

Overview

IntegrIT CrystalSpeech Microphone Array is a promising technology for the range of applications from transportation and industrial automation to mobile gadgets. Technology allows utilization of the benefits of multiple microphones selecting the speech signal and eliminating the noise. However, traditional microphone arrays require special installation efforts, microphone calibration and not fight with acoustic echo.

IntegrIT CrystalSpeech Microphone Array software outperforms traditional algorithms and:

- **requires no microphone calibration**
- **eliminates echo** together with noise allowing **full-duplex** conversations
- detects and **suppresses** frequency selective **jams** very fast
- has **low CPU** usage

Features

- up to 4 microphone inputs
- echo tail up to 512 msec
- narrowband and wideband modes
- full-duplex and half-duplex echo cancellation
- advanced noise suppression algorithms
- mic. equalizer, speech driven automatic gain control, automatic microphone leveling, comfort noise generation, non-linear processor and other features for audio preprocessing
- low stack and CPU usage (less than 5% of typical C64xx DSP)
- glueless integration **IntegrIT VoIP Engine**

Applications

- intercom devices for industrial automation and transportation
- conference phones
- car hands-free kits
- mobile handsets

Specifications

Modes	narrowband (sample rate 8 kHz), wideband (sample rate 16 kHz), optionally supplied with resamplers to support most popular sample rates
Robustness to delay variation or time drift	yes
Nonlinear/intermodulation distortion compensation	yes
Additional ac harmonic suppression	yes
Jam detection	yes
Comfort noise generator	yes
Echo cancellation	full-duplex and half-duplex modes
Maximum echo tail	512 msec
Compensation of audio drivers delay	512 msec
Total algorithmic delay	60 msec
Equalizer with resonance blocking	yes
Voice activated automatic gain control	yes
Noise suppression	joint echo-noise cancellation
Musical noise removal	yes
Typical resource consumption	see Table below
Maximum data requirement	worst case: 250 kbytes data RAM + 75 kbytes scratch data (4 microphones, wideband mode)
Supported CPUs	ARM9, ARM11, Cortex A8, Marvell Kirkwood, Marvell Armada, C64xx, DaVinci, OMAP, Tensilica HiFi2, ConnX D2, x86
Operating systems	Linux, Maemo/MeeGo, Windows, Windows CE/Mobile, Android, DSP-BIOS

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MIPS consumption of microphone array depends on multiple factors where the most important are:

- sample rate (8 kHz for narrowband mode or 16 kHz for wideband mode)
- type of echo cancellation (full or half-duplex)
- noise suppression

The table below summarizes MIPS figures for some typical cases. It is already optimized for C64+ and ARMv6 cores and may be used on many modern microprocessors with ARM/Cortex cores and/or dual-core OMAP/DaVinci chips. These numbers are given as a reference and performance on a real target may be different depending on memory interfaces, specific core, etc.

Mode					Processor			
Number of microphones	sample rate, kHz	full-duplex echo+noise cancellation	half-duplex echo+noise cancellation	noise suppression	Texas Instruments C64+		ARMv6	
					MIPS	CPU usage	MIPS	CPU usage
2	8	x		x	14	2%	95	12%
			x	x	8	1%	53	7%
				x	7	1%	47	6%
	16	x		x	23	4%	160	20%
3	8	x		x	20	3%	114	14%
			x	x	11	2%	61	8%
				x	10	2%	57	7%
	16	x		x	32	5%	190	24%

NOTE: %% of CPU load is given for typical 600 MHz C64+ and 800 MHz ARMv6 cores

Availability

- Texas Instruments C64/C67, DaVinci
- ARM9E, ARM11
- x86 Windows/Linux Object Library

Porting on other platforms is upon request

Licensing

Call