Enabling Festival-wide Social Network Interaction using 2D Barcodes, Mobile Phones and Situated Displays

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ABSTRACT
In this paper we report our experiences with an exploratory prototype festival-wide social network applying unique 2D barcodes on wristbands and mobile phones to uniquely identify the festival participants. Experiments were carried out at the CO2PENHAGEN music festival in Denmark. We describe a set of social network applications involving participant profiles, a microblog and images shared on situated displays, and competitions created for the festival and our experiences from initial use of these. The pilot study included 73 participants each creating a unique profile. We found that our novel approach had potential to enable anyone at the festival to participate in the festival-wide social network, as participants did not need any special hardware or mobile client application to be involved. The 2D barcodes was found to be a feasible low-cost approach for unique participant identification and social network interaction.

Categories and Subject Descriptors
H.3.5 [Online Information Services] Web-based services, Data sharing

Keywords
Social network, 2D barcode, mobile phone, situated display.

1. INTRODUCTION
In the Web 2.0 area social networks have played a pivotal role. They connect people throughout the world, regardless of their actual localization, enabling participants to communicate, easily share experiences and photos. Recently, social networks that take advantage of the physical proximity of the users have gained attention. Festivals are creating websites that allow people to register, exchange information, opinions, ratings, etc. In addition festivals increasingly use popular social networks, such as, Facebook and Twitter. These social networks are more focused on a particular event and can have some unique features related to the fact that participants will be (at some point) in the same location. Music festivals are interesting in the context of urban computing [7] as they typically form small city-in-a-city environments with short lasting communities.

Barcodes on wristbands have been applied in health care typically to promote patient safety, such as, patient identification to eliminate medical errors and medication mistakes. However, in the area of mobile social applications [14, 15] barcodes have mainly been applied to link physical objects in the environment to available information [6] and other applications of barcodes [13] include games, situated learning [8], tourist applications, focusing on the barcode augmenting a physical object with information typically presented through a mobile device. Thus the use of 2D barcodes for participant identification in this study is a novel approach. The barcodes allow us to use low-cost off-the-shelf solutions as the means to support social network interaction, and thereby enable quick and cheap prototyping of social network interaction using situated displays in a festival setting. Prior work on large situated displays has focused on applications in CSCW research and groupware systems [1, 4, 5]. An experiment with social interaction on a situated display in a festival setting has been tested using a collaborative story writing game (a WAP based solution) [3] and Peltonen et al. [12] experimented with additional touch-based interaction on large displays. In the present study our focus is to study the use and feasibility of participant wristbands with 2D barcodes for unique identification of participants to enable interaction in festival-wide social network services that we created for the CO2PENHAGEN festival.

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2. FESTIVAL-WIDE SOCIAL NETWORK INTERACTION AND APPLICATIONS
The CO2PENHAGEN festival was a two-day music festival and arts event with 40+ bands playing, lounge areas, and activity areas with a set of installations with an emphasis on environmental aspects. The grounds were divided into several areas including two music stages, explore zone (e.g. electric cars), and lounge (food). An overview of the festival area is shown in Figure 1.

In the center of the festival grounds was the Information area where two 42" displays were situated. A total of 10 volunteers took shifts over the two days to work in the Information area and help carry out experiments. That included enrolling participants in the social network by creating profiles, making sure our applications were working. On the two displays were a slideshow showing random photos taken by the volunteers, including a small map segment (from GoogleMaps) indicating where the photo was taken, similar to the approach described by Cheverst et al. [2]. Moreover, the displays also showed a microblog containing the latest status messages from different participants (sent via SMS); it was shown as a list of messages after being accepted by a moderator. The participant profile name and picture was shown

next to the status message. Recycling was registered as part of festival competitions. The festival had several zones where people could throw out waste into different containers and our volunteers were scanning the wristbands of the participants who correctly sorted and threw out waste. Collected points were added to the participant profile and prizes were given for the most active participants. The moment a wristband was scanned the photo of this participant (if available) was shown on the large displays. Finally, beer glasses were tagged with 2D barcodes, making it possible to buy refills for one glass (and to buy additional refills later). In the bar there was a special fast line for people with tagged glasses and a volunteer scanning them. Thus, in the environmental spirit of the festival people were encouraged to keep the glasses instead of throwing them out. In total 10 mobile phones were operated by the volunteers, who performed all the tasks related to the project, i.e. scanning of barcodes in the various activities. They were working in shifts, changing activities and there were always about six volunteers active.

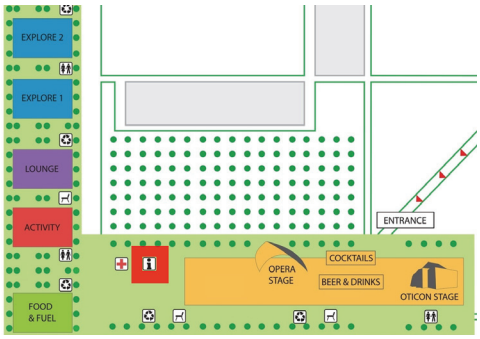

Figure 1. Sketch of the festival area with zones, stages, entrances and the Information area in the center.

The barcodes on the participant wristbands were scanned with a system built for Nokia mobile phones (Nokia N95 8GB) including a component from QuickMark for the barcode scanning. We built a custom Symbian mobile application, which handled the results of scanning acting as a thin client with a webserver backend. The mobile client application contained several modules: camera, GPS, networking, which were customized for the particular purpose. The mobile phones were connected to the Internet via WiFi or cellular network and operated by the volunteers.

Figure 2. Scanning of wristband barcode with mobile phone

After entering the festival area and getting their wristbands, some participants would walk by the Information area located in the center of the festival area. At the Information area random festival participants were asked if they wanted to create a profile to be part of the CO2PENHAGEN social network. They were briefly explained about the above mentioned applications. A sticker with a unique barcode was then attached to the participant wristband.

A participant profile included a personal webpage at the festival website and was created by scanning the participant's wristband with a mobile phone (see Figure 2) along taking a profile picture of the participant (see Figure 3). The participants could add additional information to the profile, including a nickname and phone number.

A personal profile (on the festival website) contained a profile picture, nickname, status messages, personal photo gallery, competition point counters, and a questionnaire about the festival. The status could be updated by the participants by sending an SMS with the new status text to an SMS gateway (standard SMS charge). Pictures taken by the volunteers using the mobile phones were automatically uploaded to the server. After taking a photo, it was possible to scan the wristbands on the participants in order to tag the picture with those participants, adding the picture to the personal photo gallery in the personal profile page. The mobile phones used GPS to geotag the pictures taken by the volunteers. It was possible for the participants to upload their own photos from the festival to their personal page, having a single place to view and share photos from the event.

Figure 3. Participant profile picture taken by a volunteer. On the left is a large display showing pictures and the microblog

3. RESULTS AND OBSERVATIONS

About six hundred people visited the festival in two days. Our pilot study was done in a time slot 1 pm. – 7 pm. both days (with most activity in the afternoons). 73 unique participant profiles were created, 67 (92%) of them were created with profile photo and 55 (75%) of the participants registered their phone number. Four profiles (5%) were created as couple profile. Participants sent a total of 30 messages and three messages were sent by unregistered users, the rest came from people with a profile. Our volunteers took 341 pictures and 89 (26%) had a valid geotag, enabling the applications to display the photo on a map where it was taken. There were five registered participants taking active part in the waste competition (children or young teenagers). Scanning of wristbands when people threw out waste was done 39 times, each time earning points to the participants. 55 glasses of beer, with the barcode attached, were sold. When purchased, they had three beers on the account. By the end of the festival, 43 of them had empty accounts indicating a successful use of the barcodes for this purpose.

When people had their wristband scanned and photo taken to create the profile we had a chance to explain the idea and get their immediate reactions. Thus our results are partly based on qualitative observations and informal user feedback. It was our

observation that people liked the idea of the barcodes used for identification. Less than 10% of the participants that were asked declined to have a profile created, but we did not obtain information why they declined. For some participants it was the first time they had seen 2D barcodes. Some did know about their existence but had never actually used or seen them being used. Some participants expressed their opinion that the 2D barcodes had a more "personal touch" than RFID tags, which some knew from work or school. It also gives more privacy [9, 10], as it is ultimately user's decision whether to show or to hide the barcode.

Another concern was lighting conditions since 2D barcodes are scanned optically, it is necessary to have decent lighting. The pilot study was running until 7 pm. and we did not observe any issues with scanning speed, related to the lighting conditions. A scan (including starting the QuickMark application) took up to ten seconds, which was used for waking up the phone from the standby mode (to preserve battery), choosing the right option of scanning from the application menu, adjusting the scanning position, decoding the barcode and handling the scanning results. Thus the actual reading of the 2D barcode was typically done in less than a second. This seemed to be an acceptable time when considering users reactions, as their focus was on the scanner and right placing of the barcode. They were also using this time to ask questions about the technology and project in general. Together with photo taking and typing the name in, the whole profile creation process was taking about 30 seconds. We did not observe any substantial problems with scanning accuracy, after several test scans our volunteers were able to perform valid scan in the first try. Participants did not express any dissatisfaction with the speed or accuracy of the whole process. On the contrary, when asked, they described it as 'well working' and 'quick'. The approach based on 2D barcodes appears to work well for the casual activities with low scanning frequency, as in the present study. However, for larger events a larger number of scanners or fixed automatic scanners would be needed.

Table 1. Categories of microblog messages

Message category	Examples
General environmental statements (due to the festival environmental theme)	"Keep the nature green" "Stop destroying the environment"
Statements about the festival itself, including the concerts, bands, food, and areas	"szhirley was cool" "BioM has good burgers!" "this is a really great concept!"
Weather statements (it was raining on the first day)	"having fun in the rain :-)" "Enjoying the sun today.."

The two large displays with photos and the microblog were attracting people's attention, as they were highly visible at the Information area. It was our observation that having both pictures and microblog on the screen was advantageous, as photos attract people's attention from a distance and the microblog was readable when people were closer and kept their attention. After the profile was created, people were expecting to see their photo on the screen. Some were sending a status message, waiting for it to show up (it took about 30 seconds). It seemed that messages were considered by the participants rather as a kind of "graffiti" message that was left behind, than the status message or feed for a live blog. This was related to the fact that the displays were seen from a limited distance and by a limited number of people at the Information area at any given moment. We would expect this behavior to change with larger displays seen by a larger number of people. The participants enjoyed that they could immediately share the experience with their friends with the message shown in the microblog on the displays. Some even checked back later to see if their message was still visible on the display. The microblog messages fall into three categories, shown in Table 1.

It was observed that the user interaction (including sending messages, creating profiles, taking pictures etc.) increased when participants were part of a group. Users were treating such festival activities as a social activity, especially if it allowed them to interact with other members of the group. For example messages sent to the microblog often address other members of the group. The waste competition was very appealing to children at the festival who were very eager to participate. They were not concerned about the prize, but were apparently participating for the sole reason of competition. When volunteers took pictures at the festival they had the option of tagging the people in the picture using their wristbands. When explaining this to volunteers and participants it was observed several times that people spontaneously uttered that this was just like tagging someone in a picture on Facebook, even though we did not describe it in this way. This clearly indicated that people immediately understood the concept of tagging them for the picture using the 2D barcode.

4. DISCUSSION

We were satisfied that we managed to setup the system and that it was running smoothly. Previous studies have mainly been carried out in laboratory settings [10], whereas we were able to study the use of barcodes in a real world festival setting. However, we were somewhat disappointed by the limited uptake of the microblog service considering we were able to get 73 participants to create profiles. We believe that the main reason was the displays being situated only in the Information area that people visited short-term and infrequently. Some participants registered a profile, but were then in a hurry to go to a concert and did not try the service later, whereas some tried out the microblog immediately with a positive attitude, as they could immediately see the result on the displays. As mentioned the displays were drawing attention from people visiting the Information area as was expected. Participants would watch the pictures and read the messages in the microblog. The original intention was to have displays situated at each stage and at the lounge area where people would spend longer time and thus it would stimulate interaction. However, the idea was abandoned by the festival organizers due to concerns about the total energy consumption at the festival, as the goal was to create an environment neutral festival. We had to accept this unfortunate decision, knowing it would weaken the deployment and experiment.

Interacting with the social network through the barcodes and mobile phones was new to most of the participants and our results confirmed the findings by Mäkelä et al. [10] that participants were open and enthusiastic about the concept, but the majority was unfamiliar with the technology. We observed that it was very easy for participants of all ages to grasp the idea of the social network and many participants were genuinely curious about various details of the concept, from the general motivation to technical details. All the technical details were hidden from the users, so no special skills were required. In general, people wanted to have

their picture taken for the profile. They also were not hesitant to submit their phone number. We were only collecting first names (there was no reason to collect last names), but people were still typing in their full name. It seems that letting people type in their own name is a good solution as it made the whole process quicker and less error-prone and people liked the fact that they participated in the profile creation process in an active way. However, it was somewhat surprising that the majority of participants were not hesitant to provide full name and phone number when registering. For privacy reasons only the nickname was shown on microblog on the situated displays (not the phone number).

Research in the area of urban computing have received critique in terms of applications not being designed for a broad audience [15] as it may require special equipment or advanced mobile phones. No special equipment is required of the participants in this project; the scanners (mobile phones) and software was carried by the volunteers that took part in the experiment at the festival, allowing anyone with a wristband and 2D barcode to become part of the social network. Future deployment could use fixed scanners and be extended to include special features for advanced users, such as scanning the barcode using a personal mobile phone. The barcode could encode more information, such as a URL linking directly to the personal profile webpage. Using 2D barcodes gives many new opportunities [13], when compared to classical tickets or RFID cards. It is a low-cost solution and as demonstrated in this study, it is easy to integrate different mechanisms into one application on mobile phones: code scanning, photo taking, GPS coordinates, etc. This can be suitable for events as the one in focus in this study, where scanning the barcode is enabling interaction in a festival-wide social network.

Our pilot study has shown that it is feasible to use 2D barcodes on wristbands for unique identification of participants. The scanning process was acceptable given the necessary scanning frequency. We have observed some interesting behavior patterns related to the activities in our project. Interaction of single participants with the system is limited to the time and place where they and other participants can immediately see the effect of their actions. For example, newly uploaded photos should appear instantly in the slideshow. In this pilot study we have created our own special-purpose social network, with profile pages, photo sharing possibility, and status. In future deployment it would probably be beneficial to integrate those services with an existing social network, such as Facebook, to utilize already existing user profiles. Based on our observations and the positive feedback from participants and the organizers, we find that the approach has a potential to facilitate social interaction in such settings, and find further studies relevant to obtain further insights.

5. CONCLUSIONS

Based on our experiences from deploying our festival-wide social network we have gotten initial indications that the approach taken using 2D barcodes to identify participant is a useful low-cost approach for events at this scale. Our novel approach enables anyone at the festival to participate in the social network, as participants do not need any special hardware or mobile applications to participate. The pilot study has provided valuable insights how to improve the social network application for future experiments at larger scale events.

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