Title
Urban Sensing or Personal and Participatory Sensing

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Publication Date
2009-05-12

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Urban and Participatory Sensing Overview

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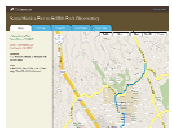
Urban Sensing | CENS - http://urban.cens.ucla.edu & REMAP - http://remap.ucla.edu

Introduction: Networks of Phones Make the Invisible Visible

For a better environment, community and personal health





PEIR
Personal Environmental Impact Report.

Spotlight
To raise awareness of personal resource consumption.

Surya
Track outcomes of the switch to clean-cooking technologies in N. India.

Biketastic
To characterize and share bicycle commuting data.

GarbageWatch
To coordinate community data collection around important issues.

HABwatch
Raising awareness of Harmful Algal Blooms.

AndWellness
To track and manage your eating patterns.

Ambulation
to detect significant variations in daily activity patterns.

Our principles, problems, and proposed solutions

Privacy is important

• Individuals should be able to control their time/space accountability.

• Our Personal Data Vault (PVD) will support individual privacy, help document data ownership, and provide visibility for data processing and inferences.

•Within the PDV, The TraceAudit logs and reveals all activities on the data. Adaptive filters dynamically resample data feeds to selectively share data with service providers.

Ethics beyond privacy

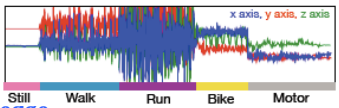
• Values such as consent, equity and openness also matter in urban sensing. An ongoing ethics project investigates places and spaces where these values can be built into sensing design.

• By consulting with designers, interviewing users, and encouraging reflection on ethics in mobile sensing, social science researchers are exploring how to design urban sensing technologies to meet users' social values.

Richer context information by activity classification

• Processing location trace and accelerometer measurements taken by participants' devices using smart heuristic, HMM and decision tree based algorithms to determine participant activities: still, walking, running, biking, driving, or using public transport.

• On-phone activity classification useful to trigger events to get feedback or prompt user to take action when activity change is detected.



Local knowledge

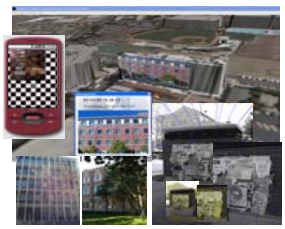
• **Remapping-LA :** engages urban communities in the design of technological systems that express their cultures and identities.



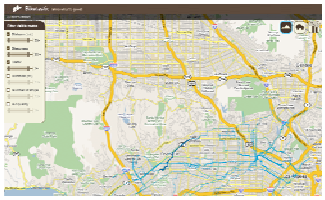
• **GeoSIM**– Social image mapping of urban geolocations.

•Using geotagged images manually captured by mobile phones to document the dynamic urban image in multiple spatial resolutions at different times.

• New development has been made in set cover and orientation based heuristics for efficient selection and assignment of viewports.



• **Biketastic** – A tool that bicyclists can use to keep track of and share their cycling routes.



•As the user bikes, the app gathers location, accelerometer, and noise data to derive elevation, road surface quality information and traffic density.

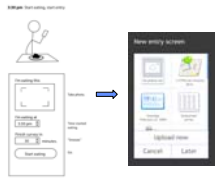
• This allows users to share their biking experience with others, with the goal of helping users find better routes to bike.

Participant comes first

Designing a better user experience by working with users to understand their mobile interactions.

• Built paper prototypes to identify which functions should be available to the user during the fulfillment of tasks.

• Iterated on the UI to present the functions in an accessible and pleasing way, so the user could complete the tasks as easily as possible.



• **Campaign Metrics**– A system to get better feedback from participants to further development, aid in debugging and open up new research questions.

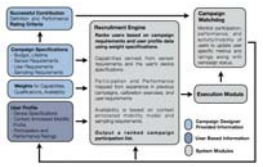
•Standardizing the logging of typical measurements for performance, usability, and user participation to a common format for ease of access, aggregation, and propagation.

•Allow building and reusing widgets and visualizations for many campaigns.

Selecting the best candidates for the job

• Based on the requirements of a campaign, determining the appropriate user base to gather the data required.

• Four pilot campaigns used this system to recruit real world participants: **GarbageWatch, What's Blooming, HABwatch,** and **NetNat**




http://habwatch.org

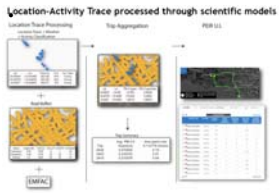
http://networkednaturalist.org/


http://garbagewatch.com


http://whatsbloomin.com/

Merging personal measurements with maps & models

Personal measurements taken by participants using their mobile devices are processed with models and data from web services to give meaning to the measurements.



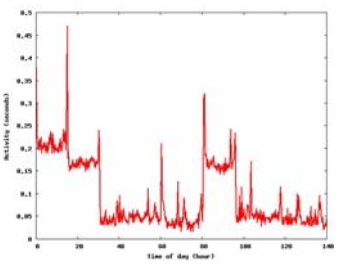
• For example in PEIR a participant's location activity measurements are processed through scientific and GIS models to calculate environmental impact and exposure.

Power does matter after all

• Our experiences with several mobile sensing applications indicate that they reduce phone battery life to less than 12 hours. Such short life is unacceptable to most users.

• We are exploring adaptive power management for mobile phones to help address this challenge.

•We have made some progress in the area of adaptive sampling and upload. These techniques show promise for significant power savings.



We have exploited the idle time model to reduce energy wasted on the screen when the phone is idle.

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