

OpenSynergy’s Voice Software Development Kit (Voice SDK) provides high quality audio signal processing to improve in-car speech recognition and hands-free telephony. It comprises noise reduction, full-duplex echo cancelling and optional dual microphone array-technology for directional microphony.

**Main Features**

- **Noise reduction** – Single microphone noise reduction
- **Acoustic Echo Cancelling** - Full duplex technology
- **Array technology** – Directional microphony
- **Library for echo cancellation & noise reduction**
- **Audio sampling rates up to 24 KHz**

**Use Cases**

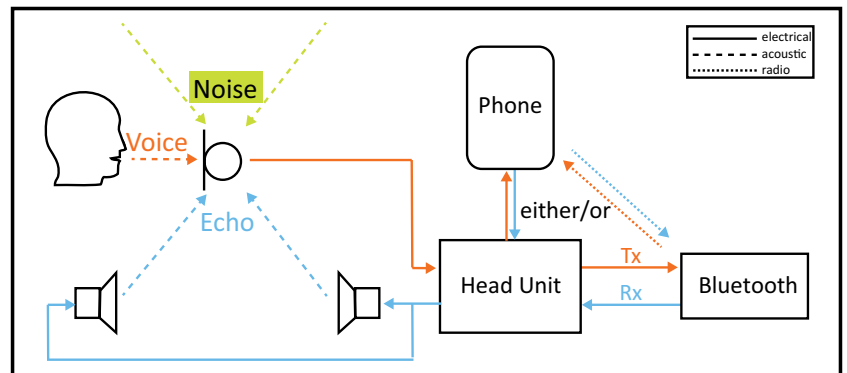
- **Hands-free voice application**
- **Speech recognition**
- **Enhanced voice quality connection in noisy environments**
- **Bluetooth or wire-based phone support**

**Benefits**

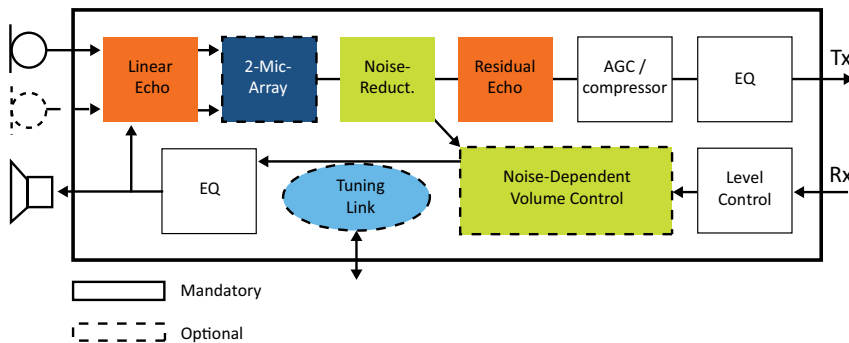
- Works out of the box
- Independence of speech recognition software
- Easy integration with Linux and Android OS
- Simultaneous application of voice recognition, hands-free telephony and in-car communication
- Flexible noise reduction and signal output depending on use case
- Excellent support

**Technical Benefits**

- Hardware independent
- Independent of Digital Signal Processor (DSP)
- Very efficient use of DSP, if available on HW
- Optimized code with small foot print
- Minimum tuning requirements
- Full parameter access for system configuration
- Wide band and ultrawide band applications



Audio Signal Flow of an Infotainment System



Building Blocks of Voice SDK

**Key Facts:**

- Full-duplex echo cancelling, Echo Return Loss Enhancement (ERLE) > 45 dB, Category 1 of ITU-T P.340, compliant with VDA 1.6
- Single microphone noise reduction up to 20 dB (tuneable)
- Optional dual microphone array technology for acoustic focus on the user
- Support of 8 kHz up to 24 kHz audio sampling rate

**Acoustic Echo Cancelling**

Acoustic Echo Cancelling (AEC) is one of the key components of Voice SDK. It is an extremely robust solution realizing full-duplex communication in a wide variety of use cases. It enables a VDA-compliant hands-free system with an Echo Return Loss Enhancement (ERLE) of at least 45 dB. Fully linear echo cancelling is combined with non linear processing (residual echo suppression), maintaining full-duplex operation to the greatest possible extent.

**Single Microphone Noise Reduction**

Noise Reduction (NR) is the second core algorithm of an automotive hands-free SDK. With only one microphone, NR is capable of attenuating stationary or slowly modulating noise components up to 20 dB. This is achieved by a proprietary algorithm, which is capable of distinguishing between voice components and slowly modulating noise components, which are typical for automotive hands-free applications. The level of noise attenuation in dB is a tuneable parameter.

**Array Technology**

With two microphones, noise reduction can be further enhanced compared to a single-microphone solution. The second microphone provides spatial information about situations of both voice signal and disturbances

that come from different directions. As a result also non-stationary disturbances like interfering voices can be efficiently reduced. OpenSynergy offers different variants of array technologies for different microphone spacings and microphone types (conventional cardioid ECMs or modern MEMS microphones).

**Additional Components of Signal Processing**

- Equalizers (receive (Rx) and transmit (Tx)) can compensate acoustic effects of vehicle interior
- Dynamic range compression increases the loudness of speech and avoids over modulation (clipping protection)
- Automatic Gain Control (AGC) adjusts the microphone gain for different loudness of user voices
- Noise dependent volume control increases loudspeaker output when the environmental noise level grows.

**Delivery**

Voice SDK comes with excellent support, and access to product updates. OpenSynergy is able to test the customer's system design before providing the library. A complete check of the audio loop, and preconfiguration can be made available. PC based tuning tools are provided. Engineering Services are available to port Voice SDK to the customer's hardware or to help in configuration or integration tasks.

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