

# Utilizing Public Displays to Enable Location-Centric Information Sharing

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## Abstract

Location-centric information sharing means that information can be shared at a specific geographic location by any person, regardless of the person's actual geographic location. Conceptually, we position location-centric information sharing as a contribution to P3 (People to People to Geographic Place) research which is about understanding the (new) meaning of place in social networks. Technically, we describe a proof of concept that links recent developments in mobile technology (smartphones and tablet computers, such as iPads) and large public displays and that demonstrates how off-the-shelf technology can be used to enable the remote sourcing of highly location-sensitive information. We are currently looking into installing the *AskAway* prototype for long-term embedded evaluation at a number of locations including universities, start-up companies and coffee shops.

*Keywords:* location-centric information sharing, information access, human computer interaction, mobility, public displays, situated displays, locative media

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## Introduction

"Push" and "pull" are two fundamental ways of accessing information. In a nutshell, pull means that the user initiates the information transaction whereas in the case of push the transaction is initiated by the system. "Information at your fingertips" (IAYF) can be regarded as an instantiation of "pull" since it is the user that would determine what information he or she wants to access, and more importantly, where (typically the user's location) and on what output device (typically the user's device, but not necessarily so as we will show below).

"Push" has become omnipresent in the age of smartphones notifying the user of incoming messages with the transaction often being initiated by another user. Push allows to specify the recipient but not normally the recipient's location. Following the IAYF vision it would not be necessary to specify location because of the recipient being in control of the where and how the information is received. There are situations, however, where pushing information to a specific location as opposed to a specific user may be desirable.

Consider the following scenario of Courtney, a backpacker who is seeking out the best gigs in town:

*Courtney is a backpacker from Canada who loves travelling, surfing and listening to live music with a preference for alternative and grunge. Planning to head North from Sydney, Australia, she already knows that over the next few weeks, she'll be in Sydney of course, the home of legendary rock band Midnight Oil, Newcastle (Silverchair's hometown), and Brisbane (home of Powderfinger). A few weeks later she'll arrive in Cairns in Australia's tropical North.*

*Searching the internet brings up a few local community websites detailing the attractions of the towns she will pass through but not the specific gig information that she is looking for. As seasoned traveler Courtney knows that often, upcoming gigs are promoted on posters around pubs and backpacker hostels. Plus... backpackers often know a great deal about upcoming gigs!*

*When Courtney comes across a web site "AskAway" that allows to push information requests to specific locations she decides to give it a go. She uses her Facebook account to login and posts questions about upcoming gigs to a number of "AskAway" message boards that have been installed in backpackers around the country.*

*To her surprise, within a few hours she knows about Sandringham and Glebe Hotel gigs not to miss when in Sydney [posted by Sharon from England who has been in Sydney for the past couple of weeks, and Bruce from the US]; she even learns that the iconic Hopetoun Hotel is closed [Aaron from Scotland learned it the hard way when standing in front of closed doors]. Gigs in Newcastle look promising too whereas it seems to be a bit early to inquire about gigs further to the North.*

The scenario helps explain what we mean by location-centric information sharing: that information can be shared at a specific geographic location by any person, regardless of the person's actual geographic location. Courtney, for example, is asking questions at locations that she intends to be at in the near future. In a way, location-centric information is the opposite of ubiquitous information access or IAYF where the specifics of location or hardware are abstracted away. The IAYF vision has been promoted for decades (see e.g., McFedries 2009) even though there are open questions about the specific representations of information that may be required in certain situation, suggesting that IAYF may not always meet people's needs (e.g., Perry et al., 2001).

## Related Work

Linking information and location has been investigated by a range of disciplines. Work in mobile and ubiquitous computing looked at using location to trigger alerts when the user (or, more specifically, the user's device) is at a specific location (e.g., Beigl 2000).

Locative media (e.g. Bilandzic & Foth 2012) is a term used for information that is "deposited" at certain locations and subsequently made available only to users that are physically co-located. It is a matter of implementation whether information is only available at a location because of physical transmission constraints (e.g., Maunder et al., 2007 using range limited BlueTooth) or whether the user's location is determined to check if the user is co-located, e.g., by using IP address or GPS like the 'National Mall' iPhone app.

The idea of leaving behind information at certain locations has been explored in a range of systems including 'GeoNotes' (Espinoza et al., 2001) and 'ActiveCampus Explorer' (Griswold et al., 2003), both allowing users to contribute content related to activities or events that take place there. We consider electronic 'graffiti' as implemented by GeoNotes an early example of locative media since depositing and accessing information left behind was constrained in specific ways: users were presented with content that previous visitors of the physical space left behind only if they were at the same geographical location where the information had been deposited.

Sharing of information at a specific location was also investigated by Annay & Strohecker (2009) using an installation of a public opinion forum 'TexTales'. TexTales utilized a large screen projection to display user contributed photos. Bystanders were encouraged to annotate the photos via SMS in order to nurture collaborative public expression and to demonstrate the potential of intermodal conversations in urban spaces. Similarly, 'Discussions in Space' (Schroeter & Foth 2009) aims to engage community members co-located in a physical space by proposing topics of discussion on an embedded screen and allowing users to contribute via SMS or Twitter.

The 'nub' system by Redhead et al., (2010) also aims to connect community members and help them share information from within their community. A large touch screen display allows for users to read and contribute to the notice board style forum. The 'nub' system is undirected, like a traditional noticeboard, and discussion can focus to any particular topics that are raised. Since 'nub' tries to cater for a wide variety of topics, it can suffer from the same information overload and clutter issues presented by traditional notice boards or web forums.

'CityFlocks' by Bilandzic et al. (2008) is an unusual system in the sense that it links visitors to a database of user contributed reviews about the physical location. Furthermore it also links visitors directly to people inhabiting the location who volunteered to be contacted in an attempt to measure the preferred method of accessing this information.

The latest iteration of 'Brisbane Hot Spots' called 'YourScreen' (Seeburger & Foth 2012) allows people to push digital media to remote screens installed at bus shelters via Twitter but does not yet allow for bi-directional information sharing as required in the aforementioned scenario.

To sum up, the notion of location-centric information sharing that we depicted in the scenario is different from aforementioned works where information is 'pre-installed' at certain locations to suit specific purposes as is the case with locative media. Location-centric information sharing is also distinct from targeted but unconstrained access to information from the internet or similar information sources even if the information is related to the location in a spatio-temporal sense.

Specifically, public-display based location-centric information sharing as described in this paper is a contribution to P3 (People to People to Geographic Place) related research which is about understanding the (new) meaning of place in social networks. It used to be the case that place-based ties were formed around specific geographical locations, such as villages, whereas ICT based ties can be formed and maintained over distance which means respective communities are largely independent of geographic locations (e.g., Jones & Grandhi 2005; Rainie & Wellman 2012).

## Enabling Location-Centric Information Sharing

In the previous section we pointed out that conceptually, location-centric information is different from the related work that we discussed since none of those approaches support an unconstrained, location-specific 'push' operation that is required to enable location-centric information sharing. In this section, we discuss *AskAway* which is a prototypical implementation of location-centric information sharing. We briefly describe the client-server architecture as well as how users interact with *AskAway* using common social media tools and platforms including Facebook and Twitter.

Before discussing the actual implementation (see Wittison 2011 for details) it is worth noting that regarding user acceptance of P3 systems, Jones et al. (2008) investigated the need for P3 systems and what the general public would want and be willing to contribute to them if they were around. Out of 500 people surveyed in Manhattan, 54% wanted to read place linked community generated comments, and over 45% of people are willing to share personal location information with others to enable P3-System services.

Relevant findings from four experiments conducted by Jones et al. include that a) information needs about a certain location were closely tied to the activity subjects were doing or planning to be doing at that location. Whether or not the information was static or dynamic made a difference depending on the location (e.g., a static train timetable vs. a dynamic time waiting to be seated at a popular restaurant). A key insight in the context of this paper is that the more dynamic the information was the greater need for some way of obtaining it.

The findings by Jones et al. support the backpacker scenario depicted earlier in the paper in the sense that a) there is a need for dynamic access to specific information, and b) there is a need to use this for both planning and current activities. Another key finding is the confirmation that people would be willing to share this kind of information with others.

## Interaction Model

Typically, *AskAway* screens are installed in safe locations such as in pubs and backpackers (hostels). In order to determine how information would be displayed and accessed on remote *AskAway* screens it is necessary to specify how users will interact with the system. If, for example, users are to interact with the display directly, then screen real estate must be reserved for an on-screen keyboard if users are to write on a virtual keyboard. That kind of interaction is fashionable but put limits on the placement of the screen as it must be placed within physical reach of users and it also increases the risk of the surface being damaged.

Interaction with large screens using mobile phones has been researched in a number of projects including Lyle et al.'s (2012) describing interaction with a 'democratic jukebox'. A relevant finding is that the social setting may influence how a user wishes to hold their mobile device when participating.

Tang et al. (2008) found that supporting covert engagement and interaction was a way to help with people crossing the threshold from viewing to participating. Covert engagement and interaction is the process of allowing users to interact and participate in a system without being easily identified as doing so, e.g. interacting by the users personal phone as opposed to interacting via a central kiosk. The particular method used by Tang et al. (2008) was SMS. It was found that this method lets people interact with less fear of social embarrassment. People who were somewhat anonymous when interacting via their mobiles also left longer and more thoughtful messages. We also considered Floyd et al. (2007)

arguing that embedding a new functionality into what potential users do every day will create an easier-to-use system.

We therefore decided to leverage the ubiquity of social networking services and utilize both Twitter and Facebook as ways for users to respond to questions shown on the *AskAway* display. Users of these services will know intuitively how to contribute to *AskAway* as the process for submitting answers is the same as replying to a tweet or to a posting on a Facebook wall, both of which are actions that users of these services would have experienced before. The decision to use Twitter and Facebook to store answers also removes the need for specialty infrastructure to support *AskAway* since all the answers are accessible from the web.

## Large Shared Display Application

The large shared display application for *AskAway* was developed for Apple's iOS 5 iPad platform (with physical screens linked to the iPads). Several choices were analyzed including custom designed systems, desktop computer platforms and various mobile tablets.

The newly released Apple iPad 2 was eventually chosen because it possessed all the features required, including computing power, and also possessed the ability to mirror to any AirPlay enabled screen over WiFi.

## Large Shared Display Interface

*AskAway's* interface for the large shared display application (see figure 1 below) requires two screens. The first connects the application to Twitter and Facebook, which requires usernames and password logins at some point. The second screen is the main display. The main display is made up of 4 sections which have been highlighted in the figure below showing:

- a static section that describes how onlookers can participate in answering questions by using their Twitter or Facebook accounts,
- past questions cycling on the display, and the number thereof, as well as the most recent question being asked,
- answers for on-screen questions posted using Twitter, and
- answers for on-screen questions posted using Facebook

## Website Plugin

A website plugin is the companion to the large shared display application described above. The plugin is situated on a community or business website and allows for people to push questions to remote *AskAway* screens. Plugins can be customized such that they only submit questions to the displays that they are associated with.

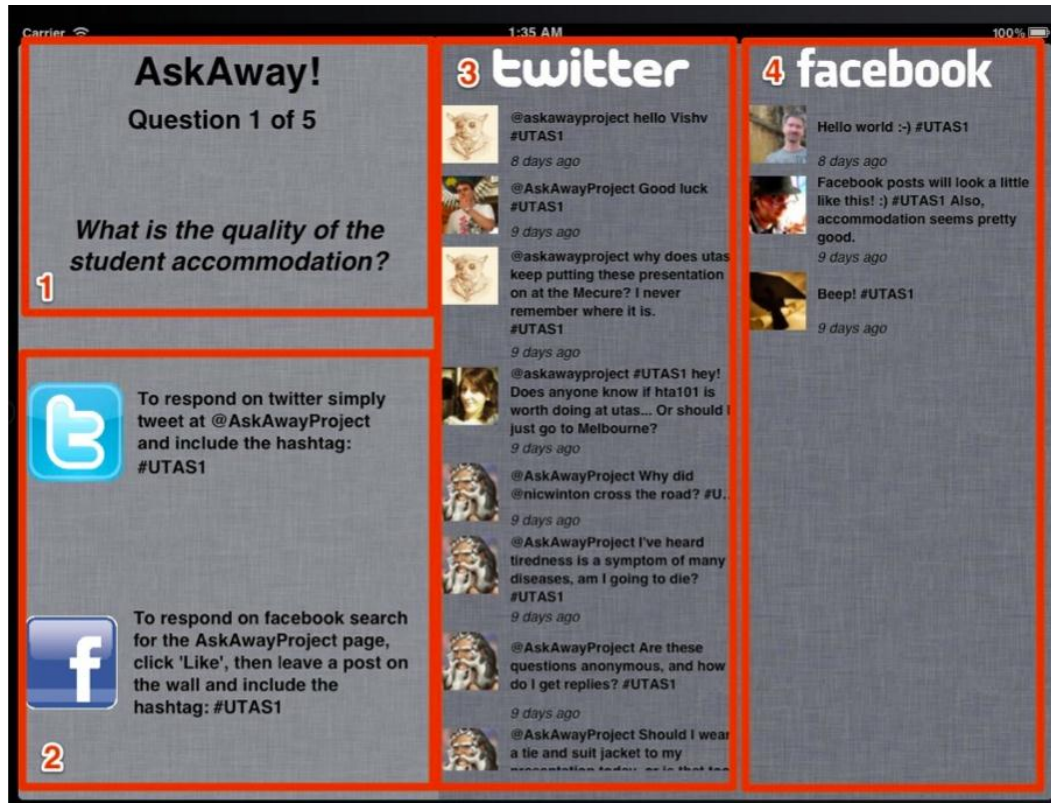


Figure 1. The AskAway screen display

## Discussion

The primary objective of this research is to investigate how off-the-shelf technologies could be used to enable location-centric information sharing by allowing users to push information requests to specific locations and pull any answers to respective inquiries. In our case the information is shared on public displays installed at remote locations that user can interact with using their Twitter and Facebook accounts.

This work makes two distinct contributions. Conceptually, location-centric information sharing provides a contribution to P3 (People to People to Geographic Place) research which is about understanding the (new) meaning of place in social networks. Location is at the core of P3 research but as yet the P3 framework does not provide the conceptual means for location-centric information sharing as explored in this paper.

Jones et al. (2004) do mention the capability of the 'Active Badge' system (Want & Hopper, 1992; Want et al., 1992), one of the earliest P3-Systems, of routing communication to a specific location: "*Active Badges were designed to facilitate communication. For example, phone calls could be routed to the phone nearest to an individual based on the last reported location*" but in the case of Active Badge, routing communication to a location is merely a byproduct of routing a call to a person; neither Want et al. (1992) nor Jones et al. (2004) discuss the potential of using Active Badge-like P3 systems to facilitate communication at and about a specific location which is what AskAway facilitates.

Technically, we described a proof of concept that links recent developments in mobile technology (smartphones and tablet computers, such as iPads) and large public displays and that demonstrates how off-the-shelf technology can be used to enable the remote sourcing of highly location-sensitive information.

We are currently looking into deploying a number of AskAway installations at locations around town including several campuses of the local university, start-up companies and, most importantly, coffee shops for long-term embedded evaluation (e.g. Churchill et al. 2003).

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