A Survey on Healthcare Applications in Urban Sensing

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Next 25 minutes

- Introduction
- General architecture
- Discussion today
- Healthcare applications in Iphone
- Healthcare applications in Blackberry
- Healthcare applications in Android
- Academia level applications
- Comparison metrics –A view
- Demo of few Smartphone applications
- Difficulties encountered
- Report Overview
- Conclusion & Questions


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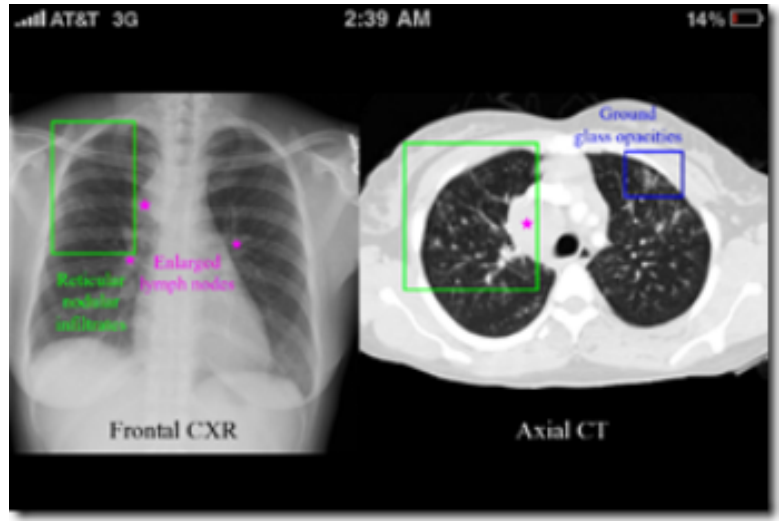
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Multiple Risk Factors Are the Rule in SIDS (CME/CE)
Sun, 14 Feb 2010 23:01
Patient-Held Record Boosts Odds of Immunization (CME/CE)
Sun, 14 Feb 2010 23:01
Herpes Therapy Slows HIV Progression (CME/CE)
Sun, 14 Feb 2010 17:30
Share Breaking Medical News with a Colleague.


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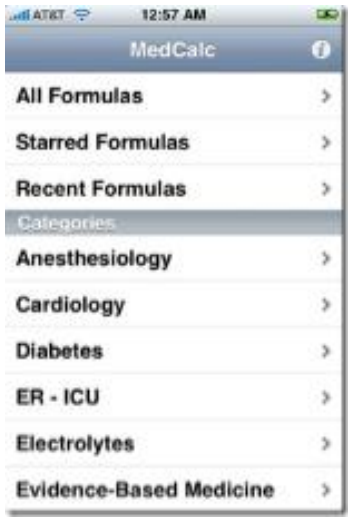
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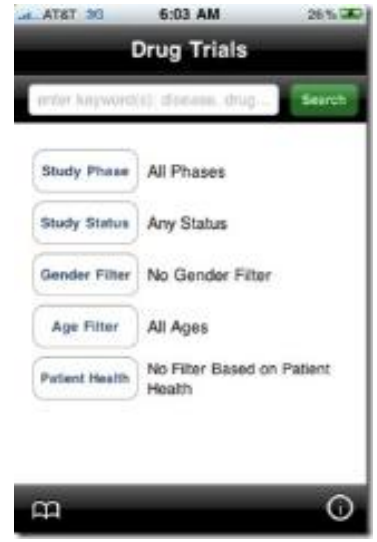
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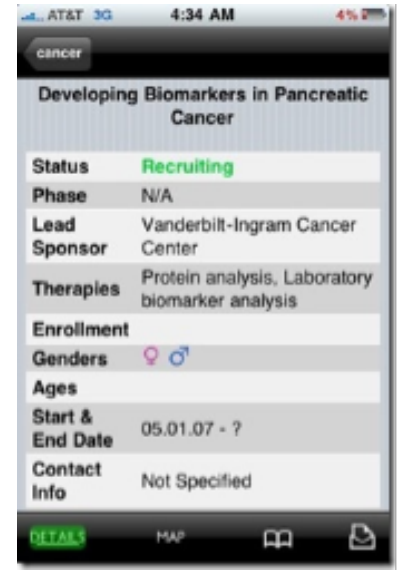
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cancer
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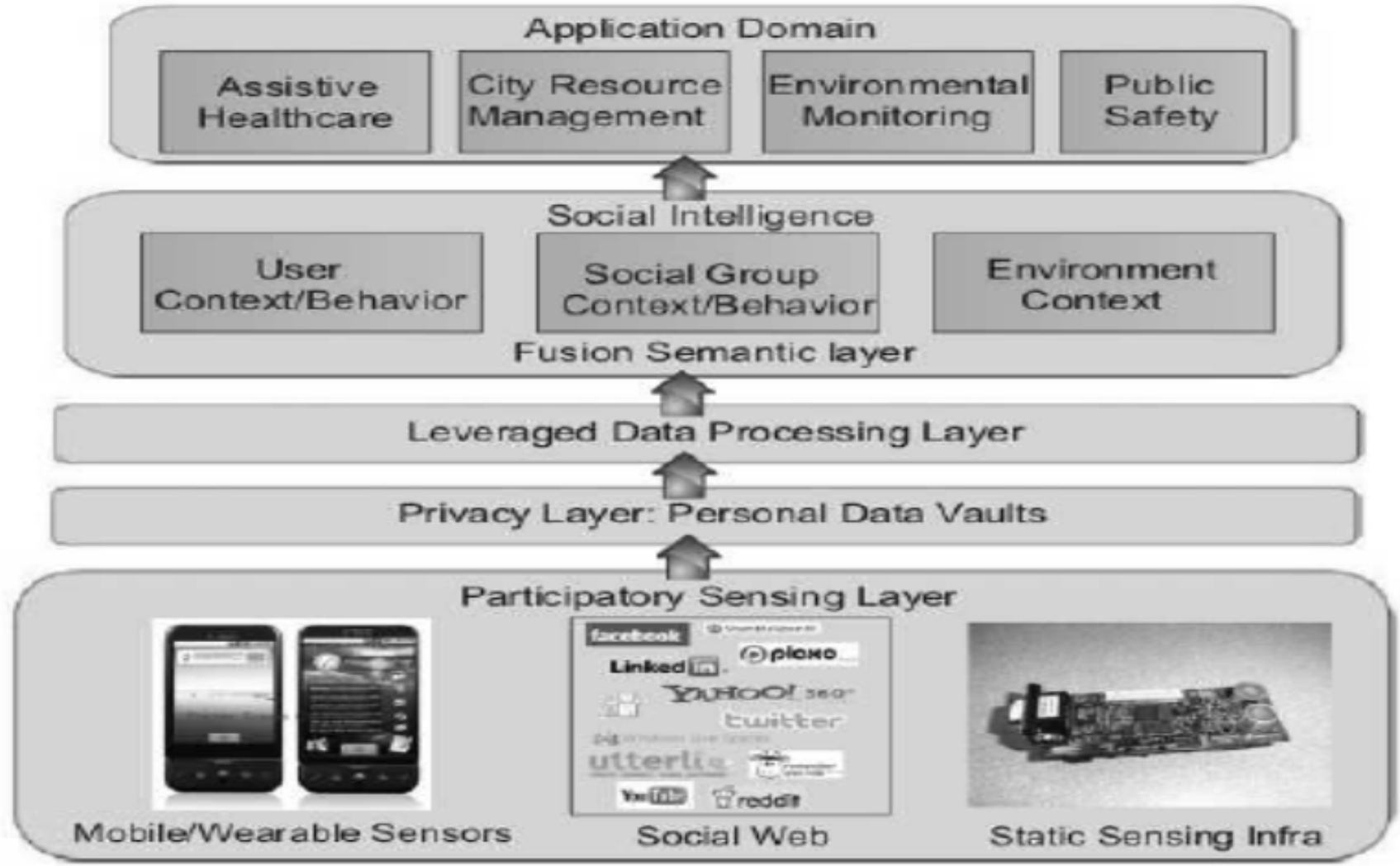
Introduction

- In the dawn of urban sensing ,healthcare applications in smart phones play a crucial role in day to day survival.

- The base of this paper is a collaboration of a number of healthcare applications in smartphones along with certain academia level forms.

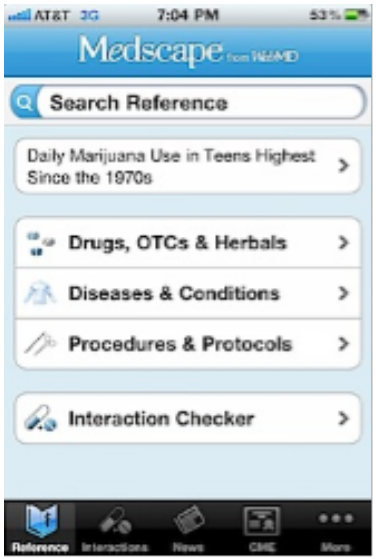
- Since healthcare applications can be numbered & widespread I have worked on most used/best rated healthcare applications on three urban sensing domains-iPhone,Blackberry,Android.

Architecture



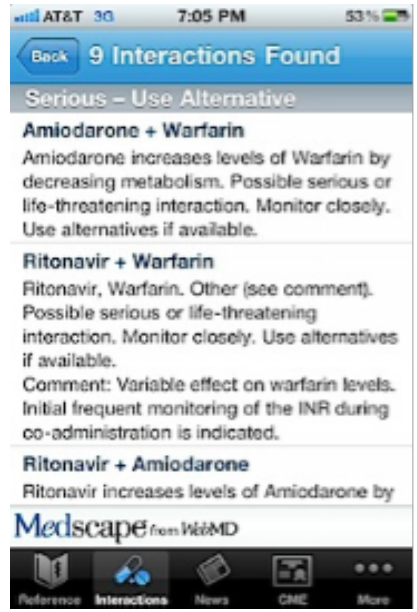
Discussion today

Iphone	Blackberry	Android	Academia
Medscape	Pain Manager	Calorie counter	
Epocrates	Walgreens	Pocket Yoga	And Wellness
iPharmacy	Baby cog	Emergency & critical care	



Medscape

- Rated #1 in downloaded medical applications of Iphone.
- A significant way to look up at medications & drug interactions.
- It tends to contain information on more than 6000 drugs
- Disease descriptions with pictures make it easy for those want to visualize some diseases.
- Best utilized as a medication reference, procedure guide & clinical reference
- Positive-Drug Interaction factor



Epocrates

- The first legitimate medical application for the iPhone is a useful medical resources for both physician & trainee.
- The main strength being its **Pill ID feature** which facilitates identifying medications based on descriptions and pictures of the actual medication pills.
- **Medication Interaction Check** is another useful feature for checking drug interactions.
- Infectious disease treatment guide
- Overall user Interface is quick making it easier to look up information at point of care

Ipharmacy

- Rated as #1 paid application of 2010.
- The drug information given includes medication guide, drug reference or drug guide.
- It contains a built in digital drug identifier that recognizes 80,000 packages and distinguish drugs of the same name

Features

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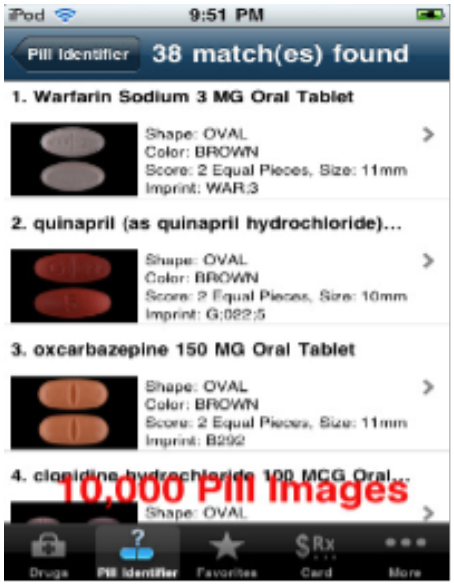
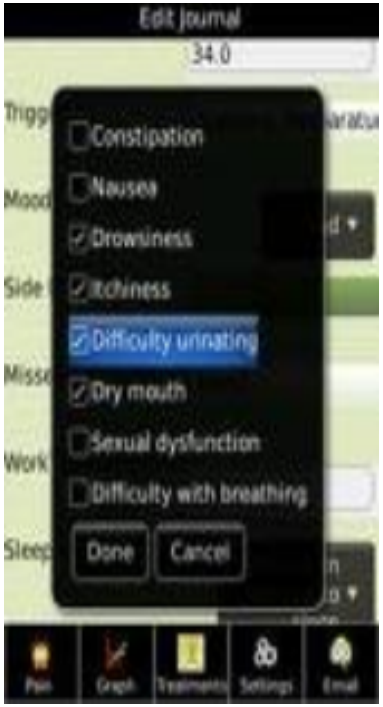
- Indications & usage
- Dosage & administration
- Contraindications
- Warnings & Precautions
- Adverse reactions
- Overdosage
- How supplied

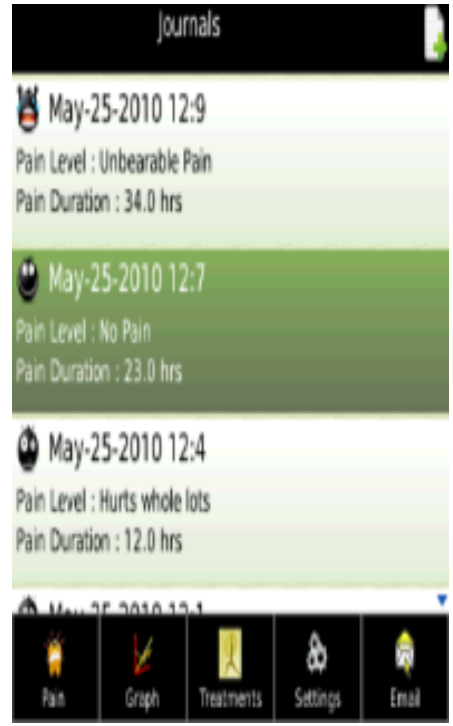


Pain Manager



Features

- Keeping track of pain levels
- Application contains more than 450 predefined treatments.
- Attractive user Interface
- Addition of custom treatments
- Saving of pain duration & work loss
- Sending log report to a family doctor

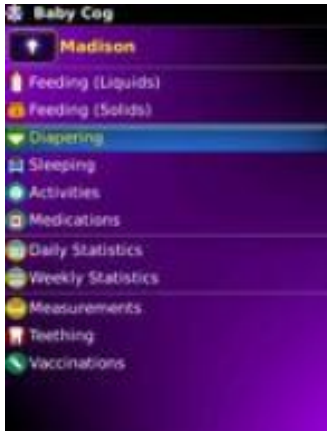


Walgreens

Features

- Store locator
- Maps & driving directions
- Product availability
- Product browser
- Maps & driving directions(Maps+GPS)

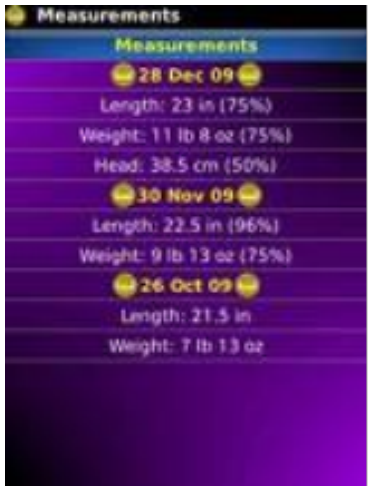
Baby Cog



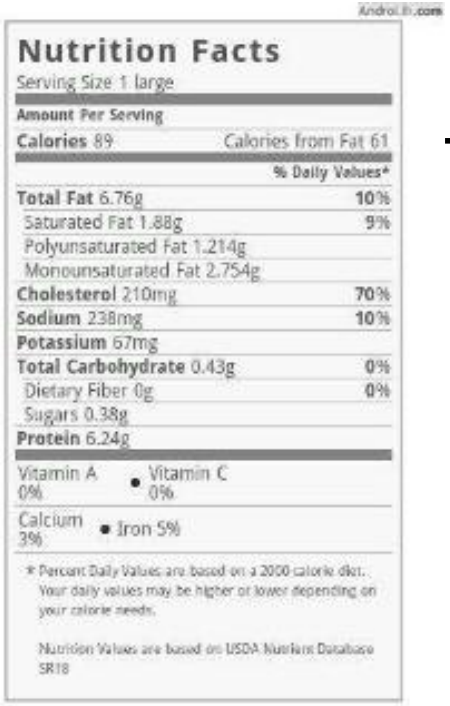
Parents can track their child's activities to provide statistics to pediatrician.

Features

- Track all of child's vaccinations, measurements.,etc
- Use with up to 10 children
- Daily/weekly statistics calculated
- Options to add automatic reminders for feeding, diaper changes,etc to the phone calendar.
- User interface customizable with 12 different color schemes.

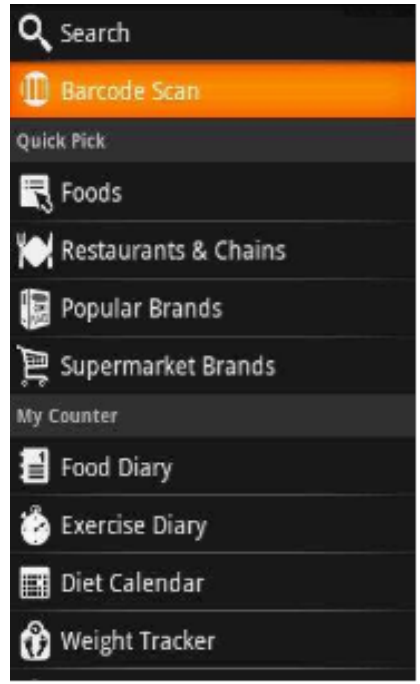


Calorie counter



Features

- Easy food tracking with food database & instant food search.
- A journal to record your progress
- A food diary to plan and keep track of what you're eating
- A diet calendar to see your calories consumed & burned
- A quick pick to find calorie & nutrition info for your favorite foods, brands& restaurants



Pocket yoga

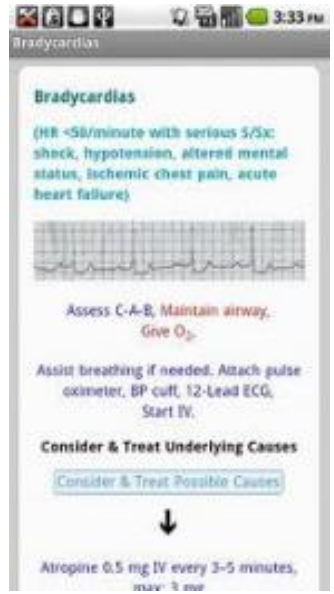
Features

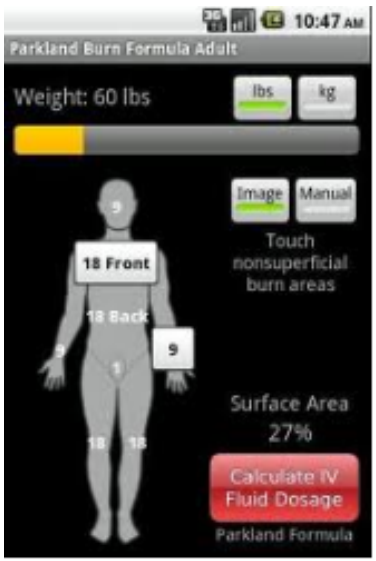
- Detailed voice & visual instruction guides you through every pose, including inhalations& exhalations.
- Over 150 illustrated pose images with correct posture & positioning
- Practices designed by experienced yoga instructors
- Ability to play music from your music library in place of default music

Emergency & Critical care

Features

- Expanded search capability
- Calculators
- Lab values, metrics & critical care
- Quick EMS Spanish translations
- Common medical emergencies
- Pulse qximetry,IV drip rates
- Trauma & glasgoq coma scales





Andwellness

Introduction

AndWellness:

- An end-to-end data collection system designed to monitor participants' daily habits and behaviors

- A personal data collection system, uses mobile phones to collect and analyze data from:
  - active, triggered user experience samples: survey responses
  - passive logging of onboard environmental sensors

Area of usage: health and behavior monitoring

Example: Cancer Survivor Study by UCLA measures the behaviors and emotions of young breast cancer survivors. Collect daily information on:

- nights sleep, various emotional feedback, behaviors
- remind users to take simple saliva sample to measure various biomarkers.

System overview

Three subsystems:

- An application to collect data on an Android mobile device
- A server to configure studies and store collected data
- A dashboard to display participants' statistics and data.

Paradigm:

- prompting participants on their mobile device to answer surveys at configured intervals
- uploading the responses wirelessly to a central server
- responses are parsed into a central database and can be viewed by both the researchers and participants in real-time.

System overview

The end-to-end data collection system contains three main components:

- Campaigns: contain surveys and other continuous data collection types or sensors.
- Sensors: location traces (GPS) and activity inference (still, walking, running, biking, driving) by GPS and accelerometer and uses clustering techniques
- Triggers: launching surveys based on time, location, or other contextual clues, can be configured.

Dashboard:

- view a summary of upload statistics
- view participant's current progress
- visualize currently uploaded data: different visualizations
- a map view: find relations between time, location, and surveys responses

System overview

Design:
has to meet a number of requirements on

- Usability
- Power
- Privacy
- Transparency

Usability:

Building an unobtrusive application on the mobile device

- avoids interfering with standard phone operation
- does not drain the phone battery too quickly
- does not notify or require the participant's attention more than necessary
- nor exhibit high latency during participant interaction.
- easy to learn and use: simple clicks
- conditional prompts: allow branching and reducing number of prompts to be completed
- automatically upload pending data

System overview

Power: avoid having to constantly recharge the phone

- continuous location and activity sensor have been optimized to balance battery drain with accuracy
- tunable to allow the researcher to adjust the balance between resolution and power drain

Privacy: personal or private information to be kept securely

- transported using end-to-end encryption
- user names are created using randomized dictionary strings to preserve participant anonyminity
- information can be made only accessible by authorized individuals
- balance between usability and privacy: how often to make the user login, to validate and to handle multiple users sharing the same phone.

System overview

Transparency:

- data are uploaded in near real time
- use dashboard to view feedback about data collection process and to know if the device is working correctly

Figure 1. AndWellness architecture on the phone.

Implementation

Server

- implemented in Java 1.6, Spring framework
- hosted in the Apache Tomcat 6.0 environment
- uses MySQL 5.1 database
- HTTP based APIs control access to upload and download

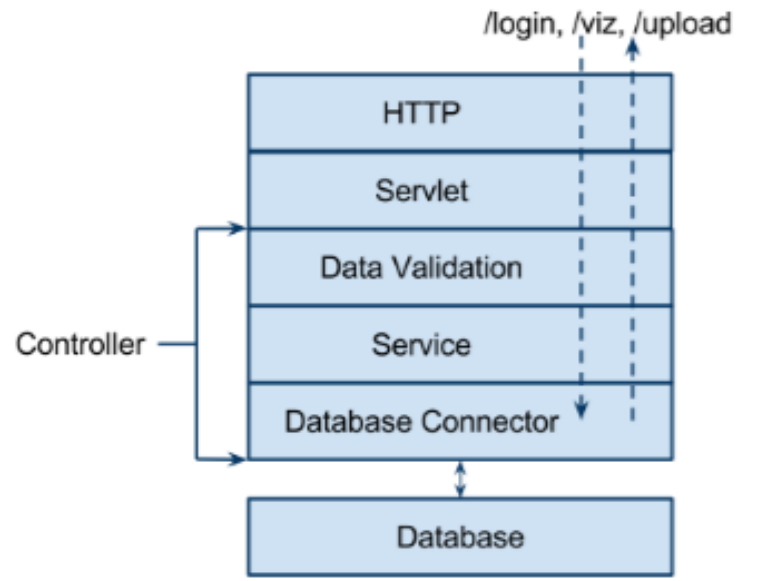
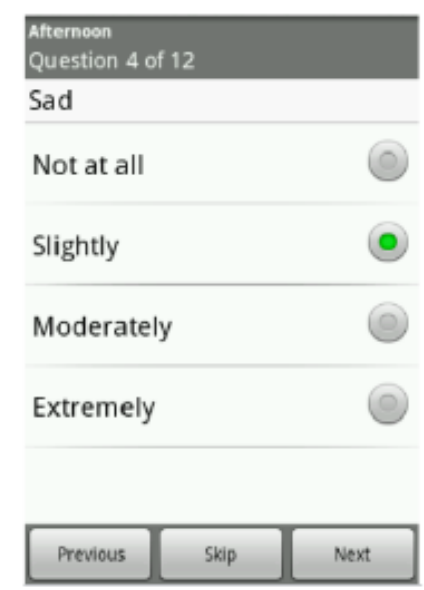


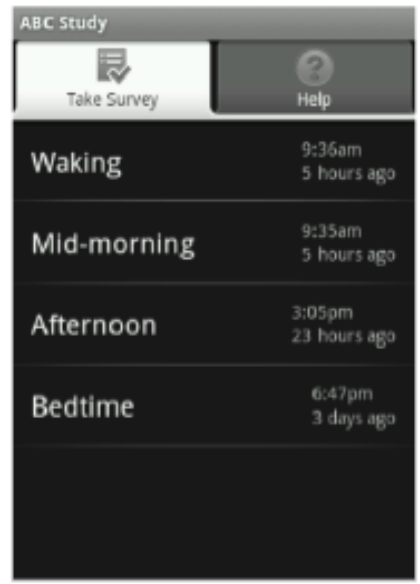
Figure 4: The modular layers of the server architecture. Incoming server calls start at the HTTP layer, make their way down to the database, then return to the HTTP layer to send any responses.

Implementation

Application on the phone:

- implemented using standard Android development framework in Java programming language
- after reading in the configuration, automatically generates the survey questions and response inputs
- user can open the settings menu to adjust the trigger times for daily triggered surveys
- securely transmits the data to the server with end to end reliability, ensuring no data is lost





Implementation

Visualizations

- online data visualizations have been implemented in JavaScript (data can be viewed w/o any custom software)
- the system constantly pre-aggregates any collected data into much lower resolutions, grab only the necessary resolution of data
- uses gzip before transport to minimize latency

Evaluation

Phone Performance: experiment using

- Android based mobile device: Qualcomm MSM 7201A 528 MHz processor, 192 MB RAM, 1150 mAh lithium ion battery.
- SystemSens: records CPU utilization, network usage, and current battery percentage

Battery Life:

Run the sampling activity at the above rates and measure the rate of battery drain for each

- the entire battery is drained in about 7.6 hours with activity inference running unfortunately fast
- main battery drains: GPS and accelerometer plan to adjust the activity inference module to better duty cycles those sensors

Comparison metrics

App/Feature	Accuracy	Quality	Trackers	Security	Usage	Comaptibility	Efficiency	Reach
Medscape	60%	+ve	Yes	Yes	High	Good	Good	Good
Epocrates	50%	+ve	Yes	Yes	High	Medium	Good	Medium
iPharmacy	>70%	+ve	No	Yes	High	Very good	Good	Good
Pain manager	<50%	-ve	Yes	Not known	Less	Medium	Poor	Poor
Walgreens	>60%	-ve	No	Yes	Medium	Medium	Good	Medium
Baby cog	50%	+ve	Yes	Not known	Less	Medium	Poor	Medium
Calorie counter	>60%	+ve	Yes	Yes	High	Good	Good	Good
Pocket yoga	>70%	+ve	No	Yes	Medium	Good	Poor	Good
Emergency & critical care	>50%	Linear	Yes	Not known	Medium	Medium	Medium	Good

Difficulties encountered

- The widespread nature makes it a task to to decide which are the applications we have to work on.
- Not many academia level applications
- Time constraints

Conclusion &Report

- The base of this paper is to emphasize on certain healthcare applications & make a thorough analysis of various of its internal features.
- Urban sensing being a deep & widespread field can be studied in various perspectives.
- My report would contain a brief description of all the commercial applications I have dealt with, its work pattern &complete list of characteristics & features.
- The academia level applications with the internal architecture being the key.
- A complete layout of comparison metrics I have worked upon.

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- Questions