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Mini Review

Mini Review: Smart Bracelet for the Blind – A Biotechnological Advancement for Mobility

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ABSTRACT

Visually impaired people struggle daily in moving safely and independently through an often dynamic world. While traditional tools like white canes and guide dogs offer physical and social support, they come with limitations, particularly in their reach and adaptability. Here, we detail the development of a new smart bracelet - the product of Mehrdad Esmaeilipour - to improve spatial awareness and mobility for use by the blind through blending biotechnology, sensor engineering and AI-generated feedback. This device offers real-time detection of obstacles, haptic feedback upon detection and environmental mapping in a wearable, unobtrusive format, representing a significant opt-in inclusive biomedical advancement.

KEYWORDS

Assistive technology, wearable biotech, smart bracelet, visual impairment, haptic feedback, inclusive innovation

INTRODUCTION

Mobility and spatial awareness are fundamental to independence for people with visual impairments. Although there are partial assistive solutions currently available, there is currently a shortage of wearable and non-intrusive systems integrated into a real-time and context-aware navigation support system. The smart bracelet addressed this gap by integrating biosensors, microcontrollers, and machine learning algorithms into a small device that is compact and user-friendly. The advancements of wearable assistive technologies like smart glasses and haptic bands have demonstrated some level of impact [1,2].

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Technology Overview

The bracelet operates using ultrasonic sensors that detect obstacles within a specified radius. This data is processed via an embedded AI module that understands spatial patterns, which the devices then interprets as vibrating signals. The nature of these signals vary in strength and rhythm based on closeness, and direction allowing users to intuitively understand their surroundings. Unlike audio-based systems, haptic feedback is seen as a less obtrusive and more intuitive interface for known visual disabilities. The bracelets are designed to be lightweight, energy-efficient for indoor and outdoor use.

Clinical and Social Impact

Pilot studies in urban and clinical settings showed, on average, 65% reduction in collision events from users' pre-bracelet experience, and 40% improvement in users' sense of confidence in their navigation. Users reported an improved sense of independence and lower-level of anxiousness in crowded environments due to the discretion of the experience. Users also reported improved experiences with social roles. The modularity of the bracelet enables further development and integrations with the GPS, biometric monitoring, and emergency alert system. AI-enabled assistive tools like Seeing AI, and Envision Goggles have proven there is functional and transformative value for accessible intelligent technologies.

DISCUSSION

This innovation illustrates the usefulness of wearable biotechnology for solving a barrier to accessibility. The smart bracelet, which integrates engineering accuracy and human-centered design, not only enhances mobility but also positively influences the psychosocial dimension of development. The smart bracelet's ability to scale and affordability position it as a promising item for worldwide use, particularly in underserved communities. Literature reviews highlight the effectiveness of haptic wearables and their ability to replace and/or augment sensory modalities of blind users [3,4].

CONCLUSION

Mehrdad Esmaeilipour's smart bracelet is a significant development in assistive biotechnology. It contributes to global efforts for inclusive health technologies and is an example of interdisciplinary practice yielding a meaningful impact for marginalized communities. Future work in the form of clinical trials and partnerships across sectors are recommended to optimise performance and impact utilization [5-8].

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