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Enhancing Presence Awareness in Instant Messaging

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ABSTRACT

Presence awareness, the basic knowledge of an individuals activities, is often an essential prerequisite to essential group communication and team interaction. This essential prerequisite is often lacking in many distributed teams. Presence awareness systems attempt to facilitate frequent informal interactions. These mechanisms have seen recent inclusion in instant messaging systems towards the objective of greater information for information communication among users. In this paper, we introduce and discuss a number of unique presence awareness and management features and demonstrate an implementation in an existing instant messaging client, BuddySpace. More specifically, we show how automatic real-time mapping of user presence and location has the potential to significantly enhance presence awareness in instant messaging systems, while at the same time reducing the effort users must apply to leverage these features.

INTRODUCTION

The idea of presence awareness, or general understanding of other's current activities and availability, is not a new concept (Dourish and Bellotti, 1992). However, the use of communication systems that integrate presence management features have only recently come into the mainstream. An example of presence management features in widespread use are modern instant messaging systems. Instant messaging is already enormously popular for informal and recreational use (Lenhart, Rainie & Lewis, 2001), and instant messaging systems are generating substantial interest in the workplace as well (Nardi, Whittaker & Bradner, 2000).

Benefits and Shortcomings of Instant Messaging

Instant messaging facilitates informal, unplanned interactions. When all of the people in a group are located in the same space, brief, face-to-face encounters happen frequently. Understandably, as a group becomes more geographically distributed, these types of interactions become far less frequent (Allen, 1975). Further, research has shown the importance of informal, ad-hoc interactions for effective communication and teamwork (Kraut, Fish, Root & Chalfonte, 1990). Instant messaging systems, with their combination of icon-based presence indicators (Online, Away, etc.) and real-time text-based chat can often be a useful tool for informal, ad-hoc communication (Nardi, Wittaker & Bradner, 2000). More recent research indicates mobile instant messaging increases chance encounters as well (Pascal, 2003). Indeed such benefits seem to be a large reason for the success and popularity of instant messaging in general.

When individuals come in frequent contact with one another, they automatically gain informal knowledge of presence without any additional effort. In contrast, most instant messaging systems require the user to explicitly update presence information with applicable availability and status changes. Since stale presence information is of questionable value, significant user effort is required for these types of systems to be practical and successful. The type of presence information many systems provide tends to be simple and text based, making it difficult for users to rapidly identify others' location and availability.

Research Focus

Our research sought to facilitate more frequent and more effective informal interactions by improving presence awareness in three key ways:

1. Increasing the amount of presence information available
2. Making presence information as relevant and timely as possible
3. Collecting presence and location information automatically

The first two goals focus on improving the quantity and quality of presence information, whereas the third deals with the amount of user effort required to realize the benefits of these improvements. While these improvements could be applied to virtually any generic instant messaging client, for purposes of expediting research, we focused on a specific open source client, BuddySpace. BuddySpace is an advanced instant messaging client that aims to reduce or eliminate many of the drawbacks of instant messaging through enhanced presence management and awareness (Eisenstadt, Komzak & Dzbor, 2003). The key idea behind BuddySpace is to incorporate geographic maps that can display the location and availability of various contacts. This kind of visual display makes it much faster and easier to gain a sense of the presence of other individuals. We have enhanced this basic idea to make this location and presence information automatically updatable in real-time, significantly reducing the effort a user must apply to gain useful information from the instant messaging system. Automatically updated presence and location information also make possible the automatic collection of various statistics concerning how users are dispersed. Realizing that some form of communication is often necessary even when presence information indicates that someone is "Away," we have extended the instant messaging client to support alternative communication channels, email in particular. The unique combination of features this enhanced BuddySpace client provides makes it a powerful tool for improving presence awareness and ad-hoc communication in both distributed and collocated groups.

RELATED WORK

There have been many previous attempts to develop tools for supporting presence awareness and real-time messaging, but most fall short of providing the integrated display and access to real-time presence necessary for effective informal and ad-hoc interactions. Tools used to gain some kind of knowledge of user presence have existed at least since the Unix finger program (Erickson, et al., 1999). Other early presence systems often attempted to provide high bandwidth, information rich presence awareness through live video feeds (Bly, Harrison and Irwin, 1993). Refinements of this kind of presence system were made to provide lower bandwidth iconic presence indicators instead (Greenberg, 1996).

Presence information in itself is not very useful without some way to leverage this information to initiate a conversation. Similarly, real-time chat applications (which at least date back to Unix chat) are also insufficient for facilitating ad-hoc communication since they provide only limited means to discover user availability. Several commercial instant messaging systems such as AIM and ICQ integrate limited text-based presence indicators such as "Online" and "Idle" in an effort to move beyond these shortcomings. The Babble system provides a graphical display of how active different individuals are in text conversations (Erickson et al., 1999).

The addition of location information to presence indicators could be very useful given the level of instant messaging communication in distributed groups.. Ljungstrand and Segerstad (2000) explore this idea in limited setting, by automatically providing users of a computer lab with the presence and location information of others in the lab. Similarly, the ActiveMap system designed by McCarthy and Meidel (1999) provides a map of an office and uses a badge tracking system to keep it updated with user's location information. Unfortunately it falls short of integrating this presence awareness system with a channel for informal communication (such as instant messaging). Meanwhile Hofte et al. (2002) investigate the idea of a place-based presence system lacking real-time chat capability and draw some interesting conclusions. Namely that any new presence management system should be interoperable with existing systems for easy migration and such systems should require minimal user effort to update presence and location information.

Enhanced Presence System Overview

The core instant message client used in this system is an open source Java-based instant messaging client that operates over the XML-based Jabber protocol. By leveraging the openly standardized Jabber protocol, the client is able to support interoperability with the major instant messaging platforms such as AIM, MSN, Yahoo and ICQ. Further, BuddySpace can easily extend the underlying Jabber protocol to support more advanced location management and mapping features. This yields a full-featured client which in addition to supporting the typical instant messaging features one would expect (such as chat, buddy/contact lists, group chat, profiles, etc.) also supports a number of novel features:

- An enhanced set of presence indicators for better presence management
- Support for arbitrary geographic maps, with dynamic presence updates
- Automatic determination of buddy placement on maps through address information stored in profile
- Real-time updates of location information using Radio Frequency IDentification (RFID)
- Support for asynchronous message fallback transport (via email and to mobile phones) when buddies are away
- Automatic calculation of statistics for gauging the dispersion of a group of contacts

Note that the first two of these features were present in the original BuddySpace client, but are included in the discussion here as a result of their role in the goal of enhanced presence. Our instant messaging client integrates these features into a consistent graphical user interface that allows for viewing of the standard contact list in addition to multiple maps and multiple chat windows simultaneously. Details for each of these unique features are described in the next several sections.

Enhanced Presence Indicators

BuddySpace provides a set of enhanced presence indicators beyond the simple "Online" and "Away" provided by most instant messaging systems. Users can indicate whether they are: currently looking to chat, online but involved with other things, signed on but in an unusual location, or if they will be gone for a long time or should not be disturbed. Support is also provided for custom presence indicators. All this provides users with more control with which to manage the online presence information they want to convey. When combined with mapping, this enhanced set of indicators gives an even better sense of user availability.

Mapping

BuddySpace supports mapping at multiple levels, from macro global levels down to more granular office maps. Multiple map levels can be combined into a single display, for easy viewing of contacts in a wide range of locations. Buddies can be placed on the map manually, or automatically as described in the next two sections. When a group of buddies are located so closely as to overlap on the map, they can be replaced by an icon representing the entire cluster. As buddies change their presence setting, the corresponding icon on the map will change automatically.

Automatic High-Level Map Placement

As is the case with most instant messaging systems, every user in BuddySpace (and in Jabber as well) can have a unique profile. The user can choose to enter a variety of information ranging from home and work address and phone number to email address and birthday. This profile information plays a very important role in our enhanced version of BuddySpace, as it is used to automatically determine some high-level information about the location of various users. More specifically, the ehanced client uses a Geographic Information System (GIS) web service (ESRI, 2003) to find the geographic location in latitude and longitude that corresponds to a particular address. This allows the client to use this geographic information to place the icon for a particular contact at the correct location on a map. Assuming that most users would have entered address information in their profile anyway, no additional user effort is required to obtain accurate high-level location information for users. Keep in mind that manual placement is still possible as a fallback mechanism. Either way, maps make for rapid viewing of presence information, and automatic placement significantly reduces the burden on users to acquire that information

Real-Time Location Changes

The automatic buddy placement just described works fine if users tend to remain in one spot, but it seems as if no one will tolerate being tied to a desk anymore. A technique for automatically determining user locations in real-time is in order. When it comes to accurate real-time location information, there are a number of possibilities including GPS and cell phone triangulation. For the enhanced client we chose a slightly different alternative: Radio Frequency IDentification (RFID). RFID provides a mechanism to uniquely identify objects. Good examples of this type of system in current use include the Mobil SpeedPass and SmartTag or EZ-Pass systems for toll booths. These systems work because they are able to uniquely identify a tag using radio waves and link this information to a credit card. RFID systems are enjoying rapid adoption and some expect RFID tags to eventually be integrated to almost all the products we buy (much as barcodes currently are). This wide support infrastructure is one of the things that made RFID attractive for use in the enhanced client. RFID merely requires carrying a small tag, rather than a separate device as would be needed for GPS or cell phone triangulation. The trade-off is that an external device is needed to read the RFID tags, and several of these devices would be needed to gain good coverage of any particular area.

Figure 1: Real-Time presence information on enhanced instant messaging client maps

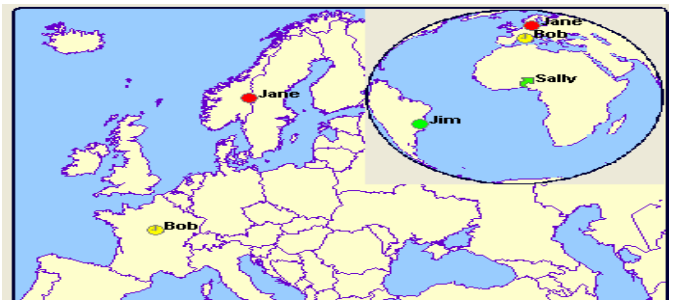
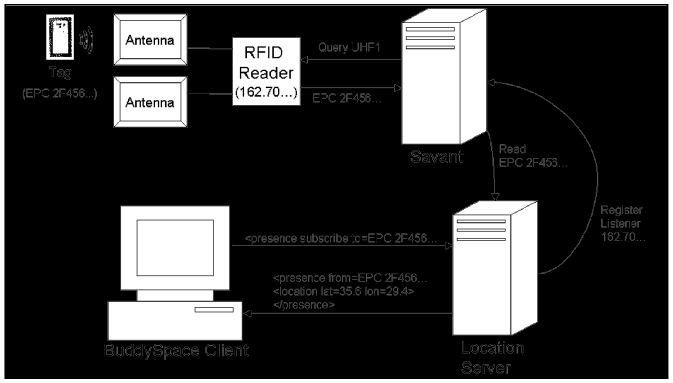


Figure 2: Systems Architecture for LocationServer



In the enhanced client, it is assumed that the geographic location of some fixed RFID readers are known, then when a tag is read by that reader, the tags location is assumed to roughly match that for the reader (see Figure 2). The basic architecture of the system necessary for real-time location updates is shown in Figure 2. In the enhanced client, each user can enter the identifier corresponding to the RFID tag they use. If tagged users wish to make their location information available to others, they must connect to the LocationServer.

The LocationServer provides a relatively generic way to keep track of up-to-date location information for various tags/users. It maintains this information by communicating through the Savant middleware (Clark, Traub, Anarkat & Osinski, 2003) with the set of RFID readers being used to identify tags. When a tagged user moves to a different location, the LocationServer will send the new location to the user's client. The enhanced client will in turn forward this new location to all other users that have subscribed to the presence of the tagged individual. In other words, the set of users that have the RFID-tagged user as a buddy receive updates about his or her location. So the location update takes the form of a standard Jabber presence update (similar to when a user sets his or her client to "Away"). Location updates are immediately reflected in any open maps.

Privacy concerns would dictate that some individuals would not want their location information available at certain (or possibly all) times. The enhanced client gives the power of location information management directly to the user. In order for others to receive real-time location updates, a number of conditions must be met:

- The RFID-tagged user must be signed on
- The user must have accepted presence subscription requests from interested parties
- The user must currently be connected to the LocationServer

This gives users a wide range of options in terms if disabling location-tracking. For instance a user could choose to restrict his or her location to certain individuals. Alternatively, by not connecting to the LocationServer a user could prevent anyone from obtaining *location* information, while still allowing other users to view his or her *presence* information. It is also worth pointing out, however, that the more people that allow their location to be monitored, the more useful the system will be. If location information is only available for a select few, it is not possible to gain much insight into the availability of various contacts. This constitutes a fundamental trade-off between privacy and effectiveness that is difficult to avoid.

Though RFID is an interesting technology, the general nature of the LocationServer allows it to support a number of different sources for obtaining users location information. In theory it would be possible to synthesize GPS, cell phone triangulation and RFID data, choosing the best available at any particular time. Regardless of the source for location information, providing updates in real-time takes presence awareness to a new level of sophistication.

Asynchronous Message Fallback

Users are not always available for synchronous communication; as a result it is helpful if asynchronous messages can be supported from the same interface. BuddySpace supports this functionality through email. By specifying a standard SMTP server, it is possible to send an instant message to a user's inbox, instead of to their BuddySpace client. In fact if you try to chat with a user that is currently away, BuddySpace will display a notification box, giving you the option of sending the message to the client anyway, or sending it through email instead.

Through the use of various SMTP to mobile phone gateways, it is also possible to deliver an IM chat message as a text message to a user's mobile phone (instead of as email). This further extends the opportunities for informal interaction beyond merely instant messaging to other forms of communication.

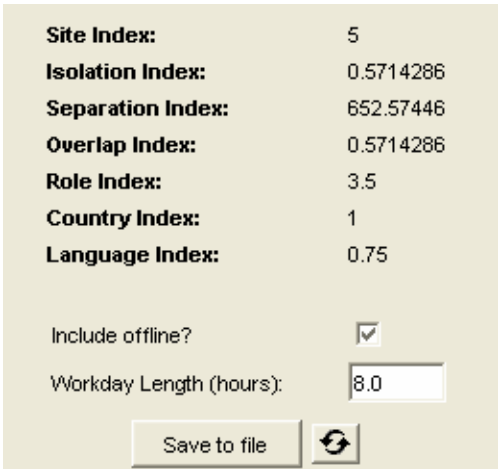
Dispersion Statistics

Enhanced presence awareness can be very useful for groups or teams that are geographically distributed around the globe. However, not all teams are distributed in the same way: in particular distributed groups can vary with regard to physical distance, time zone differences, and cultural and language differences among others. Cummings and O'Leary (2002) have proposed a set of dispersion indices for characterizing these kinds of differences. As a simple extension to show the kind of power an advanced instant messaging system can bring to distributed work groups, we have implemented in BuddySpace a feature to calculate the dispersion characterization for a particular group automatically. These dispersion statistics are transparently collected and computed from the profile information of the various users in a contact list. Changes in these statistics can be monitored over time as different users in a team sign-on and off of the BuddySpace system. The hope is that the dispersion statistics can provide a useful way to gauge the distribution and ultimately the potential of a certain geographically dispersed group (See Figure 3).

Contributions and Future Work

While great advances have been made in the areas of presence awareness and instant messaging, these systems still tend to be less than ideal for facilitating the kind of frequent, informal interactions that are so crucial for effective communication. The enhanced client addresses this problem by extending the traditional instant messaging presence mechanisms in several ways. By providing a richer set of presence indicators, users can better indicate what their current status and availability is. The addition of mapping to instant messaging allows for rapid understanding of the presence and location of a large number of individuals. Through automatically updated presence the enhanced system is unique in its use of radio frequency identification and geospatial information systems to display real-time maps of user's presence and location information. This set of features should significantly reduce the cost and time associated with distributed informal communication.

Figure 3: Automatic Calculation of Dispertion Statistics



Automatic static placement of buddy locations on geographical maps reduces the effort required of users to effectively use such a system, while real-time location updates further extends the presence concept to improve the information users have at their disposal. Finally, support for asynchronous message delivery and calculation of dispersion statistics give a sense of the power enhanced presence awareness features can bring to instant messaging clients. Further research in this area could include quantitative and qualitative field studies to evaluate how advanced presence features are used in practice and the impact of those systems on areas such as quality in focused dispersed teams. Studies could be conducted to explore the privacy issues of using the instant messaging system or to determine the role of instant messaging and presence in user selection of alternate communication. Ultimately this work paves the way toward a better understanding of geographic dispersion and how it affects the communication and interaction in distributed teams.

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