Diabetes: 7th Leading Cause of Death

- More than 300 million people worldwide have diabetes
- In 2012 diabetes cost the United States $245 billion
Diabetics Need to Measure Glucose Levels

- Blood glucose meters use chemically active test strips to measure glucose.
- Results shape meal plans and medicinal administration.
Oxidation of Glucose

GOx

Glucose

Gluconolactone

Mediator (Ox)

Mediator (Red)

2e⁻

Working Electrode
Oxidation of Glucose
Oxidation of Glucose

GOx
Glucose
Gluconolactone
Mediator (Ox)
Mediator (Red)
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Working Electrode
Advancing Glucose Meter Technology

- Current monitoring devices have little functionality and are expensive
- Develop a multi-functional device
- Create functions for data analysis
- Make available to iOS
  - About 145 million iPhone users in the world
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QuickDraw System Overview
The Arduino

- A single-chip microcontroller
- Programmed to read and convert voltages to glucose levels
- Wirelessly transmits max glucose reading to smart-phone
Calibration Curves

Measured Voltage (V)

Time (Seconds)

317 mg/dl
Calibration Curves

Measured Voltage (V)

Time (Seconds)
Calibration Curves

Increasing Glucose Concentration

Measured Voltage (V)

Time (Seconds)
Calibration Curves

Time (Seconds)

Measured Voltage (V)

21 mg/dl

266 mg/dl

222 mg/dl

317 mg/dl

118 mg/dl

21 mg/dl
Confirming Accuracy

Maximum Voltage (V) vs. Glucose Concentration (mg/dL)

$r^2 = 0.987$
QuickDraw: Android App

- Analyzes glucose data for easy interpretation
- Stores large amounts of data for future reference
Take Test Screen

115 mg/dL

Start Test

Glucose History

Glucose Concentration (mg/dL)

Previous  Next
The Future of Glucose Monitoring

- Integration of monitoring systems on or into the human body
- Incorporation of non-invasive testing
- Incorporating a glucose meter into smartphones
Conclusion

◦ Programmed Arduino to convert voltage readings into glucose levels

◦ Ran calibration tests to ensure accuracy

◦ Tested connection with Android app

◦ Began progress on an iOS app