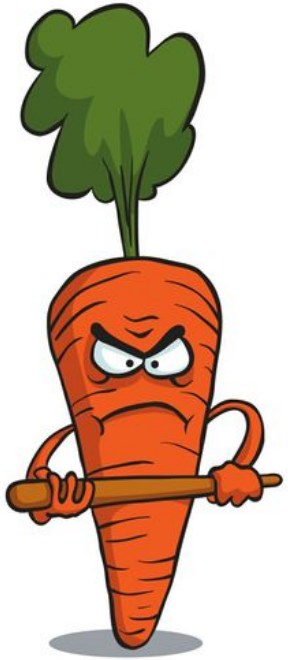
Crowd Soft Control
Moving Beyond the Opportunistic



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User Mobility and Networked Services

- Community sensing
  - Urban monitoring
- Pocket switched networks
  - People as routers in ad-hoc networks
- Mobile content dissemination
  - Content distribution over low power radios

Movement for Coverage

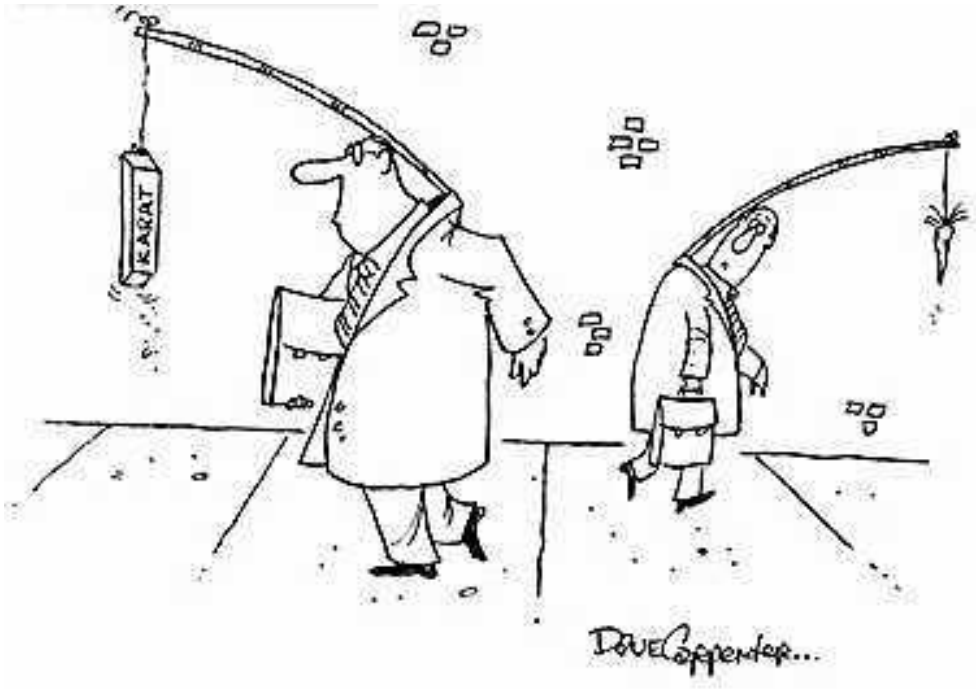
- Application effectiveness is a function of coverage
  - Possible if assuming random movement of users
  - And/or large user populations

- But user populations are never large enough
- People are creatures of habits
  - Limited, predictable routes
- *And we cannot control them!*

Or can we?

Crowd Soft Control

- Using somebody else's carrots to control people's movement
  - Reuse incentives of location-based applications like games and social apps
  - Gain coverage without scale by *soft controlling* users' movements



Whose Carrot?

- Location-based gaming and social networks
  - e.g. Game objective where you want sensing

foursquare

facebook

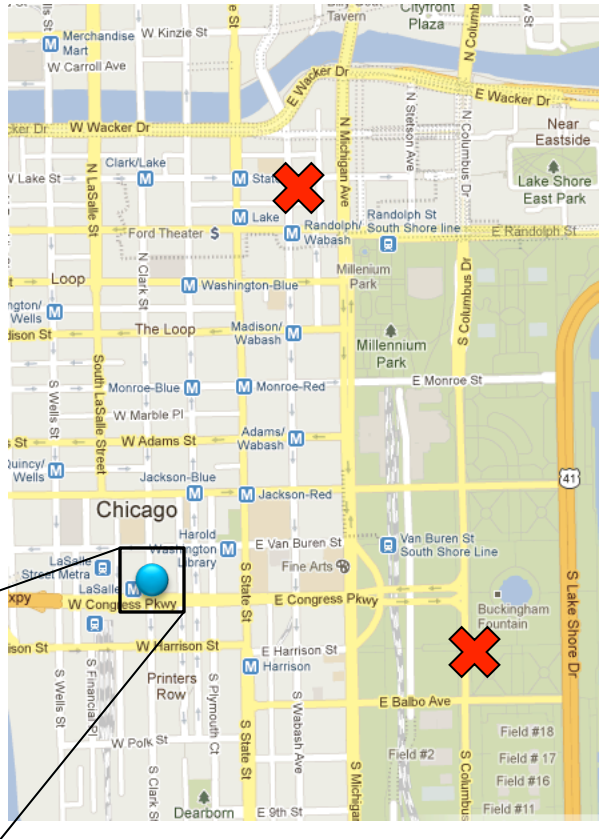
Google latitude

What CSC is not

- Not direct incentive – no $$$ exchange, no shouting at people either
- Not just a game, we are not game developers (yet), the game is an example
- Neither linked to a single game or social network app – one common platform to leverage all

CSC in action

CSC Manager



Network Service

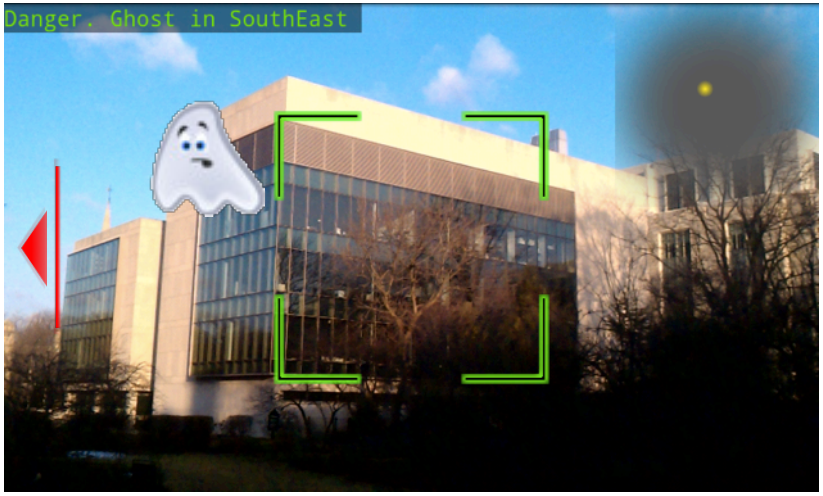
GhostHunter Game
(Location-Based App)

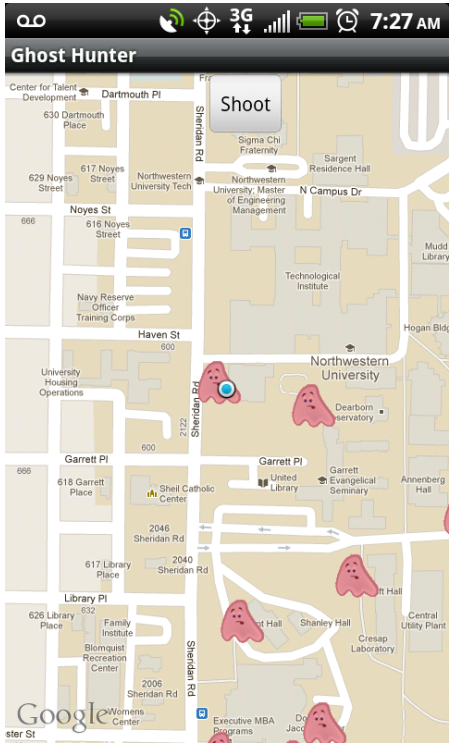
What for?

- Sensing coverage
  - Driving users toward areas in need of sensing
- Ensure connectivity in MANETS
  - Establishing meet-ups between message carriers
- Mobile drop-zone for bulk transfers
  - Lure users toward high bandwidth areas for transfers

A CSC Prototype

- Implementation for Android
- Location-based augmented reality games *GhostHunter* for Android
- Two networked services, one game, one shared platform





Case study evaluation

- Photo hunting used for 3D building reconstruction
- Noise pollution map

- CSC measured through Ghost Hunter game
- Baselines
  - Collected using an opportunistic sensing app for noise
  - Crawled Flickr for photos

Case study: Photo hunting

- Northwestern's Deering Library
- Crawled 152 images from Flickr
  - 138 are of front of building

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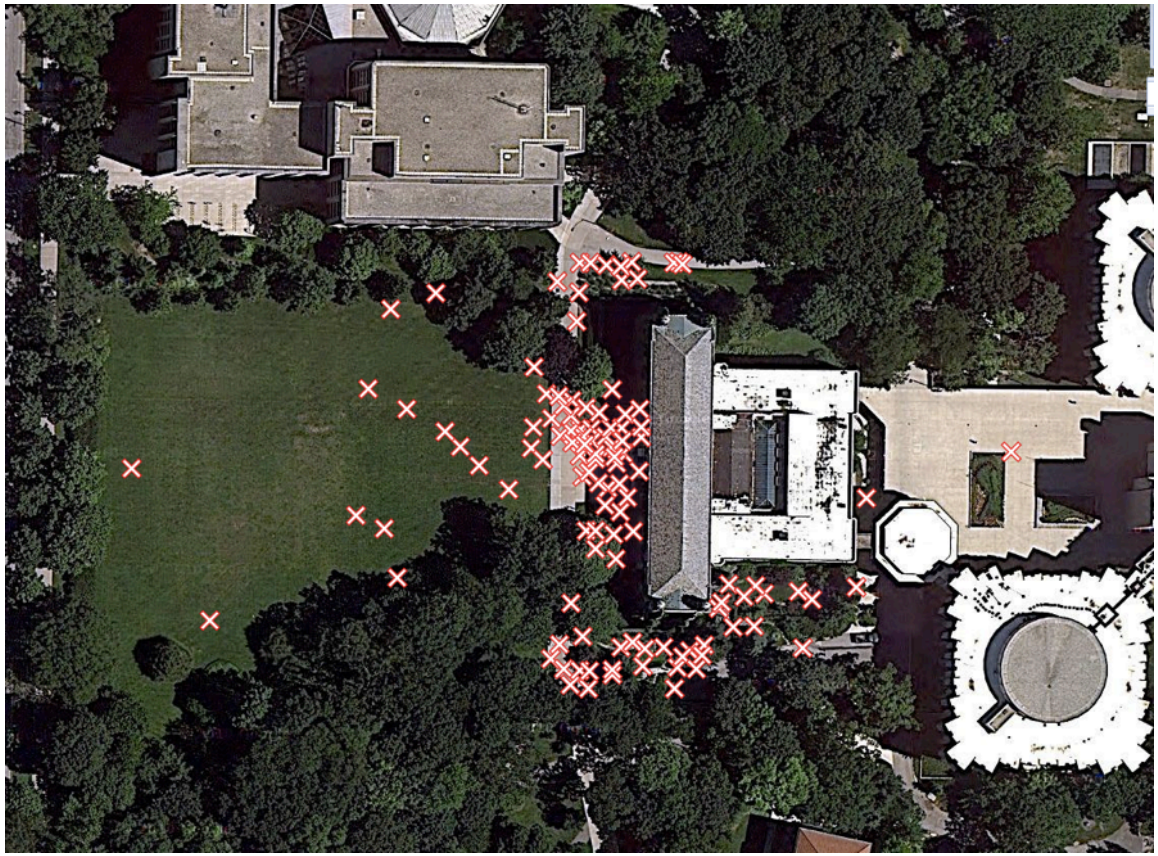

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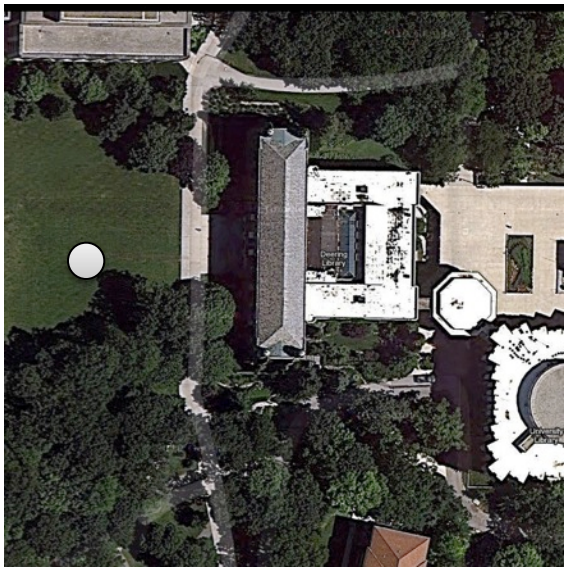

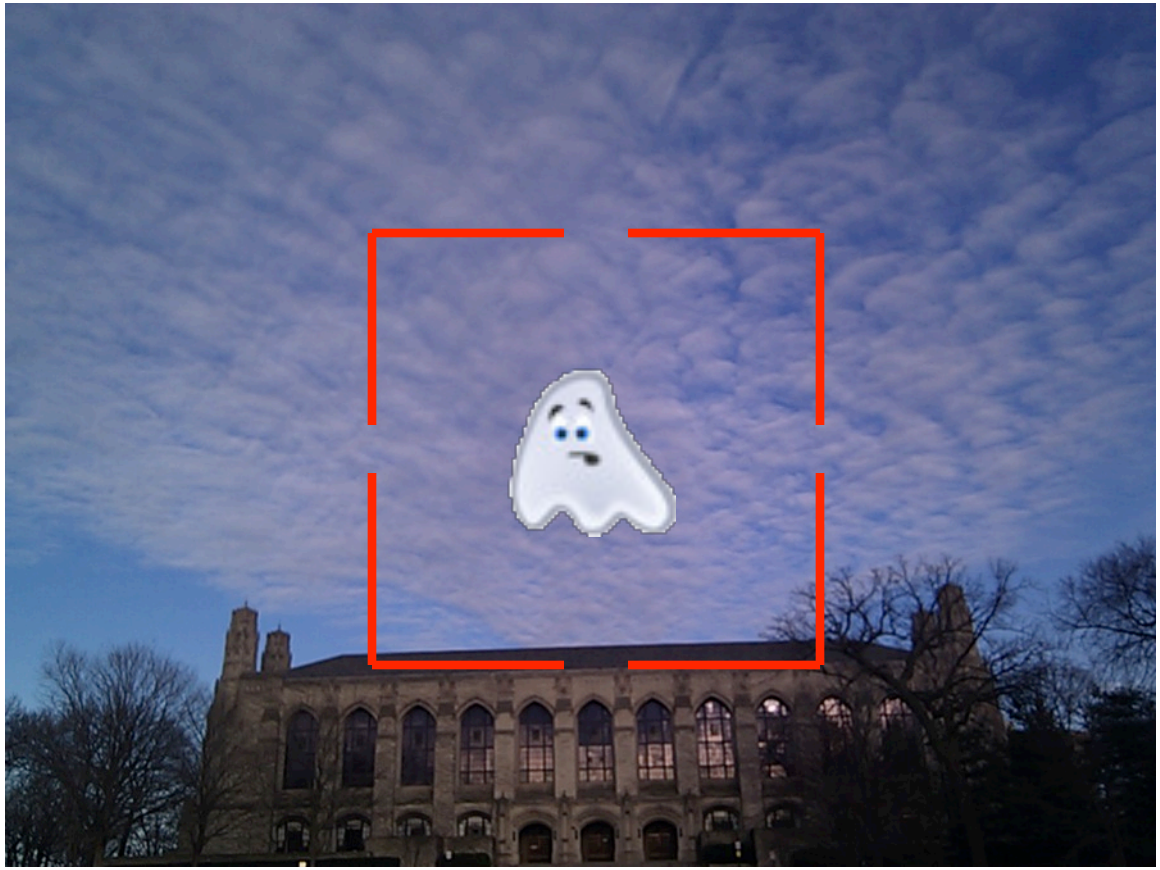

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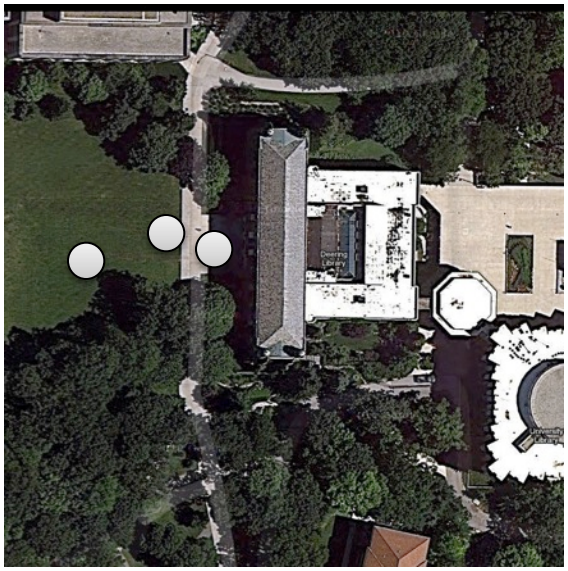

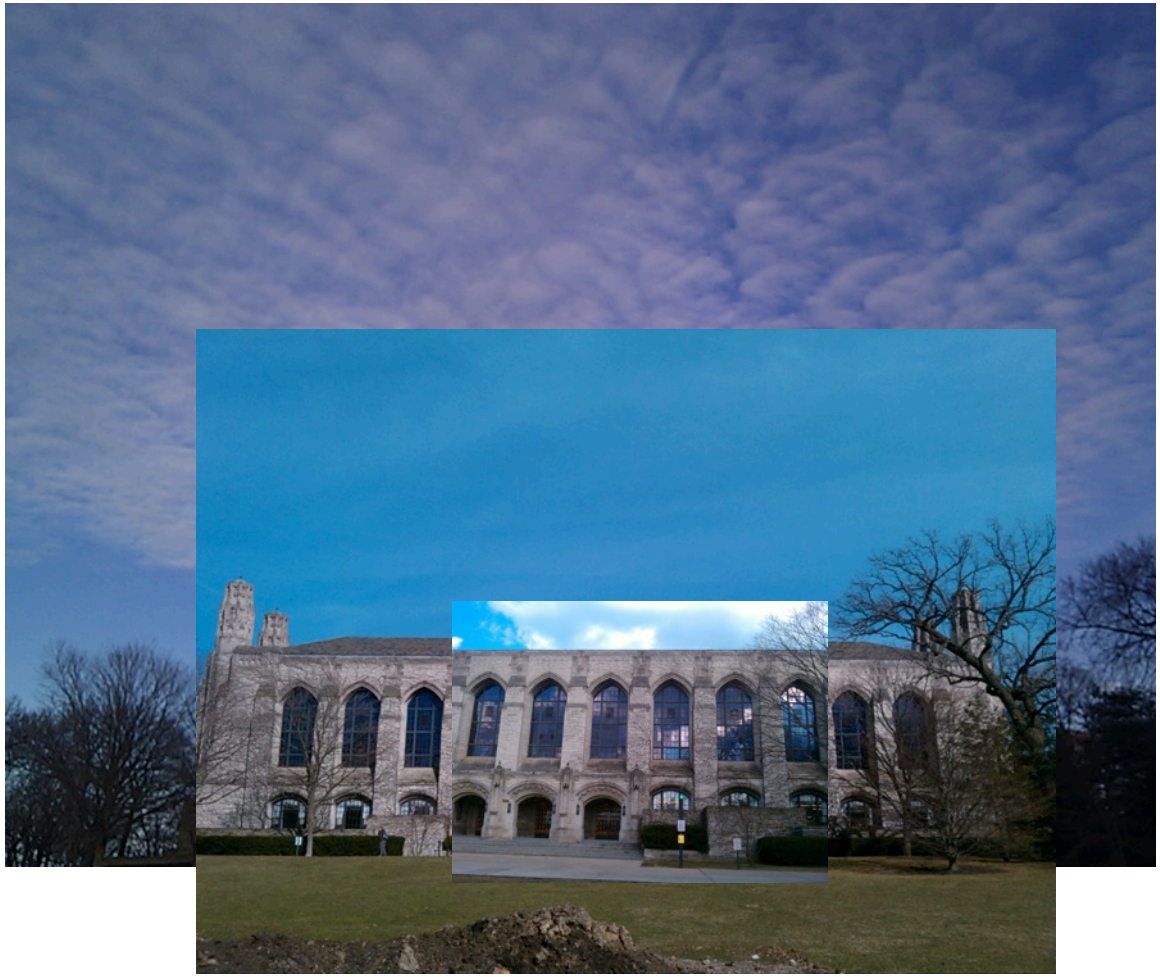

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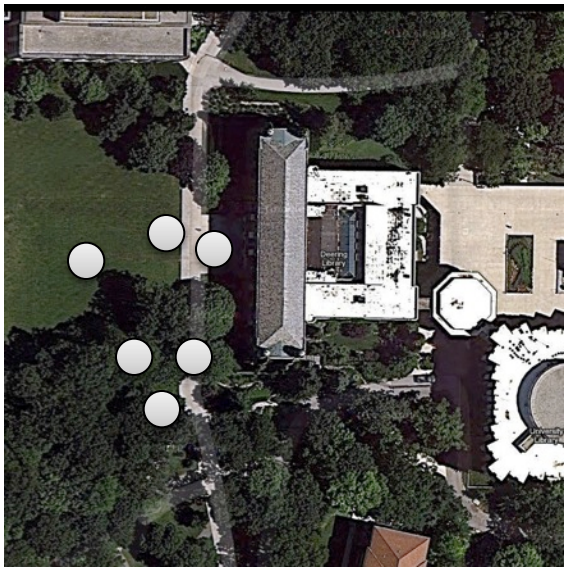

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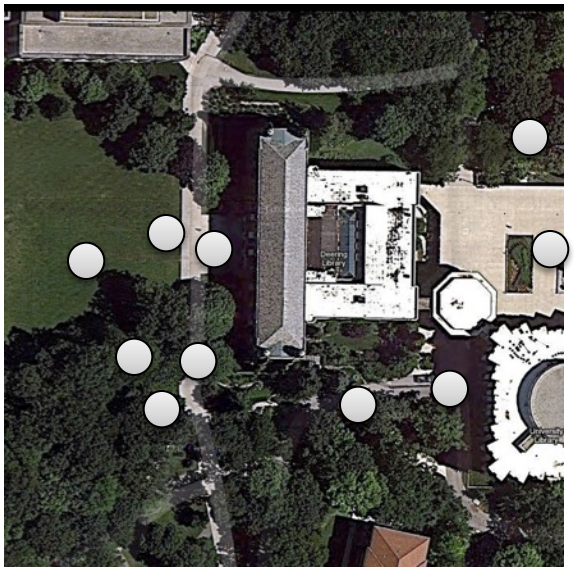

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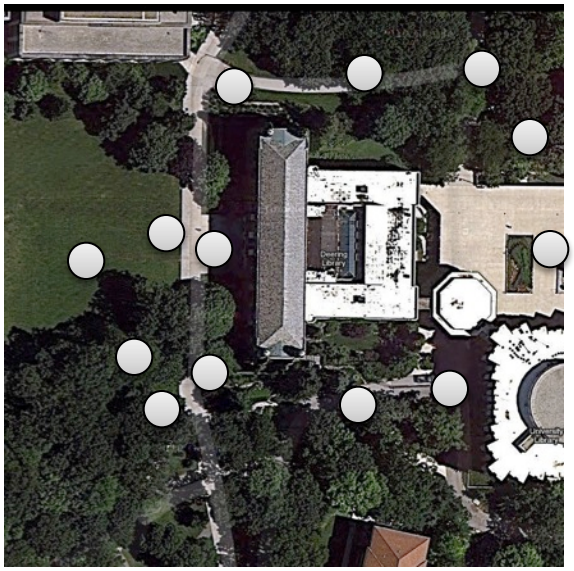

Case Study: Noise map

- Create a map of noise pollution

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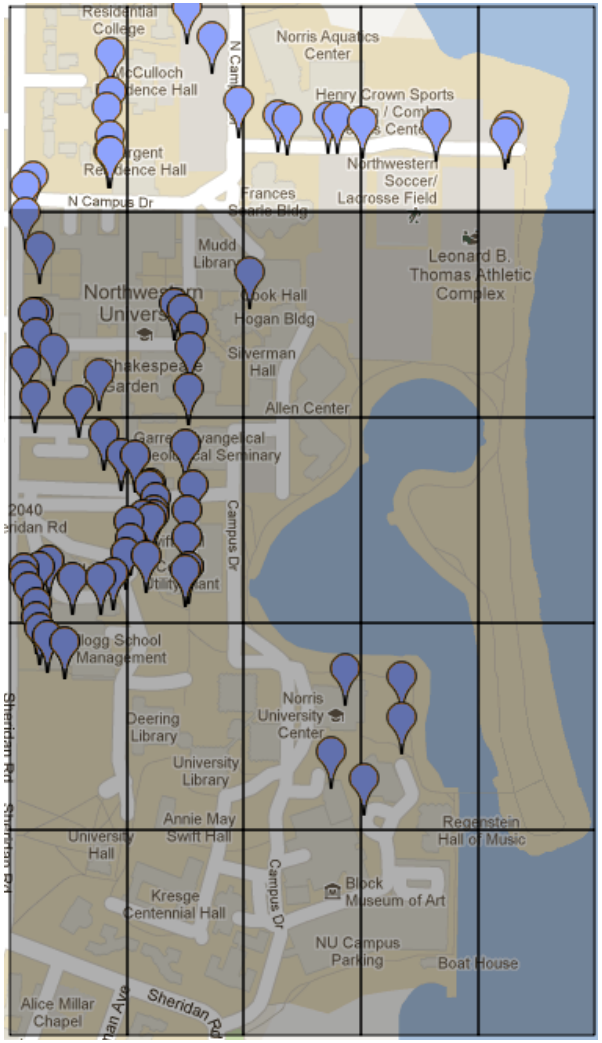
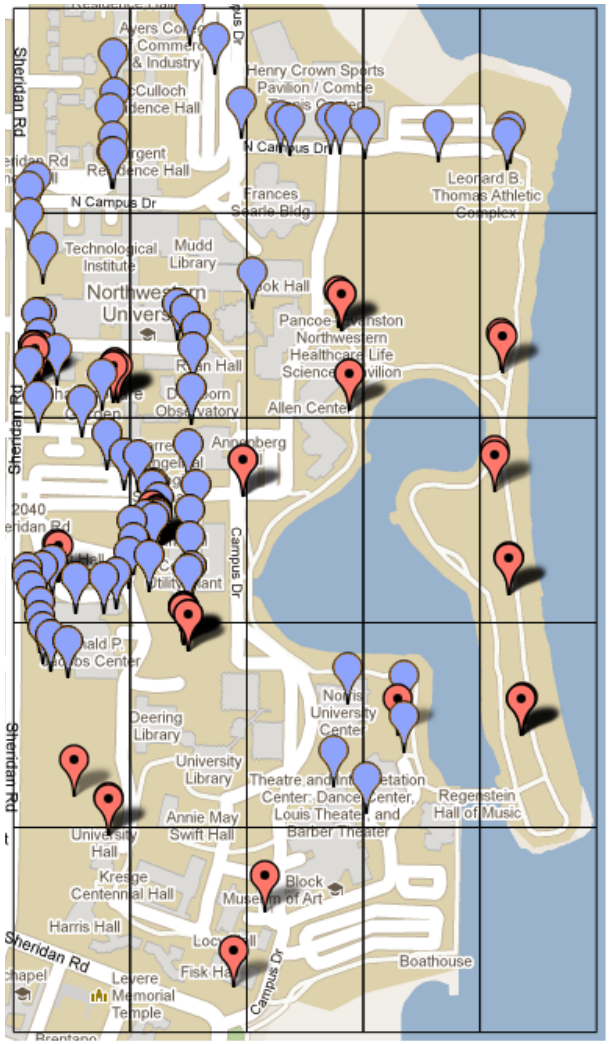
- Measurements along human traffic corridors



Case Study: Noise map

- Create a map of noise pollution
- Measurements along human traffic corridors
- CSC compared against “traditional” opportunistic measurements



Summary and future work

- Crowd soft control
  - Repurposing others' incentives to soft control people's movement
  - To ensure coverage for network services
- Presented preliminary results from two case studies
- Some future work
  - Additional networked services
  - Integrate with popular games and social apps
  - CSC as a shared platform

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Related work

- Predictive approaches
  - Past mobility traces (Reddy et al.)
  - Social network connections (Hui et al., Pietilainen et al.)
  - **CSC provides control without prior knowledge**

- Mobile gaming with a purpose
  - CityExplorer (Matya et al.)
  - PhotoCity (Tuite et al.)

  - **CSC is a framework allowing for multiplexing of networked services**