



# Northern Illinois University

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

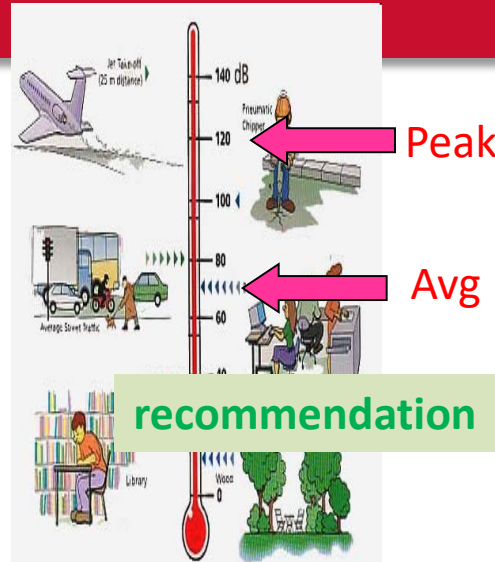
Sabbatical leave report  
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College of Engineering and Engineering Technology

2/15/2018

# The problems at Neonatal Intensive Care Unit (NICU)



20 million infants admitted to NICU globally



Sleep disturbance

Developmental language problems

Hearing loss



Missed bonding opportunities

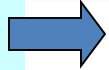
Monitors attached to infant's body



# Current solution



Noise control



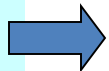
Reduce staff activities



Reduce 3-5 dB (2-2.5 times lower)

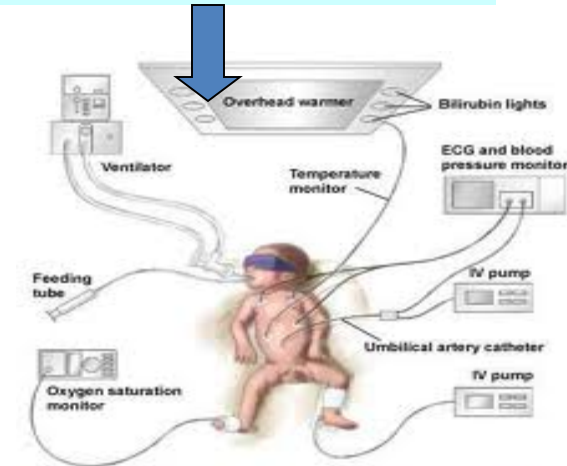
Not efficient

Bonding



None

Monitoring



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Intrusive monitoring

**Bonding, Attenuation, and non-intrusive Monitoring**

**BAM noise cancellation system**

# The BAM system advantages



Old

Two way wireless communication

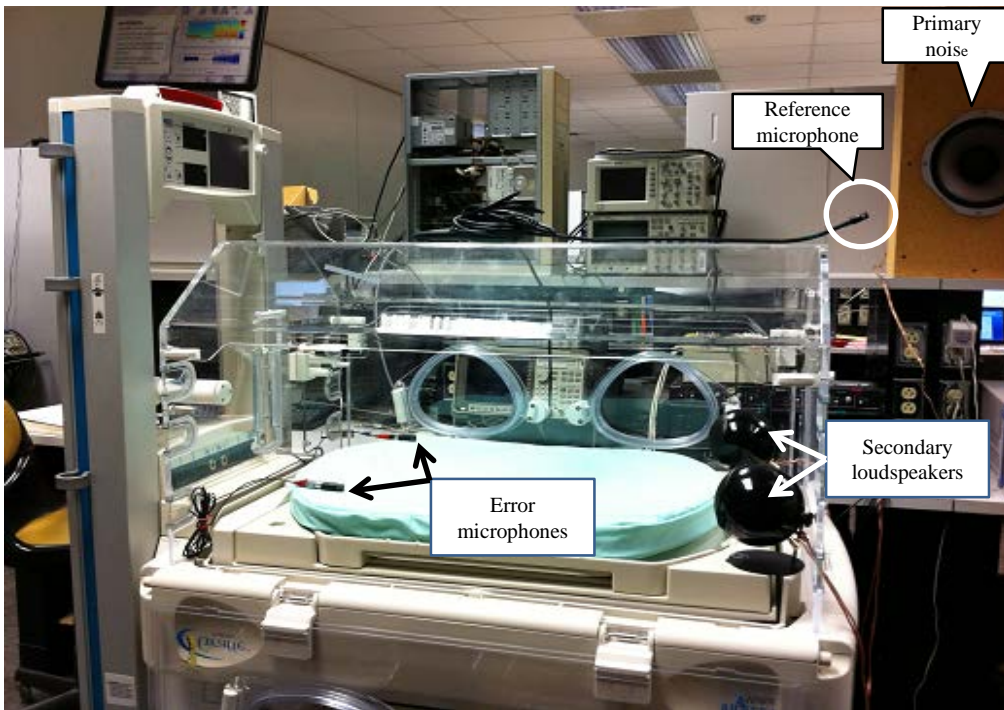
Bonding



New

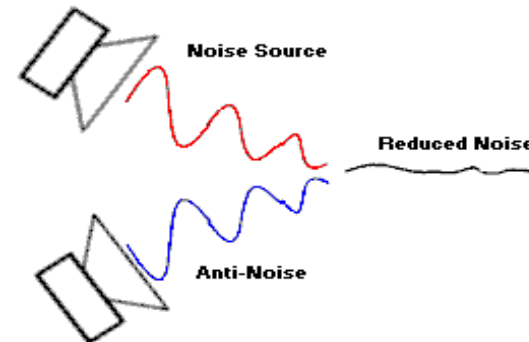
Active noise control (ANC)

Attenuation noise

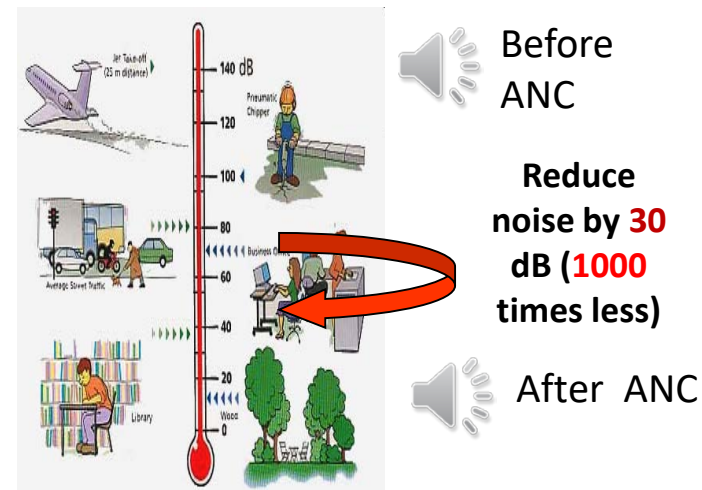


Infant sound classification

Monitoring



Active Noise Reduction



# Research outcomes



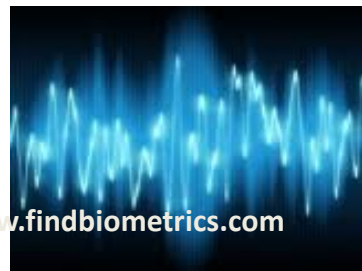
- Publication

- 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 ([https://www.nsf.gov/awardsearch/showAward?AWD\\_ID=1631818](https://www.nsf.gov/awardsearch/showAward?AWD_ID=1631818))
- Gerber foundation 50K
- NIU internal 30K



Long term



Sound recognition: explosion, human being activities

- Current application

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

Long term



Other applications for active noise control



Improving the lives of newborns

# Teaching and education outcomes

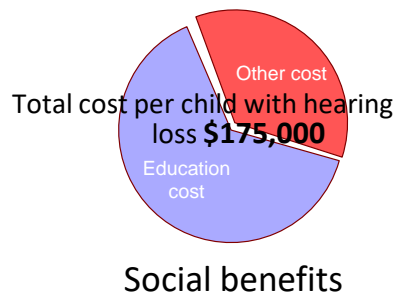


- Teaching
  - Curriculum
    - 4 new course proposals
      - In progress
      - 1 under graduate and 3 graduate level courses
    - Update 4 existing courses
      - 1 undergraduate course
      - 3 graduate courses
- Education
  - 4 MS theses
  - 4 Independent studies
  - 2 MS research projects
  - 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
    - (1<sup>st</sup> place award)
  - 2 Honors undergraduate research
- Broader impact



Family benefits



Northern Illinois University

NIU research reputation

# Questions?



- Thank you!