Overnight Pediatric Oxygen Delivery System (OPOD)

Sponsor: DesignWise Medical Inc.

Sponsor's Mission Statement: DesignWise Medical is a nonprofit medical device company focused on identifying, creating and developing solutions to the unmet medical needs of our society's children.

Company Sponsor Advisors:

Brad Slaker (BSME, MBA)
Founder of DesignWise Medical Inc.
Engineering Manager for the Institute for Pediatric Innovation [IPI]

Ann Gettys (MS)
Human Physiology, University of Oklahoma
Chairman of the Board- Children's Interstitial Lung Disease (chILD) Foundation

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University of St. Thomas School of Engineering Academic Advisor: Howard W. Stolz, PMP Manager Project Management, MFG Solutions, Inc.

Project Team Members: Fushcia-Ann E. Hoover (ME), Ahmed N. Jaffer (EE), Jacob R. Maida (ME), Benjamin O. Valley (ME)

Senior Design 2008-2009 Project Description: We were given the task of designing an Overnight Pediatric Oxygen Delivery System (OPOD) that would reduce the child's non-compliance with traditional methods of overnight oxygen delivery, specifically nasal cannulas and face masks.

Major Design Requirements:

- Facial detection or positioning system to activate appropriate oxygen output location
- Hood design to incorporate the controls system and increase oxygen concentration around the child (Collaboration with UW-Stout)
- Air handling system with multiple oxygen output locations
- Design for in-home use (Safety and Simplicity)
- Compatible with a crib up to a twin size bed
- 10 year life cycle

Senior Design Project Summary: The project required investigation into medical devices incorporating designs for infants. FDA research was also done because this device will be seeking approval as a Class 2 medical device. The major features of the design include the oxygen flow rate, facial detection system and valve controls. A control system integrates all of these components in addition to an alarm system. We used computer modeling software, ANSYS-CFX, to analyze the oxygen output to determine the flow rate distances and pattern. Testing was conducted to map five zones surrounding the child's face through the use of a light reflective dot placed on the forehead. The system locates the dot in a zone and opens the corresponding valve closest to the zone. The final design includes 2 cameras and 6 valves; one valve per zone with an additional default valve for an oxygen pillow to be designed by our sponsor in the future.