Tailoring Large Interactive Public Displays For University Students
Abstract

Nowadays, communication technologies are becoming increasingly advanced, digital media have the capability of supporting communication processes, increasing the speed, saving time and reducing the consumption of natural resources in order to help the environment. Amongst new technological and digital communication devices, large interactive public displays are seeing increased popularity. These kinds of displays are used for different purposes such as advertising or showing maps in different contexts such as a shopping mall and even in the aerospace industry (in NASA).

Choosing functions for large interactive displays depends on the domain of use: private, semi-public or public use. Furthermore, functions depend on the business and information need of the setting. Moreover, these devices should be aligned with cultural expectations related to the place.

This study tried to find the needs that a large interactive public display can respond to, in support of internal communication and information sharing of students at a higher education organization. The aim was to obtain ideas for the exploitation of large interactive public display systems in such settings.

For this purpose I studied scholars’ experiences in the literature about large displays. I observed traditional bulletin boards and other media used at the area of Linnaeus University as an international university. I tried to evaluate the functions of previous experiences and gather ideas, needs and issues of students that can be responded to by large displays. The emphasis was on gathering creative ideas as much as possible. This can help to bring the young field of large interactive public displays to more maturity. In order to reach that aim a combination of data collection methods were used: Observation, a creativity workshop and interviews with international students. The data gathered from those methods was analyzed by the help of hermeneutic theory, which is also the underlying philosophy of this research.

The Findings of this research were a collection of functions and ideas that cater to the information needs of students in regard to potential applications for large interactive public displays (LIPDs). Some categories of ideas are for example general information about the university and studying, about campus life and the university area, translation of the content, or posting subjects to gather comments or votes.

Keywords: Large Interactive Public Displays, Internal Communication at Universities, Ubiquitous Computing, Creativity Workshop
Acknowledgements

- Thank you Lord. You have made it happen.

- It is easy to believe friends are God’s guardian angels when you have friends such as ”Samira Atashi”, “Lars Lorenz”, “Hamid Kashfi” and ”Fariba Ghoutaslou”. Thank you so much! It was not possible without you.

- I would like to thank my supervisor Dr. Birgitta Fagerström-Kareld for helping me in doing this thesis.

- I would also like to express my gratitude to Prof. Christina Mörtberg for her encouragement for studying the subject of this thesis at the beginning.

- I would like to thank my parents for a lifetime support and also my dear brother “Jousef” who reviewed my thesis and gave me some valuable comments.

- Special thanks to all the participants of this research.

- Last but not least thank to my dear friend in Växjö campus for their friendship and the great time that I had with them.

Mehrnaz Amirjani

Växjö, 2013
# Table of Contents

Abstract ........................................................................................................................................... 3  

Acknowledgements .......................................................................................................................... 4  

Table of Figures .................................................................................................................................. 9  

Table of Tables ................................................................................................................................... 10  

1. INTRODUCTION ............................................................................................................................. 11  
   1.1. BACKGROUND AND PROBLEM AREA .................................................................................... 12  
   1.2. OBJECTIVE AND RESEARCH QUESTION ............................................................................... 15  
       Research Question ....................................................................................................................... 15  
   1.3. JUSTIFICATION ...................................................................................................................... 15  
   1.4. TARGET GROUP OF THE STUDY ........................................................................................... 16  
   1.5. LIMITATIONS/DELIMITATIONS ............................................................................................. 16  
   1.6. DISPOSITION ......................................................................................................................... 17  

2. REVIEW OF THE LITERATURE ....................................................................................................... 19  
   2.1. INTERNAL COMMUNICATION ............................................................................................... 19  
   2.2. UBQUITOUS COMPUTING ...................................................................................................... 21  
   2.3. LARGE INTERACTIVE PUBLIC DISPLAYS ............................................................................... 23  
   2.4. SYSTEM CHARACTERISTICS AND REQUIREMENTS ............................................................. 25  
       2.4.1. Requirement Engineering .................................................................................................. 26  
           2.4.1.1. Requirement Elicitation and Analysis ............................................................................. 27  
           2.4.1.1.1. Requirement Gathering in Participatory Design .......................................................... 33  
           2.4.1.1.2. Experiences on Creativity Workshops ......................................................................... 31  
       2.4.2. Participatory Design .......................................................................................................... 32  
           2.4.2.1. Requirement Gathering in Participatory Design .......................................................... 33  
           2.4.2.1.1. Future Workshops ...................................................................................................... 33  

3. IDEAS FROM THE LITERATURE ABOUT LARGE DISPLAYS ....................................................... 35  
   3.1. ANYTIME, ANYPLACE ACCESS .............................................................................................. 35  
   3.2. CONTENT MANAGEMENT ....................................................................................................... 35  
       3.2.1. Categorization .................................................................................................................. 36  
       3.2.2. Content Administration or Gate Keeping ............................................................................ 36  
       3.2.3. Different Access Levels for Content Input .......................................................................... 36  
       3.2.4. Keeping the Content Updated and Removing Outdated Content ...................................... 37  
       3.2.5. Archiving .......................................................................................................................... 37  
       3.2.6. Particular Content in Multiple Displays or Several Times on One Display ......................... 38  
   3.3. INFORMATION TAKE-AWAY AND FORWARDING THE INFORMATION ............................ 38  
   3.4. NEWS, EVENTS, AND ADVERTISEMENTS .......................................................................... 39  
   3.5. PRESENTATION OF SCHEDULES ......................................................................................... 40  
   3.6. PRESENCE AWARENESS ....................................................................................................... 40  
   3.7. MAPS AND DIRECTIONS ...................................................................................................... 41  
   3.8. INFORMATION OF RESTAURANTS ...................................................................................... 42  
   3.9. VOTING AND COMMENTING ABOUT A SUBJECT .................................................................. 42  
       Using Nicknames for Commenting ............................................................................................... 43  
   3.10. EMERGENCY AND INSTANT MESSAGES .......................................................................... 43  
   3.11. PERSONALIZATION OF THE CONTENT ............................................................................. 43  
   3.12. LIPD AT LIBRARIES ............................................................................................................. 44  

## INTRODUCTION

1. BACKGROUND AND PROBLEM AREA

The study focuses on the potential of large interactive public displays (LIPDs) to enhance communication and collaboration in various settings. The primary problem area is understanding how LIPDs can be effectively integrated into daily communication processes. The study's background sets the stage for the research question by providing an overview of the current landscape of LIPD usage and the challenges associated with it.

2. REVIEW OF THE LITERATURE

2.1. INTERNAL COMMUNICATION

The literature review begins with an examination of internal communication practices, exploring how LIPDs can be used to improve information dissemination and collaboration within organizations. This section outlines the importance of communication in modern organizations and how LIPDs can facilitate more effective communication.

2.2. UBQUITOUS COMPUTING

Moving into ubiquitous computing, the review highlights the role of LIPDs in creating a seamless digital experience for users. This includes the integration of mobile devices, sensors, and other technologies to enhance information access and interaction.

2.3. LARGE INTERACTIVE PUBLIC DISPLAYS

Large interactive public displays (LIPDs) are a primary focus of the literature review. This section examines the design, functionality, and usability of LIPDs, along with case studies demonstrating their implementation in various contexts.

2.4. SYSTEM CHARACTERISTICS AND REQUIREMENTS

This part of the review delves into the technical aspects of LIPDs, including system characteristics and requirements. It covers topics such as network infrastructure, user interface design, and the integration of LIPDs into existing systems. The section also discusses the importance of participatory design in the development of LIPDs, emphasizing user involvement and feedback throughout the design process.

2.4.1. Requirement Engineering

2.4.1.1. Requirement Elicitation and Analysis

Requirement elicitation and analysis are crucial steps in the participatory design process. This subsection discusses methods for collecting and analyzing requirements from stakeholders, ensuring that LIPDs meet the needs of their intended users.

2.4.1.1.1. Requirement Gathering in Participatory Design

Techniques for gathering requirements in participatory design settings are explored, including brainstorming, workshop facilitation, and participatory prototyping.

2.4.1.1.2. Experiences on Creativity Workshops

Experiences from creativity workshops show how the collaborative environment can facilitate creative problem-solving and innovation in LIPD design.

2.4.2. Participatory Design

Participatory design is a central theme in the review, focusing on the role of stakeholders in the design process. This section discusses the benefits of involving users, designers, and other stakeholders from the outset to ensure that LIPDs are user-centered and effective in their intended settings.

2.4.2.1. Requirement Gathering in Participatory Design

This subsection elaborates on the process of gathering requirements through participatory design, including the use of workshops and other collaborative methods.

2.4.2.1.1. Future Workshops

The review outlines future directions for participatory design, highlighting areas for improvement and new approaches to involving stakeholders in the design of LIPDs.

3. IDEAS FROM THE LITERATURE ABOUT LARGE DISPLAYS

3.1. ANYTIME, ANYPLACE ACCESS

This section explores the potential of LIPDs for providing access to information anytime, anywhere. It discusses various access levels and strategies for maintaining content relevance and currency.

3.2. CONTENT MANAGEMENT

Effective management of LIPD content is crucial for maintaining its utility and relevance. This section examines strategies for content categorization, administration, and gatekeeping, as well as different access levels for content input.

3.2.1. Categorization

3.2.2. Content Administration or Gate Keeping

3.2.3. Different Access Levels for Content Input

3.2.4. Keeping the Content Updated and Removing Outdated Content

3.2.5. Archiving

3.2.6. Particular Content in Multiple Displays or Several Times on One Display

3.3. INFORMATION TAKE-AWAY AND FORWARDING THE INFORMATION

This section addresses how LIPDs can be used to facilitate the take-away and forwarding of information. It covers the importance of archiving and ensuring content is updated and removing outdated content.

3.4. NEWS, EVENTS, AND ADVERTISEMENTS

LIPDs offer unique opportunities to disseminate news, events, and advertisements. This section explores methods for effective news dissemination and event promotion, as well as the role of LIPDs in advertisement campaigns.

3.5. PRESENTATION OF SCHEDULES

The use of LIPDs to present schedules is a practical application. This section discusses how LIPDs can be used to display schedules in various formats, catering to different user needs.

3.6. PRESENCE AWARENESS

LIPDs can provide presence awareness, allowing users to know if someone is available for communication. This section examines how LIPDs can be used to enhance presence awareness, including through visual cues and notifications.

3.7. MAPS AND DIRECTIONS

Maps and directions are essential for LIPDs, particularly in public spaces. This section explores how LIPDs can be used to provide maps and directions, enhancing navigation and wayfinding.

3.8. INFORMATION OF RESTAURANTS

LIPDs can serve as a valuable resource for information about restaurants. This section discusses how LIPDs can be used to provide restaurant information, including reviews and special offers.

3.9. VOTING AND COMMENTING ABOUT A SUBJECT

3.9.1. Using Nicknames for Commenting

Using nicknames for commenting can enhance the anonymity and engagement of online discussions. This section examines the benefits and implementation strategies for using nicknames on LIPDs.

3.10. EMERGENCY AND INSTANT MESSAGES

LIPDs can play a critical role in emergency situations and providing instant messages. This section explores how LIPDs can be used in emergency contexts, including during disasters or other critical incidents.

3.11. PERSONALIZATION OF THE CONTENT

Personalization of content is key for tailoring LIPD outputs to individual users' preferences. This section discusses methods for personalizing content in LIPDs, including through user profiles and adaptive algorithms.

3.12. LIPD AT LIBRARIES

LIPDs in libraries offer unique opportunities to enhance learning and community engagement. This section examines how LIPDs can be used in libraries, including for information sharing, community events, and educational purposes.
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Large Amount of Print Products</td>
</tr>
<tr>
<td>2</td>
<td>Unordered bulletin boards, coverage of print products with other ones and in incomprehensible language for international students</td>
</tr>
<tr>
<td>3</td>
<td>Combination of Boden and Poincare models and techniques (Maiden, Robertson, and Gizikis, 2004, p.3)</td>
</tr>
<tr>
<td>4</td>
<td>Analysis by hermeneutic circle and its relation with data collection and literature</td>
</tr>
<tr>
<td>5</td>
<td>Name of bulletin board categories in Swedish language</td>
</tr>
<tr>
<td>6</td>
<td>Information take away in paper-based bulletin boards</td>
</tr>
<tr>
<td>7</td>
<td>News in Swedish language</td>
</tr>
<tr>
<td>8</td>
<td>Anywhere anytime access</td>
</tr>
<tr>
<td>9</td>
<td>Content management</td>
</tr>
<tr>
<td>10</td>
<td>Information take-away</td>
</tr>
<tr>
<td>11</td>
<td>News, events and advertisements</td>
</tr>
<tr>
<td>12</td>
<td>Teachers’ and TAs’ info</td>
</tr>
<tr>
<td>13</td>
<td>Course, rooms and seminar schedules</td>
</tr>
<tr>
<td>14</td>
<td>Offices contact info</td>
</tr>
<tr>
<td>15</td>
<td>Campus life and information needs of the area</td>
</tr>
<tr>
<td>16</td>
<td>Voting and commenting</td>
</tr>
<tr>
<td>17</td>
<td>Instant/emergency messages</td>
</tr>
<tr>
<td>18</td>
<td>Personalization of the content</td>
</tr>
<tr>
<td>19</td>
<td>Library</td>
</tr>
<tr>
<td>20</td>
<td>General aspect of navigation and use</td>
</tr>
<tr>
<td>21</td>
<td>Ideas about photo albums</td>
</tr>
<tr>
<td>22</td>
<td>Meeting schedule of a research group at the university</td>
</tr>
<tr>
<td>23</td>
<td>An outdated conference announcement - the conference date is 2010 and we are in 2013</td>
</tr>
<tr>
<td>24</td>
<td>University magazines</td>
</tr>
<tr>
<td>25</td>
<td>Summarization of all the ideas</td>
</tr>
</tbody>
</table>
## Table of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>TABLE 1</td>
<td>IDEAS RELATED TO ACCESS TO THE SYSTEM AT ANYTIME AND ANYPLACE</td>
<td>81</td>
</tr>
<tr>
<td>TABLE 2</td>
<td>IDEAS ABOUT CONTENT MANAGEMENT</td>
<td>83</td>
</tr>
<tr>
<td>TABLE 3</td>
<td>IDEAS ABOUT INFORMATION TAKEAWAY</td>
<td>85</td>
</tr>
<tr>
<td>TABLE 4</td>
<td>IDEAS ABOUT NEW, EVENT AND ADVERTISEMENTS</td>
<td>86</td>
</tr>
<tr>
<td>TABLE 5</td>
<td>IDEAS RELATED TO GENERAL INFORMATION ON STUDYING AND THE UNIVERSITY</td>
<td>88</td>
</tr>
<tr>
<td>TABLE 6</td>
<td>IDEAS RELATED TO CAMPUS LIFE AND INFORMATION NEEDS OF THE AREA</td>
<td>91</td>
</tr>
<tr>
<td>TABLE 7</td>
<td>IDEAS ABOUT VOTING OR COMMENTING ON A POSTED SUBJECT</td>
<td>93</td>
</tr>
<tr>
<td>TABLE 8</td>
<td>IDEAS ABOUT INSTANT AND EMERGENCY MESSAGES</td>
<td>94</td>
</tr>
<tr>
<td>TABLE 9</td>
<td>IDEAS ABOUT CONTENT PERSONALIZATION</td>
<td>95</td>
</tr>
<tr>
<td>TABLE 10</td>
<td>IDEAS ABOUT THE LIBRARY</td>
<td>96</td>
</tr>
<tr>
<td>TABLE 11</td>
<td>IDEAS ABOUT GENERAL ASPECT OF NAVIGATION AND USE</td>
<td>97</td>
</tr>
<tr>
<td>TABLE 12</td>
<td>IDEAS ABOUT PHOTO ALBUMS</td>
<td>98</td>
</tr>
<tr>
<td>TABLE 13</td>
<td>SUMMARY OF IDEAS AND FUNCTIONS FOR LIPD APPLICATION FOR LINNAEUS UNIVERSITY STUDENTS</td>
<td>142</td>
</tr>
</tbody>
</table>
1. INTRODUCTION

In this section the study is introduced. Background and problem area, objective and research question, justification, limitations, target group and contribution are presented.

Nowadays processors and computing are embedded in, and distributed through, our entire environment. Every-day and routine tasks with familiar devices are augmented with computing in order to make them easier. The emergence of the internet and new networking technologies enabled the devices to communicate with each other and with other sources of data. New technologies made it possible to have a computerized version of everything - for example, instead of books we now have e-books. Those are the characteristics of the Ubiquitous computing era (Bardram et al., 2010; Kuniavsky, 2010, pp.3-9).

Today we can see many large displays around us - for instance at airports or train stations. Large displays are becoming increasingly popular and they are becoming a part of our ubiquitous environment (Kenton et al., 2003). They are used for various purposes: Non-interactive displays are used as digital versions of bulletin-, advertisement- and notice boards, and also to show the current and past activities of the organization. The usage of displays that users can interact with (interactive displays) has been customized for a variety of groups or individuals, providing different functions for each (Kaviani et al., 2009; Redhead, et al., 2007; Binder, Lowgern & Malmborg, 2009; Izadi et al., 2003).

As the technology of large displays gets more advanced, their prices decrease. (Alt et al., 2011a) The interaction methods with large displays are increasing; nowadays there are touch screens as well as multi-touch screens; which enable more than one user to interact with the displays simultaneously, and to use more than one finger. Large displays can interact with mobile devices; even interacting through hand movements of users is possible via gesture recognition (Vajk, Coulton, Bamford, & Edwards, 2008). Some advancement in technologies made large displays applicable in a variety of places and settings, even outdoors. Among these technologies the most important ones are the internet and seamless technologies of communication such as Bluetooth, and tangible interface as well as bigger display sizes, which increase content visibility for users at a distance.

Scholars considered three categories for displays: private, semi-public and public displays. **Private displays** have no more than pairs of potential users. Private displays are mostly not large, for example monitors at offices or homes (Huang and Mynatt, 2003); the users of private displays are typically familiar with the use of touch screens and computer systems. Besides, some mobile devices with displays, such as cell phones, present private information that only an individual person can see (Olivier et al., 2006). **Semi public displays** have customized applications for small groups of people. They have around 10 potential users in semi-public areas. An example is groupware displays which help people to share information about their work place, for a specific group of people, such as colleagues in a company (Huang and Mynatt, 2003). **Public displays** usually have a large group of potential users, more than twenty people. They are placed in public places like urban areas, shopping malls.
and airports. Large displays are usually public and semi-public displays (Vogel & Balakrishnan, 2004; Olivier et al., 2006; Huang & Mynatt, 2003).

New technologies make it possible to use large interactive public displays (LIPDs) for different tasks. Large interactive public displays as a young type of devices need creative ideas in order to be used beneficiary and to be well exploited. LIPDs can support internal communication and present information that caters to the information needs at the area (Mencarini, Giusti & Zancanaro, 2012). (In all the chapters when I talk about LIPD, I consider the application system which is using LIPD not the hardware as an input/output device. It means the phrase LIPD system, LIPD application or the abbreviation LIPDs have the same in meaning.)

“Internal communication is the exchange of ideas and information within an organization” (Bovee & Thill, 2000, cited in Ragusa, 2010, p.7) and the goal of internal communication is information sharing through internal communication media (Gillis, 2006, p.258-259; Kalla, 2006). Internal communication media has four channels: face-to-face such as meetings, electronic such as using websites, broadcast such as audiovisual programs in a close circuit to provide educational videos, and finally the print channel that includes brochures, flyers and bulletin boards (White, Vanc and Stafford, 2010; Gillis, 2006; Miller, 2012).

This study searches for the proper potential ideas for utilization of large public displays at a university, and for exploiting their digital structure and opportunities that LIPD-related new technologies can bring.

1.1. Background and Problem Area

Scholars found some problems with paper-based notice boards. Alt et al. (2011a) mentioned that paper based notice boards are not well organized. It is not easy to control the content and remove unwanted materials from the boards, something that is not proper for the setting. It is not obvious whoever put the content on the boards, following up becomes difficult. Updating content and removing the outdated ones is not easy and it is hard to decide which one is still relevant and not outdated. Luong et al. (2012) believed that management of postings and collecting information that visitors want to collect is difficult (such as phone numbers, emails or URLs). Besides, the space on the boards is limited. People put their announcements on top of other announcements. People might take some of the content away, before others have had the chance to read it. Besides, some people do not have time to stay and read the relevant information. To summarize, bulletin boards are mostly unorganized (Osamor et al., 2010).

Churchill, Nelson & Denoue (2003) studied the usage of paper based bulletin boards in their context, and related them to internal communication. The scholars concluded that people in small organizations are more inclined to use face-to-face or emails as communication media, for spreading ads and other types of content that can be put on a bulletin board. But in big organizations according to the more prominent position hierarchy, people do not feel comfortable or are not allowed to do that. Therefore, the usage of bulletin boards is more popular in big organizations. Those scholars also studied a problem called intrusion into
**personal digital space.** It means although employees in the study setting considered the content sharing and social communication as a valuable matter, they did not feel comfortable to send or forward any type of email or hyperlinks about their personal interest to other people. Since, employees might get bored or annoyed if they find their own email box full with informal emails from colleagues.

Churchill, Nelson & Denoue (2003) also researched the opportunities for using large interactive public displays in their study. They realized that employees in the investigated organization setting liked to find out about their colleagues and what was happening around them in the organization in a short time, while they are waiting for something or someone, walking around the building or chatting with others. The scholars consider this inclination of employees as an opportunity for using large public displays as a lightweight communication medium, by providing a less intrusive and more public method of sharing information.

These mentioned studies about large displays, their relation to internal communication and considering them as lightweight communication medium, made me think about the state of bulletin boards and the communication issues at the university where I study. There is a large amount of paper used for printed announcements, flyers, brochures and internal magazines (Figure 1 shows an example). Those materials ultimately will end up in the trash after use, will be shredded before use or become outdated. That is a waste of resources (e.g. paper and ink).

![Figure 1- Large amount of print products](image)

I study at an international University in Sweden, with many students from different nationalities. As a student I have seen many notice boards in corridors, full of advertisements and announcements. There are many opportunities lying there which might have a positive role in someone’s life: recruitment announcements, research participation announcements and any other helpful information that can be a new positive stage in student’s life. But for some students these boards and the content are not useful, since they cannot read Swedish. Some announcement may be taken, some maybe get hidden and covered by newer announcements.
(See Figure 2), or some important announcements may be put on boards which are not in the students’ sight.

![Image of bulletin boards with flyers]

**Figure 2: Unordered bulletin boards, Coverage of print products with other ones and in incomprehensive language for international students**

Besides, there are other needs at a University area, such as informing students if a lecture is cancelled when students did not know this before (because they had not checked the official webpage which announces this information). Sometimes a note is put on the classroom door to announce class cancellations. In one case, one of these notes had remained on the classroom door for more than a week, and our class was almost canceled by mistake, because students did not know that it was an outdated announcement. Concerning this issue, Mitchell et al., (2006) believe that traditional electronic services such as emails and other pull-based services where people should check their account in order to retrieve information (to send a request for pulling the messages out of the server) are not appropriate for disseminating sensitive messages such as lecture cancelations, room changes or other emergency messages. There is no guarantee that they will be delivered and checked in a timely manner. In the study of Mitchell et al., (2006) sending SMS was used to announce sensitive messages.
Moreover, at my university, to know about the room of a lecture, students have to check a webpage that presents the courses schedule and the room numbers. But if they forgot to check that, they have to find a computer at the university area, or call a classmate to ask about the place (if they also did not forget their cell phone), these methods are time consuming.

This study was triggered by observed problems related to bulletin boards and communication at the university at which I am studying. Those problems made me think about digital versions of bulletin boards. After some research I found ideas of scholars about supporting internal communication with large interactive digital displays, and exploiting their digital characteristics. Moreover, scholars mentioned usage of large public displays as digital versions of bulletin boards (Kaviani et al., 2009). I concluded that applying large public displays can support internal communication in presenting information needs and sharing information. Therefore, I will search for a solution for those problems, and exploring more opportunities of exploitation of large interactive public displays.

1.2. Objective and Research Question

The objective of this research is to explore ideas for application of large interactive public displays from international students’ perspective at a university, to support internal communication.

In this study the literature is explored in order to find out ideas and functions for the application of large displays in public and semi-public settings. Afterwards students’ information needs, internal communication issues and suggestions are gathered. Moreover, ideas and functions from the literature are evaluated in order to identify if the previously gathered ideas (gathered from the literature) are appropriate from the student’s perspective.

Research Question

- When applying large interactive public displays to support internal communication at a university, what relevant ideas can be identified from the students’ perspective?

1.3. Justification

As a justification for this research I point to my observations at my University, and ideas of scholars which are mentioned in section 1.1 that showed some potential situations to exploit large interactive public displays (LIPDs). Moreover, in the literature research I found out that there are many studies about public displays. The majority of them are assessing the systems which are implemented and finished. However there are few studies about user needs and expectations of large public display systems before the implementation, and among those studies about needs of university students are rare.

This study contributes to the notion of internal communication, ubiquitous computing and large interactive public displays. Since the latter is one of the devices which provide ubiquitous computing, moreover LIPD is a medium that is used for internal communication and usually these two (internal communication and ubiquitous computing) have been studied in relation with large interactive public displays. The workshop of this study is based on
creativity workshop; therefore this study contributes to that concept as well. (Creativity workshops use physiological methods to stimulate creativity of the participants. See section 2.4.1.1.1). Besides, the study contributes to Hermeneutic theory and Hermeneutic circle since they were used as the underlying philosophy and analysis method.

1.4. Target Group of the Study
This research could potentially be beneficiary for Information Systems, computer science and media technology students and scholars, people who might be involved in implementing large interactive public display systems and also researchers in internal communication field and ubiquitous computing.

1.5. Limitations /Delimitations
Basically large interactive Public displays (LIPD) are valuable because of the software systems that they are presenting. Separate from that system, they are just input/output devices. What I have studied and the main concern of this research is the application system, not the hardware.

This research focuses on functions of LIPD applications. Economical aspects of using LIPDs are not included in this research. In this research it is considered that LIPDs are affordable in an unlimited amount, and there can be multiple LIPDs even in one of the university buildings if it is needed.

Implementation and development is not part of this research, since the implementation needs at least financial resources. Explaining technical details of the ideas for the application of LIPDs is not part of this study. Just the title of the ideas and functions, why it’s needed, a brief description, or the problem being solved, are addressed. Student needs are categorized and explained. Moreover, the evaluation of the results is not part of the study.

Only the ideas that lead to functions which the system should support are of concern in this study – for example the capability of sending email. Ideas that concern properties of the LIPD system such as safety or security of the information are not concern of this study. However, if participants persistently emphasized some points that were related to system properties, I shortly mentioned these in the analysis and research result sections.

Internal communication at a university can be between students and the university (including academic staff and administrative staff), between students, or between university staff (including academic staff) and other university staff. Internal communication in this research is limited to internal communication between the university and students (as a group not individually) and students with students. However, the type of information to be shared on LIPDs is up to participants of the study. It means students in their communication with other students or the university might like to inform them about anything.

In addition, Internal communication has divided to four channels which are Electronic, Print, Face-to-Face and Broadcast (Gillis, 2006; White, Vanc & Stafford, 2010; Miller, 2012), which are described more in literature review (See section 2.1). This study focuses on print channel, which includes bulletin boards and their content such as announcements,
advertisements, flyers and notices (Miller, 2012; Gillis, 2006). Although, the emphasize is on the print channel of internal communications, if there are possibilities to support or facilitate other channels that participants mentioned as their needs, they are also considered.

The study focuses on large interactive displays customized for a public place (university). The ideas of applicability, gathered from large public displays besides large semi-public displays, since their functions might also be applicable for public displays. Private displays are not investigated in the literature review. Functions and ideas of digital whiteboards and tabletop displays are not considered in this research, since they have a completely different application.

As one of the methods of data collection I use the creativity workshop which has its background in the field of requirement engineering\(^1\) (see section 2.4.1). However, this research is not using requirement engineering or other related concepts of that field. Implicitly the aim of this research is similar to requirement elicitation and analysis\(^2\) (see section 2.4.1.1). In addition requirement engineering section implicitly helps to understand the study.

1.6. Disposition

In Chapter 2: ‘REVIEW OF THE LITERATURE’. I review subjects related to the study. This section presents information that will be used in the following chapters, especially in Chapter 3 and Chapter 5.

Chapter 3: ‘IDEAS FROM THE LITERATURE ABOUT LARGE DISPLAYS’, contains the functions of large displays that I found in the literature. In public and semi public settings (interactive and non-interactive) the sections and subsections of this chapter will be used as the base for sections and subsections (categories) for presentation in chapters 6 and 7.

In Chapter 4: ‘METHODOLOGY AND METHOD’ the scientific methods for doing the research is described. Philosophical worldview, Research approach, introducing data collection methods and Generalization of the result is explained in this chapter.

Chapter 5: ‘CONDUCTING THE STUDY’, shows how do I conduct the empirical study. The chapter includes sections such as research setting, data collection processes, reliability, validity, ethical considerations and researcher’s role.

In chapter 6: ‘EMPIRICAL FINDINGS’, I present the collected data and its analysis through the categories which are aligned with the categories of chapter 3 with some modifications base on the findings.

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1 “Requirement engineering is the most effective phase of software development process. It aims to collect good requirements from stakeholders in the right way.” (Sommerville, 2011)

2 Requirement elicitation and analysis is a process in which the development team will define the requirements of the system and gain information about the application domain, with the help of potential end users and other stakeholders that collaborate. (Sommerville, 2011)
Chapter 7: ‘RESULTS- IDEAS FOR USING LIPD AT A UNIVERSITY’, Shows the Result of data analysis and answer of the research question. Besides, solution of problems in section 1.1, a table and a diagram help in this chapter to summarize answer of the research question.

Chapter 8: ‘DISCUSSION AND REFLECTION’ presents discussions of findings including discussion on internal communication and ubiquitous computing. Moreover reflection on the use of creativity workshop is discussed.

Chapter 9: ‘CONCLUSION AND CONTRIBUTION’ presents the summary, contributions and opportunities for further research.
2. REVIEW OF THE LITERATURE

In this section, I present information from reviewed books and articles. Some of these sections are presented to make the reader familiar with the related concepts for making the rest of the study comprehensible, such as information on large interactive public displays. The Section “Internal communication” reviews the essential concepts that I will use later. Ubiquitous computing is the concept that embraces the LIPDs. “System characteristics and Requirements” is implicitly related to the objective of this research. Moreover, “Requirement Engineering” is the field that leads to one of the data collection methods of this study.

2.1. Internal Communication

Some of the problems mentioned in Background and Problem Area as well as information needs at the university are related to the concept of internal communication. Besides this, LIPDs have a large potential to cultivate communication (Alt et al., 2011a). Mencarini, Giusti & Zancanaro (2012) believe large public displays affect internal communication of an organization. They also speak about the relation of the large public displays on employee’s views about the organization. For these reasons I mention internal communication alongside public displays.

“Internal communication is the exchange of ideas and information within an organization” Bovee & Thill, 2000, cited in Ragusa, 2010, p.7). Internal communication refers to the social process of communication and the personal interactions among people (Ragusa, 2010, p.7). The goal of internal communication is information sharing which affects the competitiveness of the organization. A substantial matter concerning the success of internal communication is to modify internal communication in response to emergent needs and changing situations. Participation of management and other members in a survey help to define these needs (Gillis, 2006, p.258-259; Kalla, 2006). Strong internal communication effects organization member’s satisfaction. It increases focus, motivation and productivity. Moreover, it has effects on increasing trust in the communication between members and the organization as well as their contribution in performance, credibility and reputation (White, Vanc and Stafford, 2010; Rauch, 2005; Morrison, 2004 cited in Gillis, 2006, p.259; Vasudev, 2013)

Internal communication and the related media are categorized into formal and informal. Formal communication is managed and structured by the organization. Position titles, distance between managers and employees and the related vocabularies are aspects of formal communication (Miller, K., 2012). Informal communication happens on a peer-to-peer or anecdotal level of information sharing. Today’s organizations try to exploit this type of communication more in organizational performance (Gillis, 2006, p.258-259; Ryynänen, Pekkarinen & Salminen, 2012). More employee-driven upward communication is the key of internal communications satisfaction (Gillis, 2006, p.258-259).

The term internal communications (communication in plural) is used to describe channels, technological devices and media, which implement communication (Spence, 1994 cited in Ragusa, 2010, P.7). Internal communications have the role of teaching, work coordination and
relating diverse sets of people (in geographic and cultural aspect) as a group (Gillis, 2006, p.258). There are different tools for facilitation and coordination of internal communications. Recently IT received special attention when looking to provide internal communication tools. Such tools are ones that supply newsletters such as blogs and intranet applications, or tools to present special events: for example spreading an event announcement through emails, memos or websites (Vasudev, 2013). The role of internal communication media is to facilitate and improve the relationship between the organization leadership and internal people with the aim of reaching to the organization goals and strategy. (Gillis, 2006, p.258; Kalla, 2006)

Internal communication media, especially internet have a significant effect on internal communication (Huang, Baptista & Galliers, 2012). These media are a tool for getting feedback from audiences. Internal communications offer channels for providing information for organization audiences, to establish information sharing culture and strengthening members’ roles in achieving goals of the organization. The Information being shared can be about organizational strategy –goals, problems, business environment, career opportunities, activities, achievements, company policies and procedures. Reliability, accessibility and being universal can guarantee the usage of internal communication media. Shared information should be useful, meaningful and valuable (Gillis, 2006, pp. 258-259).

Consequently, a proper choice of media is critical for internal communication and suitable connections between the business plan, management and employees (Gillis, 2006, p.258; Kalla, 2006). However, there is no “one” best method for selecting internal communication media. (Gillis, 2006, p.258-259) In selecting and planning the use of internal communication media we should consider these items: resources and speed of delivery, internal audience’s information needs, expectations and preferences. Therefore, to answer diverse people’s needs, a variety and combination of media might be needed. Internal audience members are employees or members of an organization (Gillis, 2006, p.258; Kalla, 2006). Moreover, a research by White, Vanc and Stafford (2010) showed that organization members are more satisfied when they get information from the organization through different internal communication channels. For example, beside by email they receive information through face- to- face communication or printed announcements.

A geographically disperse organization usually has more complex internal communication. Today many organizations have a multicultural and diverse population. This has a significant effect on the internal communications (media), since organization members prefer to interact with those who are similar to them in language and culture, which affects the information sharing in the organization.


"Corporate communicators in multinational organizations also need to address the issue of multilingualism within their internal population. Failure to address the language needs of internal audiences sends an unintended message of authority and apathy to their communication needs and preferences.”
Scholars categorize the internal communication media into four groups: *print or written, broadcast, electronic* and *live or face-to-face* (White, Vanc and Stafford, 2010; Gillis, 2006; Miller, 2012)

The *live or face-to-face* channel has the highest social presence. Individual meetings and group meetings can enable a direct message from CEO to employees. It can be used for formal and informal communication (White, Vanc and Stafford, 2010; Miller, 2012)

The *print or written* channel is the most traditional one. It includes desk memos, human resource materials such as brochures and policy handbooks, posters and flyers on bulletin boards, guidelines, instructions, employee magazines, formal annual reports, letters and newsletters (Miller, 2012). The print media channel has a low speed in answering the audience needs. Social presence and interaction are also low. Interpretation by each recipient of a message-text varies from person to person. The aim of print media is to increase employee’s and member’s understanding of organizational processes, activity plans and aims as well as employee’s accomplishment of a job and educating employees and organization processes. Of course, this type of medium is effective only for organizations where employees work in one location or at least congregate in a communal location on a regular basis. While this communication channel may seem very low tech in today’s age of electronic media, this can be an effective way of reaching an internal audience with short, timely pieces of information (Gillis, 2006, p.264).

*Audiovisual Programs and Broadcast Media* are becoming necessary for huge organizations. They provide close circuit broadcasts, educational videos, presentations and teleconferences. It is used for employee training. (Gillis, 2006, p.264)

*Electronic Media* appeared with the emergence of internet, e.g., intranet and internet websites and email, blogs and wikis. Electronic Media brings the capability of having all the other types of media in electronic form, either simulated or duplicated. For example Print Media can be simulated in e-newsletters or e-mails (White, Vanc and Stafford, 2010; Gillis, 2006)

Large interactive public displays are devices which can facilitate the print channel of communication, since they are used to simulate bulletin boards. LIPDs assist communication of one person (or organization) to many people (one-to-many communication). (Alt et al., 2011a)

### 2.2. Ubiquitous Computing

Large Interactive Public Displays are related to the subject of Ubiquitous Computing. Ubiquitous Computing, which is also called ambient intelligence or Ubicomp (Bardram et al., 2010, pp.2-11) is the third era in modern computing. The first era was mainframe computing, which is a large time-shared computer, used by many people in an organization. The second era was personal computers, in which a computer is used and owned by a person. In the third era a person uses multiple networked small devices. Ubiquitous computing tries to use computation in familiar devices and environments to increase their usefulness in performing certain tasks. In the Ubiquitous Computing era “computing and data communication are embedded in, and distributed through our entire environment” (Kuniavsky, 2010, pp.3-4)
this era, a person uses and owns many computers. Some examples of the devices in Ubiquitous computing category are smart phones or PDAs (Personal Digital Assistant, or personal data assistant - a mobile device with internet access capability which works as a information manager and for digital note taking (Kot, 2011)), public digital displays and digital signage (similar to digital signs but for presenting multiple advertisements) or even Apple mp3 players and Xerox machines (Diaber et al., 2012, pp.31-40; Kuniavsky , 2010, pp.3-4; Bardram et al., 2010, pp.2-11)

This era leads to many computers being integrated in everyday life. This is in the opposite of virtual reality that tries to create a world inside the computer (Kuniavsky, 2010, p.9). These computers and processors which are embedded in different devices are getting more invisible but at the same time they get indistinguishable from our daily life. Also some of these mobile and embedded processors can communicate with each other. Eventually, they provide a seamless infrastructure that surrounds us to support our daily life (Bardram et al, 2010). New wireless technologies such as WiFi (WiFi - wireless fidelity, is technology to provide internet and network access by using radio waves) and Bluetooth are used in production of Ubiquitous Computing devices and their communication. Examples are communication of cell phones with Vending machines (Fischer, 2009), or between Laptops and large public displays (Buerger, 2011). In Ubiquitous computing, computation is not necessarily a separate specific activity. We might already use it in everyday practices and in combination with other activities. Moreover, Ubiquitous computing gives the opportunity of having different, improved style of computing; not just sitting on a chair, starting a screen, using a keyboard or mouse (Bardram, et al, 2010, p.2-11). Ubiquitous computers enables people to carry the minimum amount of hardware and software, and if they need more, they can use one or a combination of devices that are embedded in their environment and in other devices (Ko, 2011, p.31). In addition, there is a possibility to link real world objects with web content. Some of the devices are also capable of connecting to the internet - such as printers, routers and cell phones and digital displays (Bardram, et al., 2010; Huang et al., 2006; Alt et al., 2011b). This is possible for devices with processors, or even for others, just by using an electronic tag (such as barcodes) that has a unique ID.

Ubiquitous computing tries to push computerized versions of everything and every technology in the physical world such as a document reader (e.g Sony’s e-reader or Amazon’s Kindle) for holding and using like a book or a digital bulletin board with the functions of the paper based version (Bardram, et al., 2010,p.2-11). According to Ko (2011, P.43), ubiquitous computing and mobile devices help to answer some questions that search engines cannot, such as ‘Is the supermarket crowded at the moment or not?’, through sensors and cameras at the supermarkets.

Some of the Ubiquitous computing devices use sensors to comprehend what is going on in their environment, the temperature, the light, time, sounds, motions, orientations and other physical variables might need to be sensed. This notion is called context awareness. This is also used in digital displays. For example gathering information about the visitors and consequently presenting them some related information (personalized content) (Bardram, et al, 2010). Presence awareness is another function which uses electronic devices to sense the
presence of people; Presence awareness is also a notion in ubiquitous computing (Rodríguez-Covili & Ochoa, 2013).

Nowadays computers are getting very small and cheap (Kuflik, 2011; Kuniavsky, 2010, p.8) and they can be embedded in many things such as displays. Displays have high quality and more flexibility these days. In addition, displays can be inserted in many devices with different sizes. Wireless internet communication is getting more available every day. Today interactive media gets more popular than traditional linear media. These factors bring new paradigms of ubiquitous display environments. Public situated displays are devices that can ubiquitously provide information for the visitors or for the residents of an area. Development of these displays is a multidisciplinary task including social, aesthetics, legal and technological aspects (Kuflik, 2011).

2.3. Large Interactive Public Displays

Public displays (Non digital or digital ones) are a ubiquitous part of our environment and visual culture. Prehistoric cave drawings, billboards, road signs, flip charts and point-of-purchase displays are visual forms of communication which are helpful in understanding, navigating and behaving in the environment. They give information about the place, events and activities of other people. They have a role in structuring group activities, conversations plus verbal communication and shaping group dynamics. They are effective as cultural reference points to build shared meaning, desires and beliefs, also in the memories of communities and groups (Kenton et al., 2003).

The technological shift, which leads to the appearance of digital displays and changes of public displays in design, materials and media, reveals important changes in environmental, political, economic, cultural and architectural circumstances. Among these technologies, wireless internet and seamless computer network technologies plus interactive media and visual contents caused popularity and essentiality of digital displays. In public places, beside the non–digital displays, digital ones continue spreading (Kenton et al., 2003; Kruger & Kuflic, 2011, p.1-5). Advancements in display technologies offer cost reduction and more opportunities in authoring, displaying, sharing and interacting with information in the environment (Kenton, et al., 2003). The significant decrease in price of large interactive displays leads to popularity and wide coverage of public places with them (Alt et al., 2011a). Airport displays show arrival and departure times, digital advertisements situate in roadsides, signs outside the conference rooms show the schedules, offices lobbies are decorated with company catalogs and maps, and parking lot displays show the empty space - moreover they are used in shopping centers, bus stops and train stations (Heikkinen et al., 2010; Kenton, et al., 2003)

Public displays are divided in two categories, Interactive and ambient non-interactive. Non-interactive ones are mostly used as bulletin boards, for broadcasting information to the public. Interactive ones can be used for individual users or targeted groups and they can be customized to the business in which they are situated (Kaviani et al., 2009).
Advancements in display technology caused the computer displays to be used in all sizes of devices from wristwatches to billboards to provide proper information for their users. This marks a transition to a radically new computer paradigm which is a ubiquitous display environment. This enables people to communicate and interact with information artifacts in a casual way. Nowadays there are some interactive digital displays that can sense, track and create models of their users in order to provide personalized information for them. (Kruger and Kuflic, 2011, p.1-5). Public displays are intended to present relevant information to people in their environment. This information can be aimed at regular inhabitants or at visitors of the area around the public display, which brings the notion of personalization of information, which relies on presenting the relevant available information, for a group or an individual person (Kuflk, Kay & Kummerfeld, 2011).

Direct input modalities used by large displays began with mouse and keyboards, later input using digital pens and touching the screen by fingers became possible. Besides these direct modalities input may come from external devices networked with an LIPD, for example from other PCs via email and web-forms (Muller, Paczkowski & Kruger, 2007; Liao et al., 2003) or from webcams and other devices with USB (Izadi et al., 2003). Recently LIPDs can take more complex forms when they support gesture recognition (Hardy, Rukzio & Davies, 2011).

Output modalities can include producing printouts and sending e-mails, which allows users to ‘take the content with them’ and again devices which use USB ports such as webcams (Churchill, Nelson & Denoue, 2003; Huang, 2006; Izadi et al., 2003).

Besides the input/output modalities that were mentioned, using mobile devices to interact with LIPDs as input/output devices is increasing. Mobile devices can act as an extended input device for submitting content to large displays (Ojala et al., 2010a) or for sending a request to the display. It is possible by using SMS, MMS, GPRS, Phone cameras and Mobile Java Applications and Bluetooth, (for definitions see Appendix E- Definitions) (Davies et al., 2009). By using mobile devices as inputs the large display will become the output device (Buerger, 2011). For example, SMS can be used to send request for specific content and the result (the requested information) will be shown on the display (Davies et al., 2009). Mobile devices can act as a pointing device and for navigation. They can control the cursor of the public display (Buerger, 2011; Boring, Jurmu & Butz, 2009). Mobile devices also can act as an output device in interaction with large display systems, the private content of large displays can be sent to mobile devices (Kaviani et al., 2009; Shoemaker & Inkpen, 2001). Another usage of mobile devices is as an output device for downloading the info from the large displays to mobile devices and taking the information with the display visitors (Alt, et al., 2011; Scheibe, Meissner & Tunbridge, 2006).

Using technologies such as Bluetooth and RFID (RFID: Radio frequency identification system. It is a contactless identification system able to store and retrieve data for the purpose of identification and tracking. It uses RFID tags which act as transponder (Bolic, Simplot-Ryl & Stojmenovic, 2010)) and allows large display systems to sense devices and consequently the corresponding owners around the display. Integrated displays allow for diversity of co-located and remote collaboration. By using the mentioned technologies they can interact with
mobile devices such as cell phones, PDA, laptops and wearable devices, for example electronic badges (Rogers & Rodden, 2003). That enables people to seamlessly move information between devices and displays (Scheibe, Meissner & Tunbridge, 2006). An example of using wearable electronic badge is ‘Blue board’ at IBM, a system that can read RFID cards to get visitor’s information, for the purpose of authenticating them (Huang, Mynatt, Russell & Sue, 2006)

Based on the possibility of interaction with mobile devices and using them as input–output devices the concept of dual display systems emerged. **Dual displays** are types of integrated displays that take advantage of input and output capabilities with mobile devices (Kaviani et al., 2009). Dual displays can solve the problems emerging from a lack of space on large displays available for interacting with the public (Kaviani et al., 2011). Problems are for example a lack of space to show the system’s state changes. User interactions and state change can be shown on the mobile devices instead of large displays. Another problem is a conflict emerging from the interaction of multiple users at the same time. Dual displays can facilitate group interaction with large public displays (Wallace, 2011). Using mobile devices increases the user’s confidence to interact with the display by allowing private interaction, where bystanders do not immediately witness the communication. This decreases the potential embarrassment of using the display for potential chance of making mistakes in public. In addition, Dual displays are suitable for retrieving details of user-specific information stored on the mobile device (Raj, Gossweiler & Milojicic, 2004; Mackenzie, 2012; Kurvinen et al., 2008).

Ambient displays, embedded displays and stand-alone displays are three other categories of displays that are not related enough to the subject of this research. Therefore they are explained in Appendix F- Ambient, Embedded and Stand Alone Displays

### 2.4. System Characteristics and Requirements

Participation of potential users (end-user) of a system in its development and implementation of a software system is essential for ending up with a useful and usable system. User involvement is significant in early software design and development processes. Needs of potential end users define what system to make, what facilities it should provide and what the requirements of the system are. Defining user needs influences the success of the software product. Moreover, it influences customer-user satisfaction and proper quality, besides it is necessary for customization of products for specific groups of users or a setting (Seyff et al. 2010; Smith & Smith, 2012)

There are different approaches and methods for system development and design. Some of them have specific phases with predefined processes that lead to final designs or final systems. Some of the approaches give the benefit of tailoring the approach to one’s interest and aim. Each of them addresses the system characteristics or requirements of the system in a different way. For example, the waterfall model in system development is one of the software development models with defined phases. It starts with defining the system goals, services and constraints, which lead to identifying system specifications. After that the development continues with other steps which in this case are: system and software design, implementation
of small units and integration of all the units and testing their relation, operation and maintenance (Sommerville, 2011, p.31).

Involving users to define the goals, characteristics and requirements of a system is addressed differently in different system design and development approaches. The following two fields involve users in their requirement gathering processes. The requirement engineering and elicitation sections help to clarify the study. Moreover, the method of data collection for this research has its background in requirement engineering.

2.4.1. Requirement Engineering
Before starting to develop a system, its purpose should be well defined. This makes sure that it supports the business, it’s strategy and business opportunities that new technology brings. Requirement engineering helps to define the purpose and the job of designers, programmers and testers (Aurum & Wohlin, 2005; Hull, Jackson & Dick, 2011, pp.7-25). Some basic terms are needed to be described for a clear definition of requirement engineering.

Requirement is a statement that shows a process, or operational, functional, design or interface characteristics or constraints of a software product. There are two major categories for requirements: functional and non-functional. Functional requirements describe what the system or software should do. A function is a useful capability of the system provided by one or more system components. Functional requirements include what users need from the software or system. Non-Functional requirements are system properties such as information safety. (Hull, Jackson & Dick, 2011, P.6-7; Firesmith, 2002; Young, 2004)

Stakeholder is a group, individual or organization that is affected by the system directly or indirectly. They may be using, benefit from, or be harmed by it. Or they may simply be responsible for the system’s operation. For example stakeholders can be users, customers, managers, organization shareholders or developers. Different stakeholders might need different requirements; sometimes conflicting with each other. The role of requirement engineering is to manage this issue by prioritizing the requirements (Aurum & Wohlin, 2005, pp.6-11; Hull, Jackson & Dick, 2011).

Pandey, Suman & Ramani (2010, p.287) defined Requirement engineering as “the most effective phase of software development process. It aims to collect good requirements from stakeholders in the right way.” Besides, Maiden, Robertson & Robertson (2006, p.1073) define Requirements engineering as “a creative process in which stakeholders and designers work together to create ideas for new systems that are eventually expressed as requirements.” Sommerville (2011) says that requirement engineering consist of four processes: feasibility study, requirement elicitation and analysis, requirement specification and validation. About the steps a brief description is given in the following.

Feasibility study is a short study at the beginning of the requirement engineering processes and system development, to determine if the new system contributes to the organization goals. It looks at questions such as “Can the system be implemented by the current technology and within an affordable budget and schedule?” and “can the system get integrated with the other existing systems in the organization?” (Sommerville, 2011, p.100).
Requirement elicitation and analysis is a process in which the development team will define
the requirements of the system and gain information about the application domain, with the
help of potential end users and other stakeholders that collaborate. (Sommerville, 2011)
Requirement elicitation is more important for my research since the aim of my research is
implicitly in alignment with the aim of the requirement elicitation process. Therefore, I
describe it in more detail in the next section.

Requirement specification is the process of writing the requirements and documenting them.
Requirements should be clear, unambiguous, consistent and easy to understand. The types of
requirements should be clear (functional, non-functional). In requirement specification we try
to have an understandable description of the requirements. Using templates to describing
requirements in this stage applies uniformity on the requirements. (Sommerville, 2011, p.97;
Aurum & Wohlin, 2005)

Requirements validation (evaluation) is checking the documented requirements and models
by validation and verification techniques. Some of these techniques are mentioned in
Appendix C- Requirement Validity Techniques. Traditionally evaluation and testing begins
when the whole system or an executable version of it is ready. Requirements are the base of
other phases such as design, development and testing, therefore any mistake and
misunderstanding in respect of requirements can spread into other phases and their resulting
artifacts. The requirement validation stage is the first step in Quality Assurance to make sure
we can meet stakeholder needs and deliver the system on-time and within the supposed

2.4.1.1. Requirement Elicitation and Analysis
Requirement elicitation is about gathering the requirements of the system which is going to be
developed or updated. Requirement elicitation determines the needs of users and stockholders,
on extracting, surfacing and uncovering the necessities to be implemented in the system. In
this phase it is recommended to gather as many requirements as possible. After that it’s
possible to categorize the requirements with the help of prioritizing, negotiation and
collaboration techniques for implementation in different versions (Sommerville, 2011; Aurum
& Wohlin, 2005, P.21; Pandey et al., 2010).

To come up with a system which is accepted by users, users’ participation when extracting
their needs and problems is necessary (Seyff et al, 2010; Smith & Smith, 2012). By
requirement elicitation techniques we can gather potential user needs. Then requirements will
be extracted from those user needs (Seyff et al., 2010). Each user need can lead to extracting
several and different types of requirements. Requirements tell the system developers what
characteristics the system should have (Hull, Jackson & Dick, 2011, pp.6-7). Requirement
elicitation and analysis consists of some processes:

1. Understanding the Application Domain: In this step one examines the real world
situation, the context where the new system does not yet exist. In this regard political,
organizational and social aspect of the situation, existing work processes, constraints,
key business goals, issues and problems are worth assessing (Aurum & Wohlin, 2005, P.22).

2. **Identifying the Sources of Requirements:** Most significant sources are stakeholders, users, domain experts, existing applications and processes and documents including existing forms, reports and annuals (Aurum & Wohlin, 2005, P.22; Zowghi & Coulin, 2005).

3. **Analyzing the Stakeholders:** Stakeholders should be identified. Most significant stakeholders are potential users, customers, project sponsors, people responsible for work process standards, product champions and key user representatives (Zowghi & Coulin, 2005).

4. **Selecting the Techniques, Approaches, and Tools to Use:** This is a success factor in requirement elicitation and ultimately in the success of the whole project. There are different tools and techniques which need to be combined based on the context in order to accomplish requirement elicitation. Structure and maturity of the organization affects the tools and techniques selected for requirement elicitation (Zowghi & Coulin, 2005).

5. **Eliciting the Requirements from Stakeholders and Other Sources:** starts with high level definition of the mission of the project by specifying some goals, functions, constraints and a scope or problem description. It furthermore includes identifying stakeholders and sources of requirements. Based on the identified sources one can conduct iterative, incremental requirement elicitation in order to gather more requirements and more details. Based on this iterative nature of requirement elicitation it should be done in a time frame considering the whole time of the project and cost, also the quality of requirement and completeness that are needed (Zowghi & Coulin, 2005; Sommerville, 2011; Aurum & Wohlin, 2005).

In some studies the categorization and prioritization of requirements are also considered in these steps but some studies believe that these two steps belong to requirements specification and documentation. Step 4 is selecting the Techniques, Approaches, and Tools for requirement discovering or elicitation, which are mostly based on social science techniques, only a limited number of them are developed specifically for requirement elicitation. Some of the techniques are named here and they are described in Appendix B- Requirement elicitation techniques(except the Innovative and creative techniques). Requirement elicitation techniques are: Ethnography, Interview, Observation, Protocol analysis, Apprenticing, prototype, Goal Base approaches, scenarios, Viewpoints, Methodology base requirement elicitation, Questionnaires, Task Analysis, Introspection, Domain Analysis, repository Grids, Card sorting, Laddering, Group work, Brainstorming, Joint Application Development (JDA), Requirement workshops, Innovative and creative techniques (Zowghi & Coulin, 2005; Sommerville, 2011; Aurum & Wohlin, 2005). Among these techniques innovative and creative techniques are going to be used in this research as well as observation and interviews. Since innovative and creative techniques are not that popular in IS researches, it will be further described in the following section.
2.4.1.1. **Innovative and Creative Techniques**

Innovative and creative techniques, which are in the category of socio-technical approaches (Jones & Maiden, 2005) of requirement elicitation, are mostly based on cognitive, social psychological and artificial intelligence theories. The aim of these techniques is producing something novel and appropriate concerning use, adaptiveness and constraints. These methods are mostly workshops, combined with some other techniques. Therefore these kinds of workshops are also called *Creativity Workshops*. In creativity workshops the most importantly techniques that usually are combined with workshops are brainstorming, RAD\(^3\) techniques and prototyping. For more information see Appendix B- Requirement elicitation techniques (Maiden et al., 2010; Pennell & Maiden, 2003; Maiden, Ncube & Robertson, 2007). (Other techniques combined with workshops in creativity techniques are storyboarding, idea combination, and analogical reasoning and JAD techniques, see Appendix E- Definitions).

Different scholars used different combinations of these methods. Creativity here is not just about the resulting requirements, but also about the combination of the chosen techniques by the scholars, concerning setting, system of focus and opportunities (Maiden et al, 2010; Pennell & Maiden, 2003; Maiden, Ncube & Robertson, 2007). Next some important methods of innovation, which are used in requirement elicitation, are described briefly. After that the previous experiences on the creative requirement gathering are mentioned. In most of these experiences creativity techniques and methods were adapted creatively for the new study or project. Boden (1990 cited in Maiden, Cornelius and Robertson, 2007) introduces three techniques in innovation and creativity: Exploratory, Combinatorial and Transitional Creativity. One or more of them is used in each creativity workshop. These techniques are described as following:

In *Exploratory Creativity* people explore ideas from not immediately related fields in order to come up with new ideas applicable to the system in question. A person or a professional from another field or industry will present a subject, or a video of a subject is shown. This subject’s characteristics can be related to characteristics or needs of the system in focus. (The system that is going to be developed) This activity called *analogical reasoning*. After that participants will be asked to relate the presented field characteristics, to the system of study, and suggest new requirements. For example, in a workshop by Maiden, Robertson and Gizikis (2004) a person talked about testing of modern composed music, another person talked about Indian textile design and its quality, since the subject of the system under develop was about testing and quality (Maiden, Robertson & Gizikis, 2004). This exploration in three subjects (music composing, textile and the new system) inspired creative ideas in the domain of the new system (Boden 1990 cited as Maiden et al., 2010).

In *Combinatorial or Combinational creativity*, participants try to combine and synthesize the existing ideas to come to new ones. A list with problems and a list with some technologies can be prepared, then for each problem participants can try to imagine how the listed

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3 RAD: Rapid Application Development is a development method which uses a prototype and tries to develop it into a final product (Howard, 2002)
technologies can be helpful. Here some objects and items for writing and painting can be
given to the participants with the aim of increasing the creative potential. (Kerkow, Adam &
Riegel, 2010; Maiden, Robertson & Gizikis, 2004)

In transformational creativity to encourage people for being creative, impossible things such
as boundaries and constraints are considered as possible. We change the domain rules,
assumption and boundaries to bring innovation and creativity for advancement of products or
technologies (Brown, 2012; Maiden, Robertson & Gizikis, 2004; Boden 1990 cited as Maiden
et al., 2010 ; Maiden et al. 2007)

Another model in creativity was originally presented by Poincare and adopted by several
scholars. It contains four stages for creativity: Preparation, Incubation, Illumination and
Verification. These four stages together enable divergence and convergence of ideas, which
lead to creativity and innovative suggestions. At the beginning participants talk about their
ideas freely, to gain a large number of inspirations and opinions - this is called divergence of
ideas. After this the ideas are further specified, proper and relevant ones are selected,
prioritized and evaluated - this is called convergence of ideas (Westendorf, 2011; 1982 cited
in Maiden, Robertson & Greenwood, 2004; Maiden, Robertson & Gizikis, 2004; Maiden et
al., 2007).

Boden’s techniques (Exploratory, Combinatorial and transformational creativity) can be used
separately or together in the incubation and illumination stages; in the relax incubation phase,
workshops participants listen to music or look at pictures. This is supposed to increase their
creativity and openness to new ideas. Besides, the participants are asked or presented topics
about their domain of expertise. In the Illumination phase these new ideas and creative
requirements suddenly appears in an unlikely time and place. (Maiden, Robertson & Gizikis,
2004; Westendorf, 2011) Figure 1 shows the combination of Boden and Poincare models and
techniques in two sessions of workshops.

Brainstorming is also used in creativity workshops; participants are allowed to talk about
their ideas, problems and needs freely, which leads to new ideas for the system in question.
One of the models for doing a brainstorming session is Creative Problem Solving (CPS). This
model suggests an initial collection of diverse ideas and, in a later step focuses on discussions
on these ideas to again converge towards a more concise set of ideas and objectives. CPS
Consist of six stages: mess finding, data finding, problem finding, idea finding, solution
finding and acceptance finding (to see if the solution is acceptable). These steps help people
to understand and be innovative more effectively. The steps can be categorized in three
categories of activities: understanding the problem, idea generation and planning for action
(Antonenko & Thompson, 2009; Maiden, Robertson and Gizikis, 2004).
Also founded ideas can be ranked as irrelevant, valued, very valued and very-very valued. All of these methods can lead to a solution-independent requirement list of the future system. Moreover, it provides a baseline for more precise use-case specifications (Maiden, Robertson & Gizikis, 2004). A use case is a system function of a software system where its use is visible for a user (Yin & Chai, 2012), and use case modeling is the illustration of interactions of users and the system through diagrams (Helming et al., 2010).

2.4.1.1.2. Experiences on Creativity Workshops

Some of the experiences of scholars about the creativity workshop are described in this section. Maiden, Ncube and Robertson (2007) have used the creativity requirement elicitation technique for an Air Space Management System based on their previous experience. In this experiment, two-day creativity workshops were considered as one complete workshop. Creativity workshops took place during four months for such a complex system (Maiden, Ncube and Robertson, 2007). Different modeling and analysis techniques took place in parallel to assist the interaction of participants and creativity. Scenarios and use case modeling (see Appendix B- Requirement elicitation techniques and Appendix E- Definitions) is used to communicate with different stakeholders. System Goal Modeling was used to model the future system. (Goal Modeling is a method in requirement analysis for presenting the future software system through diagrams and elements containing actors, objects, relationships etc. (Kavakli, 2005)). Actors, boundaries and existing dependencies, use case models and use case précis (a short description of a use case) were used as inputs for workshops. Use cases were posted on a pin board. Some of the RAD/JAD techniques were used as inputs for workshops. (JAD; joint application development, Offsite meetings including end-users and development team members to work out on and decide about detail of a system under development (Tiwari, Rathore & Gupta, pp.201-222))(See Appendix B- Requirement elicitation techniques). Rules were applied to facilitate the workshop and increase its performance, such as avoiding criticism of other people and time-boxing for each subject under the discussion. Different materials were used to assist the participants in writing their ideas and taking notes or facilitating the other tasks, such as Idea Cards to write ideas on them, A3 papers, pens and blue tacks and post-it-notes. Everything on the board was documented electrically. (Maiden, Ncube and Robertson, 2007)
In the first workshop for the morning session, brainstorming was conducted using the use case diagrams and other inputs, transformational technique was used. After lunch exploratory technique (analogical mapping) was used by a presentation of museum exhibition. Stakeholders suggest new ideas for the future system after that. In the second day workshop the previous ideas were reviewed and another presentation on TV program scheduling was conducted. Outputs of the workshops were 145 new ideas over the two workshops. They were revised and prioritized. Use case and their précis’s, storyboards and revised diagrams were written (Maiden, Ncube & Robertson, 2007).

Another practice by Pennell and Maiden (2003) was about exploitation of biometric technologies in the UK Police’s Information Technology Organization. For this system two workshop were established. Presentations were shown on large displays. The ideas raised in the workshops were put on pin boards. Atmosphere of the workshops were fun and no one was allowed to criticize the other’s ideas, since it prevents creativity and suggesting new ideas. Time boxing was considered, otherwise the workshop and talking about specific ideas would take to much time. For encouraging creativity and capturing the workshop ideas and results, A3 papers, snow cards, felt pens; blu-tack and post-it notes were used. Everything that was put on the pin-boards was recorded electronically. In the first workshop there was an introduction about creativity, followed by brainstorming, about the current method of people’s identification, and the related problems in the police system. Combinatorial creativity was used to combine bio-technology capabilities with current problems and situation. The next activity was voting for the generated ideas by the participants to select the ideas for focus on in the second workshop. The second workshop was held a week after the first one. Between the two workshops participants were encouraged to do further creative thinking for new ideas. Then the new ideas were considered as input for the second workshop, which was called interim phase. In the second workshop exploratory creativity was used. For exploratory creativity, a presentation on an air traffic management system had been held. Participants were supposed to relate the system’s characteristics to the policing system. The participants made storyboards that showed scenarios for as many ideas as possible that were created during the previous activities (Pennell and Maiden, 2003).

2.4.2. Participatory Design

Participatory design (PD) originated in Scandinavia for providing partnership between academics and trade unions. Participatory design aims to involve the end users in design processes to make sure that user’s needs and expectations are considered by the designed system, the users’ voice is not neglected and their concerns are being responded to. This approach tries to empower the users, supporting them to make their own decision and have control over their work (Wagnar & Piccoli, 2007; Spinuzzi, 2005; Yamauchi, 2012). PD is an approach concerned with the procedures and processes of design but not a style of design. It has a variety of approaches (Eberhagen, 2011; Törpel, 2005):

“Participatory design is a research approach characterized by user involvement” (Spinuzzi, 2005, 163).
Participation of the users is not just for the purpose of confirming the user’s opinions but an essential part of the design process. Collaboration of system designers with the users, people involved in the setting and affected by the design makes it possible to design artifacts, workflows and work environments. This approach tries to apply the tacit knowledge and invisible aspects of human activity, to be examined ethically and productively (Spinuzzi, 2005). Participation of the users helps the technical implementers to gain the user’s knowledge. Including users in the design has multiple benefits such as: increasing responsibility and accountability of users in the process of design, which leads to commitment of users to the designed system as well as reducing users-employees’ resistance for change in using and moving to the new system. Furthermore, it increases the user satisfaction and workplace democracy. Participants will feel a sense of ownership of the end product (Yamauchi, 2012; Wagnar & Piccoli, 2007; Eberhagen, 2011).

2.4.2.1. Requirement Gathering in Participatory Design
Participatory design involves the users in the process of design before the requirement gathering phase in order to define goals of the system collaboratively (Shi et al., 2012). Stakeholders are involved in all of the design processes such as specifying the design, implementation as well as delivering and installing - not just the requirement gathering (Carroll & Rosson, 2007).

Participatory design is an approach to design a research (Spinuzzi, 2005). For conducting a research, participatory design has a methodological orientation, methods, tools and techniques. Some of the methods in participatory design are ethnographical observation, interviews, analysis of artifacts, questionnaires, group interviews, storyboarding, prototyping, future workshops, consensus building, evaluation, mock ups, observations and analytical observation. Shi et al. (2012) named some of those methods as “need assessment techniques” (users’ needs). These methods are for considering the user’s opinions in the process of design. The methods help to transcend, shape and envision the activities with the help of users. Usually a combination of methods are used to create a mutual understanding (e.g. the work of Jansson, Mörtberg & Mirijamdotter (2008)). The result of using that combination is a design. Requirement gathering is an integrated part of design by using those tools (Spinuzzi, 2005). There are methodologies for applying participatory design such as We!Design, which gives a formed solution to apply participatory design. The role of the participatory design methods (e.g. future workshop and prototyping) is to design, however the design includes the requirement gathering by needs and problem discovering such as what We!Design does. (Triantafyllakos, Palaigeorgiou& Tsoukalas, 2008). Törpel (2005,p.179) believes “The field of Requirements Engineering is relevant to PD when efforts focus on generating a realistic picture of a settings' IT needs from the perspectives of the practitioner groups that will be affected by the computer application under development, e. g. by preparing and facilitating respective meetings”.

2.4.2.1.1. Future Workshops
Future workshops are techniques that are used in participatory design to create vision of the future with the help of participants. Future workshops are highly structured. They are also used for system development. Usually scholars considered three phases for future workshops,
which are: The critique phase, the fancy phase and the implementation phase. In the critique phase participants try to discuss and address the problems of the current problematic area such as work practices or a system. In the fancy phase participants try to make a vision of the ideal situation in the future ignoring limitations of any type, such as technical or financial. In this phase participants try to come up with solutions for problems identified in the critique phase. In the implementation phase again participants return to the reality and try to find barriers for implementation of the ideal solution (vision). The vision will be adapted to the resources. An action plan and related activities will be provided; furthermore estimation will be made about the needed resources for implementing the vision (Brandt, 2006; Biskjaer, Dalsgaard, & Halskov, 2010). Some scholars consider a follow up phases, preparation phase or both for future workshops. There are some rules for this type of workshops such as not criticizing each other in the fancy phase (Biskjaer et al., 2010; Jansson, Mörtberg & Mirijamdotter, 2008).
3. IDEAS FROM THE LITERATURE ABOUT LARGE DISPLAYS
In this chapter I am presenting some of the most used functions implemented before or ideas for application of large displays in different public or semi public settings, that scholars presented in the literature. The functions will be categorized and the categories are used as headings for the presentation. The categorization is based on qualitative coding (as it is presented by Creswell (2009)). The categories are as follows: 1. Anytime, Anyplace Access 2. Content Management 3. Information Take Away and Forwarding the Information 4. News, Events, and Advertisements 5. Presentation of Schedules 6. Presence Awareness 7. Maps and Directions 8. Information of Restaurants 9. Voting and Commenting About a Subject 10. Emergency and Instant Messages 11. Personalization of the Content 12. LIPD at Libraries 13. Search Bar 14. Photo Album and Media Content.

3.1. Anytime, Anyplace Access
There are some LIPDs that their content is accessible through desktop computers via network connection or internet. Hereunder I point out some of these cases.

Izadi et al. (2003) believes that the possibility of remote connection to the large display that they studied is a success factor, although it is a complementary and an extra function. They also emphasized that large public displays should be capable of working without network connection as Dynamo System does. Since, connecting to the internet sometimes is a problem itself; therefore we should not rely on that. The information which is needed on a display should be provided on the device itself without need of internet connection.

A study by Huang et al. (2006) shows that MessyBoard of Carnegie Mellon University gives the possibility of observing the presented content from desktop computers, in addition to the large display, by support of network. Another study talks about connecting some of large public displays and creating a network of them as well, to upload event posters and classified advertisements. (Alt et al., 2011b)

Dynamo system (Izadi et al., 2003) has the capability of linking to other dynamo systems, taking a copy of their content and disconnecting or just connecting to update its content.

Churchill, Nelson and Denoue (2003) think that accessibility of the LIPD content from a distance is an important characteristic. Access to BlueBoard system studied by them is possible through the large display also through web forms that enables community members to access to the content, share media and take notes from their desktop computers. People use the display for gathering and sketching new ideas and they could do the other individual tasks from their desktop computers.

3.2. Content Management
Possibility of managing and feeding information to the LIPD systems by web pages is mentioned by many scholars such as Storz et al. (2006) in e-campus project. Generally this is used for posting information via network to be shown on the LIPD. For example Network’s CoolSign system uses internet to post content such as fliers, and announcements on the
display (Churchill, Nelson & Denoue, 2003). The managing web pages usually have some characteristics. Following I present some of the important ones and the associated studies.

3.2.1. Categorization
Content grouping and categorization are important characteristics for easy administration in a LIPD System. It makes scanning or reading of the displays easier and possible in a shorter time. It is possible to have separate displays for each category of content, or a display can be categorized to several partitions for each category (Ribeiro & José, 2010) (Churchill, Nelson & Denoue, 2003).

Ribeiro & José (2010) believe that the interface of large displays should be categorized and the content should be in a way that can be divided easily to categories which are relevant to the area and setting. Jakobsen & Hornbæk (2012) assert that partitioning the display space and having discrete territories is a crucial parameter in having an effective collaboration. Ribeiro, Costa and Metrólio (2011) mentioned that their studied LIPD system provides an opportunity that enables the system administrator to categorize the feeds base on each place (display zone) and its nature. For example in a computer science school the system administrator may specify feeds about IT, technology, jobs and institutional feeds. In this system the display is divided into two parts, one for showing the public content and the other to present the place related content.

Categorization in the system studied by Muller, Paczkowski and Kruger (2007) was done through two displays; News and Reminders. Totally new content is put on News display and after awhile they will move on the other display which is called Reminders.

3.2.2. Content Administration or Gate Keeping
In physical boards providing control before publishing is not easy or let’s says not enough since there is always possibility of putting something on the boards by any person at any time (Churchill, Nelson and Denoue, 2003). At official and municipal institutions displays should be controlled at the content submission stage, by the director and before publishing. Scholars noticed that the political, provocative or offending content are mostly not allowed in organizations with paper base notice boards. This control is also a requirement in digital displays (Alt et al., 2011b) (Storz et al., 2006).

In digital displays it’s possible to control the content through a gate keeper, in order to prevent inappropriate content on the display. If someone sends something on the system to be published on the display a person check it before it publishes (Churchill, Nelson & Denoue, 2003). This function is needed when more than one person in a public place have access to publish content on the display (Muller, Paczkowski & Kruger, 2007). In system implementation, Process and workflow of content approval and appropriate tools should be noticed (Alt et al, 2011b) (Storz et al., 2006).

3.2.3. Different Access Levels for Content Input
In many large displays such as ‘Plasma Poster’, people are allowed to put content on the display to keep the content up to date (Huang et al., 2006) (Churchill, Nelson & Denoue, 2003).
Controlling the access level is one of the functions in managing content of large displays. Alt et al. (2011b) emphasize on noticing access control implementation for content providers. They believe one of the important questions to answer before implementing the system is how will be the access control, for content providers and also for content viewers?

Jurmu et al. (2011) in their study have mentioned a large digital display that implies control over access to the display for updating through mobile devices. A study about a large display system in a Danish hospital by Bardram, Hansen and Soegaard, (2006) presents a system which is called AwareMedia, for keeping the hospital personnel and patient accompaniers aware of the works around the hospital. The study shows that the system did not have access control for inputting and modifying the information of the system which caused problems: such as people could move an operation time unintentionally, by leaning against the display. Then in the system evaluation they decided that the access control is necessary for avoiding mistakes and tracing the person who changes the information.

3.2.4. Keeping the Content Updated and Removing Outdated Content
One of the most important advantages of digital displays over the paper base displays is that updating is easier and possible at any time. Public display systems are using network and web forms for updating the digital displays content (Kaviani et al., 2009; Muller, Paczkowski & Kruger, 2007; Alt et al., 2011b).

Alt et al. (2011b) say that the content posted on the display should be available for a certain time. Outdated data should be removed; this should be done through defining an implicit expiration date for a specific content in creation time, or by a default expiration date, if the posts do not have a specific expiration date (e.g. after 15 days of posting). The process of removing outdated content should be definite.

3.2.5. Archiving
Saving the expired content in the system as a repository is implemented on a LIPD that is studied by Ribeiro, Costa & Metrôlho (2011). The repository helps for future access to the data since someone might need the related information. A large display system named Dynamo Screen which is for communication of a community members, has also a function to archive content. For example, the result of monthly meetings is archived in that system (Izadi et al., 2003).

Blue Board system was developed at IBM Almaden Research Center, for informal synchronous collaboration of members’. That includes a data repository for old posts (Huang, et al., 2006). In addition another study by Muller, Paczkowski and Kruger (2007) about a large display system in a university shows that the system has an archive for old posts for later referring. The archive is also accessible online; it can show the detail information of an archived post. The archive function is developed since in the paper base boards in that setting, content providers use the archive for storing old contents, such as posters, also for posters that are not approved for being published.
3.2.6. Particular Content in Multiple Displays or Several Times on One Display

If you observe a bulletin board you will see that sometimes people use multiple ads or notices beside each other to make it more visible and eye catching. Moreover, at paper based boards usually we can see a specific poster or ad on multiple bulletin boards. These features help the content to be more eye-catching and be seen with more people. Then it is a proper feature if LIPDs also have this opportunity, if there is enough space available. Using a network connection among the large displays can facilitate having a specific content on multiple displays, since once the post enters the system, it can be put on multiple places (Alt et al, 2011b).

3.3. Information Take-Away and Forwarding the Information

In physical bulletin boards we usually see that observers can take fliers or take a tear from a tear-away with them, to be able to follow up by having the required information; such as email, telephone, time, date or place. Alt et al. (2011a) talk about this as a requirement for LIPD systems under the name of information take-away. They believe that there should be a function on LIPD to answer this need. Some studies show that different systems use different ways and technologies to cover this requirement and implement information take-away for large displays. The followings explain more about the related studies.

Churchill, Nelson and Denoue (2003) mentioned the possibility of sharing an interesting content (such as an ad or some news) with someone else. In their studied display, **printing** something from the content on the display and forwarding a specific part of the content to a visitor’s or any other person’s **email**, is possible. Huang (2006) studies a large workgroup screen. People who are interested to a specific part of the content that is presented on the display can swipe their ID badges at a card reader to have the full text of that particular content **emailed** to them. In a study by Izadi et al. (2003) exchanging info using devices which use USB port, such as USB disks, and Mp3 players is possible. Another system named ‘**Awareness Module**’ uses RFID reader to read users ID card (augmented with RFID) to fetch their info containing email address and email them the selected items (Huang et al., 2006).

Taking-away parts of the presented content on digital displays can be done using cell phone facilities such as: providing the information in SMS (sending SMS to a user-visitor), **taking photos** from a part of the content using cell phones, providing a **QR code** on a specific content to be scanned by cell phones (Clinch, 2012) (Kukka et al., 2011), or using **Bluetooth** for transferring some specific presented content to the cell phones. It can be also done by downloading the specific content from the web version (they considered that LIPD system has a web version) (Alt et al., 2011b).

Another new method for information take-away is using cell phones which are NFC enabled to download a specific part of the content such as an advertisement from the display to the cell phone, to have and take away the information (Bravo, et al., 2008). **NFC** is a set of standards

4 QR Code: QR-codes can be called as a two dimensional barcodes that can be decoded to extract information. Usually cell phone applications are used to decoding that (Sun and Liu, 2007) In fact by taking a picture of a QR code with a cell phone information such as website address, email, telephone and so on transfers to your phone rapidly
for smart phones and other similar devices to communicate with each other and transmit data by touching or getting very close (Agrawal & Bhuraria, 2012).

Scheibe, Meissner & Tunbridge (2006) studied a large display which is capable of sending vCard, vEvent and vCalendar formats to cell phone of visitors. (vContact is an object used for presenting contact information of people or organizations in mobile phones, vEvent and vCalendar object represents the information of events or meetings in a calendar software (Scheibe, Meissner & Tunbridge (2006)) Data such as phone number and name of an advertiser can be sent to visitors cell phone in vCard format, and information of an event can be sent in vCalendar and vEvent format to the mobile calendar of visitations.

3.4. News, Events, and Advertisements
Having a digital display in public places facilitates to have the news, announcements of events and advertisements electronically and paperless (Alt et al., 2011b). Usually these types of content are non interactive (Kaviani et al., 2009).

Alt and his colleagues (2011b) believed that local news, local events and their related information and advertisings about local stuff or sometimes about other products or movies are fit to digital displays. Since they exist on paper based notice boards. Authors found out that in paper based notice areas, posts and contents are mostly related to the local setting, posts with no relation to the local rarely appear. Paper ads are usually about: offering and looking for housing, matchmaking opportunities, exchanging books and furniture selling which should also be possible electronically.

Some of the contents on an LIPD at the city center of Oulu are news of the town, arts, educational content, fun facts, current events, upcoming events, adverts about local businesses, products, services, free movies at universities and upcoming talks and lectures(Huang, Koster & Borchers, 2009) (Ojala et al. , 2010b).

A research shows that people in a group like to know about the whole group or other groups work status on a large public display. They like to have up-to-dated information about the status of the work in the group (Huang & Mynatt, 2003).

NASA used a large public display named MERBoard in the Mars exploration discovery mission. One of its functionalities for the group is making the group related information visible to every group member. In another workgroup display, people wanted to know about the high level milestones information in their organization and each other’s activities on the display. The large display was also used to show project’s news (Huang, 2006).

AwareMesia is a large interactive display system with interaction to a shared messaging system, situated around a Danish hospital. The system is used to create mutual awareness about the activities taking place in a specific room and about the flow of a special work in the hospital. For example what is happening in a specific operating room? What is the status of the operation? Who are the people involved and who is the patient? The large interactive display shows videos stream from the operating rooms. Messaging system is to provide simple communication pathway between cooperating users, information to inform personnel
about the work of their colleagues and their geographical place of presence. Studies show that coordination of work in hospitals and clinical areas are challenging and this system is helping to bring social awareness (Bardram, Hansen & Soegaard, 2006).

In a research about an LIPD in Lancaster University campus Davies et al. (2009) mention that the content of LIPD is about news, related to the university, by the University and other type of content that is specific to the location, furthermore about information of changes to the schedule of the lectures, announcements of seminars and special lectures. There is another study about five large displays in Duplin University which shows the news about upcoming seminars and conferences (Rashid & Quigley, 2009).

Another study in Munster University by Daiber et al. (2012), talks about 7 large public displays (40+ inches) in 5 buildings, in the first iteration of the system. They are increased after that to 22 displays. The displays are divided into two groups. News displays and reminder displays. The news displays just shows the new information. The reminders display shows reminders of the old information such as the reminders of a seminar which is going to be held today.

3.5. Presentation of Schedules

Nowadays we can see public displays showing schedules in train stations and airports. (Kern, 2008) Muller, Kruger and Kuflik (2007) believe that the dynamic information and updates about the timetables in bus/train stations are very useful. Ojala et al. (2010a) (2010b) mention availability of bus schedules on a multipurpose large public display that they study in Finland, Oulu in the city center.

Presentation of Schedules on large public display is also used for schedule of operating rooms (OR) which is studied by Bardram, Hansen and Soegaard (2006). They present a system called AwareMedia for showing the schedules of operating rooms and clinical ongoing events of a hospital in Denmark on a large interactive display.

Another study shows that a large public display is used in a conference hall to show the conferences schedule on the display. When people get close to the display, and stand in detection zone of the display, their RFID cards can be detected by the display and information will be shown to them (Lee et al., 2012). Huang, Koster and Borchers (2008) studied another large public display that announces schedule of the upcoming lectures in a university.

3.6. Presence Awareness

There are some studies about finding out people’s presence in a place through detection of Bluetooth of their mobile devices that they are carrying with themselves. Some studies show that function is combined with large displays in a way that the information of the mobile device owner (such as his name or his Bluetooth device name) is shown on the public display.

The following are the studies:

Otero and Rui (2008) in their study which was done at a University bar talked about a presence awareness system. In that study there is a system which contains these items; one or more Bluetooth enabled computers, each connected to a public display and linked to a central
repository. These computers gather the information about devices with Bluetooth around and nearby. The central repository has the data about previous sessions, and collects new data from distributed devices, and shows the data on multiple public displays. All the information of the repository is from the presence history and there is no profile or prior registered information about the devices. Some social practices and communication among people emerged by people seeing their device name on the display. The same study also mentions some cases such as McCarthy’s (2003) that a system detects the nearby RFID tags and shows the information of the RFID owner’s profile information on a large display. The role of people is just moving around and be detected by the system.

O’Neill et al. (2006 cited in Otero & Rui, 2008) presented a system that scans the devices which are using Bluetooth and shows their names on a screen in a public space. They studied a system that uses a long term Bluetooth scanner (today there are devices enable of scanning around 100 meter) for detecting people and the names of their Bluetooth and other information such as unique Bluetooth address, date, time, class of device (e.g. phone, laptop) and the Bluetooth traffic. A specific culture emerged around the display.

In a Danish hospital a large interactive display system is used for sharing information about the clinical works, and keeping hospital employees and patient accompaniers aware about the works round the hospital. One of its functions is tracking the location of clinicians by using Bluetooth and showing the related information on the displays. The detectors were avoided to put in locations such as bathrooms or cantinas (Bardram, Hansen & Soegaard, 2006).

3.7. Maps and Directions

Presenting map of venue location is another usage of LIPDs. Ojala et al. (2010a) studied a network of LIPDs in downtown Oulu, Finland. The system is called UBI-hotspot. It has many functionalities but the evaluation of the system showed that map is the most useful service. Moreover, people often request for address search and route finding.

Kaviani et al. (2009) presents the opportunity of using maps in two ways: First is using Google map to see the map of the area; second, presenting list of restaurants, museums and other fixed venues, the information of selected venue will be shown on the large display.

In another research by Kim et al. (2011) a digital way finding system is studied which is used in a university campus that leads to more satisfaction of new visitors. The study mentions some problems in paper based way finding and navigation such as; facilities at the buildings are not mentioned in paper maps, name of the buildings are not mentioned, no clear street name is available, distance cannot be noticed on paper (since it’s not obvious which destination the visitor is looking for), directions are not given, maps are too small and reading them is difficult, moreover map and the reality are very different. For these problems some design ideas are mentioned as: indicating directions on the digital map, consistent between real objects and distance, determining current location and updated and reliable information on map.
3.8. Information of Restaurants
Lunch menu was also shown on Plasma poster studied by Churchill, Nelson and Denoue (2003) using multimedia content. Likewise, Muller, Paczkowski and Kruger (2007) studied the development process of a situated display that one of its functionalities was for cafeteria menus.

An study was conducted by Kukka et al. (2011) to find out what information people need to have around urban spaces. The study uses methods such as interview and card sorting (see Appendix B- Requirement elicitation techniques) to get the participants view on the useful information services. They finally implemented the selected services. The result of card sorting shows that participants believed that information about restaurants around and restaurants menus is needed.

3.9. Voting and Commenting About a Subject
Large interactive public displays are used for suggesting something, such as a change. Moreover, a subject might be presented on the LIPD; visitors give opinions as comments, or just select something as their vote. Following studies talked about these functions:

MobiLenin System at a restaurant in Oulu, allow the customers to vote for the next video to be played. They can interact with the system using their mobile phones. The system shows the result on the display and switches the video. This type of voting causes cooperation among public for defining, promoting and improving the quality and quantity of actions and situation in a public place (Calderon et al., 2011)(Buerger, 2011)(Scheible & Ojala, 2005). The MAGICBoard is another LIPD in a university that seeks for votes and opinion on topics. People can interact with the system and sending texts through cell phones as a topic, votes or comments, using their mobile phones for sending SMS or their laptops. Users send topics as texts for voting that stays on the display until the new one pushed that off the display (Lucero, Holopainen & Jokela, 2012).

Another system made possible attaching the digital graffiti comments and annotations to the publicly post content. Annotations can be collaborative. The system allows anchoring (for determining the place for annotations), sketching (for writing annotations) and audio recording tools for recording voices as annotations. These are possible by using Wi-Fi enabled PDA or cell phones. (Carter et al. cited in Kaviani et al., 2009) A study by Du, Rosson and Carroll (2012) presents a system called Café commons that used on campus cafeteria in a northeastern university in United States. People can interact with the display using their student email account to send messages as comment on a post (which was posted as a subject for a discussion), offering suggestion; for instance one person sends a message to suggest extending the opening hours of the café, for reporting a problem or for information and thought sharing. Hosio et al. (2012) have another study about a large interactive public display named Ubinion in Oulu, Finland that enables young people to give comments and feedbacks on municipal issues to local workers. Most of the sample feedbacks they received were about school food. Some other comments are suggesting a new parking lot and feedback on decision of cutting students funding.
Using Nicknames for Commenting
Buerger (2011) in his study found out that people prefer to use their first name or a nickname in commenting on a post on a large public display, even when there are a few people watching the display. It helps the person who interacts with the display to stay vague enough; which prevents social embarrassment of being identified by a large amount of audience. It is also good to encourage people for interacting with the display without fear of embarrassment or being ridicule.

3.10. Emergency and Instant Messages
Large displays are used for emergency notifications. They can be deployed as emergency warning systems which can quickly be updated in emergency situations to alert the public (Chandler, 2010). There is a study by Friday, Davies & Efstratiou (2012) which presents functions on large public displays of e-campus project in Lancaster university; which one of those functions is announcing alerts and notifications. The system gives priority to the emergency alerts if there are so much content to show.

3.11. Personalization of the Content
Adapting and filtering the content of LIPD based on the visitor’s needs and interest is what I am explaining in this section. Advancement of integrated displays brought a new notion which is using the technology for personalizing the content on the LIPDs, for visitors or potential users. Nowadays RFID cards or Bluetooth detection of mobile devices (e.g. cell phones or laptops) is used to show information that a specific user might be interested in, without any need for direct interaction with the displays. By detection of the Bluetooth or FRFID cards of display visitors, identity and some information about the visitor can be defined. Consequently the potential interests of the display visitor will be shown on the display; for example base on the study major of a student as a visitor, the relevant content will be presented on the display. Or in some systems people can register to the system and introduce their interests, then according to those information the display content will change whenever the Bluetooth detector sense them around the display (Costa & Metrôlho, 2011)(Ribeiro & José, 2010) (José et al., 2008).

Ribeiro, Costa and Metrôlho (2011) studied an LIPD that is capable to customize its content base on the visitor. The system has a registration form. Each person can fill the form in a web page which contains the information of her/his Bluetooth device such as mobile device, and her/his area of interest. The display has Bluetooth scanner and when visitors (users) are in front of the display, if they get detected through their mobile device and the system can recognize them (if they are registered users) then the display changes its content base on the predefined interests of the user. Otherwise the display continues with its default page unless the user interacts with the display. In addition Hardy et al. (2009) proposed that if in a system the private information is critical (e.g. address information or credit card); the large public displays can be used for public information, while the private part moves on the mobile devices of the users instead of be presented on the display, to ensure about the privacy protection.
3.12. LIPD at Libraries
According to the related literature a large display system that is called ‘You Serve’ is situated at a university library lobby to present the available library services and helps people to get familiar with the services and to find the needed services (Moghnieh & Blat, 2011). Two other studies by Veenstra et al. (2011) and Kanis et al. (2012) discussed about a large screen application named BieBBeep in a new library- Almere in Amsterdam. The display is a place to experiment gathering, sharing information and to facilitate communication and social function of the public place. The display shows the relevant local information such as news, book trailers, local acquisitions and events by RSS or YouTube videos. (RSS: Rich site summary is a web feeding format for easily distributing and feeding online content, RSS are for computer – to computer communication and can be parsed by newsreaders (Duffy & Bruns, 2006).

3.13. Search Bar
Some characteristics mentioned for Plasma Poster display system, reviewed by Churchill, Nelson and Denoue (2003). Which includes a search box. This function facilitates finding the desired content on the large display system. Kukka (2012) studied version 2.0 of a large interactive public display in Oulu, Finland at the city center and mentioned the ability of the device to search for restaurants, Public transport schedules and English news service ‘65° North’. Ribeiro, Costa & Metrôlho (2011) studied a display with a search bar, if related content to the searched word does not exist, system finds the closest content to the interests of the user (base on the searched word).

3.14. Photo Album and Media Content
Photo albums and other type of media on different displays and settings are used. The photos and media make the displays interesting. In addition, they support social learning and communication (Huang, Mynattand & Trimble, 2006 cited in Kurvinen et al., 2008) (Du, Rosson & Carroll, 2012)

Huang et al. (2006) called a function on a display named ‘the collaborative collage’ which people share media such as webcam feeds, photos, webpage thumbnails, notes and other media. Sharing media is also one of the functionalities of MessyBoard that was developed in Carnegie Mellon University (Huang et al., 2006). Another Large public display is used for ‘sharing personal photos’ on CoCollage and C3Collage large display systems. CoCollage Projects is at a university campus. Both are in cafés (Du, Rosson & Carroll, 2012). In another study a series of LIPDs in Sapporo’s underground station (Sapporo is a city in Japan) is augmented with a Photo-Swapper application which enables people to share their photo from mobile devices with others to encourage social interaction (Choi & Seeburger, 2011).

Citywall is a successful instance of large multi touch screens in a public crowded place, Helsinki, Finland in a central location (Kurvinen et al., 2008). Citywall presented multimedia content such as photos and videos. It has organized the public city images and enables image exploration from Flicker website. Pictures could be resized, removed, rotated and moved using one or two handed gesture. Overview of the pictures and detail principle is available (Huang, Mynattand & Trimble, 2006 cited in Kurvinen et al., 2008). City wall has interaction
log to see which photos were more interesting, the amount of users and interactions, to show the content updates. Significant outcomes of this experience were that wider screen interacts and accommodates more users to use the screen simultaneously (Kurvinen et al., 2008).
4. METHODOLOGY AND METHOD

Philosophical worldview, Theory, Research approach, data collection methods and generalization of the outcomes are presented and discussed in this chapter. Hermeneutics theory is presented first followed by the research approach then data collection methods and finally generalization of the result.

4.1. Hermeneutic Theory

The underlying philosophy of this research is Hermeneutics. Hermeneutics can be the underlying philosophy and tradition of a research and also a tool for mode of analysis. In addition, Hermeneutic Theory is called as the art or tool of understanding (Gadamer, 1975) Hermeneutics is a general theory defining textual meaning and interpretation of texts and anything that can be described in textual form, such as an organization, human artifacts, action or culture. Hermeneutics can be used to interpret what people do and say, by analyzing text and text analogue (Boland, Newman & Pentland, 2010; Mayers, 2004; Myers, 1997) (Myers & Avison, 2002, p.10)

Hermeneutics is used in human sciences in nineteen century and in twentieth century it became a philosophical tradition. Heidegger believes that human beings are related to their nearby and environment via their understanding, and the understanding is possible through interpretation (Vessay, 2006). Vessay (2006, p.209) believes “Hermeneutics, as the study of interpretive understanding, becomes both the means for self-understanding and the model for how humans interact in their environment.” Hermeneutics field of application includes all conditions that the meaning is not immediately understandable. Hermeneutics bridges the gap between the familiar world that we understand and the strange meaning that we do not. (Gadamer, 1976). Bridging the gap is possible through using Hermeneutic circle.

Hermeneutic circle of unconscious understanding and situated behavior was introduced by Heidegger to use interpretation as a basis for further understanding and discussion (1976 cited in Cole & Avison, 2007) Hermeneutics uses hermeneutic circle to make sense of the study subject and bringing clarifications. Hermeneutic circle uses loops for discovering more about the subject by the help of previous understandings and knowledge about the subject and the whole. By trying to use existing knowledge, knowledge about the whole and relate that to parts that the whole is consist of. It will be continued until the cloudy parts of the subject disappear, and the whole, its parts and their relation get obvious and clear, until researcher can relate all the opinions, find the reasons and sees no absurdity, but the sense and reason inside. Taking back and forth between whole and detail of something is the engine of hermeneutic circle. (Boland, Newman & Pentland, 2010).

Hermeneutic circle talks about the dialectic of understanding the whole and interpretation of its parts in relation with each other, which is used as mode of analysis (Myers, 1997), the interpretation becomes a basic for further understandings and findings (Cole & Avison, 2007). Butler (1998, cited in Cole & Avison, 2007) believes understandings are the result of comments or interpretation and executed action. And the goal is reflectively deny or approve those aspects of pre knowledge which can be re-specified or theoretically developed. This leads to one of the important concepts in hermeneutics theory which is prejudice or
prejudgment. This concept states that for understanding a concept or phenomenon a pre-knowledge is needed, to be a base for more understanding. Understanding involves interpretation. And interpretation is possible by applying a preconception about a subject in a way that its meaning become clear (Meyers, 2004, p.109). In addition, Gadmer (1975 cited in Prasad, 2002) emphasized on the pre judgment and pre knowledge and said any kind of interpretation happens in circular movement between the pre knowledge of the whole and examination of the parts. The interpreter has a pre expectation about the whole, which is affected by his/her cultural tradition and history. And when s/he reads the text or subject as the parts his/her interpretation is affected by the pre knowledge. Gadamer (1975 cited in Prasad, 2002) calls the pre knowledge prejudice.

Hermeneutics horizon is another concept that plays a role in interpretation and understanding. Gadamer (1975 cited in Prasad, 2002) believes that our prejudice defines the limits of our horizon of understanding or hermeneutics horizon. Therefore, prejudice is an obstacle but necessary for understanding. Prejudice can be ‘productive prejudice’ which is determinative for understanding or can hinder the understanding and lead to misunderstanding. Gadamer (1975, cited in Laverty, 2003) thinks that interpretation is fusion of horizons. That is the dialectical interaction between meaning of the text and the reader’s prejudice and expectation. “A ‘horizon’ is a range of vision that includes everything seen from a particular vantage point” (Laverty, 2003, p.25) To not have a horizon means that a person cannot see far enough and just relies on the knowledge they have immediately at hand. Having a horizon means the person can see far beyond. Questioning is a way to make new horizons and more understanding. It means that for understanding we should go beyond re-creating someone else’s interpretation and meaning. Questioning makes it possible to understand a new interpretation and brings the meaningful thinking about the subject to the interpreter-reader’s mind. For making a new horizon person should put him/herself in a communication and conversation that they get transform by that (Laverty, 2003).

Hermeneutics can be used in studying the organization when there are controversies about IS and its consequences. Also in ethnographic researches where interviews, observations, case study notes and voice recordings are used and they need interpretation. Moreover, it works when we need to determine different views and values given, regarding a new IS, or studying the usage of new technology and IS development and design. Additionally, Hermeneutics can be used for assessment of failure of an IS, evaluating user role in participatory design, in development and analyzing communication modes of distributed teams. Besides, to study problems of IS design in virtual communities and computer – mediated discussion groups (Mingers & Willcocks, 2004). Cole & Avison (2007,p 820) said “unlike other research methods, hermeneutics aims to transcend existing notions about some phenomena”.

This research tries to find out the ideas and opportunities for exploiting a new IS that works base on using a device (LIPD) with related technologies, in a higher education organization, for supporting internal communication. The aim is similar to the beginning steps of IS development, gathering the requirements of a new system. Then, it is compatible with usage of hermeneutic theory as it cited in the previous paragraphs. Therefore, I chose hermeneutics as a general theory that has a dominant and guiding role and view, that affect the whole
research specially data collection and data interpretation (analysis) with using hermeneutic as a tool for analysis.

By considering the LIPD as a subject and chosen technology of this study and as a whole, Hermeneutics can help to understand it and gain knowledge about its application. Hermeneutic circle can help to determine how much data collection is needed. Since, I as the researcher can understand if there is any unclear part left about the data, LIPD and its detail or related functions. If any unclear part about those items is left then, more data collection and analysis is needed to clear ambiguous parts and their relation to the whole (LIPD). Hermeneutics is the theory of interpreting the text. Literature in this study has a major role for gathering, categorizing and analyzing the data. Therefore hermeneutics is proper for this research. Additionally, I have documents and transcripts of data collection methods to interpret and analyze.

4.2. Research Approach
Qualitative approach is used for this research; this approach is proper for relying on people in the context of study to talk about their situation and feelings. Qualitative approach gets help from textual data to understand the social and cultural context of people, which they live or work in. (Myers, 1997) It is suitable for change and study of human interactions with other objects or subjects (Denzin & Lincoln, 2005)(Creswell, 2009, p.62-65)(Conboy, Fitzgerald & Mathiassen, 2012)(Myers, 1997) It is useful for studying some perspectives such as feminism, different races conditions and for being critical to empowering human beings by transcending the constraints (Creswell, 2009, p.62-65).

In the context of the study (the university) internal communication issues of students, their needed information and the print communication channel should be studied. That leads to identifying the characteristics of the LIPD system and what system should be able to do. Opinions of different nationalities are going to be explored. Different people have different opinions, which are important for this research. This study presents those different ideas for application of LIPDs at the university context, in support of internal communication. The research is not about gathering statistical and numerical data for approving or rejecting suitability of a function for LIPD system. All the suggestions and potential functions are studied. Therefore, the qualitative approach fits to this research.

4.3. Data Collection Methods
For data collection, I used complementary methods; creativity workshop of requirement engineering, interview and observation. The processes are described in the next chapter (see Section 5.2. Data Collection Processes).

Why Creativity Workshop?
Creativity workshops are explained in literature review (see section 2.4.1.1.1, 2.4.1.1.2 ). The workshop of this research is based on creativity workshops. Just as a reminder there are methods and techniques used in this type of workshops that can excite and stimulate participants’ creativity. These workshops let the participants to talk about their opinions
freely, without limiting them by questions. Consequently, the outcome of these workshops is creative ideas (Maiden, Robertson and Gizikis, 2004; Maiden et al., 2010).

For answering the research question of this research I need to gather ideas. I care about suggesting ideas in this research not only for solving the problems mentioned in section 1.1 (Background and problem area), also for maximum exploitation of LIPDs. Maximum exploitation is possible by suggesting creative ideas, which is aim of creativity workshops.

Besides, some scholars justify using the creativity workshop base on an opinion which is one of the reasons that I choose this method. An idea is mentioned by Nye et al. (2006, cited in Maiden et al., 2010, p.58) which is “necessity is often not the mother of invention, and that software tools often exist before the problems to be solved.” Also Norman (2009, as cited in Maiden et al, 2010) believes that technology have often emerged before user necessities. Moreover, Maiden (2010) point out that nowadays innovation and creativity in products are necessary and bring competitive advantages. It is the power of being innovative and imaginative in the twenty first century economy that brings success and winning. We can call that power of ‘i’ in product and services (Wiley, 2002, p.7). iPhones/ smart phones and Google map are examples mentioned by Maiden et al (2010) in this respect. To make advancement in technologies such as cell phones, and creating new innovative technologies, the requirement gathering process must change the rules in defining the possible requirements. Cell phones are needed for making or answering a call wherever you are, but the functions of smart phones as new generation of cell phones are far more than that. If technologists had limited themselves to the user needs, the existing useful and popular capabilities in smart phones and related application and technologies would unlikely to appear (Maiden et al., 2010).

Similar to cell phones, LIPDs are young technologies. Better exploitation, their integration in their use setting and their advancement needs creativity and new ideas. Therefore, I think planning for using LIPDs and idea gathering for its application, should goes beyond currents problems. Then, to make it possible and increase the chance of gathering creative ideas, creativity workshop is one of the chosen methods used in this research.

4.4. Generalization of the Result
Creswell believes that generalization of the result is not the intention of qualitative research (2009, p.193). Qualitative is the approach of this study. Gray (2009, p.148) believes that the resources of doing a research are limited, therefore participation of everyone in the research is impossible, that’s why researchers use a sample group as participants of the research. Consequently, he thinks generalization of the result from a sample group to everyone is not possible.

Besides, during my data collection and analysis I have realized that some factors about the setting and participants can affect the result of this study. The functions expected by students for LIPD system, are affected by; the current setting characteristics, how much their setting is enriched with new technologies, and how much they use and are familiar with new technologies before. Therefore, the result of this research for each setting is specific to that
context, and generally it might not be completely matching or consistent for other universities. Even though, the result of this research can be used for preliminary requirement elicitation and as a base, for other universities and higher education institutes.
5. CONDUCTING THE STUDY

In this chapter I present the research setting, data collection processes, reliability and validity techniques. Moreover, ethical considerations, what is the researcher role and the data analysis process are presented.

5.1. Research Setting

For data collection in this study, I have chosen a case which is Linnaeus University, in Sweden. The observation of initial issues that were previously mentioned in section 1.1, happened at that university. Participant students are also from this university. Linnaeus University is located in Kalmar and Växjö, in Kronoberg province of Sweden. It has over 40,000 students and 2,000 staff, in 150 degree programs and 2,000 single-subject courses. Some of the domains that are taught at the university are humanities, social sciences, natural sciences, engineering and computer science. Linnaeus University is one of the universities which accept exchange of students from all around the world. Therefore, needs of international students should not be overlooked and should be taken care of. Linnaeus University in its strategy is defined as a modern international university. Also modern university is defined as a university which can think innovatively and has dynamic every day activities which are in line with the demands and needs of students and community. Also the defined vision for the university is being “An attractive international learning environment promoting curiosity, creativity, companionship and utility” (Linnaeus University communication department, 2009, p.9). Therefore being international is obviously a strategy and policy (Linnaeus University communication department, 2009).

5.2. Data Collection Processes

Processes of creativity workshop, interviews and observation are explained in this section and reliability, validity and ethical considerations will be explained in the following sections.

5.2.1. Creativity Workshop in This Research

As one of the data collection methods, I have conducted a workshop based on creativity workshop, used for requirement gathering of computer systems by some scholars (e.g. Pennell & Maiden, 2003; Maiden et al., 2010).

The workshop was held on 23rd July 2012, for three hours and twenty minutes including 20 minutes break between two sections.

Participants were invited via an invitation event on Facebook, which contained a description of what is the aim of the workshop, what is the objective of my thesis and address of some online videos about large displays. I had provided a schedule before the workshop (see Appendix H- Workshop Agenda)

5.2.1.1. Workshop Participants

Nine international students from Linnaeus University participated at the workshop. A participant left after the first section. Participants were three male and six female; four Master’s students, one PhD, three Bachelor’s student and one student who only has some
courses but not any program. They were from different nationalities studying different programs and were selected randomly.

5.2.1.2. Aim of the Workshop
The aim of the workshop was to gather ideas for utilizing LIPDs at the university, from students’ point of view, besides discovering students’ problems in internal communication and their required information at the university environment (in support of internal communication). In order to achieve the aim of the workshop, more emphasize was given to freely talking not questioning and answering. Free talks were about the subject (LIPDs), communication issues and information needs at the university area. Although, during this free talks some questions were asked for clarification and expanding the conversation.

5.2.1.3. Data Collection Process and the Schedule
For the workshop, I provided a schedule before the workshop (see Appendix H- Workshop Agenda). At the first section, there was a PowerPoint presentation for introducing the workshop aim. I presented my research in such a way to make it more understandable for the attendees. And for making the subject more clear and understandable, I compared the LIPD to digital version of bulletin boards. The subject of the research and the aim of the research were presented. Two videos were played (xeeliz, (2010) and PSDJD2011, (2011)) regarding the existing large display projects in order to make participants familiar with large public interactive and un interactive displays. The role of participants was explained to them. I asked the participants to imagine the LIPD as a digital bulletin board and suggest functions for that (However anything that was suggested I presented as a function or idea for LIPD). They were asked to talk about any ideas that they have freely, and not being shy to suggest something. The rules of workshop presented as: not criticizing others’ ideas; and not interrupting people when they are talking.

By getting ideas from exploratory creativity (Boden 1990 cited as Maiden et al., 2010) used in creativity workshops by Maiden, Robertson and Gizikis (2004) after introduction, two videos were screened to provoke creativity (Awesometouchscreens (2011) and PNNL.gov(2010)). They were about emergency management and a way finding system (a system that gives the visitor direction to go somewhere). Then participants were asked to somehow link what they saw in the videos to the subject of the study (LIPD) by giving suggestions for functions of a device which can work as a digital bulletin board at the university. After few minutes given for thinking, participants talked about their ideas and suggested some functions and features for large public displays. Later on, participants took a break and they were asked to notice the bulletin and advertisement boards that they see around in the corridors, since I wanted them to find out the problems or come up with new ideas. Workshop was conducted in main building of the Linnaeus University in a corridor that many bulletin boards with different usage and categories of information exist.

In the second section, we started with music as Maiden, Robertson & Gizikis (2004) suggested, to stimulate creativity. Again for using exploratory creativity (Boden 1990 cited as Maiden et al., 2010) another video about using a type of glass which can be a monitor in many of the devices we use daily, was presented (Corning Incorporated, 2011), in order to
help participants’ imagination for new ideas. Then considering the idea of Creative Problem solving (CPS) (Maiden, Robertson and Gizikis, 2004) I asked participants to think about the problems which came to their notice in bulletin boards of the corridors that they spend their break time in. this stage is aligned with problem finding in CPS. Up to this moment workshop was in the phase of diverging ideas. Participants talked freely about their ideas and whatever comes to their mind, that they think it is suitable for the large public display at their university.

Afterwards, workshop entered the phase of convergence of the ideas. I asked participants to discuss the ideas and functions, which they think should have higher priority, and are more suitable for a university context, considering their experiences and needs at Linnaeus University. In some cases people criticized each other’s ideas since it was accepted in this part of the workshop (Convergence of the ideas). Participant asked each other about reasons of giving priority to a specific function.

Maiden and other researchers used to have one of the creativity models (Exploratory, combinatorial or transformational) in each single workshop. Before conducting the workshop I was going to have two workshops in order to use more than one creativity model, but after reviewing the first workshop I decided that the second one is not needed since combinatorial and transformational models are almost informally covered in the first workshop conversations.

In the workshop I did not limit the required resources such as money and the number of large public displays, location or department that is going to use the large public display system. The only limitation was that functions and functionalities should be appropriate for a university context. I mentioned that there is no constraint and condition in the beginning of the divergent phase; In addition, I repeated that whenever participants asked me about the limiting conditions such as money. Moreover participants also tried to relate the functions that could meet other contexts such as shopping malls and airports to the university, which totally can be considered as thinking beyond the only limitation (university context). Therefore, I decided that the transformational creativity is not needed to be applied in a separate workshop.

Besides, one of the participants was familiar with new ICT technologies very much, such as NFC and its usage in Digital Wallet and applying that in mobile phone applications. In addition, QR codes, using Bluetooth for advertisement and possibility of using these technologies on students’ ID cards to enhance the features and functions of large public

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5 NFC is a set of standards for smart phones and other similar devices to communicate with each other and transmit data by touching or getting very close (Agrawal and Bhuraria, 2012).

6 A digital wallet is an application or service uses by a device, that assists user in conducting online transactions (Sibert, 2005).

7 QR-codes can be called as a two dimensional barcodes that can be decoded to extract information. Usually cell phone applications are used to decoding that (Sun, Sun & Liu, 2007).
screens. Therefore, I believe that the discussions in the workshop covered the concept of *combinatorial creativity* perfectly and strongly.

5.2.2. **Interviews in This Research**

After the workshop, I conducted semi-structured interviews containing open-ended questions with students. Interviews were conducted in November 2012.

5.2.2.1. **Aim of the Interviews**

The most important purpose of the interviews was evaluating the ideas and functions gathered from the literature, which were not covered by the workshop data. In addition, in analysis of workshop data, I have found some ambiguous parts. More data collection with interviews could clear those ambiguous parts. Some suggestions and ideas were not discussed perfectly at the workshop and needed more clarification, discussion and reflection of students. Finally, gathering more ideas were intended. Interview questions are available at Appendix I - Interview questions.

5.2.2.2. **Participants of Interviews**

Twelve international students from Linnaeus University participated in the interviews, seven female and five male. Participants were a PhD candidate, seven Master, two Bachelor and two students who had single courses. Some of the participants at the workshop and interviews were the same. Since I wanted to clarify some ambiguous data gathered at the workshop, then it was better if the interviewees knew what happened at the workshop. Other participants were selected randomly.

5.2.3. **Observations: Aim and Process**

Observation of some issues (section 1.2) at the Linnaeus University, by the researcher, was the inspiration of this research. Linnaeus University area was the context of observation. I have observed any type of boards or any other devices containing information at the university area. Content of bulletin boards, advertisement boards and other printed materials such as internal magazines, flyers and brochures were observed, to find out about the type of information that is shared, how students get access to them, and how is the interaction and treatment of students with these materials at the university and what these materials end up to. I observed map of each building at its entrance, and the boards which shows the teachers’ office. I tried to notice about how they are helpful, and what the difficulties to use or read them. I got some pictures from bulletin boards, and I took notes during the observation. Moreover I tried to notice if I need any information when I am at the university. Or, when I am at home what information I need about the university. And can I get that information or not.

5.3. **Data Analysis Process**

In this section the data analysis process which is tied in with the data collection processes is described. As Creswell (2009) mentioned, the analysis of qualitative data should be started from the initial steps of the study. I started the analysis by taking notes during the literature review from the first steps of the research. After that, I took notes during each of the data
collection processes whenever an idea came to my mind. Moreover, I wrote comments and notes when reviewing the workshop recordings, notes and interview materials.

I used generic qualitative data analysis method (Creswell, 2009) and coding of data to come up with some categories for structuring the data, which I gathered from the literature. All the data that I gathered from the literature which were written were coded and then categorized in a table based on the codes. After that, by merging some of the related categories, some main categories emerged - these are presented as the titles of each section in chapter 3. After that I used those categories as a base for organizing and analyzing the collected data (data from the workshop, interviews and observations). The process of analyzing collected data contains these steps:

1. After the data collection, I have listened to the voices or watched the videos and transcribed them. I wrote descriptions about the pictures and notes of the observation.
2. I read the transcripts and descriptions several times and summarized the transcripts and descriptions.
3. I categorized the summarized data in categories of the same table which contained the data of each category form the literature. Categorization was done by comparing the data to the title of existing categories in that table.
4. If the data did not fit in any category, I put it in a new row of the table, after that the coding of data was used again for this type of data in order to categorize it.
5. I have read the data in each category and put that in order.
6. Then, for each category, the hermeneutic circle was used. (Described in the following paragraph)
7. Sometimes, based on the findings in each category of collected data (from the participants or setting) I modified the name of the category and will present that in the sections of 6.

I should mention that In my analysis, I tried to find ideas and suggestions of exploiting the LIPD, communication problems, information needs of students and to find out if the idea is new or was addressed in the literature and, if the reflection of students on the use of a function is similar to the literature or not.

The underlying philosophy of this research is Hermeneutics. I talked about hermeneutics and the hermeneutic circle for the analysis in section 4.1, I use the hermeneutic approach and hermeneutic circle for analysis of the data. The information in chapter ‘IDEAS FROM THE LITERATURE ABOUT LARGE DISPLAYS’ (chapter 3) and the including categories (sections), helped to have a pre-understanding and prejudice about the subject of the study. The information in chapter 3 aided for further understanding the participants and analyzing their opinions. Moreover, it acted as a guide for data collection and analysis. Besides, information about the previous studies (3) helped me to be more analytical about participants’ reflection on functions and ideas related to LIPDs. By using this information, it was easier to analyze if users’ opinion is different or aligned with the previous experiences. I tried to relate the data to my pre-knowledge - the categories - and their related information of the literature ideas (chapter 3), but if no data was collected about a category in the literature, I went through more data collection. This means for each category I used the hermeneutics circle. How deep I
needed to go through the data collection and interpretation (analysis) and when the literature review and data collection was enough was decided with the help of the hermeneutics view. This means based on the hermeneutic circle, I continued the data gathering and analysis until all the opinions looked related and reasons became obvious, no absurdity remained and an understandable view of the whole LIPD system, and the ideas and functions as the details were captured.

For using hermeneutics and the hermeneutic circle as an analysis tool, I considered the LIPD application system as a whole and tried to find functions as parts through the hermeneutic circle by the help of the categories of previous ideas (chapter 3). I conducted a back and forth analysis through the collected data and the literature. If it was necessary, I did more data collection in order to add functions as parts to the whole. Then, I evaluated the functions in data collection and afterward analysis of that data.

During the circles, I did some observation at the university area to understand the print channel of internal communication at the university, its issues as information needs at the area. Then I used the gathered data to add to the whole and my understanding of the situation.

Afterwards, in order to go forward in the hermeneutic circle, I conducted a creativity workshop. Here the analysis of notes and transcribing them brought some valuable data such as suggestions and opinions, issues in communication, information and communication needs.

Next, I again reviewed some literature in order to be able to interpret some unclear gathered data. Moreover, I searched the literature in order to find out if the suggestions of participants have been implemented before or not. The literature also supported many of my findings, and gave the findings more validity. I also gathered some functions from the recent literature review; therefore I updated the categories of ideas in my analysis table and afterward the categories of ideas from the literature (chapter 3). Then, I noticed some gaps in the data, which led to more data collection by interviews.

Consequently, I conducted some interviews. I analyzed the collected data in order to define parts (functionalities, issues and information and communication needs), interpreted them, and consolidate them to my understanding about the LIPD system (the whole). The hermeneutic circle continued by searching the literature in order to find out if there is any background about new emerging suggestions and functions. At that time everything was clear and no cloudy point remained. Therefore, I stopped the circle. Figure 4 shows this process.
5.4. **Reliability of the Research**

The reliability of this study can be derived from all the data collected during the collection processes including workshop, interviews and observation. According to Creswell (2009, p.190) qualitative research steps and procedures should be documented as much as possible to make the research reliable. Different type of recordings enables the researcher and any other person to recheck the gathered data and findings for evaluating the reliability of the result (Gray, 2009, p.158).

At the workshop of this research, I took notes, and the participants were asked to write down the Ideas that they talked about. The workshop was video recorded and transcribed. Interviews were voice recorded. I took notes in the Interviews and transcribed them. For the observation process I took pictures of bulletin boards and other related objects, for instance a white board with certain data is located at a corridor and I took its picture. Moreover, I took
some notes during the observation and after reviewing the pictures I wrote down descriptions of them.

I have checked the transcripts and observation pictures as well as their descriptions with my notes at the interviews and the workshop, in order to make sure that my understandings are right. Moreover, as Gibbs (2007 cited in Creswell, 2009) suggested, I checked the transcripts to ensure that there is no obvious mistake in them.

5.5. Validity of the Research
In this section I discuss the validity of the research, collected from all the data collection processes (workshop, interview and observation). In qualitative research validity depends on how accurate the research is from the researcher’s, participant’s and reader’s point of view (Creswell, 2009; Creswell and Miller, 2000).

Member checking was used for findings of the workshop and interviews by participants, in post-workshop contacts and post-interviews contacts, as Gray (2009, pp.362-363) suggested.

After the workshop, a summary of each participant’s opinions and suggestions besides the summary of the whole workshop was sent to the participants as a polished result.

After the interviews, a summary of the interview was sent to the participants as a polished result in order to ensure reflection and control of accuracy and validity. At the interviews, if the interviewee had participated in the workshop I mentioned the main findings of the workshop for more checking and reflection.

Validity in observation is difficult since it’s a personal interpretation. As Gray (2009, p.416) and Creswell (2009, p.191) suggested, I tried to describe the observed subject or the issue completely to address rich description as the validation technique in this regard.

In addition, triangulation of data is used, which is using different sources of data (Creswell, 2009, p.191). Interviews and creativity workshops as well as observation add to the validity of the data and consequently the result.

5.6. Ethical Considerations
Considering ethical issues is an important notion in academic researchers and scholars usually discuss its necessity (e.g., Gray 2009; Creswell, 2009). Following I explain some ethical considerations that I followed for my research, based on Gray’s (2009) and Creswell’s (2009) suggestions.

Participants in all types of data collection were informed that data and findings will be used for academic purposes and confidentiality will be considered. However, the interview questions and workshop content did not include any political, ethical, economical and financial aspects that might be dangerous or risky for participants to answer or discuss about. Participants were assured that their names will not be used in the research. I tried to respect the time of the participants in data collection activities by starting and finishing on time and informing the participants about the approximate time of the activity earlier. As my invitation
for the creativity workshop, I formed a Facebook event and mentioned the approximate duration time, the place and the time of the workshop, the usage of the collecting data, alongside a brief description about what the workshop and the research are about. Before any recording at the workshop and interviews permission was asked, furthermore I explained that the recordings will just be heard or viewed by me, my supervisor and my examiner if they ask.

Before the workshops started, participants were asked to not criticize or ridicule other’s opinions, and to not interrupt the person who is speaking. As Gray (2009) suggested, after the interviews each interviewee had access to his own transcribed summary that was used in the research if they asked for it.

At the beginning of the workshop I asked written permission of participants for using the results of their contribution at the workshop in my thesis and further research. Participants were free to leave the workshop whenever they wanted, as one of them left after the first session since she had other obligations. After the workshop, the summary of each participant’s opinion was sent to them (besides the summary of the workshop result), in order to ask their confirmation of what they said. At the interviews, participants were free to reject answering any of the questions. They were also free to ask any questions.

5.7. Researchers Role
The researcher does the data collection and analysis. The researcher also interprets the collected data and describes her/his understanding as the result and findings. That might interfere with the researcher’s values and perception on these activities (Creswell, 2009, p.196). However, I tried not to affect participants with my opinions in data collection, while I was interviewing them, or at the workshops. Besides, I had the creativity workshop before the interviews, which let the participants to be creative and speak freely, without being limited by any question (like what exists in interviews) prevent the affection of participants’ opinions by researcher’s values. Moreover, observation was my role as the researcher, and since I am a master student in Linnaeus University - the setting of the research, it was easier to observe the internal communication print channel and student’s interaction with that.
6. EMPIRICAL FINDINGS

This chapter presents the empirical findings from observations, the creativity workshop and interviews. The presentation is structured with the categories used in chapter 3. IDEAS FROM THE LITERATURE ABOUT LARGE DISPLAYS. The categories are: 1. Access from Any Place Any Time- Access from Other Places and Other Displays 2.Content Management 3.Supporting Information Takeaway 4.Presenting News, Events, Announcements and Advertisements 5.General Information on Studying and the University 6.Campus Life and Information Needs of the Area 7.Posting a Subject for Voting and Commenting 8.Instant and Emergency Messages from LIPD to Cell Phones 9.Personalization of the Content 10.Library Information 11.General Aspect of Navigation and Using LIPD 12.Using Photo Albums. However there are some differences between categories of this chapter and chapter 3. I have found some information in empirical findings around and related to the main concept of the categories of chapter 3. That information and relation of some of the categories have caused modifications of the previous categories in title, sub categories, spreading among other categories or combination of two categories. Therefore the categories here are not exactly the same categories of chapter 3.

As it is mentioned in Methodology and Method chapter, I have used hermeneutics circle for analysis, I had some loops backward and forward among data collection and analysis, whenever it was needed and still there was a gap in the data or ambiguousness in analysis result. The sources of data are literature, observation, creativity workshop and interviews.

To answer the research question and analyzing the data, I have used information in sections of chapter 3. That information provided me with some pre-understanding and prejudice for easier interpretation and analysis. Moreover, I have used the functions of previous studies to see how they are suitable for the university in students view. In the analysis I seek to find out students’ information needs and internal communication issues, In addition to get participants’ (as students) suggestions and ideas for exploiting the LIPDs to support internal communication. I try to realize how the participated students think of ideas and functions from the literature (ideas presented in chapter 3) to be used at Linnaeus University, in a LIPD application system.

Having definite functions list for implementing the LIPD system needs to include other aspects, such as other stakeholders’ opinion (e.g. teachers and university employees), beside technical and financial considerations and limitations. Those aspects are not part of this research. The answer of the research question is the summarization of what is described in each category of this chapter, that you can read that in the next chapter (RESULTS- IDEAS FOR USING LIPD AT A UNIVERSITY). The title of each category shows an area of ideas for application of LIPD. For each category there are students who were agreed and who were not. Description of each category in this chapter is the reflection of students on that area, including students’ information needs, problems and related functions that students suggest or require. Now I am presenting the categories:
6.1. Anyplace, Anytime Access

More than half of the participated students believed that LIPD system should be accessible from home and outside the university. A workshop participant said “It is necessary to enable access to the LIPD by the internet. Then students can check for information that they need, which is on the bulletin boards or at the university environment, but they forget. And it makes possible to look more to the content of the display for more information”. For instance, date of a seminar might be needed to be checked from home. Furthermore, some of the participants believed that many of important announcements such as recruitments announcements and research partnership opportunities are not at student’s sight, those are usually announced on the bulletin boards, which are close to teachers’ offices, and are not on the floors which students usually pass. Base on the problems and discussions mentioned in this section, participants take into account the accessibility of information at any place and any time. The system should provide the possibility of access to the content at any time and any place.

6.2. Content Management

Workshop participants all agreed on the fact that content of the LIPD needs management. Moreover, they asserted that LIPD needs an administrator. We also discussed about the necessity of different access levels for feeding the content, keeping the content updated and archiving the old content which are described more below:

6.2.1. Categorization of the Displays and Content of Each Display

There are many different type of content on the bulletin boards at Linnaeus University (the case of the study) such as advertisements, announcements of academic, educational, cultural, sport or social events. A workshop participant believed that “the amount of stuff on some boards is a lot, which makes the people uninterested to read the bulletin boards. Then you cannot find the thing that you need or are interested in.” Participated students in the study believed that different types of content should be categorized, then people can easily look for the type of information that they are interested in or seek for. Another student said: "There is no categorization which can be useful and time saving. It is better if there will be a categorization for boards. As an example, a display for social and student nations events, one for student’s ads and one for academic events.” Also another participant said: “categorization of a specific display’s content and functions on the display is needed, which can be also base on popularity and usage rate of the content or function”. She mentioned that “name of each category should be mentioned at the top of each board”. Considerable point is that according to my observations at the Linnaeus University some of the bulletin boards have category name (Figure 5- Name of bulletin board categories in Swedish language) and some do not. Some of the boards with category name also have irrelevant content. None of the participant students have seen the name of any of the categories. The category names are mostly in Swedish language and are not understandable for international students. Also board names are not as eye-catching as they should be. Since students suggested naming for each category right after they were out to the corridors to observe the bulletin boards (see section. 5.2.1) but none of them saw the category names of bulletin boards. According to the participants categorization of LIPDs and putting a name for each category make them easy to capture, read and more interesting.
Participants cared about easy usage of LIPD and usability. Since, assuming that the LIPD should have categorization, a participant said: “The first page or default screen should be categorized, easy to scan and understand and easy to search for information.” Categories which were specified during the workshop; are academic events, social and cultural events, sport events, educational announcements, advertisements such as student ads or sport ads, Job and recruitment including academic job vacancies, internships or companies recruitment announcements.

6.2.2. Content Administrator or Gate Keeper
Participants cared about controlling to have proper information on LIPDs. More than half of the workshop participants emphasized on the necessity of controlling and checking the LIPD content by an administrator or a gate keeper before publishing. Almost every participant agreed that controlling the content on some of the categories is more important than the others. They added that not necessarily all of the categories need to be checked, as one of the participant said: “general advertisements are not that important to be checked before publishing, but if students have access to publish something on the category of ‘News’ or ‘Events’ it should be checked before publishing.”

6.2.3. Posting Content through Different Access Levels
Participants all agreed that students, teachers, university staff even people outside the university (such as companies who want to put a recruit advertisement on LIPD) should have access through internet and web pages to input content on LIPD. But the level of access
should be different. Participants thought that different access levels affect the security of the LIPD and it’s necessary. As a workshop participant said: "Students should not be able to put something like course announcements, but putting ads, or some interesting news after their approval by the LIPD administrator is OK”.

They mentioned that it is also the same in paper based advertisement boards, although having control over that is difficult. Different group of people such as students, student nations, university staff (for example a department secretary or an employee who is responsible for communications in each department) put different type of content and information on bulletin boards. Although they believed that different groups should have different access levels to put on different categories of information.

6.2.4. Keeping the LIPD Updated
According to a workshop participant: “there are so much outdated announcements on the University bulletin boards, many of the ads have no date, students cannot understand if a presented opportunity on an advertisement still exists or not”. Also based on my observations in many cases an event announcement remains on the bulletin boards long time after the event is passed. Those outdated materials with no date on bulletin boards and walls will confuse the visitors. Therefore most of the participants claimed that LIPD should be kept updated. They said outdated content should automatically be removed or archived.

In addition students asserted that LIPD system should be connected to other sources and data bases at the university, such as the university web site or intranet. That connection causes LIPD system getting updated simultaneously and automatically, when those sources get updated. Base on the mentioned opinions of the participants, they cared about up to date information, integration and validity of data.

6.2.5. Archiving
A workshop participant mentioned that “old and expired content is better to be archived”. He also added "search on the archive using a period of time is also needed and archive should be sorted base on date”. He believed it helps people to get some information from outdated content, such as a lecturer’s email of an academic seminar. Most of the participants think that archiving is not a necessary function.

6.2.6. Having a Particular Content in Several Displays
All the interviewees agreed that, possibility of putting a particular content on multiple displays (in multiple places) is a necessity. The reason of one of the interviewees was that: “a problem of paper base displays is that they cannot contain all ads. Therefore you might miss the ones that are not on a display which you are passing.” It means, by availability of the content on different places people are able to see that content even if they are usually passing just one of the buildings. Besides, more people can see that content, when it is available on different displays, and get the information. Interviewees were concerned about the accessibility of information since one of them said: if someone is not passing a specific LIPD then there is a chance to see the ad somewhere else. Even a participant emphasized that ‘it should be possible to put an ad or announcement on Kalmar LIPDs’. In addition as the
interviewees believed, the essential point is that putting the content in different places should be decided based on that particular content. An interviewee said:

“If it is a general content, then it is needed to be available in different places. But if it is related to a specific department, announcing it at the related building and on the related LIPD is enough. This matter should be controlled and decided by the administrator of the system. Students can make a request for their content to be available on different places, and the administrator will decide. Otherwise people start distributing irrelevant contents everywhere”.

6.2.7. The Same Content Multiple Times on the Same Display or Board

Most of the participants believed that the idea of having the same content several times beside each other in the same display is not a good idea. Participants considered the aesthetic matters to evaluate this item. Since an interviewee said: ‘it makes the display look messy and uninteresting, or it looks like there is a lack of content to put on the display’. They believed that in order to make the content more attractive, it is better to use other methods. Depending on the design of the display these methods can be different. For example an interviewee said ‘if slideshow technique is used, the time of showing the content can be longer, or it can be shown more than once in a loop. Bigger size for that content, bigger size of the font or a bolder one, more eye catching colors and design are better solutions’. One person also suggested that ‘even if it is allowed to put the content several times on a display, it should be limited, like maximum three times’. A few of the participants also thought, if enough and free space exists on the display, then multiple times presenting the same content, does not make any problem.

6.3. Supporting Information Take-away

In print communication channel and interaction with paper base bulletin boards at Linnaeus University, usually it is possible that people take the information of the advertisements or announcements with them. Taking the flyers, or part of an ad as a tear-away facilitate having the contact information for future use (Figure 6). There was a discussion at the workshop for covering these items to digital version as requirements for LIPDs.

Participants of the workshop and interviewees all agreed that having facilities for information take-away, to take some parts of the information that is presented on LIPDs, is a necessity. participants believed that ‘information take-away facility helps to take the info such as: ads and announcements contact information, news, course, conferences and other academic events schedule, buses timetables, university phonebook, maps or information of publications’ (they supposed these information will be available on the university LIPDs) They believe different methods should be possible to cover students with different available resources. Besides, some of the participants suggest that it should be possible to see who put a particular content on the system, in the take-away info; it is helpful for following up the content.

Most of the students agreed on the fact that printing parts of the information presented on LIPD should be possible. A student said” A printer should be connected to the LIPD using a network cable or Wi-Fi to help visitors taking needed information with them.” A participant
said in digital information take-away there is no limitation, caused by running out of the physical resources’, such as flyers or tear a ways, and this is an advantage.

We also talked about digital methods of information take-away such as using cell phones and emails via usage of technologies such as Bluetooth, RFID, NFC, QR codes. (See Appendix E-Definitions) A participant said “since students already are using RFID cards and they are familiar with this technology, using that cards for information take-away causes the LIPD to be more accepted by users” We also discussed about possibility of emailing a content to another person, for example if a LIPD visitor finds a conference announcement which she knows her friend is interested in, she can email that announcement to that friend. But what was unexpected for me was that participants said that it’s not a good idea to send anything to someone except yourself, since it is kind of spamming for that person. Just one person agreed with just sending academic events.

Base on my observations at the Linnaeus University environment, I have seen many magazines (Appendix A- Figure 24). A usage of information take-away function via mobile devices can be taking the digital version of these magazines away, from LIPDs as one of the contents. This facility can decrease the usage of paper at the university.

About information take-away participants cared about remembering and accessing to the information anytime and anywhere, saving natural resources by not using paper base flyers and simplicity of interactions.
6.4. Presenting News, Events, Announcements and Advertisements

According to the data gathered in the workshop and interviews, participants stated that the content that we usually see on bulletin boards such as news, events, announcements and advertisements are proper for presenting on LIPDs; those can be easily converted to digital version ‘It also decreases the paper usage’. A participant said ‘using multimedia content is possible on LIPD which is an advantage. For an ad about a trip we can use a movie to present the destination.’ According to my observations at the university area Advertisements can be about student offers, introducing a sport complex or its offers, selling or buying ads; such as second hand stuff or books, courses outside the university, announcing for a roommate or subletting an apartment. Announcements can be about course and announcements of departments, academic job positions, recruitments and job vacancies. Another type of announcements is Events. As participants believed Events inside and outside the university are proper content for LIPD, that based on my observations can be categorized as follow:

- **Academic events:** such as seminars at the university or conferences anywhere in the globe, upcoming defense sessions and guest lectures, they also can be categorized by department and related science.
- **Cultural and social events:** Student Union events, parties, student gatherings, events of the different student nations, art exhibitions or theater plays, historical or religious celebrations or charity gatherings.
- And **sport events** such as matches and games.

The important point is that based on my observation, most of the news and events are available through the website of the university. Students believed the events should be sorted by date. Then, tracing the upcoming events is easier. Upcoming events were concern of students at the workshop as well. In addition, many of the participants suggested to have another eye-catching categorization for events: Current and Today’s events. Then if someone is at the university and interested in events of the day s/he can be informed easily and participate. More than half of the workshop participants mention that in current situation they usually miss the academic events, since there is no reminder at the university area. Moreover, one of the interview participants said: “I want to be able to automatically add an event which is announced on the LIPD to my calendar”. I did not expect that students care this much, about participating in seminars and educational events, and have problems with having suitable reminding facility. Therefore having reminder facilities is needed.

Another student believed that non-academicals events of the current day (or night) are good to be announced as well, one said: “then students know where they can have fun tonight. Although, students should search for the events at websites, Announcing current and today’s events can work as a reminder if someone passes the LIPD. As an advantage of using LIPD, one student mentioned in the workshop that “VIS (Växjö International Student) Group which usually announces student trips via posters on bulletin boards can use videos of previous trips
on its announcements on LIPDs”. Workshop participants suggested for presenting deadlines of upcoming conferences for sending papers, and for signing up in events.

According to the participants, News headlines about the university and educational environment is required on LIPD. Currently this type of news exists on university bulletin boards. Headlines of the news and related brief summary, is proper to be shown on the default page, more detail can be shown if user interacts and clicks on the headline. Participants were all advised to keep the news very short, since the website is the proper media for detail of university news, but for the people who do not usually check the website eye catching headlines can encourage them to check the website. Besides, some workshop participants said that presenting content using slide shows can make the appearance of LIPDs dynamic and interesting. A student added: “if someone wants to read one of the items, by selecting that item on the slide show she should be able to see the details in a bigger size”.

Another function suggested by workshop participants was that visitor should be able to take the announcement or ads with them, which is described completely in upcoming section; (see section3.3).Moreover, as I said in the previous section according to my observations, the university publishes some internal magazines. The internal magazines also can be provided on the LIPD for take away, since the content is long, time consuming to read and makes the device busy; in this way the usage of paper for those magazines decreases. Students in their evaluation of news, events and advertisements, considered some factors: First, being very brief and short, in describing all of the items especially for news and announcement contents to save time and not making the content boarding. Second, students liked to be surrounded and be aware of information regarding their academic environment and context of living, besides related information from outside of the University, mostly academic events and opportunities. One of the participants said: “to be surrounded is better than searching for the info since sometimes you don’t know what exactly to search for”. Third, No information overload (information overload is a situation when the available information go beyond the user’s ability for processing it, it happened nowadays with the availability of internet, newspapers and other different medias which provide information (Bergamaschi & Leiba, 2010)). Over loaded Information makes the LIPD untidy, hard to capture and use. Forth, easy- user friendly interactions, participants were afraid of using a complex- high tech device. Getting reminded is very important for the students since different people have suggested something related to getting reminded. They had suggestion for reminding events, reminding the deadlines, having the category of current events and upcoming events as a reminder. Participants suggested some university related news. I am presenting them in the following.

6.4.1. Announcing New Academic Members, New and Ongoing Researches and Projects in Each Department
Most of the participants believed that announcing new professors, teacher and PhD students is proper for presenting on LIPDs. They emphasized on very short background of academic members, their academic and professional background. What is their position? What they are going to do in this university? Which courses they will teach? Which research projects they will participate in? What is the related department and where is their office. Moreover, the majority of participants agreed on presenting new and ongoing research projects, categorized
by departments, science, aim of the research, brief description, members, sponsors and partner companies or universities. This information helps the students to find a person or a group who have common research or job interest with them. All this information helps the students to be aware of what is going on in their context, to get benefit of that. Besides, a participant said: “it is a way for students to know the academic people who have common research interest with them. Ultimately they might end up finding an opportunity to join them.”

Minority of interviewees believed that announcing new academic people or research projects is not necessary. Since finding complete information about them and about the projects should be available through the university website. Another interviewee thinks that just the research projects that are very special, for example the one which won a Nobel Prize should be presented on the display.

6.4.2. Announcing Defense Sessions
Almost all the participants agreed that announcing the public defense sessions is necessary and useful. Since, it informs the students, who have common interests to the subject. Then they can participate to the session if they have time, make plans for participation or tell someone else who is interested. A student suggested that “even schedule of the defense sessions should be available on the display, and I would like to be able to download that on my cell phone too”. Although another participant asserted that: “announcing a defense session should be optional and up to the defender, since some students might get stressed to defend in public.”

6.4.3. Announcing New Accepted Proposals
Presenting new approved theses proposals was suggested in the workshop. Mostly participant agreed on its necessity. Just one person believed that it is not necessary. Another participant said that presenting your accepted proposal on the LIPD should be optional: “If someone feels that it might help her to attract any help or ideas, she can present her proposal on the LIPD.” Some participants thought that somehow it is presenting the success. Some believed that it helps others to know what topics are in and who is working on her/his favorite topic?

6.4.4. New Publications and Books by Teachers, PhD Candidates or Students
Participants believed that, announcing new publications and books of academic people as well as students are interesting news to be presented on LIPD. Since, it helps students to find academic resources that they need more easily. A participant added “Information for accessing or buying these resources is also appropriate”. Participants emphasized that these publications should be categorized base on the subject, field or departments. Opposite to the most of the interviewees, one thought that announcing the new books and publications of the university academic members is not necessary, because it is ordinary that they have scientific publication. Just announcing student’s publications is enough as it is a motivation for them.

6.5. General Information on Studying and the University
In this section, I explore different schedules that students need that exist at the university and some other information that students as the participants emphasized to be attached to that schedules, and be available on a LIPD.
6.5.1. Course Schedules and Classrooms

I would expect that some people have problems with no course schedule available at the university environment, but almost all of the participants emphasized on necessity of presenting course schedules and related classrooms on LIPDs at the university environment.

Students who participated the workshop, all said that they have problems finding their class rooms when they are at the university. In case they forgot to check their schedule for room number before coming to the university, there is no facility at the university to check the room of the lecture, but connecting to the internet and checking the related website. When students are at the university it would be a time consuming process, since they need to find a computer and login to the system. When students are in hurry, this wasted time to find the concerned room is very bothersome. Besides, a student believed that “even using smart phones to find the course information such as room number is not easy since the website is too cumbersome for my cell phone”. Therefore, availability of course schedule and room numbers on LIPDs helps students to get their needed information quickly.

The webpage which currently shows the university course schedules and related room numbers can be available on LIPD. Based on my observations at Linnaeus University, there is a system which is exclusive to information desk employees which shows all the courses schedule of the day and the related information such as the room number and teacher’s name. Since, the system is filtered based on the day, then adding another filter based on department leads to quicker way of getting the information, because it will be a shorter list and there are high chances that scrolling will be enough to find a specific course. Participants suggest that, for each building the situated LIPD just needs to show the courses of the departments which are situated at that building in their default page. For example if we assume that at Linnaeus University and in D building, there are four departments, then the LIPD situated in D building just needs to show the daily schedule of the courses which will be held in concerned building. For information of other department courses students can use a search bar on this LIPD function (course schedules). A participant speculated ‘the course and schedule part on LIPD should provide a search function base on course name to show the place of the lecture’. Moreover, an interviewee asserts that ‘the name of the department should be included in data fields’.

Additionally a student suggested that ‘LIPD can have a function to give students their schedule of the day when they enter to a building or on their cell phones or print that’, which was welcomed by more than half of the student. It means that the students want to have this information with them. This need is discussed in detail in sections 3.3 and 3.11. An interviewee suggested that if there is a seminar or conference at the university, the related info and schedule should be added to the LIPD system content, since it is needed for participants of the conference and seminar, especially for latecomers. Moreover, at Linnaeus University, each classroom has its schedule printed and hanged on the door. A Participant suggested for having those schedules also available on the LIPD.
In the conversation about the class schedules items, students considered short and simple interactions and consequently speed of getting the info. Moreover, availability of needed information at the university area was important for them.

6.5.2. Teachers’ Schedule, Contact Info, and Their Presence

In chapter 3, I describe two separate sections, Presentation of Schedules and Presence Awareness. Collected data for this study shows that the needs of students for presenting teachers schedule is a reason for using presence awareness. Therefore, I discussed these two sections of chapter 3 together in this section.

Base on the workshop participants, finding a teacher at the University, to talk to him/her, is a hard task for students. One student said “for meeting a teacher you should come to the university and at the door of the teacher’s office, and you might need to repeat this for a week or more, as I use to come to my teacher’s office for two weeks, to finally meet him”. There was a discussion in the workshop about necessity of having a function for deterring presence of teachers at the university at each moment to facilitate meeting them and show the information about them and their assistants’ presence at the university on the university LIPD.

At the workshop there was a conversation based on suggestion of a participant for using the RFID cards which teachers have. The cards can be used to check teachers’ presence at the university buildings and their offices. Student A suggested to change the keys of teachers offices to RFID cards, then there will be the possibility of detecting their presence and showing that on the LIPD which can be accessed by using internet. But another student said: "it is an expensive change and it will not be supported by the university also teachers will not accept to use this system". Finally, at the workshop we concluded that we need a system for presence announcement of the teachers at the university. The concept of providing just in time information about the place of people is called presence awareness which discussed in section 3.5. By this service students will be able to check the LIPD, from distance or at front of LIPDs, to know if they can visit a particular person at the university buildings or at their office.

Besides, Schedule of the teachers is what almost the entire participants thought is a necessary function to be presented on LIPDs. I have observed that, currently at Linnaeus University a paper base teacher’s schedule is available at their office doors. The schedule shows at what days and hours they are present at the university. Students thought that the schedules are not quit precise, updated and helpful. They said maybe it is not up to date, and it doesn’t necessarily show the times that the teacher stays at his or her office. A workshop participant said: ‘It just shows that she or he is at the university but not exactly where’. Participants emphasized that ‘having an electronic version of the schedules that gets updated automatically, through other sources and existing data bases which teachers use, is necessary.” since it can provide more precise information about teachers’ schedule.

Participants suggested that another function which can affects this schedule to be more precise is meeting schedule of the teachers. Some participants believed that ‘schedule of the teachers’ meetings should be available on LIPD which helps to get access to them’ (After or
before meetings). Base on my observation, currently there is a monitor in informatics department corridor at Linnaeus University which shows the daily meetings and the participant teachers. Although, an issue of that monitor is that students should come to that specific place that the monitor exists which is not always easy. Also a white board (Appendix A- Figure 22 ) shows meetings schedule of a research group, which the members are mostly university teachers and PhD candidates of that department. That meeting schedule can also be transferred to LIPDs. Adding this information to LIPDs helps the students if the LIPD system is accessible through internet, then these schedules can be seen from outside of the university which facilitates connecting and communicating with teachers.

One of the workshop participants suggested for presenting teachers contact information on LIPD, information such as their office room number and email. He also suggested availability of the place of the offices on a map on LIPD system including directions.

Two students postulated to have the possibility of setting an appointment with the teacher on LIPD. They said the interaction for setting the appointment can be done through usage of RFID cards to read students information and reserving a specific free time of the teacher to meet that student. The pre requirement is that the schedule of the teacher should be available in the system.

One student also suggested to have the facility of sending emails to the teachers by using a function on LIPD system. This idea was not accepted by other participants, since it is more suitable using a personal computer not a public device, and the process of writing and sending an email is long and time taking. Moreover, participants believed that by this way passengers can see some personal information of the users (such as the content of the email) which is not desirable. Besides, participants said it has the potential of making a queue in front of LIPD.

In conclusion base on the conversations at the workshop, students need the schedule and information about the teachers and their assistants to save time. Short interactions and no unnecessary functions, prevention of making a queue in front of LIPD were concerns of the participant students in discussion about the mentioned functions.

6.5.3. University Offices Visiting Hours and Contact Info

Two workshop participants suggested that the university offices which have clients can announce their contact information and visiting hours on LIPDs. In case students want to visit the employees they should know when the visiting hours are. This provides saving time by not going and facing closed doors. The others were not disagreed but they thought it is not a priority. Offices such as Graduation, Admission, IT support, Student Union and VIS office (Växjö International Students) are the ones at Linnaeus University which have clients. Students ask for visiting hours or address of these offices from information desk.

Two of the participants recommended the availability of contact information of each department secretary and the department manager on LIPD. Their names, office address, visiting hours, phone number and email. Moreover, participants said for the specific building that LIPD situated in, we can have information of the departments which are inside that building on the LIPD. For other departments a search box can be used. Accessibility of this
information through the web version (see section 3.1) is needed as well. In that way, you don’t need to come to the university to get the information.

Also I observed that sometimes you might come to the university for visiting someone like an admission office employee but at their office door you will see an announcement that shows that employee is on leave for a week (for example). Announcing if the contact person of an office is on leave on the LIPD can solve this problem.

In suggesting and assessment of this function participants were considering availability of information around and at the university area. Since information of offices and departments secretary or manager is just available through the website. Participants also noticed about not having function overload or information overload on LIPDs.

6.6. Campus Life and Information Needs of the Area

In analyzing the data some new categories emerged. Based on the fact that they are about students information needs at the university and the area (campus, town) I choose a heading category ‘Campus life and information needs of the area’. Moreover, I have realized that the three categories of chapter 3 from the literature: maps and directions, information of restaurant and a part of the category ‘presenting the schedules’ is related to this heading. Therefore, I come up with new subcategories which are as follow:

Generally, in discussing these subcategories of this section, Participants were emphasizing on no extra and unnecessary information or function, which causes information overload and a complex device that is not easy to work with. Also participants cared about user friendly interface and interactions. Moreover, presenting brief information was noticed besides to have functions and facilities on LIPD that do not causes making a queue in front of the LIPDs. A Participant asserted that “no one is interested to stand at front of a LIPD and read a long text”.

6.6.1. Presenting Maps and Directions

All the participants of the workshop agreed on necessity of an interactive map at the university which can show the important places inside and close to the university. It helps the students to know about the facilities around and receive benefit from them. Based on the participants, these following places needed to be presented on an interactive map; University buildings, educational departments, class rooms inside each building, teachers offices, graduation office, admission office, student union office, VIS (Växjö International Student) office, exam rooms, conference rooms and saloons, restaurants and café’s inside the university, telephone kiosks, library, information desk, laboratories, computer laboratories, rest rooms, campus and its buildings, shops and stores around and inside the university, ATMs, vending machines, students welfare office, gyms, medical clinic, dental clinic and health care center. Participants all agreed on some important characteristics and functions for maps which are:

The map information should be available in English and Swedish language, according to the fact that Linnaeus University is an international university and many students do not know
Swedish language. The map should be augmented by some information about the places that exists on the map, such as a link to its website, or by clicking on library icon on the map and opening hours should be shown. Map should provide directions and approximate time distance, from the place that user is standing to the desired- searched destination. The participants insisted that the interactive map needs a user guide as well. About teachers offices on the map, contact information and schedule of the teachers and their assistants should be available, over selecting their office icon. The teachers’ presence at the office at that moment, and facility to book for a meeting with them should be possible. Also menus of restaurants and café’s can be seen by selecting them on the map.

6.6.2. Information of Restaurants
All the students agreed to have information about restaurants inside and around the university on LIPDs. Information such as: daily menus, prices and opening hours. Since if someone decides to eat at the University this function helps her/him to make a decision based on information and make a fast comparison among the restaurants. Moreover, they suggested for presenting the restaurants special offers. An interviewee added that ‘sometimes there is some free food offers in one of the restaurants but no one knows about that. This can be announced on LIPDs at the university’. Students also believed that the information about place of the restaurant, and the related building is also relevant, to be provided on LIPDs.

Interviewees and workshop participants considered some factors such as timely and quick acquisition of needed information and understandable language.

6.6.3. Presentation of Schedules and Information about Public Transport Systems
At the creativity workshop, many of the students recommended for having some information about public transport system, timetable of the buses which pass inside or around the university and taxi information. In Addition, one of interviewees believed that train timetable schedule to Kalmar on the LIPD is also proper, since there are some students who come to Växjö from Kalmar campus of Linnaeus University. Students suggested that there should be possible to download those timetable and information on cell phones. Almost all of Interviewee participants supported this idea. Also other methods for taking the information should be possible for people who do not have a cell phone with them. Possibility of taking the information is also a good solution for having the schedule of busses which do not pass inside or around the university.

6.6.4. Information for New Students
A student suggested for presenting some information for new students on the display, in addition of sending notices about those info and some of their needed information to their cell phones. He said:

“When a person comes to a university building he/she will receive notices, announcements or advertisements, using Bluetooth, on his/her cell phone. Bluetooth advertising system can be helpful in early days of each new semester to send basic and essential information to students, besides presenting that information on LIPDs.”
The same student pointed to ‘students survival guide’ as a good example. Students’ survival
guide is a document that contains some information for new students of Linnaeus University,
such as address of shops for furniture, grocery, bicycles or secondhand stuff. One of the
workshop participants suggested for introducing the shops and places which sell cheap stuff.
Another workshop participant suggested “that information is not short and needs a long time of
reading which makes the LIPD busy”. Many of the participants agreed with him. They
suggested that a link on the university website which contains that information for new
students can be presented on LIPD. Another student said: “Student survival guide can be
provided just for taking away and downloading”. Many of the participants supported the idea
of sending information to the new students. They were concerned about speed of getting the
information of the area. In opposite, a student was worried about information overload and
said it’s not a necessary function. This function is a potential to use integrated displays. (See
section 2.3)

6.6.5. Medical Service Information
Other suitable information, suggested by three participants is where and how to see a doctor,
a nurse or a dentist and health care office info, and what is the process very briefly. Which
doctors are available today in student’s health care center? Free visiting hours of the health
care center (if exists) and other important news about this centre. No one disagreed.

6.6.6. Information of Students Nations
Another suggested function by students was information of student nations. Introducing
student nations and categorizing them based on their activities, to help students find the one
which matches their interest, along with link to their events in events category. A few of
students agreed with this suggestion.

6.6.7. Information of the Entertaining Places and Sport Clubs
An interviewee suggested for having information of the pubs on LIPDs. He said we can
present some information on LIPD such as “Where are the pubs? What are their schedule,
their special days and the offers that they have”. At the workshop we had a conversation
about presenting the offers of the sport club near the campus. Moreover, an interviewee said
that she would like to see the schedule of the campus sport club (Olympen) on the LIPD as a
personalized info.

6.7. Posting a Subject for Voting and Commenting
Eight out of twelve interview participants believed that students should be able to upload a
subject on LIPD for voting, getting feedbacks and comments from other students. They
suggested that voting can be used for evaluation of teachers and courses, security in the
campus, library services, for changing the schedule of course, for voting or commenting on
the course content and irrelevancy of its assignments (in students opinion). Students hope that
this will be a way that they can share their problems with the university and they believe if
responsible people see the subject of voting in public, the result, comments and opinion of
students they will care and reflect on the issue. In addition students also saw this voting and
commenting function as the method for interaction of the university with the students. A
student said “It can be a way for the university to ask students about their opinion and
preferences before deciding on or confirming something, for instance to decide about the date of an exam ceremony or asking about the most interesting presentation in a specific workshop.'

Students also mentioned some controlling and checking ideas. For example a student said to prevent abuse, the subject of vote or comment should be checked before being published and get accessible for everyone. In Addition, an interviewee added that ‘it should be possible to exclude the people who participate in the voting or gave opinion when they are not affected by the subject or situation’. He said for instance, if the subject of voting is related to the students of Information system program we must be able to distinct the vote of other students. Another student mentioned that “it is necessary to control that no one can vote on a subject more than once”. In another word, students were concerned about validity of the gathered data. In addition, students all were worried about their identity get traced then they will face a problem for their vote or comments. They emphasized on the need for voting and commenting anonymously or by a nickname, as an optional function.

Another view was that standing in a public place for voting or commenting is not comfortable. Therefore, using mobile devices specially cell phones for sending the vote or comment was suggested. Another student preferred that: 'the voting should be possible on the university website; just the subject of the vote should be announced on the display and the address that students can vote’. Another idea was that for voting, just the subject and the final result of the voting should be presented on the LIPD not presenting every vote.

As a conclusion, participants cared about being anonymous in voting or commenting and not being traced, trusted gathered information, communicating with responsible people at the university and at the departments.

### 6.8. Instant and Emergency Messages from LIPD to Cell Phones

At the workshop a person suggested for sending emergency messages such as class cancelations on the LIPD and also on the students cell phone as a SMS at the same time. After that interviews showed that almost all the participants thought that the idea of receiving emergency messages on their cell phone, concurrent with announcing them on LIPD is a good idea. Since, it increases the student’s awareness in a timely manner. Participants all mentioned about the problem of class cancelation situation, which regularly happens in a short notice, on the web based application that is used as learning management system (Moodle or Blackboard at Linnaeus University), and usually students do not see the notices on time. A workshop participant about class cancelations said “A teacher can send a message for the class cancelation to be presented on the LIPD, and at the same time it can be sent to the students who registered in that course, and registered their cell phone number for emergency messages.” Other examples of emergency messages that students thought are proper to be announced on LIPDs are: place of the exams (Today’s exam) and a sudden change in place of a lecture.

An interviewee said “There should be a possible way to announce instant messages. For example a person went to the city center and realized that there is a good sale at H&M shop.
She should be able to announce this immediately on the related university LIPD.” An interviewee participant asserted that “If there is a problem in computer centers or university network, printers, copy machines, student emails and so on it should be announced on the LIPDs” these suggestions means that a part for emergency messages on LIPD system is needed. Accordingly, participants suggested for combination of cell phone alerts and notifications on the displays.

6.9. Personalization of the Content

At the workshop a participant proposed for customization of LIPD for each user, for example student A said “students can see their own daily or weekly schedule of courses on the display when they are in front of the display “, (without any interaction by users) he added :”system should be able to recognize people using student’s RFID card”. Another student said” LIPD “should present general and public not personal and customized information for each student. Since, it can make a queue for interacting with the system”. Instead of this customization, LIPD can show the general daily schedule of the courses. Student A talked about another possibility “when people come to one of the university buildings through detection of their cell phone by a Bluetooth detector, their daily schedule can be send to them by SMS or Bluetooth”. Since, all of the participants said that they have difficulties finding their course’s room number when they are at the university. Most of the interviewees supported this idea of using cell phones for customized information.

In the interviews I asked more about personalization of the LIPD content, I asked the participants that what kind of personalized information you would like to see on the LIPD. They mentioned about their schedule of the day, course name, the exam room numbers (if they have any exam at that day), which courses and which defense sessions in their department are running today, which one of their department teachers are at the university today, moreover VIS events and other different activities. An interviewee said ‘I would like to see the group training schedule of the Olympian on the LIPD’ (Olympen is the sport club at Linnaeus University campus),

One of the participants totally agreed with the notion of personalizing information on LIPDs. About half of the participants preferred that they receive the personalized info on their cell phones not on the display. Other half did not agree on the concept of personalized information on the LIPDs at their university. A student was concern about being traced and tracked by the system and its logs; she argued that ‘even getting personalized info on the cell phone means the person can be tracked’. Another interviewee was worried about people around him finding out some information about their interesting subjects that is going to be shown on the LIPD. This was unexpected for me; I don’t think that it makes any problem if people know that you are interested in academic news or a particular sport. Two students believed that in a crowded area such as a university this system cannot work properly since too many people can be around the LIPD. Then, how the system can manage showing personalized information of too much people?

A student pointed out that ‘I would like to receive the messages only if I had agreed on that before. And I want to receive some notifications about the news on the LIPD if I had
registered for that before’. In another word, that participant was worried about receiving spam messages on his cell phone; therefore he thought a confirmation is needed at the beginning before system starts to send messages to students. Another person said ‘there should be a registration system for that, which allows the students to select the category that they want to receive its related messages.’

In conclusion, participants were concerned about some issues mostly technical, security and spamming; how detecting more than one visitor and demonstrating their information at the same time is possible? However, most of the participants did not deny the need for personalized information. Since, they all had suggestions in support of what information is proper to be personalized for them.

6.10. Library Information
Three of interviewees and two of workshop participants emphasized for having library information on LIPDs at the university. They suggested for having a part to present library related news on LIPD such as new books, magazines or papers that are bought by the university library. All the info in this part should be categorized by the educational departments and the related science. Also opening hours of the library can be presented on LIPD. Each category will be shown in related department or related building.

Besides, participant speculated that the library itself needs a separate LIPD to show the related news (for example new bought books, magazines and papers). Map of the library, opening hours and library announcements. An interviewee also suggested that “the name of recently bought books or magazines by the library can be send to students’ cell phone as a message but of course the book should be in a category related to the student’s interest or major of study”. Participants were concerned about getting aware of information and facilities in their study environment when they suggest for library information.

Based on my observations, there are some services at the library which not all of students know about them. For example, when you are writing your thesis a librarian can guide you in academic writing. Again I realized that a few of students specially the new ones are not familiar with all parts or facilities of the library. One of my friends did not know that there are lockers that he can use at the library. These info can be presented on the library related LIPD.

6.11. General Aspect of Navigation and Using LIPD

6.11.1. Search Bar
In the workshop the idea of having a search bar for the LIPD mentioned. Easy usage and quick access to information of LIPD (usability) and speed of access to the needed information was important for participants. Since, nobody was disagreed with having a search bar, but they emphasized that “search should be on the LIPD data not more. For example to find room number or a specific announcement, not on the internet pages like what Google does.” Search is required for all of the LIPD functions. Moreover, one of the participants added that the search should be possible on the important data fields such as course name (in searching for room number) or on the event name (in search of events).
6.11.2. Translation of the Content
Participants cared about the language, usable information and facilities at their study environment. Since, almost all of the female participants (except one) and a male participant mentioned that “there are many advertisements, news and announcement on the bulletin boards at the university environment, especially at the library entrance, which are in Swedish language, and not understandable for the international students.” (Figure 7 shows an example). One of the male interviewees said that “I have never read the advertisement

Figure 7- News in Swedish language

boards” Advertisement boards had never got his attention. A participant emphasized that “English version of advertisement and announcements on the bulletin boards is necessary to be available, English is more important since here is an international university”. A workshop participant stated that “having two separated content in English and Swedish language is not the solution since the university website, which has this state, always has different information in Swedish and English version, and English version is not updated”. Therefore, they thought a translation facility is needed on LIPD system to simultaneously translate the Swedish content to English, similar to what Google Translate or Bing Translator do. Moreover, some of the participants noticed about the fact that many of the ads and
announcements contain both image and text, and then the translation service should be able to translate the text that is combined with images.

6.11.3. FAQ and User Guide
Another suggestion at the workshop was having an FAQ and a user guide to present the LIDP itself, to help users finding out which kind of information is available and how to interact with the LIPD. Having a video available on the university website and on the LIPD system itself to show how to work with LIPDs was recommended. Almost everyone agreed.

6.12. Using Photo Albums
Eight out of twelve interviewees believed that photo albums can be proper for using on LIPD. This was unexpected for me. This function is used for fun things therefore I was expecting that most of the participants reject it. Some participants thought that photo albums are good to be used for sharing photos of seminars and other academic events, for example, exam ceremonies. Some interviewees believed that photo albums are also proper for non academic and entertaining events, inside the university and in campus, such as VIS events, trips to other cities or career days. Other ideas for using photo albums mentioned by participants are; to show some photos of special places with special facilities at the university such as laboratories and computer laboratories, sport complexes inside or around the university, restaurants, buildings or library. An interviewee said: ‘Photo albums are good options for using as screen savers’. In addition, a participant suggested for using photo albums to present interesting places in the town which might be attractive for new students. Besides, three interviewees thought that pictures are not suitable as a separate content since they don’t contain any useful information. Based on the mentioned discussions and believes of participants, they minded about achieving information of their area in evaluation of photo album.
7. RESULTS- IDEAS FOR USING LIPD AT A UNIVERSITY

In this chapter the ideas for using LIPDs at a university are presented. The ideas also are part of requirements for LIPDs. Ideas have emerged based on analysis of the empirical findings. The same categorization in chapter 6 is used to present the result. I have tried to propose an optional situation for having the functions which gathered less than half of the participants’ support (e.g. providing registration forms for selecting the services and interests). In each section first the reason of why the idea/function is needed, or the problem that it will solve is discussed and after that the characteristics (ideas and functions) of the system are presented in italic format. The problem that the function can solve might be also one of the problems that mentioned in section 1.1. The answer of the research question is the collection of characteristics of the system (texts in italic format).

Each category presents the main ideas for the system and some smaller functions that are needed to construct those main ideas. Just for the main ideas (not constructing ideas), if more than half of the participants agree on having them, I have used the words ‘should have’ or ‘highly suggested’. Otherwise I have used ‘suggested’ or ‘can’ to describe that idea. A table in each category summarizes the ideas of that category. The orange rows show the main ideas. The primary ideas have the support of more than half of the participants. Primary ideas are also shown in a diagram. Other rows are constructing functions-ideas. Also a table and a diagram in Appendix G- Summarization of All the Ideas, summarizes all the ideas.

The goal of internal communication is sharing information and in that, information needs, expectations and preferences of organization members should be considered (Gillis, 2006, P.258-259; Kalla, 2006). I have declared students suggestions and argues in chapter 5. Findings and Analysis and the resulted. Ideas and functions in this chapter are based on those suggestions and arguments. They all share information that students need or the functions that students expect or prefer. Therefore the ideas and functions that are mentioned in this section are all in support of internal communications of students.

There is no main idea that all of the participants agreed that is not proper for the university. During my analysis I have realized that in evaluation of each function participants consider some points to decide if the function is suitable for the university and to cover their needs or not. Those points are mostly; speed of interaction for extracting the info, right time to get the info, security, avoiding crowd and queue in front of the LIPDs, easiness of use, short texts and content, getting aware of the facilities at the context (at the university), aesthetics, getting reminded, information overload and function over load. Although for each function in analysis I have mentioned which points were more significant in participants’ opinion. Based on the analysis of participants’ ideas, opinions and problems, I find the following results:

7.1. Anytime, Anyplace Access

The result of analysis shows that some of the participants have a problem which is: many important academic announcements, recruitments announcements and research partnership opportunities are not at the bulletin boards which are at student’s sight. The other problem was the need to check the display from distance for the information that they might forget,
for example a date of a seminar that is announced on the display. Access to the displays from distance also helps the people who do not have time to stay in front of displays or a paper based bulletin board at the university, to read the displays. Since, they can read them whenever they have time from somewhere else. To solve those problems: The system should be accessible from any place inside or outside the university. (e.g. through internet). The system should make it possible to see each LIPD content form the other LIPDs.

Table 1- Ideas related to access to the system at anytime and anyplace

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Access from other places and other displays</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Accessing to the system from any place</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Accessing to each LIPD content from the other LIPDs</td>
<td></td>
</tr>
</tbody>
</table>

Figure 8- Anywhere Anytime Access

7.2. **Content Management**

The result of analysis determines that a web based application is needed for posting and controlling the content on LIPDs. (CMS- content management system). Different groups of people should have access to post information on LIPDs, for example students, teachers and people from outside companies. In this way LIPDs can have richer content. Each group of people should have access to definite categories of data. Controlling access levels for each group helps the security and reliability of the content and brings control and easiness over posting and publishing content over the LIPDs. Since access to the system makes posting available through the web based system and access levels bring control. Therefore, the system should provide a web based system to post content to the LIPDs by different users. The system should define user groups. Each user group should have access to input data in definite categories of data.
LIPDs can be well organized and easily get captured and reviewed if their content is categorized. Besides, specifying each display for a category of data supports the same purpose. **Categorization** assists in solving the problem of messy boards and existence of a lot of content on them by bringing order. It solves the problem of no well organization in paper based bulletin boards. Thus, **LIPD system should provide categorization for content. Content on the LIPD should be presented in categories. Each category should have a name. Name of each category should be presented in an eye catching way. Name of each category should be available in English and Swedish. Controlling and removing irrelevant content in each category should be possible.**

Controls are necessary to not abusing LIPD possibilities and to have proper information on LIPDs. The unwanted materials can be removed or not allowed for publishing by the gatekeeper. This brings control over the display. Therefore, **the system should enable a gatekeeper (administrator) to control sensitive categories of data before publishing. System should enable the gatekeeper to remove improper materials in any category.**

Having an **archive** for outdated data can be helpful if someone needs any information about an outdated content. **Therefore, LIPD can have an archive for outdated data, sorted by date. Archive can have a search based on a period of time.**

LIPD should be updated by new content and by removing the old and expired content automatically. LIPD should be updated simultaneously and automatically with other internal communication channels at the university (e.g. websites). **Updating** makes LIPDs proper system to get to the latest (up to date) information, easy to use and capture. Then it helps to solve the student’s problem of getting confused about what content is still relevant and the problem of messy boards. **Thus, system should provide facilities to define expiration date of content, by the content creator. For the contents with not defined expiration date, System should provide a validity period and expiration date after that period. System should archive (or remove) the content with expired validity date. System should create content using information of university websites.**

The possibility of **having a particular content** in several LIPDs makes the content accessible for different people in different places. If someone doesn’t usually pass a display s/he can see the content on other displays. **Therefore, content creator should be able to request the presentation of the content from different selected displays. Gate keeper (Administrator) should be able to allow or reject a specific content visible from different selected displays. The system should be able to present a specific content on several displays.**

Possibility of presenting a specific content **several times on the same display** assessed from aesthetics view. This function makes the content more eye-catching. The decision about possibility of using this function is up to the policies of use and considering the free space and condition of the display. **Therefore, a content creator can make a request for showing the content multiple times on a display. Gate keeper can allow or reject the content to be presented several times on a display. System can present the content several times on a display.**
<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Posting content and Supporting different access levels</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Providing a web based system to post content to the LIPDs by different users.</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Determining different user groups</td>
<td></td>
</tr>
<tr>
<td>1.3.</td>
<td>Determining different access levels for each group of users</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Categorization of the displays and content of each display</td>
<td>Primary</td>
</tr>
<tr>
<td>2.1.</td>
<td>LIPD system should provide categorization for content.</td>
<td></td>
</tr>
<tr>
<td>2.2.</td>
<td>Determining a name for each category should be possible. Name of each category should be presented in an eye catching way</td>
<td></td>
</tr>
<tr>
<td>2.3.</td>
<td>Name of each category should be available in English and Swedish.</td>
<td></td>
</tr>
<tr>
<td>2.4.</td>
<td>Controlling and removing irrelevant content in each category should be possible</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Having a Gatekeeper (Administrator)</td>
<td>Primary</td>
</tr>
<tr>
<td>3.1.</td>
<td>Checking the content of critical categories by a Gatekeeper(Administrator) before publishing the data</td>
<td></td>
</tr>
<tr>
<td>3.2.</td>
<td>Removing the inappropriate content of any category by the Gate keeper</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Keeping the LIPD updated</td>
<td>Primary</td>
</tr>
<tr>
<td>4.1.</td>
<td>Defining expiration date for content by the content creator.</td>
<td></td>
</tr>
<tr>
<td>4.2.</td>
<td>Defining publish date by the system</td>
<td></td>
</tr>
<tr>
<td>4.3.</td>
<td>Defining validity period for the contents with no expiration date</td>
<td></td>
</tr>
<tr>
<td>4.4.</td>
<td>Archiving or removing the content with expired validity date or passed expiration date</td>
<td></td>
</tr>
<tr>
<td>4.5.</td>
<td>Creating up to date content using information of university websites</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Archiving the outdated content</td>
<td>Secondary</td>
</tr>
<tr>
<td>5.1.</td>
<td>Sorting the archive by date</td>
<td></td>
</tr>
<tr>
<td>5.2.</td>
<td>Searching the archive by a date period</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Presenting a particular content on multiple displays</td>
<td>Primary</td>
</tr>
<tr>
<td>6.1.</td>
<td>Making request by content creator for showing the content multiple times on a display</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Allowing the content to be presented on several displays.</td>
<td>Primary</td>
</tr>
<tr>
<td>7.1.</td>
<td>Making a request by content creator for presenting an specific content on different places</td>
<td></td>
</tr>
<tr>
<td>7.2.</td>
<td>Allowing or rejecting a specific content to be visible from different displays, by the gate keeper(Administrator)</td>
<td></td>
</tr>
<tr>
<td>7.3.</td>
<td>Showing an specific content on several displays</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>displaying a particular content several times on the same LIPD</td>
<td>Secondary</td>
</tr>
<tr>
<td>8.1.</td>
<td>Sending a request via the website(CMS) to the administrator for presentation of a content several times on a display by content creator</td>
<td></td>
</tr>
<tr>
<td>8.2.</td>
<td>Allowing or rejecting the request by the administrator</td>
<td></td>
</tr>
<tr>
<td>8.3.</td>
<td>Presenting the allowed content several times on the selected display</td>
<td></td>
</tr>
</tbody>
</table>
Figure 9 - Content management
7.3. Information Take-away
Possibility of taking some of the information away with the LIPD visitor helps to follow up LIPD contents (e.g. contact information of a seller on an ad). Moreover, Information take-away helps reducing usage of paper since it is digital and it does not use paper based flyer tear-aways. By supporting information take-away on a digital content, content remains on the display for others to see. However, at the same time LIPD visitors can take the information that they require with themselves. It solves the problem of paper based boards that content might be disappearing before others reading it (see section 1.1). Moreover, by including name of the person who posts something on the display, following up the subject gets easier. It solves one of the problems of paper based bulletin boards, which is: follow up and contacting the sender is hard (see section 1.1).

Therefore, system should support information take-away from the LIPDs, by different methods such as printing, emailing and downloading on cell phones, to support different students with different facilities.

Table 3- Ideas about information takeaway

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supporting information take-away with different technologies for students with different facilities</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1</td>
<td>Taking the information away by cell phones</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Sending an email to LIPD visitor containing the information of LIPD</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Printing the content</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Presenting the name of the post sender</td>
<td></td>
</tr>
</tbody>
</table>

7.4. News, Events and Advertisements
Analysis of the data showed that students would like to be aware of what is going on at their academic and city environment, to exploit the opportunities. Academic, social cultural, entertainment and sport event, news and opportunities are important for students. In addition,
the usual contents that exist on the bulletin boards of the university are news, events, advertisements and internal magazines. Then by using LIPD for these types of content, the amount of usage of paper will be reduces. Using slideshow solves some of the problems on the paper based bulletin boards. Since, it makes it possible to show more amount of content on the display. Then the fixed size of the display would not be a limitation for showing the contents, as it exists on paper based boards. Moreover, by using slideshow, there is no need for putting the contents on the previous ones. Having reminders about the events at the area on LIPD (events of the day, current events), and with the students, on their mobile devices or desktop computers is highly needed as they said. Students need to take away some information about the content that they see on LIPD. Based on the mentioned needs, Characteristic of LIPD systems, for making students aware about what is going on at their surrounding and academic environment are:

**LIPD application at Linnaeus University should present News, Events, Advertisements** (see section 6.4) internal magazines can be provided for take away. LIPD should be able to sort the content based on date. Slide shows are highly suggested for presenting News, events and announcements. Description of news headlines should be presented very briefly. LIPDs should present university related messages, new academic members, new and ongoing researches and projects in each department in brief. Other highly suggested items to be present on LIPDs are: new publications and books by academic staff or students very briefly, announcing defense sessions and new accepted proposals. Publications should be categorized based on the subject, field of study and department.

System content should be categorized and name of each category should be presented in an eye-catching way (See section 6.2.1). Events of the day and current events should be presented on the system. System should have a facility to make the visitors able to automatically add reminders of the events to their cell phone, or to their calendar of personal computers, through network facilities. System should present deadlines of upcoming conferences and events for registration or sending papers. (See section 6.4) LIPD Visitors should be able to takeaway contact information and important data of advertisement, announcement or the published news.

Table 4- Ideas about new, event and advertisements

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Publishing different categories of News, Events and Advertisements.</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1</td>
<td>Presenting each category in a separated section with an eye catching style for the name of the category</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Sorting the content of each category by date</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Presenting the description of news and events very briefly</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>Using slideshow for presenting content of each category</td>
<td></td>
</tr>
<tr>
<td>1.5</td>
<td>Presenting the detail of news or events very briefly</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>Presenting events of the day and current events</td>
<td></td>
</tr>
<tr>
<td>1.7</td>
<td>Possibility of adding a reminder about the events automatically to cell phones or other digital calendars</td>
<td></td>
</tr>
<tr>
<td>1.8.</td>
<td>Presenting deadlines of upcoming conferences and academic events for registration or sending papers.</td>
<td></td>
</tr>
<tr>
<td>1.9.</td>
<td>Providing Internal magazines just for take away</td>
<td></td>
</tr>
<tr>
<td>1.10.</td>
<td>Presenting university related messages</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Announcing new academic members (teachers and professors, new PhD students)</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Presenting new and current research projects, categorized by department</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Announcing defense sessions</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Announcing new accepted proposals</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Declaring New publications and books by academic members or students, categorized by subject and department</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram: News, Events and Advertisements](image)

**Figure 11 - News, Events and Advertisements**
7.5. **General Information on Studying and the University**

Result of the analysis presented that students have problem finding their course classroom at the university area (See 6.5.1). Therefore, unexpectedly presenting **Course schedules of the day, and the related classroom numbers is highly suggested.** Moreover, system can show **classrooms’ schedule**. Presenting the related department, course code and the teacher’s name are complementary. Filtering based on the department and a search bar is needed. System should be able of transferring the course schedule information on the student’s cell phone from the LIPD system, when they come into university buildings. If there is a seminar or conference at the university, the related **schedule of seminars and conferences** can be accessible through LIPD as well. Taking away all the schedule information should be possible (see Figure 13).

Students have problems finding their teachers or teacher assistances (TAs) at the university. Easy access to teachers when it’s needed was the concern of all the participants, which was unanticipated for me. To solve this problem, **system should present the updated daily and weekly schedule of teachers and their TAs presence at the University.** System should present academic staffs contact info and office address. System should present meeting schedules of teachers and their TAs. System should demonstrate presence of teachers and their TAs at their offices or at the University buildings (it is possible using presence awareness system). **System should present all the above information at the university area and from distance** (see Figure 12).

Students do not like to spend time and go to an office and face a closed door. Therefore, for saving time and easy access to contact person of offices such as admission, system can have these characteristics: **System can present the offices visiting hours, address and their contact info**. to be accessible at the university area and from a distance. System can show the name, contact info and visiting hours of secretary and the manager of each department. System can present if the contact person of each department is on leave (See Figure 14).

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Presentation of Course schedules of the day and related classroom, course code, teacher</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Possibility of taking away course schedules by cell phones when students come to university buildings</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Presenting class room schedules and the related course code, department and teacher</td>
<td></td>
</tr>
<tr>
<td>1.3.</td>
<td>Presenting schedule of conferences or seminars and possibility of taking them away on cell phones.</td>
<td></td>
</tr>
<tr>
<td>1.4.</td>
<td>Filtering and searching on all type of schedules based on course code or name, teacher and department</td>
<td></td>
</tr>
<tr>
<td>1.5.</td>
<td>Taking away the schedule info is possible</td>
<td></td>
</tr>
<tr>
<td>1.6.</td>
<td>Sending course schedule of the student to their cell phone when they come to university buildings around LIPDs</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Presenting information of Teachers and Their TAs contact info</td>
<td>Primary</td>
</tr>
<tr>
<td>2.1.</td>
<td>Presenting Teachers and their TAs contact info, office address</td>
<td></td>
</tr>
<tr>
<td>2.2.</td>
<td>Presenting Teachers and their TAs up to date weekly schedule of presence at the University</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td><strong>2.3.</strong></td>
<td>Presenting Teachers and their TAs up to date meeting schedule</td>
<td></td>
</tr>
<tr>
<td><strong>2.4.</strong></td>
<td>Presenting teachers and their TAs presence at their offices and university buildings</td>
<td></td>
</tr>
<tr>
<td><strong>2.5.</strong></td>
<td>Accessibility of all the above information at the university area and from distance</td>
<td></td>
</tr>
<tr>
<td><strong>3.</strong></td>
<td>Presenting Visiting Hours of University offices, Address and Contact Info</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary</td>
<td></td>
</tr>
<tr>
<td><strong>3.1.</strong></td>
<td>Showing contact info and visiting hours of secretary and the manager of each department.</td>
<td></td>
</tr>
<tr>
<td><strong>3.2.</strong></td>
<td>Presenting if the contact person of each department or office is on leave</td>
<td></td>
</tr>
<tr>
<td><strong>3.3.</strong></td>
<td>Accessibility of all the above information from the university area and from distance</td>
<td></td>
</tr>
</tbody>
</table>

![Diagram](image-url)  
**Figure 12- teachers’ and TAs’ info**
Figure 13 - Course, rooms and seminar schedules

Figure 14 - Offices contact info
7.6. Campus Life and Information Needs of the Area

Result of the analysis indicates that presenting Maps and Directions helps the students to know about the facilities around them. *Places and facilities should be presented on the map on the display.* For instance university buildings, class rooms, offices at the university also some important venues for students around the university or in the town such as immigration office and supermarkets around. *Map should be accessible in English and Swedish.* Presenting directions to a place and approximate distance from the current place of the LIPD should be possible. Moreover, combining the locations on the map with other information such as pictures or website address should be possible.

*Information of restaurants* inside or around the university should be accessible on the LIPD. *Their menus and prices also special offers and working hours are proper information to be available on the LIPD.* *Timetable of the buses* around or inside the university, also trains to Kalmar is highly suggested. Taking away the info should be possible. Other bus and train schedules at the town should be accessible for takeaway. These two functions bring awareness about the facilities in the area.

*Information for new students* can help them to know their area and its facilities. Therefore, *system should have a category of information for new students.* System should send some information to new student’s cell phone; system sends notices about information available on LIPDs for new students. System provides facilities for downloading and taking away the information of new students from the LIPDs.

To know about facilities of the area a part for presenting *medical services* besides the information of *entertaining places and sport clubs* is needed. Therefore *system should present information about medical services of the area.* System can present information of the *pubs of the area.* Presenting *students’ nations* helps the students to find the union and nations which matches their interest. *System can present the list of student unions.* The system provides categorization base on the nation’s activities. Linking between the name of nation and their event in event list is needed.

<table>
<thead>
<tr>
<th>Table 6- ideas related to campus life and information needs of the area</th>
</tr>
</thead>
<tbody>
<tr>
<td>item</td>
</tr>
<tr>
<td>1.</td>
</tr>
<tr>
<td>1.2.</td>
</tr>
<tr>
<td>1.3.</td>
</tr>
<tr>
<td>2.</td>
</tr>
<tr>
<td>3.</td>
</tr>
<tr>
<td>3.2.</td>
</tr>
<tr>
<td>3.3.</td>
</tr>
<tr>
<td>4.</td>
</tr>
<tr>
<td>4.2.</td>
</tr>
<tr>
<td>4.3.</td>
</tr>
</tbody>
</table>
4.4. Downloading and taking away the information of new students from the LIPDs.

5. Presenting information of medical services at the area

6. Presenting info of sport and entertaining clubs

7. Presenting student nations

7.2. Categorization of nations base on the activities

7.3. Linking between the nation name and the events in event list

7.7. **Posting a Subject for Voting or Commenting**

Posting a subject about educational or university related issues for having votes or comments (feedbacks) of students, supports the students in their upward communication with the university. Students hope that responsible people such as department manager see the result of votes or comments and do a proper action to fix the issue. Or the university can use this function for asking students opinion about something, like a change or in making decision about something. Moreover, voting is good for evaluation of courses and teachers. Controls are needed for not abusing this function also for reliability of results and comments. Besides,
participants in voting or commenting should be able to stay anonymous if they like to. Consequently, System should facilitate students and university staff to upload a subject for voting or gathering comments and opinions. System should keep the people who vote or comment on a subject anonymous, by using nicknames. System should not be able to trace the voters if they do not want that. The Subject should be checked by gatekeeper (administrator) before publishing and being visible on LIPDs. System should not allow a person to vote twice. Presenting the address of the subject on the university website to vote for the subject or comment on can be possible. Interaction with the LIPD through cell phones for voting or commenting can be possible.

Table 7- Ideas about Voting or Commenting on a Posted Subject

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Providing facilities for voting or commenting on a posted subject</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Providing facilities to upload a subject for voting or getting feedbacks by students and university staff</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Keeping the people who vote or comment on a subject anonymous and untraceable, if they want to, and make possible to use nicknames</td>
<td></td>
</tr>
<tr>
<td>1.3.</td>
<td>Checking the subject before presenting on the LIPDs by gate keeper</td>
<td></td>
</tr>
<tr>
<td>1.4.</td>
<td>Abandoning people from voting twice.</td>
<td></td>
</tr>
<tr>
<td>1.5.</td>
<td>Abandoning irrelevant people from voting or commenting on a particular subject.</td>
<td></td>
</tr>
<tr>
<td>1.6.</td>
<td>Presenting the address for voting on the university website</td>
<td></td>
</tr>
<tr>
<td>1.7.</td>
<td>Supporting interaction with mobile devices for voting, commenting or suggesting.</td>
<td></td>
</tr>
</tbody>
</table>

Figure 16- Voting and Commenting
7.8. **Instant and Emergency Messages**

Result of the analysis shows that sending the *instant or emergency messages* on the LIPD and at the same time on students’ cell phones solves the problem of missing the massages of class cancelation on the learning management system website. This function causes spreading instant messages with proper speed. Moreover, presenting the messages on the LIPD at that time, instead of putting an announcement at the class room door, make it possible to realize if the message is relevant or it is out dated. Since, the system is supposed to be kept updated automatically, and contents have an automatic publishing date. It can handle some needs for spreading instant messages that students mentioned (see section 6.8). Admission for each course should contain an option to see if students would like to receive instant messages of that course. This function informs the students about the uncommon happenings at the university area in a timely manner. Administration of the system will decide which users are allowed to send emergency messages. Therefore, *System should supply a facility for admitted users to send emergency messages to the system. The system should provide the students facility to register for receiving instant messages of their interests on their cell phones. Such as courses instant message, administrations instant messages or instant messages from other students. System should send the instant messages to registered students’ cell phone and at the same time show the emergency message on the LIPD.*

**Table 8- Ideas about instant and emergency messages**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Showing instant / emergency messages on LIPDs and sending them to cell phones of registered users at the same time.</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Receiving messages from admitted users (e.g. teachers) as instant messages</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Registering users for receiving instant messages in different categories.</td>
<td></td>
</tr>
<tr>
<td>1.3.</td>
<td>Presenting the instant messages on LIPD and at the same time sending them to registered users</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 17- Instant/emergency messages**
7.9. **Personalization of the Content**

Existence of a function for *personalized information* provides quick access to the information that students need. Therefore, the system can provide a service for presenting customized information, to cell phones of users or on LIPD. System can have a registration form for users, who want to use personalized information. System makes it possible for users to choose cell phone or the LIPD for seeing their customized information on. Users are able to choose the category of information that they want to see, as their personalized info, on the registration form, for example sport news, daily course schedule or any other info which is included in the system. System shows the user their personalized info on the selected device when they come to university buildings. System should not keep a log about people showing up at the university buildings.

**Table 9 - Ideas about content personalization**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Capability for Personalization of the content</td>
<td>Secondary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Possibility for users to sign up in a registration form</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Choosing cell phone or LIPD to see the info on that</td>
<td></td>
</tr>
<tr>
<td>1.3.</td>
<td>Choosing the categories of personalized info among available info of the LIPD</td>
<td></td>
</tr>
<tr>
<td>1.4.</td>
<td>Showing the user the personalized info on the selected device when they come to university buildings.</td>
<td></td>
</tr>
<tr>
<td>1.5.</td>
<td>Not keeping the logs of user’s presence at the university buildings.</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 18- Personalization of the content](image-url)
7.10. Library Information

Result of the analysis indicates that presenting library services, announcements, news (e.g. new books) and different facilities helps students to be aware of their context facilities. Also a separate display at the library can be specialized for library functions. Therefore, System can have a function for presenting library services, facilities, new books and magazines. System should categorize the new books and magazines of the library based on the science and field of study. Users can register in a system, selecting their categories of interests, major of study and if they want to receive their interesting info on their cell phone or not. System can send the name of new bought books and magazines to registered relevant users.

Table 10- Ideas about the library

<table>
<thead>
<tr>
<th>Items</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1. LIPD at the university library, presenting new books and magazines bought by the library</td>
<td>Secondary</td>
</tr>
<tr>
<td>1.1</td>
<td>categorizing the new books and magazines of the library based on the science and field of study</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>registering users in the system, selecting their categories of interests, major of study and if they want to receive their interesting info on their cell phones or not</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Sending the name of new bought books and magazines to registered relevant users.</td>
<td></td>
</tr>
</tbody>
</table>
7.11. **General Aspect of Navigation and Use**

A **search bar** provides quick access and easy usage of LIPD information. Therefore, the **system should have a search bar which searches in all content and categories of LIPD information**. System should provide different search fields for different content categories of the LIPD system.

**Concurrent Translation** facility for the LIPD solves the problem of international students that do not understand Swedish language. Therefore, the **system should provide a facility to concurrently translate the Swedish content to English**. Content that needs translation is pure texts or texts combined with images.

Having a **user guide** and **FAQ** helps students to realize how to use the LIPD. Therefore, the **system should have a User Guide and FAQ**. Having a video user guide for the system is highly suggested. The video should be accessible through the LIPD and the university website.

**Table 11- Ideas about general aspect of navigation and use**

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Having a Search Bar</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Searching for all content categories and LIPD information</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Providing different search fields for different content categories of LIPD system.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Concurrent Translation of the content</td>
<td>Primary</td>
</tr>
<tr>
<td>2.1.</td>
<td>Translating texts and texts combined in pictures</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Having a User Guide and FAQ</td>
<td>Primary</td>
</tr>
<tr>
<td>3.1.</td>
<td>Presenting a video user guide on LIPD and on the university website</td>
<td></td>
</tr>
</tbody>
</table>

**Figure 20 - General aspect of navigation and use**
### 7.12. Photo Album

*Photo album* as a function can be used to present visual information about the context and the city. It can be used as a screen saver. Therefore, system can have a function for creating photo album. System can use the photo albums as the screen saver.

#### Table 12- Ideas about photo albums

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Using Photo album</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Creating photo albums</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Using photo albums as screen savers</td>
<td></td>
</tr>
</tbody>
</table>

![Figure 21- ideas about Photo Albums](image-url)
8. DISCUSSION AND REFLECTION

This chapter discusses the result of the study related to Internal Communication, Ubiquitous computing and in general. Moreover, reflection on using the Creativity Workshop and reflection on result in general is included in this chapter.

The objective of this research is to explore international students’ ideas about how large interactive public displays can support internal communication at a university, and I aim to gather as many potential ideas as possible. Moreover, students as other social groups are diverse in their priorities and opinions, but it doesn’t mean that the ideas with which only a minority agrees have less value. The result and answer of the research question is the collection of ideas presented in categories of chapter 7 which is also summarized in Appendix G- Summarization of all the ideas. Now I discuss the result.

8.1. Discussion

Discussion of Internal Communication

In the objective of this research internal communication plays a significant role, since the ideas that are going to be found for LIPDs should be in support of internal communication with the university in students’ point of view.

Scholars mentioned some characteristics for internal communication and how it affects the organization. In this section I mention them and explain how they are supported in this study, which also presents how this study contributes to the notion of internal communication.

As Wilkes et al. (2005) believe public displays are media to support internal communication. The goal of internal communication is information sharing. In the process of information sharing information needs of the organization members should be considered. In other words, the shared information should be useful, meaningful and valuable. In deciding about internal communications (media), speed of delivery, audience needs and preference are important. To support those factors scholars believe that a combination and variety of media might be needed (Gillis, 2006, p.258-269; Kalla, 2006).

The resulting functions of this study facilitate information sharing on LIPDs, in order to cater to the needs of the students as university members. Students talked about their problems and we came up with some functions in response to their needs and problems. This means that all the resulting ideas for functions, support students’ need of information sharing and address their communication problems. For example, functions such as information about teachers’ presence at the university, course schedules, and reminders of events are in response to student’s problems (for detail see sections 6.5.2., 6.4) therefore they are meaningful, valuable and useful. In this way, the idea of Gillis (2006) and Kalla (2006) is addressed by this study. Moreover, one of the student’s needs was to have a proper speed of delivery, then some functions appeared, such as instant/emergency messages and a search bar. In addition presence of personalized information on cell phones or LIPD, course schedules, access from a distance and room numbers are again functions which provide information with acceptable speed of delivery. In this way the LIPD functions will be valuable which is in alignment with

The result of this study showed that students prefer to achieve information from a variety of media, which is in support of what White, Vanc and Stafford (2010) believe. For example, as you can see in the Result and Empirical Findings chapters (chapters 6 and 7): Although the news about the university and academic events is available through the university website, students want to see them on the LIPDs. Class cancelation notices are announced on the learning management systems of Linnaeus University, however students prefer to receive them on their cell phones and LIPDs. Bus schedules are available at the information desk. Teacher’s schedules are available at their office doors (a printed paper) and course schedules are available through a webpage, but participants suggest that information to be available as functions to be presented on LIPDs.

In addition, another support for what White, Vanc and Stafford (2010) believe about need of presenting the info via diverse channels, is an unanticipated finding, which is the suggestion of a function for checking the presence of teachers at the university or at their offices (by electronic mobile devices or wearable devices such as RFID cards). This function does not currently exists at the university, however other information needs suggested in this category currently exist in different styles and channels. These existing functions are teachers’ weekly schedules of presence at the university (on a paper), meeting schedules (on a monitor) and contact info (on the website). It means the variety of information that exists is not enough for easy contacting and communication with teachers or their assistants. Students prefer the information to be presented from diverse communication channels and even using other technologies.

In the literature it is mentioned that the role of internal communication media is to facilitate and improve the relationship between organization leadership and internal people with the aim of pursuing the organizational goals and strategy. Moreover, employee-driven upward communication is the key for success in internal communications (Gillis, 2006, pp.258-269; Kalla, 2006). Scholars found out that a relation exists between strong internal communication, satisfaction and the performance of organizational members (Vasudev, 2013; White, Vanc & Stafford, 2010).

One of the functions as findings of the study is to use LIPDs for posting a subject for voting and commenting (see section 6.7 & 3.9). Students consider the function of voting for serious subjects, such as assessment of courses content, which is completely different from previous experiences such as studies of Buerger (2011) and Scheible & Ojala (2005). In these studies the function was used for fun subjects, for example voting for the next music to be played, but no students mentioned any fun and entertaining usage for this function in my research. Students expect this function to be used as a media that they can use to inform the responsible university staff, such as managers or teachers, about their problems in the education system and the university. In addition, they hope that university managers ask the students their opinion about a particular subject by using this function. This usage of voting supports upward internal communication, which according to Gillis (2006, p.258) is effective in the
success of internal communication. The usage of this function in this study facilitates and supports the communication between organization leadership and students—internal members, to bring students satisfaction, improve the education performance and achieve organizing goals, as Vasudev (2013) and White, Vanc & Stafford (2010) believe.

Another function which emerged in support of internal communication and organizations strategy is the translation facility. As it is presented in section 5.1. Research Setting, it is mentioned at the strategy of Linnaeus University that this organization is an international university. The research showed that the international students have language barrier and difficulties when using the print channel (see section 6.11.2.). Based on these issues the translation function emerged. Emergence of this function confirms the idea of Gillis that says internal communications should address the language and multicultural needs of organization participants with different communication media (Gillis, 2006, p.258).

A geographically disperse organization usually has more complex internal communication. Internal communication media can appear supportive to address this complexity (Gillis, 2006, pp.258-269). One of the resulting ideas of this study is access from a distance by using network connections and the internet. Linnaeus University has a campus in Kalmar. Accessibility of LIPDs by network and internet can cover the Kalmar campus. Therefore, the result addresses the complexity of internal communication at Linnaeus University as a geographically disperse organization in relation with what Gill (2006) declare.

According to Gillis (2006, p.264) the print channel has a low speed but is effective in spreading information through internal communication channels. We can improve the low speed by using LIPD systems, which support access via the internet at any place any time, using search bars, spreading emergency messages by the LIPD with support of cell phones. Those functions increase the speed of spreading and finding information, which makes this medium quicker. Some of the suggested functions for LIPDs support parts of the print channel (bulletin boards and internal magazines). In addition easy updating through web pages improves the speed in transferring information needs of the university.

Alt et al. (2011a) believe that large displays provide one-to–many communication. However, using access levels (see section Content Management & 6.2.3) and allowing students to post content, supports students to be able to communicate with other students or the university (by voting on ideas), which is many–to–many communication.

**Discussion of Ubiquitous Computing**

This study contributes to the notion of Ubiquitous computing. As it mentioned in the literature (section 2.2), Ubiquitous computing is the era of bringing computing in the everyday tasks, and into devices that we usually use, in order to increase their usefulness. Ubiquitous computing tries to introduce computerized versions of each device (Kuniavsky, 2010, p.9). As we see in this study, computing facilities (LIPD) are simulating bulletin boards, and augmenting them with other functions. Updating, controlling and managing are easier and quicker in this digital version of bulletin boards; it means the LIPD improved the task of paper based bulletin boards. Based on the result, the routine usage of paper-based bulletin
boards is just a part of functions of the result and the device provides information that goes beyond the capabilities of paper based bulletin boards.

Furthermore, in Ubiquitous computing there is a concept which is called context awareness. Personalization of the content is one of the notions in context awareness which is: Gathering some information about large displays visitors and showing them some associated information (Bardram et al, 2010). Also presence awareness is another function in context awareness and consequently in ubiquitous computing. Presence awareness is about sensing presence of a person in an area and reflecting on it (Rodríguez-Covili & Ochoa, 2013). One of the functions in result of this study is the personalization of content through the combination of LIPDs and cell phones. (Sections 3.11, 6.9 & 7.9) Presence awareness is another function in the result (section 6.5 related to section 3.6). Identifying these functions in the result of the study means students sensed that computing is needed and supportive in their simple communication activities such as contacting a teacher (in presence awareness) or capturing their required information from their environment (in personalization of the content). Students expect different usage and presence of computing in a variety of dimensions of their everyday life. Therefore, these functions are in alignment with the concept of ubiquitous computing. As it mentioned in the literature review, ubiquitous computing enables people to carry the minimum amount of hardware and software, (Ko, 2011, p.31) and this study supports that idea. LIPDs presents a certain amount of information, some of it is typically retrieved via cell phones. For example, to look for bus schedules, nowadays many students use smart phones. For checking the location of the nearest grocery store we might use Google maps or a similar GPS services on our smart phones. Providing this information on LIPDs is a help for students who do not have a smart phone, and enables the students to get this information without smart phones.

**General Discussion of the Result**

The result of this study can be helpful in finding a part of the requirements for the deployment of LIPD systems at a university. It is not encompassing all possible requirements, since, for implementation of an LIPD system, other aspects need to be considered - such as technical and financial ones. Besides, other stakeholders’ opinions (e.g. university employees and teachers) are important and valuable. Therefore arriving at a definite list of functions is possible by dealing with all of these aspects.

None of the function groups found in the literature (sections of chapter 3) were rejected by all of the participants. At least a few of the participants agree with each main group of ideas (each section in chapter 3). This means the present study confirms previous findings and contributes additional evidence to those functions presented in chapter 3. Although, each function group resulted from this study, contains some functions that include specialized information needs related to the specific setting of this study which is a university (Linnaeus University). *This means that the main ideas for functions of LIPDs in other contexts can be customized for a university setting.* Some of the customized functions are in the category of news, events and advertisements (see sections 6.4. News, Events and Advertisements):
presenting new academic members, defense sessions, new accepted proposals and ongoing or new research projects.

There are some information needs and functions suggested by some of the participants which are not addressed in literature that I found. These are: Information for new students, Medical Service Information, information of student nations, Information of the entertaining places and sport clubs. These are the functions that appeared based on the needs of the participating students and the setting. Students require information about their context and local area to improve living. Therefore, they have been put in the category of ‘campus life and information needs of the area’. The local public transportation schedule was added to this category to complete it (See sections 6.6.3 & 7.6).

Other findings that were not addressed in the literature are: Concurrent Translation Facilities, FAQs and User Guides of the LIPD (See sections 7.11, 6.11.3, 6.11.2). ‘Concurrent Translation Facility’ is the only finding which was directly related to the fact that the participants were international students. The ‘FAQ and User Guide’ function appeared since participants care about usability and easiness of applying the LIPD system. Besides, the participants are not familiar enough with LIPDs, since there is no LIPD in their current context; therefore they think that this function is necessary.

The functions related to LIPD for a library are aligned with the literature; however, the functions of this study do not address the providing of content by the LIPD via external resources, such as YouTube videos or RSS (see Appendix E- Definitions). The resources that were addressed for content providing in this research are internal. Although, according to the participants, updating the LIPD and keeping it up to date is important. Participants suggested that it could be good to connect the LIPD to other sources of data such as the university website to present information such as news in parallel with these resources. Therefore, a suggestion is: using sources from outside the university and automatically generating content based on these. This implies content that is proper for the university setting and in alignment with its goals, for example academic news and events (e.g. conferences), recently published books related to the educational programs at the university which can be gathered through other websites (e.g. by using RSS).

Another suggestion is to use presence awareness for informing users about the presence of contact persons of each university office, during the visiting hours of the office. This function facilitates the communication by providing just-in-time information about the presence of people who you might need to contact. In addition, students have suggested information takeaway for some functions, however I think it can be used for all the information on the LIPDs.

The important notion that should be considered is that the current facilities in the setting of the study (in this case Linnaeus university), the background of participants, how much they are familiar with new technologies and what facilities they have in their daily life, is determinative in their reflection on the LIPD requirements and their expectations. Consequently, caution must be applied, as the findings might not be transferable completely.
to other settings, the result of the same research question might be different in other universities. Although, I think the result of this study can be used as a base, to assess if the functions are proper in a similar higher education environment. For those reasons, this study contributes to the literature about large public displays.

8.2. Reflection

Reflection on the Use of Creativity Workshop

I held a workshop based on creativity workshops in order to collect data for this study. In my opinion applying the creativity workshop had some positive points. In my study I had to explain to the participants about the subject of the study on which we collected ideas. When you are explaining the case and situation to a group of participants at the same time, you will save time. Moreover, participants can help each other in understanding the situation; they give hints to each other for considering some of the conditions and issues related to the concept. For example, they hint each other to imagine the situation while working with LIPDs. An example situation would be where they have to stand in public and interact with the display, or some of the functions they are suggesting might be time consuming and create a queue in front of the LIPD. Another positive point is that one idea by someone can be completed by others, or be the stimulus for another idea by others. In addition when participants know that their creative idea will be supported they will use this opportunity. Moreover, Participants with good experiences or information can bring many good ideas, where each of them can potentially open a conversation by other participants to deeper exploration of the subject. It happened in my workshop: one of the participants accidentally (I did not have any clue about that) had very good information about LIPD related technologies, which was very helpful. It especially helped to unintentionally cover combinational creativity (relating existing technologies to answering the needs and problems).

I find out some issues about the creativity workshop: convincing the participants to attend in the workshop is not easy. A workshop takes at least 3 hours. (As Maiden (2003) used it) Although usually there is a break, participants might get tired. Therefore, a strong motivation is needed for participants to attend in further workshops. I have used a creativity workshop for my master thesis, and it was successful. But what I think is that in business environment participants are real stakeholders, they are the employees who are working in the business setting, or they might be affected very soon by the system. They usually have a duty responsibility to participate in the creativity workshops as part of their job, but in my case participants had no obligation to attend, their only reason was to help the researcher (as their friend), but it is not enough motivation to attend in more workshops, or not getting tired. Something like an exciting catering in a coffee break might help to satisfy them at least to participate in the second section.

As it was mentioned in the literature review (see section 2.4.2) Participatory Design (PD) is an approach for conducting researches (Spinuzzi, 2005). It has methods for design which in combination they are usually used for doing a research (e.g. the work of Jansson, Mörtberg, & Mirijamdotter(2008)). PD is for conducting the whole design process, a combination of PD methods is usually used for the complete design of the research, including idea or requirement
gathering. Therefore, it is possible to use PD methods such as future workshops for gathering ideas as it was done in this research. This means that in this research conducting a future workshop from PD instead of the creativity workshop would also have been possible.

**General Reflections**

Among the findings, some are unexpected or exciting for me. These types of findings are presented in this section.

When I started this research, I was expecting that participants care about information related to the university environment. However, the result shows they also consider the academic information from outside the university relevant and appropriate, such as information on academic conferences outside the university. Moreover information about their living area such as information about pubs or events in the town is important for the students (participants) (See section 6.4 & 6.6).

Unexpectedly, all of the female participants except one, mentioned the problem of not being able to read Swedish content on classic bulletin boards at the university area (language barrier). Much of the content on the bulletin boards is in the Swedish language and not readable for international students. Many of the male participants said that they usually do not read the bulletin boards. A possible explanation might be that the content of bulletin boards is usually colorful and graphically interesting, which attracts females more than males.

One of the unexpected functions is **need for a reminder of events** which can be transferred to the user’s cell phones and other electronic calendars. This finding is in accord with the function that Scheibe, Meissner & Tunbridge (2006) presented. They studied a large display capable of sending the events and contact info to cell phones calendar and contact lists (see section 7.4).

The function for **Emergency/Instant messages** is another surprising finding, although I faced the issue before starting the research, I did not expect that the majority of participants noticed the same problem and suggested including an Instant/Emergency messages function.

Another unexpected finding was the negative reflection of students on the **personalization of the LIPD content**. I would expect that students support this idea at least because technologically it sounds interesting. Although students evaluated that function very cautiously, a reason might be the word ‘personalization’ itself. I think the word ‘personalization’ brings the word ‘personal’ into the participant’s mind. They then think that this function might put their privacy in danger. Since, even after I explained them that it doesn’t mean personal information, some of them remained feeling unsecure about this functionality. Some participants mentioned a lack of technological possibility in implementing this functionality as a reason for their doubt about this aspect. Furthermore, a few of the participants believe that by this function they can be traced, which threatens their privacy.
9. CONCLUSION AND CONTRIBUTION

In this section I present the conclusion, contributions and opportunities for further research.

9.1. Conclusion

The research idea began with my observation and understanding that some information is needed at the university environment - such as course schedules and their related classroom numbers which are not available right now. In addition, I saw many unordered advertisement boards with much shredded paper ads, which seem a waste of paper. Moreover, I saw many advertisements and announcements in the Swedish language which is not understandable for me as an international student, who does not know Swedish. I have thought that usually we solve the problem of wasting papers with digital versions, which leaded me to think about the digital version of bulletin boards; I tried to find out what other problems a digital bulletin board can solve. I searched the literature and realized LIPDs can go significantly beyond being a digital bulletin board and there are limited just by designers’ imagination. There might be the possibility to solve other problems, and exploit more benefits. An example would be an interactive search for the room number of courses. In addition, when using digital media doing translation work becomes easier since some tools exist for digital information translation, such as Google translator and Bing Translator. I considered that preparing LIPDs just for these mentioned issues might not be convincing. Since the mentioned matters are all related to the print channel of internal communications, I thought of having a study to explore the functions for application of large interactive public displays in support of student’s internal communication at a university. Then I have limited the study participants to students.

During my literature review, I recognized that I can find many remarkable functions for LIPDs in the literature and it is a significant source, therefore the literature review is a major task. I intended to identify further functions beside the functions mentioned in the literature. As the literature review would be a major part of my task, and since I was aware that hermeneutic is the theory of interpreting text, I concluded that it would be a suitable choice for my study. I searched the literature to know about the diverse applications of large screens in any type, in different settings. By different types I mean Interactive large screen, non-interactive and ambient displays. I familiarized myself with some technologies, which can enable further functions for displays. I realized that there will be controversies about different needs and requirements in each participant’s opinion, but they are all worth to be assessed and to think about, therefore I chose the qualitative strategy of inquiry to value different opinions. I have found many functions for LIPD throughout the literature. I used general qualitative analysis method (Creswell, 2009) to analyze and organize literature functions, and then I structured a chapter based on that.

The type of my research question is in alignment with finding needs and requirements of a software system. When deciding about the methods of data collection, I therefore searched in the requirement elicitation techniques of requirement engineering in order to find a proper technique for doing my research. From the early days of staring the thesis I have been told
that the research should be a potential solution to a problem. However, I always had the thought in mind that, in that way, for example, creative ideas for amazing applications and functions of smart phones would be unlikely to emerge. Maiden et al. (2010) pointed to the same opinion: “necessity is often not the mother of invention, and that software tools often exist before the problems to be solved” (Nye et al., 2006, cited in Maiden et al., 2010, p. 58). Therefore, since I was looking for creative ideas to exploit the LIPD I followed Maiden’s method- creativity workshop. The result of the creativity workshop lighted up some new functions. Then, according to what hermeneutics theory suggests, I went back and forth between the literature and more data collection with interviews and observation to complete the data and analyze it. The details of participants’ opinions have been mentioned in chapter 6. EMPIRICAL FINDINGS.

Based on the agreements gathered for having each of the functions, I divided the general ideas (general/main idea includes some ideas related together or supporting a main idea) into primary and secondary ideas (functions). Primary functions show that the function is more important for the students in comparison with secondary functions.

The primary functions are: Access from other places and other displays, Posting content and Supporting different access levels, Categorization of the displays and content of each display, Having a gatekeeper (Administrator), Keeping the LIPD updated, Presenting a particular content on multiple displays, Allowing the content to be presented on several displays, Supporting information takeaway with different technologies for students with different facilities, Publishing different categories of News, Events and Advertisements, Announcing new academic members (teachers and professors, new PhD students), Presenting new and current research projects- categorized by department, Announcing defense sessions, Announcing new accepted proposals, Declaring new publications and books by academic members or students categorized by subject and department, Displaying map and directions, Presenting information of the restaurants, Showing schedule of public transport systems around the university, Presenting information for new students, Presenting information of medical services at the area, Presenting course schedules of the day and related classroom, course code and teacher, Providing facilities for voting or commenting on a posted subject, Showing instant/emergency messages on LIPDs and sending them to cell phones of registered users at the same time, Having a search bar, Concurrent translation of the content and Having a user guide and FAQ.

Secondary functions/requirements are: Archiving the outdated content, Displaying a particular content several times on the same LIPD, Presenting info of sport and entertaining clubs, Presenting student nations, Presenting university offices visiting hours, address and contact info, Capability for personalization of the content, Presenting new books and magazines bought by the library on a LIPD at the library and Using Photo album.

Among the findings having concurrent translation facilities was not mentioned in previous works and literature. That show international students have issues reading the Swedish content on the bulletin boards. Personalization of the content is a secondary requirement in
international students’ opinion that shows the background of students using communication technologies affects their expectations and needs.

9.2. Contribution of the Study
This study contributes to an information systems concept. The research objective is to explore ideas for application of large interactive public displays from international students’ perspective at a university, to support internal communication. The resulting functions should support students in their internal communication with the university, and provide them their information needs. The aim is about information needs and information sharing through an internal communication medium, which is LIPD. Moreover, ubiquitous computing and hermeneutics theory connect this study to information systems.

The acceptance of the users after the implementation of an information system, needs the participation of the potential users in defining their needs and requirements of the systems (Seyff et al., 2010; Smith & Smith, 2012). This research encounters the needs and expectations of potential users of LIPDs at Linnaeus University - the organization- which guarantees that students will accept the system.

In addition, one of the data collection methods of this research is a creativity workshop. Therefore this study contributes to this subject. Hermeneutic Theory is the underlying philosophy and analysis method of this research, therefore this study also contributes to those subjects. Moreover, base on the discussions mentioned in section 8.1 the study contributes to the literature about Large Interactive Public Displays, Internal Communication and Ubiquitous Computing.

9.3. Further Research
As I mentioned in section 5.2, the participants of this study are limited to students. Therefore, to cover this limitation, another study for collecting teachers and university staff opinions would be proper. Specially if there will be a chance to implement such a system at Linnaeus university, the opinions of teachers and employees are valuable. Moreover, in an implementation situation, it seems proper to define the exact list of requirements including opinions of students, teachers and employees together besides using a mixed method approach, to define a definite list of requirements.

During my analysis I found out that participants were mostly concerned about not making a queue and crowd in front of the LIPDs. But some scholars such as Veenstra et al. (2011) consider gathering people in front of LIPDs as a way for communication. Therefore, Social communication beside LIPDs and effect of LIPDs on visitor’s communication can be subject of another study.

In this study I faced the possibility of using cell phones in many conditions for example for sending instant messages or personalized messages. The usage of cell phones and its related technologies such as SMS, MMS and mobile advertising at higher education organizations can be studied.
Conducting the study by using future workshop instead of creativity workshop is also an opportunity.
10. References


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Figure 22- Meeting schedule of a research group at the university
Figur 23- An outdated Conference announcement - the conference date is 2010 and we are in 2013
Figure 24- University Magazines
Appendix B- Requirement elicitation techniques

1. Ethnography
Ethnography is the study of people in their natural setting, participating passively in the activities or analyzing actively to gather information about their operations and collaborative activities in the context and to define social patterns and complex relationships between human stakeholders. (Zowghi and Coulin, 2005)

2. Interview
Interview is informal and good method for gathering lots of in-depth information, interview types include Structured which is used for predetermined questions which lead to specific data gathering. Some templates are available to direct the interviews, Unstructured to gather information about a subject or a domain which we do not have enough information or understanding about it. Not specific questions are used and interviewer has little control over the discussion. Semi-structured interviews are a combination of these two. (Zowghi and Coulin, 2005)

3. Observation
Observation is one of the social science and ethnography techniques which analyst observes performing of the processes by users directly. Effectiveness of this technique depends on the tendency of people being observed to regulate the way of doing their activities when someone is watching or not. If they do observation result is not valuable enough. (Zowghi and Coulin, 2005)

4. Protocol Analysis
In Protocol Analysis the operator of a process talks about the steps of the process he is performing, the reasons, the thought he has in doing them. This provides the rational and information of the processes and their activities to the analyst. (Zowghi & Coulin, 2005)

5. Apprenticing
In apprenticing analyst performs the processes activities under an experienced user supervision and instruction. This technique is useful when the analyst is not familiar with the business domain, and when users cannot explain their action easily. (Zowghi & Coulin, 2005)

6. Prototype
Prototypes are used for assessing possible solutions, feedbacks and detail information. Preliminary requirements mostly implemented in prototypes. Different techniques are exists in prototyping such as storyboards, throwaway, executable and evolutionary. (Zowghi & Coulin, 2005)

7. Goal Base approaches
Goal based approaches are using the main objectives of the system and elaborate and decompose these to sub goals in a way that requirements to reach these goals show up. These approaches are suitable to present detail relation among, system objectives, requirements and
entities. The example of such approaches are F3 project, KAOS Meta model and I * Framework (Zowghi & Coulin, 2005)

8. **Scenarios**
Scenarios are narrative and detail description of current and future needs of the developing system which leads to requirements elicitation. Also it is concerned about gathering all the potential exception states .They are useful for developing test cases ,understanding and validating the requirements. Scenario based approaches are Inquiry Cycle, CREW, SBRE, Scenario Plus. (Zowghi & Coulin, 2005)

9. **Viewpoints**
This is applying different views from different sources about a specific subject in system domain, which is useful for the complicated systems domains and complex relationships to provide multiple flexible models for a system. (Zowghi & Coulin, 2005)

10. **Methodology base requirement elicitation**
There are some methodologies for gathering requirements such as **Structured Analysis and Design (SAD)** which is function oriented. It uses some definite diagrams and artifacts such as Data Flow Diagram (DFD), Entity Relationship diagrams (ERD). SAD techniques are using Data Dictionary and Event List. **Object Oriented (OO)** Approaches specifically using UML (Unified Modeling Language) that has specific diagrams and artifacts such as Use Cases, Use Case diagram and description are suitable for demonstrating functional behavior of the system. Which are used in academia and in practical setting and play as abstraction of scenarios, Class diagrams and activity diagrams. Also some approaches try to combine different techniques in a specific way for requirement elicitation. For example one Suggests to start understanding the business domain with ethnographic methods then has interviews with stakeholders to extract details and priorities. Another Approach is **SSM(Soft System Methodology)** which is appropriate for requirement elicitation in complex social context, it can addresses organizational problems which need change and **Quality Functional Deployment** with the aim of customer satisfaction. Starting points and context free questions are other techniques used by Gause and Weinberg (1989 cited in Zowghi, D. and Coulin, C., 2005) for requirement elicitation. **Agile methods** emphasis on incremental and iterative elicitation of requirements using interview, prototype, customer and user stories and index card technique (Zowghi & Coulin, 2005)

11. **Questionnaires**
Questionnaires Provide information that are not in-depth. It uses a set of open or close questions to get information in a short time from multiple stakeholders. Concept, terms, domain and boundary of the system should be well understood to have a successful Questionnaire. (Zowghi & Coulin, 2005)
12. Task Analysis
A top-down approach to decompose high level tasks to specify all the activities inside the hierarchy, identifying the sequence and the information required in the interaction of user and system to performing this task. (Zowghi & Coulin, 2005)

13. Domain Analysis
In domain analysis analyst tries to understand and gather domain knowledge and determine the reusable components and concepts. Applications and existing legacy systems, design documents, forms and instruction manuals. (Zowghi & Coulin, 2005)

14. Introspection
Introspection is a method that analyst relays on his own understanding and believes about users needs from the system. (Zowghi & Coulin, 2005)

15. Repertory Grids
Repertory grids is a method which analyst asks stakeholders to determine attributes and assign values to those attributes to model the system in a matrix which elements of the system categorized in that matrix , instances of the categories are determined and variables and related values of categories are specified. (Zowghi & Coulin, 2005)

16. Card sorting
If the domain is well understood by analyst and stakeholders as participants, a complete set of domain entities wrote on cards will be sorted by stakeholder’s groups. And then stockholder will explain the reason of this categorization. (Zowghi & Coulin, 2005)

17. Laddering
Laddering is base on asking a bunch of short prompting questions known as probes with the ultimate aim of placing the answers in a hierarchical structure. (Zowghi & Coulin, 2005)

18. Group work
Group works are Collaborative meetings by directly participation of stakeholders which should feel confident and comfort to talk about the problems, needs and business/ application domain situation. This method is kind of default base method in requirement elicitation. (Zowghi & Coulin, 2005)

19. Brainstorming
Brainstorming is an Informal meeting with free discussions to gather basic information about the new systems mission and preliminary tasks, but not for making big decisions and deep understanding of processes. Participants are from different stakeholders groups. (Zowghi & Coulin, 2005)

20. Joint Application Development (JDA)
Joint Application Development are structured meeting sessions with defined steps, actions, goals and role of participants, to discuss about a specific problem and assessment of possible solutions and decision to selecting a solution. (Zowghi & Coulin, 2005)
21. Requirement workshops

Requirement workshop is a generic word for a category of group meetings for requirement gathering. Some of the famous workshop types are; cross functional by participation of different stakeholders from different areas of business, CRC (cooperative retirement capture) which has definite set of goal and activities and development team also participate in this workshop. Focus Group which is another type of workshop used in market analysis. Also Creativity which encourages the innovation in requirement elicitation. (Zowghi & Coulin, 2005)

22. JAD

“Joint Application development, is a requirement engineering methodology in which stakeholders, subject matter experts (SME), end-users, software architects and developers attend intense offsite meetings to work out on a system’s details. JAD focuses on the business problem rather than technical details. Its success depends on effective leadership of the JAD sessions, on participation by key end-users, executives, developers, and on achieving group synergy during JAD sessions. The focal point of the JAD process is a series of workshops that are attended by stakeholders, executives, SME’s, end-users, software architects and developers (Tiwari, Rathore & Gupta, 2012).

23. RAD

Rapid Application development techniques, RAD, is a development method which uses a prototype and tries to complete that as the final product (Howard, 2002).
Appendix C- Requirement Validity Techniques

Analytical approaches assess the requirement specification to check if they fulfill the quality criteria but there is no reference document for that but two of the approaches are requirement specification and test case creation. Inspection has four steps planning, detection of the issues means searching for the issues, collection or meeting up steps to list the issues and problems and correction of the issues. Reading techniques are also in inspection approaches category which provides the inspectors techniques for deep understanding of the requirement specification to detect the issues such as ad-hoc reading that just relies on the experience of the inspector, check lists reading which is using a list of question to check the potential places for issues, and scenario base reading by using a step-wise description to help the inspector in detecting the issues. Another analytical approach is testing base on the requirements or having test cases base on requirements. One important notion is that requirement and use case specifications are substantial sources for developing test cases, which should be developed after specifying requirements and use cases, in this stage test case development can help defect detection and a richer test case comparing to test cases which are developed in test phase. Some automated approaches are also available for analytical testing which is not much. For example, some tools can phrase requirement documents base on a pre-defined glossary for detecting ambiguity cause by using words such as if possible, may, and could and so on (Aurum and Wohlin, 2005, pp.163-182) (Hood, Wiedemann, Fichtinger & Pautz, 2008).
Appendix D- Abbreviations

- LIPD: Large Interactive Public Displays
- IT: Information Technologies
- IS: Information Systems
- TA: Teacher Assistance
- SMS: short message system
- MMS: Multimedia messaging service
- GPRS: General Packet Radio Service
Appendix E- Definitions
There are some phrases that their acronym used in the text which their full forms are following:

**Use case**: Use case is a system function of a software system which its use is visible for a user (Yin & Chai, 2012).

**use case modeling**: illustrating interactions of users and the system through diagrams (Helming et al., 2010)

**Goal Modeling**: A method in requirement analysis for presenting the future software system through diagrams and elements containing actors, objects, relationship and etc. (Kavakli, 2005)

**System**: in this research system mostly applied as an application which is presented by Large interactive Public Display LIPD: Large Interactive Public Display

**Bulletin Board Systems**: such as teletext on TV

**RSS**: Rich site summary is a web feeding format for easily distributing and feeding online content, RSS are for computer – to computer communication and can be parsed by newsreaders (Duffy & Bruns, 2006)

**RFID**: Radio frequency identification system. is a contactless and remotely Identification system able to store and retrieve data for the purpose of identification and tracking. It uses RFID tags which act as transponder. (Bolic, Simplot-Ryl and Stojmenovic, 2010)

**Blackboard**: a Learning management system software which is used at in Linnaeus university

**QR-codes**: can be called as a two dimensional barcodes that can be decoded to extract information. Usually cell phone applications are used to decoding that (Sun, Sun and Liu, 2007) In fact by taking a picture of a QR code with a cell phone information such as website address, email, telephone and so on transfers to your phone rapidly

**NFC**: is a set of standards for smart phones and other similar devices to communicate with each other and transmit data by touching or getting very close. (Agrawal and Bhuraria, 2012)

**SA**: Situation awareness –

**PDA**: (Personal Digital Assistant, or personal data assistant is a mobile device with internet access capability which works as a information manager and for digital note taking (Kot, 2011)

**Leap Motion**: even interacting through hand movements of users
**Bluetooth advertising:** it is a method of mobile advertising in which a transmitter device sends a message to mobile devices, using Bluetooth, in its surrounded area and asks if the user of the mobile device would like to receive an advertisement. (Parvizi & Heidari, 2013)

**Digital wallet:** A digital wallet is an application or service uses by a device, that assists user in conducting online transactions. by allowing them to store billing, shipping, and payment information; and to use this information to automatically complete a merchant's check-out page, usually by dragging the needed information to the appropriate place. (Sibert, 2005)

**Digital signage:** a form of electronic display that presents information, advertising and other messages. they can be found in public and private environments, such as retail stores and corporate buildings. (Sun, Zhang, & Chou, 2010)

**Geotag:** “is a web service to provide the adding of geographical identification metadata to GIS, such as photographic image data. The Geotag ties the image data to the location for visual display.”(Otake et al., 2012)

**Mashup** is a webpage or web application that emerges by combining and mixing content, presentation and functionality from more than one resources mostly from API’s (application programming interfaces) to create a new service. (Yu, Benatallah and Casati,, 2008)

**SMS:** short message system is a text messaging service component of phone, web, or mobile communication systems.

**MMS:** Multimedia messaging service is a standard way to send messages that include multimedia content to and from mobile phones.

**GPRS:** General Packet Radio Service. is a packet oriented mobile data service on the 2G and 3G communication system’s global system for mobile communications (GSM).
Appendix F- Ambient, Embedded and Stand Alone Displays

Ambient Technologies and Large Displays
Ambient displays are designed to display information that not always demands user’s full attention and interaction. Ambient displays do not need user’s interfering to do their primary task. Ambient displays can sense activities of the users and provide real-time feedback. They present (or switch their current) information according to changes in sound, light, smell, amount of human presence, change in weather, stock, currency and movement of objects. Then the changes and presence of information is more implicit than explicit. These kinds of displays represent uncritical information that can move from periphery to the center of attention and back again. They can make subtle changes in the environment which are aesthetically agreeable (Streitz et al., 2003)(Kim, Hong, and Magerko, 2010)(Rogers et al., 2010)

Hello wall is an example of ambient displays. That is a context dependent ambient display that reflects identity and distance of the people passing by in the environment, with turning on and off the light cells (lighting patterns) of the display. People can have interaction with Hello.Wall through a mobile device named ViewPort. Which is a device like a PDA(Personal Digital Assistant, or personal data assistant is a mobile device with internet access capability which works as a information manager and for digital note taking(Kot, 2011)) that utilize WLAN , RFID and sensing technology to provide more detail and personalized information. The view port device which team members carry can be recognized and detected by the display then they can get some information related to their team on the viewport device. The display became to a medium that gathers people around for talking beside the device for transferring some information to group members in the organization. Then the display conveys social awareness and supports informal communication in the organization. (Occhialini, Essen and Eggen , 2011) (Ramos et al., 2010)

Embedded Displays
An Embedded display is the integral part of the physical places. Such as meeting rooms or a room for a workgroup to do their job with a shared display that people can connect to that and share information about their tasks and their progress state. An example studied by Rogers and Rodden (2003)which in that study also mentioned that it’s possible for group members to comment on an existing content (shared by others) on the display. These two scholars also talked about the meeting rooms augmented with large interactive tables and large interactive wall displays(they also called them tiled-wall displays) which were linked together side by side, that also set up to allow portable devices to be connected to the wall displays. They were helping to dynamic visualization and multiple presentations of complex data beside interaction with the presentations. This usage of large interactive displays supports group awareness and collaboration in workspace besides supporting media sharing and social communication and interaction. Large interactive displays also used in a travel agency for presenting the travel plan to the customer by the seller in an interactive way. Photographs, videos and funny anecdote were used on the display. (Novak, 2008)
Collins et al. (2009) put the notion of embedded displays for sharing information and planning in a workspace e.g. large wall displays and tabletops in front of carried devices displays such as cell phones and laptops.

**Stand Alone Display**

Those displays are placed into existing spaces (chapter 3. Social and interactional aspects of share display technologies). Stand alone displays are usually placed at existing work places, social and learning spaces, such as electronic whiteboards, electronic tabletops (horizontal surfaces with displays which look like a table). (Rogers and Rodden, 2003) In electronic whiteboards the key notion is supporting the electronically base drawings and handwritings also selecting and moving the handcraft objects around the display. (Rogers and Rodden, 2003)

Wall sized and large –tiled displays; to enable interaction and observation of small group of people with large collection of information visualizing complex data sets which can be very useful for comparing, sequencing and compiling different information. Some of these screens also allowed gesture base interactions (Rogers and Rodden, 2003)

Moreover, Single display groupware supports people working together in the same group work to enable people work concurrently on a shared object (Rogers and Rodden, 2003)

Public, community and situated displays. Many researchers have put large displays in public places such as offices or other public places to provide information and notices relevant to the social community and the setting with the aim of finding out how they might be used in practice. The key objective here is to determine the role of these displays in improving the sense of community (Rogers & Rodden, 2003)

To summarize, Tabletop displays that are the displays embedded in the tables. They allow users to interact with them when they are sitting (or standing). The main advantage of this kind of displays is that people can gather around the display and more people can get close to the information. Also people can put their personal accessories (e.g. book, notebook, pen, paper, key or coffee cup) that they want to use during the meeting around the table (Rogers & Rodden, 2003).
Appendix G- Summarization of all the ideas

Table 13 - Summary of ideas and functions for LIPD application for Linnaeus university students

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anytime, Anyplace Access</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Access from other places and other displays</td>
<td>Primary</td>
</tr>
<tr>
<td>1.1.</td>
<td>Accessing to the system from any place</td>
<td></td>
</tr>
<tr>
<td>1.2.</td>
<td>Accessing to each LIPD content from the other LIPDs</td>
<td></td>
</tr>
<tr>
<td><strong>Having Content Management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Posting content and Supporting different access levels</td>
<td>Primary</td>
</tr>
<tr>
<td>2.1.</td>
<td>Providing a web base system to post content to the LIPDs by different users.</td>
<td></td>
</tr>
<tr>
<td>2.2.</td>
<td>Determining different user groups</td>
<td></td>
</tr>
<tr>
<td>2.3.</td>
<td>Determining different access levels for each group of users</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Categorization of the displays and content of each display</td>
<td>Primary</td>
</tr>
<tr>
<td>3.1.</td>
<td>LIPD system should provide categorization for content.</td>
<td></td>
</tr>
<tr>
<td>3.2.</td>
<td>Determining a name for each category should be possible. Name of each category should be presented in an eye catching way</td>
<td></td>
</tr>
<tr>
<td>3.3.</td>
<td>Name of each category should be available in English and Swedish.</td>
<td></td>
</tr>
<tr>
<td>3.4.</td>
<td>Controlling and removing irrelevant content in each category should be possible</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Having a Gatekeeper (Administrator)</td>
<td>Primary</td>
</tr>
<tr>
<td>4.1.</td>
<td>Checking the content of critical categories by a Gatekeeper(Administrator) before publishing the data</td>
<td></td>
</tr>
<tr>
<td>4.2.</td>
<td>Removing the inappropriate content of any category by the Gate keeper</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Keeping the LIPD updated</td>
<td>Primary</td>
</tr>
<tr>
<td>5.1.</td>
<td>Defining expiration date for content by the content creator.</td>
<td></td>
</tr>
<tr>
<td>5.2.</td>
<td>Defining publish date by the system</td>
<td></td>
</tr>
<tr>
<td>5.3.</td>
<td>Defining validity period for the contents with no expiration date</td>
<td></td>
</tr>
<tr>
<td>5.4.</td>
<td>Archiving or removing the content with expired validity date or passed expiration date</td>
<td></td>
</tr>
<tr>
<td>5.5.</td>
<td>Creating up to date content using information of university websites</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Archiving the outdated content</td>
<td>Secondary</td>
</tr>
<tr>
<td>6.1.</td>
<td>Sorting the archive by date</td>
<td></td>
</tr>
<tr>
<td>6.2.</td>
<td>Searching the archive by a date period</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Presenting a particular content on multiple displays</td>
<td>Primary</td>
</tr>
<tr>
<td>7.1.</td>
<td>Making request by content creator for showing the content multiple times on a display</td>
<td></td>
</tr>
<tr>
<td>Section</td>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Allowing the content to be presented on several displays.</td>
<td>Primary</td>
</tr>
<tr>
<td>8.1.</td>
<td>Making a request by content creator for presenting an specific content on different places</td>
<td></td>
</tr>
<tr>
<td>8.2.</td>
<td>Allowing or rejecting a specific content to be visible from different displays, by the gate keeper(administrator)</td>
<td></td>
</tr>
<tr>
<td>8.3.</td>
<td>Showing an specific content on several displays</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Displaying a particular content several times on the same LIPD</td>
<td>Secondary</td>
</tr>
<tr>
<td>9.1.</td>
<td>Sending a request via the website(CMS) to the administrator for presentation of a content several times on a display by content creator</td>
<td></td>
</tr>
<tr>
<td>9.2.</td>
<td>Allowing or rejecting the request by the administrator</td>
<td></td>
</tr>
<tr>
<td>9.3.</td>
<td>Presenting the allowed content several times on the selected display</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Supporting information takeaway with different technologies for students with different facilities</td>
<td>Primary</td>
</tr>
<tr>
<td>10.1.</td>
<td>Taking the information away by cell phones</td>
<td></td>
</tr>
<tr>
<td>10.2.</td>
<td>Sending an email to LIPD visitor containing the information of LIPD</td>
<td></td>
</tr>
<tr>
<td>10.3.</td>
<td>Printing the content</td>
<td></td>
</tr>
<tr>
<td>10.4</td>
<td>Presenting the name of the post sender</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Publishing different categories of News, Events and Advertisements.</td>
<td>Primary</td>
</tr>
<tr>
<td>11.1.</td>
<td>Presenting each category in a separated section with an eye catching style for the name of the category</td>
<td></td>
</tr>
<tr>
<td>11.2.</td>
<td>Sorting the content of each category by date</td>
<td></td>
</tr>
<tr>
<td>11.3.</td>
<td>Presenting the description of news and events very briefly</td>
<td></td>
</tr>
<tr>
<td>11.4.</td>
<td>Using slideshow for presenting content of each category</td>
<td></td>
</tr>
<tr>
<td>11.5.</td>
<td>Presenting the detail of news or events very briefly</td>
<td></td>
</tr>
<tr>
<td>11.6.</td>
<td>Presenting events of the day and current events</td>
<td></td>
</tr>
<tr>
<td>11.7.</td>
<td>Possibility of adding a reminder about the events automatically to cell phones or other digital calendars</td>
<td></td>
</tr>
<tr>
<td>11.8.</td>
<td>Presenting deadlines of upcoming conferences and academic events for registration or sending papers.</td>
<td></td>
</tr>
<tr>
<td>11.9.</td>
<td>Providing Internal magazines just for take away</td>
<td></td>
</tr>
<tr>
<td>11.10.</td>
<td>Presenting university related messages</td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Announcing new academic members (teachers and professors, new PhD students)</td>
<td>Primary</td>
</tr>
<tr>
<td>13.</td>
<td>Presenting new and current research projects, categorized by department</td>
<td>Primary</td>
</tr>
<tr>
<td>14.</td>
<td>Announcing defense sessions</td>
<td>Primary</td>
</tr>
<tr>
<td>15.</td>
<td>Announcing new accepted proposals</td>
<td>Primary</td>
</tr>
<tr>
<td>16.</td>
<td>Declaring New publications and books by academic members or students, categorized by subject and department</td>
<td>Primary</td>
</tr>
<tr>
<td>17.</td>
<td>Displaying Map and Directions</td>
<td>Primary</td>
</tr>
<tr>
<td>17.1.</td>
<td>Presenting maps and directions combined with information of the venues in English and Swedish</td>
<td></td>
</tr>
<tr>
<td>17.2.</td>
<td>Presenting approximate distance from the current place to the destination</td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Presenting Information of the restaurants</td>
<td>Primary</td>
</tr>
</tbody>
</table>
19. **Showing Schedule of public transport systems around the university.**

19.1 Possibility of taking the information away

19.2 Possibility of taking away the timetable of buses or trains at the town

20. **Presenting information for new students**

20.1 Sending some proper information to new student’s cell phone

20.2 Sending notices to new students’ cell phones about information available on LIPDs for them

20.3 Downloading and taking away the information of new students from the LIPDs.

21. **Presenting information of medical services at the area**

22. **Presenting info of sport and entertaining clubs**

23. **Presenting student nations**

23.1 Categorization of nations base on the activities

23.2 Linking between the nation name and the events in event list

**General Information on Studying and the University**

24. **Presentation of course schedules of the day and related class room, course code, teacher**

24.1 Possibility of taking away course schedules by cell phones when students come to university buildings

24.2 Presenting class room schedules and the related course code, department and teacher

24.3 Presenting schedule of conferences or seminars and possibility of taking then away on cell phones.

24.4 Filtering and searching on all type of schedules base on course code or name, teacher and department

24.5 Taking away the schedule info is possible

24.6 Sending course schedule of the student to their cell phone when they come to university buildings around LIPDs

25. **Presenting information of Teachers and Their TAs contact info**

25.1 Presenting Teachers and their TAs contact info, office address

25.2 Presenting Teachers and their TAs up to date weekly schedule of presence at the University

25.3 Presenting Teachers and their TAs up to date meeting schedule

25.4 Presenting teachers and their TAs presence at their offices and university buildings

25.5 Accessibility of all the above information at the university area and from distance

26. **Presenting University offices visiting hours, address and contact info**

26.1 Showing contact info and visiting hours of secretary and the manager of each department.

26.2 Presenting if the contact person of each department or office is on leave

26.3 Accessibility of all the above information from the university area and from distance

**Voting or Commenting on a Posted Subject**

27. **Providing facilities for voting or commenting on a posted subject**

27.1 Providing facilities to upload a subject for voting or getting feedbacks by students and university staff

27.2 Keeping the people who vote or comment on a subject anonymous and untraceable, if they want to, and make possible to use nicknames

27.3 Checking the subject before presenting on the LIPDs by gate keeper

27.4 Abandoning people from voting twice.

27.5 Abandoning irrelevant people from voting or commenting on a particular subject.

27.6 Presenting the address for voting on the university website
### Instant and Emergency Messages

| 28. | Presenting instant / emergency messages on lipds and sending them to cell phones of registered users at the same time. | Primary |
| 28.1. | Receiving messages from admitted users (e.g. teachers)as instant messages |  |
| 28.2. | Registering users for receiving instant messages in different categories. |  |
| 28.3. | Presenting the instant messages on LIPD and at the same time sending them to registered users |  |

### General Aspect of Navigation and Use

| 29 | Having a Search Bar | Primary |
| 29.1. | Searching for all content categories and LIPD information |  |
| 29.2. | Providing different search fields for different content categories of LIPD system. |  |
| 30 | Concurrent Translation of the content | Primary |
| 30.1. | Translating texts and texts combined in pictures |  |
| 31 | Having a User Guide and FAQ | Primary |
| 31.1. | Presenting a video user guide on LIPD and on the university website |  |

### Content Personalization

| 32 | Capability for Personalization of the content | Secondary |
| 32.1. | Possibility for users to sign up in a registration form |  |
| 32.2. | Choosing cell phone or LIPD to see the info on that |  |
| 32.3. | Choosing the categories of personalized info among available info of the LIPD |  |
| 32.4. | Showing the user the personalized info on the selected device when they come to university buildings. |  |
| 32.5. | Not keeping the logs of user’s presence at the university buildings. |  |

### Library

| 33 | LIPD at the university library , presenting new books and magazines bought by the library | Secondary |
| 33.1. | categorizing the new books and magazines of the library base on the science and field of study |  |
| 33.2. | registering users in the system, selecting their categories of interests , major of study and if they want to receive their interesting info on their cell phones or not |  |
| 33.3. | Sending the name of new bought books and magazines to registered relevant users. |  |

### Photo Albums

| 34 | Using Photo album | Primary |
| 34.1. | Creating photo albums |  |
| 34.2. | Using photo albums as screen savers |  |
Figure 25- Summarization of all the ideas
### Appendix H- Workshop Agenda

<table>
<thead>
<tr>
<th>items</th>
<th>time</th>
<th>comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Presenting the</td>
<td>15 min</td>
<td></td>
</tr>
<tr>
<td>- introduction presentation and the schedule</td>
<td></td>
<td>Talking about the videos – asking about the ideas and detail</td>
</tr>
<tr>
<td>- introducing the research and the workshop goal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Presenting the rules</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Presenting the LIPD basic video’s :</td>
<td>15 min</td>
<td></td>
</tr>
<tr>
<td>- Xeeliz</td>
<td></td>
<td>Talking about the videos – asking about the ideas and detail</td>
</tr>
<tr>
<td>- Awesometouchscreens</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- PSDJD2011</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Presenting videos:</td>
<td>6 min</td>
<td>Exploratory</td>
</tr>
<tr>
<td>- Awesometouchscreens</td>
<td>7 min</td>
<td></td>
</tr>
<tr>
<td>- PNNL.gov</td>
<td>7 min</td>
<td></td>
</tr>
<tr>
<td>4. - I should describe the limitations and scope</td>
<td>10 min</td>
<td>Maybe Music - Boost Creativity - Mozart Symphony 40 with Brain Wave Entrainment - 6 min</td>
</tr>
<tr>
<td>- Asking people for new ideas and relating the ”day made of glass ”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- ”way finding” to large displays</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. -discussion</td>
<td>30 min</td>
<td></td>
</tr>
<tr>
<td>6. Break - Asking people to walk around the building and suggesting</td>
<td>10 min</td>
<td></td>
</tr>
<tr>
<td>features for LIPD after observing Bulletin Boards and Printed stuff</td>
<td></td>
<td></td>
</tr>
<tr>
<td>that exists around, and their characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. - Music :Wild child</td>
<td>-3to5 min</td>
<td></td>
</tr>
<tr>
<td>- Presentation of the “a day made of Glass”</td>
<td>-5 min</td>
<td></td>
</tr>
<tr>
<td>8. Asking people about</td>
<td>About 80 min</td>
<td></td>
</tr>
<tr>
<td>- Internal communication problems, whatever it is. Even if it’s not</td>
<td></td>
<td><em>Creative Problem solving (CPS)</em>- mess finding, data finding, problem finding, idea finding, solution finding and acceptance finding</td>
</tr>
<tr>
<td>related to LIDB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Asking about the information they need around the university</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I- Interview questions

1. What is your reflection or suggestion about the concepts that discussed at the workshop?
2. What functions do you think a large public display should have at the university?
3. What is your opinion about the type of news that could be available about the university?
   - You can reflect and discuss your opinion about:
     a. Announcing new teachers and Professors, new PhD students, new researches and projects in each department, new proposals by students.
     b. defense sessions
     c. New publications and books by teachers or students
4. How do you think about having “photo albums” on the LIPD?
5. How do you think about using mobile phones to interact with LIPD at the university?
6. How do you think about having information about the restaurants and Cafés at the university?
7. How do you think about usage of LIPD for posting a subject for gathering votes, comments or as suggesting something
   - What do you think about availability of your identity on the large public display if you work with the display, if you vote or suggesting or commenting on something?
   - How do you think about using a nickname or your first name for voting or commenting?
8. If you agree with the students being able to upload some content on the display, then how do you prefer to do that? How do you think putting the content on the LIPD should be? (Reflect on devices and technologies).
9. How do you think about instant messages showing up on LIPDs and also as a message on your cell phone? (e.g. class cancelations)
10. How do you think about the displays showing personalized information when you come to one of the buildings?
    - By cell phone?
    - By the display?