VoiceBoost™ Voice Activation Solutions for NXP LPC5411x Microcontrollers

“Always listening” audio signal processing solutions allow hands-free device wakeup and voice control with biometric voice authentication

Overview

The VoiceBoost™ speaker-independent voice activation solution allows OEMs to offer hands-free voice wakeup functionality which wakes and unlocks a device for any user speaking the predefined keyword. In contrast, the speaker-dependent voice activation solution allows OEMs to offer biometric voiceprint identification functionality which wakes and unlocks a device only upon hearing a user’s private pre-enrolled password spoken by that user’s own voice. The Speaker Verification solution therefore provides three-factor authentication by requiring the device, the password and the voice of the authorized user.

Both solutions can execute in an “always listening” mode on the NXP LPC5411x family of microcontrollers with ultra-low power consumption for extended battery life, while providing market leading recognition performance in low noise and high noise, near-field and far-field conditions.

Key Features

- Speaker-independent and speaker-verification solutions
- Multiple keyphrases supported, in any language
- Multiple private user voiceprints supported, in any language
- Speaker independent solution includes multi-keyword “phrase spotting”
- Speaker verification solution includes anti-spoofing “liveness test”
- Speaker verification solution provides multi-factor authentication
- Effective with accents and non-native language speakers
- Effective to several meters distance in noisy environments
- Effective with single or multiple microphone devices
- Effective with off-axis and inverted device orientations
Specifications

<table>
<thead>
<tr>
<th>Component</th>
<th>RAM (Kbytes)</th>
<th>Flash (Kbytes)</th>
<th>Mcycles (peak)</th>
<th>Mcycles (avg)</th>
<th>Solution Current* (mA)</th>
<th>System Current* (mA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speaker Independent Voice Activation</td>
<td>16.1</td>
<td>24.2</td>
<td>11.9</td>
<td>1.6</td>
<td>1.33 peak 0.0 idle</td>
<td>1.65 peak 0.32 idle</td>
</tr>
<tr>
<td>Each additional keyphrase</td>
<td>0.5</td>
<td>11.1</td>
<td>3.0</td>
<td>0.3</td>
<td>0.36 peak 0.0 idle</td>
<td>0.36 peak 0.0 idle</td>
</tr>
<tr>
<td>Speaker Verification</td>
<td>10.5</td>
<td>11.8</td>
<td>3.4</td>
<td>0.7</td>
<td>0.38 peak 0.0 idle</td>
<td>0.7 peak 0.32 idle</td>
</tr>
<tr>
<td>Each additional voiceprint</td>
<td>7.7</td>
<td>3.0</td>
<td>0.7</td>
<td>0.07</td>
<td>0.08 peak 0.0 idle</td>
<td>0.08 peak 0.0 idle</td>
</tr>
</tbody>
</table>

* Solution Current is incremental current draw of adding Voice Activation to existing firmware
* System Current is measured Solution Current plus measured baseline current draw of all integrated components of LPC54114; excludes microphone and any other off-chip peripherals

Performance

The Speaker Independent Voice Activation solution provides market leading recognition rates, equal error rates, and accent tolerance in low and high noise environments at distances from near-field to several meters. Quantitative benchmark results are published for various configurations and environments.

The Speaker Verification solution provides market leading imposter rejection rates and market leading recognition rates and equal error rates for the enrolled speaker in low and high noise environments at distances from near-field to several meters. Quantitative benchmark results are available for various configurations, keyphrases, speaker distances and noise environments.

Both solutions offer OEM-selectable acceptance thresholds. The speaker verification solution also provides a voiceprint strength metric which allows OEMs to reject weak voiceprints during user enrollment.

About Malaspina Labs

Malaspina Labs performs applied research in the field of speech processing. Malaspina Labs and its subsidiaries provide portable software implementations of proprietary algorithms which execute in real-time on ultra-low power processors.

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