Sinnova Social Wall: a low-cost multi-touch wall supporting visitors in a trade fair

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Abstract
This paper reports an application designed as a guidance for visitors at a regional trade fair. We exploit our low-cost multi-touch approach to make the wall at the entrance interactive, displaying useful information to visitors about the companies participating at the fair and their products. The main goal of the application is, first of all, to allow a potentially large group of users to easily and simultaneously browse the contents. On the other hand it is designed to provide a mean of social interaction whereby visitors can establish a first connection with sellers, as if business cards were exchanged. Our idea is to make smart places building a shared interactive space starting from a real wall. We were also interested in designing systems that include interaction across different displays, in particular we aimed to explore the potential of combining shared displays (the wall) with personal devices (mobile phones), to manage the information during the trade fair, providing a suitable and faster way for keeping the visitors informed also when they leaved the information area. We discuss about the adopted technology, the interface and the installation design, motivating our choices and reporting user impressions.

Author Keywords
MT-Wall, User Experience Design, User Interface Design, Input and Interaction Technologies, Social Interaction,

Multi-touch, Mobile-Interaction, Multi-user environments, Large-sized displays

ACM Classification Keywords

H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

Introduction

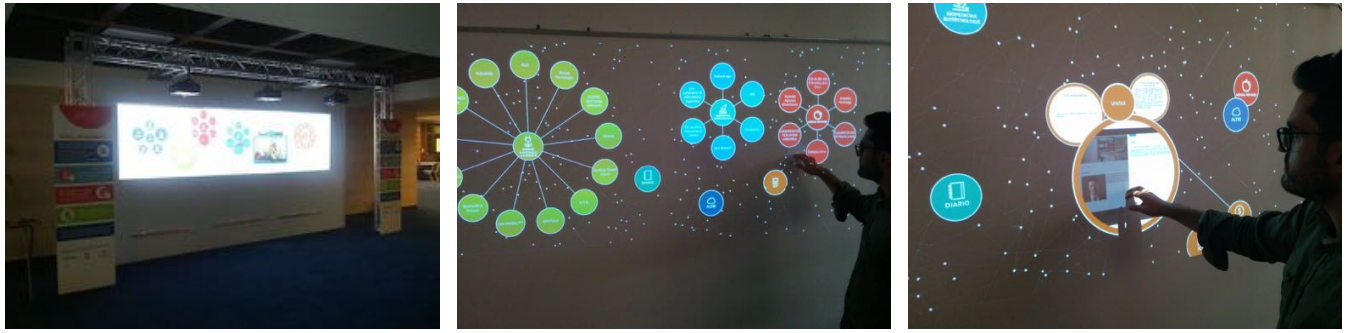
Following seminal work and up to recent developments that have turned into commercial devices [8][5], multi-touch and gestural devices with computationally enhanced surfaces has gained considerable attention. Thanks to them we can better exploit our manipulative and gestural abilities through actions that are very much like manipulations of physical objects like images, maps or documents. Moreover touch-tables and walls systems [1], whether they are home made built or are commercial platforms, offer a suitable working environment for computer supported co-operative work, leveraging the exploration of new frontiers of social computing.

Compared to touch-table, multi-touch walls, thanks to their vertical setup, require less space and are the ideal for building multi-user systems without the need to change the environment configuration. They are consequently useful in different applications that involve multiple users in shared spaces, like museums or trade fairs, where collaboration and social interaction are key aspects.

Having an important role in the commercial world, trade fairs are events where different companies have the possibility to expose their products and describe their business, with the aim of acquiring new customers and starting new collaborations. On the other hand, visitors, that can be potentially customers or other sellers having the intention to do business, are interested in buying or acquiring information about something to their liking. During these events generally companies take place in stands that has been assigned to, while visitors walk along the locals and corridors to visit the stands, using brochures and printed posters or billboards to orient themselves. Our idea is to place an interactive wall in a strategic position, as the entrance or an open-space room, to guide and inform visitors. Providing a user-friendly interface with dynamic contents, an interactive wall is complementary to classic paper supports and applications can be designed to provide tailored services for the users. For example the software can filter companies profiles by users interests, allowing customers to inform and get in touch with the companies in a easier way.

Interactive walls in shared spaces

Recent installations combines multi-touch screens and very large-scale projection surfaces to realize large interactive shared spaces [6, 7], demonstrating their potentiality in multi-user environments. Other works [10] present interactive tabletop system with integrated seats and a camera based user tracking system, to create interactive applications in museums and exhibitions.
The technology used for the interactive installation requires some desirable features. Many fairs cannot have a fixed location, but they moves in different places from year to year. For this reason they require transportable installations. Furthemore the multi-touch wall should not alter the location, it have to take as less space as possible and it can be easily fitted on any existing surface. Moreover, it should have a display adequately wide to host a potentially large group of users. Least but not last, it have to support applications and teamwork even in unfavorable light conditions, typical of open spaces and crowded places.
Concering the display layout, multi-touch devices can be



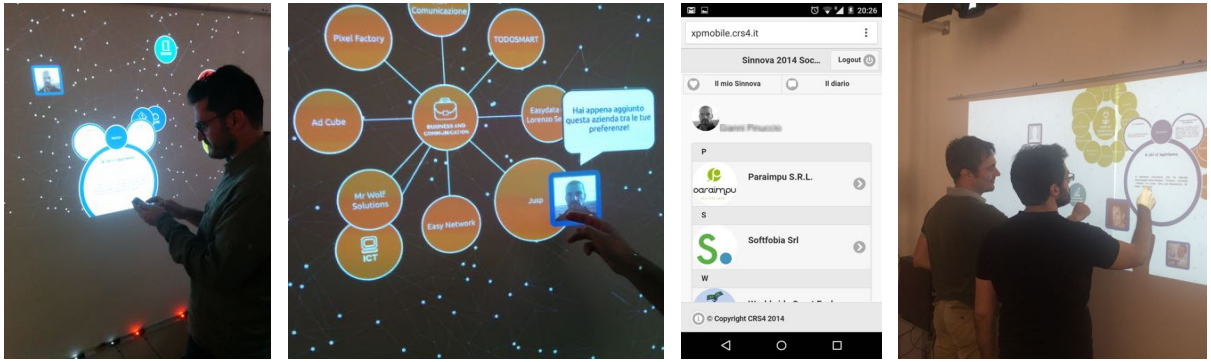
(a) (b) (c)

Figure 1: a) The *interactive* 5mt multi-touch wall installation. Sensors are placed in metal bars on the bottom of the screen the screen, facing upwards. b) The contents are arranged around its parent node. c) The user explores by means of swipe gestures.

divided into two categories: closed boxes and multi-touch surfaces. The former have a sensor, tipically a IR camera, placed behind the sensing surface. Exploiting FTIR, DI or DSI optical technologies [8], various lab-made multi-touch displays recently were transformed into commercial devices [2][11]. However these systems require prearranged structures and a certain amount of space, then they do not fit our needs.
Industrial capacitive technologies are used to produce multi-touch surfaces. Despite their accuracy, these technologies are anything but cheap and make the construction too expensive when covering large surfaces.
Other approaches *zerotouch* [5] build a multi-touch surface arranging cameras or sensors around the screen while the position of the fingers is determined through triangulation. However these techniques need a meticulous arrangement of the sensors, require synchronized cameras and appropriate triangulation algorithms. Moreover the more recent cannot manage large displays because of synchronization problems due to propagation delays in electrical signals.
Our multi-touch approach, named *t-Frame* [9], consists of a set of low-cost cameras placed on the top or bottom edge of the screen, facing down or upwards, as shown in figure 1(a). After a calibration step, the position of fingers is easily calculated by a triangulation algorithm. *t-Frame* allows to build a multi-touch surface starting from an existing wall, and it can also cover large displays even when using multiple projectors. It also distinguishes between hands and fingers, allowing us to develop alternative interfaces.

The social wall

For the reasons described above, we have chosen our low cost multi-touch technology to create an application as a guidance for visitors at a regional trade fair, called Sinnova (contracted form of 'Sardegna Innova'), the most important trade fair about innovation and innovative



(a) (b) (c) (d)

Figure 2: a) Visitors can use their own mobile device to interact with the social wall. b) Drag-and-drop gestures can be use to express a preference for a certain company. c) The mobile application shows the bookmarked companies. d) Multiple users at the wall.

product in Sardinia. The application, named 'Sinnova Social Wall', is based on a 5MT interactive wall. With the intent of supporting as many people as possible, we have decided to make the wall at the entrance interactive. Since the fair lasts two days, the installation has to be transportable and easy to assemble. This way, we create three modules containing a array of sensors (low-cost IR cameras) placed on the bottom of a 5MT projected screen, as shown in figure 1(a). Users can interact with the multi-touch wall also with their personal devices (mobile phones); the application is designed to keep users informed when they walk away from the wall to start or continue their visit. Moreover it fosters social interaction, and, exploiting the tools and features of social network, it enables visitors to establish a connection with the preferred companies using the multi-touch wall.

The multi-touch wall interface

Participating companies are grouped by categories and both appear in the wall as circles (figure 1(b)). When the user touches a category, the item is opened; an animation displays the child items, arranging them in a circular path around the father item. The user can continue the navigation up to the company item; on the contrary a pressure on the father item causes the closure of the category. As described in figure 1(c), the company's contents are displayed as bigger circles around the company item and contains textual information, images and videos. When the company item is opened, the user explores the contents using swipe gestures, causing the rotation of the child items around the company.

Social Interaction

As introduced before, the application allows not only to inform a trade fair visitor, but helps users to explore contents in order to get in touch with companies of his

interests. Using their own mobile device (figure 2(a)), users can connect to the wall application. After a login step in which they have to enter their own credentials for a social network profile (Facebook or Twitter), the user profile image appears in the wall as a squared item (figure 2(b)). This item (the user avatar) can be used to generate a connection with a company: by dragging-and-dropping a company item over the user avatar, the application automatically posts in the social profile page of the user a message representing his intention to get in contact. The message contains the user and the company tags, so both user and company members can connect to the social network to see the link among them: the company members, accessing to their own social page, read the messages of interested users. Furthermore, the mobile interface of our application helps users to keep track of their preferences. Whenever a company item is dropped over the user avatar, a list of dropped companies is populated (figure 2(c)), so that the interaction can continue also when visitors walk away from the information area.

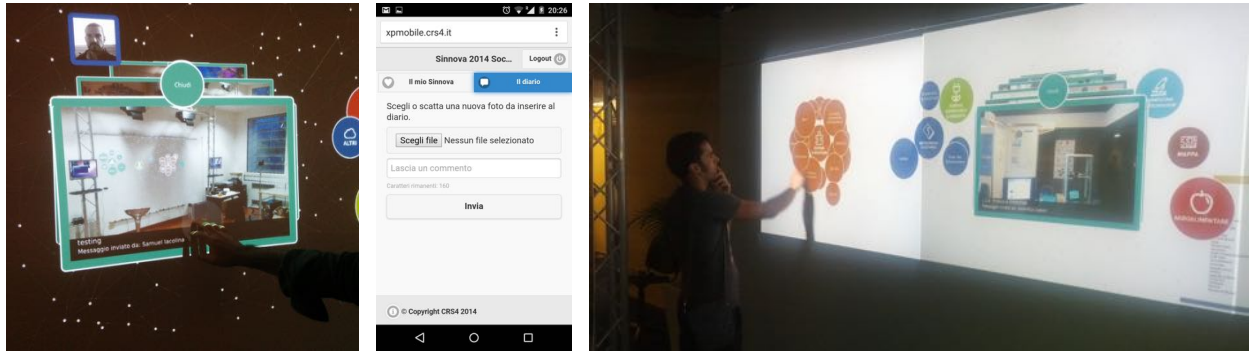
The diary
The mobile application (figure 3(b)) includes also an interface that can be used to upload a photo with a short comment. These photos are available in the wall under a special item, that represents the diary of the event (figure 3(a)), that can be explored by means of swipe gestures.

The OCGM metaphor and visual feedbacks
Being a gestural interface, the multi-touch interface of the wall is based on the (OCGM) metaphor [4]: objects and containers are represented as circular (contents) and squared (users) items, a touch gesture is used to open/close the item, a swipe gesture allows the browsing of the contents, a gesture of drag and drop is used to create a connection between contents of different type (user and a company), and finally manipulations on items are used to move them along the entire surface. The interface provides also some visual feedback. For example the item size represents user interaction on categories and companies. At the beginning the items have the same dimensions. Whenever users interact with them, simply opening and closing an item, or drapping a company item over the user avatar, the items involved in the interaction became bigger (figure 3(c)).

Software details
The network part of the application is entirely developed with *xPlaces* framework [3], that allowed us to create an architecture of communicating components. With the intent of not forcing the user to install an application from a mobile app store, the mobile application is a web application developed in NodeJs with a responsive interface. The wall interface is developed combining QtQuick libraries (of Qt5 framework) with native OpenGL code, while data about companies and categories come from an external restful web-service.

Evaluation
About one hundred people used the application and seemed to be enthusiastic of their experience. Some visitors used the interactive wall at their arrival to the fair, exploiting the multi-touch surface to acquire useful information. Therefore, the act of express a preference for a certain company was used like an appointment, to keep track of companies they intend to visit immediately after they leave the wall.

In other cases the wall was explored when users were exiting from fair, and some of them find it helpful to select companies they were most liked. Still other users



(a) (b) (c)

Figure 3: a) The diary containing photos and feedbacks uploaded by visitors. b) The mobile application can be used to upload a photo on the wall. c) The multi-touch wall interface.

used reached the wall during their visit, simply intrigued from the interactive installation. Although we did not provide any instruction or user guide to visitors, they approached the wall and started to use without our suggestions. Especially young people were excited to use an immersive installation, and used the application without particular problems.

Discussing user impressions about touch sensing performances, our interactive wall was assessed equally fast but less accurate compared to commercial devices. But the icons were properly sized and the animation and gestures helped the exploration of the contents, so the their feedbacks were overall positive.

Even if people employ multi-touch devices in everyday life, some visitors seemed to be unconfident in the use of the multi-touch wall. The large size of icons and containers forced the users to execute large movements, that in the long run tired the user.

Conclusions and Future Works

Multi-touch wall are useful in different applications that involve multiple users in shared spaces, where collaboration and social interaction are key aspects. In this work we propose an application that use a multi-touch wall to support visitors in a trade fair, informing them about fair companies and their products. With the idea of building a multi-touch surface starting from an existing wall, we choosed our approach to made the wall at the entrance interactive. This allowed us to easilly create a large installation that can host many users, helping them once they arrived at the fair. The installation also provides a mean of social interaction, allowing visitor to get in touch with sellers and company members. Since the application makes information and contents available when visitor walk away from the information area, and even when they leave the fair, users can consult them

during their visit (or even from home) and continue the interaction or collaboration with companies members.

Future work will be aimed at recognizing users and tracking their position in order to move interface items according to user movements. This feature could be very important in the construction of large multi-touch environments, because it allows the user to have his own workspace always closed at hand without the need to execute actions and hand gestures during his movements. Furthermore this behaviour can be used also to catch the eye of users that are walking near the interactive wall, with the aim of encouraging them to use the applications.

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