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RFID BASED APPLICATIONS IN CULTURE, MEDIA AND CREATIVE INDUSTRIES

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Abstract: *This article presents two different approaches to visualise information from culture, media and creative industries by using RFID based tracking and identification. Besides the required RFID backend, the paper also introduces the information system built on top of the backend. The first approach is based on passive RFID whereas the second uses active RFID. In particular, the differences in the processing of system events, delivery of needed information and the implemented infrastructure will be discussed and evaluated.*

Keywords: *RFID, NFC, multimedia installation, culture and creative industry, fashion.*

1. INTRODUCTION

In the context of a research project for position and context based information systems for museums demonstrating the potentials of RFID, called POSEIDON[14], different applications for the culture, media and creative industries were realised. The key aspects of our work include:

- computer architectures to process RFID data,
- development of a RFID based ticket system,
- 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 and data and security concepts.

This article will introduce two of these applications. They were developed in cooperation with schmidttakahashi – a fashion label in Berlin. The purpose is to visualise additional information, such as washing hints, materials or the price of a specific piece of clothing. A single garment is made from several contributing items of clothing. This principle is based on the project “Reanimation”. It describes a completely new and unusual method of creating clothes. The idea is about revival, reanimation and the recycling of used clothes donated by the public for the creation of entirely new and unique pieces by assembling the most interesting and valuable parts of the used clothes into a new outfit. The general concept is illustrated in Fig. 1. In this way the afterlife of the used clothes can be visualised and tracked. Additionally the clothes and materials are considered reasonable and economical as the final products (and also products made from products) would be able to last for hundreds of years. It will save energy and waste less in the long run [1].

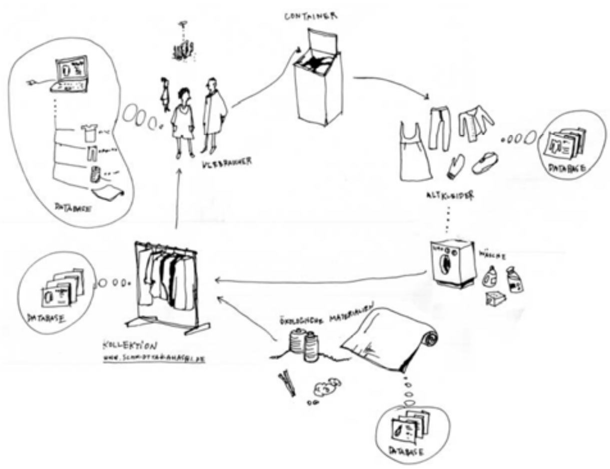

Fig. 1 – The circular flow of the concept called “Reanimation” by the fashion label schmidttakahashi

2. CONCEPTUAL AND TECHNICAL BACKGROUND

All information about the donated clothes and their former owner, the colour, the material of clothing and photographs were stored in a database. Every donated piece is divided into several parts, e.g. the back, front, body, collar or pockets. These parts are treated as the base for the creation of new products being made from different parts of different donations. Hence this design is like a construction plan for further productions.

There is also a unique ID of a RFID transponder that is connected to every product and additionally referenced to the owner. This RFID transponder was designed as a custom chassis, additionally serving as a three-dimensional label and was easily sewn onto the garments that are represented as products in the database. The information about the clothes could now be accessed by reading the ID from the garment and performing a lookup in the database. All information about the parts being used to construct the products can be evaluated.

Based on the available data and the concept “Reanimation” by schmidttakahashi there are two different modes that should be distinguished by the implemented solution. The first one should give the customer the possibility to retrieve information about a single garment they are interested in. The most intuitive design for this case is the development of a hat stand representing the interface to the customer. The second one shall be used in a more dynamic environment such as fashion shows where customers need the appropriate information as soon as models enter the runway. Both modes will be presented consecutively.

RFID and its technology in general is mainly used in production and logistics to optimize and visualize processes around the flow of people and goods. For example, active and passive RFID is used for vehicle identification and traceability, identification of people, animals, and goods, and it is also used as a authentication feature for medics as well as of different other application scenarios. In textile and clothing industries, RFID is being used increasingly in areas like anti-theft protection and surveillance (e.g. [2], [3]) but also to optimize supply and distribution channels [4]. To offer a modern experience and enhanced service, Prada provides plasma screens in the fitting rooms at their Manhattan store in New York City. Depending on the garments a customer took in appropriate fashion shows are triggered visualizing the articles of clothing [5].

These different examples and case studies prove that RFID is already being used for years in fashion industries. Nevertheless, the usage was focused in business processes like distribution and security. Direct interactions for customers and users is a new kind of experience.

3. IMPLEMENTATION OF THE HAT STAND

We used different technologies for the implementation of a stationary installation being able to display information about a single garment. In principle the system consists of a two-tier architecture that is built upon a classic RFID backend system and an information system.

A RFID reader, an external antenna, a computer, which also acts as a host for the information system, form the RFID backend 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[1] 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 centimetres. 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.

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. Querying the database generates the visualisation data. 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. The data being transferred to the website that is displayed on the different client systems uses JSON (RFC 4627[2]), a lightweight yet human readable format. It is used to exchange the data of the clothes.

When a customer attaches a new garment to the hat stand, the transponder moves into range of the installed antenna and so the unique ID is read. By using this ID the RFID backend looks for the JSON dataset. If it cannot be found locally a request to the external database is executed and a JSON file is generated and saved for the following requests.

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 JSON file that is analysed by Javascript. 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. These include the production number, the name of the clothes, prices or the materials the clothing is made of (see Fig. 3). The

[1] See http://www.iso.org for more details.
[2] See http://www.ietf.org/rfc/rfc4627 for more details.

interaction between the different components of the installation can be seen in figure 2.

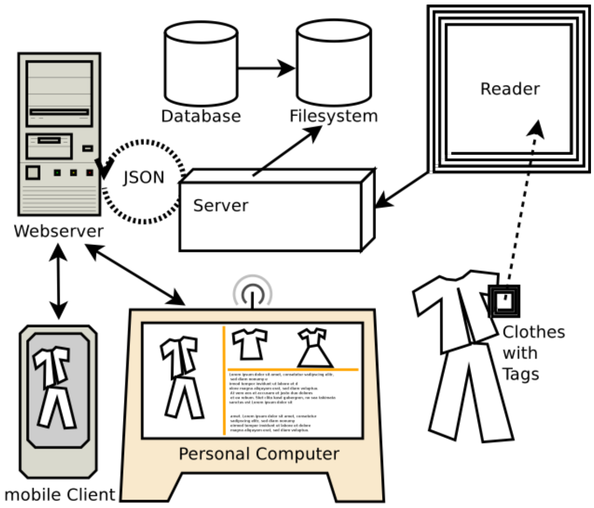

Fig. 2 – Design of the infrastructure of the hat stand

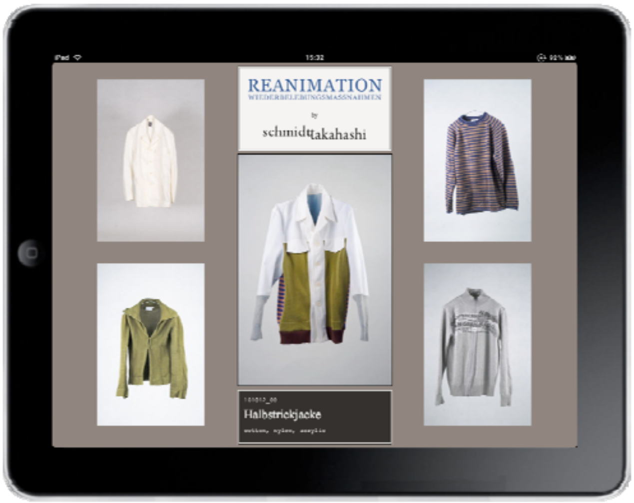

Fig. 3 – Displayed information after a jacket of the collection was attached to the hat stand. The picture in the center is the current product of the selection. On its left and right are the original clothes it was made of. By touching one of the pictures additional information can be accessed

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. ACTIVE EXPANSION OF THE INSTALLATION

The developed hat stand can be used to present different collections at vernissages or in basic show rooms. By following the principle "Keep it simple and smart" the customer is able to use it without additional assistance. All information is automatically triggered when a single piece of the collection is attached to the hat stand.

In the culture and creative industries there is one more important use where a piece of clothing has to be presented: fashion shows. Typically in a very short space of time, models present different sets of clothes. Interested people have to remember specific pieces or have to take notes on an additional paper to obtain further information afterwards. By introducing a similar technology as the hat stand in the context of fashion shows, this workflow can also be simplified.

A RFID application server as described in [12] converts all messages received from the OpenBeacon RFID system into messages of a self-defined PTN (Proximity Tag Network) Protocol. In figure 4 you can see a package for communicating a contact between two transponders. These packages are central components in the realised solution. Every contact being reported by the RFID application server is analysed by a custom client, a web application that connects to this application server. 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.

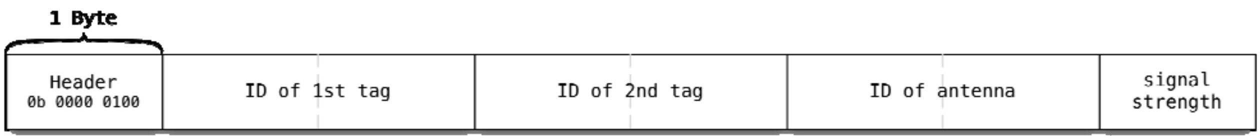

Fig. 4 – Examplary design of a PTNP (short for Proximity Tag Network Protocol) package. This type is used for communicating a contact between two tags being defined in the following four bytes within the package. The concrete type of the package is defined in its header byte. Additionally the ID of the antenna and the received signal strength is appended.

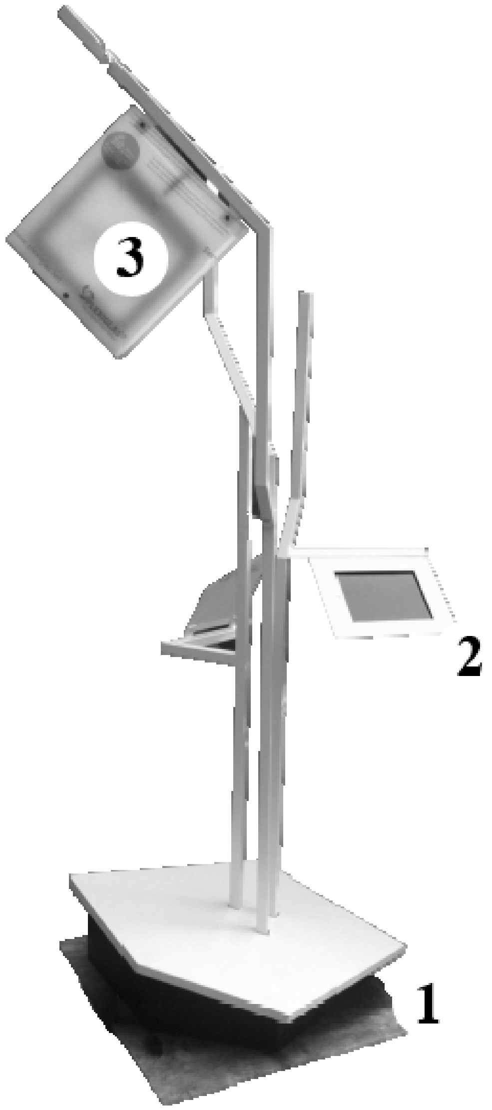

Fig. 5 – Schematic representation of the hat stand. The ground of the installation (1) contains the hardware and cables, e.g. the computer where the software is installed. Additionally there is a small touch display (2) visualizing the information of clothes being attached in front of the RFID antenna (3)

Whereas passive RFID was used in the installation for show rooms, where the range of identification was limited, active RFID has to be used in the very active and dynamic environment of fashion shows. The intent is to display required information to the interested audience of the current set of clothes for a single model as soon as the model enters the runway.

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. The installation should be minimalistic and as invisible as possible: the main focus should be the presented fashion.

5. TECHNICAL IMPLEMENTATION

We decided to use the OpenBeacon [6] technology being actively developed by Bitmanufaktur [11]. OpenBeacon is an open source solution in hardware and software for active RFID. Since 2010 the project offers a new generation of RFID tags, so called proximity tags, broadcasting additional information about the tags in their surrounding. This is realised by setting up the RFID tags in a transceiver mode. The transponders scan their neighborhood by alternating transmitting and reception cycles. They use a specific radio channel to send low-power packets first, then they switch into receive mode and listen on the same channel for packets sent by nearby devices [10]. These responses serve as indicator for proximity evaluations. These special tags can be considered as a kind of RFID reader. As transponders are much smaller and also cheaper than an ordinary RFID reader, the option of using the proximity tags to realise the runway use case was chosen.

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.

The final part of the implemented software system consists of two loosely coupled components:

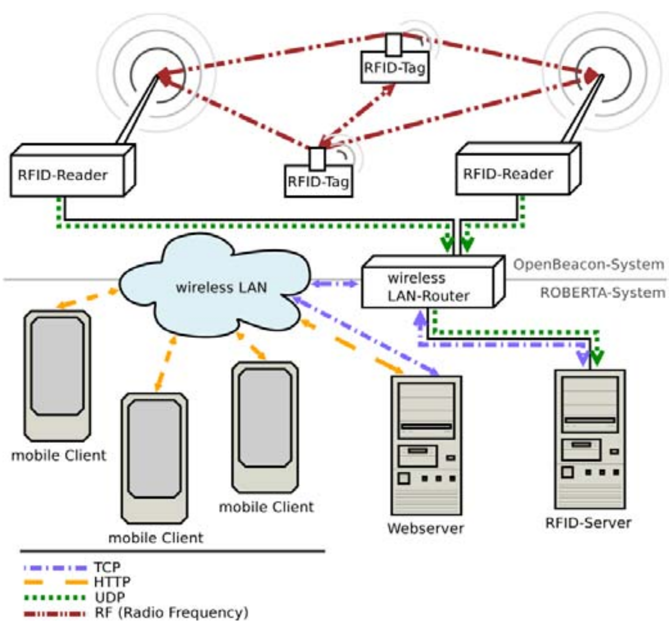

Fig. 6 – Design of the RFID application Server. The web server registers for the different PTNP messages and delivers the contents to the mobile clients

In this case, a web application has been developed to recognise all contacts between a model's transponder and the fixed RFID transponder. This web application also serves as a web server for different client devices like home computers, laptops or mobile devices as described in [13]. In contrast to the first approach that was presented previously, this system uses a long polling mechanism that is a variation of the traditional polling used before. It tries to emulate 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.

5.1. CONFIGURATION AND INSTALLATION

An important and basic part of the implemented solution is to configure these fixed transponders that virtually represent a gate that all models must pass. This is done with the aid of a XML configuration file as the external database of schmidttakahashi does not have to be changed using this method. All known tags acting as a gate and the tags being linked to sets of fashion must be configured before using the system.

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.

6. CONCLUSION AND FUTURE DEVELOPMENTS

Two different approaches have been developed for the culture, media and creative industries. They have successfully been presented in different events, the Berlin Fashion Week in July 2010 [8] and the show night "Two Worlds – One Future" of Projekt Zukunft [9] in October 2010. Both solutions act as self-contained systems and use different technologies for the technical part and the visualisation of required information. Therefore future developments will concentrate on consolidating both systems and accomplishing a modular system able to support different RFID standards. This will include the integration of positioning and the improvement of tracking moving objects to realise new functionalities, e.g. the illumination of a model on the runway. The development will also deal with the generalisation and optimisation of the current solutions. This will include the establishment of different external interfaces enabling a loose coupling of different systems. For example, the current solution could be extended by integrating the visualisation into a webshop, enabling the customers to buy or track different clothes.

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