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Innovative Mobile Conversation - User Friendly Integration of Short Message Service and Voice Call

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Abstract

Mobile phone technology is our constant companion; it keeps us connected to other people such as families, friends and colleagues. Its constant usage can lead to potentially intrusive calls creating challenges for the user, having to decide to answer the phone or not. The purpose of the study is to propose an innovative way of using mobile phone by integrating both Voice Call service and SMS[1]. In order to do this we studied the behavior towards the usage of mobile phone. By observing and studying the different services available to mobile phone users, we have come up with a conceptual design integrating SMS and Voice Call services in a user friendly way, which was then evaluated with the help of interviews. We found that our SMS-Voice Call service helps in confined space as it is easy to use, easy to learn and can also be used in many other places such as concert, religious places, at home or while sitting beside your parents talking to your girlfriend/boyfriend. By evaluation we are hoping to contribute to the study of mobile phone and the problem area of context awareness.

Keywords confined space, Voice Call, SMS, context awareness, conceptual design, SMS-Voice Call service

[1] Short Message Service

1. Introduction

While attending a seminar few months back, it was noticed during the seminar that someone's mobile started ringing. It was a person sitting at the other end of the seminar hall; he lifted his hand as if to apologize and rejected the phone call. Simultaneously, everyone sitting around started taking out their mobile to check and see that they had switched off their phone or turned it to silent mode. In such situation you are left with the dilemma of rushing outside to answer the phone call or reject the phone call. Most mobile phone technology does not support this kind of situation.

In our study, we seek to identify the different services of mobile phone, and how these services, when identified are used to solve problems which occur in constant usage of mobile phone. We also looking to solve problem that occur with the usage of mobile in confined space.

Mobile phone has become fastest growing consumer device in this era of globalization. People use mobile device wherever and when ever in public places or in the privacy of their homes. This unique technology has simply become a part of the user's life that their constant presence and availability affect and shape the life of the users (Wei, 2007). The proper use of mobile phones has become a great concern among today's researchers. Mobile users are also faced with the dilemma of doing other activities and at the same time be available to answer mobile phone calls.

The sudden ringing of the mobile causes disturbance and there many people who do not appreciate the use of mobile (Voice Call) in public places. This has also been pointed out by Ling (1997), who studied the changes and the boundaries between appropriateness of mobile phone usage especially in restaurants. As mobile Technology advances and becomes popular such social problem comes into existence (Tarasewich, 2003). Although society encourages the use of mobile technology but at the same time there is always the question of appropriateness of mobile phone usage in different places. This has also been supported by Isaac, Nickersen and Tarasewich (2004), who presented the results of survey of mobile phone use and the attitude of use among university students in France and USA. Their aim was to identify the social issues that have emerged with mobile technology and to find ways of addressing some problem that come with it.

Voice Call service on mobile phone demands immediate response, but there is always a concern on the part of the user being overheard. Researchers Nelson, Bly and Sokoler (2001) have pointed out several different ways that the mobile phone users try to deal with different situations while having a private conversation. According to them, "Be Noisy" is one of the approaches, where the mobile phone user just does not care of people around and continue to talk aloud. While others "Talk Quietly" by moving into corner of a room and trying to speak quietly. Then there are others who "Move the conversation elsewhere" by basically moving out of the room at the same time disturbing others around. Others "Don't take call" because they are busy in other activities and use voicemail instead and the last one is "Use an inaudible approach"

this approach allows the phone users to change to different modality (two-way test pagers), but then both parties in conversation must have similar modality in order for this to work (Nelson, Bly and Sokoler, 2001).

The main reason for such inconvenience (intrusive calls) is that the caller does not have the knowledge of the recipient's context. This lack of context awareness in mobile communication has become a problem in mobile phone Technology (Rahlff et al, 1999). There has also been number of studies done around mobile conversation and location. Weilenmann (2003) has investigated the ways in which location and its references are used in conversations. While Laurier (2001) indicates how professionals use their mobile phone by choosing different modes on their mobile to state their location. Both these studies point out that location value is embedded into activates the mobile phone user are engaged in and they are easily communicated through conversation on the mobile phone.

There are many services provided by the different mobile service provider, Voice call being the most important service, another means of communication has become equally popular, short message service (SMS). This is particularly true as it was observed by the research authors on the public transportations. The main reason for it to be popular is that it is fast, cheap, easy and convenient as quoted by Amin, Kresten et al (2005). Another advantage of using sms is that it can also be used silently in public places without actually disrupting others space. It is more discreet than a voice call, making it the ideal form for communicating when you don't want to be overheard. This brings us to the focus of this study and thus the main research question of this thesis:

> ***"Can the integration of the SMS and Voice Call services; benefit the mobile user in conversation when in confined space, without having to reject the in-coming phone call?"***

This paper will analyze the already existing services of the mobile phone especially the Voice Call and the SMS and suggest a new and user friendly approach to the conceptual design by integrating both these services. These services are commonly used by different groups of people belonging to all ages. The design suggested will use a mixed mode of communication where the callee uses a quiet mode of communication to answer the caller. Based on the situation and location the callee can choose the mode of communication, while the other caller can understand the location awareness of the situation.

As Nelson, Bly and Sokoler (2001) have already pointed out that the mobile phone user find it difficult to keep the conversation quiet when confined to a particular space. By doing this study, we are hoping to provide help to the problem of keeping the conversation quiet in confine space and not disturbing others around. This system will provide quiet talking, continuous flow of talking in real time (combination of Voice Call and SMS). This way the recipient of the call is given more opportunity and possibility to communicate in a more flexible way by choosing either SMS or Voice mode of reply.

Our study will give a short overview of SMS, voice call and context-awareness in the mobile phone area and also introduce and discuss of the conceptual design which will tested by the potential users.

This study will not focus on the technical aspects of the mobile phone; neither will it look into the economical issues related to the cost of the calls.

2. Methodology

The study is qualitative research (Creswell, 2002) more inclined to Grounded theory (Sharp, Rogers& Preece, 2007). The aim of the grounded theory is to develop a theory that fits a set of collected data (Sharp, Rogers& Preece, 2007). Sharing similar idea as grounded theory approach, the first step of our study also started with data gathering. Our study started from gathering data through observation, we try to find out how people are using mobile phone in different situations and then notice and identify the problem. The problem area for the study is mainly focused on make mobile conversation in confined space. To find out the existing applications, services and the researches related to the problem area through literature review. Based on the data gathered from the observation and literature review, we explore a suitable solution for the problem area, and then outline the conceptual design, by integrating SMS and Voice Call service in a user friendly solution. The conceptual design is further evaluated through interviews, the purpose of the evaluation is tried to find out if the solution fits people who use mobile phone within confine spaces. Figure 2.1 is the methodological process of the research, the details of each phases will be described in the following sections.

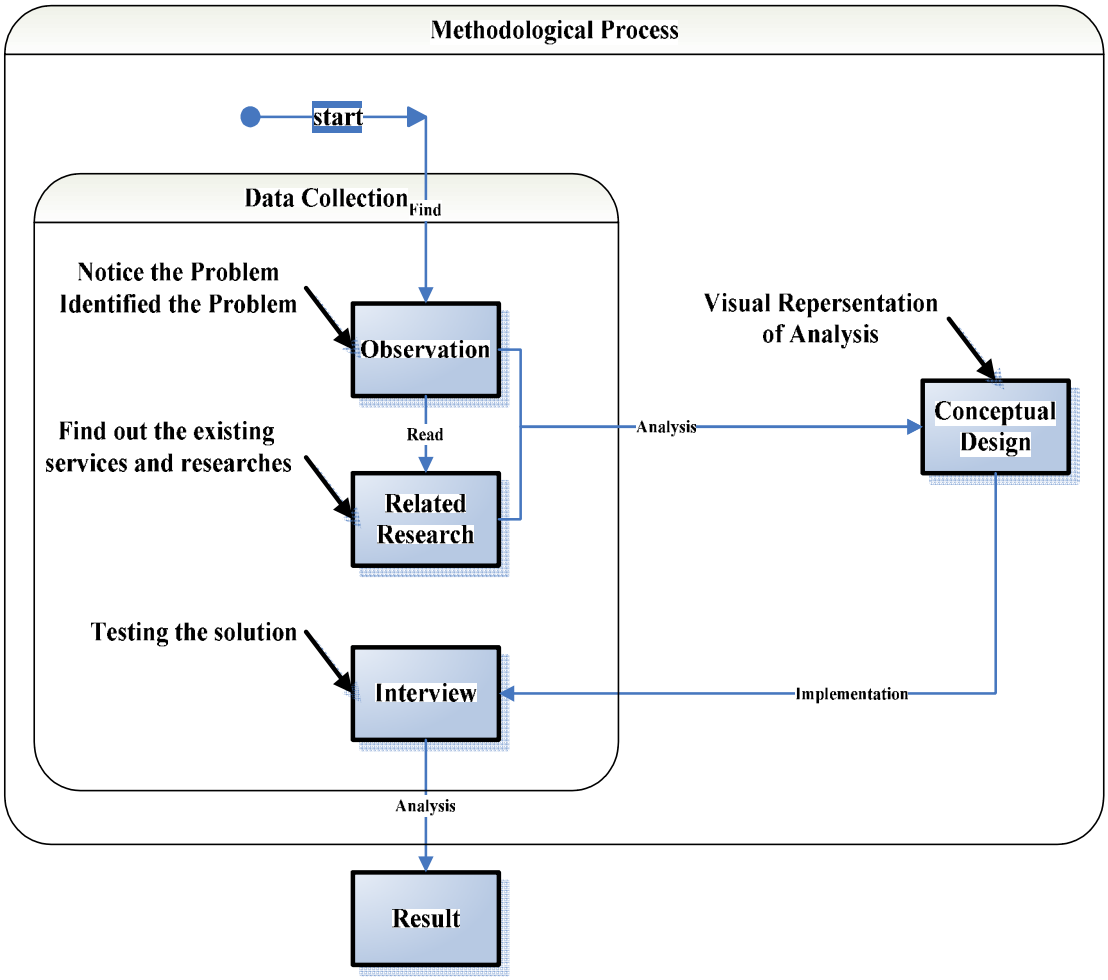


Figure 2.1 Methodological Process of the Study

2.1 Data collection methods

The methods used to gather data at an earlier phase is observation and literature review, a conceptual design is then proposed. The interviews method will be based on the conceptual design to collect data in order to evaluate the solution.

2.1.1 Observation

The observation method is inspired by Ethnographic methodology (Sharp, Rogers& Preece, 2007). As in ethnographic study the observers actually observes in order to gain an insight into the people lives and the problems. We have also observed the usage of mobile phones in public places, and their problem. Thus observation was done to actually notice and identify the problem. The observational study was done in a form of indirect observation in natural setting, which was helpful in gathering data for analysis of the problem.

Observation 1:

The first observation was with people using mobile phone in crowded area (city center in Gothenburg) and also on the busses and trams, in order to find out:

- Which services are used the most?
- The mobile phone services have been used in different situations (different people using same service in different situations).
- The ways in which of people using the service.

Observation 2:

The second observation was with people sitting in confined spaces (lecture and meeting) use the mobile phone, in order to find out:

- What is the mobile phone status (silent mode, meeting mode, switched off) for people in confined spaces?
- When people sit inside a confined space how do they deal with the in-coming calls?

2.1.2 Literature Review

This method is used to find out the existing researches, service and applications. It is related to four categories:

- Voice Call
- SMS

- Context awareness
- Context awareness applications

The details of four categories will be found in the literature review chapter.

2.1.3 Interview

The interview is the method used to evaluate the conceptual design and also tracing back to the results got from the observation.
The interview was done in two parts:

First part:

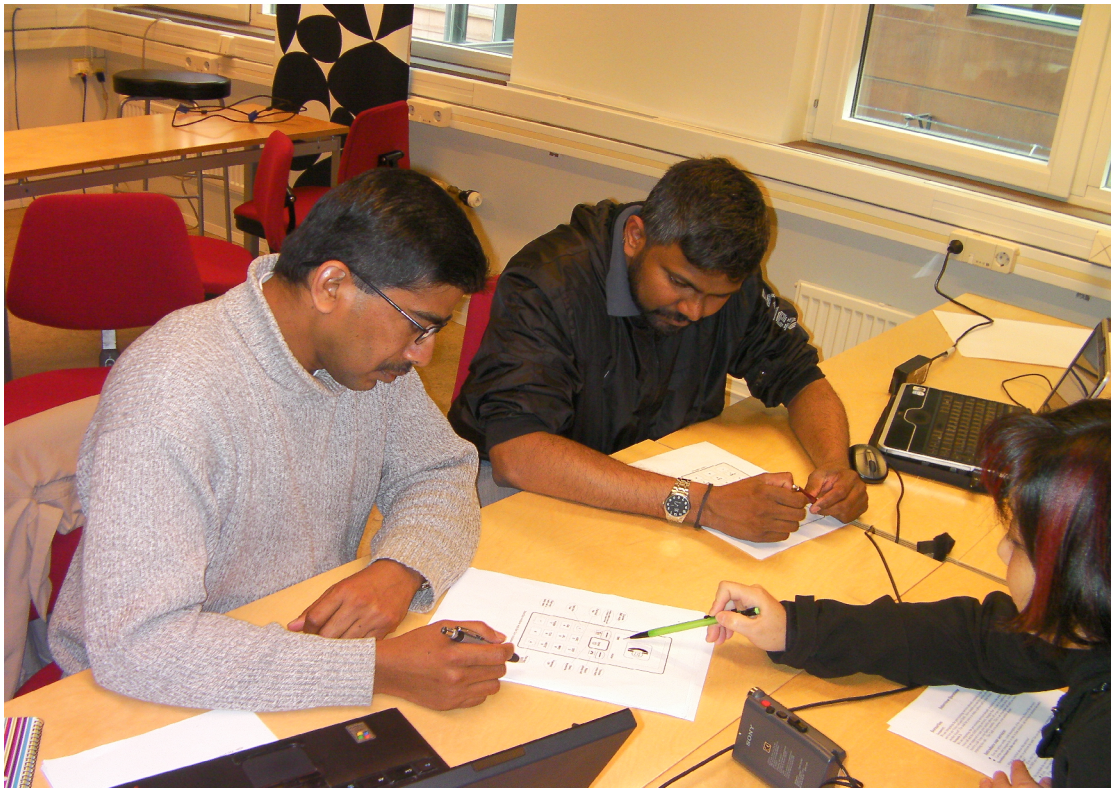
The first part consisted of just general questions about the different services or different means of communication used by the interviewees.
The interview process:

1. General question on the mobile phone usage.
2. Questions on different services
3. Questions on how the interviewees dealt with usage of mobile in confined space

Second part:

The second part of the interview was about the conceptual design. The purpose of the interview was to gain an understanding of the concept by testing the usability of the design prototype. The presentation tool was paper-based prototype.
The interview process:

1. A verbal description of the service and their function keys.
2. This was then followed by a scenario description and then the interviewees were asked to perform the task.
3. Interviewees followed the scenarios and performed the task described to them on the paper-based prototypes.
4. Interviewees were then asked questions based on the design, service and their understanding of the paper-based prototypes.



Participants of the interview chosen from different gender and age, one importance is that all the participants had met the problem of using the mobile phone in the confined space before. The participants has been set up in 4 groups, which are 2 groups with participants between 21 to 28 years old, one female group and one male group. The other two groups consisted of participants between the ages 35 to 45, of these two groups one was female group and the other male. The participants are chosen from the young generations and middle age users, based on the literature review, it shows in different generation groups may have different interest of using the mobile (3.2), for the limitation of the research, there is no teenager's participants. The interviews were group interviews (Sharp, Rogers& Preece,2007), the interview questions will be semi-structured (Sharp, Rogers& Preece,2007), use both open and close questions, bringing the interviewees focus of using the new designed service, let the participants feel free to talk about the new designed service, get feedback from the interviewees. The tool for recording the interview was mainly a Dictaphone, some interview was also recorded in video sequence, and camera was used to take pictures of the interviewees. Notes were also taken during the interview.

2.2 Data Analysis

For this study the analysis steps as follow:

First the study noticed and identified the problems of people using mobile phone in the specific situation and also identified the common services which people often used by data gathered from the observation method.

Secondly, by doing literature review, we coded the similarity between the recently used services, applications, researches which related to the problem area, also the research which trying to increase the contact awareness is identified. The data gathering from the literature review categorized into three categories (you can find the details in 2.1.2, Chapter 3).

Thirdly, authors grouped the results got from the observation and literature review, analyzed the data and found the user friendly way of using common services to solve the specific situation, which is different from the previous studies and existing services and applications. Conceptual design carried out.

Fourthly, authors evaluated the conceptual design by doing the interview, the results from the first part of the interview was used to tracing back to the observation results. The second part of the interview focused on the usability of the conceptual design. All the data got from the interviews have been recorded by Dictaphone or video, also notes have been taken during the interview. Based on the questions which asked in the interviews, we listened to the tapes and watched videos again, wrote down the answers of the interviewees' matched the answers with the notes which took in the interviews.
Finally, gathered all the results both from the observation and the interview (You can see the results of the research in Chapter 6).

2.3 Conceptual Design

The conceptual design has done after coding the data from the observation and the literature review; it is a visual representation of the analysis of the results. After the conceptual design the interview has been used for evaluate the design.

3. Literature Review

This chapter will give an overview on literature of mobile phone services and its social usefulness. Connection between different people is maintained through the use of voice call and the use of text messaging. With mobile phone being such an advance device, comes a social downside to this that is the lack of context of the recipient. How people use these services without taking into account the other person location and situation. By looking at these three areas, deeper understanding of these services is gained at the same time problem faced is also understood.

3.1 Voice Call

Voice Call as a fundamental service of mobile phone has been widely used by people in their daily life. International Telecommunication Union recently announced that the world would see more than 4 billion mobile cellular subscribers before the end of

2008. The growth of mobile cellular subscribers has been impressive, with year-on-year growth averaging 24 per cent between 2000 and 2008. While in 2000, mobile penetration stood at only 12 per cent, it surpassed the 50 per cent mark by early 2008. It is estimated to reach about 61 per cent by the end of 2008 (International Telecommunication Union, 2008).

It is common to see people making voice call in public places, for example, walking on the street or waiting for the bus. It makes a convenient way for people verbal sharing information in different places. Phone calls have many of the benefits of voice communication such as paralinguistic cues, back channels, and cross-cultural understanding (Danninger, Takayama et al, 2007). But still Voice Call service has some limitations for the usage, research on mobile use in the workplace finds that approximately 60% of phone calls fail to reach intended recipients, and only 40% lead to an immediate conversation (Danninger, Takayama et al, 2007).

3.2 Short Message Service

Short Message Service (SMS) was first introduced in 1992; however it was only in 1997 that it became widely popular (Nieminen-Sundell &Vaamamem-Vainio-Mattila, 2003, quoted in Cox, Cairns et al, 2008). It allows users to communicate non-verbally, expressing themselves via combinations of alphanumerical characters with a maximum of 160 characters per single SMS message. SMS has infiltrated global communications because SMS is a cheap, quick, and effective means of communication between individuals of any distance (Soriano, Raikundalia et al, 2005). In December 2004, the Mobile Data Association recorded 2.5 billion SMS messages sent over the UK GSM net work in one month, which was the highest record monthly total at that time (www.mda-mobiledata.org, quotes in Soriano, Raikundalia et al, 2006). Messaging services provider, Acision says that - according to their figures - global SMS traffic over the 2007/2008 New Year period increased by 30 per cent compared to the same period last year. Around the world, phone users sent a total of 43 billion text messages to wish their loved ones a happy New Year (International Telecommunication Union, 2008).

Much research has been done to deal with the usability of SMS (Soriano, Raikundalia et al,2005, Soriano, Raikundalia et al,2006, Groot &van Welie,2002) and the benefits of using SMS has been identified:

- Mobile messaging allows for a relaxed planning when people are to meet up. It is possible to adjust the time and place literally down to the last minute (Svendsen, Gunnvald et al, 2005).
- SMS allows information to be communicated in a quick and short manner that is both unintrusive and discrete, and also give an example said that “you can receive messages without disturbing a meeting” (Soriano, Raikundalia et al, 2005).

- Text messaging allows us to maintain contact with friends and colleagues, but at the same time it is inconspicuous. Texting allows us to be expressive even in situations where other forms of communication are not appropriate (Ling, 2004).

In Europe, teenagers were among the earliest and biggest users of text messaging (Grinter &Eldridge, 2001). On the other way round, the research done by Soriano, Raikundalia and Szajman (2005), found out many middle ages users from the participants felt that if an individual had the time to compose a message, then that individual was in the position to communicate verbally via a voice phone call. The benefits of SMS messages do not outweigh the benefits of a voice call for users of middle-aged group, "As far as I am concerned, a phone is a phone! It should be used to ring and talk to people" (Soriano, Raikundalia et al, 2005). Cox, Cairns et al (2008) identified that universal key press mode of interaction is inherently restrictive as it ties the user both visually (eyes-busy) and manually (hands-busy).

For texting message there are two text entry methods (Cox, Cairns et al, 2008), which are multitap text-entry and predictive text-entry.

- Multitap text-entry requires the user to press each key repeatedly until the desired letter appears on screen (Cox, Cairns et al, 2008). For example, if you want entry YES, you need to press 9-9-9-3-3-7-7-7-7, which means you will get Y by pressing three times on 9, you will get E by pressing two times on 3 and you will get S by pressing four times on 7.
- Predictive text-entry requires only one key press per letter. As each letter is entered, the system compares the sequence of key strokes against an internal dictionary of words, guessing the letters that the user is trying to enter (Cox, Cairns et al, 2008. and Lee, 2008).

3.3 Context awareness

Society has a similar convention that determines the way we initiate communication. When communicating with each other, context in which communication takes places play a vital role (Suchman, 1987). In natural face-to-face conversation, participants modify their behavior according to the other person's mood and behavior. With the advancement of technology, provision for other means of communications has become possible. Some examples are is the telephones and the mobile phones of this century. There is also a negative side to such technological advancement, people do not follow the traditional rules and loose the sense of context of the other person they are trying to call.

Mobile phones of today are an extension of the stationary phones; it has inherited a lot from the stationary phone. For example some of its interface designs, the way it rings, and the way one holds and talks through it. Few decades ago, when stationary phones were more popular, people were more aware of the other person's location and time. The stationary phone is associated with places, while the mobile phones are more

associated with people. When calling to a stationary phone we are more aware of the place being static while with mobile phones is more connected to a person, who may or may not be on the move (Ljungstrand, 2001).With mobile phone being more popular today, the mobile owners are meant to be constantly be available to answer calls and at the same time be engaged in their daily activities. This creates situations for many intrusive calls because of the lack of information of the recipient's context. Context is according to Dey and Abowd (1999)…

"Any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and application themselves."

This has definition has been widely accepted among many researchers, to be context aware is essential to all human conversation and this is a problem in mobile phone conversation(Rahlff et al., 1999). According to them there is a difference between situational feedback and communicational feedback. When doing face to face conversations both situational and communicational feedback is used while in mobile conversation situational feedback is almost none (Ljungstrand, 2001). In current mobile conversation, most information has to be conveyed by the people, through the conversation. Many researchers have also looked into conversations and how people try and orient in the conversation their location, activities and availability (Weilenmann, 2003). By investigating the ways in which people communicate in a conversation. These studies have provided a great source of help in designing the context awareness application and context aware phones.

3.3.1 Context awareness applications

Many applications have been built in support of context awareness and communication. Examples include Portholes, information tools to support the light weighted awareness in distributed work groups (Dourish, Bly, 1992). Video images of the members of a working group are sent to the desktops of the other members of the group in 5 minutes interval, so as to provide awareness of others activities. This stationary application provided a way of locating colleagues, even though it was not its primary purpose.

Another example is the hummingbird which was also used in for locating colleagues nearby (Holmquist, Falk & Wigströ, 1999). This is a hand held device built to support awareness and provides help in collaborating with each other within approximate distance of each other. This device was meant as a complement to other means of communication such as emails and phones. This was especially for office workers who are always mobile; this provided a means of being away and at the same time close to each other.

Online Instant messaging (IM) includes the ICQ, MSN, yahoo, Skype and similar applications on desktop computers. These applications could be described as a multi-

user domain (MUD) where users communicate with each other directly in real time via text message or through icons where user can see (Leung, 2003). He also quotes LaGesse, (2001) by stating that there are 60 million users of IM and it does not have time lag associated with it, as in email communication. These application also shows the availability of the others users, which the user chooses himself/or herself.

Other attempts to design application that provide awareness on mobile phones or on PDA[2] have also been made. The live address book works like a telephone manager providing Personal Presence information to the callers (Milewski & Smith, 2000). This application allows user, to make more informed calls either through a wireless PDA or desktop browser. Unlike other address books such as e-mail address book, the information are of static nature, but the live address book provides dynamic information of the recipient. Since the phones does not allow the user display personal presence on the mobile phones, this live address book extends the telephone with data service such as desktop browser or PDA. The Users are allowed to set up availability status and this information is continuously updated by the user.

Another example is Comcenter, (Bergqvist & Ljungberg, 2000); it is a system that provides the user with information before actually initiating the communication. It is a based on client/server system that combines the WAP[3] mobile phones to be integrated in to the company's communication network.
For instance, if an organization uses open calendars, the current calendar entry can be shown or a user specified message could be displayed, which enable some sort of rudimentary one-way "negotiation" before communication is initiated (Bergqvist, Dahlberg, Kristorferssen & Ljungberg, 1999).

Researchers have also tried to combine both calendar data with contextual information that have been automatically retrieved. One such example is SenSay, a context-aware mobile (Siewiorek et al., 2003). It constantly adapts to changing environment and the physical state of the recipient. It changes the ring volume; it also allows the caller with the information in case of emergency calls. It also provides feedback to the other SenSay users in case the person is idle. It uses sensors such as accelerometers, light, and microphones which are all placed at various places on the body. All these sensors provide data about the user's context. A decision module is used which works on the decision to the different states.

Quiet Call is a technology which allows the mobile phone user to answer telephone conversation without having to talk aloud. It combines three buttons for responding to call from a PDA or a mobile phone. These are pre- recorded audio conversation on the mobile phone (Nelson, Bly& Sokoler, 2001). They use a mixed mode communication, where the caller and the recipient are separated. The recipient usually has pre-recorded voice into the phone, while the caller uses natural or normal means of communication.

[2] Personal Digital Assistant or Smart Phones
[3] Wireless Application Protocol

Current phone technologies provide the user with Caller ID which allows the receiver/caller the privilege to see who has called. While others, allows mobile phones the user to select the predefined context such as "outdoor", meetings or silent etc. These are associated with some cues such as loud melodies in case of outdoors vibration in case of silent mode. There is also a possibility to allow giving a certain audible tone (busy) even when one is busy to answer the call. But all these have limited usefulness as this is only one sided to the person being called.

Instants messaging have also been incorporated into the mobile phones in recent years which provide context awareness (Kayode Adesemowo & Tucker, 2005).

Insipte of all effort by the research to finding different solutions for context awareness, it is still on the experimental stage and researchers are still working on better and easier solution. Today's solution still lies on the fact that the mobile phone user still provides contextual information through conversation (Weilenmann, 2003). And there is other solution which allows the technology to decide for you when it is appropriate to be called or when to be called (Siewiorek et al., 2003). Weilenmann and Esbjörnsson (2005) also talks about the appropriateness for a conversation, which is decided by both parties of the conversation. Both parties do not always agree on the appropriateness for the conversation, but negotiate it through. However we believe that by integrating both SMS and Voice Call service in a user friendly way, we can take into account context awareness in mobile technology. Our solution supports the recipient of the call by allowing him/her to make decision and choose the mode of reply. This way the recipient of the calls gets more possibility to communicate in a flexible manner. This way nothing important is lost between the caller and the callee and the technology does not decide for him/her, when it is appropriate for him/her to use the mobile phone. It might also solve the problem of appropriateness for conversation between two parties by allowing the recipient to choose the way to answer the call, at the same time making the other person (caller) aware of the callee context.

4. Implication for the design

Lots of mobile phones literatures, show that there are various solutions available and most solution talk about increasing context awareness. Some of these solutions are applications in desktops, others are handheld devices. Like porthole (Dourish, Bly, 1992) solution which sends video images to a desktop computer. This means that there is always a person sitting in front of the desktop to view the images sent by the other group members and only one side of the group is mobile while the other group must be stationary. In our solution both the caller and callee are constantly moving, it does not bind anyone to any particular place.

Hummingbird (Holmquist, Falk & Wigströ, 1999) is a hand held device where both the user of the device is mobile, the humming only starts when both people using the device comes within an approximate distance of each other. Our SMS-Voice Call

service does not have such limitations; it does not have to be in close approximation of each other. It works like a normal mobile phone with the only exception that the recipient of the call chooses the mode of communication.

Instant messaging is also an application which needs technology for it to function for example a pc, it also needs internet connection and the other person must also have this application. Our solution uses the basic services (SMS-Voice Call) which is provided by all service providers; the only similarity is that both people must have this service on their phone.

Live Address book (Milewski & Smith, 2000) includes live address book which provides dynamic information of the recipient and it is constantly updated. This way the caller is notified before hand of the availability of the other person. But it uses desktop browser and PDA as a means to display availability. Our SMS-Voice Call solution does not include PC functions on the mobile phone. Instead it simply allows the replier to choose the mode to reply.

Our SMS-Voice Call service differs from Comcenter, (Bergqvist & Ljungberg, 2000) as it does not need to integrate into the organization's network using the WAP. Our solution focuses only on the basic services as mentioned above and the choice is given to the callee to reply in the mode he/she wants to.

"senSay" (Siewiorek et al., 2003) which uses sensors and decision modules to constantly update context awareness but this solution adds sensors and other technological gadgets making the solution difficult to understand and at the same time very confusing. This not what we propose in our solution, we do not have sensors or decision modules in our solutions we use the basic services already know by all users of mobile phones.

Another solution which is quite similar to our solution is called "Quiet Call" (Nelson, Bly& Sokoler, 2001). It is a technology that uses pre-recorded messages. The recipient of the phone call has prepared himself prior to having the actual conversation by recording message to be said during the conversation. At the same time our solution SMS-Voice Call service is different from the "Quiet Call" (Nelson, Bly& Sokoler, 2001), in the sense that it uses combination of SMS and Voice Call service. One person makes a normal voice call to the other person, while the other person replies back with SMS to keep the conversation flowing but at the same time not speaking aloud.

By studying the literature we gain a deeper understanding of the problem of context awareness, which needs to be taken in account to avoid intrusive phone call problems. This way we understand and at the same time propose a different solution to solving this context problem which is what major related studies have tried to solve. The solution that we propose is different from the other solutions in the sense that the solution integrates already existing services. These two services Voice Call and SMS are common services used by most mobile phone users, which is supported through

our observation, literature review and evaluation. The users of the mobile phone have some prior knowledge of its usage, which makes it easier to learn and use the new service. Thus a new way using the mobile phone by making use of the already existing service, while at the same time incorporating more awareness in the mobile phone.

5. Conceptual design

This chapter will represent the conceptual design. The purpose is to give a visual view of the idea of this study- integration of SMS and Voice Call. The idea of the conceptual design is based on the results from the observation and literature review .The designed service called SMS-Voice Call service, which allows the callee choose the suitable mode to answer the phone call . Both the caller and the callee can switch the conversation mode during the conversation. There are four kinds of conversations within SMS-Voice Call service:

- The caller is voice chatting with the callee; the callee is replies by SMS.
- The caller is using SMS chatting with the callee, callee is voice replying.
- Both the caller and the callee are chatting through SMS.
- Both the caller and the callee are voice chatting.

The SMS-Voice Call service aims to integrate the existed service SMS and Voice Call in a friendly way, try to enhance the usage of the normal used services, keep the original benefits of the services and implement in a new way, in order to help people use mobile in confined space and increase context awareness. The following sections will go through the details of the SMS-Voice Call service and the interfaces of the SMS-Voice Call service.

5.1 Overview

Figure 3.1 is an overview of the SMS-Voice Call service. With this service both Person A and Person B can call each other. If Person A calls Person B, Person B can choose the reply mode and the service system will inform Person A the reply mode of Person B. It can be vice versa. During the conversation both of Person A and
Person B can switch the reply mode and will be informed by the service system. For clear understanding the main concept of the service, here is an example of how the system will work. Person B is in the lecture and Person A makes SMS-Voice Call to Person B. Person B chooses the SMS reply mode, the service system informs Person A the reply mode of Person B, then conversation starts, Person A is voice chatting with Person B while Person B is replying with SMS. Suddenly lecture is over; Person B switches the reply mode to voice reply, and the service system informs Person A about the changed mode of Person B, based on the changed mode the conversation continued, both Person A and Person B are voice chatting through the mobile. For more details of the work flow of the SMS-Voice Call service describes in the work flow section.

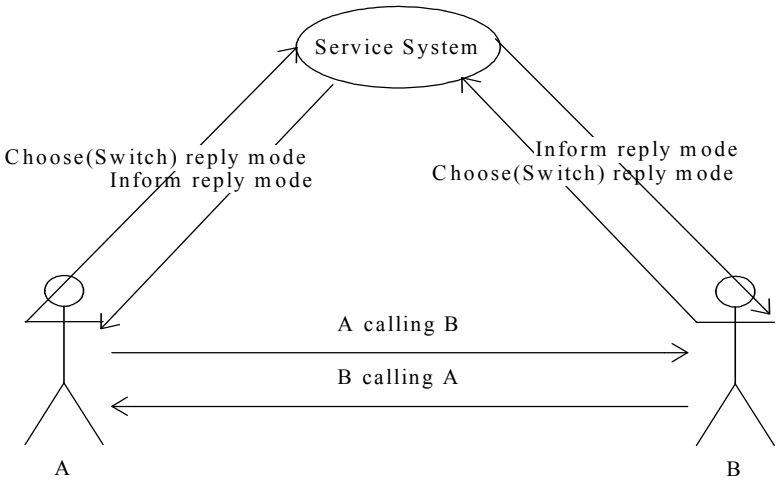


Figure 3.1 Overview of the SMS-Voice Call Service

5.2 Working Flow

Figure 3.2 is the flow chart of the SMS-Voice Call service. As it starts, the caller should dial the callee's number and press the SMS- Voice Call button. (The SMS-Voice call button is the designed button for the service which will described in 5.3.1)Then the callee's phone starts ringing and displays the caller's number. The callee can choose to answer the phone call or reject the phone call. The callee can answer the phone call in two ways, SMS reply and Voice reply. If the callee chooses voice reply, the service system will inform the caller and the service works as same as the normal voice call service, both the caller and the callee are voice chatting through their mobile; If the callee chooses SMS reply, the service will inform the caller, and then the SMS - Voice Call conversation starts. After the callee chooses the SMS reply mode, the callee will directly go to the default SMS reply mode (The default SMS reply mode is the designed mode allows people reply by fast key. For the details of the fast key will be described in 5.3.4.1).In this SMS default reply mode, callee can reply caller by fast keys or switch to normal SMS mode (The normal SMS mode is the normal SMS service, the details of the normal SMS mode will be described in 5.3.4.2). The callee can also switch to voice reply mode by press the SMS- Voice Call button, the caller will be informed of the switched mode by the service system. If the callee rejects the phone call, the service could share the idea from existing service in the market, such as reply by a busy tone or reply with message. On the caller side, if the callee has chosen SMS reply, the caller has been informed by the system and the caller needs to look at the interface and check the replied messages. The caller can also switch the reply mode during the conversation by pressing the SMS-Voice Call button; the callee will be informed by the service system. The SMS-Voice Call service allows both the caller and the callee in the voice reply mode or SMS reply mode during the conversation.

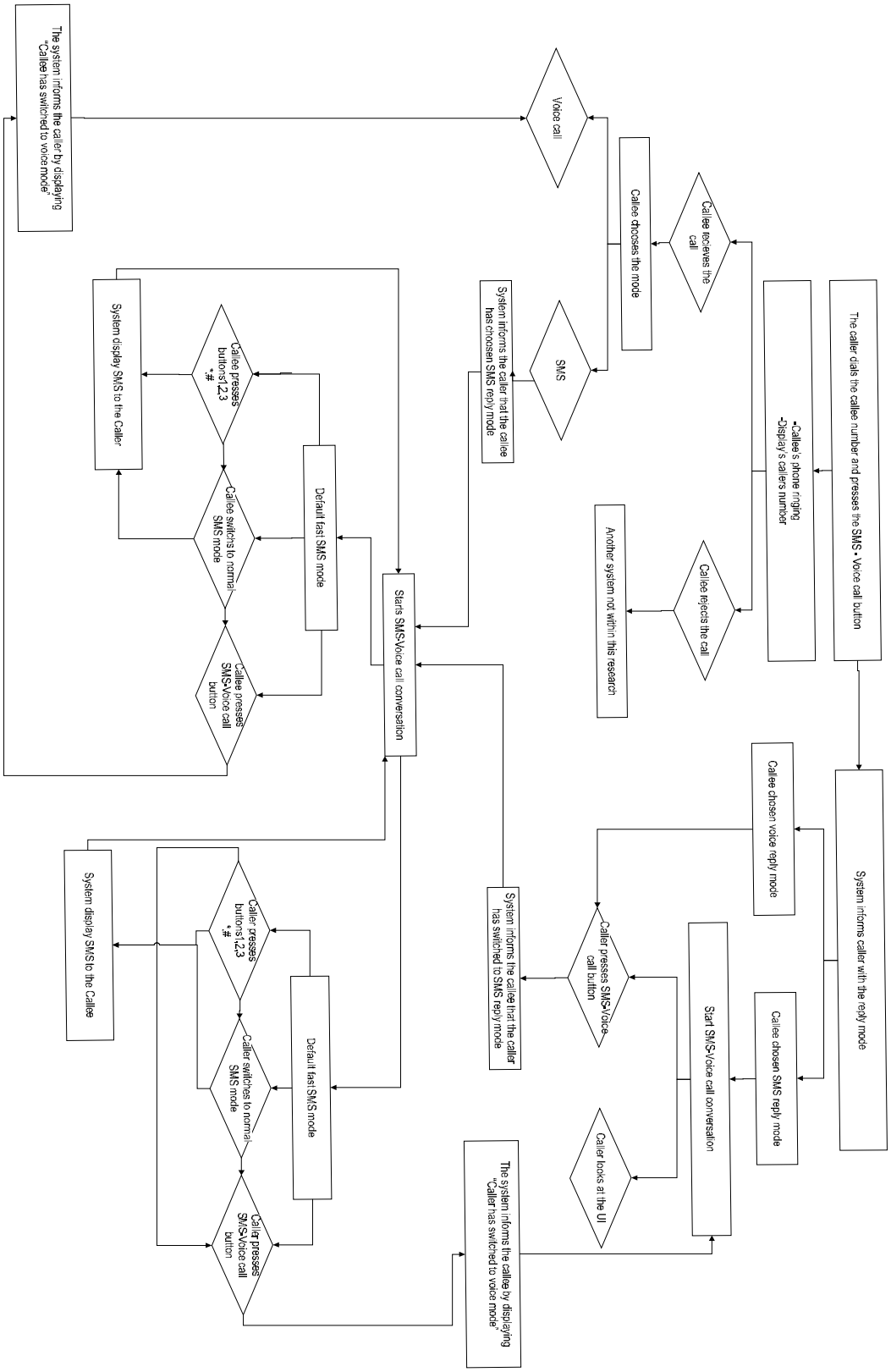
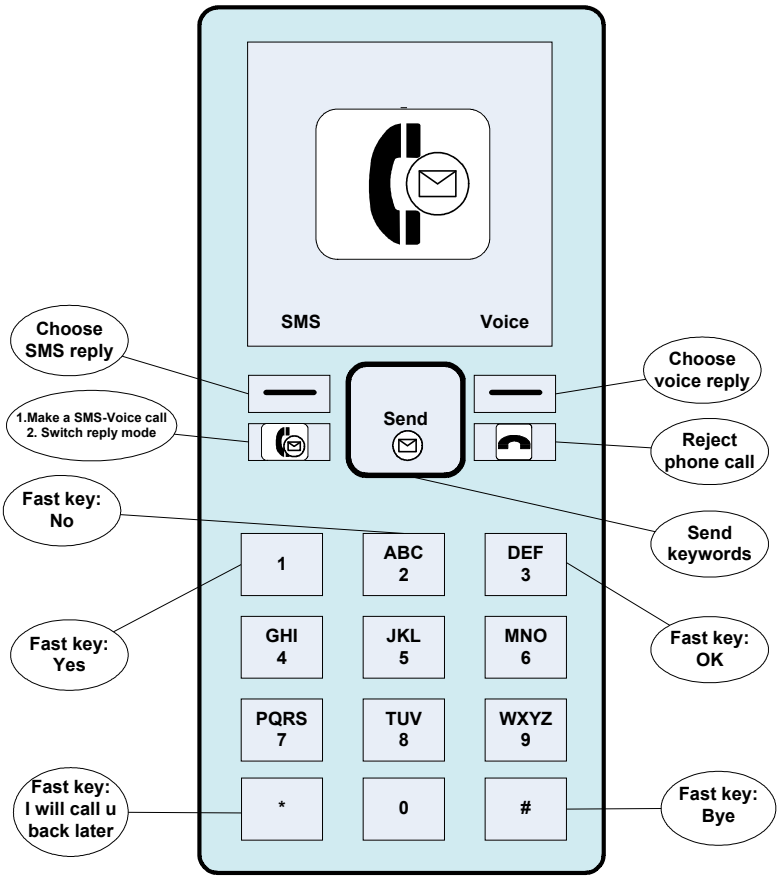


Figure 3.2 Flow Chart of the SMS – Voice call Service

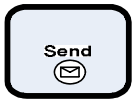
5.3 User interface

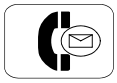
The pre-condition of the SMS-Voice Call service is that both the caller and the callee should have the SMS-Voice Call service, headset and switch on the mobile.



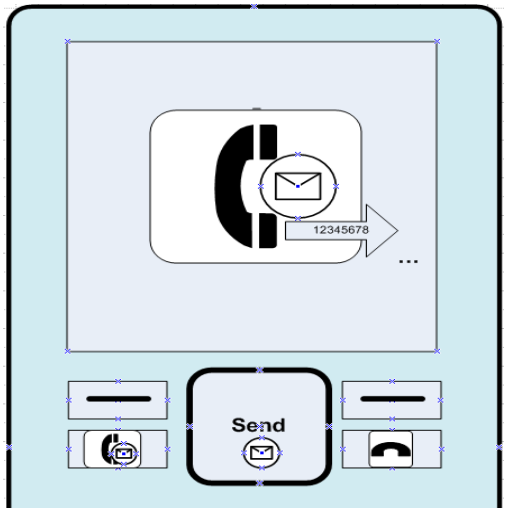
5.3.1 Function keys

This section shows the function keys for the SMS-Voice Call service. The function keys helps the users interact with the user interface. The explanation of the function keys as follow:

-  : There are two same function keys. The left one is used to choose the SMS reply mode, the right one is used to choose voice reply mode. These two function keys also have different functions in different user interface which will be described in the other user interface (5.3.4.1, 5.3.4.2).
- 

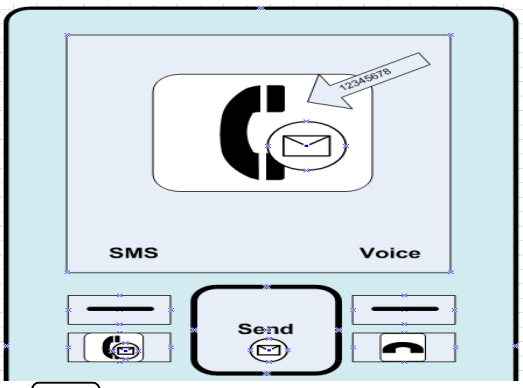
: This key is used to send messages. The details of this button will be described in other user interface (5.3.4.1,5.3.4.2).
-  : This key named SMS – Voice Call button. It is used to make a SMS – Voice Call conversation. It is also used to switch the reply mode during the conversation (from SMS reply mode to voice reply mode and from voice reply mode to SMS reply mode).
-  : This key is used to reject phone call.
- "1": It is the fast key reply message "YES".
- "2": It is the fast key reply message "NO".
- "3": It is the fast key reply message "OK".
- "*": It is the fast key reply message "I will call you back later"
- "#": It is the fast key reply message "BYE".

5.3.2 Call out user interface



This is the call out user interface. On the user interface you can see the calling number. In order to make a SMS-Voice Call, the user needs to dial the number and then press  button.  button is used to interrupt the SMS-Voice Call service (conversation).

5.3.3 Receive SMS-Voice Call user interface



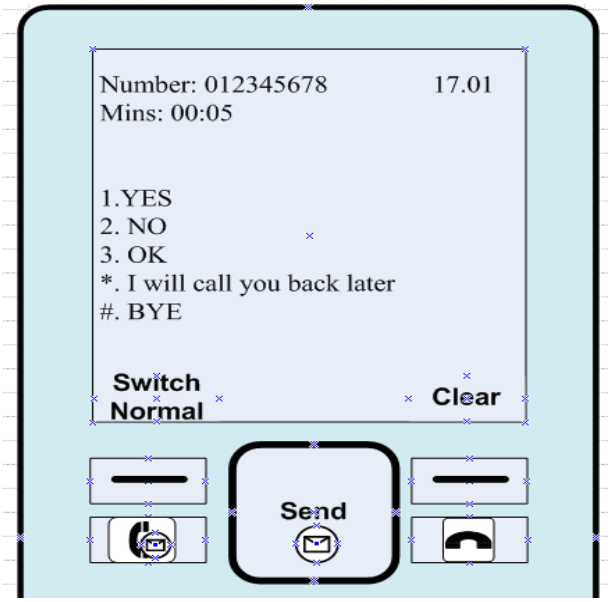
This is the user interface for the callee, when they receive a SMS-Voice Call. In the user interface it shows the caller's number and also the options of the SMS reply and the Voice reply.  button is used to choose SMS reply or Voice reply to answer the phone call in this user interface. The SMS-Voice Call conversation starts after callee chosen the reply mode. User can also press  to reject the phone call.

5.3.4 SMS reply user interface

The SMS reply mode allows the user reply the user on the other side of the conversation with the SMS.

5.3.4.1 Default SMS reply mode (fast key message reply)

The default mode of the SMS reply uses the fast keys to reply. The fast keys can be pre-defined before using the service. It means you can replace the default fast keys' contents with the message which you needed.



5.3.4.1.1 Overview

This user interface will be shown after the user has chosen or switched to SMS reply. If both of the user is in the SMS reply mode the interface from (5.3.4.2) will be shown instead.

In this user interface shows:

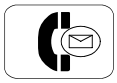
- All the fast keys and the contents of the fast keys
- The caller number
- The conversation time
- The current time
- Two options
  - **Switch Normal**

    It is the option used to switch from the default SMS reply mode to the normal SMS mode (the normal SMS mode will described in 5.3.4.2).  button on the left is used to switch the mode.

  - **Clear**

    It is the option especially used for the short press fast key (5.3.4.1.2);  button on the right is used to remove the previous chosen fast messages.

-  button is used to cut the call .

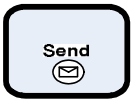
-  button is used to switch to the voice reply mode.

5.3.4.1.2 Three ways of the fast keys

There are three ways to interact with the fast keys in the default SMS reply mode.

Long press:

By long press the fast keys, the contents of the fast keys will send directly to the other side of the conversation. For example, when you long press the fast key "1", the content of the fast key "1" is "YES", and then the message "YES" will send directly to the other side of the conversation, without any additional actions.

Short press + 

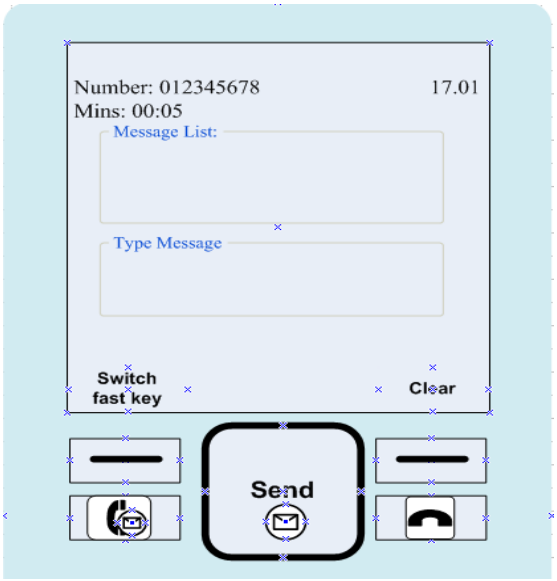
:

By short press the fast keys (more than one fast key) and then press send button, the contents of the fast keys will be sent together to the other side of the conversation. For example, the fast key "1" is "YES", the fast key "*" is " I will call you back later", and the fast key "#" is " BYE", then short press "1","*","#" and send button orderly, the message " YES, I will call you back later, BYE" will send to the other side of the conversation.

Touch (for touch screen):

For the touch screen the fast messages will be listed on the interface, the user just needs to touch the fast messages on the screen during the conversation.

5.3.4.2 Normal SMS reply mode



Normal SMS reply mode is used to type long messages. In this user interface will have all the functions and the options which the user normally have and familiar with on their mobile phone. Different mobile phone has different functions and options for the SMS service, therefore the user interface here is just a general view and not specific.

If both the caller and the callee chosen or switched to SMS reply this user interface will be shown.
The user interface contains:

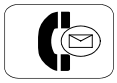
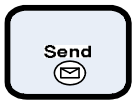
- The caller's number
- The conversation time
- The current time
- The message list
  The message list is used to list all the history of the conversation messages.
- The type message space
  The type message space is used for the ongoing messages which the user is typing now.
- Two options

  ■ **Switch fast key**

   button on the left is used to switch back to the fast key user interface.

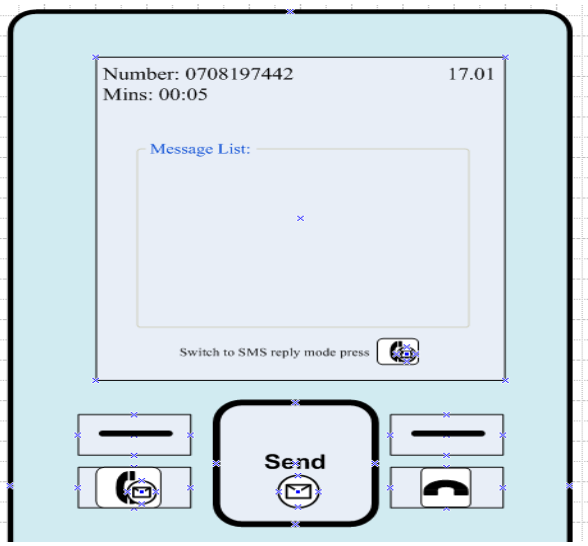
  ■ **Clear**

   button on the right is used to remove the previous typing from the type message space.

-  button is used to cut the call .
-  button is used to switch to the voice reply mode.
- 

  button is used to send the message.

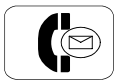
5.3.5 Callers user interface



This user interface will presented when the callee has chosen SMS reply. The user interface contains:

- The callee's number
- The conversation time
- The current time
- The message list
- The prompt (To inform the user how to switch to the SMS reply mode)

The message list -lists all the messages with its time.

-  button is used to cut the phone call .
-  button is used to switch to the SMS reply mode.

6. Results

This chapter will present the results both from observational studies and also the results from the interview evaluation. The first section of this chapter shows the results from observational studies. This was necessary for our thesis, to notice the problem area in field of mobile technology, to identify the services mostly used by the mobile phone users and the results also helped in identifying inappropriateness of using mobile phones in different location and situations. Thus the observational study was one of the ways of collecting data, which is relevant to this study.

The second section of this chapter will consist of results from the evaluation of the conceptual design. The evaluation results are also relevant to this study because it corroborate our finding from the observational study. It also helps to test the usability of the concept of integration of both SMS and Voice call service.

6.1 Observation results

Results from the observation showed that the most mobile phone users normally used Voice call service and SMS services as mean of communication in their daily lives. Most used voice call as means of communication in public places while some also used SMS communicate. This was usually noticed by authors on busses, trams and in educational environment. Some confined places and how the mobile phone user reacted to each incident is shown below:

Place or moment	Actions or solution
Meeting	Silent mode, switch off vibration mode---Reject
Lecture	Silent mode, switch off vibration mode 5. Reject 6. Reject + send SMS 7. Go out and pick up the phone call
Bus	Short call SMS
Private conversation	Reject Pick up said : ” I will call you back later”

6.2 Evaluation Results

This section will present the evaluation results from the interview. The interview was divided into two parts. The first part of the interview consisted of general questions, this was actually done to get corroboration for the findings from the observational study. The second part of the interview consisted of the results from the conceptual design. The participants were asked to perform a number of tasks on the design prototypes. The results from the evaluation help in getting support for the conceptual design, which is important source of data, to help answer the research question.

General Questions Results

All participants responded by stating that they used voice call and SMS services in their mobile phones. 100 percent answered that their first choice of communication was voice call service. One participant mentioned the use of Skype on his mobile phone. He mentioned that he only used Skype when he could get access to wireless internet, which was mainly available at home. But in school he had to log in to the network, which was not an easy task for him. Seven of the participants have MSN in their mobile, but they have not used that at all. The reasons include "I spend most of my time per day with my computer no need to use that.", "I am not using MSN also my friends." and "Make a phone call or send a SMS is enough to use, no need to pay extra for the other service."

The middle age groups of both genders do not prefer to use text message, although they use the service when situation demands it. One of the participants text short message and use abbreviation to text message, for example, for 'You' he used the alphabet 'u', 'for' he used '4' instead and for 'tomorrow' he used '2morrow'. He said this is the easy way for him to use this service. One participant pre-stored the messages, which meant that he typed message and saved it as drafts, when he needed it, he just forwarded the stored message. When asked question related to the usage of the SMS service, we found out there are several reasons for people using the SMS service listed below are reasons behind the usage of SMS services:

- In the public place not available to talk openly
- Searching for a friend
- When the caller did not want to initiate long conversation.
- Reminding something(to decide time for meeting)
- Save the history of the message (The participant uses Iphone, which could both save the send message and receive message with the same person in the same list)
- The caller needed to get in touch with the recipient of the call, due to some reason the callee does not answer the call or caller received a busy tone.

The participants were asked on how they dealt with the voice call when they were in the confined space, such example is meeting or lecture, participants had several solutions:

- reject the phone call
- reject the phone call and send message
- ignore
  - silent mode
  - vibration mode
  - just don't want to pick up
- Switched off the mobile phone
- Go out and pick up the phone call

Due to rejection of phone calls many important phone calls are missed, jobs are lost and important knowledge was also lost. All of participants had some time in their life missed many important phone calls by ignoring the phone calls or rejecting the phone calls.

Conceptual Design Results

The results are from the specific task performed by the participants on the concept design. All participants thought of the design as easy to use with few steps for the different task. The fast key buttons which already had predefined messages to send was very much appreciated by the participants. According to the participants it was a convenient way to deal with sending messages. Other function that was very much liked was the predefined message could be changed according to one's own needs. The participants from the middle ages group strongly thought that the fast key reply SMS mode could help them texting message.

All the participants thought the design could help them in the confined space or uncomfortable situations. According to the participants other examples of confined places are such as listed below where the concept designs service could be also helpful:

- Crowded places.
  A lot of people around and they are talking. For example concert.
- Sharing Secrets.
- Not wanting your parents to overhear your conversation with girlfriend/boyfriend.
- At night when you do not want to talk
- Busy at home
- In open office spaces
  A lot of workers working in the same office
- Restaurants.
- Religious places.

The participants also said this is a new service, they needs time to remember all the process and the fast keys, and four of the participants thought the designed button make them confused when they picked up the SMS- Voice Call, because they get used with the normal pick up button, and normally it is the same button for them to

make a phone call or receive a phone call. But still all of the participants agree that our designed service could replace the normal phone call service.

All fourteen participants agreed that the interface provided an overview of all information needed for sending messages short and fast message. Two persons were a bit confused with switching to normal text mode, but manage to switch. According to these two participants, they wanted a bit more information when switching to normal text mode.

The participants were also asked about the disturbance of somebody sitting around using the design service, 75 percent of the participants said it would not disturbed, 25 percent said yes, it will disturbed , because it will bring his or her attention, and the noise for typing long message beside them will also disturb them.
All participants responded very positively when asked about the concept which integrated both Voice Call and SMS. About 75 percent were concerned about the economic situation, about the cost of such services, as the young generation groups of participants were mainly college students. They do not usually have enough money for expensive installment payment.

7. Discussion

We have looked into the usage of mobile phone through observation and mobile communication literature. Findings from the literature (e.g. Ling, 2007; Wei & Leung, 1999) and from the observation have shown that there are many places the usage of mobile is considered inappropriate and disturbing to others. In additions to annoying ones neighbours, intrusive calls can also cause inconvenience, disruption and embarrassment to the owner. These situations can be avoided if the mobile phone users are given more ways to communicate, taking the context into account.

Findings from the literature review show that there is a lot of research available and many solutions have been designed to solve such problem of not having to reject phone calls or switching off the phones. And also through our evaluation we found out that the participants identified themselves as to having been in confined places, thereby supporting our findings. At present, they have different ways of dealing with such situations, some people reject the phone, some ignore and some go out and answer the phone (chapter 6). Most solutions today is based on Technology, for example senSay (chapter 3) which is based on sensors, IM is the computer application which also been incorporated into the mobile phone (chapter 3). By looking at the different solutions and also looking at the different services that are used by most mobile phone user, we identify and incorporated a simpler and user friendly solution to answer the main research question. The concept solution is then tested through evaluation, which is positively supported by the participants, who state that this service can also be applied in many other places.

> ***"Can the integration of the SMS and Voice Call services; benefit the mobile user in conversation when in confined space without having to reject the in-coming phone call?"***

Also through observation, we noticed that the mobile phone user used the services for different purposes. Although mobile phone is an extension of stationary phone, but the purpose of both the phone is the same, which is to stay connected to families and friends and work mates. This view is supported by the participants of the evaluation. All participants used the mobile phone for voice call, to remain connected to their near and dear ones. While SMS was used when it was not suitable for voice call or when the caller did not initiate long voice call. It was also used for informational purpose. SMS was also used when one did not want his/her conversation to be heard by other especially by the parents. All these view was also shared by the participants of the interview. Both these services were never used together, but on its own. But integrating both SMS and Voice Call services to one service, the give more option to the mobile phone users and create a more flexible way to communicate.

Lastly through the literary review, we got a deeper understanding of the problem behind such situations. The main problem was the lack of context awareness which could be solved; if we could find a solution to this context awareness problem. By looking at advantages of these two services (Voice Call and SMS separately) we integrate these two services to form a single service. The reason behind this is because from the findings of the interview, all participants preferred to initiate Voice Call and also used SMS when necessary. These two services are already known to most mobile phone user, the simplest solution was to integrate both services in the simplest way possible. At the same time the mobile phone user should be able to understand the concept of integration.

7.1 Advantages

According to the interviews, the main benefit of the SMS – Voice Call service is to help people who in the confined space. Also in the interviews the participants mentioned the SMS-Voice Call service could applied in many other places, the crowded place is one of the examples. If you are in a crowed place which has a lot of people around and they are talking really loudly, you can hardly hear the voice come from the other side of the conversation. The religious places, the open office and restaurant can use SMS-Voice Call service (More about the suggested places from the participants described in the 6.2). The SMS-Voice Call service can be used under some situations, the participants thought that the SMS-Voice Call service can used for the teenagers, if they what to talk with the girlfriends or boyfriends when papa and mamma are around. Our service can also used to share secret quietly when a lot of people always around.

The SMS – Voice Call service allows users make mobile conversations in many places by using the normal used services (SMS and Voice Call). While the user is using the normal Voice Call service, SMS can also be sent at the same time. But one

needs to change to another interface by searching for SMS service in the mobile phone; this task itself can be quite frustrating for some mobile phone users. The SMS-Voice Call service will allow you to send messages in a user friendly manner. The SMS – Voice Call service somehow could increase the usage of the normal used service and the rate of the mobile conversation. More mobile conversation will be made by using SMS-Voice Call service, which benefits the mobile service provider. And also the SMS-Voice Call service does not need internet connection; the place which has the mobile signal the service could be used.

The design purpose of the SMS- Voice Call service is trying to replace the normal Voice Call service. Instead of making a phone call and asking for the possibility of the conversation, SMS – Voice Call service can increase the user's awareness of the Callee which depend on the reply mode of the Callee. In this way, it may also help the Callee to get the important information from caller in short words.

Different mobile phone user groups use the phone in different ways. Bolin and Westlund (2009) based their studies on SOM surveys (2003-2007) which indicate that calling over the mobile phone is part of everyday life routines among the youngest generations, but not among the eldest. According to Bolin and Westlund in 2007, youth group were considered regular users of texting message. In fact, almost 80% send text messages daily, and almost half of the generation more than four times a day. This can be contrasted with the very low levels of messaging made by the eldest generation, where only a tiny fraction can be considered frequent users (Bolin & Westlund, 2009). From the interview we have found out that middle age group users don not like texting message, they prefer make phone call when needed. Also in Soriano, Raikundalia and Szajman (2005) (3.2), one of the middle age participant said "AS far as I am concerned, a phone is a phone! It should be used to ring and talk to people" (Soriano, Raikundalia and Szajman, 2005). The SMS – Voice Call service is giving an opportunity to people in different groups based on how one uses the mobile phone start the conversation by choosing the service in the preferred way.

Instead of text long message, the predefined message could help the users reply in a fast, easy and convenient way. In (Cox, Cairns et al, 2008) identified that universal key press mode of interaction is inherently restrictive as it ties the user both visually (eyes-busy) and manually (hands-busy). In the SMS-Voice Call service, if the users can remember the predefined messages and the matched fast keys by heart, the users can easily interact with the SMS default reply mode and start the conversation without look at screen (The precondition is the user on the other side of the conversation is voice replying). Instead of pressing three times of 9, two times of 3 and four times of 7 to get "YES", the user only needs to long press fast key "1" once, "YES" will directly be sent to the other side of the conversation. The SMS –Voice Call service in this way helps the users from the eyes-busy and hands-busy situation. The SMS – Voice Call service also keeps the normal text message function for people who like and could text long message, ensure not lose the interest of people who prefers texting message, especially teenagers.

7.2 Limitation

This section will present the limitation of the conceptual design.

The pre requirement of the SMS-Voice Call service is that the user must have the service and a headset, also both side of the user needs to switch on the mobile phone.

The design is more apt to the key board controlled mobile phone, in the conceptual design chapter only gave a solution on how default SMS reply mode (5.3.4.1) could applied to the touch screen mobile phone. Recently the touch screen mobile phones have become more and more popular. For the future study, SMS-Voice call service can also be applied to the touch screen mobile phone by transferring all the key-press functions to hand-touch functions based on the designed interface. But there will be a problem with the default SMS reply mode for the touch screen mobile phone. For touch screen mobile phone users, it might be hard to keep eyes free from the screen when they in the default SMS reply mode. Without feeling the actual key board (key board controlled mobile phone), it might be difficult for the users to find the right position of the pre-defined messages on the touch screen mobile phones.

8. Conclusion

Mobile phones offer huge flexibility at the same time accessibility, human are no longer bound to a particular place. Insipte of this of all this flexibility and accessibility, there is still the down side to this advance technology which we have tried to contribute a solution to. Our SMS-Voice Call service is helpful both in confined space and other places. Even though we started the study with confined space in mind but through evaluation results, we realized that it could also be used in many other places such religious places, to talk secretly etc. The participants of the study very much appreciated this new innovative way of using mobile phones as it provides the user with more ways to communicate Although there is many solutions already available to solve context awareness problem, our solution makes use of the basic services already known by most mobile phone user of today. By integrating both SMS and Voice Call service in a user friendly way, we hope to help solve the context problem by letting the recipient of the phone call decide, in which way he/she answers the phone call. This way, the caller is made aware of the context of the callee.

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