КОМП'ЮТЕРНІ Й ІНФОРМАЦІЙНІ МЕРЕЖІ І СИСТЕМИ

АВТОМАТИЗАЦІЯ ВИРОБНИЦТВА

COMPUTER AND INFORMATION NETWORKS AND SYSTEMS

MANUFACTURING AUTOMATION

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INFORMATICS IN THE CULTURE AND CREATIVE INDUSTRIES

Ю. Зік. **Інформатика в культурі та креативних індустріях.** Розвиток комп'ютерних технологій, мобільних пристроїв і сенсорних технологій протягом останніх 30 років постійно впливає на створення нових додатків, заснованих на виникаючих технологіях. Об'єднавши переваги існуючих технологій з новими підходами, адаптуючи в наслідку ці критерії з урахуванням різних потреб користувачів і сценаріїв додатків, у тому числі таких, як розташування користувачів, ми можемо інкорпорувати нові мобільні компоненти і послуги в існуючи програми.

Ключові слова: додаток, мобільні компоненти.

Ю. Зик. **Информатика в культуре и творческих индустриях.** Развитие компьютерных технологий, мобильных устройств и сенсорных технологий в течение последних 30 лет постоянно влияет на создание новых приложений, основанных на возникающих технологиях. Объединив преимущества существующих технологий с новыми подходами, адаптируя в последствии эти критерии с учетом различных потребностей пользователей и сценариев приложений, в том числе таких, как расположение пользователей, мы можем инкорпорировать новые мобильные компоненты и услуги в существующие приложения.

Ключевые слова: приложение, мобильные компоненты.

J. Sieck. **Informatics in culture and creative industries.** The development of computer technology, mobile devices and sensor technology during the past 30 years has continually affected the creation of new applications based on emergent technologies. By combining the advantages of established technologies with these new approaches and furthermore adapting those criteria to the different user needs and application scenarios, including the location of users, we are able to extend existing applications with new mobile components and services.

Keywords: application, mobile components.

Introduction. The development of multimedia technology, mobile devices, wireless networks and sensor technology during the past years has continually affected the creation of new applications based on emergent technologies. While newly developed device types with different technical specifications have surrounded us in our everyday life and private environment, new base technologies have also been established step-by-step [1…5].

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In the context of our research projects for multimedia systems, mobile devices, sensor systems, wireless networks, near field communication and story telling, different applications were realized. The key aspects of our work include:

— multimedia systems and computer architectures to process sensor data;
— development of RFID and NFC based ticket systems;
— position and context based services based on RFID and NFC technology;
— RFID and NFC based point of interest data collection;
— design and implementation of visitor media stations;
— development of personalised web portals;
— data and security concepts.

Industrial standards and paradigms strongly influence invention and development in both public and private sectors, starting in the field of hardware design and ending with common patterns for highly effective software engineering and electrical power efficient hard- and software development.

By understanding the key features of modern information and communication technologies and combining the advantages of technologies with new approaches and the specific environmental conditions, we are able to extend existing applications with new components and services [2].

1. "A La Carte" Installation — Personalized Information Systems Based on Passive RFID Tags for the Jewish Museum Berlin. The main idea of the RFID based "A La CARTE" installation is data collection without a typical computer interface . The visitor to the museum receives a spoon with an attached passive RFID tag as an entrance ticket and a short description of how to use the spoon for data collection (fig. 1). Additionally, a unique spoon (RFID-) ID and the URL of the "Koscher & Co" website are printed on the spoon. The user can find one media station in each of the ten rooms of the temporary exhibition "Koscher & Co". The media station consists of a plate, a hidden RFID reader and a hidden miniature computer. The plates have unique labels, for example fish, lamb, grapes, chicken, and pomegranates. The user will see only the plate, and only the spoon and the plate can interact.

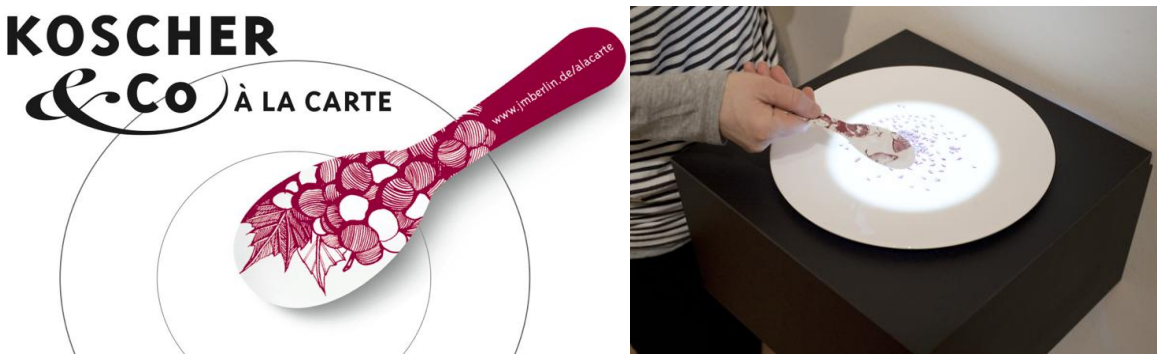

Fig. 1. Passive RFID Tag, Reader and Feedback Light

If a visitor wants to have more information regarding the objects in the room and the attached recipes they have to place the spoon on the plate. The RFID reader under the plate receives the ID from the spoon and sends the ID with a time stamp to the server. If the transfer of the ID was successful the media station generates an optical and acoustic feedback. Now the visitor knows that they have collected the recipes on their spoon.

There are three recipes of three different categories in each room (fig. 2). The three categories are "5 ingredients", "5 senses" and "5 minutes". The "Koscher & Co" context-sensitive software determines which recipes best fit the visitor. The selection of recipes and relevant category for the specific visitor is dependent on their visit of the exhibition. Criteria are for example the visited media station, the sequence and the duration of the visit.

Following the visit to the museum visitors can enter the website. Firstly, they have to log in (by typing the ID found on the spoon).

Fig. 2: Personalised Webpage of "Koscher & Co" (login)

Following that they will see their profile, the category and the collected recipes (fig. 3). The visitor can continue to visit the exhibition – not in reality but the virtual exhibition. They can, for example, collect more recipes from their category and additionally recipes from the other two categories. To do, so they have to visit a virtual table with ten plates and have to place their virtual spoon on a specific plate. They can do this on three different tables, one for each category.

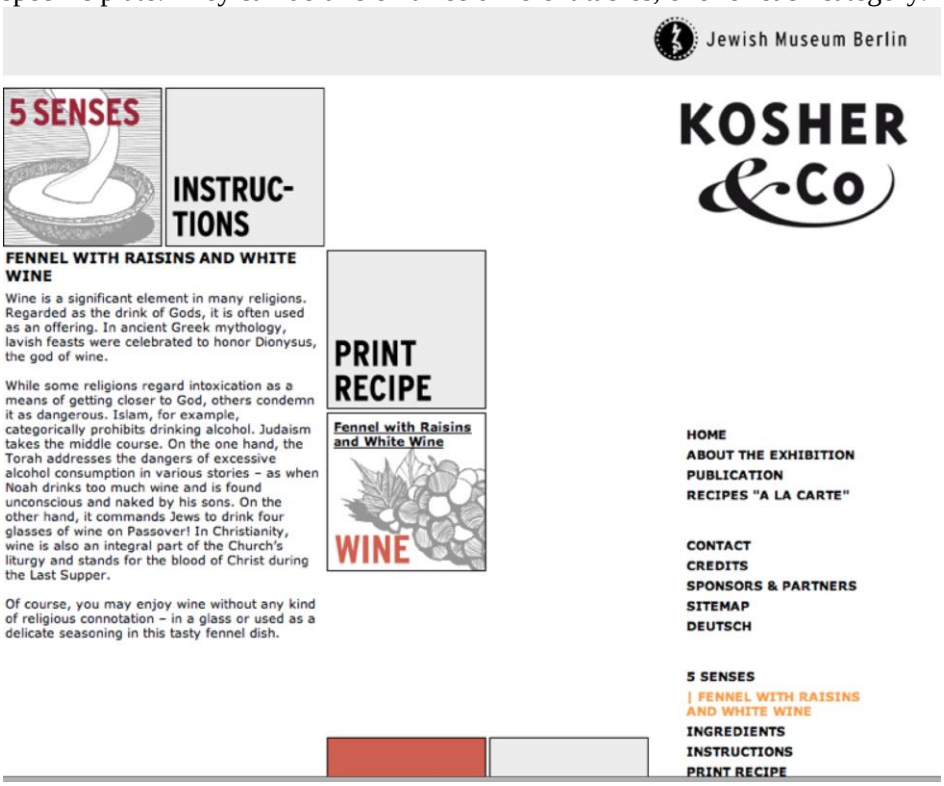

Fig. 3. Personalised Webpage of "Koscher & Co" (recipe)

Further applications are possible. The visitor research department can analyze the data collected and provide the visitor with more detailed information about the artefacts visited or additional information about other artefacts in the exhibition. The museum can also recommend additional tours

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through the museum. Staff members can use the data and sensor networks for the management of the museum and the exhibition.

2. Story Teller Project Schahname at the Museum of Islamic Art in the Pergamon Museum. The main focus of the project was to design mobile multimedia indoor information systems, context sensitive services based on a RFID sensor network in the Pergamon Museum Berlin, and personalized information systems based on passive RFID tags. The challenges are the realization of these services and systems throughout the building as well as within the permanent and temporary exhibitions with the following requirements:

— high performance;
— reliability and precision;
— cost-effectiveness;
— non-intrusive installation;
— easy maintenance.

In order to fulfil all requirements we developed a standard system architecture. The main components of the system are RFID transponders (active and passive) and RFID readers, data collections and a management system, sensors, a web server as well as wireless and cable-based network systems, see Fig. 4:

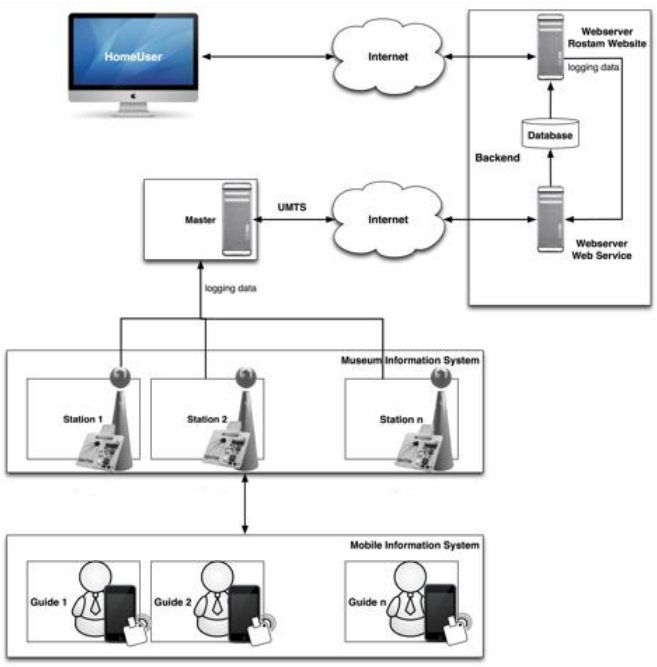

Fig. 4. System architecture

All RFID components, a controlling computer, audible and visual feedback components and antennas are installed in a shell. Only the shell varies for different applications, e.g. a digital storyteller for the Schahname exhibition the Museum of Islamic Art in the Pergamon Museum Berlin. A visitor to the museum can collect information; in this case stories of the Schahname exhibition, with a passive RFID tag equipped bookmark, see Fig. 5.

The museum creates a private website for each visitor of the museum. The visitor has to register on this website with the code printed on their bookmark (in the example "AQ9BDD"). After registration the visitor has access to all collected stories, see Fig. 6.

The main components of the system are active RFID transponders located at different locations, with 10 to 15 meters distance between each transponder, and a mobile device-based determination of the position as well as passive RFID transponders in bookmarks and on artefacts in the museum. Each active RFID transponder, for example, sends signals with different signal strengths and unique signal IDs. The mobile device determines the closest transponder [4].

Fig. 5. Storyteller of the Schahname Exhibition & Bookmark with RFID Tag

The museum can also recommend additional tours through the museum. The staff members can use the data and sensor networks for the management of the museum and the exhibition [6, 7].

3. Hat stand installation. In principle the system consists of a two-tier architecture that is built upon a classic RFID backend system and an information system.

The RFID backend is formed by a RFID reader, an external antenna, a computer (fig. 7), which also acts as a host for the information system, and the RFID transponders being coupled with the clothes of the fashion label schmidttakahashi. The first prototype used a passive RFID system based on 13,56 MHz and the ISO/IEC 15693 standard. Passive RFID tags rely entirely on the electromagnetic field being produced by the reader to read their stored value. Therefore the range of passive RFID is usually of the order of centimeters. In our case it is a good compromise between the range of the installation for detecting the clothes and on the other hand the reliability of the detection rate.

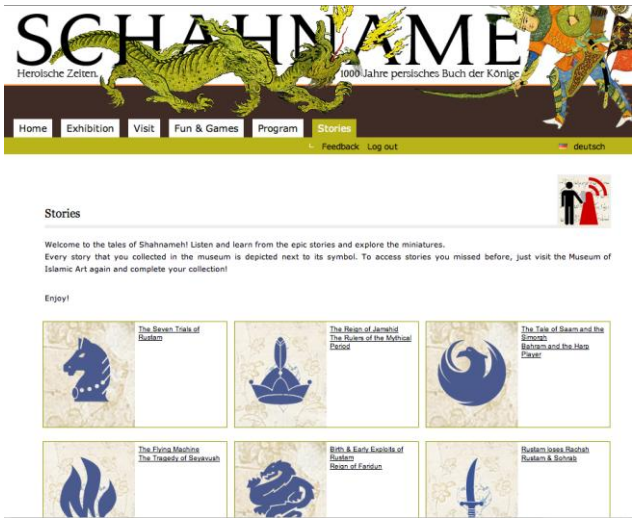

Fig. 6. Website with Stories

As previously mentioned, the computer is also used for the information system. It is connected to the database of schmidttakahashi and provides the runtime environment and web server to guarantee the accessibility of the installation. The visualisation data is generated by querying the database. As the system uses a polling mechanism to retrieve the most current information the data is cached to minimise the amount of access to the database.

When a new garment is attached to the hat stand, the transponder moves into range of the antenna and so the unique ID is read. By using this ID the RFID backend looks for the dataset.

On the client side there is a standard web browser accessing the information system. It delivers a HTML page that is based on Ajax/JQuery and uses a polling mechanism to submit requests every second. As soon as a new garment is attached to the hat stand, the RFID backend delivers a new data

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set. Depending on the delivered information the DOM structure of the HTML document is adapted and completed. For example, with the knowledge of the original clothes that were used to create the product a different amount of information and pictures are added to the DOM structure of the HTML document (see Fig. 7). The interaction between the different components of the installation can be seen in figure 8.

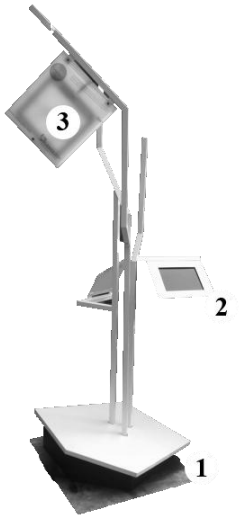

Fig. 7. Schematic representation of the hat stand. The ground of the installation (1) contains the hardware and cables, e.g. the computer where the software is installed. Additionally there is a small touch display (2) visualizing the information of clothes being attached in front of the RFID antenna (3)

Because of the use of HTML5 and CSS3 to visualise the information of the collection, the portability of the information system is very high. There are a vast number of devices that are able to display the required information: home computer, laptops, netbooks, tablet PCs or smartphones including different mobile operating systems such as iOS, Android or J2ME. In our showcase we attached an Apple iPad that displays the current information.

4. Fashion show installation. With the help of active RFID, moving objects can be tracked. In contrast to passive RFID, the active solution has its own power supply usually attached in form of a small battery. This power supply is used to periodically broadcast its unique ID. One important problem to solve was how to identify one model at a time and at a specific position without installing a complex RFID infrastructure.

This is realized by setting up the active RFID tags in a transceiver mode. The transponders scan their neighborhood by alternating transmitting and reception cycles. These responses serve as indicator for proximity evaluations. Therefore this technology was used to logically register some special tags that had to be installed locally at the entrance of the runway area to detect nearby transponders – the models wearing the different tags. In this way, contacts between the alternative reader and the model tags at this position could be realised by the implemented software.

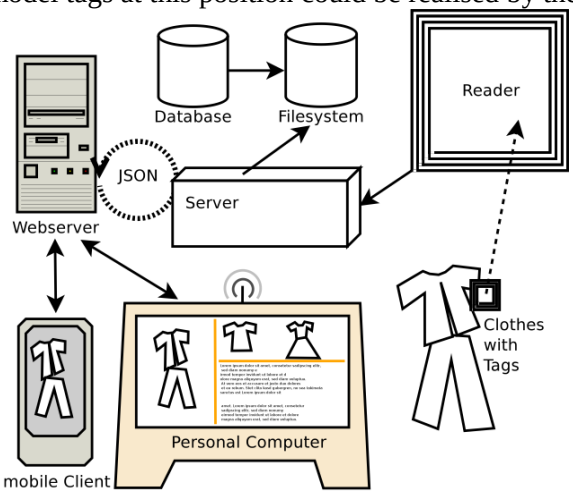

Fig. 8. Design of the infrastructure of the hat stand

The final part of the implemented software system consists of two loosely coupled components: a RFID application server as described in [7] converts all messages received from the OpenBeacon RFID system into messages of a self-defined PTN (Proximity Tag Network) Protocol. These packages are central components in the realized solution. In principle the RFID application server is implemented to accept an amount of clients being able to register for the different message types (e.g. tracker messages, running contact messages, closed contact messages and position messages) defined by the PTN protocol. Each client obtains all the messages they are registered for by the server.

In contrast to the hat stand approach that was presented previously, this system uses a long polling mechanism that is a variation of the traditional polling used before. It emulates a real push service by holding the request until relevant data has to be submitted to the client. In this way, requests from the mobile devices to the web server obtain a response just in time when a specific event occurs.

After the configuration process the gates have to be positioned on the gateway and the models have to wear the according transponder. As soon as the model, fully dressed with different clothes of different collections of schmidttakahashi, passes a gate the appropriate PTNP package is triggered and is evaluated by the client. Depending on the fact of the recognised ID belonging to one set of fashion that is presented in the current fashion show, the client sends notifications to all customers that are interested in obtaining information about the garment.

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