View & Share: Supporting Co-Present Viewing and Sharing of Media using Personal Projection

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ABSTRACT

Viewing and sharing media on mobile devices are popular scenarios, however, the limited screen size results in multiple users having to gather around a single display leading to an undesirable viewing experience. Similarly, sharing a single image with a single person is cumbersome and requires several steps to complete. This demonstration paper presents an approach in which a mobile phone is coupled with a personal projector to overcome the output limitations of mobile phones. The large mobile projected display allows several users to simultaneously view media. We also present a group based sharing approach allowing users to intuitively and easily share media between mobile devices. We reverse the typical role of sharing and introduce a technique whereby the receiver of the media is responsible for performing the sharing interaction. This allows sharing with a single member or multiple members of the group. Sharing with every member of the group is also easily possible.

Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *Input devices and strategies; Prototyping.*

General Terms

Design, Experimentation, Human Factors,

Keywords

View & Share, personal projection, co-present.

1. INTRODUCTION

Viewing media on mobile phones, even when considering the small screen, is a very popular scenario. However, the small screen hinders users from both viewing and managing large amounts of rich media content and information. To alleviate the issues imposed by the small screen, several approaches have been presented in the past to optimize the viewing of media and information on mobile devices [1]. Kindberg et al. stated that co-present image sharing, sharing through viewing regularly takes place on the mobile screen and accounted for a third of sharing cases [2], however this is problematic. Typically, co-present viewing of media relies on individuals physically gathering around the small mobile display or passing the phone from person to person. One possible solution to overcome this problem is to use large screens in the environment to display media. Unfortunately, such displays are neither readily available nor accessible and would certainly destroy the degree of mobility.

Recent advances in technology have allowed the development of pico projectors in several forms with the first projector phone commercially released in 2008 [3].

A large mobile projected display removes the need for users having to gather around or pass the mobile phone from person to person. It allows several people to simultaneously view media and supports the communication of experience between friends. Frohlich et al. depicts this as the main reason for sharing photos and reports that co-present sharing is also a desirable and popular activity [4]. However, it is neither supported by mobile phones nor easily achievable with current methods. Several concurrent user interactions are required to send a single picture to an individual. This results in a time consuming and frustrating experience.

[5, 6] report on several approaches that use group sharing semantics to share media content between friends. Buddy lists facilitate automatic or controlled sharing between multiple people but problems may arise with people joining or leaving the group. The ability to omit recipients form the group or any kind of filtering is typically not supported or requires further effort. The task of sharing is normally executed by the owner of the media and requires them to repeat a repetitive and rigorous process each time they wish to send an image. We believe that this task burdens the owner and could act negatively towards sharing.

In this demonstration paper we present and describe View & Share, a mobile application supporting the co-present viewing and sharing of media [7, 9]. A personal projector coupled with a mobile phone is used to project a large mobile display allowing several users to simultaneously view media and further enhance the viewing experience. We introduce an alternative sharing style that changes the typical role of sharing; focusing on the recipient rather than the owner. Sharing is simplified, both quick and effortless whether sharing with a single recipient, multiple recipients or the entire group.

2. VIEW & SHARE

The typical scenario which is addressed by the View & Share system is a group of friends who meet each other and who want to view and share their pictures. The View & Share application encapsulates the sharing process, once a user is connected and thus a member of the group media requests are handled automatically, transparent to the user and only require a single user action rather than multiple steps.

Within this group users belong to one of two roles either a *presenter* or a *viewer*. The *presenter* is the user with the projector phone or phone coupled with a personal projector who wishes to project her media for others to view and share. Within the group the *presenter* is the dominant role. This principle is founded upon the *presenter* being the owner of the personal projection device and thus should always have full control. The *viewers* are the remaining users of the group.

Figure 1 illustrates the presenter oriented sharing technique. Here the *presenter* browses through her pictures which are then displayed to the group via the projection. The *presenter* can send a particular picture to the *viewers* through selecting the *send to all* function on the mobile device. The picture is then copied, displayed and stored on each of the *viewer's* mobile phone.
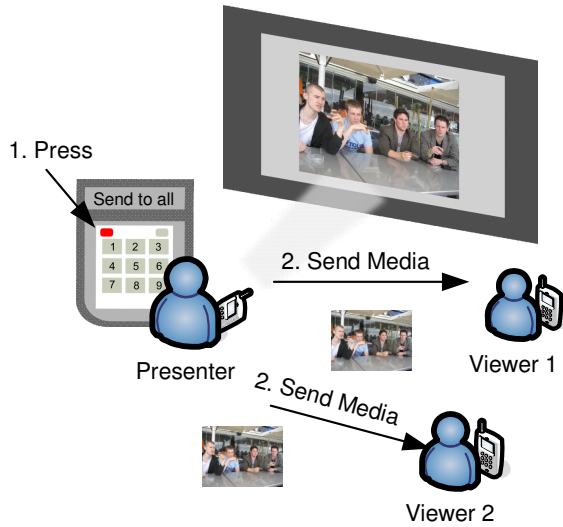

Figure 1. Presenter Oriented Sharing.

Figure 2 illustrates the viewer oriented sharing technique. The role of sharing is shifted and undertaken by the recipient of the media, the *viewer*. Here the *viewer* submits a request for the currently projected image. When received by the *presenter* the image is automatically sent to the *viewer*. Because the sharing originates from each *viewer* sharing with a single *viewer* or multiple *viewers* is easily achieved.

The *presenter* can switch to *private mode* in which the projection is not used. This mode can be used when viewing and sharing private pictures in a public setting. Using this mode, the *presenter* browses through their photos using their device and opts to share private photo(s). The photo is then displayed on all the *viewer's* devices. Here sharing is achieved by each user through viewing their private mobile screen, but without uses having to gather around a single screen as is currently required when using mobile phones.

Viewers within the group can also temporarily borrow the projected display to allow them to view and share their media using the *presenter's* projector.

The approach we describe here has the following advantages:

- The large projected image solves the issues of collaboratively viewing media on a mobile phone. Several users can simultaneously view the same projected image and make comments. This supports active discussion and storytelling. The viewing experience is further enhanced as all group members can see that picture at the same time.
- Sharing within the group either with a single member, multiple members or all occurs quickly and requires only a single user interaction.
- The burdens associated with current sharing practices are not experienced and users hopefully feel more inclined to share.

- The viewing and sharing of content for all members of the group is possible. A *viewer* can borrow the large projected display without having to physical own such a device.
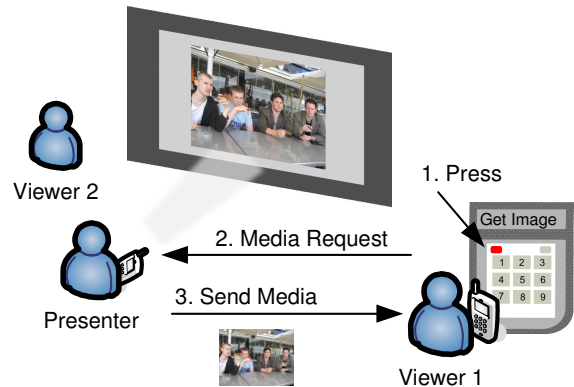

Figure 2. Viewer Oriented Sharing.

3. IMPLEMENTATION

Java ME (CLDC 1.1 / MIDP 2.0) was used to implement the View & Share application and was tested using three Nokia N95. One Nokia N95 was connected to an Optomo Pico DLP Pocket Projector. When coupling the mobile phone with the projector the contents of the mobile phone screen are directly projected and also viewable on the mobile screen, it is not possible to manipulate the two displays individually.

The File Connection API (JSR 75) was used to provide access to media content stored on the mobile phone and the Java APIs for Bluetooth (JSR 82) were used to facilitate communication within the group. It was not possible to use the currently available projector phone as it does not support the Bluetooth APIs. Figure 3 illustrates the system architecture of View & Share.

3.1.1 Group Formation

On startup the View & Share application asks the user which role they wish to occupy. The owner of the pico projector is the first user who starts the View & Share application and selects the *presenter* option. Afterwards the remaining users start the View & Share application on their mobile devices and select the *viewer* option. This triggers a Bluetooth device discovery process, the device names of the discovered *presenters* are displayed, and the *viewer* selects the intended *presenter*.

Formation of the group, and communication within (coordination and media requests) is achieved using Bluetooth and uses a lightweight message protocol. Message requests describe the origin of the message, the operating mode (*presenter* or *viewer*), the message function and current privacy setting (public or private).

The mobile phone designated to the *presenter* in the group is the root entity running a Bluetooth sever within the View & Share application, and is responsible for accepting group formation requests from other *viewers*. Members of the group must first connect to the *presenter* using a Bluetooth connection address. It is not necessary for *viewers* to connect or communicate with other *viewers*. The address is acquired by performing a Bluetooth Device and Service discovery. Once connected clients stay connected and effective two way communication is provided between the *presenter* and every member of the group. The

approach described here is applicable and scales well to other group based scenarios. *Viewers* are free to leave and re-join the group at any point in time.
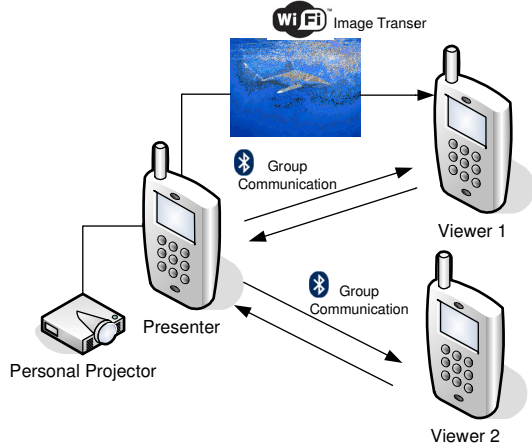

Figure 3. View& Share Architecture.

3.1.2 Viewing Media
Images are by default presented in a thumbnail view 4 x 3 with the option to enlarge images. Browsing is possible in both modes and standard navigation principles are used.

Browsing images in the thumbnail view preserves context, essentially allowing the user to preview upcoming images and quickly navigate to a specific image. This is not possible when viewing enlarged images. Previous work highlighted that providing two independently controllable screens can provide this functionality, whereby the projection displays the enlarged picture and the mobile phone displays a grid of thumbnails [8].

3.1.3 Sharing Media
WiFi is used as the underlining transfer medium to physically share media with devices within the group. Figure 4 illustrates the *presenter* oriented sharing. First the *presenter* selects *Send Image to All* (Figure 4 left). The selected picture is then sent to all *viewers* (Figure 4 middle), is saved and displayed on their mobile phone (Figure 4 right).
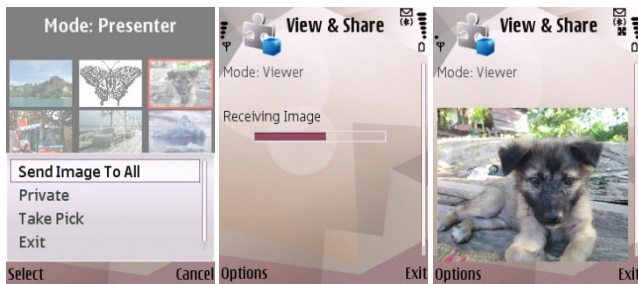

Figure 4. Presented oriented sharing.

Figure 5 illustrates the viewer oriented sharing. The *viewer* selects *Get Image* (Figure 5 left) in order to request a picture which is currently projected by the *presenter*. The picture is then automatically transferred to the *viewer's* mobile phone (Figure 5 middle), saved and displayed (Figure 5 right).
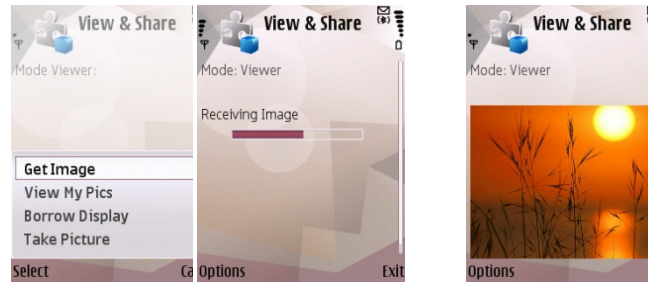

Figure 5. Viewer oriented sharing.

All images received are automatically saved and added to the *viewer's* media collection which they can browse at their own leisure.

3.1.4 Private Viewing
The *presenter* can switch to the private mode through selecting the *private* option in the context menu (Figure 6 left).
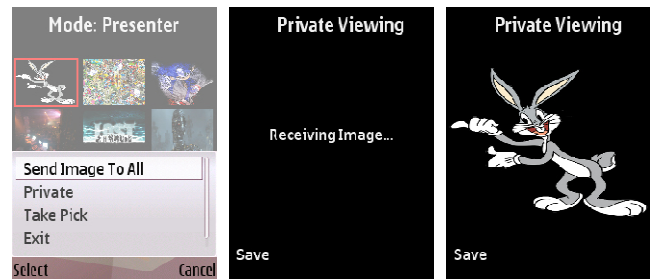

Figure 6. Private Viewing.

The projector is disabled and the private mobile screen of each *viewer* is utilised to view the images. The *presenter* still browses through their pictures and uses the *Send Image to All* (Figure 6 left) to send the picture to all *viewers*. The *viewers* receive the image (Figure 6 middle) and it is displayed on their mobile phone screen (Figure 6 right). The *viewer* must manually choose to save the received image.

3.1.5 Borrowing the Projection
Figure **7** illustrates the borrow display function. Here two options are available. Firstly, the *viewer* can opt to borrow the display from the main menu (Figure **7** left). In this case the *viewer* gains control of the projection if granted, and the first image in the collection is projected. Alternatively the *viewer* can choose to borrow the display whilst browsing their media collection, here the currently selected image is projected (Figure **7** middle). The *presenter* must always grant permission to give the display to a *viewer* (Figure **7** right).
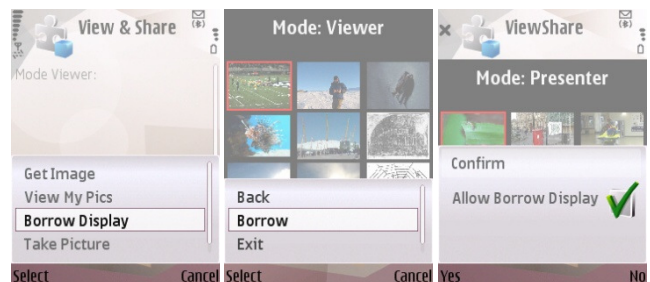

Figure 7. Borrowing the projected display.

If permission is granted a role reversal occurs. The *presenter* (root *presenter* who founded the group) temporarily becomes a *viewer* and is now eligible to view and share the temporary *presenter's* content. The *viewer* who requested to borrow the display becomes a temporary *presenter*. The temporary *viewer* (root *presenter*) maintains control of the projected display at all times and can retain direct control at any point without consent from the temporary acting *presenter*. The temporary acting *presenter* can also relinquish control of the display at their discretion. Only one *viewer* can borrow the display at any one time.

4. DEMONSTRATION SETUP

This demonstration will begin with an overview and demonstration of the hardware and a description of the functionality of the prototype. Following this, co-located users will be immediately able to seamlessly view and share media. Figure 8 illustrates a group of users using View & Share.

Figure 8. Co-present users viewing and sharing media

Three Nokia N95's shall be available whereby one is connected to an Optomo Pico DLP Pocket Projector. Users will be able to use and thoroughly evaluate all aspects of the prototype. Throughout the demonstration additional features shall be discussed.

5. EVALUATION

An explorative 12 person user study was conducted observing four groups of 3 friends using View & Share [9]. All 12 participants preferred our approach to support the co-present viewing and sharing of media when compared to other approaches using mobile devices which require several steps, are error prone and frustrating. The large projected mobile display provided simultaneous group viewing of pictures by all members. Due to this, face to face in the moment experiences were experienced and shared amongst the entire group. Participants enjoyed viewing pictures together, were thoroughly engaged and a large amount of active discussion, reminiscing, storytelling and commenting on photos took place. In total 129 sharing cases, 87 viewer oriented and 42 presenter oriented were recorded across the 4 groups. The majority of sharing occurred through viewing. Many of the participants saw benefits in the ability to borrow the projector to share their content. Private sharing using the mobile display to view inappropriate images was reported as positive and a necessary feature. Observations led us to believe that the social setting and relevance of the projected content specific to the users within the group impacts users viewing and sharing behavior. In a more relaxed setting, for example, the users home an increased amount of photo-talk occurred, comments were of a various natures: embarrassing, mocking, descriptive and participants seemed to have more fun in sharing the experience.

6. CONCLUSION

We presented View & Share, a mobile application supporting the co-present viewing of and sharing of media using a pico projector. By coupling a mobile phone with a pico projector a large mobile display is created and is used to overcome the limited output of the mobile phone. Using the large display several people can simultaneously co-presently view media without the need to crowd around a single mobile phone or pass the phone from person to person. The large display further enhances the viewing experience, promotes active discussion, commenting and storytelling whilst in a mobile setting.

View & Share supports viewer and presented oriented sharing, supporting group sharing with a single member, multiple or the entire group. Sharing is fast, intuitive and requires a single action as opposed to multiple steps per image which is nowadays the case. It is possible that new users join the group and that members can leave they group. New group members can instantly view and share both their own and other group member's media by borrowing the projected display. We also present a solution to viewing inappropriate or unsuitable content in public whereby the private mobile phone screen is used rather than the projection.

This prototype focuses currently on viewing and sharing of images. Future work will explore the sharing of several other forms of media content such as videos. We also aim to explore how we can further interact with the projected display to enhance the experience.

7. ACKNOWLEDGEMENT

8. REFERENCES

[1] Patel, D., Marsden, G., Jones, S., and Jones, M. An Evaluation of Techniques for Browsing Photograph Collections on Small Displays. *In:* Mobile HCI 2004. Springer. Glasgow, Scotland.

[2] Kindberg, T., Spasojevic, M., Fleck, R., and Sellen, A. The Ubiquitous Camera: An In-Depth Study of Camera Phone Use. IEEE Pervasive Computing. Vol. 4, No. 2, 2005.

[3] Gadget Graver. World's First Video Projector Mobile Phone Epoq EGP-PP01. http://www.gadgetcraver.com/videoprojectormobilephone-p-198.html

[4] Frohlich, D., Kuchinsky, A., Pering, C., Don, A., and Ariss, S. Requirements for photoware. *In:* CSCW '02. ACM. New Orleans, Louisiana, USA

[5] Sarvas, R., Viikari, M., Pesonen, J., and Nevanlinna, H. MobShare: controlled and immediate sharing of mobile images. *In:* ACM Multimedia 2004. New York, NY, USA.

[6] Ah Kun, L. M. and Marsden, G. Co-Present Photo Sharing on Mobile Devices. *In:* Mobile HCI 2007. ACM. Singapore.

[7] Greaves, A. and Rukzio, E. View & Share: A Collaborative Media Viewing and Sharing Framework for Projector Phones. *In:* MIRW 2008. Amsterdam, Netherlands.

[8] Greaves, A. and Rukzio, E. Evaluation of Picture Browsing using a Projector Phone. *In:* Mobile HCI 2008. ACM. Amsterdam, Netherlands.

[9] Greaves, A. and Rukzio, E. View & Share: Exploring Co-Present Viewing and Sharing of Pictures using Personal Projection. *In*: MIRW 2009. Bonn, Germany.