AERIS

Smart IoT System for Optimized Indoor Environment & Air Quality Control

AERIS

Clean Air. Clear Mind. Total Comfort.

Final Pitch | Grupo 28

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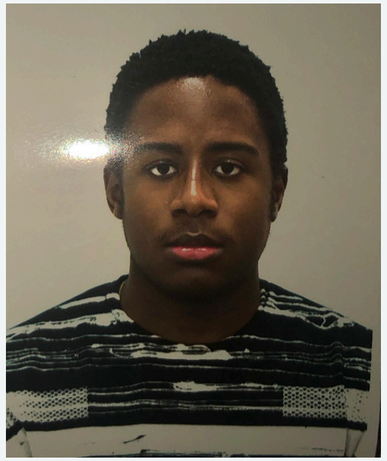
TÉCNICO LISBOA

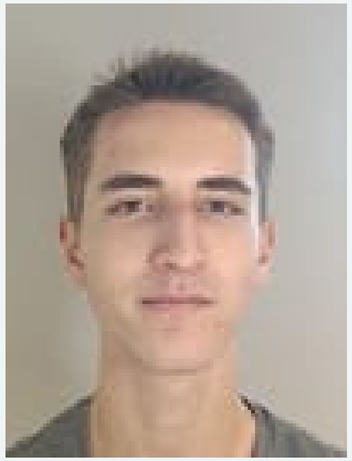
web.tecnico.ulisboa.pt/ist1106892

Meet The Team:

Frederico Fernandes



Ricardo Jorge



Guilherme Romeiras

Afonso Sousa

Fernando Silva

Vítor Mourão

Coordinators: Professor Francisco Alegria and Duarte Marques

01

Problem

Indoor quality air affects health, comfort and productivity — but current slutions fall short

Problem Definition and Market Need

The Problem

- People spend over 90% of their time indoors.
- Poor indoor air quality affects health, comfort and productivity.
- Air quality deterioration often goes unnoticed.

Existing Gap

- Current solutions can be expensive or difficult to deploy.
- Many systems provide limited information.

Market Need

- Growing awareness of indoor environmental quality.
- Demand for affordable and connected monitoring solutions.

Problems

Health Risks

Sick Building Syndrome from poor air quality. High CO_2 and VOC levels cause fatigue, headaches, and reduced cognitive performance.

Energy Waste

Inefficient HVAC systems waste significant energy. Lack of real-time data prevents optimized climate control and ventilation scheduling.

Fragmented Solutions

Current systems are expensive, monitor single variables only, and operate passively without real-time actionable insights for users.

AFFECTED ENVIRONMENTS

Students & Teachers
Educational environment

Office Workers
Corporate spaces

Facility Managers
Building operations

Residential Users
Home air quality

Patients and Doctors
Hospital environments

02

Our Solution

ElectroCap — a low-cost, integrated IoT platform for continuous indoor air quality monitoring and smart control.

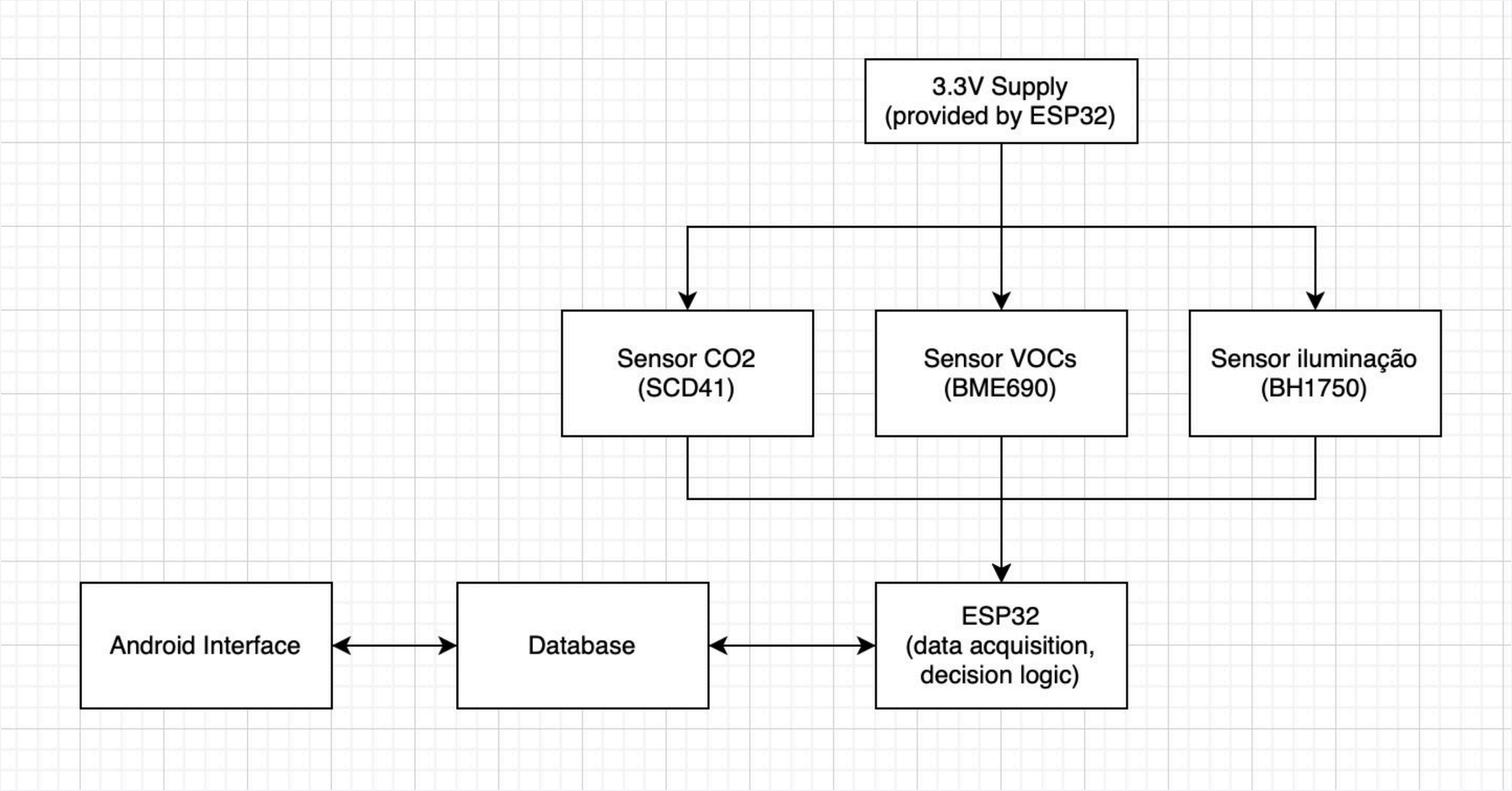
AERIS vs Competitors

Feature	Professional Systems	Consumer Sensors	Building Management Solutions	AERIS
Low cost	✗	✓	✗	✓
Easy deployment	△	✓	✗	✓
Multi-parameter monitoring	✓	△	✓	✓
Real-time measurements	✓	✓	✓	✓
Historical data visualization	✓	△	✓	✓
Alerts and notifications	✓	△	✓	✓
Remote access	✓	△	✓	✓
Customizable platform	△	✗	✓	✓

✓ = typically available, △ = depends on the solution, ✗ = generally limited or expensive

Architecture

Aeris is a low-cost IoT system capable of continuously monitoring environmental parameters and transmitting data wirelessly to a cloud platform for real-time visualization and alerts.



Integrated Monitoring Technology

SENSORS
CO_2, VOCs, temperature, humidity, pressure and light sensors connected to microcontroller

DATABASE
Wi-Fi data transmission from ESP32 to cloud/server infrastructure

APPLICATION
Real-time dashboard , alert system and historical trends

COMPETITIVE ADVANTAGES

- **Multi-sensor** integration in one low-cost device
- **Real-time** actionable insights and alerts
- **Automation** potential for smart building systems
- **Low cost** vs. competitors

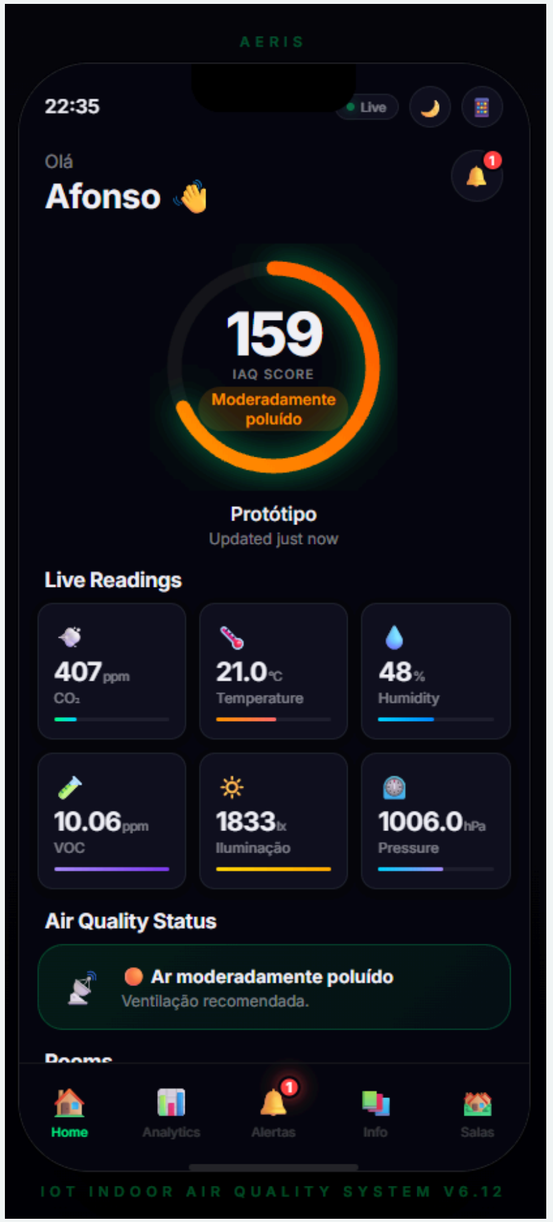
VS. COMPETITORS

Feature	IQAir / Ecofirma	Agimclima	ElectroCap/Aeris
Multi-sensor	Limited	Single variable	6 parameters
Real-time	Passive reports	Delayed data	Live dashboard
Cost	High	Medium	Low-cost

Our App

Aeris features a user-friendly web platform that provides real-time access to environmental measurements.

Users can monitor parameters, visualize historical trends through interactive graphs, receive alerts when air quality deteriorates, and access device information from anywhere with an internet connection.



Testing and Validation Metrics

Parameter	Validation Method	Expected Response
Temperature	Air conditioning	Decrease in measured temperature
Humidity	Air conditioning and ambient conditions	Variation in humidity readings
CO_2	Breathing near the sensor	Increase in CO_2 concentration
VOC	Perfume exposure	Increase in VOC levels
Light Intensity	Covering and exposing the light sensor	Variation in illumination values
Pressure	Ambient pressure changes	Stable and continuous measurements
Connectivity	Real-time data transmission tests	Successful communication with the web application
Alert System	Exceeding predefined thresholds	Automatic warning generation

03

PROGRESS & RESULTS

Where we are now, what we've achieved, and how we're adapting to challenges.

Solution developments

01

Requirements DONE

Project scope defined, system architecture designed, main hardware components selected

02

Prototype Done

Sensor integration, 3D-printed enclosure and hardware assembly completed

03

Web Application Done

Real-time monitoring dashboard, alerts and historical data visualization developed.

04

Connectivity & Testing Done

Wi-Fi communication, database integration and system validation successfully completed.

Achieved Results

01

Functional prototype successfully developed

02

Six environmental parameters monitored in real time

03

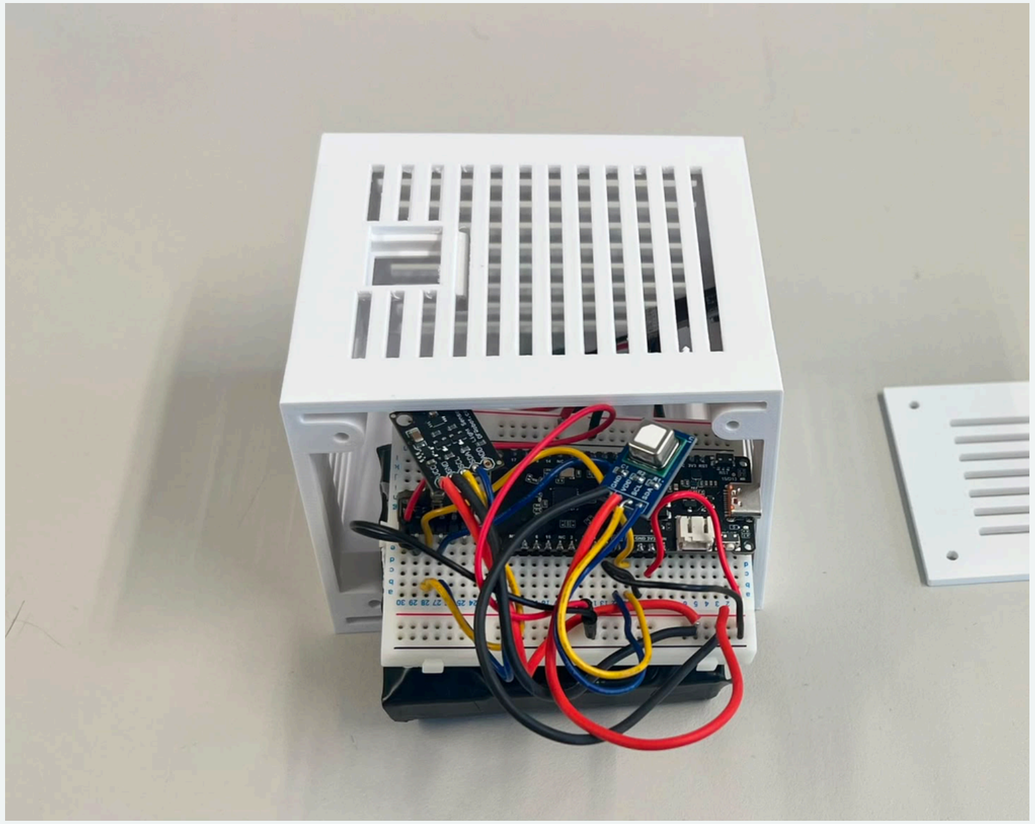
Web application with live visualization and alerts implemented

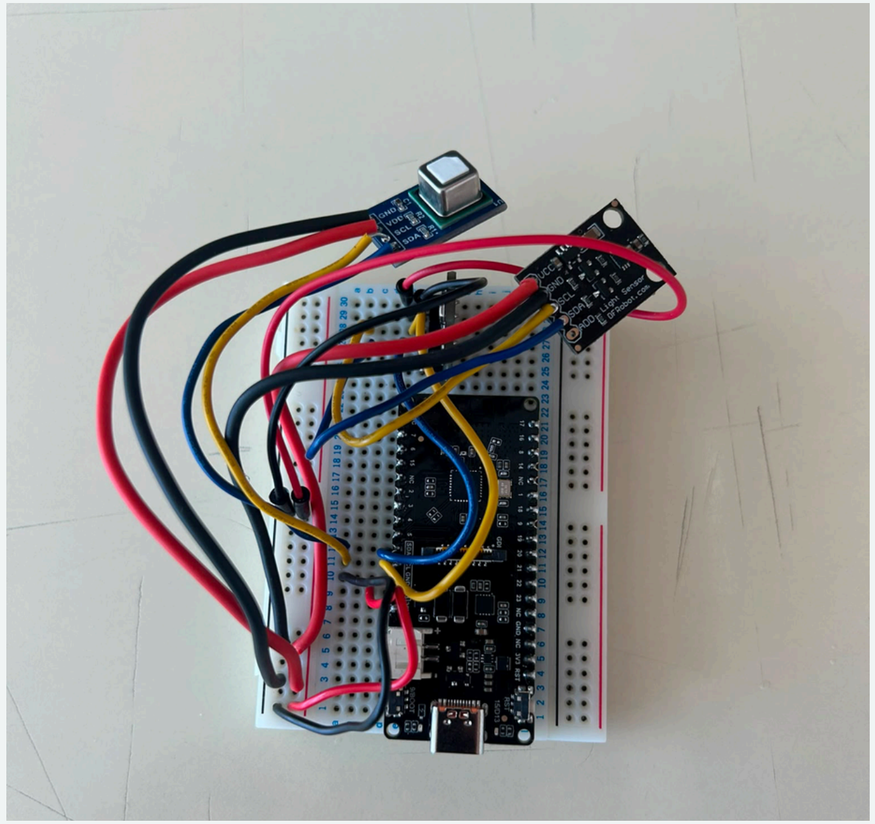
04

Reliable wireless communication and database integration achived

Physical Prototype

Custom 3D-printed enclosure with integrated sensors and battery compartment.





Final Outcomes

01

Complete end-to-end IoT system

02

Custom 3D printed enclosure

03

Cloud database and web dashboard

04

Scalable platform for smart buildings and indoor environments

Deviations from the Initial Timeline

Initial plan

Multiple industry interviews planned to gather requirements and validate approach

Early client engagement expected to validate product-market fit before prototyping

Quick component selection planned to accelerate prototype development timeline

Current plan

Fewer interviews than expected — compensated with deeper desk research and INEGI partnership for validation

Limited client contact at this stage — pivoting to INEGI partnership for professional validation environment

Extra time for component selection — resulted in better hardware choices and more robust system design

Challenges & Lessons Learned

Selecting the most suitable sensors while keeping the system low-cost	Importance of balancing cost and performance
Integrating hardware, firmware and web application components	End-to-end IoT system integration
Ensuring reliable Wi-Fi communication and data transmission	Robust communication and database management
Designing a compact and practical enclosure	3D design and rapid prototyping
Defining meaningful environmental parameters and thresholds	Understanding indoor air quality indicators

04

TEAM & Validation

The people behind Aeris and the roadmap to the final project.

Individual Team Member Contributions

Member	Contribution
Afonso Sousa	Website + application + 3D Modeling
Frederico Fernandes	Database + application
Guilherme Romeiras	Setup prototype
Ricardo Bonfim	Prototype coding + Database
Fernando Silva	Prototype coding
Vitor Mourão	Setup prototype + Video Editing

Timeline

APRIL — **MAY** — **JUNE** — **END**

Completed

Design

- Requirements definition
- Component selection
- System architecture design
- Initial research

Completed

Development

- Sensor integration
- ESP32 programming
- Wi-Fi communication
- Database implementation
- Web application development

Completed

Project Conclusion

- 3D enclosure design
- Alert system implementation
- System testing and optimization
- Final integration
- Documentation and video production

Outcome: A fully integrated low-cost IoT platform for indoor environmental monitoring was sucessfully developed and validated

Partnerships & Validation

INEGI

Technical meetings with INEGI provided valuable feedback and opened the possibility of future access to specialized laboratories and equipment for system evaluation.

Validation Metrics

- Sensor accuracy compared with reference equipment
- Data consistency and long-term stability
- Continuous system reliability
- Response to environmental changes
- Alert system performance

Testing Approach

Controlled Experiments

Functional and performance testing carried out by the team to verify system operation and measurement consistency.

System Integration

Verification of sensor operation, wireless communication, database storage and web application functionality

Successful validation demonstrated the reliability and applicability of the proposed solution.

Future Work

- Integration of more sensors to better describe the environment conditions
- Integration of atuators to optimize conditions
- Smart building integration
  - In hospitals, Schools, Offices, and others
- Alerts for emergency services
- Capability of monitoring multiple rooms
- AI-based predictions and anomaly detection

Our long-term vision is to transform Aeris into an intelligent environmental management platform capable of improving safety, health and comfort across homes, institutions and smart cities.

Video demonstration

Website

Thank You

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Mentor: Prof. Francisco Alegria

Grupo 28 | Técnico Lisboa

QUESTIONS?