Advertising with NFC

Paul Holleis, Gregor Broll, Sebastian Böhm

DOCOMO Euro Labs
Landsberger Str. 312, 80687 München, Germany
{holleis, broll, boehm}@docomolab-euro.com

Abstract. In this paper we describe our ongoing work and first prototypes in the area of advertising on public screens in combination with mobile devices. We are especially interested in exploiting personal user profiles and explicit input from users in order to provide appropriate advertisement content. Static displays such as paper posters as well as dynamic displays such as projected surfaces or LCD screens have been augmented with grids of Near-Field Communication (NFC) tags, which allow direct interaction with a mobile phone. The physical interaction with public displays opens up exciting new possibilities for the distribution of personalized advertisements, tailored to the preferences of mobile users in the very moment.

Keywords: Pervasive advertising, mobile interaction, Near Field Communication (NFC), multi-tag interaction, static/dynamic displays

1 Introduction and Usage Scenario

Most people have become used to the traditional way of experiencing and consuming advertisements as part of their daily lives. The success of advertisements and their value for the individual is defined by its type, content and placement (in terms of location and time). We often see posters or even screens in public, mainly being used for attracting people to communicate a specific brand, product or corresponding message. Public screens can be found in subway stations or even on top of or on the surface of vehicles such as taxis, at bus stops, on the front of buildings, in hotel lobbies, etc. In the digital world, advertisements appear within Web search results, on Web portals, within applications, or even games. However, people tend to ignore those displays that are either in the periphery of their vision or miss to provide any value to the consumer. In order for advertisements to make sense, one approach is to tailor them to the users' current activities, goals, location, history, etc.

We tackle the problem of finding appropriate connections between the user and advertising content by exploiting two aspects: first, user profiles that include for example basic demographic data (e.g. gender, age), personal preferences (e.g. specific types of food), and a history of activities (e.g. purchased articles). A number of well-known issues arise, such as how to collect the data, where to store them, how to

access them while ensuring privacy, and how to map those to interesting advertisement content. Second, we deploy specific information displays with which users can interact. This provides a point of contact where users can directly or indirectly express their goals and interest through conscious and intended interaction with these displays. This, however, means that the interaction must be observed and raises the issue of how to let users take information with them after they have left the display.

In the following, we describe an approach designed to solve most of the mentioned issues. The users' mobile phones play a central part within this process. We use them to store information about their owners, track their activities, and let them interact directly with information on specifically deployed displays. On the phone, an application is running that collects data such as location, encounters with other persons, etc. and connects with several social community platforms. This can provide a rich basis of information to be used for targeting advertisements in general. On the other hand, we designed a system that enhances paper posters as well as projections and other displays such that users can interact with them using Near Field Communication (NFC). The main advantage with respect to other possibilities such as static posters or touch screen interfaces is that people can simply interact with our displays by touching items with their phone and the information is automatically available on the users' phones. Another important aspect of the described system is that there can be a combination of dynamic and static displays deployed within an environment. While the dynamic display offers a more flexible and potentially more interesting and up-to-date interaction, the static display is cheaper and easier to deploy. However, as the look&feel can be designed in similar ways, the users can still be offered a coherent interface across all versions.

Sample scenario: Peter arrives at the Narita International Airport in Tokyo, Japan. He plans to make a holiday trip around the country and is thus happy to see an interactive display from a car rental company offering their services. With his NFC-enabled phone, he browses the available options by touching the NFC-tags of the dynamic screen to choose a type of car and uses an interactive calendar to mark the required days. While he is specifying the start and end location of his trip, the display shows specific adverts and offers for the particular places. Corresponding coupons are automatically transferred, some of which he is interested in, and stored on his mobile device as part of his personal itinerary. He proceeds in the rental order, with payment options shown on his personal phone (only). As the phone has stored his personal details and credit card information, he can directly place the order without having to reenter anything. After that, he uses the displayed map in order to find his hotel and gets route information displayed on the big screen and on the phone. Having all the information he needs, he leaves the display on his way to the car. As he looks at the map on his phone, he notes a coupon from a restaurant in the vicinity of his hotel. As it is already nearly dinnertime, he marks the coupon for later use at the restaurant.

2 Underlying Technology and Components

This section gives an overview on the technical and conceptual components of the proposed installations. This includes NFC tags and their use in installations as well as the use of user profiles.

2.1 Near-Field Communication

Near Field Communication (NFC), is a radio-based technology for short-range data exchange between reading devices, e.g. mobile phones, and passive wireless tags [1]. Many applications take advantage of the physical, touch-like interaction between them to reduce interactions like information retrieval, identification, ticketing or mobile payment to the simple touching of a tag. Tagged objects can act as expressive physical user interfaces (UI) that complement mobile UIs, adopt some of their features and thus exonerate the tedious interaction with small displays, confusing UIs and nested menus on mobile devices.

NFC and related technologies, like RFID (Radio Frequency Identification [1]) are already popular in Asia (e.g. NTT Docomo's i-mode FeliCa[1], Octopus Card[2]), and there are many academic and industrial trials held in Europe as well (e.g. Touch and Travel[3] by Deutsche Bahn). In Ubiquitous and Mobile Computing Research, the SmartTouch project[4] has investigated the usage of NFC in a variety of different use cases, such as ticketing, access control, home care or entertainment.

2.2 Applications Beyond Simple "Touch-and-Go"

While many applications take advantage of the interaction with single NFC-tags to facilitate mobile interactions, they neglect the potential of objects tagged with multiple tags to serve as advanced physical UIs. The PERCI-project [2] has presented some of the first examples for smart posters that comprised multiple tags to let users invoke Web Services for mobile ticketing. As another example, Häikiö et al. [3] present a home care service that allows elderly people to order meals for home-delivery by touching RFID-tags for different meals on a physical menu with their mobile devices. Going even further, Touch&Interact [4] uses a grid of NFC-tags as an interactive surface for applications whose GUI is projected onto the tag-grid. The mobile phone is used to interact with the tags and to manipulate the projected interface. This technique can also be used on the back of a laptop-display as shown in Touch&Select [5] for up- and downloading pictures between a computer and a phone.

An important design decision for advertising installations is to choose between static and dynamic displays. Concerning the combination with NFC, paper posters are

[1] NTT DoCoMo i-mode Felica, http://www.nttdocomo.co.jp/english/service/imode/make/content/felica/
[2] Octopus Card website: http://www.octopus.com.hk/home/en/index.html
[3] DB AG. Touch and Travel: http://www.touchandtravel.de/site/touchandtravel/de/start.html
[4] SmartTouch Project: http://www.smarttouch.org

easy to augment with a layer of NFC-tags at the back. This renders a poster interactive without any necessary visual indication but with the cost that all visual feedback has to be performed on the mobile device. A dynamic display such as a surface with a front projection or even an LCD screen, on the other hand, can indicate to the user where the phone is currently held, can show tooltips, and can change the interface according to the current target of the user. In [6], Hardy et al. acquired a more comprehensive set of pros and cons for the two implementation options.

2.3 Personal Profiles

In order to have a mobile platform for storing and accessing information about the user, we suggest employing a mobile application that offers the user more advantages than simply storing user preferences. We chose the IYOUIT platform [7], a mobile, social, and context-aware application that combines implicit sensing and logging of the users' environment and actions with explicitly entered information such as photos with captions and explicit status updates. The data stored within the IYOUIT databases about its users contains a combination of static information such as age, sex, home country, etc. and dynamically found and updated information such as office location, most often visited restaurants, and preferred types of music.

For the representation of user profiles we chose the Friend-Of-A-Friend (FOAF)[5] vocabulary, the de-facto standard for describing user-specific information in a machine-readable fashion. This extensible vocabulary facilitates information exchange across distributed knowledge sources and allows for advanced query mechanisms. Therefore, FOAF is one of the most widely used vocabularies in the field of the Semantic Web, with a growing number of extensions being defined by the community. In [8], the authors define a number of requirements for the creation and representation of user profiles in pervasive computing environments. In particular the personalization needs of multiple separate systems could be satisfied by FOAF or similar semantically well-founded representation formats.

Besides being able to exploit potential advantages within the application itself, users also are encouraged to enter information, to keep it up-to-date, and to use such an application 24/7 by the fact that all data can be shared automatically or manually with others in a community network as well as on other social platforms such as Facebook.

This means that a vast amount of personal information is stored and made accessible. We are currently exploring further techniques to explore and to extract more value from this data in an automatic fashion [9]. An important feature offered by the IYOUIT system is a sophisticated privacy mechanism. Thus, data is protected against access by non-authorized parties [10]. Besides general default settings, the user can opt to make a particular type of data (e.g. all photos) or a single instance (e.g. one specific note) available for a group of people (e.g. all connected buddies) or even only for a specific person.

[5] http://www.foaf-project.org/

Obviously, further extensions that may go beyond the social community aspects are necessary in order to capture more details with respect to targeted advertising. IYOUIT offers the possibility to simply scan the barcode of a product and publish a personal or public note about it (e.g. 'currently reading X' or 'product Y is fantastic'. However, only if, for example, the mobile phone is used as a standard means for payment (as easily possible and already wide-spread with the use of NFC technology, see next section), the phone can really keep track of personal preferences with regard to the use of everyday products.

Still, there is a large amount of data that can be automatically retrieved using this application, including: location, photos with titles and captions, weather, nearby objects or people, musical preferences, status updates, etc. In addition, trends in a user's personal history of digital traces can be identified and used to further adjust the placements and contents of advertisements.

3 Choosing and Displaying Advertisements

During the creation process of advertisements, there are essentially two aspects to be considered. First, the content and the appearance have to be chosen. Second, the location where to actually place the rendered content with respect to the main content of the display needs to be carefully selected.

3.1 Appropriate Advertising Content

In our application context, the choice of advertisement content depends on the personal user profile stored on the phone and the current activities of the user. Methods of choosing the appropriate content derived from a set of contextual information has been studied elsewhere, see e.g. [11]. Nevertheless, we will touch upon on some feasible concepts and identify specific opportunities of the described approach.

User Profiles: Content can be chosen by taking advantage of personal profiles stored in the users' mobile phones. These profiles can be application specific (e.g., in a touristic application domain: what type of sights a person has visited or is interested in) or rather generic (e.g., what types of food / music / brands / … someone likes). Such kind of information can be inherited in a users' profile in two ways. Users can directly specify items such as age, gender or preferences such as diets or preferred brands, or the application can infer knowledge from implicitly gathered information over time such as preferred routes, restaurants, and music. This lays the foundations for a general selection of different types of advertisements.

Direct User Input: Direct interaction with the previously described information displays provides explicit information on what the user wants in a particular moment. This additionally facilitates a more concrete and often more fitting selection of advertising content.

The combination of profiles and user interaction as a basis for finding corresponding advertisements can be a dynamic process. Although we have not yet

fully explored the possible design space here, one promising approach would be to use the more generic profile information at the start or even before an interaction with a display is being initiated. There are several possibilities to detect when a user is in the vicinity of an appropriate installation. IYOUIT, for example, supports the detection of a person entering a specific place, which is a location with a certain geographic size. As soon as users interact with a display, their choices and queries can be logged and subsequently used for replacing or refining the shown adverts. Information revealed by the users at that very moment can give more detailed and specific hints at what they would like to see in that particular moment. For example, searching for a particular city or requesting information about a specific place can help in providing a list of restaurants that offer the users' preferred food.

3.2 Placing Advertisements

The possible type (e.g. text vs. animations) and the actual location where some advert is placed depend on the type of display that is in use:

Static displays: Obviously, there can be some static advertisement printed on the poster. This can be related to the content or the location shown on the poster, however, it cannot depend on any user profiles or change between users. The second and more interesting option here is to show advertisement directly on the users' phones. As all dynamic information is shown on the phone in any case, this is a natural place for using some screen space next to the information requested by the users. Using the phone as carrier of advertising elements also has the advantage that advertisements can be embedded or added there when the phone is no longer used in combination with the display. As an example, consider a person who received some routing information to a specific hotel. During the time when this person uses the phone to navigate to the hotel, the phone's display can be used to show additional information or adverts, e.g. some restaurants in the vicinity. For the advertisements, there are two options: Whether the adverts are downloaded during the interaction with the display and are then static (this means there is no need for any further data transmission to the phone) or the adverts can be dynamically updated according to actual measurements. An example for the latter type would be that the application takes into account the actual path the person takes to the hotel.

Dynamic displays: In addition to all the options that static displays offer, dynamic displays enable dynamic and up-to-date information according to the profile and the current selections in general. The application has the choice of showing adverts either on the phone as described above or on the big display or on both. The latter options can be implemented by displaying adverts in close proximity to information requested otherwise or within a dedicated area such as often used in current web browsers. For example, appropriate restaurants could be directly shown besides the path to a hotel as described in the example above.

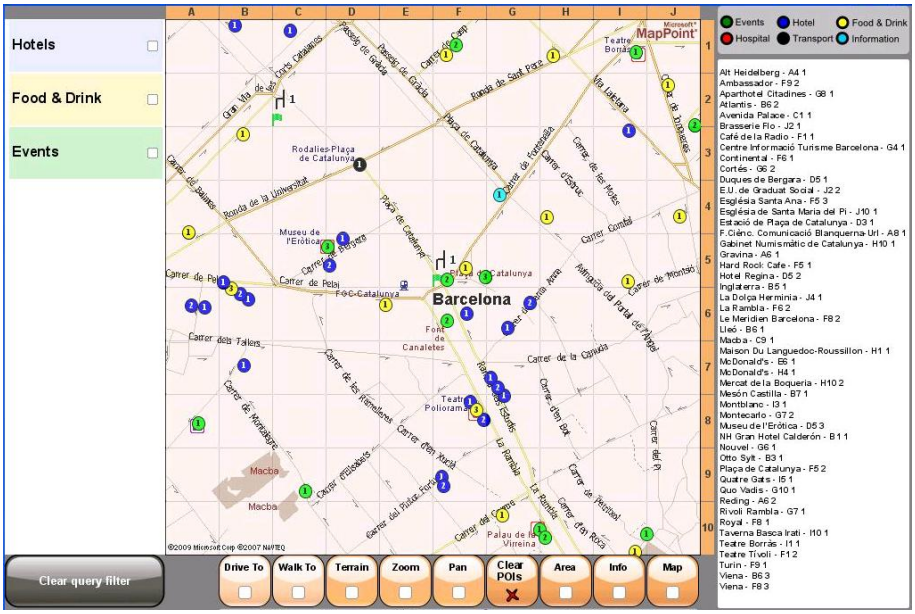

Fig. 1. A screen of a dynamic multi-tag display: it shows the initial display with an expandable menu on the left, a map in the center, and a list of POIs on the right. Fig. 2 shows how advertisement can be embedded.

Fig. 2. The initial view of the dynamic NFC display shown in Fig. 1 during interaction. Targeted advertisements are displayed, e.g. in the right column as well as directly on the map.

Fig. 3. *Left*: a printed, NFC-enabled poster very similar to the dynamic version shown in Fig. 1 and Fig. 2. *Right*: Phone screen after interaction showing the route to a sight and an advertisement offering a special price for a night for two in a hotel along the route.

4 Implemented Prototypes

Dynamic Display Application: As Fig. 1 shows, in the prototype, users can browse through a map and select points of interest (POIs), get route information, and store an entire itinerary to their phones. Advantages of the dynamic implementation here include features such as zooming and panning with the map, showing a more structured and comprehensive list of options for querying, and offering a wider variety of spaces for placing adverts as discussed above. Fig. 1and Fig. 2 show the dynamic prototype at two different times. The first displays a standard initial screen of a map with some options on the left and below. The rightmost part is used to depict a list of hotels, restaurants, sights, etc. that are indicated as POIs within the map. The second figure provides a view that can appear after a user has started interacting with the application. As the user chooses the option 'hotels' from the menu on the left, corresponding adverts can be shown in the rightmost part. As shown, a specific hotel or brand can be further indicated on the map. This is for instance valuable when the display has been put up or is sponsored explicitly by some hotel chain. After the user has chosen further options (not shown), the adverts can be even more targeted by, for example, showing only high-class hotels. User profiles can be used in a similar way: a vegetarian could, e.g., receive only information on appropriate restaurants on the way.

Static Display Application: A static poster displays a map of a specific geographical region (e.g. at the point of deployment or a remote spot for travel purposes). It can have a similar design as a corresponding dynamic application (see Fig. 2). However, besides the fixed region that the map shows, all options must either be always visible

on the poster or can only be reached by interaction on the phone. In [6] we present a corresponding study that evaluated different general designs in which the ratio between options that are displayed on the poster and those only available on the phone is varied. As soon as users have chosen the information that they wanted to have – or even during the interaction – the phone can show additional information and advertisements. These or other content that is dynamically updated can also be shown after the users have left the interaction display. As soon as they access the information stored on their phone, e.g. route information to a hotel, further opportunities for displaying advertisements can be found.

5 Discussion of the Approach

There are many benefits of the approach to combine user profiles with information extracted from direct interaction with NFC-augmented posters and displays:

- *Intuitive and quick interaction*: posters and displays can use a large screen such that visitors can see much information at one glance. Simple touch interaction minimizes entry barriers and enables interesting interfaces.
- *In comparison to touch screens*: touch screens possibly offer an even easier or more natural interface as one can directly point to items of interest. However, using the phone as mediator, requested data can be stored on the phone and thus directly accompany the users on their further way. There are several ways to overcome potential issues with lower input resolution due to tag and phones size (see [12]).
- *In comparison to visual markers*: barcodes or QR Codes are quite widespread. However, their visual appearance on the display can make their integration into a desired interface design challenging. In addition, locating and focusing with the camera on the mobile phone is cumbersome and time-consuming.
- *Similar look&feel on dynamic and static version*: the primary interaction with both, static and dynamic displays is practically identical (with feedback given on the phone in the first case). In addition, the interface design can also be very similar which helps users in remembering and using the application on different media.
- *Advertising can be added consistently*: personal profiles stored on the users' phones can help finding meaningful content to be displayed. Information generated during interaction can be recorded and used for further refinement.

6 Summary and Future Work

We gave an overview of our current work on the combination of user profiling and direct interaction displays with NFC technology in order to extend the application scope with advertisements that fit more closely to the needs of mobile users. By relying on the interaction with mobile phones, users' preferences can be conveniently stored and refined and interactions can be logged. Those two approaches can prove a powerful combination for an automatic provision of additional information and

advertisements. Providers and designers alike have much freedom to choose a fitting implementation and visual design for their purposes. As an example, an interactive, dynamic display can be placed in a supervised area, e.g. in the lobby of a sponsoring hotel, whereas printed, interactive posters can be placed more freely around the city as they are relatively cheap to produce and put up.

It will be interesting to see exactly what data can be retrieved from both approaches and how issues with contradictory or inconsistent data can be solved. There are also some open issues as to how to integrate advertisements in a general form into dynamic displays or the small phone screens. As described in [6], we have started to build a framework that can help developers of such NFC-enabled displays in creating applications. This will need to be extended in order to have advertising options be an integral part in the data model and visualization.

7 References

1. Want, R. An Introduction to RFID Technology. IEEE Pervasive Computing, 5 (1). (2006) 25
2. Broll, G., Rukzio, E., Paolucci M., Wagner, M., Schmidt, A., and Hussmann, H. Perci: Pervasive Service Interaction with the Internet of Things. IEEE Internet Computing 11/12 2009, IEEE Computer Society, (2009) 74 - 81.
3. Häikiö, J., Wallin, A., Isomursu, M., Ailisto, H., Matinmikko, T., and Huomo, T. Touch-based User Interface for Elderly Users. In Proc. of MobileHCI'07. (2007) 289-296.
4. Hardy, R. and Rukzio, E. Touch & Interact: Touch-based Interaction of Mobile Phones with Displays. In Proc. of MobileHCI'08. (2008) 245-254.
5. Seewoonauth, K., Rukzio, E., Hardy, R., and Holleis, P. Touch & Connect and Touch & Select: Interacting with a Computer by Touching it with a Mobile Phone. In Proc. of MobileHCI'09. (2009)
6. Hardy, R., Rukzio, E., Holleis, P., and Wagner, M. Mobile Interaction with Static and Dynamic NFC-based Displays. In Proc. of MobileHCI'10. (2010)
7. Boehm, S., Koolwaaij, J., Luther, M., Souville, B., Wagner, M., and Wibbels, M. Introducing IYOUIT. In Proc. of ISWC'08. (2008) 804-817.
8. Shannon, R., Stabeler, M., Quigley, A, and Nixon, P. Profiling and Targeting Opportunities in Pervasive Advertising. In 1st Workshop on Pervasive Advertising at Pervasive'09. (2009)
9. Böhm, S., and Luther, M. FOAF on Air: Context-aware User Profiles for the Social Web. In Proc. Workshop on Social Data on the Web at ISWC'09. (2009)
10. S. Böhm, J. Koolwaaij, and M. Luther. Share Whatever you Like. In Proc. of CAMPUS'08. (2008)
11. Payne, T., David, E., Jennings, N. R., and Sharifi, M. Auction Mechanisms for Efficient Advertisement Selection on Public Displays. In Proc. of ECAI'06. (2006) 285-289.
12. Seewoonauth, K., Rukzio, E., Hardy, R. and Holleis, P. NFC-based Mobile Interactions with Direct-View Displays. In Proc. of Interact'09. (2009) 24-28.