Delivering Oxygen Only During Inhalation

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Background

Supplemental oxygen is traditionally delivered to sedated hospital patients at a constant flow rate via nasal cannula. The current gold standard in oxygen delivery is a constant flow, which:

- Prevents accurate monitoring of patient breathing and CO2 level, and
- Generates discomfort in patients by drying out their sinuses

The lack of effective monitoring often results in the nurse being unable to detect patient respiratory depression resulting from inadequate ventilation of the lungs. This often leads to death or severe brain damage if left unchecked [1].

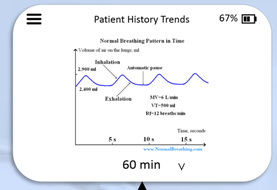
Objective

The goal of this project is to develop an intermittent oxygen delivery device which improves:

- Depressed breathing detection
- Patient monitoring
- Potential for user error
- Patient comfort

Conclusion

- Potential for catastrophic failure significantly reduced due to elimination of human error through automated monitoring and alerts
- Display provides easy access to patient's breathing and O_2 delivery profiles in real time
- Digital readout is much less prone to error of interpretation and malfunction compared to existing pressure gauge
- Replacement of constant oxygen flow with pulses upon inhalation reduces drying of sinuses



Sensing

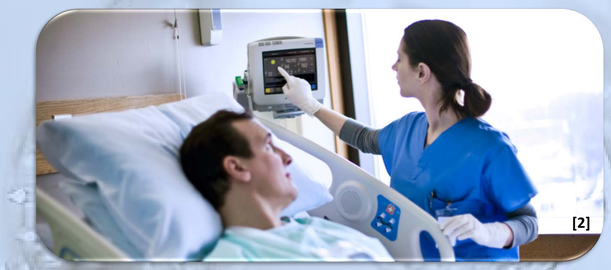
The nurse will:

- Perceive alarms (auditory/visual)
- Read the screen
- View patient data

Information Processing

The nurse will:

- Interpret Parameters
- Respond to Alarms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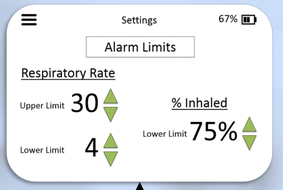
Nurse

Device



Control Capabilities

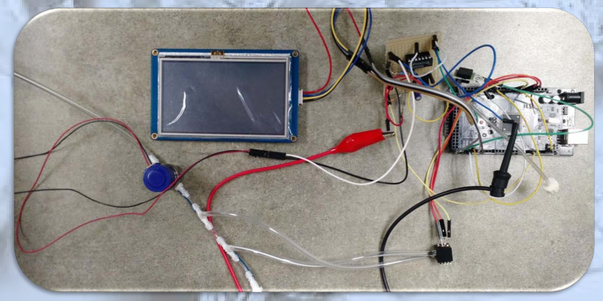
The touchscreen interface allows adjustment of:

- O_2 flow and delivery settings
- Display settings to user preference
- Alarm threshold settings

Display

The device will display:

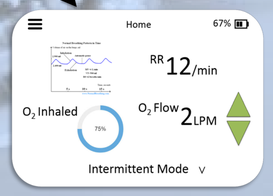
- O_2 delivery profile
- Patient breathing profile
- Alarm thresholds
- Flashing LEDs and auditory signal when alarm thresholds are crossed



Control Panel

Accepts user input for changes to settings via:

- Screen Buttons
- Power Button
- Adapter

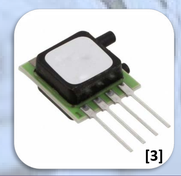


Hardware and Sensors

Pressure sensor triggers O_2 delivery pulse in response to patient's breathing profile when negative pressure is detected.

Pressure profile from cannula sensor and O_2 delivery represented on the display as the patient's breathing profile.

Patient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Output

Oxygen pulses delivered to patient in response to negative pressure

Input

Inter-cannula air pressure perceived by the sensor

[1] Lee, Lorri A., et al. "Postoperative Opioid-induced Respiratory Depression: A Closed Claims Analysis." Anesthesiology 122.3 (2015): 659.
[2] www.newscenter.philips.com
[3] media.digikey.com/Photos/All%20Sensors%20Photos/DLVR-L0xD-E1NS-C-NIxF.JPG

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