CS 525M Mobile & Ubiquitous Computing

Mobile Health Mashups:
Making Sense of multiple streams of wellbeing and contextual data for presentation on a mobile device

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Application Objective

- Improve one’s health
  - Use mobile device to collect health activity
  - Aggregate data
  - Data correlation to identify behavioral anomalies
    - Ex: If I sleep more, I tend to be more active the following day

- Ease of data interpretation
  - Simple representation of information
  - User don’t have to wade through multiple graphs
  - UI displays easy to understand interpretations
    - Ex: “You walk 80% more on weekends than weekdays”
Functional Overview

● What is a Mashup?
  ● Describes a Web application that combines multiple services into a single application.*

● Data sources
  ● External devices (Wi-Fi enabled scale, Fitbit)
  ● On-board mobile device sensors and applications
  ● Manual data entry (meal diary)

● Cloud computational & data storage services
  ● Statistical computations
  ● Amazon S3 mid-size cloud resource

*http://www.techterms.com/definition/mashup
Functional Overview cont.

- Mobile device domain
  - Calendar app
  - Meal diary app
  - Main application widget
  - REST API to push data to cloud

- Cloud domain
  - Withings server
  - Fitbit server
  - REST API to pull data from Withings, Fitbit and mobile device
Functional Overview cont.

- **S3 Backup**
  - Amazon Web Services
  - REST API with shared key

- **Withings**
  - WiFi
  - Data pulled nightly from REST APIs

- **Fitbit**
  - Ant+
  - Cloud services

- **Server**
  - Data pushed on demand to REST API
  - WiFi/3G

- **Mobile services**

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Architectural Overview

● Data acquisition
  ● Withings & Fitbit provide public API
    ● Employs OAuth to allow to share with other services
  ● Native calendar app entries
  ● Meal diary entries
  ● Location information
  ● Acquired data pushed to server nightly for processing

● Security
  ● Raw data not stored on server
  ● Personal information cannot be reconstructed
Architectural Overview cont.

- Information processing
  - *Multiple time scale analysis*
  - *Data feeds analyzed:*
    - *Weight, body fat, steps, sleep, awoken, food, exercise...*
  - *Deviations calculated and thresholds applied*
  - *Data that satisfied threshold criteria is sent to mobile device*
  - *Templates define levels of probability*
Usability Issues

- Difficult to setup – e.g. Withings scale authentication
- Users did not use sensor devices frequently
  - Sparse data lead to unpredictable results
- Service restart problems
- Manual data entries not complete or non-existent
Recommendations

- Single sign-on service
- Keep app in constant use
  - Games
  - Contests
  - Tie into social media
  - Keep content fresh
- Save app state when power hits low H2O mark
- Use accelerometers and proximity sensors to track app usage