

A TECHNO SOCIAL COLLABORATIVE PLATFORM TO MANAGE OPTIMIZE AND CROWDFUND CULTURAL HERITAGE INITIATIVES

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Abstract – This paper presents the first results of HERIBITS, a research project co-funded by the Tuscany Region Government, under the Operative Regional Program FESR POR 2014-2020. The project proposes an innovative methodology as well as advanced technology platform enabling a new paradigm for bottom-up and top-down management of cultural heritage initiatives. The techno-social platform integrates collaborative tools for CrowdSourcing, as well as analysis tools for rating project ideas and evaluate socio-economic impact, to propose best practices and to detect similar initiatives in order to avoid project duplications. The platform provides also social network capabilities and integrates an ad-hoc CrowdFunding shop.

INTRODUCTION

Cultural initiatives such as the protection and enhancement of cultural heritage, the promotion of local identities and the impulse to cultural tourism often suffer of a chronic inability to effectively engage and spend substantial community and national resources for underdeveloped areas.

In fact, there is virtually a lack of structured methodologies that provide the correct time to market of planned initiatives, as well as the alignment of projects to industry best practices and a coordination of cost centers, avoiding duplication and lack of critical mass.

This paper introduces the results of the research project HERIBITS, co-funded by the industrial research program “Bando Unico della Ricerca” issued by the Tuscany Region. The project proposes an innovative methodology as well as advanced technologies enabling a new paradigm of collective awareness in the planning, sourcing and execution of Cultural Heritage initiatives.

The objective of the project is to prototype a software platform able to support the process of selection, design and implementation of a large scale of initiatives of cultural innovation, ensuring: (i) timing; (ii) sharing from the bottom; (iii) the quality of project management by comparison with certified success cases; (iii) the socio-economic effectiveness by effective and objective methods of rating; (iv) sustainable integration in the social fabric, through a direct participation of the stakeholders involved; (v) sharing between regions, adopting proper communication and sharing initiatives.

To this end, the project will develop techniques to use linear funds to manage the exponential complexity of the aggregated cultural initiatives: (i) crowdsourcing and sentiment analysis, (ii) project analysis

and matchmaking, (iii) rating of socio-economic impact and social crowdfunding of project ideas, (iv) adapting and refining the existing methodologies, and (v) integrating them in an original way for the aims of the project.

To demonstrate the method, the HERIBITS project is developing an innovative web platform that will integrate several application modules to crowdsource a project ideas, to optimize them both technically and structurally, to assess their impact, for crowdfunding and stakeholders participation) in a user interface oriented to usability and characterized by a sharp style of organizational communication. This platform can be viewed as a *project factory* based on sharing models of proven effectiveness, integrating crowdsourcing tools as well as assessment techniques to evaluate the socio-economic impact of the initiatives to be implemented.

By implementing *matchmaking* techniques for candidate initiatives to find relevant success cases, the project factory strongly focuses on clustering and re-use of certified existing solutions in contrast to the current state of obsolescence, mediocrity and duplication of projects, amplified by the multiplicity of centers of public spending. In addition this platform provides a mechanism of project management based on *social revenue crowdfunding* solutions involving circles of "social investors" clearly identified as indirect beneficiaries of the innovation projects, in a context of *accountability* and effective communication of the initiatives implemented.

The most relevant areas of innovation are the deployment and integration of a set of *artificial intelligence* technologies (machine learning, neural networks, text analytics, ontologies) to analyse unstructured data and find meaningful relationships (i.e. matchmaking of projects ideas and solutions, identifying new significant evaluation metrics).

The HERIBITS project is also developing solutions of socio-economic analysis of the cultural projects dropping at the project factory, in order to determine their priorities according to their expected returns and to their contribution to higher level development policies. In addition, financing management solutions are adopted based on a crowdfunding engine able to connect the investment projects to stakeholders who will benefit directly or in terms of visibility.

METHODOLOGY

HERIBITS developed a techno-social web platform, able to support shared programming by accepting bottom-up requests, and involving the community in the processes supporting the long-term management of the works carried out. In the current panorama of consultancy services carried out in isolated (and to some extent intentionally esoteric) environment of the regional programming technostructures, HERIBITS proposes a decidedly innovative approach, in opening the process, through appropriate tools, to a Collective Awareness methodology. It is a real revolution, which can, even if with some implicit risk in the methodological novelty, open new markets and effectively change the current rules of the game.

HERIBITS intends to support this transition not only with the "bottom-up" balancing of the traditional top-down logic of programming, but also through the introduction and integration of technical modules able to direct the change towards new objectives, guaranteeing greater socio-economic efficiency. of the shipyards initiatives, their correspondence to criteria of structural solidity and non-duplication, and the rooting of the results achieved over time, according to new shared management models.

We started by reengineering the entire process of conception, formulation and implementation of cultural innovation projects for territorial development, through a critical examination of concrete cases,

and with the support of domain experts. To this aim, we defined a set of key succeed factors as well as critical aspects in need of optimization. Such optimization is realized by leveraging the technical modules of the HERIBITS platform, capable of giving an effective response to the critical issues that have emerged.

Subsequently, we translated the set of requirements and functional needs emerging from the reengineering process into a complete system architecture, defining from a technical point of view the different application modules that the system needs, their operational integration and the general characteristics of the collaborative techno-social platform provided by HERIBITS. (web system with cooperative nodes, inspired by platforms of collective awareness).

Then we realized the technical modules composing the HERIBITS platform, namely: a collaborative tools for CrowdSourcing, analysis tools for rating project ideas and evaluate socio-economic impact, propose best practices and advice on possible project duplications, as well as an ad hoc CrowdFunding shop.

We implemented the modules composing HERIBITS techno-social platform according to an iterative software development process, as foreseen by the incremental and evolutionary software development paradigm known as Unified Process (UP). UP is the process for the development of systems based on UML (Unified Modeling Language) and object-oriented analysis and design (OOA & D), which follows an iterative and incremental approach, guided by use cases and focused on the system architecture.

HERIBITS TECHNO SOCIAL PLATFORM

The HERIBITS platform is composed of the following technical modules: **collaborative tools for CrowdSourcing, analysis tools for project rating** dedicated to the **a-priori evaluation of potential project outcomes**, to evaluate **socio-economic impact**, propose **best practices** and **de-duplications**, that is advising on **existing similar projects**, The platform, enabled with native as well as third party **social networks** capabilities, integrate also an ad-hoc **CrowdFunding** shop. The key innovative aspects of such modules are detailed in the following paragraphs.

The module for **explicit and implicit crowdsourcing methodologies of cultural innovation** is dedicated to designing, modeling and technically specifying the reporting software module from the bottom of design ideas, and of presenting successful cases with storytelling techniques.

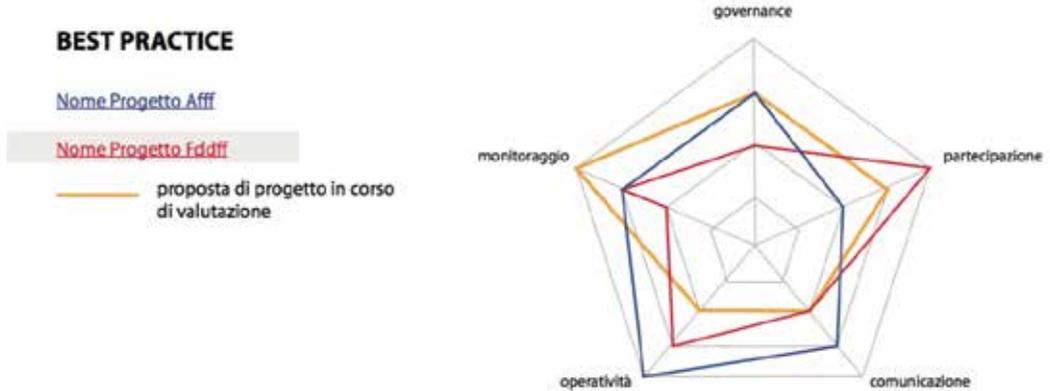
The module for for crowdfunding cultural innovation initiatives is dedicated to implementing the most suitable crowdfunding models and methodologies to maximize the involvement of local stakeholders in the launching and running of new structures and services of cultural and tourist interest.

The module for the **deduplication and best practicing of project initiatives** is a design optimization software module which performs functions of deduplication (analysis of similarities and reconditioning of polygenetic instances to unit models implemented in a shared way) and best-practicing functions, ie analysis the weaknesses of each project compared to the best practices certified, with suggestions for the actions needed to optimize the organizational structure and operational parameters.

To this aim, we defined deduplication and best-practicing analysis models for design optimization, and seamlessly integrated into HERIBITS platform the third party analysis tool *Asset* from K4D (Knowledge for Development, a socio-economic analysis consultancy dedicated to public administrations).

The study of a methodology aimed at defining the criteria of deduplication and best practicing was based on the analysis of questionnaires submitted to project designers and/or project partners of 25 tourism and cultural heritage projects. Such projects have been selected in different Italian regions (geographical criterion) and for different types of actions implemented (variety criterion). This allowed gathering information on a broad, though not exhaustive, sample of projects in the sector of interest.

The questionnaire was developed to detect the relevant aspects of the projects following the Logical



Framework Analysis (LFA) scheme.

Figure 1: Best practices

The module for the **ex-ante multi-criteria evaluation of cultural innovation projects** is aimed at developing a model of socio-economic analysis of the projects and their potential short and medium-term effects, based on multicriteria analysis techniques implemented through analysis dashboards and dynamic simulation of simple and composite georeferenced indicators. The aim is to evaluate the projects ex-ante, assigning them specific priorities, in terms of expected socio-economic impact, in order to be able to better allocate the available resources (both public/government and crowdfunding). Also this module is implemented by properly integrating the Asset software tool into the evaluation workflow provided by the HERIBITS platform.

IMPLEMENTATION

The techno-social platform is implemented in the form of a web application, adopting a three-tier architecture. We used the widely adopted XAMP platform (OSX, Apache, MySQL and PHP) which is a valid development environment for web server applications, based on Apple's operating system, the open source Apache web server, with license also for commercial use, the very popular open source relational database MySQL and the server-side scripting language PHP, in PHP5 version with JSON

support, which will be used to implement the business logic. The Symfony web development tools will also be used to make business logic software more efficient.

All the **development frameworks** adopted are cross-platform and implement the Model View Controller (MVC) paradigm, a *design pattern* that ensures portability and interoperability. We also used front-end (ionic2, Angular2JS, ReactJS, vue.js) and back-end frameworks (react2, php + laravel 5, nodejs, sails.js).

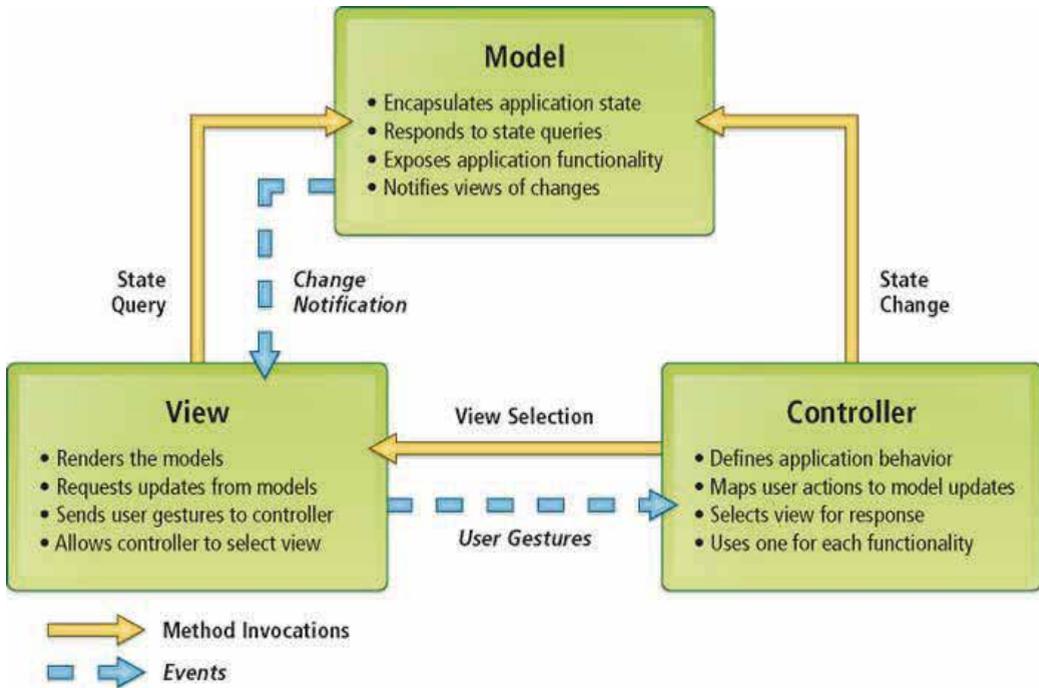


Figure 2: MVC design pattern

For the automatic analysis of non quantitative data from the HERIBITS project database, as well as to mine unstructured information scraped from external Social Network (SN), we used MongoDB as content repository, for its speed in data storage and support for JSON format, a Javascript-based open standard format¹ used to exchange data among distributed web applications and services, widely used by SN APIs and SN aggregators.

MongoDB is a document-oriented NoSQL-Database. MongoDB stores records not in tables as a relational database but in BSON documents, which is a binary version of JSON and very similar to the object structure. The usage of MongoDB makes his development easier and deployment faster.

¹ JSON (Java Script Object Notation) uses human-readable text to transmit data objects consisting of attribute-value pairs. It is used exchange to transmit data between a server and web application, as an alternative to XML

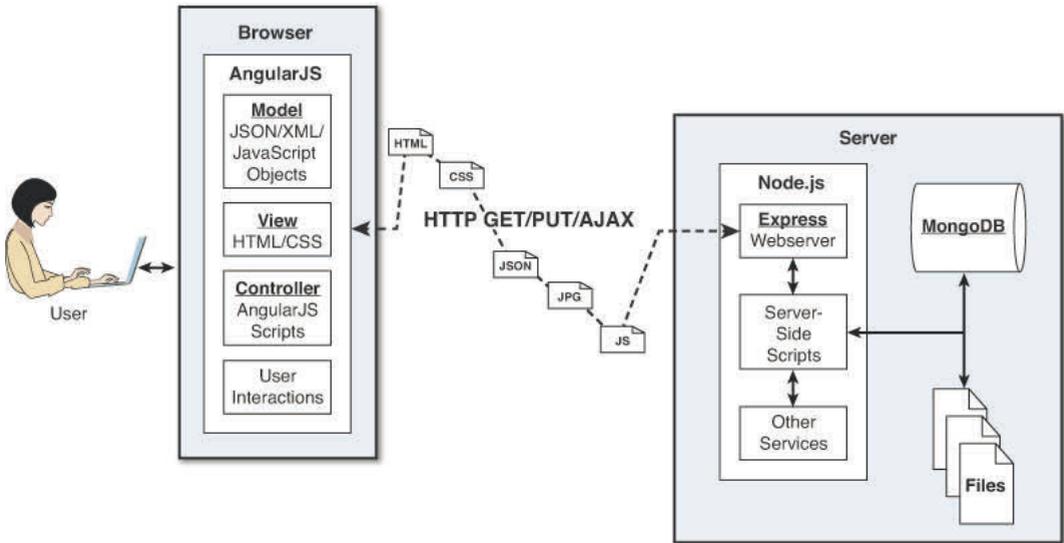


Figure 3: server and client frameworks with MVC

In addition, we used ElasticSearch to query MongoDB, since it is very efficient to query large and complex databases, again with JSON support.

Elasticsearch is used to process the vast amount of content in social media. Many recommendation engines use Apache Mahout², we preferred Elasticsearch for a more general support to query data, while Mahout is specialized on user profile data (e.g. Mahout is capable of recommending articles based on user's preference). In addition, Elasticsearch is dedicated and optimized for data query, and it is a perfect complement for MongoDB.

Elasticsearch is a Java-based search server based on Lucene. It provides a distributed, multitenant-capable full-text search engine with a RESTful web interface and schema-free JSON documents. It provides scalable search and near real-time search.

Elasticsearch supports data-intensive distributed applications and implements a computational paradigm named MapReduce (via the plugin Taste from GroupLens). The Taste plugin for Elasticsearch is Mahout Taste-based Collaborative Filtering implementation, providing the following features: (i) Data management for Users/Items/Preferences, (ii) Item-based Recommender, (iii) User-based Recommender, (iv) Similar Users/Contents and (v) Text Analysis.

² Apache Mahout is aimed to produce implementations of distributed machine learning algorithms focused primarily in the areas of collaborative filtering, clustering and classification. Many of the implementations use the Apache Hadoop platform

CONCLUSIONS AND FURTHER WORK

This paper presents the first results of the Heribits project, a research initiative to leverage collective awareness and openness in the planning, sourcing and execution of Cultural Heritage initiatives, focusing on the technological aspects of the research.

The project proposes an innovative methodology as well as an advanced technology platform enabling a new paradigm for bottom-up and top-down management of cultural heritage initiatives.

The techno-social platform integrates collaborative tools for CrowdSourcing, as well as analysis tools for rating project ideas and evaluate socio-economic impact, to propose best practices and to detect similar initiatives in order to avoid project duplications. The platform provides also social network capabilities and integrates an ad-hoc CrowdFunding shop.

The first part of the research was dedicated to re-engineering of the process of cultural project proposal and evaluation, through critical examination of real world cases, and with the support of domain experts.

Subsequently, we translated the set of requirements and functional needs emerging from the reengineering process into a complete system architecture, defining the technical modules implementing the different macro functions.

Finally we implemented the collaborative techno-social platform, in the form of a web application with cooperative nodes, inspired by platforms of collective awareness. The system is currently being tested with alfa and beta users, and will be subsequently validated with real users several locations in Italy.

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