Aalborg University
Department of Computer Science
Selma Lagerlöfs Vej 300
9220 Aalborg
Telephone:(45)96358080
http://www.cs.aau.dk

Title:
Students cooking habits and the potential for pervasive computing to increase their willingness to cook.

Theme:
Human-Computer Interaction

Project Timeframe:
SW9, 1. September - 7. January, 2011

Project Group:
d511a

Group Members:
Martin Lejsgaard Myrup
Martin Skouboe Pedersen

Supervisor:
Jan Stage

Abstract:

This paper explores the potential for pervasive computing in students kitchen with regards to cooking.

This is done by documenting the research done within the field of pervasive computing in the domestic kitchen in the form of a literature study. To be able to conclude the robustness of the literature study, affinity diagramming has been utilized along with an algorithm called 'Any-two agreement' used to calculate the actual robustness of the study.

In order to identify the potential for pervasive computing in students kitchens, a survey has been utilized. This survey has been sent to three study programs in an effort to identify cooking habits of students along with reasons as to why students do not cook at home.

Furthermore, a workshop has been held. This workshop had nine students attending and the main purpose of the workshop was for the students to identify their own reasons as for not cooking at home and come up with ideas to systems that could solve these problems.

Finally, the paper documents, by cross referencing results from the literature study, survey and workshop areas that are of interest if new systems where to be designed with the main priority of getting students to cook more at home.

Copies: 2

Total Pages: 85

Appendices: 28

Paper Finished: 07-01-2011

Signatures

Martin Lejsgaard Myrup

Martin Skouboe Pedersen

Preface

This paper is written by two software engineering students, currently attending ninth semester at Aalborg University. The course of the project was commenced on the 1st of September 2010 and the paper was handed in on the 7th of January 2011.
The theme of this semester is *Infomation Systems* and the study program states that the purpose of the project is to gain an in depth insight into central topics within this theme or broaden insight to the field in terms of both theories and methods and central elements and their linkages. The goals are to be able to demonstrate knowledge of relevant theories and methods within the chosen problem statement, being able to independently identify, formulate and analyse the problem, being able to relate the problem statement to the subject area and being able to identify relevant scientific, theoretical or experimental methods to illustrate the problem.

This paper explores the potential for pervasive computing in students kitchen in relation to cooking. During the process we have received help from our supervisor Jan Stage, workshop participants Kasper Guldbrand, Rene Bach Gustafson, Kaspar Henrik Moss Lyngsie, Kim Fiedler Vestergaard, Henrik Sørensen, Simon Lind Damgaard, Liv Stahl Madsen, Lea Maria Klaaborg and Line Kjærgaard Hoff. We would like to use this opportunity to thank everyone for their help and effort.
The paper will concentrate on subjects related to computer science and thus it is assumed that the reader has equivalent knowledge in the field of computer science, as that of an ninth semester software student.

Two types of source references are used throughout the paper. A reference placed after a period, refers to the given section, and if the reference is placed before a period or in a sentence, it refers to the particular sentence or word. Sources to the references used throughout this paper can be found at the end of the paper in the bibliography.

Aalborg, January 2011
- d511a

Contents

1 Introduction

The theme we have chosen for our 9th semester project is 'Pervasive Computing and the Kitchen'. Pervasive computing is a term for computers and Information Technology (IT) becoming an omnipresent and yet unassuming part of the world and everyday life. So far this tendency has been less prominent in the kitchen. We do not see any reason why IT, here in the form of computer and software systems designed with focus on Human-Computer Interaction, could not have a place in the kitchen. We think IT has great potential as a tool in general kitchen activities and would like to explore this potential further.

The kitchen is the setting for a wide array of tasks ranging from very simple to very complex. It can hold many challenges for people who are trying to manage their busy daily lives in an environment where shops and restaurants can save people the hassle of cooking food for themselves. We think the kitchen is a fascinating topic of study as there are a multitude of potential areas of improvement, from making the use of the kitchen a more interactive or even social experience, to helping the user manage shopping and meal planning. There are also other concerns that are invariably connected with the kitchen; the quality of the food, how interesting it is to cook and even whether or not it comes from sustainable sources. These things can all play a role in how and why the kitchen is being used.

Kitchen designers and manufacturing companies are already exploring ways to integrate various technological advances in the kitchen. In an article on *livstil.guide.dk* [1] various people from the industry talk about current trends and ideas with relation to the kitchen. According to this article the kitchen is becoming about the food again and sustainability environmental concerns are in focus. The intelligent kitchen is gaining popularity and new kitchens will increasingly be designed with technology integration in mind. Another article from *pcworld.dk* [2] reviews IKEA's kitchen of the future. IKEA has tried to imagine how the kitchen will look in the year 2040, by asking ordinary people how they picture the kitchen of the future. They imagine that it will be saturated with technology. One idea is that the refrigerator will be able to analyze your body and tell you which nutrients you need. They also believe that the kitchen should be able to monitor the energy and water consumption and that a cooking robot will be able to get dinner started before you get home. There could also be a 3D printer that can literally print food based on a recipe. There seems to be a general consensus that the kitchen will become more and more

technologically advances in the future. However, it is unlikely that everyone will be able to go out and buy a brand new 'kitchen of the future', so it would be interesting to explore the potential for IT solutions that can be integrated or used in the kitchens of today.

This report will investigate the established literature on the subject of and apply various research methods in an effort to identify key areas in the kitchen that could potentially benefit from integration with IT.

1.1 Problem Statement

Students have been chosen as the target group, specifically university students and focus has mainly been on issues that directly involve cooking in private home kitchens. The merit of design ideas will be based mainly on their ability to get students to cook more themselves.
We have extrapolated the following questions that we will seek to answer in this report:

- What is the potential for pervasive computing in a student's kitchen, with regards to cooking?
  - What HCI research has already been done on the subject of IT in the kitchen?
  - How is the kitchen currently used by students?
  - What features do students want from an IT solution for their kitchen?

2
Literature Study

A literature study is basically a study of what has previously been published about a certain subject. Literature studies can be utilized for numerous reasons, some of these are listed in the list below:

- If a subject is already thoroughly studied, a literature study can be used to establish an overview of what has been studied so far or what lacks research.
- A literature study can be used to investigate how a subject has been studied, meaning what methods have been used to study the subject. Are the methods utilized in the proper manner, have the methods been changed to fit the subject or if second-hand methods or results have been used.
- Literature studies can also be used to compare several studies and their methods.
- As an inspiration, insight or overview to a certain area or subject of interest, literature studies can be used.

There were two main motivations behind making this literature study. The first being to help shed light on research done in the area of IT in the domestic kitchen and to determine which areas and to what extent IT has been implemented or incorporated already. This would allow for us to become familiar with the current research and get some inspiration as to what is possible to do with the domestic kitchen and IT, along with design ideas.

The second motivation was to be able to determine where to focus our attention to prevent us from doing research other researchers have already preformed. The literature study should enable us to select an area of research where not too much research has already been done or areas where research is lacking. The study will also make it clear what the trends within IT inside the domestic kitchen are as well as the methods used to carry out research within this field.

2.1 Process

According to [3], writing a literature study consist of four steps, however in addition to these four steps we have chosen to add two steps, namely 'Keyword

categorization' and 'Grouping categorization'. Adding these two steps allows for affinity diagramming, which allows for calculations of robustness of the literature study. The steps are as follows:

1. Design a search protocol.
2. Search for literature.
3. Screen and examine literature critically.
4. Keyword categorization.
5. Grouping categorization.
6. Create a literature report.

2.1.1 Design a Search Protocol

A search protocol structures the process of gathering relevant information. It is the basis for being able to repeat the search or make changes to it later in the process. The search protocol contains the following:

- The background information and problem that the study is investigating.
- Explanation of the exclusion and inclusion criteria that is used in the protocol to gather informations.
- State the search strategy, meaning which databases, keywords and search combination to use.
- Outline the strategy for critical screening of the literature.

The search protocol made for this literature study reflects the main motivation of clarifying and determining where and how much research has already been done within the field of IT in the domestic kitchen. To allow for a wide as possible literature search, a minimal number of two inclusion and one exclusion criteria were specified. Following is the inclusion criteria followed by the exclusion criteria:

- Inclusion of specific references to the domestic kitchen in publications.
- Inclusion of implementation of technology in the domestic kitchen.
- Exclusion of publications published before 2003

The inclusion criteria was regarding the content of the publications. Every single publication had to have specific references and implement IT of some sort in a domestic kitchen, since this is the main focus of the literature study. The exclusion criteria was posed to avoid reading obsolete publications.

2.1.2 Search for Literature

When a search protocol has been established, the search for literature can commence. To make sure the search has been comprehensive enough, an evaluation is often needed. During this evaluation the search is repeated to make sure that the same results appear and no publications have been missed.
To search for publications the basic search strategy mentioned above was implemented. This search strategy made clear where to search for publications, in terms of which databases to utilized. The databases used in this search was *The ACM digital library*[4] and *SpringerLink*[5]. *Google Scholar*[6] was also used to do follow-up research as to whether or not further publications had been made from the original publisher or to investigate if newer research had been made concerning the subject of the publication. Even though no explicit keywords or search combinations where stated in the search strategy, the group utilized some themes when searching. All search combinations made by group members contained at least one keyword referring to the domestic kitchen.

2.1.3 Screen and Examine Literature Critically

Screening and examining literature consist of four steps. These steps helps select publication that seems to have the most relevance to the subject being studied. In the same manner these steps should avoid spending unnecessary time studying non-relevant publications. The steps are as follows:

- The title and abstract of publications are found and read.
- Publications which have an interesting title and abstract are acquired.
- The publications that have been acquired are studied and evaluated systematically according to relevance.

A strategy for screening publications was also implemented. This allowed for quick and easy screening of publications. Basically, the content of this strategy was to search through the databases specified in the search strategy and every time a publication with an interesting title was found, the brief description of the publication was read along with the appurtenant keywords. If this brief description and the keywords of the publication seemed interesting enough, the publication was downloaded and the full abstract read to determine whether or not the publication had relevance to the field of study. If so, the downloaded publication was uploaded to an online repository to be further processed later on.

Using these strategies, a total of 36 publications were acquired. Most of these, 21, were found using The ACM digital library, while a few were acquired from *SpringerLink*, 9, and *Google Scholar*, 6. These 36 publications represented a closure, meaning that references in these publication either pointed to other publications already found or publications with no relevance to the field of study. Furthermore, using Google Scholar we were able to conclude that no newer research was available in regards to these publications. We used roughly a week searching the databases for publications and tried numerous search themes, to make sure we did not miss any publications.

Screening and systematic evaluation of the publications involved three steps. First, the group decided on a number of requirements each publications had to uphold in order to be used in the study. If these requirements where not met, the publication where discarded. Secondly, the publications where split up among group members. Each publication were then read carefully by the appointed member and whether or not the publication had sufficient content and enough relevance to the field of study - based on the requirements it was up to each member to decide. If it met the requirements a resume of the publication was written and posted to a Wiki [7].

This Wiki was available for both group members and an easy way to share information. Out of the 36 publications found during the literature search, 16 of these were found to have enough relevance and content to be used in the literature study. Table 2.1 lists these publications.

There were no guidelines in the resume making, other than key points in the publication had to be captured. Making resumes of each publication were done in order to have sort of a publication database. This database could then be used to get a quick resume of a specific publication if one had forgotten the content of or missed a certain part of it. Furthermore, since key points were listed for each publication, information could easily and quickly be retrieved from these resumes.

Title of publication	**ID number**
Enabling Nutrition-Aware Cooking in a Smart Kitchen[8]	*1*
An Evaluation of a Meal Planning System Ease of Use and Perceived Usefulness[9]	*2*
First-Person Cooking A Dual-Perspective Interactive Kitchen Counter[10]	*3*
Cook's Collage Deja vu Display for a Home Kitchen[11]	*4*
Kitchen stories sharing recipes with the Living Cookbook[12]	*5*
SuChef An In-Kitchen Display to Assist with 'Everyday' Cooking[13]	*6*
The Diet-Aware Dining Table Observing Dietary Behaviors over a Tabletop Surface[14]	*7*
Living Interfaces The Impatient Toaster[15]	*8*
Context-aware kitchen utilities[16]	*9*
Cooking Navi - Assistant for Daily Cooking in Kitchen[17]	*10*
CounterIntelligence - Augmented Reality Kitchen[18]	*11*
The Kitchen as a graphical user interface[19]	*12*
Kitchen of the Future and Applications[20]	*13*
Smart Kitchen - A user-centric Cooking Support System[21]	*14*
Smart Cooking Support System based on Interaction Reproducing Model[22]	*15*
Augmenting Kitchen Appliances with a Shared Context using Knowledge about Daily Events[23]	*16*

Table 2.1: List of publications that have been used in the literature study. The ID number is used later on to identify the different publications from this point forward.

2.1.4 Keywords Categorization

Since this literature study is used to shed light on what has been researched and where research lacks, affinity diagramming [24] has been used to create a literature table. This table can be used to examine where the focus of research has been. To be able to do affinity diagramming, each member of the group had to make keywords to each of the publications, these keywords would then be used to create groupings, which in turn would be used to create the literature table. Keywords were made by reading all the resumes and for each resume each group member would write down the keywords he found necessary to cover all key points in the publication. When both members had finished making keywords, they where posted to each of the publications on the Wiki along with the name of the person who had made these keywords. Keywords were first posted after both group members had finished making them, to avoid bias towards certain keywords. No restrictions were made on what could be conceptualized as a keyword, as well as no restrictions were put on the amount of keywords a member could assign a publication.

2.1.5 Grouping Categorization

Since affinity diagramming is being used to create the literature table, each group member also had to group together the keywords. Again, no restrictions were put on how many groupings could be made or how many keywords could be in a grouping. Members were allowed to erase keywords they did not find explicitly descriptive, as long as they noted this for later discussion. They were also allowed to group keywords that resembled each other - as long as the keywords were from the same publication and rename keywords as long as the meaning of the keyword was not altered or changed.

2.1.6 Create Literature Report

The selection of publications and the critical screening of these should then be used to create a literature report. This report should clarify what the criteria has been for selecting publications and the procedure for screening and evaluating these. Finally, the report should sum up the scientific documentation of the studied subject.

After each member had made keywords and groupings, the group sat down and looked through all the keywords. The reason for examining all the keywords together was to erase meaningless keywords, keywords that was not useful to the table or discuss keywords one member had erased but the other had not.

2.2 Results

To give an indication of how the literature table was made, figure 2.1 shows the keywords written on white slips of paper along with a Post-IT indicating the theme of the grouping. These slips of paper with keywords where then, in cooperation between group members, grouped into groupings, as seen in figure 2.1. Group members were allowed to take keywords one member had placed in one grouping and put this in another grouping. If group members could not

agree on to which grouping a keyword belonged, the keyword was written on yet another slip of paper and put in both groupings.

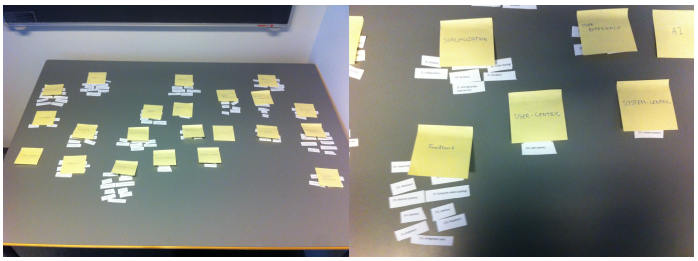


Figure 2.1: Keywords are seen on the white paper slips and the Post-IT indicates which grouping it is.

2.2.1 Robustness of Keywords, Groupings and Literature Study

To investigate and calculate the robustness of the keywords, Morten Hertzum and Niels Ebbe Jacobsen's 'Any-two agreement' algorithm has been utilized [25]. In their study, they used this algorithm to study whether evaluators, who evaluate the same system with the same usability evaluation method, detect roughly the same problems in the system. However, this algorithm can also be used in our study to evaluate if the same keywords are identified by both group members. Table 2.2 shows the coherence among the keywords made by the members of the group.

To be able to calculate the robustness of the literature table, some initial data analysis had to be done. Table 2.2 is a summary of the number of keywords each member found for each publication along with the number of identical keywords. Furthermore, the 'Any-two agreement' algorithm has been used to calculate the robustness of these, which in turn is used to deduce the robustness of the keywords. Robustness provides a means of concluding how likely it is that other people trying to replicate this study will end up with the same keywords. To see the full list of keywords identified by each member see appendix A.
As can be seen in table 2.2, the robustness of the keywords vary quite a lot for many of the publications. Several observations can be made from this table. First, it is clear that 'Member2' made significantly more keywords for most publications compared to 'Member1'. This is probably because of the free terms for classifying keywords. No model for classifying keywords were present and hence keywords were based on what the group member found necessary to cover the entire article. If some sort of protocol for classifying keywords had been present, this high variation in number of keywords could probably have been decreased.

Most publications have between four and eight keywords in common. This indicates that even though no protocol for classifying keywords were present,there is some coherence in what members found necessary to cover the publication. The average coherence in keywords for each publication is 34.75%, with the highest being 71% and the lowest being 11%. The reason for this variation is probably

ID	Member1	Member2	Common keywords	% of identical keywords
1	*9*	*13*	*8*	*8/14 = 57%*
2	*4*	*6*	*2*	*2/8 = 25%*
3	*6*	*13*	*5*	*5/14 = 36%*
4	*4*	*9*	*3*	*3/10 = 30%*
5	*8*	*27*	*7*	*7/28 = 25%*
6	*4*	*11*	*3*	*3/12 = 25%*
7	*6*	*14*	*4*	*4/16 = 25%*
8	*4*	*8*	*3*	*3/9 = 33%*
9	*6*	*6*	*5*	*5/7 = 71%*
10	*9*	*7*	*3*	*3/13 = 23%*
11	*6*	*14*	*6*	*6/14 = 43%*
12	*6*	*9*	*3*	*3/12 = 25%*
13	*8*	*17*	*3*	*3/22 = 14%*
14	*6*	*7*	*5*	*5/8 = 63%*
15	*4*	*6*	*1*	*1/9 = 11%*
16	*4*	*5*	*3*	*3/6 = 50%*
In total	*95*	*172*	*64*	
In average	*6*	*11*	*4*	*34,75%*

Table 2.2: Table showing the number of keywords identified by the two members of the group for each publication, common keywords and the robustness calculation of these.

the perception of what was the most important parts of the publications, along with the fact that members might have used varying numbers of keywords to cover these parts. The reason might also be, that members have used different words to describe different parts of a publication.

Table 2.3 shows the keywords identified for publication 13 and 15, the two with the lowest coherence, 14% and 11% respectively. As can be seen from this table, it is obvious that 'Member2' in general uses more keywords to describe a publication than 'Member1'. Since no protocol outlining how to classifify keywords is present, this will almost certainly have led to a lower coherence than if one had been present. Since the higher number of keywords requires for more of them to be identical for a high coherence, whereas a lower number of keywords would mean that only a few had to be identical to get a high coherence. This could perhaps have been countered by using a loft on the amount of keywords one were allowed to classify for each publication. In the case of publication 13, the fact that multiple keywords have been used to cover the same area by 'Member2' also greatly influence the result. 'Member2' has identified 'Computer-augmented environment', which in essence covers 'Sink', 'Preperation spaces' and 'Stove' as these are part of the augmented environment in the publication. A protocol dictating that only the most important parts should be classified could have minimized the difference in keywords, as 'Member1' to a greater extend has tried to do that, whereas 'Member2' has tried to cover the entire publication in more detail. The problem is also obivous in publication 15. Where 'Member2' explicit have mentioned all system desgined to help the user, such as 'Motion detector', 'Images, text, visual and verbal aid' and 'Member1' has simply used

'Adapted support'. This leds to 3 keywords being different instead of a single keyword.

ID of publication	Member1	Member2
13	*Learning, Teaching, Videoconference, Web-recipes, Cooking instructions, Foot-switches, Image/audio recording, Remote cooking support*	*Computer-augmented environment, Record cooking process, Videoconferencing instructions, Interactive cooking, Sink, Stove, Preparation spaces, LCD, Camera, Microphone, Foot switch, Internet connectivity, Remote communication, Socializing, Record cooking, Memo to explain, Images, sound and video*
15	*Interaction, Interactions patterns, Adapted support, Recognizing skill level*	*Support by recognizing, Visual-audio sensors, Interaction patterns, Images, text, visual and verbal aid, Motion detector, Voice detector*

Table 2.3: List of keywords identified by both group members for publication 13 and 15.

Taking the above mentioned problems into account, an average of 34.75% is satisfying in our opinion. If one where to do this again however, a specific protocol or strategy for classifying keywords would most likely be implemented.

As mentioned in step 5, the same calculations where done to group members groupings of keywords to calculate the robustness of these. The following table 2.4 shows a resume of these groupings. The first column shows how many groupings were made by each member and the other shows the coherence of groupings. Again, these calculations have been made using the 'Any-two agreement' algorithm and can be used to deduce the robustness of the groupings and in turn the table. To see the full detailed list of groupings made by each group members, see appendix B.

	Member1	Member2	
No. of groupings	*20*	*22*	
Common groupings			*11*
% of identical groupings			*11/31 = 35.48%*

Table 2.4: Table showing the number of groupings each group member identified, the number of groupings identified by both and the robustness of these groupings.

Some initial remarks have to be said about this table before the results are discussed. As can be seen in appendix B, only a small subset of the groupings actually have the same headline. However, if one looks at the keywords put in some of the groupings, several of these do actually denote the same area of interest. As an example, looking at the grouping named 'Sensor' by one group member and the grouping marked 'not labeled' both seen in figure 2.2, the resemblance is significant. Cases like these, where groupings cover the same area but have been labeled differently, have been treated as a match or identical grouping. If one were to do this experiment and only look at the labels put on each grouping by each member, this study would have had merely two common

groupings, whereas when one looks at the the meaning of the groupings there are actually several more.

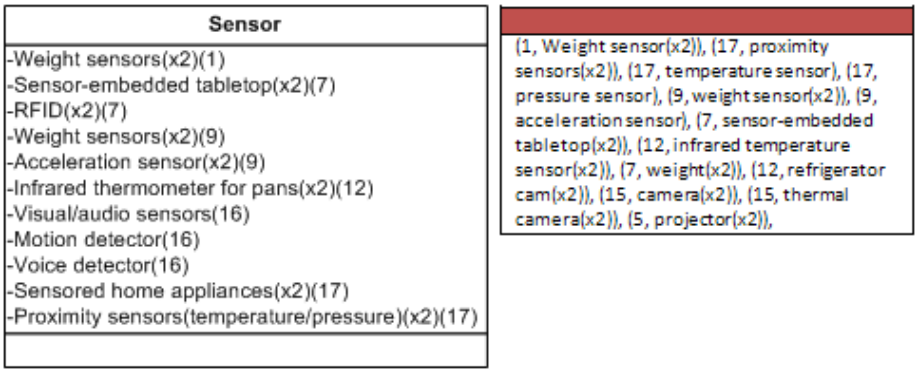


Figure 2.2: An example of similarities in groupings.

Table 2.4 shows that, whereas one group member made significantly more keywords than the other, groupings are more equal, with 'Member1' creating 20 groupings to cover all the keywords and 'Member2' creating 22 groupings. Even though the same amount of groupings more or less were used, the coherence between these were not as high as one could have hoped. Of the total 42 groupings, 11 of these were deemed to be equal in meaning and area covered. This gave a robustness of 35.48%, much like the keywords.

2.2.2 Literature Table

The above mentioned keywords and groupings were then used to create the literature table shown in table 2.5. The literature table was created in conjunction with the whole group. As shown in figure 2.1 the literature table was created using white slips of paper and Post-ITs. The backbone of the literature table was the 11 groupings identified by both group members. In conjunction between group members, these 11 groupings were reduced and used to create the overall column headers in the literature table. The remaining keywords, not included in the 11 common groupings, were then distributed between these new overall headers wherever possible. Finally headers were made from the remaining keywords giving us a total of seven new groupings. For the y-axis the keywords 'User' and 'System' was used. These were chosen as most of the publications were easy to divide into whether they required interaction from a user (system-centric) or provided help to the user during kitchen activities without the need for constant interaction (user-centric). However, this resulted in some fairly large groupings in the table, so 'User' and 'System' were further split into 'Before', 'During' and 'After'. This split adds a new dimension allowing for examination of whether focus has been put before, during or after the actual cooking process.

		Interaction	A.I.	Visual aid	User experience	Education	Kitchen environment	Support
User	*Before*	[12], [13]		[12], [13]	[13]	[12]	[12], [13]	
	Under	[1], [9], [12], [13], [15], [16], [17]		[1], [4], [12], [13], [15], [16]	[1], [13], [15]	[12]	[1], [9], [12], [13], [17]	[1], [4], [15], [16]
	After	[7]			[7]			
System	*Before*	[12]	[8]	[6], [12]	[2], [6], [8]	[12]	[8], [12]	[2], [6]
	Under	[3], [5], [11], [12], [14]	[8]	[3], [5], [12], [14]	[3], [5], [8], [11], [14]	[3], [5], [11], [12], [14]	[8], [12], [14]	[3], [11]
	After	[5], [14]	[8]	[5], [6], [14]	[2], [5], [6], [8], [14]	[5], [14]	[8], [14]	[2], [6]

Table 2.5: The final literature table showing the areas each publication covers.

Looking at the literature table in table 2.5 allows for some general points to be deduced. The following two lists outline, first the areas where research seems to have been focused thus far and the second outline the areas that seems to be lacking research.

Areas focused:

- Systems that focus on visual aid seems to have been given lots of focus. This goes for system-centric and user-centric system.
- Interaction systems, that focuses on helping the user during the cooking process has also received lots of attention. This goes both for system-centric and user-centric systems.
- Systems designed to give users a better experience of being in the kitchen also seems to be well studied. However, in this case the main focus has been on system-centric systems.
- Helping people during their cooking with education on how their meal should be cooked seems well documented. However, in these cases the main focus of the research has been on system-centric systems.
- Finally, user-centric systems supporting the user during cooking has also received a lot of attention.

Areas lacking focus:

- Of all the publications identified for this study, only a single had artificial intelligence as its main focus. This means no user-centric artificial itelligence system has been identified during this study.
- Whereas system-centric systems that focus on providing a better user experience for the user has been given a great amount of focus, user-centric systems with the same focus has been given significantly less.
- Educational systems also seems to be lacking focus. The only focus put on this subject so far has been on system-centric system that educate the user while cooking. In general user-centric and system-centric systems that focus on educating before and after the actual cooking is severely lacking.

Apart for these points, the general observation is that the main focus seems to have been given to systems that helps the user in one way or another during the cooking process, meaning not much attention has been given to systems which help the user before cooking or after. When looking closer this becomes apparent for user-centric system, two publications is what have been found covering systems that help the user beforehand and only one publication has been found covering afterwards. For system-centric systems the trend is the same, however not as significant. Finally, not much attention has been given to the social aspect of cooking. This is also the reason for its absence in the table. Most of the research done so far seems to focus on helping one person with a single task or overcoming a single problem while cooking. None of the system are aimed at e.g. helping people have fun, being creative or being sociable.

3
Survey

Our literature study helped us gain knowledge on the existing research on the subject IT in the kitchen but we also wanted to get an overview of the use of the kitchen within our target group of students as stated in section 1.1. For this we decided to do a survey as it would hopefully provide us with a large sample of statistical data.

When choosing to do a survey we have to consider the benefits and drawbacks of such a strategy. These are as follows [26][p. 101]:

Benefits:

- Easy to collect data from a large number of people.
- Relatively low cost.
- Useful when an overview or snapshot of a user population is needed.
- Relatively unobtrusive.

Drawbacks:

- Mostly provides shallow data.
- Usually not possible to ask follow-up questions.
- Can sometimes lead to biased data.

We of course recognize the benefits as reasons for choosing to do the survey but the main reason is that we need an overview of our target population and this is easy to do through a survey. The fact that surveys mostly provide shallow data are in many ways self evident but as long as this is kept in mind when analyzing the data this should not pose much of a problem. With regards to not being able to ask follow-up questions it is simply something that we have to accept as part of the nature of a survey and a direct trade-off to the benefits that comes with it. The most problematic drawback is the possibility of biased data. This problem is most pronounced when the questions asked relates to moods or e.g. recollection of the frequency of past actions or performed tasks. We will attempt to minimize the possibility for biased data but it is difficult to avoid completely as we will need some estimates on past behavior and task frequencies.

3.1 Distribution Method

It was decided to distribute the survey electronically to three study programs; Computer Science (CS), Humanistic Informatics (Hum. Inf.) and Architecture & Design (A&D). CS was chosen due to it being our own department and so it would be relatively easy to distribute it here. Choosing only CS would have made the target population predominantly males and so to balance this out Hum. Inf., which normally attracts more female students was included. We had previously had contact with A&D to consider the design aspects of computer integration in the kitchen and since they also have a more balanced ratio of males to females than CS we decided to distribute the survey here as well.

With a target population of university students electronic distribution was the obvious choice. University students are often contacted via e-mail regarding participation in surveys so distributing the survey on paper and having students send it back via regular mail would almost certainly be more of a hindrance to university students who are so used to using computers in their studies. Paper distribution would also make it considerably more time consuming to distribute the survey and prepare the data for analysis.

It is important to note that results found through survey data collected within a specific target population can rarely be generalized to other populations[26][p. 100].

Initially we had imagined that the survey would be distributed to mailing lists for each study program, however both Hum. Inf. and A&D seemed very reluctant to do this. As a result the survey was distributed to mailing lists within CS and the remaining two study programs put the survey on their respective intranet pages. It was especially difficult to get in contact with the correct people at A&D and we never received confirmation that the survey had been posted on their intranet but we did receive a few responses. In the end the survey was distributed to mailing lists at CS on November 16th, on the intranet of Hum. Inf. on November 17th and as already stated. We do not know the details of when the survey was distributed at A&D. Data collection ended December 2nd.

3.2 Tool

Originally we had settled on the survey tool provided by *Google* as part of *Google Documents* [27]. However, we had to abandon this tool as it kept replacing question headlines or downright removing questions from the form once the survey reached a certain size. We tried to make it work twice but in the end we decided that it was too unreliable. Even if we managed to finish the survey, we had no guarantee that the survey would remain intact all the way through the data collection process. We instead gained access to Survey Xact [28], through a university license and did not encounter any issues with this tool. Survey Xact also had some support features for data analysis and the ability to export the data to Microsoft Excel.

3.3 Preparation

The purpose of a survey is to ask the participant a series of questions; however, these questions do not exist in a vacuum but as a part of the overall survey structure. As such we will have to give consideration to the overall survey structure as well as the structure of each question.

3.4 Survey Structure

With regards to the overall survey structure it is important to start out with an introduction with directions to the participant on how to interact with the survey and what can be expected. If a survey is split into several sections it should also be made clear who should fill out the different portions. It is important to group questions relating to a similar topic or idea together and each section should also be given an appropriate heading to provide navigation for the participant. Additionally it is a good idea to place less interesting and potentially objectionable questions at the end of the survey, at a point where the participant has hopefully become interested in the survey. Lastly it is important not to mind the length of the survey and not include too many questions. At some point the survey becomes too long which can lead to low response rates. [26][p. 113 - 115]

The final survey structure can be seen below:

- General information.
- Physical surroundings.
- Cooking.
- Healthy food.
- Cooking aid.
- Workshop.
- Thank you.

In the General information section basic questions about the participants such as age, gender and relationship status was asked. This was followed by Physical surroundings which contained questions on kitchen size, number of hot plates etc. We considered whether or not to put the questions regarding general information and physical surroundings at the end of the survey. The idea behind this is that participants might find filling in general information boring as opposed to the questions regarding their experiences in the kitchen. By putting these general questions in the back, participants who had already filled out the rest of the survey would be less inclined to throw it all away by not finishing the last few questions. In the end we decided not to do this as we felt that we had relatively few general questions and by putting these in the beginning we would get a better flow in the survey. We were also concerned that people who were answering a question on whether or not they felt they did not have enough

room to cook in their kitchen could potentially and feel a need to explain how big their kitchen actually was before telling us if they found it too small.

In the Cooking section of the survey we put questions pertaining to the frequency with which the participant cooked breakfast, lunch and dinner. We also made an effort to clarify the obstacles that stand in the way of cooking more. This was followed by the Healthy food section which, as the name implies, had the purpose of determining whether or not there was a need to cook more healthy food and what attributes should be included for the participant to consider the food to be healthy. The last of the sections, with questions pertaining to the goal of the survey to establish the cooking habits of the participants, is the Cooking aid section. Here we asked where the participant found inspiration and help when cooking and if she used computers or other devices related to IT in the kitchen.

We concluded the survey by asking if the participant would consider being part of a workshop on IT in the kitchen. We use the term 'IT' because participants would likely be unfamiliar with terms like pervasive computing.

3.5 Question Structure

The structure of each question is also important. The goal is to develop well-written, non-biased questions and as most surveys are self administered questions must be easy enough to understand that participants can fill them out by themselves. There are three main structures of questions: open-ended, closed-ended with ordered response and closed-ended with unordered response. Open-ended questions allow users more flexibility in their response but also pose the challenge of asking questions that lead to usable responses with enough information to gauge the views and opinions of the participant. [26][p. 111]

We decided that we would strive to formulate closed-ended questions wherever possible as this would provide consistent data that would be easy to analyze. Open-ended questions would mainly be used to follow up a closed-ended question to gain some additional information. As an example we asked participants what categories made up healthy food in their opinion. This was structured as a closed-ended multiple choice question and was followed up by an open-ended question in which we asked if the participant had any categories to add. In addition, we decided that we would avoid using a numerical range in our closed-ended questions with an ordered response. This decision was based on personal experience with surveys that utilized the numerical range. We both felt an aversion to this way of rating problems and were confident that short worded ranges would suit our purpose just as well.

There are a few points we can bear in mind to avoid some of the most common mistakes when designing survey questions [26][113]:

- Avoid asking two questions at the same time.
- Avoid the use of negative words to negate the point of the question, such as 'Do you agree that the software is not easy to use?'

- Avoid asking questions with a biased undertone, such as 'Don't you agree that...' or identifying the position of a well-known or well-respected person as these can also lead to a biased response.

3.6 Beta Test

Before the finished survey was distributed we did a small informal beta test. We asked five people to fill out the survey and to report any errors, inconsistencies or problems they had encountered. Three of the five beta testers filled out the survey on their own and provided feedback after completion. These three caught many simple errors such as errors in spelling or incorrect response options. The last two beta testers filled out the survey together while discussing each question in detail. These two testers had considerably more comments on the survey. Where the first three testers had mainly found smaller errors, the pairing approach discovered errors such as the formatting of the questions i.e. not all questions being the same font and style. They also noted that the introduction text seemed too long and asked if open-ended questions could be written in Danish, which was later added to the introduction text. They also found considerably more errors where closed-ended question answers could be misconstrued.

Overall, roughly 30 errors were discovered during the beta test. Around half were what we considered cosmetic, such as formatting and spelling errors, while the other half were severe errors such as the introduction text being too long and questions being difficult but not impossible to understand. No critical errors were found during the beta test but shortly before distribution we found a critical error with the question 'How many hot plates do you have' which had the possible answers of 'None', '0 - 2', '2 - 4' and '5 or more'. This had most likely not been caught during beta testing because all testers had between two and four hot plates and did not register the other possibilities. The possible answers were changed to 'None', '1 - 2', '3 - 4' and '5 or more'. No additional errors were found after distribution.

3.7 Results

96 people responded to the survey. Of those 96 participants, 18 answered some of the questions but never completed the survey and 10 never got past the introduction page to answer a single question. The remaining 68 completed the survey. In this section we will only present a selection of the results from the survey. They will first be explained and in the end we will discuss design ideas and concepts resulting from them.

3.7.1 General Information

An overview of the general information can be seen in table 3.1
The disproportionate data regarding gender can likely be explained by the fact that the survey was distributed by mailing lists at CS, which is predominantly males, while we could only get the survey put on the intranet at Hum. Inf.

	Female	Male	All
Respondents	*11 (16%)*	*57 (84%)*	*68 (100%)*
Age (avg.)	*25*	*23*	*24*
Single	*3 (4%)*	*32 (47%)*	*35 (51%)*
In a relationship	*8 (12%)*	*25 (37%)*	*33 (49%)*
Computer Science	*2 (3%)*	*54 (79%)*	*56 (82%)*
Hum. Inf.	*6 (9%)*	*1 (1%)*	*7 (10%)*
A&D	*3 (4%)*	*2 (2%)*	*5 (7%)*

Table 3.1: General information.

and A&D which has considerably more females attending. This observation is supported by the distribution of participants over the three study programs.

3.7.2 Physical Surroundings

The most important goal of this section was to get an estimate on the size of the participant's kitchen. We asked the participants about the size of their kitchen and how much wall space they had available. The results can be seen in table 3.2.

	0 - 5m^2	**6 - 10** m^2	**More than 10** m^2
Kitchen size	*35 (52%)*	*26 (38%)*	*7 (10%)*

	0 - 1m^2	**1 - 3** m^2	**3** m^2 **or more**
Wall space	*34 (50%)*	*21 (31%)*	*13 (19%)*

Table 3.2: Physical surroundings - kitchen space.

These numbers will certainly prove useful if we need to validate or shape a particular design or idea, but it is excessive to speculate on the impact on future work before we have something tangible to go by as e.g. a small kitchen size can be positive or negative depending on the system.

3.7.3 Cooking

We asked participants about their cooking habits and to rate a list of potential obstacles for them to cook more. A selection of the results for cooking habits can be seen in table 3.3 and the obstacles can be seen in the diagram in figure 3.1.
The majority of participants in the survey (86%) answered that they often or almost always cook from home. Ideally, we would like to see the vast majority of students almost always eat home cooked food if the alternative is unhealthy fast food or expensive restaurant visits that cripple the monthly budget. However, only 25 (37%) answered 'almost always'. It could of course also be the case that others cook the participant's food for them, which is what we asked next. We assume that if others often cook for the participant and if she also cooks often for herself, then the food she eats is almost always home cooked. This is of

	Never	Occasionally	Often	Almost always
How often do you personally cook or prepare food from home?	*1 (2%)*	*9 (13%)*	*33 (49%)*	*25 (37%)*
How often do others cook or prepare your food from home?	*19 (28%)*	*25 (37%)*	*16 (24%)*	*8 (12%)*
How often is your breakfast home-cooked?	*13 (19%)*	*8 (12%)*	*6 (9%)*	*41 (60%)*
How often is your lunch home-cooked?	*10 (15%)*	*22 (32%)*	*15 (22%)*	*21 (31%)*
How often is your dinner home-cooked?	*1 (2%)*	*6 (9%)*	*16 (24%)*	*45 (66%)*

Table 3.3: Overview of cooking frequencies.

course not an exact way to measure but of the 33 who personally cooked food 'often', 16 had other people cook for them 'often' or 'almost always'. Based on our previous assumption this would mean that 41 (60%) participants generally almost always eat home cooked food, which is consistent with the results for breakfast and dinner with 41 (60%) and 45 (66%) respectively, which is higher than we expected. Additionally we can identify lunch as being the meal that most participants do not prepare or cook themselves which is not unexpected.

We also asked the participants to rate several possible obstacles to cooking by how big of a problem they felt those obstacles posed. These obstacles were as follows:

- My kitchen is too small.
- I don't have enough time.
- I don't like cooking.
- It is too difficult.
- I don't have time to shop.
- I don't feel like making the trip to and from the shop.
- I don't know what to make.
- I can never use all the ingredients I buy and end up throwing a lot away.

The two biggest obstacles were 'I don't have enough time' and 'I don't know what to make'. The smallest obstacle was 'It is too difficult'. The results for these three obstacles can be seen in diagram 3.1.
It is clear that the difficulty is considered a minor obstacle to cooking. In stark contrast, only 7 (10%) of the 68 participants answered that they had no problems finding time to cook while 36 (53%) said that it was a minor problem and 25 (37%) rated it as a major problem. In the following open-ended question a few participants commented that even when they did have time to cook, it was not necessarily how they wanted to spend their time. The open-ended question was only answered by 18 people and there was not enough repetition in the answers

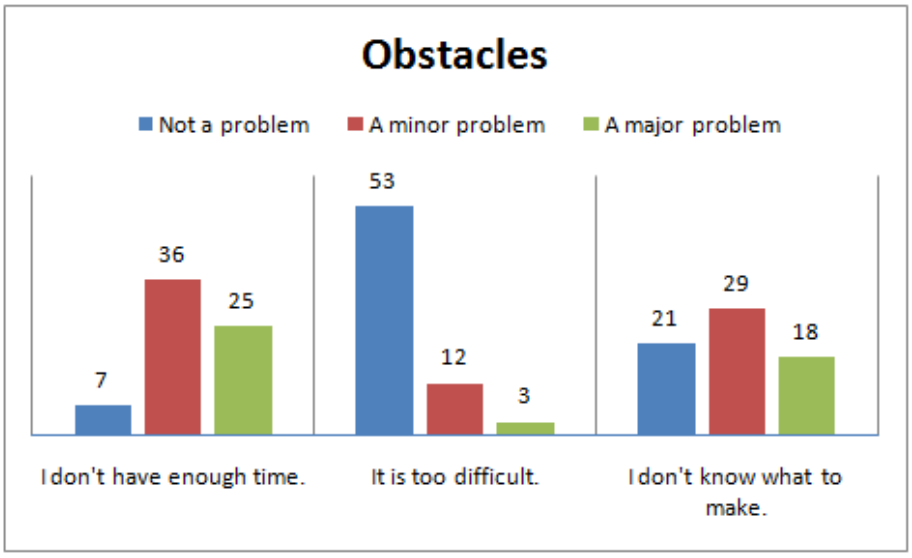


Figure 3.1: Diagram of selected cooking obstacles.

to generate any statistical data of any significance but we made a list of some of the general problems that emerged. (Number of respondents includes partial responses to a category)

- Limitations on physical surroundings such as too few hot plates, lack of an oven or generally bad kitchen design. (3 respondents)
- Only cooking for oneself is boring and uninteresting especially with regards to cooking more elaborate or complicated dishes. (4 respondents)
- The thought of the menial tasks associated with cooking and eating, such as doing the dishes and cleaning. (2 respondents)
- Motivation after long day. (2 respondents)

3.7.4 Healthy Food

Apart from the physical surroundings and obstacles related to cooking we also wanted to know how much focus students had on eating healthy. We asked them whether or not they wanted to cook more healthy food. The results can be seen in table 3.4.

	Never	Occasionally	Often	Almost always
To what extent do you cook healthy food currently?	*5 (7%)*	*25 (37%)*	*30 (44%)*	*8 (12%)*

Table 3.4: Frequency of healthy cooking currently.

We did not specify what constituted healthy food but let each participant decide for themselves if what they cooked was healthy or not. From a public health

perspective ideally the majority of food cooked or prepared in the kitchen should be healthy. With 30 (44%) participants answering that they never or only occasionally cooked healthy food there is room for improvement in this regard. And in fact when asked, 41 (60%) answered that they would like to cook more healthy food, however there was no significant relation between how much healthy food people cooked currently and whether or not they wanted to cook more healthy food. We then asked those 41 participants why they wanted to cook more healthy food by choosing from a multiple choice list. The results were as seen in table 3.5

Eating healthy makes me feel better	*29 (74%))*
To avoid illness	*23 (59%)*
I just like to know that I'm eating healthy	*19 (49%)*
I would like to lose weight	*16 (41%)*

Table 3.5: Frequency of healthy cooking currently. Percentages are of the 41 participants who answered 'Yes' to wanting to cook more.

We can conclude that the primary motivation behind wanting to cook more healthy food is a general desire to feel better and avoid illness. We followed the multiple choice question with an open-ended question if anyone had anything to add and although there were not more than 6 answers a few of them were fairly interesting.

- To increase physical well-being and get more energy.
- Organic or healthy food tastes better.
- Better for the environment to eat less meat and more vegetables.

3.7.5 Cooking Aid

The last thing we wanted to know was to what extent IT were being used in relation to the kitchen currently and where students found their cooking related information. Knowing which IT-devices and technologies are already being used in the kitchen will help when trying to design new systems. First we asked the participants to gauge how often they found inspiration and help from a list of sources. The results can be seen in table 3.6
Our data shows that the internet is the primary source of inspiration and help to students, which makes sense as the internet is also a good resource in general university related work. Cookbooks as well as friends and family are also often used both for inspiration and a source of help. Finally students rarely find inspiration from TV-shows and restaurant visits.

In an open-ended question we asked participants to specify which IT-devices, if any, they already used in the kitchen. There were a few cases of very specific hardware such as using cookbook software developed for the Nintendo DS and one participant even answered that he had mounted a flat screen TV on the wall that was connected to a media center and controlled by a wireless keyboard. However, predictably the most used IT-devices were laptops and smart

	Never	Occasionally	Often	Almost always
Inspiration from the internet	*5 (7%)*	*26 (38%)*	*21 (31%))*	*16 (24%)*
Inspiration from cookbooks	*10 (15%)*	*29 (43%)*	*27 (40%)*	*2 (3%)*
Inspiration from friends and family	*7 (10%)*	*33 (49%)*	*27 (40%)*	*1 (2%)*
Inspiration from TV-shows	*49 (72%)*	*12 (18%)*	*6 (9%)*	*1 (2%)*
Inspiration from restaurant visits	*49 (72%)*	*18 (27%)*	*1 (2%)*	*0 (0%)*
Help with problems from the internet	*7 (10%)*	*17 (25%)*	*24 (35%)*	*20 (29%)*
Help with problems from cookbooks	*16 (24%)*	*27 (40%)*	*20 (29%)*	*5 (7%)*
Help with problems from friends or family	*7 (10%)*	*20 (29%)*	*32 (47%)*	*9 (13%)*

Table 3.6: Overview of sources of inspiration and help.

phones. 20 (29%) of participants had specified that they used a laptop in the kitchen and 9 (13%) used a smart phone.

We also asked the participants to rate a list of general concepts on IT integration in the kitchen. They had to assess how well these concepts would work in the kitchen.

Interaction with a cooking aid system by issuing voice commands was slightly favored to interaction through a touch screen. Almost 70 percent of participants thought a monitor mounted on the wall was good or very good. In comparison, only around 30 percent thought a monitor standing on the counter top was good or very good. Neither of the concepts presented was deemed completely unviable by the participants.

Lastly, in an open-ended question, we enquired about the participants' own ideas on integration of IT in the kitchen. We have compiled a short list of the general concepts presented:

- Refrigerator should be able to keep track of the foods items stored within it and alert the user when they are about to expire
- Projection of information on the counter top and other kitchen surfaces
- Kitchen software should be able to suggest healthy alternatives to foods brought into the kitchen by the user
- Digital recipes, timers, automatic recipe scaling and guides explaining cooking techniques such as sautéing etc.

3.7.6 Discussion

In this section we will list some design ideas and concepts we have come up with through working with the results of our survey. These are then discussed in detail.

- Time and resource optimization rather than help and lowered difficulty.
- Inspirational or meal planning systems.
- Cooking as a social activity.
- Help for cooking healthy food.

From our data on obstacles we can conclude that the focus of cooking aid systems should be less on step-by-step help and more on the issue of time. It could e.g. be systems that help students be more efficient while cooking or systems that teach the benefits of cooking good, nutritious food. Understanding these benefits might make cooking less of a chore and help students understand that food is not only a means to escape hunger but is vital for energy and health. In the article 'SuChef: An In-Kitchen Display to Assist with 'Everyday' Cooking' [13], the authors observed that people don't often decide what to cook for dinner until very close to meal time and end up with what the authors refer to as 'everyday meals' which are tasty, quick, familiar and cheap. The problem with 'everyday meals' is that they are cooked so often that they become 'tired'. Our survey supports this observation as students rated lack of inspiration as one of the major hindrances to cooking. This could be helped by designing systems that suggest recipes to the user based on many different variables. With regard to these systems, we asked the students whether they used any sort of online meal planning system or systems which help find recipes based on what groceries they had available, and very few of them ever did. In light of this, it might be a good idea for anyone designing such a system, to examine existing systems to determine why they are not used. There might be some usability factors or lacking functionality that discourages students from using them. Students also suggested that cooking only for themselves is boring, especially when it comes to cooking more elaborate or complicated dishes. The answer to this could be to develop systems that support the social aspects of cooking. Such systems could also address the students' desire to cook more healthy food by incorporating healthy recipes into the meal plans.

Finally, our data regarding integration concepts was not definitive. In this regard, it would seem that an integration method is more likely to come through trial-and-error and continuous usability testing than through survey data as it is difficult to account for innovation. Innovation often revolutionizes the possibilities for human-computer interactions which make it difficult to reject an idea completely.

3.7.7 Improvements

Originally, we were planning to ask about the amount of table space available to students but unfortunately this was one of the questions that the survey tool from Google Documents deleted and we did not notice its absence until data analysis. This information would have been incredibly useful to determine whether or not it would even be viable to interact with a system through a touch screen standing on the counter top. We would also have liked know how much cupboard space students had available as a 'canvas' for projection of information.

On a more general note, we realized, during our data analysis, that our questions could have been slightly more specific. Not all of our questions were designed in context to each other. This meant that we did not always explore a given topic in depth leading us to a natural conclusion but rather got some very general information but very little clarification as to the root cause.

4
Workshop

According to 'Oxford dictionaries' a work shop is *a meeting at which a group of people engage in intensive discussion and activity on a particular subject or project.* [29] This also applies for our study. We first used the literature study to get an overview of what had been done with in the field of IT in the domestic kitchen. As described in section 1.1, students were chosen as the primary target for the workshop. The survey is used to get an understanding of how often student would cook their own meals, the reason for not doing it and what would increase their desire as to cook their own meals.

The motivation behind the workshop is a union of these preliminary studies. We want a group of students to sit down and discuss ideas that would make them want to use their own kitchen more. During this discussion the participants will be introduced to the research we have done so far, to let them know what their fellow students see as the greatest obstacles for cooking home cooked meals. They will be introduced to the research done so far by other researcher as an incitement to get inspiration if this should prove to be a problem. The goal of the workshop is then to get some tangible ideas from students on IT solutions they would like in their kitchen.

4.1 Participants

Already during the preparation of the survey, we had in mind that we would like to make a workshop for students on the subject of IT in the kitchen. So the last question in the survey was used to ask people if they would like to participate in a workshop concerning this subject. Furthermore, we would like to get people from different study programs as there might be a difference in the usage of the kitchen between students studying at CS compared to people studying at A&D. Also we would like to get a fair division of male and female participants for the workshop, as male or females might use the kitchen more than the other gender. Even though we got a fair amount of responses to the survey, only five people answered that they would like to participate in the workshop This meant that we had to find some ourselves. We wanted to have between nine and 12 participants, to be able to make groups of either three or four. Without the survey we managed to acquire an additional five people to participate in the workshop.

Of these nine, six were male students and three were female students. Seven of these, six male and one female, studied at CS at Aalborg University, while the remaining two females studied at 'A&D' at Aalborg University. The age of the participants varied from 24 to 29 with an average of 25. Eight of the nine participants had also responded to the survey.

4.1.1 Grouping

Since we were able to get nine people to attend our workshop, we decided that three groups of three participants would be optimal. Two groups of four or five participants would be to little diversity, meaning that too few ideas would be generated and four or more groups would result in groups of two or less participants, which in turn would limit the amount of discussion in these groups. We were convinced that having groups of three would allow for discussion and for all to be heard. Since we had a total of six male participants and three female, we decided to make the groupings such that there would be a group dominated by females, in this case two females and a male participant, a group with both female and male participants, in this case one female and two male participants and a group consisting only of male participants.

4.2 Course of the Workshop

Roughly speaking we used two weeks to prepare for the workshop. Most of this time was used to prepare presentations and handouts for the workshop. Early on we had the idea to split up the workshop into three modules, with some deviating activity in between each of these modules. This would allow for participants to get a break from brainstorming and discussions and get some new and relevant information they would be able to use later on.

The following section will describe how the workshop was carried out and afterwards, a presentation of the results will be given. The list shows the course of the workshop and each step will be explained in the text following the list.

- Welcome and a brief presentation of the workshop and its purpose.
- Module 1 - Brainstorming.
- Lunch.
- Short presentation of the research in the field.
- Module 2 - Mature ideas.
- Present ideas to each other
- Module 3 - Conceptualize ideas

Welcome and a brief presentation of the workshop and its purpose

People were invited to show up for the workshop at 10:00 AM on Wednesday the 15 of December. We showed up at 7:30 AM that day, to prepare the room and and go through the plan of the day one last time. At 10:10 AM all participants

Figure 4.1: Martin Pedersen giving the welcoming presentation.

Figure 4.2: The setup for the group work

had showed up. The first event to happen was a presentation that explained to the participants who we were and what we were studying as seen in figure 4.1. The presentation then explained the agenda for the day and in greater detail explained the purpose of the first module.

After the presentation we had all participants introduce themselves to each other, including name, what they were studying and with who. This introduction of participants was done in order to make people more relaxed and more comfortable with each other. The hope was that this introduction would ease up the tension and make the participants feel more comfortable. During the workshop we experienced no problems of this kind. After the presentation the groups were announced and some reconfiguration of the room was done to allow for a better setup for group work. Figure 4.2 shows the way groups were working. After this, a short presentation of what should happen next was given to participants.

Figure 4.3: One of the groups preparing a prototype for their idea.

Module 1 - Brainstorming

The groups were advised to start discussing their problems or reasons they had for personally not cooking at home and then brainstorm ideas to overcome these. We walked around the room and tried to help the groups during this phase, with ideas and inspiration if needed. At the end of this session, a summery of the survey was handed out to each of the groups, giving them a quick look at the data produced by the survey. The reason for not giving them this information at the beginning was to avoid forcing issues on them. If they were handed this survey data from the start they might have focused on problems identified in the survey. The survey hand-out was hence meant as a source of inspiration for the groups after they had had their initial discussion of problems they have encountered. Participants were free to study the survey data themselves if they needed inspiration. This hand-out can be seen in appendix C.

Short presentation of the research in the field

After lunch, a short presentation was given, informing participants of the research done within the field of IT in the domestic kitchen. For this presentation, the literature table created in section 2.5 was used. We presented the areas of focus identified by the group while making the literature study, along with the major trends identified. The presentation was meant as a source of inspiration, to enable participants to keep discussing more ideas. After the presentation, handouts was handed out. Whereas the presentation covered a summary of the focused areas of the research done within this field, the handouts described some of the actual systems developed for the kitchen. See appendix E for an example of a spreadsheet used during the workshop.

Module 2 - Mature ideas

After the presentation groups were advised to use this to see if any new ideas would emerge, if not the goal of module two was for the groups to start maturing their ideas. At this point our hope was that groups had several ideas for how the kitchen could be improved.

Figure 4.4: One of the groups presenting their idea.

Groups should then select a couple of ideas and start maturing these. Maturing them meant that we would like for them to be more descriptive as to how their idea worked, how the their idea should be incorporated into the kitchen and possibly what the interface of their idea should be like. Finally, the groups were informed that they should prepare a quick presentation of their ideas. To help them visualize the ideas to the other groups, we advised the groups to create rough paper prototypes of their ideas.

Present ideas to each other

After groups had matured their ideas and created paper prototypes of these, they presented these for each other. Some of the groups had focus on one idea while others had more ideas. During the presentation we asked groups to present the idea they found the most promising. After the presentation groups were allowed to ask each other questions to help the group further develop the idea or to clarify certain aspects of their idea.

Module 3 - Conceptualize ideas

Finally, the groups were asked to write down their idea on a piece of paper specifically made for this purpose. This paper can be seen in appendix D. This would allow for us to be able to analyze and evaluate the ideas afterwards. Participants were then asked to leave all notes and papers used throughout the day, in order for us to be sure we would not miss any of the ideas they had generated during the day.

4.3 Results

The following section will describe the problems identified by the different groups attending the workshop. Following this will be a short description of the ideas generated during the workshop and the main ideas generated by the groups. Appendix F shows a set of papers representing the data collected from each of the groups after the workshop finished.

Several problems were identified as reasons for not cooking at home. These were as follows:

- Physical surroundings, e.g. lack of an oven or lack of table space.
- Lack of time, e.g. lack of time to do the actual cooking or lack of time to plan for a meal.
- The need for shopping.
- Expiration date on groceries, e.g. the need to use certain groceries before they expire.
- Lack of healthy food.
- Boring to only cook for oneself.
- Lack of inspiration.
- Forget ingredients, e.g. when grocery shopping or when cooking.
- Get frozen food from the freezer in time.
- Know when a dish is to old to be eaten.
- Boil over or burn food.

In total, 12 problems for not cooking at home were identified during the workshop. Of these 12 problems, three were identified by multiple groups, namely the need to do grocery shopping and the lack of inspiration.
As well as problems, several ideas were generated to help make students want to cook their own meals. The following list shows a brief description of all of the ideas generated during the workshop. Following this will be a presentation of the main ideas generated by the groups.

1. A system consisting of a screen which people can interact with through voice commands. The system should be able to generate meal suggestion based on several parameters such as, difficulty, healthiness or cost of recipes. The user is then able to interact with the system and inform whether he wants an easy or difficult recipe, whether or not the recipe should be healthy or if the recipe should be cheap. The user can either inform the system of all parameters or some of these. The system generates a shopping list for the user and shows the recipes to the user.
2. Meal planning system which is able to generate a meal plan based on numerous parameters such as number of days that needs to be planned for, how much time one has available for cooking, healthiness of the meals etc.
3. Device to measure bacteria in food or nutritions in food.
4. Device to prevent water boiling over and burnt food.
5. Device that helps when tasting food. This device is configurable in several ways, if persons using this device like salty food, the device could be configured to test if enough salt has been added to the dish.

6. Oven connected to a freezer. Via mobile telephone it should be possible to inform the freezer of a food item that should be transferred to the oven. A mechanism will then bring the food item from the freezer to the oven.

7. System to recommend recipes and guide the user through the chosen recipe.

8. Point system. A system with inspiration from the tv-show 'Til middag hos...'. where people are invited to dinner and then rate the food. The idea is to have kind of a league, where people can invite other people to participate. People are then able to either cook for other participants in the league or attend a dinner hosted by someone else. Points are then given by participants to the host based on the quality of the food.

9. Sociable refrigerator. A system with keeps track of the food in the refrigerator. People are able to share this information with other people using this system. The system is then capable of recommending people to dine together if they have ingredients the other person needs to cook a specific recipe.

A total of nine ideas for improving the likelihood of students cooking more at home was identified during the workshop. Following is a presentation of the groups main ideas.

Group 1

The first group focused on the problem of people finding it too hard and time consuming to cook. In addition to this, they focused on the problem of using all groceries in the refrigerator. The system they imagined would be able to help users in a fashion where the user has the possibility of deciding how difficult the recipes should be, how expensive, how healthy and how long they should take to prepare. They imagine that their system would avoid people throwing away food because of expired expiration date, causing more people to cook healthy and in general make more people cook, since the system will make it more manageable and take into consideration the settings one have given the system in terms of difficulty, time to cook and healthiness. The minimize the burden of the user in terms of finding inspiration, recipes that are easy to cook and healthy.

The system itself is a screen controlled with either touch commands or voice commands. The screen could be hung somewhere in the kitchen or placed on a table in the kitchen. The system should, as shown in figure 4.5, have four sliders allowing the user to choose how many days a plan should span, how much time each recipe must take to prepare, the difficulty of the recipe and the healthiness of the recipe.
A 'Random'-button is also available, if the user has no requirements to the generated meal plan, this button can be used to generate a completely random meal plan. Beneath this button is placed an 'Empty the refrigerator'-button which in turn will generate a meal plan that makes sure to use all the groceries found in the refrigerator. It is also possible for the system to find recipes containing certain ingredients, if they are specified in the text field below the 'Empty the refrigerator'-button. Using the 'Generate meal plan'-button located

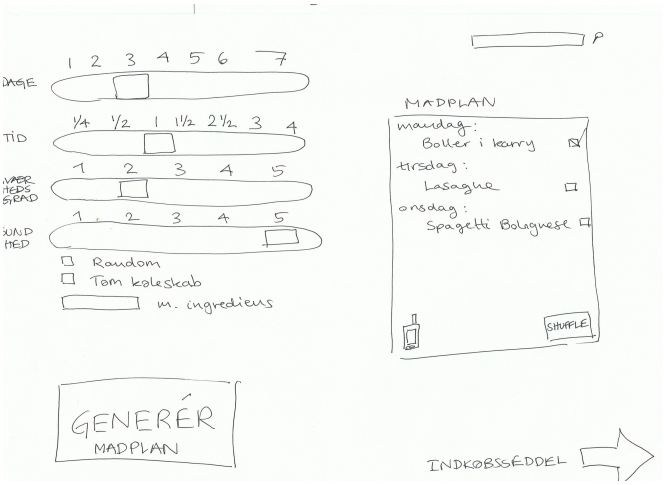


Figure 4.5: Sketch of the interface of the system.

at the bottom left of the screen generate a meal plan using the properties one has given the system. The meal plan is then shown in the display to the right. If recipe suggestions is not satisfying, it is possible to mark one and generate a new recipe. Again, the slider-properties are used for generating the new recipe. This mean, that the user can keep generating new recipe suggestion until a satisfactory meal plan is generated. The 'Shuffle'-button in the bottom right of the meal plan display can be used to shuffle the recipes. The 'Mobile telephone'-icon in the bottom right can be used to send the meal plan to the users mobile telephone. The system can also be used to search for recipes, from the text field in the top right corner of the screen. Finally, the system is able to generate a shopping list for the generated meal plan. This shopping list is either shown on the screen or sent to the users mobile telephone.

Group 2

The second group focused on the problem that they think people find it boring to cook only for themselves. Their goal was to make meal preparation more sociable. They imagined that their system should allow for a more social approach by combining several sociable elements with the cooking. They wanted to combine the competitive element from online manager systems[30] with the element of cooking. The idea is, that users of the system should be able to create leagues. In these leagues they can invite friends, family or people with the same food interest as themselves. People are able to join more than one league. When a league is started, participants are given a certain number of points. The goal of the participants is then to be the user with the highest number of points when the league ends. The end date of the league is decided by the person creating the league. Points can be acquired in different ways, either by bringing food ingredients to a dinner hosted by someone else or by cooking a meal for other participants in the league.

As shown in figure 4.6 the system consist of a portable screen. When a user

starts the system the presentation screen, shown in figure 4.7, is presented to the user. From here the user can either chose to create a new league and invite people to participate, get an overview of leagues currently attended, get recipe suggestions or get recipe suggestion based on what is currently in the refrigerator. Along with these options, the user also has a calender available. This calender is used to view when the user is invited to participate in a dinner with others from the leagues the user is attending. The calender is also used by the user to set up dinners.

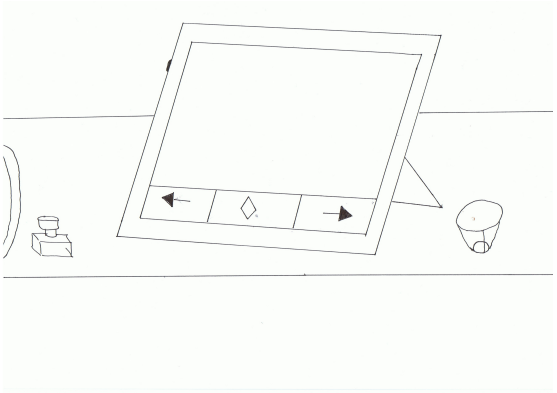


Figure 4.6: Sketch of the physical shape of the system.

When a dinner is setup points are in play. Participants of the dinner are deducted a certain amount of points for participating. Participants can acquire points by bring ingredients needed for the meal the host want to serve. At the end of the dinner, participants are then asked to rate the host' meal. The host is allowed to specify a theme when the invitation is sent to the participants. These themes could be a western theme or drama theme, the only limitation is the ingenuity of the host. Points given are based on their perception of the meal, taste, presentation etc.

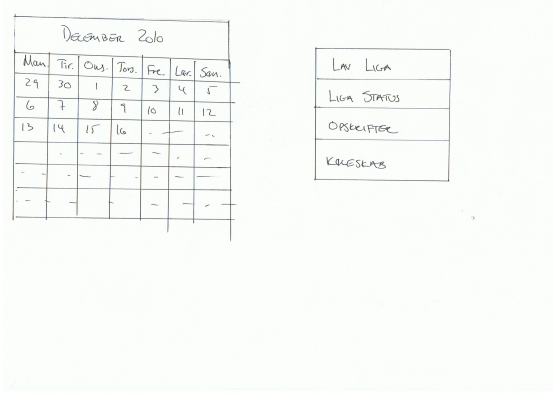


Figure 4.7: Sketch of the menu and calender of the system.

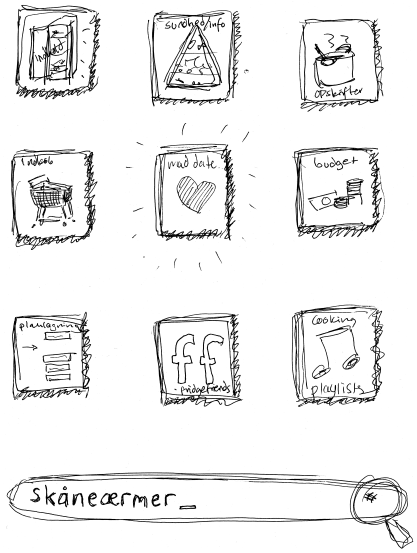


Figure 4.8: Sketch of the menu system.

Group 3

The third and final group focused on the issue of groceries not being used before the expiration date and the fact that it can be difficult to motivate one self to cook a meal everyday. The way they imagine they could solve this problem, was to direct focus on making the task of being in the kitchen more sociable. They came up with a system they named 'FrigdeFriends'. They want to make a system that connect peoples refrigerators in a network. Then a screen is used to interact with the system. Much of the inspiration for 'FrigdeFriends' is taken from is namesake brother 'Facebook'.

In addition to creating a network of refrigerators, the system is also able to manage groceries in the refrigerator. Using this information the system is then able to suggest recipes based on these groceries, suggest friends that have some groceries that can be used to cook a meal together, in their presentation they called these kind of suggestions 'dinner-dates'. Like 'Facebook' people are able to add other people in the system as friends. As can be seen in figure 4.8 the system has a lot more to offer. The system can show information of what is in the refrigerator, nutrition and health information concerning recipes and groceries, act as a shopping list and even generate meal plans.

4.4 Conclusion

Several observations were made during the workshop. First, some very clear observations appeared in the ideas generated by the groups. Much of the attention giving by groups in this workshop was on making the course of creating meals more sociable. Two of the three main ideas, described above, focused on making cooking a sociable event, making it fun to cook and to connect people.

Secondly, two of the three groups also identified the problem of using groceries before the expiration date. It seems participants were getting frustrated over buying groceries and then throwing these away because they expired. This experience of throwing away groceries and food bought with the limited amount of money a student has, seemed as a major reason for some of the participants to not cook.

Thirdly, not so surprisingly as the first two, people wanted systems that were able to inspire them to cook. The obvious solution to this, also used by all three groups, was for the system to be able to generate recipes. Some of the groups wanted systems that were able to generate recipes based on a number of parameters, others wanted a system that suggested recipes based on the groceries at hand and some wanted a system suggesting recipes based on what groceries you and your friends have available, but equal for all systems was that they should be able to inspire the user to cook by providing recipe suggestions in one form or another.

Finally, groups seemed to like the idea of being able to get information about the healthiness of the recipes suggested to them. Even though no group made an explicit remark about system being able to generate healthy recipes, two of the ideas are concerned with whether or not recipes are healthy.

5
Design ideas

Having written a literature study on the subject of IT in the kitchen, carried out a survey of students kitchen habits and held a workshop to determine what students want from an IT system in the kitchen, we are now able to look at how these results relates to one another. The following chapter will describe relations between results, from two or more, of the activities carried out during this project and identify and discuss similarities and differences.

5.1 Similarities

Lack of time

The main issue related to users not cooking at home, identified by the survey was lack of time. 61 of the 68 participants in the survey identified lack of time as a minor or major(36 and 25) problem when it comes to cooking at home. This is the highest number identified for all eight reasons asked as reason for not cooking. No differentiation was found between single participants and participants in a relationship.

Lack of time was not given that much attention during the workshop. However, when looking at section 4.3 it is clear that participants identified the problem of lacking the time to cook at home. Group 1 from the workshop also incorporated a way of telling the system whether the recipes suggested for a meal plan could take half an hour, an hour, two hours etc.. The system would then only consider recipes with preparation time less than the specified.

As mentioned in section 2.2.2 a lot of the research done so far within the field of IT in the domestic kitchen has been on systems helping the user with a specific task or problem during the cooking process. However, most of the systems identified during the literature study would indirectly save the user time.

Expiration date

During the survey 41 of the 68 participants identified the problem of using groceries before the expiration date expired as an issue for not cooking at home. The same issue was identified during the workshop as can been seen in section 4.3. Two of three groups came up with systems that would be able to help

the user use the groceries in the refrigerator. Group 1 made a meal planning system where the user is able to inform the system of what groceries are in the refrigerator and the system can then generate recipe suggestions based on this information. Group 3 made a system that allowed people to connect their refrigerators. Based on the information given by the users of what was in their refrigerators, the system could then come up with ideas that uses these groceries. This can help the users in two ways. First, the system can compare groceries available in other refrigerators and come up with meal suggestions according to this information. Secondly, the system can inform users of what groceries they need in addition to the ones available in order to cook a certain meal. Both of these suggestion helps the user use the groceries in the refrigerator and avoid throwing away any groceries. Group 1's system also had an 'Empty the refrigerator' button that would generate recipe suggestion to empty the refrigerator. During the literature study however, no publication dealing with the problem of using groceries before the expiration date was expired where found.

Inspiration

The first similarity identified was the need for cooking inspiration. 47 out of the 68 participating in the survey answered, that finding inspiration for cooking was difficult. Of these 47, 23 were single and 24 were in a relationship, indicating that whether or not a person is in a relationship do not help with acquiring inspiration for meals. Of these 47, inspiration were at the moment primarily found using the Internet, cookbooks or from friends and family.

During the workshop two of the three groups incorporated some way of inspiring the user to cook into their system. Group 1 made a meal planning system, that inspired people by suggesting recipes for a user-specific number of days. People were then able to alter these suggestions until satisfactory suggestions had been found. These suggestions are based on a number of user adjustable settings such as how healthy the recipe suggestion should be, how long the preparation time for the meal is etc. Furthermore, they also wanted the system to be able to make recipes suggestions based on whatever was available in the refrigerator at any given moment. Group 3 made a system that was able to suggest recipes to the user in two ways. First, the system should also be able to inspire people to cook by suggesting random recipes when the user needed a recipe. Secondly, the system should be able to inspire people to cook by informing the user when a friend had groceries in the refrigerator that combined with the users groceries could make up a meal. This would both inspire the user and promote sociability.

Where participants in the survey and workshop seems to have focused on the need for inspiration, the research done so far within this field does not seem to be as focused on inspiration. As can be seen in the literature table in table 2.5 inspiration has not been identified as a main research area indicating a lack of focus. When analyzing the publications used for this study, three of 16 publications directs attention to the need of inspiring users. One of these publications does actually resemble Group 1's idea. This publication looks at a meal planning system that is able to generate recipe suggestions for a user-specific amount of days based on several user adjustable settings. The two other

publications focused on inspiring each other. The first one did this by making a system that was able to record the cooking process of the user. The user was then able to share this experience with other users of the system and inspire them to cook the same dish. The other system used video conferencing to make user inspire each other to cook. Some similarities can be seen in the systems design by our participants and the research done so far. The two meal planning systems resembles each other.

Healthy food

The survey gave a clear indication of peoples awareness of healthy food. Of the 68 participants only 5 answered that they never bought healthy food. 27 answered they occasionally bought healthy food and 28 answered they often did, while the last 8 said they always bought healthy food. In the same manner only 5 answered they never cooked healthy food, while 25 said they did occasionally and 30 did often. The last 8 answered they almost always cooked healthy food. This showed a trend in people being aware of healthy food and cooking healthy food. During the literature study not many publications were identified dealing with the fact of creating healthy food, only two of the 16 publications dealt with the matter of cooking healthy. The one being a system that allowed the user to keep track of the nutritions in the meal being cooked and the other being a meal planning system that allowed for the user to specify if recipes suggestions should be focused on healthy recipes.

However, during the workshop two of the three groups made clear that their systems should be able to suggest healthy recipes. Group 1 made a meal planning system where the user using a slider could determine how healthy recipe suggestions should be, rating from 1 - not healthy to 5 - very healthy. Group 3 made a system that should be able to suggest healthy recipes, in this system no settings were possible as to how healthy a recipe should be, only if one wanted a healthy recipe or not.

So healthy food seems to be an area that has not received much attention in general, however the survey and workshop conducted in this study identifies healthy food as an area of interest.

Boring to cook for oneself

During the workshop it became apparent that people wanted systems that made the whole process of creating and eating meals more sociable. Group 2 came up with a system where people were motivated to cook for each other by using a point system. The host of the meal was given points by the attending people in terms of the meal and how the day went. Group 3 made a system that allowed refrigerators to communicate. People were able to become friends with other people using the system and their refrigerators were then able to communicate and suggest recipes based on what people had available in their refrigerator. These two systems are aimed at making cooking more sociable and avoid people skipping the home cooked meal cause they find it boring to cook for themselves.

During the survey questions we asked why people did not cook at home. Eight reasons for this was given to the participants, however they also had the possibility to specify reasons other than the eight presented to them. Even though, as mentioned earlier, lack of time and lack of inspirations were the main reasons for not cooking, people also identified the fact that they did not want to cook only for themselves. It seems as people do not want to go through all the trouble of preparing the meal and do the dishes afterwards, if it is only for themselves.

No publications were found dealing with the problem of having to cook for oneself. Most of the publications deals with helping a person through the cooking process, but none of these focuses on the fact that people might find it boring having to go through the entire meal preparation and doing the dishes afterwards when dining alone. This opens for an area where focus in the future could be placed.

5.2 Differences

Social

As mentioned in the section 'Boring to cook for oneself' above, a difference exist between the literature study on one side and the survey and workshop on the other side. Whereas the research done so far seems to not focus on making the experience of cooking meals more sociable, two of the three system designed during the workshop focus primarily on making the cooking process more sociable. This goes in hand with the survey where more people explicitly stated, that the lack of sociability is a main reason for them not to cook home made meals.

Not difficult to cook

Most of the publication identified during the literature study focus on helping the users overcome certain tasks during the cooking process. This could either be help with the actual cooking, help with remembering what and how much has gone into the dish so far or how to prepare multiple meals at the same time etc. However, the survey shows, that people do not find the actual cooking of meals that difficult, 53 of 68 participants answered that the actual cooking was not a problem. Only 3 answered that the cooking was a major problem and the remaining 12 only saw it as a minor problem. Similar observations were made for the workshop. None of the systems made by the participants of the workshop focused on making the process of creating a meal easier. This is in deep contrast to the literature study, where most of the focus has been placed on making system that helps or ease the user while preparing meals at home.

5.3 Conclusion

From the above mentioned similarities and differences areas of interest are able to be deduced. These areas constitutes areas that according to the literature table 2.5 have not been focus as intensely as other areas. The following list list these areas:

- Systems that focus on minimizing time spent in the kitchen.
- Systems that focus on avoiding throwing away groceries because they expire.
- Systems that focus on inspiring the user to cook.
- Systems that focus on creating healthy food.
- Systems that focus on making the process of cooking more sociable.

6 Conclusion

In this project we have tried to establish the current status of the kitchen as it relates to students and the possibilities for IT systems to provide support for kitchen activities. The effect of these systems should be to increase willingness and interest in cooking.

In the problem statement in section 1.1 we posed the following main question with three sub-questions:

- What is the potential for pervasive computing in a student's kitchen with regards to cooking?
  - What HCI research has already been done on the subject of IT in the kitchen?
  - How is the kitchen currently used by students?
  - What features do students want from an IT solution for the kitchen?

In this conclusion we will first answer these sub-questions first and then answer the main question.

What HCI research has already been done on the subject of IT in the kitchen?

We did a literature study to establish the current state of research pertaining to IT in the kitchen. We performed an extensive literature search on The *ACM digital library* and *Springerlink* and cross-referencing using *Google Scholar*. The search yielded 36 articles which were then systematically screened to check that they contained sufficient content and relevance to the field of study. A total of 16 articles were approved in the screening process. We then developed keywords for each article and affinity diagramming was used to construct a literature table. The average robustness was 34.75% on our keywords and 35.48% on groupings over all 16 articles.

From the literature table, which can be seen in section 2.2.2, we were able to conclude that the majority of the articles deal with systems that help the user during cooking and less with activities before and after. Generally most articles focus on Interaction, Visual Aid and User Experience while less research has been done in the area of Artificial Intelligence and Education. Lastly, the majority of systems were designed to support the activities of a single user.

How is the kitchen currently used by students?

To answer this we created a survey which was distributed to the three study programs: Computer Science, Humanistic Informatics and Architecture & Design. 96 students visited the link and of those 68 completed the questionnaire satisfactorily. Unfortunately, the questionnaire distribution over the three study programs was not equally effective, which resulted in participants being predominantly male with 84%.

We were able to determine that the majority of students in our survey almost always cook or prepare breakfast and dinner at home, while it is only a third for lunch. Only a minority found cooking to be so difficult that it presented an obstacle to cooking more frequently. The two biggest obstacles to cooking were found to be a lack of time to cook and finding inspiration for meals.

There was also a great aspiration from the students to cook more healthy food mainly due to a desire to increase their general wellbeing and avoid illness. Lastly, we could conclude that while friends, family and cookbooks are also often used sources of cooking aid and inspiration, the internet is the primary source of aid and inspiration to students and almost a third use their laptop in the kitchen.

What features do students want from an IT solution for the kitchen?

We invited nine students, six male and three female, to be part of a four hour workshop with the purpose of generating design ideas for IT solutions for the kitchen. The participants were students from Computer Science and Architecture & Design. The participants were split into three groups of, two females and one male, one female and two males and an all male group. There were three modules in the workshop: idea generation based on their own experiences in the kitchen and a compilation of selected data, maturing ideas and conceptualization.

From the designs generated by the workshop, we were able to identify some overall observations. Two of the three ideas focused heavily on making cooking a social event that should be fun and help to connect people. There was also a great deal of focus on meal suggestions, either automated meal plan generation from an adjustable set of criteria or through suggestions from friends. The groups also wanted the systems to provide support for cooking healthy food and using previously bought ingredients before they spoil.

What is the potential for pervasive computing in a student's kitchen in relation to cooking?

In the course of this project we have utilized three research methods in an effort to establish possible uses for IT in the kitchen. We have conducted a literature study which explored much of recent research done on the subject. We also distributed a survey to three study programs and found a range of needs and issues that could potentially be addressed by various designs. Lastly we hosted a workshop for nine students in which they were able to come up with several designs that they believe could be beneficial in the kitchen and none of which,

in our opinion, posed insurmountable technical challenges.

We conclude that pervasive computing has a significant untapped potential in the kitchen e.g. by providing a setting where cooking can become an enjoyable and social experience. This could be done by creating leagues where students cook for each other and are then awarded points based on various factors, as was suggested by a group in the workshop. It might also be possible to add a social aspect to cooking by simply setting up a video conferencing system, so friends and family feel like they are cooking with someone else. There is also a potential for meal planning systems that, aside from making it easier to create meal plans, can be a help with inspiration and healthy alternatives.

Limitations

There are some limitations to the results presented in this report and in this section we will go over those we have identified.

Literature study
We found it difficult to find literature on the subject of literature studies and affinity diagramming. Because of this it took longer than anticipated to complete the literature study and the overall quality of the study suffered slightly due to our lack of experience.

Survey
It was difficult to contact the people responsible for survey distribution in other study programs and differences in procedure meant that the survey was not distributed the same way in all three study programs. Distribution through mailing lists, as was the case with Computer Science, was predictably more effective than a post on the intranet at Humanistic Informatics and Architecture & Design. As a result the vast majority of responses were male students from Computer Science, which makes it hard to generalize our findings to the overall student population.

Our lack of experience in designing surveys has left us with small gaps in our results which have made it hard to follow some observations through to an informed conclusion.

Workshop
We had problems finding people to participate in our workshop. We asked participants in the survey to consider being part of our workshop, however, only five students entered their contact information and only one answered the follow-up email asking for confirmation. Due to scheduling conflicts the remaining respondent from the survey was not able to attend either. Because of this the participants in the survey were mainly students that were also friends or acquaintances, which could potentially have had an effect on the results of the workshop.

7 Future Work

Throughout this report we have presented specific design ideas, resulting from our research. In this chapter we will discuss our ideas for future work with focus on those general concepts that could be used to motivate people to cook more.

7.1 The effects of reward systems

One of the more fascinating ideas resulting from the workshop was the idea of a point based reward system to motivate people. Some of the ideas generated by our workshop are utilized the concept of points. This could potentially be paired with a number of other ideas. A point based reward system could e.g. motivate people to eat and cook healthy food. It could also be combined with the desire for weight loss and award points for exercise in addition to eating healthier. Several other ideas such as meal planning could be included to make it easier for the user to cook and eat healthy food.

By creating a system such as the one described above, or parts of it, we could setup an experiment to measure the effects of a point based reward system on the motivation of the users to cook more at home.

7.2 The Social Aspect

Observations from our workshop and survey point to the social aspect as a main area of interest and in indeed social networks such as *Facebook.com* has become increasingly popular in recent years. It would be interesting to explore new and interesting ways of combining social aspects with cooking. We could create a stand-alone system like a webpage specifically for social cooking. It could also be interesting to develop a so-called 'App' for an existing social network like *Facebook.com* as it instantly has a very large potential user group and tools designed for sharing such 'Apps' with friends. Such a system would not necessarily need to be very complex but could focus on a single concept such as recipe sharing or planning dinner dates.

7.3 In General

In chapter 5 we present all the similarities and differences between our research methods. All of the areas covered by these similarities could potentially be interesting to explore further.

8 Bibliography

[1] Pernille Glavind Olsson livsstil.guide.dk. Nu er det traadloese koekken her. http://livsstil.guide.dk/K%C3%B8kken/Design/Opskrifter/Inspiration/Isenkram/Nu_er_det_tr%C3%A5dl%C3%B8se_k%C3%B8kken_her_1831696 checked: 02-01-2011.

[2] Jeppe Christensen pcworld.dk. Droemmeland for it-noerden: Ikea's fremtidskoekken. http://www.pcworld.dk/art/100679?a=rssreader&i=230 checked: 02-01-2011.

[3] OUH. Litteraturstudier. http://www.ouh.dk/wm134761 checked: 03-01-2011.

[4] ACM. Acm digital library. http://portal.acm.org/dl.cfm?CFID=4306525&CFTOKEN=92951221 checked: 03-01-2011.

[5] SpringerLink. Springerlink. http://www.springerlink.com/home/main.mpx checked: 03-01-2011.

[6] Google. Google scholar. http://scholar.google.dk/ checked: 03-01-2011.

[7] Kim Fiedler. Sw9mm. http://projects.kimfiedler.dk/projects/sw9mm checked: 06-01-2011.

[8] Hao-hua Chu Bing-Yu Chen Pei-yu Chi, Jen-hao Chen. *Enabling nutrition-aware cooking in a smart kitchen.* ACM, 2007.

[9] Johan Aberg. *An evaluation of a meal planning system: ease of use and perceived usefulness.* British Computer Society Swinton, 2009.

[10] Peter Russell Jan Borchers Sarah Mennicken, Thorsten Karrer. *First-person cooking: a dual-perspective interactive kitchen counter.* ACM, 2010.

[11] Elizabeth D. Mynatt Quan T. Tran, Gina Calcaterra. *Cooki¿½s Collage: Di¿½ji¿½ vu Display for a Home Kitchen.* 2005.

[12] Andreas Butz Lucia Terrenghi, Otmar Hilliges. *Kitchen stories: sharing recipes with the Living Cookbook.* Springer-Verlag London, 2007.

[13] Mark Newman Joshua Palay. *SuChef: an in-kitchen display to assist with "everyday" cooking.* ACM, 2009.

[14] Hao-hua Chu Jane Yung-jen Hsu Cheryl Chen Tung-yun Lin Chieh-yu Chen Keng-hao Chang, Shih-yen Liu and Polly Huang. *The Diet-Aware Dining Table Observing Dietary Behaviors over a Tabletop Surface.* Springer Berlin, 2006.

[15] Reto Wettach Eva Burneleit, Fabian Hemmert. *Living Interfaces The Impatient Toaster.* ACM, 2009.

[16] Alexis Maldonado Radu Bogdan Rusu Michael Beetz-Benedikt Hï¿½rnler Gerhard Rigoll Matthias Kranz, Albrecht Schmidt. *Context-aware kitchen utilities.* ACM, 2007.

[17] Ichiro Ide Shin'ichi Satoh Shuichi Sakai Hidehiko Tanaka Reiko Hamada, Jun Okabe. *Cooking navi: assistant for daily cooking in kitchen.* ACM, 2005.

[18] Ted Selker Leonardo Bonanni, Chia-Hsun Lee. *CounterIntelligence: Augmented Reality Kitchen.*

[19] Chia-Hsun Lee Leonardo Bonanni. *The Kitchen as a Graphical User Interface.* ACM, 2004.

[20] Noyuri Mima Itiro Siio, Reiko Hamada. *Kitchen of the future and applications.* Springer-Verlag Berlin, 2007.

[21] Takuya Funatomi Yoko Yamakata Koh Kakusho Michihiko Minoh Atsushi Hashimoto, Naoyuki Mori. *Smart Kitchen: A User Centric Cooking Support System.*

[22] Yuichi Nakamura Hideki Aoyama, Motoyuki Ozeki. *Smart cooking support system based on interaction reproducing model.* ACM, 2009.

[23] Jose H. Espinosa Henry Lieberman Ted Selker Chia-Hsun Jackie Lee, Leonardo Bonanni. *Augmenting Kitchen Appliances with a Shared Context using Knowledge about Daily Events.* ACM, 2006.

[24] Balanced Scorecard Institute. Affinity diagram. `http://www.balancedscorecard.org/Portals/0/PDF/affinity.pdf` checked: 03-01-2011.

[25] Niels Ebbe Jacobsen Morten Hertzum. The evaluator effect: A chilling fact about usability evaluation methods. `http://www.informaworld.com/smpp/content~db=all?content=10.1207/S15327590IJHC1501_14` checked: 06-01-2011.

[26] Harry Hochheiser Jonathan Lazar, Linjuan Heidi Feng. *Research Methods in Human-Computer Interaction.* Wiley, 2010.

[27] Google. Google documents. `https://www.google.com/accounts/ServiceLogin?service=writely&passive=1209600&continue=http://docs.google.com/&followup=http://docs.google.com/&ltmpl=homepage` checked: 06-01-2011.

[28] Ramboell. Survey-xact. `https://www.survey-xact.dk/` checked: 06-01-2011.

[29] Oxford University Press. Oxford dictionaries. http://oxforddictionaries.com checked: 06-01-2011.

[30] Football Association Premier League Limited. Fantasy premier league. http://fantasy.premierleague.com/ checked: 04-01-2011.

Part I

Appendices

A
Keywords

These are the keywords made by Martin Pedersen along with the once he discarded:

1. Nutrition(x2), LCD display(x2), user-centric(x2), Healthy cooking(x2), Weight sensor(x2), cabinet(x2), stove(x2), counter(x2), recognize cooking activities
   Discarded: Meal preparation, Cooking process, Digital feedback, Food ingredients, Raise awereness

2. Meal planning(x2), Recipe suggestions(x2), Healthy cooking, Nutrition
   Discarded: Ease of use, Perceived usefulness, Food consumption behavior, Cost

3. Confidence(x2), teaching(x2), touch screen(x2), display(x2), step-by-step, audio/video(x2), lower recipe complexity, Counter
   Discarded: Beginners and advanced hobby chefs, Adjustable information depth, Touch-sensitive overlay in the kitchen counter, Dual-perspective, Computer-aided cooking, happiness(????), Display embedded in the kitchen counter, Interactive kitchen counter, Screen behind the stove

4. Memory aid(x2), Visual summary(x2), LCD panel, video recording/playback(x2), recent events(x2)
   Discarded: Real time, Components distributed and embedded within the home kitchen, 'Memory slips', Experimental evaluation method

5. Collaboration(x2), communication(x2), audio/video recording(x2), fun(x2), creativity(x2), system-centric, touch screen(x2), projector(x2), Teaching(x2), Sharing
   Discarded: intimacy, education, Cooking as a social activity, Cultivate communication and collaboration, people's cooking experiences recordable and shareable, Cross-cultural, Cross-generational fertilization, Visible technology, Device to share their favorite recipes, Available for others, the cook talks aloud, providing instructions and performing her/his 'kitchen story', the device projects the recorded video of activities onto the kitchen wall, Design process, Evaluation

6. display(x2), meal planning, suggestions, social recipe sharing(x2), meal ideas

Discarded: Everyday cooking practice, Observations, Evaluation, Suggestions to help users find cooking inspiration, More details, including a shopping list and a full recipe, Suggest meals to friends

7. health(x2), weight(x2), RFID(x2), sensor-embedded tabletop(x2), user input, food consumption tracking(x2)
   Discarded: Diet-aware dining table that can track what and how much we eat, Dining table augmented with two layers of weighing and RFID sensors, Weight-RFID matching algorithm to detect and distinguish how people eat, Experiments, Evaluation, Monitoring the dietary behaviors of individuals potentially contribute to dietaware healthcare, No digital access devices needed in order for human users to interact with this digital dietary service, Many table participants, RFID, RFID surface can obtain nutritional information, Calorie, Weighing surface for measuring amount of food transferred across different containers and amount of food consumed by an individual, Divide tabletop surface into multiple cells, Common sense semantics(where single-cell-concurrent-interactions problem occour)

8. AI, kitchen appliance(x2), emotional response(x2), life-like(x2)
   Discarded: Living Interfaces, Signalizes hunger through nervous movements, Evaluation, Explore the acceptance of domestic appliances with character of their own, Interaction strictly based on verbal and gesture-based negotiation

9. knife(x2), cutting board(x2), food recognition(x2), recognize cooking activities(x2), weight sensor(x2), acceleration sensor
   Discarded: Force/torque transducer

10. step-by-step, tree structure, resource management, video/audio tutorials(x2), learning(x2), effectiveness(x2), scalable, system-centric, Cooking assistance, Text
    Discarded: Questionair, Multiple recipes(Cooking in parallel), Novice/advanced users, Multimedia information, cooking

11. virtual recipe(x2), projected interface(x2), infrared temperature sensor(x2), refrigerator cam(x2), light-based inventory, water temperature lighting(x2), Increase confidence
    Discarded: Multiple tasks, Cabinet, Counter, Augmented surfaces, Vision recognition, Webcam, Projected images

12. projected interface(x2), user-positioned information table(x2), contextual information, water temperature lighting, danger awareness, interactive floor
    Discarded: Overlay of digital information, Augmented Objects/surfaces, Information annotation of kitchen, Sink, Social floor, Tabletop projection, Projector, Dishwasher, Automated multimedia reminder

13. learning, teaching, video-conference, web-recipes, cooking instructions, foot-switches(x2), image/audio recording(x2), remote cooking support
    Discarded: Computer-augmented environment, Videoconferencing instructions, Interactive cooking, Sink, Stove, Preparation spaces, LCD,

Camera, Microphone, Internet connectivity, Remote communication, Socializing, Record cooking, Memo to explain

14. user-centric(x2), food recognition(x2), cooking step recognition(x2), camera(x2), thermal camera(x2), cooking step categorization, Tree-structure recipe
    Discarded: Recognition techniques

15. interaction, interactions patterns(x2), adapted support, recognizing skill level(x2), visual and verbal aid
    Discarded: visual- audio sensors, Motion detector, Voice detector

16. kitchen appliances, networked appliances(x2), proximity sensors(x2), interaction prediction, temperature sensor, pressure sensor, Action recognizion
    Discarded: Sensored home appliances, Augmented surfaces, Action recognizion

These are the keywords Martin Myrup made along with the once he discarded:

1. Nutrition(x2), Smart cabinet(x2), LCD display(x2), Smart Counter(x2), Smart stove(x2), Meal preparation, Cocking process, Healty cooking(x2), Weight sensors(x2), Digital feedback, Food ingridients, User-centric(x2), Raise awereness, Recognize cooking activities
   Discarded: Food ingridients

2. Accessibility, Meal planning(x2), Ease of use, Recipe suggestions(x2), Healthy cooking, Food consumption behavior, Nutrition, Cost
   Discarded: Iteratively refine settings, Perceived usefulness

3. Computer-aided cooking, Increase user confident/happiness(x2), Multidisplay(x2), Dual-perspective, Interactive kitchen counter, Teach about food preparation(x2), Support with textual, visual, and audio information while cooking, Beginners and advanced hobby chefs, Touch screen(x2), Step-by-step
   Discarded: Unravel the complexity of recipes, Screen behind the stove, Display embedded in the kitchen counter, Adjustable information depth, Touch-sensitive overlay in the kitchen counter

4. Memory aid(x2), Visual summary of activities(x2), Capturing countertop activity, LCD panel, Real time, Video recording/playback, Presenting recent events(x2)
   Discarded: Components distributed and embedded within the home kitchen, Experimental evaluation method, 'Memory slips', Visual summery

5. Collaborative cooking(x2), Share cooking experiences, Educate other/education, Communication(x2), Fun(x2), creativity(x2), Socialize, Audio/video recording(x2), Sharing recipies, Touch screen(x2), Camera and a projector(x2), Augmented surfaces, System-centric
   Discarded: Intimacy, Cultivate communication and collaboration, Cross-cultural, Cross-generational fertilization, Allows users to record, annotate and play back cooking sessions, Visible technology, Device to share their

favorite recipes, Available for others, Record, playback, fast forward, backward and pause, Teaching mode, the cook talks aloud, providing instructions and performing her/his 'kitchen story', Learning mode, the device projects the recorded video of activities onto the kitchen wall, Design process, Evaluation, collaboration(skal med)

6. Meal ideas, Sharing of recipes, In-kitchen displays(x2), Suggestions(x2), Socialization(x2), Meal planning
   Discarded: Everyday cooking practice, Observations, Evaluation, More details, including a shopping list and a full recipe, social sharing(er under socialization)

7. Food consumption tracking(x2), Sensor-embedded tabletop(x2), Healthy eating(x2), RFID(x2), Nutrition awarness

8. Living Interfaces, Emotional Interaction(x2), Kitchen Appliance(x2), Life-like behaviour(x2), AI, life-like
   Discarded: Signalizes hunger through nervous movements, Evaluation, Explore the acceptance of domestic appliances with character of their own, Interaction strictly based on verbal and gesture-based negotiation

9. Knife(x2), Cutting board(x2), Food recognition(x2), Weight sensors(x2), Acceleration sensor(x2), Recognize activities(x2)
   Discarded: Detect activities

10. Cooking assistance(x2), Step-by-step,Tree-structure, Resource management, Video/audio tutorials(x2), Learning(x2), Optimize cooking procedure(x2), Scalable, System-centric, Cooking in parallel, Novice/advanced users
    Discarded: Improve cooking skills, Multimedia information, Text, video and audio

11. Virtual recipe(x2), Projected interface(x2), Infrared thermometer for pans(x2), Projected information, Refrigerator cam(x2), Light-based inventory, Water temperature lighting(x2), Sink, Multiple tasks, Increase confidence, Cabinet, Counter, Vision recognition, Webcam
    Discarded: Increase confidence, Virtual Recipe, Augmented surfaces, Faucet water temperature

12. Augmented Objects/surfaces(x2), User-positioned information table(x2). Contextual information(x2), Water temperature lighting, Danger awareness, Interactive floor(x2), Sink, Projector, Dishwasher
    Discarded: Information annotation of kitchen, Automated multimedia

13. Learning, Teaching, Video-conference(x2), Web-recipes, Cooking instructions, Foot-switches(x2), Image/audio recording(x2), Remote cooking support, Computer-augmented environment, Interactive cooking, Sink, Stove, LCD, Camera, Microphone, Internet connectivity, Remote communication, Socializing, Record cooking, Memo to explain images, sound and video
    Discarded: Preparation spaces

14. User-centric(x2), Food recognition(x2), Recognizing cooking action(x2), Cameras(x2), Thermal camera(stove)(x2), cooking step categorization, Tree-structure recipe
    Discarded: Recognition techniques

15. Interaction, Interactions patterns(x2), Adapted support, Recognizing skill level, Support by recognizing, visual/audio sensors, Images, text, visual and verbal aid, Motion detector, Voice detector

16. Networked appliances(x2), Proximity sensors(temperature/pressure)(x2), Interaction prediction(x2), Augmented surfaces
    Discarded: kitchen appliances, Sensored home appliances(x2)

B
Groupings

Healthy cooking	**Meal Planning**	**Classic display**
(1, Nutrition(x2)), (1, Healthy cooking(x2)), (2, Nutrition), (2, Healthy cooking), (7, health(x2)), (7, food consumption tracking(x2)*)	(2, Meal planning(x2)), (2, Recipe suggestions(x2)), (6, meal ideas), (6, suggestions), (6, meal planning), (12, virtual recipe(x2)), (14, web-recipes), (14, cooking instructions), (7, food consumption tracking(x2)*)	(1, LCD display(x2)), (4, LCD panel), (6, display(x2)), (3, display(x2)),
Augmented equipment	**Activity tracking**	**System-centric**
(1, cabinet(x2)), (1, stove(x2)), (1, counter(x2)), (3, Counter), (9, cutting board(x2)), (17, networked appliances(x2)), (17, kitchen appliances), (8, kitchen appliance(x2)), (9, knife(x2)),	(9, recognize cooking activities(x2)), (9, food recognition(x2)), (1, recognize cooking activities), (15, cooking step recognition(x2)), (15, food recognition(x2)), (17, Action recognition), (16, recognizing skill level(x2)), (7, RFID(x2)), (15, cooking step categorization), (16, interactions patterns(x2)), (17, interaction prediction),	(11, system-centric), (16, interaction), (5, system-centric), (7, user input), (14, foot-switches(x2)), (5, touch screen(x2)), (3, touch screen(x2)),
		User-centric
(1, Weight sensor(x2)), (17, proximity sensors(x2)), (17, temperature sensor), (17, pressure sensor), (9, weight sensor(x2)), (9, acceleration sensor), (7, sensor-embedded tabletop(x2)), (12, infrared temperature sensor(x2)), (7, weight(x2)), (12, refrigerator cam(x2)), (15, camera(x2)), (15, thermal camera(x2)), (5, projector(x2)),	(4, Memory aid(x2)), (4, recent events(x2))	(1, user-centric(x2)), (15, user-centric(x2)),
Efficiency		**Learning**
(11, effectiveness(x2)), (11, resource management), (15, Tree-structure recipe), (11, tree structure),	(4, Visual summary(x2)), (13, contextual information), (16, visual and verbal aid*), (13, user-positioned information table(x2))	(14, learning), (11, learning(x2)), (11, tutorials), (3, lower recipe complexity), (3, Confidence(x2)), (12, Increase confidence), (11, Cooking assistance), (16, adapted support), (3, step-by-step), (11, step-by-step),
	Teaching	**Interactive AI**
(5, creativity(x2)), (5, fun(x2)),	(14, teaching), (5, Teaching(x2)), (3, teaching(x2))	(8, AI), (8, life-like(x2)), (8, emotional response(x2))
Audio/Video		**Projected environment**
(5, audio/video recording(x2)), (3, audio/video(x2)), (11, video/audio(x2)), (4, video recording/playback(x2)), (14, image/audio recording(x2)), (16, visual and verbal aid*)	(13, interactive floor)	(13, projected interface(x2)), (12, projected interface(x2)), (13, water temperature lighting), (12, water temperature lighting(x2)), (12, light-based inventory),
Communication		
(14, video-conference), (5, communication(x2)), (5, collaboration(x2)), (6, social recipe sharing(x2)), (5, Sharing), (14, remote cooking support),	(13, danger awareness)	

Figure B.1: Groupings made by Martin Pedersen

Sensor
-Weight sensors(x2)(1)
-Sensor-embedded tabletop(x2)(7)
-RFID(x2)(7)
-Weight sensors(x2)(9)
-Acceleration sensor(x2)(9)
-Infrared thermometer for pans(x2)(12)
-Visual/audio sensors(16)
-Motion detector(16)
-Voice detector(16)
-Sensored home appliances(x2)(17)
-Proximity sensors(temperature/pressure)(x2)(17)

Recognition
-Recognize cooking activities(1)
-Food recognition(x2)(9)
-Recognize activities(x2)(9)
-Vision recognition(12)
-Food recognition(x2)(15)
-Recognizing cooking action(x2)(15)
-cooking step categorization(15)
-Support by recognizing(16)
-Recognizing skill level(16)
-Food consumption tracking(x2)(7)

Projection
-Camera and a projector(x2)(5)
-Refrigerator cam(x2)(12)
-Webcam(12)
-Projector(13)
-Camera(14)
-Microphone(14)
-Cameras(x2)(15)
-Thermal camera(stove)(x2)(15)

Augmented surfaces
-Augmented surfaces(5)
-Living Interfaces(8)
-Projected interface(x2)(12)
-Augmented Objects/surfaces(x2)(13)
-Tabletop projection(13)
-Computer-augmented environment(14)
-Augmented surfaces(17)
-Capturing countertop activity(4)
-Projected information(12)
-Information annotation of kitchen(13)

Socialize
-Collaborative cooking(x2)(5)
-Share cooking experiences(5)
-Socialize(5), Sharing recipies(5)
-Sharing of recipes(6)
-Socialization(x2)(6)
-Video-conference(x2)(14)
-Remote cooking support(14)
-Remote communication(14)
-Socializing(14)
-Image/audio recording(x2)(14)
-Record cooking(14)
-Communication(x2)(5)

Ease of use
-Ease of use(2)
-Increase user confident/happiness(x2)(3)
-Memory aid(x2)(4)
-Presenting recent events(x2)(4)
-Cooking assistance(x2)(11)
-Resource management(11)
-Increase confidence(12)
-Memo to explain images, sound and video(14)
-Images, text, visual and verbal aid(16)

Kitchen appliance
-Smart stove(x2)(1)
-Kitchen Appliance(x2)(8)
-Knife(x2)(9)
-Cutting board(x2)(9)
-Sink(12)
-Sink(13)
-Dishwasher(13)
-Sink(14)
-Stove(14)
-Networked appliances(x2)(17)

Display(split op?)
-LCD display(x2)(1)
-Multidisplay(x2)(3)
-Dual-perspective(3)
-Touch screen(x2)(3)
-LCD panel(4)
-Touch screen(x2)(5)
-In-kitchen displays(x2)(6)
-LCD(14)

Kitchen furniture
-Smart cabinet(x2)(1)
-Smart Counter(x2)(1)
-Interactive kitchen counter(3)
-Cabinet(12)
-Counter(12)
-User-positioned information table(x2)(13)
-Interactive floor(x2)(13)
-Foot-switches(x2)(14)

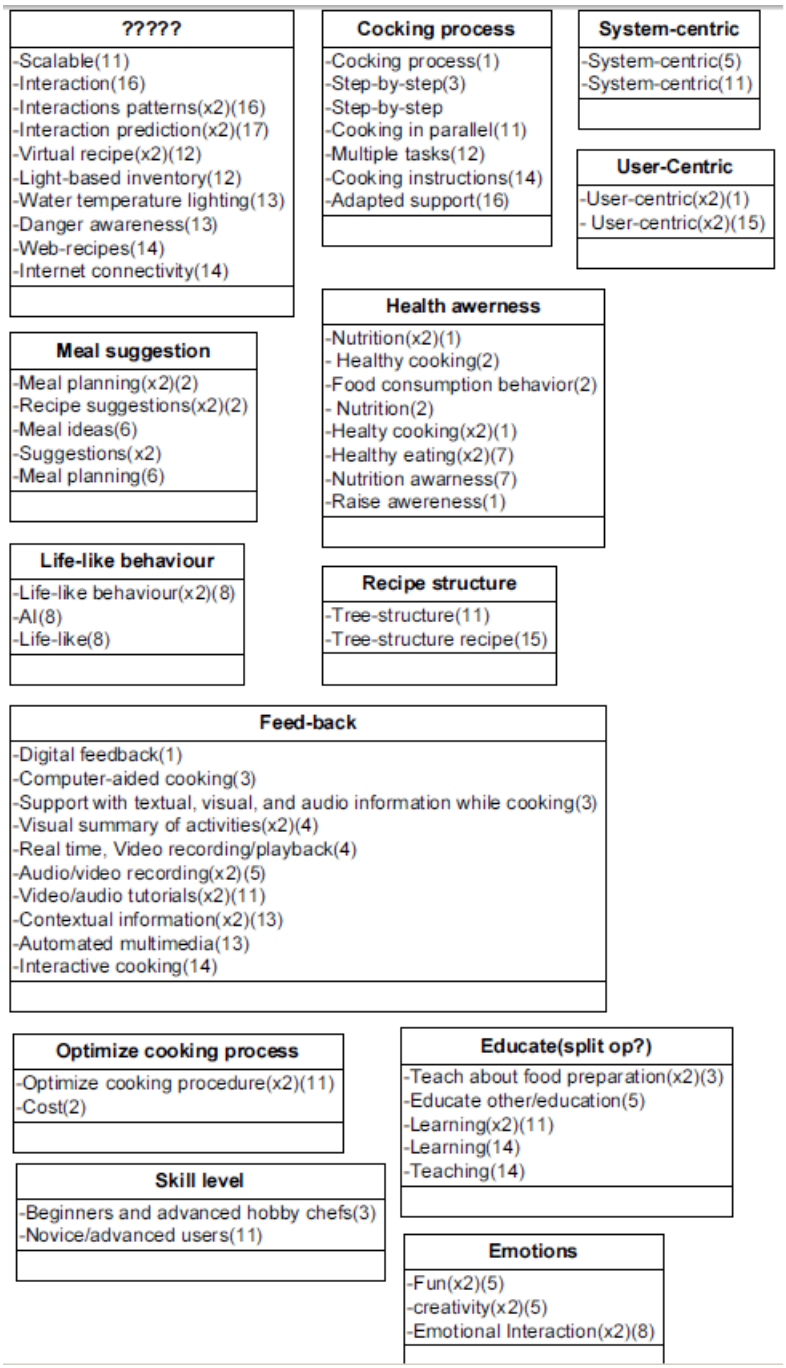


Figure B.2: Groupings made by Martin Myrup

C

Survey Summary

Contents

Survey data

General information

Approximate kitchen size.

	Respondenter	Procent
Small (0-5 m2)	35	51,5%
Medium (6-10 m2)	26	38,2%
Large (More than 10 m2)	7	10,3%
I alt	68	100,0%

Approximate kitchen wall space.

	Respondenter	Procent
0 - 1 m2	34	50,0%
1 - 3 m2	21	30,9%
3 m2 or more	13	19,1%
I alt	68	100,0%

Number of hotplates.

	Respondenter	Procent
None	0	0,0%
1 - 2	16	23,5%
3 - 4	52	76,5%
5 or more	0	0,0%
I alt	68	100,0%

Cooking frequencies

Food cooked or prepared from home.

	Respondenter	Procent
Never	1	1,5%
Occasionally	9	13,2%
Often	33	48,5%
Almost always	25	36,8%
I alt	68	100,0%

Breakfast cooked or prepared from home.

	Respondenter	Procent
Never	13	19,1%
Occasionally	8	11,8%
Often	6	8,8%
Almost always	41	60,3%
I alt	68	100,0%

Lunch cooked or prepared from home.

	Respondenter	Procent
Never	10	14,7%
Occasionally	22	32,4%
Often	15	22,1%
Almost always	21	30,9%
I alt	68	100,0%

Dinner cooked or prepared from home.

	Respondenter	Procent
Never	1	1,5%
Occasionally	6	8,8%
Often	16	23,5%
Almost always	45	66,2%
I alt	68	100,0%

Obstacles to cooking

Not enough time.

	Respondenter	Procent
Not a problem	7	10,3%
A minor problem	36	52,9%
A major problem	25	36,8%
I alt	68	100,0%

Do not like cooking.

	Respondenter	Procent
Not a problem	44	64,7%
A minor problem	17	25,0%
A major problem	7	10,3%
I alt	68	100,0%

Too difficult.

	Respondenter	Procent
Not a problem	53	77,9%
A minor problem	12	17,6%
A major problem	3	4,4%
I alt	68	100,0%

Not enough time to shop.

	Respondenter	Procent
Not a problem	30	44,1%
A minor problem	26	38,2%
A major problem	12	17,6%
I alt	68	100,0%

Do not feel like making the trip to and from the shop.

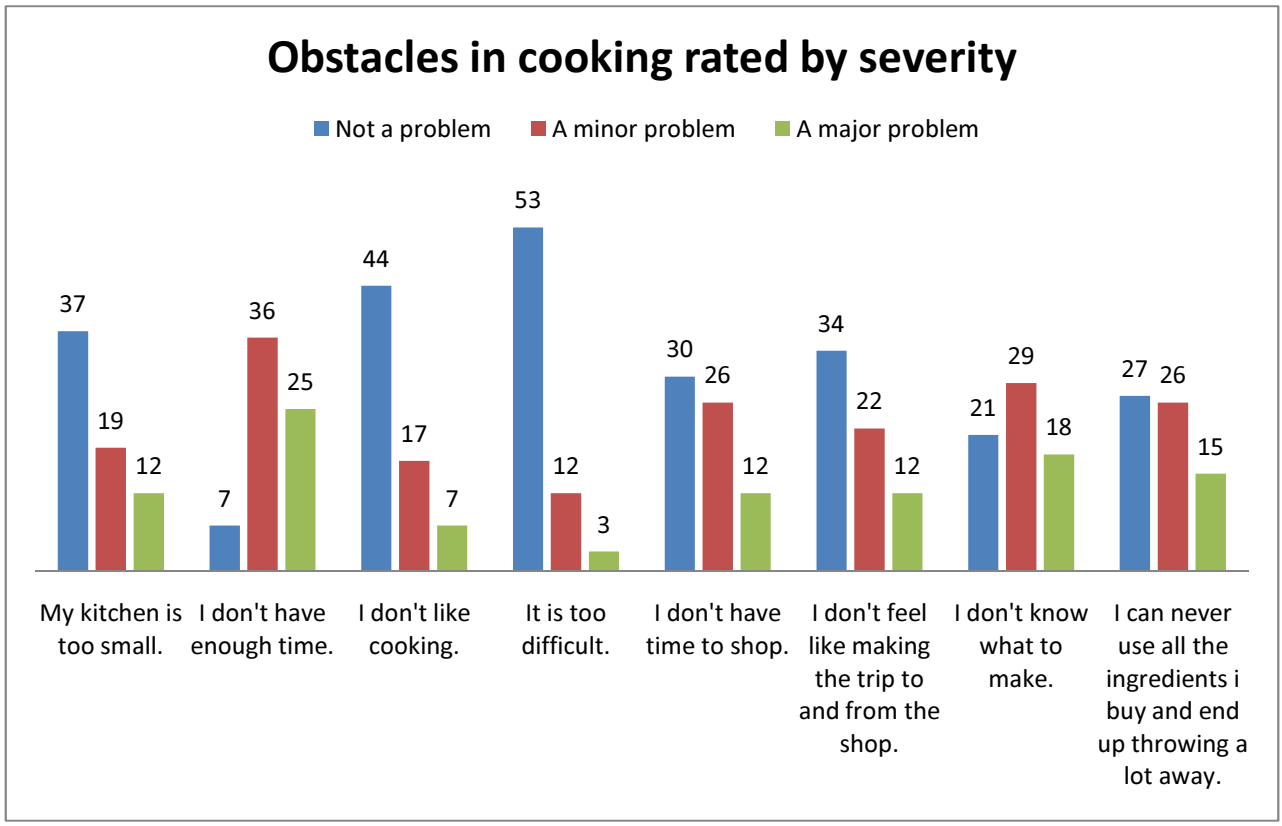
	Respondenter	Procent
Not a problem	34	50,0%
A minor problem	22	32,4%
A major problem	12	17,6%
I alt	68	100,0%

Do not know what to make.

	Respondenter	Procent
Not a problem	21	30,9%
A minor problem	29	42,6%
A major problem	18	26,5%
I alt	68	100,0%

Can never use all the purchased ingredients and end up throwing a lot away.

	Respondenter	Procent
Not a problem	27	39,7%
A minor problem	26	38,2%
A major problem	15	22,1%
I alt	68	100,0%



Healthy cooking

Healthy food cooked or prepared currently.

	Respondenter	Procent
Never	5	7,4%
Occasionally	25	36,8%
Often	30	44,1%
Almost always	8	11,8%
I alt	68	100,0%

Desire to cook more healthy food in the future.

	Respondenter	Procent
Yes	41	60,3%
No	27	39,7%
I alt	68	100,0%

Reasons for cooking more healthy food.

	Respondenter	Procent
I would like to lose weight	16	41,0%
To avoid illness	23	59,0%
Eating healthy makes me feel better	29	74,4%
I just like to know that I'm eating healthy	19	48,7%
I alt	39	100,0%

Current information sources

Inspiration found on the internet.

	Respondenter	Procent
Never	5	7,4%
Occasionally	26	38,2%
Often	21	30,9%
Almost always	16	23,5%
I alt	68	100,0%

Inspiration found in cookbooks.

	Respondenter	Procent
Never	10	14,7%
Occasionally	29	42,6%
Often	27	39,7%
Almost always	2	2,9%
I alt	68	100,0%

Inspiration found through friends and family

	Respondenter	Procent
Never	7	10,3%
Occasionally	33	48,5%
Often	27	39,7%
Almost always	1	1,5%
I alt	68	100,0%

Inspiration found through TV-shows.

	Respondenter	Procent
Never	49	72,1%
Occasionally	12	17,6%
Often	6	8,8%
Almost always	1	1,5%
I alt	68	100,0%

Inspiration found through restaurant visits.

	Respondenter	Procent
Never	49	72,1%
Occasionally	18	26,5%
Often	1	1,5%
Almost always	0	0,0%
I alt	68	100,0%

Help for cooking problems found on the internet.

	Respondenter	Procent
Never	7	10,3%
Occasionally	17	25,0%
Often	24	35,3%
Almost always	20	29,4%
I alt	68	100,0%

Help for cooking problems found through cookbooks.

	Respondenter	Procent
Never	16	23,5%
Occasionally	27	39,7%
Often	20	29,4%
Almost always	5	7,4%
I alt	68	100,0%

Help for cooking problems found through friends and family.

	Respondenter	Procent
Never	7	10,3%
Occasionally	20	29,4%
Often	32	47,1%
Almost always	9	13,2%
I alt	68	100,0%

General concept evaluation

Interacting with a cooking aid system through touch screen.

	Respondenter	Procent
Very bad	8	11,8%
Bad	20	29,4%
Neither good nor bad	13	19,1%
Good	22	32,4%
Very good	5	7,4%
I alt	68	100,0%

Interacting with a cooking aid system by issuing voice commands.

	Respondenter	Procent
Very bad	7	10,3%
Bad	12	17,6%
Neither good nor bad	15	22,1%
Good	24	35,3%
Very good	10	14,7%
I alt	68	100,0%

Getting cooking information from a monitor mounted on the wall.

	Respondenter	Procent
Very bad	2	2,9%
Bad	4	5,9%
Neither good nor bad	15	22,1%
Good	31	45,6%
Very good	16	23,5%
I alt	68	100,0%

Getting cooking information from a monitor standing on the counter top.

	Respondenter	Procent
Very bad	4	5,9%
Bad	17	25,0%
Neither good nor bad	29	42,6%
Good	13	19,1%
Very good	5	7,4%
I alt	68	100,0%

D

Concept Schema

Koncept skema

Problemet

Beskriv, det problem I vil forsøge at løse.

Systemet

Beskriv, hvordan jeres system løser det ovennævnte problem. Gerne først med et kort overblik over systemet, efterfulgt af eventuelle detaljer om den fysiske opsætning samt hvordan I forestiller jer, systemet skal fungere.

Fremhæv detaljerne

Er der noget, I mener, er specielt godt eller smart ved jeres system? Evt. noget, som I selv mener, skiller sig ud eller håndterer en bestemt problemstilling godt.

E

Handout

Artikel: Enabling nutrition-aware cooking in a smart kitchen

Generel ide:

Ideen med Smart Kitchen er at forbedre den traditionelle måde vi laver mad på, ved løbende at informere om næringsinholdet i de ingredienser der tilføjes den mad man er ved og lave.

I praksis:

For at gøre dette muligt har de tilføjet en LCD skærm i køkkenet og vægt-sensorer i bordet, køkkenskabet og kogepladerne.
Disse deles op i to elementer, et element til at genkende madlavningsprocessen og det andet til feedback omkring næringsindhold i ens mad.

Den første del:
Køkkenskabet har vægt-sensorer til at holde styr på vægten af de forskellige køkkenredskaber således at det er muligt at holde styr på hvor meget af en ingrediens der puttes i maden, uden at medtage køkkenredskabets vægt.
Køkkenbordet og kogepladerne og har også vægt-sensorer til at holde styr på hvor meget af de forskellige ingredienser der tilføjes til det man er ved og lave eller om madvare overføres fra et køkkenredskab til et andet.

Den anden del:
Som det er nu, bliver brugeren selv nød til at indtaste informationer om ingredienser første gang det bruges til madlavning, men i fremtiden er det meningen at køkkenet skal kunne genkende det automatisk vha. RFID chip, tale kommandoer eller computer genkendelses teknikker og derefter hente næringsinformationer ud af en offentlig database.

Chili with Beans

Nutrition Facts

Serving Size: 1 cup (253 g)
Servings per container: 2

Calories 260	Calories from Fat 72
	% Daily Value
Total Fat 8g	13%
Saturated Fat 3g	17%
Cholesterol 130mg	44%
Sodium 1010mg	42%
Total Carbohydrate 22g	7%
Dietary Fiber 9g	36%
Sugars 4g	
Protein 25g	

Infrastruktur med vægt-sensorer i køkkenskabet, køkkenbordet og kogepladerne gør det muligt ved hjælp af en algoritme og holde styr på de forskellige madvarer og hvor de ender. Det er fx muligt og udlede om noget er flyttet fra en skål til en anden eller om noget er flyttet fra en skål til en pande og tilbage igen.
Løbende med der holdes styr på dette, bliver der på LCD displayet i køkkenet vist informationer om hvor mange næringsstoffer der er i det man er ved at bruge og lave.

Det sammen setup er lavet hvor man i stedet for fokuserer på at kigge på kalorier i mad i stedet for næringsindhold.

F

Workshop Notes from Group 3

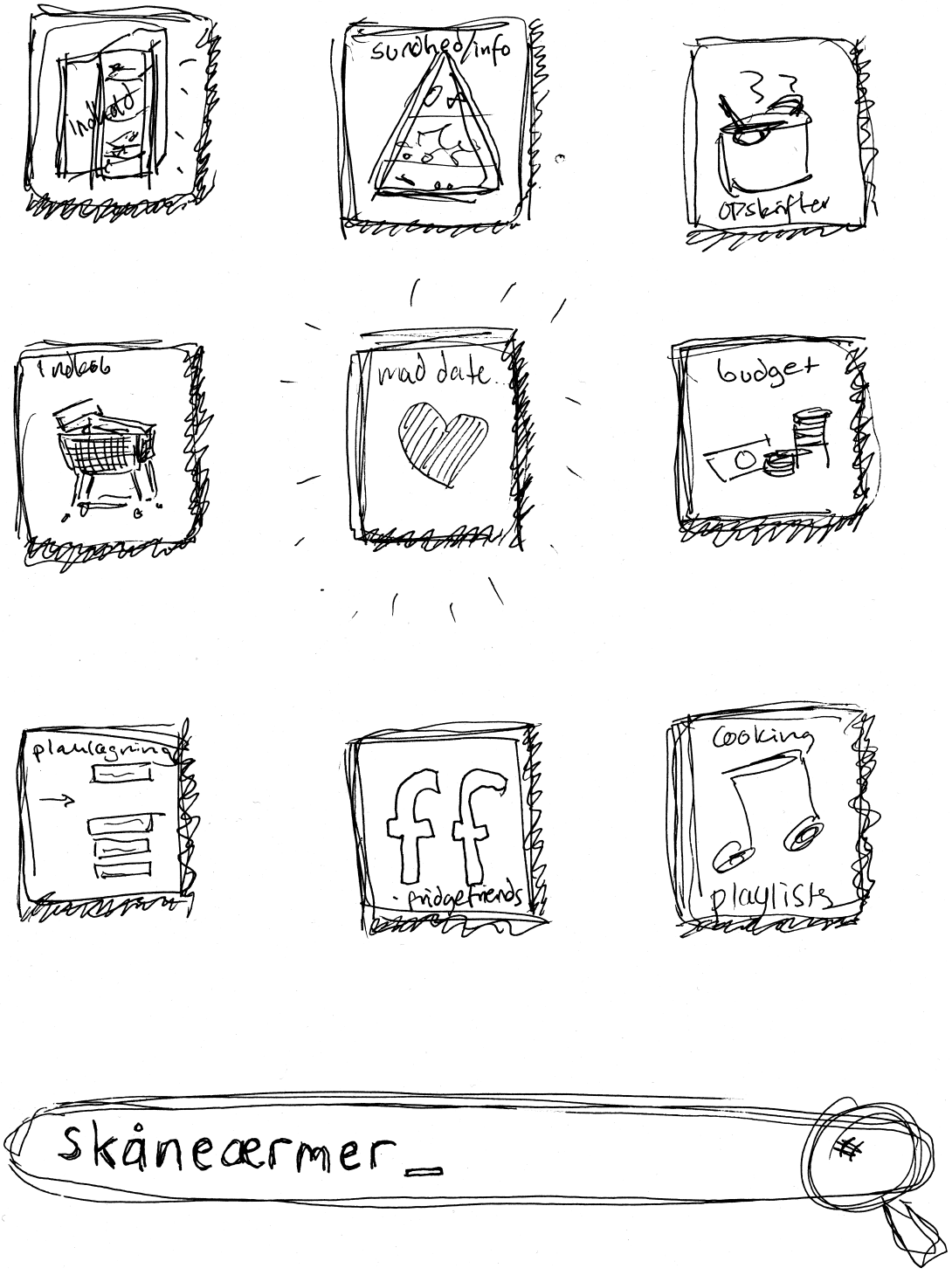


Figure F.1: Sketch of the system.

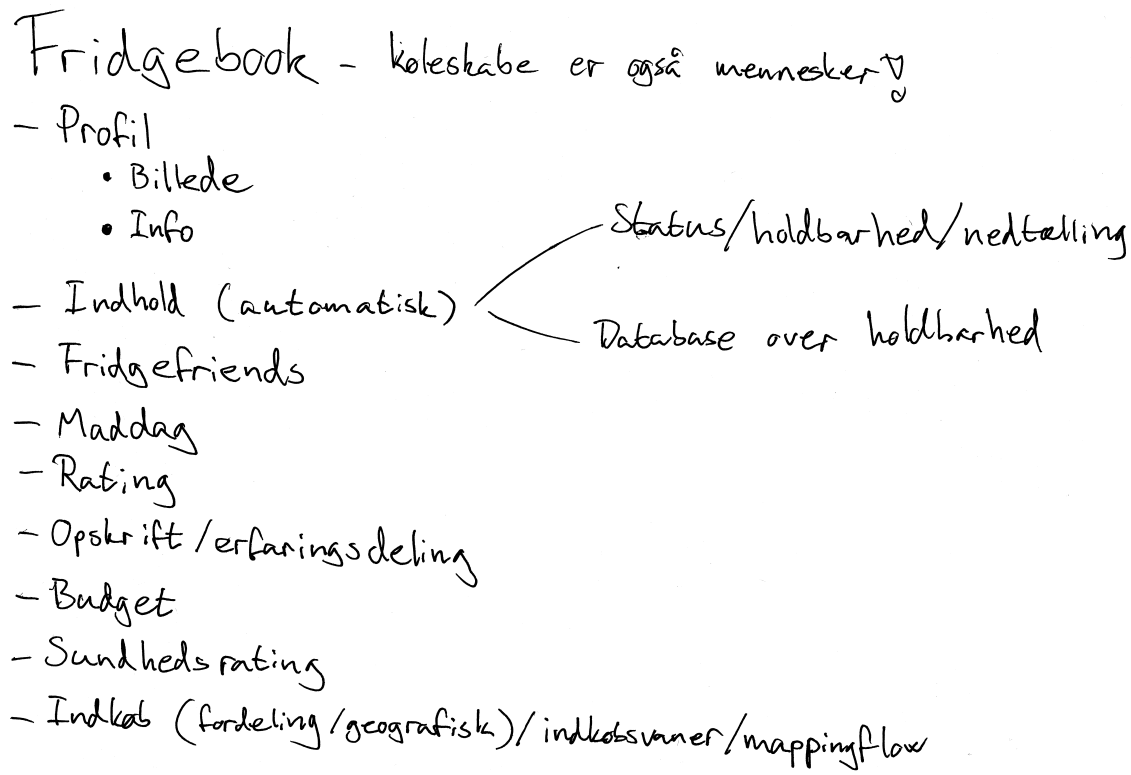


Figure F.2: Ideas for there system.

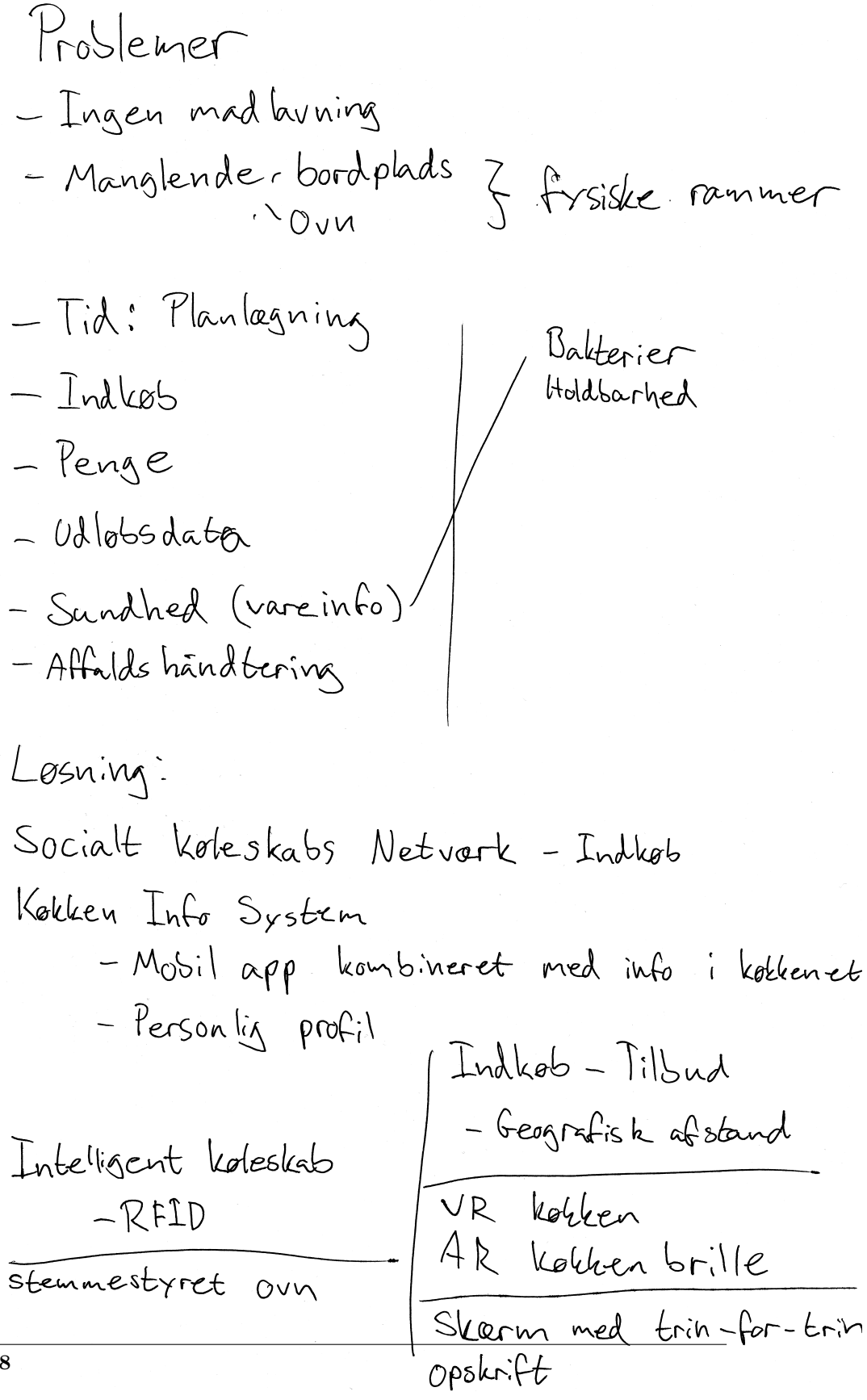


Figure F.3: Problems identified by the group 3.

Koncept skema

Problemet

Beskriv, det problem I vil forsøge at løse.

I en travl hverdag kan det være svært at motivere sig til at lave mad hver dag. Dette gælder især hvis man bor alene, skal købe ind til én person, lave mad til én og spise alene. Derudover er det svært at få brugt alt i køleskabet inden det bliver for gammelt

Systemet

Beskriv, hvordan jeres system løser det ovennævnte problem. Gerne først med et kort overblik over systemet, efterfulgt af eventuelle detaljer om den fysiske opsætning samt hvordan I forestiller jer, systemet skal fungere.

Fridgebook laver et socialt netværk af køleskabe og dets varer. På den måde kan man arrangere maddates med folk (fridgefriends) som evt. har ingredienser der kombineret med ens egne kan udgøre en ret. Systemet består af en stationær "skærm" på køleskabet, samt et system der automatisk holder styr på indholdet. En tilhørende mobil app kunne bruges til holde styr på maddates og indhold på farten.

Fremhæv detaljerne

Er der noget, I mener, er specielt godt eller smart ved jeres system? Evt. noget, som I selv mener, skiller sig ud eller håndterer en bestemt problemstilling godt.

Det overordnede koncept er det sociale, men systemet kan nemt udbygges.

PS: God hjemmeside for information om ALLE! madvarer: madlog.dk

Figure F.4: Concept schema filled out with information about group 3's idea.