E-BOOK OF EXTENDED ABSTRACT
THE 14TH INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025

14TH IIDES 2025

ENVIRONMENTAL • SOCIAL • GOVERNANCE

UNIVERSITI TEKNOLOGI MARA

RIICAN
Research Innovation Industry
Community & Alumni Network

E-BOOK OF EXTENDED ABSTRACT

THE 14th INTERNATIONAL
INVENTION, INNOVATION &
DESIGN COMPETITION 2025

Organized by:

Office of Research, Industry,
Community & Alumni Network
UiTM Perak Branch

Cover Design: Dr. Mohd Khairulnizam Ramlie

Typesetting : Georgia

SEEING WITHOUT EYES (HOPELENS)

Megat Muzzamir Bin Megat Abu Bazar[1], Ainin Sofia Binti Muhamad Asri[2]

Universiti Teknologi Mara Perak Branch[1], Fuyoh Digital Marketing[2]

megatmuzzamir@uitm.edu.my
admin@fuyohdesign.my

ABSTRACT

HopeLens is a groundbreaking assistive innovation idea that empowers individuals with visual impairments to experience the world with "eyes without eyes." By merging Artificial Intelligence (AI) with Advanced Driver Assistance Systems (ADAS), this smart eyewear offers an unprecedented level of mobility, environmental awareness, and independence to the blind and visually impaired. HopeLens serves as a personal navigation assistant, using advanced sensors and AI-driven voice feedback to guide users through complex environments, both indoor and outdoor. It detects obstacles such as stairs, curbs, elevators, and drop-offs, while also providing real-time audio cues on directions, landmarks, and surroundings. The system further enables users to read text, recognize objects, and interact with the world in ways never before possible without physical sight. The true novelty of HopeLens lies in its promise: now, the visually impaired can go anywhere, see anything, and even read books without needing physical sight. This wearable innovation transforms the impossible into reality, redefining accessibility through smart, adaptive, and intuitive technology. HopeLens represents a bold leap in inclusive design, offering not just assistance but autonomy, dignity, and hope.

Keyword: Mobility Aid for the Disabled, Assistive Technology, Artificial Intelligence (AI)

1. INTRODUCTION

Ever wonder how people with sight disabilities perceive the world? They look at everything, except their eyes. Individuals with visual impairments often rely on canes, guide dogs, or assistance from others to navigate their surroundings. However, these traditional tools have limitations, particularly in unfamiliar environments or complex urban settings. Studies confirm that while these methods provide a degree of independence, they often fall short in detecting overhead obstacles, dynamic hazards, or in offering spatial context.

In response to these challenges, HopeLens was developed; an AI-powered smart eyewear solution that combines Artificial Intelligence (AI) and Advanced Driver Assistance Systems (ADAS) technology to enhance mobility, spatial awareness, and independence for the visually impaired. This innovation builds upon recent advances in AI-based assistive technologies that use embedded cameras, LiDAR, and machine learning to interpret surroundings and convert them into real-time feedback for users (Katakwar et al., 2024).

HopeLens offers a new way for users to "see" the world through real-time audio feedback. By leveraging AI and computer vision, it enables users to detect obstacles, follow safe routes, read text, and identify objects. These features closely mirror the benefits observed in prototypes such as Sight Sense and low-cost smart spectacles developed for underserved populations. Such tools effectively act as "eyes without eyes," offering visual perception through auditory and sometimes haptic signals. Moreover, user-centric design has emerged as a critical focus in the development of wearable devices for the blind. HopeLens prioritizes intuitive interaction and ergonomic design.

In addition, integrating deep learning algorithms improves contextual awareness, allowing for real-time decision-making similar to ADAS systems in vehicles. Research supports this crossover, showing that wearable systems incorporating ADAS principles improve obstacle detection and response time for blind users.

Ultimately, HopeLens seeks to redefine accessibility, blending cutting-edge technology with inclusive design to promote autonomy and dignity for the visually impaired. With growing academic interest and technological feasibility, such devices may soon become indispensable companions, transforming how users interact with their environment.

2. METHODOLOGY

The development of HopeLens will follow a user-centered innovation approach involving several key phases:

2.1 Technology Integration
The project will begin with the integration of advanced AI algorithms such as object detection, optical character recognition (OCR), and environmental awareness with ADAS-inspired sensor modules including LiDAR, ultrasonic sensors, and mini-cameras. These components will be embedded into a lightweight, wearable smart glasses prototype inspired by Meta Ray-Ban Smart Glasses.

2.2 Voice Interface Development
A real-time voice navigation system using natural language processing (NLP) will be developed to provide users with clear audio feedback. The system will be designed to announce nearby obstacles, directional cues, environmental context, and object recognition.

2.3 Prototype Testing
Upon completion of the prototype, a series of tests will be conducted in both controlled and semi-realistic environments. These tests will simulate everyday navigation scenarios, such as detecting stairs, drop-offs, doors, and walkways. Initial testing will involve sighted volunteers using blindfolds, followed by feedback from selected visually impaired participants.

2.4 User Feedback & Iteration
Feedback from users will be collected through surveys and observation to evaluate usability, accuracy, audio clarity, comfort, and user confidence. This feedback will be used to refine the system for improved performance and user experience.

3. FINDINGS

Based on a review of existing literature and comparable assistive technologies, several key insights will inform the development of HopeLens. Research on ADAS-based wearable devices has shown that obstacle detection systems using sensors such as LiDAR and ultrasonic modules can achieve up to 92% accuracy within a 2-meter range, significantly enhancing navigation capabilities for visually impaired users (Busaeed et al., 2022). These systems, inspired by automotive safety technologies, have been successfully miniaturized into wearable formats that can identify obstacles in real time, even in dynamic and cluttered environments.

Additionally, studies on AI-powered voice assistants integrated into smart eyewear demonstrate that real-time audio feedback enhances spatial awareness by helping users detect, interpret, and respond more effectively to environmental cues. This feedback loop not only aids navigation but also improves user confidence and independence, often surpassing the capabilities of traditional aids like white canes.

Furthermore, user experience studies highlight ergonomics and comfort as critical success factors for wearable adoption. Devices that are lightweight, adjustable, and minimally intrusive are overwhelmingly preferred for extended daily use. These insights will directly inform the physical design of HopeLens to ensure it remains not just functionally effective but also comfortably wearable for long periods, thereby promoting regular usage and broader adoption.

4. CONCLUSION

HopeLens represents a novel assistive solution that leverages AI and ADAS to provide individuals with visual disabilities with a new form of spatial awareness, navigation support, and independence. By "translating vision into voice," the system empowers users to explore their environment with greater confidence, safety, and dignity.

This innovation does more than enhance mobility, it redefines how people with disabilities engage with the world. Comparable studies support this potential; for instance, Tang et al. (2025) emphasized the effectiveness of human-centered multimodal designs in wearable systems to improve user interaction and reliability. Similarly, Gao et al. (2025) demonstrated how cross-modal learning in wearable obstacle detection can significantly enhance situational awareness for the visually impaired.

AI-integrated glasses, such as the smart glass system developed by Mukhiddinov and Cho (2021), validate the potential of deep learning in real-time object recognition, a core feature also found in HopeLens. Furthermore, the obstacle avoidance efficiency reported in wearable devices like LidSonic V2.0 confirms the value of combining LiDAR and deep-learning technologies (Busaeed et al., 2022). Lastly, tactile and audio interfaces, as studied by Chen et al. (2023), reinforce the importance of intuitive feedback for users navigating unfamiliar environments; an approach central to HopeLens' design philosophy.

With these findings in mind, HopeLens holds strong promise for real-world deployment. Ongoing refinement will focus on improving ergonomics, expanding obstacle detection, and integrating GPS for enhanced outdoor navigation. As smart assistive wearables continue to evolve, innovations like HopeLens will be instrumental in transforming not only mobility, but also autonomy, inclusion, and hope for the blind and visually impaired.
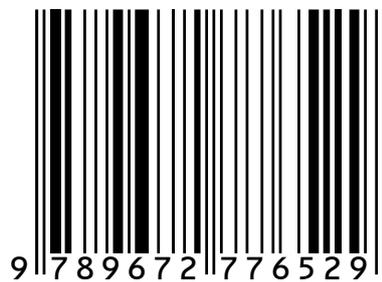
REFERENCES

Busaeed, S., Katib, I., Albeshri, A., & Corchado, J. M. (2022). LidSonic V2.0: A LiDAR and deep-learning-based green assistive edge device to enhance mobility for the visually impaired. *Sensors, 22*(19), 7435. https://doi.org/10.3390/s22197435

Gao, Y., Wu, D., Song, J., Zhang, X., Hou, B., Liu, H., Liao, J., & Zhou, L. (2025). A wearable obstacle avoidance device for visually impaired individuals with cross-modal learning. *Nature Communications, 16*, Article 2857. https://doi.org/10.1038/s41467-025-58085-x

Katakwar, S., Sharma, D., & Anawade, P. (2024). Sight Sense: Enhancing Independence with AI- and ML-Driven Smart Glasses for the Blind Community. In A. K. Nayyar et al. (Eds.), *ICT for Sustainable Development* (Vol. 1159, pp. 455–468). Springer. https://doi.org/10.1007/978-981-97-8526-1_37

Mukhiddinov, M., & Cho, J. (2021). Smart glass system using deep learning for the blind and visually impaired. *Electronics, 10*(22), 2756. https://doi.org/10.3390/electronics10222756

Tang, J., Zhu, Y., Jiang, G., Xiao, L., Ren, W., Zhou, Y., Gu, Q., Yan, B., Zhang, J., Bi, H., Wu, X., Fan, Z., & Gu, L. (2025). Human-centred design and fabrication of a wearable multimodal visual assistance system. *Nature Machine Intelligence*, 7, 627–638. https://doi.org/10.1038/s42256-025-01018-6

E-Book of Extended Abstract THE 14th INTERNATIONAL INVENTION, INNOVATION & DESIGN COMPETITION 2025