Mobile Lenses

A Hybrid Approach to Direct Interaction with Maps and Kiosks

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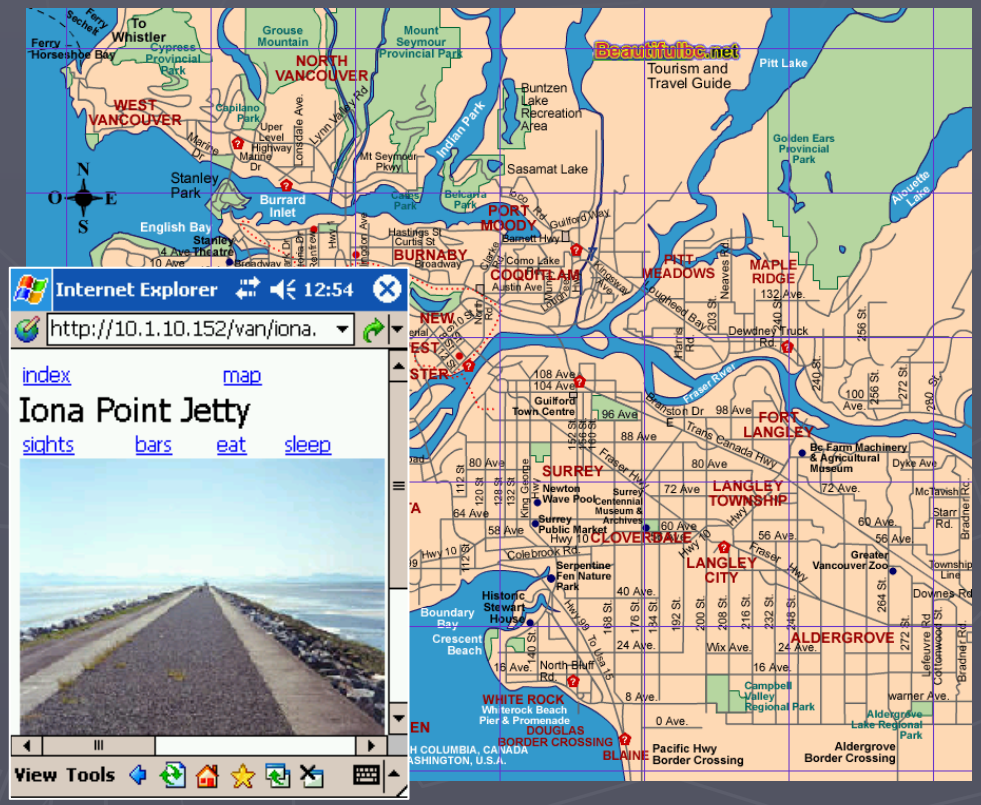
Marked-up Maps

- Continue to use paper maps when mobile, for survey knowledge
- Link to electronic information through direct interaction

Previous Work

- Point-and-click hyperlinking

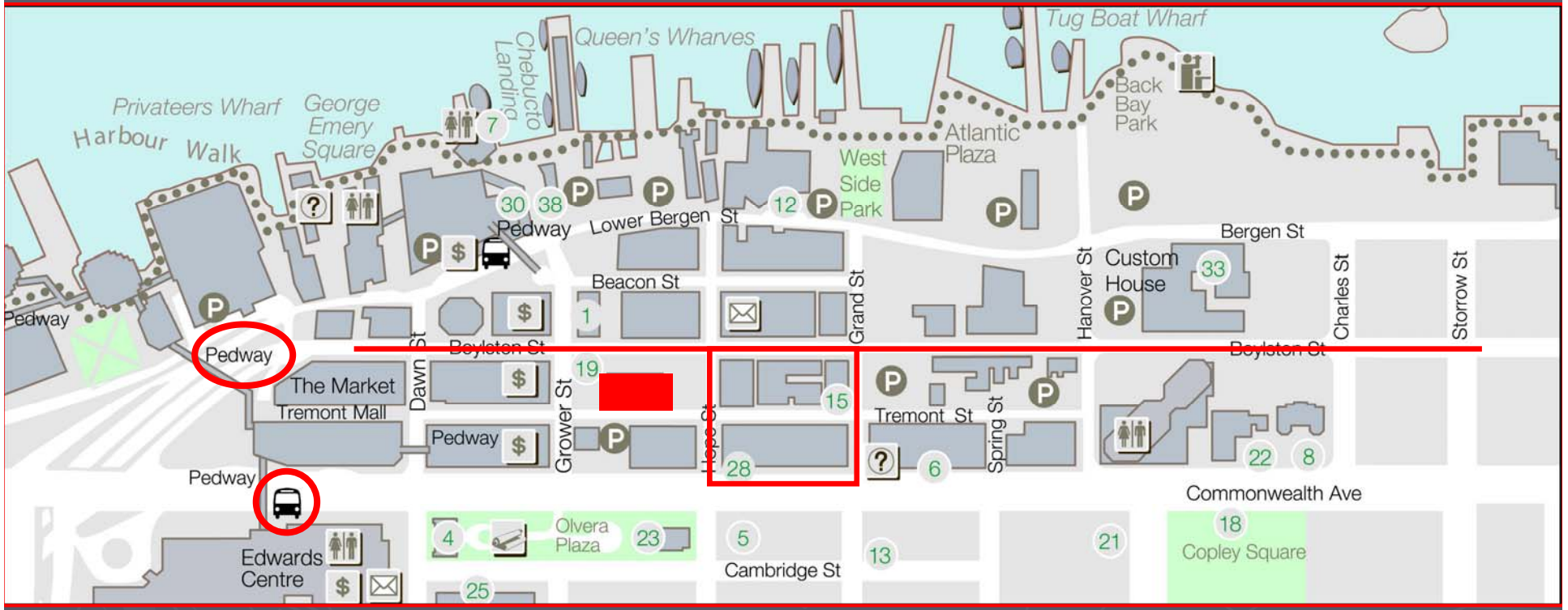


“Make-believe” study

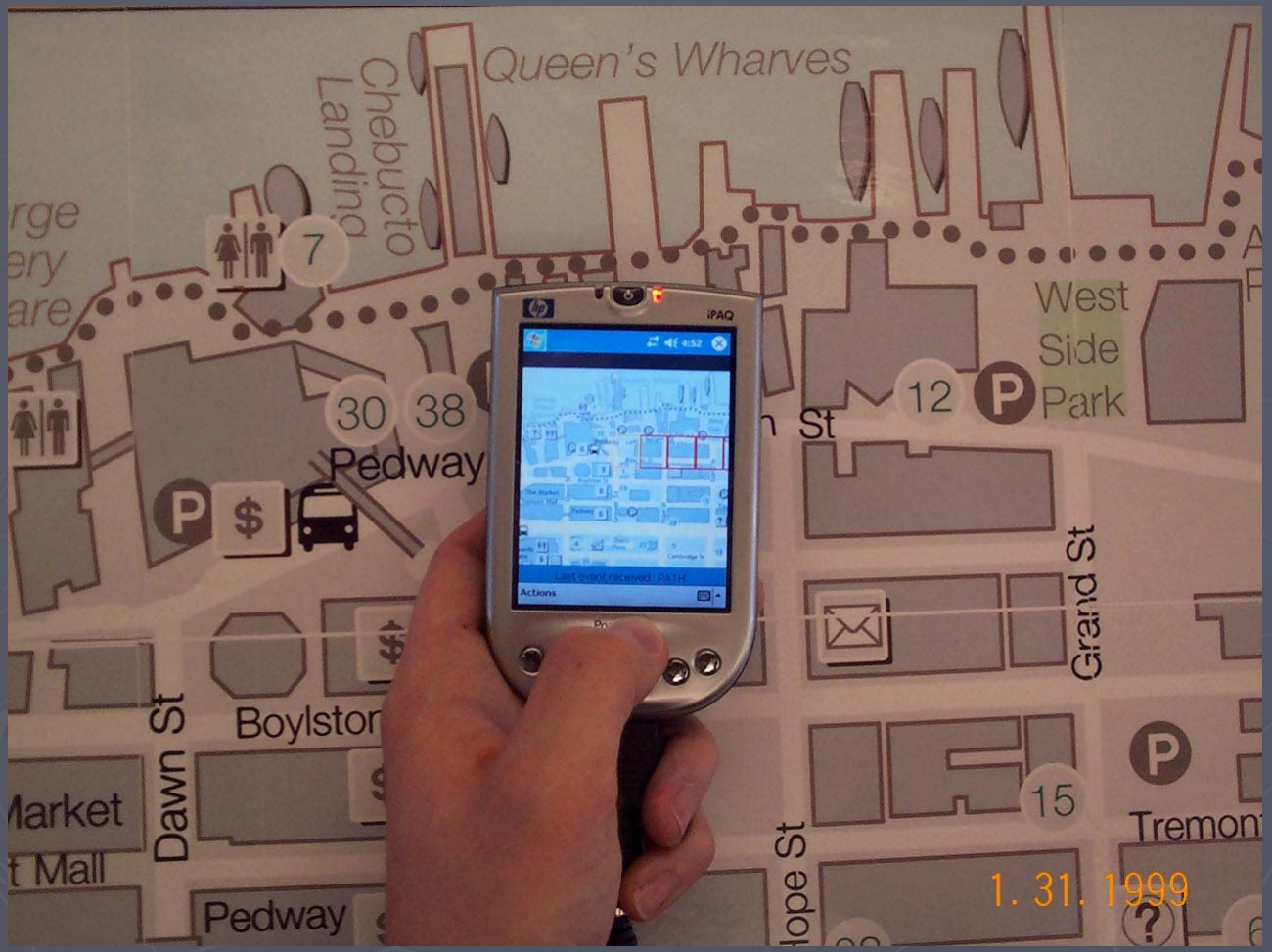
- Intended to help drive prototype design
- Informal, 7 participants
- Given mobile phone or PDA, **turned off**
- Presented with three maps
- Asked to envision interaction

- ***Almost exclusively point and click interaction envisioned***
- ***Expect lots of interaction with device interface***

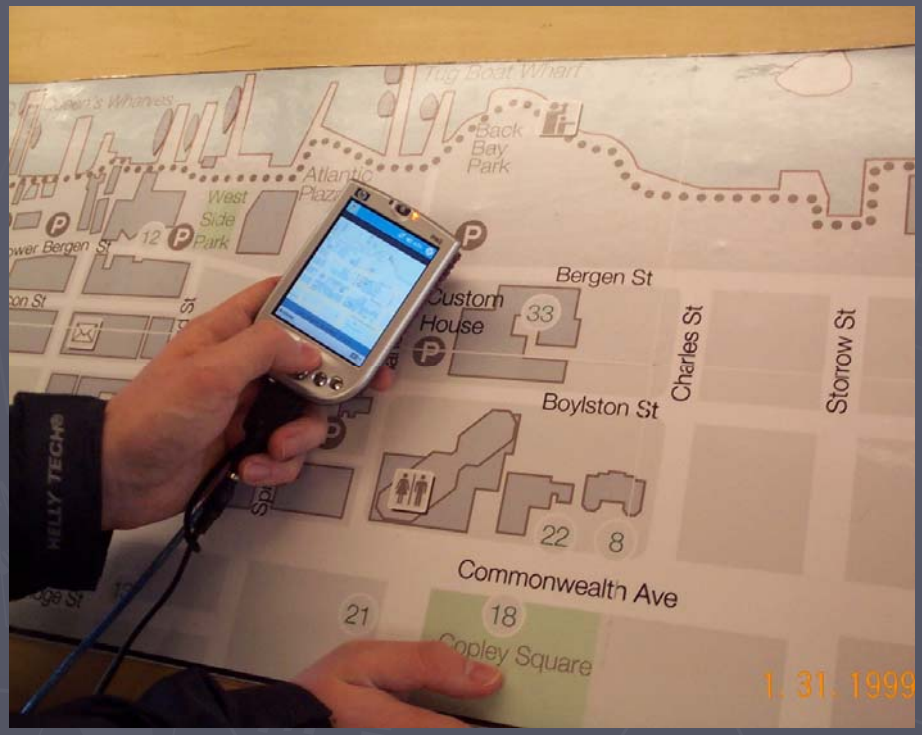
Additional Techniques



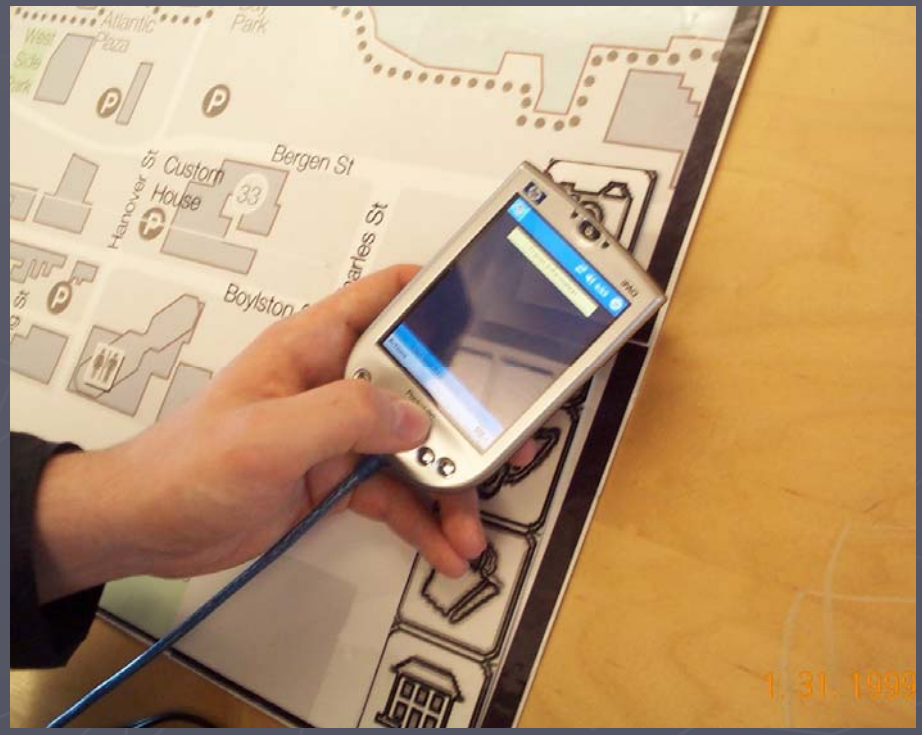
Functional Prototype design



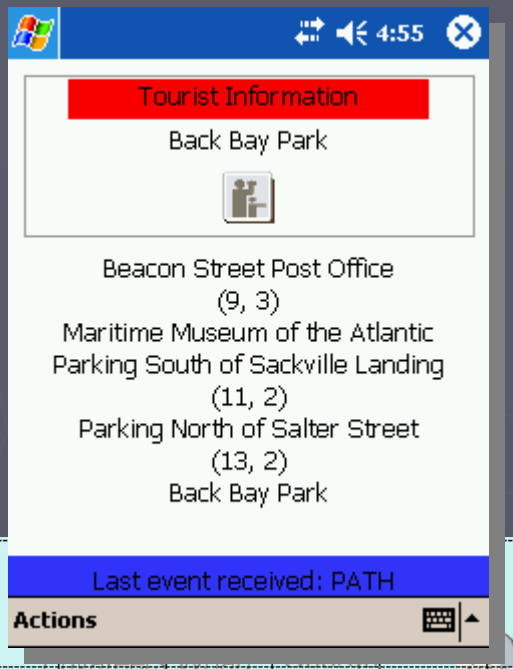
Functional Prototype design



Express queries directly



Paper menu controls



RFID Granularity is limiting

Possible improvements

- Increase pointing resolution
- Permit lens functionality
  - Requires precise location and orientation, track movement

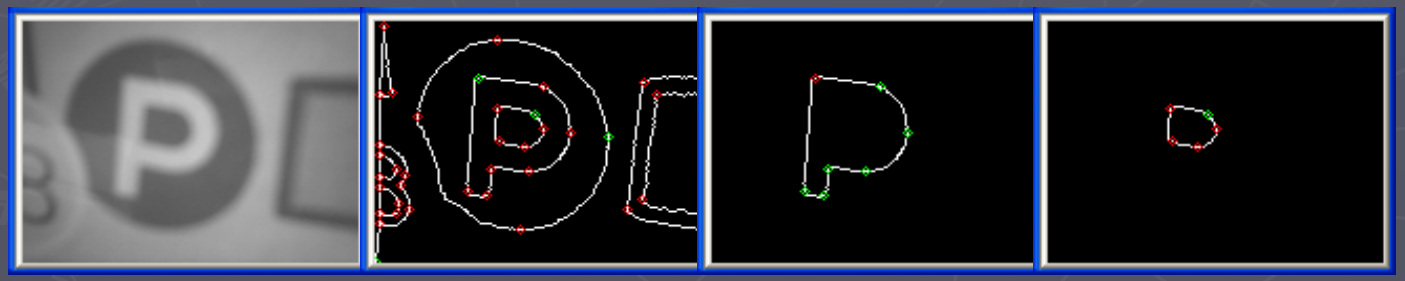
	Resolution	Orientation	Distance	Motion
RFID	Coarse	No	Partial	Yes (coarse)
Vision	Fine* ^	Yes	Yes*	Theoretically.
RFID+Vision	**Fine***	Yes	Yes*	**Yes...**

* Depends on resolution of image

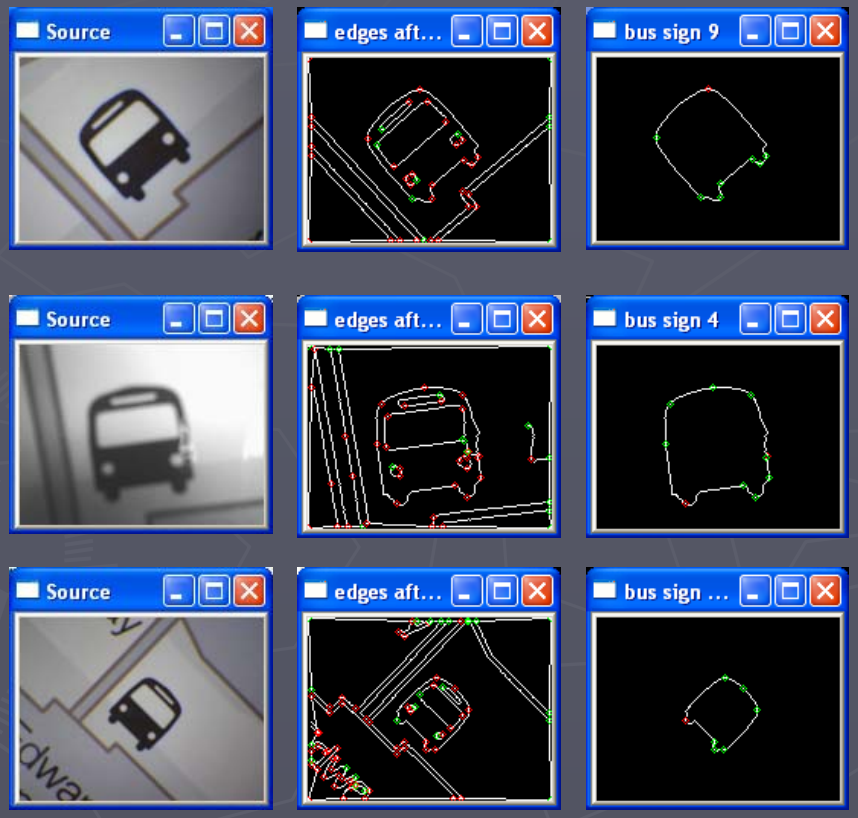
^ Depends on ability to determine location from sample image

Using Icon Recognition

- Generic Edge Tokens (GETs)



Method is rotation-independent



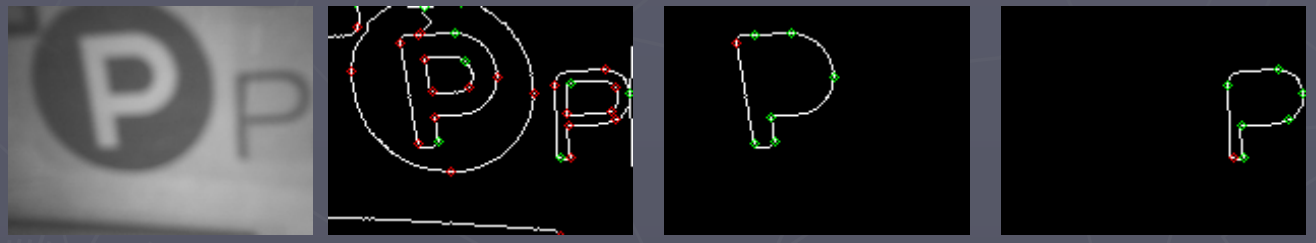
Rotation =320.91

Rotation=352.24

Rotation=41.82

Issues

- False positives



- Missed icons

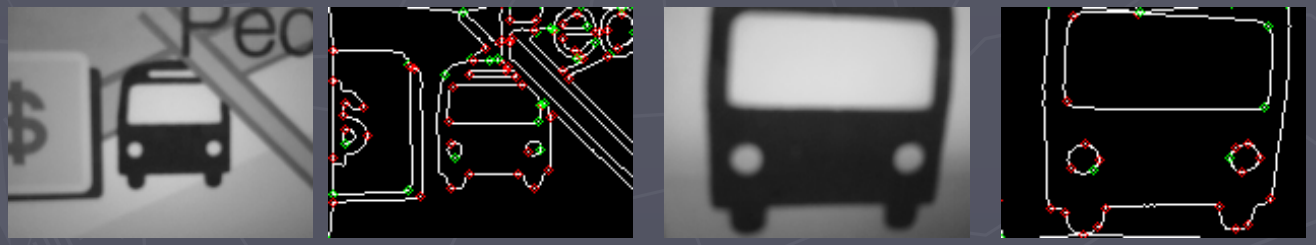


Image Testing Sets

- Base set
- Rotation
- Distance
- Lighting

Testing Results

Image Set	$N_{correct}$	N_{recog}	N_{all}	*recall*	*precision*
Base image	19	20	20	95%	95%
1 (rotation)	9	9	10	90%	100%
2 (distance)	8	9	10	80%	89.9%
3 (lighting)	38	39	42	90.5%	97.2%

Resolving icons to map locations

- Relative placement to other icons
  - Must be within range of camera
  - Must find a set of relations that uniquely determines *which* icon is being recognized
- By giving a course position, RFID grid can reduce space of possibilities

Questions?