ECE 1778:
Creative Applications for Mobile Devices

Lecture 4

January 31, 2012

Today

1. Logistics
2. Case Studies: Some Context for Proposal Discussions
   - Rosano Coutinho – musical composition app
   - Selected Apps from Last Year
3. Proposal Discussions

Logistics

Assignments

- A2 and P2 were due yesterday
- A3 and P3 will not go out until next week
  - To give you this week to work on your plan

- A1 and P1 have been graded, with comments online
  - See blackboard portal

Project TimeLine

1. Forming Groups
   - are there still un-attached students?
2. One-Page Proposal
   - Due today – need my approval to proceed
3. **Project Plan**
   - **Due Next week, Feb 7th**
4. Proposal/Plan Presentations
   - Weeks of February 14 and 28 [No class in Reading Week]
5. Spiral 2 & Spiral 4 Presentations
   - 2: March 6/13 4: March 20/27
6. Final Presentations
   - Weeks of April 3 & 10
7. Final Report Due April 12th

Plan Due Next Week: Feb 7

Contents of Plan Document:

1. Reprise Goal, make more precise
2. Rough design of what the user sees
   - Mock-ups of screens; Appers must be key part of this
   - Any drawing package will do
3. Block Diagram overview of planned code
   - Top down
   - With short prose description of each
   - Should be linked to the screens

Plan, continued

4. Statement of Risks/Issues
   - What roadblocks/issues/challenges do you foresee?
   - App-wise, programming-wise, hardware-wise, ethics-wise
5. What do you need to learn that you don't know
   - all members
6. **Important:** for Groups with Appers
   - Submit a separate essay on how App relates to field of Apper, and how the Apper will contribute to project
   - 500 words, not included in above count

Plan Document

- Plan length: 1500 words max, 10 pages max
  - Should have pictures!
  - Word count doesn't include Apper essay 500
  - Include word count, penalty for overage.

- Seeking clarity, not quantity of words
  - Omit needles words

- Worth 10% of final grade

- Submit plan by email to me: jayar@eecg.utoronto.ca
- Due Tuesday February 7 by 9am

Class Participation

Class Presentations & Participation

- A key part of what happened last year in this course was the contribution students made to other's projects
- Your will do many presentations in this class
  - Indeed, one side-effect of this project course is some real practice in giving high-quality, concise & clear communication
  - Most presentations will be 5 minutes in length
  - Must be geared so that most people in the class will understand
- Want everyone to come, listen & provide useful input
  - So, have modified grading scheme to include participation
  - Expectation that you'll listen and provide thoughtful feedback and suggestions to other's presentation, starting today

Grading - modified

- Assignments: 16% (down 4%)
  - 4 assignments
- Project: 80%
  - Proposal 5% (down 5%)
  - Plan (incl presentation) 10%
  - Spiral 2 Presentation 10%
  - Spiral 4 Presentation 10%
  - Presentation/Demo 10%
  - Final Report 30%
- **Class Participation 9% (new)**

Case Studies

Our Goal – Creativity!

- Today we'll be discussing your proposals
- Will first go through some example Apps, from a guest, from last year and others outside

iLift – Musical Adjustment

Rosano Coutinho

iLiftApp

iLift – Slow down music, change the key, and loop

iLift Video

- http://youtu.be/4Y_JctRK8EI

ECE 1778
iAnkle

Lyndon Carvalho
Nirtal Shah
Ivan So

Physiotherapy for Injured Ankles

- If your ankle is injured (broken, sprained) it loses something called ‘proprieoception’
  - A sense of balance
- You need physiotherapy to get it back
- A physiotherapist has to watch you do exercises to see how well you’re doing
  - Expensive, time-consuming

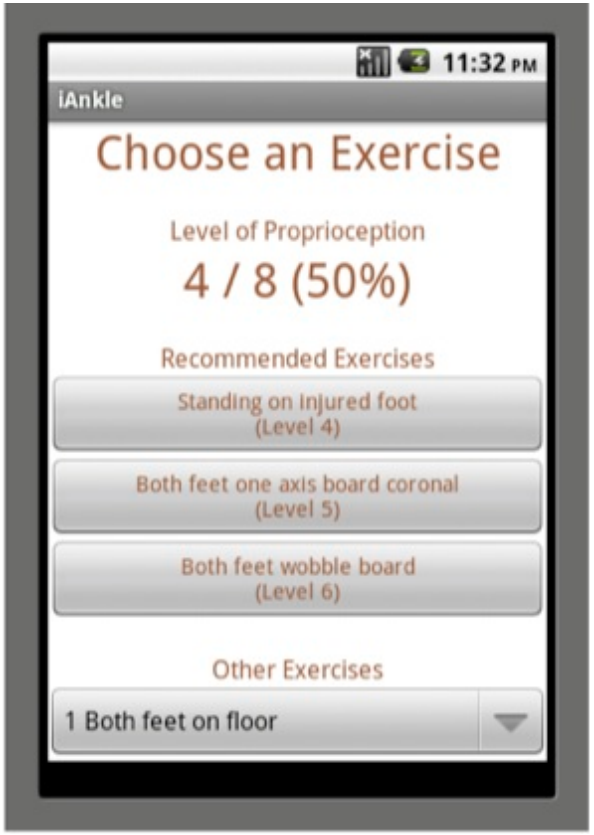
- Instead: **iAnkle** an app that replaces the physiotherapist

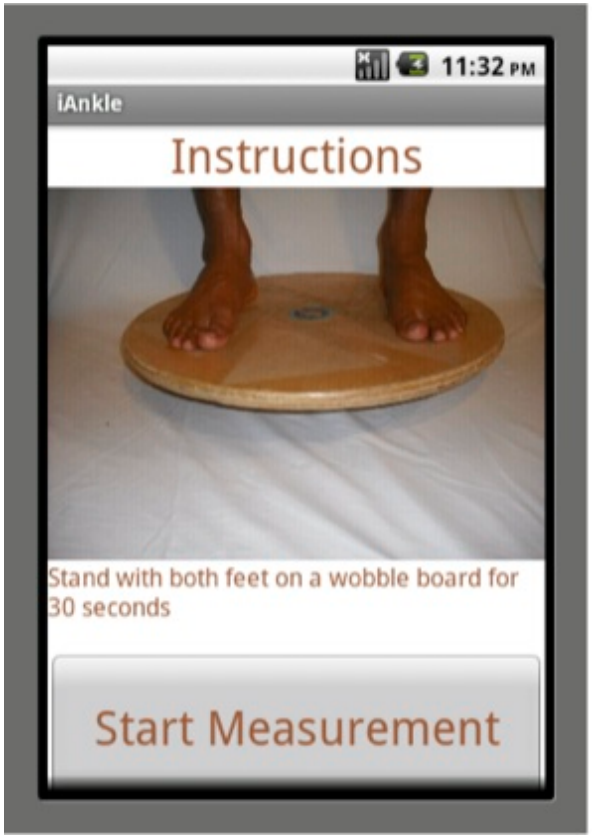
How It Works

- Phone tells you what exercise to try
  - .e.g. standing on one foot

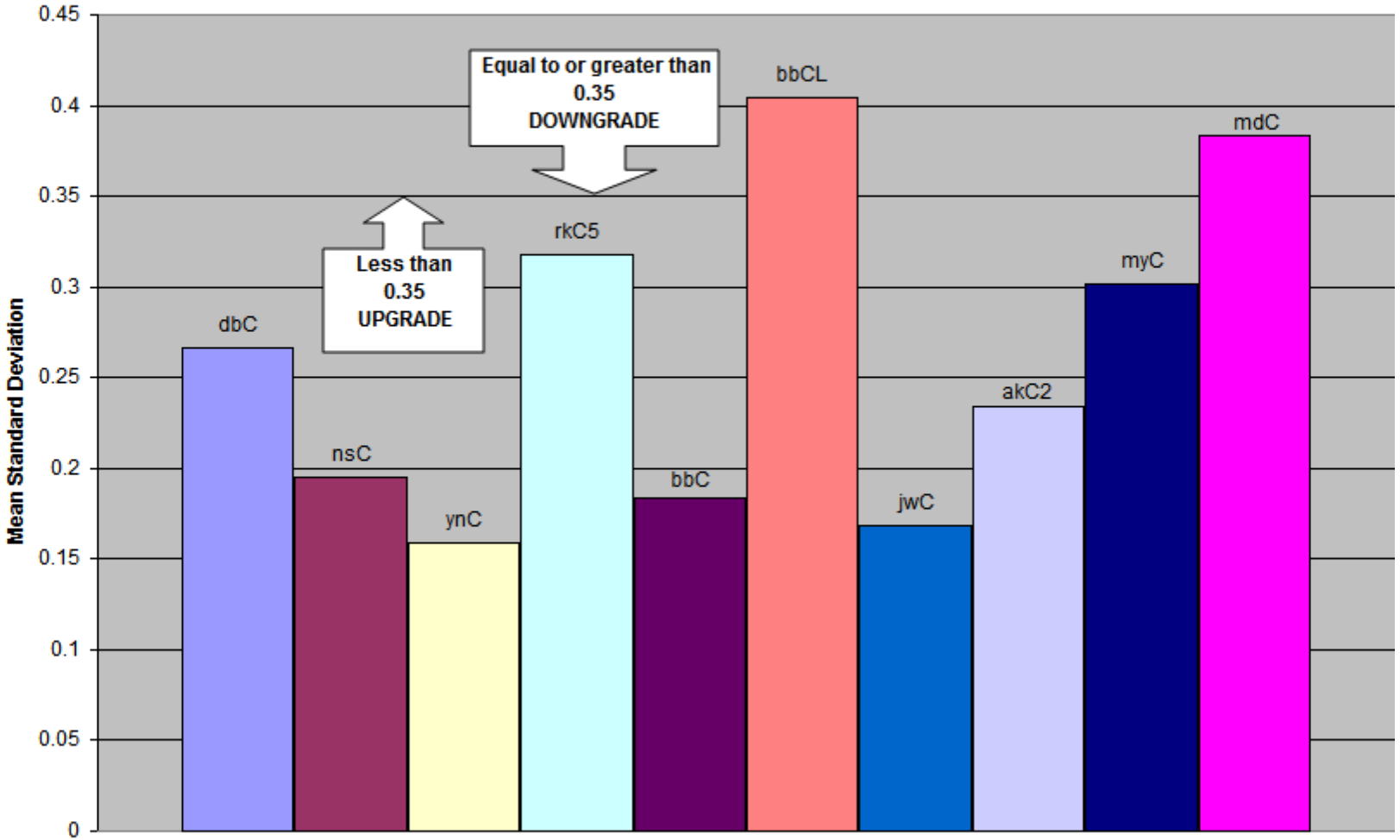
- Strap phone to your ankle
- The accelerometer measures how well you're balancing in the exercise

Screen Sequence:





Single Leg Stance – C



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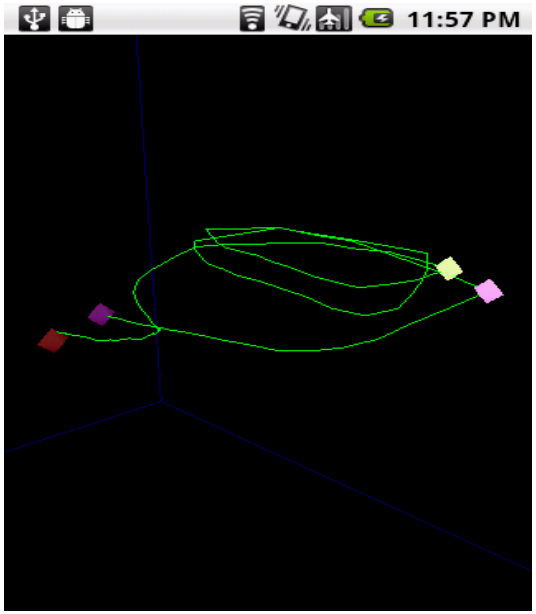
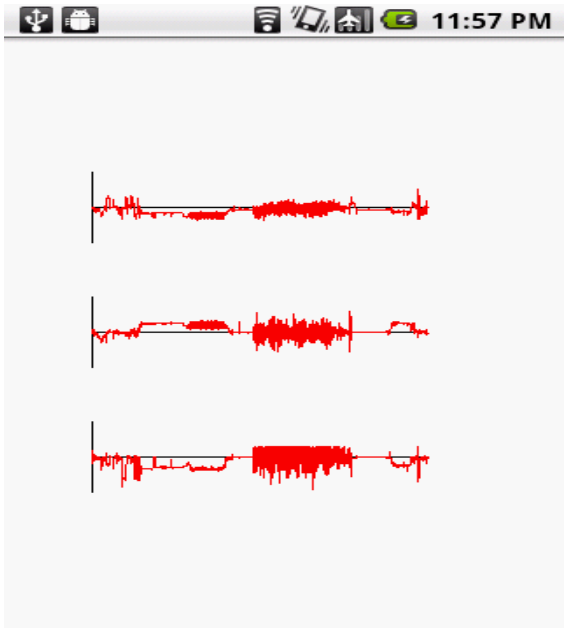
Aerospace Sensor Suite

Jin Choi
Mathew Leonard
Vincent Tarantini

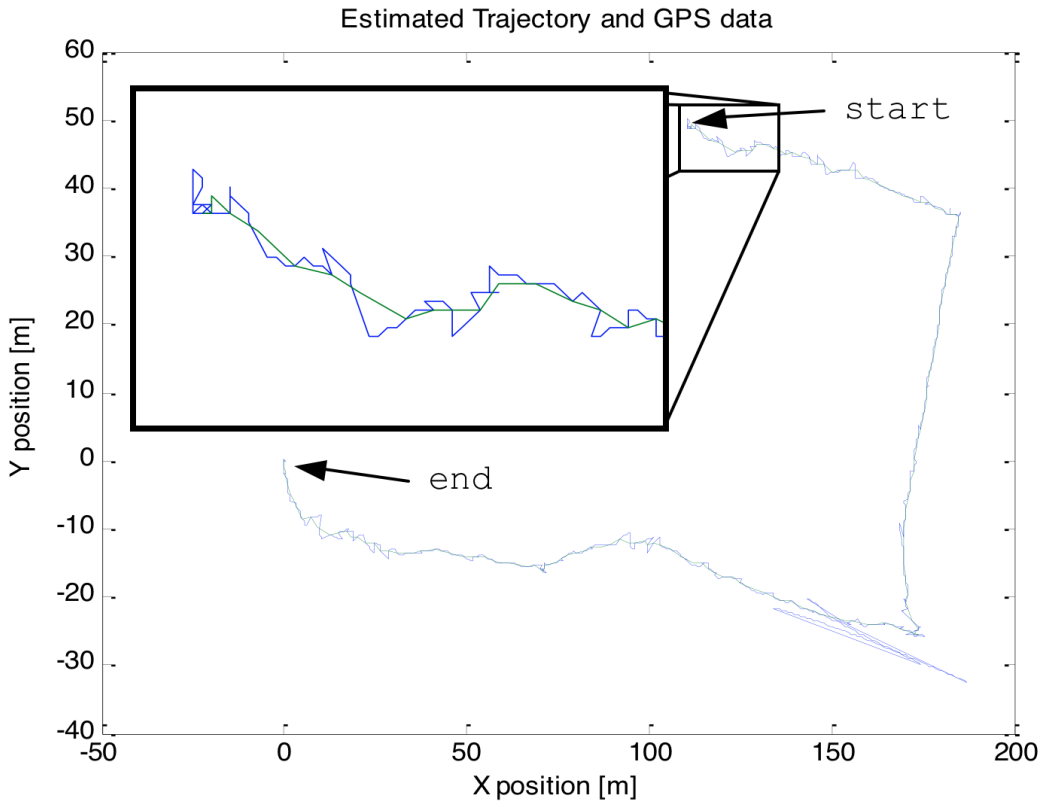
Aerospace Sensor Suite

- Sensor Suite: use phone to track the flight of small (or large airplanes)
  - Record the path of the radio-controller flyer in 3D and 2D





Estimated Position using State Estimator



State estimator solution and GPS recorded trajectory overlaid

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Shoptimus Prime

Michael Kipper
Bryce Leung

The Idea

- A mobile grocery shopping application
- Helps you find the things you want at the lowest cost to you, including the cost of travel.

- “Crowd-sourced” price gathering.
- Prices are entered using barcode scan and manual price entry.

- This information will then be looked up either on our own database or third-party UPC databases available on the Internet to figure out what that item is, and then entered into our database along with a timestamp and location information.

The Long-Term Idea

- Over time, this will create an aggregated crowd-sourced snapshot of where grocery items can be purchased and for how much.

- Using the crowd-sourced grocery database, we can then find the lowest possible price of the total basket of goods and then advise the user where to go to buy everything.

Search Screen

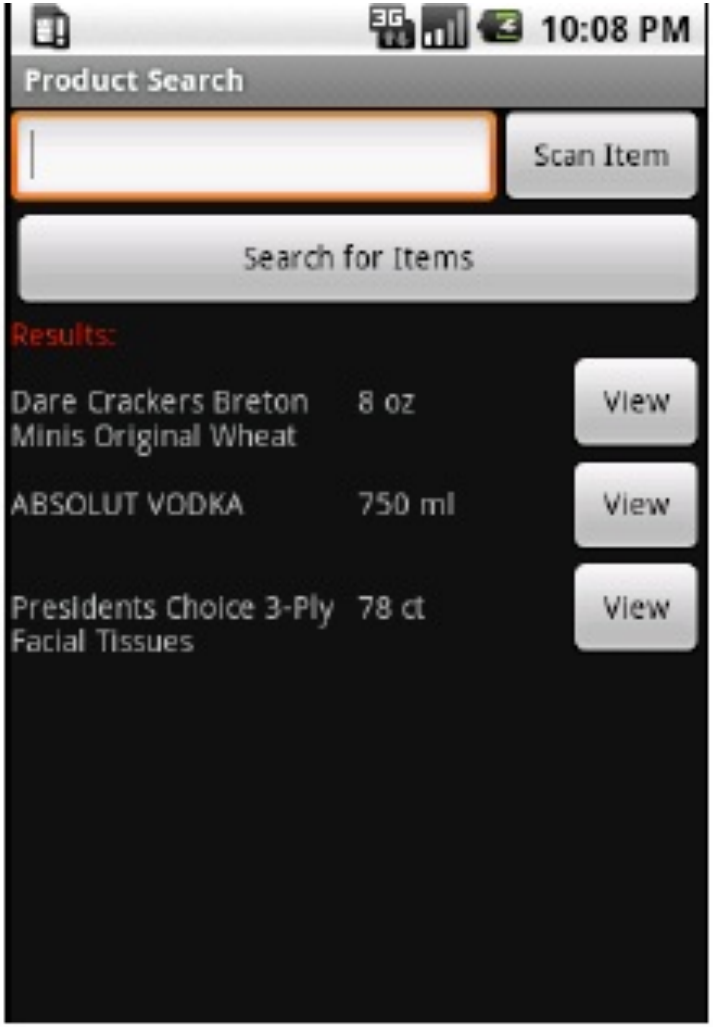
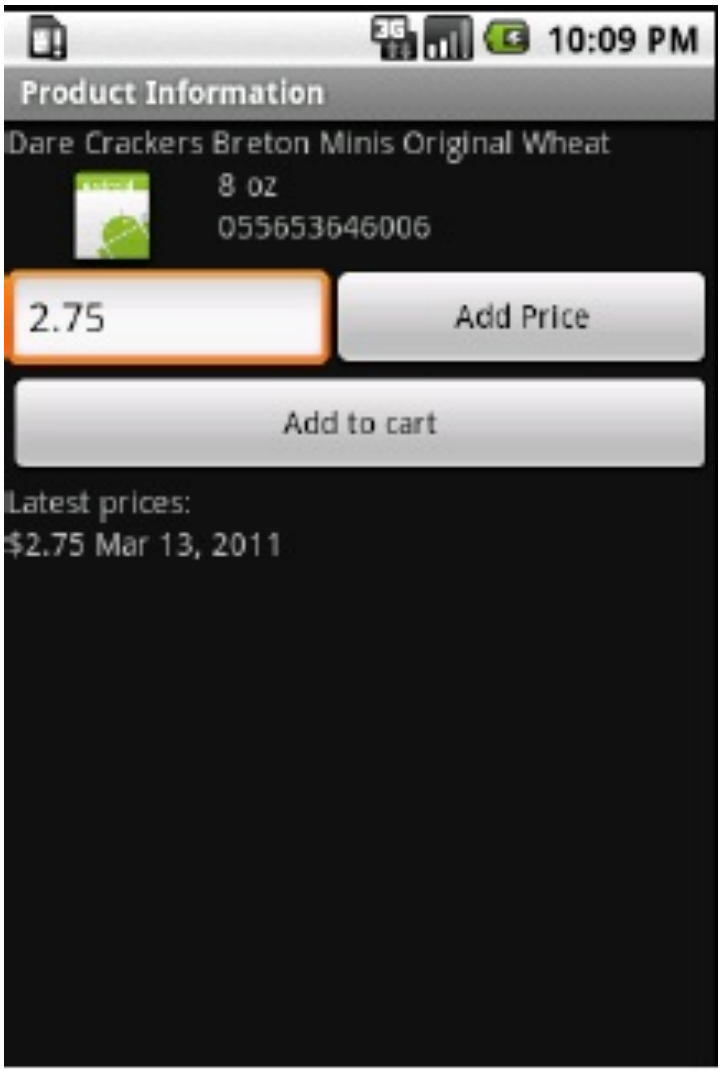
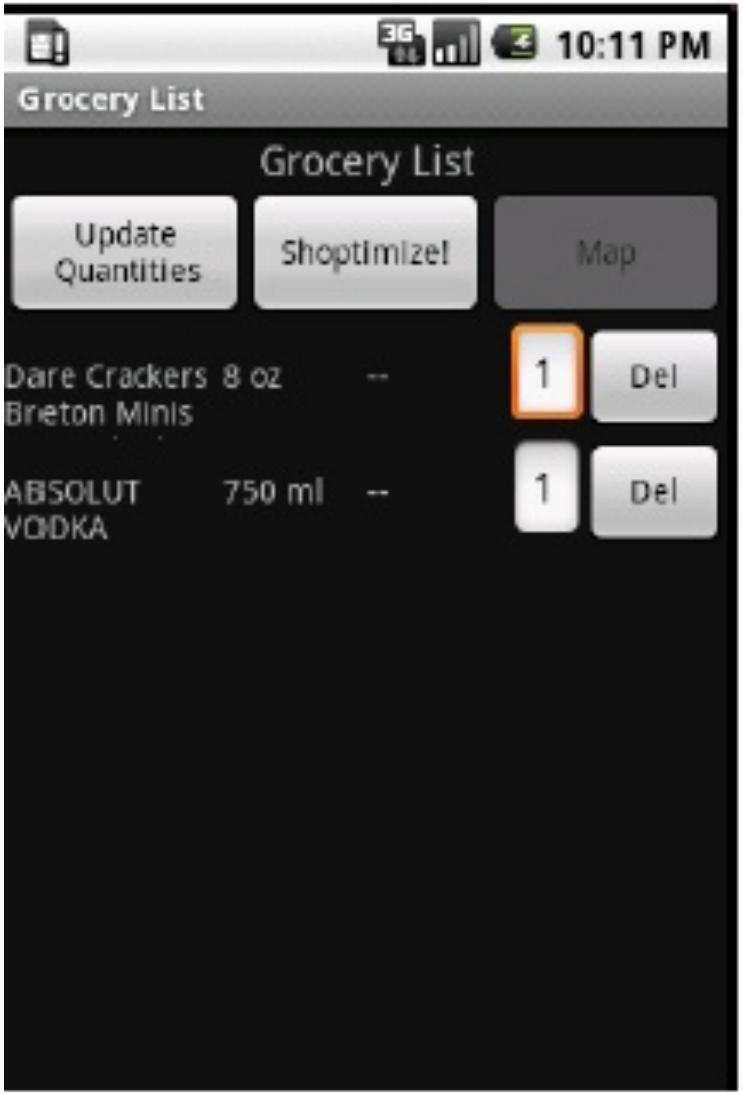


Figure 3. Search Screen.

View Item Screen

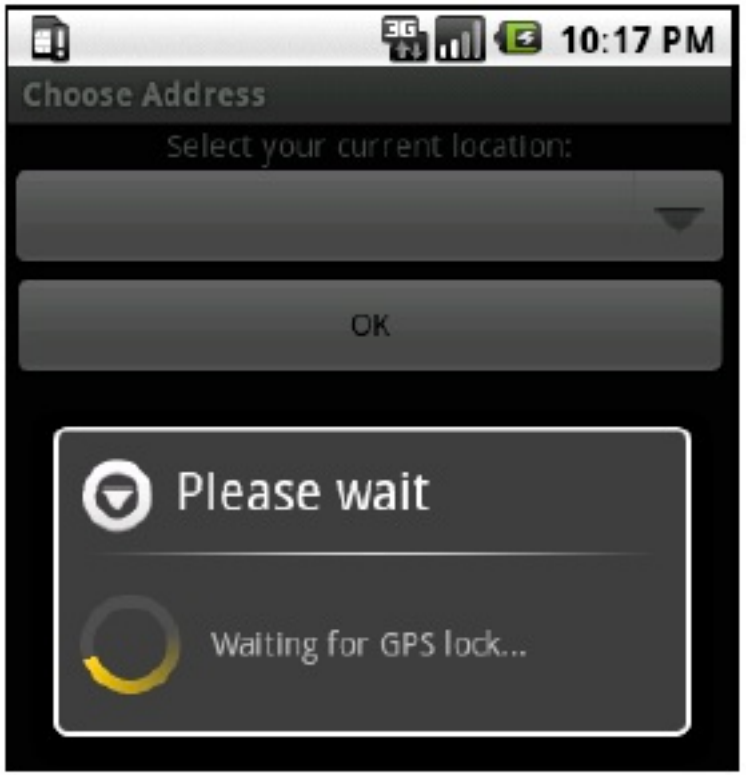


Grocery List Screen



Location Screen Shot

- Use GPS to determine location of stores.



Shoptimize!

- Given
  - the cost of gas – the cost to travel
  - The grocery list
  - The set of locations that sell those groceries

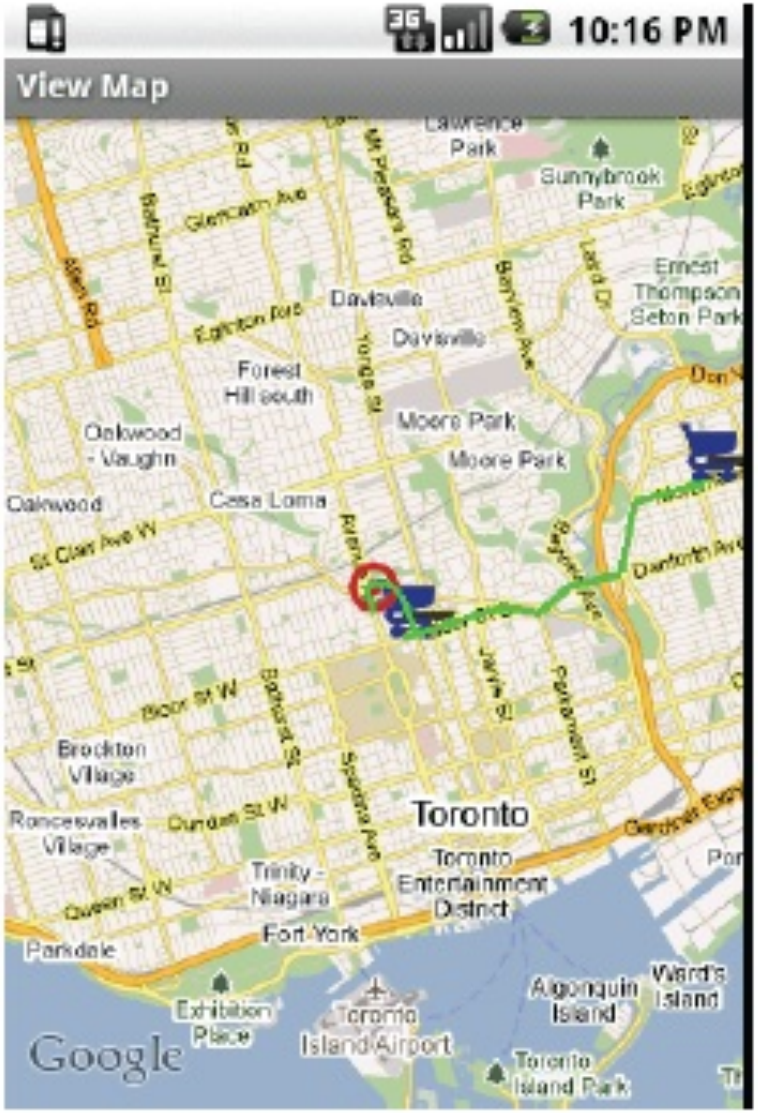
- Find:
  - The set of stores to travel to, using the car, so as to minimize the overall cost

$$Cost = \sum_{i=0}^{N} C_i + D * C_D$$

Where C_i is the cost of each individual item at that location, D is the total distance to travel from the user's current location to each location, and C_D is the cost of covering that distance. The nice thing about this algorithm is that it's simple, and is guaranteed to find the

Map View

- Used exhaustive search, guaranteed ‘optimal’
- Result of ‘shoptimize’ is the route that minimizes cost
  - of purchase and of transportation costs



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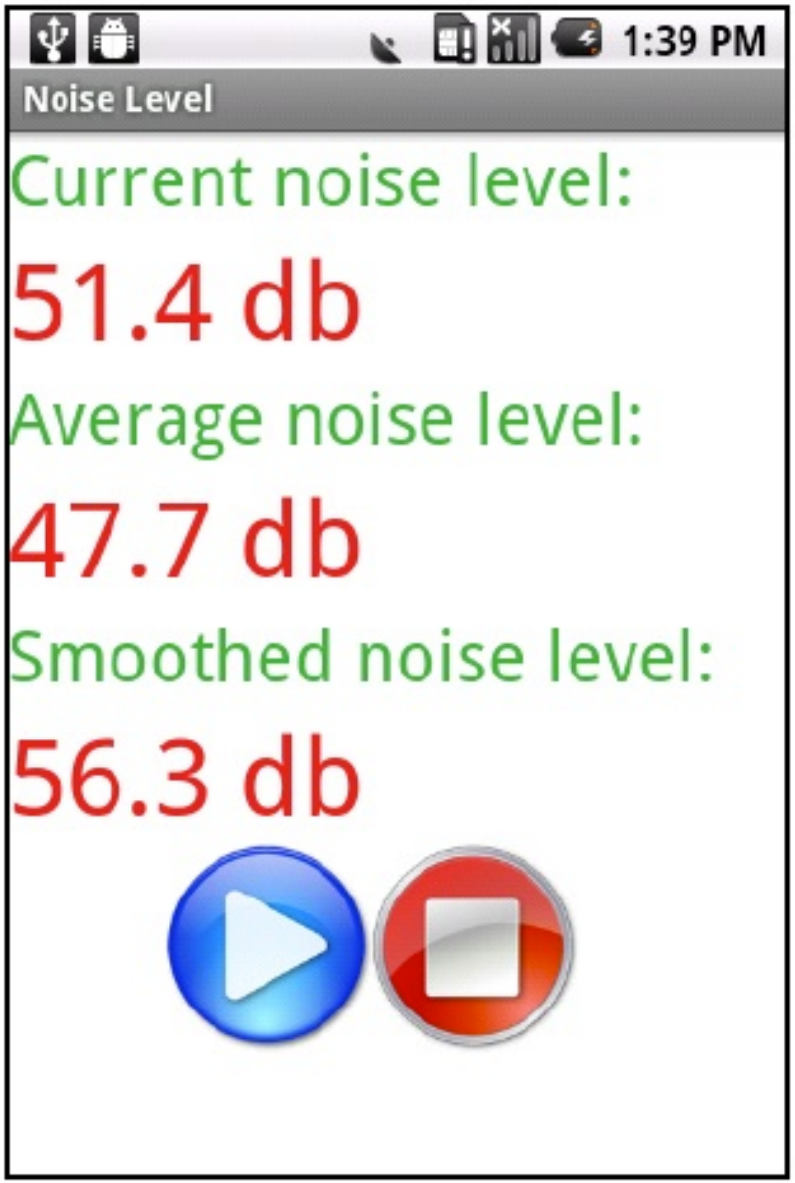
WhimPer – A Noise Mapping App

Yeliny Bonilla
Ali Sabti
Sajad Shirali-Shareza

Whimper – Noise Mapping

- The issue: the world is full of noise, and noise pollution can reduce hearing
- The goal: create an app that can measure the noise at each location the phone ‘walks’ through
- Use this to create a Noise Map
  - Assuming more than one person uses it – crowd sourcing – a map of a city can be easily created.

Live Measurement Screen



Daily Noise Measurement v. Time

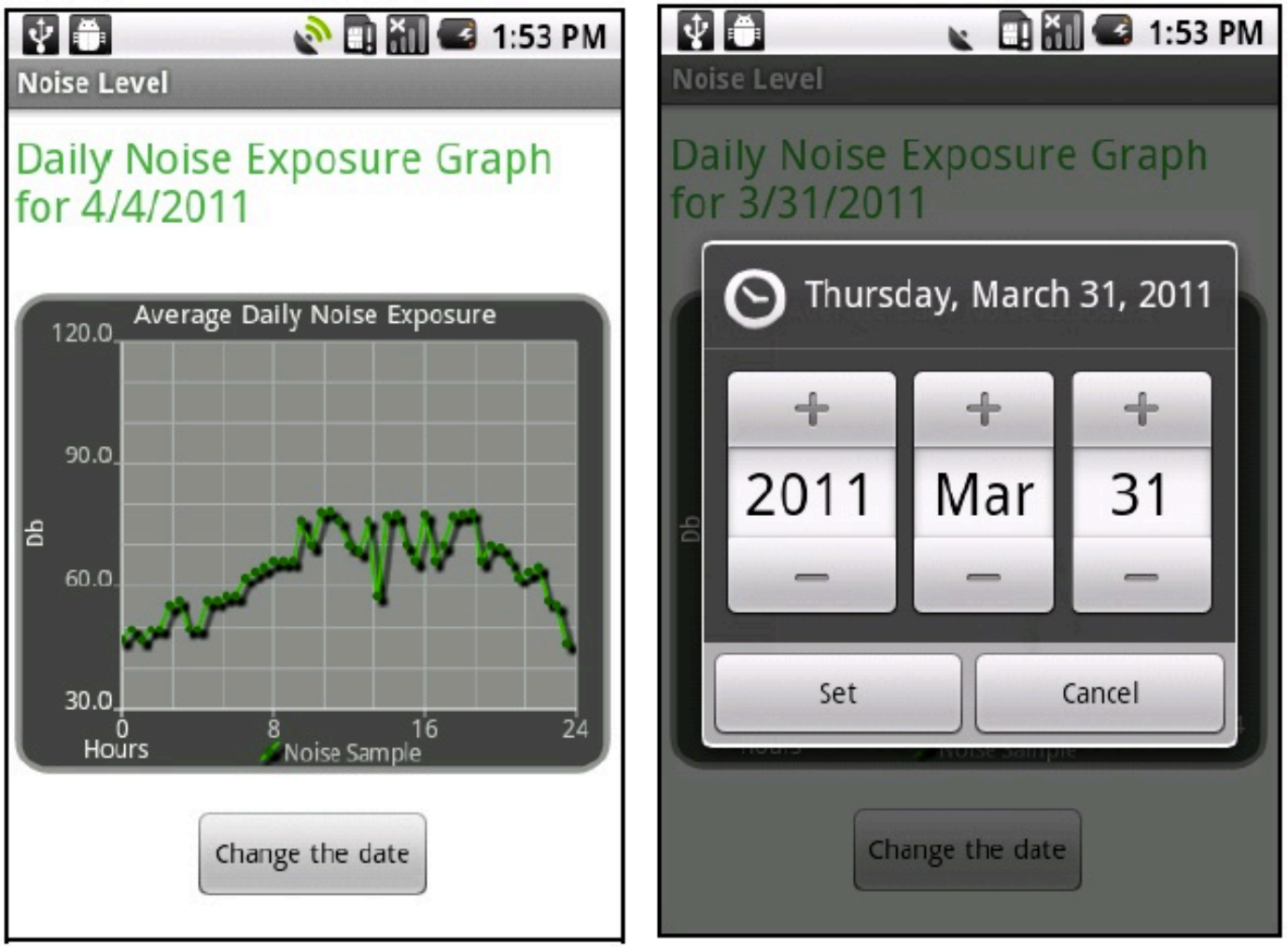


Figure 4. Noise exposure feature of the WhIMPeR application. The figure on the rights shows the ability to change the date for which the data is displayed

Noise Map

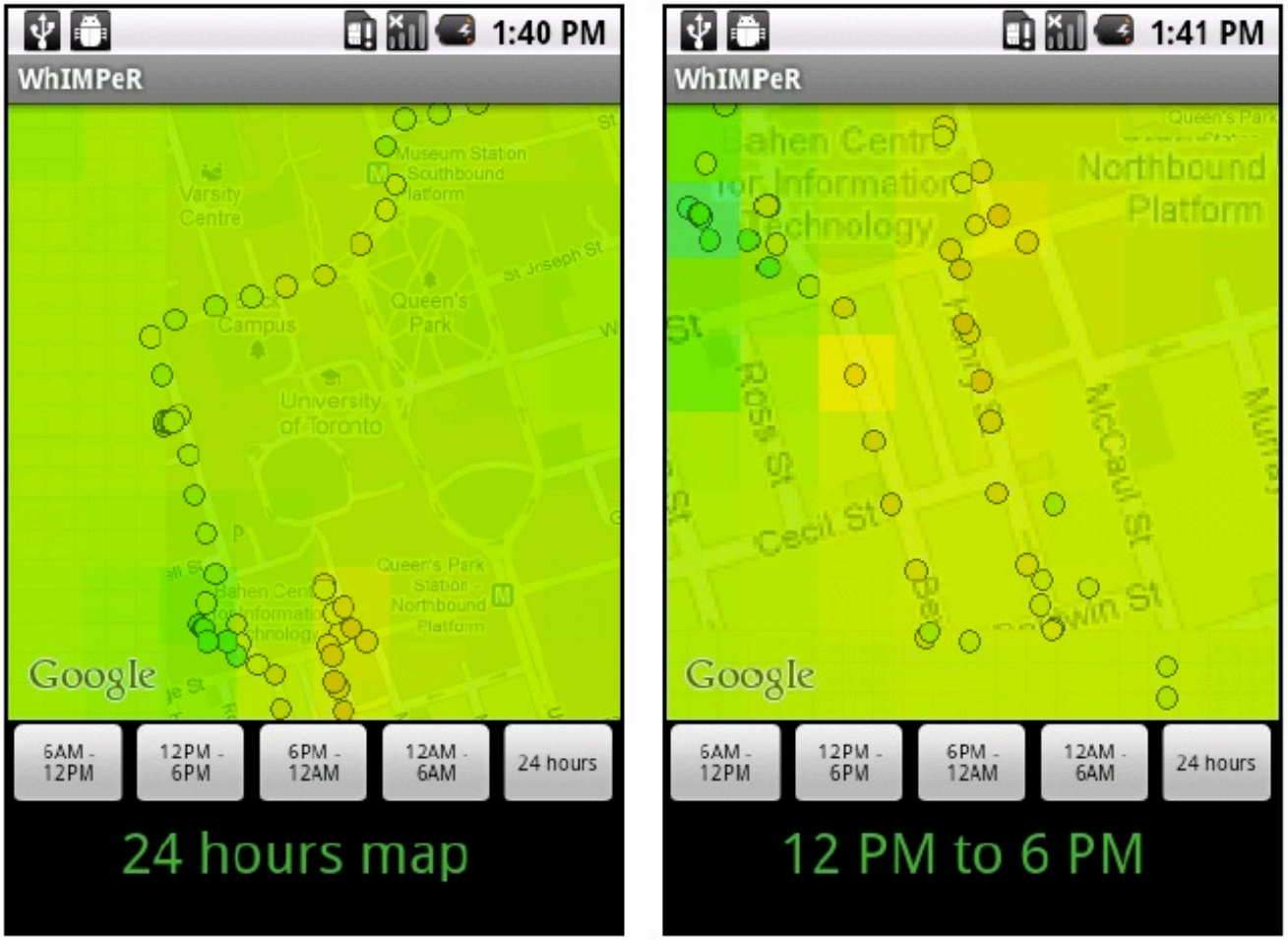
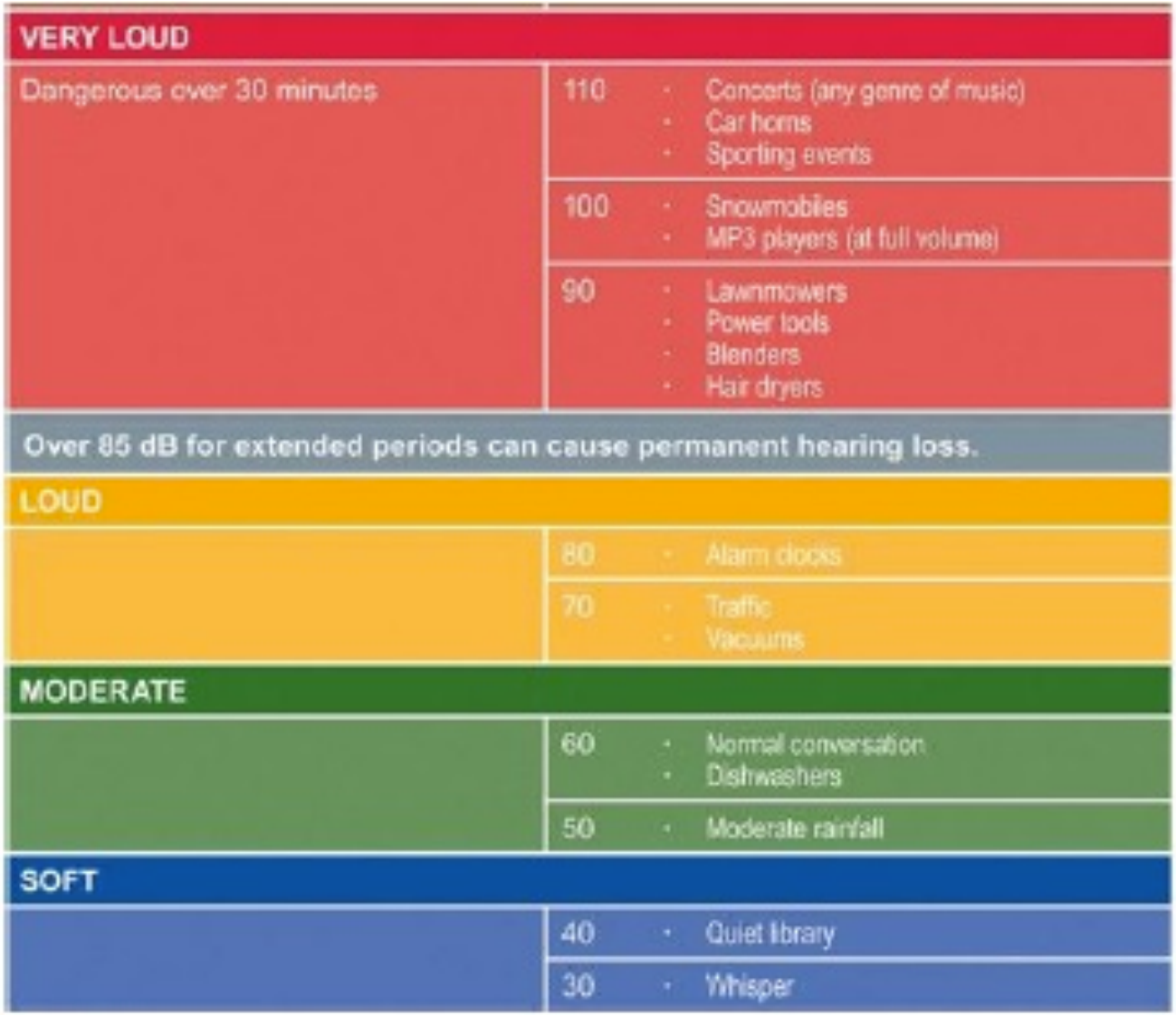


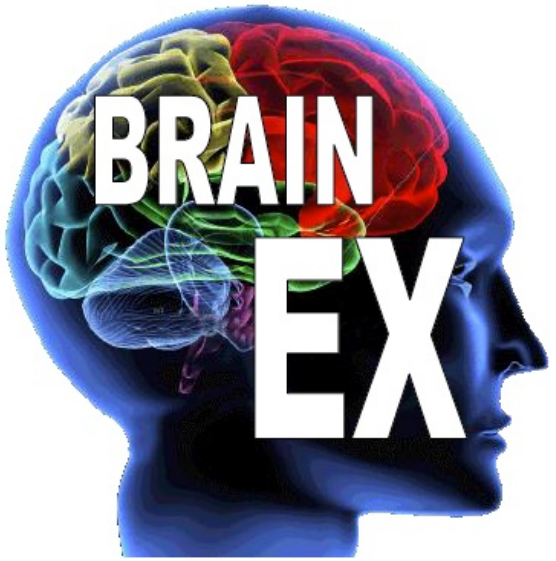
Figure 5. Noise map showing selected points of the noise data as well as a noise intensity overlay. The figure on the right shows the feature of time interval selection.

Noise Colour Code for Map



ECE 1778
BrainEx – Exercise for your Brain

Jinyoung Kim
Rowa Karkokli



Dementia & Brain Exercise

- Dementia is a cognitive disorder resulting in loss of memory, changes in personality, and loss of social ability.
- Prevention is the key since most types of dementia are permanent and cannot be cured.
- Research suggests brain exercise and activities that stimulate the brain may delay memory declines and can also reduce one's risk of getting dementia and related symptoms.
- The BrainEx application is designed for this specific purpose.

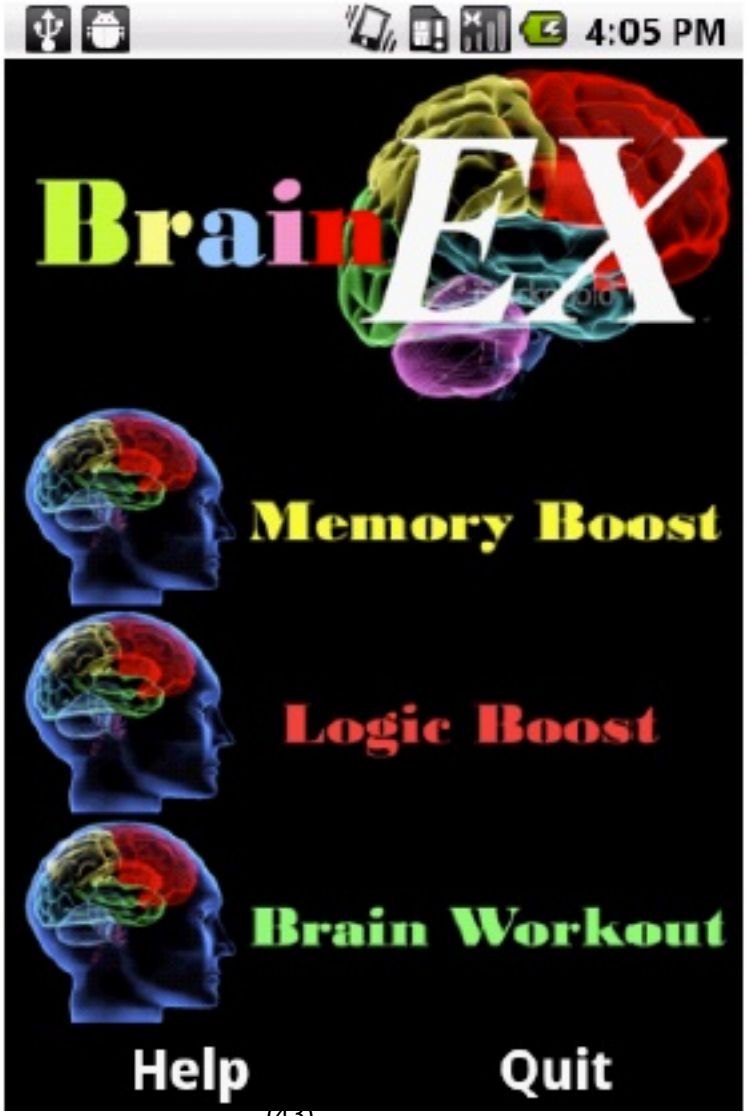
The Games

- Three games that stimulate the brain in different ways
  - allowing the user to choose a game of their interest.

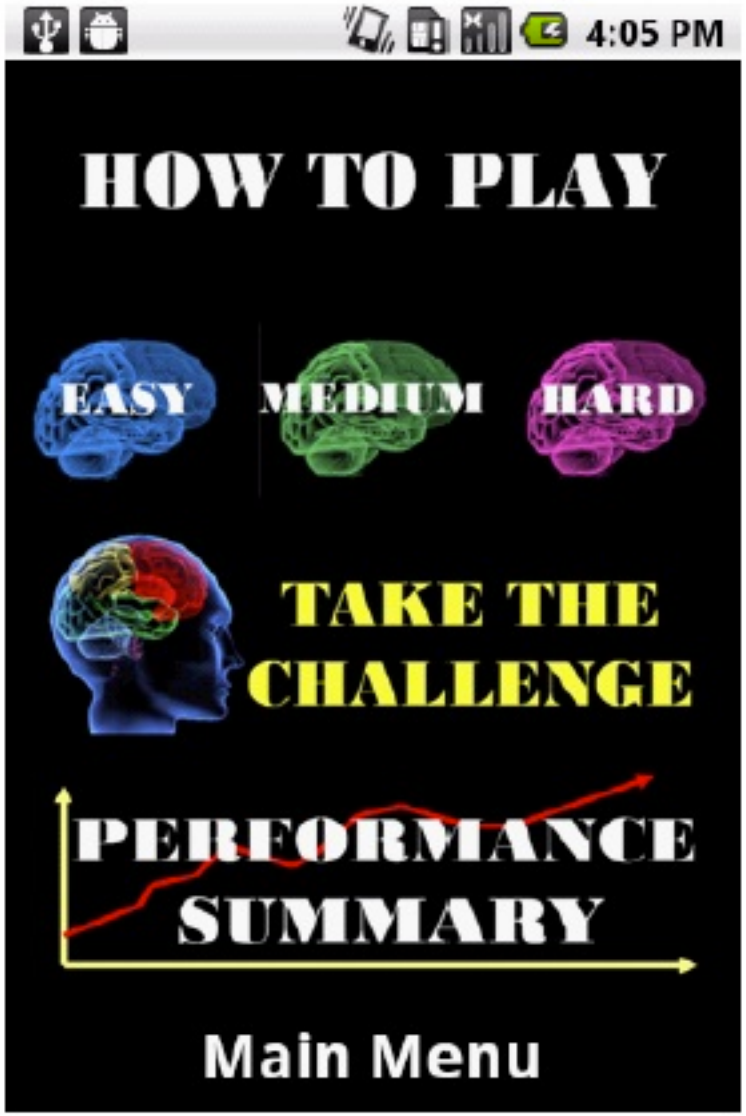
1. Game 1: designed to stimulate the user's memory,
2. Game 2: target the user's problem solving skills,
3. Game 3: targeting both memory and problem solving skills.

- Each game assesses the user's performance and speed and advances the game to increase the stimulation of the brain.

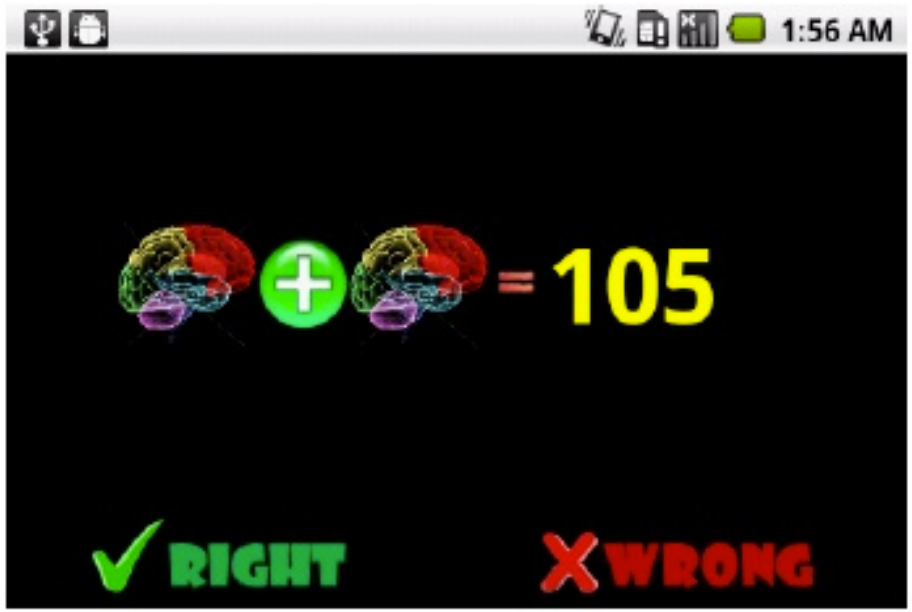
Starting Screen – Choose Game

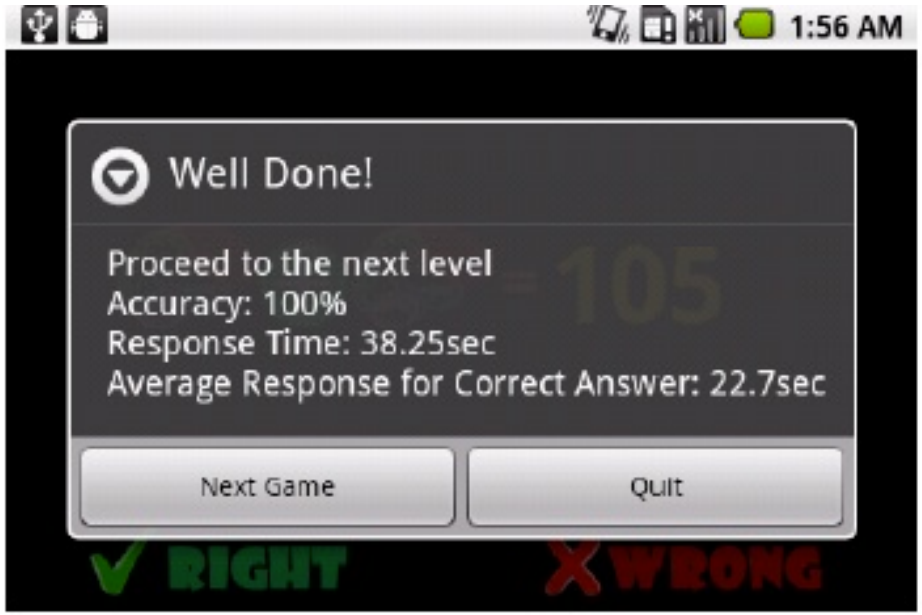


How To Play


4:05 PM
HOW TO PLAY
EASY
MEDIUM
HARD
TAKE THE CHALLENGE
PERFORMANCE SUMMARY
Main Menu

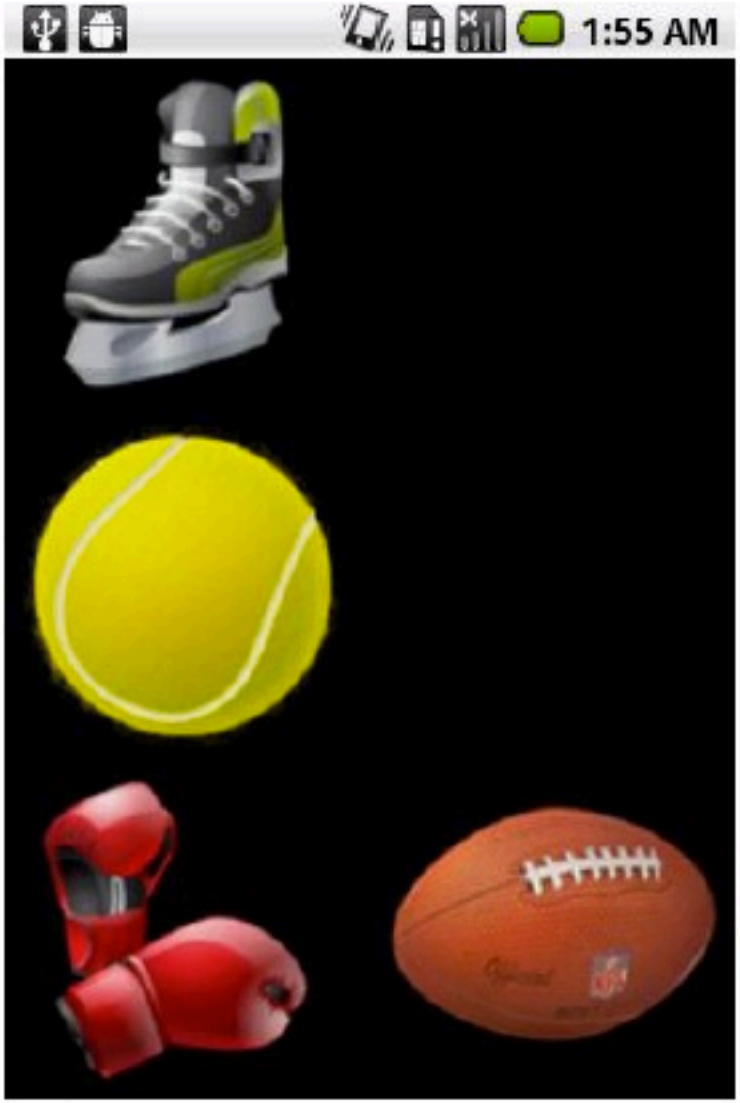
The Result

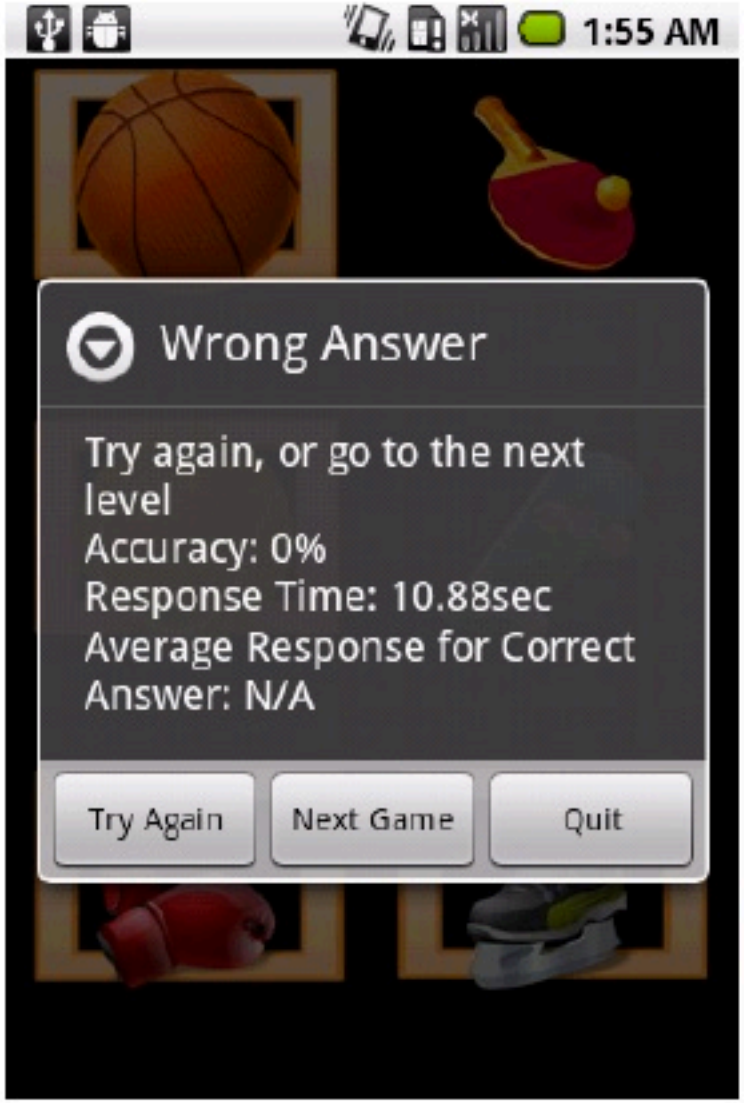

1:56 AM
=105
RIGHT
WRONG


1:56 AM
Well Done!
Proceed to the next level
Accuracy: 100%
Response Time: 38.25sec
Average Response for Correct Answer: 22.7sec
Next Game
Quit
RIGHT
WRONG

Number Calculation

Sport/Pictures





Summary of Results

APPnea: A Sleep Apnea Detection Android App

Phil Lam
Regina Leung
Thuva Sivayogan

What is Sleep Apnea

- Sleep apnea is a common (and underdiagnosed) sleep disorder that is characterized by periods of interrupted or shallow breathing during sleep.
- Sleep apnea affects the quality of life of affected individuals such as extreme fatigue and poor concentration, but may also lead to other serious medical conditions such as
  - cardio/cerebrovascular problems with mortality rates as high as 35%.

Sleep Apnea, continued

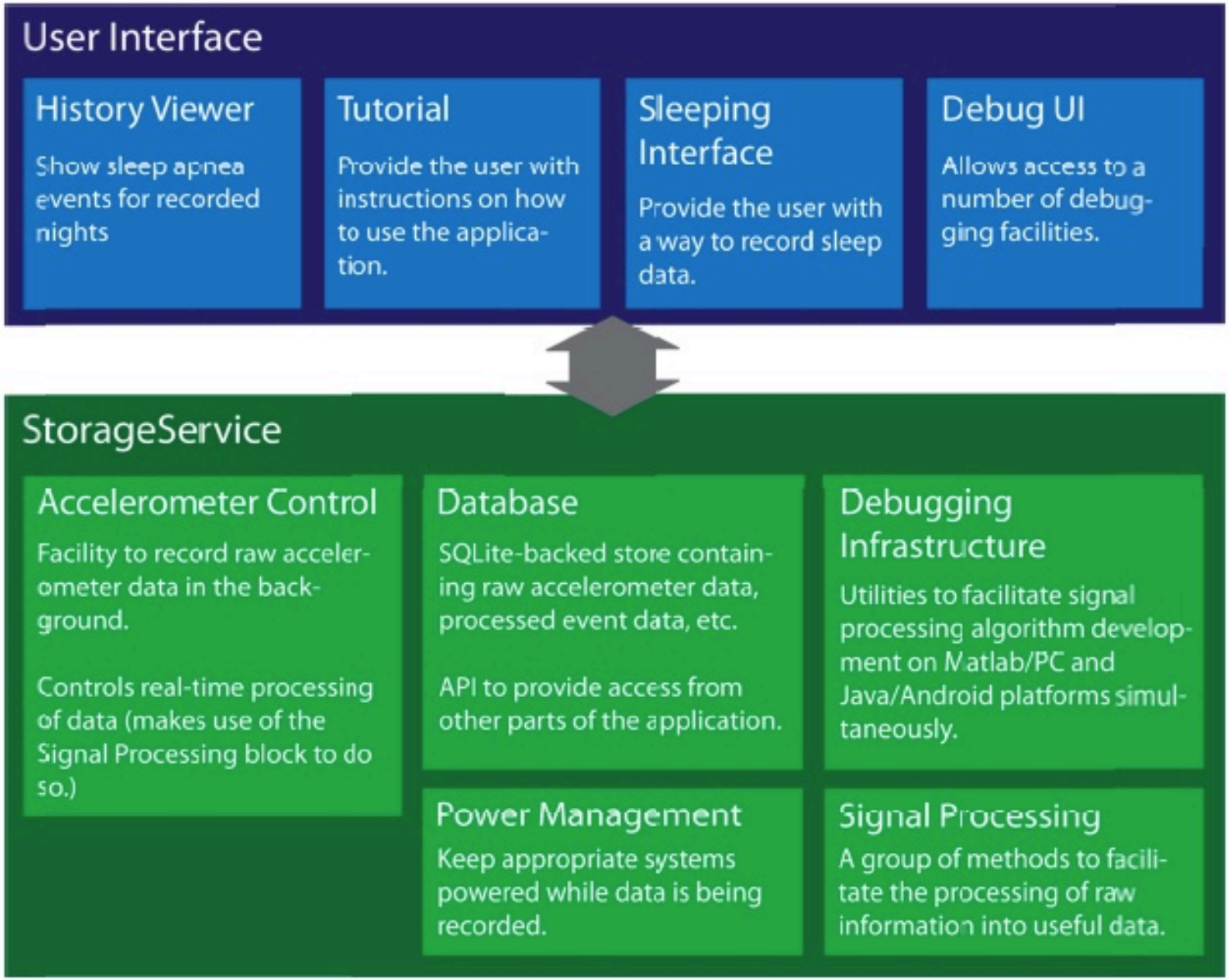
- Key issues in Apnea detection and treatment:

1. Limited availability &high cost of clinical sleep apnea detection method: patient must spend a night under observation by technician and clinician in a “sleep lab.”
2. The sleep lab test is performed in foreign environments with multiple electrodes attached to the individual which may induce stress & cause inaccurate results.
3. CPAP (Continuously Positive Airway Pressure) is a commonly prescribed treatment for sleep apnea, but offers low rates of patient compliance. This is primarily due to the fact that the required mask over the nose and mouth is uncomfortable.

The App

- APPnea operates by detecting the rate of respiration with the phone's accelerometer.
- This is accomplished by using a pouch to attach the phone to the user's chest.
- Signal processing algorithms involving a combination of time domain and frequency domain techniques are used for the detection of apnea events.
- The number of sleep apnea events per night are recorded, saved in a log, and displayed back to the user in the form of a histogram for daily sleep apnea monitoring.

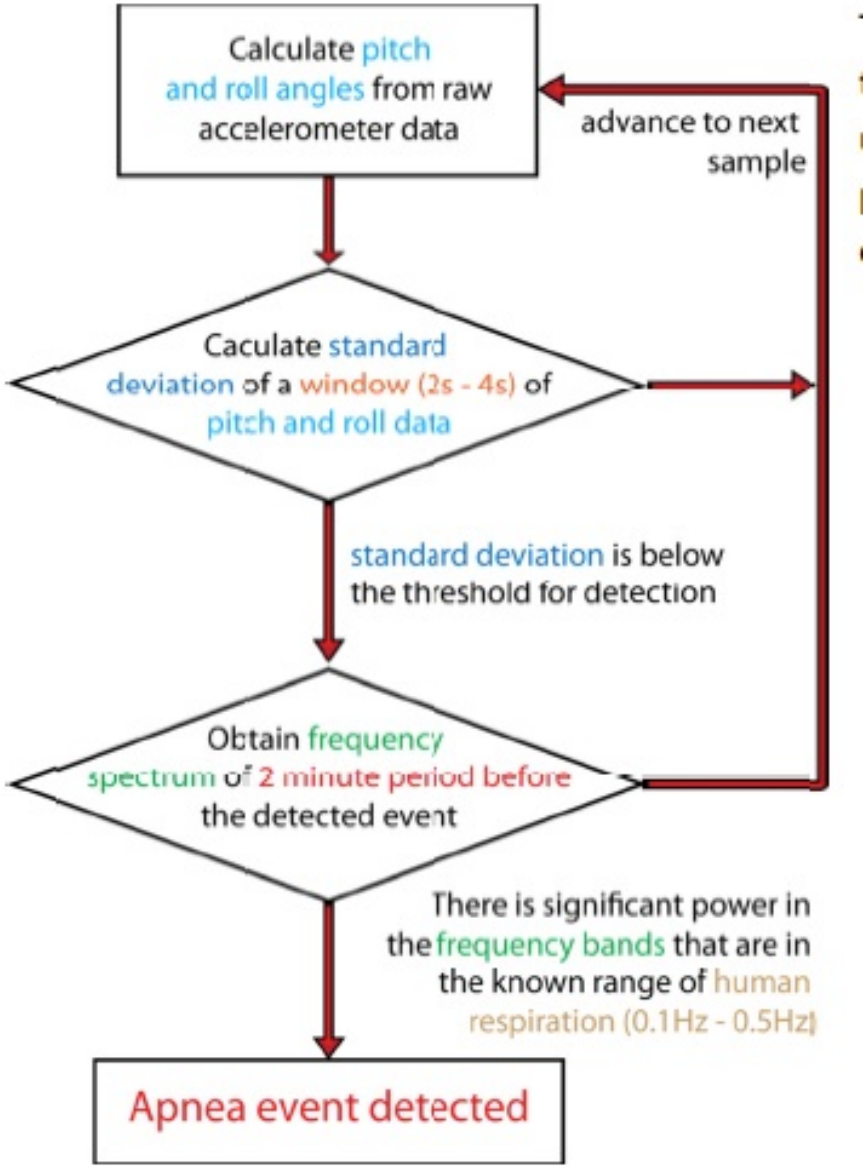
Application Software Architecture



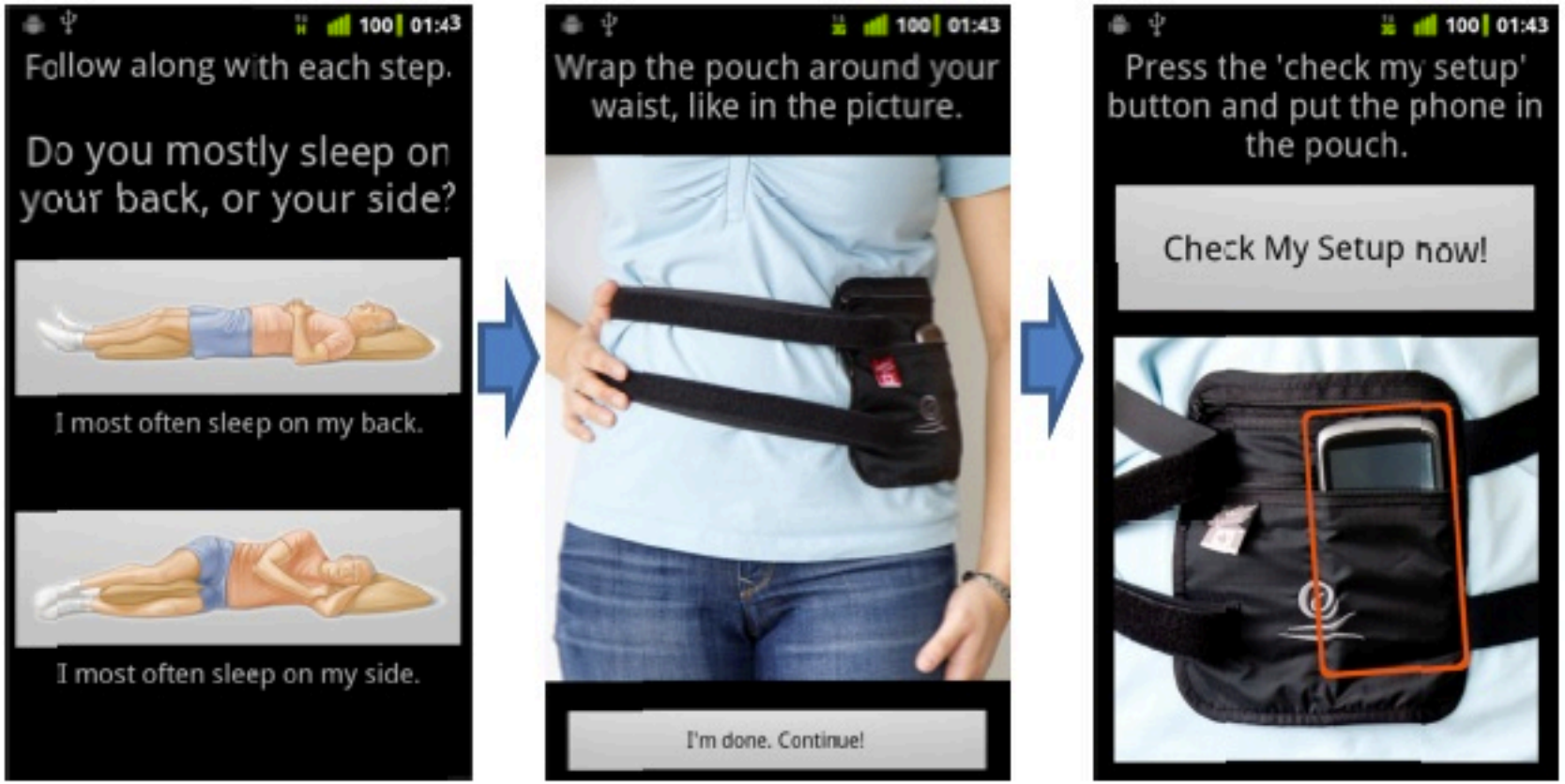
Detecting an Apnea Event

- Apnea: person stops breathing while sleeping
  - Assume this means the chest stops moving
- Strap phone to chest, and use accelerometer to calculate pitch and roll with respect to gravity
- Search for periods of no movement, ranging from 10 seconds to 2 minutes
  - Followed by 2 minutes of breathing

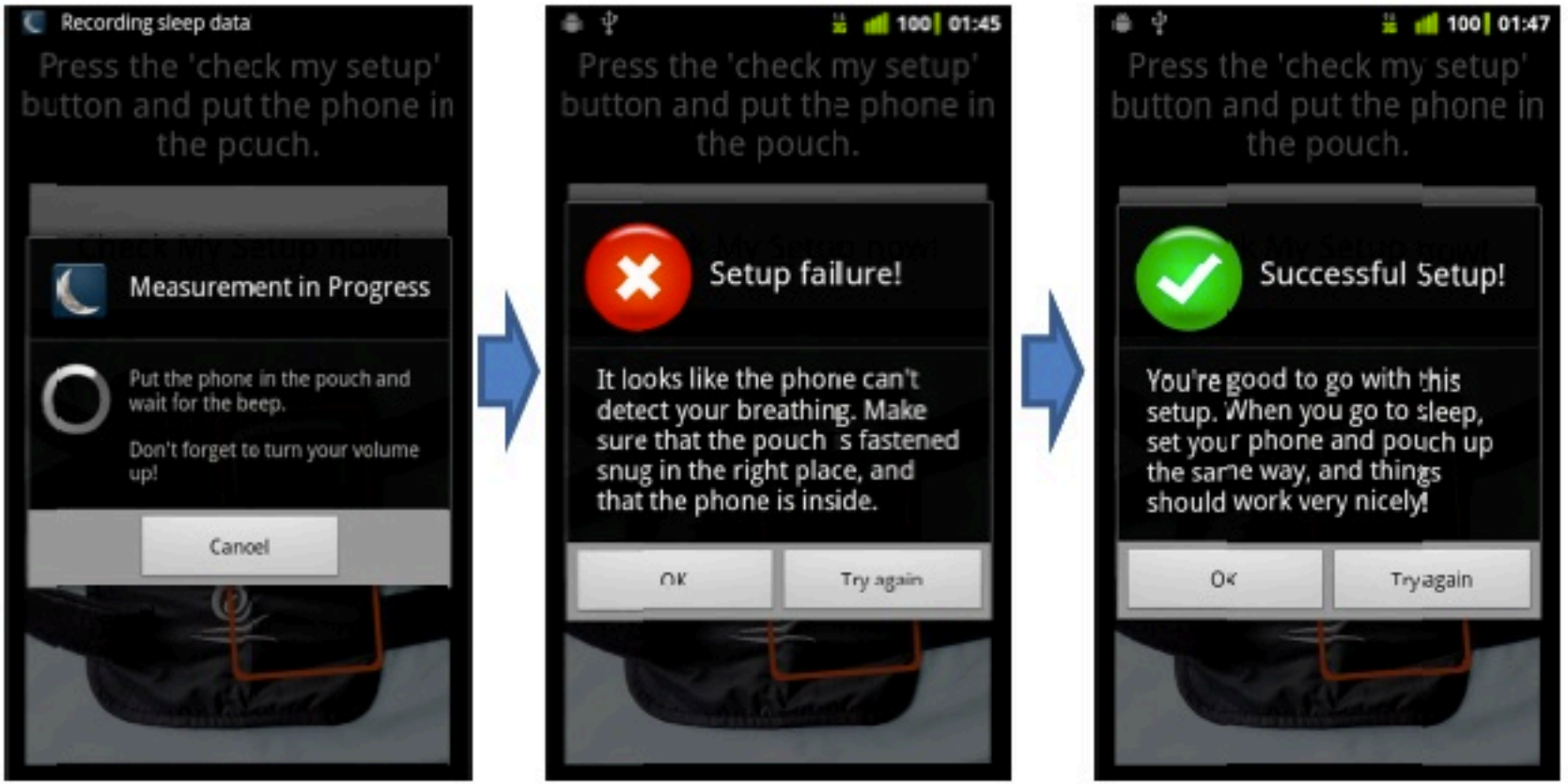
Detection Flow



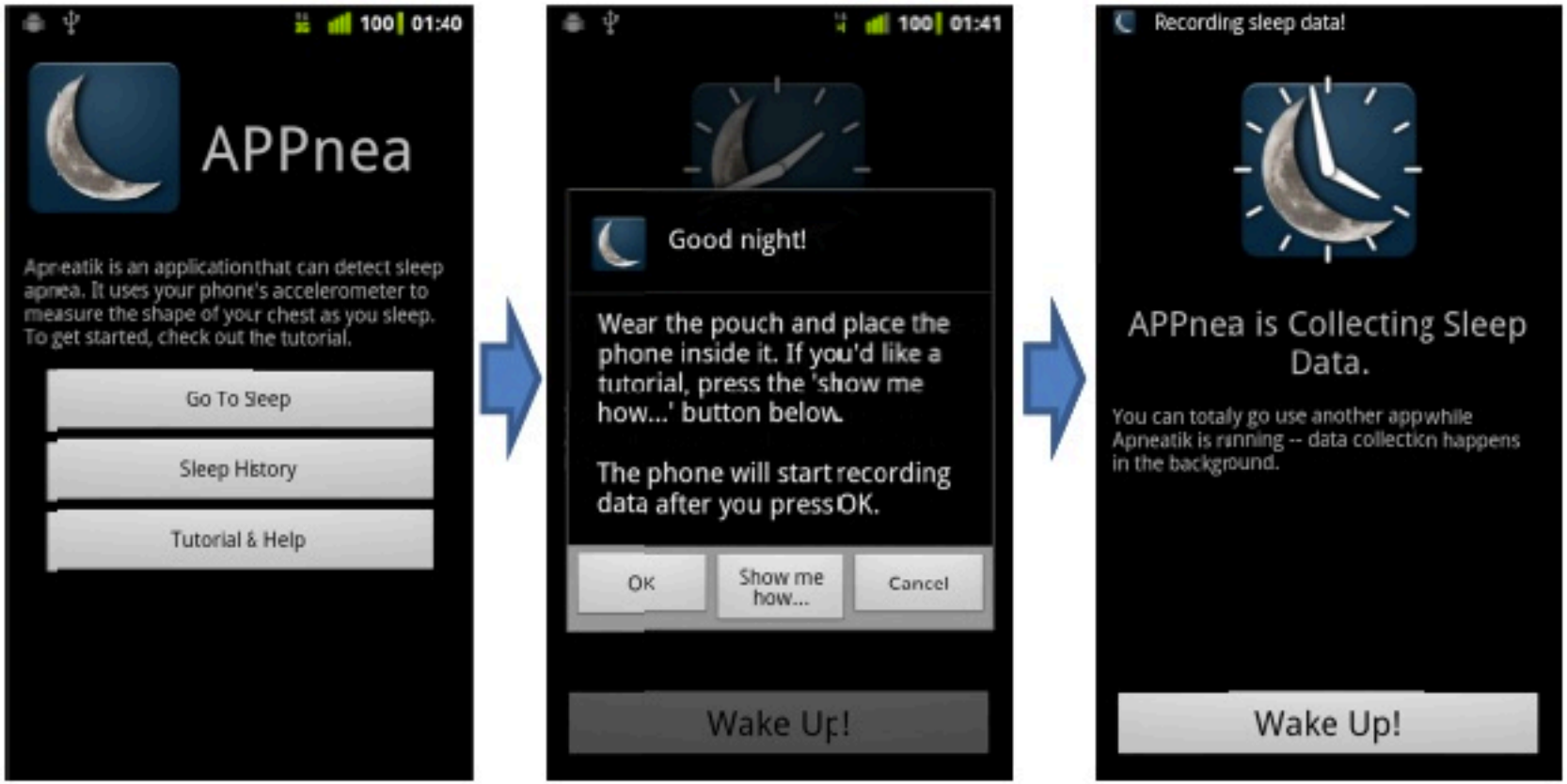
User Tutorial 1



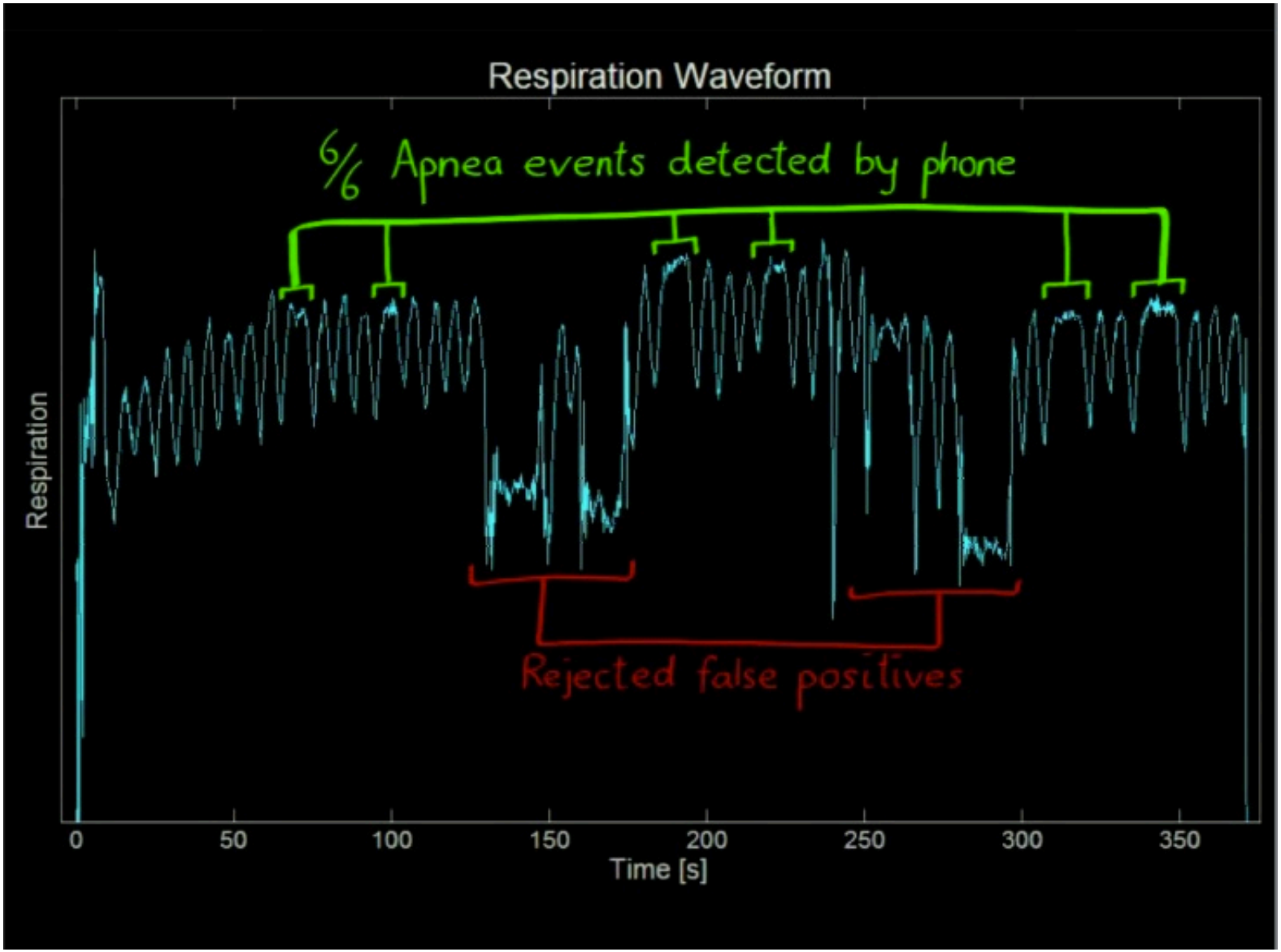
User Tutorial 2



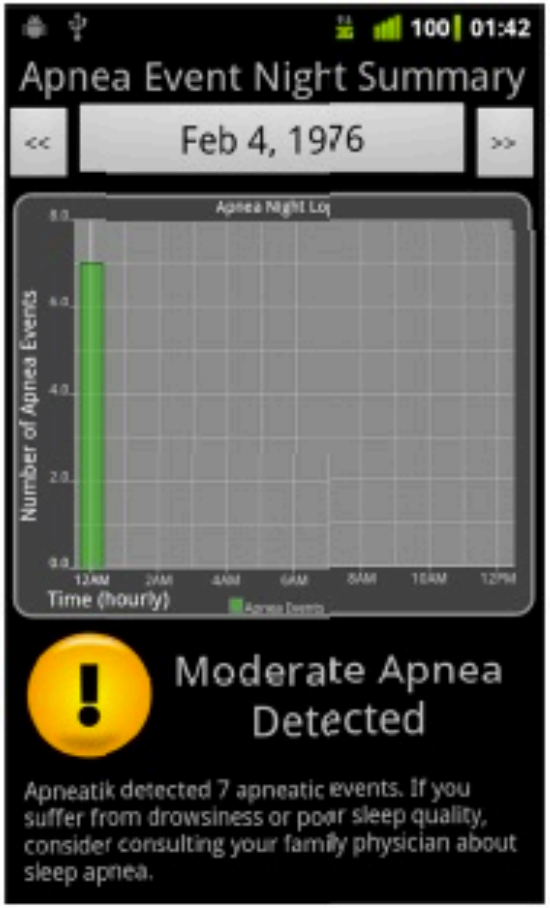
App Controls

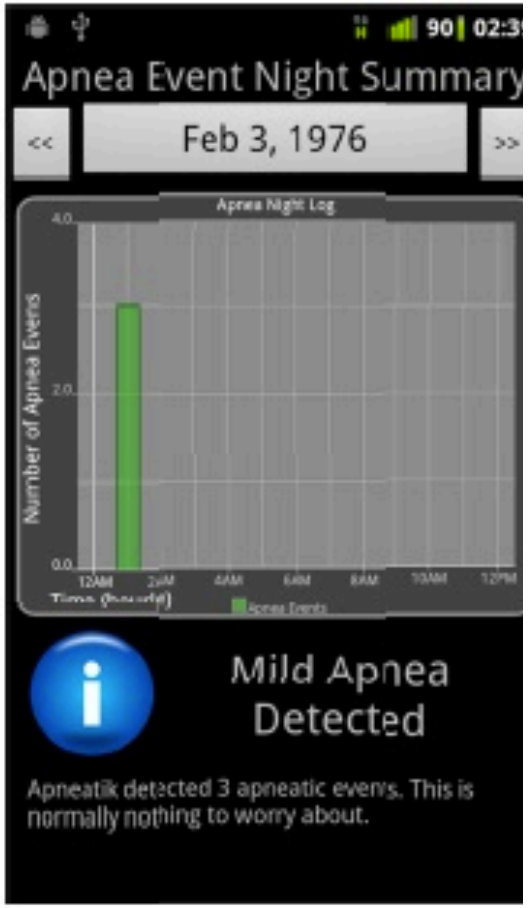


Example Collected Data



Output From App





My App: TeamChooser

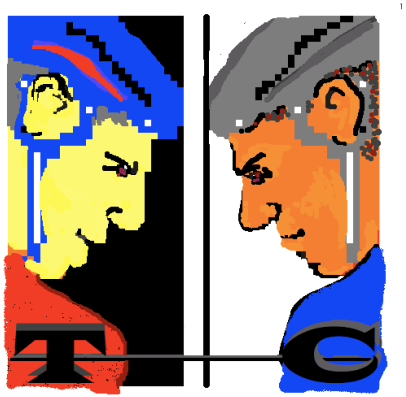
Solving a Problem

The Problem

- In pick-up team sports games, we like to have fun
- It is good if the teams are ‘even’ so that the game is fair
- Someone usually has to pick the teams
  - That is hard to do well
  - People get mad at that person when the game is uneven
- Random teams can be bad
- Using Team Captains to select
  - means someone is selected last ☹

The Solution: TeamChooser

- Wouldn't it be great if an App made the teams?
  - No one to yell at
  - Possibly give better teams
- Who needs this?
- Every pick-up hockey, soccer, basketball game around!

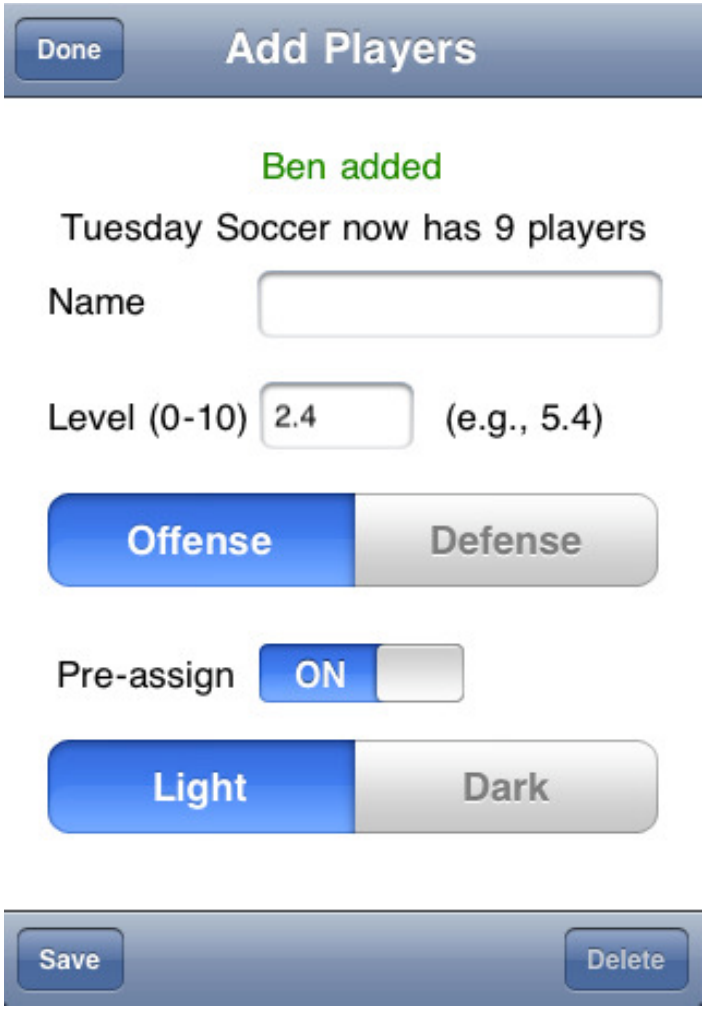


TeamChooser: How It Works

- Enter every user in advance of game day
  - Player's name
  - Preferred position (offence or defense)
  - **A rating, from 1-10, as to how effective player is**
    - Rating is the trickiest part
    - Key: keep ratings secret from all but a few
    - (apps **are** personal)

- On game day – select all players present
- Push 'Make Teams'
  - And voila, two evenly matched teams

Entering Players



Selecting Present & Making Teams

Team Selection Method

- A good method, used over the years
  - Sort in order
  - Top goes to team A
  - Next 2 to team B
  - Next 2 to team A …
- More complex when dealing with pre-assigns, or making incremental changes to teams when someone shows up late; new release including special ‘odd man’ algorithm
- Many discussions from CS and ECE Professors over algorithms in hockey game

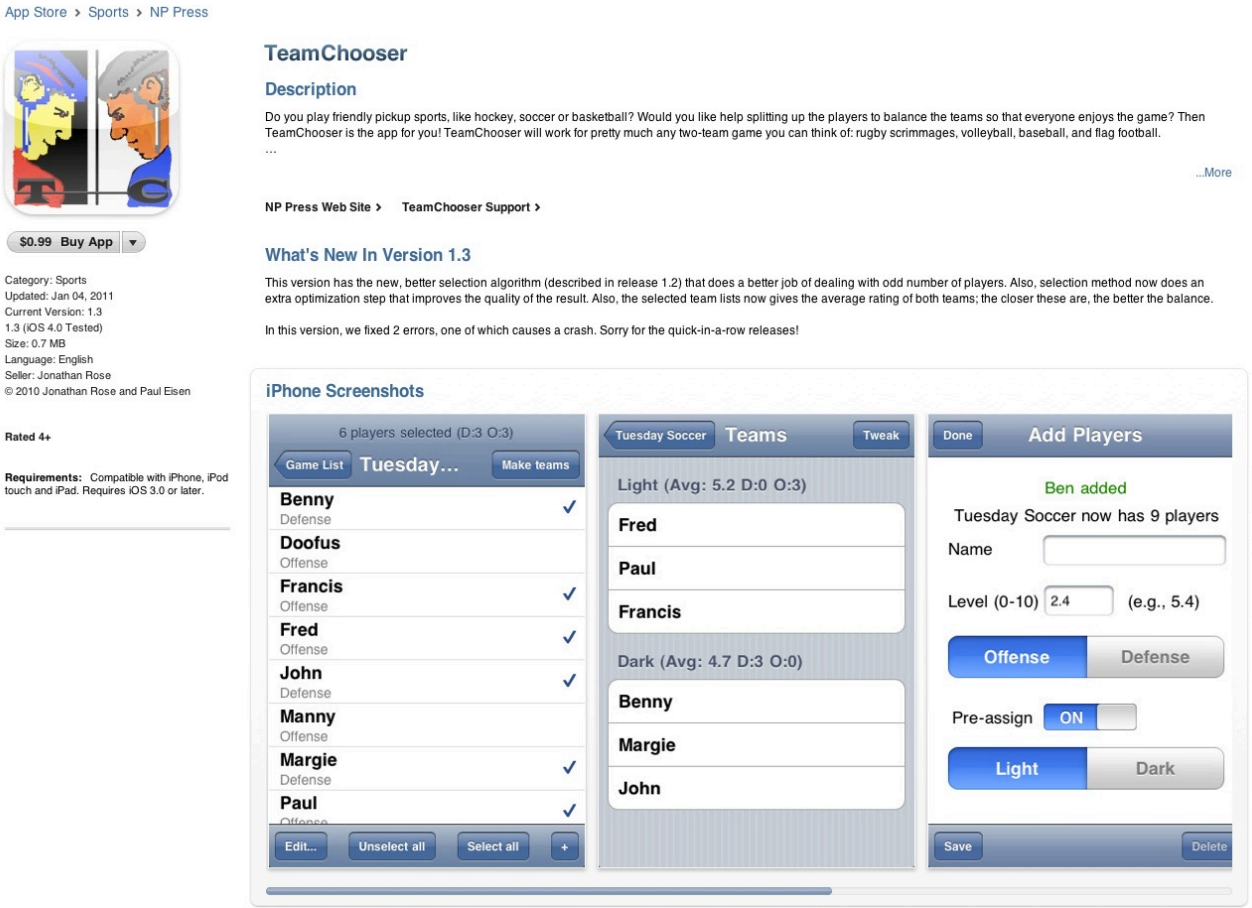
Does it Work?

- Yes!

- I've been using it with friends in roughly 100 hockey games and it has often done a good job.
  - We've tweaked it's algorithms here and there
  - Added some features
  - Occasionally very unbalanced games, bad luck?

- The rating of players gives rise to some unusual issues, sometimes funny, sometimes not.
  - Apps are **personal**

On iPhone App Store Since May 2010



- 160+ Sales
- Mostly in US/ Canada, but a few in UK, Ireland, Japan, Norway, Romania, Portugal, Australia, Denmark, Finland

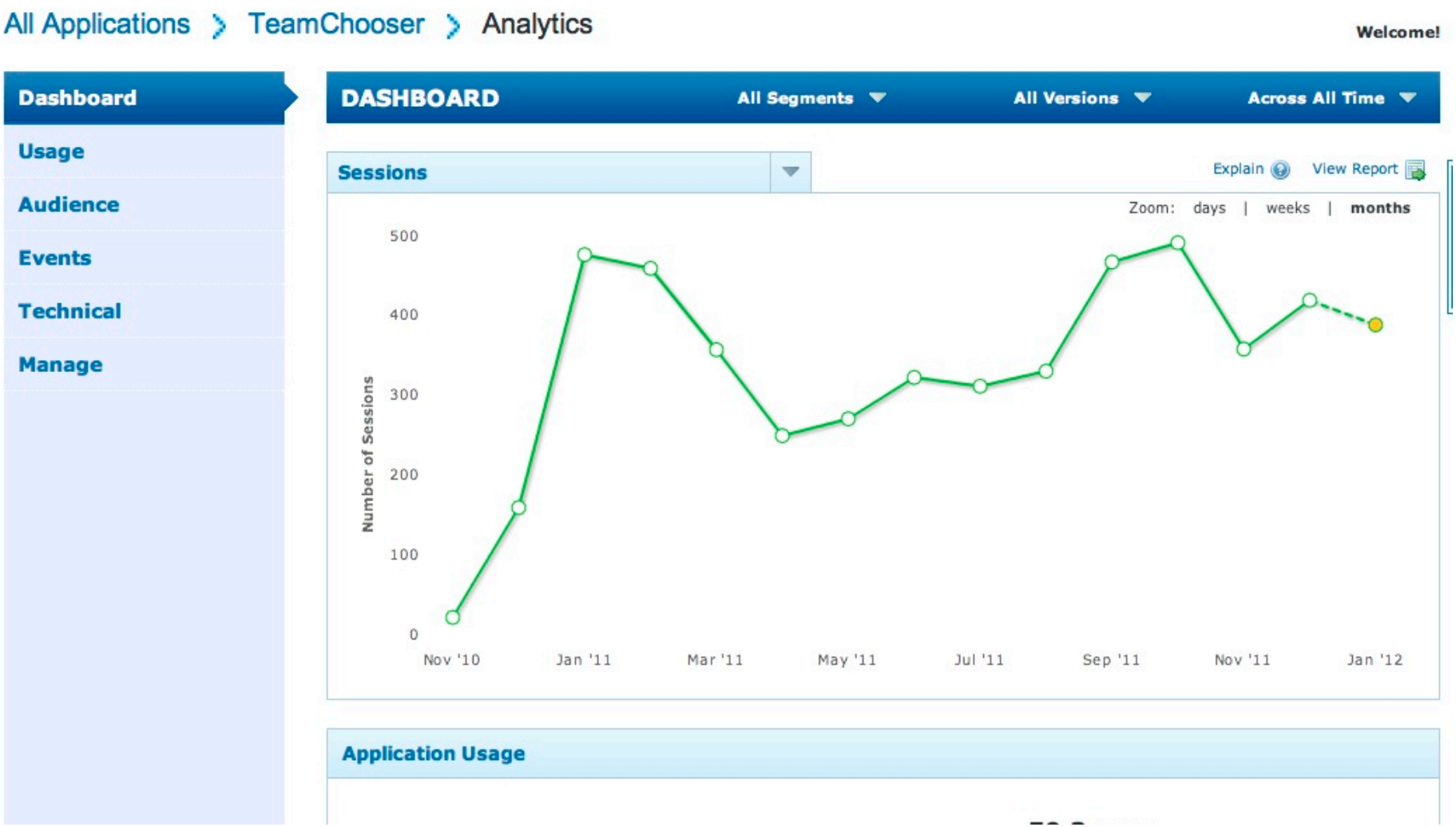
Improvements Needed

- **Really** needs a backing website
  - To support a business model of advertising, promotions related to sports
- Much discussion about using results of games to determine better ratings
  - Rating players is the most difficult part of using

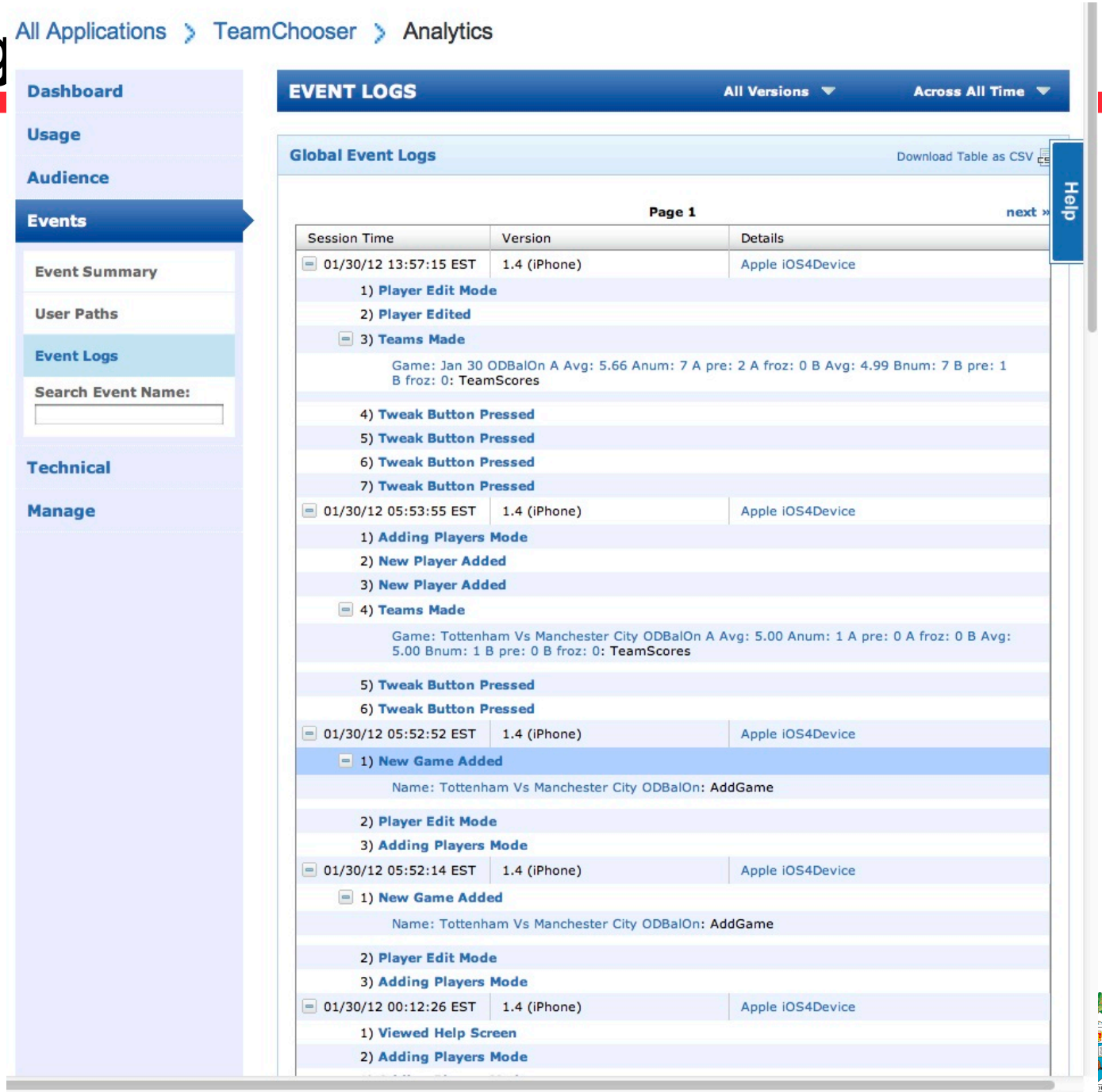
Is Anyone Using it Who Bought It?

- Instrumented Using Flurry.com
  - Analytics for iPhone, Blackberry and Android
- Reports:
  - # of users sessions, amount of time spent on app
  - Specific pages/events, as you wish from each user
  - Location of user, if already use GPS (no other ID).
  - **Anything I wish to report!**
- Flurry also gives guess as to age & gender of users!

Sample Flurry Reports

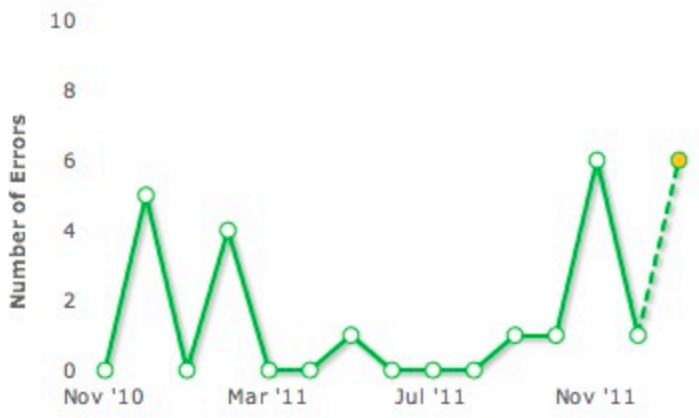


Event Log


All Applications › TeamChooser › Analytics
Dashboard
Usage
Audience
Events
Event Summary
User Paths
Event Logs
Search Event Name:
Technical
Manage
EVENT LOGS
All Versions
Across All Time
Global Event Logs
Download Table as CSV
Help
Page 1
next »
Session Time
Version
Details
01/30/12 13:57:15 EST
1.4 (iPhone)
Apple iOS4Device
1) Player Edit Mode
2) Player Edited
3) Teams Made
Game: Jan 30 ODBalOn A Avg: 5.66 Anum: 7 A pre: 2 A froz: 0 B Avg: 4.99 Bnum: 7 B pre: 1 B froz: 0: TeamScores
4) Tweak Button Pressed
5) Tweak Button Pressed
6) Tweak Button Pressed
7) Tweak Button Pressed
01/30/12 05:53:55 EST
1.4 (iPhone)
Apple iOS4Device
1) Adding Players Mode
2) New Player Added
3) New Player Added
4) Teams Made
Game: Tottenham Vs Manchester City ODBalOn A Avg: 5.00 Anum: 1 A pre: 0 A froz: 0 B Avg: 5.00 Bnum: 1 B pre: 0 B froz: 0: TeamScores
5) Tweak Button Pressed
6) Tweak Button Pressed
01/30/12 05:52:52 EST
1.4 (iPhone)
Apple iOS4Device
1) New Game Added
Name: Tottenham Vs Manchester City ODBalOn: AddGame
2) Player Edit Mode
3) Adding Players Mode
01/30/12 05:52:14 EST
1.4 (iPhone)
Apple iOS4Device
1) New Game Added
Name: Tottenham Vs Manchester City ODBalOn: AddGame
2) Player Edit Mode
3) Adding Players Mode
01/30/12 00:12:26 EST
1.4 (iPhone)
Apple iOS4Device
1) Viewed Help Screen
2) Adding Players Mode

Total Exceptions

View Report



Sessions Per Month

View Report

Sessions	User-Months*	% of User-Months
1 - 2	230	43.5%
3 - 5	82	15.5%
6 - 9	62	11.7%
10 - 19	88	16.6%
20 - 49	48	9.1%
50 - 99	16	3.0%
100 - 499	3	0.6%
500+	0	0.0%

* - User-Months represent one unique user over the period of one Month.

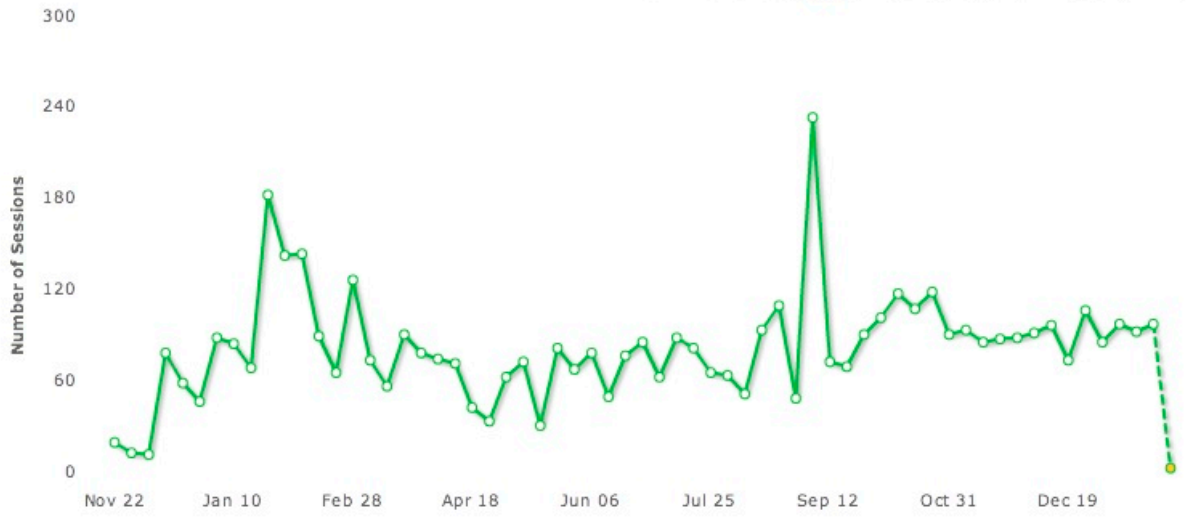
New Users Map

Explain View Report

- Sessions

5,077 Sessions Explain | Download CSV

Zoom: time of day | hours | days | **weeks** | months

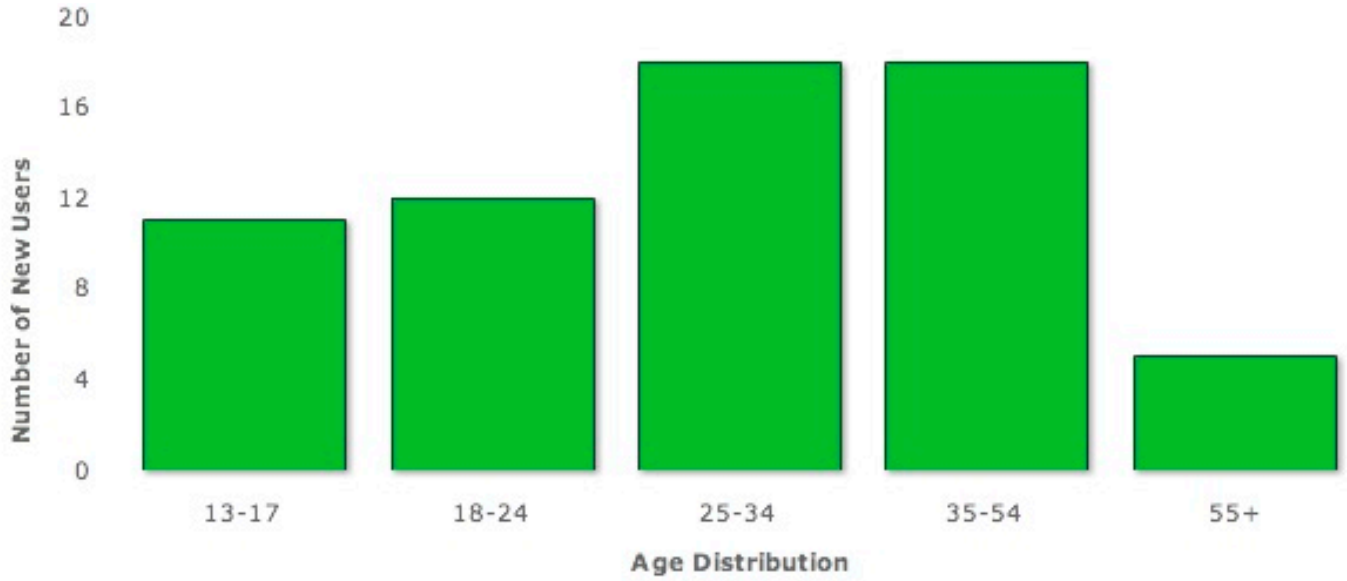


Detailed View Explain | Download CSV

Zoom: time of day | hours | days | weeks | **months**

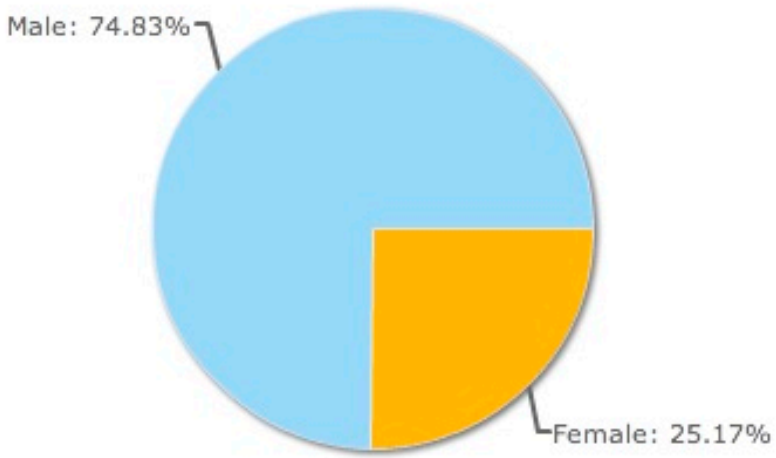
Date	Sessions	% of Sessions
Jan '12	388	7.6%
Dec '11	419	8.3%
Nov '11	358	7.1%
Oct '11	491	9.7%
Sep '11	467	9.2%
Aug '11	330	6.5%
Jul '11	311	6.1%
Jun '11	322	6.3%
May '11	270	5.3%
Apr '11	249	4.9%
Mar '11	357	7.0%
Feb '11	459	9.0%
Jan '11	476	9.4%
Dec '10	159	3.1%
Nov '10	21	0.4%

Age & Gender Estimates!



33.16%
64 users
Known Age

66.84%
129 users
Unknown Age



78.23%
151 users
Known

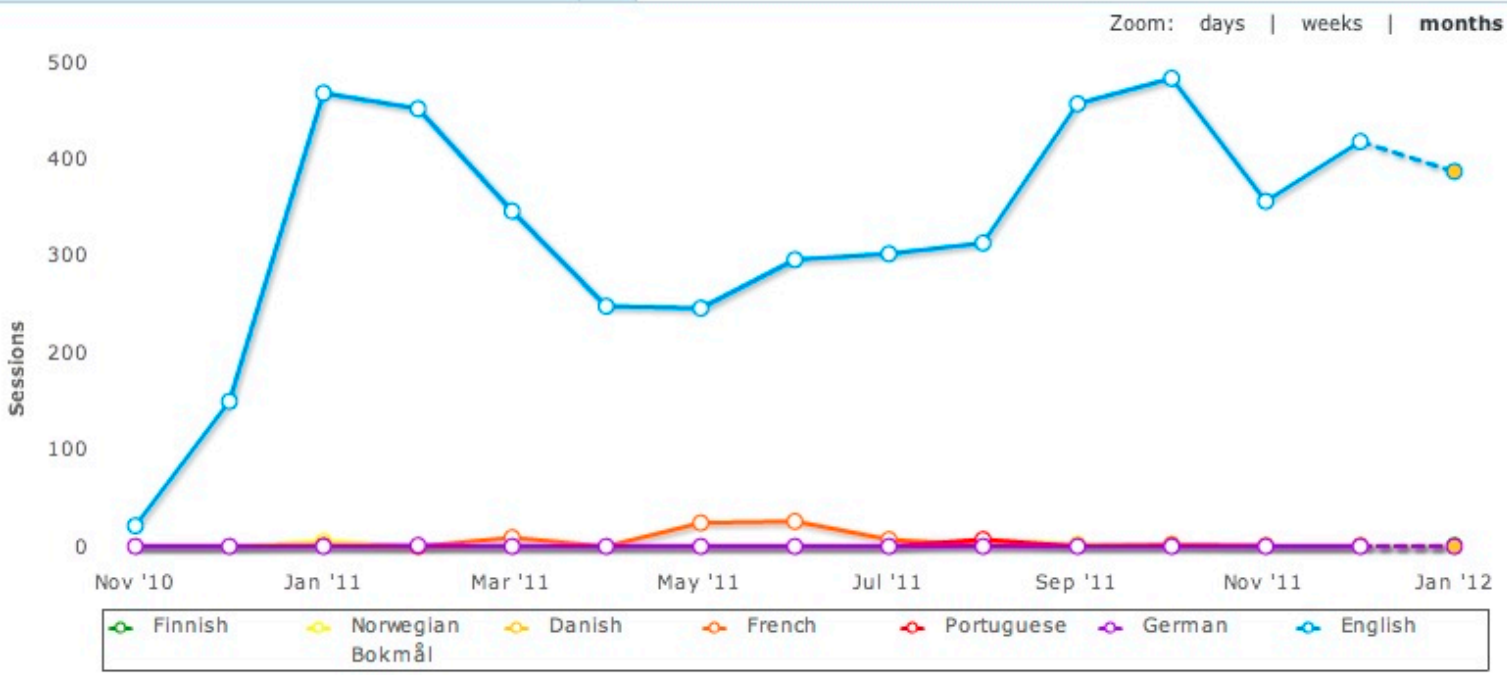
21.76%
42 users
Unknown

Top 8 Languages

All Segments | Across All Time

Sessions

Explain | Download CSV



Detailed View

Explain | Download CSV

Language	Sessions	% of Sessions
English	4,943	98.0%
French	72	1.4%
Norwegian Bokmål	15	0.3%
Portuguese	7	0.1%
Danish	4	<0.1%
German	1	<0.1%
Finnish	1	<0.1%

Proposal Discussions

One Member from Each Group

- Please stand up, and describe your proposal

- What & Why
  - Describe the idea, and its motivation
- Scope
  - Give a good sense of functionality – what is involved
  - Show that you've thought about the pieces

- Apper: how it relates to field/expertise

Groups

- Here is the list I have, missing some info

Group #	Apper	Apper Field	Programmer1	Field/Degree	Programmer2	Field/Degree	Platform
1	Marc Halatsis	iSchool	Felix Lazbin	ECE/M.Eng (?)	Blair Fort	ECE/PhD	Android
2	Adrian Matheson	Industrial Eng/PhD	Frances Awachie	ECE/?	Matthew Thorpe	ECE/M.Eng	Android
3	Justin Chee	Rehabilitation Science	Tuck-Voon How	IBBME/?	Eric Wan	ECE/M.A.Sc.	Android
4	Shannon Linde	iSchool	Abhinav Goyal	ECE/?	Maryam Samizadeh	ECE/?	Android
5	Scott Pollock	iSchool/Museum Studies	Xu Sheng	ECE/M.Eng	Tony Ming Zhou	ECE/M.Eng	?
6	Alexandra Makos	OISE/PhD	Rebecca Dreezer	CS/PM	Cindy Lau	IBBME/M.A.Sc.	?
7	Jill Cates	IMS/M.Sc.	Eddie/Zi Hi	ECE/M.Eng	Theodore Avery	CS/M.Sc.	iPad
8	Graham Candy	Anthropology/?	Steve Chun-Hao Hu	ECE/?	Chenliang Man	ECE/?	Android
9	Gabby Resch	iSchool/?	Ani Tumanyan	CS/PM	Arsen Tumanyan	CS/PM	Android
10	Sam Liu	?	Jonathan Tomkun	?	Simran Fitzgerald	?	?
10	Dario Kuzmanovic	?/?	Valmiki Rampersad	ECE/M.A.Sc.	Colin Chung	ECE/M.Eng	
11			Heyse Li	MIE/?	Matthew Ma	CS/?	Android
12			Nanxsuan Wang	ECE/?	Peng Liang	ECE/?	
13			Fitsum Andargie	ECE/PhD	Paul Bovbel	MIE/PhD	Android
14			Sana Haghighi	ECE/M.Eng			