Information Radiators – Using large screens and small devices to support awareness in urban space

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ABSTRACT

Information radiators are ubiquitous stationary installations that radiate information that is likely to improve awareness of passers-by in semi-public environments like organization floors. In this paper, we present the idea of using several kinds of information radiators for enhancing urban participation of seniors – by providing awareness for supporting the planning and execution of activities in public environments. We motivate the idea and discuss interaction design as well as HCI challenges to be addressed in future work.

CCS CONCEPTS

• **Human-centered computing → User centered design** • **Human-centered computing → Accessibility;** design and evaluation methods • **Social and professional topics → Seniors**

KEYWORDS

Awareness, information radiator, benefits, large screen, public screen, pervasive display, seniors

ACM Reference format:

M. Koch, A. Kötteritzsch and J. Fietkau 2017. Information Radiators – Using large screens and small devices to support awareness in urban space. In *Proceedings of IEEE/WIC/ACM Intl. Conf. on Web Intelligence, Leipzig, Germany, August 2017 (WI' 17)*, DOI: 10.1145/3106426.3109039

WI '17, August 23-26, 2017, Leipzig, Germany

ACM ISBN 978-1-4503-4951-2/17/08...$15.00
DOI: 10.1145/3106426.3109039

1 INTRODUCTION

In urban areas, the continuously speeding up pace of life is particularly demanding for older adults who might additionally encounter age-related physical or cognitive impairments. With an increasing percentage of older adults, communities are facing the challenge of encouraging participation in public activities for people with and without need of assistance [11]. In the living environment of older adults, social engagement and self-determination is mainly dependent on the ability to move safely within the environment outside of their home.

Information and communication technology (ICT) offers supportive means to orientate oneself in such situations. Examples include navigation systems for routing [15] as well as community knowledge on places in the vicinity [14] which help people to explore their environment. However, many ICT approaches require older adults to carry personal devices and interact with them in urban space, drawing their attention towards the devices instead of the urban environment.

We see potential in using information radiators in urban space to improve awareness of possible activities and of the environment. The basic idea is to encourage and support activity with older adults, and thereby change the feeling of safety.

In the following, we first present the idea of smart urban objects. Then we elaborate on the idea of information radiators as a class of smart urban objects, and discuss how these tools can help to achieve the goals discussed in the previous paragraphs. Then we present the idea of how to implement information radiators in our project, and elaborate on arising HCI questions in this process.

2 SMART URBAN OBJECTS

Even though an increasing number of older adults becomes technology-savvy, and the stereotype of anxiety and helplessness when using technology does not apply for many older adults [9], technology needs to be non-intrusive and easy to use as well as easy to access in order to include people with cognitive and motor impairments. Therefore, we aim to

Figure 1: Envisioned smart urban objects – lights reacting to people approaching (left), augmented reality information system on a tree (mid left), vibrating bench that reacts to upcoming older adults by vibrating (mid right), kiosk system that shows how to overcome barriers along the way and gives information on the ducks living on the lake (right)

create technology that makes digital contents accessible for everyone, even when not owning or carrying personal electronic devices.

Smart urban objects are elements of the urban environment, e.g. posts, bulletin boards, and benches, which are connected to a digital information space and allow for implicit or explicit interaction in public spaces. Those objects range from interactive information billboards, or sidewalks that can be lowered for people in wheelchairs, to benches that indicate potential occupation by an older adult with a wheeled walker.

While some of the features we are addressing might also be achievable via smart phone apps, we deliberately do not follow this approach, and concentrate on smart urban objects only. Doing so, we are trying to improve knowledge on how to best achieve the potentials of this class of tools. A real-world solution might later combine the best from smart urban objects and personal mobile applications.

There are already some approaches to help people with impairments in urban space via smart urban objects. For example, responsive street furniture aims to help blind people by combining personal technology and public urban technology into an in situ responsive system, which provides information as well as adjusts environmental features, like electric lighting [1]. Sensors attached to lamp posts already collect masses of data in pioneer areas in order to analyze movement in cities, contextual information, as well as social interaction. This processed and filtered information may then be used to create added value for target groups in the city, including information on how to find accessible public transport by tracking locations of busses and passengers [2], connect urban neighborhoods and online communities via public interaction booths [3], or encourage safe behavior by engaging pedestrians in activities while waiting at traffic lights [10].

We envision to integrate smart urban objects into the urban infrastructure to create spontaneous multi-user interaction resulting in awareness within the social environment with a focus on older adults (see Figure 1). Technology is either implemented into existing urban interior by attaching kiosk systems, lighting, and sensors (left side of Figure 1), or new interior and machinery is being installed, already integrating electronic components (right side of Figure 1). As soon as a person approaches these objects in a viewable, reachable, or detectable distance, the object triggers a reaction in order to attract attention, e.g. blinking lights or moving mechanical elements. Information that is gathered and presented in order to provide an added value for older adults includes information on the users themselves, the immediate (built) environment, (social) activities, events taking place in an area, distances, transportation means, and available services, products, and vendors. Furthermore, environmental conditions like weather forecast and exhaust pollution are included through sensor and online data. The interaction itself can consist of implicit interaction with a personal device, like sending a status update, up to complex interaction of browsing through data notes on the smart object, depending on the awareness goal that the object is designed for.

3 AWARENESS THROUGH INFORMATION RADIATORS

According to Dourish and Belotti [8] the term *awareness* can be defined as "an understanding of the activities of others, which provides a context for your own activity". We use this definition, focusing both on becoming aware of potential activities taking one's impairments into account, and on the process of becoming aware of others' activities and of the presence of others. Increasing awareness of one's options and of how these options can be executed despite various impairments can greatly improve participation in urban communities. Older adults e.g. with mobility impairments will engage more in activity that is suitable even for people with

wheeled walkers. That is where we want to start. We want to create smart urban objects that radiate personalized information to increase this awareness – so called information radiators.

The term *information radiator* has first been coined by Alistair Cockburn for frequently updated posters showing the current state in software development processes in a high traffic hallway [5]. The radiators provide pieces of information – in other words concrete visual representations of information objects – stored in the underlying data sources in a way that makes them consumable peripherally. In contrast to most other IT systems which only provide access to information after a certain user interaction (e.g. a search), information radiators proactively distribute their *info particles* independently from any user.

Information radiators are quite common in urban space in the form of digital signage solutions and advertising displays [7]. Solutions for improving awareness often can be found in semi-public indoor environments. One example for such a solution is the CommunityMirror [16]. Supporting the serendipity effect [18], a CommunityMirror facilitates the "accidental" discovery of relevant information without having to explicitly look for it. The re-integration of information objects into their social surrounding enables people to directly talk about the discovered information without computer mediation. Thereby, the additional interfaces can help to efficiently generate a common ground for successful collaboration. Similar ideas have been tried in several other projects (e.g. Aware Community Portal [19], Plasma Poster Network [4] or FizzyVis [6]).

In contrast to simple digital signage solutions all these approaches allow for interaction and often for personalization of the radiated information.

4 THE BASIC IDEA

We aim to improve participation by providing information when needed – both for planning (motivation) and execution of plans (assistance) – via smart urban objects (information radiators). To achieve this goal, the information radiators should communicate information about:

- Potential activities (personalized to the abilities of the user)
- The direct environment – locations or objects (that might be useful), events, services
- People in the direct environment (and their activities)
- Next steps of current activities and features of the direct environment relevant for the execution

This list already shows two different usage situations of information radiators:

- Planning and motivation of potential activities – usually done when in relaxed semi-public spaces like the lobby of a retirement home or the lobby of a local shopping center or retail bank
- Execution of activities – while "on the road"

The following short scenario describes the potential usage of information radiators by an older woman and highlights the differentiation between activity selection and execution.

4.1 Step 1 - Activity selection

Margot wants to explore what is new in the neighborhood. In the lobby of her retirement home she passes by a large interactive information screen. The screen offers some general suggestions of what to do in the environment or what other people are planning to do.

When the screen recognizes Margot, it offers some personalized suggestions and information on what Margot's friends are planning or doing. In the personalization process the screen uses analyzed information about Margot's abilities. It does not limit suggestions to already achieved activities but tries to exceed her range of activities.

When Margot selects an activity, the screen presents the next steps she should perform to execute this activity – and information that is helpful to do so – taking into account features of the environment and of people in the vicinity. For example, the screen suggests to visit a local museum or to visit three cafes in the next week.

4.2 Step 2 – Activity execution

While performing her selected activity, the system supports Margot in finishing individual steps. At the first crossing towards the museum, a small information radiator at the traffic lights shows information about the environment – and after recognizing Margot it shows more personalized information about the next steps in her activities, e.g. where to cross the street safely, where the next possibilities for resting or the next toilets are located, and where there are people in the vicinity, who can accompany her or provide help if needed.

When Margot is in her comfort zone (which is determined e.g. by places she has visited or where she feels at home), the information focuses on exploring the environment. When she is outside of her comfort zone, it aims to help her in achieving her goal and on overcoming barriers [13].

5 LARGE AND SMALL INFORMATION RADIATORS

As the scenario description shows, we currently envision different kinds of information radiators:

- *Large screen information radiators (digital information boards)* – large interactive wall screens for multiple users, located in protected, semi-public environments, like the lobby of a retirement home or the lobby of a banking facility
- *Mini information radiators* – small kiosk screens for single users, located at crossings, bus stops, or outside shops, cafes and restaurants
- *Micro information radiators* – devices without screen that communicate via light and sound, located at lamp posts,

benches, traffic lights, places where it is possible to cross the street, or shops and cafes

The different information radiators are all interfaces to the same information system, and work together via the information system to provide support for the users. The large screen information radiators mainly support activity selection, the mini and micro information radiators mainly support activity execution.

6 INTERACTION DESIGN

Adding smart technology to objects in the urban environment requires enhancing interaction design in terms of walk-up-and-use scenarios. In the following, we present our current thoughts about interaction design for the envisioned information radiators. Thereby, we differentiate the following two possibilities for interaction:

- *Implicit interaction* when approaching the information radiators (e.g. the information radiator recognizing the user)
- *Explicit interaction* when using the information radiator from a close distance

It is important to note that digital information boards are active even when no user interacts with them – presenting awareness information to anonymous users looking at the screen. The same is true for mini information radiators – for potential users looking at them. No information will be radiated by micro information radiators when they have no recognized user in their vicinity.

In the following we present our preliminary ideas regarding implicit and explicit interaction with the different types of information radiators.

6.1 Large information radiators (digital information boards)

In idle mode, information particles – selected based on the location and time - are presented in an animated way. Anonymous users can interact with this information via touch interaction to access detail information or browse the information.

As soon as a user is recognized, personalized information and personalized details are shown. The user can then accept an activity and request further support. Additionally, the user can request other services (in case they apply to the information and the user). First examples for additional services are the reservation of wheelchair spaces in public transport, requesting special assistance in a movie theater or simply booking a time slot at a hair studio.

6.2 Mini information radiators

Again, location specific (and potentially user specific) information is shown – only a few information particles with only one user in mind. In addition to approaching the information radiator to get personalized information, explicit interaction with the information radiator might be performed using touch, gestures or speech. Target of the interaction might be to communicate a need for getting better recommendations, or to browse the provided information.

6.3 Micro information radiators

Without a screen, these information radiators can only use light and sound to communicate with the users. It is not yet clear what interaction possibilities these information radiators can and should offer. We are currently envisioning minimum interaction to identify users (i.e. by approaching the radiators). Additionally, gestures and speech might be used as input channels – to acknowledge a signal or to request additional information or help.

7 HCI CHALLENGES

In the previous section, we have elaborated on how the information radiators might look like and how to interact with information radiators in urban space.

A key challenge will be to design interaction with the individual information radiators and with the whole system consisting of different information radiators and other smart urban objects – both for our particular user group of older adults, and in general for walk-up-and-use i.e. for usage without requiring training or reading of manuals.

We identified four major HCI meta challenges for designing information radiators for urban areas: adaptivity, multi-user ability, walk-up-and-use ability, joyfulness.

Adaptivity: To support heterogeneous user requirements, the system should be able to adapt its recommendations and supportive means to the individual users (in particular to their abilities). Implementing this ability includes creating a (privacy aware) solution for identifying users and accessing user profiles, for modeling abilities in user profiles, and for matching user profiles with potential information to display.

Multi-user ability: The large screens and the micro information radiators are multi-user devices, e.g. the devices will be used by more than one user at the same time – perhaps not by active interaction but at least by being next to the radiator, being "logged in" on the radiator, looking at what the radiator displays. Thus, the (interaction) design must address several users at once.

Walk-up-and-use ability: Urban areas are characterized by many passers-by, who might spontaneously interact with technology present in the environment. Therefore, systems have to be intuitive to users.

Joyfulness: When aiming to engage older adults in urban activities, motivation is a key factor. If there is no perceived benefit [17] or no destination [12], older adults are less likely to take part in any outdoor interaction. The awareness of people, familiar faces and neighbors as well as people engaging in outdoor activities and visitors have shown to be encouraging factors for walking in older adults [12]. Also,

being aware of one's own actions and abilities is a promotional factor in cognitive and physical health related behavior change [20]. Thus, different attempts to increase awareness have been made in HCI e.g. through playful or persuasive technology.

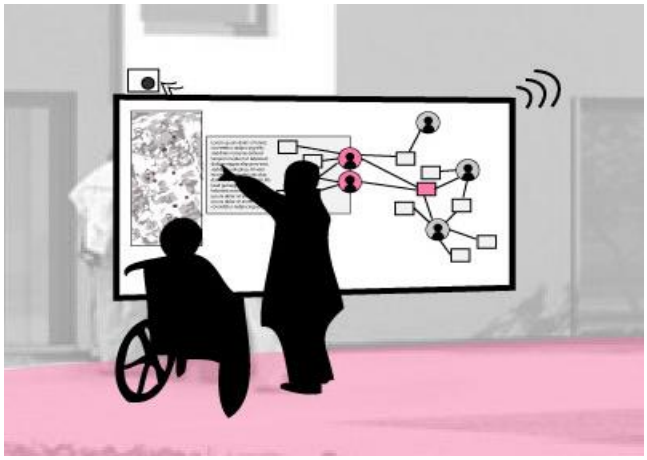

Figure 2: Large Screen Information Radiators

6 SUMMARY AND FUTURE WORK

In this paper, we have presented the idea of information radiators as smart urban objects for enhancing urban participation of seniors – by providing awareness for supporting the planning and execution of activities in public environments. We motivate illustrated the idea by presenting usage scenarios and interaction design ideas for the application class.

Our future work will continue to elaborate the design of the solution in an iterative user-centered approach, particularly addressing the HCI challenges presented in the previous section. Results of the research therefore should be a firm establishment of the application class, but also contributions to how these challenges could be met when designing public outdoor objects.

ACKNOWLEDGMENTS

This work was fully conducted in the scope of the research project *UrbanLife+* (16SV7443), funded by the German Federal Ministry of Education and Research.

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