Welcome to the VocalFusion dev kit for Amazon AVS, an evaluation kit for the XMOS XVF3510 far-field voice processor. The XVF3510 voice processor interfaces to a 2-mic array and uses the XMOS voice algorithms to capture commands several metres away from the device, and deliver a voice stream optimised for the Amazon Alexa Voice Service (AVS) running on the system application processor. The algorithms include Acoustic Echo Cancellation and an Interference Canceller for static point noise sources, making the XVF3510 the ideal solution for smart TVs, set-top boxes and TV accessories that output multi-channel audio.
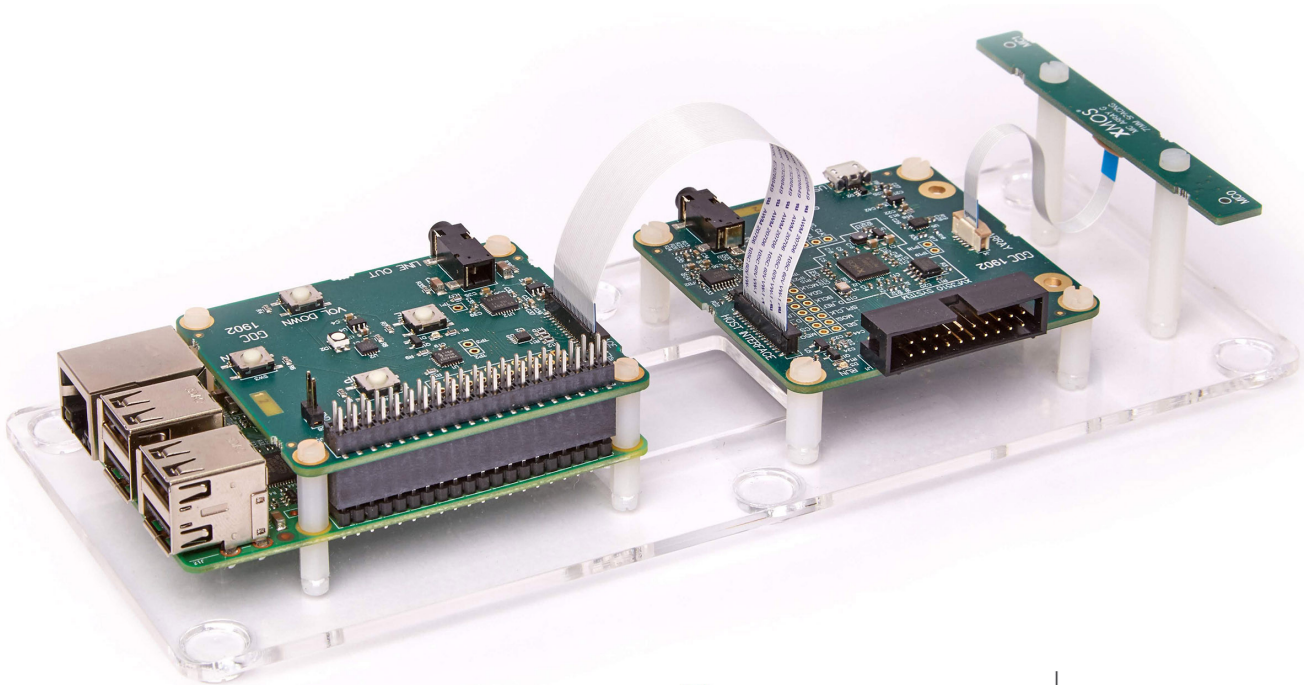
NOTE: Raspberry Pi 3 not included in VocalFusion dev kit for Amazon AVS

6. CONTENTS

1. VOCALFUSION DEV KIT FOR AMAZON AVS FEATURES

VOCALFUSION DEV KIT FOR AMAZON AVS HARDWARE:

- 2-mic linear array board with Infineon IM69D130 MEMS mics
- XVF3510 base board with XVF3510 voice processor
- RPi HAT board for connection to a Raspberry Pi 3

- XTAG debug adapter, ribbon cable to the mic array board and ribbon cable to the Pi HAT board

ADDITIONAL HARDWARE REQUIRED

You will need to provide the following hardware:
- Powered speakers with a 3.5mm input jack - see Section 2.1 for details on suitable speakers
- Raspberry Pi 3 with RPi power supply - see Section 3 for connection details
- HDMI monitor and USB keyboard
- 16GB SD Card running NOOBS, used to run Raspbian on the RPi

    Either purchase a new microSD card with NOOBS preinstalled, for example:

      http://www.amazon.com/dp/B01H5ZNOYG

    or, download NOOBS and copy to your own microSD card by following the official Raspberry Pi guide:

      https://www.raspberrypi.org/documentation/installation/noobs.md

VOCALFUSION SOFTWARE

- Latest XVF3510 firmware available from: https://www.xmos.com/xvf3510

ADDITIONAL SOFTWARE REQUIRED

INSTALLATION SCRIPTS AND SOFTWARE

- Amazon Developer Account
- https://github.com/xmos/vocalfusion-xvf3510-avs-setup
- https://github.com/alexa/avs-device-sdk/wiki/Create-Security-Profile

2. SETTING UP THE VOCALFUSION DEV KIT

The development kit is shipped with pre-installed firmware for demonstrating Amazon AVS integration. Follow the steps below to set up and test the VocalFusion dev kit for Amazon AVS

- Configure hardware

- Create an AVS Product and Client ID

- Run the XMOS installation script to install the AVS SDK and Sensory TrulyHandsfree wake word engine

- Verify installation and test the AVS app

2.1. CHOOSING YOUR SPEAKERS

The choice of stereo speakers can greatly affect overall system performance.

- The amplifier in the speakers should have linear gain. Non-linear gain (e.g. soft clipping) should be disabled or avoided.

- Any audio processing available on the speakers should be disabled.

- For low quality speakers it is best to use low volume settings to avoid non-linear distortions of the reference signal.

The Logitech Z130 stereo speakers, for example, work well with the VocalFusion dev kit.

Place the kit on a horizontal surface, for example on a table at the edge of the room. Place the powered speakers either side of the kit, making sure they don't point directly at the microphone array.

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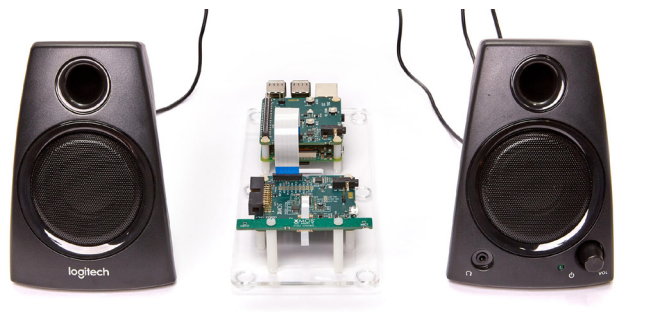
3. GETTING STARTED

The XVF3510 AVS configuration uses an application processor (Raspberry Pi) to run the Alexa Voice Service client and the Sensory TrulyHandsfree software. The audio captured by the XVF3510 device is streamed to the AVS client across an I2S interface with an I2C interface for control functions.

3.1. HARDWARE CONFIGURATION

1. Undo the plastic screws and remove the large plastic spacers that hold the Pi HAT board in place, taking care not to damage the ribbon cable that connects it to the XV3510 base board.
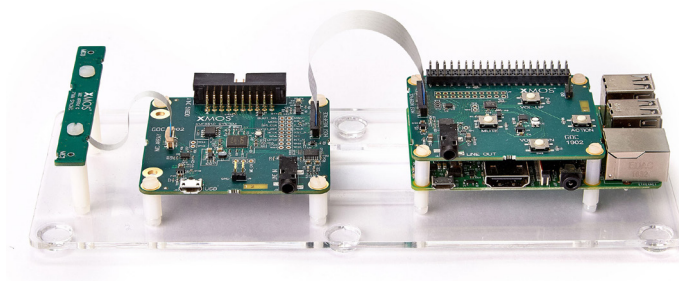

2. Fix the Raspberry Pi to the plastic stand using the shorter plastic spacers to support the RPi.
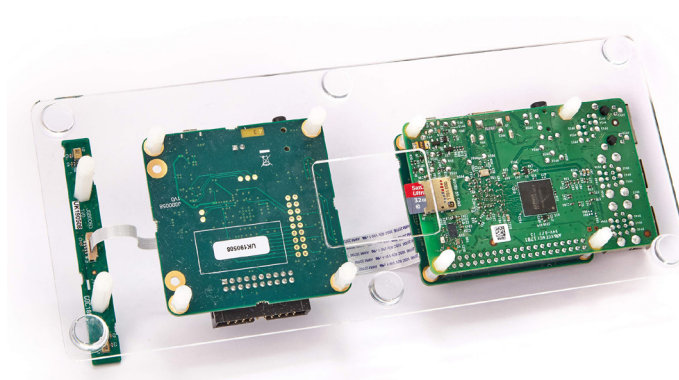

3. Screw the longer spacers into place on top of the RPi and then push the Pi HAT onto the RPi.

4. Use the plastic screws to fix the Pi HAT board in place on top of the RPi.

5. Turn the kit over and slide the SD card into the Pi through the hole in the plastic kit stand. Make sure that NOOBS is installed before you add the SD Card to the kit.

6. Turn the kit back over and connect the powered speaker cable to the 3.5mm LINE OUT socket on the Raspberry Pi HAT.

7. Connect the micro-USB socket to one of the USB sockets on the Pi to provide power to the XVF3510 base board.
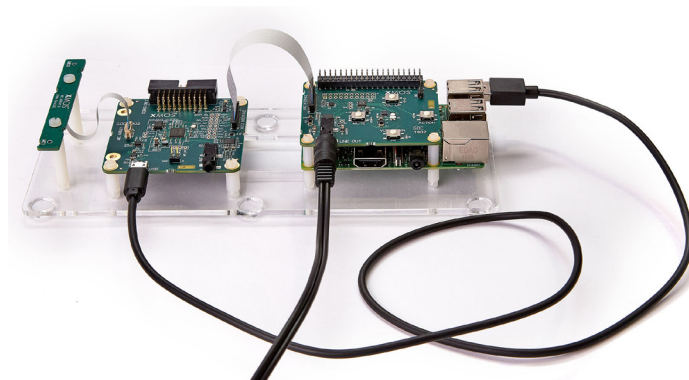
3.2. SOFTWARE CONFIGURATION

XMOS provides a setup script in the GitHub vocalfusion_3510_avs_setup repository, to help install and configure the AVS SDK. Clone the vocalfusion_3510_avs_setup repository:

```
git clone https://github.com/xmos/vocalfusion_3510_avs_setup
```

Before you run the script you also need to define information about your Alexa product and security profile. The following sections provide a brief overview of the processes you need to follow. The readme.md file in the XMOS XVF3510 AVS setup repo provides a detailed explanation of each step.

3.2.1. INSTALL RASPBIAN

1. Connect your peripherals (keyboard, mouse, monitor and Ethernet) to the Pi, and then connect the Pi to the mains power using a Raspberry Pi power unit.

2. Follow the on screen instructions to install Raspbian.

3.2.2. REGISTER YOUR ALEXA PRODUCT WITH AVS

Follow the instructions at:

https://github.com/alexa/avs-device-sdk/wiki/Create-Security-Profile

to create an Alexa product and security profiles. Refer to the *vocalfusion_3510_avs_setup/readme.md* file for required details including:

Allowed origins

Allowed return URLs

Keep a note of the *ProductID*, *ClientID* and *ClientSecret* keys.

3.2.3. INSTALL THE AMAZON ALEXA VOICE SERVICE (AVS) SDK

1. Go to the downloaded vocalfusion_3510_avs_setup folder, and run the XMOS installation script:

```
cd vocalfusion_3510_avs_setup
./auto_install.sh
```

2. Accept the AVS Device SDK license agreement and enter the *ProductID*, *ClientID* and *ClientSecret* keys when prompted. You will also need to accept the Sensory TrulyHandsfree license agreement.

3. As a final step, the script will open http://localhost:3000 in a browser on the Raspberry Pi. Enter your Amazon Developer credentials and close the browser window when prompted.

4. Once the installation script has finished, reboot the Raspberry Pi to complete configuration of the new audio device:

```
sudo reboot
```

3.3. TESTING THE AVS APPLICATION

If you select the option to run the Sample App on boot you should now be able to execute an AVS command on the Pi such as:

"Alexa, what time is it?"

The LED on the Pi HAT board changes colour when the system hears the *Alexa* keyword, and then cycles back and forth whilst waiting for a response from the Amazon AVS server.

To test barge-in, ask Alexa to start playing some music from your favourite streaming service, and then execute an AVS command, such as "Alexa, what time is it?"

The music will be paused while the AVS command is processed, and continue when the command is finished.

Walk around the room executing AVS commands and asking Alexa questions. Try "Alexa, ask XMOS what's new".

4. FURTHER INFORMATION

4.1. DOCUMENTATION

Title	Download
VocalFusion dev kit user guide	http://www.xmos.com/file/vocalfusion-dev-kit-user-guide
XVF3510-QF60-C datasheet	http://www.xmos.com/file/xvf3510-qf60-datasheet
XMOS Tools User Guide	http://www.xmos.com/file/xmos-tools-user-guide

4.2. UPDATING THE XVF3510 FIRMWARE

The VocalFusion dev kit for Amazon AVS is shipped with firmware that lets you to start evaluating the XVF3510 device without installing additional software. If you need to reinstall or upgrade the firmware, you will need to download the XMOS software tools, which are available free of charge for registered XMOS users.

Download	URL
XVF3510 firmware	https://www.xmos.com/xvf3510/resources

You will also need to use the XTAG debug adapter included with kit. For further details on flashing new firmware onto the XVF3510 see the Tools User Guide and XVF3510 datasheet.

4.3. HARDWARE/FIRMWARE VERSIONS

This user guide applies to the following hardware and firmware versions:

Hardware	XVF510 base board	1V1	In kit
	Microphone array	1V0	In kit
	Raspberry Pi HAT	1V0	In kit
	Raspberry Pi 3	3.0 or later	Not in kit
Firmware		v0.10.0	Available on xmos.com

5. REVISION HISTORY

Date	Comment
2019-08-16	First release