TÉCNICO LISBOA

VISUALIZE

Bridging Vision Gaps in University Spaces

EletroCap pitch deck-Grupo 6

How it started ?

Everything started when we met **João**, a blind student who attended Instituto Superior Técnico. He was **forced to drop out**, not only due to the lack of Braille documents and adapted teaching methods but also because of the **campus's inaccessibility**. The poor accessibility meant he spent a lot of time searching for classrooms, which led him to frequently rely on the NAPE (Student Support Center) members, thus compromising his autonomy.

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Statistics

Inaccessible Education for Visually Impaired Students in **Portugal**

28,000

citizens are **unable to see**, even with glasses or contact lenses.

22.1%

of young people aged **18 to 24** with impairments **drop out** of school.

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Problem Definition

Navigation Challenges in University Environment

Limited Accessibility

- **Complex layouts:** Campuses with multiple buildings and hidden pathways are challenging for the community. Over time, the difficulty of navigating such an environment without adequate support can also discourage visually impared students from continuing their education leading to higher dropout rates.
- **Inadequate signage:** Traditional signs are often not accessible. Many campuses lack tactile signs, braille labels, or auditory cues for independent navigation.

Inefficiency and Time Loss

- **Wasted Time:** We often waste a lot of time searching for a room, resulting in being late for classes. This problem is worsened for first-year students, Erasmus students unfamiliar with the campus, and visually impaired individuals.
- **Difficult to find classrooms:** Poorly marked campuses make finding classrooms difficult, causing delays and missed classes. For sighted students, this can be a source of frustration and anxiety, while for visually impaired students, it can be even more daunting.

Technological and Economical Challenges

- **Existing solutions are often expensive:** Many accessibility solutions are expensive and often require additional hardware. Educational institutions often operate under tight budgets, preventing them from investing in necessary improvements. Consequently, these students experience ongoing difficulties in navigating the campus independently, impacting their academic success and overall university experience.

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Solution

Our **goal** was to develop a **navigation app** tailored to the needs of visually impaired students, enabling them to navigate the university environment confidently and independently, thereby reducing the risk of dropping out of studies due to accessibility challenges.

The **restrictions** were the cost of the solution, which meant making sure **we would not need any aditional hardware,** other than the users phone. Ensuring a **precise location**, to meet our primary users needs. Making sure the solution was **easily implemented in other spaces** other than our university and **acessible to all** the user's **phones**.

Therefore we choose **Flutter**, an open source framework by Google for building elegant, multi-platform applications from a single codebase, to build our **App**. And began our search for the best indoor navigation solution that would meet our requirements.

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Conception process

01/

Initially, we carried out **numerous tests** with the different options we found (Osiris, AnyPlace, Situm, Apple's map, Navigine ...). Some of them had a short **trial period**, meaning that we would waste a lot of time implementing them and after that, all the work would be deleted. Others **required aditional hardware** or were **imcompatible with some of the most common Operating Systems**.

02/

After a long period of research, we realised that in 2015, **Técnico had partnered with Google Maps** to create an indoor map. We contacted DSI to find out more about it but there was one big problem: the map had very few rooms and the directions didn't work.

03/

Given this, we accepted the challenge of trying to implement our maps, using the **Google Maps Software Developer Kit (SDK)**. And developing our own navigation system.

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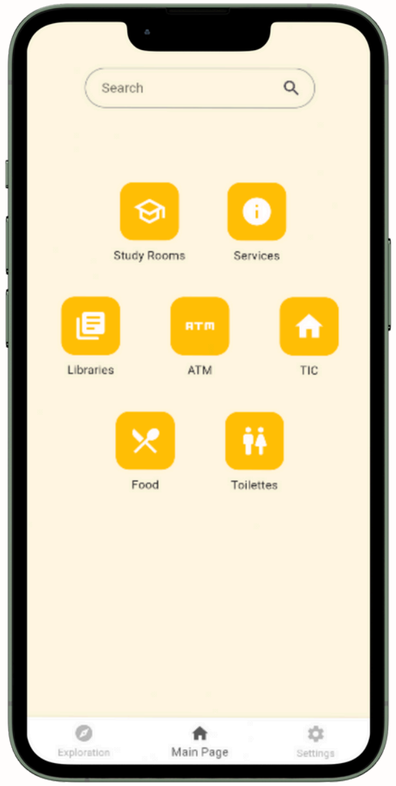
Product

Login

Simple and easy login page where you have the multiple and usual ways to get into most apps. With a Firebase Database to keep all users acounts.

Product

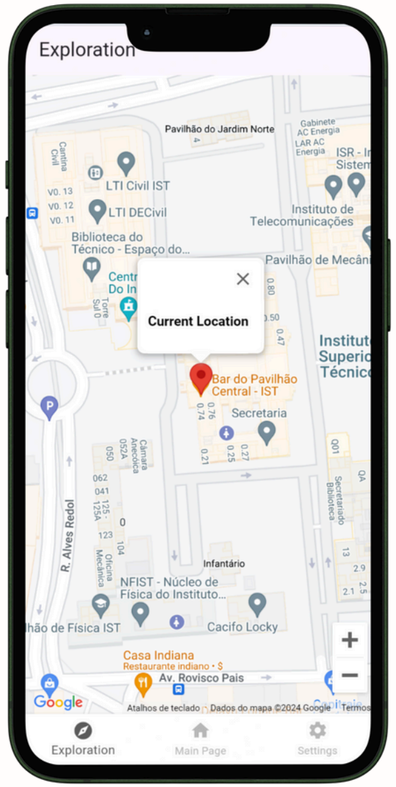


Main Page

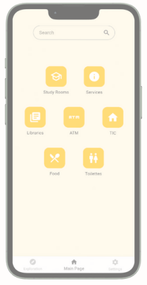
In the center seven easy access buttons that hold the main places you can go to in your university (Food places, Libraries, Study Rooms, Student Services...).
Down bellow a navigation bar leading you to the main page, exploration page and the settings. There is also a bar where you can search for the place you want to go to.

Product

Exploration



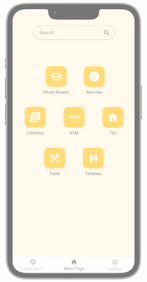
The exploration page allows the user to determine their current position. The app provides this information both visually and through audio, indicating the specific building or street they are on.



Product

Space Choices

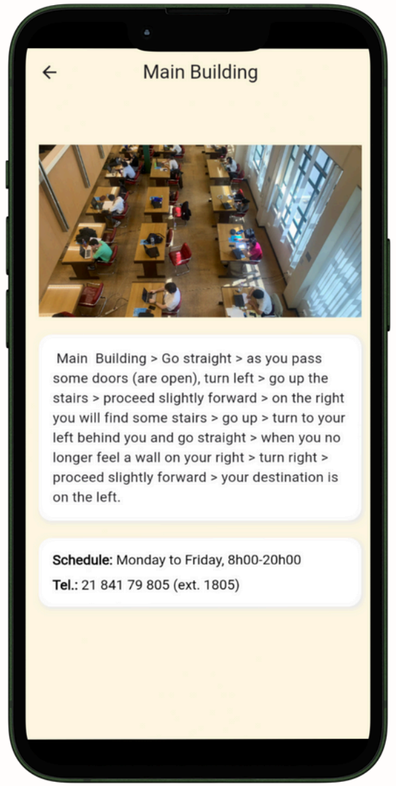
Inside the categories there is a list with the spaces of that type. Each with tree options: More Info, our apps Directions, a Google maps shortcut.

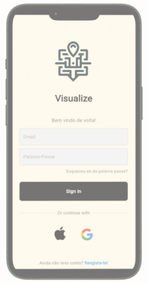


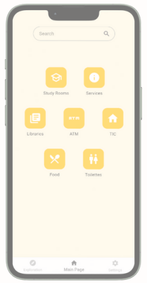
Product

More Info

Where you have a brief description of the directions from the main entrace of the specific building to the selected space. Also access to the places's schedule as well as its contact information.



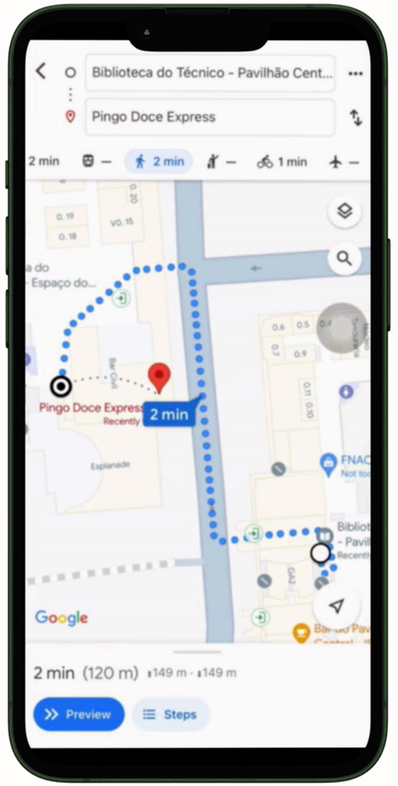


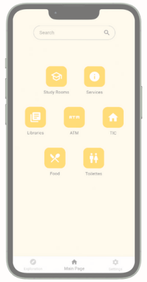


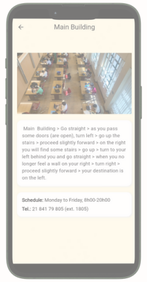
Product

Directions

Here is where you can have sound and vibration guided directions to your desired destination.







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3 ways to find your destination

More information

At each destination, you can consult images of the place, written directions (with labels, to work with the accessibility shortcut on mobile phones). In the study rooms and services, you can check the opening times

Visualize Map

We have implemented our map using the Google Maps SDK, an API to get routes and developed an algorithm based on sound and vibrations for custom navigation.

Google Maps Shortcut

Implementation of shortcuts directing to the desired destination on google maps.

App Development Process

- Designed a user interface with shortcuts to the most useful destinations on campus
- Implemented an interactive map within the app
- Enabled real-time location tracking for users
- Established and drew routes between the user’s location and selected destination
- Developed a navigation system that provides directions for the user to follow the route
- Integrated the map and its related features seamlessly with the app’s interface

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Navigation System

Designed and developed by Visualize Team

Overview

- Takes the routes between the user's location and destination
- Provides sound and vibration real-time instructions to guide the user to their destination

Guidance Features

- Ensures users stay on the correct path
- Provides intuitive, real-time guidance

Advantages

- Avoids reliance on visual cues and cardinal directions like "turn east" or "turn west"
- Accessible and practical for blind users

System Dependencies

- Routes API from Google Maps for accurate routing information
- Compass packages for determining the phone’s direction
- Real-time location tracking packages for precise user location data

Indoor Features

- Utilizes Wi-Fi-based positioning for indoor positioning on Android devices
- Currently limited by precision and availability of accurate indoor routes
- Potential for improved performance with advancements in indoor positioning accuracy and route mapping

User Benefits

- Addresses unique navigation challenges
- Offers greater independence and confidence in navigating surroundings

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Navigation System

Designed and developed by Visualize Team

? How it works

- Parses the route provided by the Routes API into multiple segments.
- Determines the user's current segment using real-time location data.
- Utilizes the phone's compass to ensure the user is heading towards the beginning of the next segment.
- Transmits sound and vibration feedback to indicate the correct direction.
- Repeats the above steps continuously until the user reaches the destination.

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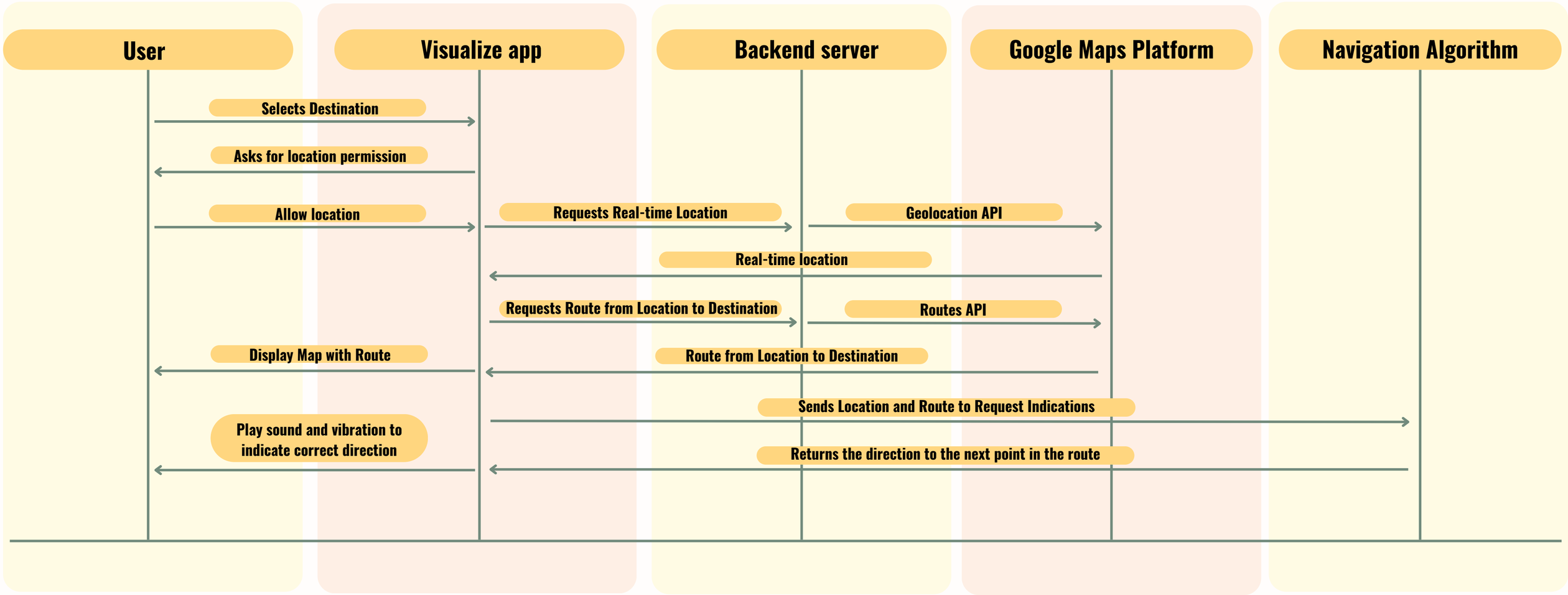
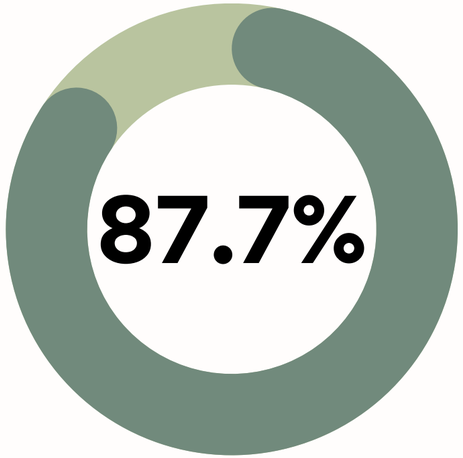
Visualize App Layers

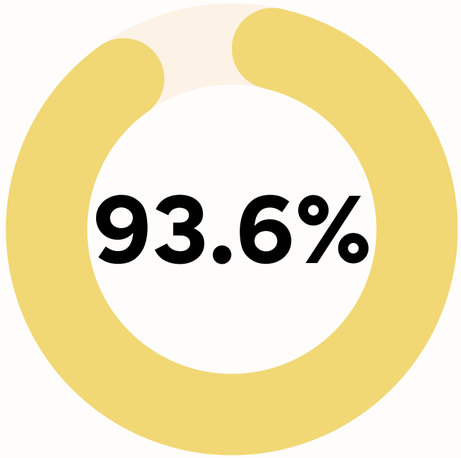


Market Research

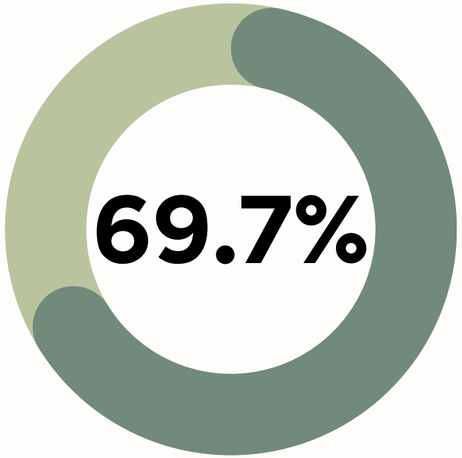
To better understand the needs of our users, we conducted a study using Google Forms. 79 students answered our questionnaire. The results highlight the importance of our solution:



87.7% of the academic community said they had already arrived late to classes because they couldn't find the room



93.6% of the academic community consider the existence of an app like ours to be important



69.7% of the academic community said they had spent more then 10 minutes looking for a room

Target Audience

Blind people

Provides sound and vibration guided navigation for independent and confident campus mobility.

First Year Students

First-year students often face challenges navigating the campus due to their unfamiliarity with the environment.

Erasmus Students

Offers multi-language guidance to help Erasmus students navigate the campus easily.

Visitors

Visitors coming to the campus for events, conferences, or meetings may find it difficult to navigate without assistance.

By providing clear directions and intuitive support, our solution **enhances campus navigation**, promoting a **welcoming** and **accessible environment.** This aligns with the institution's commitment to **inclusivity**, making the campus more **inclusive** and **supportive** for all. In addition to the main target audiences, teachers, researchers and regular students will also benefit from the solution.

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Competitors

	Visualize	NAPE	Google Maps	Fénix	Apps like Lazarillo
Voice Guidance	🔴	🟢	🟢	🔴	🟢
User Accessibility	🟢	🟢	🔴	🔴	🟢
Integration with the Institution	🟢	🟢	🟡	🟢	🔴
Accuracy of Information	🟡	🟢	🟡	🔴	🟡
(1) Low Cost of Implementation	🟢	🔴	🟡	🟢	🔴
User Independence	🟢	🔴	🔴	🔴	🟢

Legend:

🟢 = Yes 🟡 = Medium 🔴 = No

(1) Cost of implementation, from the point of view of someone who wants to solve the challenge of lack of accessibility. For example, a NAPE member receives a salary, so it's not a cost-free alternative. Visualize, having no associated hardware, is completely cost-free

Benefits

Accessible to all

Simple and intuitive design ensures everyone, regardless of tech skills, can easily navigate the campus.

User friendly Navigation system

Adapted for blind community

Includes sound and vibration based navigation and adaptive features, ensuring safe and independent campus navigation for blind users.

Support for International Students

Time saving

Quickly find destinations on campus, reducing stress and allowing more focus on academic and professional activities.

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Costs

Zero Cost Development

- Software development by our team;
- User interface and navigation system design by our team;
- Initial testing and debugging by community members.

Free Resources

- Open Source Tools: Utilized free, open-source software and platforms;
- Development frameworks;
- Design tools;
- Testing environments.

Support and Maintenance

- Community Support: Ongoing support and maintenance provided by volunteers;
- Regular updates and bug fixes;
- User support through community forums.

A 100% free solution, without hardware

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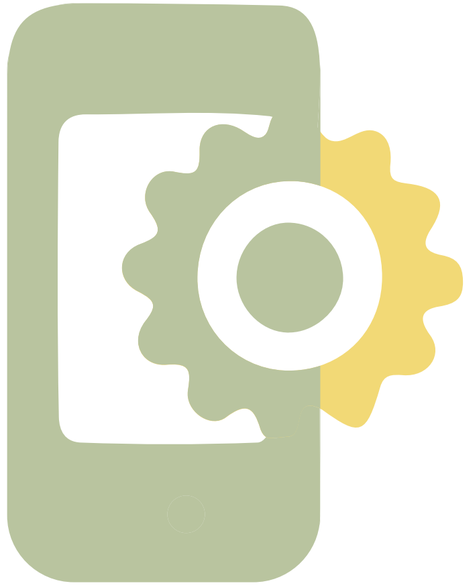
Results

01/ App Development

We successfully developed our app using Flutter. We implemented the following functionalities:

- Simple and intuitive login page
- Home page with quick access buttons to the main university locations (canteens, libraries, study rooms, student services)
- Exploration page with visual and audio indication of current location
- Integration of a map within the app
- Drawing routes between the user's location and selected destination
- Providing sound and vibration navigation based on the drawn route until the destination is reached
- Integration with Google Maps for external directions (shortcuts)



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Results

02/ Integration and Implementation

- Internal Mapping: We implemented our internal maps using the Google Maps SDK, overcoming the limitations of existing maps.
  - Through vibrations and sounds, using data from magnetometer we are able to tell the user the direction of the next point on the route, until he reaches the destination.
- At the door of the pavilion, an announcer indicates the way forward.
- Compatibility: the application is compatible with all common systems (Android, web, IOS) and requires no additional hardware beyond the user's smartphone.

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Future Considerations

Customised account

In the future, it would be beneficial to create a personalized experience for each user of the app, allowing them to add their favorite spots on campus. The first step towards achieving this goal was the creation of the database.

Indoor Features

Enhance the accuracy of indoor location tracking, possibly with hardware , and define clear indoor routes to enable effective indoor navigation.

Accessibility

Tests conducted with a visually impaired person highlighted the need for more audio information to help users understand their surroundings and locate themselves more easily.

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Our Team

Diana Coelho

Mafalda Brito

Marta Catalão

Maria Neves

Mariana Ramos

Tomás Esteves

Advisors and Mentors

Marcelino Santos
Scientific Advisor

Francisco Simplício
Scientific Co-advisor

Luís Caldas de Oliveira

Coordinator

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	Website	Video/Poster	Others
 **Diana**	• Helped designing the website • Updated the blog several times	• Helped filming the video • Edition of the video	• Colaborated in preparing the pitch deck apresentation
 **Mafalda**	• Helped designing the website • Updated the blog several times	• Design and conception of the poster	• Colaborated in preparing the pitch deck apresentation
 **Maria**	• Helped designing and developing the website; • Updated the blog several times.	• Design and conception of the poster; • Helped filming the video.	• Colaborated in preparing the pitch deck apresentation.

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Project

Diana

- Conducted a comparative analysis of open-source solutions for indoor GPS to evaluate their advantages and disadvantages, identifying the most suitable option for our requirements.
- Development of the application's front end (login page, main page, settings, and subpages) with simplified navigation and audio feedback for ease of use by blind individuals.
- Performed tests with TalkBack on the Android Emulator to ensure the accessibility of our app.
- Integrated the Firebase database into the application and deployed it to the hosting server to enable more detailed testing and to obtain feedback from blind users.

Mafalda

- Researched and contacted our first navigation solution (Situm). Then tested the different open sources to decide what would be the best option (Osiris, AnyPlace, Situm, Apple’s indoor map, Navigine, Google Maps...).
- Integrated the Google Maps shortcut option into to the app, including specifying each place’s Coordinates and Waypoints to better the routes provided by Google.
- Idealized and implemented the additional features to the navigation inside our app. Using Google Maps SDK made sure the current location is always known to the algorithm and that it would be displayed in the center. Helped make the functions needed to guide the users through the route with haptic vibrations (Algorithm).

Maria

- Collection of information about Técnico's spaces for the app and redesigned the app on Figma to be blind-friendly, maintaining contact and gathering feedback from blind users.
- Development of the app.
- Tested how we could integrate the user's location with Wi-Fi signals throughout the campus.
- Researched and tested solutions (open sources) to implement indoor location at Técnico, providing directions for the blind students.
- Implemented the option to provide the current location through sound when opening the app (exploration button).
- Collection of schedules, photos, contacts and directions for various spaces in the app (More Information Button).

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	Website	Video/Poster	Others
 **Mariana**	• Helped designing and developing the website • Updated the blog several times	• Helped filming the video • Design and conception of the poster	• Collaborated in preparing the pitch deck presentation
 **Marta**	• Helped designing the website • Updated the blog several times	• Creation of the final design and conception of the poster • Helped filming the video	• Collaborated in preparing the pitch deck presentation
 **Tomás**	• Created and developed the website • Updated the blog several times	• Helped filming the video • Designed App's technological schematic on the poster	• Collaborated in preparing the pitch deck presentation

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Project

Mariana

- Contact point between the team and APEC;
- Seeking the best option to develop the app; (Flutter)
- Development of the first prototype of the web app;
- Tested how we could possibly integrate the user's location with Wi-Fi signals throughout the campus;
- Development of the app (search-bar);
- Research and tested solutions for audio directions. Identified and marked strategic and interest points on our maps that would be possibly made available to the user through sound.

Marta

- Researched and explored multiple methods to implement a map within the app (Osiris, AnyPlace, Situm, Navigine, Google Maps...).
- Researched and experimented with different techniques to implement a navigation system tailored for blind users
- Conceptually designed the custom navigation system
- First design of the application (changed after feedback from APEC)
- Searched for different tools to develop the app

Tomás

- Researched and explored multiple methods to implement a map within the app
- Developed the app’s backend and managed communication with APIs, including request and response handling
- Investigated and tested multiple approaches to establish routes between the user’s location and selected destination
- Researched and experimented with different techniques to implement a navigation system tailored for blind users
- Conceptually designed and developed the custom navigation system
- Integrated the user interface with the app’s backend

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Useful Link