Wireless Pulse Oximetry

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Presentation Overview

- Oximetry Background
- Problem Statement
- Product Design Specifications
- Design Alternatives Considered
- Top Design
- Future Work

Pulse Oximetry is the measurement of arterial oxygen saturation

- Infrared radiation of LED lights
- Absorption of radiation
- Two species of hemoglobin
- Plethsymograph

http://www.kinxomedicals.com/images/MULTI-SITE%20WRAPS%20(NEL%20&%20TUF).jpg and http://www.med-worldwide.com/media/ss/210/BoundTree/D5218.jpg

Certain pulse oximeters are designed for mobile patients.

- 3100 WristOx and SPO 7500

- Philips Intellivue System

Picture: turnermedical.com and healthcare.philips.com
Info: http://www.wpi.edu/Pubs/E-project/Available/E-project-042408-101301/unrestricted/WPO_MQP-Final_04242008.pdf

Sensaris' "Zao" Wireless Pulse Oximeter

- Operates on Hospital WiFi
- Sends data to multiple interfaces
- Provides real time data
- Obtains more than just pulse oximetry readings

Info and Picture: http://www.sensaris.com/zao-wireless-pulse-oximeter-blood-pressure-monitor-thermometer-glucometer-interface-in-a-single-device/

Problem Statement

The pulse oximetry sensor will collect real time blood oxygen saturation data from patients and will transmit the information to a base-station ‘agnostic’ database via wireless data transmission. From this database, the information will be sent to a healthcare provider.

Project Motivation

- Wired instruments cause mobility limitations
- Real time data collection unrealistic for patients in a ‘home’ setting
- Constant monitoring of the patients is necessary
- A more comfortable, wire-free device is preferred to relay spO2 levels to a physician.

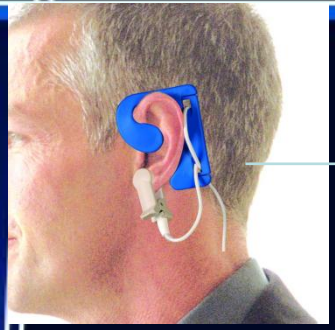
Product Design Specifications

- **Functionality:** Send data every 15 minutes
- **Battery Life:** Minimum of 7 days (1200 mAh)
- **Transmission Range:** 30 meters
- **Cost:** Less than $100
- **Size/Weight:** Standard hearing aid size: ~3 grams

Decision Matrix of Wireless Transmission Design Alternatives

Factor Weight	Factors Evaluated	Low Energy BlueTooth	Ziggbee	WiFi	3G Cellular	Ziggbee + 3G Cellular
24%	Compatibility with Circuit System	8	8	6	6	8
19%	Battery Life	10	10	8	8	8
19%	Transmittion Range	3	6	6	10	10
14%	Cost	7	7	5	5	5
14%	Accuracy/Reliability/Robustness	6	8	5	10	10
10%	Size/Weight	10	10	6	10	9
100%	Total	7.2	8.1	6.1	8.0	8.3

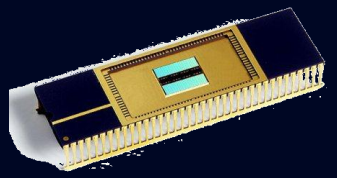
The Pulse Oxitelemetry prototype block diagram



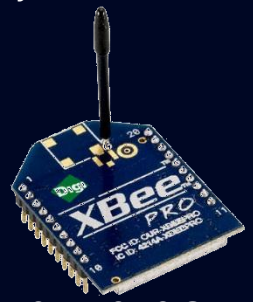
spO_2 Sensor

BCI Digital Pulse Oximetry Board

Atmel ATMega 128L Processor (MicaZ)

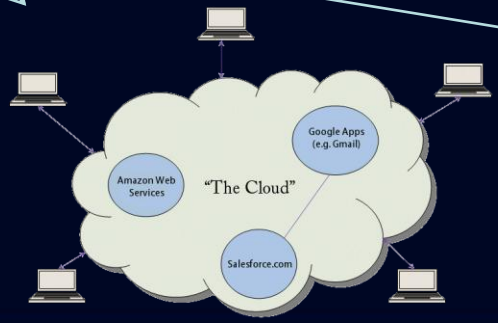


Flash memory (MicaZ)



2.4 – 2.48 GHz IM Band Zigbee

Four-Faith Zigbee + EDGE Network IP Modem



- Secure data centers or 'clouds'
- Configured IP addresses
- Mobile phones
- Other signal 'agnostic' base stations

Future work in the development of Pulse Oximetry

- Secure circuit systems
- Calibrate/program circuit systems to mutually compatible data parameters
- Configure IP Modem to transmit data through SMS messages and to ‘data center’ IP address
- Test and validate 3G pulse oximetric data vs. ‘wired’ pulse oximetry devices

Thank You!

Dr. Fred Robertson

Dr. Chris Brace

MEMSIC

Smiths Medical

Four-Faith Telecom