osxAcousticSL
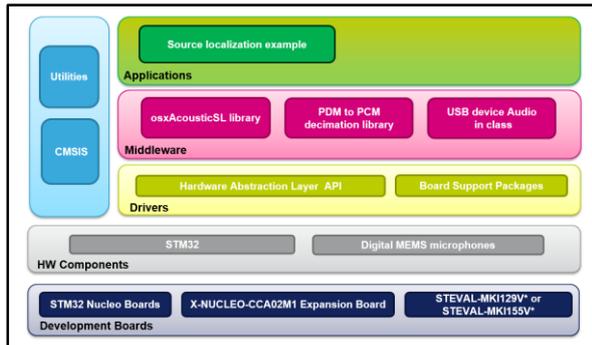
Real-time sound source localization software expansion for STM32Cube

Data brief

Features

- Real-time sound source localization algorithm (under OpenSoftwareX license) based on two or four digital microphone audio signals
- 180 or 360 degree range
- PCM input
- Adjustable resolution up to 1 degree
- Parameters editable at runtime
- Complete middleware to build applications on top of X-CUBE-MEMSMIC1
- Easy portability across different MCU families, thanks to STM32Cube
- Sample implementation available on the X-NUCLEO-CCA02M1 board mounted on a NUCLEO-F401RE board

Description

The osxAcousticSL software lets you implement a real-time sound source localization algorithm using two or four signals acquired from digital MEMS microphones to estimate the arrival direction of an audio source.

It is based on three different DOA algorithms exploiting cross correlation in the time domain, generalized cross correlation with phase transform and a matching pursuit routine using sparse representation framework.
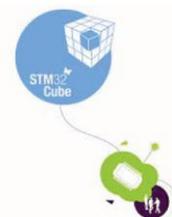
The angle can be estimated over a 180 or 360 degree range, depending on the number of channels adopted and microphone placement.

The resolution of the computed value can be chosen at runtime, allowing you to determine the best tradeoff between localization precision and resource consumption.

The osxAcousticSL library is provided in binary format inside a software package with sample applications running on the X-NUCLEO-CCA02M1 expansion board connected to a NUCLEO-F401RE board.

The example package is an add-on for the X-CUBE-MEMSMIC1 package; it is based on STM32Cube technology and is easily ported to any STM32F4 microcontroller with an FPU unit.

Information regarding STM32Cube is available on www.st.com at http://www.st.com/stm32cube.

For further information contact your local STMicroelectronics sales office

www.st.com

What is STM32Cube?

STMCube™ represents the STMicroelectronics initiative to make developers' lives easier by reducing development effort, time and cost. STM32Cube covers the STM32 portfolio.

STM32Cube version 1.x includes:

- STM32CubeMX, a graphical software configuration tool that allows the generation of C initialization code using graphical wizards.
- A comprehensive embedded software platform specific to each series (such as the STM32Cube for the STM32 series), which includes:
  - the STM32Cube HAL embedded abstraction-layer software, ensuring maximized portability across the STM32 portfolio
  - a consistent set of middleware components such as RTOS, USB, TCP/IP and graphics
  - all embedded software utilities with a full set of examples

How does this software complement STM32Cube?

This software library package is based on X-CUBE-MEMSMIC1 software expansion that extends STM32Cube by providing a board support package (BSP) for the microphones expansion board and some middleware components performing PDM to PCM decimation and USB audio streaming to a host PC. Thanks to these features, microphone data is made readily available to aid the integration of additional packages performing audio analysis and DSP operations.

osxAcousticSL is an add-on software package for X-CUBE-MEMSMIC1 implementing a real-time sound source localization algorithm that, using data acquired by two or four digital MEMS microphones, can estimate the direction of arrival of the audio source. The resolution of the computed value can be chosen at runtime, allowing the user to find the best tradeoff between localization precision and resource consumption. Parameters and modalities can be modified at runtime to allow adaptation to the varying ambient conditions

The osxAcousticSL package includes a sample application that developers can use to experiment with the code and as a starting point for building customized applications. The example uses the signals from 4 coupon microphones connected to the X-NUCLEO-CCA02M1 expansion board and estimates the direction of arrival of the sound source over a 360 degree range. The result can be transferred to a PC via serial port; at the same time, the acquired audio can be streamed to a host via a standard audio USB driver.

Revision history

Table 1: Document revision history

Date	Version	Changes
27-Oct-2015	1	Initial release.
01-Sep-2016	2	Minor text edits Updated cover page image and Description

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