The Coudenberg Heritage Building Information System

Roland Billen, 18/06/2020
1. Geomatics Unit

2. Coudenberg Heritage Building IS – Phase 1
   • Project description
   • Global approach
   • User requirement analysis
   • Conceptual design level
   • Design and implementation level
   • Usability evaluation

3. Perspectives - Phase 2

4. Conclusions
Geomatics Unit

http://geomatics.ulg.ac.be

Faculty of Sciences / Dept. Geography / ~ 20 staff members
• 10 years of interaction with archaeologists
e-thesaurus – médiation holographique 3D – Pierre Hallot
Coudenberg HeBIS - Phase 1
The Coudenberg archaeological site presents the remains of the palace of the Dukes of Brabant, destroyed by a fire in 1731 during the reign of Marie-Elisabeth of Austria, the Governess of the Netherlands.
Call for tender

- **COUD 2017-01**
  - Get an accurate 3D model of the site
  - Manage archeological information in an Archeological Information System (AIS)
  - Link between the 3D model and the AIS

*Exiguous spaces / dark places*

*Heterogeneous set of data*

*Duration*

5 months
June 18 – Oct. 18
Global Approach

- A methodology...

<table>
<thead>
<tr>
<th>Quality criteria (inspired by ISO 9126)</th>
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</thead>
<tbody>
<tr>
<td>• Functionality</td>
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<tr>
<td>• Reliability</td>
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<tr>
<td>• Usability</td>
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<tr>
<td>• Efficiency</td>
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<td>• Maintainability</td>
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<td>• Portability</td>
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Information System

- Point Clouds
  - Interfaces
  - DBMS
  - Data

Human-centred design for interactive systems (inspired by 9241-210:2019)

User Centred
- User Requirements Analysis
- Conceptual Design
- Design and Prototyping
- Usability Evaluation
- Implementation and Maintenance
Global Approach

- A Meta model...
Detailed specifications (functionalities and data)
Conceptual design level

Specifications

Conceptual data model

Databases

Interfaces

3D data

Semantic data

Time data

Unstructured data

Usage

Developers only

Users and developers

Users only
Conceptual Data Model
Conceptual design level

Conceptual Data Model
Information System Structure
Design and implementation level

Conceptual data model → Interfaces → Specifications → Databases → Usage

Specifications:
- Interfaces
- Databases

3D data
- Semantic data
- Time data
- Unstructured data

Permissions:
- Developers only
- Users and developers
- Users only
Information System Architecture
• Linking 3D models and DBs
Design and implementation level

User

Semantic interface

Point cloud interface

Search

Objects Visualisation

Creation/ modification

Creation/ modification

Objects Visualisation

Point cloud Visualisation

Semantic objects

Spatial objects

Fusion

Geographic objects

Semantic select

Insert/ Update

Spatial select

Insert/ Update

Semantic database

Spatial database

Point cloud data
Design and implementation level

Data acquisition

- 24,315,758,526 points / 12,000 photos / 17 stations / 110 scans (25 min/scan)
- 34 man-day (acquisition)
Design and implementation level

Data acquisition
• Training sessions / feedback
Usability evaluation

- Semantic Interface
Usability evaluation

• 3D Interface
Usability evaluation
<table>
<thead>
<tr>
<th>USERS</th>
<th>DESIGNERS</th>
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</table>
• Phase 2 – started in May 2020 – on process...
### Perspectives

- **IS – phase 2?**

<table>
<thead>
<tr>
<th>Client Layer</th>
<th>Application Layer</th>
<th>Data Layer</th>
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</thead>
<tbody>
<tr>
<td>Point cloud interface</td>
<td>Geographic objects management</td>
<td>Point Cloud database</td>
</tr>
<tr>
<td>Spatial interface</td>
<td></td>
<td>Spatial database</td>
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<tr>
<td>Semantic interface</td>
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<td>Semantic database</td>
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</tbody>
</table>
• Future IS?

**Perspectives**
• Enhanced CDM?

Geometry
Function
Time

version
Event

Episode
Life Map

Source
Interpretative Sequence

Historical Object

MIDM – Muriel Van Ruymbeke
• Interpretative sequence by author 1

- **EP-V3.1**
  - House
  - 5th c AD

- **EP-V3.2**
  - P. Of Worship
  - 5th c AD

- **EP-V4**
  - extension
  - 6th – 7th c AD

- **EP-V5**
  - Relics’s acquisition
  - 860

- **EP-V6**
  - Church
  - End of 9th c.

- **EP-V1**
  - Church with tower
  - 1091

- **EP-V2**
  - Gothic choir
  - 1520

- **EP-V1**
  - Church
  - 1175

- **EP-E1**
  - Relics’s acquisition
  - 860

- **EP-E2**
  - Norman’s destruction
  - 881
Perspectives

- Interpretative sequence by author 2
• Life Map
Perspectives

- Enhanced CDM?

MIDM mapping to CIDOC CRM
• Smart Point Cloud (Florent Poux)
• **Smart Point Cloud (Florent Poux)**

Diagram showing the components of a Smart Point Cloud system, including:

- Parsing Module
- Point Cloud Database Module
- Classification Module
- Language and query processor module
- Reasoner module
- Visualisation & Interaction

The diagram illustrates the flow of information between these modules, indicating relationships and interactions within the system.
Perspectives

- VR in Point Cloud
Conclusions

• High challenging project for a University lab
  → Real scale experience!

• « Collaborative » IS design approach
  → Requires interdisciplinarity

• Such IS needs to be open and maintainable
  • Fast growing acquisition techniques
  • Fast growing IT solutions

• Huge change of paradigm for Heritage experts
References


Forthcoming

• *Marker-less mobile augmented reality application for massive 3D point clouds and semantics, KHARROUBI, Abderrazzaq; Billen, Roland; Poux, Florent*

• *HeBIS-PC An Heritage Building Information System based on Point Cloud Data*
Thanks for your attention

Prof. R. Billen  Prof. P. Hallot  Dr. P-H. Lefebvre  Dr. C. Dubois  Dr. F. Poux  Dr. J-P. Kasprzyk

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