

NAVISenseVest

Intelligent Multisensory Assistive Vest for Safe Navigation and Awareness

1 Identified Problem

People with visual impairments, elderly users and professionals in risk environments face difficulties navigating safely and independently. The lack of immediate information about obstacles increases the risk of collisions, falls and disorientation. Although solutions such as smart canes or sensor-based wristbands already exist, they remain limited, as they provide reduced perception of the surrounding environment. Therefore, a portable and intuitive solution is needed to improve users' safety and independence. In this context, the **NAVISense Vest** emerges as an assistive solution designed to improve environmental awareness, increasing safety, confidence and independence during navigation.

2 Solution Concept

The **NAVISense Vest** is a portable technological solution developed to support safe navigation for people with visual impairments, elderly users with mobility difficulties, workers in low-visibility environments and emergency teams. The system consists of a smart vest capable of detecting nearby obstacles and transmitting alerts to the user through vibrations, allowing greater awareness of the surrounding environment.

3 Why is the NAVISense Vest an innovative solution?

The **NAVISense Vest** differs from existing solutions, such as smart canes or sensor-based wristbands, by integrating obstacle detection directly into the vest, offering a more distributed and intuitive perception of space. In addition, it combines sensors, real-time processing, vibration alerts, GPS location and online monitoring in a single solution, making the system more complete and versatile.

4 Architecture

The prototype is composed of ToF distance sensors, responsible for collecting information about obstacles in the surrounding environment, and a BPM heart sensor for monitoring the user's heart rate. This data is processed by an **ESP32** microcontroller, which activates vibration motors placed on the vest whenever an obstacle is detected. The system also communicates with a mobile application via Bluetooth, allowing data to be sent to an online monitoring platform through a 4G/5G connection, where it is possible to monitor the GPS location, sensor data, system status and whether the vest user is in danger or not, known when they press the emergency button on the vest.

5 Results

Through the tests performed and the validation of the prototype, it was possible to verify the potential of the **NAVISense Vest** as a support solution for safe and autonomous navigation. The results obtained show that the integration of sensors, real-time processing, vibration alerts and remote monitoring can contribute to improving awareness of the surrounding environment and increasing user safety.

6 Team

The **NAVISense Vest** was developed by a team of students from Instituto Superior Técnico Lisboa, composed of Francisco Mariquitos, Raquel Barroso, Daniel Khom'yak, David Reimer, Tiago Pinto and Frederico Pinto, under the supervision of Professor Francisco Alegria and with the support of Duarte Marques. The team worked collaboratively across different areas of the project, including component selection, prototype development, vest design, mobile application, online dashboard, data communication, pitch deck and poster.

7 Conclusion

The **NAVISense Vest** contributes to safer, more autonomous and intuitive navigation, promoting greater confidence for people with visual impairments, elderly users and users in risk environments. Its ability to detect obstacles in real time, transmit vibration alerts and enable remote monitoring through GPS and an online dashboard makes it a portable, accessible and socially relevant solution, with potential application in domestic, urban, professional and emergency contexts.