Can I See It If I Cannot Hear It? Real-Time Visualization of Incoming Sound for People with Hearing Disabilities or Ear Obstruction

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According to World Health Organization, over 360 million people have disabling hearing loss, and it is expected to get worse with the younger generation due to exposure to loud music. The purpose of this project is to develop a device that will help people to sense the sound that they are unable to hear even with hearing aids or implants, enhancing their quality of life. This device converts sound characteristics into visual information in real time using a programmable Arduino microcontroller. The direction of incoming sound is shown by a corresponding LED on an LED array, with the color and brightness of the light representing the pitch and amplitude. The sound direction is calculated from the measurements of amplitudes of four unidirectional microphones, positioned 90 degrees relative to each other. Several algorithms were tested, and the most accurate approach appeared to be based on the ratio of two pairs of microphone readings. A thorough calibration was performed and used for the measurement of incoming angle. Simultaneously, the frequency of the sound is determined by an omnidirectional microphone and a 7-channel frequency analyzer. If the incoming sound is one of the pre-determined sounds (e.g. a car horn), then it is detected by comparison to a calibrated spectrum template of that sound. The results are visualized to the user in real-time via a 16-LED circle. This lightweight and low-power device can enhance the perception of incoming sound for people with hearing disabilities or ear obstruction.

Awards Won:
Acoustical Society of America: Third Award of $1,000