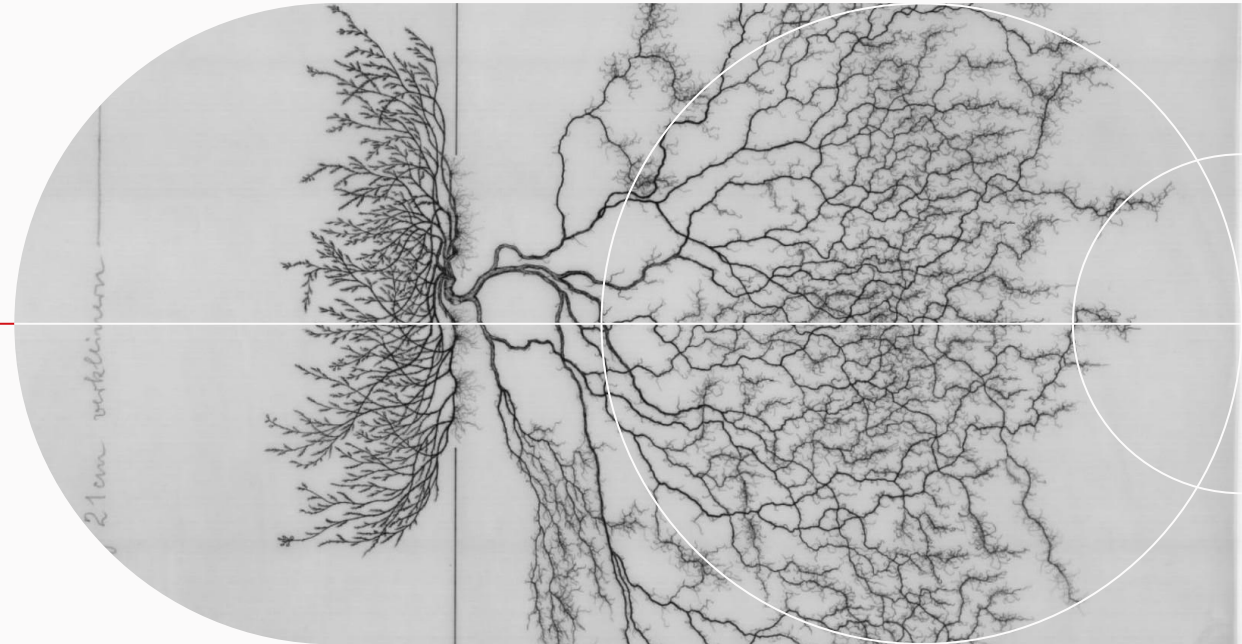
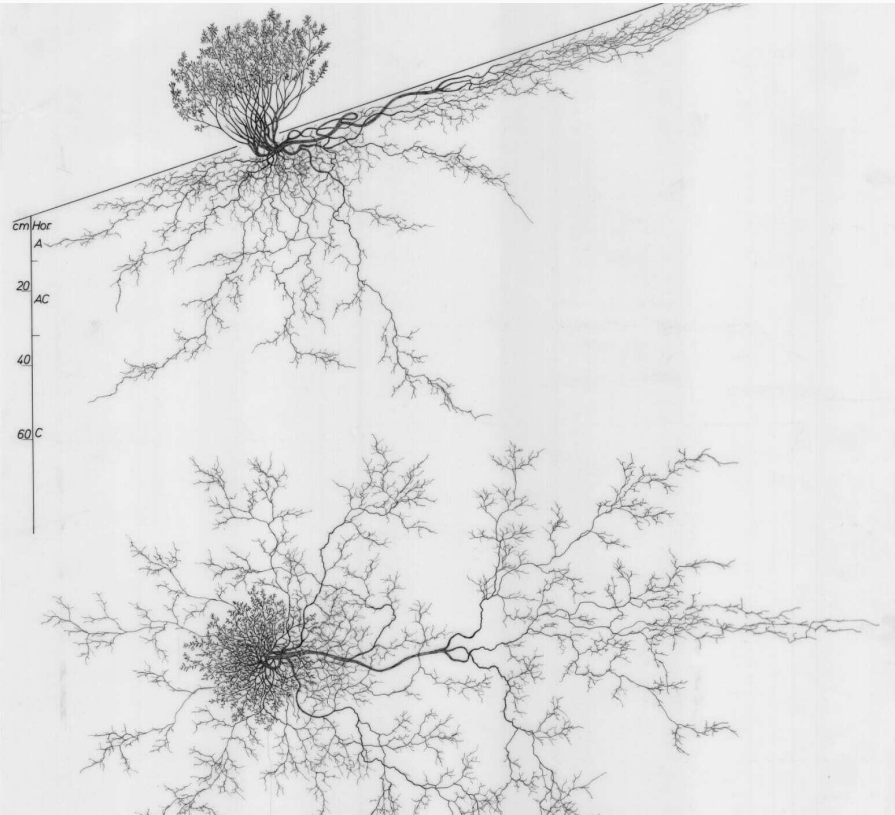


# ROOTLINE

Figure 1 Lichtenegger, E. (1992). *Calluna vulgaris* [Draw]. En *Wurzelatlas mitteleuropäischer Grünlandpflanzen, Band 2/1: Pteridophyta und Dicotyledoneae*.



# Interconnected bioresponsive collars for ecological and social reconnection



## 01 Project Concept

ROOTLINE is a system of interconnected bioresponsive collars that operate as sensitive interfaces between the human body, plants, and other people. Made from roots and mycelium, the collars read environmental parameters—particularly ambient and plant humidity—and translate them into vibration and textile-based light perceived directly on the body.

Figure 2 Lichtenegger, E. (1992). *Calluna vulgaris* [Draw]. En *Wurzelatlas mitteleuropäischer Grünlandpflanzen, Band 2/1: Pteridophyta und Dicotyledoneae*.

# ROOTLINE

Beyond an individual experience, the collars communicate with one another, generating synchronized or contrasting patterns of light and vibration when multiple bodies share the same space. The project frames the body as a node within a living network, where sensing the environment also means sensing others, directly addressing the phenomenon of nature amnesia through collective, embodied experience.

Figure 3 Collage created by the author.



# WHY

---

We face a double disconnection: from ecosystems and from one another. Nature amnesia has normalized environmental degradation, while digital technologies often reinforce isolated and abstract forms of interaction.

ROOTLINE understands the ecological crisis as a relational condition that requires collective, more-than-human forms of awareness.

Figure 4: Textile XY. (2006). *Textile XY* [Textile installation]. Futurotextiles Exhibition, Lille, France.



## **The mission of the project is to:**

- Reactivate ecological memory through the body
- Translate environmental data into shared sensory experiences
- Position design as a practice of connection, care, and interdependence

# WHEN / WHERE

---

The project is situated at the intersection of:

- Climate crisis and sensory disconnection
- Bioart, critical design, and wearable technology
- Regenerative and non-extractive design practices

It is relevant to:

- Contemporary art and design exhibitions
- Academic and research contexts
- Platforms exploring ecological futures and social connection

ROOTLINE responds to an urgent contemporary need: to collectively feel the environment before attempting to transform it.

## Systemic Elements

- A network of interconnected collars
- Environmental and plant-based humidity sensing
- Feedback loops between body, plant, and body

Figure 5: Collet, C. (2012). *Lace Doily growing on strawberry plant roots*.  
Project *Biolace*



## Technical Elements and Prototypes

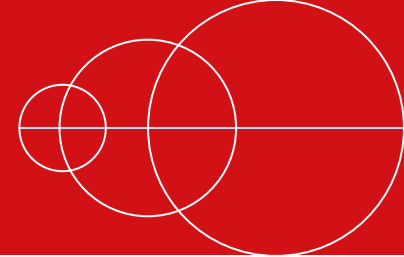
- Collar structure grown or assembled from **roots and mycelium**
- Ambient and soil humidity sensors
- Microcontrollers and inter-device communication
- Vibration motors and LEDs integrated into e-textiles
- Dynamic light and haptic responses based on shared data

# *My previous proposal*

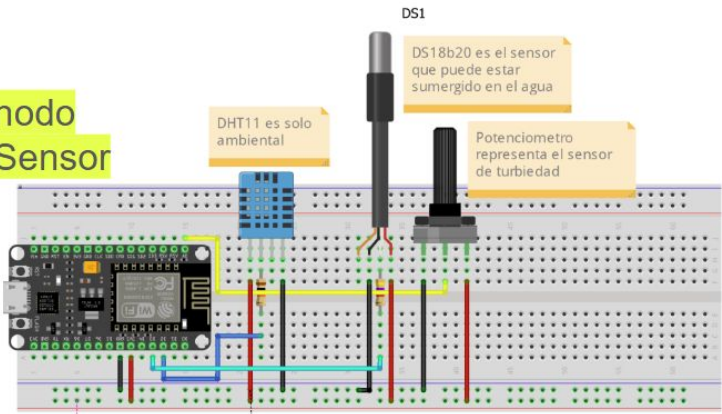
The design shifted from a jacket to a collar after feedback indicated that the jacket did not clearly evoke or reference roots. While the jacket functioned conceptually as a wearable interface, its form and scale diluted the material narrative and made the relationship to underground, living systems less legible.



# Technical Elements and Prototypes



## nodo Sensor



```
esp8266_espnow_SENDER_sensor_node.ino

12  versión adaptada: v1.0.0
13  Requerimientos de conexión:
14  D2 --- --- --- Signal pin DHT11
15  D3 --- R4.7K --- Signal pin DS18B20
16  A0 --- --- --- Analog pin (Sensor turbiedad)
17  */
18
19  #include <ESP8266WiFi.h>
20  #include <espnow.h>
21  #include <DHT.h>
22  #include <OneWire.h>
23  #include <DallasTemperature.h>
24
25  typedef struct{
26    float tempDHT; // sensor_tem
27    float humDHT; // sensor_hum
28    float tempDS; // sensor_tem
29    uint16_t pot; // valor anal
30  } sensor_data_t;
31
```

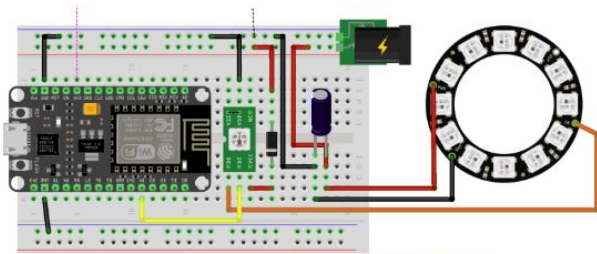
prototipo 1 > Programacion

Tipo: Personas Modificado Fuente

Nombre

- esp8266\_espnow\_SENDER\_sensor\_node
- esp8266\_MAC\_address\_print
- esp8266\_espnow\_RECEIVER\_nodo\_colector

## nodo Colector

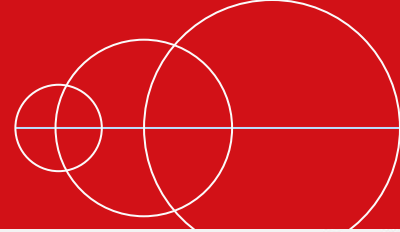


Este arreglo de "sacrificar un pixel" lo puedes encontrar en la información que te compartí.

```
esp8266_espnow_RECEIVER_nodo_colector.ino

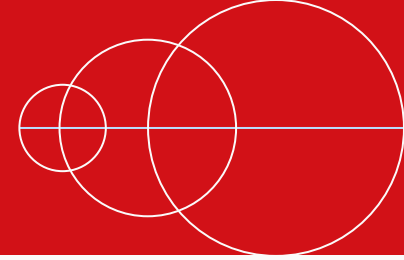
7  DataPIN neopixel : D4 (Lolin v3)
8
9  */
10
11 #include <ESP8266WiFi.h>
12 #include <espnow.h>
13 #include <Adafruit_NeoPixel.h> //buscar libreria Adafruit_neopixel
14
15 // ----- 1) Definición del mismo struct -----
16 typedef struct {
17   float tempDHT; // 4 bytes
18   float humDHT; // 4 bytes
19   float tempDS; // 4 bytes
20   uint16_t pot; // 2 bytes
21 } sensor_data_t;
22
```

# Code



```
esp8266_espnow_SENDER_sensor_node | Arduino IDE 2.3.6
File Edit Sketch Tools Help
NodeMCU 1.0 (ESP-12E M...
SKETCHBOOK
esp8266_espnow_SENDER_sensor_node.ino
18
19 #include <ESP8266WiFi.h>
20 #include <espnow.h>
21 #include <DHT.h>
22 #include <OneWire.h>
23 #include <DallasTemperature.h>
24
25 typedef struct{
26     float tempDHT; // sensor_temperatura DHT11
27     float humDHT; // sensor_humedad_relativa DHT11
28     float tempDS; // sensor_temperatura DS18B20
29     uint16_t pot; // valor análogo pot (0-1023)
30 } sensor_data_t;
31
32 // REPLACE WITH RECEIVER MAC Address
33 uint8_t masterMAC[] = { 0x8C, 0xAA, 0xB5, 0x65, 0x33, 0xD5 };
34 sensor_data_t dataToSend;
35
36 // --- sensor ambiental dht11 ---
37 #define DHTPIN D2
38 #define DHTTYPE DHT11
39 DHT dht(DHTPIN, DHTTYPE);
40
```

# Code SENDER



```
#include <ESP8266WiFi.h>
#include <espnow.h>
#include <DHT.h>
#include <OneWire.h>
#include <DallasTemperature.h>

typedef struct{
  float tempDHT; // sensor_temperatura DHT11
  float humDHT; // sensor_humedad_relativa DHT11
  float tempDS; // sensor_temperatura DS18B20
  uint16_t pot; // valor análogo pot (0-1023)
} sensor_data_t;

// REPLACE WITH RECEIVER MAC Address
uint8_t masterMAC[] = { 0x8C, 0xAA, 0xB5, 0x65, 0x33, 0xD5 };
sensor_data_t dataToSend;
// --- sensor ambiental dht11 ---
#define DHTPIN D2
#define DHTTYPE DHT11
DHT dht(DHTPIN, DHTTYPE);
// --- sensor temperature ds18b20
#define ONE_WIRE_PIN D3
OneWire oneWire(ONE_WIRE_PIN);
DallasTemperature ds(&oneWire);
unsigned long lastSend = 0;
const unsigned long sendInterval = 5000; //tiempo entre
msg
```

```
//Función Callback de envío
void onDataSent(uint8_t *mac, uint8_t status) {
  Serial.printf("Envío %s\n", status == 0 ? "éxito" : "falló");
}

void setup() {
  Serial.begin(115200);
  dht.begin();
  ds.begin();

  WiFi.mode(WIFI_STA);
  if (esp_now_init() != 0) {
    Serial.println("Error iniciando ESP-NOW en nodo sensor");
    return;
  }
  esp_now_set_self_role(ESP_NOW_ROLE_SLAVE);
  esp_now_register_send_cb(onDataSent);
  esp_now_add_peer(masterMAC,
ESP_NOW_ROLE_CONTROLLER, 1, NULL, 0);
}
```

```
void loop() {
  if (millis() - lastSend < sendInterval) return;
  lastSend = millis();

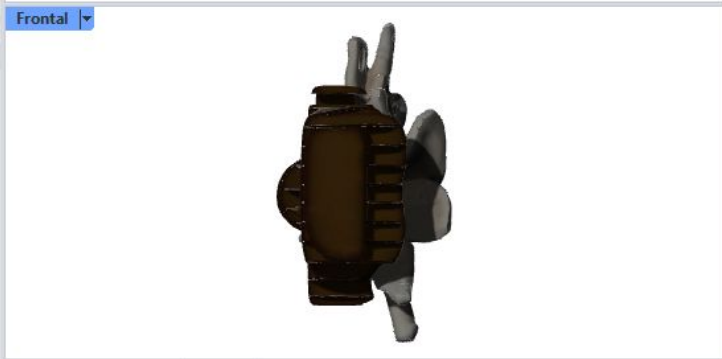
  // lectura de sensores
  dataToSend.tempDHT =
dht.readTemperature();
  dataToSend.humDHT =
dht.readHumidity();
  ds.requestTemperatures();
  dataToSend.tempDS =
ds.getTempCByIndex(0);
  dataToSend.pot = analogRead(A0);

  // log local de mediciones
  Serial.printf(
  "Enviando -> DHT: %.1f°C %.1f%%\t|
DS18B20: %.2f°C\t| Pot: %u\n",
  dataToSend.tempDHT,
  dataToSend.humDHT,
  dataToSend.tempDS,
  dataToSend.pot
  );

  //Envío de lectura sensores
  esp_now_send(masterMAC,
(uint8_t*)&dataToSend,
sizeof(dataToSend));
}
```

El modo de visualización se ha definido a "Renderizado".  
El modo de visualización se ha definido a "Renderizado".

Comando:



Capas

Capa

Capa 01	✓	■	○
---------	---	---	---

- Referencias a o...
- Fin
  - Cerca
  - Punto
  - Med
  - Cen
  - Int
  - Perp
  - Tan
  - Cuad
  - Nodo
  - Vértice
  - Proyectar
  - Desactivar



# WHO

## Primary Audience

- Art and design curators
- Cultural and academic institutions
- Bioart and wearable technology researchers

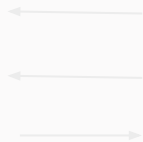
## Secondary Audience

- Designers, artists, and technologists
- Environmentally engaged publics
- Educational communities



*THANK YOU*

---



# PITCH



*If people do not perceive the presence or absence of vegetation in their surroundings, it becomes difficult for them to value its importance or imagine its restoration.*

## PROBLEM

Environmental degradation does not only involve the loss of ecosystems, but also the progressive loss of ecological memory. Each generation grows up in increasingly impoverished environments and perceives that condition as normal. As a result, the reduction of biodiversity and vegetation cover becomes almost invisible in everyday life.

In cities, where more than half of the world's population lives, direct contact with complex ecosystems is becoming increasingly rare. Nature is often reduced to ornamental elements, and the perception of living systems remains largely visual.

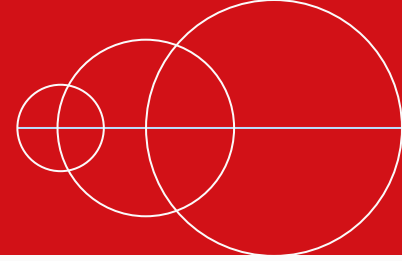
# WHY

The relationship between humans and nature has become increasingly abstract and mediated by data. However, much of environmental experience occurs through the body.

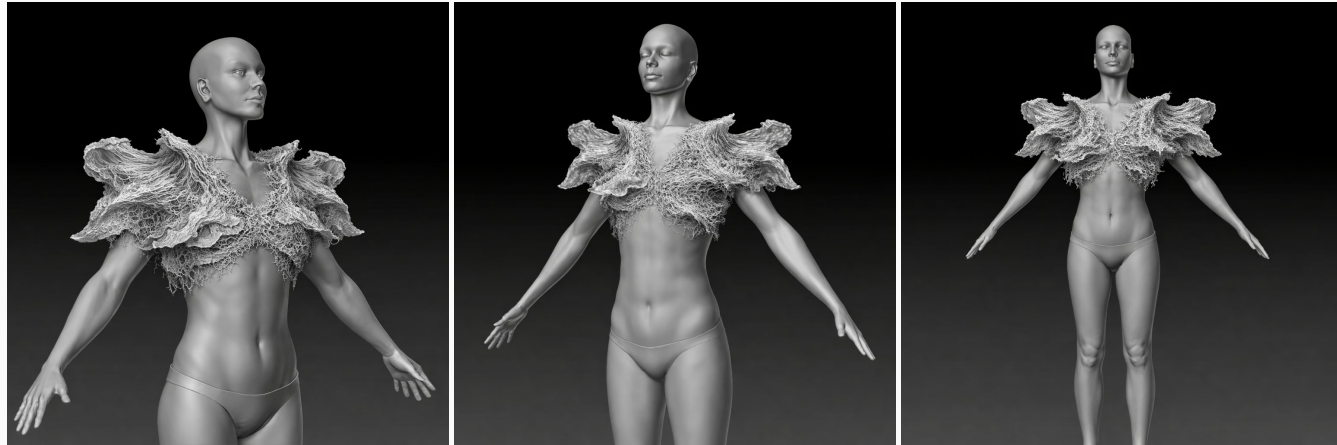
*What would happen if the body could directly perceive the presence of vegetation in the urban environment?*



# *A device that translates plant signals into sensory stimuli could help to:*



- *make the scarcity of nature in cities visible*
- *reconnect human perception with vegetal systems*
- *generate everyday environmental awareness*



# WHAT

A wearable device that detects characteristics of surrounding vegetation and translates them into bodily stimuli and environmental data.

The system identifies signals associated with foliage—such as green intensity, chlorophyll reflectance, and leaf proximity—and converts that information into:

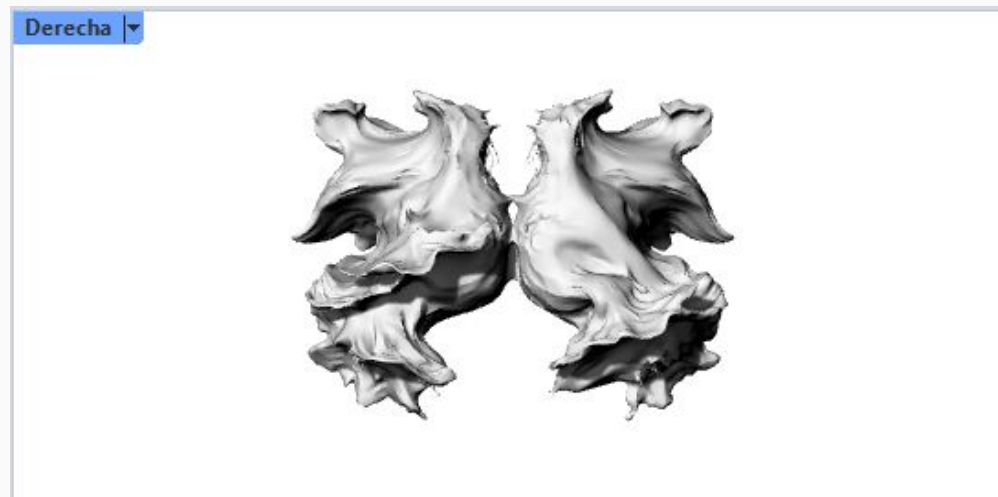
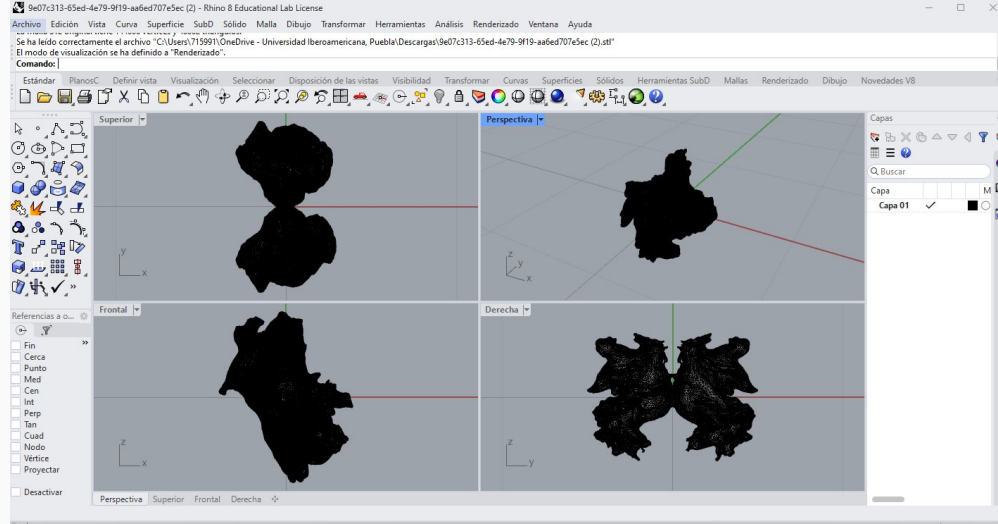
- light pulsations
- soft vibrations
- pulse-like light patterns

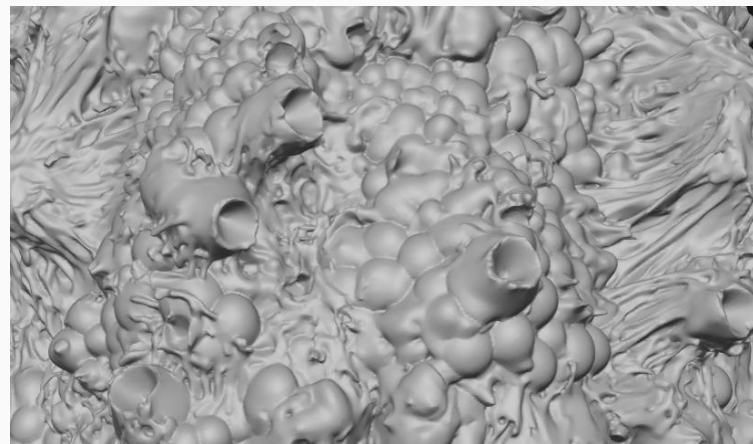
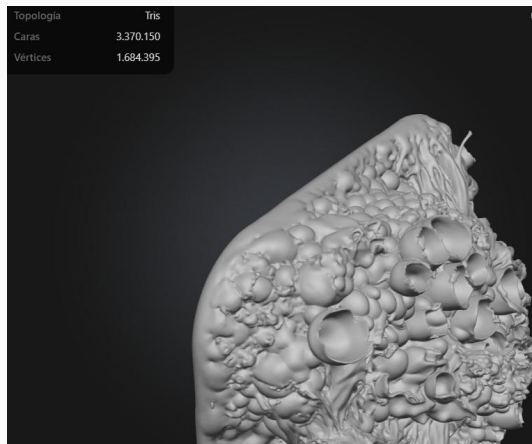
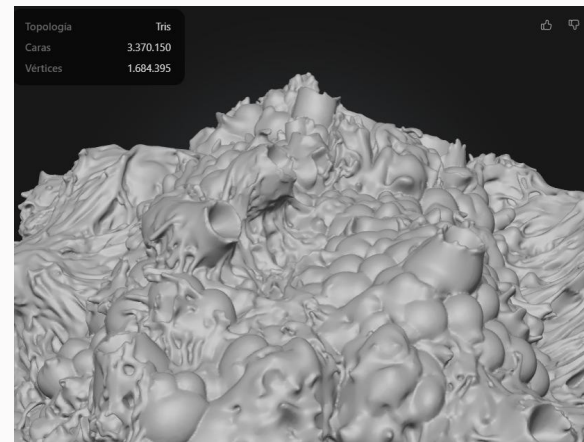
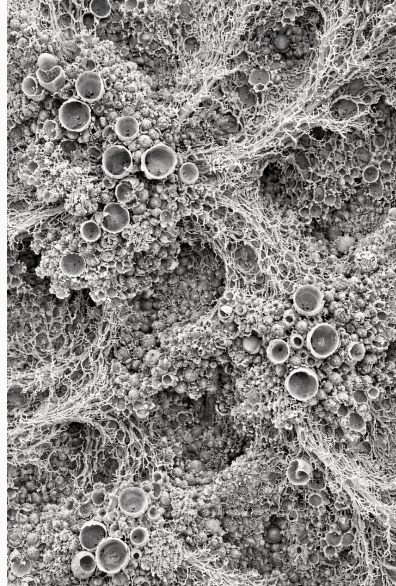
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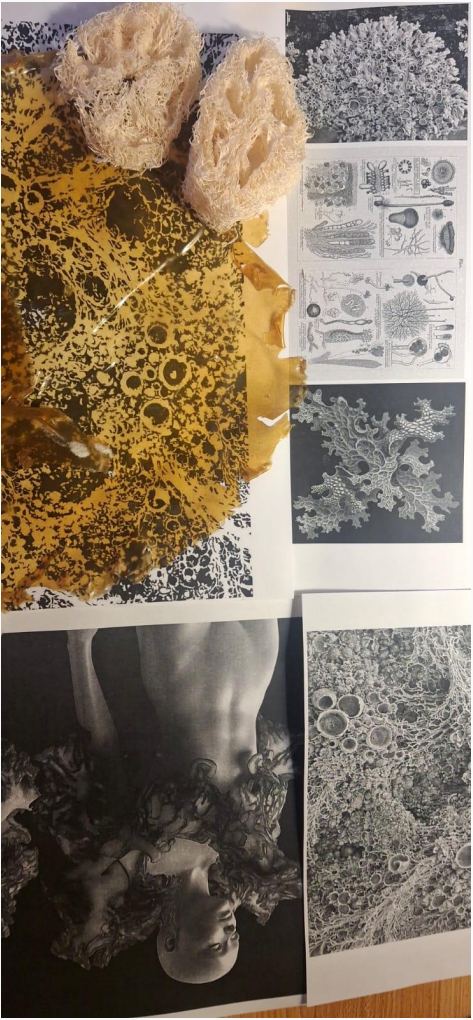
The greater the presence of vegetation in the environment, the more active the sensory response of the device becomes.

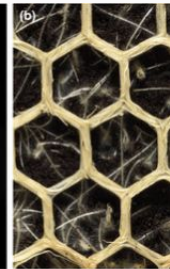
At the same time, the system can record data that allows the creation of urban vegetation maps.

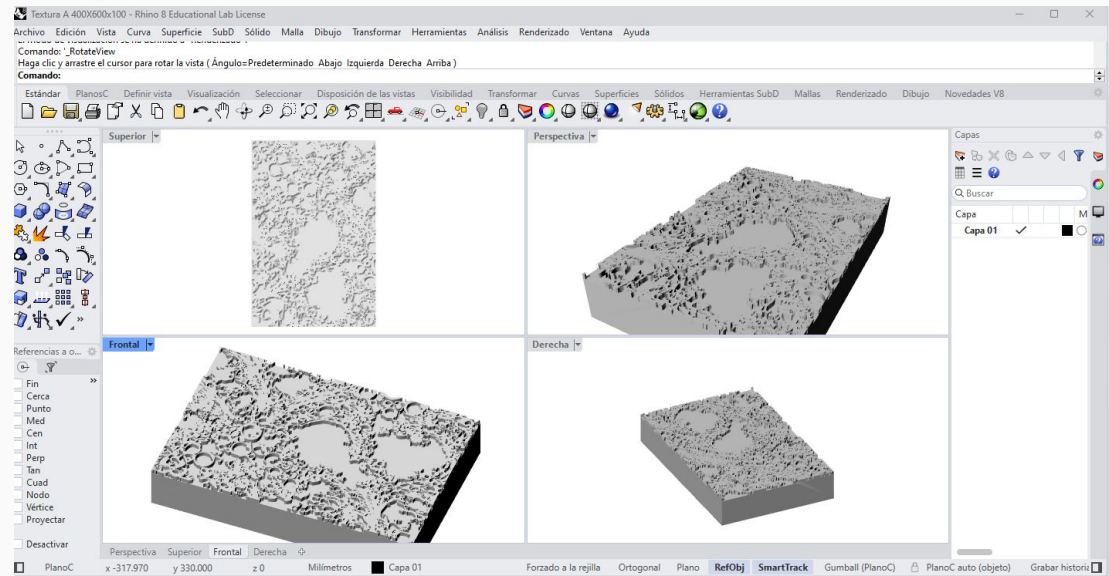
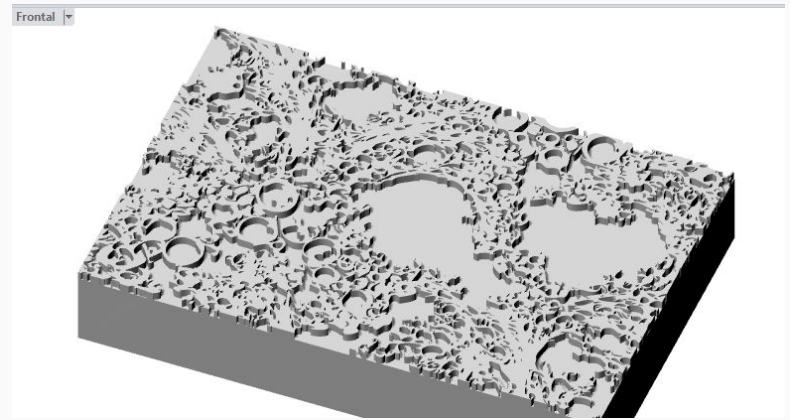
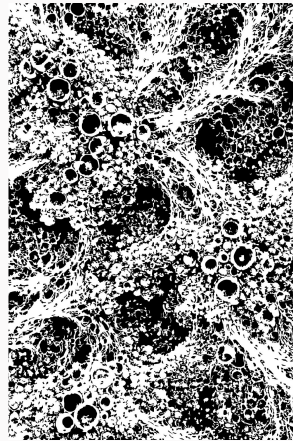
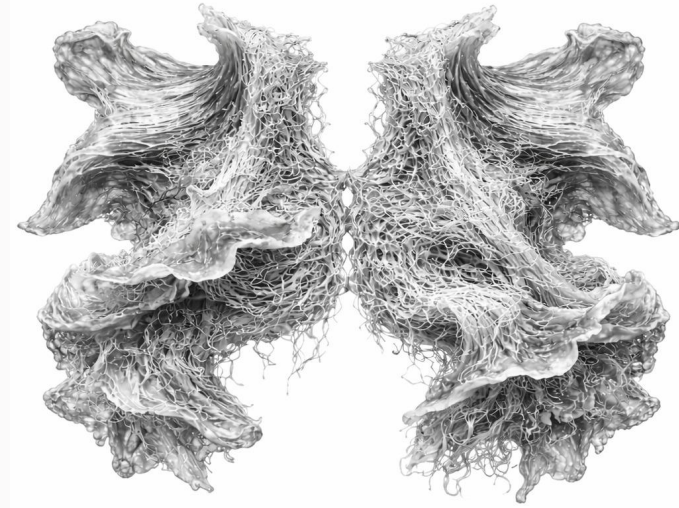














# WHO

The device can be used by different groups:

- Urban inhabitants  
People living in highly urbanized contexts with little daily contact with natural ecosystems.
-

# SOLUTION

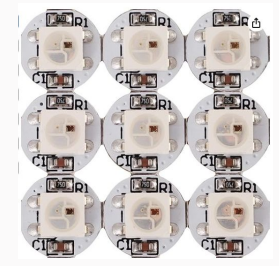
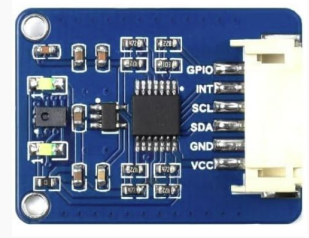
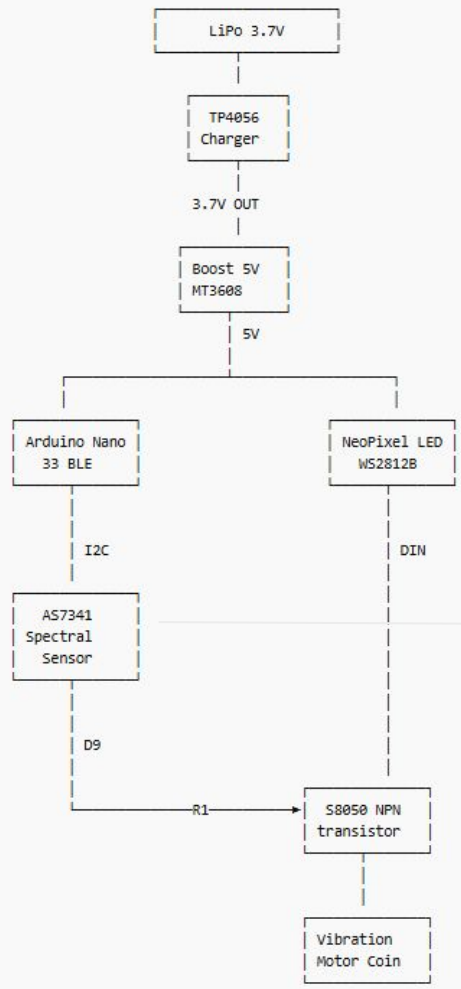
he project proposes a **bodily interface for vegetal perception** that combines sensory experience and environmental observation.

The system consists of:

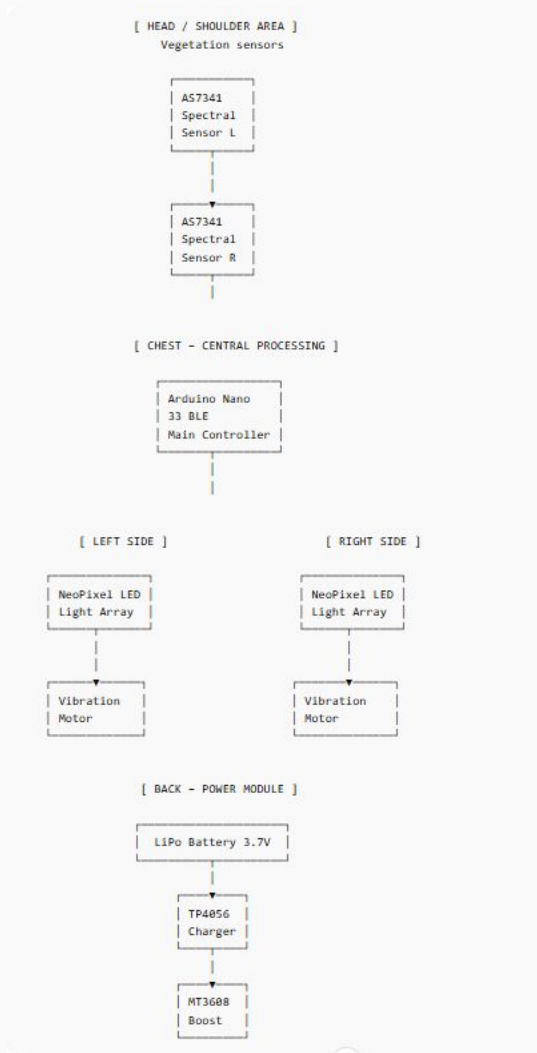
- color or spectral sensors that detect foliage characteristics
- a microcontroller that interprets the data
- haptic and light actuators that generate stimuli on the body

The device transforms plant information into **direct sensory experience**, allowing users to perceive vegetation as rhythm, pulse, or vibration.

---



vegetation  
↓  
spectral sensor  
↓  
microcontroller  
↓  
processing algorithm  
↓  
body feedback  
  
(light + vibration)



# FACTS

Some contextual data related to the problem:

- More than 55% of the world's population lives in cities.
- Urban areas continue expanding, reducing natural ecosystems.
- Human perception of biodiversity tends to decrease when degradation occurs gradually.

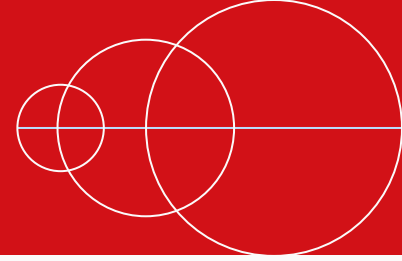
In this context, everyday interaction with nature becomes increasingly limited.

---

# FIGURES

Environment	Estimated Vegetation Presence	Device Response
Urban avenue	Low	Sensory silence
Urban park	Medium	Soft pulsations
Dense garden or forest	High	Continuous heartbeat





The system operates through four stages:

## 1. Sensing

An RGB or spectral sensor detects the composition of light reflected by the environment.

## 2. Processing

A microcontroller analyzes the proportion of green and other signals associated with vegetation.

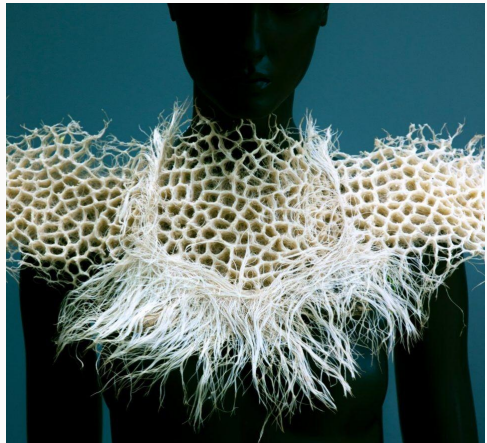
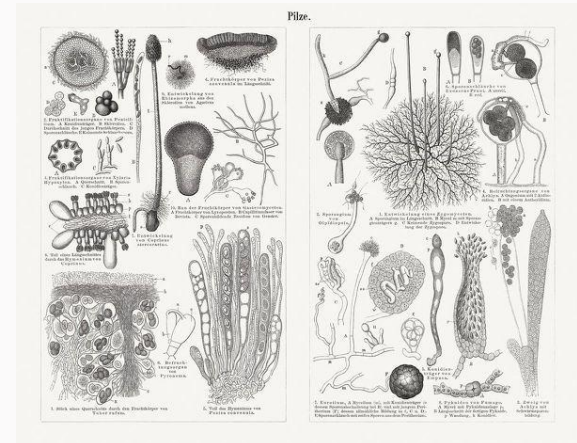
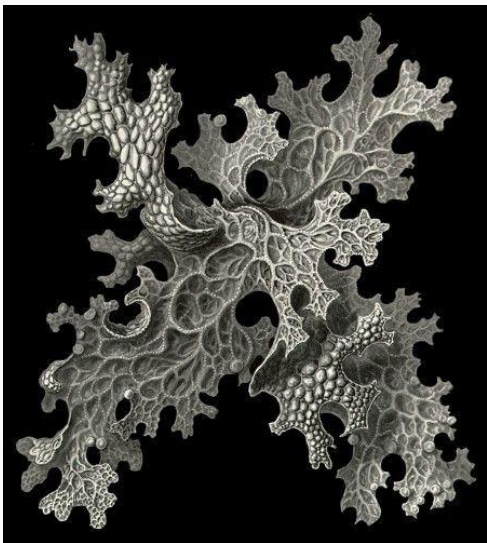
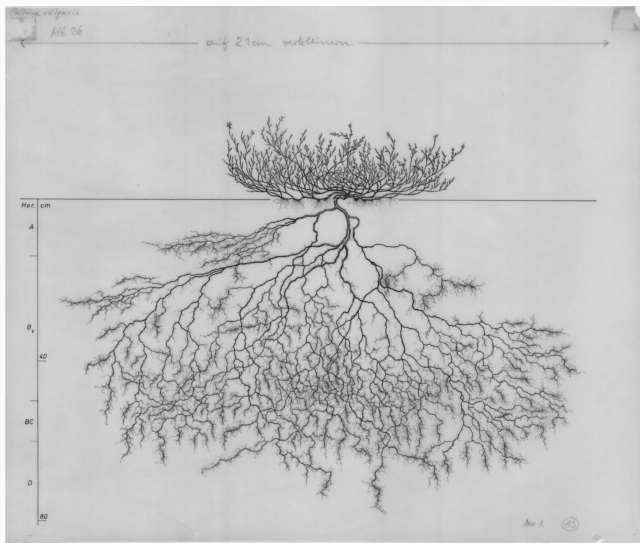
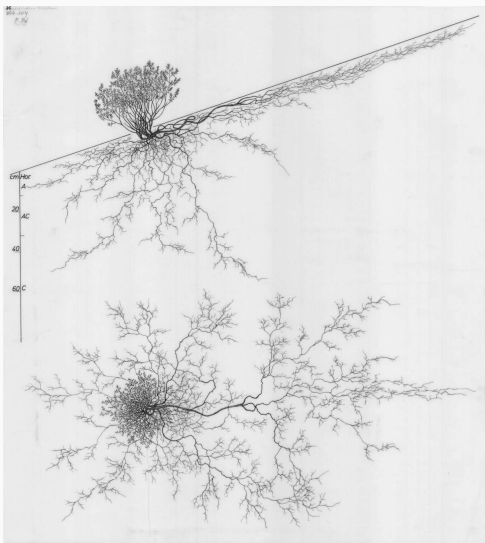
## 3. Classification

The system interprets the presence or intensity of foliage.

## 4. Bodily Feedback

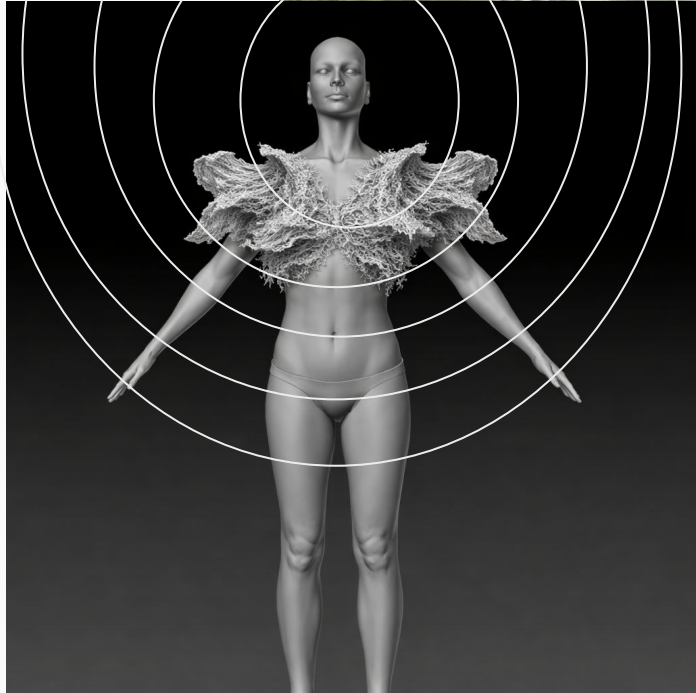
Actuators produce vibration or illumination proportional to the vegetation detected.

This logic transforms environmental signals into **immediate bodily experiences**.









# Storytelling

The device detects signals associated with vegetation—such as the intensity of green, the reflectance related to chlorophyll, and the proximity of leaves—and translates this information into **bodily sensations**.

When the user walks through the city:

- in areas dominated by concrete, the body remains silent
- in urban parks, the device produces soft pulses
- in dense vegetation, the body feels a continuous rhythm

Light and vibration simulate a kind of **shared heartbeat between the human body and plant life**.

The more vegetation around you, the more alive the device feels.