Whereabouts Screens: Supporting social interaction and location awareness at the workplace.

KONSTANTINA PANTAGAKI
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The Whereabouts Screens are a minimalistic publishing system offering location awareness at the workplace. The employees can share information with their colleagues, relevant mostly to their whereabouts, by publishing it on several situated displays located around the office space. The Whereabouts Screens have been installed with minimal changes since 2012 at the Mobile Life center and as a relatively new system, it has still not reached its full potential. Despite its “primitive” characteristics however, the employees show a continued interest in using them.

Based on related research on situated displays the research questions to be answered are:

- What do the semi-public situated displays in the workplace have to offer to their users?
- How can they be augmented and better integrated in their environment using the existing technology?

To investigate these questions, Human-Computer Interaction methods such as in-situ observations, interviews, a design workshop and prototyping were used.

The result was a prototype of an augmented system, in the form of a notice board where the users can post notes of different types (text, images, etc.). The board is extended beyond the limits of the screen with LEDs. The intensity and colors of the LEDs are affected by the use of the system, and illuminate the area around the screen. The augmented Whereabouts Screens aim to promote social interaction and location awareness at the workplace. They were evaluated through user testing and the first results show a positive reception from the users.

SAMMANFATTNING
Whereabouts Skärmar är ett minimalistiskt publicerings-system som bjuder närvarokännedom på arbetsplatsen. De anställda kan dela information med sina kollegor, mestadels kopplat till vad de befinner sig, genom att publicera det på flera skärmar belägna runt om på arbetsplatsen. Whereabouts Skärmar har funnits installerade med minimala förändringar sedan 2012 vid Mobile Life centret men har som ett relativt nytt system ännu inte nått sin fulla potential. Trots begränsningar i systemet visar anställda ett fortsatt intresse av att använda dem.

Baserat på relaterad forskning kring situerade skärmar tar sig uppsatsen an två frågeställningar:

- Vad har semi-publika situerade skärmar på arbetsplatsen att erbjuda sina användare?
- Hur kan deras funktionalitet utökas och integreras bättre i omgivningen med hjälp av befintlig teknik?

För att undersöka dessa frågor, används människa-datorinteraktion metoderna in-situ observationer, intervjuer, designworkshops och prototyppbyggande använts.

Resultatet är en prototyp av ett system med utökad funktionalitet i form av en anslagstavla där användare kan lägga upp anteckningar av olika slag (text, bilder, etc.). Anslagstavlan sträcker sig över gränserna för skärmen med LEDljusen. Intensitet och färger hos LEDljusen påverkas av användningen av systemet, och lyser upp området runt skärmen. De utökade Whereabouts skärmarna syftar till att understödja social interaktion och närvarokännedom på arbetsplatsen. De utvärderades genom användartester och de första resultaten visar på ett positivt mottagande av användarna.
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Keywords
Situated displays; workplace; social interaction; location awareness; notice board.

1. INTRODUCTION
Today’s ongoing digitalization of our society, is transforming the workplace. New and flexible ways of working have been introduced with teleworking (working away from the physical space of the office), being one of the most prevalent flexibility programs offered to the employees [1]. Teleworking, also known as telecommuting, has many advantages. Lower absenteeism, attraction of a wider talent pool, more schedule flexibility and fewer distractions, are some of them [2]. One of its greatest disadvantages however, is social and professional isolation of the teleworking employees. Employees avoid telecommuting because they are afraid that being away from the office will limit their opportunities to professionally evolve (professional isolation). At the same time, they miss the informal interaction with their colleagues like gossip and work-related spontaneous discussion (social isolation). One of the most characteristic examples of informal interaction at the workplace is the discussions around the coffee machine. This is a place where the employees use to have casual conversations that can sometimes result to better work coordination. The lack of coordination among the employees is another negative effect of teleworking [3]. As a result, it is getting more and more important to find a way to combine the physical presence at the office with the remote presence of those working from distance. The goal is to strengthen the feeling of connection and community among the coworkers and facilitate coordination.

At the Mobile Life office space, a research center in Stockholm that focuses in the area of mobile services, the Whereabouts Screens are a first attempt to achieve this goal (Figure 1). They are semi-public situated displays with the term situated referring to displays that have a site, situation, or location [4], excluding i.e. the displays of mobile phones and other mobile devices. The Whereabouts Screens are a minimalistic and easily accessible publishing system with very few limitations. The system is implemented as a shared Google doc that anyone who has the link can edit. The document is displayed at the different Whereabouts Screens around the office. Some of them are connected to a keyboard and a mouse, offering the possibility of quick editing on the spot. All the Mobile Life employees have access to publishing on the screens either on the spot or remotely by accessing the document from any computer. Several types of information such as the current location of the employees, important upcoming events, latest office related news and more, are common things that users would publish. The screens are semi-public in the sense that they are located in a private office space where only the employees usually have access. In some cases however, there are visitors and other externals who could read what is published on the screens.

The main use of the Whereabouts Screens so far in Mobile Life has been to provide location awareness information about the employees. The ones working away from the office would post information about their location or the activity they are taking part in and when they expect to be back at the office. At the same time, the ones arriving at the office would add their name to a list of everyone currently present at the office, to inform everyone that they are there. The system is used with variable frequency, some days more frequently than others, depending on whether there is something noteworthy to publish, or not. The displays have been installed with minimal changes since 2012 and as a relatively new system it has still not reached its full potential.

According to O’Hara et al. [5]

“At their most basic, digital display technologies allow information to be more easily updated dynamically and remotely. However, these new kinds of interaction technologies also allow
people to use these situated displays in novel ways both as for the individual’s purposes and in the support of group work.”

Figure 1: One of the Whereabouts Screens

With the increased level of connectivity between the different spaces and devices at the workplace, caused by the introduction of the Internet of Things (IoT), the Whereabouts Screens could play a more significant role in the workplace [5].

Based on all the above and the existing research, the questions to be examined are:

- What do the semi-public situated displays in the workplace have to offer to their users?
- How can they be augmented and better integrated in their environment using the existing technology?

The aim of the first research question is to get a more in-depth understanding on why the employees use the Whereabouts Screens and what they gain by interacting with them. With the second question, the aim is to explore different ways to augment the system so that the interaction reflects the needs of the users.

2. LITERATURE STUDY

Below, part of the research related to the Whereabouts Screens is presented and exemplified with three relevant projects. The main topics discussed are situated displays in general, and more specifically in the workplace environment, and location awareness.

2.1 Situated Displays

There is significant research conducted on situated displays [6,7,8,9,10,11,12]. Today, they mostly serve commercial purposes through advertising and signage. The great number of existing displays as well as the low utility of their content however, have made users practically blind to them [10]. There are two main problems identified when it comes to the low usability of public situated displays: the displayed information is not adapted to the environment and the potential users, and the interaction, if any, is minimal and not always relevant to the environment, the displayed content or the users [10].

There are also several limitations when it comes to public situated displays. In order for them to be open for the users to publish information, it is necessary to overcome issues of privacy and content ownership and some policies on what is appropriate for publishing need to be enforced [12]. In the workplace environment, where the displays are only semi-public and a certain level of intimacy and informality can be assumed between the users, these limitations are not as relevant as in truly public settings. Due to the assumed social accountability of the employees and the limited audience, no content moderation is required. The employees can be trusted to only publish content that is appropriate for the workplace [12]. As a result, it becomes easier to explore the different possibilities of the situated displays and experiment with different types of displayed information and interaction.

2.1.1 Situated displays at the workplace environment

In the workplace, the displays can serve as a location awareness medium, offering a virtual presence to all the employees whether they are physically at the office or not. Awareness is defined as “the state of knowing about the environment in which you exist; about your surroundings, and the presence and activities of others” [13, pp. 1]. It is shown that background awareness in both co-located and distributed groups can positively affect the efficiency and productivity of the group members [15]. Although positioning becomes more and more important today, location awareness can come in conflict with privacy [14], an issue that needs to be taken into consideration when designing location awareness systems.

One of the characteristics of the situatedness of public displays [10,11] is that they can reflect the sense of community existing in the place they are located, as well as the identity of that place. With the Whereabouts Screens, a sense of belonging in a group can be created and locating people becomes easier [15]. Furthermore, the displays can act as a reminder of the community activities and can trigger interaction both in the office space and with remote members. Through the Whereabouts Screens, shared cultures can be developed, an important aspect when it comes to maintaining working relationships, especially when the employees are distributed in several different places [16].

2.2 Related projects

The Whereabouts Clock (WAC), a situated location awareness device for families [14] is a project similar to the Whereabouts Screens. It is designed as a mantelpiece clock and shows the location of the family members. The location is tracked through the family members’ mobile phones and there are four different zones where someone can be at: home, work, school or elsewhere. The coarse grained location information supported, provides a sense of privacy to the family members. The evaluation of the prototype showed that the WAC strengthened the emotional connection among family members, offering reassurance, connectedness, and family identity.

Another related project, the Community Wall (CWall) [12] is an interactive large screen display system at the Xerox Research Center Europe. Everyone can post information on the screens and passes by it several times on a working day. The supported information includes plain text and web sites that can also contain images. CWall is a metaphor of a bulletin board. Each item has a title, a rating, the number of comments for this item, the name of the person who submitted it and some action buttons. The screen is touch sensitive and users can interact with it to expand, email, print, rate or add a comment to a posted item. There is also face

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recognition implemented to detect when someone is standing in front of the display to make the content more static compared to when the screen exists in the periphery of the users.

Finally, Plasma Posters [12] is a situated touch displays system placed at a software research company in California. The content displayed on the Plasma Posters is either posted by the users or automatically retrieved from intranet Web pages. The information that can be posted includes text, pictures and live URLs. Once posted, images can be zoomed, reduced and dragged and content can be scrolled. All the posts are removed after 2 weeks unless a different posting duration is set manually by the user who posted them. There are different ways people can interact with published content. They can peripherally notice the displays, actively read what is published, browse and search through the posts, message comments to the author or forward interesting posts to others. Six months after deployment, 20 out of 23 respondents to a relative survey replied they would miss the screens if they were taken away [12].

3. METHOD
Several methods were used to better understand the Whereabouts Screens from the users’ perspective and to redesign them according to their needs. For the first part of the project, an evaluation of the existing system was conducted using qualitative methods. Three designs were then proposed and a first prototype was developed and evaluated.

3.1 Initial Evaluation
To get a more in-depth understanding of the Whereabouts Screens, an initial evaluation of the existing system was conducted. 13 of the employees having access to the screens were interviewed. The interviews were semi-structured and were from 15 to 30 minutes long, depending on how much the interviewees were using the Whereabouts Screens. The interviews were focusing on how the screens are used by the employees, what works well and what does not. For the participants that did not use the screens, more detailed questions on the reasons they do not use them were asked. All the interviews were recorded using a mobile phone and the key points were later transcribed. For the analysis of the results, some important quotes from the users were isolated and marked as positive, negative and neutral comments, description of their interaction with the screens and recommendations for changes on the existing system. The quotes were then printed out and the ones referring to similar topics were grouped together making it easy to identify any existing patterns (Figure 2).

The publishing and reading behavior of the users was also examined through in-situ (in the natural or original position or place [17]) observation. Keeping track of the changes on the screen revealed some patterns the users follow for publishing. Working next to some of the screens for a few weeks, helped with observing their reading behavior without intruding, ensuring that their interaction was natural. There were notes kept during the observation period that were later analyzed to shed some light in the behavior of the users. The key findings of the observation were taken into account during the design phase.

3.2 Design
A design workshop was organized, based on the results of the interviews. The aim of the workshop was to explore different options when redesigning the Whereabouts Screens. During the workshop, nine participants worked in groups of three for about three hours. The results from the interviews were used in the form of cards with quotes from the actual users.

![Figure 2: Grouping quotes from the users: green for positive comments, orange for negative, yellow for neutral, light blue for descriptions of the interaction and pink for recommendations.]

Since some of the workshop participants were already familiar with the Whereabouts Screens, the system was presented in a different setting, a student accommodation with shared areas, instead of the office space. This technique known as defamiliarization can be used to promote innovation. By hindering the users’ recognition of the problem at hand, the vividness of their perception is increased and discovery is supported [18].

At the end of the workshop, each group presented their ideas through sketches, physical prototypes of the screens and by acting out the designed interaction. The presentations were video recorded and all the material was collected for further analysis.

Based on the results of the workshop and the interviews, the next step was a round of parallel prototyping. “Parallel prototyping is the process of considering a range of potential design ideas simultaneously before selecting and refining one specific design approach” [19, pp. 122]. As a technique, parallel prototyping has the advantage that a wider range of ideas is explored before starting design iterations with a more concrete design. The different approaches are evaluated and the best qualities of each design can be selected and merged into an optimized design [19].

The workshop ideas that were more relevant to the workplace environment and the remarks from the users, were reshaped and combined to create the first sketches of the augmented system. These sketches were presented to fellow interaction designers. Based on their feedback and the expected difficulties and time limitations of the prototyping phase, the design to be developed as a first working prototype was chosen.

3.3 Prototyping
For the prototyping, the available tools and materials were explored through tinkering. Tinkering as an activity can help designers overcome cognitive barriers and allows them to “see, appreciate and utilize all the potential applications already present” [20, pp. 2]. Rapid prototyping [21] was then used to quickly create a working model of the system with as many of the designed features as possible. The aim at this point was to find out whether the design met the users need, and not to develop a high quality, fully functional system.
3.4 Evaluation of the prototype
The first working prototype of the system was deployed at the Mobile Life office space for one week replacing the existing system. The users were informed of the change and were given some relevant information on how to access the system, login credentials etc. along with a short description of the new system. The publishing and reading behavior of the users was observed during this week through in-situ observation.

After the trial period was over, three of the users were interviewed to understand what their reaction to the new system was. The interviews had similar format to the ones from the initial evaluation. Some of the questions were repeated and the participants were asked to reply based on their experience with the new system this time. Since not all of the designed features were included in the prototype, the interviewees were also asked to express their opinion on the ones that were not implemented yet.

4. RESULTS
Below is a short description of the results from the initial evaluation of the Whereabouts Screens and the design, implementation and evaluation of the new version of the system.

4.1 Initial Evaluation
For the initial evaluation two sources of information were used, in-situ observation and interviews.

4.1.1 In-situ observation
The observation of the use of the system revealed certain patterns in the users’ behavior both for publishing and for reading information on the screens. People usually glanced at the screens while passing by and only slowed down when they noticed some new information. Next to one of the displays there is a button used for refreshing the displayed content. A few slowed down enough to press the button while passing by. Very rarely did people stop in front of the screen. This was only observed in some cases when people would stand in front of the screen while talking with their colleagues.

One of the screens is placed in an open space area with several desks around, next to the door of the room where the copying machine is. For this screen a mouse and a keyboard was also installed so that it is possible to edit the published information, on the spot. For the length of this project, no employee was observed to spontaneously stop in front of the screen. This only happened in a few cases after relevant conversations about the ongoing project on the Whereabouts Screens.

As far as the publishing behavior is concerned, it was observed that the information posted on the screens was mostly from the ones away from the office. It was mainly their whereabouts, whether for example they were travelling or working from home, information of any activities they might be taking part in, etc. The majority of the posts were observed in the morning.

4.1.2 Interviews
Several patterns emerged from the interviews as well. The main reason for using the Whereabouts Screens is the information on the employees’ whereabouts. Users reported to be reading the whereabouts both when they are at the office and away. The whereabouts are useful for coordination purposes, when trying to contact someone they haven’t seen during the day, and for social interaction. One of the interviewees, mentioned that

“It’s quite nice to know where people are, it’s interesting to know what they are doing. It gives a feeling of connection.”

(Participant 1)

Since many of the Mobile Life employees work from different offices, it was often mentioned that the screens help “to create a base” and

“...to show that you care about your colleagues and where they are.”

(Participant 3)

When asked for the format of the displayed information they reported liking how it is open and can be easily adapted and changed. They all said however that they have never tried to change it.

The advantages of the existing format are that

“there is good balance between text and empty space.”

(Participant 4)

and that it’s easy to locate the information they are looking for.

The fact that you can access the screens remotely was mentioned by several interviewees as one of the advantages of the existing system. One of them especially noted that

“the screen is following me wherever I go.”

(Participant 5).

Some mentioned however having trouble finding the link to the Google doc and that it’s not very easy to use with a mobile.

Another interesting pattern emerging from the interviews was that although some of the employees are actively using the screens, they believe that what they offer is not something they cannot live without. They would miss them if they were taken away but they feel that they offer some

“added, bonus information”

(Participant 6),

and

“it is not a very fast channel. Rarely something unknown is published there first.”

(Participant 7).

Furthermore, for the important work related issues they rely on emails and other more private platforms than the Whereabouts Screens.

Something everyone agreed on, was that the screens are more interesting when there are pictures published.

“It’s nice when there is some extra stuff, like pictures, that make it a bit cozier.”

(Participant 3)

" The corridor is dull, could be more interesting with nice images.”

(Participant 2)

“I enjoy especially the pictures so maybe I should publish more.”

(Participant 8)

“It would be more fun to have images, not so static [content], so that the screen has its own personality.”
There is also room for improvement in terms of interaction.

“*It would be interesting to see more interaction.*”

(Participant 10)

“*[It] would be fun to naturally interact with [the screen].*”

(Participant 2)

“Sometimes screens are screens so maybe something additional would make them more attractive.”

(Participant 11)

At the same time the interaction should be simple and non-intrusive. The users wouldn’t want to feel forced to interact with the system.

One major disadvantage of the existing system is that the employees forget to write their names on the screen when they arrive at the office or are travelling.

“*It’s hard to keep the information up to date and then you can’t rely on them since it’s not always updated.*”

(Participant 3)

“If it was definitely up to date, I would maybe look at it more regularly. Now it’s more like a last resort when I am trying to see where people are, because it’s not updated.”

(Participant 1)

At the same time very few of them were comfortable with the possibility of their location being updated automatically.

On the other hand, they would like to see some automated content as long as it’s not cluttering the screen with useless information. The majority of the proposed sources were of a social/recreational character like

“news about fellow colleagues, cool HCI content”

(Participant 1)

“where there are lunch and dessert leftovers”

(Participant 6)

“after works”

(Participant 11)

“translate data from different sensors in other modalities to spark the imagination”

(Participant 12)

To sum up, the main points that came up during the observation and the interviews are:

- The users only glance at the screen when passing by
- The Whereabouts Screens are used for coordination and social interaction
- The users like a flexible format that keeps the screen uncluttered
- They want to be able to access the screens remotely
- They like pictures and aesthetically pleasant content and interface
- They would like to see more interaction
- They forget to write their names on the screen when arriving at the office
- They would like to see some automated content.

These points were taken into consideration when designing the new Whereabouts Screens.

### 4.2 Design Workshop

The three groups at the workshop worked individually to redesign the Whereabouts Screens. The participants used the cards with the quotes from the interviews as inspiration for their designs (Figure 3). As a result, the majority of the designs were based on the outcomes of the initial evaluation. Figure 4 shows all the sketches that were produced during the workshop.

![Figure 3: The cards with quotes from the users.](image)

Some of them were connected with the student corridor environment in such an extent that it wasn’t possible to be transferred to the workplace setting (i.e. a visualization of how clean the kitchen surfaces are).

![Figure 4: The material collected from the workshop.](image)

There were several though that could be adapted and redesigned for the office space. Below are the ones that were the most inspiring for the next phase of this project.

**Timeline:** A way to present the history of the corridor in the form of a time line. Information relevant to the corridor such as who moved in/out and when, when there was a big party etc. is shown along with pictures. It’s a memory of your time living there.

**Extended notice board:** An easy way to add notifications, text, videos etc. The users are the moderators and do most of the editing. Some notes come from other sources such as the housing office. The screen mirrors the people living there and makes it easier for the users to find common activities to do. People are not interacting just with the screen but with each other through the screen (Figure 5a).

**Activities board:** People can create post-it’s with events they want to attend i.e. a concert or activities such as grocery shopping, and others can use the board to join them.
Visualization projecting on the wall: The screen shows an ambient visualization that is pretty to look at, and relevant to everyone living there. The information visualized can for example be the energy and water consumption or the indoor air quality. The visualization is not limited on the screen, it is projected, coloring the whole wall behind the screen (Figure 5b).

Collage of Pictures: The users can post any pictures they want and they appear on the screen as soon as they enter the shared area. When there is more than one person in the room, their pictures are mixed creating a collage. It’s a way to connect the people living in the corridor and help them get to know each other while making the space more personalized (Figure 5c).

4.3 Design
The three following sketches are proposed for the augmented Whereabouts Screens. They are based on the results from the interviews and the observation, and inspired by the outcomes of the workshop.

4.3.1 Social Board
The Social Board is a digital notice board where the users can place digital notes (Figure 6). They can create and publish notes with text, an image or video. The board can be accessed from any computer and the notes can also be published and read remotely. The users can create automated notes as well from the Flickr and Twitter accounts, YouTube channels etc. of their choice.

Each note has a color and life span defined by the user. As time passes by, the note becomes fainter. As a result, the users can easily distinguish the recently posted notes and it’s hard to miss previously unread information. The fading color of the notes follows the metaphor of a real life notice board, where the notes usually lose some of their color after some time, due to external conditions like i.e. sunshine.

Using a knob placed next to the screen, the users can scroll back and forth in time, displaying all the changes made and how the board has evolved. This feature is inspired by the Timeline concept proposed at the workshop. Older notes can be deleted from the current state of the notice board without the users losing any information. The screen remains uncluttered and new information is easy to spot at a glance. At the same time, there is an extra layer of interaction added, for anyone who is interested in exploring the content more.

The Social Board is inspired by the Extended notice board, the Activities board and the Collage of pictures proposed at the workshop. It is designed to make the displayed content more interesting and to promote social interaction between the coworkers, through the screen. By making it easier to publish images and video, the content can become richer and the screen nicer to look at. Adding automated content, will make it less static while the users can choose how busy the screen will be, keeping a good balance at the displayed content. Furthermore, by providing an easy way to publish notes, social interaction is encouraged between the co-workers. The Whereabouts Screens can become a medium for them to share their interests. The format of the published content is kept simple and flexible. The notes can be moved around and placed in any arrangement that fits their purpose. All the above qualities are based on the results of the initial evaluation.

4.3.2 Aura
LEDs create a pulsating aura around the screen (Figure 7). The pattern, intensity and colors of the aura, are mapped in the way the screen is used. The aura pulsates in a heartbeat pattern that looks healthier the more the screen is used and less healthy when it receives less attention. Both posting and reading frequency can be used as measures of the attention the screen receives. The aura is brighter and more colorful in the areas with the latest changes, to notify the user at a glance when something new was published. Furthermore, by highlighting the exact area of the new notes, it is easier to locate the changes on the screen.

With Aura, the screen starts looking like a living entity with its own personality. It looks bright and happy when it receives attention compared to dim and sad when it’s not used. The light also attracts the attention of the passerbys making it hard to forget that there is a screen there. At the same time, Aura informs at a glance when changes are made. Moreover, the screen is now something more than a screen since the whole area surrounding the display is affected by its use.
Aura is inspired by the design proposed at the workshop for a visualization projected on the wall. From the in-situ observation of the users’ reading behavior, it was apparent that they only glance at the screen when passing by. Based on that, Aura is designed to make new information easily located on the screen. It is also based on the remarks of the users that would like for the screen to have “its own personality” and to be “something more than a screen”.

![Figure 7: Aura](image)

The lighting patterns however need to be carefully designed so that they are not intrusive. They should offer subtle cues without being a distraction.

### 4.3.3 Check my mood

Check my mood is a magnetic board placed at a busy but not overly public part of the office (Figure 8). It is divided in six different zones happy, relaxed, sad, angry, stressed and away. Each employee has their own magnetic badge. When passing in front of the board, the employees can check in the office by placing their badge in the zone that best describes their mood.

The board is connected to the Whereabouts Screens and the whereabouts information is automatically updated based on the state of the board. At the same time, the information collected from the mood zones can be used to visualize on the screen, the mood of the office. At the end of the day, all the badges can be pushed at the away zone for the whereabouts to be updated anew the next day.

Check my mood is an attempt to make the interaction with the screens more natural and interesting, a requirement that was brought up during the interviews. The displays are extended and the employees can naturally interact with them without having to use a computer. At the same time, having a physical object, the employees are passing by often, it will be easier for them to remember to check in. This has the potential to solve one of the problems that arose during the interviews, forgetting to update the whereabouts. This means that the information on the screens will be more accurate since it will be regularly updated. As a result, the users will be able to rely on the screens more.

![Figure 8: Check my mood](image)

Check my mood has a social dimension as well since it reflects the current mood at the office. It can be used as a way to express compassion and support between coworkers in times of distress and as a way to express positive feelings in happier times.

One disadvantage of the magnetic board is that some of the employees might not feel comfortable displaying their mood to the rest of the office. This could be solved by adding a neutral zone or by making the badges more anonymous (i.e. different colors, patterns and symbols on the badges for the employees to recognize their own badge instead of names and pictures on them).

Furthermore, the mood information might not be as accurate during the day since the employees would have to remember to move the badges around the board as their mood changes.

### 4.4 Physical Prototype

From the three proposed designs, the Social Board and the Aura were chosen to be part of the first prototype. Check my mood, although addressing some important findings of the initial evaluation, requires more design iterations and user feedback before prototyping. The decision was also based on the time limitations.

The social board is implemented as a web application, that everyone that is authorized can access. The users, after logging in, can create new notes and read the existing ones. The first prototype only supports text and image notes, manually created by the users.

The web app is a Javascript application hosted on a web server to be easily accessed remotely. The tools used for building the app is AngularJS, jQuery, HTML, CSS and Bootstrap. Firebase is used for login authentication and to store the data. Due to the small size of the database, pictures are only supported as links, the users cannot upload their own content.

The app is designed to be very simple and minimal, with the focus being on the posted notes. Below are some screenshots of the app (Figures 9, 10)

The changes made on the board, affect the intensity and color of the LEDs around the screen. The LEDs are in the form of a 5m strip where each LED can be individually programmed. The screen is divided in 6 areas A-F as shown in Figure 13. When a
new note appears in any of these areas, the adjacent LEDs light up (Figure 11).

A simple PHP script is used to store, on the server side, information about the ages of the notes in each area. A Processing script running on the computers connected to each of one the Whereabouts Screens, reads the information and sends it through Serial Port Communication to an Arduino, a microcontroller, connected to the same computer. Arduino receives the ages of each area and lights up the LEDs that are attached to the specific area. The areas with new posts have a bright and colorful light on their edges notifying for the recently added content.

4.5 Evaluation of the Prototype
The in-situ observation revealed a few patterns in the use of the prototype. The first 2 days of the trial week, the reading and publishing behavior of the users was more explorative in comparison to their previous behavior. People would stop more often in front of the screen, either individually or in small groups with the intention of exploring the prototype. The first 2 days there were 10 notes published. In a common day during the initial observation period there were rarely more than 3 individual posts per day. Pictures (and a gif) were chosen these first days instead of simple text notes, to inform that someone would or wouldn’t be in the office. There was also an image posted advertising a future seminar, and another stating the fact that the users could now post anonymously. There was also a test note published that was deleted immediately after.

After the 2 first days, the user’s behavior turned back to usual, with the notes being mostly text and closer in nature to the posts on the previous system. The users were again only glancing at the screen without stopping in front of it.

4.5.1 Interviews
All three interviewees showed a positive attitude towards the prototype.

They all agreed that the concept of the notice board is interesting and provides a good structure to the displayed information. One very interesting finding was that through the
The interviewees were also asked to give their opinion on the features of the design that weren’t implemented as part of the first prototype.

For the video posts, they were positive but at the same time one of them said:

“The gifs are a good work-around since there is no sound [required].”

(Participant 1)

The automatic posts were also thought to be a good idea:

“Not just notes that people are not here but different kinds of notes as well. Then it could also be interesting for other people passing by to see what is important for us.”

(Participant 3)

However, it was also mentioned that

“I have a hard time figuring out a single source that would be relevant enough for this.”

(Participant 1)

For the possibility to drag and drop the notes around, their all had the same opinion. It is good to have the notes in a chronological order with the newest on the upper left corner. They would like however, to be able to rearrange them in order to bring attention back to some of the older ones, after they are pushed down by newer notes. Even pinning some important notes on the top of the list would be useful according to one of the participants.

The notes being deleted after some time was also something they thought is a good idea with the default lifespan of the notes being one week. At the same time, they would like to be able to go back and see the older notes.

“I sometimes go to the Whereabouts Screen when I need to remember when I was sick, for example, since I don’t write it in my calendar. Some of the content, especially pictures, is only shared on the Whereabouts Screen so it’s nice to go back and see it after sometime.”

(Participant 2)

5. DISCUSSION

From the first interviews, it became clear that the Whereabouts Screens are mainly a tool for social interaction. Although the employees often use the whereabouts as a coordination tool, their true value is the sense of connectedness they provide.

As a result, the focus of this project was on how to use the Whereabouts Screens to promote social interaction between the co-workers and to offer a sense of community.

By publishing content and creating automated notes that express their interests, conversation is triggered between them on topics other than the strictly work related ones. The Whereabouts Screens can be a place in the office where the employees go to, when having a break, to glance at what their co-workers have to say. The screens mirror the people working there, by showcasing their interests and personalities. Since the Whereabouts Screens can be accessed remotely this applies to the employees that choose to work away from the office as well. They can use the screens to remotely connect with their coworkers. As a result, the screens can help to prevent the social isolation that is observed when the employees telework.
The fact however that the displays are located in an office space, poses some limitations that cannot be overlooked. The interaction and the content need to be kept interesting but simple. The screens have to be non-intrusive. The employees are the ones to choose whether they want to interact with them or not.

All the above answer the first research question of this project: “What do the semi-public situated displays in the workplace have to offer to their users?”

The second research question: “How can they be augmented and better integrated in their environment using the existing technology?”, is a far broader one. There is no single answer to this question. The designs and the prototype developed for this project, show only one example of how the existing technology can be used to augment and better integrate the Whereabouts Screens in the workplace.

According to the evaluation of the prototype, the users seemed to have a positive reaction to the proposed design. There are however, more ideas that can be examined that might answer this question equally well or better.

The fact that the prototype allowed the users to think of new ways to use the Whereabouts Screens shows how much the use and purpose of a system depend on its design and implementation. Even small changes can change the way the users perceive the system and affect their interaction with it. As a result, it is clear that the results of this project could have been completely different, had a different design path been chosen.

The method used for this project follows the guidelines of traditional HCI practices. In my opinion, the most useful part of the method used, was the initial evaluation of the system since it shed a lot of light to the problem at hand. The design and prototyping was supported by the results from the in-situ observation and the interviews.

Something that would have been done different under different circumstances, is the evaluation of the prototype. Due to limitations on time and resources the evaluation was relatively limited. The prototype was deployed to only one of the screens, where less than 15 users had access. As a result, it was hard to find enough participants for the interviews. The results of the evaluation are reliable enough to understand that the design has potential but more design iterations and extended user testing is required.

5.1 Future work

The first working prototype only included part of the designed features and a short evaluation. As a future step, more of the features can be added to complement the existing prototype. More design iterations followed by user-based evaluation are also required.

The automated notes is a feature that needs to be explored more. There was some interest shown during the last interviews but it is not yet clear how the users will react to them. Some boundaries need to be set as to how often the notes are updated, if there should be a limitation on the amount of automated content on the screen, who will be responsible for choosing the content and how. How would the users react to such a concept and whether they would use the feature or not, are some more questions that need to be answered.

Another part of the design that needs to be further explored is the patterns of the light around the screen. For the first prototype the light was static and colorful with the colors having no meaning at all. Exploring more dynamic patterns, like pulsating light and mapping the colors to the state of the screen or the colors of the existing notes is something that has a potential for future development.

The positioning of the notes also needs to be redesigned in a way that maintains the advantages of the chronological order but at the same time is flexible enough for the users to rearrange the notes based on their priorities.

Based on the feedback from the users, it would be interesting for the notes to be removed after some time offering at the same time the possibility to go back to time and see older notes that are now deleted.

Some more attributes can also be added to the notes like the publication date and the name of the author (these have the potential to be added automatically).

Finally, the possibility to build a working prototype for Check my mood can be further explored based on user feedback and after more design iterations.

6. CONCLUSION

This project aimed to reply to the following research questions:

- What do the semi-public situated displays in the workplace have to offer to their users?
- How can they be augmented and better integrated in their environment using the existing technology?

In-situ observation and interviews showed that the situated displays can be used at the workplace to promote social interaction and location awareness between coworkers.

A design workshop and a round of parallel prototyping resulted in three sketches that can be proposed as a way to augment the Whereabouts Screens. The first sketch, Social Board, is a digital notice board where the users can post text, image and video notes. The users can choose the color and the lifespan of their notes after which they will be deleted from the board. By scrolling back in time, they have the opportunity to see the older notes that have been deleted and how the board has changed through time. There is also the possibility to add automated notes that fetch content from social media accounts of the users’ choice. Another way to augment the Whereabouts Screens is through Aura, a pulsating light around the screen that illuminates the surrounding area. The light patterns, color and intensity, reflect the way the screen is used and highlight the areas on the screens with the latest changes. The third sketch presented is Check my mood, a magnetic board divided in 5 zones that describe different moods, and an “away” zone. Each employee has their own magnetic badge that can be placed in the zone that best describes their mood when at the office, or in the away zone when they are away from the office. The whereabouts on the screens are automatically updated based on the state of the board and the mood information can be used to create and display on the screens a visualization of the mood if the office.

A first working prototype that was a combination of the Social Board and Aura was created and evaluated. The evaluation
showed that the users were positive towards such a concept but more design iterations and user feedback is required.

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8. REFERENCES