Navigation aid for the Visually Impaired

DFP Group-39

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Why this problem area?

Globally, at least **2.2 billion** people have a near or distance vision impairment. In at least 1 billion of these, vision impairment could have been prevented or is yet to be addressed.

WHO report https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

Affected young can experience delayed motor, language, emotional, social and cognitive development, with **lifelong consequences**.

Vision impairment severely impacts quality of life among adult populations. Adults with vision impairment can experience lower rates of employment and higher rates of **depression** and **anxiety**.

Vision impairment poses an enormous global **financial burden**, with the annual global cost of productivity estimated to be US$ 411 billion.

WHO report https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment

Even a small intervention has the potential to be very impactful and create a positive ripple effect in their lives.

We chose to intervene in aiding their ways of navigation, so that they become less dependent on other factors, to perform such a basic activity. This will account to a lot of time and effort saved.

Problems faced while navigating

Unsafe navigation in unfamiliar environments.

Difficulty detecting obstacles at varying heights and distances.

Lack of accessible and reliable assistive technology.

Research

Smart Wearable Guiding Device for Impaired People

It is a low-cost, efficient solution to assist blind individuals in navigating their environment. Using a GSM module and an Arduino-based system, the device incorporates ultrasonic sensors to detect obstacles and provides feedback through sound (buzzer) and vibration signals. The frequency of these signals increases as the user approaches an obstacle, alerting them to potential hazards.

https://www.ijraset.com/best-journal/smart-wearable-guiding-device-for-the-visually-impaired-people

Research

Obstacle avoidance for blind people using a 3D camera and a haptic feedback sleeve.

The system provides non-intrusive, multidimensional feedback using vibrations on the forearm, which users can interpret to navigate obstacles. With a 98.6% accuracy for single motor patterns and 70% for more complex multi-motor patterns, it performed well in both indoor and outdoor environments, including in complete darkness, and users improved their navigation performance over multiple runs.

https://arxiv.org/abs/2201.04453

Research

Exploring the Opportunities of Haptic Technology in the Practice of Visually Impaired and Blind Sound Creatives

Access barriers faced by visually impaired sound creatives using digital audio workstations (DAWs) can be addressed through haptic technologies leveraging tactile feedback. Interviews with 20 participants reveal technical, practical, and cultural challenges while highlighting haptic tools' potential to enhance workflows and inclusivity in music production.

https://www.mordorintelligence.com/industry-reports/assistive-technologies-for-visually-impaired-market

Research

Guiding Blind People with Haptic Feedback

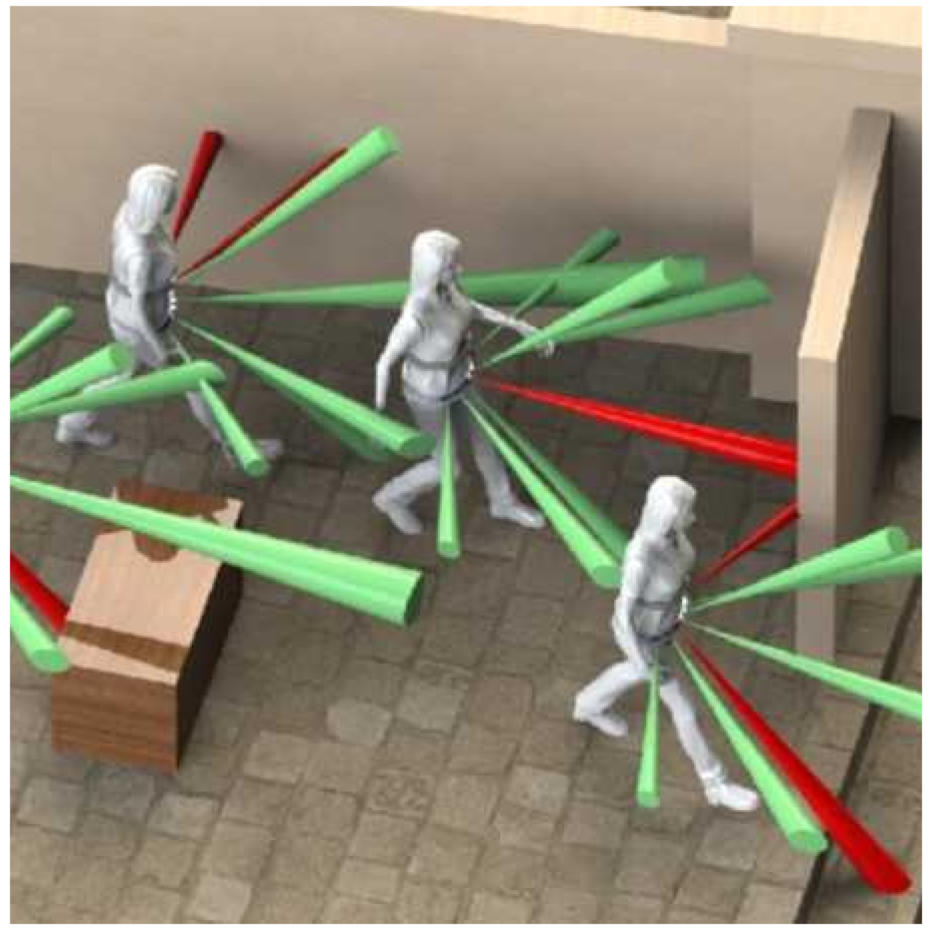
The paper explores a haptic feedback system designed to assist visually impaired individuals in navigation. It utilizes wristbands with vibration actuators to guide users, aiming to reduce cognitive load compared to auditory instructions. Preliminary studies indicated vibrations on the wrist were effective for detecting direction, though patterns could sometimes confuse users. A prototype system simplifies navigation by using distinct vibration patterns or dual wristbands to indicate direction. Future work aims to refine the haptic design and establish guidelines for effective navigation support.

https://www.researchgate.net/publication/235005436_Guiding_Blind_People_with_Haptic_Feedback

Market Study

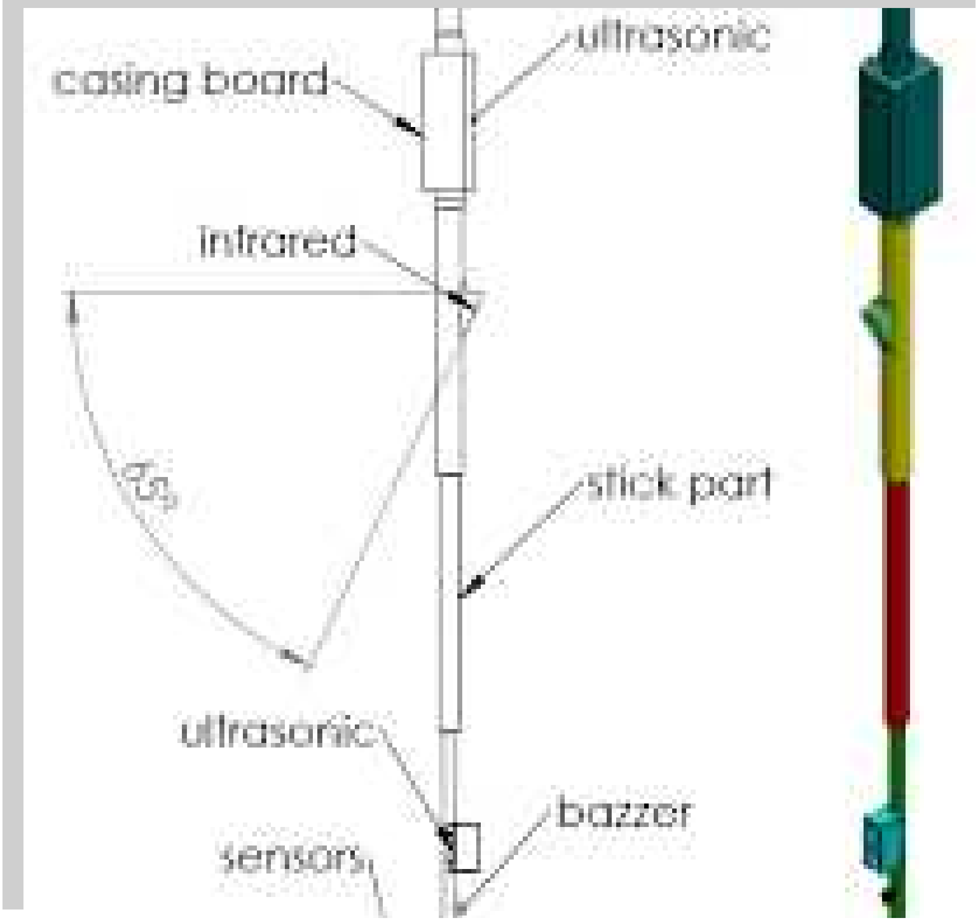
EchoSpecs

Smart glasses with sonar technology that provide real-time auditory and haptic feedback to help blind users detect and navigate around obstacles.



GuideBelt

A wearable belt with integrated sensors that offers haptic feedback to help blind users detect and avoid obstacles in their surroundings.



Smart Stick

A smart stick that assists a visually impaired person to his destination safe and secure.

PathBand

A wristband with obstacle-detection sensors that delivers haptic feedback to guide blind users safely through their environment.

Market Study

HaptImage

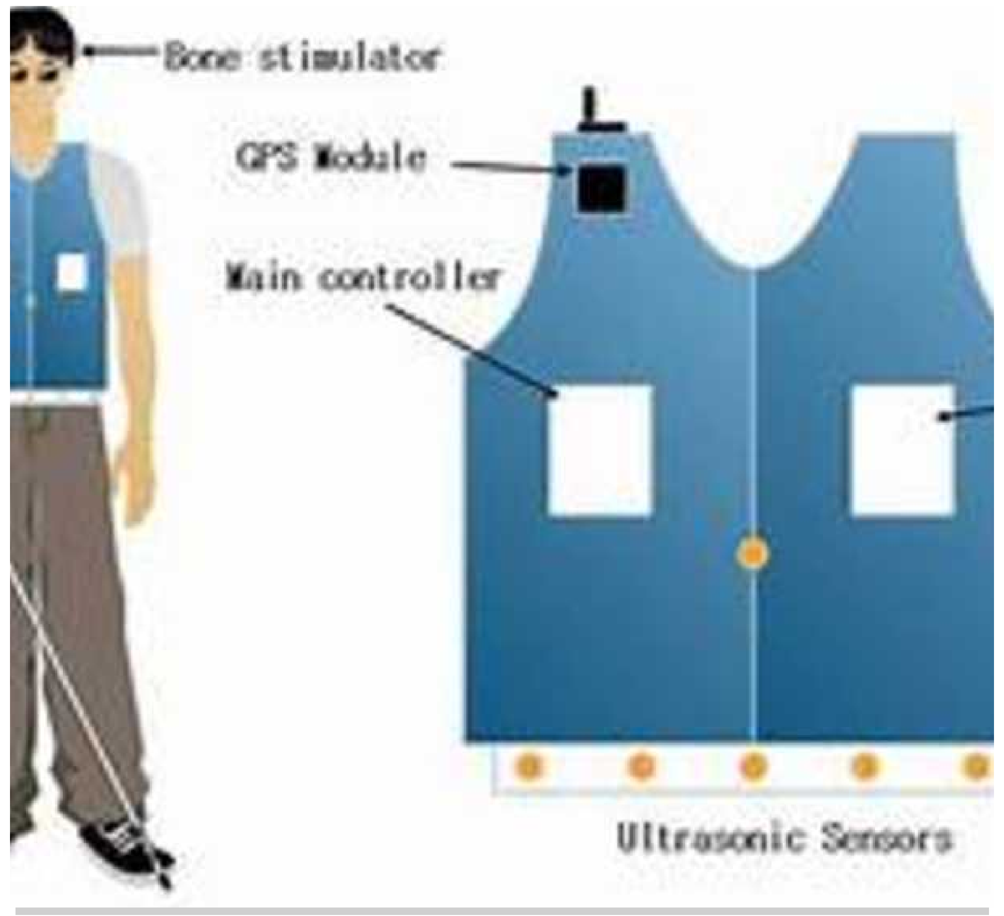
A wrist-worn haptic device that provides tactile feedback to assist visually impaired users in interpreting images and spatial information.

SenseWatch

A wristwatch-style device that uses tactile feedback and audio cues to assist blind users in detecting and navigating around obstacles seamlessly.

VisionCap

A wearable cap equipped with sensors that provides haptic feedback to help blind users detect and avoid obstacles in their path.



NavJacket

A wearable jacket with embedded sensors that provides tactile feedback to assist blind users in detecting and navigating around obstacles safely.

Opportunities

Real-time dynamic environment detection.

Easier onboarding and prioritizing user-friendliness.

Varying feedback preferences that can adapt to individual needs.

Direction for Ideation

User Needs and Challenges:

Blind individuals face challenges related to spatial awareness, obstacle detection, navigation in complex environments, and safety. A haptic device can address these needs by providing real-time, intuitive feedback, allowing them to better understand and interact with their environment.

Technology Exploration:

The key technologies for a haptic device for blind individuals are primarily centered around feedback systems (such as vibration motors, piezoelectric actuators, and electrocutaneous feedback) and environmental sensing technologies (like ultrasonic sensors, LiDAR, infrared sensors, and computer vision). Integrating these components effectively will allow for real-time feedback to users, enhancing spatial awareness, navigation, and obstacle avoidance.

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