WEB TECHNOLOGIES FOR MULTIMEDIA-BASED, MOBILE MUSEUMS

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Abstract: *The paper presents a web-based tour documentation. An interactive map of Germany displays stations already being visited by a mobile museum and those being planned. Station details offering further information as well as various media representation. A barrier-free HTML version also provides editorial and administrative functionality.*

Keywords: *mobile museum, tour documentation, rich internet application, geographical information presentation, user-generated media content*

1. INTRODUCTION

In many cases it is difficult to visit a museum regarding local, temporal, or financial issues – particularly for youths. The concept of a mobile museum inverts the regular visit; rather than the visitor coming to the museum, the museum is brought to the visitor. It provides a solution so that museum employees can reach schools, colleges, or universities to show selected exhibits, to present multimedia-prepared content of the museum context, and to develop fields of knowledge with pupils in workshops.

For documentation issues, an online presentation with modern Web 2.0 techniques and an appealing processing of activities and multimedia content reflects this young idea. The participants are encouraged to prepare and to rework the museum stop. Subsequently, they can edit their produced media content and publish it to the public. Pupils can access the backend toolbox and integrate their media content. Embedding various media content, like images, videos, podcasts, vodcasts, audio or textual articles, created on spot records the visit and gives users an insight into operating principles of the mobile museum as well as reports on visitor's experiences. That supports the participant's identification to the mobile museum and its cause as well as provides prospective participants with an idea about the visit and encourages sustainable interchange between participants.

2. CONCEPTS AND FUNCTIONALITY

The tour documentation is provided in two ways:

A Rich Internet Application (RIA) determines the primary usage by offering extended graphical representation of geographical information and media content. Additionally, a HTML version ensures the operational capability in public institutions, where barrier-free web access is mandatory for handicapped people.
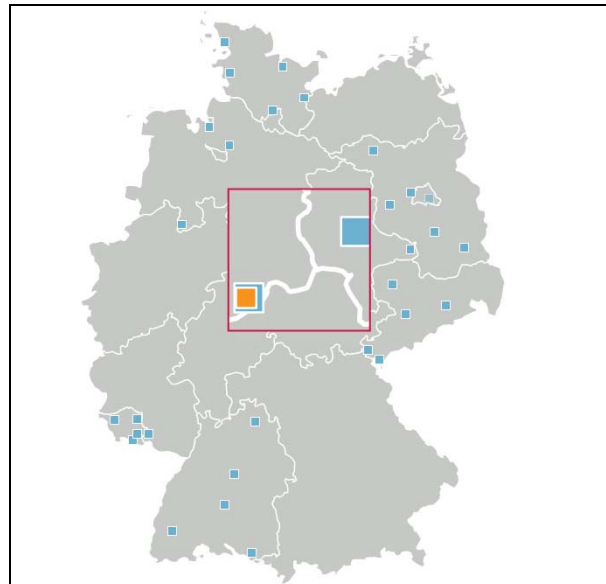

Fig. 1 – Initial map overview of Germany with towns being visited, and magnification square

A. THE RICH INTERNET APPLICATION

This version is being displayed by default, when the user accesses the tour documentation web page. A link provides the opportunity to switch to the HTML version.

Map overview

Initially, the tour documentation offers a map of Germany with its federal states. Coloured markers indicate towns the mobile museum had already stopped, is currently attending, and planned stops. A part-scalable magnification function also displays surrounding points of interest [Fig. 1]. Clicking a town marker, a submenu offers available station or points of interest.

Besides its geographical presentation on the map, the user can alternatively choose a tour-organised, time-based list presentation to select the station desired.

Station detail

After station selection, additional information is provided – a next-door environmental map, contact and tour stop details are displayed [Fig. 2].
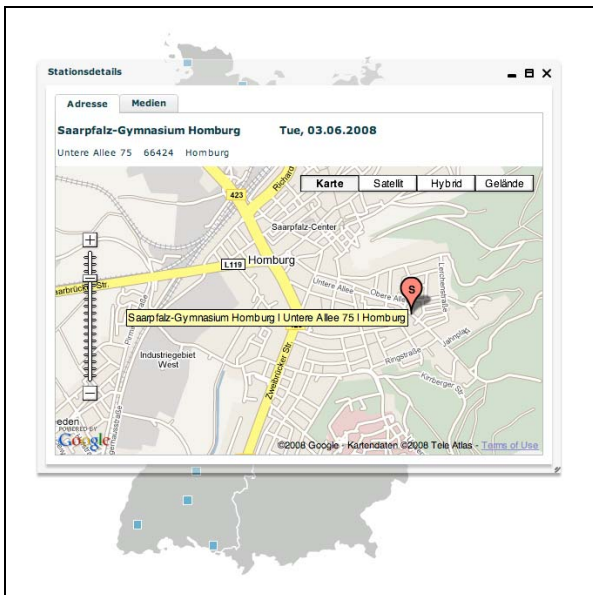

Fig. 2 – Station detail – contact and geographical information

Furthermore, a gallery offers various media content for the station selected, i.e. images, videos, audios, podcasts, vodcasts or text-based reports, that have been produced by participants on site and then published as well as released by a platform administrator [Fig. 3]. A pop-up gallery view with thumbnails as well as integrated volume control and forward and rewind functionality implements standards on web-based media presentation.

The same metaphor applies after selecting a point of interest. According to the museum's context, in preparation or reworking to the visit of the mobile museum, pupils are asked to solve tasks while discovering their surroundings and document corresponding objects with its geographical representation, media created and own impressions. Pupils use mobile devices and wireless networks to collect, process and transfer the media content.
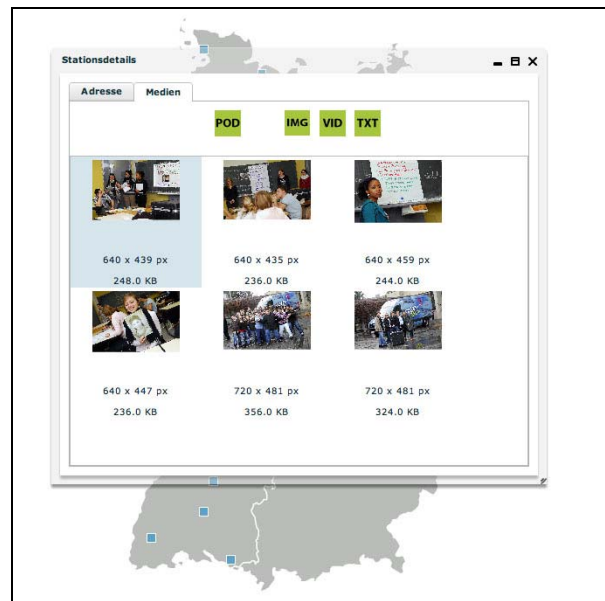

Fig. 3 – Station detail view, image gallery with thumbnail preview

Media content upload

To present specific results based on the visit of the museum, users have the possibility to upload self-produced media content. In this context it is necessary that people are registered and logged in to prevent misuse. As there are users of different age groups, educational background and media competence it is important to minimise technical barriers so that many people are able to access the media upload without having specialised knowledge.

Therefore users do not need to consider a specified format when uploading media. The application supports different types of media such as text, images, audio and video. Advanced users also have the possibility to transfer podcasts and vodcasts.

After uploading selected files, they are automatically converted to a standardised format on the server. This enables applicants to use the system in an easy way.

As the application is used for educational purposes, a review process is needed. Staff has to approve uploaded content before it is accessible to the public.

Administration back-end

All work regarding administration is performed by the administration back-end. Therefore it is accessible only for staff members. They are able to control user accounts and to manage the contents [Fig. 4]. In this context, content includes all tour and station details. Furthermore, administrators need to confirm suitable content uploaded by users and they also need to delete inappropriate media.
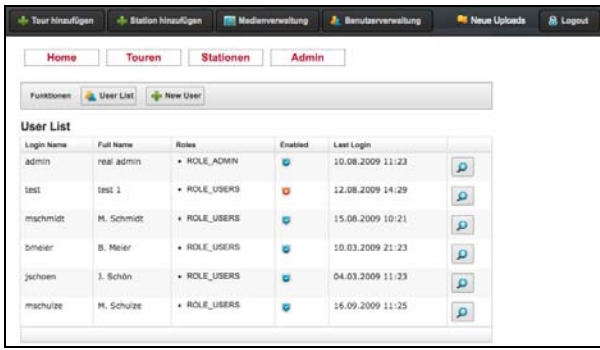
Fig. 4 – User administration

B. HTML APPLICATION

The HTML-based application offers the same content like the RIA, but allows textual magnification, alternative contrast settings etc. according to the user's needs.

Initially, the main page shows list-based information about the current tour and its stations as well as planned stops where applications are currently possible [Fig. 5]. On the tour list page, the user can filter tours with its station entries by geographical and time-based features as well as text search.
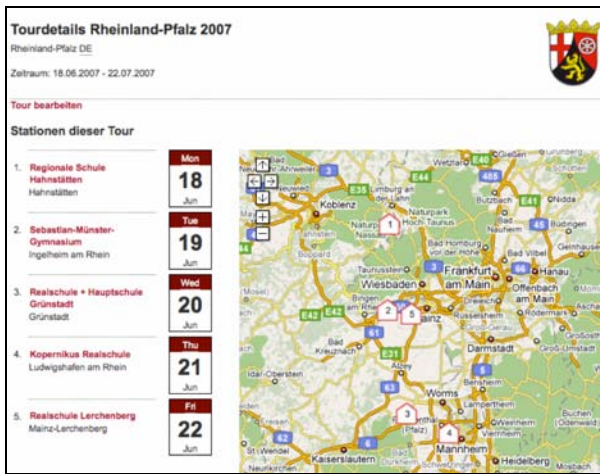

Fig. 5 – HTML-based application with view tour overview

After choosing a station, the detail page offers also ongoing information. Besides the graphical representation in an environmental map, the surrounding points are also displayed textually in a list. Associated media content – images, videos, podcasts, vodcasts, audios, and text – is being displayed in a comparable way, but realized with HTML.

To realise the Web 2.0 metaphors of user-generated content, participants can register and login to the web backend and upload their prepared media content treating workshop experiences, impressions of visiting the mobile exhibition, or own progress reports. Depending on the privileges users owned

they are able to interact.

General User

Participants – pupils and teachers – can create their own account being associated with their station the museum is going to visit or has visited. When logged in, the user can upload own created media content, which is linked to the station. Furthermore, the user can comment other articles and media.

Administrator

The museum staff typifies this user. They are able to create, alter and delete tours as well as the associated stations with geographical and time-based attributes [Fig. 6]. The user management is another functionality owned by this user type: The administrator can create user accounts manually, link to and unlink from stations, and inactivate or delete it. Additionally, this role also allows an editorial function: Media content being uploaded by users is not published for now to prevent misuse. After checking against wrong, abusive, or disgusting content, the record is been released and displayed to the public or been refused and deleted.
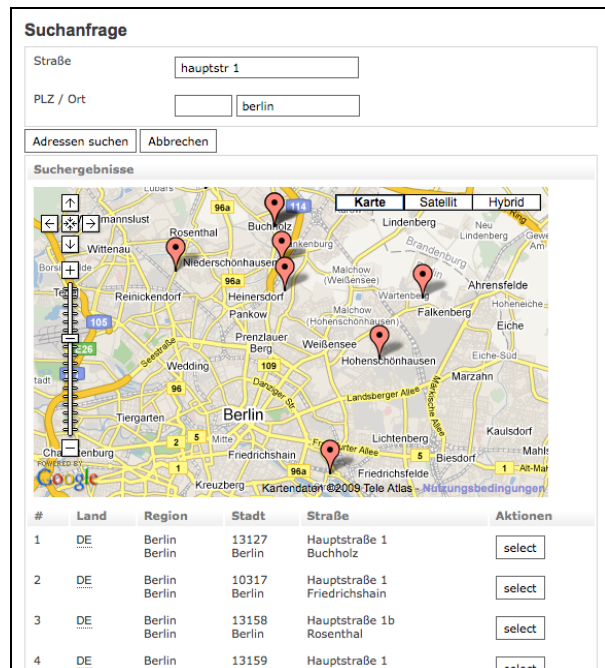

Fig. 6 – Creating a station while selecting address object queried and displayed with Google Maps API

3. TECHNIQUES

The use of modern techniques is one aim to keep face with current developments, to implement innovative functionality under the usage of modern interaction and design issues.
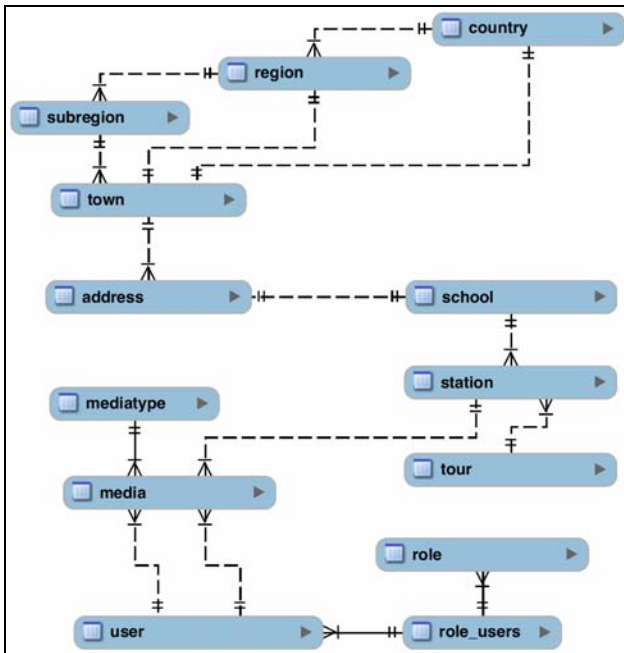
Fig. 7 – Data model

A. DATA MANAGEMENT

Most of the data are primarily stored under the use of the relational database management system MySQL to obtain non-redundant data management, take advantage of its performance issues, and separate storage from application according to common multi-layer architectures.

The data model [Fig. 7] is divided into three parts to keep open for reuse in other appropriate applications: Relations affecting general address attributes, like country, (sub-) regions, towns, and addresses with its districts and geographical coordinates, pools the first one. The user management with relations identifying a person, its allocated roles and permissions to an application are encapsulated in the second database. Finally, the tables containing named tour and station information with its time-based classification and references to geographical attributes as well as management of the media being uploaded represent the core data of the application itself.

B. RICH INTERNET APPLICATION

The main front-end is a rich internet application realised with Adobe's Flex Framework. This offers a better implementation of multimedia content and covers high platform independence as the application is deployed into a regular Shockwave file, which can be used on most common web browsers integrating a Flash plug-in. It also enables the user to access the application on their mobile devices via wireless connections. Clients, Flash files on client's browser, access a server-side implemented Java application, which returns the

serialised model data queried from the database.

C. WEB APPLICATION

The web-based backend is realised with the modern web framework Grails, which allows the usual separation of model, view and control. As it is built on standardised components, i.e. Spring Framework, and uses Java-based script language Groovy, proven range of functionality, especially for media content editing, can be used and finally deployed on a standardised servlet container, i.e. Apache Tomcat. The integrated object-relational mapping tool GORM (Grails Object Relational Mapping) is based on Hibernate 3 and it enables to query various databases comfortably via Hibernate Query Language as well as dynamic query methods.

Automatic data binding, validations, internationalisation capabilities fulfil standards of a modern web framework. Java script-based Web 2.0 functionality, like auto completion and multiple select box updates, are available via different libraries. The continuous increasing number of plug-ins, encapsulating generic functionality, shows the rapid development and acceptance. Application-related functionality, like rendering a map under the usage of Google Maps API with numbered markers according to a list of address domain objects provided, can be light-weighted implemented in own created tag libraries for multiple reuses in order to develop an intuitive graphical user interface similar to JSP/JSF behaviour.

D. MEDIA FORMATS

With the use of standardised and widely spread media formats such as MP3 for audio and H.264 for video, people can access those files without special requirements.

By using Adobe's Flex Framework for the rich internet application, the MP3 and H.264 codec is supported natively and the media can be integrated in the front-end without external media players.

The HTML-based application allows users to listen to audio and to watch video with web browser's plug-ins. If there is not a plug-in available, the media files can be downloaded to the computer.

E. WEB MAPS SERVICES

Several organisations, like Google, Microsoft (Bing), Yahoo, MapQuest, and OpenStreetMap, offer web-based mapping services to display a scalable map extract with several surface options and opportunities to customise it with own design markers and ongoing information.

Comparing platform independency, general usage

in a modern web browser without additional plugins, and customisation, the actual decision was made for Google Maps. Besides advanced availability for web applications, it also provides an API for Flash, which allows the homogeneous integration in the RIA to ensure a consistent appearance as a whole.

F. GEOCODING SERVICES

Receiving geographical coordinates associated by data like town, district or an explicit address, or vice versa, is one of the main tasks within the tour administration and its stations or points of interest. Besides Yahoo's GeoPlanet API, the Geocoding Service of Google Maps API also provides the functionality for the purposed area, Germany. After evaluation, latter was chosen as it resulted more detailed outcomes and more processable XML responses [Fig. 6].

4. CONCLUSIONS AND OUTLOOK

The current development replaces the list-based information done with static HTML. The geographical and chronological representation offers dynamic interaction with the application, especially to the young target group, the participants being visited by the mobile museum.

Enhancements

The capabilities of RIA's under the use of the Flex framework should be maxed out: For example, the alternative list-based station representation can be replaced by an interactive "strip map", similar to those known from system maps of public transport companies.

To emphasise the mobility of a museum, an additional client application for mobile devices can offer retrieval of geographical data directly by GPS, creation of a station or point of interest object on spot, associated media content and comments, and immediately or subsequent upload functionality.

An exchange of the database, from MySQL to PostgreSQL with its PostGIS information system, that allows advanced geometrical data types, like points and polygons, and specific methods and operations, like distances, intersections and overlaps, is to be evaluated.

Relative applications

In context of a mobile museum, the design and development of the mobile, multimedia Jewish museum within the "HardMut" project, relative applications mesh into parts of the tour documentation:

For instance, the digital library allows participants of the mobile museum to archive their own objects brought to station stop. Putting it into the "digital wonder box", a VRML or QuicktimeVR file is imported into the library and specified with tags and comments. User identification and station information with its geographical data is also been used in this application.

5. ACKNOLEDGEMENT

6. REFERENCES

[1] Research group INKA, HTW Berlin, http://inka.htw-berlin.de/

[2] on.tour – Das JMB macht Schule, http://www.juedisches-museum-berlin.de/

[3] Adobe Flex product page, http://www.adobe.com/de/products/flex/

[4] BlazeDS product pages, http://opensource.adobe.com/wiki/display/blazeds/BlazeDS/

[5] Widjaja S., 2008, Rich Internet Applications mit Adobe Flex 3, Carl Hanser Verlag München

[6] Google Maps API Geocoding Service http://code.google.com/intl/en/apis/maps/documentation/services.html#Geocoding

[7] Grails Web Application Framework, http://www.grails.org/

[8] Judd C., Nusairat J., Shingler J, 2008, Beginning Groovy and Grails, Apress

[9] Rocher G., Brown J., 2009, The Definitive Guide to Grails, Apress

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