A Flexible 3D Sound System For Interactive Applications

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Description

We have constructed a 3D sound system for headphones with real-time sound source and user displacement in a virtual acoustic environment.

The degree of simulation complexity can be chosen prior to rendering, making the system adaptable to both available CPU power and application requirements.

No signal processing knowledge is required in order to select the appropriate simulation complexity.

Applications

The targeted user group is developers of interactive applications wishing to use 3D audio technology.

The system could be used in applications where resources are limited such as in hand-held or wearable computing.

Design Approach

Flexible Signal Processing

Due to a flexible signal processing structure, the degree of complexity of the simulation can be adapted to available CPU power and application requirements.

The system is not application-specific.

Easy Selection of Simulation Complexity

The user can choose between four different models with different degrees of simulation complexity, depending on resources and on the level of realism needed.

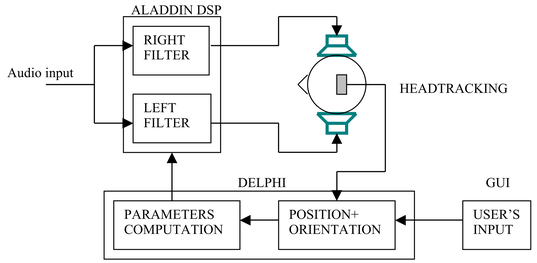
Selecting an appropriate model does not require knowledge in Digital Signal Processing.

Implementation and Use

The signal processing is based on physical modeling, which allows for various combinations of linear filters.

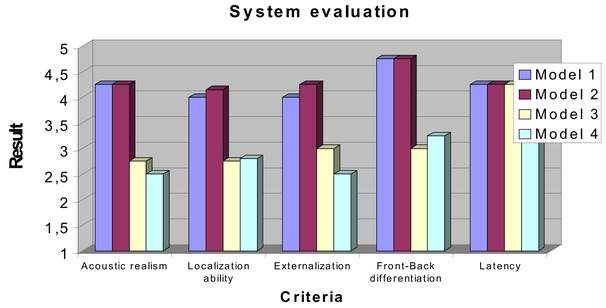
Both user and sound source can be displaced in the virtual environment in real-time with 6 degrees of freedom.

The size and absorption coefficient of the virtual environment can be modified.



Preliminary User Experience

User tests were conducted on four subjects, all interested in audio technology. They were asked to explore the functions of the system and to rate different aspects of it from 1 (total failure) to 5 (perfection). Model 1 to 4 are ranged with decreasing simulation complexity.



Models 3 and 4 need improvement, but models 1 and 2 were highly rated.

General reactions to the system and to the degree of control over the choice of simulation complexity were enthusiastic.

These preliminary results are therefore promising.

Future Work

The current simulation models 3 and 4 will be improved and new ones implemented.

More extensive studies, using the system in the actual context of interactive applications development, will be performed.

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