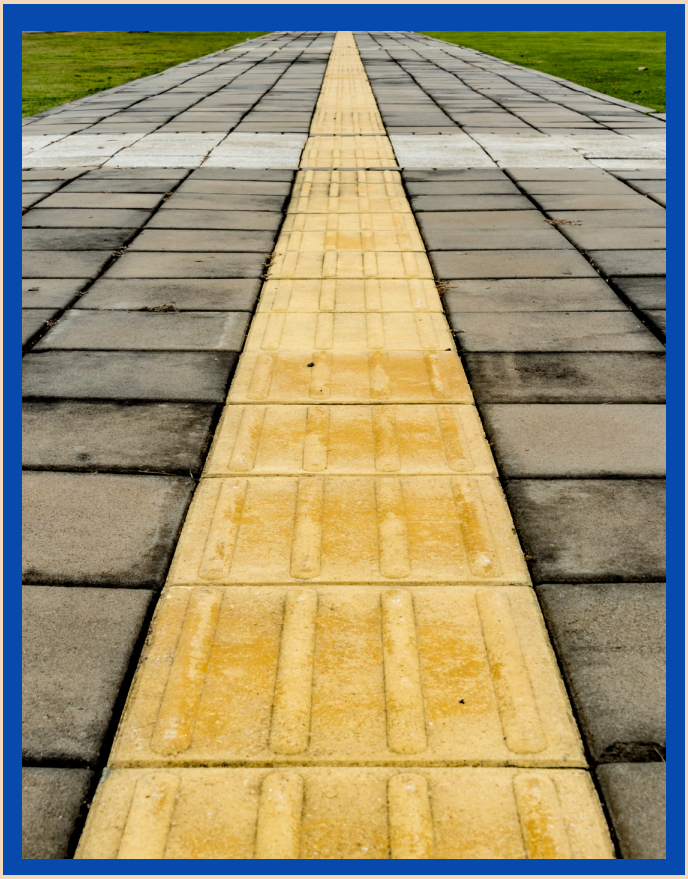
Dreamwaves' waveIn – Indoor Audio Navigation for Blind and Visually Impaired People

ACT4DYS

Background

Navigating indoor public transportation stations poses major challenges for people who are blind or have low vision. Traditional guidance systems, such as tactile paths or static signage, often fall short, especially in large, complex transit hubs. Recognising the gap in accessibility, the Austrian startup Dreamwaves developed waveIn, a smartphone-based, infrastructure-free indoor navigation solution. This project was initiated with support from EIT Urban Mobility and piloted in collaboration with Vienna's public transport operator, Wiener Linien. It reflects a broader push in Europe to make smart city technology inclusive, focusing specifically on non-visual orientation methods in complex environments like metro stations.



Key Activities

- The waveIn project created an app that uses audio Augmented Reality (AR) to help users navigate by following "virtual sound beacons" placed along an indoor route. Users wear headphones or use their phone's speaker to hear spatialised audio cues that guide them forward, left, or right, mimicking the experience of hearing a sound from the direction they need to walk.

- To provide accurate localisation without GPS or Bluetooth beacons, waveIn uses advanced 3D scanning and visual-inertial odometry. The team mapped indoor areas like Vienna's U-Bahn stations using LiDAR and computer vision, enabling the app to offer centimetre-level location accuracy. The system is able to update routes in real-time if users deviate from the intended path.

- The pilot included testing across multiple public transport stations, incorporating direct feedback from people who are blind or have low vision throughout the process. This ensured the app's sound design, usability, and accessibility features matched real-world needs.

Co-funded by the European Union

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Impact

Enhanced accessibility: The waveIn pilot demonstrated that indoor navigation for blind and visually impaired users could be delivered without relying on fixed infrastructure. Participants reported that the system enhanced their sense of independence and intuitive guidance that was superior to conventional voice directions. One user described the experience as "a bit like seeing," highlighting the power of spatial audio cues to support intuitive navigation.

Recognition: Beyond usability, the project has drawn international attention. Dreamwaves won the first prize at the European Investment Bank Institute's Social Innovation Tournament in 2022. The solution is scalable and cost-effective because it does not depend on physical installations like beacons, making it easier to replicate in other cities or buildings.

Challenges & Solutions

Indoor localisation in environments where GPS does not work: The solution combined real-time image recognition with inertial measurements from smartphones to maintain high accuracy even in crowded spaces or areas with limited lighting.

Ensuring users could easily interpret the directional cues: Instead of using traditional verbal instructions, Dreamwaves fine-tuned the spatial audio rendering to create precise, intuitive audio cues that guide users naturally without overloading them cognitively.

Battery life and device performance: The app was optimised to function smoothly even on older smartphones, increasing its accessibility across socioeconomic groups.

Tips for Similar Projects

- **Co-design with users:** Involving visually impaired users early and throughout the development process is critical. Their input improves both usability and trust in the technology.
- **Leverage audio AR:** Spatialised sound can offer a much more intuitive navigation experience than screen readers or verbal instructions.
- **Avoid infrastructure dependence**: Solutions that don't require physical installations (like Bluetooth beacons) reduce cost and increase scalability.
- **Partner with transit authorities:** Collaboration with operators like Wiener Linien enabled smoother testing and alignment with public infrastructure goals.

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Identified Limitations/Weaknesses

- The app's reliance on mobile camera input for visual localisation may encounter limitations in poorly lit environments or in conditions with heavy pedestrian traffic.
- Mapping large spaces requires technical expertise at the outset, which may limit community-led implementation in the short term.
- While the app is optimised for accessibility, some users without smartphones or technical proficiency may still face barriers. A hybrid approach with low-tech alternatives may be needed to serve all users equitably.

Video

Watch this video - **"How is Dreamwaves transforming mobility for the visually impaired?"**

Video Description

This short video by Dreamwaves and EIT Urban Mobility introduces waveIn (formerly waveOut), an innovative audio navigation app that guides visually impaired users through indoor spaces like metro stations. The app uses spatialised sound cues that feel as if they come from physical directions, allowing users to navigate independently. The video features demo footage of the app in use, along with insights from the co-founder on the importance of inclusive, infrastructure-free solutions.

Image Source

Image courtesy of Dreamwaves GmbH – www.dreamwaves.io

Resources

- EIT Urban Mobility Project Profile
- EIB Social Innovation Tournament recognition
- Company Site (Dreamwaves)

Partners

CARDET

EUROPEAN DISABILITY FORUM

Proportional Message

spectrum RESEARCH CENTRE

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