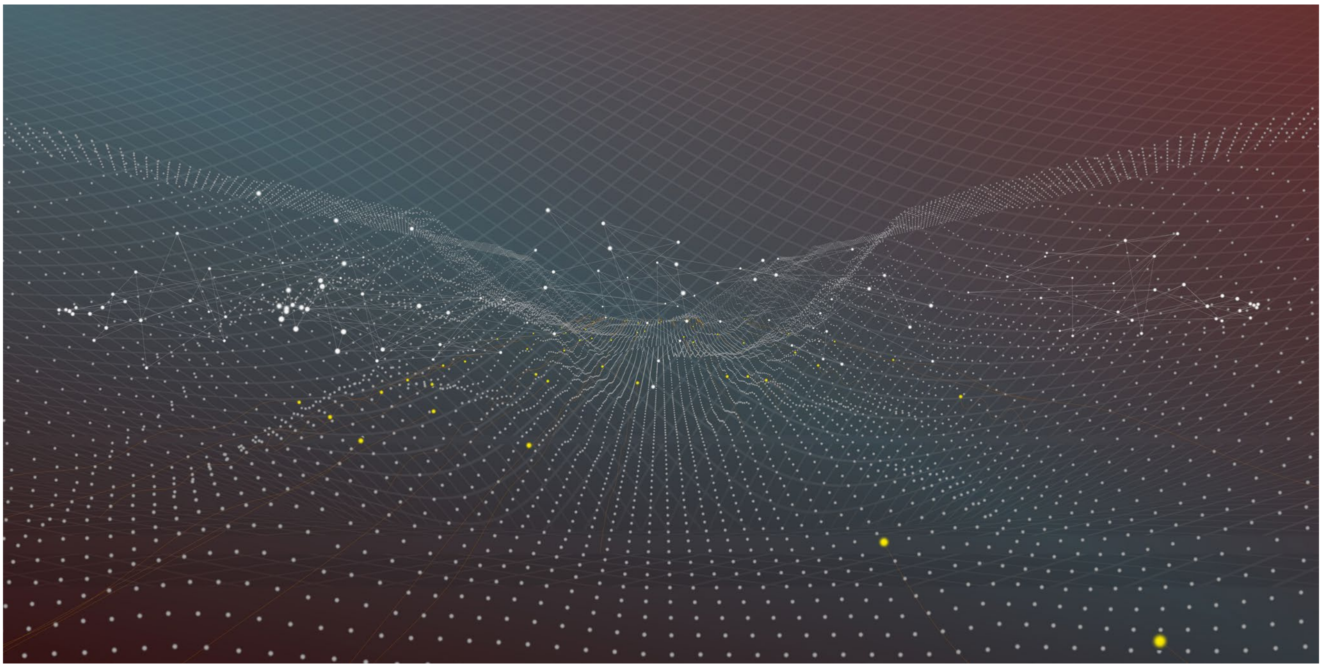
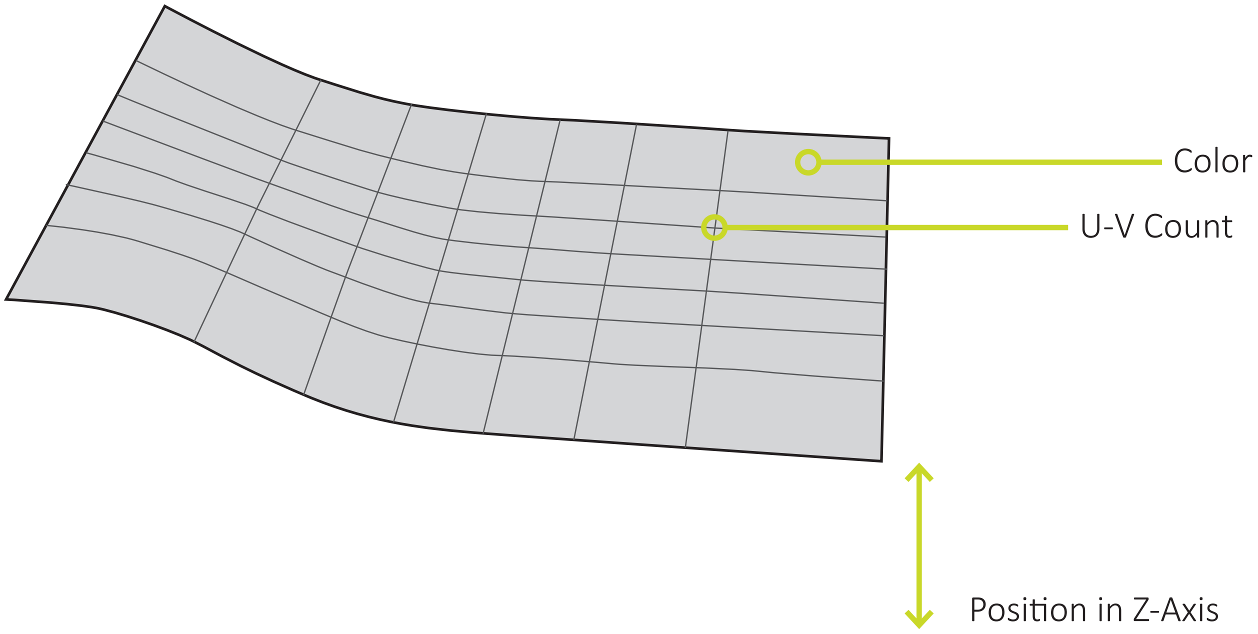


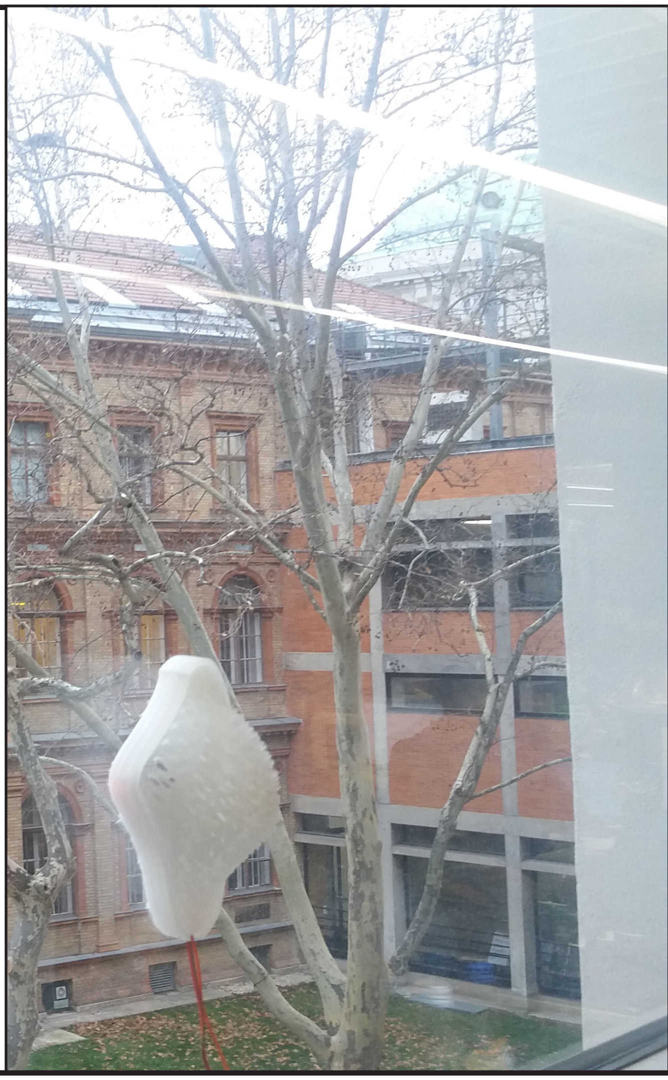


Sense8
Kristina Schramm, Marion Waid



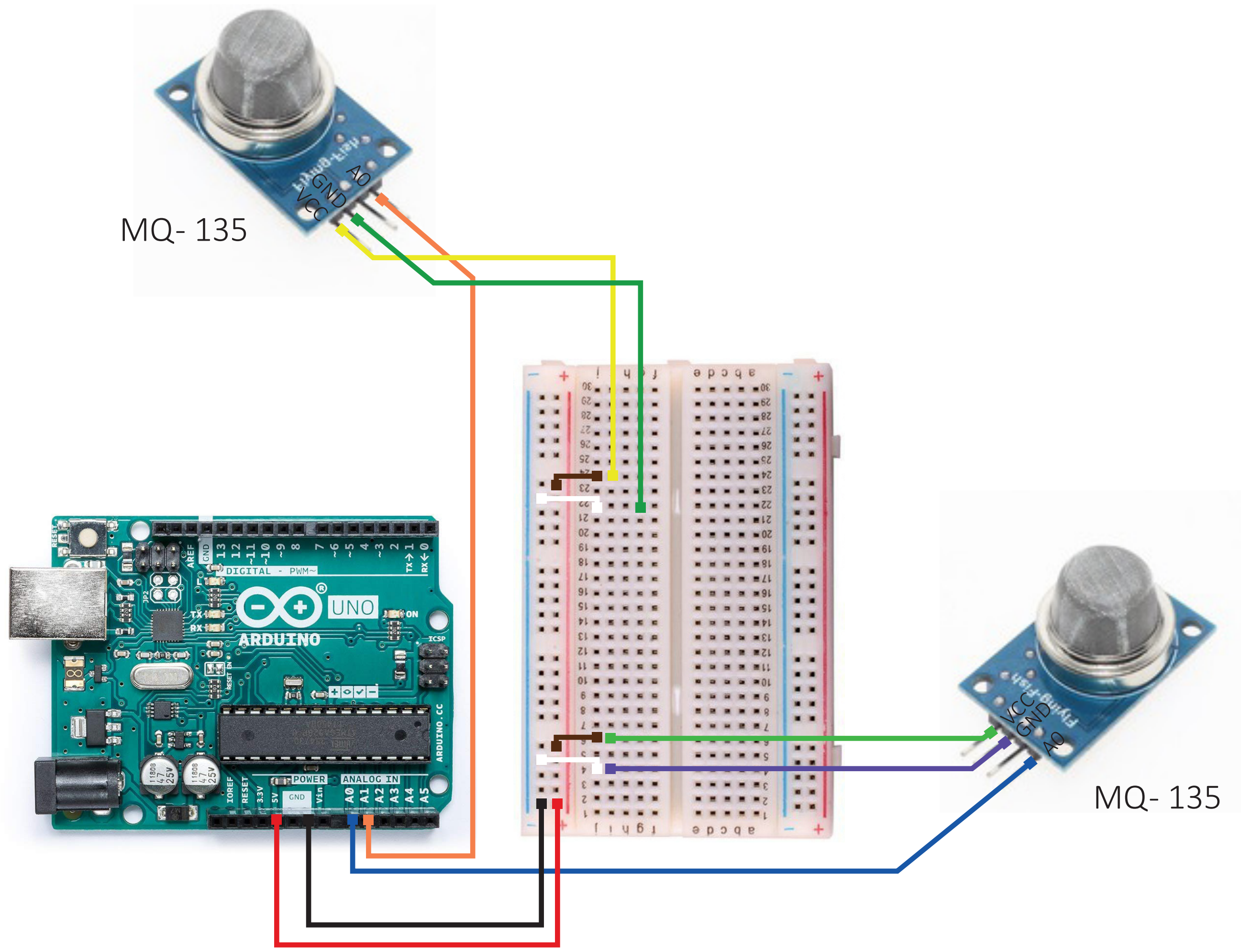
The Idea behind the Interface is to compare the values of the CO2-Level measured on the inside and the outside of the given room and to show those trough a surface fluidly moving in Z, changing color and having a higher or lower U-V count depending on how much CO2 is being picked up by the sensors.

Sense8
Kristina Schramm, Marion Waid



The idea is to make sure the air ventilates properly and no one can touch it as the sensors get quite hot.
The outdoor sensore is to be protected by the rain while still guaranteeing a good ventilation

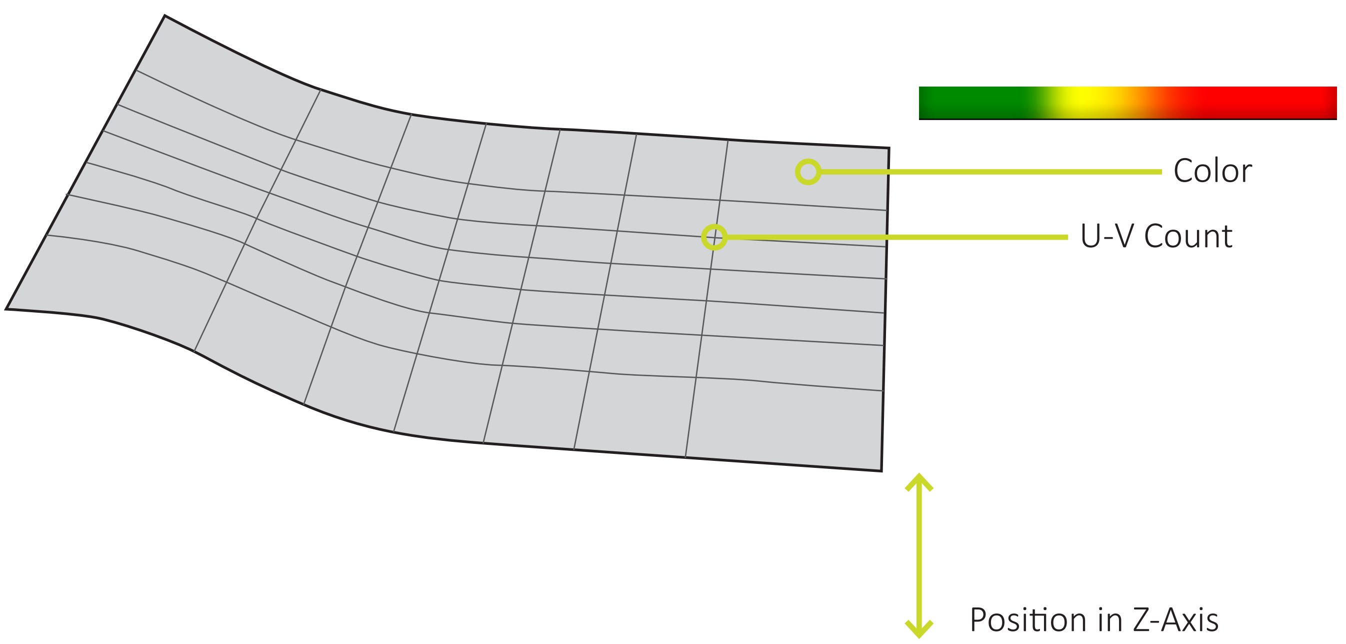
Sense8
Kristina Schramm, Marion Waid



We used two MQ-135 sensors (Flying-Fish). Said sensors measure gas in the air.
In our case we used is to measure the CO2 levels on the inside of a given room and compare it to the outside air.

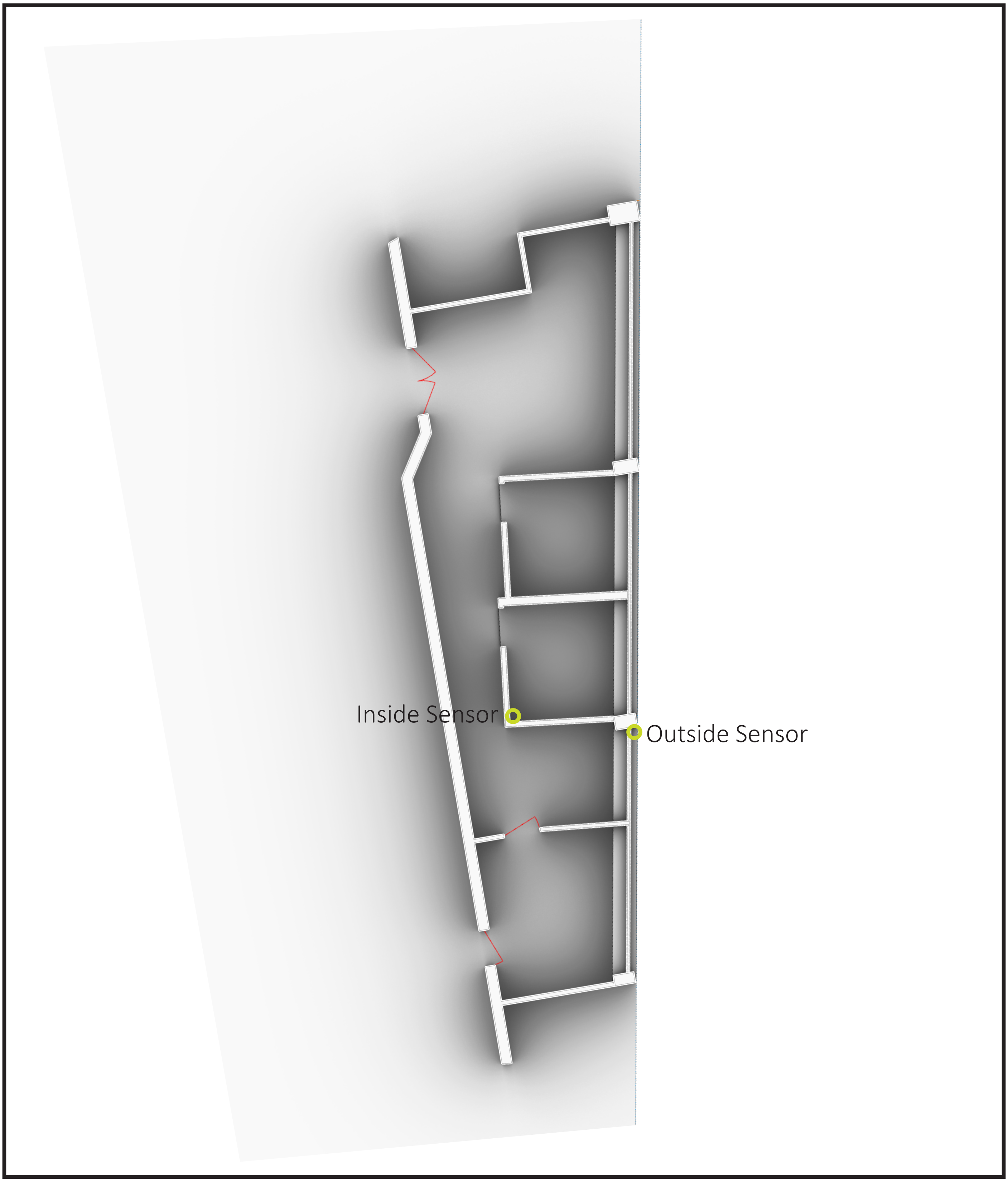
Values:
Normal background concentration in outdoor ambient air: 250-350ppm
Concentrations typical of occupied indoor spaces with good air exchange: 350-1,000ppm
Complaints of drowsiness and poor air: 1,000-2,000ppm

Sense8
Kristina Schramm, Marion Waid

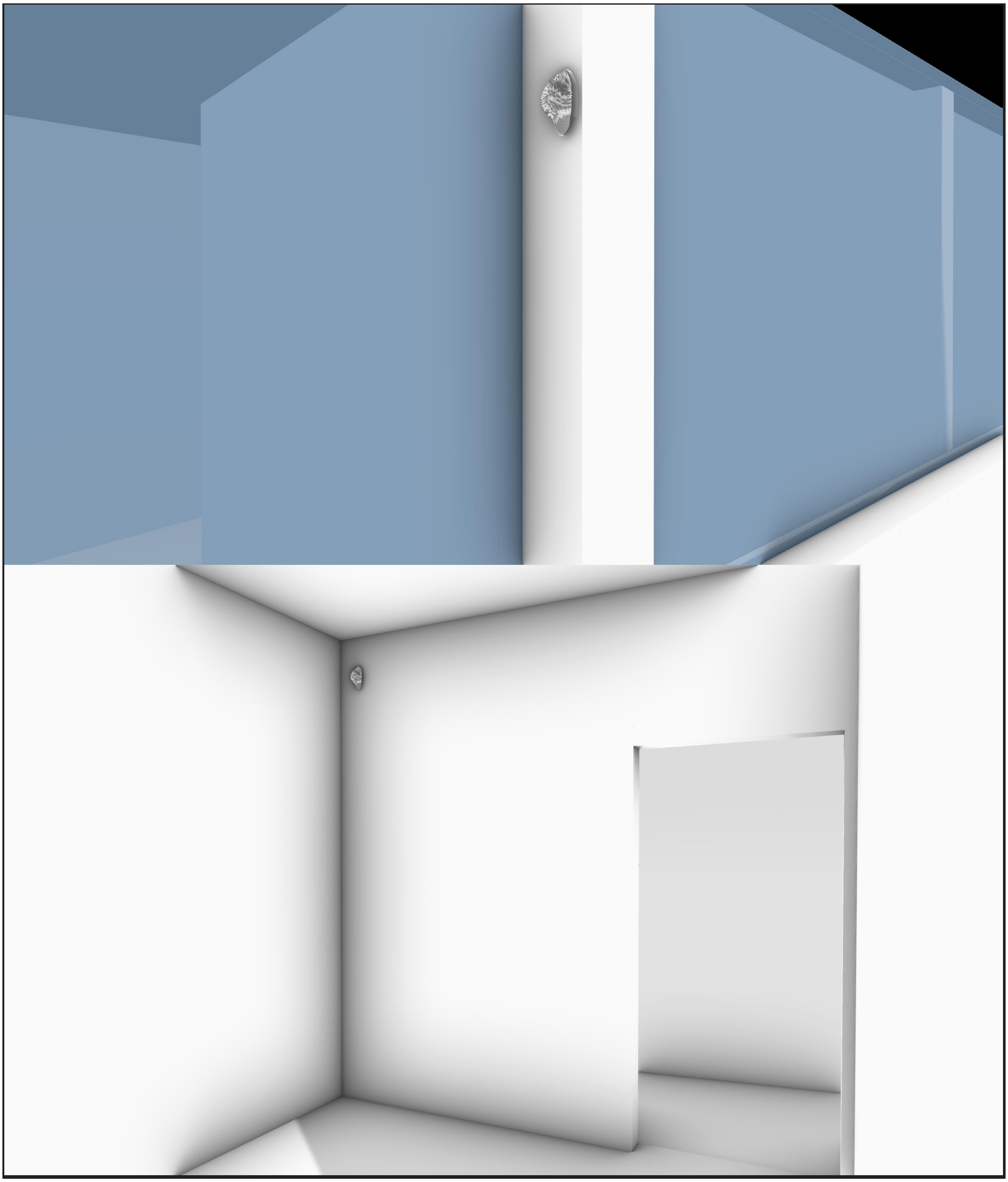


	good air quality	medium air quality	bad air quality
Color	green	yellow - orange	red
U-V Count	low	medium	high
Position in Z	high	medium	low

Sense8
Kristina Schramm, Marion Waid



Sense8
Kristina Schramm, Marion Waid

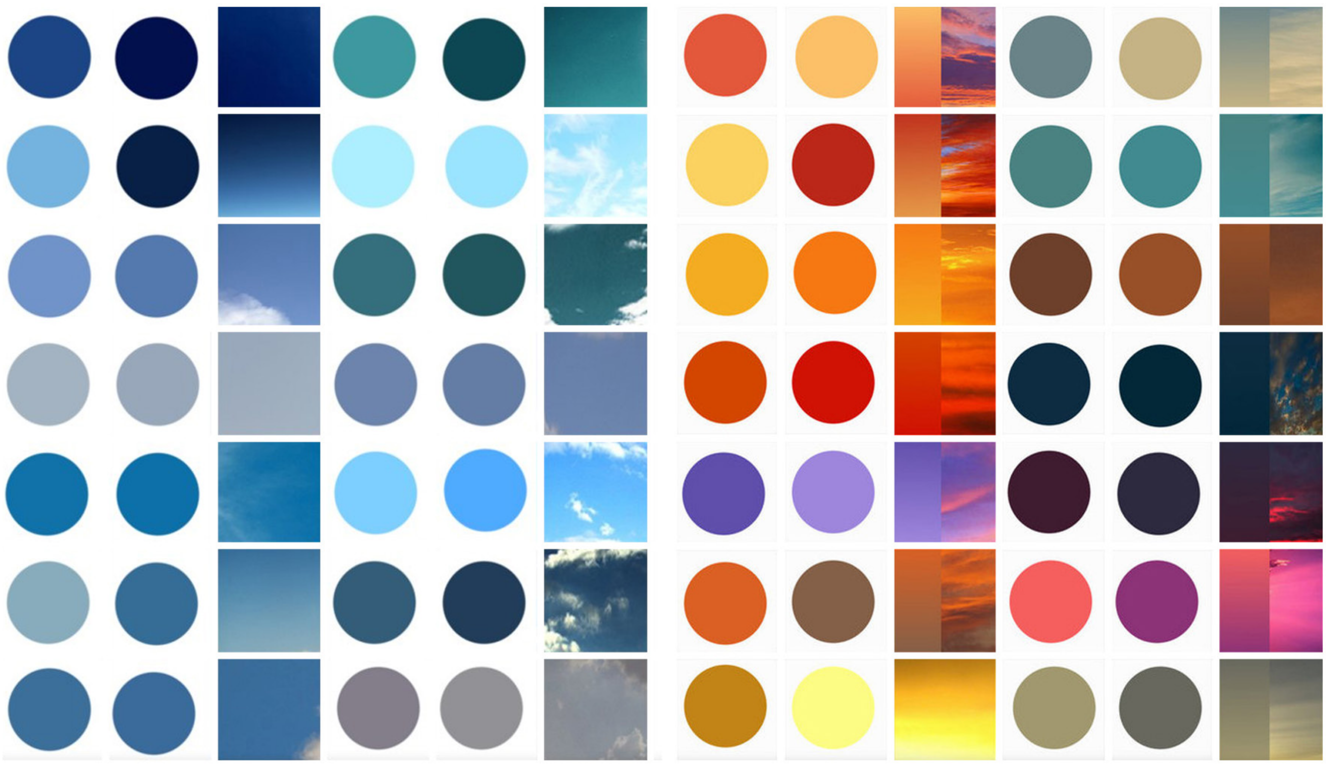


COLOR COLLECTOR
Jonghoon KIM / Shilun YANG

DAY AND SUNSET GRADIENT COLOR

The sky is mostly blue during the daytime, but it also has various changes depending on weather conditions and time. Because the sun is low on the horizon, sunlight passes through more air at sunset and sunrise than during the day, when the sun is higher in the sky. Distance between sun and your eyes decides how much of the blue and violet light scatters out, and this is why skys are often blue, yellow, orange, and red.

The purpose of the project is to collect and diagrammatize environmental color data. We expect collected data over a period of time through the poject to be used to create a better light environment in the future.

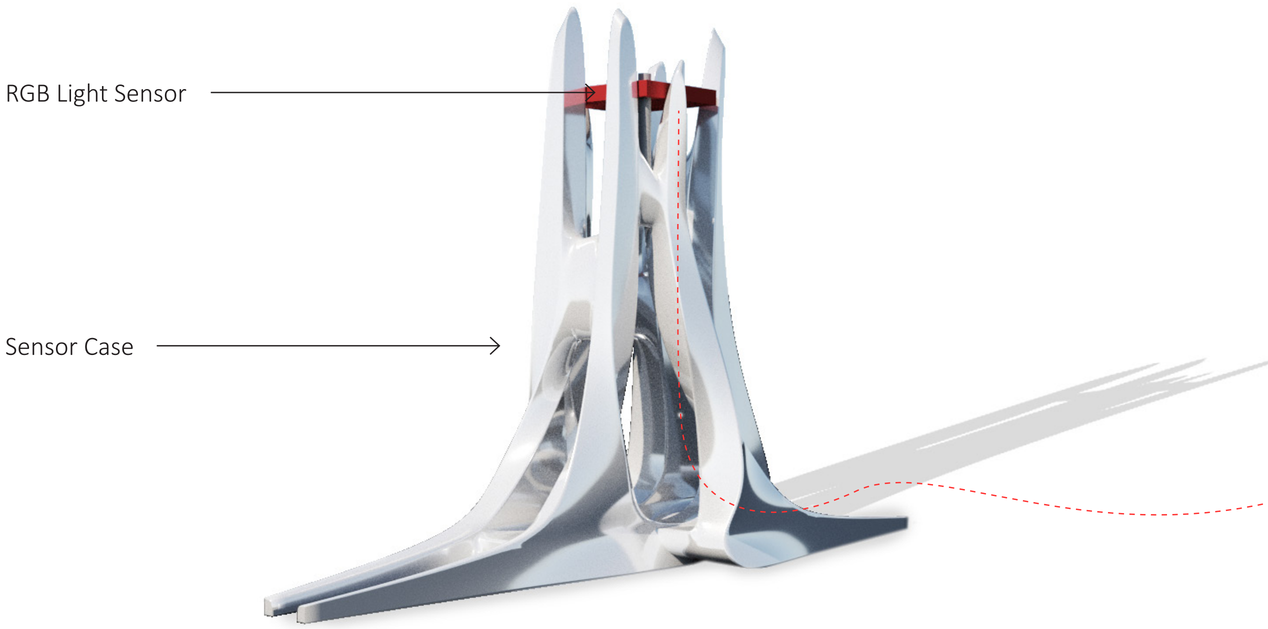


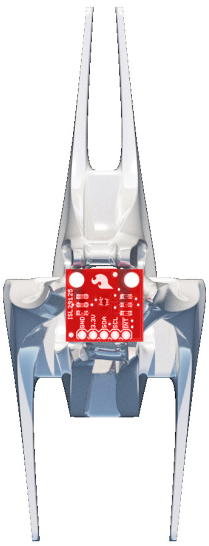
COLOR COLLECTOR

Jonghoon KIM / Shilun YANG

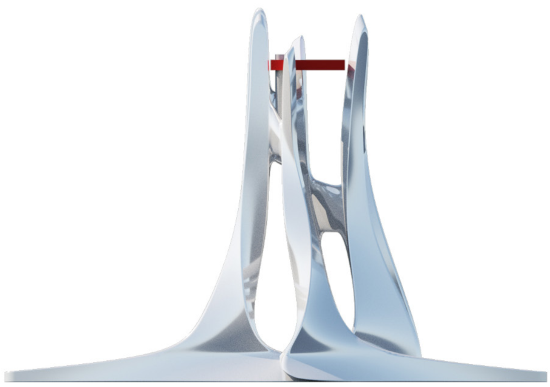
SENSOR CASE

We proposed a sensor case inspired by the bionic form of plants that produce energy through photosynthesis. The sensor is mounted to the top of the standing case, which is based on the stem and root of the plant, and the collected data is transferred to the computer via a cable.





Top



Side

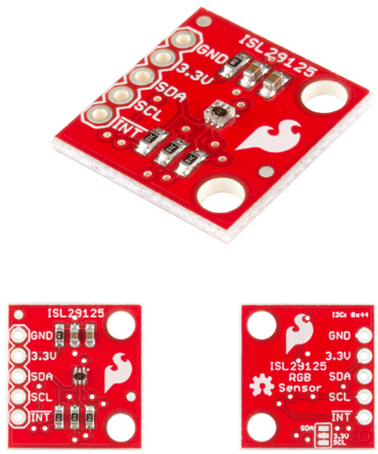
ENERGY DESIGN FFG

COLOR COLLECTOR
Jonghoon KIM / Shilun YANG

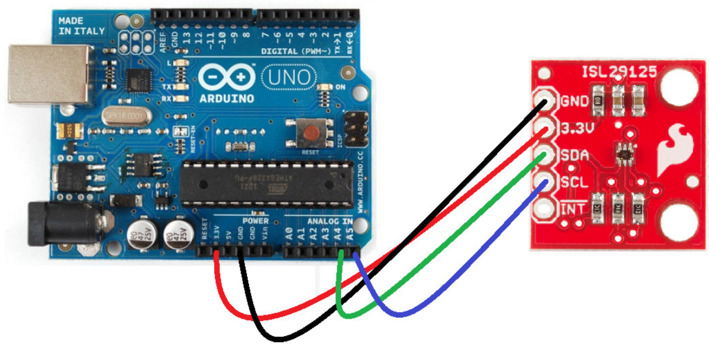
HARDWARE INFORMATION

ISL 29125 RGB LIGHT SENSOR

SL29125 is a low-power, high-sensitivity, red, green, and blue color light sensor (RGB) with an I2C (SMBus compatible) interface. Its state-of-the-art photodiode array provides an accurate RGB spectral response and excellent light source to light source variation (LS2LS). The ISL29125 is designed to reject IR in light sources allowing the device to operate in environments from sunlight to dark rooms.



ISL 29125 RGB Light Sensor



Arduino Hook Up Diagram


RGB Wheel Picker

R 0 G 0 B 0

R 255 G 255 B 255

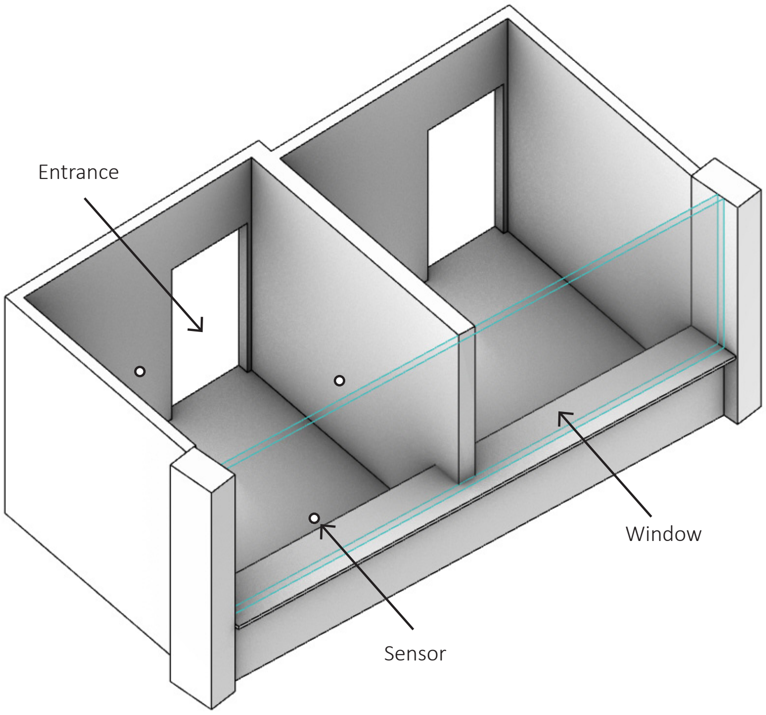
R 255 G 0 B 0

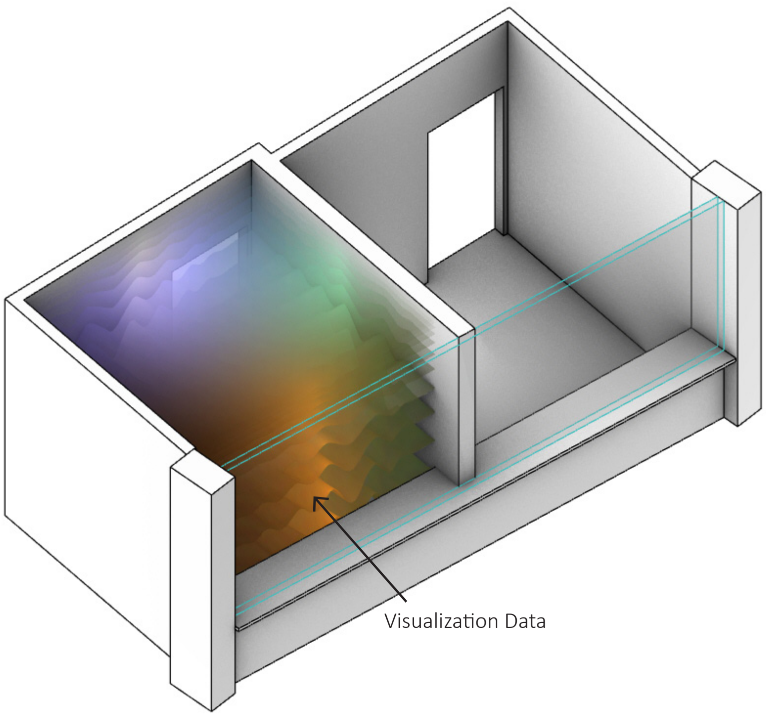
R 0 G 255 B 0

R 0 G 0 B 255

Standard Color RGB Value

COLOR COLLECTOR
Jonghoon KIM / Shilun YANG





INSTALLATION PLAN

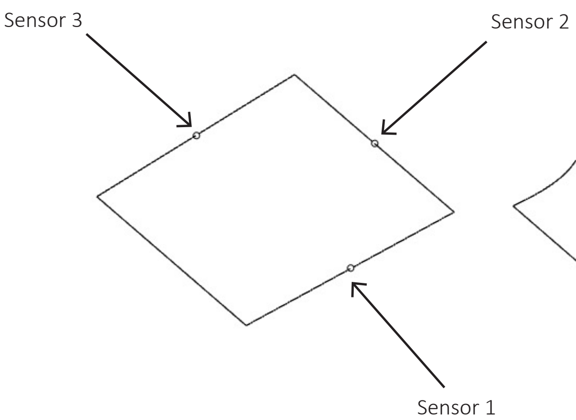
Three sensors are arranged three sides of the room. Two of them are on the wall which can collect the illuminace data from artifical lights, the rest one is near the windows which can collect the illuminance data from natural light. we can observe the diffiences of artifical lights and natural light in the daytime or night to help us design the light system for buildings

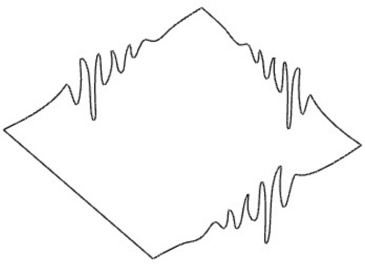
COLOR COLLECTOR

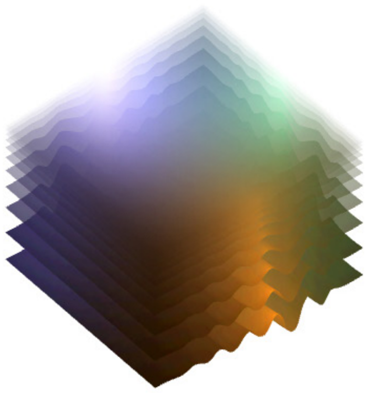
Jonghoon KIM / Shilun YANG

DATA VISUALISATION

SL29125 can collect RGB data from light. Data visualisation base on a simple square as initial state. Three edges of the square are as same as the positions of sensors, the illuminance will influence the control points of the these three edges, that means the curvatrue of edges can represent the intensity and color of lights. Then three dynamitc edges with a static edge can form a surface. The color of the surface is composed by the RGB information which the sensors provide.







Final result

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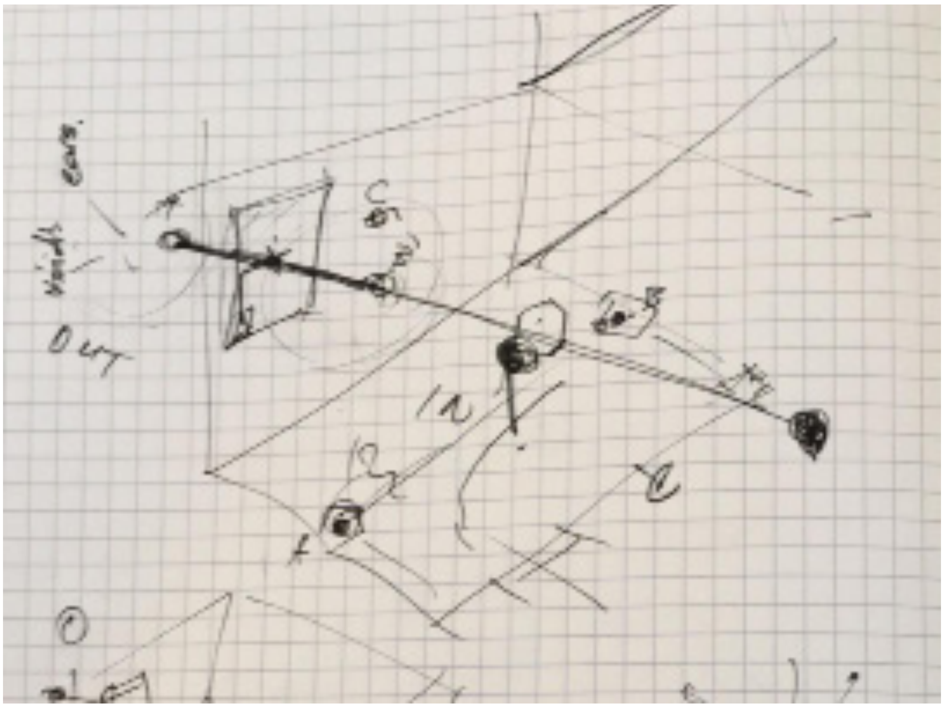

Two sensors — one sensing the exterior condition / activity (wind force, other vibration), second screening activity through vibration inside the room.

Those two datasets are compared and evaluated. The goal is to be able to qualitatively compare outside/inside conditions. This information could be later on passed to the facade to alter the interior conditions. Each module has LED signaling device, changing colour according to data received, eliminating the need for external PC screen.

Example scenario: SensorIN detects high level of vibration — either higher activity of individual or more individuals inside the room — SensorOUT detects low vibration outside — low air flow (safe to open window) — scenario is evaluated and prompt to the facade to completely open up is sent.

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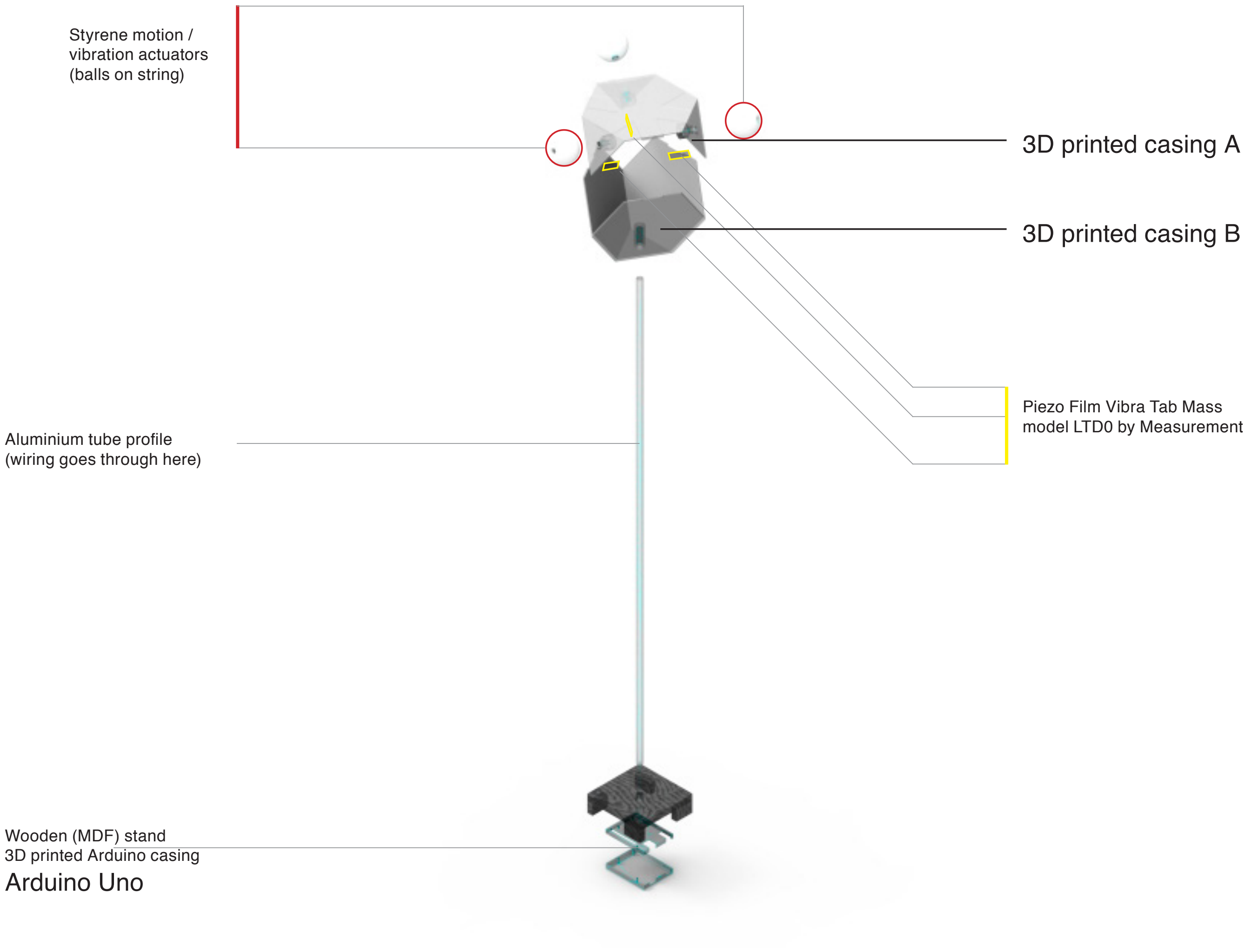

Human interaction actuated piezoelectric vibration sensory sculpture connected to Arduino Uno.

Sculpture is designed to engage the visitor by letting them move the balls which are attached to elastic string. Upon release, ball hits the sensory head, creating specific vibration echo. Each ball has its own dedicated piezo sensor.

Vibration is enhanced by mounting main sensor head to aluminium tube of 80 cm length, creating pendulum effect.

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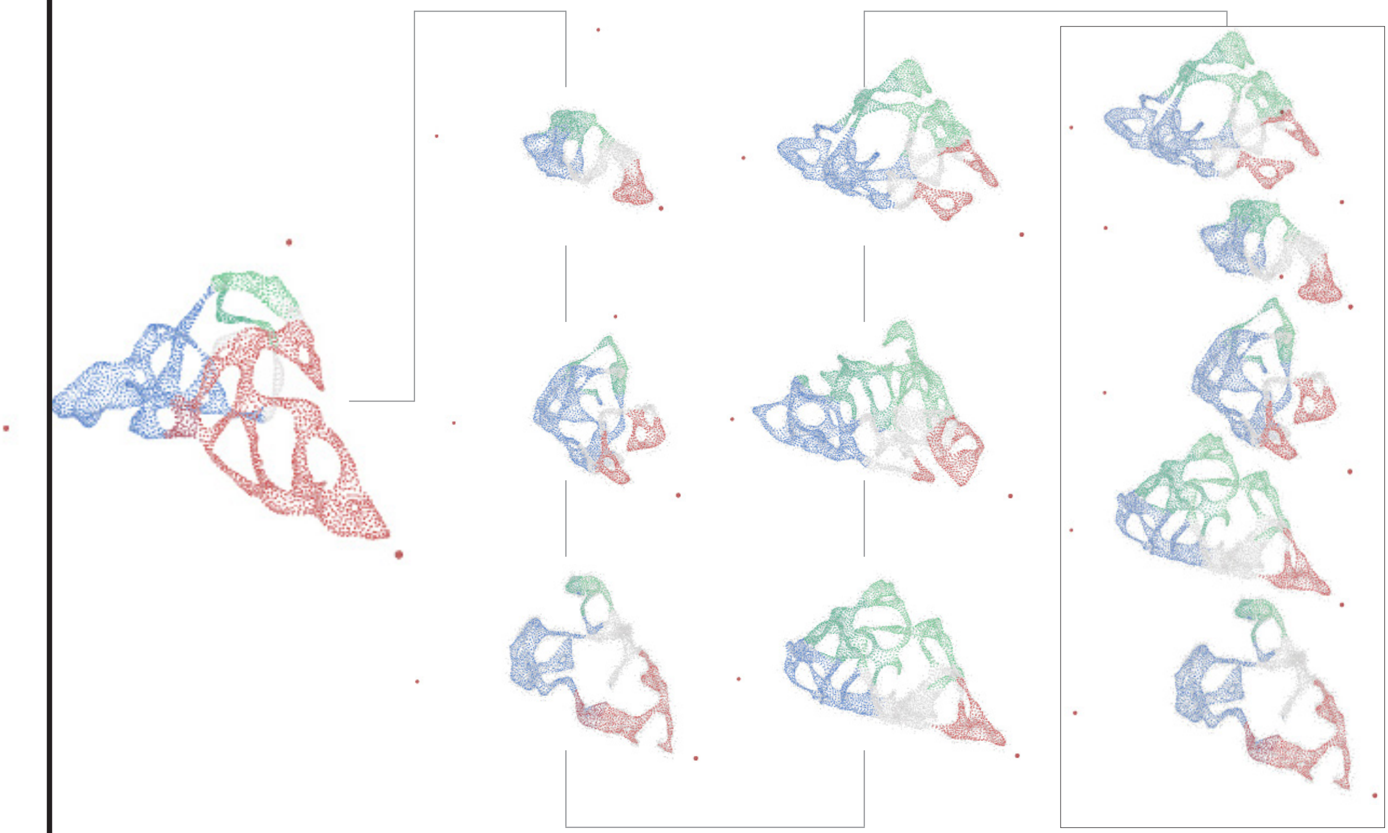
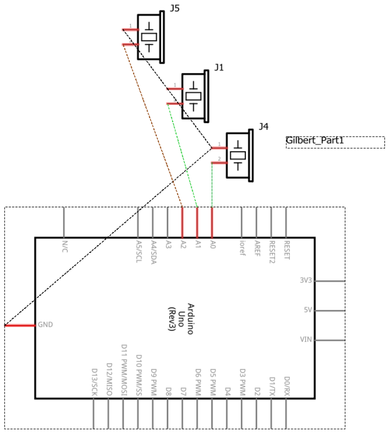
Data visualization



Vibration data of one of the three sensors is visualized in real–time in Grasshopper. Interactive 3D graphic shows interdependencies between the sensory output of all the sensors in space as a modulating pointcloud shape with color–coded gradiant.



Board schematics:
— Arduino Uno
— 3 x MEAS Piezo Film
Vibra Tab Mass model LTD0
(Analog input)

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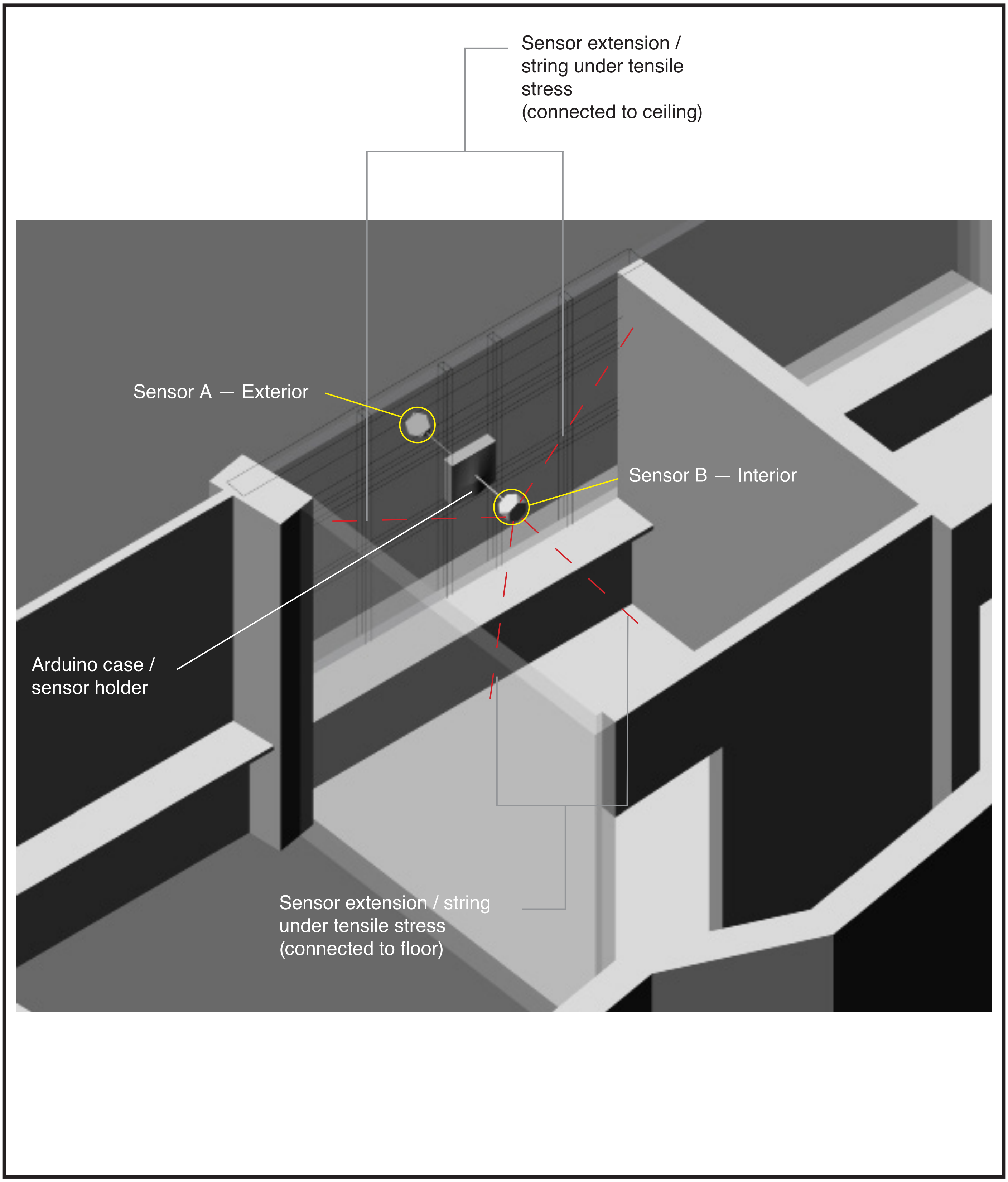

ENERGY DESIGN FFG

TALK TO ME PROTOTYPE
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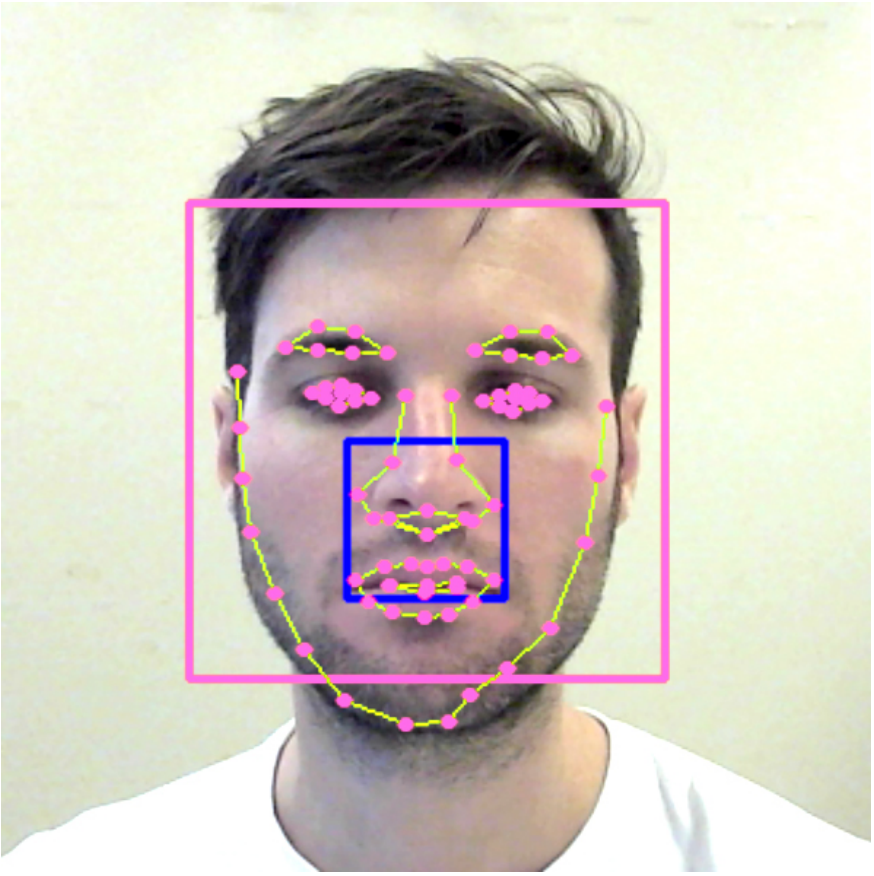
Shaun McCallum 01646362
Aleksandra Belitskaja 01646364



What is the concept of your interface? (40-60 words)

Our prototype actively plays with the role of machine vision in a current architectural framework. By giving the facade eyes, it allows for direct feedback from an object which appears to understand similarly to ourselves. Yet there are moments of estrangement in the conversation between this somewhat humanoid, somewhat amorphous object and the user who approaches it naively seeking feedback. In turn it adds a level of symbiosis with human and machine, something that is not felt through the averaging data sets of comfortability, and climatically controlled systems, instead our prototype acts on a personal level rather than addressing the average inhabitant we address the individual.

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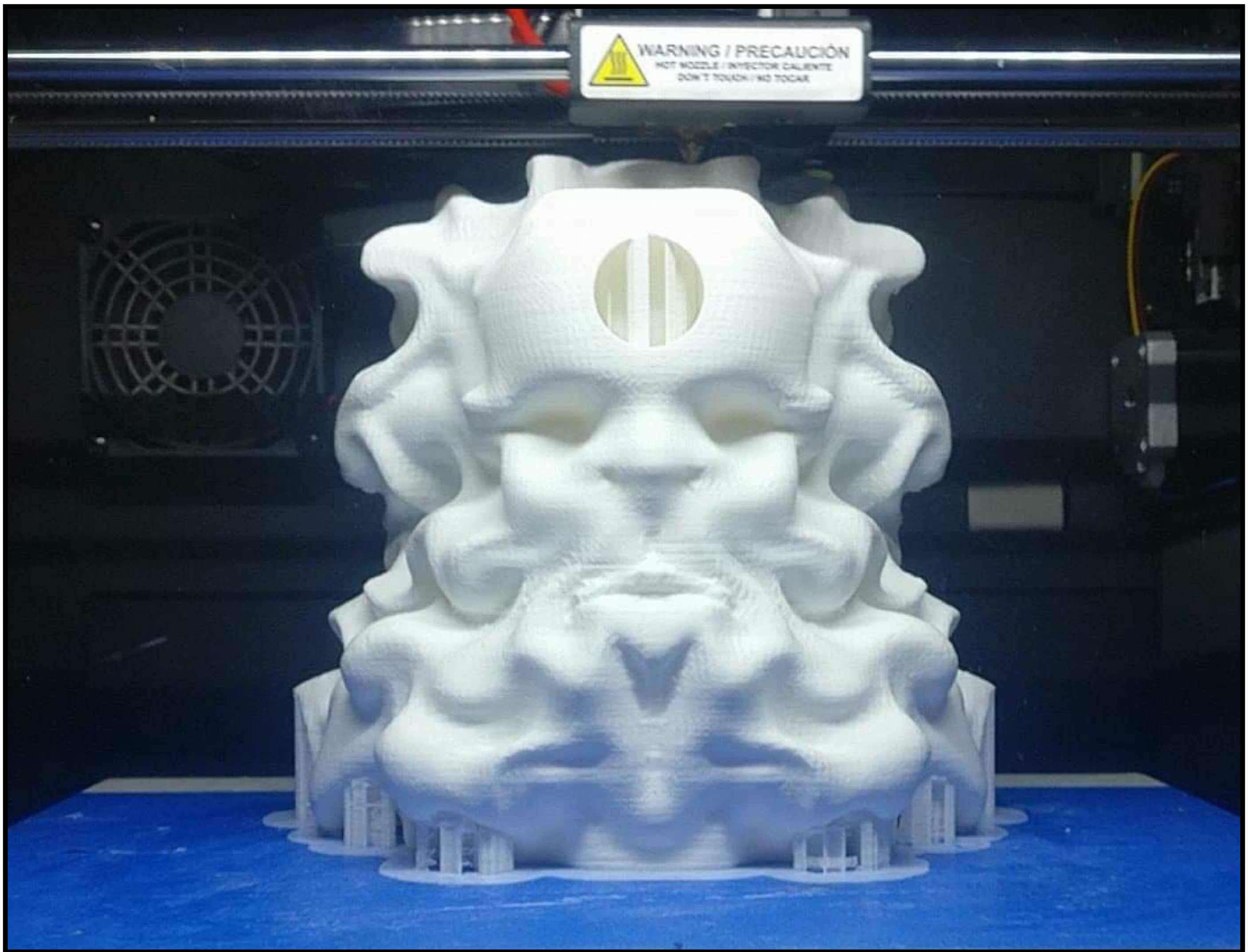

What is the design idea for the sensor case?(40-60 words)

Our sensor case has a somewhat humanoid face geometry which allows the user to engage with technology on a personal and strangely familiar level. A strage convesation between humanoid, amorphous object and the user occurs, adressing the individual issues and face expressions, and giving feedback in form of a sound.

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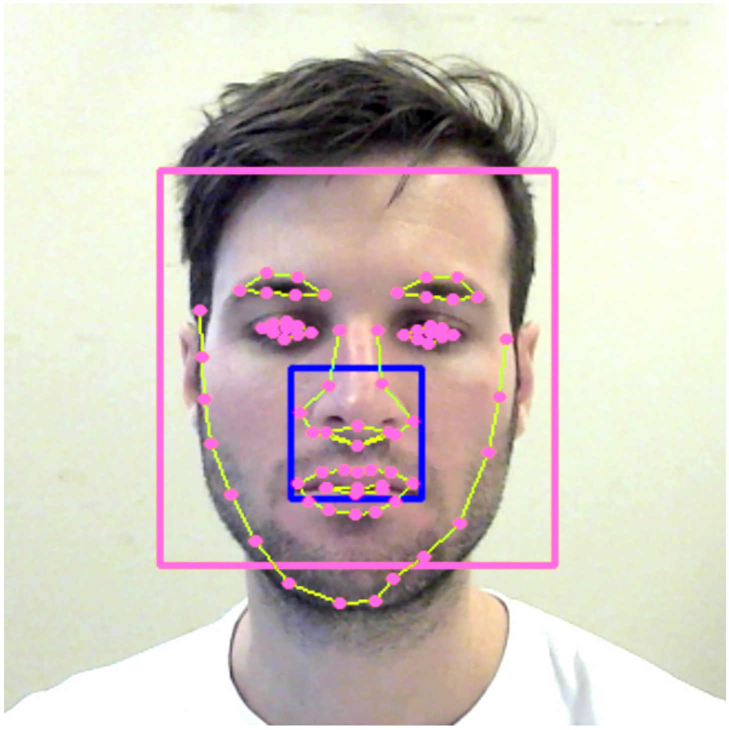

What sensors are used?
What is being measured?
What information do you get from the data (eg spatial distribution of sound...)?

Our main sensor is a webcamera, which translates live video information of the user's face to Unity. Our system uses two primary drivers: Unity Gaming Engine and Grasshopper. The first is used to recognise facial patterns and bifurcate data into an understandable structure for further analysis. In our case this involved segmenting point data into categories related to facial features. Once this structure was achieved in Unity using C#, the data could be exported in real-time to Grasshopper using UDP (User Datagram Protocol). Grasshopper was used to evaluate the data and trigger certain events. Depending on the type of point data generated through facial recoginition the length and orientation of a line (e.g. the connection of points in an eyebrow) or the area (e.g. of the connection of points in the mouth) was used to establish first a baseline and second an acceptable standard deviation. For example, if the mouth opened (based on the increase in area above the specified standard deviation) it would trigger a boolean operation to 'true' and cause a sonic and / or visual effect.

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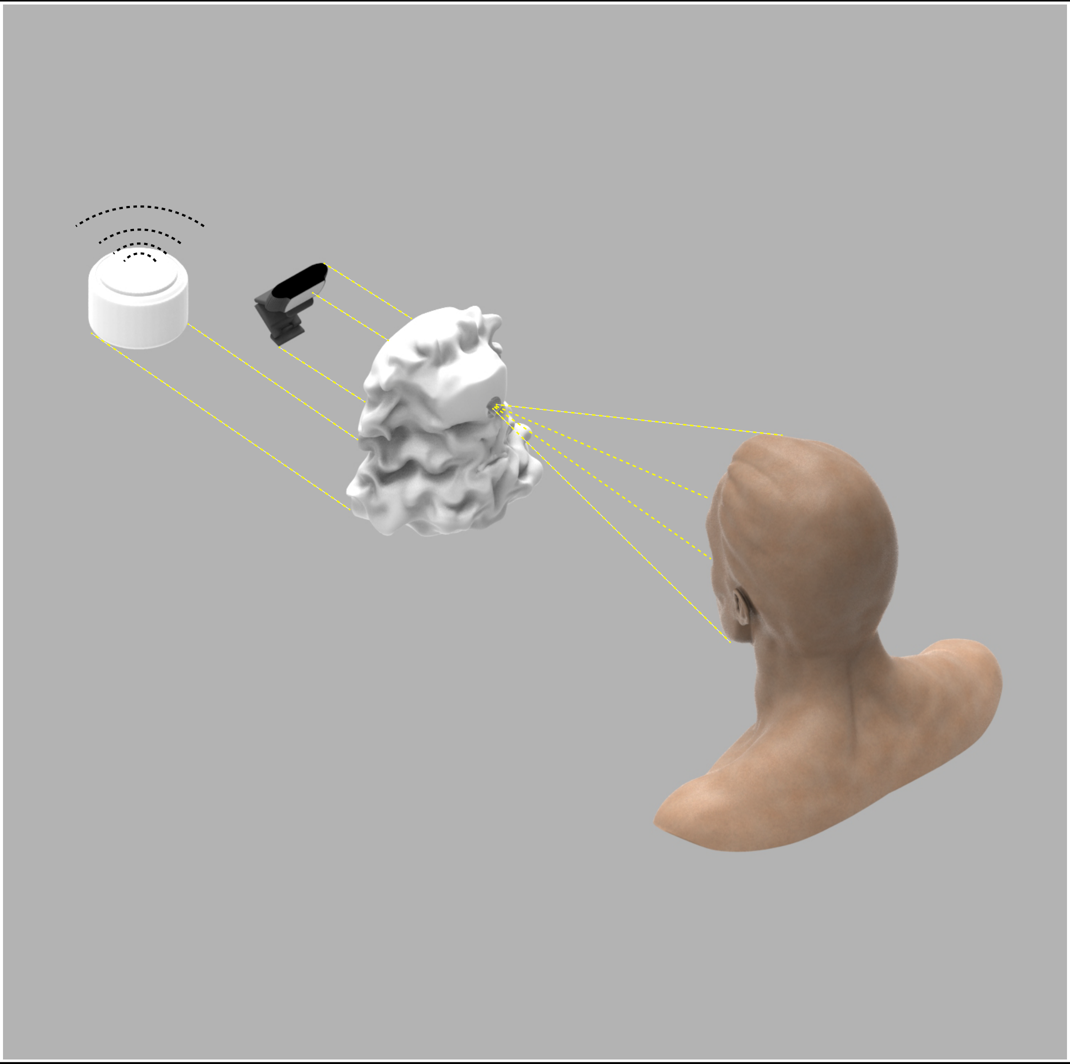

What is shown in the interface?

Webcamera located in the case, receives live-video information transaltes it into unity, which after regonsising position of eyes, nose and mouth give a certain feedback sound through a speaker.

POTENTIAL APPLICATIONS

The application is currently in a beta stage but functions accurately when certain variables are controlled, especially distance betweena users face and the web camera. This requires a fixed camera position, however, we could imagine a more emmersive and flexible system in which the app is used on mobile devices allowing it to be omni-present in the exhibition. In addition, it is difficult (with a limited data set) to correlate facial data into emotion, but with a larger data set this should be possible.

Regardless, in it’s current state, the prototype could give indication as to whether the participants are having a positive vs negative experience (as defined by our conditions) and trigger certain environmental effects accordingly. For example, while a temperature trigger could adjust the room to established norms for average comfort, the prototype could give indications that users are unhappy and therefore heat the room to evaluate if that made users more happy.

ENERGY DESIGN

FFG

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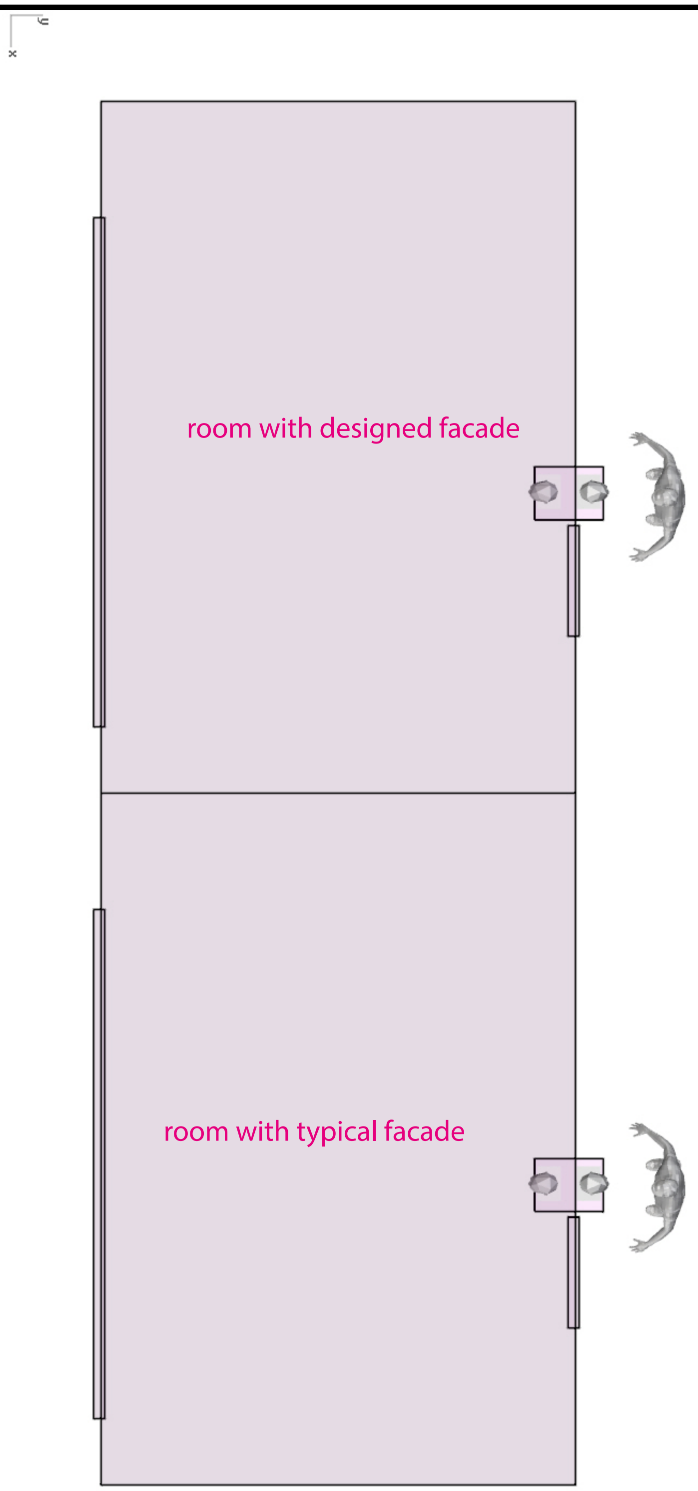

Visitors would enter both rooms and the TALK TO ME PROTOTYPE would interact with them while entering and extering the rooms checking the users mood and wellbeing.

TALK TO ME PROTOTYPE

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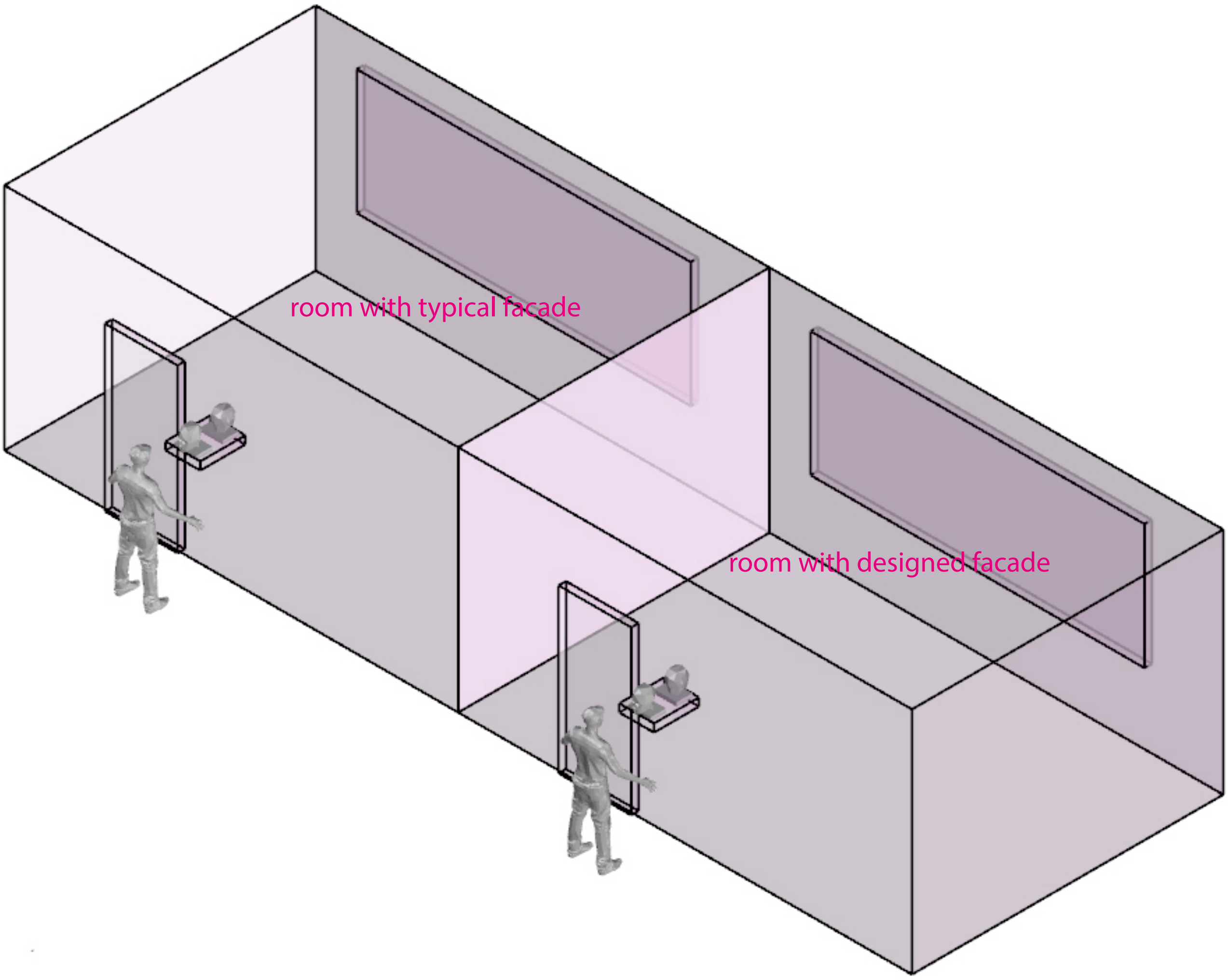

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SYSTEMS DIAGRAM