Team 8

SAFENOISE

ELECTROCAP MID-PROGRAM PITCH DECK

Website: Team 8

https://web.tecnico.ulisboa.pt/~ist1106327/public/

TÉCNICO LISBOA

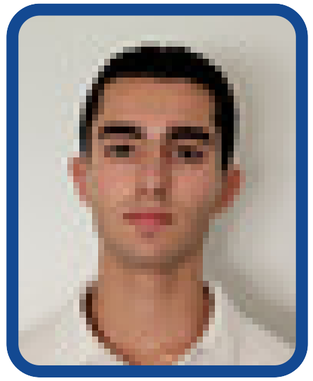
SAICA

April 2025

ABOUT US

WHO WE ARE

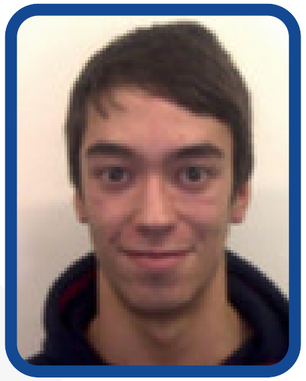
Team 8



Tiago Gonçalves

David Antunes

João Silvestre



Tomás Dias

Miguel Simões

João Campos

ADVISORS AND MENTORS

Director of Quality, Environment, Safety and Occupational Health at Saica Group

Scientific Advisor and Mentor
Eng. Patricia Prudêncio

Quality, Environment and Safety Technician Saica Group

Scientific Co-advisor and Mentor
Catarina Teixeira

Co-Director of iStartLab Innovation Laboratory, Instituto Superior Técnico

Coordinator
Prof. Luís Caldas Oliveira

MSc. Student in Electrical & Computer Engineering

Co-coordinator
Tiago Lourinho

PROBLEM DEFINITION

→ Workers exposed to environments with intense but non-permanent noise often neglect the use of Personal Protective Equipment (PPE).

→ Occupational Hearing Loss is one of the most common work-related ilnesses, often going unnotice until irreversible damage occurs.

→ Workplace safety personnel lack adequate tools to measure and analyze the severity of this issue.

SOLUTION BENEFICIARIES

01 **Workers and Employers**

Workers become aware of noise levels through real-time alerts, reducing the risk of hearing loss caused by improper PPE usage.

02 **Ineffective Digital Presence**

Employers benefit by minimizing workplace injuries and avoiding legal responsibilities.

03 **Occupational health care**

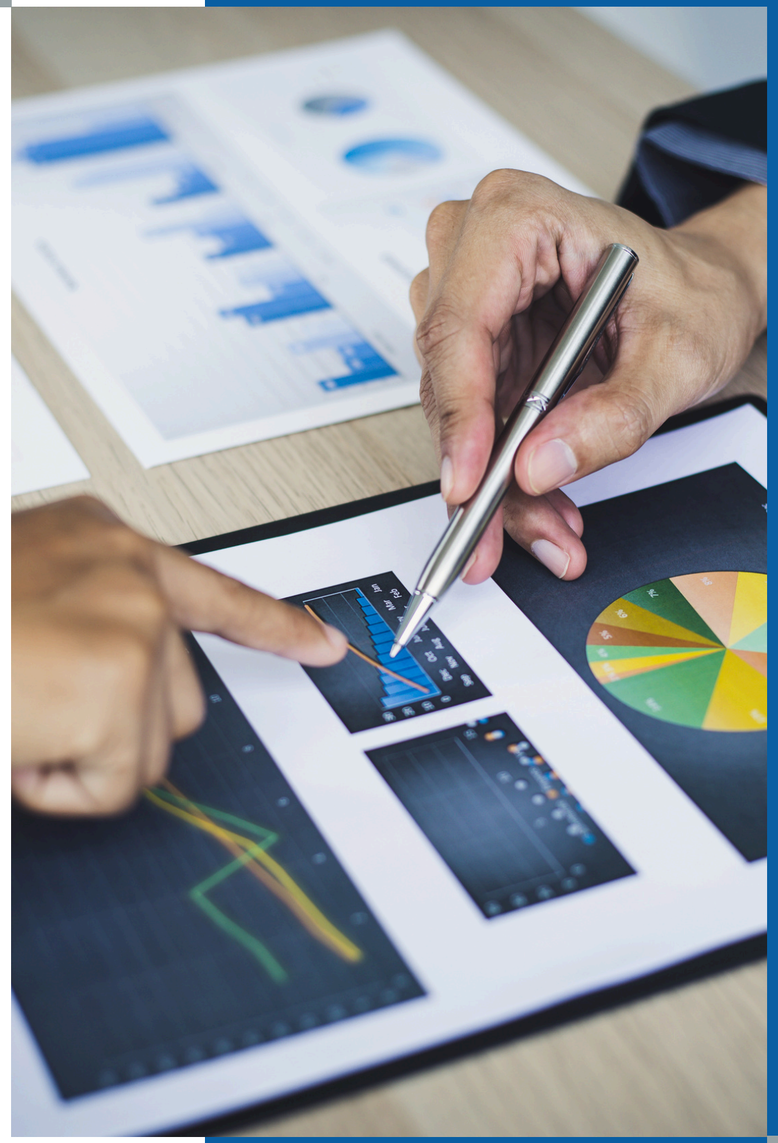
Occupational health care can use this data to improving support.

04 **Technicians of Safety and Health**

Technicians of Safety and Health at Work can get more data to support improvements in workplace and raise awareness to the importance of the use of PPE.

TECHNOLOGICAL SOLUTION

A system of sensors integrated into the earmuff that detects whether the worker is using the PPE correctly, along with another device that communicates with it and measures the noise level the worker is exposed to, alerting them when necessary.



COMPETITORS AND PREVIOUS WORK

COMPETITORS

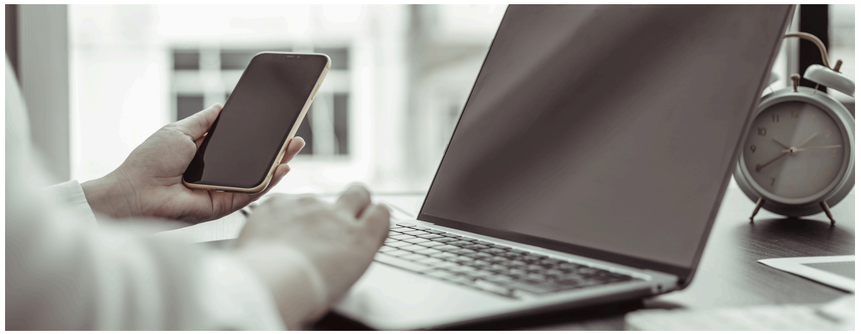
→ Sound Level Meters for measurements on fixed machines.

→ Dosimeters, developed for dynamic exposure profiles and fixed measurements.

PREVIOUS WORK

We are unaware of measurement equipment that fully meet the proposed requirements, but this may be achievable by integrating it into tools we are considering developing. If feasible and available, both proposals could be useful.

SOLUTION REQUIREMENTS



01 **Compliance with Legal Standards**

Accuracy in Noise Level Detection: Spectral Analysis in 1/1 Octave bands from 63 Hz to 8000 Hz.

02 **User Alerts & Awareness**

Ensuring that workers receive real-time alerts and respond appropriately to hazardous noise levels.

03 **Daily reports**

Implement a formal report or a visual scoreboard system.

04 **Monitoring Correct Use of PPE**

Verifying whether employees are properly using earmuffs.

05 **Scalability**

Scalability to accommodate future expansions.

TECHNICAL CHALLENGES

01 Real-time noise detection accuracy and range.

02 Verification of PPE usage, using a capacitive sensor.

03 User Compliance: Ensuring workers comply with using this device.

04 Data analysis: The algorithm to group data and treat noises measurements.

05 Ensure proper calibration of the device.

06 Battery Life and Power Consumption: Ensuring the device operates continuously for entire work shifts (8 hours).

07 Ensure the device maintains an acceptable level of comfort.

PARTNERS

OUR CLIENTS COME FROM EVERYWHERE

With more than 12,000 employees and operations in Spain, France, Italy, Portugal, the United Kingdom, Ireland, Turkey, Luxembourg, the Netherlands, the United States and Poland, the Saica Group provides sustainable solutions for paper and packaging manufacturing, as well as for waste management and recovery. Saica has been developing sustainable and innovative solutions for more than eight decades.

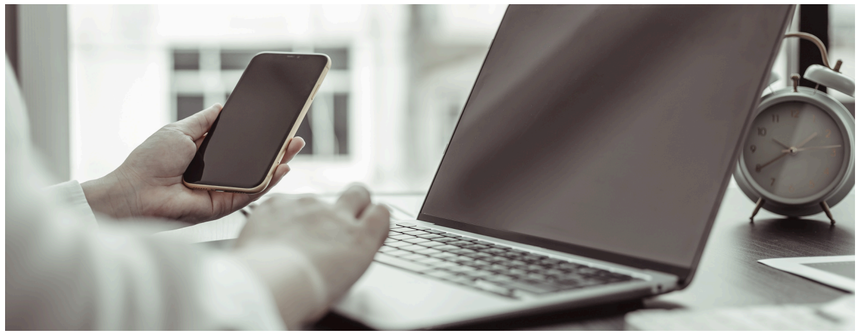
Saica Pack, Loures

The Saica Group provides sustainable solutions for paper and packaging manufacturing, as well as for waste management and recovery

Others

During P3, we had the opportunity to talk with several companies. Some of them helped us achieve the specifications of our prototype and provided other information.

TESTING AND VALIDATION METRICS



01 **Proof of Concept**
Conduct user acceptance testing to ensure the system solves the problem.

02 **PPE Usage Monitoring**
Detection accuracy, false positive/negative rates.

03 **Noise Level Accuracy**
Precision of noise measurements, frequency response, and real-time processing.

04 **Battery Life Assessment**
Continuous operation tests to confirm battery life under work shift.

05 **BLE Connection Stability**
Ensure consistent and stable Bluetooth communication between components during operation.

DIVISION OF LABOR (1)

João Campos	Miguel Simões	Tiago Gonçalves
Capacitive Sensor	Capacitive Sensor*	3D Model*
Systems connections	Systems connections*	Data Analysis
Video*	Video	Mid-Term Presentation
Poster	Final Presentation	Poster*

The “*” represents the responsible for that task

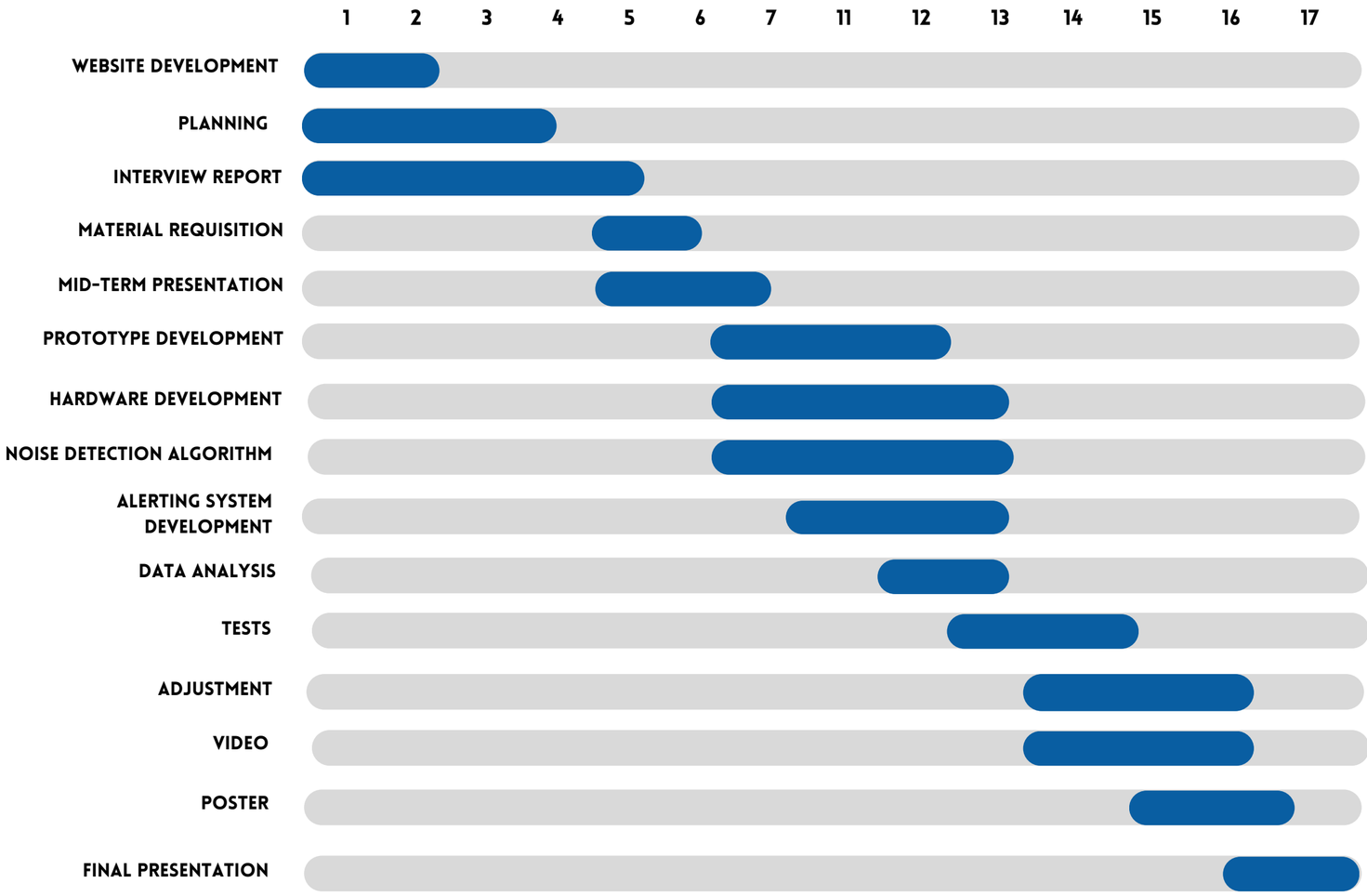
DIVISION OF LABOR (2)

David Antunes	João Silvestre	Tomás Dias
Noise Detection*	Alerting System	Alerting System*
Data Analysis*	Computer Connection*	Computer Connection
Website Design*	Logistics*	Logistics
Poster	Mid-Term and Final Presentation	Mid-Term* and Final Presentation*

The “*” represents the responsible for that task

ORIGINAL SCHEDULE

SCHEDULE TEAM 8



DEVIATIONS FROM ORIGINAL SCHEDULE

COMMUNICATION

→ Team dynamics and communication issues.

→ Inefficient time management.

→ Personal commitments and workload.

NOW, EVERYTHING IS ON TRACK AND ON SCHEDULE

Part of the team put in extra effort to compensate for the delays on the other side.

DEVIATIONS FROM ORIGINAL SCHEDULE

→ Added Task Responsibles

→ Specified Prototype Tasks:

- Noise detection algorithm
- 3D Model
- Capacitive Sensor
- Systems connections

→ Also added differentiated testes:

- User acceptance testings

CORRECTED VS ORIGINAL SCHEDULE

Added Task Responsibles

Specified Prototype Tasks:

- **Noise detection algorithm**
- **3D Model**
- **Capacitive Sensor**
- **Systems connections**

Also added diferenciated testes:

- **User acceptance testings**

There were no delays on the plans

CORRECTED SCHEDULE

SCHEDULE TEAM 8

MID-PROGRAM STATUS

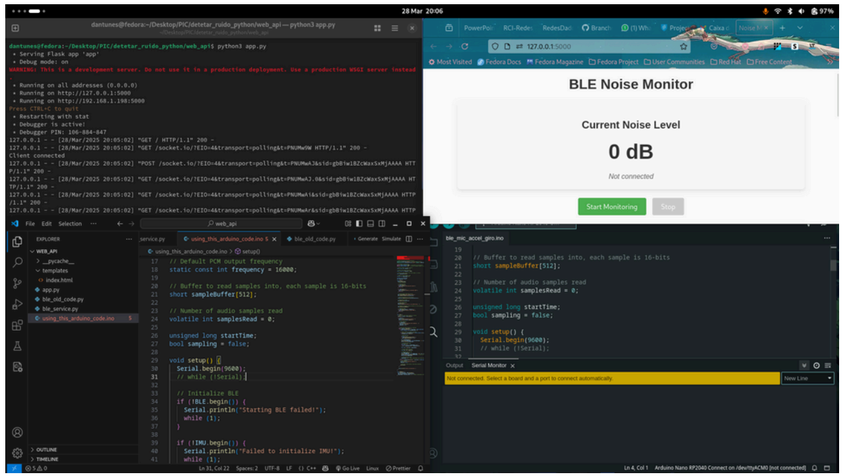
CURRENT STATUS OF THE PROJECT

01 We are following the UC calendar.

02 We have a partner and adjusted the project according to their input.

03 We have sketches of implementation and design.

ACHIEVED RESULTS (1)



01

All team

Project Definition and Scope

Our goals are to measure noise, develop a PPE detection system, alert workers, and analyze daily noise exposure.

02

Tomás D.
João S.

Background Research

We talked to the competition in Portugal and noticed that there is a gap in the market. We are trying to fight it with a focus on Portuguese and European legislation.

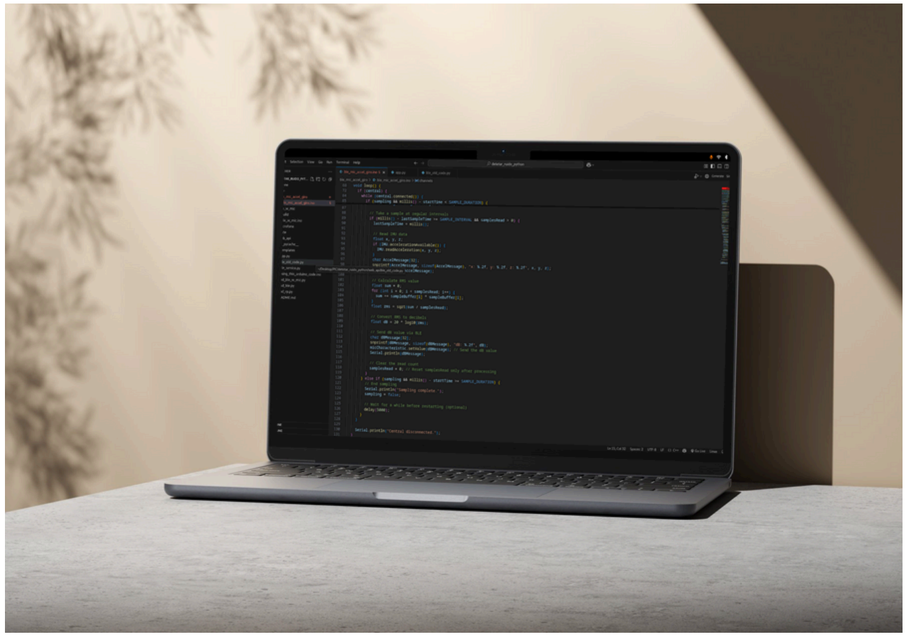
03

All team

Requirements

The system detects noise and verifies the correct use of PPE, alerting the user through a device. It operates offline, communicating via BLE with a mobile application for monitoring and report generation. It must be affordable, easy to use, and compliant with safety regulations.

ACHIEVED RESULTS (2)



04 All team

System Design

An RP2040 detects noise and alerts the user if levels are high (with LEDs). A Bluetooth transmission module verifies PPE usage.

05 Joao S. Tomás D. David A.

Project Management

The team has WhatsApp and Discord groups where project-related debates take place. With partners and interested parties, we communicate in person and via email. We have reunions, and website/blog is updated at least once a week.

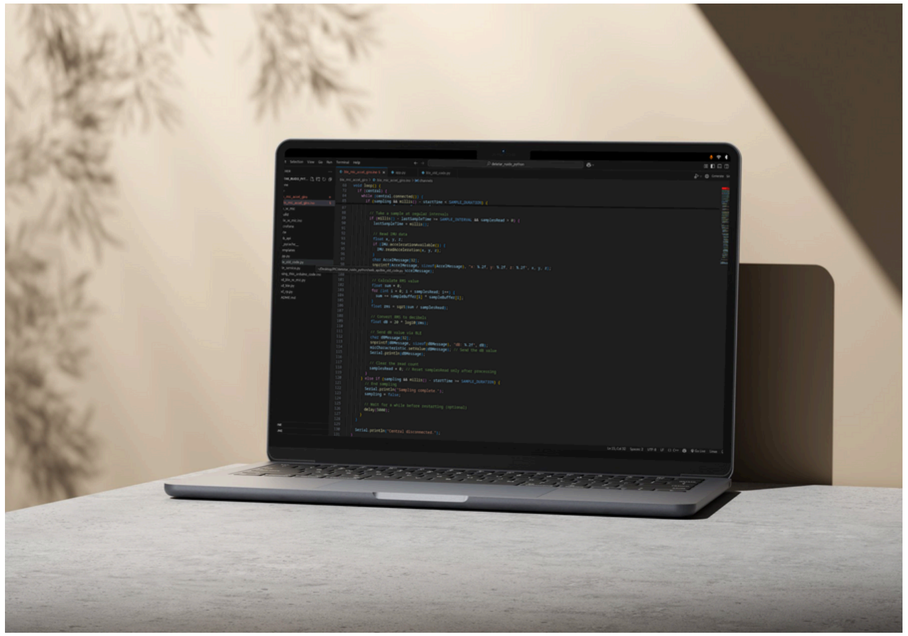
06 All team

Prototyping

Two devices are made using 3D printing. The noise detector is versatile and can be used in various contexts.

ACHIEVED RESULTS (3)

INTERVIEWS



01

Joao S.
Tomás D.

Occupational Noise Measurement Specialist

- No existing devices integrate measurement, alerts, and PPE verification.
- Both portable and static devices are useful depending on the context.
- Must comply with standards like Decree-Law No. 182/2006 and NP EN ISO 9612:2011.

02

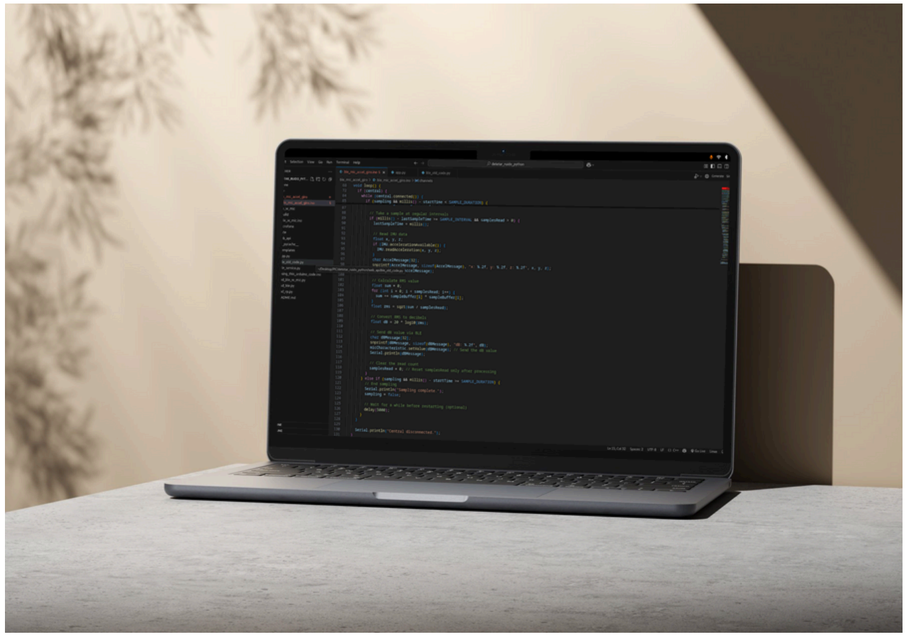
Joao S.
Tomás D.

QSE Manager

- Portable devices suit dynamic environments; static devices fit controlled spaces.
- Solution should benefit workers and safety professionals.

ACHIEVED RESULTS (4)

INTERVIEWS



03 Joao S. Tomás D.

QSE Director in Construction

- PPE negligence is common due to cultural factors.
- Portable devices are better for dynamic environments.

04 Joao S. Tomás D.

QSE Manager

- Workers often neglect PPE despite knowing risks.
- Solution must be low-cost and protect both workers and companies.

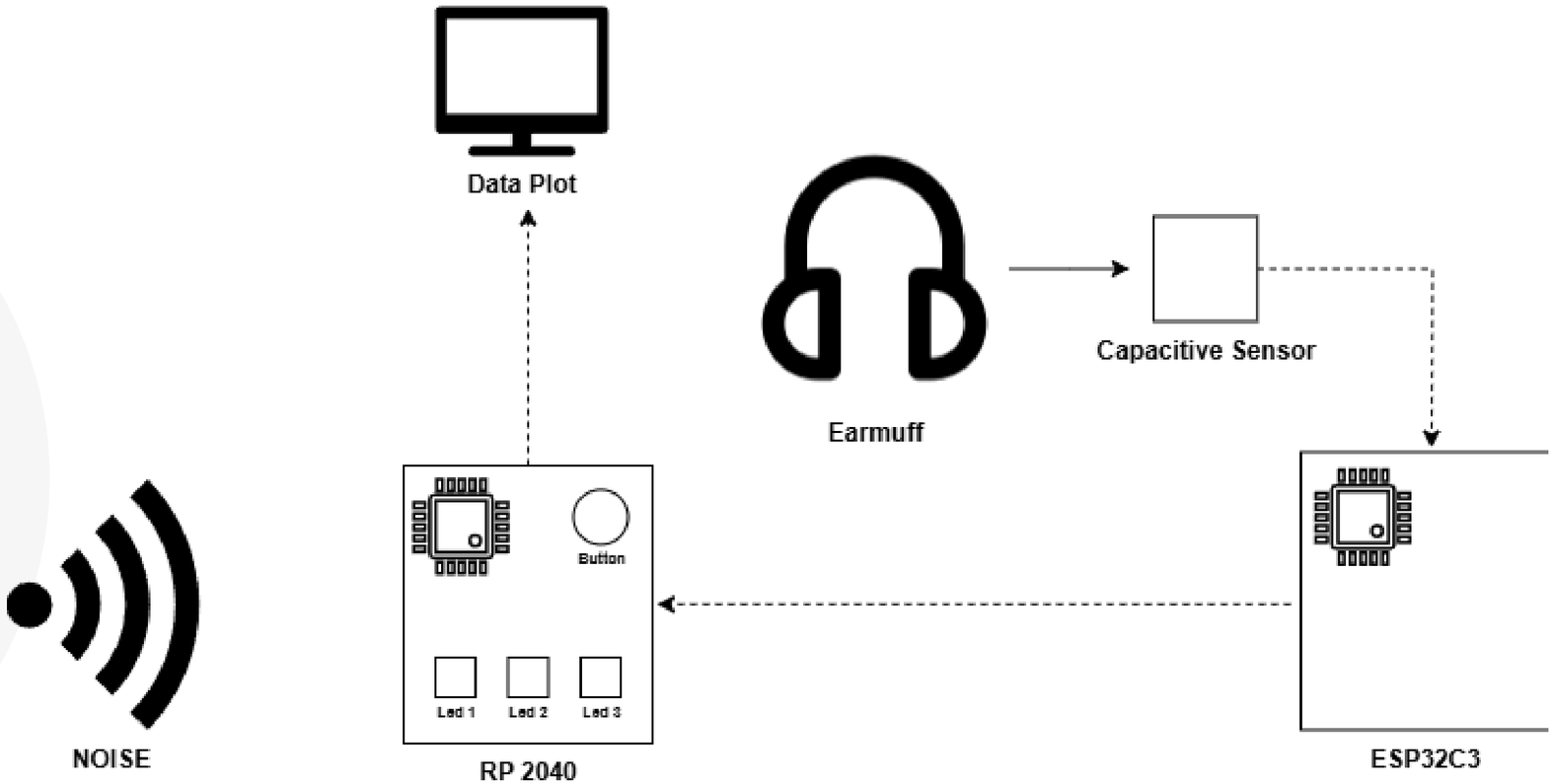
05 Joao S. Tomás D.

QESH Director in Industrial Environments

- Adaptability to different environments is crucial.
- Portable devices are versatile; static devices suit fixed areas.

ACHIEVED RESULTS (5)

PROTOTYPE SCHEME

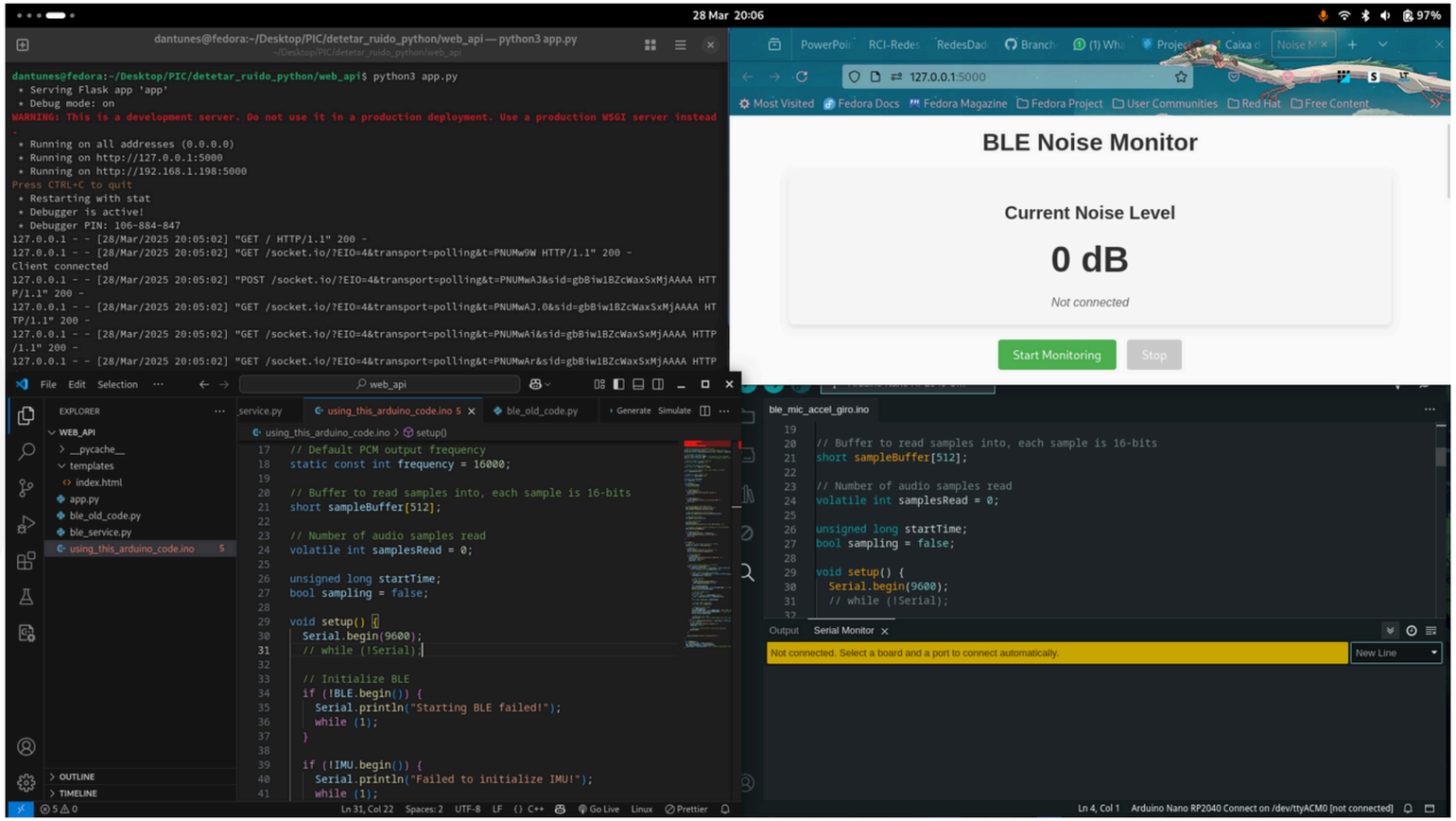


System's operation and structure

João S.

ACHIEVED RESULTS (6)

PROTOTYPE SOFTWARE (BLE AND NOISE DETECTION)



Code and web progress

David A.

SAFENOISE BLOG

URL

https://web.tecnico.ulisboa.pt/~ist1106327/public/

WEB DEV

David Antunes

WEB UPDATES Weekly summary

Tiago Gonçalves

GENERAL CONCLUSIONS FROM THE INTERVIEWS

01 Problem confirmed:

- Negligence in using EPI in noisy environments is a real issue, especially in sectors like construction and industry.
- There are some gaps/failures in the products already available on the market.

02 Proposed solutions:

- Portable devices are preferred for dynamic environments.
- Static devices are suitable for controlled environments.

03 Priority features:

- Real-time alerts.
- Verification of correct EPI usage.
- Daily reports for monitoring and awareness.
- Affordable cost and ease of use.

04 Standards and legislation:

- The solution must comply with applicable standards and legislation, such as Decree-Law No. 182/2006 and the NP EN ISO 9612:2011 and EN 458:2016 standards.

CHALLENGES FACED BY THE TEAM

01 Communication challenges between Alameda and Tagus.

02 Task management has been difficult.

03 Companies are not always available to assist us.

CONTRIBUTION OF EACH TEAM MEMBER (1)

			Tiago Gonçalves	David Antunes	João Silvestre	Tomás Dias	Miguel Simões	João Campos
1	HR	Work distribution			*			
	NT	Scope and objective of the challenge		*				
	NT	Communication with the group						
2	T	Define metrics					*	
	T	Ideas to solve the problem						
	NT	Existing solutions				*		
	T	Best solution						
	NT	Review relevant literature			*			
	NT	Identify beneficiaries, clients, and partners			*			
	NT	Review the final version				*		
	NT	Communication with the group						
3	T	Create a website		*				
	NT	Activity report	*					
	NT	Communication with the group						

Work Distribution	
M	Management
HR	Human resource
T	Technical
NT	Non-Technical
Bad	God

The “*” represents the responsible for that task

CONTRIBUTION OF EACH TEAM MEMBER (2)

4	NT	Interviews			*			
	NT	Interview report				*		
	NT	Communication with the group						
5	T	Solution diagram					*	
	NT	External opinions			*			
	T	Solution requirements		*				
	NT	Communication with the group						
	NT	Internal meeting						
6	T	Material list					*	
	NT	Prototype cost				*		
	NT	Communication with the group						
7	T	Results obtained						
	NT	Task report	*					
	NT	Final version planning				*		
	NT	ElectroCap mid-program pitch deck				*		
	NT	Communication with the group						
	NT	Internal meeting						

The “*” represents the responsible for that task

Team 8

End

SAFENOISE

ELECTROCAP MID-PROGRAM PITCH DECK

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TÉCNICO LISBOA

SAICA

March 2025