ElectroCap Project Proposal

Optimizing Smart Irrigation

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TÉCNICO LISBOA

1. Advisors and Mentor

- Scientific Advisor:
- Scientific Co-advisor:
- Coordinator: Prof Marcelino Santos
- Mentor:

2. Problem definition

Our project aims to save water by optimizing the amount of water used in agriculture. Currently, farmers lack the information needed to calculate the precise amount and timing of irrigation for their crops. This results in either insufficient watering for the plants or the wasteful use of water.

3. Solution beneficiaries

Our project aims to develop a viable and scalable solution for large fields that are too expansive for conventional systems utilizing technologies like WiFi or Bluetooth communication. We also aim to create a fully autonomous and more efficient water management system. The primary beneficiaries will be medium and large-scale farmers seeking to conserve water and enhance their yields.

4. Technological solution

- Our solution aims to integrate soil and climate-based data to calculate whether to irrigate the plants or not. To achieve this, we will have a main node that receives data from peripheral nodes connected to the soil, measuring soil moisture. The main node collects climate data and uses it to estimate evapotranspiration. With these two parameters, we can make a more precise decision on whether to open the valve and irrigate the crops or not.
- The user will define the time of day for the soil to be evaluated and for a decision to be made. Using evapotranspiration, we can predict the water that will be lost from the soil, ensuring that the crops will not be under water stress until the next soil evaluation.
- We will maintain a database with crop and field parameters selected by the user. These parameters are used to estimate evapotranspiration more precisely.
- The valve's opening time will be calculated based on the current soil moisture, and crop water needs, which are also influenced by the soil type.

5. Competitors and previous work

Competitors: There are numerous companies in the market offering smart irrigation systems. Some are solely focused on acquiring data to assist farmers in deciding when to irrigate, while others utilize sensors (such as soil sensors and/or climate sensors) to estimate Irrigation Water Need (IWN). Most systems establish thresholds for these parameters, determining when to initiate irrigation.

-NOS Rega Inteligente, Earthscout:

A system that collects and provides users with data, assisting them in deciding when to irrigate. Users can remotely control valves and pumps.

-Watersystems:

A system that uses climate data to estimate evapotranspiration and predict IWN.

-IRRIOT, Spherag, Hydropoint:

Systems that acquire data with soil and climate sensors, controlling irrigation based on thresholds defined by the user.

Previous work

From research conducted by the group, we discovered that many universities and companies have developed solutions and systems to address this problem. They utilize technologies such as:

-Soil moisture sensors that schedule irrigation and activate irrigation systems based on soil moisture.

-Climate-based solutions that use climate data to estimate evapotranspiration, predicting soil water levels and scheduling irrigation accordingly.

6. Solution requirements

Our system must detect, during specific times of the day, whether our crops need water. The prototype must take into account the current presence of rain, evapotranspiration, soil moisture, and the time of day to generate the irrigation schedule. This schedule will be calculated based on the parameters defined by the crop's needs and the type of soil. If the calculations indicate that the crop requires irrigation, the valve will be opened.

7. Technical challenges

The group is confronted with the challenge of accurately and precisely determining when to define that the plant needs water and calculating the evapotranspiration level. This parameter will be computed based on the temperature and solar radiation levels, which will be estimated by a sensor conceptualized by the group; radiation sensors prove to be too expensive

8. Partners

The biggest partner will be IST and its professors and students of Agronomy in Instituto Superior de Agronomia.

9. Testing and validation metrics

The metrics that will evaluate the success of the project include maintaining a fully autonomous and self-sufficient prototype, ensuring the health and proper care of the crop, and comparing the experimental evapotranspiration to a real one captured by a dedicated sensor available online.

10. Division of labor (I)

Filipe Cruz	André Carvalho	António Simões
Control and sensors	**Website and sensors**	**Control and communication**
Designing the system	Arduino Programming	Designing the system
Testing and MATLAB analysis	Sensors and Valves management	Testing and MATLAB analysis
Designing the valve’s controllers	Website Management	Designing the valve’s controllers
Sensors and Valves management		Lora antenna communication

11. Division of labor (II)

Rodrigo Arriegas	João Galego	Gonçalo Amado
Energy and communication	**User interface**	**User interface**
Solar Panels	Web application	Web application
Energy sources for all the equipment	Crop and soil data base	Crop and soil data base
Lora Antenna communication		

12. Schedule

Week 2 - Design and product inventory;

Week 4 – Connection and calibration of the sensors;

Week 6 – First tests to make the prototype self sufficient and decision support system; App with a functional data base.

Week 8- Fully functional peripheral node without connection to others. Decision support system and valve controller fully functional;

Week 10 – Test with a wireless implementation and communication with the main node; App using the data gotten from the main arduino.

Week 12 – Optimization and field testing;

Week 14 – The system fully works.