MULTI-SENSOR INFANT MONITORING SYSTEM

LooK Instruments:
Kemal Simpson
Lindelle Davis
Opeoluwa Aladekomo
Obafemi Otelaja
BACKGROUND:

- **Sudden Infant Death Syndrome (SIDS):**
  - Sudden unexplained death of an infant

- **Industry affected:** Biomedical

- **Technology:** Infant Monitoring System
  - Detect multiple vital signs
  - Alerts caregiver to reduce the onset of SIDS

- **Customer:** Caregivers of infants
PROBLEM FORMULATION

- NIH/NICHD reports that “Back-to-bed” program significantly reduces SIDS occurrence by 50% since 1990
  - “Back-to-bed” program - designed primarily to stress that babies should be put to sleep on their back

- Existing monitoring technologies:
  - Detect singular vital signs
  - Limited in scope

- Multi-sensing monitor system required

- A working knowledge of various subjects
PROBLEM FORMULATION (CONT’D)

Specifications
- Mountable in typical bedroom
- Work in light or dark room
- Not excessively heavy, providing ease of travel

Regulations
- Must meet the definition of a medical device in section 201(h) of the Federal Food Drug & Cosmetic (FD&C) Act
- Must adhere to the Food and Drug Administration (FDA) regulation of a maximum level of 0.5 µg/mL for lead content products intended for use by infants and children
SOLUTION APPROACHES

- System level schematics

- Example:

  - Signal transduction → Transmission → Processing → Decision making

  - Example diagram with signal waveform, decision logic, and output action.
MAJOR SOLUTION

- PAT Baby Suit (Hybrid)
  - Merges the concepts and functionality of:
    - Integrated Multi-senor Baby Suit
    - PAA (Position, Alternans, Apnea)
      Infant Monitoring System

- Monitors:
  - Position – Pressure sensors
  - Temperature
  - Heart Alternans
    - Electrodes → Input unit → Processor → Comparator
ALTERNATE SOLUTIONS

- Integrated Multi-sensor Baby Suit
  - Monitors:
    - Position, Temperature, Pulse

- Position Monitoring Mattress
  - Monitors:
    - Position, Pulse, Air quality, Noise monitor, Video Surveillance

- PAA(Position, Alternans, Apnea) Infant Monitoring System
  - Monitors:
    - Position, Heart alternans, Apnea
DELIVERABLES & VERIFICATION PLAN

Deliverables

- Wearable prototype with detachable sensors
- Mannequin baby
- Crib-side mountable alerting device
- User manual
- Virtual instrumentation with Labview programming

Verification plan

- Turn the mannequin infant over to test pressure sensors
- Heat the mannequin infant to emulate a rise in temperature to test
- Emulate heart beat by pressing on the mannequin infant
PROJECT MANAGEMENT & TASKS

- Research
  - SIDS
  - Patents for baby monitoring
  - Ways to alert caregiver

- Development
  - Pressure switch circuit
  - Heart Alternans monitor
  - Temperature monitor

- Test and analysis

- Implementation
  - Establish a method of alerting
  - Determine optimal positions of sensors
  - Attach sensors

- Production
  - Prototype
  - Alerting device
  - Manual
COSTS AND RESOURCES

Resources:
- Dr. Anderson
- Internet
- National Institute of Health (Journals, statistics, etc.)
- United States Patents & Trademark Office

Costs:
- Microprocessor - $300
- ECG Electrodes - $27.50
- Alarm Buzzer - $74.50
- Comparator - $20.00
- Pressure Sensor Switches - $100
- Miscellaneous costs - $100
- Labview – free
- Labview toolkits - $1250

Total Budget - $1872.00
CONCLUSION

- Our system will effectively detect multiple signals and vital signs associated with the onset of SIDS.

- We hope to thoroughly evaluate and test our solution implementation for our design according to the projected timeline.

- Completion of final design and deliverables, including prototype by end of March 2008.

- Upon project proposal review, we are willing to make any necessary changes to our design and/or functional requirements.