

# ElectroCap Project Proposal

## Bridging Vision Gaps in University Spaces

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TÉCNICO LISBOA

# 1. Advisors and Mentor

- Scientific Advisor: visually impaired person
- Scientific Co-advisor:
- Coordinator: Marcelino Santos
- Mentor: software engineer (e.g: Situm); computer systems student

\*None of these people have yet been confirmed

## 2. Problem definition

The lack of accessibility in higher education institutions in Portugal makes it very hard for blind people to continue their studies.

To address this challenge, we propose a solution with a technology that enables blind individuals to navigate within enclosed spaces, specifically focusing on Instituto Superior Técnico.

Since mobile phone GPS doesn't work inside enclosed spaces due to the inability to communicate with satellites, blind students face a challenge in independently navigating to the rooms where their classes are taking place.

Based on the research for solutions that we conducted, this would require very little to almost no investment.

# 3. Solution beneficiaries

The solution we're suggesting is mainly for visually impaired individuals who face challenges due to the lack of accessibility in educational institutions.

However, this indoor navigation system isn't just for blind people; it helps anyone who isn't familiar with the space. This means it benefits not only blind individuals but also those who are less acquainted with the surroundings.

# 4. Technological solution

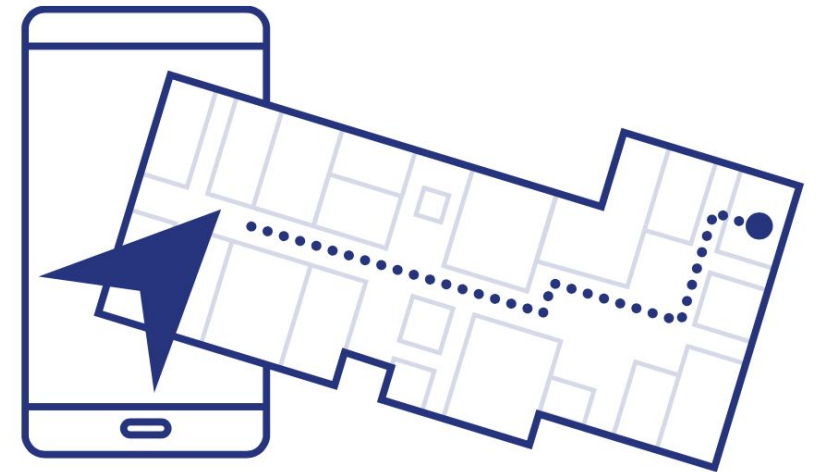
## Overview:

Our team is going to develop a smartphone application designed to assist blind individuals in navigating Instituto Superior Técnico.

The primary goal of the app is to provide sound-based guidance to visually impaired users as they move through various spaces.

Users can choose their destination, and the app will then offer instructions, based on their real time location, for either the shortest route or a path adapted for those with limited mobility.

Additionally, the app will display a visual map incorporating indoor navigation, offering visual users a comprehensive and inclusive indoor navigation experience.



# 4. Technological solution

## Application Main Functionalities:

- **Mandatory:**
  - Indoor map and turn-by-turn directions for users
  - Options for the shortest route or a path adapted for those with limited mobility
  - Complete audio experience
  - Favorites tab for users to select their most frequently visited places
- **Nice to Have:**
  - Synchronization with IST schedules
  - Prediction of path time to alert the users about how early they need to start their path
- **Extra:**
  - Integrate Microsoft Azure API which is an augmented reality AI that might be useful in certain situations (ex: finding a specific door, finding an empty seat, etc.).



# 4. Technological solution

## **Application Software:**

We are planning on using a cross-platform framework, such as Flutter, to build our mobile app with a single codebase for both Android and iOS.

Situm provides an SDK (Software Development Kit), that we'll use to integrate advanced indoor positioning features seamlessly into our app.

Flutter also provides capabilities for audio integration, that we will use to add spoken directions and instructions in our application.

By combining the flexibility of Flutter and the powerful features offered by the Situm SDK, we aim to deliver a robust and user-friendly mobile app experience for our users

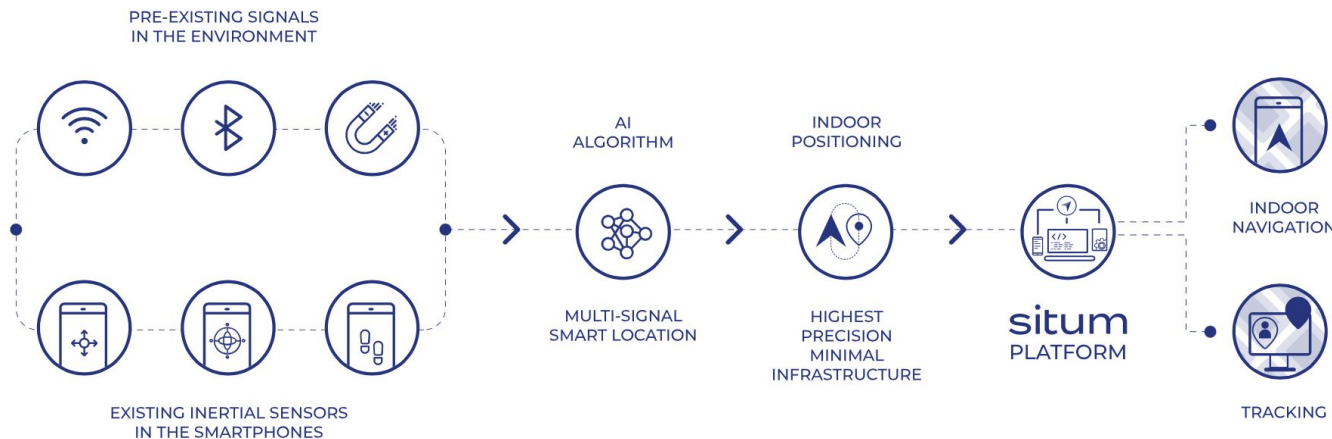


# 4. Technological solution

## How the Algorithm works:

To achieve our goal, we will implement in our app an indoor location algorithm from [SITUM](#).

This algorithm ensures high accuracy without the need for additional infrastructure investment, utilizing existing environmental information like magnetic fields, Bluetooth, and WiFi. The algorithm also incorporates smartphone-integrated sensors such as a compass, gyroscope, accelerometer, and barometer to infer user movement.





# 5. Competitors and previous work

BlindSquare: An app that provides GPS-like navigation for blind individuals indoor and outdoor.

- Disadvantage: Relies heavily on external data sources and doesn't provide detailed information about specific indoor places.
- Our advantage: Focus on delivering highly detailed, room-level information within Instituto Superior Técnico

Lazarillo: Another navigation app designed for the visually impaired, offering indoor and outdoor navigation.

- Disadvantage: Similar to blindsquare, may lack precision indoor navigation and might not provide specific information inside the educational institution.
- Our advantage: our solution will be tailored for the unique layout of the educational building, offering precise indoor navigation.

Kontakt: Use beacon technology to help users navigate within enclosed spaces.

- Disadvantage: Beacons may require significant infrastructure setup and maintenance, making them less cost-effective.
- Our advantage: It's a low cost solution that requires minimal infrastructure changes and it's adapted to blind individuals.

It is noteworthy that, even with all these technologies, there isn't currently a system that helps the orientation of visually impaired individuals in Técnico.

## 6. Solution requirements

In the context of aiding visually impaired individuals in educational institutes (Instituto Superior Técnico), key requirements include accurate indoor navigation functionality utilizing IPS technology, efficient real-time performance, an intuitive and efficient user interface, consistent reliability and scalability for potential expansion to other institutions. These requirements serve as the foundation for developing a successful, accessible, and user centred solution.

# 7. Technical challenges

- Integration of the application into the website
- Having a precise location tracking;
- Develop an intuitive and user-friendly application for visually impaired people
- Incorporating clear and easily understandable voice-guided instructions to enable efficient and seamless interaction with the app for users;
- Consistent real-time performance.
- User Data Security Concerns: with the use of location and probably some personal information, ensuring user security and privacy can be considered a technical challenge.

## 8. Partners

In order to get feedback on the effectiveness of the system we are developing, we hope to be able to count on the help of ACAPO or the Helen Keller Center.

We will also be able to count on the help of the Instituto Superior Técnico, as we will need to test our technology there and we may also need some information (maps, routers, etc).

We also hope to be able to count on the help of Situm.

# 9. Testing and validation metrics

- Test in diverse indoor environments with different layouts (narrow corridors, spacious areas, corridors with multiple rooms, etc)
- Perform tests with individuals with visual impairments to ensure the accessibility and user-friendliness of the interface.
- Evaluate the effectiveness of the information provided by the system in terms of orientation and navigation.
- Evaluate the system's capability to provide secure and safe guidance.
- Collect feedback from potential users to understand their experiences and needs, making necessary adjustments for continuous improvement.

# 10. Division of labor (I)

<b>Diana</b>	<b>Mafalda</b>	<b>Maria</b>
Planning and implementation of the website	Development of the app	Planning the website content (information presented, how to display the information, etc)
Demonstration video (editing, planning, etc.)	Research/decision-making and implementation of how to transmit the information to the users (most likely audio)	Website Design
Support for the development of the app	Audio System Integration on the app	Creation of the poster
Digitalize IST map layouts for our purpose	Implementation of the location algorithm	Support for the development of the app
Creating user manuals and technical documentation	App Design	App Design



# 11. Division of labor (II)

<b>Mariana</b>	<b>Marta</b>	<b>Tomás</b>
Planning and implementation of the website	Planning the website content (information presented, how to display the information, etc.)	Development of the app
Front-end development of the app	Contact ACAPO / Centro Helen Keller/ mentores/ IST... and management of their help	Exploring software options for app development/ design
Planning and conducting user testing (ensuring the ease and accessibility of the app)	Support for the development of the app	Implementation of the location algorithm
Creating user manuals and technical documentation	Implementation of the location algorithm	Audio System Integration on the app
Implementation of the location algorithm	Creation of the poster	Digitalize IST map layouts for our purpose

# 12. Schedule

## Timeline



# Semana 2 (26 mar- 1 mar)

Marta

Implementação website

Mariana

Implementação website

Tomás

Implementação website

Maria

Implementação website

Resumo semanal de atividades no website

Mafalda

Implementação website

Diana

Implementação website

# Semana 3 (4 mar- 8 mar)

Marta

Resumo semanal de atividades no website

Design Web app

Mariana

Pesquisa de soluções para criar a web app e avaliação de prós e contras

Tomás

Pesquisa e integração da solução da Slum no algoritmo

Maria

Design Web App

Mafalda

Pesquisa e integração da solução da Slum no algoritmo

Enviar email à Situm

Diana

Design Web app

# Semana 4 (11 mar- 15 mar)

Marta

Implementação Web App

Mariana

Implementação Web App

Enviar email a ACAPO

Tomás

Integração da solução da Sltum no algoritmo

Maria

Implementação Web App

Mafalda

Integração da solução da Sltum no algoritmo

Resumo semanal de atividades no website

Diana

Implementação Web App

# Semana 5 (18 mar- 22 mar)

Marta

Implementação Web App

Mariana

Implementação Web App

Resumo semanal de atividades no website

Tomás

Integração da solução da Sltum no algoritmo

Maria

Implementação Web App

Mafalda

Integração da solução da Sltum no algoritmo

Diana

Implementação Web App



# Semana 6 (25 mar- 29 mar)

Marta

Implementação Web App

Mariana

Implementação Web App

Tomás

Integração da solução da Sltum no algoritmo

Maria

Implementação Web App

Mafalda

Integração da solução da Sltum no algoritmo

Diana

Implementação Web App

Resumo semanal de atividades no website

# Semana 9 (15 ab- 19 ab) (Semana 7 e 8 :Preparação para exames e exames )

Marta

Implementação Web App

Mariana

Implementação Web App

Tomás

Integração da solução da Sltum no algoritmo

Resumo semanal de atividades no website

Maria

Implementação Web App

Mafalda

Integração da solução da Sltum no algoritmo

Diana

Implementação Web App

# Semana 10 (22 abril- 26 abril)

Marta

Últimos retoques na Web App

Testes no IST

Mariana

Últimos retoques na Web App

Testes no IST

Tomás

Sistema de áudio para as direções-  
concretização

Testes no IST

Maria

Últimos retoques na Web App

Resumo semanal de atividades no  
website

Mafalda

Sistema de áudio para as direções-  
concretização

Diana

Últimos retoques na Web App

# Semana 11 (29 abril- 3 maio)

Marta

Últimos retoques na Web App

Iniciar contacto com ACAPO para realização de testes

Mariana

Últimos retoques na Web App

Resumo semanal de atividades no website

Tomás

Sistema de áudio para as direções-concretização

Maria

Últimos retoques na Web App

Testes no IST

Mafalda

Sistema de áudio para as direções-concretização

Testes no IST

Diana

Últimos retoques na Web App

Testes no IST

# Semana 12 (6 maio- 10 maio)

Marta

Considerações finais

Design Poster

Mariana

Considerações finais

Design Poster

Tomás

Considerações finais

Design Poster

Resumo semanal de atividades no website

Maria

Considerações finais

Planear vídeo

Mafalda

Considerações finais

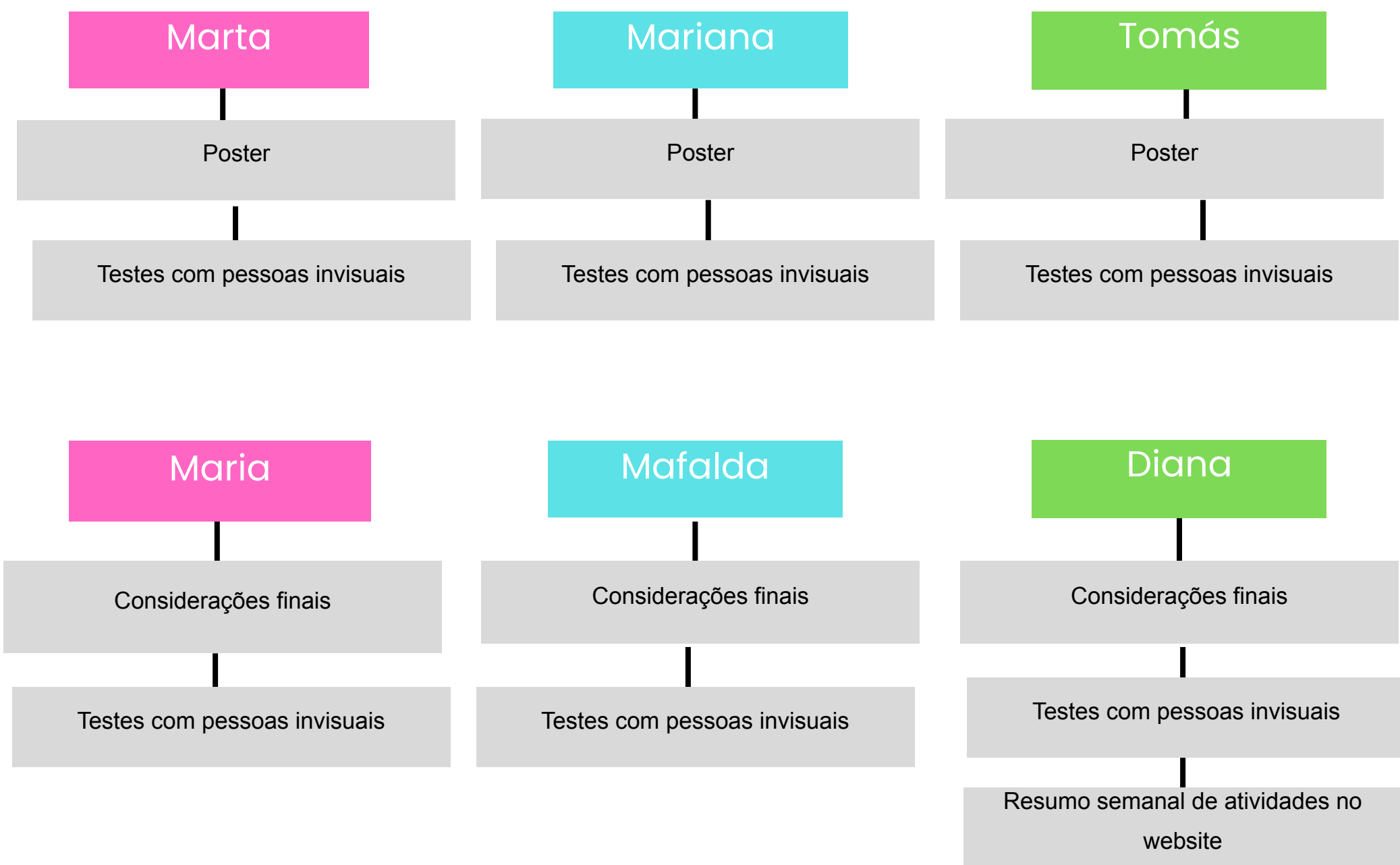
Planear vídeo

Diana

Considerações finais

Planear vídeo

# Semana 13 (13 maio- 17 maio)



Marta

Poster

Testes com pessoas invisuais

Mariana

Poster

Testes com pessoas invisuais

Tomás

Poster

Testes com pessoas invisuais

Maria

Considerações finais

Testes com pessoas invisuais

Mafalda

Considerações finais

Testes com pessoas invisuais

Diana

Considerações finais

Testes com pessoas invisuais

Resumo semanal de atividades no website



# Semana 14 (20 maio- 24 maio)

Marta

Gravação vídeo

Mariana

Gravação vídeo

Tomás

Gravação vídeo

Maria

Gravação vídeo

Mafalda

Gravação vídeo

Resumo semanal de atividades no website

Diana

Gravação vídeo

# Semana 15 (27 maio- 31 maio)

Marta

Gravação vídeo

Mariana

Gravação vídeo

Tomás

Gravação vídeo

Maria

Gravação vídeo

Resumo semanal de atividades no website

Mafalda

Gravação vídeo

Diana

Edição vídeo

# Semana 16 (3 jun- 7 jun)

Marta

Rever o trabalho realizado

Fazer eventuais alterações

Mariana

Rever o trabalho realizado

Fazer eventuais alterações

Tomás

Rever o trabalho realizado

Fazer eventuais alterações

Maria

Rever o trabalho realizado

Fazer eventuais alterações

Mafalda

Rever o trabalho realizado

Fazer eventuais alterações

Diana

Rever o trabalho realizado

Fazer eventuais alterações

Resumo semanal de atividades no  
website