

An Integrated ICT Architecture for Intelligent Content Harmonization in European Cultural Heritage Domain

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Abstract: Cultural heritage is a wide concept that includes not only monuments, architecture and history (tangibles) but also languages, folklore, traditions, events, music, festivities, customs and life styles (intangibles). The combination between tangible and intangible heritage represents the richness of a specific place therefore the identity of local communities has to be preserved and promoted in order to enhance the benefits for the tourist locality and its customers - visitors, citizens, and businesses, in the general perspective of sustaining multiple cultural identities. The main objective of this research is to develop a novel ICT integrated and participatory system for the cultural heritage destination that can preserve and promote European cultural heritage from its diverse aspects - tangible and intangible - with the objective of experiencing all aspects of the visit and above all, to add value to the cultural heritage itself by the interpretation and valorisation of the cultural goods. The system makes use of Web 2.0 key concepts, such as user-generated content and folksonomies, as a baseline.

1. Introduction

Cultural heritage can be understood as a wide concept that includes not only monuments, architecture and history (tangible goods) but also languages, folklore, traditions, events, music, songs, dance, festivities, customs and life styles (intangible heritage). The combination between tangible and intangible heritage represents the richness of a specific place and have to be preserved and promoted in order to improve the benefits for the destination and its customers – tourist, citizens and businesses, in a general perspective of sustaining multiple cultural identities. In this aspect, a more comprehensive approach needs to be developed in order to appreciate heritage as a source of cultural identity and diversity, while taking into account the existing interaction between the tangible and intangible heritage of the place. Towards this objective, cities and tourism destinations in Europe need intelligent environments that are able to manage, integrate and harmonise their cultural

heritage knowledge in order to organize distributed and diverse public information on cultural destinations and sites via existing and new e-services.

The main objective of this research is to develop a novel ICT system for the cultural heritage destination that can preserve and promote European cultural heritage from all its dimensions, with the objective of experiencing all details of the visit and above all, to create new values to the cultural heritage itself by the interpretation of the cultural good.

Against these objectives, the current study is multi-disciplinary in nature aiming to valorise the cultural assets as tourism resources through user-friendly and stakeholder-relevant integrated e-services in urban tourist destinations. For this purpose, a new user-centric, integrated and participatory ICT environment is being developed. It can be understood as a distributed repository of cultural heritage intelligent content and a software architecture enabling content interoperability (service-oriented), content customised access and presentation (agent-oriented) providing integrated e-services to European cultural destinations to support the tourism experience life cycle (pre-visit, during visit and post-visit phases). The work is part of the ongoing EU FP6 Project ISAAC “Integrated e-Services for Advanced Access to Heritage in Cultural Tourist Destinations”.

2. Objectives

This paper has several inter-related objectives.

Firstly, to describe the ICT challenges and innovation aspects of this research from the point of view of data collection and harmonization based on an in depth review of current digitization issues and cultural data interpretation for cultural heritage in tourist destinations’ web sites, with a special focus on three case study cities – Amsterdam (The Netherlands), Genoa (Italy) and Leipzig (Germany) [1]. This in depth analysis has identified substantial weaknesses in all e-governance aspects of the destinations’ web sites in Europe (relevant to the participation of the users in service development and destination’s promotion) and a lack of links between tourism web sites and the main city portals, which has resulted in the short of coordinated action in the cities’ promotion among the concerned players. The present study aims to overcome this existing lack in data integration, due to heterogeneity of sources, fragmentation of the information and absence of a unique way to view information, by defining a European reference model to standardise representation, annotation and retrieval of cultural heritage content in cities by using new and emerging semantic harmonisation techniques to support uniform knowledge-based access to distributed information resources and pre-existing heterogeneous databases. In this line, the ICT system resulting from our research collects data from private entities and public administration’s resources and harmonizes and integrates them with the publicly available information and databases. This work of harmonization has been based on the definition of a new classification (or taxonomy) [2] that combine a hierarchical classification of general cultural goods categories, from the tangible to intangible, with a particular reference to potential e-services to be integrated in the new platform. The result is an enhanced access in the cultural heritage domain (content interoperability via service-oriented architecture) and content organisation according to the user preferences (customised access and presentation of information via agent technologies). Since preferences change over time, in relation to experience, knowledge, perception, awareness and sensitivity, because human being are part of a dynamic community of interest, the proposed taxonomy is designed as a folksonomy, which allows implementation on the base of a “wiki” approach.

Secondly, to describe how our research is based on the Social Web and Web 2.0 approach using the concept of folksonomy. The latter is understood as a dynamic content classification by people who associate terms with content that they generate or consume. Our work attempts to associate this emergent phenomenon of the Social Web with the

Semantic Web concept of Ontology (explicit formal specifications of the terms in the domain and relations among them [3]). These two ideas, because of their conceptually different bases (top-down vs. the bottom-up approach), have been highly opposing from the very start. Yet, recent studies highlight that, as the Semantic Web matures and the Social Web grows, there is an increasing value in applying Semantic Web technologies to the data of the Social Web. In this line of emphasis, we create a new ontology defined as folksonomy. This approach allows us to develop a new framework in which the harmonization of the knowledge is based on the ontology viewed as an instrument for sharing information and on a folksonomy, understood as data that is emerging from shared information through tags that introduce distributed human intelligence into the system.

3. Methodology

Several steps were used for the design and development of the ICT system, which started in 2006 and will be completed in 2009. The system is implemented in three city cases (Amsterdam, Leipzig and Genoa), which were selected because they offer diversity nature and degree of digitalisation of their cultural heritage assets. This, along with other EU relevant practices [2], served to define an ISAAC European reference model to standardize representation, annotation and retrieval of cultural heritage content that can be used not only in Amsterdam, Leipzig and Genoa but in other European cities as well. A five-step methodology has been used as follows:

1. State-of-the-art analysis of cultural heritage information systems.

In November of 2006, a full assessment of the state-of-the-art, with particular focus on the current multimedia, data representation and harmonisation, and visualisation technology, was carried out. The main aim was to develop the plan for extending and improving the technology within the ISAAC prototype framework to achieve access and management capabilities for the cultural assets from a user perspective view [9].

2. Review and documentation of lessons learnt from other relevant projects.

In the summer of 2007, fourteen EU projects (AGAMEMNON, BRICKS, CASPAR, CINeSPACE, DELOS, EASAIER, EPOCH, IMAGINATION, MEMORIES, MINERVA PLUS, MOSAICA, MultiMATCH, COLLATE and MICHAEL) were selected and reviewed. This was aimed at using these projects' experiences as a baseline so as to define the ISAAC European reference model. These projects were selected based on their similarities in scope to ISAAC in a sense that they aimed at developing digital and electronic services for tourism and better access to European cultural heritage [2].

3. Development of the ISAAC concept of folksonomy and principles of Web 2.0.

In parallel with phase 2, an extensive literature review was carried out to provide the basic principles for developing the ISAAC taxonomy. Subsequently, extensive exploration of alternative classification systems and approaches to support the development of metadata for digital content was carried out, including the decentralized social approach named folksonomy. Finally, the latter – a user centred approach (bottom-up approach) - was adopted in parallel to the experts' perception of cultural goods (top-down approach) studied by the ISAAC team [2] and further explained in section five of this paper.

4. Identification of user requirements.

Between December 2006 and January 2007, seventy two focus groups workshops were held in the three partner cities (Amsterdam, Leipzig and Genoa) aiming at identifying key user preferences for the development of the system e-services [10]. These activities provided valuable insights in support of the project objectives, the state-of-the-art, and the cities' legacy IT systems and their needs. In this way, our taxonomy has benefited from all actors' views and perceptions in regard to the selected folksonomic approach.

5. Design, development and testing of the ICT system.

Drawing on the results of the first four phases ISAAC is currently developing the ICT system for the partner cities. The work is divided in three stages: system design, development and pilot testing. In the process, issues of intelligent data harmonization, user requirements and limitations in test cases are being tackled. The effort is coordinated by the project's IT developer, TXT e-Solutions SpA, in close cooperation with the cities' ICT and tourism representatives. Sections four, five and six discuss the major findings from the four first phases of the study and the attributes of the ISAAC ICT system.

4. Technology and Developments

The ICT system resulting from this research is entirely based on open source software. New Web 2.0 concepts (such as the folksonomy) are used as a basis for dealing with data collection and harmonization issues, encouraging platform independence but also allowing the reduction of development costs for the stakeholders. The instruments related to the social web are regarded as most powerful for translation in technology terms, the concept of interpretation of cultural goods and the perspective domains. Our case study research has shown too that the later emerges as a key driver of future developments in city systems toward the internet technologies, particular with regard to the new instruments allowing the user to be directly involved in the city promotion and management (the governance paradigm).

This notion originates from the concept that the user has to be an active actor in the city affairs, not only as a visitor or a static viewer. Instead, the user in our case, tourists, citizens and decision makers, has to have the opportunity to enhance the promotion of the cultural goods using the instruments available in the city information system. By surfing the net it is very easy to find official cities' web sites where the cultural goods or the places are presented to the viewer. However, these "conventional" systems have limitations, as far as new roads for cultural promotion are considered within the context of the Web 2.0, and specifically:

- an official site focuses the promotion on "official" cultural goods;
- an official site does not take into consideration "hidden treasures";
- an official site does not take into consideration the intangible aspects of a place;
- typically the official web site is designed and run by "institutional" actors that for the most part are citizens of the destination.

This last point highlights a very important concept that this study takes forward: citizens even if they love the place where they live, are not as careful to all the destination's aspects as tourists can be. Imagine the place where you live: how many times you discover something unknown in your city just because a friend has come over as a tourist and has discovered something that you have ignored as a citizen?

The essential point is that tourists are more focused on the discovery because when they decide to undertake a cultural tourism experience, their main objective is the discovery of the visited place or attraction. For this reason the latter are the best candidates to discover hidden cultural goods and, most importantly, they are the most adequate users to embrace the immaterial aspects of the place, catching the cultural goods' or the site's soul. We make operational this concept through the so called "interpretation" of the cultural heritage. For this reason the city needs to provide tourists with the right ICT instruments that can help them share their experiences and, in doing so, promote the cultural tangible and intangible aspects of the place and its people.

This is a truly an innovative approach in the domain of cultural heritage that can be viewed as an interactive development of an interpretative strategy. First, it is "interactive" because the user itself is directly involved in the creation of the cultural heritage promotion. And, second, the condition of "interpretative" is given in conformity with the baseline of

this strategy, the concept of “interpretation”. From a technical point of view, the main way to create a self-promotional strategy is the user-generated content.

In this way, the User-Generated Content (UGC) is considered as either “implicitly generated” or “explicitly generated”. Implicit UGC is created by the actions of users as they go about their normal business of viewing pages or selecting search results [4]. This can be used to generate items such as “general most viewed lists” or “you could like also these places”, which are based on data generated by people with similar search and browsing patterns. It is important to note that user generated content is not written by random voices from an undifferentiated mass of users. Users are required to create a log-in and content is usually associated with a user name.

Thus, it becomes clear that conventional techniques in the information technology field do not help to catch this objective because they do not allow this interactive interpretative strategy. But, fortunately, there are instruments able to reach the intended results. In this line, the only way to drive the development toward this direction is to focus on the new Web 2.0 concepts and integrated e-services. For instance, social web networks such as “Flickr.com” or “Youtube.com” facilitate greatly the sharing of personal experiences by publishing user-generated content that is based on cultural heritage’s real interpretation, accounting for both tangible and intangible aspects.

All of the above mentioned instruments are based on a new and very interesting concept, arisen a few years ago in the content management environment, called folksonomy. While the user generated content allows the collection of new and special content coming from different sources and provides new forms of interpretation for cultural goods, the folksonomy constitutes the cornerstone of the project’s objective so long as it harmonizes heterogeneous data. Often cultural objects are described by institutions in language that is highly specialist. Folksonomies allow users to describe contents using their own vernacular language, bridging the “semantic gap” between the institutional language and that language of the user, so facilitating other users find things that interest them.

Of course this way of navigating the cultural goods needs to be moderated, but the system reduces this requirement by setting barriers to entry, such as a login mechanism. This allows users reporting offensive content for review by a moderator and a “reputation” model to help the useful content rise and the non-useful content filter down (tag clouds give prominence to the most popular tags while less popular tags become less visible).

With the folksonomic approach users can get content coming from different resources, official and unofficial, and harmonize them in a unique place, where cultural heritage is interpreted in a better and social-like way. Despite its name, a folksonomy is not taxonomy, because it moves away from the hierarchical approach to an approach more akin to that taken by faceted classification or other flat systems. Folksonomy is not a static classification, but a dynamic organization where the user itself becomes an active actor.

5. From Taxonomy to Folksonomy

As argued in section one, the ICT system’s specific solution is based upon a detailed taxonomy of urban cultural heritage components developed by the ISAAC consortium. A brief conceptualizing framework to the term “taxonomy” is introduced for the purpose:

The word “Taxonomy” (from Greek verb *τάσσειν* or *tassein* = "to classify" and *νόμος* or *nomos* = law, science, cf "economy") [...] refers to either a classification of things, or the principles underlying the classification [...]. Taxonomies [...] are frequently hierarchical in structure, commonly displaying parent-child relationships. Simpson’s (1961) [5] defines taxonomy as the theoretical study of classification, which includes its bases, principles, procedures and rules. Bailey (1994) [6] also stated that a taxonomy is like a classification, and it can refer to both the process and the end results. He also addressed taxonomies are often

hierarchical and evolutionary. The term taxonomy may also be applied to relationship schemes other than hierarchies, such as networked structures. Ravid (2002) [7] defined “Taxonomy is the science of classification according to predetermined system used to provide a conceptual framework for discussion, analysis or information retrieval”. A taxonomy might also be a simple organization of objects into groups, clusters or even an alphabetical list (lexicographic order). In current usage within "Knowledge Management", taxonomies are seen as slightly less broad than ontologies.” (Wikipedia). “[...] in digital terms, automated classification of documents in a hierarchy based on information gathered by a metacrawler” (DCMI Glossary [12]).

In the light of ISAAC’s integrated ICT system, our taxonomy [2] combines a hierarchical classification of general cultural goods categories, from the tangible to the intangible, with a more user oriented perspective. Attention is paid to the significance that such a taxonomy can enhance access in the cultural heritage domain, with particular reference to the potential new and integrated e-services [11] that are currently being developed for the ISAAC platform.

As a result, the ISAAC architecture classifies both tangible and intangible cultural content according to the ISAAC taxonomy. Hence, content inserted by users will be uploaded onto social networks such as “Youtube” (for videos) and “Flickr” (for pictures) and tagged according to this taxonomy. Additionally, both “Flickr” and “Youtube” provide an API (Application Programming Interface) that enables the system to build contents (photos, video) back into the city website with their own look and feel. In this context, although contents are decentralised from the city website they will have a better exposure since they are accessible from two locations. Moreover, the system also allows the user to insert new tags in order to implement the Web 2.0 concept of folksonomy facilitating a new re-harmonization of the whole content. However, the development of a folksonomy requires a Cultural Heritage’s taxonomy as a starting point. Therefore, the main research activities were first focused on creating an appropriate taxonomy for retrieving cultural heritage assets and, subsequently, on developing the folksonomic approach (see section two).

The next two subsections provide alternative principles and an overview of a hierarchical classification for cultural heritage. This provides an overview of the main cultural heritage characteristics, highlighting the most relevant categories of the users’ interests and values associated to cultural heritage, as identified in the field of cultural studies. The development of this taxonomy is strictly linked to the necessity to develop a form of tagging of information, which might help retrieval. Whilst simplifying the articulate nature of cultural goods, it gives the correct information.

5.1 Alternative principles for a classification system in cultural heritage destinations

There are a number of different alternative principles underlying the development of a classification system. A short overview for cultural heritage destinations should recognize at least:

- a. a hierarchical classification of cultural goods. Examples are:
 - geographical distribution (i.e.: Nation, County, City)
 - authorities in charge of (i.e.: National / Regional / City Tourism Authority)
- b. a networked classification of similar cultural goods. Examples are:
 - heritage families (i.e.: Baroque)
 - style life families (i.e.: Slow cities)
- c. a plain list of different cultural goods. Examples are:
 - alphabetical list

- list by amount of yearly number of visitors
 - amount of visitors of the web sites
 - richness in term of cultural goods' availability
- d. a short list of basic concepts referred to cultural goods. In contrast to the comprehensive holistic approaches, a different and better operational approach focuses on the selection of a small number of core categories. Examples can be found in Dublin Core Metadata Initiative (DCMI, 2005): the Simple Dublin Core Metadata Element Set (DCMES) consists of 15 metadata elements (Title, Creator, Subject, Description, Publisher, Contributor, Date, Type, Format, Identifier, Source, Language, Relation, Coverage, Rights) [13].

5.2 A hierarchical classification of Cultural Heritage

The suggested taxonomy of cultural heritage includes three intermediary levels of hierarchical classification, starting from the most general tangible and intangible CH categories of Goods, Places, Landscapes and Activities, to the most specific elements, supported by examples from the case studies [2].

Firstly, the class of Goods is specified in terms of Monuments, Streets, Buildings, Infrastructure, Popular venues and Settlement. Secondly, the category of Places includes both Public and Private places. Thirdly, the family of (Cultural) Landscapes includes all the followings sub-categories: Agricultural Systems, Environment, Modified Landscapes, Patterns of Settlement and Human Activity, Scene, Urban Landscapes. Fourthly, the last section of the Cultural Heritage hierarchical classification about Activities includes Events for all the three groups of potential users such as Events for Everybody (all stakeholders), Events for Residents and Events for Tourists.

The participants in the ISAAC Focus Groups helped in defining the implementation of the vocabulary. This has confirmed the need to adopt a dynamic system in our IT platform. Overall, the taxonomy list of cultural heritage categories included 257 terms. Following our folksonomic approach, the proposed Cultural Heritage hierarchical classification supports the user participation for implementing this initial list. For example, a stakeholder, e.g. manager of a historical café, could be interested to contribute to the third level of the list of private places.

Once the classification criteria has been chosen, the hierarchical approach typical of a taxonomy leaves room for a flat classification created by a group of individuals (folksonomy), typically the resource users, who add natural language tags to online items, such as images, videos, bookmarks and text.

6. The ISAAC Architecture

All instruments described in this paper have been put together to develop an advanced integrated architecture. From a platform perspective, the ISAAC IT platform features the integration of intelligent content, intelligent agents (as the one we developed for the user profiling), information advanced presentation features and new integrated e-services. The ISAAC architecture is designed to incorporate all stages of the cultural tourism experience:

- Pre-visit: during this phase users can plan all details of the cultural experience they are going to live
- Visit: this phase represents the cultural experience itself
- Post-visit: during this phase, users can share their experiences with other people via chat, forums, blog, image and video sharing, etc.

In view of realizing the first step of the interpretative strategy above, this architecture provides a set of advanced services that are integrated in the cities' web sites, allowing users to exploit the ISAAC platform. Thanks to the folksonomy the user generated content

is integrated and classified according to the classification. This content is then made available for other users and is presented in an innovative way catching the most complete meaning of a cultural good from its tangible to the intangible aspects. This integrated and participatory architecture and its services present an innovative set of cultural heritage promotional instruments for the benefits of tourists, citizens and the local decision makers in the context of the urban tourist destination.

7. Conclusions

This study attempted to demonstrate that traditional approaches to intelligent content harmonization in the European cultural heritage domain are in need of fundamental revision. It is revealed, through the analysis of existing approaches and case studies, that cultural heritage “consumers” have to be provided with new forms of information tagging that facilitate interactive retrieval processes and, at the same time, support cultural heritage’s valorisation, hence preservation and promotion.

Research focused on the ISAAC’s specific folksonomy, its main users, and how the later can be further assisted, by the taxonomy, in developing their interests in cultural heritage, when the cultural tourism e-services are organized in relation to timing of the visit and their preferences. The analysis shows that What, Who, How, When, and Why, are five key questions answered by the ISAAC taxonomy:

- a. What. The taxonomy provides a systematization of both material and immaterial Cultural Heritage categories (which link directly to the ISAAC Glossary terms) [8];
- b. Who. Users may implement the list of activities included in the ISAAC taxonomy of Cultural heritage;
- c. How. The Cultural Heritage e-services provided by the ISAAC platform assist users with the opportunity to develop their interests in Cultural Heritage;
- d. When. The available Cultural Heritage e-services are organised in relation to the time of the visit (pre, during and post actual visit);
- e. Why. Users are motivated to implement ISAAC’s Cultural Heritage list as a folksonomy, seen as an asset to participation and e-governance.

Innovation has occurred at the level of data harmonization based on the Web 2.0 approach, and the destination-wide territorial approach to Cultural Heritage promotion and interpretation for both tangible and intangible assets, together with the integration of existing e-services in advanced combinations [11].

The challenge ahead is to merge all the above attributes in an integrated IT system to assist broader access and utilisation of Cultural Heritage in the European destinations. This requires aiming at applications that learn from their users (intelligent agents) through using architecture of participation to build a commanding advantage not just in the software interface but in the richness of the shared data. The test cases for the cities involved in the ISAAC project (Amsterdam, Genoa and Leipzig) are the starting point to prove the system in real environments, currently in progress.

This, in turn, can have important implications on how cities may see their future when using their cultural heritage in promoting themselves as centres of culture, heritage and tourism. As the study shows, they need intelligent systems that can increase the access of all users to the local riches – tourists, citizens and the decision-makers alike. Moreover, new integrated and user-specific interfaces (folksonomy) are necessary to preserve and promote the diverse but dispersed and heterogeneous cultural heritage contents. Yet, achieving this requires further research not only from a technical point of view but with regard to the users’ preferences and cultural heritage interpretation as well as their participation and involvement in the development of integrated ICT systems of European destinations.

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