Environment Based Messaging

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Abstract. This paper describes the idea, first implementation and evaluation of an environment based messaging system. The basic motivation builds on the observation that it is sometimes more convenient to leave or send a message to a specific location as opposed to presenting it to a certain person (like when using SMS or email). We show and give conclusions from the first iteration of a system that allows sending text messages to small display devices that are kept at certain locations. Using gestures as input method, one can choose between possible answers defined by the sender of each message.

1 Introduction

We present a messaging system that is less targeted at specific persons but more location centric. This is implemented by placing small display devices at certain places where the users see them regularly. This includes prominent places like close to the main entrance of a house, besides a computer monitor or the fridge, etc. Their small size ensures that they are ambient and disappear into the background for those not directly interested in them. We also anticipate that even in normal households the number of screens and displays already installed will significantly increase in the years to come.

To those displays, messages can be sent through a web interface. This interface has also been optimized for small devices. In order to keep the use of those message displays simple, reduce their cost, and to enable a seamless integration into the environment we did not add any visible means of input. Replies to messages are restricted to a small set of options that can be defined separately by the sender of a message. We use a small number of gestures that are easy to learn to initiate possible actions. The database that backs the system ensures that several messages can be sent and stored until the user reads them.

Other communication systems that use situated displays include the Hermes system [1] where a PDA is installed next to an office door. In contrast to our system, each device is owned by one person and only this owner can send messages without being close to the display. These restrictions have been lifted in the WebWall project [2]: large public displays are used to communicate various kinds of information and allow direct replies or changed. This, however, implies that information is always on display and there is no way to restrict the visibility of private messages to one or several specific persons. The IM Here project [3] implements such a system but it needs complete computers with accessible keyboard and display to read and answer messages.

Many of these projects use scenarios dealing with computer supported collaborative work. However, most types of messages sent in the home environment are similar: pure information, task reminders, appointment arrangements, etc. Their complexity, however, is normally much lower, short informal texts like greetings or compliments are passed more often and users are of a less technical background. Therefore, much simpler methods are needed to achieve acceptance. We propose simple interfaces to generate messages, and restrict the functionality of the displays to browsing all received messages and choosing between up to four predefined answers by simple gestures. Examples are simple messages like "Don't eat the cake" posted to the display at the fridge or requests like "Can anyone please feed my fish?" with possible answers "done" or "already died".

2 Architecture and Implementation

As prototypes, we chose a combination of a Barton I²C LCD display that can display 5 lines of text with 16 characters and the Particle hardware platform [4] which we also use for other projects. Particles offer a programmable microcontroller, a radio transceiver and can be extended with a variety of sensors. To be able to recognize states and gestures, each display contains a 3D acceleration sensor (LIS3L02AS4).

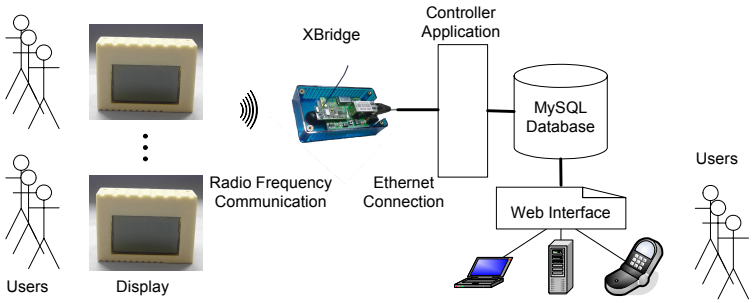

Fig. 1. General architecture of the system: Users interact with small display devices that communicate wirelessly with one or more PCs running a controller application. This application transfers data to and from a database that can be accessed through a web interface

One or several XBridges are used to communicate between a PC network and the displays. On the PC side, a MySQL database is running storing all messages being passed and their corresponding state (not read, answered, etc.). The database has a web interface optimized for both browsers on PCs and small devices. This serves as main entry point for adding messages, setting personal information or administrative purposes. Although messages can also be read, deleted and answered through this web interface, the main interaction will take place using the displays themselves. We defined a small set of gestures that are mapped to the actions of browsing through the set of received messages, giving an answer to a message, and putting the device into stand-by mode. There is a small controller application that implements the logic to interpret the result of the state/gesture recognition algorithm on the Particles, update the database and send information (e.g., new messages) to the devices.

3 User Study

Based on the prototype described in the previous section we conducted a small user study with 8 students aged between 21 and 25. The goal was to evaluate the overall idea of environment based messaging and the concept of using gestures to interact with small displays in this context. At the beginning we explained the testers a specific scenario of such a system in a flat-sharing community. We said that every person in the flat has a small display in her private room and, in addition to that there are displays in all public rooms like kitchen, floor or toilet. First the testers should use the system without any knowledge about the provided functionalities and supported gestures. Afterwards we explained how to use the small displays. Based on this, the testers conducted the second phase. In every phase there was a predefined sequence of messages provided by the display and the students had to set predefined answers.

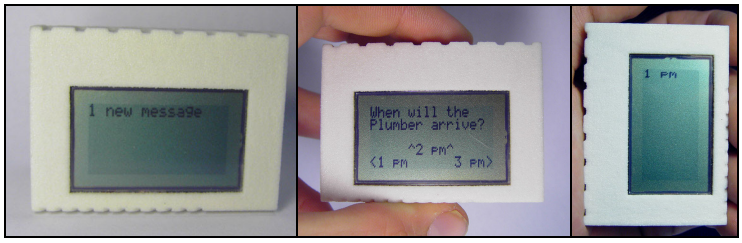

Fig. 2. This figure illustrates a typical message and the interactions during the user study. First the tester saw that there is a new message. After picking up the display (turning it) a message was shown. The last picture shows the selected answer after turning the display.

The goal of the first phase was to figure out how intuitive the gestures and the provided functionalities are. Therefore we just told the tester that they have to use gestures without giving any details. In the first phase most testers had big problems to figure out the provided functionality, especially the foreseen gestures for interaction with the display: some testers moved the display on the table because they thought that the arrows (see the picture in the center of figure 2) indicate a direction and not a rotation which was our intention. Furthermore their gestures were often too fast for our implementation and they were not able to set answers. Figure 3 shows other experiences from the first phase.

Before the second phase we explained all possible gestures and functionalities to figure out how fast one can learn to use our implementation of gestures. The result was that everybody was able to give correct answers to the provided questions. This leads to the general conclusion that the provided gestures were not intuitive enough to use them without explanations but it is easily possible to learn them in a short time.

At the end we discussed the general idea of environment based messaging with the testers. They liked the idea in general but questioned the advantages compared to SMS and pagers.

Most of them were very interested in the concept of sending messages to places instead of sending them to specific persons. Furthermore it was often mentioned that the system should be extended in such a way that SMS and fixed displays are integrated in the next iteration.

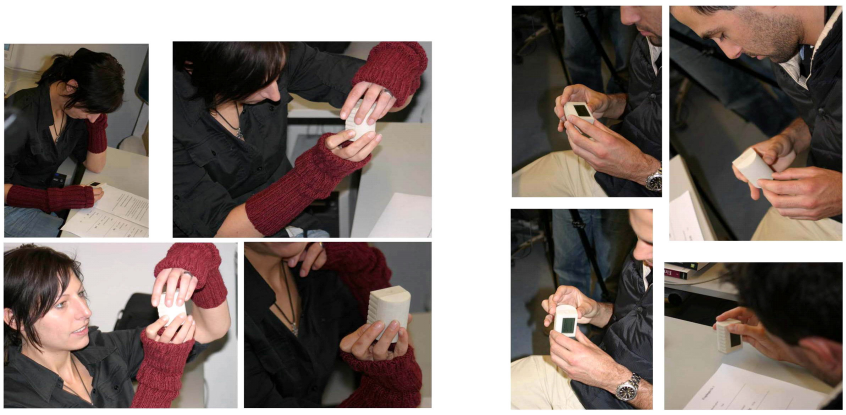

Fig. 3. The test person on the left hand side used the prototype as anticipated but first she used uncomfortable display positions till she figured out a better one. The other test person held the display in such away that it was not possible for him to see the text on the display

4 Conclusion

We recognized during our user study that affordance is a very important factor for the usability when designing tangible user interfaces like our small display devices which can be controlled by gestures. Therefore in the next iteration we will on the one hand work on this problem and on the other hand we will build displays with a button based interaction instead of supporting gestures. Based on these two prototypes we will compare these two interaction techniques in the given context. In addition to that we will integrate SMS functionality and fixed larger displays in our system for environment based messaging as requested in the user study. Furthermore we will evaluate the concept of displaying messages without any feedback channel.

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