dsPIC30F Acoustic Echo Cancellation Library

Summary

The dsPIC30F Acoustic Echo Cancellation (AEC) Library provides a function to eliminate echo generated in the acoustic path between a speaker and a microphone. This function is useful for speech and telephony applications in which a speaker and a microphone are located in close proximity to each other, and therefore susceptible to signals propagating from the speaker to the microphone resulting in a perceptible and distracting echo effect at the far end. It is especially suitable for these applications:

- Hands-free Cell Phone Kits
- Speakerphones
- Intercoms
- Teleconferencing Systems

For hands-free phones intended to be used in compact environments, such as a car cabin, this library is fully compliant with the G.167 standard for Acoustic Echo Cancellation.

Description

The Acoustic Echo Cancellation Library is written entirely in assembly language and is highly optimized to make extensive use of the dsPIC30F DSP instruction set and advanced addressing modes. The algorithm avoids data overflow. The AEC Library provides an "AcousticEchoCancellerInit" function for initializing the various data structures required by the algorithm and an "AcousticEchoCanceller" function to remove the echo component from a 10 ms block of sampled 16-bit speech data. The user can easily call both functions through a well-documented Application Programmer's Interface (API).

The "AcousticEchoCanceller" function is primarily a Time Domain algorithm. The received far end speech samples (typically received across a communication channel such as a telephone line) are filtered using an adaptive Finite Impulse Response (FIR) filter. The coefficients of this filter are adapted using the Normalized Least Mean Square (NLMS) algorithm, such that the filter closely models the acoustic path between the near end speaker and the near end microphone (i.e., the path traversed by the echo). Voice Activity Detection (VAD) and Double Talk Detection (DTD) algorithms are used to avoid updating the filter coefficients when there is no far end speech and also when there is simultaneous speech from both ends of the communication link (double talk). As a consequence, the algorithm functions correctly even in the presence of full-duplex communication. A Non-Linear Processor (NLP) algorithm is used to eliminate residual echo.

The dsPIC30F Acoustic Echo Canceller Library uses an 8 kHz sampling rate. However, the library includes a sample rate conversion function that ensures interoperability with libraries designed for higher sampling rates (9.6 kHz, 11.025 kHz or 12 kHz). The conversion function allows incoming signals at higher sampling rates to be converted to a representative 8 kHz sample. Similarly, the conversion function allows the output signal to be converted upward from 8 kHz to match the user application.

Resource Requirements

Acoustic Echo Cancellation

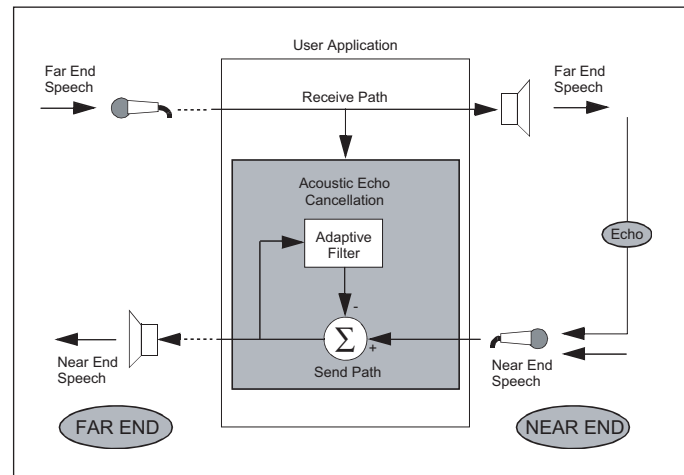| Echo Tail Length (ms)	MIPS	Program Flash Memory (KB)	RAM (KB)
64	16.5	6	5.7
32	10.5	6	3.4
16	7.5	6	2.6

Sample Rate Conversion
Computational Requirements: 1 MIPS
Program Flash Memory: 2.6 KB
RAM: 0.5 KB

Note: The user application might require an additional 2 KB-2.5 KB of RAM for data buffering (application-dependent).

Features

Key features of the AEC Library include:

- All functions can be called from either a C or assembly application program
- Five user functions:
  - AcousticEchoCancellerInit
  - AcousticEchoCanceller
  - InitRateConverter
  - SRC_upConvert
  - SRC_downConvert
- Full compliance with the Microchip dsPIC30F C30 Compiler, Assembler and Linker
- Simple user interface – just one library file and one header file
- Highly optimized assembly code, utilizing DSP instructions and advanced addressing modes
- Echo cancellation for 16, 32 or 64 ms echo delays or 'tail lengths' (configurable)
- Fully tested for compliance with G.167 specifications for in-car applications
- Audio Bandwidth: 0-4 kHz at 8 kHz sampling rate
- Convergence Rate: Up to 43 dB/sec., typically > 30 dB/sec.
- Echo Cancellation: Up to 50 dB, typically > 40 dB
- Can be used together with the Noise Suppression (NS) Library, since the same processing block size (10 ms) is used
- *dsPIC30F Acoustic Echo Cancellation Library User's Guide* is provided to help the user understand and use the library
- Demo application source code is provided with the library
- Accessory Kit available for purchase includes: an audio cable, headset, oscillators, microphone, speaker, DB9 M/F RS-232 cable, DB9M-DB9M Null Modem Adapter and can be used for library evaluation

Devices Supported

dsPIC30F6014
dsPIC30F6012
dsPIC30F5013 (for a maximum of 32 ms echo delay)
dsPIC30F5011 (for a maximum of 32 ms echo delay)

Host System Requirements
(For programming and debugging using MPLAB IDE)

- PC-compatible system with an Intel Pentium class or higher processor, or equivalent
- A minimum of 16 MB RAM
- A minimum of 40 MB available hard drive space
- Microsoft® Windows® 98, Windows 2000 or Windows XP

Part Numbers and Ordering Information:

dsPIC30F Acoustic Echo Cancellation Library		
Part Number	**Description**	**Availability**
SW300060-EVAL	dsPIC30F Acoustic Echo Cancellation Library Software License (Evaluation Only)	Now
SW300060-5K	dsPIC30F Acoustic Echo Cancellation Library Software License (Up to 5K units)	Now
SW300060-25K	dsPIC30F Acoustic Echo Cancellation Library Software License (5K+ to 25K units)	Now
SW300060-100K	dsPIC30F Acoustic Echo Cancellation Library Software License (25K+ to 100K units)	Now
AC300030	Accessory Kit (includes: audio cable, headset, oscillators, microphone, speaker, DB9 M/F RS-232 cable, DB9M-DB9M Null Modem Adapter)	Now

Note: Quantities are per project, payable as a one-time license fee based on estimated lifetime volume for products resulting from the project. Please consult the factory for quantities above 100K.

dsPIC® Development Tools from Microchip	
MPLAB® IDE	Free
MPLAB® Visual Device Initializer (included in MPLAB® IDE)	
MPLAB® C30 C Compiler	SW006012
MPLAB® ICD 2 In-Circuit Debugger/Programmer	DV164005, DV164007
MPLAB® ICE 4000	ICE4000
MPLAB® PM3 Universal Device Programmer	DV007004
dsPIC30F Math Library (included in download of MPLAB® C30 C Compiler)	Free
dsPIC30F DSP Library	Free
dsPIC30F Peripheral Library	Free
dsPICworks™ Data Analysis and DSP Software	Free
dsPIC® Digital Filter Design	SW300001
dsPIC30F Soft-Modem Library	SW300002/3/4/5
dsPIC® Speech Recognition Library	SW300010/11/12
dsPIC® Symmetric Key Embedded Encryption Library	SW300050
dsPIC® Asymmetric Key Embedded Encryption Library	SW300055
dsPIC30F Acoustic Echo Cancellation Library	SW300060
dsPIC30F Noise Suppression Library	SW300040
CMX-RTX™ for dsPIC30F	SW300031
CMX-Tiny+™ for dsPIC30F	SW300032
CMX-Scheduler™ for dsPIC® Devices	Free at www.cmx.com
dsPICDEM™ Starter Demonstration Board	DM300016
dsPICDEM™ 28-pin Starter Demonstration Board	DM300017
dsPICDEM™ 1.1 General Purpose Development Board	DM300014
dsPICDEM™ MC1 Motor Control Development System	DM300020
dsPICDEM.net™ 1 Connectivity Development Boards	DM300004-1
dsPICDEM.net™ 2 Connectivity Development Boards	DM300004-2

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- Поставка более 17-ти миллионов наименований электронных компонентов;
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- Подбор аналогов;
- Консультации по применению компонента;
- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.

Как с нами связаться

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