Designing Cooling Stations for Food Sharing in Public Spaces

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***Abstract*— Approximately one third of the world food production is wasted, although the food would still be appropriate for consumption. The project described in this paper is targeting this problem by developing cooling stations containing an information system to access their contents. These cooling stations are supposed to be deployed in public places in a European city. The important advantage of such an approach is that it conforms to legal regulations concerning food distribution and consumption, in contrast to simple public refrigerators. Two studies were conducted to assess whether such cooling stations can be used for food sharing purposes – a field test and focus groups. These investigations indicate that relevant stakeholders find such cooling stations helpful. Nevertheless, there are still problems concerning trust, especially in the quality of the food offered through food sharing when there is a large anonymous community. The paper outlines possible solutions for this problem.**

Keywords—Sharing economy; sustainability; field study; cooperative consumption; kiosk

I. INTRODUCTION

FAO (Food and Agriculture Organization of the United Nations) data indicate that about one third of the world food production is either thrown away or lost [1]. On the other hand, there are many people in need of an adequate supply of varied types of food. Modern information technology can link donors of food with recipients, provided that these systems are designed appropriately. This could support a more sustainable way of food consumption. There are already several online platforms in place that support the exchange of food products [1]. The German platform foodsharing.de, for example, helps citizens to share excess food locally. On the other hand, there are many humanitarian aid organizations that share surplus food with people in need without the help of IT systems. These organizations provide very valuable help to persons in need. One disadvantage of this approach is that access is usually restricted to certain periods of time.

978-3-901882-99-9

Fig. 1. Cooling station prototype (1: tablet, 2: windows of refrigerator, 4: waste paper basket); "Kühlstation im Test" means "Test of a Cooling Station"

The goal of the project described in this paper is to combine the advantages of both these worlds – easy access to surplus

food and accessibility also after closing of shops. Project partners were a university, a private research institution and a company producing cooling systems. We developed a concept for cooling station consisting of a cooling element (a sophisticated refrigerator) and an information system.

One goal of the implementation of this cooling station is to overcome problems with legal regulations for food distribution [2]. Normal public refrigerators cannot comply sufficiently with such regulations.

The concept described in this paper is, to the best of our knowledge, unique in that it ensures compliance with legal regulations. When a normal refrigerator is used, anybody can open it to donate and retrieve food. In this process, there is some risk involved that spoiled or poisonous food is put into the refrigerator. One characteristic of the cooling station proposed here is that there is a responsible organization that checks the food before storing it. Single items of food are dispensed from the cooling station after users have interacted with the information systems, so that people cannot freely access the interior of the cooling station. In addition, a community of donors and recipients has to be established. We know that food sharing depends on trust between the participants of such a community. These relationships of trust have to be supported by the cooling stations and their operators in an appropriate way. The process described above is one way to ensure this trust of donors and recipients.

The project encompasses technical issues of how to construct the cooling station, legal and social issues, sustainability aspects and also issues of how to design an information system appropriate to support all different users of such systems. The main focus of this paper will be the design of the information system and how recipients can interact with it. Nevertheless, this cannot be discussed without considering the legal and social issues concerning the cooling station. We developed a mock-up of such a system in the course of the project. As the cooling station also addresses users who have a low computer literacy (e.g., older people or people with no access to computers) the information system has to be as simple as possible to ensure accessibility for all.

To test this mock-up, two studies were conducted: a field study and a study adopting focus groups as methodology. The description of these studies form the main part of this paper. The aim of the field study was to test the information system in a naturalistic setting and to get feedback whether food sharing using publicly accessible cooling stations was accepted by the general public (see Fig. 1). We think that the results of this field test where we could reach participants which are usually difficult to find for user testing are especially valuable. The focus groups aimed to collect data on the usefulness and usability of the information system in more detail. In addition, we also discussed more general issues of how to organize food sharing with the paricipants. The results indicate that the system we developed is really easy to use and that the idea of food sharing is very attractive ("belief in the commons", [3]). Nevertheless, there are still several open issues – especially concerning privacy and trust. In the course of the project, we have developed some tentative solutions for these problems. We think that several of these solutions can be generalized to similar systems.

Much research has been done in the area of for-profit sharing economy (e.g. [4] on Airbnb). There is less research investigating non-profit sharing. In addition, food sharing is still not investigated extensively. The research described in this paper aims to help to close this gap. There are several initiatives to institute publicly accessible refrigerators throughout Europe, but there are still many open questions, but to the best of our knowledge there is no research addressing this issue systematically.

II. Related Work

The sharing economy has received increased attention of researchers in recent years. Nevertheless, it is still an open question how to design IT systems appropriate for the support of sharing products, time and skills [5]. Some first ideas have been proposed in recent years [6]. An important issue in this context is not only sharing but also community building [7]. Sharing products or services over the Internet is sometimes done anonymously, but participants nevertheless enjoy personal meetings. They often also share a common attitude concerning sustainability and social welfare [8]. They appreciate the possibility to develop a community where they can exchange ideas and opinions [7]. This community building is essential especially for food sharing. Food sharing depends to a certain degree on mutual trust [9] because recipients have to be confident about the quality of the food they accept. Food sharing systems have to generate trust among a community to be successful. This is easier in local communities with existing ties among the community members.

Botsman and Rogers have developed a framework of four principles of collaborative consumption: critical mass, idling capacity, belief in the commons, and trust between strangers [3]. Collaborative consumption and sharing all share these four principles, but each of them can be more or less important in different contexts. Dillahunt and Malone discuss these four principles in the context of the sharing economy among disadvantaged communities [10]. They identify trust and critical mass as major issues in this context.

McLaren and Agyeman [11] argue that Smart and Sustainable Cities are based on novel concepts of sharing products, services and activities. Sharing has a long tradition in human communities – water, air or other common properties have been shared for centuries. The novel character of the sharing paradigm is related to the usage of the Internet which enables a more individualistic type of sharing than traditional sharing supported by governments (public transport, education, health). McLaren and Agyeman [11] also discuss food sharing. They point out that food sharing can take on many different forms. They describe initiatives of collaborative consumption (shared cooking, collaborative dining) in addition to the well-known initiatives of sharing surplus food.

There is a controversial discussion about advantages and disadvantages of the sharing economy. In this context, it is important to distinguish between for-profit and non-profit applications. The criticism concerns mainly for-profit applications [12]. It is also important to distinguish between the

motives for sharing in for-profit and non-profit applications. In for-profit applications, especially the users predominantly have service-oriented motivations while in non-profit applications users and providers are more altruistic [13].

There is some research concerning food waste and sustainability specifically. There is some indication that even people who waste food have no intention of doing so, but engage in daily practices through which food waste can arise. In this context, it is possible to design IT-systems which support more sustainable behavior [14]. The analysis of food waste diaries shows that food waste is a fairly complex process, and no simple measures can overcome this [15]. An analysis of the German food sharing platform foodsharing.de shows that participants have strong guiding values, and empowerment by participating in a group of likeminded persons is an important factor in such platforms [7].

Researchers have dealt with different kind of kiosk-systems for establishing the requirements of the user's needs [16]. Design guidelines for public information kiosk systems addressing stakeholders were developed [17]. The issue of older people thinking of themselves of not being good with technology has also been addressed [18]. This research can help to design an appropriate interface for the planned cooling station.

III. Description of the Project

The goal of the project described in this paper is the development of a system to share food on a local level. The cooling stations consist of a cooling element in conjunction with an information systems that enables donors and recipients to interact with the system. It is a kind of a kiosk-system which allows users to donate and withdraw food. The information system provides the user with information about the contents of the cooling station and helps them to retrieve individual products.

Serious problems in the context of the project which have to be solved concern legal issues and hygiene. In addition, the organization of this process has to be adapted to the needs of the concerned community. In this context, target groups for donors and recipients have to be identified. Stakeholder interviews and focus groups with possible participants of a food sharing community have been conducted to identify the needs of these persons. The company which will design the cooling station is also involved in the project and participates in the development of the concept for the cooling station.

A. Target Groups

At the beginning of this project, information regarding the target group was gathered through stakeholder-interviews with people who already share food to some extent. Many different models of food sharing were found: From a private person, who stores and shares food in refrigerators on his/her property, to some small shops or restaurants which provide some kind of cooling unit – all of them offered important experience to the project. According to these interviews, the target groups are heterogeneous: On the one hand, there seems to be a tendency that regular customers of restaurants/shops that provide a cooling unit, people who are living close to some kind of sharing platform or who know the operator of such a platform are more likely to use them. On the other hand, there are organizations which share surplus food with needy persons. These organizations also attract predominantly people from the local environment.

The stakeholder interviews also strongly confirm that donors of food are more likely to be female, this is in line with the fact that in many households food practices are still the woman's responsibility [19]. Similarly, this is consistent with the gender results obtained in [10]. Age groups may vary due to different organizations. The project not only targets needy persons but also persons adopting a sustainable lifestyle. Persons with a sustainable lifestyle not only act as donors but also as recipients, not because they are in need but because of their general attitude towards protection of resources available on our planet.

B. Open Issues

Designing an information system for such a heterogeneous group is a challenging problem. Based on the stakeholder-interviews we found that there are several problems which should be addressed, so that a cooling station for food sharing can successfully be deployed. These general issues will be discussed in the following because they are also essential for the development of the information system.

C. Legal Issues

There are European laws regulating food sharing. When food is passed on to a larger group of people legal regulations for normal food trade also apply to food sharing. This has led to a heated controversy in some European countries [20]. In the project described in this paper we also have to take these regulations into account. Two main aspects are relevant for the design of the information system of the cooling station. One is the requirement that foodsharers have to document precisely where the food they offer comes from. This makes it necessary that donors must be identified in every case. This has some consequences for the issue of registration. In addition, the legal regulations make it necessary that there is a responsible operating organization which takes care of the cooling station (hygiene, stocking up the cooling station, organizing maintenance, etc.). This organization is also legally responsible for the cooling station.

The second aspect concerns the information about the ingredients of the food which is offered, especially allergens. The information system must be designed in a way that these ingredients can be entered easily into the system and are accessible when recipients take food out of the cooling station. The cooling station must be equipped with a bar code reader. Information which is legally necessary but cannot be entered automatically must be entered manually by a representative of the operating organization.

D. Hygiene/Safety

Hygiene is a concern which is mentioned in all discussions with stakeholders and interested persons. An operating organization has to take care that the cooling station is cleaned regularly and to check that the condition of the food in the

cooling station is in accordance with legal regulations. We also decided early on that food like fresh meat or fish was not appropriate for a cooling station for food sharing because of the difficulty to guarantee the quality of these products.

E. Privacy/Registration

Privacy and the discussion about registration is a central issue in the discussion about cooling stations. In the two studies, we describe below we found that there are two different opinions about this. One group accepts the necessity of disclosing information about their identity, the other group is absolutely against this. This is an issue of trust. In smaller food sharing communities where people are to a certain extent acquainted with each other or where donors are well-known in the community, this is not such a problem. In contrast to that, a cooling station would be more anonymous and provides for a larger community. Therefore, the issue of trust is much more sensitive. People are concerned about the safety of such a cooling station and how much they can rely on the quality of the food offered here. In addition, legal regulations make it necessary that at least the donors can be clearly identified. We would like to point out that this also depends on the operating organization and the context in which the cooling station is situated. A cooling station which is operated by a well-known organization within a neighborhood and which targets a smaller community might have less problems with this issue of trust. Within the project consortium, we tried to find an appropriate solution for this problem.

F. Access

Most of the existing public refrigerators for food sharing can be accessed without restrictions. People can open the door of the refrigerator and take out or put in whatever they want. This is appropriate for smaller communities where trust is not such a problem. In the case of the cooling stations which are described here, such kind of free access is not possible. Together with the company partner in the project we will develop a solution which allows the recipients only to take one item (1 bottle of milk, one yoghurt, 1 bag of potatoes, etc.) per step out of the refrigerator.

In addition, we also identified several more specific issues which have to be addressed in the context of the design of the interface of the information system.

As discussed previously, all age groups and social classes should be able to access the cooling stations. People with limited (computer) literacy should be addressed as well as technically experienced people. Therefore, the information system should be as simple to use as possible. This is more challenging than it sounds. From the design of ticket machines, we know that such systems can easily lead to confusion. Therefore, a careful design and user testing with persons who are not computer literate is necessary.

One possibility to make the access to a food sharing cooling station easier is to use pictures or icons. They can offer first information about the food but may not be recognized by all users. A powerful method could be the cooperation of designers and users to design those icons.

Another challenge is language: Which languages should the interface provide? If you just offer one language you might exclude immigrants who do not know one of these languages. Providing more languages can lead to high cost and will still exclude smaller groups of immigrants whose language is not available.

Based on the requirement analysis we know that some of the recipients called the restaurants/shops where existing food sharing refrigerators are located to tell them what was stored in the cooling unit of their sharing platform. Offering an app or a website which shows the current stored food, may be important to save the time which is needed to get to the cooling unit. However, this can lead to another problem: Frustration may occur if the food is no longer stored after a short trip to the cooling unit. Reservation of one or more items could be the solution.

IV. DESCRIPTION OF THE INVESTIGATION

A. Description of the Mock-Up of the System

The mock-up is based on an extensive requirements analysis with stakeholders and persons interested in food sharing. This requirements analysis will not be described here because it comprises several topics which are not interesting for the design of the information system (e.g., where a cooling station should be positioned, how the cooling station should look like, what kind of food should be offered in such a cooling station, etc.). Nevertheless, there were several aspects which are also relevant for the information system, especially concerning safety and registration. Participants of this requirements analysis were concerned about the possibility of vandalism, hygiene, and whether the food on offer was still of good quality. A possibility to solve this is registration of donors and recipients. In the focus groups which will be described below we also found that views on this topic are controversial. We will discuss a possible solution for this issue in the Discussion section.

In addition, participants of the requirements analysis stated that the system should be as simple as possible. The discussion with those participants also indicated that the usage of pictures and icons might be advantageous for the system because some of the users might be immigrants or people with low literacy. It should be mentioned, however, that there are some elements of the information system which have to use language (especially the description of the ingredients of the products).

The system was implemented on a tablet PC. In accordance with the company partners who design the cooling station as such, we decided this size for a screen would also be appropriate for the final cooling station. The screens of tablet PCs are fairly small which restricts how much information can be shown on the screen. Therefore, the combination of the system with a Website where people can get more information seems to be advisable. The Website will contain detailed information about the contents of the cooling station, about its location and how best to get there, information about the food sharing project and usage rules for the cooling station and the

possibility to exchange experiences in a forum. We also intend to combine the cooling station with a Smartphone App which will basically contain the same information as the Website.

Providing information about the contents of the cooling station is possible because there is a database which underlies this system. This information has to be captured due to legal regulations. The mock-up already contains a basic version of this database. This database has to contain information like the ingredients of the products available, the best-before date, the donor and the date when it was donated.

Fig. 2. Entrance screen of the information system: Users can choose between four different ways of searching the information system (from left to right: by number of the shelf, contents of the whole cooling station, product categories, full text search)

B. Field Study

The goal of the field study was to identify possible problems of the information system in a naturalistic setting and, more generally, to assess whether the idea of deploying publicly accessible cooling stations was attractive. This investigation was conducted in the course of a "garbage collection" festival of the municipality of a major European city. This festival is well received, and many families with children attend. The visitors of the festival come from very diverse backgrounds, and have varying attitudes concerning sustainability and a "green" lifestyle. Therefore, it was possible to test the prototype with different representatives from the intended user groups. We got some feedback on how recipients would use the system and how they could integrate it into their daily lives. Such investigations are not very common in HCI because they require a major effort from the research team, even if they provide a comprehensive overview of opinions in the user group. Nevertheless, there has been renewed interest in such studies. Interaction Design "In The Wild" attempts to study IT systems in naturalistic settings ([21], [22]). Marshall et al [23] point out that there are differences in results between laboratory studies and results from the implementation of similar systems in naturalistic settings.

The whole field study lasted two days. We tested 314 participants and had to exclude 11 cases, partly because people came twice because they got food for free and partly because the questionnaires we gave them were not filled in properly. 64% of the participants were female and 36% male. The age ranged from 5 years (the parents filled in the questionnaire for this child) to 81 years.

The mock-up was built by the company partner in the project consortium. It consisted of a refrigerator, a frame of wood and a tablet PC (see Fig. 1). The tablet PC is number 1 in figure 1, the refrigerator is number 3 (it is one refrigerator possessing three windows), number 4 is a trash can. The refrigerator and the tablet PC were not yet connected, and members of the project team "played" this connection and opened the refrigerator to give participants the food they had chosen via the information system. The project members stood beside the prototype during the whole experiment. They were able to watch the participants the whole time and help them if needed. We were supported by several companies who donated food (mineral water, cocktail sauce, apples, pastries,…). The free food was the incentive for the participants to take part in the study, but some of the participants were just interested in sustainability and the project. The cooling station was positioned in a large hall together with several other stands. People passed by, and those who were interested stopped and took part in the investigation. The participants spent approximately 5 minutes with the system. We also talked informally with some of the participants after the test.

The participants were first informed about the goal of the project. Then we asked them to choose food using the tablet PC. They got no information about how to use this system. Afterwards, participants had to fill in a very brief questionnaire about their experience with the cooling station.

In the questionnaire, we asked three questions:

1. Which of the four possibilities to choose food (show contents of a single shelf, show contents of the whole cooling station, show categories, product search) have you used? (see Fig. 2)
2. Are there any functionalities which are not clear?
3. Would you personally use such a system for food sharing?

We counted the frequencies of answers to these three questions. In question 3 we also asked for reasons for using the cooling station. Not everybody answered this open-ended question, but we describe the reasons that were given most often. The results of the questionnaire are discussed below.

1. Question:

63% of the participants used the possibility to click on the icons of a single shelf to choose food. The food was easily visible through the glass windows of the refrigerator, and it was clear which number the shelf had. 23% of the participants checked the contents of the whole refrigerator and then chose the food. 12% used the categories and 2% the product search. The product search is probably the most cumbersome way to choose food because users have to type in the search terms. The frequencies for children and adults were very similar.

2. Question

94% of the participant said that the information system was clear and easy to use, 4% had problems. The problem which was mentioned most frequently concerned using the number of the shelf. Users often thought that they could already click on the number of the shelf in the overview panel (see Fig. 2). Contrary to this expectation, this is only meant to symbolize this choice because it was only an icon. Choosing a specific shelf is only possible on the next panel.

3. Question

95% of the participants said they would use this system for food sharing. Many of them mentioned they have surplus food in the refrigerator which they will not consume. Such a cooling station would be a possibility to avoid throwing it away. Some people mentioned that they are already sharing food and are interested in the issue of sustainability. Some of them also mentioned they would only use such a cooling station when the food was still in its original packaging, and the package was closed. The participants who said they would not use such a cooling station said that they did not trust the food from such a source and that it was tedious to go to such a cooling station.

We also discussed informally with the participants. They expressed a great deal of interest in the idea of cooling stations and food sharing. From the informal discussions, we also got the impression that community building is not such an important issue in this kind of food sharing. People are more interested in getting the food and information about the food efficiently than in relating to other donors or recipients. Nevertheless, this does not mean that such a community may not emerge in some situations. We also observed the participants informally whether they needed our help or not. The vast majority of the people were able to use the system without help. The only people who had problems with the system were immigrants who had difficulties to understand the language.

In general, the field test indicates that cooling stations might be an interesting possibility to support food sharing, in addition to the already existing forms.

C. Focus Groups

The goal of the focus group investigation was to identify additional and more detailed problems of the information system and discuss the issues inferred from the requirements analysis with the participants. The focus groups took place right after the field study. Both studies were planned in connection with each other. The participants of the focus group did not see the the mock-up itself, but only the tablet with the information system. We gave them a comprehensive presentation of the concept of the cooling station. This enabled them to discuss the information system and related issues of the cooling station in general in great detail.

We conducted five focus groups with 21 participants between the age of 25 to 69. About half of the participants of each focus group was female. We asked persons from the interested communities (food sharing communities, public markets, new housing projects) to take part in the focus groups. Some of the members of the focus groups were people who had no previous experience with food sharing. The focus groups lasted approximately one hour. People first signed an informed consent form, then they got a short introduction about the goal of the project. We then presented to them a brief scenario that they wanted to get a certain product from the cooling station. We did not give them any explanation how the interface worked to get a good understanding of whether it was intuitive.

Based on the requirements analysis and discussions in the project group we developed a guide for the focus group which consisted of the following questions:

- Questions about details of the interface (start page, different search possibilities)
- General questions about the interface (e.g. about usage of different languages and usage of icons)
- Registration

  Do you see any problems with registration? Do you think that your privacy will be infringed when you have to register?
- Gamification

  Do you think that a system of rewards could be useful to motivate people to use food sharing (e.g. if they have saved 12 different kinds of food from the garbage)?
- Website/App/Social Media

  Which kind of information would you expect to be on the Website?
  Do you need a map with all locations of cooling stations and their contents?

We conducted a qualitative content analysis [24]. This method is used for studying the meaning of verbal material, but can also be generalized to other kinds of materials (pictures etc.). Based on the guide we developed for the focus groups we developed a coding schema. This coding schema was used to analyze the results which are described below.

In general, participants found the information system easy and understandable. There are some usability issues which will not be discussed in detail here, but we want to clarify some issues which are of more general interest.

Show contents (see Fig. 2): Users mentioned that too much information was shown here. Due to legal regulations, a lot of information has to be provided about food. Users would prefer to have a quick overview of the contents of the cooling station. Additional information should only be provided on request. This is an indication that a highly minimalist design is required by the users.

Show categories (see Fig. 2): The choice of appropriate categories is a challenging one because users should be able to find the products they want easily and where they expect them to be. In addition, it is well-known that different users categorize products differently. There is also the constraint that due to limited screen size the maximum number of categories is twelve. In general, the participants identified categories correctly.

The participants also discussed the problem of how to indicate the amount of products of one category in the cooling station. If there is a lot of zucchini in the cooling station in summer, users should be motivated to take them home.

Languages: There was some controversy among the participants of the focus groups about how many languages should be made available. In Europe, there are many immigrants who speak Turkish, Serbian or Arabic. In general, we tried to use as many pictures as possible, based on the previous requirements analysis with potential users and stakeholders. This was appreciated by the participants. Still,

there are some interaction possibilities which have to use language. There was some consensus in the focus groups that an explanation of the system should be displayed on a poster somewhere on or near the cooling station.

Registration: Registration was an extremely controversial topic in all discussions with potential users, and also in the focus groups. One half of the participants had no problems about disclosing the data to the operating organization of the cooling stations. Some of them argued that especially people in need have to disclose their data anyway to get benefits from social security (e.g. access to so-called social markets with lower prices than in conventional supermarkets). Related to the issue of registration is the problem of trust. Participants argued that registration might help to ensure that the cooling station is used in a responsible way. They were especially concerned that users might take out too many products, so that nothing is left for other users or that users might soil the interior of the cooling station. Accountability for any harm which might result from consuming the food from the cooling station is also an important issue in this context.

The other half of the participants were concerned about disclosing their data to an anonymous organization. One participant said that s/he felt discriminated when s/he had to announce sensitive data to the operating organization. Some of the participants also argued that there are already public refrigerators in operation, and nothing had yet happened.

Rewards/Gamification: In the project consortium, we discussed whether it would support food sharing behavior in the community when users of the cooling stations got rewards (similar to gamification in e-learning or to encourage users to exercise more effectively [25]). This is not yet implemented in the prototype we tested. The idea was, for example, to celebrate an outstanding donor of food or somebody who comes regularly to remove items from the cooling station every month. There was consensus in all focus groups that this is a good idea and that this would help to encourage people to use the cooling stations.

Website, Smartphone App: These are features which are not yet implemented. We plan to connect all the cooling stations to a Website and a Smartphone App, so that users get an indication of where available cooling stations are and what can be found in these cooling stations. Participants suggested that a map would be valuable that shows where the cooling stations are and provide some idea whether these cooling stations are full or whether there is just "one banana" in the cooling station so that it is not worth the effort to go there. Participants also indicated that they would like to get some detailed information about the contents of the cooling stations. They would also appreciate to get information on how to get to the cooling station (especially by public transport).

Forum, Social Media: Using Social Media to form a food sharing community is not central for the participants, but some of them argued that they would like to exchange their experiences on Facebook.

V. Discussion

A. General Considerations

One of the principles of collaborative consumption/sharing is trust [3]. This is a major issue in the context of food sharing in anonymous communities. Food sharing systems have to be designed in a way that they foster trust. We would like to point out, however that this depends on the context in which the food sharing takes place. Another principle is critical mass. In the case of the cooling station, only practical experience can show whether the critical mass can be reached. We plan to do a practical test of the cooling station in a follow-up project. The third principle is idling capacity. It is obvious that this is available in the case of food sharing. The last principle is belief in the commons. Our studies indicate that this belief is quite strong. Most of the participants of our two studies indicated that they think that food sharing is a very important issue and that they would participate in such efforts.

A specific requirement in the context of our project was to keep the system as simple as possible to make it accessible for people with low (computer) literacy. We successfully introduced pictures to achieve this. The pictures were understood and appreciated by all of the participants in the focus groups.

B. Solutions

As a result of our studies, several issues could be identified which have to be addressed in a food sharing system of public cooling stations. We have developed tentative solutions for these issues.

Registration: Legal regulations make it necessary that donors have to register in all cases. As a consequence of the controversial discussion in our two studies, we think that the cooling station developed in this project also has to offer optional registration for recipients if this should be necessary. It depends on the operating organization and the community whether registration for recipients is obligatory.

Rewards: The results of our studies indicate that rewards for active members of the food sharing community should be put into place. One possibility would be to thank these donors and recipients publicly on the Website of the cooling station. Identification of the most active members of the food sharing community requires identification of these persons. We think that it is possible to do this without disclosing the identity of the majority of users by adopting nick-names. Such a system would also solve the problem of excessive claims on the contents of the cooling station by single users without disclosing sensitive personal information.

Languages: We think that the system should be accessible for speakers of several different languages, but due to the significant cost of translation and implementation the number of these languages should be restricted. We plan to publish dictionaries of the most important words in more languages on the Website.

We think that these issues are important for our work. In addition, they can also be relevant for similar systems in other contexts. The question of trust, rewards for taking part in sharing processes, or using pictures and icons to address

persons with low (computer) literacy is of general interest in the sharing community. Successful solutions and best practice examples can be helpful for further design processes.

C. Limitations

The prototype presented here is still low fidelity and some of the potential features we plan to introduce are not realized yet. We conducted a broad investigation to test the prototype and identify additional requirements by potential users. This provides us with useful information for the future design of the system. We intend to deploy a cooling station in an urban location in cooperation with an operating organization. This will give us the opportunity to test the cooling station in a long-term study.

VI. Conclusion

In this paper, we describe a prototype for an information system for a public cooling station for food sharing. The design of this cooling station goes beyond currently available public refrigerators. Such refrigerators are controversial because of legal problems concerning their usage. Our solution can overcome these problems. We conducted a broad, systematic study of how such cooling stations might be used by recipients and of additional requirements for a successful implementation. We identified several important issues (registration, rewards, languages). We have defined some tentative solutions for these issues which might also inspire similar systems.

Acknowledgment

The work presented here was conducted within the context of the UrbanFoodSpots project which was sponsored by the Austrian Ministry for Transport, Innovation and Technology/FFG.

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