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Faculty Summit
10
YEAR ANNIVERSARY

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Using the Ubiquity of the Cell Phone to Record Physiological Activities

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[1] Microsoft Research
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Overview

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- Background
  - Cell Phone Ubiquity
  - Lifelogging
- Cell Phone Data Logger
  - A Cell Phone Data Logging Framework
- My Physiological Diary
  - Reviewing Physiological Data Using Contextual Information
- Ongoing Work

Cell Phone Ubiquity

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- 2.5+ billion Cell Phones in World (Approx 1bn PCs);
  90% of the world's population is in cell tower range
- Almost 70% of new cell phone subscriptions come from developing nations
  (Source: International Telecommunications Union)
- Bluetooth is now standard on most cell phones

Cell Phone as a Platform for Healthcare RFP

Microsoft Research

- 14 Projects awarded funding –
  Final reports for projects this week
- Several in posters, talks and demos at the Faculty Summit
- Culminating in an mHealth event taking place in Washington, DC in October

October 29-30, 2009 | Washington, DC

Ronald Reagan Building and International Trade Center

How Often Do You Visit Your Doctor?

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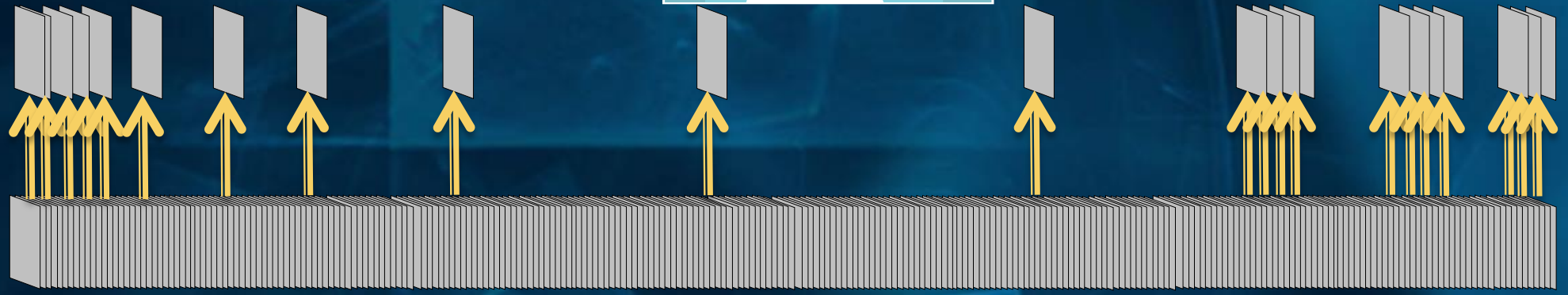
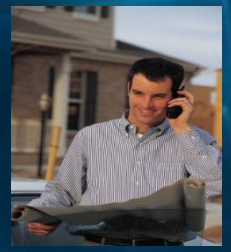


Visits to Dr.

My Life



Project Aims

Microsoft Research

- Utilize cell phone ubiquity
  - Logging platform on Windows Mobile devices
  - Framework allows easy integration of new BT sensors
- Reviewing physiological values
  - Interface to monitor, analyze & browse through huge volumes of sensor data
  - “Individualize” medical baselines

SmartLogger Overview

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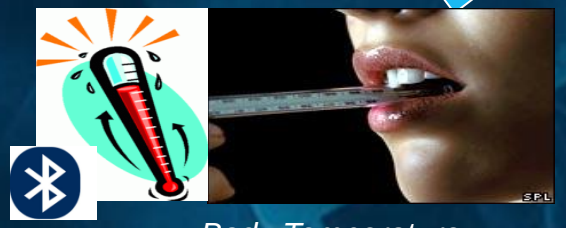
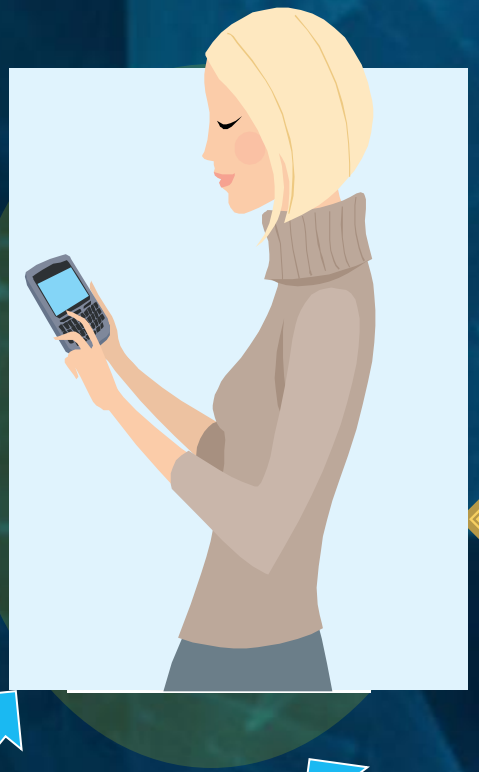
Heart Rate

Location

Images



Body Temperature



Cellular
Wi-Fi
LAN
ActiveSync
…

Data Store

Easily Include New Sensors

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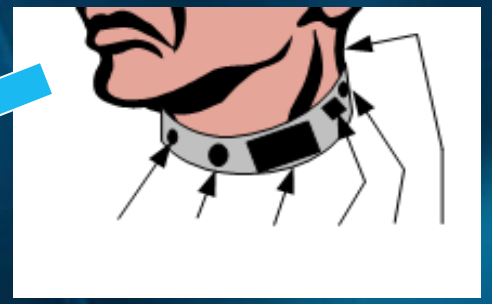
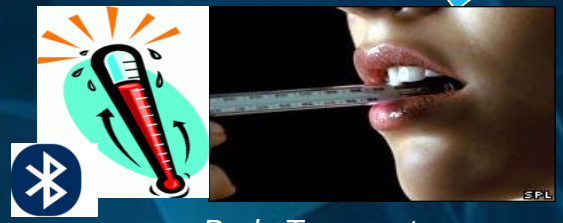
Heart Rate



Sleep apnea neck cuff with oximeter, accelerometer, microphone, & gsr sensors

Location

Images



Body Temperature

Zephyr HxM: An example of a modern biometric sensor sending out BT readings

How to Review Lots of Data?

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- Physiological data:
- Little emphasis on visualization

IEEE TRANSACTIONS ON INFORMATION TECHNOLOGY IN BIOMEDICINE, VOL. 8, NO. 4, DECEMBER 2004 439
A Wireless PDA-Based Physiological Monitoring System for Patient Transport
Yuan-Hsiang Lin, I-Chien Jan, Patrick Chow-In Ko, Yen-Yu Chen, Jau-Min Wong, and Gwo-Jen Jan

Our Take…

Microsoft Research

- To effectively help people understand their physiological data it must be:
  - Passively logged cell phone (no manual data entry)
  - Data gives potential associative “cues” (context+images)
  - Queryable on “temporal” axes (calendar constraints)
  - Highlight more “distinctive” events (charts)

My Physiological Diary

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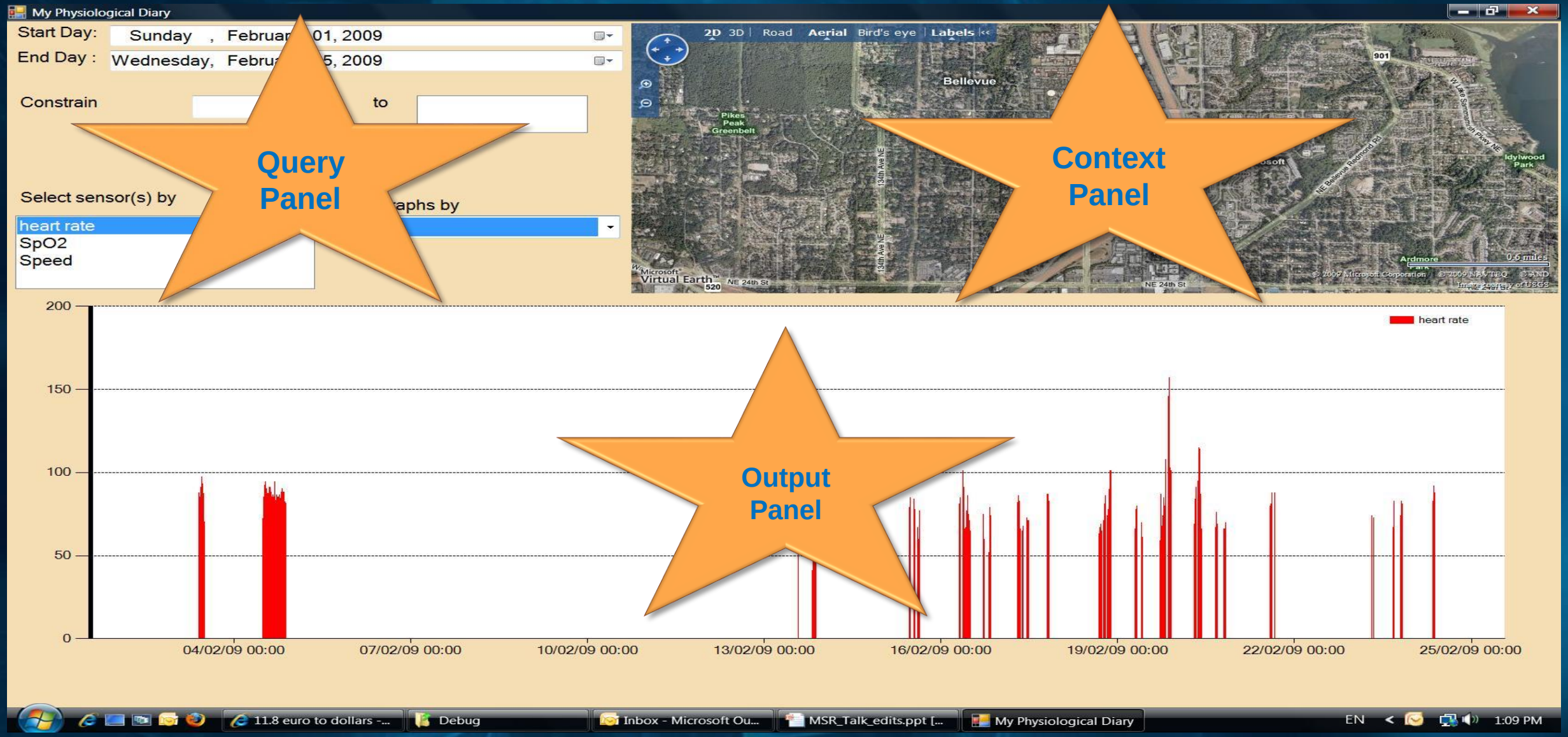
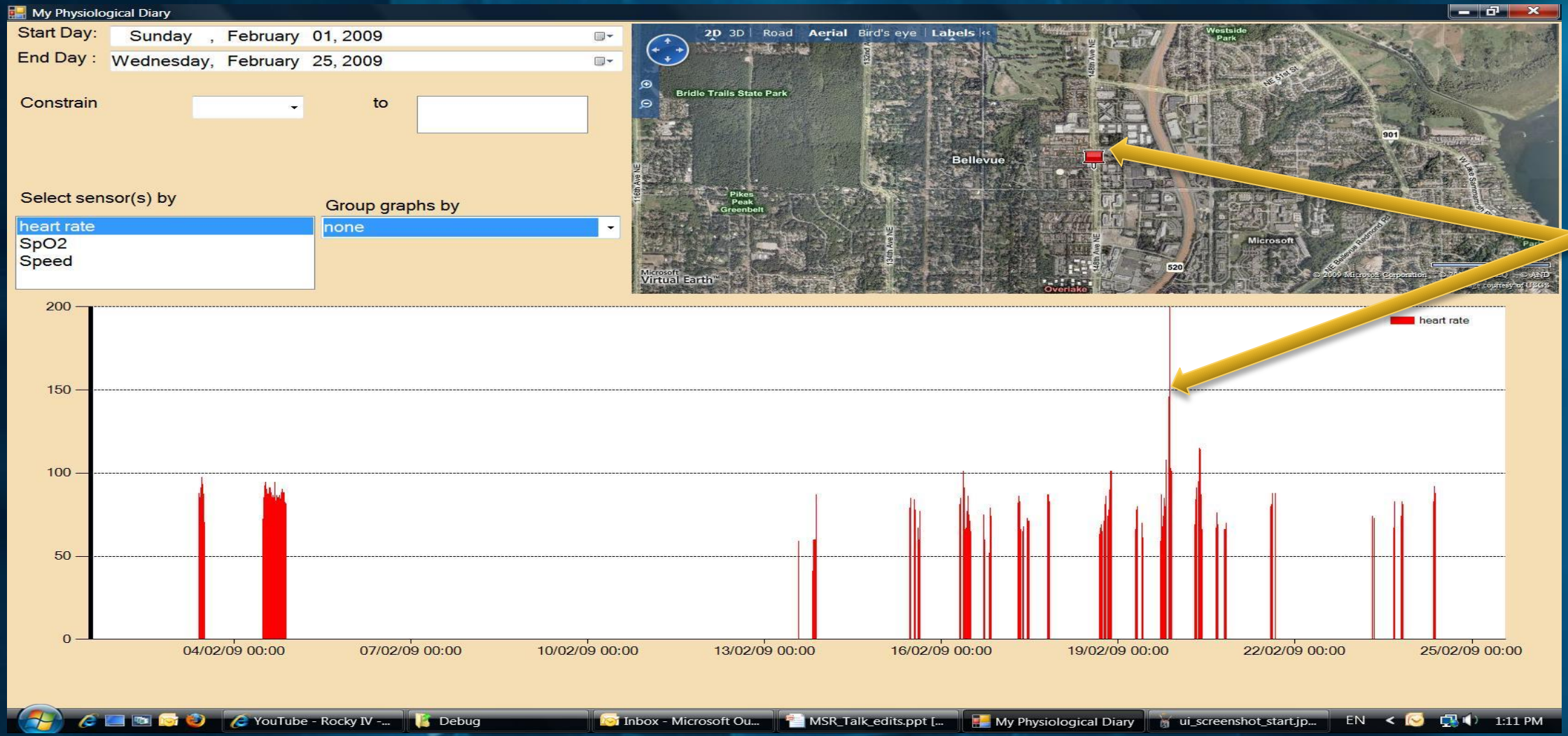


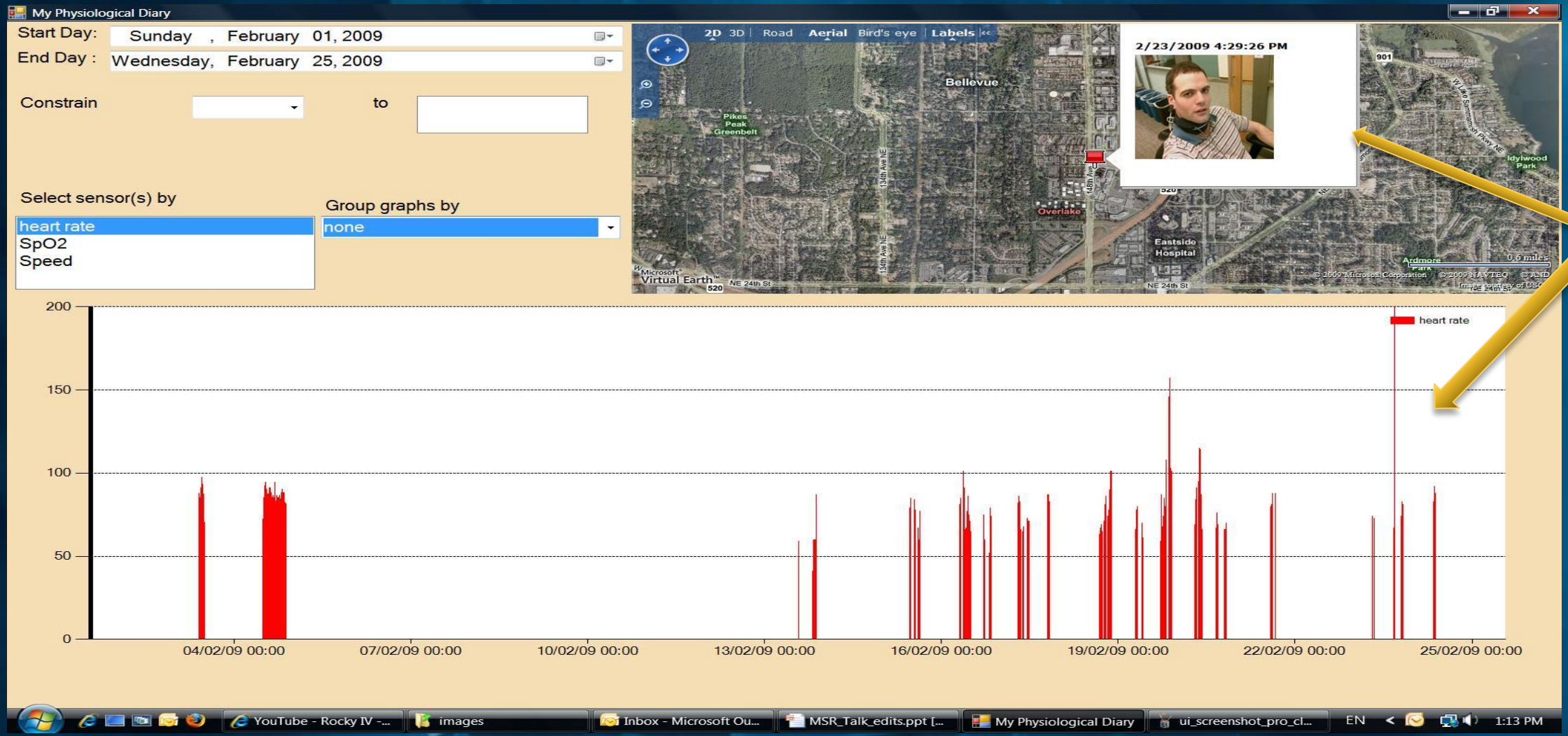
My Physiological Diary: Location Context

Microsoft Research



My Physiological Diary: Image Context

Microsoft Research



My Physiological Diary: Compare Across Days/Months/Years

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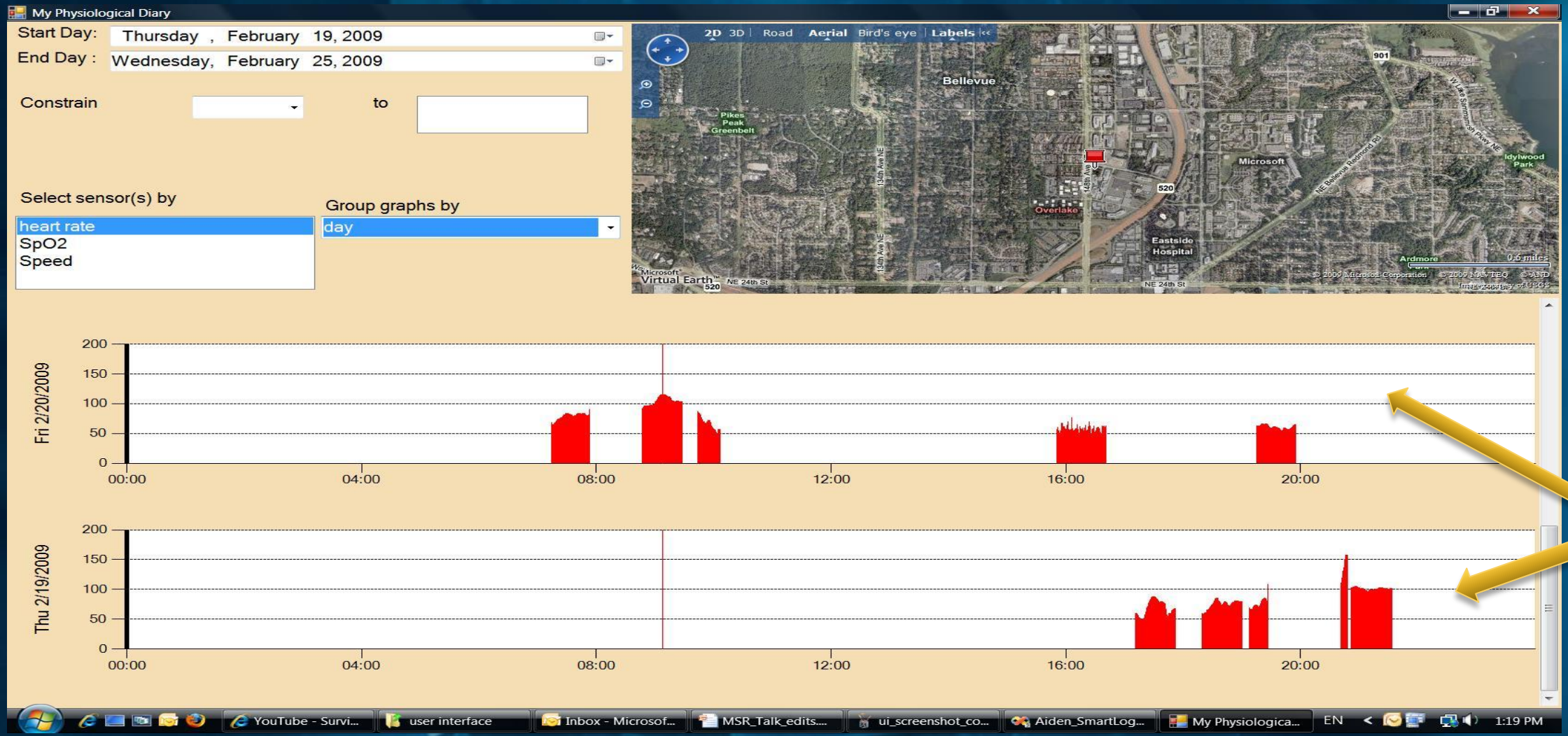

My Physiological Diary: Display Normalised Values

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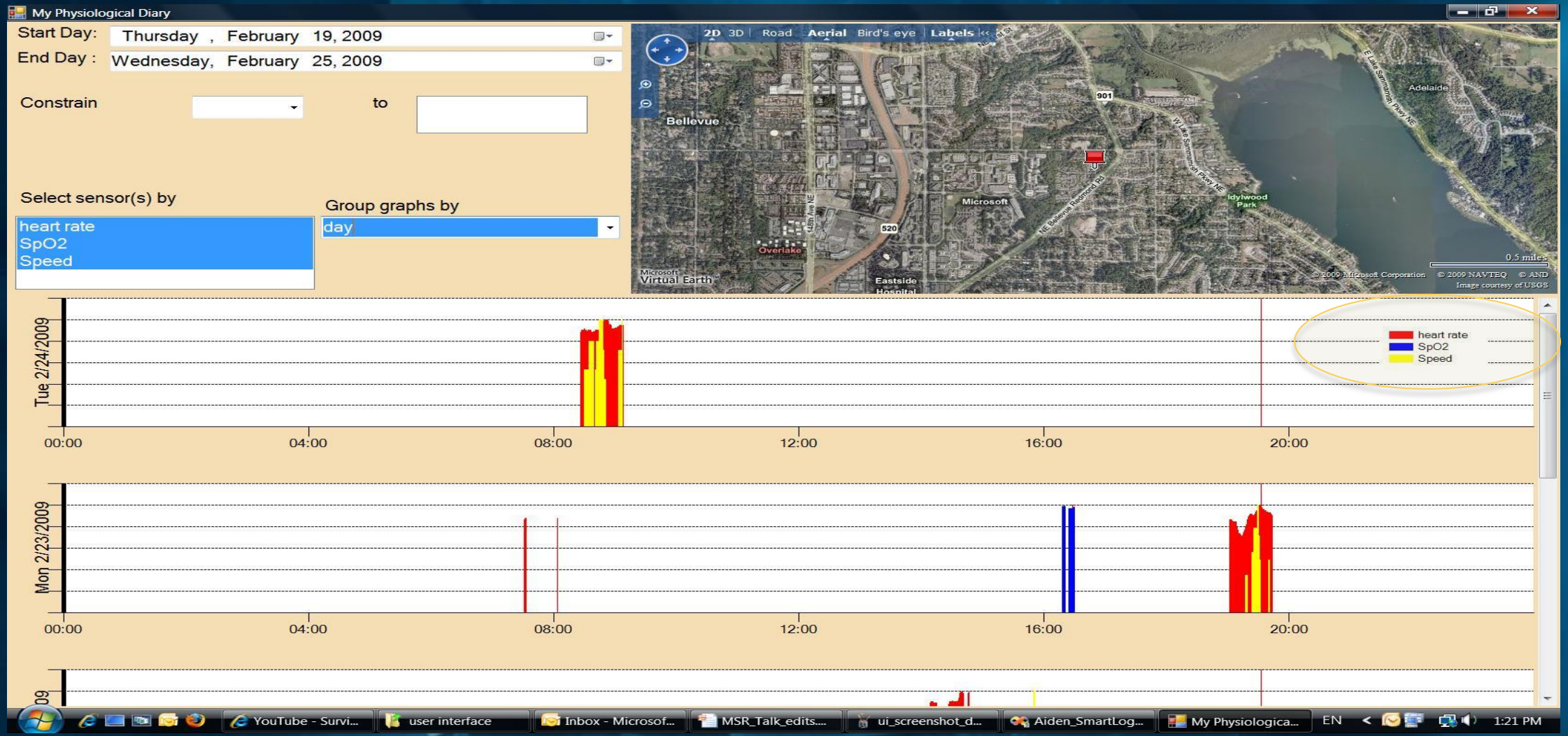

My Physiological Diary: Delve Deeper into Data

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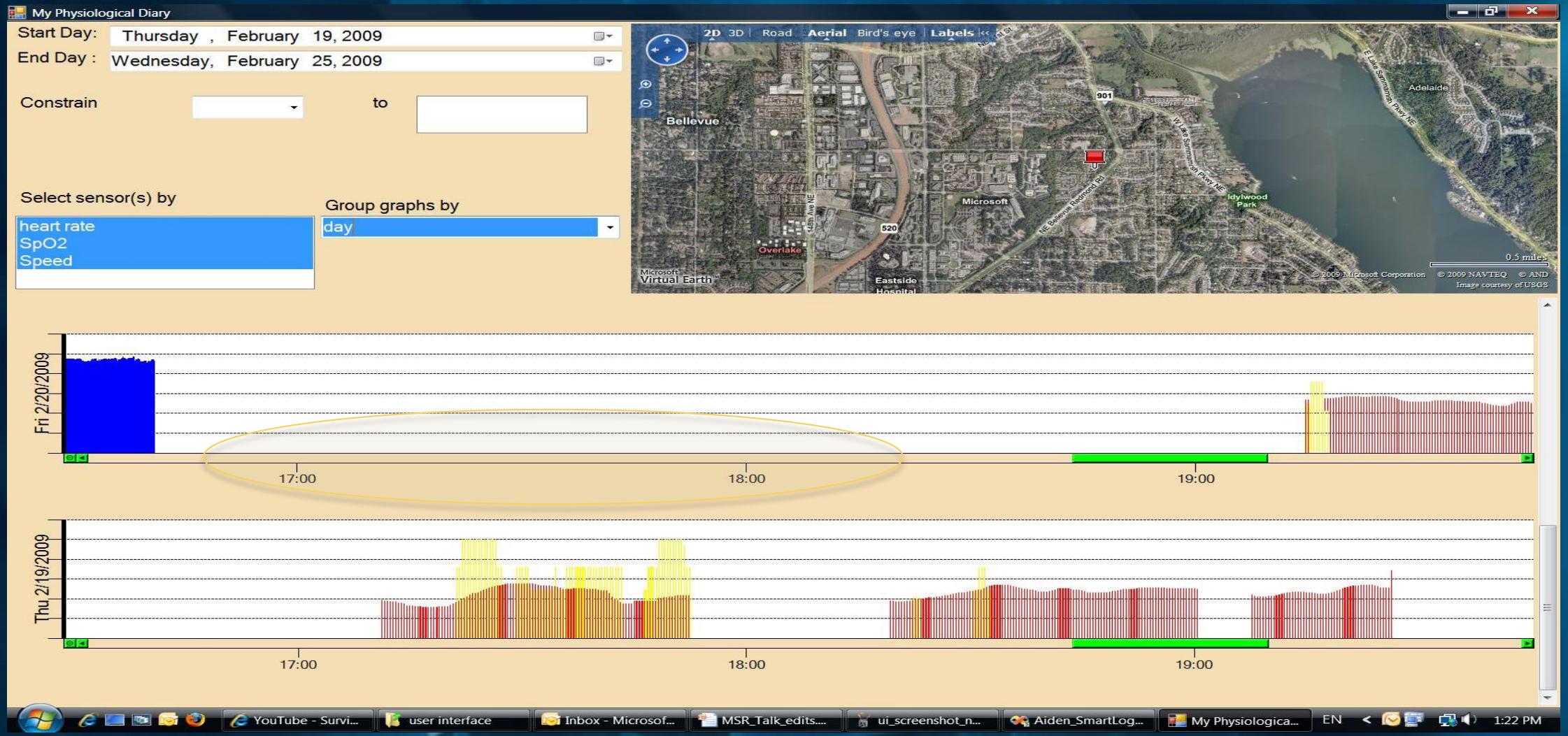

My Physiological Diary: Adaptively Query Based on Time

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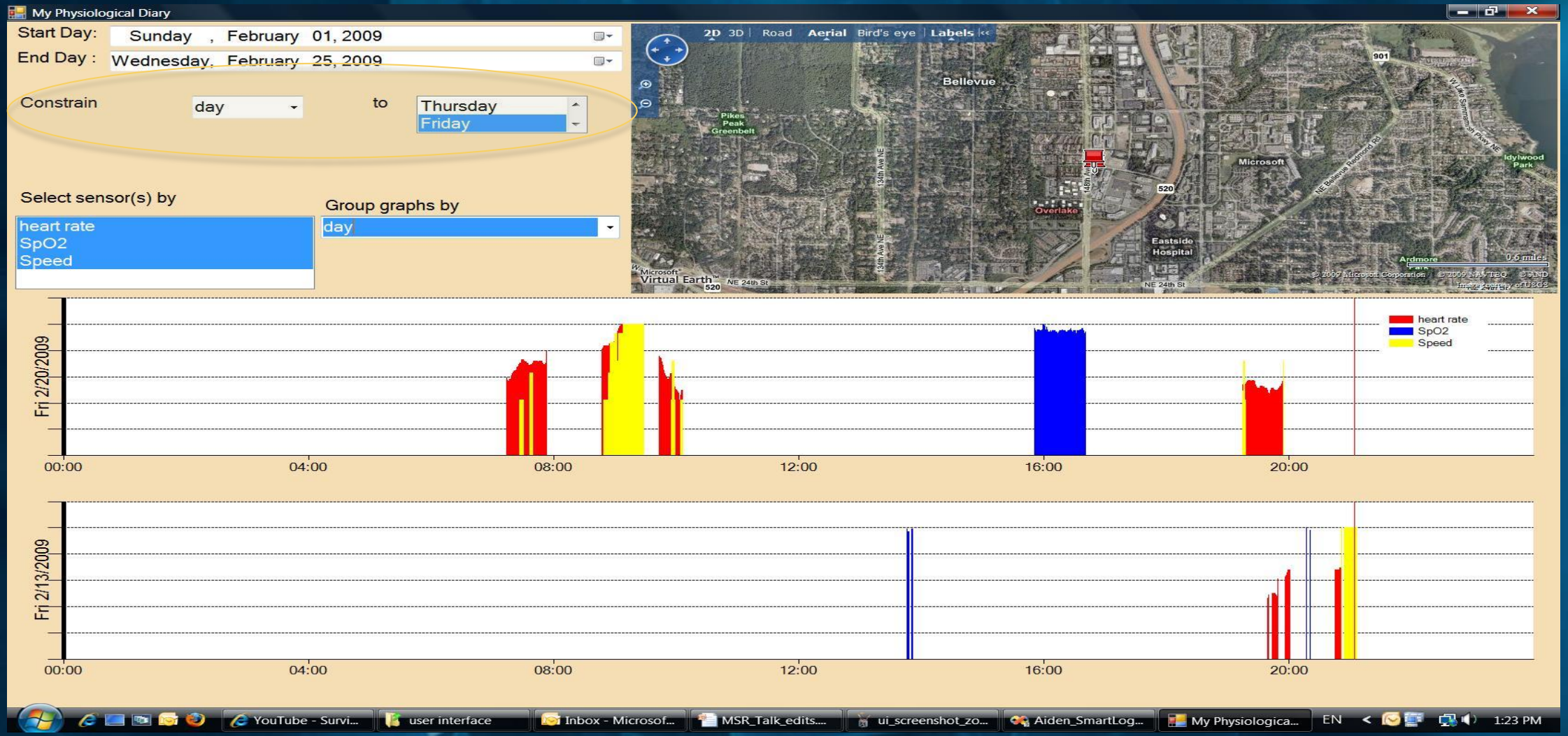

Results

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- Allows sensor device researchers to concentrate on their hardware/chemistry/physics strengths
- Will allow machine learning researchers to easily aggregate data to apply their techniques
- Will allow health conscious individuals to more easily make sense of the data they've been collecting

Use Case – Sleep Apnea

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- 12 million people in USA have sleep apnea
- Process of diagnosis can involve going to “sleep lab”
- In preliminary discussions with Sleep Disorders Center in UW Medical School

Device Details

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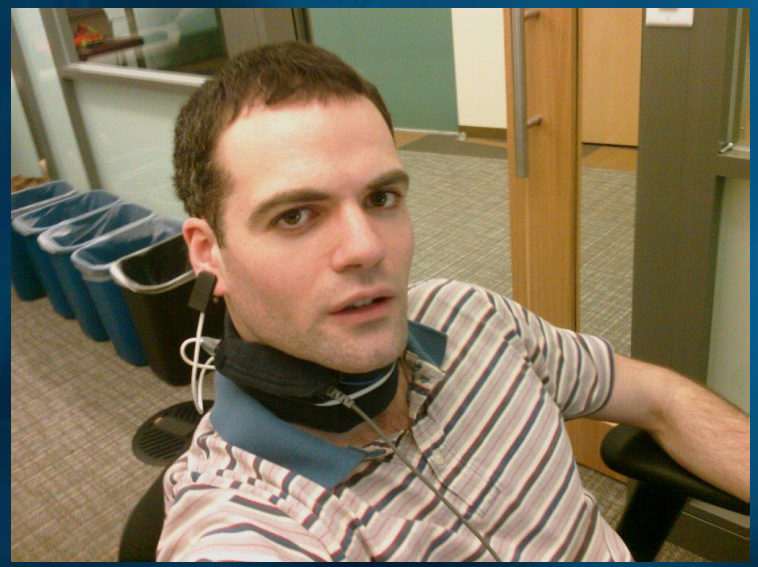
- Sleep apnea neck cuff
- Sensors:
  - Pulse oximeter, 3D accelerometer, microphone (breath sounds and pulse), & galvanized skin response
  - Considering EEG
  - All Bluetooth enabled



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Future Directions

Future challenge – Security

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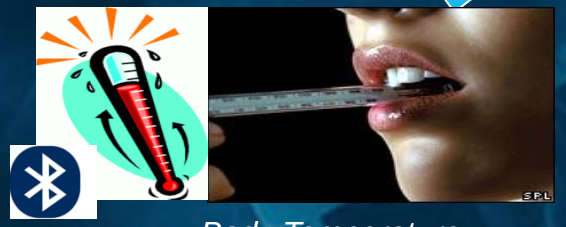
Heart Rate

Location

Images



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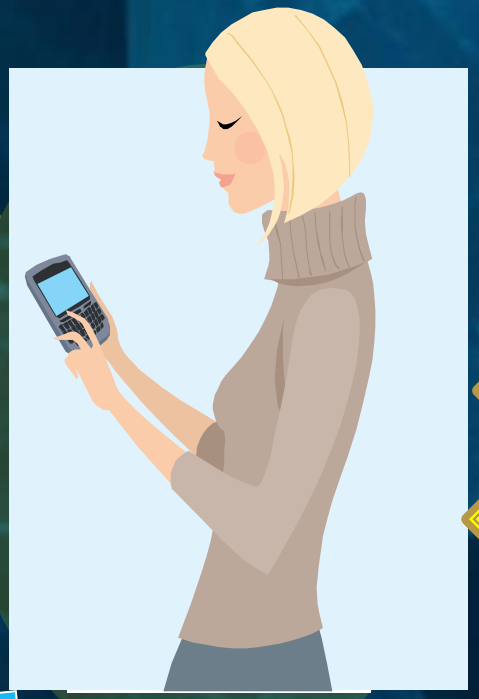

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Data Store

Future – Health Vault

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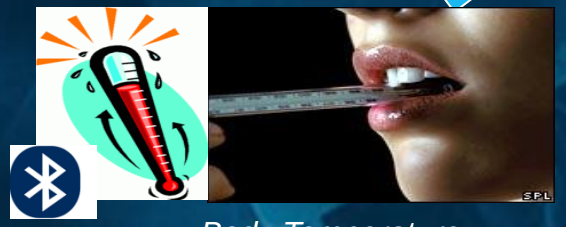
Heart Rate

Location

Images



Body Temperature

Cellular
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Data Store

Future – Symptom detection

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Hear

Lo

Data Store

Body Temperature

Future – Zigbee

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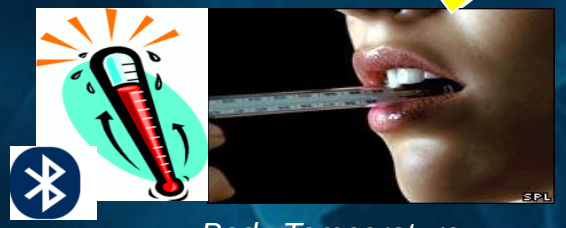
Heart Rate

Location

Images



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Conclusions

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- Utilising cell phone ubiquity
  - Logging platform on Windows Mobile devices
  - Framework allows easy integration of new BT sensors
- Reviewing physiological values
  - Interface to monitor, analyse & browse through huge volumes of sensor data
  - “Individualize” medical baselines
- Lots of exciting future directions!!!

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Questions?

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