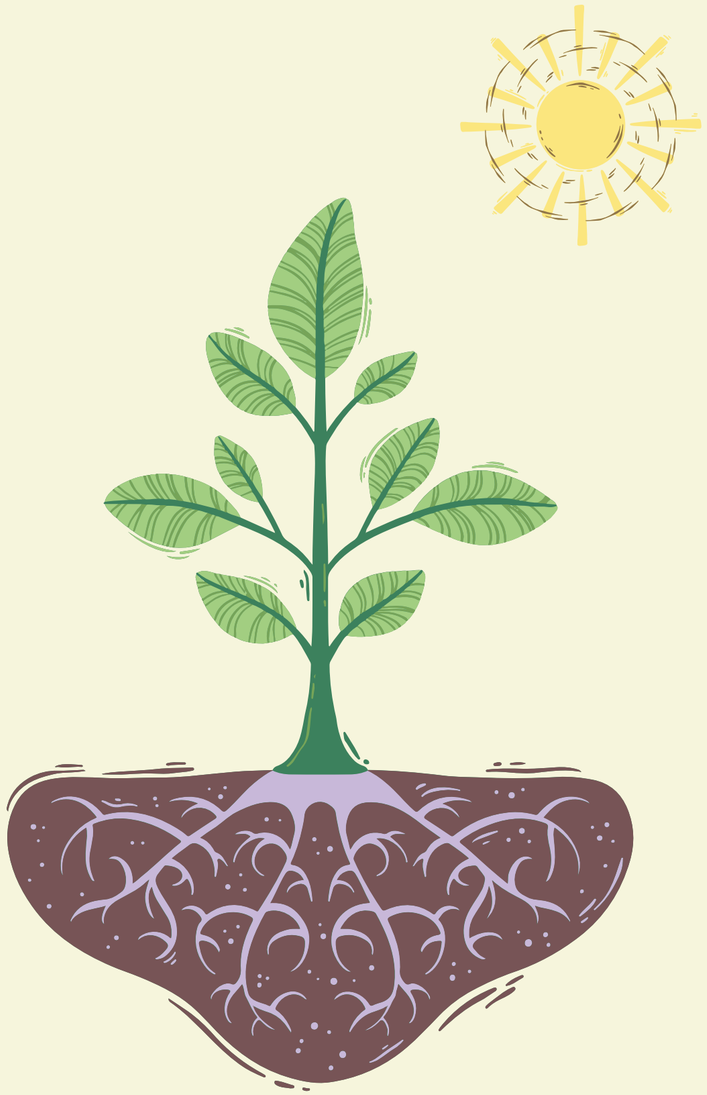
TÉCNICO LISBOA

SoilSense: Automated Nutrient Monitoring and Irrigation System

ElectroCap Project Proposal



Meet our team

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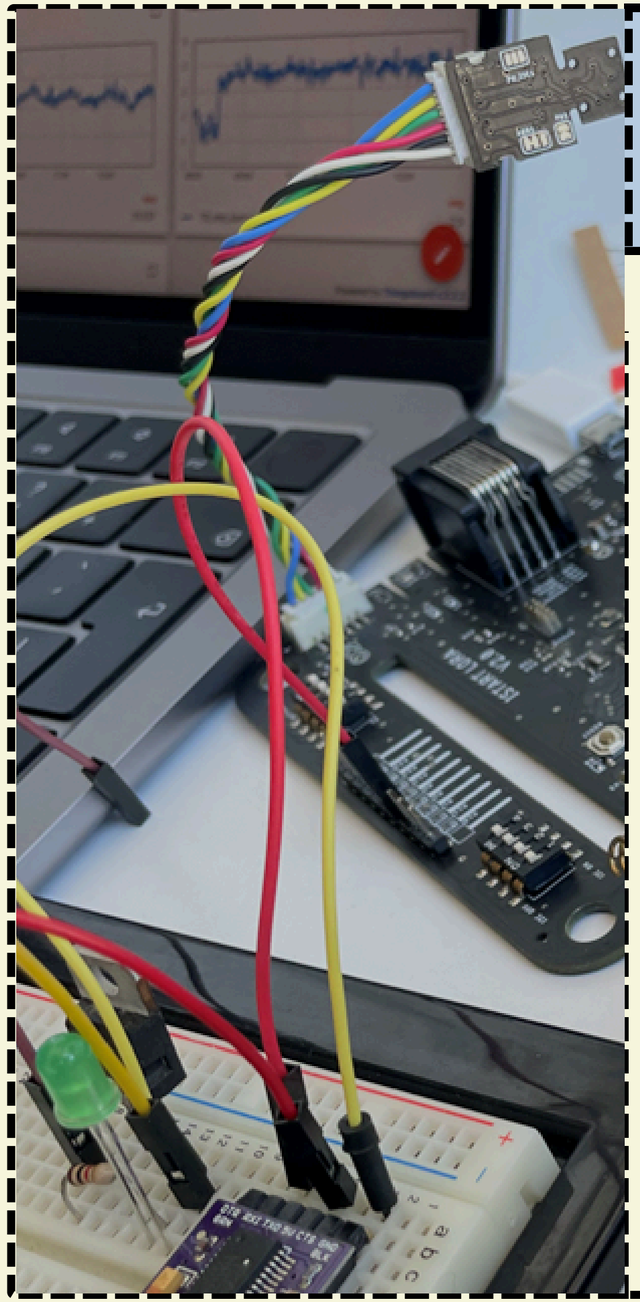


Advisors and Mentor

Scientific Advisor: Prof. Pedro Vítor/
Prof. João Gaspar

Coordinator: Prof. Pedro Vítor

Mentor: Engenheira Sónia Isaque

Problem definition

Time-consuming methods

Most current soil assessment methods require **manual testing**, which is time-consuming and ineffective at consistently measuring the nutrient levels in the soil.

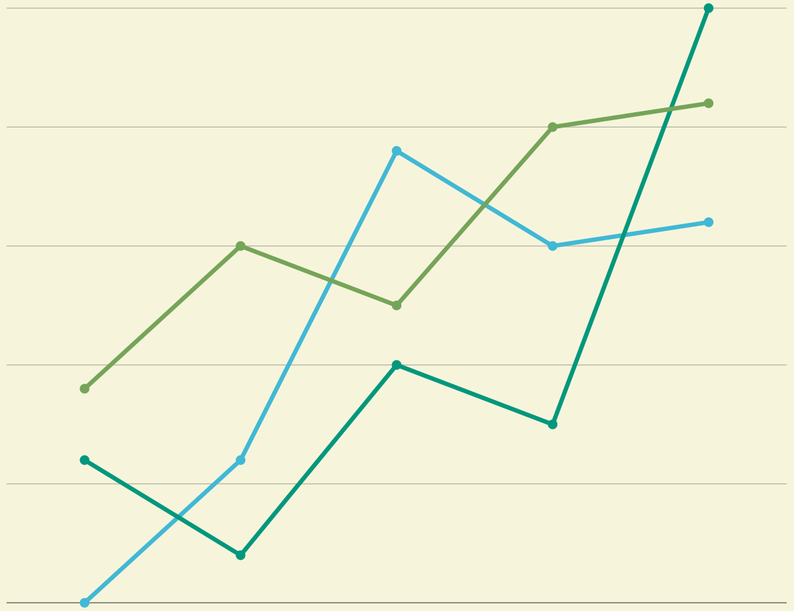
Inefficient resource use

This results in inefficient use of **water and fertilizers**, resulting in financial losses and environmental harm.

Problem definition

The lack of real time data in agriculture

Impacts crop health, quality and yield, necessitating continuous monitoring and automated solutions.



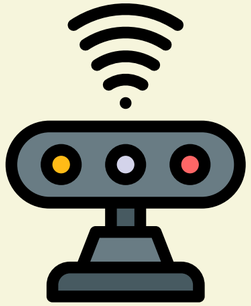
Solution beneficiaries

- Farmers
- Agriculture business
- Gardeners
- Public bodies
- Universities

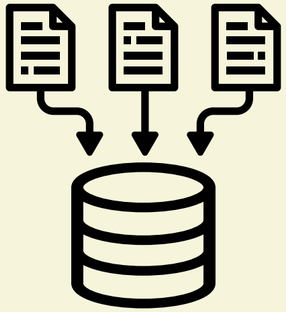
Technological solution:

Objectives

Measure sun exposure, moisture and the **amount of nutrients** in the soil



Register all important information in a database (e.g. amount of nutrients used)



Automatically provide the amount of moisture and nutrients for each crop

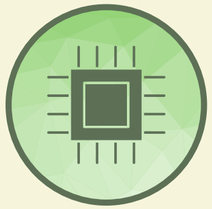
Inform the user in case of malfunction

Technological solution:

Main Areas

Sensors: Measure the amount of nutrients in the soil

Microcontroller: Sends instructions to the nutrient disposer



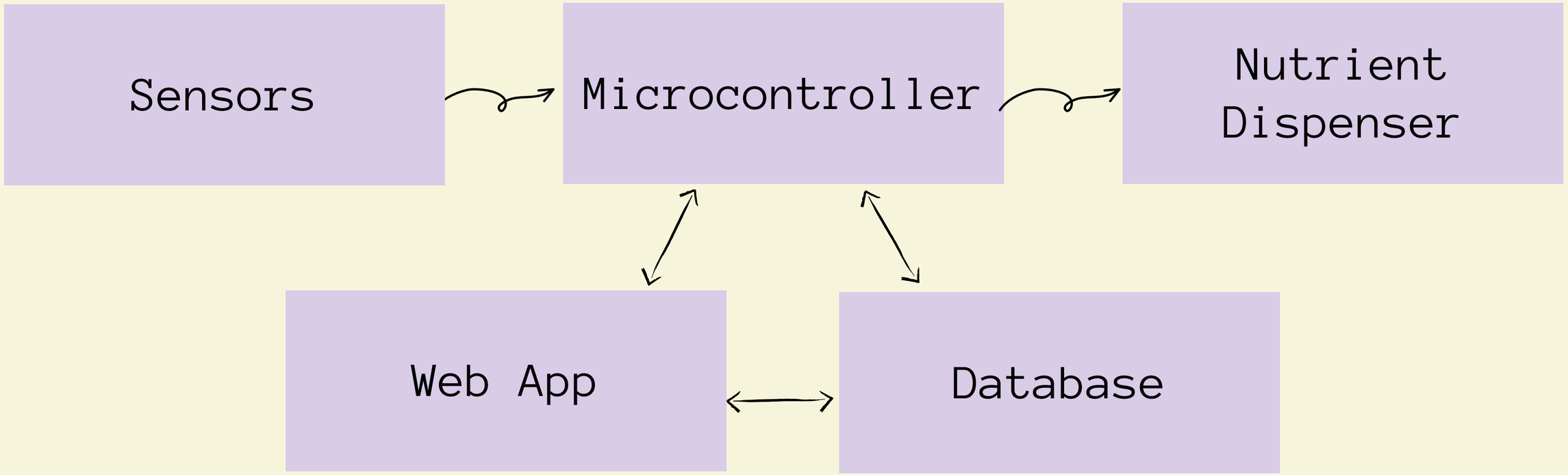
Nutrient dispenser: Store nutrients to mix with water

Database: To store information about the nutrient usage

Web App: Interface between the user and the database

Technological solution:

Architecture



Competitors and previous work

NETAFIM™ An Orbia business.	Campbell SCIENTIFIC	Parrot	DAVIS	TORO
A sensor that monitors humidity and automates irrigation control.	A portable sensor that monitors humidity and automates irrigation control.	A wireless sensor that measures light, temperature, humidity, and soil fertility.	A soil monitoring system with automated irrigation and meteorologic analysis.	A soil sensor for automated irrigation systems.

Solution requirements

Functionality:
It should **autonomously** analyze soil nutrient levels in real-time and **adjust irrigation and fertilization**, accordingly, based on crop needs, without manual intervention.

Reliability:
Continuous operation with high availability.

Performance:
The system must process data in real-time and respond to changes in soil conditions, ensuring **optimal resource delivery**.

Solution requirements

Usability:
It should feature an **intuitive interface**, allowing easy monitoring and configuration by farmers, with customization options for different crops and conditions.

Compatibility:
It should **integrate** smoothly with existing agricultural infrastructure, including IoT devices and cloud platforms.

Scalability:
The system must be scalable for farms of various sizes, with modular components that can grow with future needs.

Technical challenges

- Sensor accuracy and calibration
- Real-time Data processing
- Communication and connectivity
- Integration with existing systems
- Power management
- User interface and usability

Partners

Frutas Classe

We are partnering with Frutas Classe, whose expertise will be invaluable to our project, bridging the gap between engineering and agriculture.

They will provide access to a **testing environment and agricultural materials.**

And will enable us to validate and refine our design under **real-world conditions**.

Testing and validation metrics

First phase:

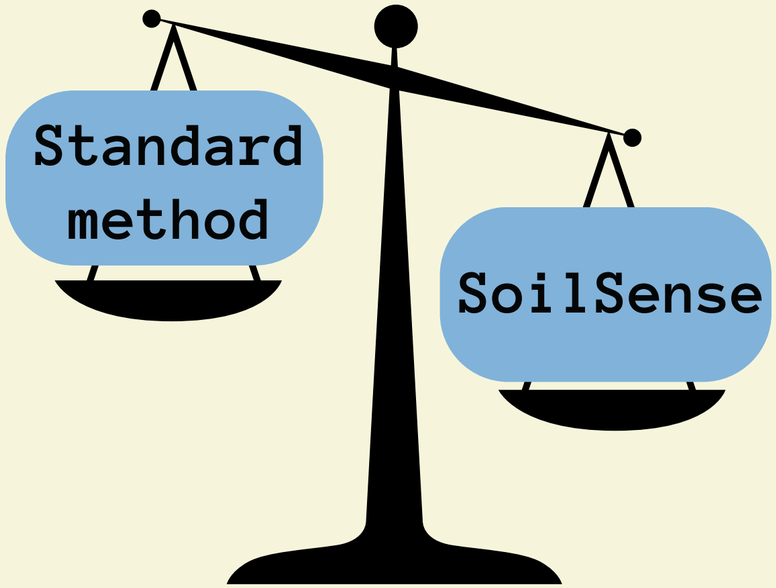
Involves manual testing to evaluate the prototype’s functionality and its ability communicate between devices and to maintain soil nutrient levels.

Second phase:

We’ll divide a strawberry plantation and irrigate half of it with the tradicional approach and the rest with our prototype.

Testing and validation metrics

To compare both approaches, we will use two key validation metrics:



Product Yield – The most effective way to assess efficiency is by measuring the total mass of strawberries produced.

Color Analysis – Using a colorimeter, we will evaluate plant health, ripeness, and overall fruit quality.

Division of labor

ELISA PEDRO	DAVID CARDOSO	PEDRO PEREIRA
Scientific Research	**Hardware**	**Webapp**
Research of materials and devices for assembly	Designing and planning the physical prototype	Creating website and base design
Investigation of the required scientific background	Assembling and connecting hardware components	Planning overall functioning of the program
Redaction of articles and posts for the website	Research of materials and devices for assembly	Programming the prototype’s synchronization and calculations
Analyzing testing results and optimizing performance	Design and 3D print the dispensers	Designing poster

Division of labor

MARGARIDA CANAS	TÂNIA RANCHORDAS	MIGUEL VIDAL
Monitorization and testing	**Website and blog**	**Software**
Contacting companies and potential advisors and mentors	Planning and implementing the website structure	Implementing nutrient dispenser automation
Planning, monitorization and maintenance of the testing	Assembling and connecting hardware components	Program the microcontroller
Analyzing testing results and optimizing performance	Updating blog and maintaining website content	Write the mathematical formulas to calculate the concentrations
Debugging and automizing the code	Planning and managing the video creation	Debugging and automizing the code

Schedule:

TASKS	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY
FIRST VERSION OF PRESENTATION						
WEBSITE AND BLOG						
INTERVIEWS						
LIST OF MATERIALS						
PROTOTYPE DESIGN						
INTERMEDIATE VERSION OF THE PRESENTATION						
ELETRODAY