Augmented Citizen : supporting cadastral surveying activities

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The Information Science Institute

- 30 staff members, 6 research laboratories
- Active in basic and applied research, technology transfer, creativity and teaching
- Domains of expertise include : 3D virtual environments, geo-related technologies, services for seniors, services for mobile users, predictive analytics, trust and security
- We currently participate in 12 research projects (EU/Swiss funding) being the leader of 4 projects

Change of Paradigm in citizen behavior

From

Passive services' and information consumer

to

Active services' and information provider

Citizen participation in Cadastral surveying

- Why?
  - Costs for updating the cadaster is very high for both, citizens and state
  - Time for introducing cadastral changes is too long
  - Need to valorize the cadastral data available to the public

The CitiGeo project

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra
Commission pour la technologie et l'innovation CTI

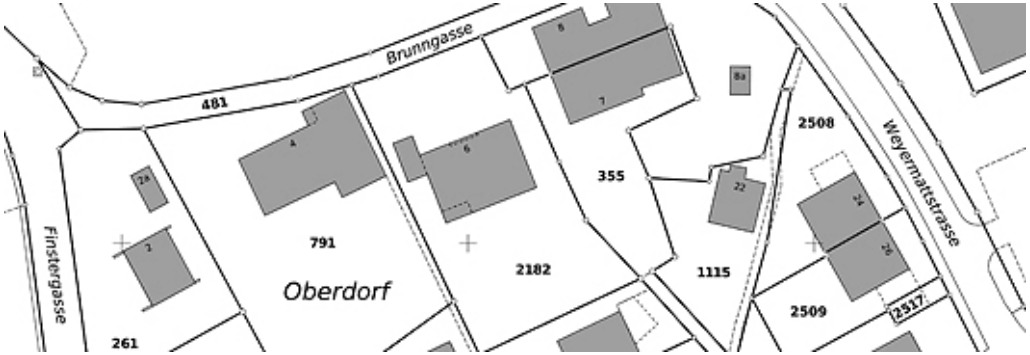
Put the power of Photogrammetry to the hands of the citizens

CitiGeo Partners

- University of Geneva
- Direction de la mensuration officielle
- Arx iT SA
- Federal Office of Topography ***swisstopo***

The CitiGeo target

Develop a web service allowing citizens to update the cadastral plan of their property by taking (digital) images of the modifications they have made.



Close Range Photogrammetry

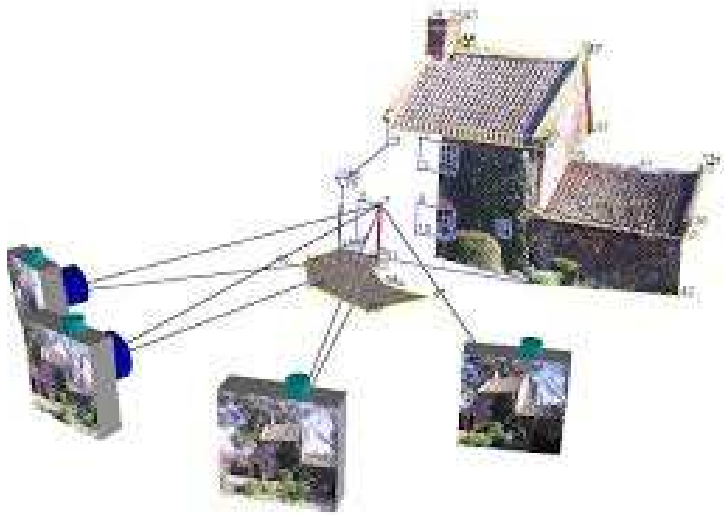
Today:

- Exclusively used by professionals,
- Based on well defined protocols
- Using sophisticated equipment

Close Range Photogrammetry in CitiGeo

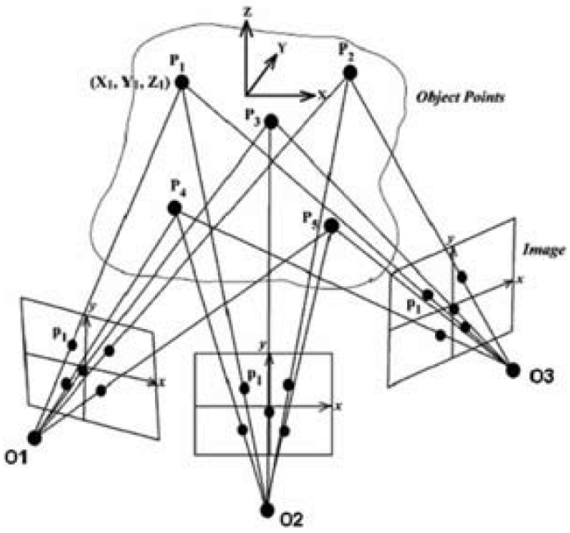
Using consumer level photo cameras:

- Guide the citizen to take digital images of the new construction
- Analyse the images and create the cadastral plan
- Integrate the plan to the official cadaster



The CitiGeo approach

- Based on the known points of the property:
  - Building corners, Windows, ….
- Taking into account the precision of the existing cadastral plan
- Taking into account the quality of the user digital images
- Identify from the user provided digital images the new construction and create automatically the cadastral plan



Research challenges

1. Correlation of the cadaster information with the image and identification of the known points
2. Identification of the new points
3. Extraction of the required measurements with the needed precision

$$\frac{d\beta}{ds} = \frac{1}{\sqrt{(a^2-b^2)\sin^2\omega + (b^2-c^2)\cos^2\beta}} \frac{\sqrt{a^2 - b^2\sin^2\beta - c^2\cos^2\beta}}{\sqrt{b^2\sin^2\beta + c^2\cos^2\beta}}$$

$$\frac{d\omega}{ds} = \frac{1}{\sqrt{(a^2-b^2)\sin^2\omega + (b^2-c^2)\cos^2\beta}} \frac{\sqrt{a^2\sin^2\omega + b^2\cos^2\omega - c^2}}{\sqrt{a^2\sin^2\omega + b^2\cos^2\omega}}$$

$$\frac{d\alpha}{ds} = \frac{1}{((a^2-b^2)\sin^2\omega + (b^2-c^2)\cos^2\beta)^{3/2}} \times$$

$$\left(\frac{(a^2-b^2)\cos\omega\sin\omega\sqrt{a^2\sin^2\omega + b^2\cos^2\omega - c^2}}{\sqrt{a^2\sin^2\omega + b^2\cos^2\omega}} \cos\alpha \right.$$

$$\left. + \frac{(b^2-c^2)\cos\beta\sin\beta\sqrt{a^2 - b^2\sin^2\beta - c^2\cos^2\beta}}{\sqrt{b^2\sin^2\beta + c^2\cos^2\beta}} \sin\alpha \right).$$

The CitiGeo Service

- Web based service with simple User interface
- Property identification in the cadaster
- Extraction of reduced set cadaster information
- Selection of type of construction
- Basic editor for indication of aprox. location of new construction
- Calculation of optimal points for images (range, angle, point of view …)

The CitiGeo Service (2)

- Visual instructions to the user
- Image quality control (resolution, focus, luminosity, etc)
- Calculation of the points
- Creation of the cadastral plan

Major issues of the service

- Precision of the cadaster information
- Lack of reference points
- Bad image quality
- Undeclared constructions
- Legal obligations
- Differences between cantonal cadastrer data

Time Plan

- 18 month project
- Started March 1st 2015
- Complete functioning prototype after 12 months
- Trials with real users

Other usages and future directions

- Ephemeral constructions
- Used by the land surveyor for public constructions
- Mobile telephone version
- Other services for citizens (ex. reduced mobility guidance)
- Automatic cadaster plan creation
- GPS information integration
- Integration of 3D photo cameras


Q&A
How
When
Why
What
Where