CYBIT -- *Sound Solutions for the Mobile World*

3Dsound is a set of digital audio manipulation and enhancement algorithms specially designed to relieve the physical constraints imposed by headphones and loudspeakers on sound presentation. These physical constraints include closely-spaced loudspeakers; headphones pressed at the ears; low-frequency loss of small speakers; mono or stereo recording of 3-dimensional sound; and the number of speakers and space needed for surrround sound; etc.

WideSound

For digital audio playback with two **loudspeakers**, WideSound broadens the narrow sound field produced by closely-spaced speakers to much wider sound field for significantly better stereophnic effect (especially for spatially-dynamic audio contents such as sound from games, movies or live broadcast). WideSound is applicable to a wide range of loudspeaker spacings, from very-narrow, e.g., 2cm center-to-center for mobilephones to much larger for home TV.

As an example, a small device as shown below (in the middle of the picture) would have produced narrow-field sound, but with WideSound added, it would produce wide-field sound just like the audio signals actually come from two wide-spaced loudspeakers on both sides of the small device.

WideSound can be easily added at the audio output of any chips or hardware/software products as a "post-processing" function. WideSound applies to any audio/visual devices with stereo (2-channel) audio output for loudspeaker listening. Examples include game devices, portable DVD player, mobile phones, MP3/MP4/PMP players, laptop/netbook PCs, portable TV/automobile TV/home TV, LCD monitors with stereo speakers, AV display/advertisement, picture/video frames, HD radio, learning devices, etc.

- WideSound allows a user to optimize sound widening effect for specific applications, from mobilephone to home TV. This is achieved by user-controllable parameters - distance between loudspeakers; listening distance from the loudspeakers; and desired widening angle.
- Audio input: mono or stereo audio signal.
- Audio output: 2-channel audio signal for loudspeaker playing.
- Preferred listening position – along the center line of the two speakers.
- Sampling rates: 8/10/11.025/12/16/22.05/32/44.1/48 KHz. I/O format: 16 bit/sample linear PCM.

WideSound -- Hardware Resources (shaded area - stereo input)

Sample Rate (Hz)	Frame Size (Samples)	RAM (kword)		ROM (kword)	MIPS	
8,000	64	0.9	**1.1**	0.4	1.43	**1.52**
10,000	64	1.0	**1.1**	0.4	1.74	**1.91**
11,025	64	1.0	**1.1**	0.4	1.89	**2.13**
12,000	64	1.0	**1.2**	0.4	2.09	**2.33**
16,000	64	1.2	**1.3**	0.4	2.96	**3.25**
22,050	64	1.3	**1.4**	0.4	4.19	**4.90**
32,000	64	1.6	**1.7**	0.4	6.10	**7.17**
44,100	64	1.9	**2.0**	0.4	9.25	**10.6**
48,000	64	2.0	**2.1**	0.4	9.90	**11.6**

OpenSound

For digital audio playback with a sterero **headphone**, OpenSound converts plain audio signal into rich, immersive sound with significantly wider perceived sound field.

OpenSound judiciously manipulates the headphone sound signal so that even if the sound is played with the headphone pressed at the ears, the listener's perception is as if the sound comes from virtual loudspeakers at some distance away. OpenSound not only creates wider -field and immersive sound (as shown by the spherical sound zone below,) but also reduces listening fatigue by relieving headphone oppression for much more comfortable, relaxed listening.

OpenSound can be easily added at the audio output of any chips or hardware/sof tware products as a "post-processing" function. OpenSound applies to any audio/visual devices with stereo (2-channel) audio output for headphone listening. Examples include MP3/MP4/PMP players, mobile phone/smart phone/PDA, stereo Bluetooth headset, laptop/netbook PCs, portable DVD players, game devices, learning devices, mobile TV, and so on.

- Audio input: mono or stereo audio signal.
- Audio output: 2-channel audio signal for headphone listening.
- Sampling rates: 8/10/11.025/12/16/22.05/32/44.1/48 KHz. I/O format: 16 bit/sample linear PCM.

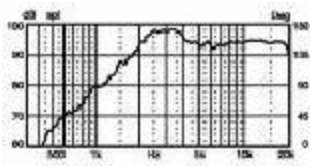
OpenSound -- Hardware Resources (shaded area - stereo input)

Sample Rate (Hz)	Frame Size (Samples)	RAM (kword)		ROM (kword)	MIPS	
8,000	64	1.0	**1.1**	0.3	1.4	**1.6**
10,000	64	1.1	**1.2**	0.3	1.7	**2.0**
11,025	64	1.1	**1.2**	0.3	1.9	**2.2**
12,000	64	1.1	**1.3**	0.3	2.0	**2.4**
16,000	64	1.3	**1.4**	0.3	2.7	**3.2**
22,050	64	1.4	**1.6**	0.3	3.8	**4.4**
32,000	64	1.7	**1.9**	0.3	5.7	**6.7**
44,100	64	2.1	**2.2**	0.3	8.2	**9.5**
48,000	64	2.2	**2.4**	0.3	9.1	**10.5**

Other 3Dsound technologies under further development and optimization:

- **MotionSound**: MotionSound renders dynamic, moving audio scenes that emulate a real three-dimensional sound environment. The audio scene can be pre-determined by following a script or the audio scene can change dynamically as event-triggered (such as by user's input or game logic in a video game.) By placing stationary sound segments in any time sequence, sequentially or simultaneously, at any position or on a trajectory in the 3D space around a listener's head, MotionSound is able to create very interesting perceptual effect.

- **BoomSound**: BoomSound dynamically generates "vritual" bass to significantly enhance bass perception for small speakers such as microspeakers in handheld devices. These speakers lack low-frequency gains and that cannot be corrected by brute-force power-boosting the low-frequency spectrum. BoomSound applications include all mono/stereo audio devices with small loudspeakers that cannot produce deep booming bass sound. BoomSound can be used in combination with WideSound and OpenSound.



LINKING customer's applications to CYBIT 3Dsound technology solutions –

- Game Device: WideSound/OpenSound + BoomSound/ MotionSound
- Mobile Phone/Smartphone: WideSound/OpenSound + BoomSound
- MP3/MP4/PMP Player: OpenSound/WideSound + BoomSound
- Wireless Stereo Headphone: OpenSound
- Portable TV/Video/Stereo Player: WideSound/OpenSound
- Notebook PC: WideSound/OpenSound
- Home and Automobile TV : WideSound
- AV Display/Ads., Picture Frame: WideSound/MotionSound
- Multimedia Software: WideSound/OpenSound/MotionSound
- Learning Device: MotionSound/OpenSound/WideSound

Audio Demos: http://www.cybit.com/Demos.htm

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