MUST SEE ADVISOR FOR KYOTO

Nicola Maiellaro*, Naoko Oishi**, Antonietta Varasano*

* ITC-CNR, Construction Technologies Institute- National Research Council - Bari, Italy
** Faculty of Policy Science, Ryukoku University - Kyoto, Japan

Abstract

This article describes a multimedia interactive map developed as sample for the municipality of Kyoto, based on a single HTML page using AJAX, with a client-side control mechanism using jQuery components. The application supports better connections between resources and the places they refer to: the user could select a Point of Interest (PoI) through its multimedia contents using their previews (in a gallery or in a tile window) or their names reported in a list. PoIs—visualized on the map with multi-shape markers using a set of unambiguous colors—could be filtered through their categories and types, accessibility status and time line, thus improving the system usability.

Keywords

Multimedia interactive map, jQuery, AJAX, Open data, RESTful web service, GeoJSON

1. Introduction

The value and meaning of local knowledge in cultural heritage and the importance of preserving it for future generations is already recognized. Consequently, the process of involving communities has matured gradually over time, overcoming the unwillingness of knowledge holders to reveal information and stories. In this context, interactive maps play a central role in gathering and sharing knowledge, as illustrated, for example, by the recent crowd sourcing initiative to create the Philippines Heritage Map, powered by the Arches, and maintained by the local stakeholders, government units, heritage practitioners, and volunteers (Philippine Heritage Map n.d.).

Multimedia maps, born with the development of the personal computer since the 1980s (Peterson M.P. 2006), provide services both to technical and non-technical users, giving them the opportunity to retain more knowledge (Soomro et al. 1999). Despite this, this kind of maps provide multimedia content using simple hypertext links, 'hot spot' for interaction through mouse clicks (Cartwright & Hunter 2001).

Another issue is the poor attention to the use of colours and icons in the markers (Maiellaro & Varasano 2017). In our work, the application connects resources and the places they refer to:

the user could select a Point of Interest (P.o.I.) not only navigating or searching for destination but also through its multimedia contents, using different functions as described in the map interface paragraph.

Moreover, there is a need of friendly-user tool to reduce the great deal of time and efforts to produce this kind of maps unfamiliar to many.

With that, in the framework of the 'Smart Cities' project financed by the Engineering, ICT and Technologies for Energy and Transportation Department of the National Research Council of Italy, in 2014 started the 'Mu.S.A.—Must See Advisor' project. It aims to develop procedures and software as a support for stakeholders—mainly secondary schools, municipalities' teams and government offices—to simplify the publication of geo-referenced information.

The procedure includes planning and execution of a survey with photos acquisition; geolocalizing Point of Interest (P.o.I.) using handheld GPS, smartphones or maps; data collecting and metadata storing in excel files: a main file containing basic information for each P.o.I. and an ancillary file containing additional information about media retrieved for each P.o.I.

Then the files, converted to '.dbf' format, are downloaded by an 'Authoring System' to produce a multimedia interactive map according to additional data provided by the user.

Applications have been developed for many municipalities and countries, progressively adding functionalities and increasing usability:

- Italy—Municipalities of Syracuse (Lerario & Maiellaro 2014), Gioia del Colle, Matera and Lipari;
- Albania (Dollani, Lerario & Maiellaro 2016);
- Montenegro—Municipality of Cetinje (Maiellaro & Varasano 2016).

A further application, described in this article, has been developed for Kyoto as a way to improve the poor information about cultural properties in this city, as depicted in the next paragraph.

2. Kyoto as Historical City

The number of the foreign tourists visiting Japan in the recent five years has increased drastically (Fig.1), with particular reference to Kyoto City, which had already been famous enough as touristic city in the world (Fig.2).
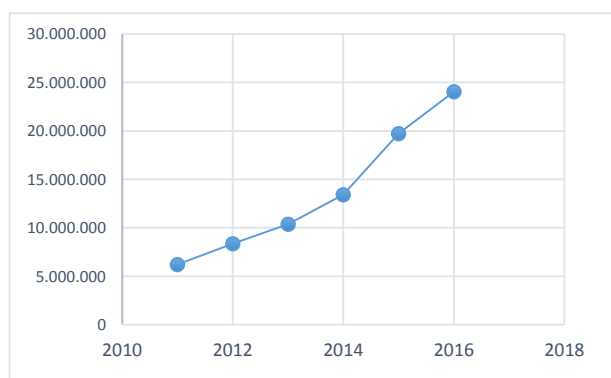

Fig. 1: Visitor Arrivals, Japanese Overseas Travelers (Japan National Tourism Organization n.d.)
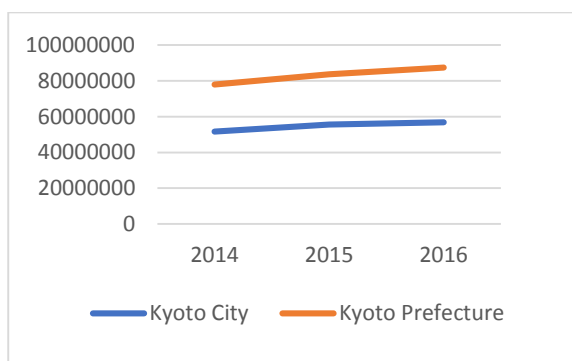

Fig. 2: Number of foreign visitors in Kyoto (Kyoto prefecture website n.d.)

Kyoto City is one of the oldest cities, based on Heian-kyo established as a capital of Japan in 794, in the Heian era and the Emperor lived until the Meiji Restoration (1876). A large number of elaborated and refined crafts had been produced for the Emperor. In addition, the refined offerings were gathered from all over the county for which the sophisticated culture prospered in Kyoto City. The typical Japanese culture such as Maiko/Geisya, traditional Japanese cuisine (Syojin-cuisine/Kaiseki-cuisine) come from Kyoto. One can say that the tourists discover the value of the Japanese identity in Kyoto history.

Currently, according to the report of Kyoto-city about the objectives of foreign visitors to Japan (Kyoto City 2015), Shinto shrine/Buddhist temple historic site is in the first place, traditional culture is in the second place and then there is the nature with its coloured leaves of cherry trees. In particular Shinto shrine/Buddhist temple/noted place raised to 43,5% in 2015 starting from 40,3% in 2014. Despite this growing interest, the official websites of Kyoto City provide poor information about its historical resources, compared with the one of European tourist countries or cities. In Japan, the industrial development department is usually in charge of websites for tourist with the aim to develop local economy but there is no collaboration with the cultural department, which is in charge of cultural properties. Therefore, the information is oriented to the presentation of local resources such as festivals, restaurants, workshops, entertainments, giving direct impact to foreign visitors' consumptions, which consequently lead to its economy development.

Nowadays the tourist official website of Kyoto City is held by Tourism and MICE Promotion Office of the Industry and Tourism Bureau, providing information about 428 Shinto shrine/Buddhist temple, located on a map, in the Japanese section; unfortunately, the English information are provided only by 72 sites.

Moreover, there is only a set of pages with static maps about the World Heritage Historic Monuments of Ancient Kyoto (Kyoto City Web n.d.), developed by the Preservation of Cultural Properties Section, City of Kyoto.

Probably this poor information involves the reduced use of the website, accessed by only 22.8% of foreign visitors (Kyoto City 2015), so the opportunity to share information about historical monuments using an interactive map to improve information quality, is not yet considered.

This reduced attention is also found in the national institutional website (which only shows only 6 points of interest for Kyoto) and in other commercial sites, as reported in the next paragraph.

Feature	Interactive map (Japan: The official guide n.d.) - Fig. A1	World Heritage Historic Monuments of Ancient Kyoto (Kyoto City Web n.d.) - Fig. A.2	Kyoto Map (Inside Kyoto n.d.) - Fig. A.3	Kyoto Map (Japan Visitors n.d.) - Fig. A.4	Map (Find your destination in Kyoto n.d.) - Fig. A.5	Kyoto Map (Google My Maps n.d.) - Fig. A.6	Japan Map (Japan Travel n.d.) - Fig. A.7	Kyoto Map Draft (Istituto per le Tecnologie della Costruzione, Consiglio Nazionale delle Ricerche n.d.) - Fig. A.8
Interactive map	X		X	X	X	X	X	X
Table function (multimedia list with search function)								X
Folder function (multimedia previews one by one)								X
Tile function (all multimedia previews in scrolling page)								X
Time slider (P.o.I. displayed until the selected century)								X
P.o.I.s allocated in categories	X		X					X
Categories share types								X
Category on/off	X				X			X
Type on/off								X
Short info about the selected P.o.I.			X	X	X	X	X	X
P.o.I. name displayed with mouseover							X	X
Link to a web page about the P.o.I.	X	X		X	X	X	X	X
List of P.o.I.s		X	X		X			X
Direction for reach the selected P.o.I.							X	X
Search function	X							X
Search function according to map area							X	
Marker shaped by category					X			X
Marker coloured by category	X		X					X
Icon in marker				X		X		X
Dynamic clustered marker (for overlapped P.o.I.s)						X	X	X
Filter panel (search parameters, accessibility status, building century, multimedia type selection)								X
Total number of features	6	2	5	4	6	5	7	**20**
Total number of P.o.I.	6	17	many		2	many		**16**

Tab. 1: Maps of Kyoto on the web (Fig. A.1-A.8 in Appendix)

3. The Map Interface

A review of web sites with maps on Kyoto found seven maps, six of which were interactive. The test indicates that many maps are not user-friendly and lack of functionalities respect to 'Kyoto Map Draft' (Tab.1): the unique features of our work is the connection inside the map among resources and places they refer to. The user could select a Point of Interest (P.o.I.) navigating or searching for destination, and interacting with multimedia previews. These are viewable using three functions (Fig. 3: 1-'Folder', 2-'Table', and 3-'Tile'), available in two components of the map (Fig. 3: A-'Menu', and B-'Callout'). Each multimedia preview has two icons: "chain", to load multimedia object they represent (a in Fig. 4), and "reverse drop" allowing the user to locate the P.o.I. which belongs (b in fig. 4). Therefore, the user is able to view a multimedia and, if interested, to see where it is located, so planning its trip in a conscious way. For example, all previews could be visualized in a scrolling window (Fig. 4: 3-'Tiles'). It is possible to see them also in a gallery, one by one, using the function "Folder" or in a list, using the function "Table". This solution is more usable than the one using three tabs (Details, Photo and Video) in the callout (Hu 2012).
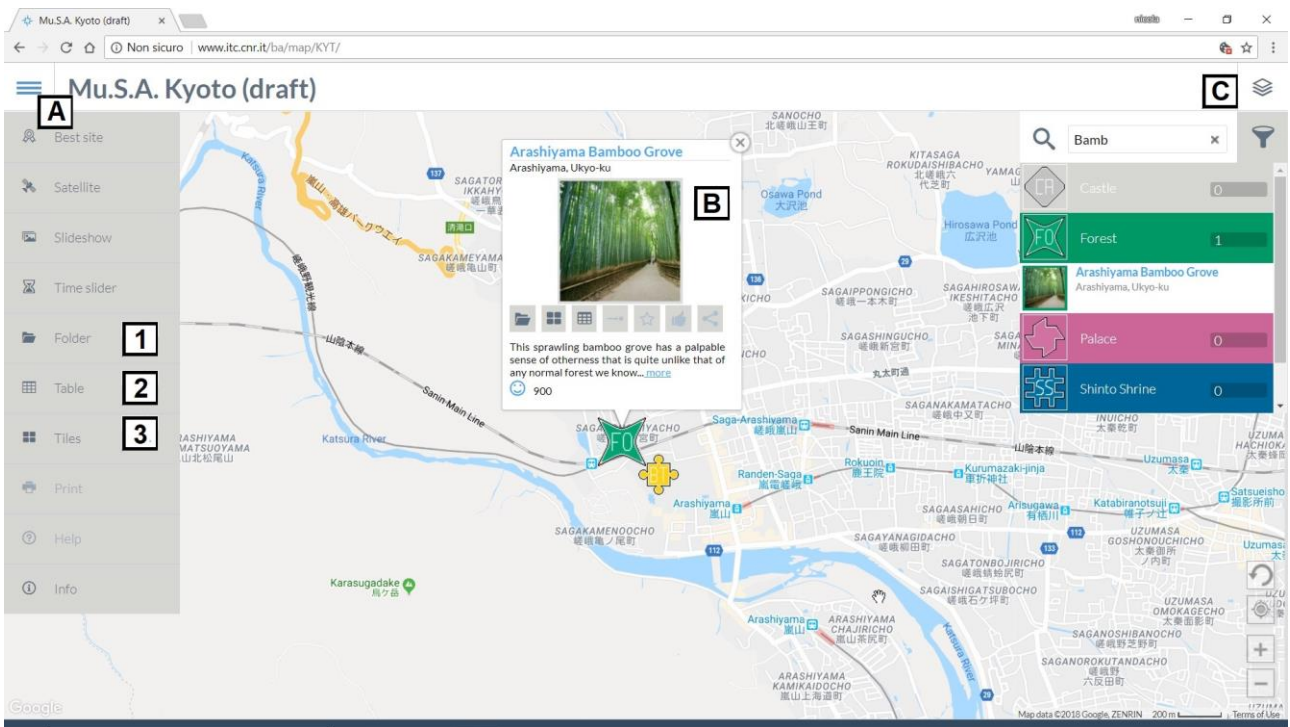
Fig. 3: The desktop interface of the multimedia interactive map of Kyoto (draft version) and its components: A) Menu; B) Callout; C) Sidebar. The first layer in the Sidebar ("CA"-Castle) has a gray color to state its turned-off status: therefore, all the P.o.I. belonging to this category is turned-off in the map, enabling the user is able to see only P.o.I.s according to its choice.
Source: Kyoto Map Draft (Istituto per le Tecnologie della Costruzione, Consiglio Nazionale delle Ricerche n.d.).
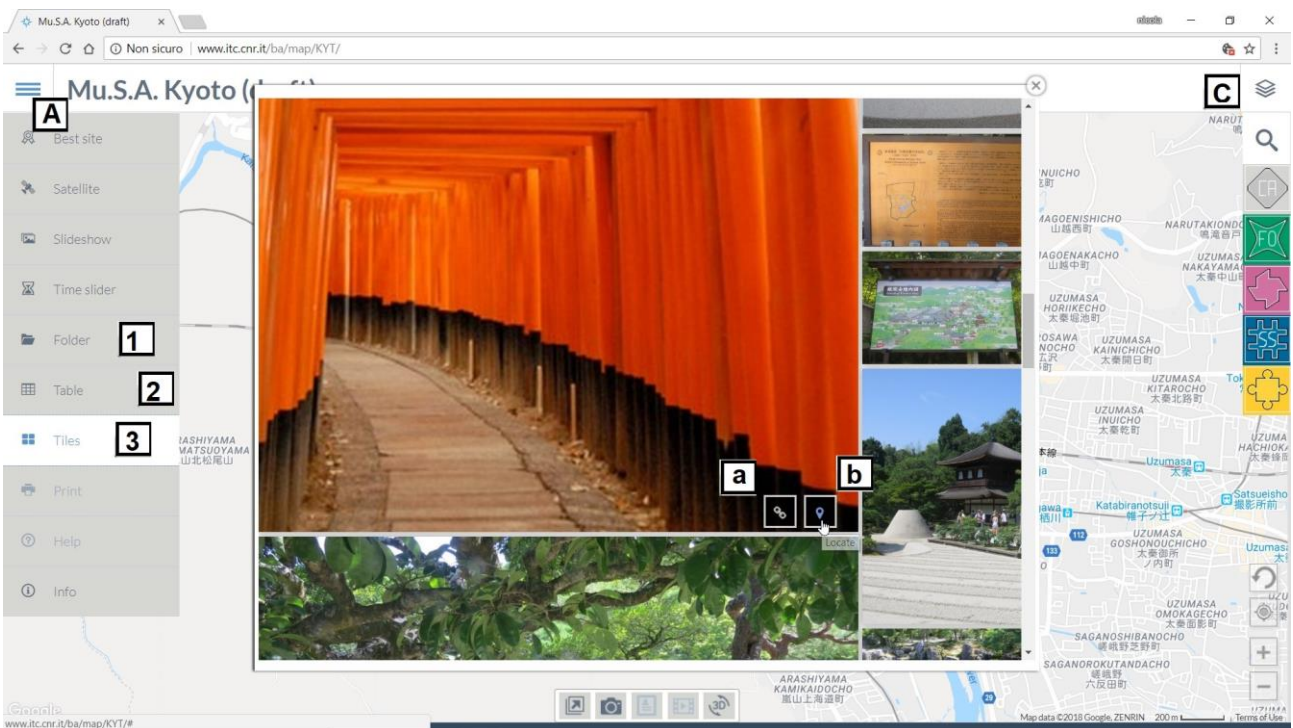

Fig. 4: Each multimedia preview has two icons: 'chain', loading multimedia object they represent (a), and 'reverse drop' (b), locating the P.o.I. to which they belongs. In this figure, all the multimedia previews have been visualized in a scrolling window using the function 'Tiles' (3). It is possible to see them also in a gallery, one by one, using the function 'Folder' (1) or in a list, using the function 'Table' (2).
Source: Kyoto Map Draft (Istituto per le Tecnologie della Costruzione, Consiglio Nazionale delle Ricerche n.d.).

The desktop map interface is articulated in three main components: 'Menu', 'Callout', and 'Sidebar'. To maximize the maps display area on monitor screens, the interface visualize them only when really needed, by clicking on their icons.

<u>'Menu'</u> (Fig. 3-A) open a list of functions applied to the all map in two ways. With mouse over the 'Menu' symbol, the list displays only 'self-describing' symbol; clicking on the 'Menu' symbol, the list shows/hides symbols and functions names:

- 'Best site', locating the most interesting site.
- 'Satellite', changing the map to earth view.
- 'Slideshow', opening a window with a moving set of thumbnails (main photo of each site). Clicking on a thumbnail, the map centres itself on the selected site, opening its callout—this function is useful for totem installation because attracts the public attention.
- 'Time slider', updating geographic distribution of markers according to the building century selected by the user in the timeline graphic using an handle control.
- 'Folder', displaying the preview of multimedia items (here belonging to all the P.o.I.s in the project) one by one in a dynamic resizing window. A command panel on bottom provides function icons for preview filtering by type and displaying control (backward/forward; play/stop).
- 'Table', listing the media items, here belonging to all the sites in the project, using a panel with columns alphabetically ordered. Two functions are available: 'Filter' to list only the selected type of multimedia; 'Search' to allow finding multimedia according to the letters typed in the textbox.
- 'Tile', displaying the preview of multimedia items (here belonging to all the P.o.I.s in the project) all together in a scrolling window. For each preview, the user is allowed to activate the following functions:
  - Link to the multimedia objects, which belongs the preview (Fig. 4-a).
  - Locate on the map the P.o.I. which belongs the multimedia object in the preview (Fig. 4-b) - not available in the 'Callout'.

<u>'Callout'</u> (Fig. 3-B) is a window (opened by clicking on a P.o.I. box in the sidebar or on a P.o.I. marker on the map) showing name, address, P.o.I. square thumbnail, function icons, a short description (expandable clicking on more), an accessibility status icon, and the building century.

The function icons in the 'Callout' includes: 'Folder', 'Table', 'Tile', as in the 'Menu', but applied only to the multimedia of the specific P.o.I.; 'Info' (link to an external webpage) and 'Destination' (get direction to reach the P.o.I.), functions not activated in this map. 'Ranking' and 'Share' function are provided but are in development.

The information about physical accessibility is fundamental: people using a wheelchair may have no difficulty at home in finding information about P.o.I.s but may find that, when they get to their destination, they cannot reach it because of—for example—the presence of staircases at the entrance. Therefore, the callout shows three kind of icons according to the physical accessibility of the P.o.I.: easy (accessible to all at all times), uneasy or restricted.

<u>'Sidebar'</u> (opened in fig. 3-C and closed in fig. 4) is another window, with a search box, a filter symbol and a three-level dynamic legend, organized as follows:

- The first depicts the main layers, using markers according to the P.o.I.s categories. If the category shares types, its marker in the 'Sidebar' has no pictures inside, as 'Temple'.
- The second level depicts the sub-layers according to the P.o.I.s types (if any) for the selected category, as 'Buddhist Temple' and 'Zen Temple' for category 'Temple'.
- The third level shows the P.o.I. box for the selected category (and type), displaying square picture, name, and address, as Daitoku-ji Temple.

Each box at the first and second level shows the number of the P.o.I. included, according to the search results and status of selections in the filter panel. Layers and sub-layers could be turned on and off, enabling information to be retrieved when required, thus enhancing what could be immediately viewed.

Clicking on the 'Filter' symbol substitutes the dynamic legend with the filter panel, allowing the user to set 'Data for search', 'Accessibility level', 'Multimedia type' and 'Building Century'.

Making the map more accessible is achieved visualizing P.o.Is in the map using markers with different shapes (Jenny & Kelso 2007) and colours; black and white markers perimeters allow their identification on all map backgrounds.

A colour-blind barrier-free pallet (Fig. 5), printable with similar colour both on screen and printers (Okabe & Ito 2008) has been adopted: "In an audience of 8 men and 8 women, chances are

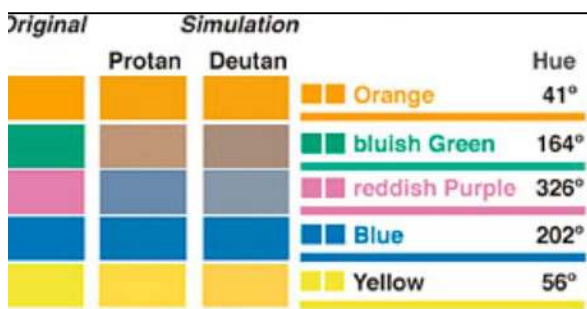50% that at least one has some degree of colour blindness" (Krzywinski et al. 2012).

Fig. 5: Colorblind barrier-free color pallet adopted in the developed multimedia map. Source: reworked from Okabe & Ito (2008).

Category Name	Category Symbol	Type Name	Type Symbol
Castle	CA		
Forest	FO		
Palace			
		Imperial Palace	IP
		Pavillon	PA
Shinto Shrine	SS		
Temple			
		Buddhist Temple	BD
		Zen Temple	ZT

Tab. 2: Categories and Types in the map

Color and shape identify a category; two alphabet letter in the marker represent the type (or category in no types are retrieved), using the same system adopted in the Kyoto subway and avoiding possible misunderstanding of pictorials symbols that are not standard.

Multimedia objects (sheet, image, video, and 3D) are accessible through their previews (Fig. 3), managed by 'Folder', 'Table', and 'Tile' functions provided in the 'Menu' (for all the PoIs) and in the PoI's 'Callout'.

4. The Architectural Solution

Nowadays, more and more organizations are making data open and retrieved around the world allowing public to discover access and use them. Therefore, we are witnessing the birth of a true ecosystem of open data (Open Data Commons n.d.), effective tools to promote the availability and reuse of data.

The widespread use of Open data portals, more and more evolved, is leading significant benefits both in terms of institutional transparency and development of advanced services aimed at citizens.

This new trend is fueling entrepreneurship,

accelerating scientific discoveries and creating efficiency in many sectors. Today there are many virtuous examples on the web, such as that of Kyoto city (Kyoto Open Data n.d.); it is now the world's very first open data portal site that automatically generates 5-star open data (Five-Star Open Data n.d.) and that has easy-to-understand and convenient data retrieval functions.

A top priority is to ensure Open Data portals are fit for purpose and sustainable in the long term. The European Data Portal report (EDP n.d.)—studies on the Economic benefits of Open Data and on Open Data maturity in Europe—sets outs how portals can reach sustainability, with recommendations drawn from in-depth interviews with portal owners across Europe, which aimed to understand individual experiences, as well as practical. Highlighting examples of successful ideas and initiatives in recommendations and case studies across Europe, the report demonstrates best practices to follow. It is against that background that the platform, entirely developed by our Institute, has been made with technical features able to construct the whole process of cataloging, publishing and displaying information.

The strongly scalable architecture of the portal has a general purposes infrastructure, suitable for recording and analyzing different types of data (structured or non-structured data); to make it more sustainable, some of the main architectural recommendations described in the European Data Portal report (Sasse et al. 2017) have been adopted:

- Select open source software solutions, as well as solutions that offer archiving/downloading options for all data published via the portal;
- Contribute to the development of standard APIs, that could be used across all Open Data platforms for sharing, summarising and presenting data;
- Build links to data held in other portals into yours, where they could be relevant for your local users;
- Even if not responsible for the publication and maintenance of data, find user needs and their preferred data formats to drive data improvements;
- Build upon recognised standards to foster interoperability and comparability of metadata across Europe.

The open source solutions, most commonly

used today for the cataloging of Open data, are (Sasse et al. 2017) DKAN (an Open data platform with the core of Drupal) and CKAN (an Open data platform developed and promoted by the Open Knowledge Foundation). For the design and updating of our platform, the CKAN solution was adopted, since it provides tools to ease the workflow of data publishing, sharing, searching and management. Similar to CKAN solution, the multimedia interactive map provides a set of visualization tools, such as interactive tables, graphs and maps, based on RESTful JSON API paradigm for querying and retrieving data.

The very innovative aspect of this solution is that the multimedia interactive map transactions adopt the JavaScript Object Notation (JSON), a leading document interchange format. Due to the use of geo-referenced information, the application stores all data using the Open data format GeoJSON (Geographic JavaScript Object Notation) - simple lists easily readable by servers.

Our research work aims to contribute to the development of standard APIs for sharing, summarising and presenting data. At present, while most open source and proprietary platforms offer standard metadata exports (XML, JSON or CSV), there are no standard APIs for other aspects of data management, such as creating datasets, updating datasets or querying datasets.

The results are provided by the hosting database as the query is made, where smaller amounts of data are requested on demand, on the fly, in real time, via web services. As there is no need to duplicate information, host organisations are able to maintain, update, delete and modify their own database without having to repeat these efforts elsewhere.

Importantly by using web services, all contributing organizations maintain ownership and control over their own data. The primary concept, in using web services, is the notion of 'hold the data once, and use it many times' (Beamer & Gillick 2010). One of the key characteristics of a RESTful web service is the explicit use of HTTP methods, protocol as defined by RFC-Request for Comments (The RFC Editor n.d.). 'HTTP GET', for example, is defined as a data-producing method, to be used by a client application to retrieve a resource, to fetch data from a web server, or to execute a query with the expectation that the web server will look for and respond with a set of matching resources.

The design of RESTful web service involves a set of constraints on the data format, giving a structure to objects that the application and service exchange in the request/response payload or in the HTTP body.

For true portability, it has been made an author system using a standard set of APIs for all data import and export for publishing a RESTful service that supports spatial queries and editing operations; with a wizard, in a few simple steps the end-user imports existing spatial files, including CSVs with the latitude and longitude of points.

The output of the process for publishing a hosted feature layer in the author system is a particular map—the multimedia interactive map—that is an example of a 'single-page application' (SPA), which is a different way of building HTML5 applications from traditional web page development.

It loads a single HTML page and dynamically updates it as the user interacts with the app. Instead of spreading the functionality of the multimedia interactive map across a collection of separate web pages with hyperlinks between them, a single root page has been defined: the application uses the JSON data to update the page dynamically, without reloading it and separates the user interface (UI) library and the data. Over the past few years, single page web applications and their frameworks have gained huge popularity. SPA solution has been adopted for its main advantage to improve the web surfing of the multimedia interactive map on mobile. This advantage can affect the positioning and the discoverability of data on the web, since the usability on mobile devices is effectively now a ranking factor. Another advantage of this type of layout is the possibility to concentrate all content in a single page, which is useful when we are targeting very precise queries. These solutions are fast and user-friendly, support ReSTful APIs and enable distributing the processing workload between the server and client computers. Finally, it is much easier to convert such web application into a mobile one.

However, it should not be forgotten that sites, with a "single page" layout type, have a single URL and therefore all input links would be referred to the same URL. Consequently, websites with many contents intended to a broad target of web user and that want to position themselves on different queries, do not perform particularly well with the "single page" layout. In fact, often, there is a

tendency to leave out a little details to fit all the contents into a single layout and this could lead to the loss of useful/important details. Moreover, SPAs are single-section sites designed in a single page and do not allow creating sections, such as data structures in which to organize the site.

While the potential of SPA is promising, actually implementing them can be tricky due to search engine optimization (SEO) (RapidAPI the blog n.d.). Search engines are still the most popular way to discover new products and find information.

Today's science increasingly requires effective ways to find and access existing datasets distributed across a range of repositories. So our research will focus on improving the discoverability of data, part of this will involve using information about how data is searched for (search terms, location, etc.) via web application and making data easier to interpret and use across different formats; visualizations and APIs will be also key to maximizing its beneficial use and impacts.

The multimedia interactive map has a layered architecture (three layer) and consists of different types of components:
- Data Source (Data Services, Data access, Offline storage): Models / Collections of Models;
- Interaction with the application (Server logic, Client logic), state capturing and navigation (Navigation): Events, Routing;
- Markup for presenting data (Initial page, User Interface): Templates.

Google Maps API is integrated in the application for rendering geospatial data within a web browser and for accessing rich mapping features.

Moreover, Google Maps API is 'optimized ' for smartphones and it is a set of application programming interfaces (APIs) developed by Google, which allow communication with Google Services and their integration to numerous other services.

Another advantage of this is that not all data has to be transferred, we only add and transmit the data we wish; the less data transferred, the faster the transfer and less likelihood of breakdown.

The application uses client-side storage for three reasons:
- The multimedia interactive map is retrieved when the user is offline, possibly synchronizing data back once the network is connected again.

- It is possible to show a large corpus of data as soon as the user clicks on to the application objects (slideshow, tile, table, etc.), instead of waiting for it to download again.
- It is an easier programming model, with no server infrastructure required.

5. Conclusions

This paper presented the design and implementation of a multimedia interactive map loaded in a single HTML page having multiple features and functions, as distinct from other maps, to support the users in searching for cultural heritage information according to their needs.

Future work will be the development of an open data digital library to store both main and ancillary data to be used not only in the interactive multimedia map but also in further application. A registered user will be able to build his/her datasets downloading geographical data through GeoJSON format, using metadata - 'data about data'. Data published in open format will continue to be of value, even if the tool used to create the library is discontinued.

6. Author Contributions

Nicola Maiellaro: project and testing (§ 1, 3, Appendix); Naoko Oishi: case study (§ 2); Antonietta Varasano: system architecture and software development (§ 4).

Acronyms

|	
AJAX	Asynchronous JavaScript and XML
API	Application Programming Interface
CSV	Comma Separated Values
Dbf	dBase Table File Format
DBMS	Database Management System
EDP	European Data Portal
GeoJSON	Geographic JavaScript Object Notation
GPS	Global Positioning System
HTML	HyperText Markup Language
JSON	JavaScript Object Notation
MICE	Meeting Incentive Convention and Event/Exhibition
PoI	Point of Interest
RDBMS	Relational Database Management System
REST	REpresentational State Transfer
RFC	Request for Comments
SEO	Search Engine Optimization
SPA	Single Page Application
SQL	Structured Query Language
UI	User Interface
URL	Uniform Resource Locator
XML	eXtensible Markup Language

APPENDIX
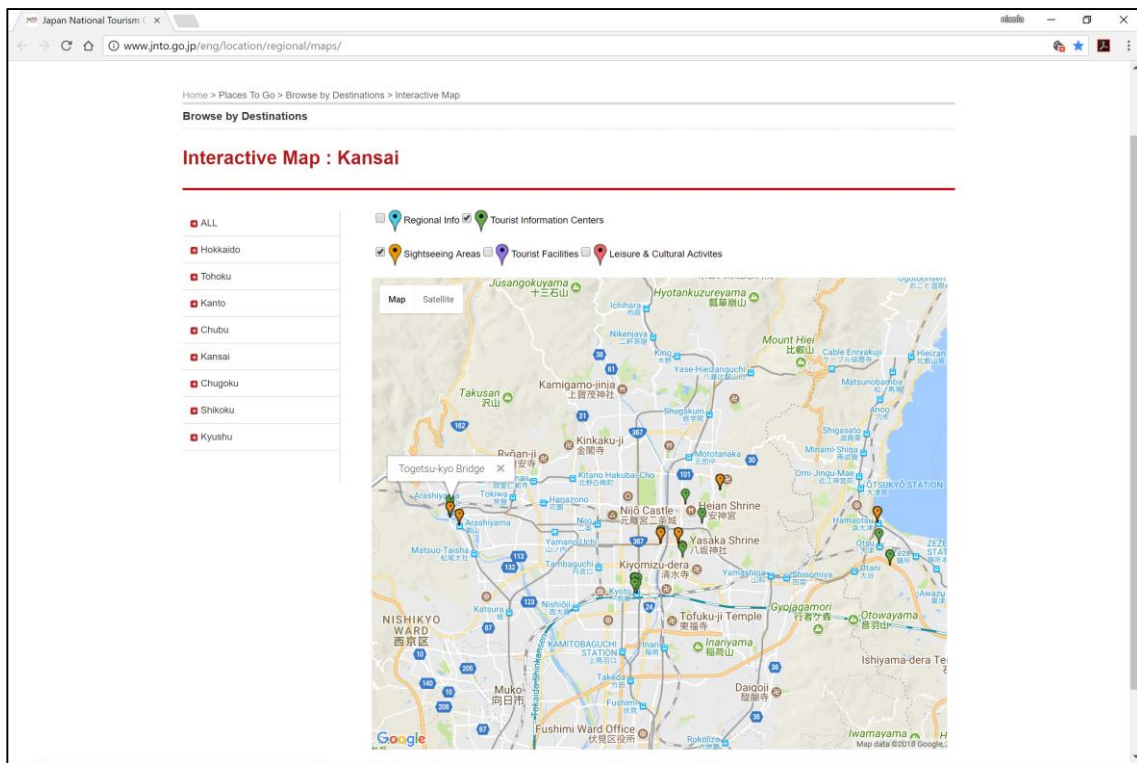
Fig. A.1: Interactive map (Japan: The official guide n.d.). It is not possible to select a specific city – only a region could be selected). P.o.I. allocated in five categories. Zoom in Kyoto City: only 6 P.o.I. in the "Sightseeing Areas" category.
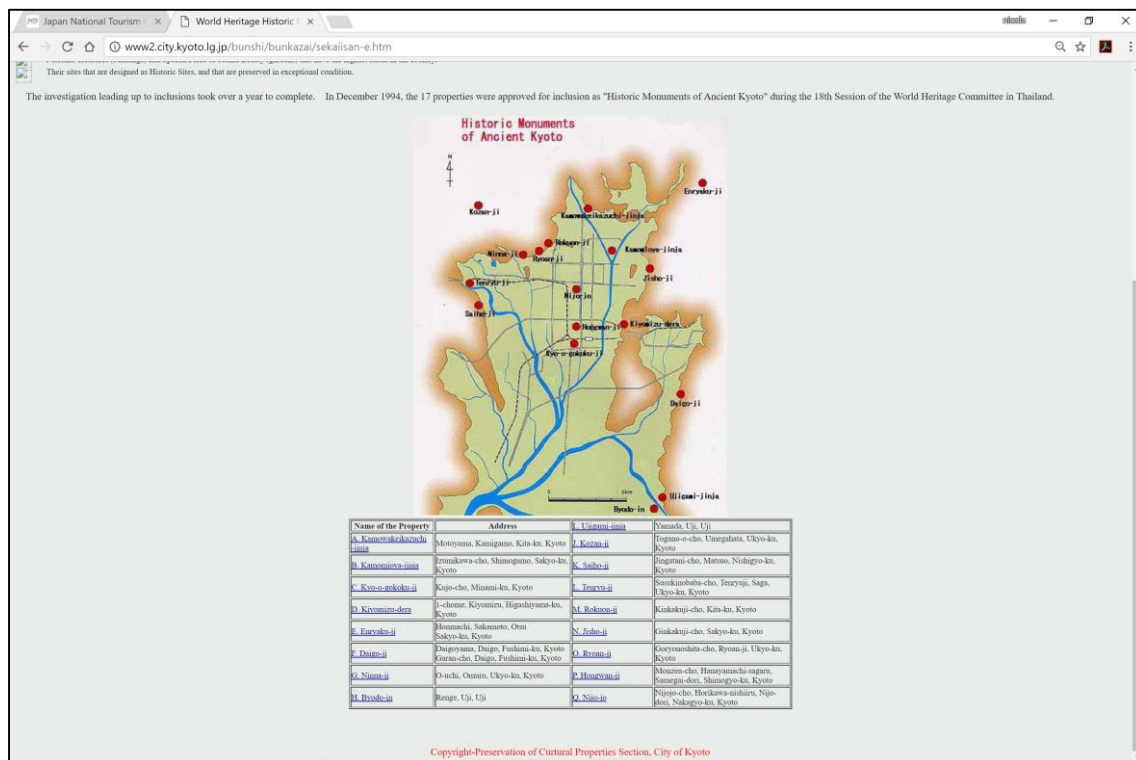

Fig. A.2: World Heritage Historic Monuments of Ancient Kyoto (Kyoto City Web n.d.). Static map; list of Historic Monuments of Ancient Kyoto with link to web pages
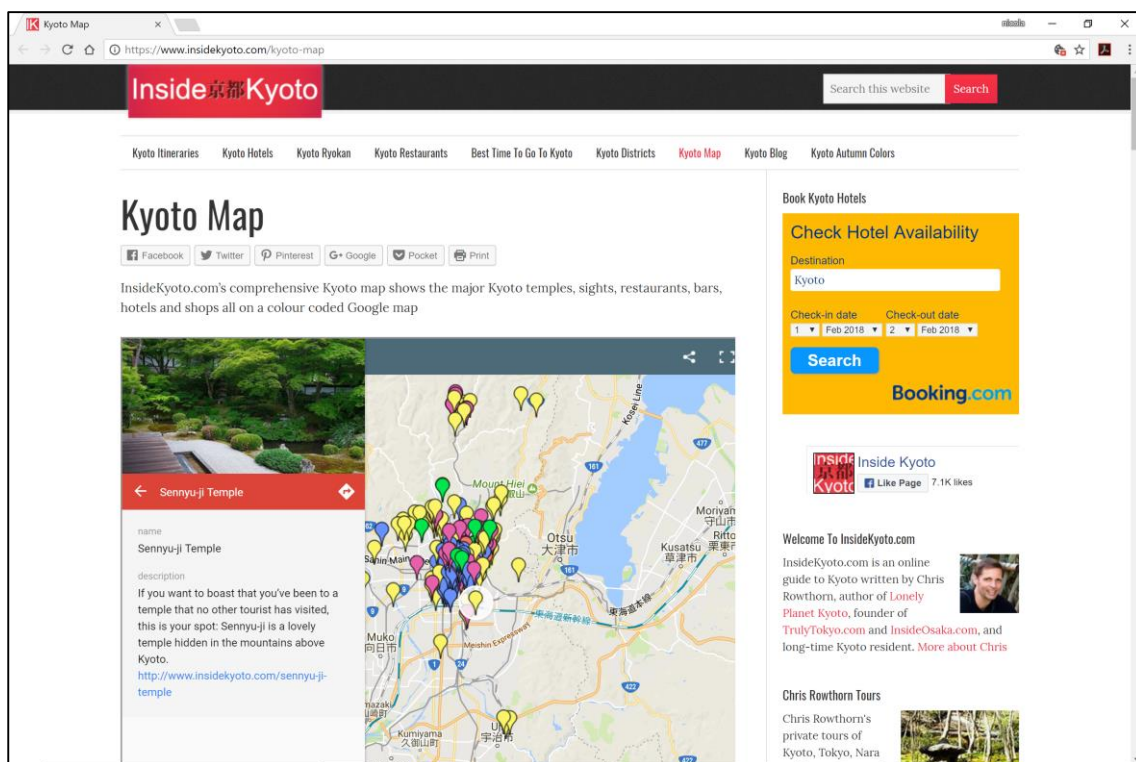
N. Maiellaro, N. Oishi, A. Varasano

Fig. A.3: Kyoto Map (Inside Kyoto n.d.). Interactive map – markers coloured by category (Sights in yellow). On left side: List of P.o.I.s and short info of the selected P.o.I. with link to its webpage.
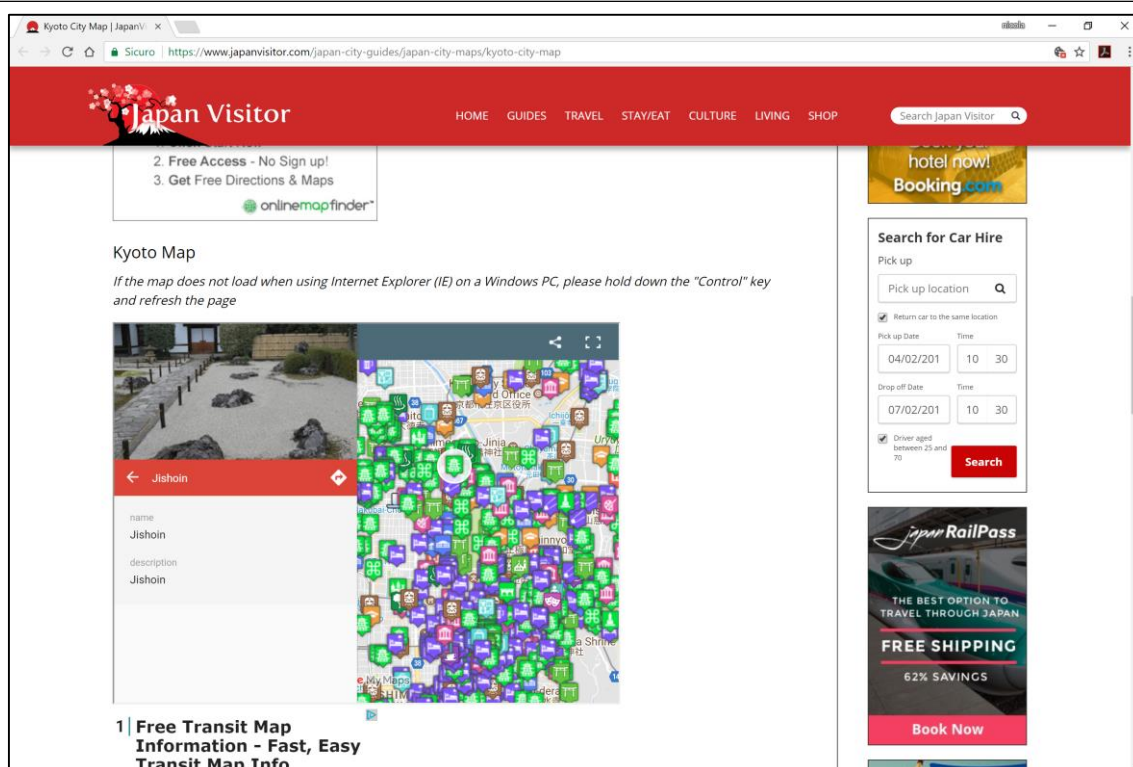

Fig. A.4: Kyoto Map (Japan Visitors n.d.). Interactive map – markers with icon by category (No legend available). On left side: short info of the selected P.o.I.
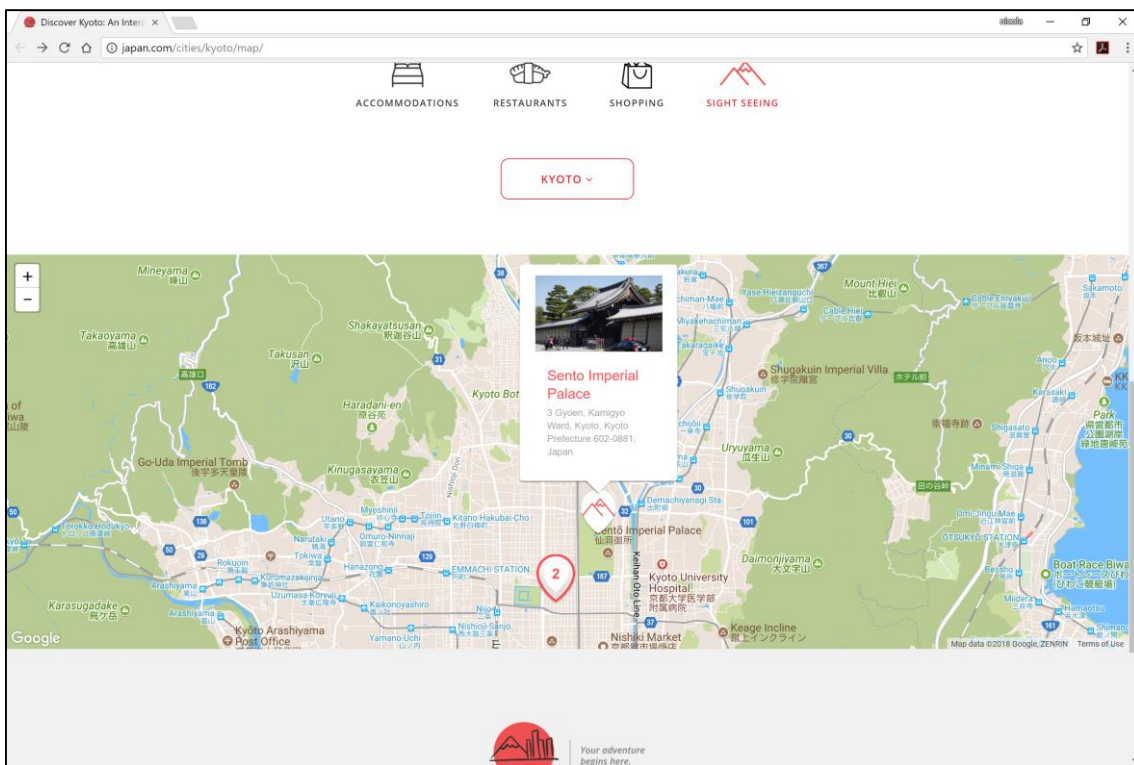
Fig. A.5: Map (Find your destination in Kyoto n.d.). Interactive map with clustered markers; P.o.I.s allocated in four categories. Short info about the P.o.I. in the callout. Only two P.o.I. are of historical interest. The mountains icon is not suitable for this kind of P.o.I.
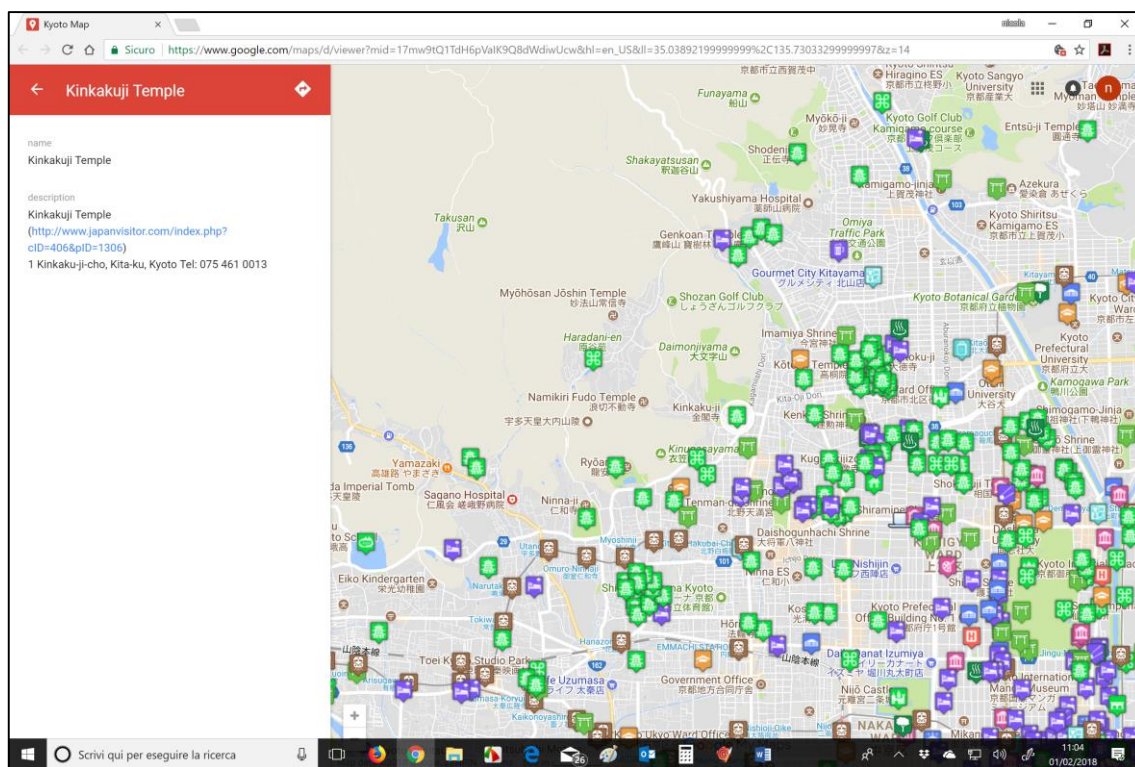

Fig. A.6: Kyoto Map (Google My Maps n.d.). Interactive map – markers with icon by category (No legend available). On left side: short info of the selected P.o.I. and P.o.I. list.
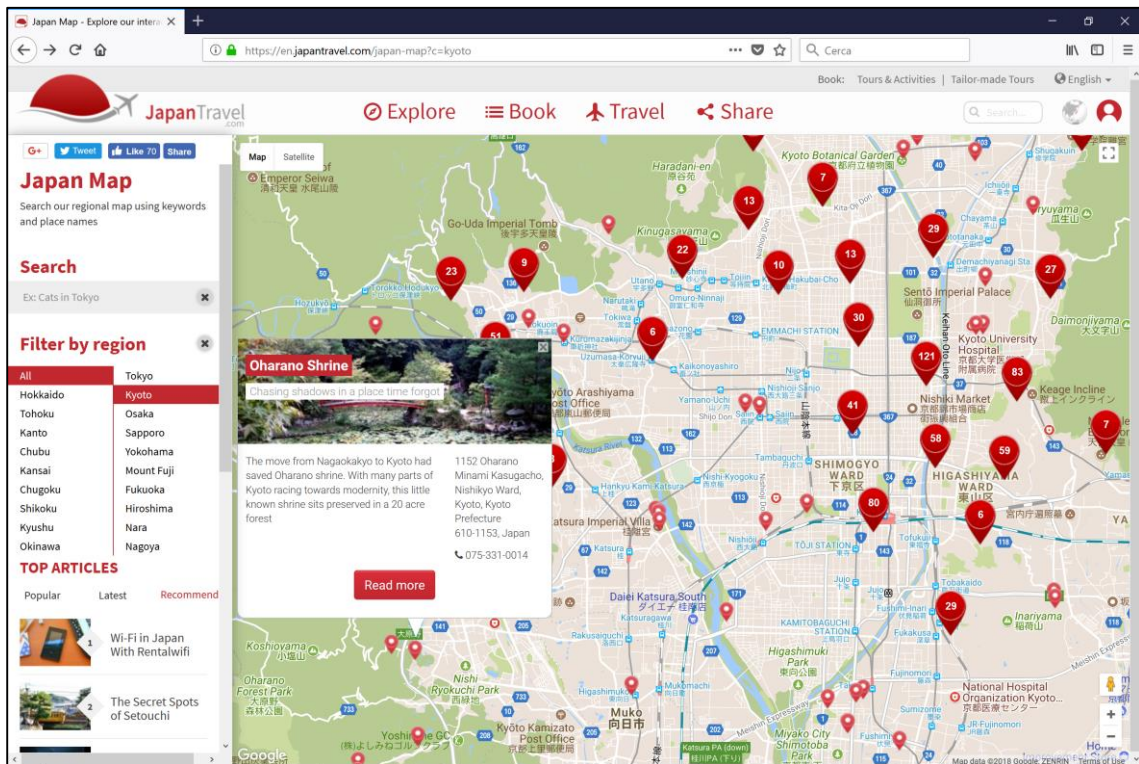
Fig. A.7: Japan Map (Japan Travel n.d.). Interactive map with a lot of P.o.I.s, not allocated in categories (red reverse drop for all P.o.I.s). Mouse over function display the P.o.I. name. Clustered marker. Callout with short info on sx, address on dx (not in this case) and red button on bottom, with different link (photo in this case).
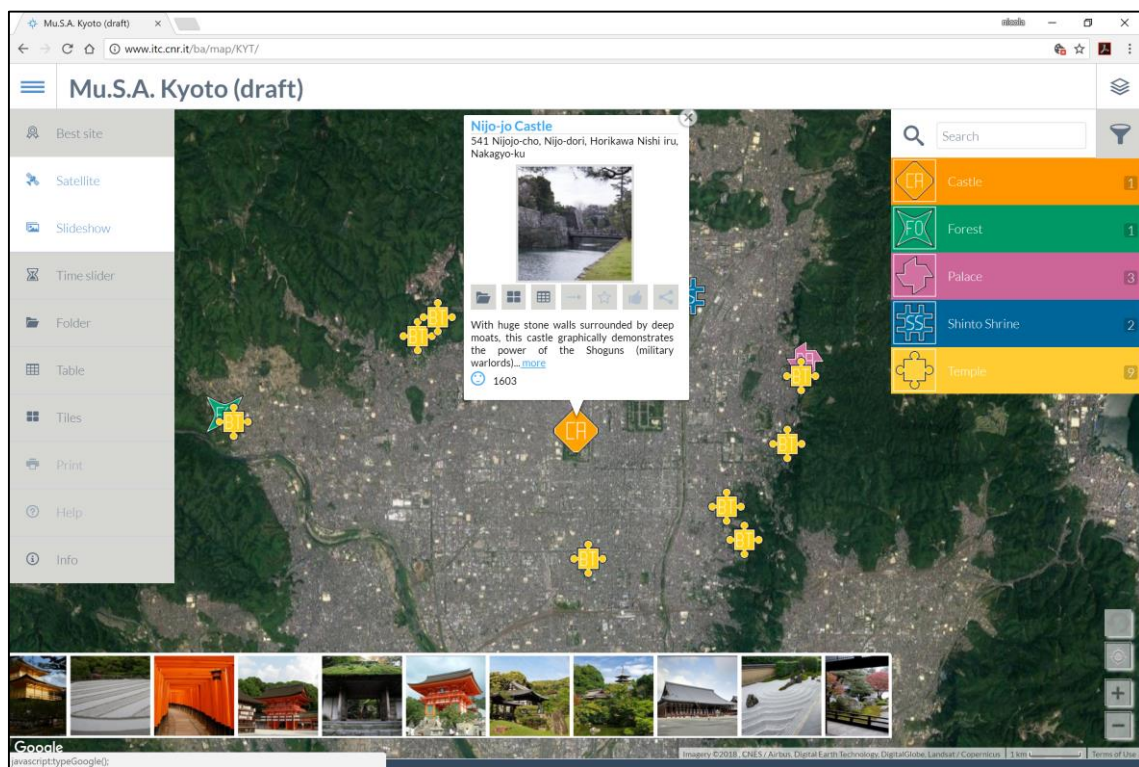

Fig. A.8: Kyoto Map Draft (Istituto per le Tecnologie della Costruzione n.d.). Interactive map with multimedia functions; filter panel; time slider; slideshow. P.o.I.s allocated in categories/types; marker shaped and colored by category; category and type on/off; text icon in marker; clustered marker. Callout with short info about the P.o.I. and link to its webpage.

REFERENCES

Beamer, A, & Gillick, M. (2010). Scotlandsplaces: Accessing Remote Digital Heritage Datasets Using Web Services. In M. Ioannides et al. (Eds.), *EuroMed 2010: Digital Eritage*, LNCS 6436 (pp. 225–239). Berlin, Heidelberg: Springer.

Cartwright, W.E., & Hunter, G.J. (2001). Towards a Methodology for the Evaluation of Multimedia Geographical Information Products. *GeoInformatica*, 5(3), 291-315.

Dollani, A., Lerario, A., & Maiellaro, N. (2016). Sustaining Cultural and Natural Heritage in Albania. *Sustainability*, 8(8), 792. Retrieved from: http://www.mdpi.com/2071-1050/8/8/792.

EDP n. d. European Data Portal. Retrieved from: https://www.europeandataportal.eu

Find your destination in Kyoto n.d. Map. Retrieved from: http://japan.com/cities/kyoto/map

Five-Star Open Data n.d. Five-Star Open Data web site. Retrieved from: http://5stardata.info/en

Google My Maps n. d. Kyoto Map. Retrieved from: https://www.google.com/maps/d/viewer?mid=17mw9tQ1TdH6pVaIK9Q8dWdiwUcw&hl=en_US

Hu, S. (2012) Multimedia Mapping on the Internet Using Commercial APIs. In M.P. Peterson (Ed.), *Online Maps with APIs and WebServices*, Lecture Notes in Geoinformation and Cartography (pp. 61-71, DOI 10.1007/978-3-642-27485-5_5. Berlin, Heidelberg: Springer.

Inside Kyoto n.d. Kyoto map. Retrieved from: https://www.insidekyoto.com/kyoto-map

Istituto per le tecnologie della Costruzione, Consiglio Nazionale delle Ricerche n.d. Kyoto Map Draft. Retrieved from: http://www.itc.cnr.it/ba/map/KYT

Japan National Tourism Organization n.d. Retrieved from: https://www.jnto.go.jp/jpn/statistics/marketingdata_outbound.pdf

Japan Travel n.d. Japan Map. Retrieved from: https://en.japantravel.com/japan-map?c=kyoto

Japan Visitors n.d. Kyoto Map. Retrieved from: http://www.japanvisitor.com/japan-city-guides/japan-city-maps/kyoto-city-map

Japan: The official guide n.d. Interactive map. Retrieved from: http://www.jnto.go.jp/eng/location/regional/maps

Jenny, B., & Kelso, N.V. (2007). Mapping: Methods & Tips. Color Design for the Color Vision Impaired, Cartographic Perspectives. *Journal of the North American Cartographic Information Society*, 58, 61-67. Retrieved from: http://colororacle.org/resources/2007_JennyKelso_ColorDesign_hires.pdf

Krzywinski, M., Birol, I., Jones S., & Marra, M. (2012). Getting Into Visualization of Large Biological Data Sets. 20 Imperatives of Information Design. Retrieved from: http://mkweb.bcgsc.ca/biovis2012/krzywinski-visualizing-biological-data.pdf

Kyoto City (2015) General Sightseeing Investigation of Kyoto City 2015 from January to December. Retrieved from: http://www.city.kyoto.lg.jp/sankan/cmsfiles/contents/0000202/202863/honsatsu.pdf

Kyoto City Web n.d. World Heritag Historic Monuments of Ancient Kyoto. Retrieved from: http://www2.city.kyoto.lg.jp/bunshi/bunkazai/sekaiisan-e.htm

Kyoto Open Data n.d. Kyoto City Open Data Portal Site. Retrieved from: https://data.city.kyoto.lg.jp

Kyoto prefecture website n.d. Retrieved from:
http://www.pref.kyoto.jp/tokei/yearly/tokeisyo/tsname/tsg1013.html

Lerario, A., & Maiellaro, N. (2014). Mappe Interattive per la Promozione Turistico-Culturale. *SCIRES-IT-SCIentific RESearch and Information Technology*, 4(1), 85-98. Retrieved from: http://caspur-ciberpublishing.it/index.php/scires-it/article/view/10939

Maiellaro, N., & Varasano, A. (2017). One-Page Multimedia Interactive Map. *ISPRS International Journal of Geo-Information*, 6(34). Retrieved from: http://www.mdpi.com/2220-9964/6/2/34/pdf

Maiellaro, N., & Varasano, A. (2016) Multimedia Interactive Map for CH Presentation. , Springer International Publishing AG 2016. In M. Ioannides et al. (Eds.): *EuroMed 2016: Digital Heritage. Progress in Cultural Heritage: Documentation, Preservation, and Protection.* Part II, LNCS 10059 (pp. 178–190). Berlin, Heidelberg: Springer.

Okabe, M., & Ito, K. (2008). *Color Universal Design (CUD) - How to make figures and presentations that are friendly to Colorblind people*. Retrieved from: http://jfly.iam.u-tokyo.ac.jp/color

Open Data Commons n.d. Retrieved from: https://opendatacommons.org/ [15 January 2018].

Peterson, M. P. (2006). Hypermedia Maps and the Internet. In E. Stefanakis., M.P. Peterson, C. Armenakis, V. Delis (Eds.) *Geographic Hypermedia. Lecture Notes in Geoinformation and Cartography* (pp 121-136). Berlin, Heidelberg: Springer.

Philippine Heritage Map n.d. Retrieved from: http://www.philippineheritagemap.org/map

Pilar, C., & Tomás, A. (2012). Mapping the Cultural Heritage: Open Source Tools Applied to Discover the Historical Infra-structures. In *Conference: 7th International Workshop on Digital Approaches in Cartographic Heritage* (pp 225-236). Barcelona.

RapidAPI the blog n. d. Optimizing SEO for Single Page Applications with Isomorphic JavaScript. Retrieved from: http://blog.rapidapi.com/2017/01/24/optimizing-seo-for-single-page-applications-with-isomorphic-javascript.

Sasse, T., Smith, A., Broad, E., Tennison, J., Wells, P., & Atz, U. (2017). Recommendations for Open Data Portals: from setup to sustainability. Retrieved from: https://www.europeandataportal.eu/sites/default/files/edp_s3wp4_sustainability_recommendations.pdf

Soomro, T. R., Zheng, K., Turay, S., & Pan, Y. (1999). Capabilities of Multimedia Gis. *Chinese Geographical Science*, 9(2), 159-165. Retrieved from: https://link.springer.com/content/pdf/10.1007/BF02791367.pdf