Applications and methodologies to collect VGI in various contexts

Sylvain Bouveret, Paule-Annick Davoine, Philippe Genoud, Jérôme Gensel, Marlène Villanova-Oliver

Grenoble Computer Science Laboratory (LIG), STeamer Research Group
Grenoble, France

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Isibat: a Web and Wireless Application for Collecting Urban Data about Seismic Risk

Paule-Annick Davoine ¹, Jérôme Gensel ¹, Philippe Gueguen ²

¹Grenoble Computer Science Laboratory (LIG), STeamer Research Group
²Earth Sciences Institute & IFSTTAR, Risques Research Team
Grenoble, France

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The Urbasis (URBan SeISmology) Project

- Seismologist, geophysicists, specialists in signal processing, computer scientists

Funded by the French National Research Agency (2010-2014)

General Objective: increasing knowledge about urban seismic risk by proposing innovating methods for assessing seismic vulnerability and seismic damages

- Vulnerability: pre-seismic period
- Damages: post-seismic period
Seismic vulnerability and damage evaluation is based on the European Macroseismic Scale EMS-98

Vulnerability parameters

From Parameters to Vulnerability Classes...

Damage observations → classifications of damage
Methods for Evaluating Seismic Risk

• **Vulnerability**: various methods based on Structural Parameters analysis of the Buildings (Radius, Hazus, Risk-UE)

• **Damage**: Visual auscultation of the urban buildings

• Limitations of these Methods
  – Difficult to get a fine-grain knowledge at the building scale
    • Few information on the structures parameters into geographical databases
  – Methods of both approaches rely on the In-situ data collect and the processing (analysis) of a large amount of data at the building scale

→ Expensive in time and human resources
To collect at lower cost a lot of data about structural parameters at the building scale, we have to propose using Web and Wireless Technologies for Collecting (and Analyzing) Data about Building Seismic Vulnerability and Damage.
Objectives

• Develop a mobile application for collecting in situ seismic data about vulnerability and about damage
• Develop a Web application that displays and extracts data collected about seismic vulnerability or seismic damage at the city scale for analysis purpose
Citizen Seismology concept

• Involving citizens and using them as a primary source of information (Bossu & al, 2010)
  – Euro-Mediterranean Seismology Centre provide a first estimation of the seismic intensity from citizen contributions (testimonies on the seismic events and the description of damages)

• More and more people have a smartphone and could contribute to a seismic inventory of urban buildings...

• More and more people could contribute to both the estimation
  – of the pre-seismic vulnerability
  – of the post-seismic damage
ISIBAT: a Client/Server Application for Collecting Urban Data about Seismic Risk

- **Client**: a mobile application for producing a seismic inventory of urban buildings
  - Need to capture the building location and to enter observable data about building design

- **Server**: a Web application for storing and visualizing collected seismic data
Isibat: Overview and principle

Isibat Mobile

http://urbasis.liglab.fr/isibatonline/

Isibat Online

Citizen

Collect / Integration

Preparation

Down / Up load data

Isibat Online

Analysis

Expert

Validation

Dissemination

General public

Raw or public data

Synthesis

Expert

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Constraints and Specifications

- The nature of data raises various problems
  - Some **look intuitive**: number of floors, type of roof....
  - But others are more complex: the precision of their description depends on the level of expertise of the contributor.

### Constraints and Specifications

- **“Regular structures” Parameter**
  - What kind of building materials

- **“Regularity in elevation” Parameter**

**Typology of the building**

- **Regular structures**
  - Concrete
  - Masonry
    - Brick
    - Stone
      - Hollow
      - Adobe
      - Rough
      - Hallow

- **Unregular Structures**
On the Client’s Side (Isibat Mobile)

Back to main menu

Add a photo

Add a voice memo

List of media files

Building name

Add a text comment

Show location

Edit the structure of the building

Edit a damage level

Edit the parameters vulnerability/damage

Listen/read/watch
On the Client’s Side (Isibat Mobile)

- Data entry screens

Vulnerability mode

Damage mode
• Data entry screens

Edition of basic parameters

Access to expert levels

Help example
On the Client’s Side (Isibat Mobile)

- Mapping components

1. Drag and drop to modify the building’s location

2. Name of the study
   - Back
   - Add one building
   - Edit/display building’s data
   - Center the map of the user’s location
   - Switch to map/satellite view

Center the map on the set of buildings

studied buildings
On the Server’s Side (Isibat Online)

Visualization through a Web Interface
• **Isibat: a Web and Wireless Application for Collecting Urban Data about Seismic Risk**
  
  – **IsibatMobile**: mobile client application (available on iPhone or iPad) that guides in an intuitive and interactive way contributors while collecting seismic data in pre-seismic and post-seismic periods
  
  – **IsibatOnLine**: Web server application that manages data collected with IsibatMobile
    
    • Dynamic and interactive cartographic components: access to collected data and multi-criteria querying of surveyed areas

• **2 case studies**
  
  – Evaluation of the seismic vulnerability in the city of Grenoble
  
  – Evaluation of the seismic damage caused by the 2012 earthquake in the Ferrara region (North of Italy)

• **Usable by non expert users, but it still raises some questions about data validation in term of protocol.**
Recitoire: a tool for qualitative surveys involving citizens in urban planning projects

Marlène Villanova-Oliver, Jérôme Gensel, David Noël

Grenoble Computer Science Laboratory (LIG), STeamer Research Group
Grenoble, France

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The FABTER project

- At the beginning, Recitoire is a request from urban planners
- Difficulty to involve citizens in urban planning project
- Difficulty to collect qualitative data in situ
Recitoire Application : case study

• A municipality wants to measure the interest of a new pedestrian area
• Realization of a diagnostic about how people perceive their environment
• Thanks to the mobile application of Recitoire the residents can give (record) their emotions passing through this area
Recitoire : mobile application for collecting media data
Recitoire application allows to design narrative scenario from the collected tracks and the recordings of contributors.
Récitoire: Web application for storing and visualizing collected urban narrative
Visualisation interface

- Extract data from mobile devices
  - Easily achievable by connecting the phone to a computer
First Tests

- Students of Urbanism Institute of Grenoble
- Citizens encountered during the Experimenta exhibition
  - Ease of use highlighted
  - Telling a story is considered as useful but not always easy
  - Suggestions for adding features
- We are currently conducting tests with experts
Future Work

Propose more advanced functionalities on the server side
- According to the tests results with the experts
- For the creation of a report

- Explore the possibility to create surveys at larger scales
  - In terms of number of respondents
  - In terms of territory

- Offer more facilities to deal with the time dimension
Isibat and Recitoire are proofs of concept...
→ towards a generic framework for designing and building client/server applications for ubiquitous and guided data collect/survey conducted by citizens

But some questions remain

→ how to take into account the questions about data quality, data validation and also data completeness to get enough data to conduct analysis (critical amount of data) ?
→ how to propose an intelligent data collect ?
→ how to encourage the collect according various contexts ?
Thank for your attention

Sylvain Bouveret, Paule-Annick Davoine, Jérôme Gensel, Philippe Gueguen, Marlène Villanova-Oliver

http://urbasis.liglab.fr/isibatonline/
Contact.Steamer@imag.fr
Enhancing the OSM tagging system with an OWL ontology

Sylvain Bouveret, Philippe Genoud

Grenoble Computer Science Laboratory (LIG), STeamer Research Group
Grenoble, France

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OSM data model : Geospatial elements

Three basic components in OSM from which everything else is defined.

- **Node**: *a geographical point defined by a latitude and longitude (using WGS84 coordinate system)*
- **Way**: *an ordered list of nodes*
  - open ways → linear features (roads, railways ...)
  - closed ways → areas (building, field, ...)
- **Relation**: *an ordered list of nodes, ways and/or other relations which can have a specific role to describe their function within the relation*

- each geospatial element has a unique numeric identifier : OSM ID
Description elements (tags) can be associated to geospatial elements to give them some meaning (used to display elements with different styles or to do analysis that relies on the attributes of features)

- **Tag**: a key-value pair. A key and a value are both free format textual fields (Unicode strings up to 255 char).

  - A tag is usually represented in a text as "<key>=<value>"

ex: tags for "Palais des sports":
    building=yes
    leisure=sport_centre
    ...
OSM data model: Description elements

- The use of keys and values is not restricted
  - allows the database to contain unlimited data about its geospatial elements

- The community agrees on certain key and value combinations for tags that are informal standards (OSM wiki Map Features)

<table>
<thead>
<tr>
<th>Key</th>
<th>Value</th>
<th>Element</th>
<th>Comment</th>
<th>Rendering</th>
<th>Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>amenity</td>
<td>place_of_worship</td>
<td>🕊️</td>
<td>A church, mosque, or temple, etc. Note that you also need religion=<em>, usually denomination=</em>, and preferably name=* as well as amenity=place_of_worship. See the article for details.</td>
<td>🤖️</td>
<td>🏛️</td>
</tr>
</tbody>
</table>
OSM data model: Description elements

• Unrestricted OSM free tagging system led to:
  – Typos in tags
  – Inconsistent Descriptions (Distinct tags: 76 M)
  – No relations between Tags
  – Outdated tags are used

• How to solve this?
  – express some knowledge about tags in a formal way that can be used by programs
  – use an OWL Ontology
Methodological proposal

• Mapping from OWL to OSM
  – through AnnotationProperties
    (isDefinedByOsmTag, isDefinedByOsmKey...)
  – can be applied on both:
    • Concepts
    • Properties

• Concepts description
  – through class definitions (union, intersection, properties restrictions)

  ▶ Concept as a Property Restriction
    Example: Church \equiv Building \cap (\forall \ hasDenomination ChristianDenomination) \cup (\forall \ hasReligion Christianity))

  ▶ Concept as a union or intersection of other concepts
    Example: BakeryBuilding \equiv Bakery \cap Building

  ![Diagram showing mapping from OWL to OSM through AnnotationProperties]

  “Une habitation individuelle occupe par une famille ou un petit groupe partageant certainsquipements comme une cuisine.”
Use cases for the Ontology

• The OWL ontology can then be used for
  – Tag guidance
    • What kind of tags exist to describe buildings?
    • What tags/key are needed to completely describe a school?

```sparql
SELECT ?relatedKeys
WHERE
{
  ?relatedProperties :isDefinedByOsmKey ?relatedKeys.
  ?concept :isDefinedByOsmTag ?tag.
  FILTER (str(?tag) = "building=school")
}
```

– Classifying multiple tags as more complex concepts
  • What do the tags “building=yes” and “shop=bakery” represent in our ontology?

```sparql
SELECT ?x
WHERE
{
  ?c1 :isDefinedByOsmTag ?name1.
  FILTER (str(?name1) = "building=yes")
  ?c2 :isDefinedByOsmTag ?name2.
  FILTER (str(?name2) = "shop=bakery")
}
```

?relatedKeys
addr:housenumber
addr:street
addr:postcode
name
contact:phone
contact:website
...

?x
BakeryBuilding
This research is just beginning

contacts

Sylvain Bouveret, Philippe Genoud

{Prenom.Nom}@imag.fr
Thank for your attention

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Architecture Isibat

Database: PostGreSQL + PostGIS
Technologies

• Isibat Mobile
  – Apple Technologies
  – Xcode Development Framework
  – Objective C
  – MapKit Framework for interactive maps
  – CoreLocation Framework for geolocation

• Isibat Online
  – Web Toolkit (GWT)
  – Google or OSM background map
Techonologies Recitoire

Client Application
- Android mobile application
- OSMDroid

Server application
- Symfony2 web application
- OpenLayers
- Google Street View and Hyperlapse
- D3.js

OpenStreetMap