A Participatory Approach to Define User Requirements of a Platform for Intangible Cultural Heritage Education

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Abstract: In the last years the protection and safeguarding of cultural heritage has become a key issue of European cultural policy and this applies not only to tangible artefacts (monuments, sites, etc.), but also to intangible cultural expressions. The i-Treasures project focuses on some Intangible Cultural Heritages (ICH) and investigates whether and to what extent new technology can play a role in the preservation and dissemination of these expressions. To this aim, the project will develop a system, based on cutting the edge technology and sensors. The main purpose of this paper is to describe how the user requirements of this system were defined. The requirements definition process was based on a participatory approach, where ICH experts, performers and users were actively involved through surveys and interviews, and extensively collaborated in the complex tasks of identifying specificities of rare traditional know-how, discovering existing teaching and learning practices and finally identifying the most cutting edge technologies able to support innovative teaching and learning approaches to ICH.

1   INTRODUCTION

In the last decades the protection and promotion of cultural heritage has become a central topic of European and international cultural policy. Besides UNESCO, who has been active in defining cultural heritage and ensuring its protection, other institutions and organizations around Europe have been involved with documenting and providing access to different forms of cultural heritage (ranging from archaeological sites and natural parks, to museum collections and folk traditions). In this process, a significant body of resources dealing with the documentation and promotion of cultural heritage through different technologies has been developed. There is little doubt that digital technologies have revolutionized scientific and public access to cultural heritage (Cameron & Kenderdine, 2010, Ioannides et al., 2010), and that these technologies may open the way to innovative teaching and learning practices in this field (Ott & Pozzi, 2011).

Moreover, following the adoption of the Convention for the Safeguarding of Intangible Heritage in 2003, even the protection of cultural traditions has become prominent on an international level, as these are considered threatened by processes of globalization. According to the 2003 Convention (UNESCO, 2003), it falls upon national governments, cultural organizations and practicing communities to transmit these vulnerable cultural expressions to the next generations. Safeguarding activities vary according to local and national contexts (Alivizatou, 2012).

Interestingly, although modern technologies are sometimes identified as a threat to traditional expressions, it is these very technological innovations that frequently play a key part in the preservation and dissemination of intangible heritage. In this vein, the i-Treasures project, funded under the 7th FP, looks at a number of rare and valuable living expressions and traditions which are still transmitted orally or by imitation, and proposes novel methodologies and new technological paradigms for the analysis and modelling of these Intangible Cultural Heritages (ICHs), with the ultimate aim of preserving them by possibly supporting innovative learning approaches to ICH.

2   THE I-TREASURES PROJECT

The i-Treasures project makes an extensive use of cutting edge ICT and sensor technologies with the aim of developing "an open and extendable platform providing access to ICH resources, enabling knowledge exchange between researchers and contributing to the transmission of rare know-how from Living Human Treasures to apprentices" (Project Description of Work - DoW[1]). Besides, the project aims to propose new methods, employ and create innovative tools able to support and enhance the passing down of rare know how to new generations.

According to the DoW, starting from 'capturing' the key aspects and features of the different ICHs, a process of data modelling will be carried out within the project, by relying on advanced Semantic Multimedia Analysis techniques. The new data acquired will thus give life to a knowledge base containing a wealth of information never available before, in such a way that it will then be possible to shape a variety of different teaching/learning paths, serving different scopes and specific educational needs, all aimed at contributing to the transmission of these peculiar artistic and cultural expressions. Thus, the i- Treasures platform is expected to take learners beyond the concept of "learning by imitation": besides offering the opportunity to acquire a variety of new information on the ICHs in different formats, it will also allow learners to be exposed to multi-modal and multi-sensory learning experiences, carrying out individual trials and receiving appropriate feedback, so to reach increased levels of competence in an easier, more direct, quicker and effective way (Dias et al., 2014).

In the wide panorama of the existing ICHs, this project will examine in detail four use cases (areas of ICH), namely: 1) rare singing 2) rare dancing 3) craftsmanship and 4) contemporary music composition. Each use case has been further instantiated in different "sub-use cases". Table 1 contains the list of the sub-use cases tackled by the

project and for each of them, the table specifies: whether the sub-use case is included in one of the UNESCO lists of Intangible Cultural Heritage, the country of origin, link(s) to get an overview of the ICH itself.

Table 1 - List of the ICHs considered in the project.

Use Case	Sub Use case	Listed by UNESCO	Country
RARE SINGING	Byzantine music[2]	Not listed	Greece
	Cantu in Paghjella[3]	List of Int. Cult. Her. in Need of Urgent Safeguarding	Corse-France
	Canto a Tenore[4]	Representative List of the Intangible Cultural Heritage of Humanity	Sardinia-Italy
	Human Beat Box[5]	Not listed	worldwide
RARE DANCING	Căluş dance[6]	Representative List of the Intangible Cultural Heritage of Humanity	Romania
	Tsamiko Greek dance[7]	Not listed	Greece
	Walloon traditional dance[8]	Not listed	Belgium
	Contemporary dance[9]	Not listed	Worldwide

[1] http://www.i-treasures.eu/filedepot?fid=4

[2] http://www.ec-patr.net/en/ http://www.i-treasures.eu/content/byzantine-music

[3] http://www.unesco.org/culture/ich/index.php?lg=en&pg=00011&USL=00315

[4] http://www.unesco.org/culture/ich/index.php?lg=en&pg=00011&RL=00165http://www.i-treasures.eu/content/canto-tenore

[5] http://www.i-treasures.eu/content/human-beat-box

[6] http://www.unesco.org/culture/ich/index.php?lg=en&pg=00011& RL=00090

[7] http://www.greekdance.org/e-library/Tsamiko
http://greekcommunity.org.nz/2012/12/greek-dance/

[8] http://www.i-treasures.eu/content/walloon-traditional-dances
http://www.dapo.be/; http://www.fgfw.be/

[9]http://www.i-treasures.eu/content/contemporary-dances
http://www.blackfishacademy.com/dance.htm
http://www.contemporary-dance.org/contemporary-dance-history.html

	The art of pottery[10]	not listed	Greece France Turkey
CRAFTSMAN-SHIP			
CONTEMPORARY MUSIC COMPOSITION	Based on music patterns of Beethoven Haydn or Mozart[11]	not listed	Worldwide

The main purpose of this paper is to describe how the user requirements of the i-Treasures platform were defined. The requirements definition process was based on a participatory approach (Schuler & Namioka, 1993), where experts, performers and users were actively involved through surveys and interviews, and extensively collaborated in the complex tasks of identifying specificities of rare traditional know-how, discovering existing teaching and learning practices and finally identifying the most cutting edge technologies able to support innovative learning approaches to ICH.

3 METHOD

Any software development process goes through the phase of requirements engineering, which is the process of discovering, analyzing, documenting and validating the requirements of the system to be developed (IEEE, 2004). Usually, defining the user and system requirements implies to identify all the stakeholders (users, customers, developers, etc.), take into account all their needs and negotiate with them what the system will be able to offer (Wiegers, 1996).

Analysts can employ several methods and techniques to elicit the requirements from the users/customers. As matter of fact, often this is a collaborative and participatory process, envisaging a continue and intensive dialogue among the stakeholders. Such dialogue may be based on the development of 'scenarios' and/ or 'use cases' (as it happens in the agile methods – Beck et al., 2001), the use of focus groups, workshops, interviews, questionnaires with the users/ customers, more ethnographic approaches based on the direct observation of the users' actions/needs, the study of the documentation of previous systems, etc. So, defining the requirements may be a very complex process, encompassing the use of more than one method or technique (Sommerville & Sawyer, 1997). The outcome of this complex process of elicitation is a list of requirements, stating what the system will do (rather than how it will do this) (IEEE, 1998).

In the context of the i-Treasures project, the stakeholders include: experts of the various ICHs (performers); apprentices / students of the various ICHs; basic users of the system (teachers, amateurs, academics, etc.); researchers (in various fields); system developers; all the partners of the i-Treasures consortium (who in some cases play one or more of the above mentioned roles). To be noted, that the partnership in itself is internally characterized by a high level of interdisciplinarity, as it consists of people from various research fields, including anthropology, ICT, bio/physical, educational, etc.

Clearly, acquiring knowledge about the ten application domains (i.e. the ten sub-use cases of the project, see Table 1) of the system that will be developed, is an essential step in i-Treasures, where we deal with very different and very complex domains (from singing to dancing and even to craftsmanship), which are very often based on tacit knowledge still belonging to experts/ performers. As a consequence of this, a participatory design approach was adopted (Schuler & Namioka, 1993), envisaging continuous interactions among the various stakeholders. In particular, this occured at two levels: within the partnership, and between the partners and the experts/ performers. User and expert groups in the various sub-use case communities were set up, who will constitute the main interlocutors in all the following phases of the project.

Due to the high level of interdisciplinarity, early in the process a need emerged to share terminology and meanings, so to avoid inconsistences and misunderstandings. Besides, given that the ICH preservation and education research field in itself still needs to be consolidated and its research community is still to be shaped, the building up of a common Glossary was proposed as a means for everyone (experts, researchers, developers, etc.) to define concepts and boundaries. Thus the Glossary is conceived as a working tool which will be enriched through time during the project life span, and will remain as a legacy for the ICH communities after the end of the project.

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[10] http://atschool.eduweb.co.uk/sirrobhitch.suffolk/portland%20state%20university%20greek%20civilization%20home%20page%20v2/docs/8/glatt.htm

http://www.vallauris-golfe-juan.fr/-A-village-of-ceramic-tradition-.html
http://turkey.amethistle.com/2008/04/glorious-ceramics.html
[11] http://www.i-treasures.eu/node/62

Given that the project addresses ten different sub-use cases, it was also necessary to allow the analysis of the various cultural expressions in a homogenous way, at the same time respecting the peculiarities of each context. This led us to conceive a common framework for the description of the ICHs, which was then taken up and customized by the different sub-use case leaders[12], according to the specificities of each context and target population. The common framework encompassed a number of dimensions:

- the General information about a specific artistic expression identifies the domain where the expression is rooted (dancing, singing, etc.) and gives an overview of its main characteristics (in terms of historical and geographical origins, etc.);
- the Physical dimension is aimed to describe how the performer should use the body, what specific parts of the body are involved, how, etc.;
- the Emotional dimension is related to the performer's feelings during the performance, her/his affective states, etc.;
- the Social dimension has to do with the relationships (if any) the performer has with the other people involved in the performance (other performers, audience, etc.);
- the Knowledge and meta-knowledge dimension includes both the theories (notions, techniques, styles, etc.) and practice the performer needs to master, and those s/he will need to keep under control during the performance itself;
- the Context/environment dimension describes the place where the artistic expression is usually carried out, its main characteristics and the tools/costumes, etc. the performer needs to use;
- the Teaching and learning dimension investigates how the cultural expression is traditionally 'taught' or 'transmitted', if there is an official training path to be followed (with schools, teachers, etc.) or if learning occurs through informal methods (observation, apprenticeship, etc.);
- lastly, the Value should highlight the aspects of each cultural tradition that experts and local communities consider valuable and the reasons why they think it is important to safeguard and preserve that specific cultural expression.

As already mentioned, these dimensions were taken up by each sub-use case and customized; such customization process was carried out at two levels:

through online interactions among the project partners (in forums) and, in parallel, through interactions with the various ICH experts to guarantee correctness and consistency.

The results of this customization process was the construction of ten questionnaires (one for each sub-use case), which are all based on the common framework, but contains specific questions.

The following Table contains examples of questions conceived for the Canto a Tenore sub-use case.

Table 2 Examples of questions for the Canto a Tenore.

DIMENSION	Exemplar questions for one specific sub-use case (i.e. Canto a Tnore)
General info	Provide a short description of the Canto a Tenore (genre, basic features, etc.) What are the main distinctive traits characterizing this artistic expression? What are the origins of the Canto a Tenore? What is the diffusion of this singing? […]
Physical dimension	What are the typical positions (if any) taken by the singer while singing? What are the main body movements that activate when the singer sings? What are the main gestures (fingers / hands) (if any) put in place by the singer when he sings? During the performance in what the internal organs are involved? […]
Emotional dimensions	Is there any mental or emotional attitude required by the performer during the performance? What are the performer's feelings while performing? […]
Social dimension	Does the performer usually perform alone or together with other people? What kind of relationship (if any) does the performer need to have with the other performers/with the audience? […]
Knowledge and meta-knowledge dimension	What theoretical aspects/notions are important for the performance? What practical skills are important for the performance? […]

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[12] Partners of the project responsible for a certain sub-use case.

Context /environment dimension	Where does the performer usually perform?
	Does the environment need to be specifically configured for the performance?
	Does the performer need any specific tool /instrument to carry out the performance? […]
Teaching and learning dimension	So far, how do people learn this ICH (by imitation, through dedicated training initiatives, etc.)?
	Where does this mainly happen (in informal settings, in formal educational settings, etc.)?
	What is the typical learning path to be followed by a leaner (stages, duration, apprenticeship, etc.)?
	Are there people officially entitled to teach ('teachers') or is this delegated to practitioners (for example Living Human Treasures)? […]
Value	What is the real 'value' of this artistic expression (historical value, economic value, innovation value, uniqueness value, cultural value, etc. …)?
	What is the reason why you think this artistic expression is deemed to be safeguarded and preserved? […]

The ten questionnaires were then delivered to the performers with different modes, according to the local contexts and needs. In particular, while in some contexts the direct contact with the performers was preferred and the questionnaires were delivered either in the form of paper questionnaires (Canto a Tenore), or as one-to-one interviews (Canto in Paghjella), in other contexts the questionnaires were delivered through mailing lists and online surveys (Human Beat Box) and lastly in other contexts a blended approach was adopted to reach the highest number of people (rare dancing).

Overall, the delivery of the questionnaires to the various communities of experts/ performers, allowed the project to collect a huge amount of data on the ten sub-use cases. Nonetheless, it is worth mentioning the fact that not all the communities responded in the same way, so while for some sub use cases the project could count on high rates of respondents, in other cases the rate was pretty low. To explain this phenomenon, various barriers have been identified, including psychological barriers (for some of the experts it was difficult to accept the idea to use new technologies for the preservation and the transmission of their skills and know-how) and practical problems (geographical distance, low availability of persons, etc.).

The result of this effort consists of a detailed account for each sub-use case, containing information about the main features of these cultural expressions.

The analysis of these data, together with an exhaustive state of the art review which was conducted in parallel by the project consortium (D2.1: First Report on User Requirements Identification and Analysis), allowed to define a first set of user requirements for the i-Treasures system. The analysis contains also germs of the ontologies that the project will build in the next few months for each sub-use case.

4 RESULTS

Drawing on the analysis of the data derived from the questionnaires distributed to the communities of experts/performers, it was possible to define basic user requirements for the i-Treasures system. Of course there are requirements that are common to various sub-use cases, others are peculiar only to one (or some) of them.

As it is shown in Figure 1, the various dimensions of the questionnaires served to identify a set of requirements, which were then grouped into 'categories', which will constitute the 'sub-systems'/modules of the i-Treasures platform.
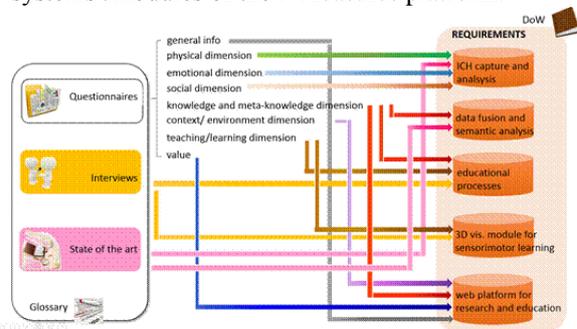

Figure 1: Dimensions of the questionnaires and user requirements.

Thus the system will encompass 4 sub-systems, i.e. the data capture and analysis sub-system, the data fusion and semantic analysis sub-system, the 3D

module for sensorimotor learning and the web platform for research and education[13].

The following Table shows an excerpt of the overall list of the i-Treasures requirements (Data capture and analysis for the Canto a Tenore sub-use case).

Table 3: Examples of requirements for the Canto a Tenore (data capture and analysis sub-system)

DATA CAPTURE AND ANALYSIS	M/D [14]
1. The system shall be able to capture the sound in a high quality in order to produce the related spectrogram and to identify fundamental frequencies, ornamentations, consonants, utter, and improvisations	M
2. The system shall be able to detect the singer's vocal tract engagement (e.g. tongue, mandibles, lips, anterior pharyngeal wall, vocal folds and vocal track constriction)	M
3. The system should be able to detect singers' abdominal breathing with suitable sensors.	D
4. The system shall be able to detect hand gestures (instrument imitation)/position and general postures.	M
5. The system should be able to detect singers' facial movements	D
6. The system should be able to detect singers' gaze	D
7. The system should be able to detect the reciprocal positions of singers	D
8. The system should be able to detect the contacts among the singers	D
9. The system should be able to capture several singers (max.4) together and be able to separate their single voices	D
10. Sensors should not affect the performance of singers; sensors technology should cause no or minimal disturbance to the singers.	D

As to the main functionalities envisaged for the i-Treasures system, one affordance will be to allow the detection and capturing of the ICH main features. In particular this will include capturing any relevant performer's posture and movements (especially: total body, feet, leg, hand and fingers, vocal tract, gaze, face, etc.), capturing sounds (through recordings, etc.), capturing contextual conditions (i.e. accessories and tools of any kind used by the performer), capturing any interactions with others, capturing single roles, single styles, and detect synchronization aspects (among performers, among different 'actions' by the same performer, etc.).

To do this, the system will need to include a variety of sensors, including: optical sensors, depth sensors, inertial sensors, electroglottographs sensors (EGG), electroencephalograms sensors (EEG), ultrasound sensors and other sensors (such as for example piezoelectric accelerometer, universal breathing belt, etc.[15]). Given that the system will use all these sensors, it is an issue that these sensors shall not disrupt or influence the performance.

Besides, the system shall be able to operate directly on the output of the aforementioned sensors; in particular, since the system will perform multimodal data capture and analysis, it will need to perform early data fusion covering the following areas: facial expressions, body and gestures, EEG signals, vocal tract and sound.

The system shall also be able to detect basic features/ sequences/ patterns of a performance, categorize improvisation patterns, as well as detect deviations from standard performance, so that the 3D visualization for sensorimotor learning module is able to support users to learn, practice and master one specific ICH.

Another important category of functionalities of the i-Treasures system has to do with its ability to guarantee access to data and information concerning the ICHs. This means that the system will allow the storage of multi-media information (video, audio, images, text, etc.) and provide adequate and multi-searching functionalities to allow easy retrieval of this information. The system shall guarantee multi-lingual data.

Another affordance of the system has to do with providing support to teaching and learning processes. This means that the system will offer the teacher the possibility to design innovative learning activities for a specific sub-use case, while the student will be able to carry them out and will be assessed. In particular, the system will allow to set up and deliver standard learning paths, as well as personalized ones, and the learning path will possibly adapt dynamically based on the student' performance in previous activities. The system will support individual activities, as well as group work, offering also communication tools; besides activities may include: readings, exercises

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[13] The categories originally identified were five, but then, in the sub-sequent phases of the process, it was agreed that two of them could be merged (see D2.2: First Report on System Specification.).

[14] M = Mandatory requirement, D = desirable requirement.

[15] The latter category of sensors has been identified in D.2.2: First Report on System Specification

(quizzes, etc.), imitation, listening/looking at performances (focusing on roles/styles/sequences/patterns, etc.), 3D visualization of models/sounds/movements, etc., practicing and receiving immediate feedback, etc.

5 CONCLUSIONS

In this paper we have presented the complex work that has led to the preliminary definition of the user' requirements for the i-Treasures system. The process has been highly collaborative and inter-disciplinary, with a strong effort devoted to involve all the main stakeholders, including not only the various partners with their variety of competences, but also the communities around the single ICHs considered by the project. The effort has given very good results, in terms of sub-use case analysis and knowledge domain definition, which have then nurtured the process of requirements' definition.

One of the main outcome of such process has been the development of a deep understanding of the sub-use cases, especially if we consider that for most of the sub-use cases, this represents the first real attempt to derive a domain knowledge representation model.

The deriving list of requirements is certainly another important result of such effort, but this is still preliminary and will need to be further refined in the future.

Lastly, the direct involvement of the experts/ performers should be regarded per se as one of the most outstanding outcome of this stage of the project. The collaboration process just started with them will certainly be further reinforced and other interactions with the experts will be planned in the near future, with the main aim to enrich the already available data; in particular this will lead to develop ontologies for the considered ICHs and possibly to design innovative teaching/learning paths exploiting the possibilities offered by the i-Treasures system.

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