MINDFUL HEALTH TECHNOLOGIES

A real-time clinical decision support tool for critical care teams

Olivia Rice, Christopher Fernandez, Rafi Sufi, & Nick Glattard

Advisors: Dr. Fred Robertson & Dr. Amit Nimunkar

UW Health
University of Wisconsin Hospital and Clinics

UW BME Design

Scientific & Clinical Background

- 5.1 million people in US have heart failure (CHF)
    - About half die within 5 years of diagnosis
- 12.7 million U.S. patients suffer from COPD (2011)
    - discharge rate of 23.2 per 100,000 admitted
- Medical errors result in deaths between 44,000 and 98,000 a year in US hospitals
- Wisconsin study indicates a 13.3% rate of medical per 1,000 hospitalizations resulting in readmissions or prolonged care

Chronic Disease Metric	Value
Cost of US chronic disease management in 2001	$500 Billion
Predicted cost of US chronic disease management by 2020	$685 Billion
30 day hospital readmission rate	1 in 12 patients
360 day hospital readmission rate	1 in 3 patients
Average cost of hospitalization in 2011	$15,734

Table 1: Chronic disease management costs along with readmission rates

Design Motivation

Financial Incentive

- Affordable Care Act Readmission Reduction Program
- Center for Medicare & Medicaid Services will not pay for hospital readmissions within 30 days of departure
- Before- more patients in the hospital meant greater revenue for doctors and hospitals
- Now- incentive to keep patients out of the hospital with better outpatient care

Reduce Readmissions

- Physician's describe a "black box" when the patients leave the hospital
- Current at home care methods are ineffective
- Readmissions could be avoided with efficient monitoring in the home setting

OBAMACARE

AFFORDABLE CARE ACT

Final Web Application Design

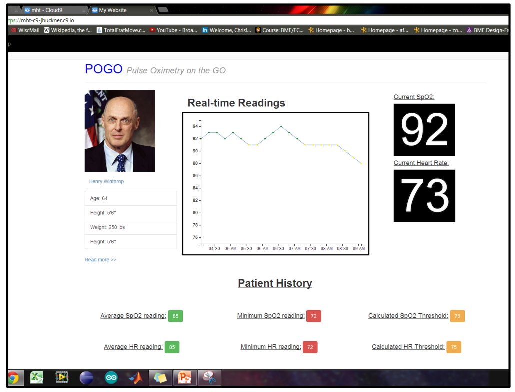

Figure 1: A patient's critical care dashboard displaying simulated data

Web Application Design Features:

- Real-time alerts and notifications when patients cross pre-determined vital thresholds
- Actionable vital data visualizations updated in real-time
- Automated patient severity categorization based on the most recent patient vitals
- Platform agnostic design enables access through any web enabled computer, tablet, or smartphone device
- High level of data, network, and system security

Web Application Testing:

- Each feature was tested and validated iteratively using the Google Chrome debug toolbar
- POGO to Xively to Web Application connectivity was tested; 100% data fidelity was observed in a real-time update trial consisting of 10 updates, 1 per 10 seconds

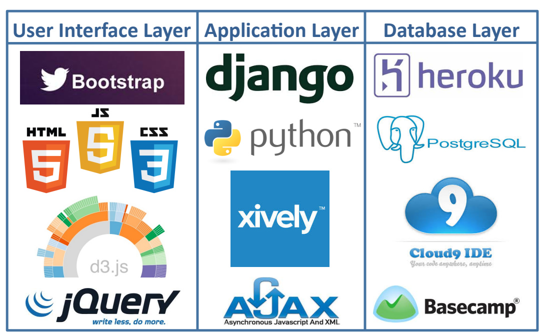

Figure 2: A diagram of the software systems that were integrated in each layer of the critical care web application

POGO 2.0

Purpose:

At appropriate intervals, a TCP/IP connection is made with the internet database to upload data that was retrieved from a pulse oximetry module.

Current Progress:

- In the first iteration of integrating the three main components into one circuit board:
    - Smiths Medical Pulse Oximetry Module
    - Wireless GSM Transmission Module
    - ATMega32U4 microcontroller
- The ATMega32U4's simple USB interface replaces the Arduino in hosting the Smiths Medical module and wireless GSM transmission module
- Designed the base circuit board using EAGLE files provided by Arduino and Seeed Studio
- Board is currently populated with everything but Seeed Studio's wireless GSM Transmission module (in transit)

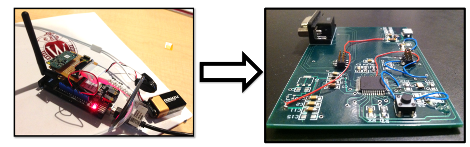

Figure 3: POGO 1.0 (left) and POGO 2.0 (right)

Future Work

- Finish current process of securing $20,000 in project funding by 12/13/13
- Continue iterative build-measure-learn web app feature development process
- Improve web application interface and data visualization interactivity
- Identify and secure a new OEM oximetry module for web application testing and validation
- Populate POGO 2.0 with GSM module components
- Investigate opportunities to launch pilot study

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