Interacting Places – a Framework for Promoting Community Interaction and Place Awareness through Public Displays

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Abstract—**The proliferation of public displays, along with ubiquitous wireless communication and sensing technology, has made it possible to create a novel public communication medium: open networked pervasive displays would allow citizens to provide their own content, appropriate close-by displays, and increase their own awareness of a display's surroundings and its local communities. We envision that such displays ultimately can create *interacting places*, i.e., public spaces that promote community interaction and place awareness. In this paper we describe our Interacting Places Framework (IPF), which helps to identify challenges and opportunities in this novel research space. Our IPF has 4 elements: 1) *content providers*, i.e., entities that supply content; 2) *content viewers*, i.e., people who consume the content; 3) a number of *interacting places communication channels* that support *inclusive*, i.e., open-for-everyone, and *exclusive*, i.e., closed-group communication; and 4) an *awareness diffusion layer* that promotes community interaction either *explicitly*, i.e., through content tailored towards a specific audience, or *implicitly*, by observing output for other people. We have begun initial deployments examining this space and will use the framework presented here to analyze future results.**

Keywords-community interaction; interacting places; public displays; urban computing; urban informatics;

I. INTRODUCTION

Public spaces form an important part of our everyday life – they create a sense of belonging, provide a place where we can socialize, relax, and learn something new [1]. Because of these properties, and many others, these spaces often form an important building block in creating local communities: people with common interests and values that share an emotional connection to each other, based on their sense of belonging to a place.

We are interested in exploring the role that pervasive open displays may play in such community building processes. Due to significant price drops of LCD screens, public displays are becoming a ubiquitous resource in urban environments. While most of these displays are still singular installations that run locally stored slide shows or videos, it is not hard to imagine that these displays will be networked in the near future [2][3]. Networked and empowered with rich interaction capabilities, e.g., touch [4], gesture [5], or mobile phone interaction [6], public displays have the potential to become a global and powerful communication channel. We envision that such a channel could be very beneficial for promoting people's values within a display's greater vicinity, and through it create awareness about a particular *place and its communities*.

We call such places *"interacting places"* – public space that uses networked public displays to stimulate community interaction (i.e., interaction between members of the same or distinct community residing within and without public spaces) and place awareness (i.e., knowledge about the place through people who occupy it). Scenarios that illustrate the potential of interacting places can be found in our previous work [7][8]. In order to operationalize interacting places we have created a framework that helps us in designing and building tools, interfaces, and applications that implement this vision: the *Interacting Places Framework* (IPF). In this paper we will describe the framework in detail and summarize early deployments.

II. INTERACTING PLACES FRAMEWORK (IPF)

Three key challenges informed the design of IPF: uncovering the *stakeholders involved (who)*, i.e., the group of people who would be affected by interacting places and who would benefit from it; identifying *suitable instruments (what)* for accomplishing community interaction and place awareness (CIPA for short); and understanding *basic use (how)* of those instruments to further the desired goal.

In order to reveal the stakeholders involved around interacting places, we conducted a study on current practices around more traditional/analog displays found in public spaces, i.e., noticeboards[9]. Our study revealed three key parties involved: 1) *display providers and managers*, i.e., people who are providing the physical notice boards, 2) *content providers*, i.e., people who are supplying/posting the content, and 3) *content viewers*, i.e., people who are consuming/viewing the content. To simplify the design of our initial framework, we have opted to include only *content providers* and *content viewers* in IPF. However, future versions of IPF may be extended to also take *display providers and managers* into account.

To discover suitable instruments that could be used to facilitate CIPA, we conducted a study on current communication practices with regard to today's ICT technologies, i.e., email, instant messaging, and social

networking services, within our own student community [10]. Echoing similar findings by Subrahmanyam et al. [11] and Barkhuus and Tashiro [12], our study revealed the need for two main types of communication channels: 1) those that allow community members to develop new ties by displaying content that is open-for-everyone, i.e., includes also hitherto unknown community members, and 2) those that allow community members to strengthen existing ties with others, i.e., channels that are more oriented towards closed-group communication with content that contains meaning only to a certain group of people and excludes others. We call these two types of channels *inclusive* and *exclusive channels*, respectively.

Our study also informed our understanding of instrument use. Both inclusive and exclusive communication channels were used to *explicitly* expresses community interests and values, e.g., by cheering a local soccer club on one's own Facebook page, or by sharing a YouTube video link with close friends. This was also apparent in our study on traditional noticeboards [9], where classifieds, event announcements, and posters would often directly express local community values. In addition, however, such public displays would also support what we call *implicit* awareness diffusion: by publicly posting information to few or many, even visitors may implicitly learn about a local community through their interests and postings.

Our current IPF (cf. Figure 1) thus comprises four components that cover the key elements of interacting places: stakeholders involved, i.e., *content providers* and *content viewers*, the instrument used for achieving CIPA, i.e., the *interacting places communication channel* (IPCC), and its expected impact through the *awareness diffusion layer*. Each of them is described in the sections below.

A. Content Providers

While in the case of traditional notice boards content providers were only people, in interacting places we envision that content can be provided by *people* and *services*. An example of an application that allows people to create and distribute content is Digifieds [13]. The name of application comes from *Dig*ital Class*ifieds*. With this application people can post advertisement on networked public displays. We have designed Digifieds based on our study on traditional noticeboards [9] and deployed it over a period of several weeks on a network of public displays in the city of Oulu, Finland. Detailed results have been published in [13].

Not all content has to come from people, however. In order to explore novel ways of creating engaging content for public displays, we designed, implemented, and deployed FunSquare [14], a service that dynamically connects information sensed from within a display's surroundings (e.g., the number of people in the space, the current weather, or the number of connected Bluetooth devices) with fixed facts, e.g., the population of Pitcairn Islands, the coldest temperature ever measured in Sao Paolo, or the number of

MacBooks produced by Apple every minute. By connecting fixed facts with local, dynamic information, FunSquare ties local events and situation to a wider context in a playful manner. More details about FunSquare can be found in [14].
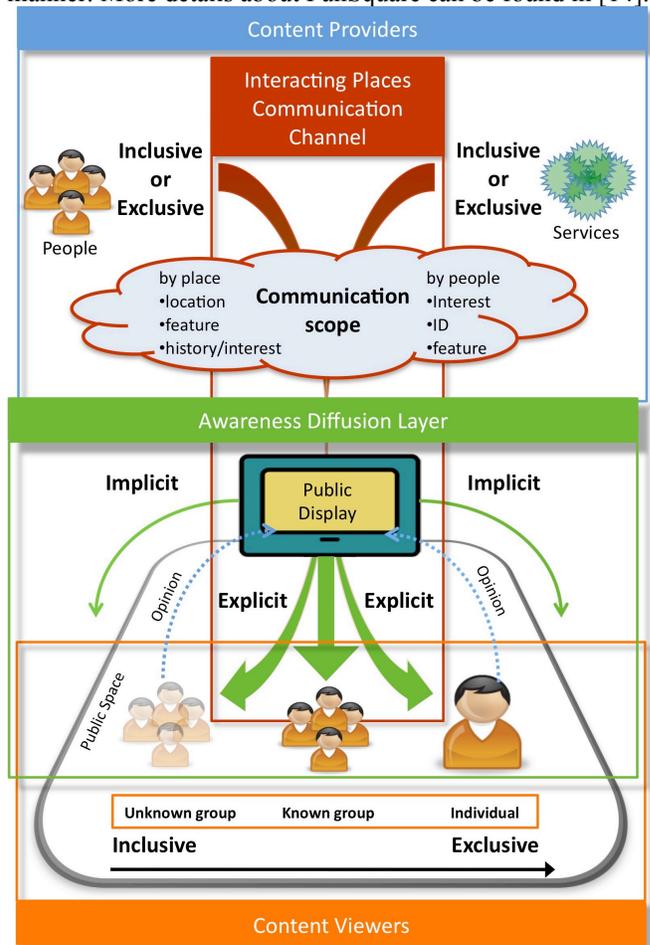

Figure 1 - Interacting Places Framework (IPF)

B. Interacting Places Communication Channel (IPCC)

No matter where the content is coming form, may it be people or services, it is distributed through a networked public display *channel*. We define a networked public display channel to be a uni- or bidirectional medium/carrier for transmitting multimedia content to its intended audience. While existing ICT channels are typically structured around protocols (e.g., email, IM) or individual services (e.g., Facebook, Skype), a networked public display channel is mainly characterized by its I/O capabilities.

An *inclusive channel* should carry content that is *open-for-everyone*, i.e., anyone can understand the meaning of the content. Both FunSquare and Digifieds portray information through the inclusive channel: classifieds and information about display surrounding are meant to be seen by anyone. According to Brignull and Rogers, this channel should also allow users to *express their opinions towards the content* [15]. In case of Digifieds people can report inappropriate content through an *abuse* button and they can also indicate

their preference towards certain classifieds through a *like* button. Similarly, FunSquare also allows people to like or dislike content thus expressing their opinion towards different content categories (e.g., weather, history, science etc.). Additionally people can also leave more detailed opinions through comments that are relate to specific information.

An *exclusive channel* should allow transmission of a directed message to selected recipients. As public displays are by definition public, exclusivity must be ascertained through other means. For example people could use avatars and pseudonyms to leave messages for the intended recipients ('@R2D2: meet you for lunch at the canteen. Yours truly, C3PO.'), or they again could use some sort of mobile phone-public display ecology where mobile phones would provide the *exclusive* channel as in Digifieds: people can create classifieds on their mobile phone and they can also take the ones that interest them on their mobile phone. Several such private interfaces have already been proposed in the literature [16][17][18].

In both cases (inclusive and exclusive), transmitted content would go to a certain place or to a certain group of people, i.e., communication can be scoped through *people* and *places*. A desired recipient for the content can be a particular person that can be reached by his/her *ID*, or a group of people who share the same *interest* or *features*. For example, we can imagine sending a message to our beloved ones (ID), or posting an advertisement about a stamp collection that needs to be sold (interest) or a new tango dance evening for the elderly in town (feature). Similarly content can be sent to a particular place at a particular location, to a place with particular interests (e.g., as determined by its history of local postings), or to a place with a specific feature. For example, we might want to send a "Happy New Year Tokyo" message when away from our hometown (location), or we might want to send a message to a place with the most FC Barcelona fans (history and/or interest), or to a place where local skaters hang out (feature). Interacting places could even exchange content automatically through services based on the above-mentioned parameters, i.e., location, interests, and features.

C. Awareness Diffusion Layer

The IPCC will carry both content that is directed towards a person or group of people, and content that is not directed, i.e., is for everyone. This means that public displays will show content that is *explicitly* tailored to a viewer, and content that is tailored for others. Digifieds is an example of an application that uses the inclusive channel to carry explicitly tailored content: although this content can be seen by anyone we can find the content that suits our interest. Similarly, Digifieds also diffuses CIPA *explicitly* by portraying information about the interests and values of individual community members. Yet by being able to see the content of interest to others, the CIPA will also be diffused *implicitly* through the effect of Legitimate

Peripheral Participation [19], where people learn about a place and its community by observing interests of others.

The *implicit* and *explicit* CIPA diffusion can also be seen (a) through content that originates from the environment, i.e., from a *place*, and (b) through content that originates from *people* [20]. FunSquare is an example of an application that presents content originating from the environment, i.e., it portrays information about a display's surrounding. For this type of content, CIPA is usually being achieved implicitly by stimulating the effect of 'triangulation', an effect where particularities of the physical space act as links between people [1]. Content originating from people, on the other hand, explicitly achieves CIPA by promoting community values through content that expresses the attitudes, beliefs, and ideas of individual community members.

To recap, IPCC will transmit content through the inclusive, i.e., open-for-everyone, and exclusive channel, i.e., one that supports communication with selected recipients. In both cases content will be shown on a public display thus providing information about the preferences and interests of people *within* and *without* the display surroundings. This will provide different opportunities for people to connect within and without public spaces. In our previous work [7] we have defined a research agenda for interacting places with four opportunities for public displays in supporting community interaction: *identity cognition* addresses the problem of weakening connections in local communities (due today's hectic life and relocation), *local connectivity* addresses the problem of time-sharing and community avoidance in public spaces (e.g., elderly vs. teenagers), *remote connectivity* addresses the problem of distributed communities (people who share the same values and interest are scattered across public spaces), and *identity infusion* addresses the sense of isolation in remote communities (e.g., communities in rural villages often feel left out and want to see what lies beyond their premises).

Place		Community	
		Intra-/Within	Inter/In Between
	Intra	**Identity Cognition** Increase community awareness between local members	**Local Connectivity** Increase awareness of social diversity between local communities
	Inter	**Remote Connectivity** Connect spatially distributed communities with similar interests	**Identity Infusion** Enrich local community through exchange w/ remote communities

Table 1 - Community-space cluster and community interaction (from [7])

By providing information about preferences of people through community interaction interacting places would also allow people to be more *aware* about a *place* where they are situated.

D. Content Viewers

Content on a public display will potentially be viewed by three different types of viewers: 1) an *unknown group* of

people, i.e., people who do not necessarily understand the content and see it just because they are situated next to a display; by 2) a *known group* of people, i.e., people for whom the message is or who understand the content; or by 3) an *individual* who is the sole recipient of a message. We can also connect these groups with the inclusive and exclusive channels: inclusive channel carries content that is open-for-everyone and its designated group of viewers is *unknown*. On the other hand *exclusive* channel would allow a closed group communication with a *known group* or an *individual*. However this classification is not very strict. For example, we might use the exclusive channel to contact a known group of people, e.g., friends or family members, but we might also use the inclusive channel to contact another *known group* of people, e.g., people with whom we share the same interests. For example, we might use the exclusive channel to send a message to a close friend, "Wolverine meet you for a coffee. Xavier", having meaning only to a *known group* or *individual*, or we might use the inclusive channel to send a message "Forza Inter" to all the places that have a majority of Inter Milan supporters, i.e., to *known group* of people who share the same values as we do.

III.   CONCLUSION

We believe that future networked public displays systems will enable a novel communication channel that would be highly beneficial for connecting communities that reside within and without public spaces. Such displays would enable what we call interacting places – public spaces that promote community interaction and place awareness (CIPA) through networked public displays. In this paper we described our initial effort on creating an Interacting Places Framework (IPF) that will help us operationalize our vision. IPF has 4 elements: 1) content providers, i.e., entities that supply content, 2) content viewers, i.e., people who consume the content, 3) interacting places communication channel (IPCC) that supports inclusive, i.e., open-for-everyone, and exclusive communication, i.e., closed-group, and 4) awareness diffusion layer that promotes CIPA explicitly, i.e., through IPCC content tailored towards a specific audience, and implicitly, by observing IPCC output for other people. We have also used two applications that we designed and deployed, i.e., Digifieds [13] and FunSquare [14], to provide more explanation and insight into how IPF operates.

We are currently preparing two additional deployments that should hopefully deepen our understanding of community communication and the role that future pervasive networked display systems will be able to play and will help us further refine and verify our IPF.

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