BOxy: Cost-effective Blood Oximeter

Beau Hsia & Derrick Wang

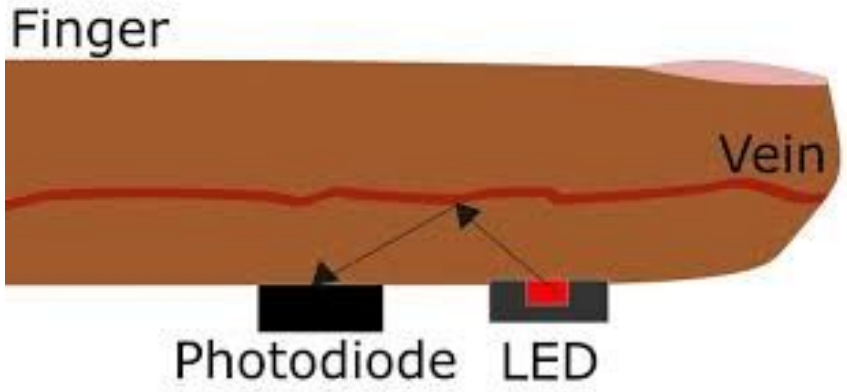
A DIY, cost-effective blood oximeter for third-world countries

Pulse oximeters: “one of the most important advances in respiratory monitoring”

Dr. Amal Jubran, Critical care specialist

The Importance of Oximeters

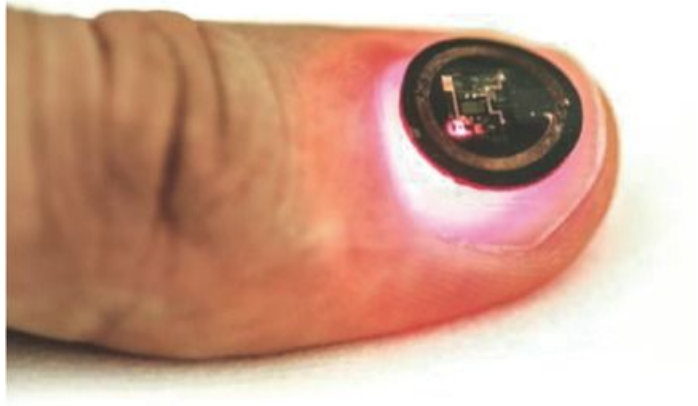
- An Oximeter works by **analyzing the wavelength** of reflected light off of the blood vessels
- Currently, Oximetry is used in situations of:
  - **Artificial ventilation**
  - **Pneumonia**
  - **General Anesthesia**
- Current need for oximeters in third-world countries:
  - 500 USD to purchase one for African hospital fees
  - 250 USD to repair
- Relate to COVID

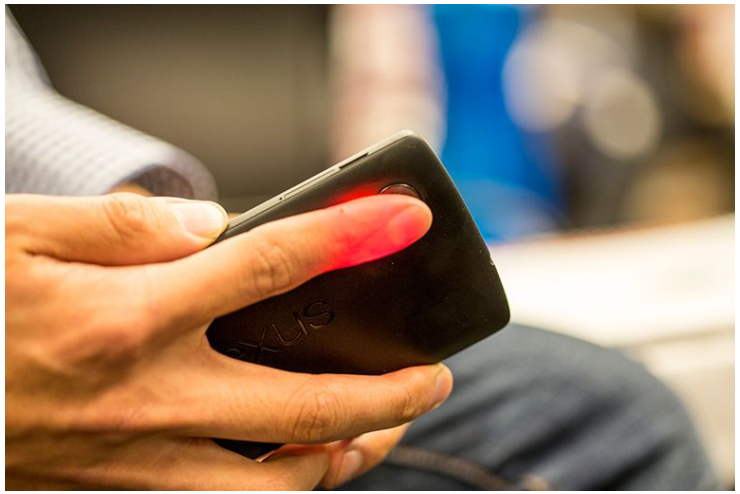


Source: https://www.healthline.com/health/pulse-oximetry

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





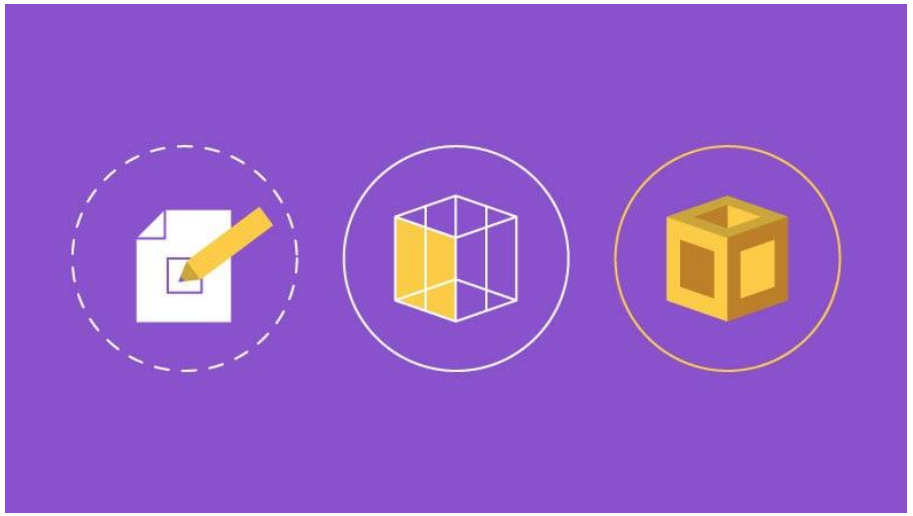
Source: https://www.medgadget.com/2016/09/hemaapp-accurately-estimates-hemoglobin-blood-using-standard-smartphone.html

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

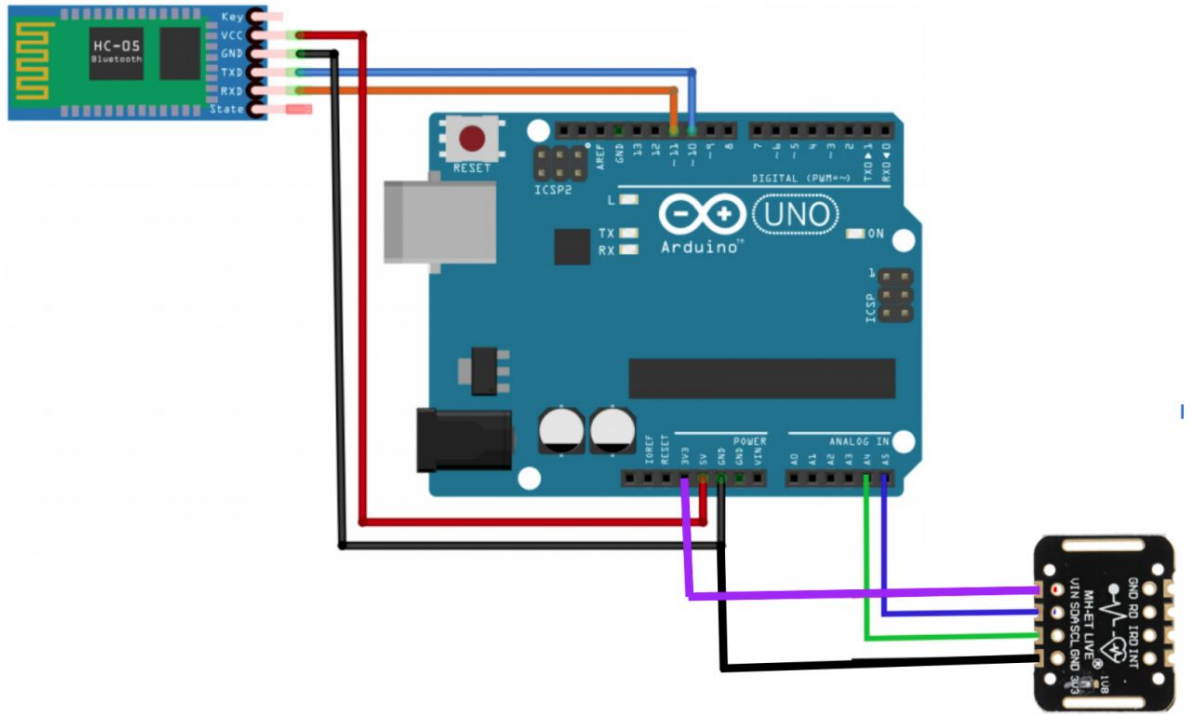
- Prototype
  - Off-the-shelf components
  - Independent unit
- Hardware
  - Simple design
- Software
  - Efficient processing
  - Bluetooth



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**

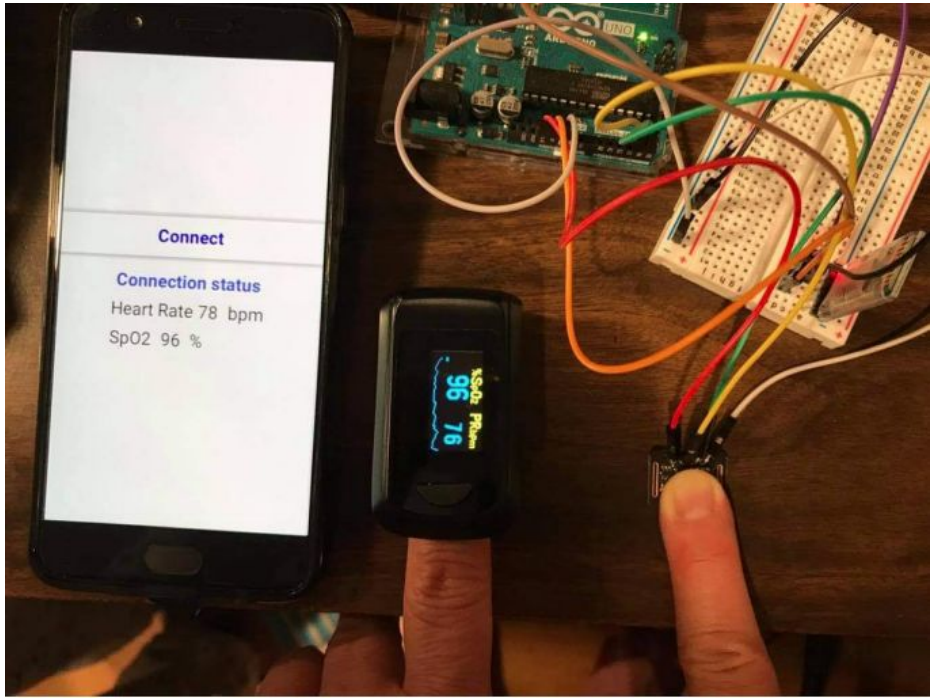


Software

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

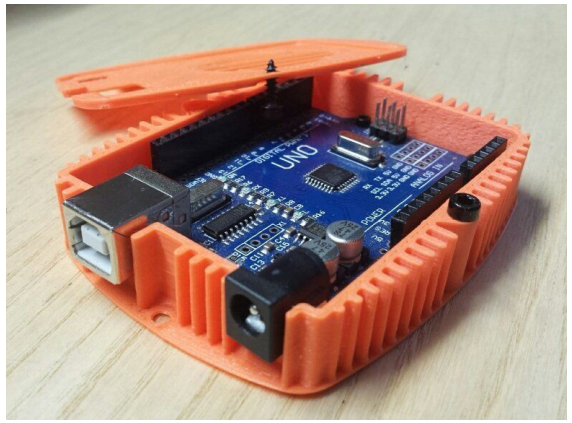
Results

- Accuracy
  - Intervals of variability
- Bluetooth
  - Successful communication
- Stability
  - Finger movement



Future Steps

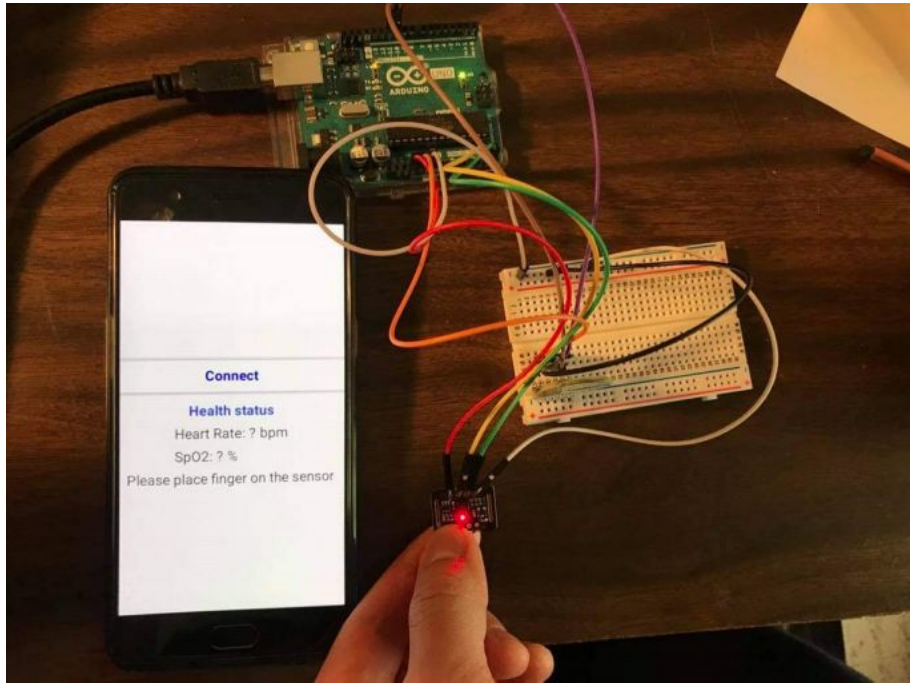
- Addition of WiFi capability
  - Different Arduino (low-power)
- 3D Printed Casing
- UI Design
- Shrinking Circuitry Size / Custom PCB
- User Testing, algorithm adjustment



Source: https://www.pinterest.com/pin/235735361732673870/

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?