Moving Sound: An Adaptive Spatial Audio System

Abstract

We present a novel system for real-time spatial audio rendering with movable wireless speakers that integrates Vector Base Amplitude Panning (VBAP) with dynamic speaker tracking. Our implementation combines a Java-based spatial audio engine with custom ESP32-based Wi-Fi audio receivers using the VBAN protocol, allowing seamless audio playback as the speakers are physically repositioned. Additionally, we extend the system to stream audio directly to mobile devices, such as iPads and smartphones, incorporating them as part of the spatial audio setup. An accompanying VR-based preliminary validation with eight speakers shows that dynamic reconfiguration of the speaker topology results in only minimal degradation of localisation accuracy. This shows that our system effectively preserves spatial audio cues during real-time speaker movement. By decoupling spatialization from fixed speaker arrays, our platform enables flexible, embodied sound interaction for applications in interactive installations, performances, and digital assistants.