# **ElectroCap** Mid-Program Pitch Deck

# Digital Wine Temperature Control

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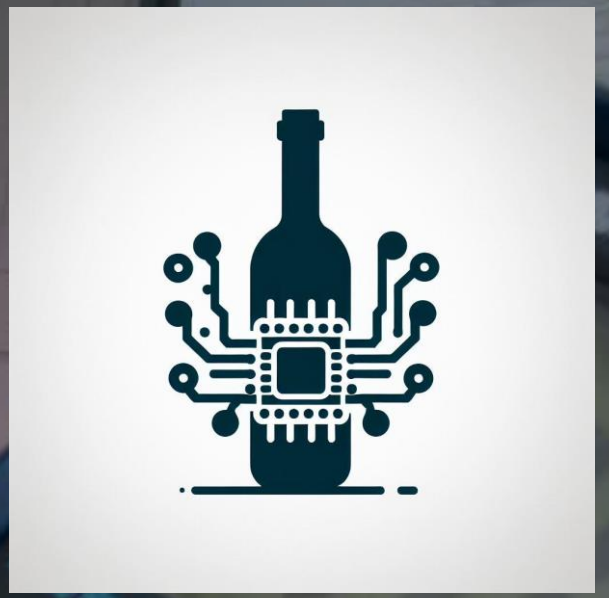


TÉCNICO LISBOA

# Team

David Antunes

Gonçalo Almeida

Henrique Póvoa

Henrique Simões

Miguel Lopes

Miguel Velo

# Advisors and Mentor

Professor Marcelino Santos

Francisco Simplício

# Problem definition

Temperature regulation stands as a cornerstone in wine production, yet the current approach in many wineries involves localized temperature measurements and controls, typically implemented during initial infrastructure setup.

While a select few wineries possess tailored temperature control systems, these are custom-designed solutions typically integrated during the initial construction of the winery. However, if the company needs to expand their production capacity, they often find themselves needing to build new electrical installations from scratch once again.

# Solution beneficiaries

Recognizing the critical significance of temperature management in wine production, it becomes imperative to democratize access to advanced temperature monitoring and control systems. The overarching goal is to empower every winery, irrespective of size or resources, with seamless temperature monitoring capabilities, thereby obviating the need for substantial investments or extensive infrastructure modifications.

# Technological solution

At the core of our technological solution for this problem lies a modular architecture, meticulously crafted to seamlessly integrate temperature control functionality with advanced data transmission capabilities. This modular design ensures easy installation and scalability, allowing wineries to expand their production capacity without needing major changes to their infrastructure. These modules continuously relay real-time data to the main module, empowering winemakers with insights to make informed decisions and maintain optimal conditions for wine production.

Our system also facilitates two-way communication between the main module and individual sensor units, enabling remote configuration and real-time adjustments based on temperature fluctuations. This proactive approach to temperature management ensures consistency in product quality and minimizes the risk of undesirable outcomes.

# Competitors and previous work

In contrast to industry giants like Omron and Siemens, known for their one-size-fits-all approaches, our team distinguishes itself with a deep understanding of the unique needs of the winemaking sector. With our blend of expertise in wine production and electrical modulation, we're well-equipped to deliver tailored solutions that address the intricacies of the industry, ensuring optimal performance and efficiency.


# Solution requirements

In crafting our solution, scalability is a key focus, achieved through the integration of multiple submodules adept at capturing sensor data and facilitating seamless two-way communication with the central module.

We prioritize functionality and reliability to ensure the system's efficacy in reading, transmitting, and analyzing sensor data for effortless monitoring and temperature control.

Recognizing the diverse infrastructure in wineries, compatibility with older systems is paramount, ensuring a streamlined and economical implementation process.

Security is embedded within our project, with stringent measures in place to safeguard data privacy. All information transmitted to the website is anonymized and accessible only to authorized winery personnel, reinforcing trust and confidentiality in our solution.

# Technical challenges

Navigating the technological landscape of our project has presented us with several challenges, each demanding innovative solutions for a successful implementation. Such as:

- Data management emerged as a significant hurdle. Effectively organizing and handling the vast amounts of data generated by temperature sensors required meticulous planning to ensure accuracy and reliability.
- Secondly, establishing seamless communication between various systems posed a formidable challenge. Coordinating interactions between the app, controller, PC, and website demanded robust protocols and interfaces to facilitate smooth data exchange and system integration.
- Thirdly, the processing capabilities of the ESP32 microprocessor emerged as a critical concern. Balancing the computational demands of temperature regulation algorithms while maintaining real-time responsiveness necessitated careful optimization and resource allocation.
- Lastly, preparing a functional prototype for demonstration at the DEMO Day event presented its own set of challenges. From hardware assembly to software configuration, each step required meticulous attention to detail to ensure a polished and compelling showcase of our technological innovation.

# Partners

In our endeavor, we're fortunate to have the invaluable support of Adega da Morgada winery. Their insights and guidance will be instrumental in shaping our project, offering invaluable perspectives on optimizing the effectiveness of a monitoring system and identifying key requirements for consideration. With their collaboration, we're poised to develop a solution that not only meets but exceeds the expectations of the winemaking industry.

ADEGA DA MORGADA

# Testing and validation metrics

Accuracy of Temperature Readings

Response Time

Reliability and Durability

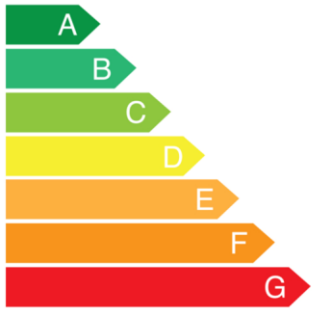
Scalability

Compatibility and Integration

Data Security

User Interface Usability

Energy Efficiency




# Division of labor (1)

| Henrique Póvoa | David Antunes | Henrique Simões |
|---|---|---|
| **Web Site** | **Web Site** | **Winery App** |
| Front End | Web Site | Documentation |
| Interface | Testing | Blog Web Site |
| Data Base | Data Base | Safety Implementation |
| Testing | Back End | Prototype |

# Division of labor (2)

| Miguel Lopes | Gonçalo Almeida | Miguel Velo |
|---|---|---|
| **Control** | **Winery App** | **Control** |
| Prototype | User Interface | Controller |
| DataBase | Safety Implementation | Prototype |
| | Documentation | |
| | Organization and Communication | |

# Original Schedule

| Time Line | Semana 3/4 | Semana 4/5 | Semana 5/6 | Semana 6/7 |
|---|---|---|---|---|
| David Antunes<br>Henrique Póvoa | Ivestigação acerca da comunicação entre o controlador e o site bem como alojamento do site e tecnologias inerentes | Inicio do alojamento do site.<br>Preparação da base de dados. | Primeiras comunicações entre controlador e base de dados.<br>Mock ups da interface. | |
| Miguel Velo<br>Miguel Lopes | Investigação dos componentes escolhidos para realizar os cálculos e esquemáticos necessários para a aquisição das temperaturas. | Caso os esquemáticos estejam prontos, iniciamos a investigação dos protcolos de comunicação entre o esp e o computador da adega. Se possível,<br>Início do código que realiza essa função | Montagem do circuito para testar os esquemáticos.<br>Investigação do envio das temperaturas para a base de dados<br>Início do código dessa função | Desenvolvimento do código de cada uma das funcionalidades. |
| Henrique Simões<br>Gonçalo Almeida | Invetigação das liguangens usadas para a aplicação de controlo das tempraturas no computador.<br>Investigação acerca dos protocolgos de comunicação | Mockups e inicio da aplicação. | | |

# Mid-program status

- Solution for the database environment (to receive the temperature readings from the controller) was initially to be serviced by cloud computing services. The solution was changed to a local server that can be accessed remotely later on the project after configuring the server's network settings.

- Brainstorm of the prototype's structure and design. Analyzing the best solution for the heating and cooling system for the demo day.

- Communication with partners and potential clients for the offered solution and requests for refining the final solution.

- Development and implementation of the app that defines the maximum and minimum temperature in each deposit.

# Achieved results

Our team has completed the foundational tasks for our winery temperature control project. We've developed the user-friendly app for winery members, enabling them to adjust temperature settings for each wine cube securely, thanks to a robust login system.

Additionally, we've implemented a PID controller using Simulink with the ESP32, enhancing our temperature regulation capabilities. Currently, we're in the anticipation phase, eagerly awaiting the arrival of necessary materials to proceed further.

Furthermore, we've successfully created a website linked to the database, providing real-time temperature updates for each cube and maintaining a historical record of temperature fluctuations. Our progress signifies a significant step towards our goal of optimizing temperature management in winemaking.

# Challenges faced by the team

Some of the challenges we faced during this initial phase were:

- Following the initially defined timeline
- Developing a solution  to present our project in a captivating way on demo day
- Choosing the most suitable framework to make our app and website, since there are so many

# Deviations from original schedule

The main causes for the deviations from the original schedule are:

- Testing communications with the ESP32 and website due to delay in the delivering of the components;
- Fine tune the schematics and testing the hardware, due to delay in the delivering of the components;
- Delay in the project development caused by work overload from other projects.

# Meetings and conversations

After a conversation with a wine producer, we've found some good sugestions to improve our project:

- Incorporation of a system capable of controlling the state of the water pumps resposible for the cooling of each wine vat;
- With this implementation we can optimise the efficiency of the controlling system, providing a more adaptable solution to the specific needs of each wine house.
- The conversation led the group to change the initial idea for the demo day presentation. With this new idea we can show more clearly and efficiently the capacities that our product has in adapting to the market needs.

# Demo day

- To demonstrate the features and aplications of our product, we'll use two pans, one inside the other, a water pump and a resistance.
- We'll use the resistance to regulate the temperature of the water pumped to the inside of the smallest pan;
- Althought this process is not totally complete and may undergo some changes, this is a good starting point in the view of the group.

# Contribution of each team member (1)

| Henrique Póvoa | David Antunes | Henrique Simões |
|---|---|---|
| **Web Site** | **Web Site** | **Winery App** |
| Setting the website | Data base | Core app development |
| User friendly interface (website) | Historical Graphic | User friendly interface (app) |
| Interface design | Server | Login system (app) |
| | | Blog website creation |

# Contribution of each team member (2)

| Miguel Lopes | Gonçalo Almeida | Miguel Velo |
|---|---|---|
| **Controller** | **Winery App** | **Controller** |
| DataBase research | Core app development | Hardware research |
| Demo day development | User friendly interface (app) | Demo day JIG development |
| | Login system (app) | Communications with teachers |
| | Organization (app) | |

# Corrected Schedule

| Time Line | Semana 3/4 | Semana 4/5 | Semana 5/6 | Semana 6/7 |
|---|---|---|---|---|
| David Antunes<br>Henrique Póvoa | Investigação acerca da comunicação entre o controlador e o site bem como alojamento do site e tecnologias inerentes | Inicio do alojamento do site.<br>Preparação da base de dados. | Primeiras comunicações entre base de dados e website.<br>Mock ups da interface. | Primeiras comunicações entre base de dados e website.<br>Mock ups da interface. |
| Miguel Velo<br>Miguel Lopes | Investigação dos componentes escolhidos para realizar os cálculos e esquemáticos necessários para a aquisição das temperaturas. | Caso os esquemáticos estejam prontos, iniciamos a investigação dos protcolos de comunicação entre o esp e o computador da adega. ~~Se possivel,~~<br>~~Inicio do código que realiza essa função~~ | ~~Montagem do circuito para testar os esquemáticos.~~<br>~~Investigação do envio das temperaturas para a base de dados~~<br>~~Inicio do código dessa função~~<br>Auxilio nos outros departamentos | ~~Desenvolvimento do código de cada uma das funcionalidades.~~<br>Auxílio nos outros departamentos |
| Henrique Simões<br>Gonçalo Almeida | Invetigação das liguangens usadas para a aplicação de controlo das tempraturas no computador.<br>Investigação acerca dos protocolgos de comunicação. | Mockups e inicio da aplicação. | Reforço da segurança do website | Desenvolvimento da interface da app |

| Semana 7/8 | Semana 8/9 | Semana 9/10 | Semana 10/11 | Semana 10/11 |
|---|---|---|---|---|
| Continuação do desenvolvimento do website e da base de dados | Continuação do desenvolvimento do website e da base de dados | Continuação do desenvolvimento do website e da base de dados | Junção com o hardware e a app da adega | Testes e melhorias |
| Ajudar os outros deparamentos e desenvolver o JIG do demoday até à chegada dos materiais | Ajudar os outros deparamentos e desenvolver o JIG do demoday até à chegada dos materiais | Esperamos ter os materiais por esta altura. Por isso comceçamos a dar assembly ao hardware | Assembly do projeto e testes com os outros departamentos | Testes e melhorias |
| Continuação do desenvolvimento da interface da app | Continuação do desenvolvimento da interface da app | Continuação do desenvolvimento da interface da app | Junção com o hardware e website | Testes e melhorias |