Active noise control system application: BAM (Bonding, Attenuation, and non-intrusive Monitoring) system for infant incubators

Sabbatical leave report
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The problems at Neonatal Intensive Care Unit (NICU)

- 20 million infants admitted to NICU globally
- Missed bonding opportunities
- Monitors attached to infant’s body
- Sleep disturbance
- Developmental language problems
- Hearing loss

Recommendation:
Current solution

Noise control
Reduce staff activities
Reduce 3-5 dB (2-2.5 times lower)
Not efficient

Bonding
None

Monitoring
Intrusive monitoring

Bonding, Attenuation, and non-intrusive Monitoring

BAM noise cancellation system
The BAM system advantages

Two way wireless communication
- Bonding

Active noise control (ANC)
- Attenuation noise

Infant sound classification
- Monitoring

Old
- Primary noise
- Reference microphone
- Secondary loudspeakers
- Error microphones

New
- Noise Source
- Anti-Noise
- Reduced Noise

Before ANC

After ANC
- Reduce noise by 30 dB (1000 times less)
Research outcomes

• Publication
  – 3 Journal articles
  – 6 Conference papers
  – 1 Technique report
  – 1 Presentation

• 3 US Patents

• Grants
  – NSF STTR
    • Phase I 250K
    • Phase II 750K Invictus Medical
  – Gerber foundation 50K
  – NIU internal 30K

Current application
- BAM system for hospital
- Separate monitoring system for consumer products

Sound recognition: explosion, human being activities

Other applications for active noise control

NIU
Teaching and education outcomes

• Teaching
  – Curriculum
    • 4 new course proposals
      – In progress
      – 1 undergraduate and 3 graduate level courses
    • Update 4 existing courses
      – 1 undergraduate course
      – 3 graduate courses

• Education
  – 4 MS theses
  – 4 Independent studies
  – 2 MS research projects
  – 2 Honors undergraduate research projects
  – 1 Senior design project
    • (1st place award)
Student Participation and Support and broader impact

• Student participation
  – 6 RAs supported by this project
  – 1 graduate MS student hired by Invictus Medical
  – 4 MS theses
  – 2 MS research projects
  – 1 Senior design project
    • (1st place award)
  – 2 Honors undergraduate research

• Broader impact

Social benefits

Family benefits

NIU research reputation

Total cost per child with hearing loss **$175,000**

Other cost

Education cost

www.allfornursing.com
Questions?

• Thank you!