Sensora: A Wearable AI-Powered Sound Detection and Alert System for Enhanced Environmental Awareness in Deaf and Deafblind Individuals

Mudalige, Anuki (School: Olentangy Orange High School)

Individuals who are deaf or deafblind face serious safety risks because they cannot perceive critical environmental sounds. Existing assistive technologies are often expensive, stationary, or require internet access, limiting accessibility. Sensora addresses these challenges with a low-cost, wearable device that provides instantaneous sound recognition and visual and haptic alerts. The system uses an ESP32 microcontroller and a microphone to capture environmental sounds, which are processed on-device by a neural network for real-time classification. Comparative testing across multiple microcontrollers identified the ESP32 as the most efficient and cost-effective solution for simultaneous sound capture and on-device inference. Its dual-core architecture enabled a “Producer-Consumer” model, with one core handling high-fidelity audio and the other performing neural network inference. The network was trained on a normalized dataset of numerous sounds and optimized to classify alerts within half a second while using minimal memory. Sensora delivers immediate feedback through an OLED display and a vibration motor, allowing users to recognize sounds via visual icons and distinct vibration patterns. Testing demonstrated consistent real-time detection and reliable interpretation of alerts. The device evolved from a basic volume-threshold system into a compact, wearable device with offline operation, costing under $25. By providing an affordable and reliable solution, Sensora improves safety and independence for deaf and deafblind individuals. The project demonstrates that real-time sound recognition and multi-sensory feedback can be achieved on budget hardware, offering a practical and scalable approach to improving daily life for individuals with hearing impairments.

Awards Won:
Fourth Award of $600
NC State College of Engineering: Scholarship to attend NC State Engineering Summer Camp