CALIFORNIA STATE SCIENCE FAIR
2003 PROJECT SUMMARY

Name(s)

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Project Number

S1203

Project Title

Emulating 3D Spatial Audio

Abstract

Objectives/Goals
The goal of this project was to create a spatial audio system, or a surround sound effect, with only two stereo speakers. The human brain has developed complex auditory cues to decipher the approximate location of origin. The time delay between the arrival of a sound between the left and right ears, known as Inter-aural Time Difference (ITD), is the most significant auditory cue. A secondary goal was to create a phased array of sound. A phased array is multiple sound sources emitting sound with differing time delays to interfere constructively at a point.

Methods/Materials
To complete the project goals, much research on sound, its properties, and its perception, had to be gathered. A program was written in C++ that calculated the ITD time difference, played a sound file, and delayed either the left or right channel so as to hopefully trick the brain into believing the sound source is at a location it is not. To create the "phased array", another program, written with the aid of streaming media framework (GStreamer), was executed on two different computers. ITD calculations will be applied to the "phased array."

Results
On average, four out of five people tested on the ITD model felt the sound source was where the program was trying to "place" it, rather than the speakers right in front of the listener. However, a source could not be "placed" behind the listener. The "phased array" test returned garbled audio and the program abruptly shutdown.

Conclusions/Discussion
It is possible to create a surround sound effect with two speakers, as shown by the successful ITD model, but only in front of the listener; for full 360 degrees of audio around the listener, speakers must be behind listener. This is why the secondary goal of the "phased array" was developed. The "phased array" test has so far been a failure. One possible error could be network traffic. Due to time constraints and no reply to critical questions e-mailed to the developers of GStreamer, the "phased array" is making slow progress, but is still being developed.

Summary Statement

This project is aimed at creating a surround sound system through C++ coding and a "phased array" of sound.

Help Received

Mother helped with board; Computer teacher taught programming and math; Mother and Father helped with driving