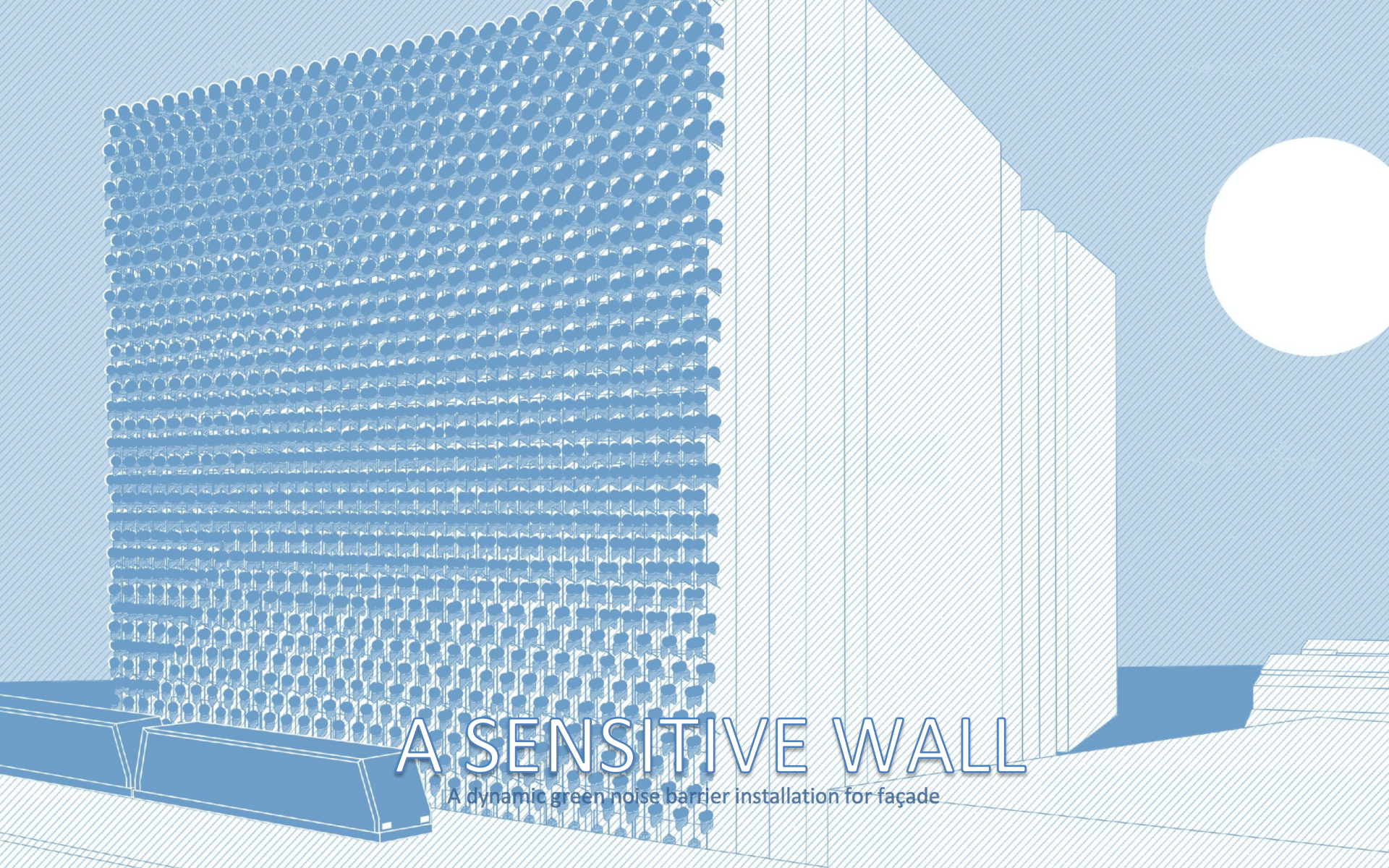
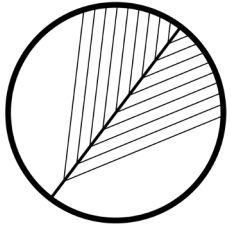


A SENSITIVE WALL

A dynamic green noise barrier installation for façade



ARCHI-Farmer

We are a startup focusing on sustainable and eco-friendly solutions for urban life. Combining architectural design, product design and biomimicry, we aim to promote a lifestyle following the UN SDGs.

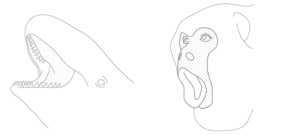
A Sensitive Wall

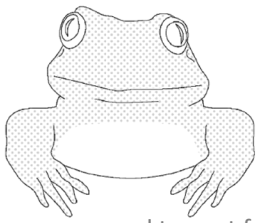
A Sensitive Wall is a sustainable and efficient noise proof and shading installation for buildings' exterior walls. A Sensitive Wall solves the urban noise and energy consumption problems. It is also an attractive and eco-friendly dynamic choice for façade.

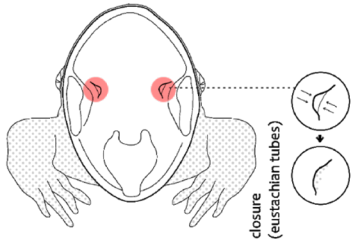
Traffic Noise/MRT Noise

Transportation construction is an indispensable infrastructure for cities, but with the development of cities and the increase in traffic, traffic noise also causes problems for people living in cities.

The operation of the Taoyuan Airport MRT and the completion of the ring line have brought convenience to most people, but for the residents along the line, the temporary noise generated by the trains has become their new worries.



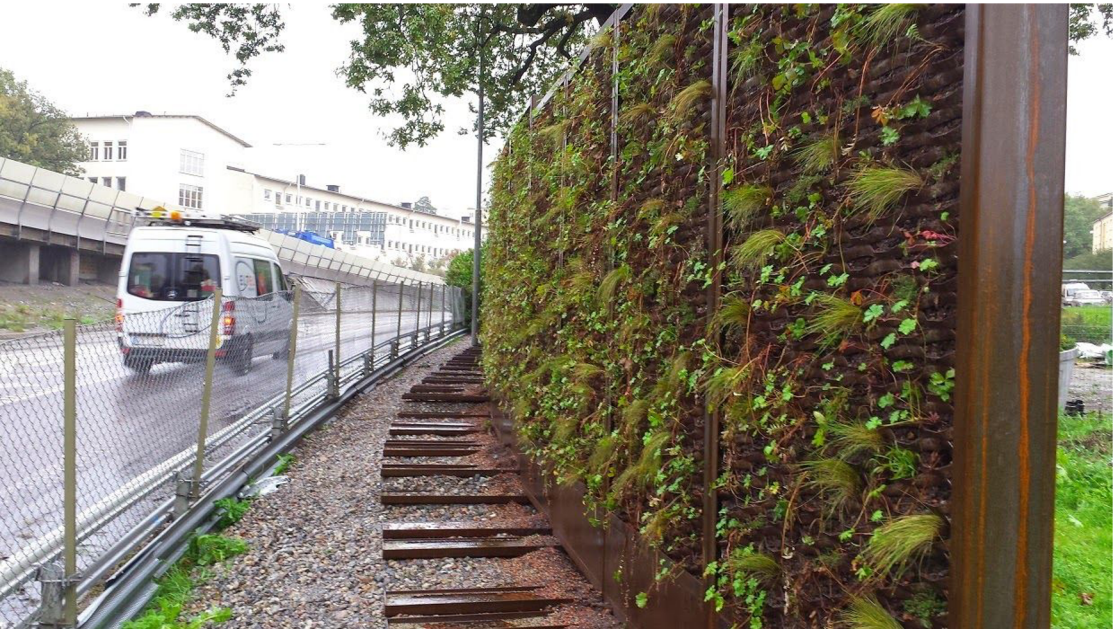

concave-eared torrent frog

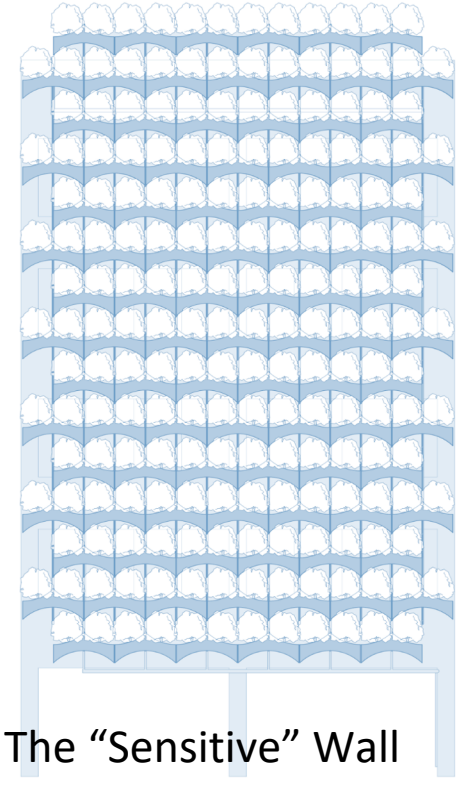


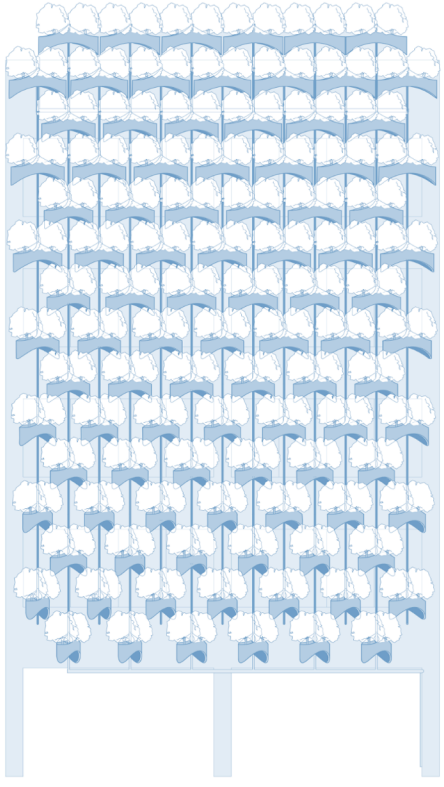
Concave-eared Torrent Frog + Green Noise Barrier

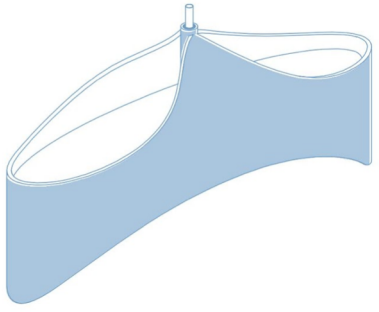
Facing the noise, animals have different methods to prevent from hearing loss. Concave-eared torrent frog close its normally open Eustachian tubes to modulate the sound level. That inspired us to design an automatic system that reacts to the noise.

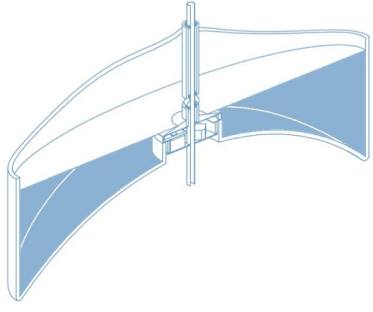
Green noise barrier is an emerging urban sound insulation technology, and many studies supported its feasibility. The branches and leaves can block, absorb, and resonate higher frequency noise, while the planting container and substrate can cope with lower frequency noise. We designed a dynamic green noise barrier responding to noise.





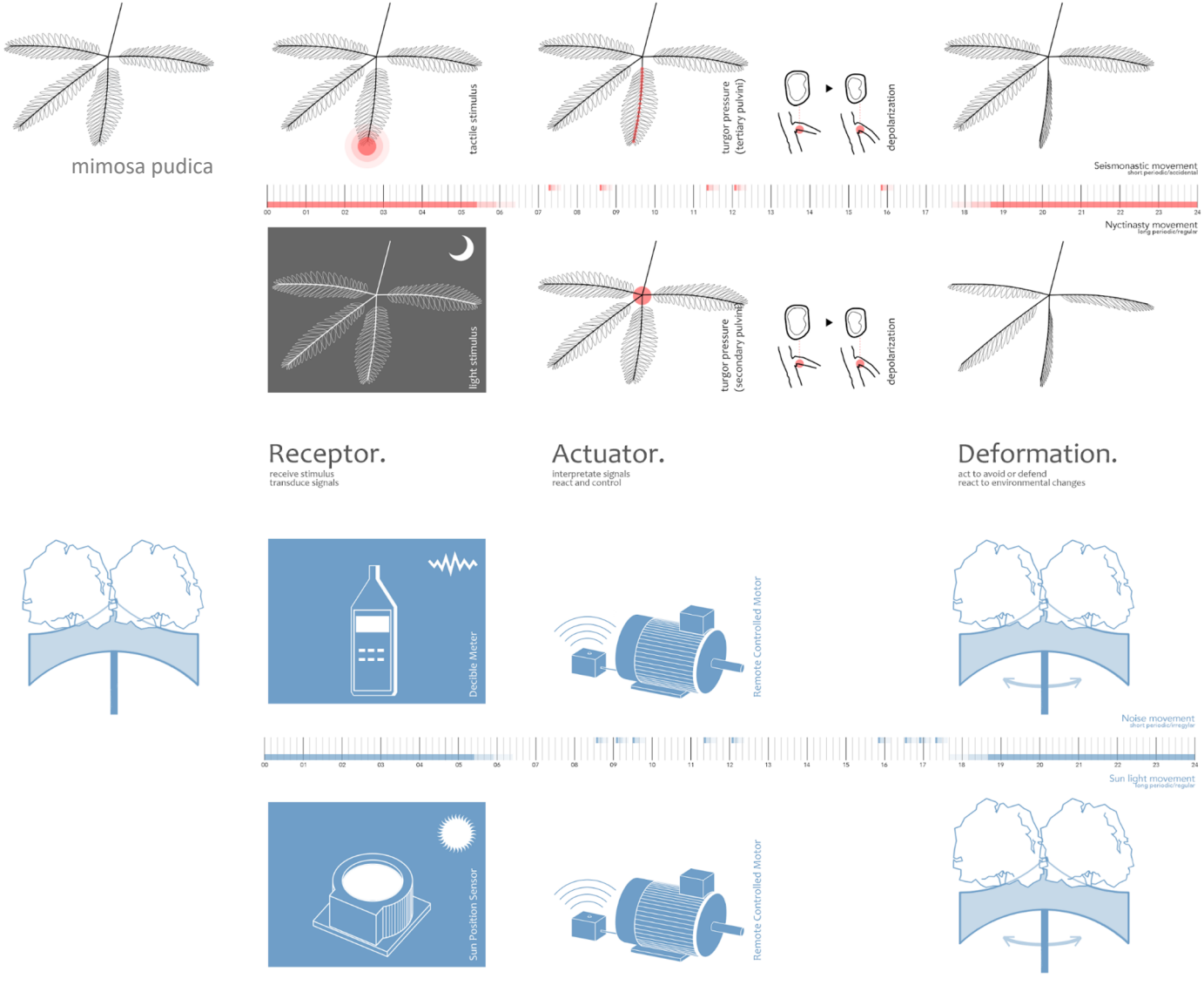






The “Sensitive” Wall

We designed a green wall composed with rotatable pot units which can respond to environmental changes. Form, material, and color of the pot unit were inspired by the desert snail, which adapts to a hot and dry environment. The egg-shape pot was made of fiber reinforced plastic (FRP) to make it light and strong. The curved surface helps to reflect radiation and reduce evaporation. The funnel-shape bottom saves water for irrigation by draining the excess water to the lower pots.

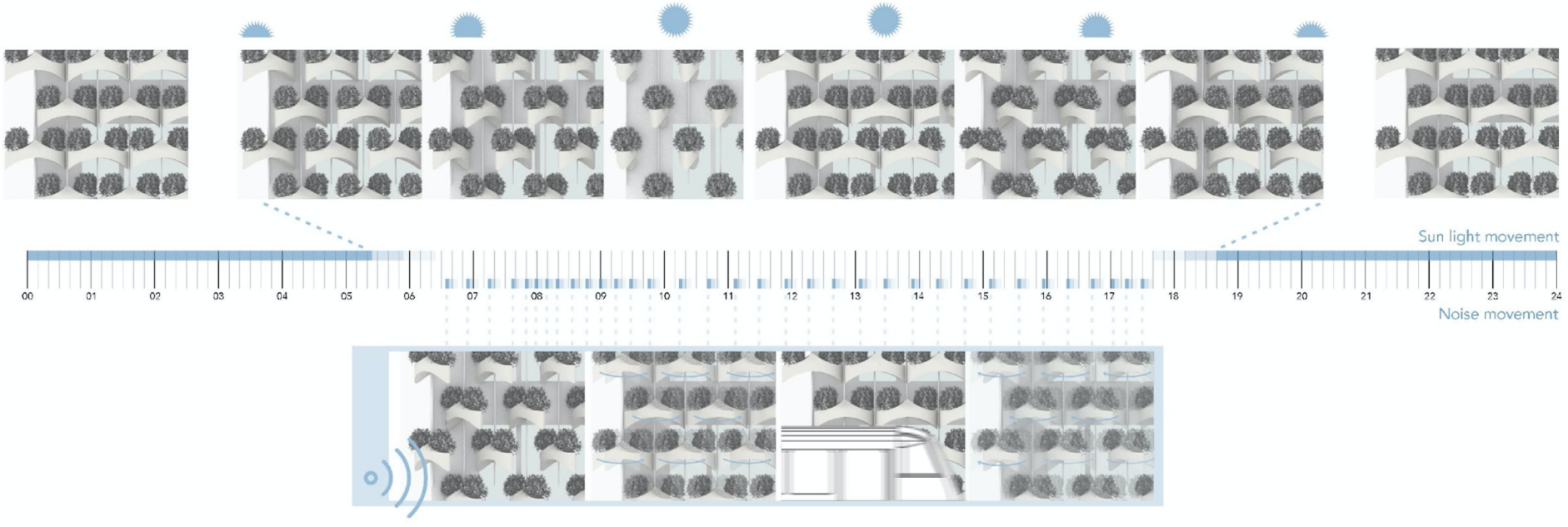


Two Movement of Mimosa Pudica

When the receptor is stimulated tactilely and thermally, the expansion pressure of the tertiary pulvini (actuator) allows the mimosa to close its leaves in a short time and maintain for 2-10 minutes. At the same time, the receptors on the leaves can also be stimulated by light and run on a daily cycle. Through the change of the turgor pressure of the second pulvini, they close the leaf at night and open again after sunrise.

Biomimicry System

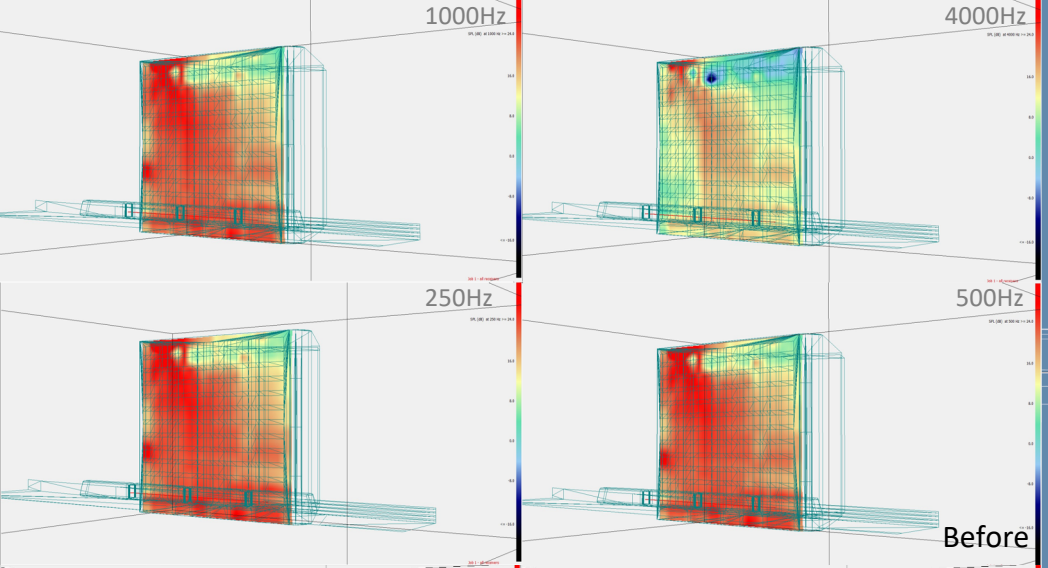
We put the receiver-actuator-deformation system and two coexisting sets of stimulative mechanisms into the green noise barrier wall system.

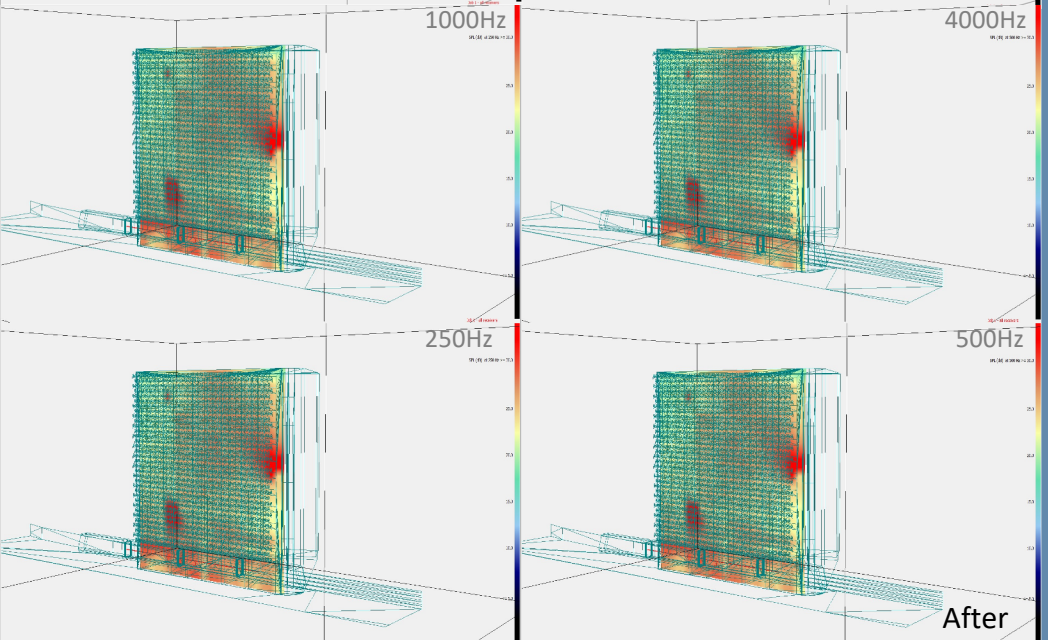


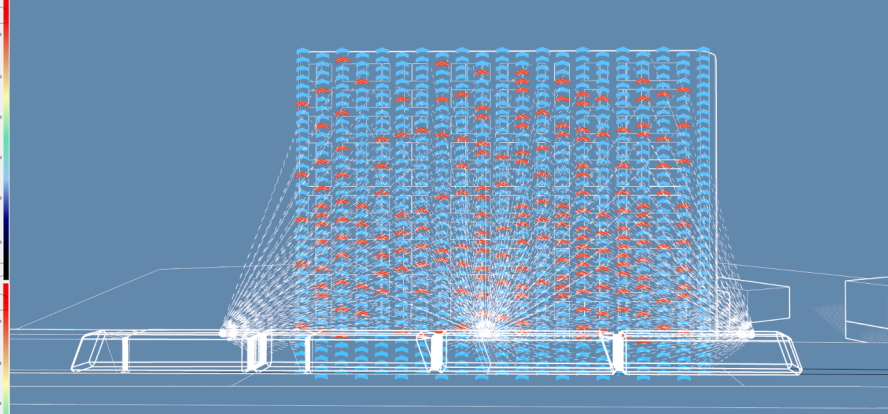
Rotation

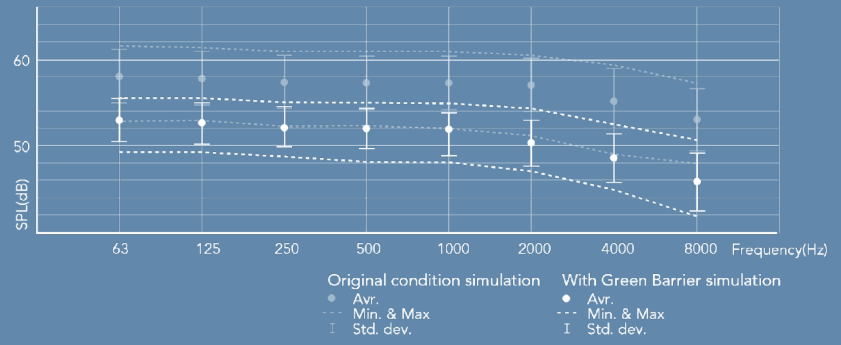
The rotation system is like mimosa responding to different environmental changes.

Normally, the pots rotate following the angle of sunlight for the best sunlight receiving. When excessive noise is detected, the pots rotate to the best noise-blocking angle. After the noise is eased, pots return to the previous angle and follow the sun again.



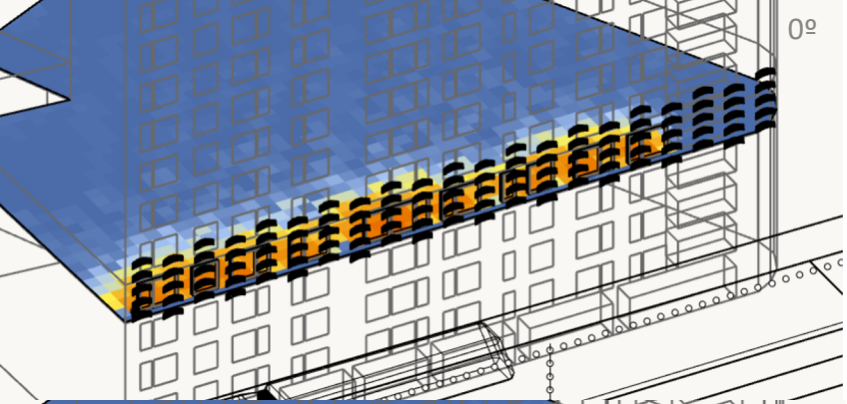


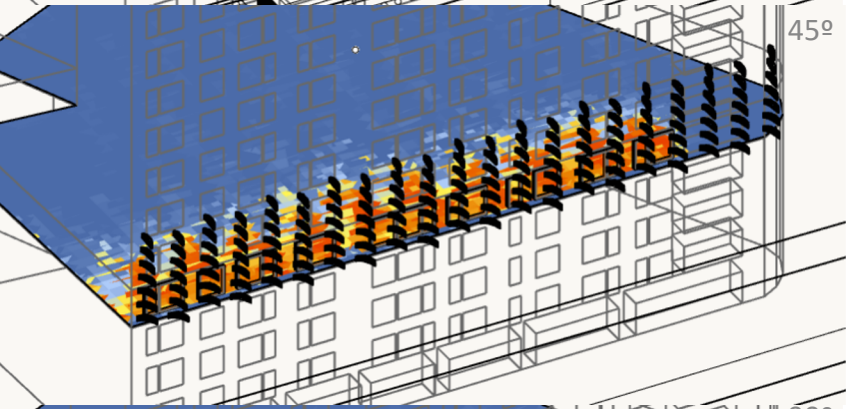


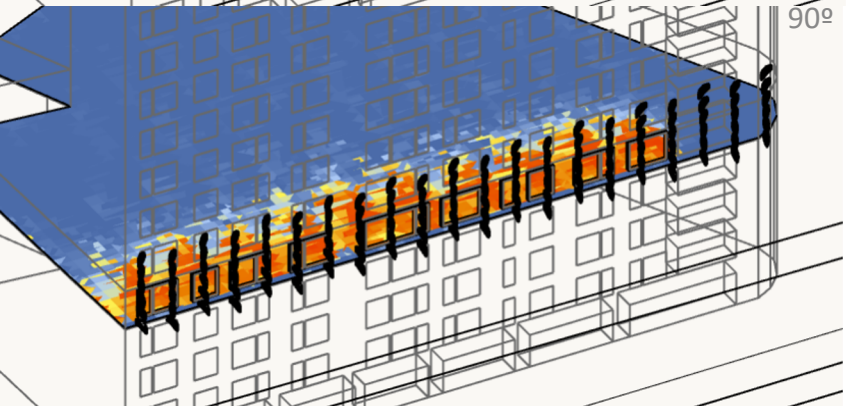


Acoustic Simulation

We built a 3D model at a real site in New Taipei City in Taiwan and put it into the acoustic analysis software to test the Sound Pressure Level (SPL) before and after the installation of our design. With the linear sound source setting to 80 dB and the distance from the MRT rail to the building set to 6.5m, we get a 2-6 dB reduction (Maximum 75% of sound energy reduction) of the SPL.

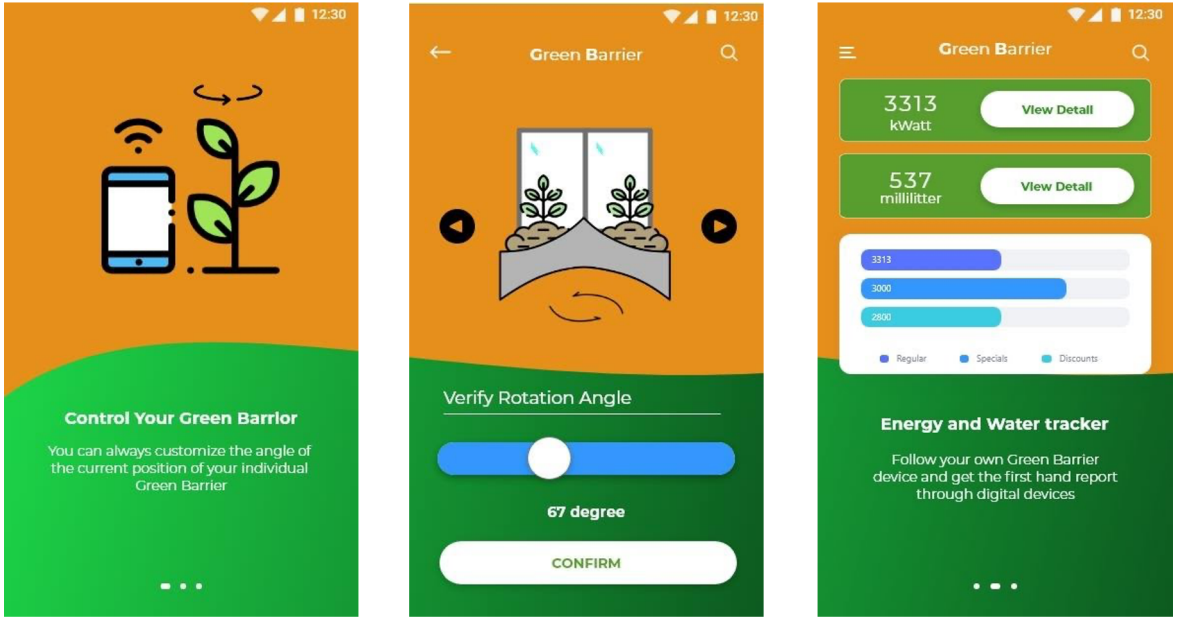






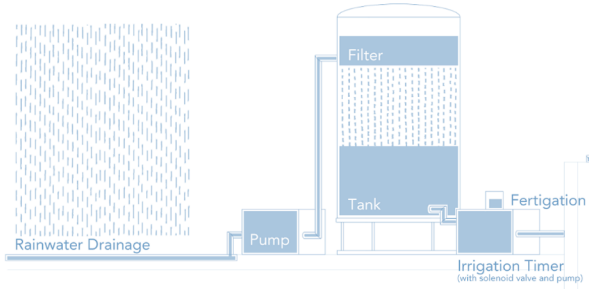
Sun Light Simulation

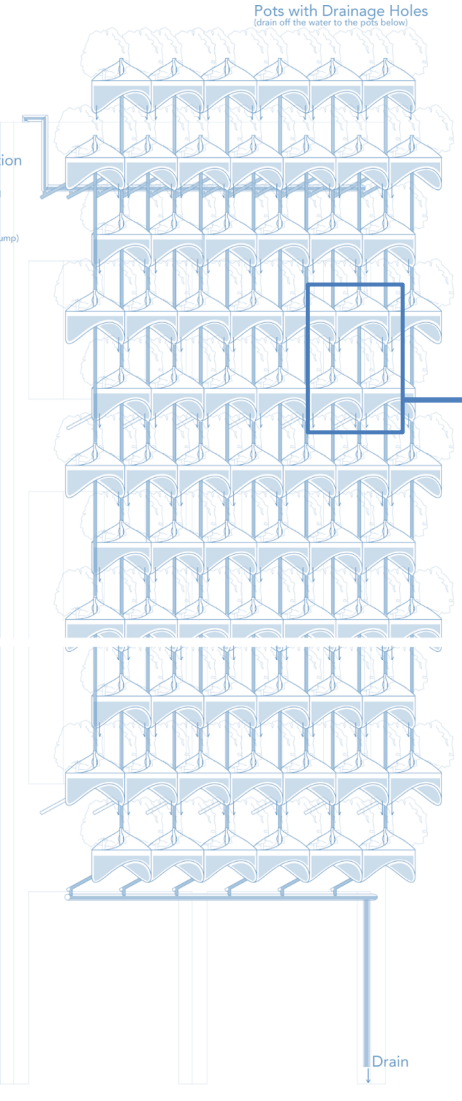
The green noise barrier system also reduces the direct solar exposure of the building envelope, thereby reducing the energy consumption of interior. Without this green barrier, the annual solar radiation absorption is 10378.29 kWh/m^2. After installing the green barrier, the direct solar radiation is reduced by 61.3% annually at the 0 degree. At 45 degrees, 59.8% of the solar radiation is reduced. At 90 degrees, 57.7% of the solar radiation is reduced.

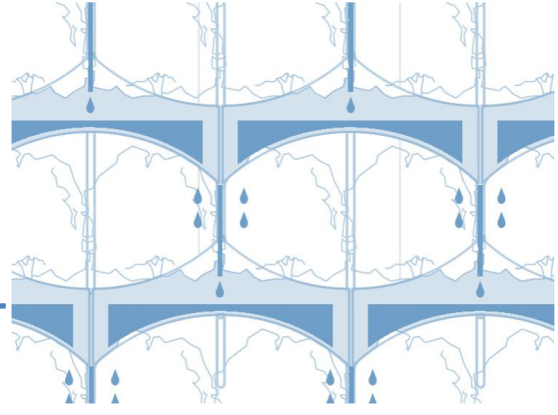


Indoor Natural Light Control – App & Personal Preference

The rotation can also be controlled through personal devices for better natural light adjustment of indoor spaces. The dwellers can check the energy and noise statistic information in the App and the prediction of the influence after their adjustment so they can find the perfect balance between personal preference and energy/noise benefit provided by the Sensitive Wall.

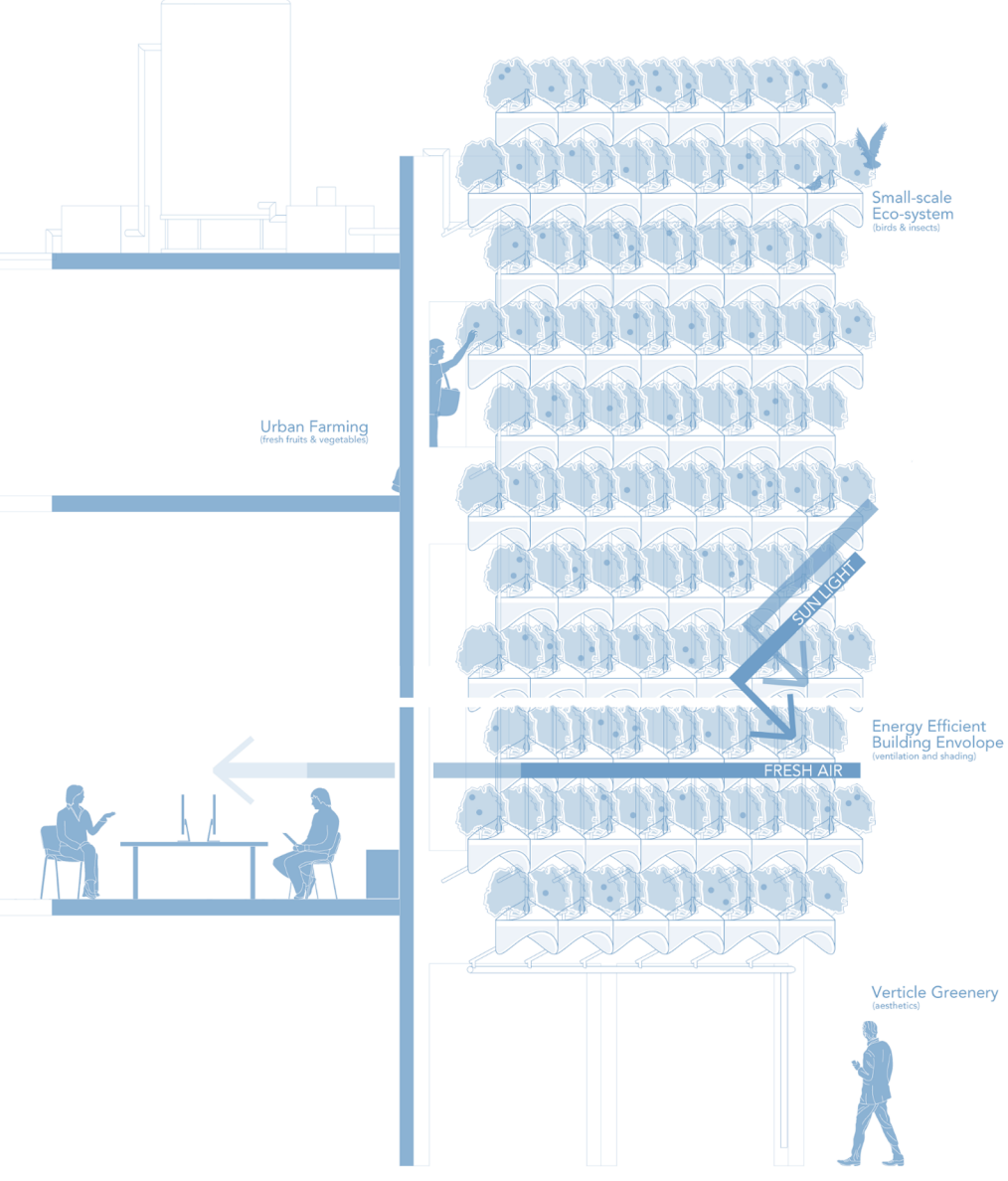






Rain Recycle & Irrigation System

Rainwater is collected and stored for irrigation. Timer is set to irrigate and fertilize at certain times automatically. Water can drip through the drainage hole on the bottom of the pot to the lower pot on the both sides.



Adaption of Nature's Unifying Patterns

The Sensitive Wall runs on information.

The main concept of the wall is to collect environmental information through sensors and respond to them.

The Sensitive Wall is locally attuned and responsive.

The wall was designed for tropical urban area to solve the problem caused by human activities and local climate. All the analyses were set in the real conditions of a building in New Taipei City to check its feasibility.

The Sensitive Wall uses shape to determine functionality.

The shape, color and material of pot unit were chosen for reflection, durability and evaporation reduction.

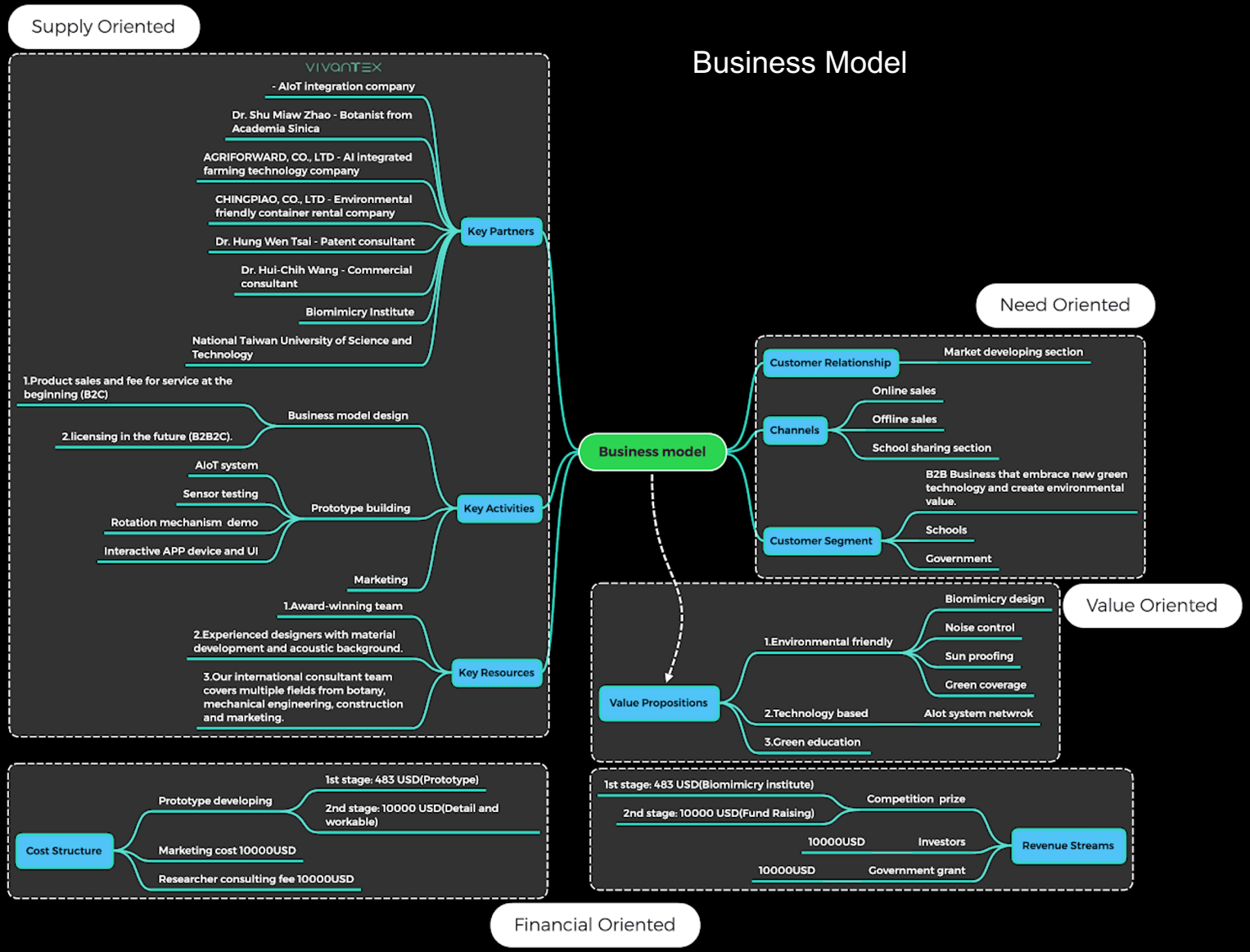
The Sensitive Wall is resilient to disturbances.

To face the most common disaster in Taiwan, typhoon, we kept the strategies of lightweight and simplicity when designed the wall system to prevent damage and hurting pedestrians.

The Sensitive Wall provides mutual benefits.

The sensitive wall provides better interior environment for attached building. It also plays an ecofriendly role in the urban space by reducing heat island effect and providing additional greenery.

Business Model



Master in Architecture
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Speciality Architectural theory
Sustainable design
Material development

Works 2016 Xin-xin Lab
2018 Mutang Bar
2018 Chinese Opera Base in the Hutong
2019 Liyang Tourist Center
2019 Longhuei Winery renovation
2019 Pavilion P

Ph. D student
-National Taiwan University of Science and Technology LEED AP BD+C

Speciality Architecture acoustic
Performance architecture
Parametric design
Sustainable design

Works 2019 National Tsing Hua University music department performance hall renovation
2019 Academia Sinica conference hall
2019 National Chiao Tung University Music performance hall renovation

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Consultant

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Hong Jiazhi
manager of Sheng Zhu Automation CO.
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Hong Yijin
experienced mechanical engineer

Li Weihan
licensed architect

Tang Ruojun
licensed architect

Liu Juhong
manager of Eurasia Ltd.
acoustic consultant

Eve Chiang
structural consultant

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