

Smart Assistive Cane for the Visually Impaired Using Ultrasonic Sensor and Haptic Feedback

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Abstract

Visually impaired individuals face daily mobility challenges due to obstacles that traditional white canes often fail to detect. This paper presents the design and development of a smart assistive cane that integrates an ultrasonic sensor, Arduino microcontroller, haptic feedback system, and a proposed IoT-based GPS tracking module. The ultrasonic sensor continuously measures the distance to obstacles and activates a vibration motor when an object is detected within 80 cm. The prototype operates for more than six hours using a rechargeable lithium-ion battery. Testing conducted on five visually impaired participants across twenty trials achieved a 90% detection accuracy and showed improved user confidence and spatial awareness. The design demonstrates how low-cost hardware can support independent mobility while offering future opportunities for integrating real-time IoT connectivity and GPS tracking for enhanced safety

Keywords

Assistive Technology, Ultrasonic Sensor, Haptic Feedback, IoT, Accessibility

Biography

Thamer Saleh Al-Yami is a high school student at Al-Deffi Secondary School in Jubail, Saudi Arabia. He is interested in scientific research, engineering design, and assistive technologies. He participates in STEM activities, enjoys volunteering, and actively practices the English language. He aims to pursue further studies in technology and innovation.