BOxy: Cost-effective Blood Oximeter

Beau Hsia & Derrick Wang
A DIY, cost-effective blood oximeter for third-world countries
Pulse oximeters: “one of the most important advances in respiratory monitoring”

Dr. Amal Jubran, Critical care specialist
The Importance of Oximeters

• An Oximeter works by **analyzing the wavelength** of reflected light off of the blood vessels

• Currently, Oximetry is used in situations of:
  • Artificial ventilation
  • Pneumonia
  • General Anesthesia

• Current need for oximeters in third-world countries:
  • 500 USD to purchase one for African hospital fees
  • 250 USD to repair

• Relate to COVID

Source: https://www.healthline.com/health/pulse-oximetry
Currently Available Oximeters

- **Portable but expensive**
  - Hewlett Packard portable oximeter
  - Micro-oximeter attached to fingernail

- **Cost-effective but inconvenient**
  - Smartphone camera oximeter
  - Headphone jack oximeter

- We need a **convenient** and **low-cost** oximeter
Main Objectives

- Low-cost
  - Third-world countries need affordable oximeters
- Easily-repairable
  - If it breaks, they could just replace parts, instead of buying new ones
- Portable
  - Not too big
- Convenient
  - No messy wires that could get tangled
Device Development

- Prototype
  - Off-the-shelf components
  - Independent unit
- Hardware
  - Simple design
- Software
  - Efficient processing
  - Bluetooth
Hardware Components

• Arduino UNO REV3:
  • $5.49, Banggood.com

• HC-05 Bluetooth Serial Module:
  • $3.99, Banggood.com

• MAX30102 Pulse Oximeter Sensor Module:
  • $2.10, AliExpress

• 8 Breadboard wires:
  • $0.12 (1.5 cents each), Newegg

(Price all in USD) **Total: $11.70**
Software

- Arduino IDE
  - SparkFun MAX3010x Sensor Library
- MIT App Inventor
  - Communication via bluetooth
  - Simple user interface
Results

• Accuracy
  • Intervals of variability

• Bluetooth
  • Successful communication

• Stability
  • Finger movement
Future Steps

• Addition of WiFi capability
  • Different Arduino (low-power)
• 3D Printed Casing
• UI Design
• Shrinking Circuitry Size / Custom PCB
• User Testing, algorithm adjustment
Conclusion

• BOxy is **cost-effective**, **portable**, **convenient**, and **easy-to-repair** and use

• Ideal for **low-income**, remote, and technologically isolated communities

• Still great room for improvement

• **Proof of concept**
  • Excited in preserving the lives of patients worldwide
Thank you!

Questions?