Investigating the Use of Proxemic Interaction Support Co-located Group Information Management

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Abstract – Group Information Management (GIM) is the management of personal information by multiple people in order to accomplish tasks, often employing simple tools such as email or shared files to accomplish these tasks. Using a multi-touch surface to collaborate, group information can be simultaneously accessed by multiple users, effectively enhancing their communication and collaboration. Multi-touch surfaces are limited by touch sensors, which cannot detect or track the user identity. This limitation creates security problems as users may collaborate on sensitive information not intended to be shared with unauthorised users. Proxemic Interaction gathers detailed information about the location, identity and orientation of users and their devices and uses this information to interact with the system. GIM systems could possibly benefit from Proxemic Interaction to address issues such as security and enable interaction from a distance. This research investigates the potential of using Proxemic Interaction to address existing issues with co-located GIM on multi-touch surfaces and identifies opportunities of new interaction methods to support GIM.

Index Terms — Co-located Group Information Management, Proxemic Interaction, Natural User Interface, Computer Supported Collaborative Work

I. INTRODUCTION

Group Information Management (GIM) consists of organising, retrieving, sharing and viewing stored information in order for groups of people to collaborate together [1]. In a group environment, single user devices such as desktop computers and mobile phones are generally poorly suited to support collaborative problem solving [2], [3]. Multi-touch surfaces have been used to support co-located collaboration to address the limitations of single user devices [4]. By using a multi-touch surface the system is unaware which of the users are interacting with the system at a given time, which can result in security issues as information usually belongs to a specific user that may not wish to grant access to unauthorised users [2, 3, 5].

Ubiquitous computing envisions techniques that allow the seamless, natural connectivity and interaction between people and devices [6]. Proxemic Interaction is a ubiquitous computing concept that uses sensors so that an environment can be monitored for users and devices. Proxemic Interaction gathers detailed knowledge about users' and their devices' location, distance, orientation, motion and identity within an environment such as a room [7].

The aim of this research is to investigate the requirements of co-located GIM to investigate the potential of combining multi-touch interaction with Proxemic Interaction to effectively support collaboration while providing opportunities for new types of interaction. Section II will cover related work on GIM and Proxemic Interaction. Section III will discuss the requirements for co-located GIM using both a multi-touch surface and Proxemic Interaction. Section IV will provide a conclusion and suggestions for future work.

II. RELATED WORK

A. Group Information Management

Co-located group collaboration usually reverts back to using paper documents to share and work on data [2]. Multi user computing devices can provide an intuitive collaborative interaction and can provide additional benefits such as efficient copying, retrieval, sharing and editing [4].Generally GIM can be used for different types of files and information, such as emails, documents, photos, videos, calendars, contact and phone numbers and social networking information [1, 5].

When sharing information in GIM, information security is an important issue that needs to be addressed as users may work on sensitive or personal information that they do not wish to share with unauthorised users [5]. Without a method to precisely identify users and keep track of their touch interaction, unauthorised modification or copying of another user's shared information may result [5, 8]. Privacy of personal information on a GIM system can also be enhanced by being aware of the users' location to determine who is not authorised to view that information, or by being aware of the attention and location of users to determine if private information can be hidden from unauthorised users' view [8].

Current systems have implemented limited solutions to address this problem, such as giving users a specific chair to sit in [9], or assigning colours to different users [4]. These solutions can sometimes result in problems, where the system cannot determine if the user is accessing objects belonging to another user [2].

B. Proxemic Interaction

The concept of Proxemic Interaction can be used with a multi-touch surface, to support collaborative GIM within a co-located environment. People naturally understand and use proxemic relationships in everyday situations. However, few ubiquitous computing systems interpret such proxemic relationships to create interaction. Proxemic relationships

can apply to any entity such as a person, digital device or non-digital object [6].

To facilitate Proxemic Interaction in an environment, information is gathered from several sensor devices. Proxemic dimensions form the basis of proxemic information and are defined in the section below. These dimensions include location, distance, orientation, motion and identity. Location provides information about where the entity is located within the environment [10]. Distance provides the distance between two entities within the environment [10]. Orientation provides information about the direction an entity is facing, this can be used to determine where the user's attention is currently directed [10]. Motion describes the changes is distance and orientation over time [10]. Identity provides information that determines the unique identity of an entity [10].

As people tend to move closer to each other when interacting, systems could use a similar approach where different types of user input is accepted at different distances. These different distances can be classified in discrete proxemic zones where a user may have to move closer to the system to have more detailed interaction [7]. For example, the system may only recognise touch based gestures once the user has moved to a close distance, further away however, the system may use in-air gestures for interaction [10].

III. Requirements

Activities and tasks that are supported by GIM systems will need to be implemented and supported by both multi-touch based interaction and Proxemic Interaction. These activities and tasks are typically identified as the acquisition and organisation of information; the retrieval, viewing and modification of the stored information and the sharing of that information [1, 4, 5].

As information and files are acquired, the way that information is organised and stored needs to be done in an intuitive manner, strategies for organisation need to be supported in GIM systems [1]. Examples of organisation strategies are using tags or classifications to organise information based on their context, similarly files can be organised by being placed into groups or folders [1].

Collaborative GIM systems should provide a means to retrieve and re-find information, for example using searches based on categories and browsing through file hierarchies [1].

Managing access to shared files may introduce complexity as there is a balance between providing sufficient access to facilitate collaboration, while avoiding exposing sensitive files. To allow sharing between individuals or groups, specific rights are granted to files. Due to the fact that access rights have to be managed, security and confidentiality issues are often introduced [5].

This research aims to propose a solution that will use Proxemic Interaction to facilitate the activities associated with collaborative GIM. The research will include solving security and identity issues by using the proxemic dimensions and incorporating interaction based on proxemic zones to make use of multi-touch gestures as well as in-air gestures and mobile input from devices such as cell phones to support interaction from a distance [8].

IV. Conclusions and Future Work

This paper has identified problems with using a multi-touch surface to support collaborative, co-located GIM and highlighted how these problems can potentially be solved by making use of Proxemic Interaction. The aim of this research is to determine how GIM can be effectively supported by using Proxemic Interaction and a multi-touch surface together, while investigating the role proxemics have on the interaction with a GIM system for providing opportunities of interaction beyond touch based gestures.

The next phase of research will involve identifying techniques of interacting with GIM and determining how Proxemic Interaction can be used to support these interaction techniques. Research will be conducted to investigate how proxemic dimensions can be determined and used to create a proxemic-aware environment. A prototype will be developed that facilitates a proxemic-aware environment and applied that supports Group Information Management. The prototype will be evaluated to determine the usability and usefulness of the proposed techniques.

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VI. References

[1] K. Voit, K. Andrews, and W. Slany, "Why Personal Information Management (PIM) Technologies Are Not Widespread And What to do About It," *Human-Computer Interaction*, 2009.

[2] S. Scott, K. Grant, and R. Mandryk, "System guidelines for co-located, collaborative work on a tabletop display," *Supported Cooperative Work*, no. 5, 2003.

[3] A. Collins and J. Kay, "Collaborative personal information management with shared, interactive tabletops," *Proc. PIM 2008 CHI Workshop*, 2008.

[4] I. Sams, J. Wesson, and D. Vogts, "An Architecture to Support Multi-Touch Collaborative Information Retrieval," *satnac.org.za*, 2011.

[5] T. Whalen, E. Toms, and J. Blustein, "File sharing and group information management," *Personal Information Management*, pp. 1-8, 2008.

[6] S. Greenberg, N. Marquardt, and T. Ballendat, "Proxemic interactions: the new ubicomp?," *interactions*, vol. XVIII, no. february, 2011.

[7] N. Marquardt and S. Greenberg, "Informing the design of proxemic interactions," *Pervasive Computing, IEEE*, 2011.

[8] S. Greenberg, "Opportunities for Proxemic Interactions in Ubicomp (Keynote)," *Ifip International Federation For Information Processing*, pp. 3-10, 2011.

[9] M. Morris, A. Huang, and A. Paepcke, "Cooperative gestures: multi-user gestural interactions for co-located groupware," *Proceedings of the*, pp. 1201-1210, 2006.

[10] T. Ballendat and N. Marquardt, "Proxemic interaction: designing for a proximity and orientation-aware environment," *ACM International Conference*, pp. 121-130, 2010.

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