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Hamed, H., Khan, R.

AI-based Detection of Potholes Ahead of a Visually Impaired Person Using Ultrasonic Sensors Array and Camera for Blind Navigation
(2024) *Proceedings of the 9th International Conference on Mechatronics Engineering, ICOM 2024*, pp. 448-453.

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Abstract
Visually impaired individuals usually depend on assistive devices like white canes, frequently equipped with ultrasonic sensors, for navigation. However, these devices face significant limitations, particularly in detecting specific hazards such as potholes and deep trenches on walkways. This gap in functionality increases the risk of accidents and impedes safe, independent navigation for the visually impaired. The research developed a prototype of a blind assistive system equipped with an array of ultrasonic sensors and a Raspberry Pi integrated with Firebase for IoT capabilities. AI models, trained on the collected datasets of road images and ultrasonic sensor readings, were deployed on the Raspberry Pi. Testing in real-world scenarios was conducted to validate the prototype's effectiveness. The results showed that the AI model successfully detected potholes with an accuracy of 93%. The prototype could detect both large and small potholes using ultrasonic sensors and a camera but faced challenges in cases where potholes were filled with water or in complex environments. © 2024 IEEE.

Author Keywords
Artificial Intelligence; Assistive Devices; Blind Navigation; Pothole Detection; Wearable Technology

Index Keywords
Ambient intelligence, Assistive technology, Drug products, Mobility aids for blind persons, Ultrasonic cameras, Ultrasonic testing, Wearable sensors; Assistive devices, Assistive system, Blind navigation, Deep trench, Pothole detection, Risk of accidents, Ultrasonic sensor arrays, Visually impaired, Visually impaired persons, White cane; Ultrasonic sensors

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