Mobile phone walk test software for the assessment of Functional Exercise Capacity

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Overview

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- Design Specification
- Fits and Hicks Law
- Design #1 – Wizard
- Design #2 – Branched
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- Future Work

Problem Statement

There is a clinically approved cardiopulmonary health test called the 6-minute-walk-test (6WMT) that accurately gauges cardiopulmonary health through a simple technician-guided walk procedure.

Our objective is to create a similar test using an iPhone application that will generate 6MWT data in an at home setting. This data will be useful in assessing patient improvement by testing the patient before and after medical intervention.

Background

6-Minute Walk Test

- Clinical exercise tests for increasing complexity
- Measures the **distance** that a patient can quickly walk on a flat, hard surface in a period of **6 minutes**[1]
- Patients choose their own intensity or exercise and are allowed to stop during tests[1]
- Measures the response to medical interventions in patients with moderate to severe heart or lung diseases (ex. COPD) [1]

Motivation

- Powerful test but only accessible clinically
- Expensive
- Time consuming

Our solution:
iPhone application + 6MWT

A larger population would be able to keep track of their health easily by accessing the 6MWT on their own.

Design Specifications

Client requirements

- Must work on **iPhone**
- Ability to store and organize test data
- GPS calibrations
- Periodic Audio Encouragements

6MWT
Six Minute Walk Test

Design Specifications

Performance requirements:

- Battery Efficient
- Ability to upload to central database

Safety Concerns:

- Must not cause detrimental visual effects and distraction
- Safety Button

Accuracy and Reliability:

- Track distance to +-5 meters
- Account for varying courses

Interface Aesthetics:

- User interface must be easy to use (Fitt's Law)
- User must be able to quick button decisions(Hick's Law)

Fitt's and Hick's Law

Fitt's Law[3]

Used for designing interfaces and predicting the index of difficulty for users

$$ID = \log_2\left(\frac{D}{W} + 1\right)$$

ID – Index of Difficulty

D – Distance to Button

W- Width of Button

Hick's Law[2]

Used to quantify the time it takes someone to make a decision between a number of possible choices

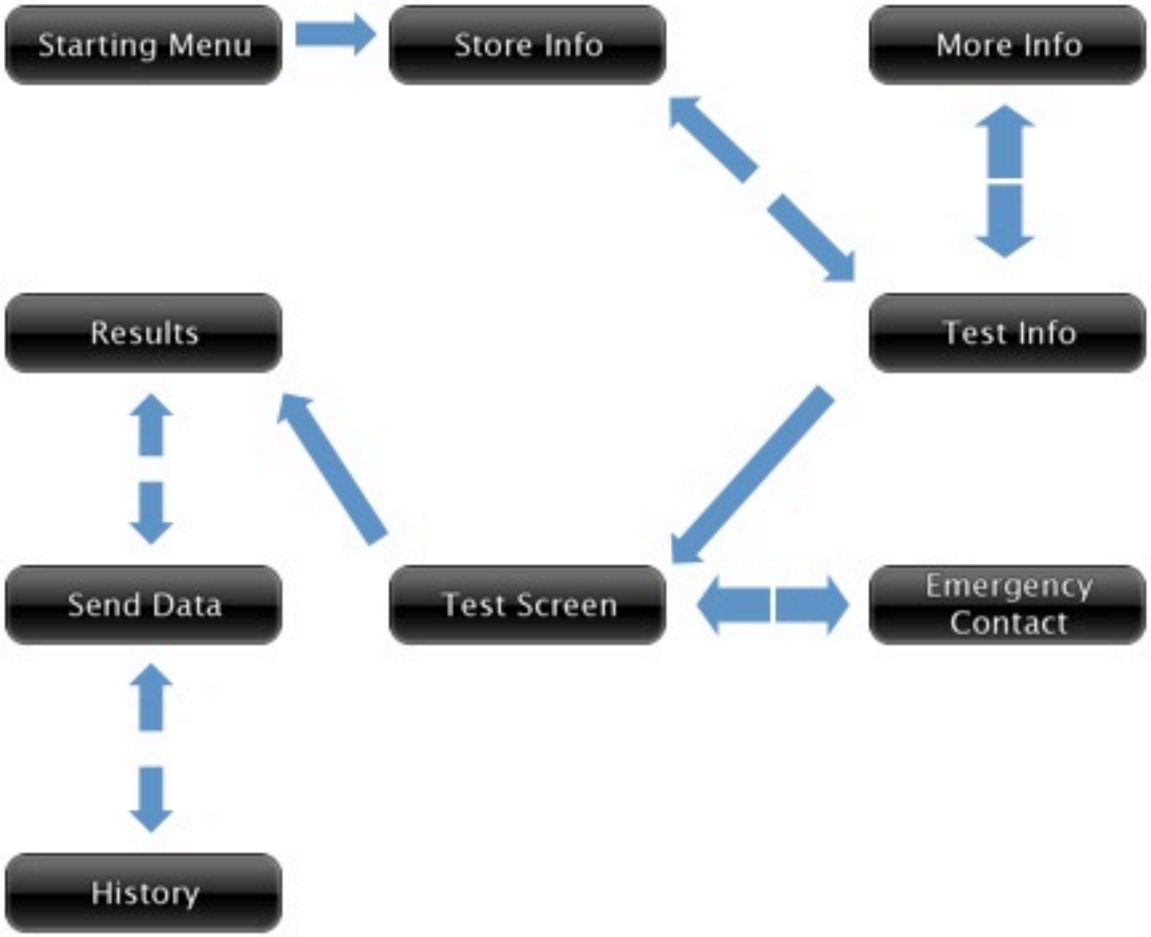
$$T = \log_2(n + 1)$$

T- Approximate Reaction Time

n – number of choices

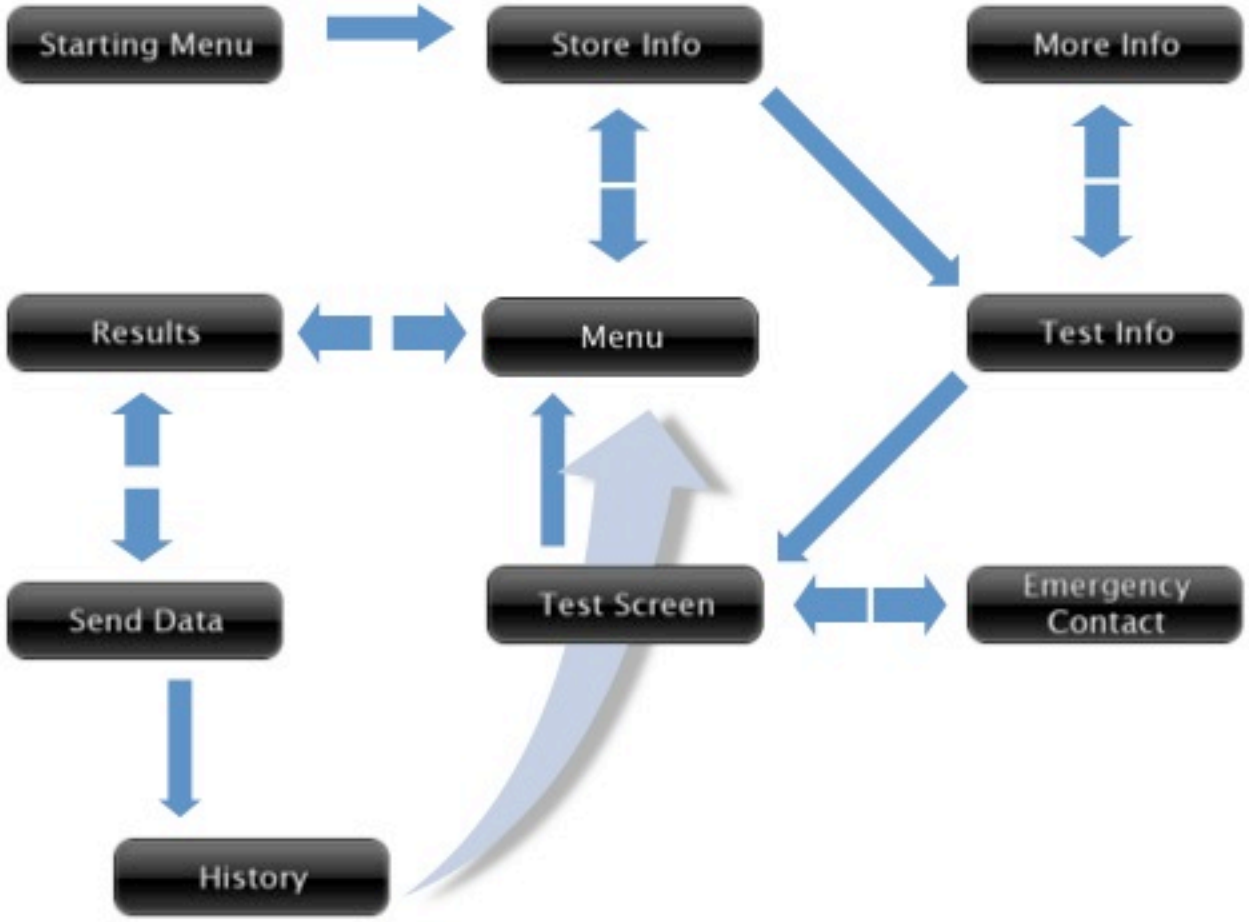
6MWT
Six Minute Walk Test

Design #1 - Wizard



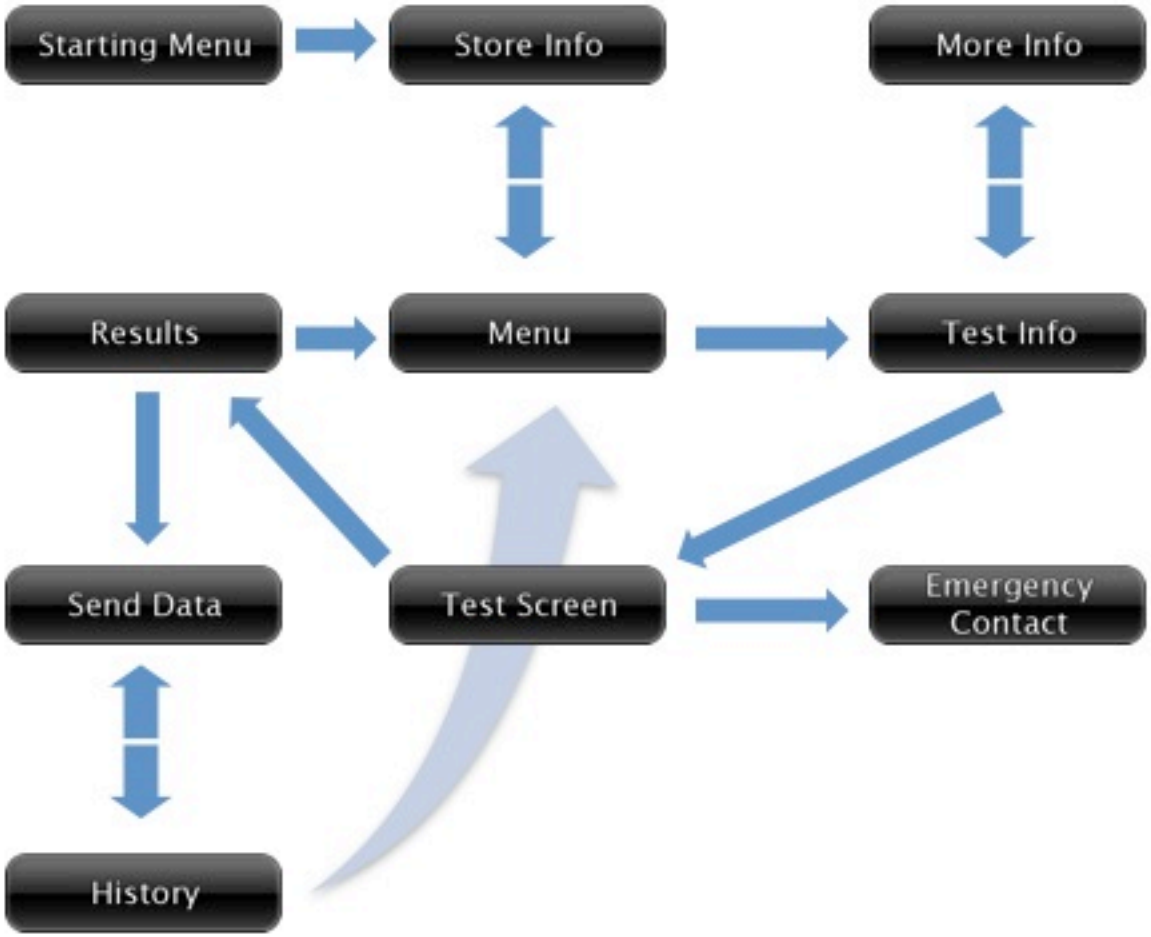
6MWT
Six Minute Walk Test

Design #2 - Branched



6MWT
Six Minute Walk Test

Design #3 - Hybrid



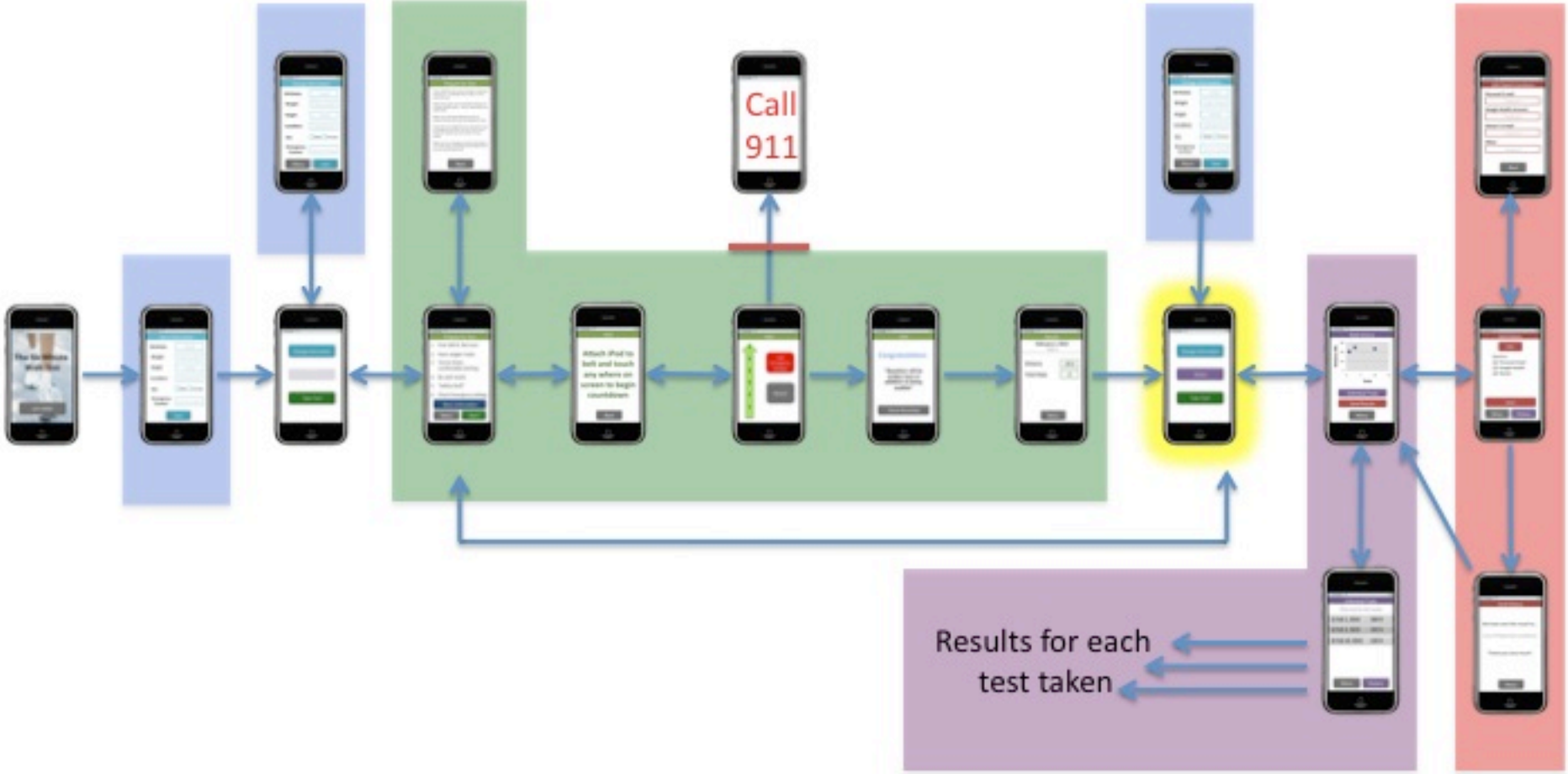
6MWT
Six Minute Walk Test

Design Matrix

Category	Wizard	Branched	Hybrid
Ease of Navigation (40)	35	15	30
User Rating (40)	16	24	35
Fitt's Law Coefficient (10)	8	6	7
Hick's Law Coefficient (10)	9	5	8
Total	68	50	80

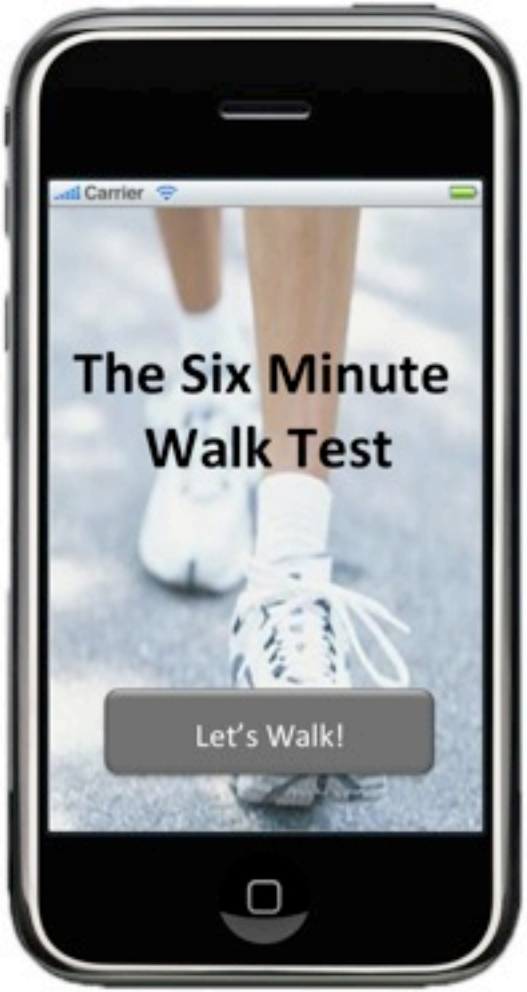
6MWT
Six Minute Walk Test

Final Design



6MWT
Six Minute Walk Test

Interface Simulation



Future Work

- Finalize accelerometer aspect of program
- Test this against a mechanical pedometer to be sure it gives reliable 6MWD data
- Code our final user interface design
- Research method for doctor patient communication (automatic email, 3rd party server)
- Interface iPhone with google health account to log population data for comparison purposes
- Test final iPhone app on patients

References

1) ATS Board of Directors (2002). ATS Statement: Guidelines for the Six-Minute Walk Test. Am J Respir Crit Care Med, 166, 111-114.

2) Beggs, W. D. A., Graham, J. C., Monk, T. H., Shaw, M. R. W., & Howarth, C. I. (1972). Can hicks law and fitts law be combined. Acta Psychologica, 36(5), 348-357.

3) Longstreth, L. E. (1988). Hicks law - its limit is 3 bits. Bulletin of the Psychonomic Society, 26(1), 8-10.