A.W.A.R.E.:Development of a Real-Time Wearable Auditory Emergency Detection System for Deaf and Hard of Hearing Individuals Using AI-Based Acoustic Analysis

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Those who are Deaf and Hard-of-Hearing (DHH) live in a world in which they may miss the sound of a fire alarm, a severe weather announcement, or an approaching car horn, not because they aren't paying attention, but because the alerts were designed for hearing people. Emergency information is primarily delivered through audio alerts, creating delayed awareness and avoidable safety risk for many in the DHH community. This project addresses that gap by designing, fabricating, building, testing, and evaluating A.W.A.R.E., an assistive wearable system that provides real-time, non-auditory emergency alerts. A.W.A.R.E. continuously scans environmental audio through an onboard microphone and streams short audio segments over Wi-Fi to a cloud-based AI engine, which preprocesses the audio and uses an audio event classification model to identify predefined emergency categories. When a critical sound is detected, or a sudden change in decibel levels is measured, the wearable delivers haptic and visual alerts, and a companion mobile app displays the detected event along with instructions. For selected emergencies, the app can notify trusted contacts. The system achieved 91.7% classification accuracy with an average end-to-end latency of 320 ms, demonstrating reliable and near-instantaneous emergency detection. A.W.A.R.E. successfully met its defined engineering goals, and represents success by providing the DHH community with a new, low-cost, and effective tool to promote independence, safety, and accessibility by delivering reliable emergency awareness without requiring reliance on another person.

Awards Won: