Need Statement

- Design a tertiary alarm system for apnea under sedation
- Use Tactile (touch) Channel
- For use by doctors as well as anesthesiologists
- To be integrated with existing CO2 End Tidal Monitors
- Wearable and non interfering
What is Apnea?

- A state of no breathing

- Under Sedation:
  - Upper airway muscles sedentary
  - Breathing airway closed
  - Possible comorbidities or death
Why Tactile Sensation?

- Skin is the largest sensory organ
- Personalized message
- Most efficient sense
- Improves Multi-tasking (based on Multiple Resource Theory)
Potential Tactile Solutions

- **Texture**: Needs relative motion, multiple inducers

- **Pressure**: Can induce pain, Threshold value differs from person to person

- **Vibration**: Single source can depict multiple patterns
Tactile Alarm System

- Strap
- LCD
- Button
- LEDs
- Tactor
Design

- 4 Vibration Motors (Tactor)
- Vibration patterns to denote respiratory conditions
- Modular Sleeve to fit different arm sizes
- Closed loop system with user acknowledgement
- Backlit LCD display shows vitals on the arm
Normal state: 8-16 Breaths/ Minute

- Periodic short buzz every 10 seconds
Reduced Breathing State: 4-8 Breaths/Minute

- Periodic short buzz every 10 seconds - 2 Vibrators
Critical State: 1-4 Breaths/ Minute

- Sequenced Pattern: requires acknowledgement - 4 tactors
- Will repeat after 30 seconds if state continues
Apnea State: 0 Breaths/Minute

- Simultaneous, repeated buzzes - 4 tactors
- Acknowledgement required
- Repeats every 30 Seconds
System Process

CO2 End
Tidal Input

Controller

Tactor Output
Demonstration
Future Scope

- Include other vital signs like BP, Heart rate, ECG
- Vital prediction algorithms
- Customizable touch display with priority based vital display
- Interactive Operating Theater
Thank You

Questions?
**Project Phases**

**Phase 1**
Project definition
- Defining Need Statement
- Goal definition
- Identifying Stakeholders
- Project Analysis
- Timing & resource requirements
- Design Prototype
- Project Kickoff

**Phase 2**
Project planning
- General planning
- Action Plan
- Project organization
- Procedure planning
- Detailed Planning
- Project structure plan

**Phase 3**
Project Execution
- Exchange of information
- Production Controlling
- Documentation
- Procurers/ providers
- Service & Support team
- Employee motivation
- Conflict Management

**Phase 4**
Project conclusion
- Product improvement plan
- Project touchdown
- Variance analysis
- Experience backup
- Resolution of the Project Organization

**Activities**
What the Doctor Sees??

PATIENT only can live if he can feel free.
Situation Overview

What the Anesthesiologist Sees
Need Statement

- Wearable device that will give a tactile sensation when apnea occurs during sedation/analgesia.

- Airway obstructions strain heart and lung function.

- Potential Death
Other Considerations

- Chest
- Arm
- Modular Fixture
- Back
- Leg
- Shoe insole
Goal Definition

Alert System Required

Specific
Measurable
Attainable
Realistic
Time-bound

Objectives have to be specific and positively described.
A goal achievement should be measurable.
It should be attractive for the project team to reach the goal.
The objective needs to be achievable in a realistic way.
The goal has to set within a time frame.
Project Objective

- Vibrotactile device
- Wearable/wireless connection
- Person specific alarm
- Measurable from end tidal carbon dioxide
Project Objective

- Proved attainable in prototype device model
- Input signal reliable from end tidal CO2
- Refer to project “ilities” for alert design
- Prototype developed in less than 48 hours
- Commercial product can be available within 8 months
Identifying Stakeholders

1. Identifying Parties
2. Classifying Importance vs. Influence
3. Appointing roles
Identifying Stakeholders

- Anesthesiologist
- Doctor
- S.D.S.A Execution Team
- Aggie Invent Mentors
- Expert
- Baylor, Scott, & White
Motivation for Need:

- Additional Warning Layer
- High risk of patient mortality
Customer

- Steering Committee
- Expert
- Project Sponsor

S.D.S.A Execution Team

Aggie Invent Mentors

Dr. Hofkamp

Baylor, Scott, & White

Anesthesiologist

Doctor