Small Array Microphone

SAM
A Fortemedia Technology

The Enabler of Voice Search

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The Challenges

- Voice Quality and Fidelity
- SNR
- Non-stationary Noise, Diffused Noise, and Wind Noise
- Echo
- Sampling Rate
- Other Assisting Features – Barge-in, VAD (Voice Activity Detection), IBI (In Beam Indicator)
Approach with SAM

- Cone Shape Beam-Forming
- Superior Non-linear Echo Cancellation Process
- Suppress Non-stationary Noise and Wind Noise
- Provide Accurate IBI (In-Beam Indicator) to Voice Recognition Engine
Cone Shape Beam-forming

Broadside Array Microphone Approaches (pie-shaped)

Uni/Omni + Omni

Desired Signal

0-1cm

(0°)

(90°)

Back Leakage

>3 cm

Noise

Noise

Noise

Noise

(0°)

(90°)

x

z
Non-Linear Echo Cancellation

- Patent pending array microphone solution to cancel non-linear echo
  - Imperfect audio design and speaker
  - Overdriven speaker
  - Mechanical vibration
  - Chamber effect
- Non-linear echo is a critical element for one piece speakerphone
Non-stationary Noise Suppression

- SAM suppresses non-stationary out-of-beam noise
- 110º cone shaped beam-forming
- Suppress up to 20dB non-stationary noise

2004 Corvette
Speed: 40-45mph

DoCoMo/Fujitsu
Raku Raku phone
featuring SAM
SAM Wind Noise Suppression

- Unique wind noise suppression offered only by SAM
- Suppress up to 25dB wind noise

2004 Sebring Touring
Speed: 65mph

Before SAM

After SAM

Gennum nxZEN5500 ($110)
... compared to ...

Fortemedia HS2188FX ref design
SAM Increase Voice Recognition Rate

- Large vocabulary, 16kHz sample rate, full blown implementation
SAM Prevent Recognition Errors

Noise from outside of the beam

• Suppress Non-stationary Noise
• Pass the IBI (In-Beam Indicator)

Voice Recognition Engine

Processed by Small Array Microphone

Voice recognition engine ignore any incoming byte from outside of the team, and focus on voice coming from inside the beam

Target Voice

Car Radio
DoCoMo Raku Raku Phone III

DoCoMo’s [Raku Raku PHONE III] F882iES

- The first cell phone in the world deploying Small Array Microphone (SAM) to create Beamforming
- Suppressing traffic noise, broadcasting announcement and human babble noises by 20 dB
- Enhance the intelligibility and the clarity of the mobile phone conversation

“Fujitsu’s Raku Raku phone offers enhanced sound quality…and a special feature…, making the words easier for the user to understand.”

The Wall Street Journal – 10/16/06
Value Proposition

• Best Performance in
  • Beam-forming
  • Noise Suppression
  • Acoustic Echo Cancellation
• Smallest Form Factor
• Lowest Power Consumption
• Enhance Voice Recognition Performance
Appendix
Company Profile

- Fabless Semiconductor Company with focus on Clear Voice Interface by Small Array Microphone (SAM) solutions since 2000
  - 12 patents granted and more than 87 patents pending
  - Focused on SAM Technology for Acoustic Echo Cancellation and Noise Suppression

- Global Operations with Headquarters in Silicon Valley
  - California (Cupertino), China (Beijing, Shanghai, Nanjing, Shenzhen), Taiwan (Taipei, Hsinchu), Japan, Korea, and Germany
  - >150 Employees

- Major Investors: UMC, Intel, Samsung, Lehman Brothers, Marvell
- Major Customers: Motorola, Docomo, Fujitsu, Samsung, LG, Sony Ericsson, Lenovo, Nokia,....
Product Portfolio

**NB** (VoIP speakerphone and Internet Gaming)
- FM1072LP (Integrated power amp and USB interface)
- FM2010 (small footprint and low power)

**Handset / Smartphone** (Noise Suppression Hands-Free)
- FM1185, FM2010, FM3010 (low power consumption)

**Headset** (Noise suppression)
- FM2190 (Integrated Bluetooth host controller)
- FM2010 (Low power voice processing)

**Automotive / PND** (Hands Free and Voice Control)
- FM1182, FM1093, FM3010 (wind noise suppression)
Handset Customers

Yulong Coolpad 8260
Handset Accessories
GPS PND / PDA Customers
Notebook & PC Peripherals
VoIP Speakerphone/ Video Phone
Automotive Customers

Jaguar’s built-in hands free functions powered by SAM

Fortemedia’s SAM in 2005 Nissan TOBE Telematics system

Sanyo portable Telematics applies SAM to enhance full duplex with beam-forming

Hyundai’s 2002 Spectra built-in hands free solutions use Fortemedia’s SAM