Digitales Osmantinum
Digital Media Integration for a Literature Museum

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Abstract(EN)

Usually the application of digital media in authentic museum environments involves the use of equipment that could easily disturb the carefully preserved atmosphere of the place. In this demo we would like to present the project »Digitales Osmatinum« (Digital Osmantinum), a museum system that makes use of a PDA based guide system in order to introduce the life and work of the German poet Christoph Martin Wieland. While the use of PDA based guide systems is quite common for ambitious museum applications, our project takes the approach of an overall system design. Therefore it combines different technologies with the requirements of the project stakeholders in order to mediate an experience for the visitor. At the authentic place, technology is integrated in such a way, that it not only visually merges with the environment but also tries to minimize user interactions. WLAN positioning is used where content should be presented without explicit user interaction but in accordance to the location of the visitor. Active selection on screen and RFID technology are of use, whenever the user requires in-depth content.

The main challenge of the project had been to develop an interface for the guide system that makes the access to the content in different contexts an enjoyable experience for the user. The museum system itself is defined as a work in progress that will never be finished. A content structure had been developed that makes it possible to continuously extend and maintain the museum system.

Keywords: digital museum guide, location based content, systematic design

Zusammenfassung(DE)

Der Einsatz digitaler Medien in authentischen Museumsumgebungen steht häufig in starkem Kontrast zur sorgsam gewahrten Atmosphäre des Ortes. In dieser Demonstration möchten wir das Projekt “Digitales Osmatinum” vorstellen. Hierbei handelt es sich um ein PDA basiertes Museumsführungssystem, das Zugang zu Leben und Werk von Christoph Martin Wieland bieten soll. Während PDA Systeme in technologisch avancierten Museumsprojekten mittlerweile relativ häufig anzutreffen sind, legt unser Ansatz den Schwerpunkt auf die Integration der Technologie in das Gesamtsystem. Diesem Ansatz folgend werden verschiedene Technologien mit den Ansprüchen der am Projekt beteiligten Interessengruppen (stakeholder) kombiniert um ein Erlebnis für den Besucher zu schaffen. Am authentischen Ort wird Technologie so eingesetzt, das sie nicht nur auf visueller

Ebene mit der Umgebung verschmilzt, sondern in der Bedienung durch den Besucher nur ein Minimum an Eingaben benötigt. WLAN Positionsbestimmung wird daher eingesetzt um Inhalte ortsbezogen, ohne explizite Interaktion, darstellen zu können. Aktive Auswahl am Bildschirm und RFID-Tags bieten dem Besucher die Gelegenheit, Interesse an einem Thema auszudrücken um sich eingehender hiermit zu beschäftigen.
Als besondere Herausforderung des Projektes kann die Entwicklung eines User-Interface betrachtet werden, das den Zugriff auf Inhalte in verschiedenen Kontexten auf ansprechende Weise ermöglicht. Auf inhaltlicher Ebene wird das Museum niemals abgeschlossen sein, sondern soll sich kontinuierlich erweitern lassen. Bestandteil des Projektes ist daher die Strukturierung der Inhalte für eine solche Art der Erweiterung.

Schlüsselwörter (DE): digitales Museumsführungssystem, ortsbezogene Inhalte, systematische Entwicklung

Résumé (FR)

Habituellement l'utilisation de médias digitaux dans les musées se confronte au risque de bouleverser l'atmosphère de sérénité propre à cet endroit.
Par le biais de cette démonstration nous aimerions présenter le projet « Digitales Ossmantium », un système adapté aux musées comprenant un PDA guidé qui vous introduira dans la vie et le travail du poète allemand, Christoph Martin Wieland.
Bien que l'utilisation de systèmes guidés de type PDA soit devenue assez habituelle dans les musées dits technologiquement avancés, notre projet met l'accent sur une approche plus globale et un design innovant. Pour la réalisation de ce projet nous avons combinés diverses technologies afin de mettre à la disposition du visiteur un outil agréable, tout en répondant aux attentes des différents groupes d'intérêt (stakeholders). Dans un environnement culturel respectant authenticité, la technologie doit être mise en place de manière à fusionner visuellement aux découvertes du visiteur. Elle se doit également de réduire l'interaction mise à la disposition de celui-ci pour ne pas le porter à confusion.
C'est grâce au système WiFi que la position du visiteur est localisée automatiquement sans que ce dernier le signale explicitement. En sélectionnant le point d'intérêt de son choix en appuyant sur l'écran tactile du PDA, le visiteur est libre d' approfondir ses connaissances.
Le défit majeur de ce projet réside dans le développement d'une interface donnant accès à un contenu dans différentes situations tout en satisfaisant l'utilisateur.
Le musée en lui même est en perpétuel mutation, tant au niveau de ses connaissances que de son contenu. Une structure de base a été soigneusement développée afin de permettre aux musées de maintenir leur système à niveau ou de l'étendre.

Mots clés:

Introduction

The project “Digitales Osmatinum” is concerned with the development of a digital museum guide system for a small to medium sized literature museum focusing on the life and work of the German poet Christoph Martin Wieland (1733-1813). The newly reopened museum is located in Wieland’s former estate in the village of Ossmannstedt, close to Weimar, Germany. It is right here where Wieland tried to fulfil his utopian idea of an ideal life in the country and where his late work took place. At this carefully reconstructed site, his tremendous literal output falls together with a network of origins and meanings related to the place itself and the still remaining memorabilia. As this network of interconnections is neither completely discovered nor transparent to the uninitiated user, demand grew for a technical solution that would offer an unobtrusive yet appealing way to guide visitors along on their approach towards Wieland’s opus.

PDA (personal digital assistant) based digital museum guide systems are regarded to fulfil these demands. Although the term describes no distinctive class of devices, comparable systems nowadays turn from research objectives (for example see Abowed, 1997; Cheverst 2000; Butz, 2001) into real projects as various implementations show (see for example Proctor, N. and C. Tellis, 2003; Tate Modern, 2005; Acousticguide, 2005; ect.). Nevertheless critics argue that the technology itself is not a universal answer to all museum guide requirements but a system, which requires careful planning and preparation in order to avoid significant design flaws. As Schwarzer (2001) describes in her study (Schwarzer uses the term augmented reality devices in her study but concentrates on portable computer devices, comparable to nowadays PDAs):

- Visitors can be distracted from the exhibition itself by concentrating on the screen
- Standard devices are delicate technical artefacts that are often fragile to handle.

Precautions need to be applied to prevent curious visitors from turning the devices inoperative

- Counter staff tends to become afraid to hand over the devices to the visitor because of fear of thievery and nontransparent handling procedures

To address these issues we integrated the demands of the different stakeholders with the features of different technologies, the design of the user interface, interaction offers and the process of content production. This design approach takes into account different demands in a systematic way (compare Fuller, 2003) and is described in the following sections of this paper before the final concept, its implementation and an outlook on future developments will be introduced.

Systematic design approach

As an approach to our project we identified that the bipolar opposition producers/users only reflects and abbreviates the complex interdependencies between the different stakeholders of our project. As a point of departure, we therefore decided to roughly identify the different groups and subgroups as well as their current demands during the three project phases (pre-opening, opening and operation).

Table 1 presents an overview of the seven different groups of stakeholders, their respective characteristics in the project, as well as their attitude towards digital museum guide systems (dmgs) and the phases of the project they are involved in.

Identifying Stakeholders

Name	Characteristics	Attitude	Phases involved
Ordering party	Financiers of the overall project. Final decision makers in terms of investments, content focus, museum design and use.	Understand dmgs as a chance and regard them as influential for the future of exhibition design. Content driven, no special relationship to technology	pre-opening opening operation
Curators and exhibition designer	Responsible for the coherence of the overall setup, selection and placement of artefacts	Benevolent on dmgs, extensive experience on the use of audio guides and POI systems. No experience concerning PDA based dmgs	pre-opening opening

Architects and craftsmen	Design suggestions, building and construction of the museum site	Interested but uninvolved into dmgs. Experienced in the setup of electronic infrastructure	pre-opening
Content producers	Producers of print and digital media content	Experienced in print and audio guide content, unaware on the features, possibilities and limitations of dmgs	pre-opening
Development crew	Setup and development of the digital museum guide system.	Experienced in the setup of PDA based digital guide systems. Limited experience in the museum environment.	pre-opening opening operation
Counter staff/surveillance personnel	Responsible for the day-to-day business including device handling and lending. Mediators between visitor and the institution.	Sceptical about dmgs. Partly afraid on excessive demands regarding technology handling	Operation
Visitors	Tourists and intrigued laities. On-site, prospective and re-visitors.	At least interested in the content of the museum, usually unaccustomed to dmgs	Operation

Table 1: Overview of the different stakeholders

In the next step we established relationships between the different interest groups and the dmgs. As a result of this process we could identify the demands of the different user groups in relation to the abstract overall system and vice versa the demands of the system in relation to the user groups. By this we were able to identify the kind of mediation necessary between the different groups at certain phases of the project. The term mediation reflects in this case that the technical system could not be completely adapted to the demands, needs and beliefs of the different user groups. As the opposite counts as well – because users cannot be completely adapted to the system – mediation as a negotiation between technology and the people becomes necessary.

It would go beyond the scope of this paper to describe the complete set of relationships between the stakeholders and the system. As an example for the potential of this process we would refer to the problem of user distraction as described above (see Schwarzer(2001)) by relating this problem to the demands of the stakeholders and their relationship to the system.

Identifying relationships: Visitor distraction and stakeholder demands in the system

Visitor distraction is, in our point of view, the result of a conflict between the content

available in the physical environment and the one presented in the virtual domain of the digital museum guide system. This inconsistence grows to distraction as the relationship between the physical object and the virtual content starts to disappear. The question is therefore how to interweave the related domains in order to reduce visitor distraction. As argued before, a solution needs to identify the different stakeholders involved and to mediate their demands in regard to the system.

1. Step: Identification of stakeholders involved

I. The visitor moves through the exhibition and deals with the exhibition by means of the digital museum guide system and the physical environment.

II. The development team is responsible for the setup and definition of the digital museum guide system. They need to adapt the system in order to meet the demands of the visitors and the content producers.

III. The content producers develop content that is closely connected to the features of the digital museum guide system in order to be mediated by this system to the visitor.

IV. The dmgs and the visitor are both located in a physical environment designed by the exhibition designer.

Although this list could be extended to include all stakeholders within the system, the described level of detail will suffice to define the conceptual design tasks necessary in order to interweave the physical and the virtual domain. As the visitor moves through the exhibition, he changes not only his position, but also his context as different places contain different meanings in this designed environment. The digital museum guide system has to incorporate these changes in order to reflect upon the shifting context. Also the content producers need to create content that interweaves the features of the physical place and the artefacts available.

2. Step: Relationships of the Stakeholders and their demands

I. Visitors/System

- Demand to receive specific and context related content that is readable, useable and understandable for them.
- Are demanded to make use of the features of the system.

II. Content Producers/System

- Demand a clear and understandable framework that defines the features of the system and its influence on media use and content quality.
- Are demanded to develop content that is closely related to the physical environment.

III. Development Crew/System

- Demand a working and stable hard- and software basis.
- Are demanded to clearly identify the limitations and features of the system in order to mediate between the visitors and the content producers.

IV. Exhibition Designers/System

- Demand for a defined physical hardware structure and a system that could be integrated in the exhibition.
- Are demanded to define the setup of the exhibition in order to establish a context through physical artefacts.

Due to these different demands it becomes clear, that the proposed connection between virtual content and physical artefacts could not be reduced only to a single demand of one user group. In order to describe how these demands were handled in our project, the relationship of the content producers and the system shall be further revisited.

Focus: Content producers and their relationship to the system

As identified above, content producers are not aware of the possibilities and limitations of the system. Therefore quality of content for this specific dmgs is not defined and the integration into the environment uncertain. Although they are well aware about the expectations of

visitors in regard to print and audio content they don't know how to serve them by means of the dmgs.

As visitors and their perception of content in the dmgs is unavailable during the time of content production, a first step to address this issue was to work out a content framework between the content producers and the development crew. This framework incorporates the media used, the features of content display, including screen size, image size, video length and size, number of separate objects on-screen, maximum length of written text on screen, type-fonts and sizes, etc. Out of this formal setup examples were developed that constitute the practical implementation of the framework. Also more abstract guidelines regarding the features of the system in terms of localization granularity and localization reliability have been defined. In a final step of preparation a connection between the tools of the content producers and the development team were implemented. The mode of operation of the content producers was, in our case, focussed on the production of text using Microsoft Word. Therefore a no-frills solution included Microsoft Word Templates that can be converted to XML-files and by means of this further processed.

Derived concept

Figure 1: The PDA component of the digital museum guide system (wienekeSELECT05_pda.jpg)

The concept of the digital museum guide system is the result of a controlled mediation process between the different stakeholders and the features of the system. The following guiding principles are the manifestation of this process. The arising consequences of these principles are described for interface design, hardware and software setup, content development and handling procedures for the counter staff. Although these different areas are described individually, none of them has been treated separately without regard to overall system.

1. In the carefully reconstructed environment of the Wielandgut Ossmannstedt the

implementation of terminals and public displays would risk to destroy the specific aura of the place. Therefore a PDA based approach is chosen as a basis of the digital museum guide system.

2. No visitor is forced to use the PDA, but could enjoy the exhibition on his own while lacking the additional content displayed by the PDA.
3. The interface of the PDA reflects the current context. User interaction is minimized to movement in space, physical gestures with the device and active selection on screen.
4. In order to preserve the atmosphere of the place and to protect the PDA devices, a specifically designed case, which is inspired by bags of Wieland's age, is applied (see figure 1, compare to Schwarz second point of critique).
5. Site-specific content is delivered by means of a localisation system, independently for each visitor and his PDA.
6. The digital museum guide system is no information based application but tries to create an experience for the user.
7. The modalities of the site itself are taken into account (compare figure 2: Footprint of the Museum Site):
    a. At the hallway being the first place a visitor enters, the PDA and its content serve as an introduction into Wielands life and work. While the visitor is advancing through the hallway, the content displayed on the PDA alters depending on the position of the visitor within zones that are related to specific periods of Wielands life (zones 1-7).
    b. The museum rooms (zones 8-10) focus on different topics of Wielands life and work. In contrast to the introduction in the hallway, the visitor has the opportunity to gain an in-depth look by exploring the various artefacts through

selection.

8. Technical devices are integrated in regard to their intrinsic features. While PDAs offer place and context specific delivery of content, common PC systems in combination with TFT monitors are superior in terms of text display and clarity. Therefore a separate room called information room features public PC terminals (zone 11).

9. The digital museum guide system is continuously extended. Production procedures and methods as well as the hardware and software setup are designed to integrate changes and extensions.

Figure 2: Footprint of the Museum Site (wienekeSELECT05_footprint.gif)

Interface design

The interface of the digital museum guide system falls back into two main categories: On the one hand the interface of the PDA device with different configurations for the counter staff and the visitors and on the other hand the interface of the PC terminals. The term interface is in our case not reduced only to the graphical user interface on the PDA and the PC but also contains physical actions as well as graphical signatures.

PDA

As described above, a twofold approach has been chosen to develop the interface of the PDA. First, in order to support the handling procedures for the counter staff, a special selection screen is implemented. By means of active selection on-screen two modes of operation can be chosen. Either a new device is handed over to the visitor at the start of his tour or a visitor replaces his device already in use due to malfunction or discharged batteries.

While these screens are usually invisible to the public, the visitor interface relates on an interaction model of growing complexity depending on the degree of involvement. In general, a flat link structure has been chosen, as content is closely related to the different positions in

the museum environment. Deliberately, not all content is available at all the places so movement in space is a requirement to shift between different content contexts. Text and images can be displayed, while audio material forms the major part of content. All audio tracks can be paused, replayed and arbitrary accessed (see the content screen on figure 3 for a screenshot).

Figure 3: *Screenshots of a collage screen(left) and a content screen(right) (wienekeSELECT05_screenshot1.jpg)*

Although alternate successions are possible, the following "ideal" sequence describes the different interfaces in the museum environment during a visit.

In the system introduction part of the interface, the PDA guide and the way it should be handled are described in some text sentences.

After this, the introduction to Wielands life and work starts in the hallway. Here, seven different selection screens are presented according to the position of the visitor and his PDA within one of the seven zones. In depth involvement is realized by the selection of places and persons, displayed as collages on the screen (compare figure 3, collage screen). These collages correspond with the chronological figures on the hallway´s wall.

The exploration of the museum rooms and the therein-contained artefacts starts with an audio introduction as a room is entered. On the PDA, objects and topics of the room are displayed for selection.

Figure 4: *Bloom Marker (wienekeSELECT05_marker.tif)*

Additionally a gesture-based selection of content is implemented. An integrated RFID reader makes it possible to handle the PDA at a whole as an input device. The visitor is able to access object related content by aiming the PDA to specific markers placed in the environment (compare figure 4). These markers picture a bloom, a memento to the role of flowers for Wieland. The symbol also contains the concept of picking up flowers, an intrinsic reminder to the gesture, which is executed by the visitor with the PDA. Ornamental motives

are also used in the graphical user interface: Collections (a set of several topics or objects belonging to the same subject) are marked, for example in the second museum room ("Wieland und seine Gäste" – Wieland and his guests), by a contemporary ornament (see figure 5).

Figure 5: *contemporary ornament in the room „Wieland and his guests" (wienekeSELECT05_guests.jpg)*

PC terminal

In contrast to the described PDA interface, the user interface of the PC terminals is designed for being operated by mouse on a large screen. All topics are arranged in tree structure. Whereas audio content had been the prevailing media form for the PDA component of the digital museum guide, the PC terminals feature longer texts for screen reading (compare figure 6).

Figure 6: *Screenshot of the PC terminal (wienekeSELECT05_pcterminal.jpg)*

Hardware and software setup

The hardware setup of the digital museum guide features a client-server approach with the PDAs and PC terminals acting as clients and a single device Linux-based PC-server acting as application and storage server.

As a means of connection between the PDAs and the server infrastructure, WLAN has been implemented in order to allow a centralized data structure. In our case, WLAN not only serves as the central network structure, but also enables the localisation of the PDA devices. For this purpose a third-party software (Ekahau Positioning EngineTM, compare for further details http://www.ekahau.com/, see also Bahl(1999) as one of the first implementations of this specific approach) is integrated into the application architecture that consists of a server and a client component. This software broadcasts all device positions based on signal strength measuring to the transGo-framework, also a third-party software developed by transformat (www.transformat.de). The transGo-Client running on the PDA applies the position data acquired through the positioning engine to a pre-defined world model of the environment. In

relation to this model, and the IDs (identification numbers) acquired through the RFID-reader, events are raised and transferred via XML-sockets to a FLASH application. The latter component displays the graphical user interface and the content according to these events.
In regard to the PDAs, commonly available hardware has been chosen. The applied devices feature a 4.0” display with a resolution of 480*640 pixel in portrait orientation. Although the content is server based, large media files are stored locally due to performance issues.
The PC terminals are connected to the server through twisted pair Ethernet connections, running a modified version of Windows XP in a POI (point of information) configuration. A FLASH application is used to display the content of the server. No local caching is applied here.

Content development

As described before, the process of content production relies on the definition of a guiding framework for the content producers. While this framework had been defined before the final setup was implemented, a continuous extension of the rules and examples becomes necessary. In the result of such an extension not only better-adapted content could be created, but also the learning curve for new content producers flattens. In our effort to create an appropriate content management system for future extensions, different foundations were laid out. A flexible data structure enables dynamic content generation from different data sources while interfaces for import and export of data are available.
The use of RFID tags makes it possible to create object specific or object related content without the necessity of a fixed world model of the environment. Objects can be tagged with specific IDs, through which a fixed reference between the physical object and the virtual content is created. Therefore, objects can be moved within the environment without an adjustment of the world model.

Handling procedures

As discussed before, preoccupations of the counter staff could become crucial for the success

of the digital museum guide system. The fear of excessive demand due to confrontation with new technology has to be dispelled. In the context of our project we tried to establish a set of written procedures for different handling situations that treat the PDA component of the digital museum guide system as a simple out-of-the-box device with few handling operations necessary. Additionally a simple backup procedure for unforeseen situations has been defined. All operations and procedures were promoted by field training after the opening of the museum.

Conclusion and outlook

In the course of this paper we have been able to show that the development of an extensive framework for technology integration, design and organisation involvement could serve as an extendable basis for the setup of a digital museum guide system. Whereas no formal evaluation of the concept has been conducted since the opening of the museum site and the digital museum on June 25, 2005 the received response can be regarded as positive and reflects common acceptance and public interest.

Future research will focus on three broader areas of activity. At first, the consequences of device specific production and the possible effects of pervasive technology for museum related business models shall be examined, second the incorporation of the user as an active producer for museum content has to be considered and third evaluation methods for visitor behaviour in active museum environments should be developed

Device specific production

The implementation of common PDA based technology proved to be a feasible solution for the development of a sophisticated museum guide as our and various other projects have shown. In terms of reproduction quality, major advances were made that nowadays allow the display of appealing content with few limitations in terms of display size, reproduction quality and processing power. Nevertheless, content development remains device specific as of the multitude of different manufacturer related hardware features (physical display resolution,

size and plug placement etc.). Such specific content development for digital museum guides accounts for a rental model that needs to be cost effective. Depending on the number of potential visitors, larger scale investments have to be made and continuous support has to be established.

Whilst in our project a setup has been chosen that incorporates the PDA and its modified appearance into the overall museum concept, other projects might benefit from approaches where technology is not borrowed to but provided by the visitor, who makes use of a given infrastructure in the museum. This relates to the idea of pervasive computing where technology gains new qualities through its widespread use. Nevertheless, today only relatively few technologies show a significant spread in such heterogeneous groups like museum visitors.

The mobile phone complies with this demand but satisfies only limited claims in terms of content richness and extensiveness (for a discussion see Abowd(2005)). Whilst mp3-players are widely available and offer high quality audio playback, the distribution of content and the establishment of a coherent user interface become almost impossible to implement, as hardware connections and interface design differ between most manufacturers and devices. Smartphones (Symbian or WindowsMobile based) could become a solution to this problem because these devices gain more and more widespread use while offering an increasingly better reproduction quality. Right now devices of this class herald the decline of the PDA and begin to replace this category of devices with an increasing rate (compare Smith(2004)). In the museum context, such a change could lead to a shift in business models from hardware system rental to content vendor. Nevertheless, smartphones are right now neither as pervasive as necessary nor offer significant content quality. Future research needs to be conducted on unified file formats for different hardware settings and distribution setups for demanding content.

The visitor as an active producer

While the project “digitales Osmatinum” itself is a finite project in the sense that it has a defined starting point as well as a defined end, the overall system should preferably bear less project oriented characteristics. The museum system needs to change in order to offer a motivation for recurring visits. Therefore arrangements within the system have to be made to alter and extend the content of the museum. While this continuous involvement is in comparison to the setup and main production phases subject to limited funding, methods and approaches need to be developed, that incorporate highly motivated and committed users from outside of the organisational frame of the museum. This transition from project to process leads towards the establishment of community based production methods as they become more and more popular (compare for example wikipedia project (http://www.wikipedia.org/) or Banks(2005)).. The advantages and disadvantages of this approach need to be carefully revisited before they can be integrated into the digital museum guide system.

Evaluation of visitor behaviour

Continuous evaluation of the digital museum under the point of view of the different stakeholders has to be conducted to identify whether the perceived goals were met or unforeseen conflicts arise. Methodologies need to be established that will make it possible to identify different usage patterns and to gain qualitative feedback in order to continuously extend and improve the museum.

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