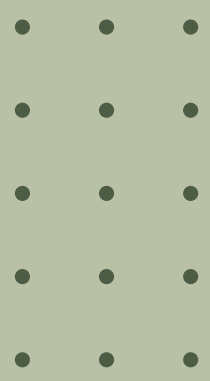
COCO CAI, JOCELYN EDDY & OMAR YUSSUF

Pervasive Media Exploration

Exploring the Ecological Interactions of the Common Mycorrhizal Networks through Robotics



“These fungal networks appear to redistribute the wealth of carbohydrates from tree to tree. A kind of Robin Hood, they take from the rich and give to the poor so that all the trees arrive at the same carbon surplus at the same time.”

Robin Wall Kimmerer - Potawatomi botanist

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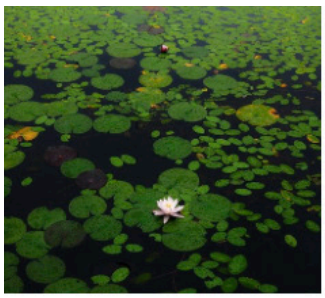
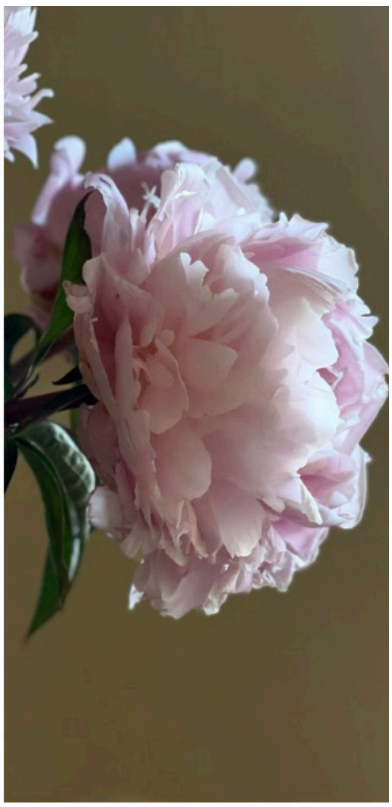
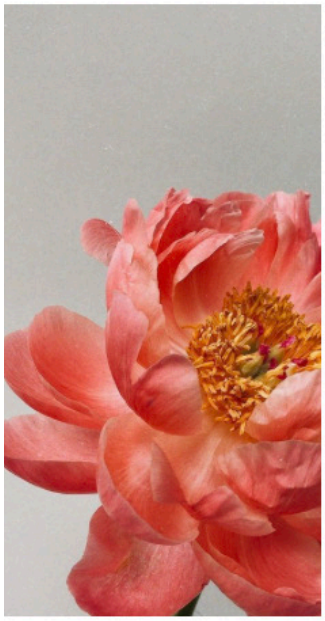
Our Concept

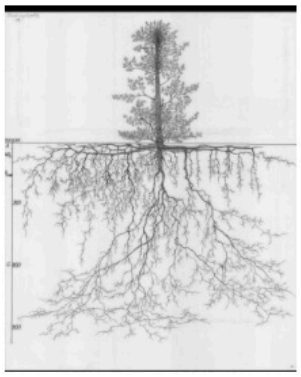
This project develops an interactive simulation inspired by mycelium-based communication, blending technology, art, and biomimicry and we feature a modular system where users send signals through a physical interface, prompting plant-like responses such as illuminated LED pathways, motorized movements, and other sensory outputs as a way to mimicking the decentralized flow of information found in fungal/floral networks and distributed computing, the simulation visualizes normally invisible biological processes.

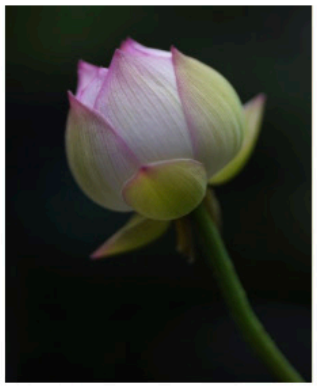
Beyond its technical scope, the installation serves educational, artistic, and scientific purposes in an attempt to making bio-communication systems tangible and encouraging reflection on ecological intelligence and nature-inspired design. By revealing parallels between organic and digital networks, it fosters dialogue on sustainability, interconnectedness, and emerging technologies. Additionally, the project explores new forms of human-computer interaction that integrate living and synthetic elements, contributing to fields like bio-HCI and biohybrid robotics.

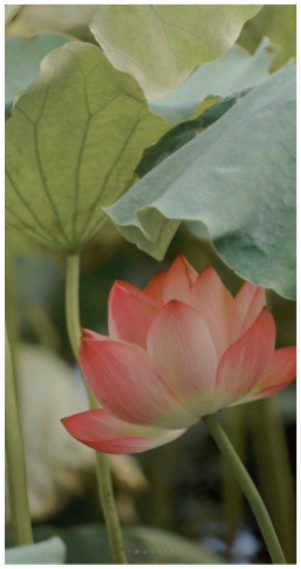


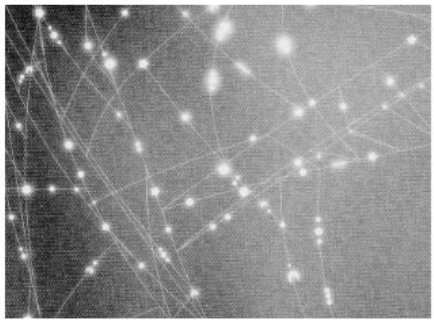


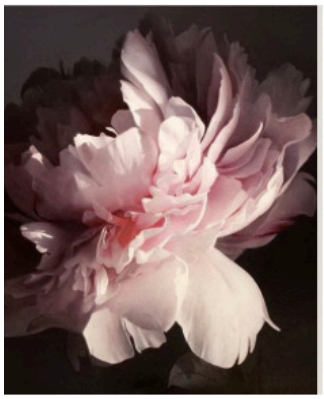


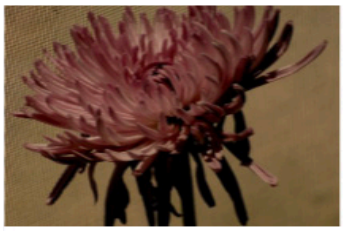


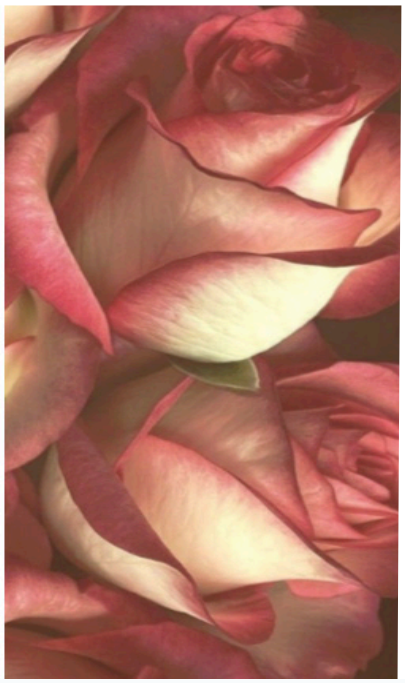


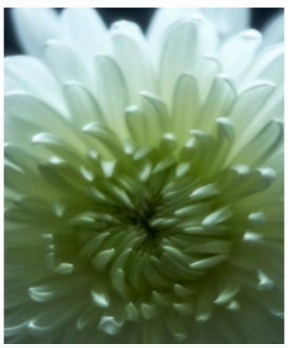


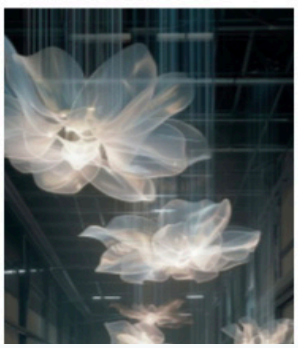






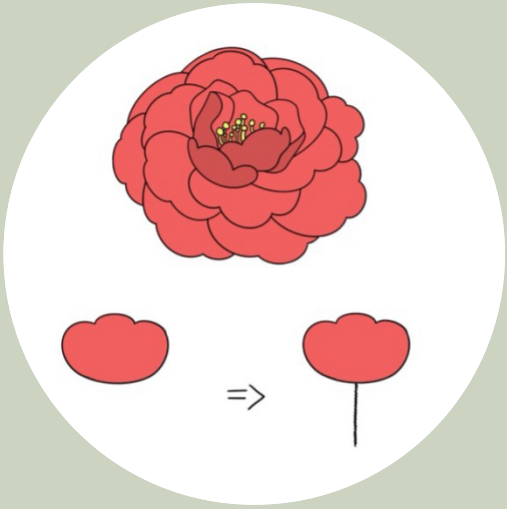






The Flowers

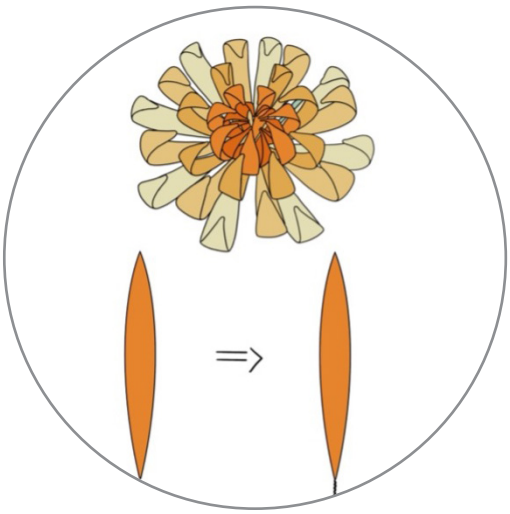
Through a programmable mechanical system, it is possible to replicate them flowering and responding dynamically to environmental changes, perfectly merging the beauty of nature with robotics. We can replicate the natural movements of petals unfolding layer by layer, slowly rotating, or gently swaying in the wind, increasing interactivity and viewing experience. Additionally a multi-layered mechanical construction can be utilized to manage the petals' slow blooming, replicating natural growth and giving it a more vibrant appearance. For example, it can cause flowers to gradually close and then blossom again, showing the theme of vitality and cyclical rebirth.



PEONY

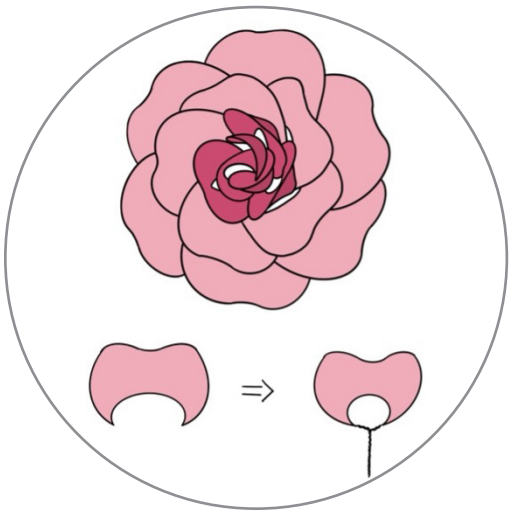
PAEONIA

THE STACKED PETALS OF THE PEONY CREATE A RICH THREE-DIMENSIONAL IMPRESSION



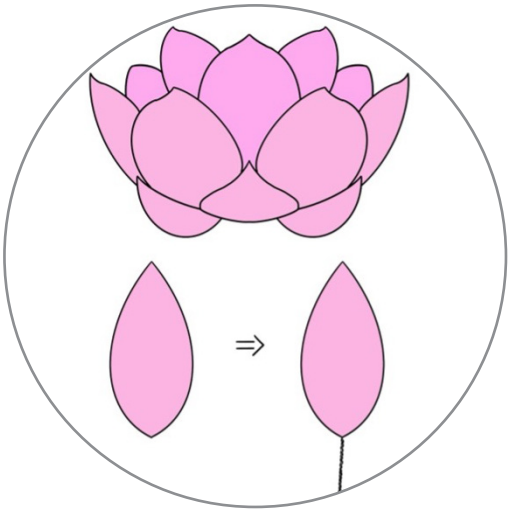
CHRYSANTHENUM

CHRYSANTHEMUM INDICUM
FEATURE A RADIAL PETAL ARRANGEMENT,
WHICH ALLOWS FOR A DYNAMIC LOOK
WITH SEVERAL LAYERS.



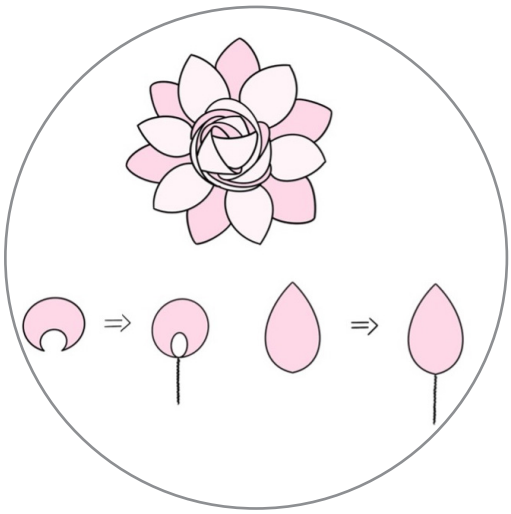
CHINESE ROSE

ROSA CHINENSIS
THE CHINESE ROSE HAS THE DISTINCT
FEATURE OF FLOWERING ONCE A MONTH.
IT CAN ENDLESSLY BLOOM, WITHER, AND
BLOOM AGAIN.



LOTUS

NELUMBO NUCIFERA
THE PETALS OF A LOTUS FLOWER OPEN
SEQUENTIALLY FROM THE OUTSIDE IN.



CAPE JASMINE

GARDENIA JASMINOIDES
GARDENIA PETALS ARE ORGANIZED UNI-
FORMLY AND CLOSELY, WITH A STRUCTURE
THAT UNFOLDS IN A SPIRAL PATTERN

Resource	Moisture	
Sensor	**DHT11** or **DHT22** humidity sensor	
How does it relate to the Common Mycorrhizal Networks	Water flows through the MCN, therefore if the amount of water in a plant has decreased, it will then increase the amount it takes from the flow, reducing the amount that the other plants will be able to receive.	
How does this resource impact the plant and its local environment.	Water makes up 80-95% of plants weight[29] and is necessary for transporting nutrients and maintaining turgor pressure[30], this is what helps the plant stand up without drooping. With reduced amounts of water, the processes of respiration, transpiration and photosynthesis are decreased.[31] Water aids in maintaining the temperature of plants and acts as a buffer.[32]	
Visible Observations	Lack of Water[33]	Excess Water[34]
	- Wilting - Yellow Leaves - Brown & Crispy leaves - Leaf Drop	- Roots become brittle and damaged - Root rot - Leaf Mold

Resource	Temperature	
Sensor	**DHT11** sensor	
How does it relate to the Common Mycorrhizal Networks	'Both mycorrhizal colonization levels and length of extraradical hyphae (ERH)'[47] increased as the temperatures got warmer. Additionally, every time the temperature drops by 10 degrees, the mycelium's ability to do chemical processes halves.[48] This affects how effective the communication between the plants is, it is necessary that the temperature remains optimum.	
How does this resource impact the plant and its local environment.	Whilst the temperature from day to night fluctuates, it is recommended that it only decrease by 10 to 15°C. Any extreme temperature change can lead to stress which can hinder the plants growth.[49] This increases their risk of disease. Warmer temperatures lead to more photosynthesis and respiration.[50] Additionally warmer soil temperature boosts the amount of water and nutrients absorbed.[51]	
Visible observations	Excessive Low Temperature[52]	Excessive High Temperature
	- Wilting - Red or purple discoloration - Plant turns mushy / black - Death of leaves, stems, or entire plants	- The leaves change angles and roll in on themselves.[53] - Wilting - Discolouration - Scorching

Resource	Air Flow
Sensor	Metal Pitot Tube, Acrylic 2.5mm ID Tubing, XGMP3v3 Differential Pressure Sensor[26]
How does it relate to the Common Mycorrhizal Networks	Whist the Air Flow doesn't directly impact the CMN, it stills influences the soil, which is where the processes occurring in the MCN are based. Where there is more air in the soil, it benefits the soil structure, soil biology and soil chemistry. This makes it easier for the plants to absorb the nutrients, water and oxygen.[27] It allows the transports of sugars from the plants to the MCN[28] to occur more effectively, improving their growth and ability to perform the necessary processes.
How does this resource impact the plant and its local environment.	When there are high amounts of air movement, it has a drying effect on the plants.[29] Therefore they require more water at shorter intervals. Without any air movement occurring the leaves become 'saturated with water vapour'[30]. This increases the risk of pathogen attacks as a warm and moist environment is the perfect place for bacteria to grow.[31] Overall this weakens the plant and can make it more susceptible to catching diseases which increases the likelihood of it spreading to the neighbouring plants[32].

Resource	Light	
Sensor	Grove Light Sensor	
How does it relate to the Common Mycorrhizal Networks	Depending on the type of light, different activity was promoted. For example, with Red Green LEDs, 'mycorrhizal development and nitrogen metabolism' increased improving the connections between the MCN and the plants. Whereas white increased the soil enzyme activities[41] which is very beneficial for nutrient cycling; the process where organic matter is converted into nutrients the plants can process. [42]	
How does this resource impact the plant and its local environment.	Light is used to regulate many of the physiological processes within plants. It is the main source of energy which is gained through the process of photosynthesis.[43] Therefore when the light decreases, so does photosynthesis. It is also a factor in 'germination, leaf proliferation and expansion', so without it the growth is slowed and stunted.	
Visible Observations	Lack of Light[44]	Excess Light
	- Dropped Leaves - Longer & thinner stems. - Turn from green to yellow to white. - Fail to produce flower buds.	- Scorched & Bleached leaves - Brittle[45]