

THESIS ROOTS

<https://class.textile-academy.org/2025/marcela-solis/>



Introduction



As environmental disconnection becomes increasingly common in contemporary urban life, designers are exploring new ways to reconnect people with the natural systems that sustain them. This project investigates the relationship between technology, the human body, and living ecosystems through the development of a wearable device capable of translating environmental information into sensory experiences.

Inspired by the complex structures and communication networks found in plant root systems, the wearable functions as an interface between humans and vegetation. Environmental data collected through light, color, and sound sensors are processed by a microcontroller and transformed into vibrations and light signals that allow users to perceive changes occurring within their surrounding ecosystem.

The project combines electronic prototyping with the development of experimental biomaterials derived from organic waste, seeking to create a physical language that reflects the textures, forms, and behaviors of natural growth. Through this integration of biological inspiration and digital technologies, the wearable challenges conventional notions of human–nature separation and proposes alternative forms of environmental awareness, empathy, and interaction.

Rather than serving as a monitoring tool alone, the device aims to foster an embodied relationship with living systems, encouraging users to experience plants not as passive objects but as active participants in shared ecological networks.

Problem Statement

The Body as a Node within More-than- Human Networks

Contemporary urbanization has intensified the separation between humans and the ecological systems that sustain life. As cities expand and biodiversity becomes increasingly scarce within everyday environments, ecological degradation is often accompanied by what environmental scholars describe as ecological amnesia: a gradual normalization of environmental loss that reduces awareness of disappearing ecosystems and species (Soga & Gaston, 2018). Vegetation becomes background scenery rather than an active participant in shared ecological processes, while the complex networks that sustain life remain largely imperceptible.

This condition is not solely ecological but also affective. Albrecht (2019) argues that environmental degradation transforms the emotional and psychological relationships people maintain with their surroundings. Through the concept of solastalgia, he describes the distress experienced when familiar environments undergo unwanted ecological transformation while individuals remain physically present within them. Solastalgia emerges when environmental loss is still perceptible; it is the emotional response to witnessing the degradation of places that once provided meaning, belonging, and ecological connection.

Ecological amnesia and solastalgia can therefore be understood as two stages within the same process of environmental disconnection. Solastalgia appears when ecological decline is recognized and felt. Ecological amnesia emerges when that decline becomes normalized to such an extent that loss itself is no longer perceived. Together, these conditions reveal how environmental degradation not only transforms ecosystems but also alters the human capacity to sense, remember, and relate to the living world.

The progressive disappearance of vegetation from urban environments exemplifies this process. As green spaces become fragmented or reduced, everyday interactions with plant life diminish. Vegetation is increasingly perceived as decorative infrastructure rather than as an active participant within complex ecological networks. The more-than-human relationships that sustain urban life become obscured, contributing to a diminished awareness of ecological interdependence.

This project responds to these conditions through the concept of relationality, understood as a mode of existence in which bodies, environments, technologies, and living systems are constituted through ongoing interactions rather than existing as autonomous entities. Drawing upon plant thinking (Marder, 2013), the research challenges anthropocentric assumptions regarding intelligence, agency, and community by proposing vegetal life as a model of decentralized, interconnected, and distributed existence.

Plants offer an alternative ontology of coexistence. Unlike models centered on individual autonomy, vegetal life operates through networks of exchange, mutual dependence, and distributed sensing. From this perspective, existence is not defined by isolated entities but by the relationships that connect bodies, environments, atmospheres, technologies, and living systems. The project therefore investigates how these vegetal logics might inform new forms of ecological perception and collective awareness.

Rather than conceptualizing the body as an isolated individual, the research approaches the body as a node embedded within a more-than-human network of relations. Interactive technology is employed not as a mechanism of control over nature but as a medium through which ecological relationships can become perceptible. Through environmental sensing and embodied feedback systems, indicators associated with vegetal presence—including color frequencies, luminosity, atmospheric conditions, and environmental soundscapes—are translated into sensory experiences that reveal otherwise invisible ecological interdependencies.

Importantly, the system does not directly detect plants. Instead, it infers vegetal presence through environmental proxies associated with vegetation and transforms these signals into haptic and visual responses. The objective is not scientific measurement but ecological attunement: creating conditions through which participants can become more aware of the living systems that surround them.

The wearable therefore operates as a relational interface rather than a representational device. By translating environmental conditions into embodied sensations, it seeks to reactivate perceptual capacities diminished by ecological amnesia while responding to the affective disconnection described by solastalgia. Positioned between sensing and speculation, the project explores how technology might mediate awareness of interdependence rather than domination.

Ultimately, the research proposes that rebuilding the collective requires moving beyond exclusively human-centered understandings of community. Inspired by vegetal forms of coexistence, it imagines collective life as an ecological condition emerging from continuous interactions among human and non-human actors. By making hidden relations perceptible, the wearable opens a space for reflecting upon responsibility, coexistence, and the possibility of constructing more sustainable futures grounded in more-than-human networks of care and mutual dependence.

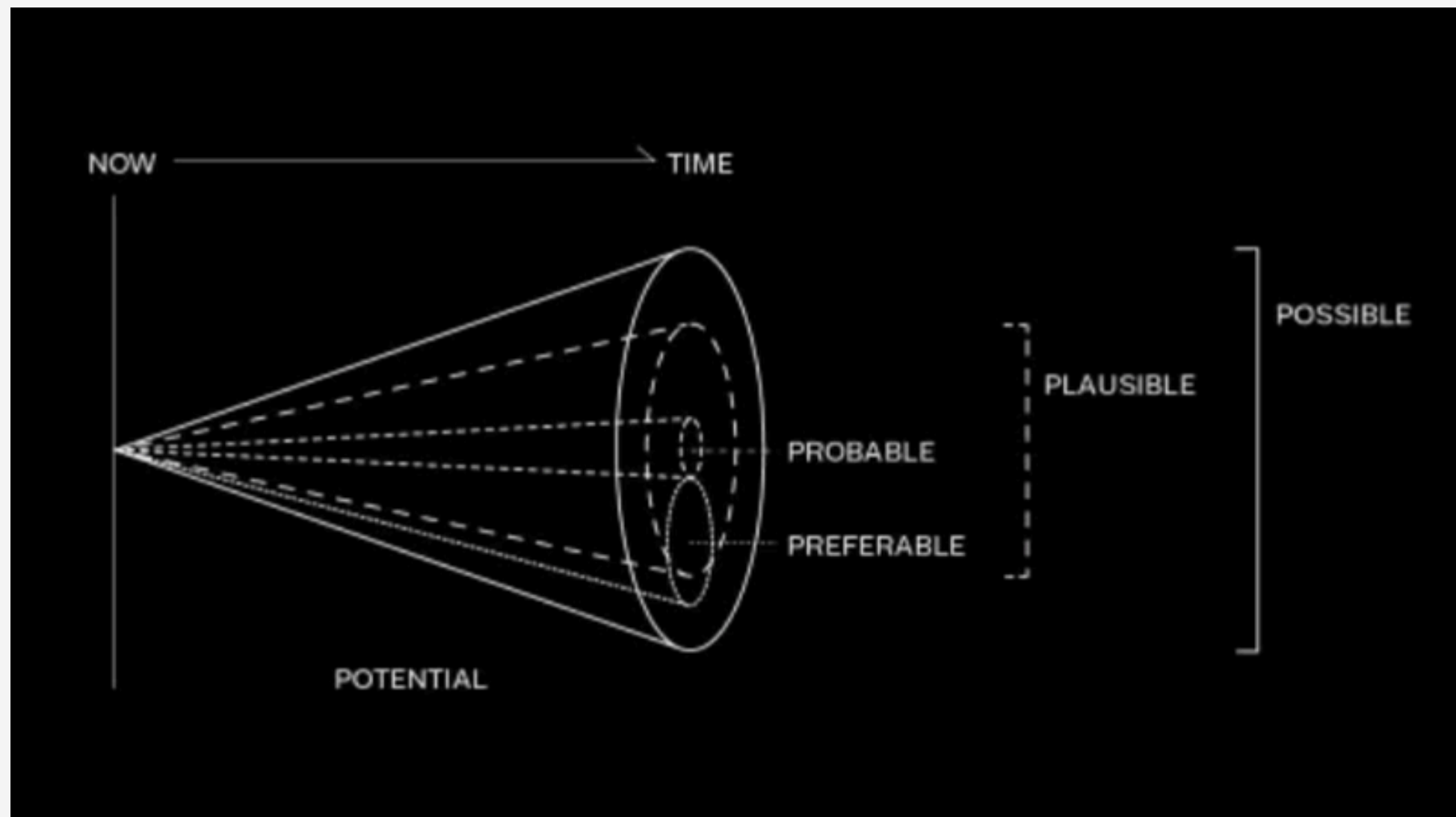
Research Question

The project emerges from the following research question:

What would happen if the human body could directly perceive the presence and intensity of vegetation within urban environments?

This question seeks to explore whether embodied interaction with environmental data can foster ecological awareness and reveal hidden relationships between humans and surrounding ecosystems.

Futures Design Methodology



This research adopts a Futures Design methodology to investigate alternative relationships between humans, technologies, and ecological systems. Futures Design moves beyond conventional problem-solving approaches by employing speculative scenarios to explore possible futures and challenge dominant assumptions regarding society, technology, and nature (Hichert & Schultz, 2024). The methodology begins with the identification of ecological amnesia as a contemporary condition associated with urbanization and biodiversity loss. From this diagnosis, speculative scenarios are developed based on vegetal principles of coexistence, including decentralization, distributed sensing, and mutual dependency. Wearable prototypes function simultaneously as design artifacts and research instruments. Through environmental sensing and responsive interactions, they materialize possible futures in which technology supports ecological perception rather than resource extraction or environmental control. Within this framework, Futures Design becomes a critical practice capable of imagining and prototyping alternative forms of coexistence where humans participate as components of broader ecological networks.

Figure 1. Hichert, T., & Schultz, W. (2024). Futures studies methods: A typology and guide to research design.



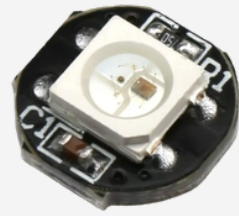
Design Proposal

The proposed system consists of a wearable interface designed to infer the presence of vegetation through environmental indicators and translate this information into bodily sensations.

Rather than directly measuring plants themselves, the system identifies environmental characteristics commonly associated with vegetation, including dominant green wavelengths present within outdoor environments. These indicators are interpreted collectively to estimate the relative presence of surrounding plant life.



TCS34725 RGB Color Sensor



NeoPixel LEDs



Vibration motors



ESP32 Development Board

The prototype integrates:

- TCS34725 RGB Color Sensor for detecting variations in green color frequencies commonly associated with foliage and other environmental indicators related to vegetal presence.
- ESP32 Development Board as the primary processing and communication unit, responsible for interpreting sensor data, managing system behavior, and enabling future wireless connectivity between devices.
- NeoPixel LEDs for generating dynamic visual feedback based on environmental conditions.
- Vibration motors for providing haptic feedback that translates environmental information into embodied sensory experiences.

Environmental data collected through the sensing system are processed by the ESP32 and transformed into patterns of light and vibration. Rather than directly detecting plants, the system infers the presence of vegetation through environmental proxies and translates these signals into sensory outputs that allow users to experience ecological conditions through their bodies.



NeoPixel Led

TCS34725 RGB Color
Recognition Sensor

Esp12E NodeMcu

Methodological Considerations

A critical distinction within the project concerns the relationship between sensing and interpretation. The system does not detect vegetation directly; rather, it infers vegetal presence through environmental proxies. This distinction is important because the wearable is not intended to produce objective ecological measurements comparable to scientific monitoring equipment.

Instead, the project adopts a research-through-design approach in which environmental sensing serves as a catalyst for perception and reflection. The goal is not to establish exact vegetation density but to create conditions through which participants can become more attentive to ecological relationships that are typically overlooked in everyday urban life.

From this perspective, the wearable operates as a device for ecological mediation. Its value lies not in the accuracy of environmental classification but in its capacity to render ecological interdependence experientially accessible through embodied interaction.

Example of Environmental Interpretation

Environment	Environmental Indicators Detected	Inferred Vegetation Presence	Wearable Response
Dense urban avenue	Low green reflectance, high artificial light, traffic noise	Low	Sensory silence or minimal pulses
Urban park	Moderate green reflectance, balanced luminosity, mixed	Medium	Soft rhythmic pulsations
Botanical garden or forested area	High green reflectance, filtered natural light, ecological soundscape	High	Continuous breathing-like light and vibration patterns

Rather than producing ecological measurements, these responses create what may be described as a sensory cartography of urban ecological conditions, enabling participants to experience environmental gradients through the body.

Theoretical Framework

From Anthropocentrism to More-than-Human Perspectives

For centuries, Western thought has been structured around an anthropocentric worldview that places humans at the center of value, knowledge, and agency. This perspective has shaped not only philosophy and science but also design practices and technological development, where nature is often conceived as a resource available for human use and exploitation (Escobar, 2018; Fry, 2020).

Contemporary ecological crises have exposed the limitations of this paradigm. Climate change, biodiversity loss, and ecosystem degradation have encouraged the emergence of theoretical approaches that challenge the separation between nature and culture, proposing alternative ways of understanding relationships between humans and non-humans. Among these approaches are posthumanism, multispecies studies, and more-than-human design, which recognize that life unfolds through complex networks of interdependence in which multiple agents participate in shaping the shared world (Giaccardi & Redström, 2020; Niceboim et al., 2024).

From this perspective, design moves beyond an exclusive focus on human needs to consider the capacities, vulnerabilities, and modes of existence of other living beings. The goal is no longer limited to creating functional objects but extends to generating conditions for more sustainable and equitable forms of coexistence.

Plant Thinking and Vegetal Ontology

One of the most significant contributions to challenging anthropocentrism comes from the philosophy of plant life developed by Michael Marder (2013). In *Plant-Thinking: A Philosophy of Vegetal Life*, Marder proposes reconsidering plants not as passive organisms but as forms of life that possess unique modes of perception, adaptation, and environmental engagement.

Plant thinking does not suggest that plants think in the same way humans do. Rather, it invites a reconsideration of traditional notions of intelligence, agency, and subjectivity. Plants operate through distributed systems without a centralized organ equivalent to a brain. Their survival depends upon decentralized processes of communication, adaptation, and cooperation with other organisms. This condition is particularly relevant for rethinking the concept of collectivity. Whereas modern social models privilege individual autonomy and centralized forms of organization, plants constitute dynamic networks based on interdependence and collaboration. Their existence relies on continuous relationships with microorganisms, fungi, insects, animals, and atmospheric conditions, creating an ecology of connections in which no element can be understood in isolation.

From this perspective, vegetal life offers both an operational metaphor and an ontological framework for imagining alternative forms of coexistence grounded in reciprocity and mutual dependence.

Relationality and Interdependence

Relationality constitutes one of the central concepts of this research. Relationality proposes that beings do not first exist independently and then enter into relationships; rather, they are constituted through the relationships they establish with others and with their environments (Escobar, 2018).

This perspective challenges modern notions of the autonomous subject and instead understands existence as an ongoing process of interaction. From this viewpoint, the human body cannot be understood as an isolated entity but as a node within a broader network composed of living organisms, infrastructures, technologies, atmospheres, and ecosystems.

Plants provide a paradigmatic example of this relational condition. Their growth depends on continuous exchanges with soil, water, sunlight, and numerous associated organisms. Similarly, humans participate in complex ecological networks that often remain invisible within contemporary urban environments.

Relationality therefore becomes a conceptual tool for questioning individualistic understandings of existence and exploring modes of life grounded in ecological interdependence.

Ecological Amnesia and Solastalgia

Accelerated urbanization has profoundly transformed relationships between people and ecosystems. As biodiversity disappears from everyday experience, the capacity to perceive this loss also diminishes. This phenomenon has been described as ecological amnesia, or the shifting baseline syndrome, which explains how each generation comes to accept increasingly degraded environmental conditions as normal when compared to those experienced by previous generations (Soga & Gaston, 2018).

Ecological amnesia is not simply a lack of environmental information; it represents a diminished sensitivity to ecological change.

Environmental degradation becomes invisible because it occurs gradually and continuously over time.

Complementing this perspective, Glenn Albrecht (2019) introduced the concept of solastalgia to describe the distress experienced when familiar environments undergo negative ecological transformation. Unlike nostalgia, which involves longing for a place left behind, solastalgia emerges when one remains physically present while the surrounding environment changes and deteriorates.

These concepts can be understood as different stages of the same process of environmental disconnection. Solastalgia arises when ecological loss is still perceptible and emotionally experienced.

Ecological amnesia emerges when that loss has become normalized to the point of invisibility.

Within this context, technology may play an important role in reconstructing ecological sensitivity. Rather than merely providing additional environmental information, technological systems can contribute to restoring perceptual capacities that enable people to recognize their dependence upon living systems.

More-than-Human Design and Technologies for Ecological Perception

More-than-human design seeks to expand the traditional boundaries of design by acknowledging that objects, systems, and services affect not only humans but also multiple forms of non-human life (Jalali & Gholami, 2023; Niceboim et al., 2024).

Within this framework, technology is no longer understood exclusively as a tool for controlling or exploiting nature. Instead, it can function as an interface capable of mediating relationships among different forms of life and making otherwise imperceptible phenomena accessible to perception.

Several scholars have emphasized the need to develop technologies that foster ecological attention, environmental awareness, and interspecies coexistence. Such approaches aim to transform relationships between humans and ecosystems through experiences that reveal the hidden interdependencies embedded within everyday life.

This research positions itself within this emerging field by exploring how a wearable system can translate environmental indicators associated with vegetal presence into embodied sensory experiences. Through vibrations, light patterns, and haptic responses, the device does not seek to scientifically measure nature but rather to create conditions for an expanded perception of ecological relationships.

Technology, the Body, and Expanded Perception

The body constitutes the primary medium through which humans experience the world. Yet many of the ecological processes that sustain life remain beyond direct sensory perception. Environmental quality, biological activity, and the presence of vegetation are often experienced indirectly or only partially.

Wearable technologies offer opportunities to extend the body's perceptual capacities through sensing systems and sensory feedback mechanisms. By translating environmental information into tactile, visual, or auditory stimuli, such devices can generate new modes of engagement with the surrounding environment.

In this research, the wearable is conceived as a relational interface inspired by vegetal logics. The body no longer occupies a central and dominant position but becomes a sensitive node within a broader network of ecological interactions. Technology therefore acts as a mediator of an experience intended to make the interdependence between humans, plants, and environments perceptible.

Importantly, the system does not directly detect plants. Instead, it infers vegetal presence through environmental proxies such as green spectral frequencies, ambient light conditions, and environmental soundscapes associated with vegetation. These signals are translated into embodied sensory experiences that encourage ecological awareness rather than objective environmental measurement.

Conceptual Synthesis

The articulation of plant thinking, relationality, ecological amnesia, solastalgia, and more-than-human design provides the conceptual foundation for understanding the proposed wearable system. The project is grounded in the premise that the contemporary ecological crisis is not solely an environmental crisis but also a crisis of perception and relationship.

In response, this research explores how interactive technologies can contribute to rebuilding ecological sensitivity through models inspired by vegetal coexistence. Rather than representing nature, the wearable seeks to make perceptible the relationships that constitute humans as participants within a shared living network. By translating environmental conditions into embodied experiences, the project aims to foster forms of collective awareness grounded in interdependence, reciprocity, and more-than-human coexistence.

Development of the Root-Inspired Wearable System

Roots as a Model of Relationality

The development of the wearable system began with an exploration of plant roots as both a biological phenomenon and a conceptual model. Previous experimentation with root growth had demonstrated their accessibility as a living material and revealed their potential as a metaphor for distributed forms of organization. Unlike centralized systems, roots operate through networks of connection, communication, and resource exchange that remain largely invisible beneath the soil surface. Their structure embodies forms of interdependence that challenge individualistic conceptions of agency and autonomy.

This characteristic resonated with the theoretical foundations of the project, particularly with notions of relationality and more-than-human coexistence. Rather than understanding existence as the property of isolated entities, the project draws from vegetal ontologies that conceive life as emerging through continuous interactions among organisms, environments, and material systems. Consequently, roots became both a visual language and a methodological framework for imagining how bodies, plants, technologies, and environments might be understood as components of the same ecological network.

The initial experiments focused on observing root growth inside controlled environments, documenting how roots expanded, intertwined, and adapted to spatial constraints. These observations informed the project's understanding of growth as a dynamic and relational process rather than a predetermined form.

Design References and Biofabrication Approaches

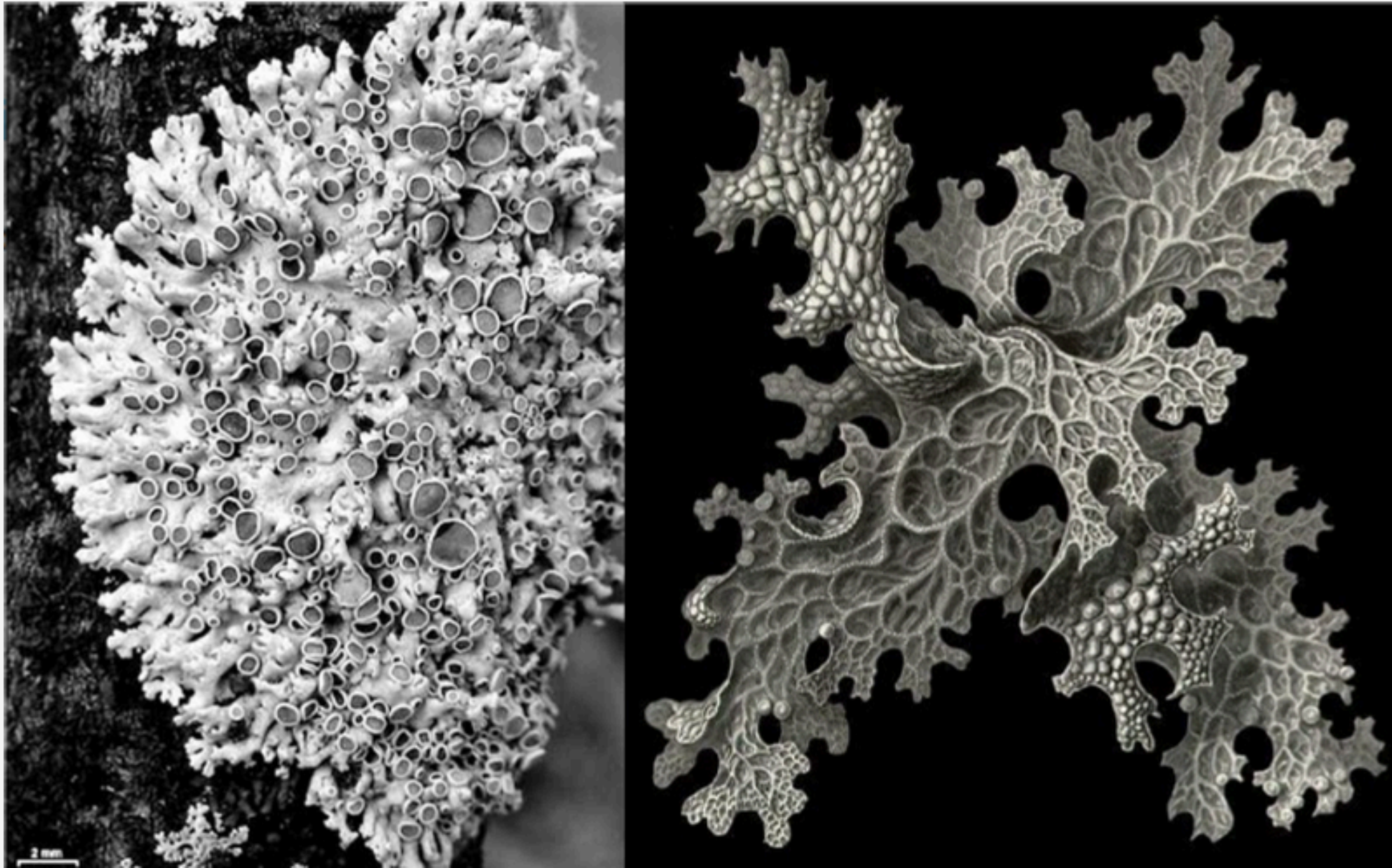
An important reference for the project was the work of Rootfull, the design studio founded by Zena Holloway. Rootfull develops lighting and sculptural objects through guided root growth, using beeswax molds to direct the development of living root systems into complex organic structures. Rather than extracting materials from nature, the process collaborates with biological growth itself, proposing an alternative model of production based on regeneration and ecological participation.

Additional influences emerged from research in root-based biofabrication and biohybrid design systems. Projects such as Flora Robotica and ReRoot demonstrate how plants and technological systems can operate together as active participants in the construction of responsive environments. These approaches challenge traditional human-centered design paradigms by recognizing non-human organisms as agents capable of contributing to the generation of form, behavior, and environmental interaction.

Collectively, these references reinforced the project's central proposition: technology should not function as a mechanism that separates humans from nature, but rather as an interface capable of revealing and mediating ecological relationships that often remain imperceptible.



Figure 2: Biocouture inspired by the organic structures developed by [Rootfull](#).



Translating Moss Growth into Fabrication Geometry

The design process began with the search for a natural growth pattern capable of expressing the project's interest in relationality and distributed networks. Particular attention was given to moss growth because of its capacity to spread across surfaces through interconnected and non-hierarchical formations. Moss does not expand according to a centralized logic; instead, it develops through multiple points of growth that collectively form continuous networks. This characteristic closely aligned with the project's conceptual framework and offered a visual representation of interconnected ecological systems.

Figure 3: Moss growth pattern used as visual reference for the root growth design..

Photographic references of moss formations were digitally processed using Adobe Photoshop. Through posterization techniques, the images were transformed into simplified high-contrast compositions that emphasized structural relationships rather than surface detail. This abstraction process enabled the identification of pathways, nodes, and branching patterns that could later guide the development of the physical structure.

The resulting compositions were imported into Rhinoceros 3D, where they were translated into digital geometries suitable for fabrication. Initial explorations considered the development of a three-dimensional mold through additive manufacturing and casting techniques. However, the complexity of root extraction and the unpredictable behavior of living roots within enclosed volumes revealed significant practical limitations. Consequently, the design strategy shifted toward a two-dimensional topology that would allow roots or root-inspired materials to develop across an open surface. This adaptation transformed the design from a contained object into a landscape-like structure composed of interconnected channels and voids.

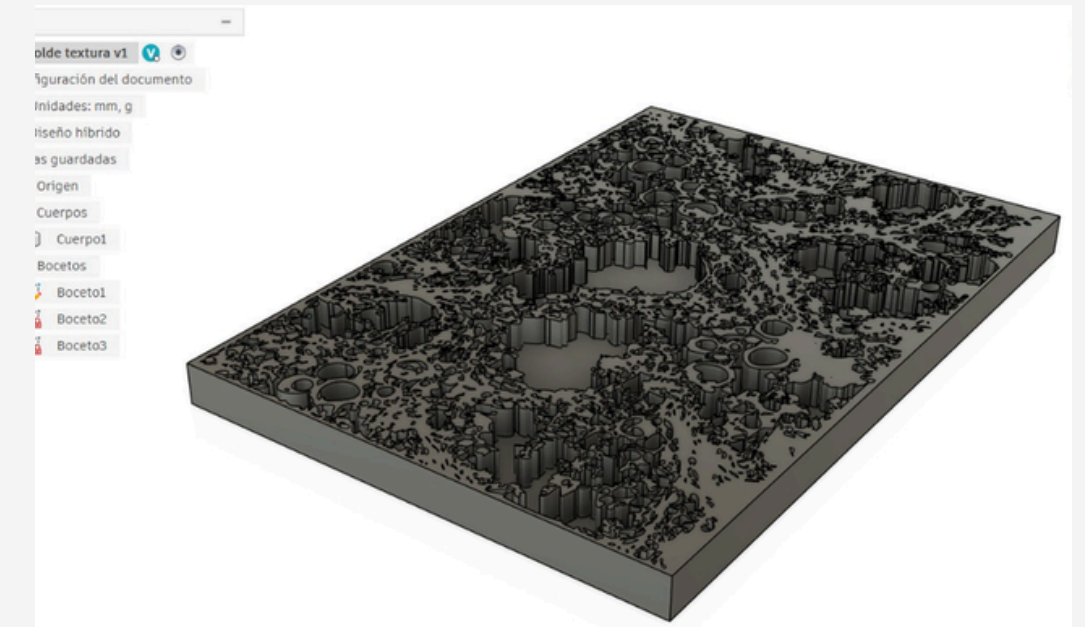
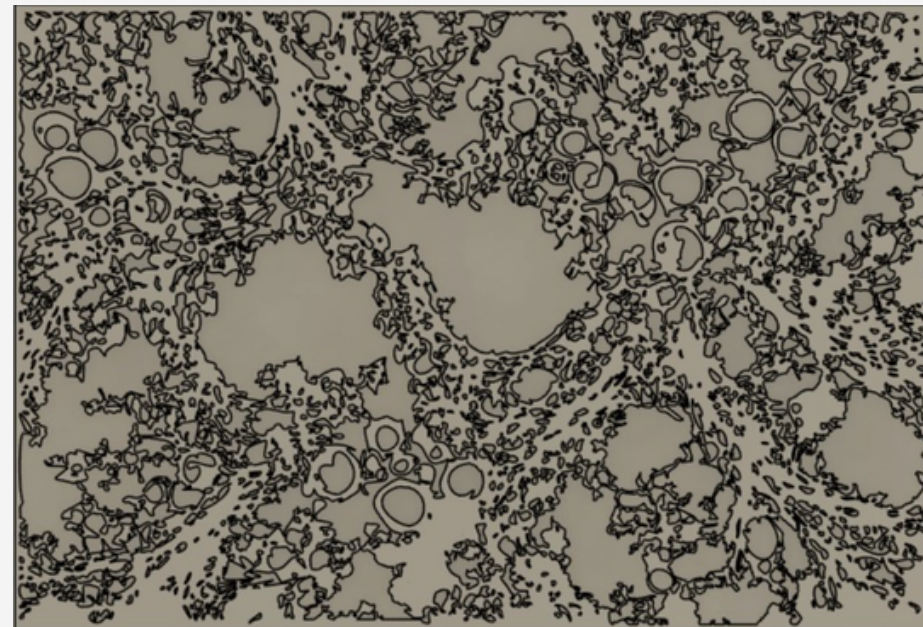
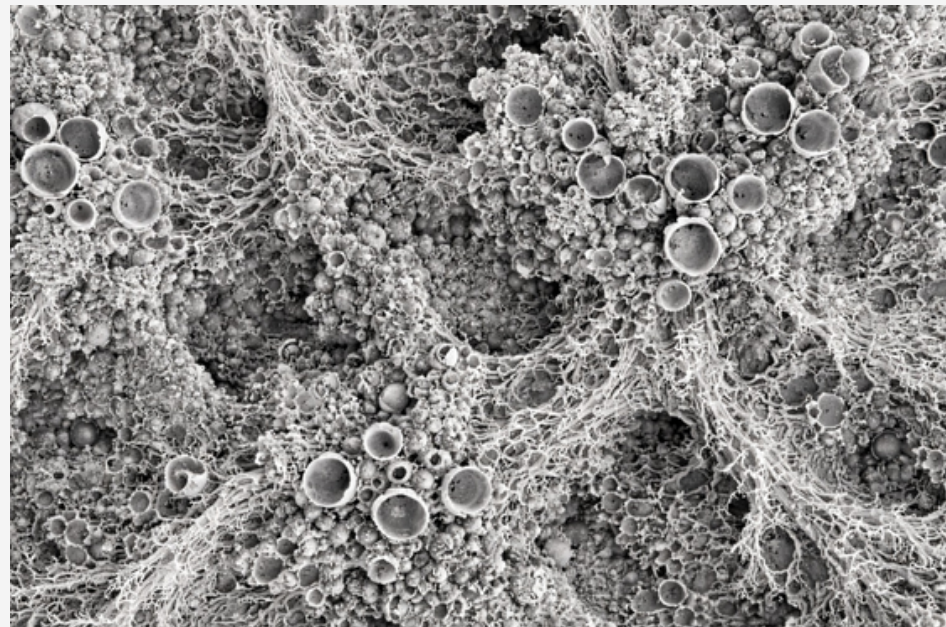


Figure 4. Photoshop posterization process applied to moss reference images to extract abstract growth patterns, and : Redesigned flat pattern prepared for CNC routing, showing perforated channels and voids. .



CNC Fabrication and Process Adaptation

The final geometry was fabricated using CNC routing technology. A wooden panel measuring approximately 50 × 90 cm was machined to a depth of 1.5 cm using a 1/8-inch milling tool. Due to the complexity of the pattern and the density of the material, the fabrication process required approximately eighteen hours of continuous machining.

The resulting structure reproduced the branching logic derived from moss growth while providing a physical substrate capable of guiding future biological development. Originally, the mold was intended to serve as a positive form for thermoforming a polypropylene sheet through vacuum forming techniques. To facilitate this process, multiple perforations were added to the surface in order to allow airflow during vacuum generation. However, technical limitations associated with the thermoforming equipment prevented the successful production of the intended mold.

Rather than considering this outcome a failure, the project adapted its methodology and transformed the wooden structure into an active cultivation environment. This shift aligned with the broader objectives of the research by allowing the fabrication platform itself to participate directly in biological growth processes.

Figure 5. Completed CNC-milled wooden mold showing the moss-inspired pattern..

Root Cultivation Experiments and Biological Limitations

May 2026

The cultivation phase involved introducing chia seeds into the CNC-milled structure and maintaining continuous humidity conditions to stimulate germination and root development. The objective was to allow living roots to occupy and reinforce the networked geometry generated through digital fabrication.

However, the experiment revealed one of the central challenges of working with living systems: biological processes cannot be entirely controlled. The humidity required for seed germination also created favorable conditions for fungal proliferation. Contamination spread rapidly throughout the structure and inhibited healthy root growth before a stable root network could be established.

Although the cultivation experiment did not produce the anticipated results, it generated valuable insights regarding the unpredictability, vulnerability, and agency of biological materials. Rather than viewing contamination as a failure, the process highlighted the complex ecological relationships involved in biofabrication and reinforced the project's interest in adaptation as a design strategy.



Figure 6. Fungal contamination developing in the humidified wooden mold with chia seeds..



Figure 7. Shift toward biomaterials resembling root systems after cultivation setbacks..

Development of Root-Inspired Biomaterials

In response to the cultivation challenges, the project shifted toward the development of biomaterials capable of visually and materially evoking root structures. This transition allowed the conceptual investigation to continue while accommodating practical constraints. A gelatin-based formulation was developed using water, gelatin, glycerin, vinegar, and plant waste. The resulting material demonstrated strong adhesion to the fabricated mold while generating textures that visually resembled intertwined root systems. Multiple layers were applied in succession to achieve sufficient coverage and structural continuity across the surface. The experimentation also incorporated cempasúchil (*Tagetes erecta*) flower waste. Beyond its cultural significance within Mexican contexts, cempasúchil provided pigmentation, fiber reinforcement, and visual complexity. The resulting biomaterial exhibited semi-translucent properties that allowed embedded plant matter to remain visible within the matrix.

Parallel experiments explored henequen fibers as a means of reproducing the fibrous qualities of root systems. These tests expanded the range of material possibilities available for integrating electronics while maintaining a visual connection to vegetal growth patterns.

The biomaterial development process became an essential component of the research, demonstrating how material experimentation can function as a form of inquiry into relationships between aesthetics, biological matter, and technological integration.

Electronic Sensing and Environmental Interaction

May 2026

The wearable system integrates environmental sensing technologies to establish a responsive relationship between the body and surrounding vegetation. The electronic architecture combines a TCS34725 RGB color sensor, an ESP32 microcontroller, NeoPixel LEDs, and vibration-based feedback systems.

The TCS34725 sensor continuously analyzes ambient color information but has been specifically programmed to prioritize green frequencies associated with foliage. Rather than functioning as a botanical identification tool, the sensor operates as a proxy for detecting environmental conditions linked to the presence of vegetation.

Data collected by the sensor are processed by the ESP32 microcontroller, which translates variations in green intensity into dynamic visual responses. Deeper and darker greens generate subtle light emissions, while brighter and more saturated greens activate more intense illumination patterns.

The NeoPixel LEDs are embedded throughout the wearable structure and programmed to produce gradual transitions, smooth fading effects, and rhythmic pulsations. These behaviors intentionally avoid abrupt technological aesthetics and instead emulate the temporal qualities associated with biological processes.

Through this interaction, environmental information is transformed into embodied sensory experiences. Users do not receive numerical data about vegetation; rather, they perceive ecological conditions through changing rhythms of light and vibration.

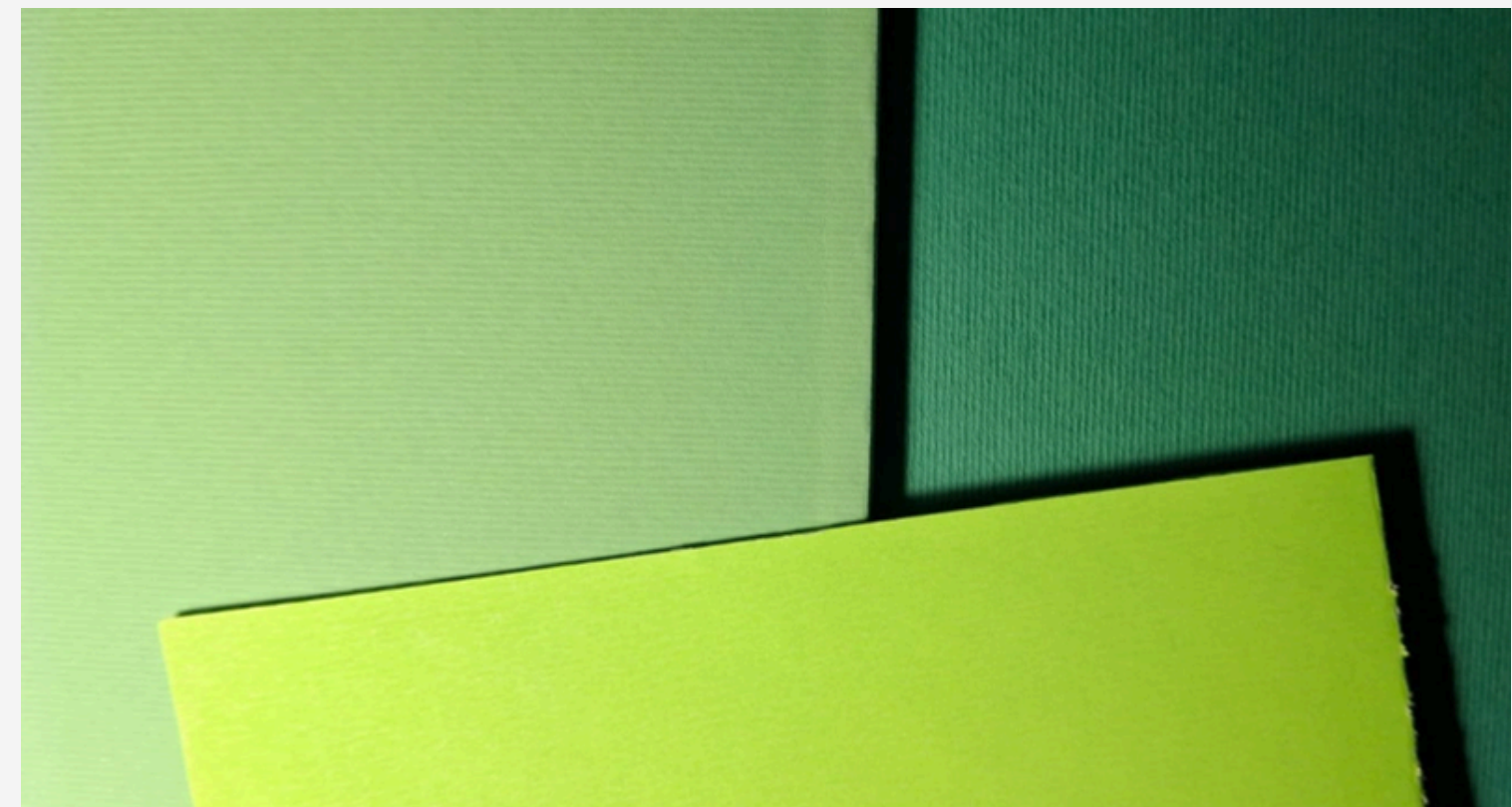
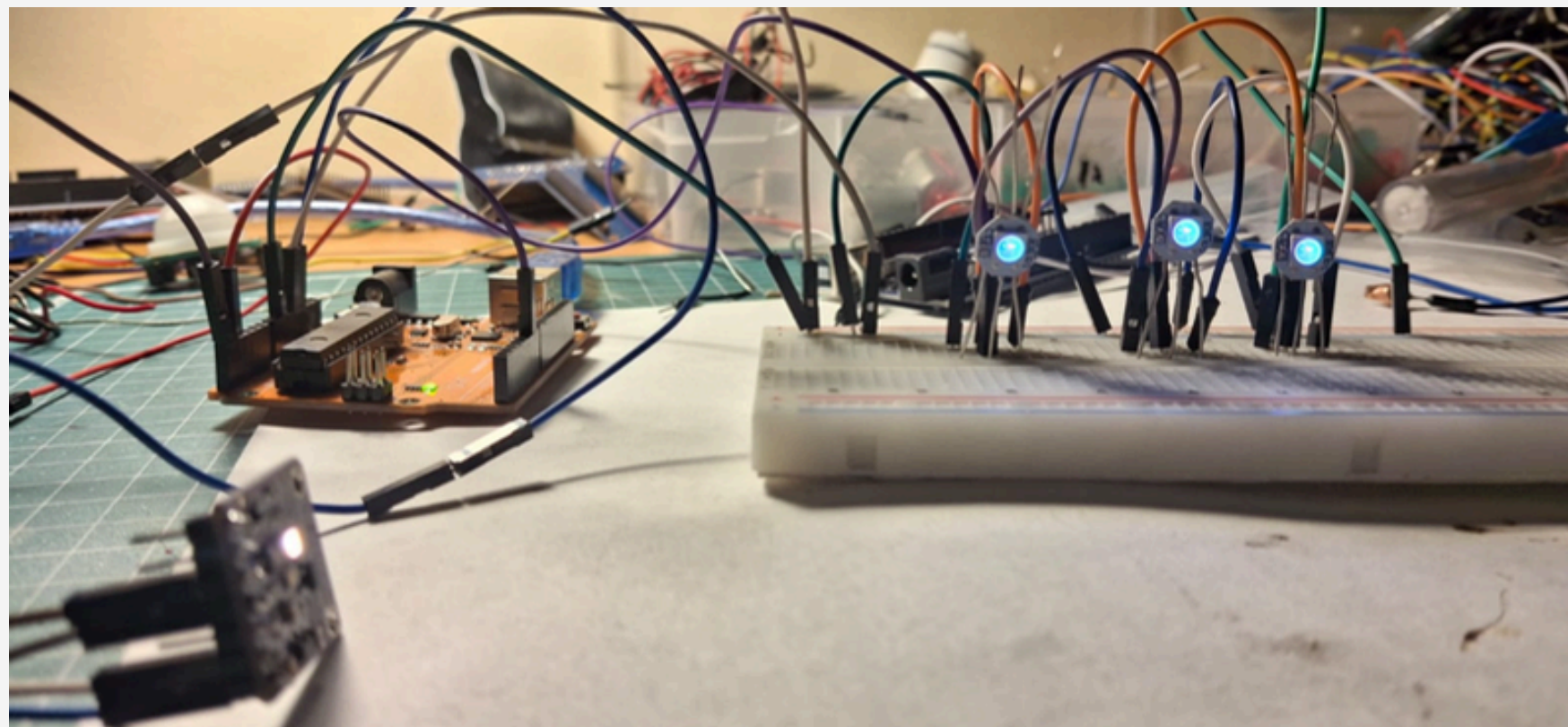


Figure 8. Breadboard prototyping and testing phase used to program and evaluate color responses. The circuit was configured to control the LEDs and explore different color outputs based on sensor inputs.



Wearable Development and Integration

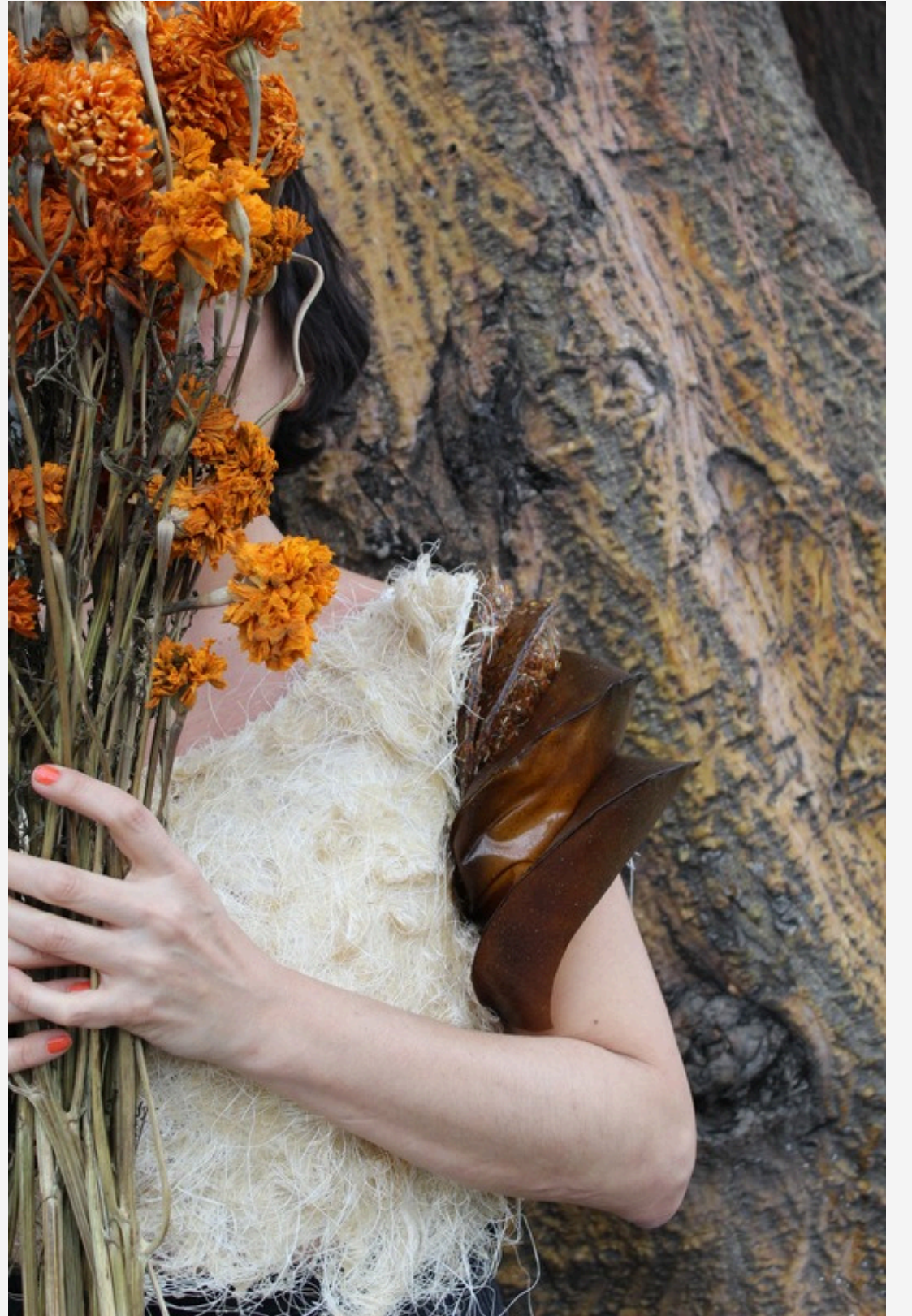
The wearable underwent multiple iterations throughout the design process. Initial prototypes successfully conveyed the desired organic aesthetic but presented excessive surface texture and limited integration between materials and electronics.

Subsequent iterations refined the distribution of biomaterials, improved structural coherence, and optimized the placement of sensors, microcontrollers, conductive pathways, and light-based outputs. This process resulted in a closer integration between technological components and root-inspired forms.

The final wearable operates as a speculative interface for ecological perception. Inspired by the distributed intelligence of root networks, the system transforms environmental signals into sensory experiences that encourage awareness of otherwise invisible ecological relationships. Rather than positioning technology as a tool for control or extraction, the project proposes technology as a mediator of relational awareness, enabling users to experience themselves as participants within broader more-than-human networks of coexistence.







Conclusion

his project explored how wearable technology, biomaterials, and environmental sensing can foster awareness of ecological interdependence through embodied experience. Inspired by plant thinking and more-than-human design, the wearable translates environmental conditions into light and vibration, positioning the body as a node within a broader network of relationships between humans, plants, technologies, and environments.

Yet one of the most meaningful outcomes emerged from what did not happen. The original intention was to cultivate living roots within the fabricated structure, allowing growth itself to become part of the material system. However, the seeds failed to develop, fungal contamination spread, and the network remained static.

Rather than being merely a technical failure, this absence became a reflection on contemporary ecological conditions. Roots are systems of connection, growth, and exchange. Their inability to grow points toward a broader reality in which ecological relationships are increasingly fragmented and ecological loss becomes normalized.

The project therefore shifted from asking how technology can reveal hidden connections to questioning the conditions that make connection possible. In this sense, the static root structure becomes a material reminder of ecological fragility and environmental disconnection.

Ultimately, the work suggests that the ecological crisis is also a crisis of relationality. The question is no longer only how to design for connection, but what happens when the networks that sustain life begin to disappear.

thank you so much!