FlickerThis:
a Mobile Service to Facilitate Grounding in Communication through Viewable Media Content

by

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Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
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Abstract

Remote communication has become part of our daily lives. Technology plays a decisive role in filling the gap caused by discrepancies in time and space between us and the people we want to reach. However, the level of immediacy and interactivity are always lacking when compared to face-to-face communication. In most cases, the desire to communicate is postponed or abridged to nonreciprocal sharing, especially when time differences are taken into account. Limited bandwidth also increases the likelihood of a misunderstanding occurring during a remote conversation. Confronting the limitations of remote communication, FlickerThis is a mobile service that facilitates grounding in communication through viewable content. Different from most communication services that rely on isolated channels to push information out, FlickerThis adapts the essential perceptions, seeing and hearing, in face-to-face communication to mediate remote communication. With photos taken by a camera phone and audio narration as the intuitive input, FlickerThis messages are composed to become stories whenever one has an intention to communicate with others. Users can talk over the phone while flipping through a virtual photo album together, or they can record and send voicemails embedded with pictures. Therefore, FlickerThis enables remote communication to switch between synchronous and asynchronous modes, and uses viewable content to enhance mutual understanding.

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Chapter 1
Introduction

Communication plays an important role in our lives. People exchange information when they communicate; they share experiences and express feelings to establish mutual understanding and develop intimacy. Today, with the development of technology, different channels and media offer people a number of different ways to communicate. As friends and family disperse increasingly for work, schooling, travel etc., new channels have emerged to make it possible for them to remain in touch with each other.

However, when compared to face-to-face communication that usually is spontaneous, interactive and multisensory, technology-mediated solutions tend to defer communication, offering either one-way or isolated channels. In some ways these interactions focus mostly on information exchange, thereby overlooking quintessential aspects of human-to-human interaction. Therefore, with the expectation that communication could involve more affective interaction, this study discusses the essence of communication and proposes a service, **FlickerThis**.

1.1 Remote Communication

With the rapid change of social structure and lifestyle, interpersonal relationships go from local to global. At the same time, people still need to maintain relationships and

interactions to avoid alienation. To adapt to the change, channels for remote communication are being developed and growing rapidly.

1.1.1 The Rising Need of Remote Communication

According to Worldwatch Institute and World Tourism Organization (**Table 1-1**), tourist arrivals internationally [1] have grown 45.28% over the last decade (1999-2008) (**Figure 1-1**). Open Doors also reported that the number of international students in the U.S. [2] itself has increased 7.0% in 2007/08 over the previous year (**Table 1-2**). In the meanwhile, more than half of the world's population owns a mobile phone [3] and the number of the Internet users [4] is growing at a rate of 342.2% in less than 9 years (**Table 1-3**). The numbers reflect that people have become more and more physically apart but virtually connected.

Table 1-1: International Tourist Arrivals 1999-2008

Year	International Tourist Arrivals (millions)
1999	657
2000	682
2001	682
2002	702
2003	692
2004	763
2005	805
2006	850
2007	908
2008	924

(By Tom Hale, http://www.globalpolicy.org)

Table 1-2: International Students in the U.S. 2006/07 and 2007/08

Total Number for Academic Year 2006/07	Total Number for Academic Year 2007/08	Change (%)
582,984	623,805	7.0

(By Open Doors, http://www.opendoors.iienetwork.org/)

Table 1-3: World Internet Usage and Population Statistics

World Population (2008)	Internet Users (12/31/ 2000)	Internet Users Latest Data (3/31/2009)	Penetration (% Population)	Users Growth
6,710,029,070	360,985,492	1,596,270,108	23.8%	342.2%

(By Internet World Stats, http://www.internetworldstats.com)

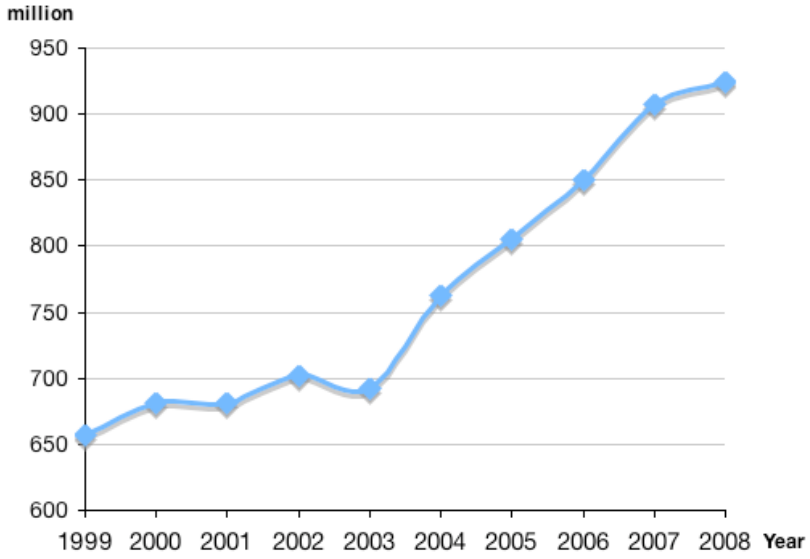


Figure 1-1. Chart showing the growth of international tourist arrivals (1999-2008).

This is a notable factor to human communication. Since humans are social by nature and communication is essential to sociable living, the numbers at the same time reveals the conceivable raising need of remote communication. Coming along the raising need of remote communication, these tables and figures should as well imply the growing need of sharing, maintaining relationships, being cared for, etc. Therefore, meeting the need of remote communication is undoubtedly one of the keys that lead to a more satisfying quality of life.

1.1.2 State of The Art

Remote communication is not new to the history of human society. As distances involved in remote communication increased, the major channel of remote communication shifted from smoke signals to mail delivered by postal systems. At the time, the main form of communicating content was text, sometimes aided by drawings or photographs. Messages were few and far between, and mail could be lost or mislaid from time to time.

It was not until the invention of the telephone in the 19th Century that remote communication started to make rapid advances with the mediation of technology.

Today, under the ubiquity of the Internet and telecommunication networks, the boundary between synchronous and asynchronous communication has been blurred. Email, SMS (Short Message Service) and instant messaging make it fast and reliable to initiate conversations. With services such as blogs, forums, online albums and online

videos, the communication medium can easily shift from static text/images to dynamic audio/video/discussion threads. Moreover, the development of VoIP (Voice over Internet Protocol) and videoconferencing has realized remote "face-to-face" communication. Also, the progress of communication devices makes remote communication mobile.

However, while it becomes easy to initiate conversations through a variety of applications, the flexibility of the communication applications also decreases the necessity to respond when compared to its counterpart in face-to-face communication. Secondly, the ease of spreading one's own content through different online services makes the quantity of information intractably large. More importantly, with all the convenience that technology brings about, there still exist great differences between remote communication and face-to-face interaction – the level of interactivity, responsiveness, and grounding.

1.2 Grounding in Remote Communication

A satisfied communication builds on the participants' willingness to understand and be understood, namely, establishing common ground. It takes more than merely exchanging information to establish common ground; according to H. H. Clark and S. E. Brennan [5, 6, 7, 8], "common ground cannot be properly updated without a process we shall call **grounding**."

Grounding is a process of establishing common ground, that is, sharing mutual knowledge, mutual beliefs and mutual assumptions [9, 10, 11, 12]; this enables collaboration between participants.

Without the process of grounding, it is impossible to engage in successful communication. So, it becomes an interesting and important issue how technologies and various media can support their users to update common ground with each other and have sound grounding even in a stricter situation of remote communication (comparing to face-to-face communication). The subject of grounding will be elaborated in Chapter 2.

1.2.1. Scenario of FlickerThis Facilitating Grounding in Remote Communication

Lisa has finally landed her dream job. However, she has had to relocate to a big city that is a ten-hour drive from her parents' home. Though excited about the changes and opportunities, she misses her family immensely, especially her younger brother, Gaspard. But Lisa also feels reassured; with FlickerThis in her camera phone, she can reach them easily and share her experiences just the way she always did.

One sunny Saturday, Lisa went to brunch in a cute neighborhood cafe. To her surprise she found the tableware in the cafe was exactly the same as what her family always had at home. She felt at home. Right away Lisa took several pictures and sent a FlickerThis message to her family.

Lisa's message contained three sequential photos. The first photo was a shot of her neighborhood street view. “Today is a sunny Saturday, but the street I live on is still buzzing with activity. I'm not used to the living pace here yet. But here's what I found today...” Lisa said and flipped to the next photo, which was a shot of the cute cafe's entrance. “A great cafe for brunch! And it's just a five-minute walk from my place!” “And the best part is…” Lisa continued to the last photo “…they have the same tableware as that in our home!” The tableware was in the last photo. “Isn't it absolutely lovely?”

Then, Lisa sent the message out to her parents and Gaspard. A minute later, Lisa saw a hint on her phone screen telling her that her mother is now reading the message. At the time she decided to call her mother, her mother's call came in.

“Isn't that person in the orange sweater your uncle Dan?” said Lisa's mother while flipping to the second photo and subconsciously pointing the man on her phone screen. The system automatically made the same photo appear on Lisa's screen and showed Lisa where her mother was pointing.

“No, mommy. Look closer, that was a lady!” said Lisa. There was a short pause and they both burst into laughter. “Everything in the cafe is just your taste!” Lisa said as she switched between the last two photos. Her mother's screen was updated to what Lisa was looking at. “The color of the wall, the flower… no need to mention the tableware of course!” They talked about the city, her mother's taste and her new work place for a long while and hung up happily.

After hanging up, Lisa saw that Gaspard, who just finished his basketball practice, had replied to her message. She heard the messages while having her coffee. Lisa saw that the replied messages were attached to the second and the third photos, so she replayed five seconds before the messages to know what Gaspard was replying to. In the first feedback, Gaspard said “Uncle Dan is there?” after she said “…the best part is…” in the second photo. In the second feedback, “Goodness! Mom's everywhere!! Hahaha…” Gaspard responded after she said “…the same tableware as in our home!” in the last photo.

1.3 Research Challenge

To enhance the level of interactivity, responsiveness and grounding in remote

communication, the design of FlickerThis started out from the question “how can the service design approach the naturalness of human-to-human interaction while confronting the fact that remote communication has its given limitations?” The challenge in the study is considered in four dimensions - When, Where, How, What.

1.3.1 When - Synchronous Communication vs. Asynchronous Communication

Time is an important factor to be concerned when communicating, especially in synchronous communication.

In all cases, synchronous communication needs to occupy the same time slot of its participants, so it requires all participants’ schedules to harmonize. Scheduling can be even more difficult for synchronous remote communication because of time differences. Besides emphasizing on how to facilitate scheduling, it is constructive to think about making the most use of the time to communicate.

Asynchronous communication is also an alternative way to manage the time issue; nevertheless, it is still essential to think about how to enhance the quality of asynchronous communication, make interaction happen and reinforce the depth of emotional communication.

1.3.2 Where - Face-to-face Communication vs. Remote Communication

In terms of the spatial factor in communication, there are two possible cases for a scenario in which a person wants to share his/her great vacation with a friend. The first possible case is face-to-face communication; one may sit down with his/her friend in a café talking about vacation stories with photos on the table and sunburned skin on his/her arms; what follows the story could be chats from about the vacation to any relevant or irrelevant topics. The second case could be a remote communication scenario; one can send his/her friend an email with a short description about the vacation and a link to a diligently annotated online album; some days later, they would possibly mention the vacation in an online chat.

Even though there are some necessary trade-offs for the sake of convenience, thinking of the great difference between the two scenarios, it definitely deserves an effort to create a better remote communication scenario.

1.3.3 How - Plain Communication vs. Mediated Communication

Communication can be aided by all kinds of media such as digital media, hypermedia, print media, etc. especially when today the media has greatly progressed with the development and spread of technology. Running parallel with the power of media, communication can still be as plain as gestures, human voice or even eye contact.

Each fashion has its own advantage; however, what is important is to have the choices when one wants to communicate.

According to the above aspects, what should be reviewed seriously is whether or not the design of a communication application has provided a range of choices for its users to make use of when expressing his/her thoughts.

1.3.4 What - Sharing vs. Interaction

In communication, the level of interactivity varies by cases. However, the higher the level of interactivity, the more likely it is that mutual understanding is being built between the participants.

As for remote communication through the Internet, given that the Internet is always on, users have learned that when sending out an email or an instant message, his/her remote friend or family might not always be available on the other side of the pipe. Thus, although it is quick and easy trying to reach others from the Internet, it becomes more like sharing a piece of information rather than expecting an interaction like it used to be in face-to-face communication.

To confront the challenges, FlickerThis attempts to offer a new interaction service with integrated media for grounded communication at a distance.

Chapter 2
Background

2.1 Grounding in Communication

Human-to-human communication is a two-way process that takes at least two people to reciprocally transfer information, such as thoughts, feelings and ideas, from one person to another. To succeed in communication, the collective activity needs its participants to sufficiently update their sharing of mutual knowledge, mutual beliefs and mutual assumptions [9, 10, 11, 12]. The shared information is called common ground, and the process of constant updating is called grounding [5, 6, 7, 8].

2.1.1 The Collective Activity

Communication is a collective activity – participants must keep track of each other's state mentally and physically to act and react properly [13].

Clark and Brennan made their argument on the coordination of collective activities [13] from an example that illustrates how two people work together:

> *… To succeed, the two of them have to coordinate both the content and process of what they are doing. Alan and Barbara, on the piano, must come to play the same Mozart duet. This is coordination of content. They must also synchronize their entrances and exits, coordinate how loudly to play forte and pianissimo, and otherwise adjust to each other's tempo and dynamics.*

This is coordination of process. They cannot even begin to coordinate on content without assuming a vast amount of shared information or common ground. And to coordinate on process, they need to update their common ground moment by moment. ***All collective actions are built on common ground and its accumulation.***

The example conveys that collective work is far more than merely doing things together; it is actually about building up and maintaining the dynamics. The same applies to remote communication.

2.1.2 Grounding in Communication by Media

To make the collective information-exchanging activity, communication, lead to a mutually accepted direction, grounding is a necessary process for the participants to update common ground in communication. The two main factors [13] that shape grounding are the purpose – the goal that people try to accomplish by communicating, and the **medium** – the communication techniques available for accomplishing that purpose.

While considering the two factors, the principle that Clark and Wilkes-Gibbs raised in 1986 helps account for many phenomena for grounding in communication; ***the principle of least collaborative effort*** [7] states that "in conversation, the participants try to minimize their collaborative effort – the work that both do from the initiation of each contribution to its mutual acceptance". Therefore, while maximizing grounding by a medium to establish mutual understanding in communication, people should ground with those techniques available in the medium that lead to the least collaborative effort.

There are eight constraints [13] argued by Clark and Brennan that a medium may impose on communication between two people, A and B.

1. *Copresence: A and B share the same physical environment;*
2. *Visibility: A and B are visible to each other;*
3. *Audibility: A and B communicate by speaking;*
4. *Cotemporality: B receives at roughly the same time as A produces;*
5. *Simultaneity: A and B can send and receive at once and simultaneously;*
6. *Sequentiality: A's and B's turns cannot get out of sequence;*
7. *Reviewability: B can review A's messages;*
8. *Revisability: A can revise message for B.*

Every media would have a different set of constraints that it imposes on grounding, and there are costs associated with different sets of capabilities. To help people establish grounding in a particular medium, the design of the medium should take these costs into account.

2.2 Storytelling

Storytelling is a valuable form of human expression that conveys events in words, images and sounds often by improvisation. The most preliminary storytelling is thought to be oral and grounded by gestures and expressions. According to the National Storytelling Network [14], storytelling consists of the following five components:

1. *Storytelling is interactive: Storytelling involves a two-way interaction between a storyteller and one or more listeners, and thereby it emerges from the interaction and the cooperative, coordinated efforts of teller and audience. The interactive nature of storytelling partially accounts for its immediacy and impact;*
2. *Storytelling uses words: Storytelling uses language, whether it is a spoken language or a manual language such as a sign language. The use of language distinguishes storytelling from most forms of dance and mime;*
3. *Storytelling uses actions such as vocalization, physical movement and/or gesture: This distinguishes storytelling from writing and text-based computer interactions;*
4. *Storytelling presents a story: Storytelling always involves the presentation of a narrative. Many other art forms also present story, but storytelling presents it with the other four components;*
5. *Storytelling encourages the active imagination of the listeners: The storytelling listener's role is to actively create the vivid, multi-sensory images, actions, characters, and events of the story in his or her mind, based on the performance by the teller and on the listener's own past experiences, beliefs, and understandings. The completed story happens in the mind of the listener, a unique and personalized individual. The listener becomes, therefore, a co-creator of the story as experienced.*

With storyteller and audience playing their proper roles along the lines of the five components explained above, storytelling as a form of communication can connect people (the teller and audience) tightly.

Nowadays, the evolution of technology has made storytelling happen at a distance. The history of storytelling reveals how it served as a strong form of communication and how people grounded their story with available media mostly through face-to-face narrations. Today, technology provides a variety of useful grounding and media options that can facilitate equally rich storytelling even when storyteller and audience are not co-located.

Therefore, if a communication medium can help tell a good story, it could go beyond the strengths of storytelling as they existed in the past and create a richer, more interactive experience where the roles of storyteller and audience are blurred and smoothly interchangeable.

2.3 Photo Sharing

Photo sharing is the public or private dissemination of digital photos for the purpose of sharing those photos with others. The first photo sharing sites [15] originated during the 1990s from services that provide online ordering of prints, but many more came into being during the early 2000s and they aimed at providing centralized long-term access to a user's photos or even video clips. Engaging in photo sharing helps people get more concrete information in remote communication than language-based communication such as phone calls or written mail.

2.3.1 Online Photo Sharing

There are various kinds of online photo sharing tools. Similar to any digital file sharing, photos can be shared online via peer-to-peer transfer or client-server connection.

Peer-to-peer photo sharing requires that corresponding applications run on peers simultaneously. The restriction of running the same application and at the same time makes peer-to-peer sharing relatively independent because it is not tied to a central host and two users can share whenever they both are ready.

Client-server photo sharing must be bound to an always-on server but at the same time provides the flexibility for its users to share over time without the concern of concurrence. Online photo album is one the most popular photo-sharing channel that applies the client-server logic.

2.3.2 Desktop Photo Sharing

The development of desktop photo sharing includes the design of devices and software that manages and presents photos.

For people in the same space, photo sharing traditionally meant passing round paper photos for perusal. With the spread of digital photography, applications have replaced physical photo sharing because computers provide a convenient way to store thousands of photos.

Chapter 3
Related Work

There have been many solutions aimed at facilitating human communication by the mediation of technology. This chapter categorizes related work in three sections; each talks about a specific advantage that the technology brings to benefit remote communication, and how it compares to FlickerThis.

3.1 Mobile Connection

Mobility was a great leap for remote communication after cellular networks and mobile devices were introduced and got popular. As communication channels became mobile, tremendous effort has gone into researching better solutions to help people maintain connectedness. Since the number of related solutions in this area is quite huge, this section will take up only two recent research projects in the Media Lab Speech and Mobility group as examples to illustrate the current research direction in the area.

Clique Here [16] is a mobile communication platform that supports a higher degree of social-connectedness. In Clique This, asynchronous multimedia is used to update a user's current state. Similar to an Instant Messenger (IM) system, the updates are shown in a contact list on a mobile phone for a user's contacts to review; other than phone clients, a home client is designed to show a person's update in Clique Here

without the need of checking one's phone screen at home. A user can also get a real-time notification when a contact reviews his/her update. The awareness of one's contacts' status can be extended to a chat via instant message or a phone call. The platform connects a community (people in one's contact list) by keeping up the awareness of each other's life status on a mobile system, so the social connectedness can remain active anytime.

Globetoddler [17] is a mobile-tangible communication platform that is designed explicitly to reconcile differences in both location and time for preschool children and their traveling parents. The system uses an embodied interface (dolls) in order to support and create more engaging, affective, and tangible interactions than conventional technologies, such as phones, can offer. In Globetoddler, parents, using a regular mobile phone as the client, can implicitly monitor their children, using a doll controller to interact with the system on a big screen. While traveling, parents can interact with their children as an avatar in the system to play with or express care for their children. The children can also ask for their parents' attention and updates by receiving photos of their traveling parents.

These works manipulate the mobility that technology brings to spell intimacy for life when separated from friends and family. However, while most solutions aim at keeping up the social aspect of intimacy by enhancing the awareness of remote contacts, FlickerThis cares more about people's initial impulse of communicating with others and makes possible for its users to take action at the moment they feel like communicating.

For FlickerThis, the mobility of technology is a way to capture people's intentions to communicate any time, so, a desire to communicate is not thwarted by the environment or limitations in applications one has access to.

3.2 Direct Sharing of Viewable Content

Technology enables the digitization of photos, videos, etc., so it becomes easier to preserve as well as spread what people see. There have been a number of projects that have focused on direct sharing of multimedia to optimize and make multimedia sharing practical.

3.2.1 Remote Photo Sharing

Photography is one of the new media forms that changes perception and changes the structure of society (Levinson, 1997) [18]. People share photos for sharing their own perception and experience. Sharing photos means more than the spread of information – it means sharing people's memory, emotions, perspectives and even more.

MobShare [19] is a picture sharing system on mobile phones that enables the immediacy of browsing, combining and discussing on pictures. To make the work of organizing images on camera phone less tedious and more rewarding, MobShare requires its users to categorize an image into a new folder or an existing folder only when they try to share the image. Shared images in a folder are visualized in a timeline. In MobShare, users can share organized (by category) pictures with others right after taking the pictures; also, users can control the privacy level of their own images and discuss any image in a thread.

Food for talk [20] is a study of how photo sharing via digital photo frames can support social connectedness for elderly people in a nursing home, as moving to a nursing home is often not a sudden moment but at the end of a long period of mental and/or physical degradation. Sharing the everyday details of life is normally not part of the relationship elderly people have with their children. In the study, SIM-based photo frames are used to keep the elderly informed about the comings and goings of their loved ones. The result showed that the photos shared in photo frames initiated conversations between the elderly people mutually, with their family members and with the healthcare professionals.

3.2.2 Viewable Media Sharing in Physical World

DiamondTouch [21] is a multi-user, debris-tolerant, touch-and-gesture-activated screen table for supporting small group collaboration. On the DiamondTouch table, digital pictures can be manipulated like simulated paper photos. The table allows its users to maintain eye contact while interacting with the display simultaneously, so the collaboration can be soundly grounded by both viewable content and body language when needed.

Mscapes is a prototyped authoring tool of mediascapes [22] technology, which infuses the landscape of an everyday environment with digital content and services. It associates multimedia, such as images and sound, to the real landscape and allows browsing, co-creating and even developing of a game according to the information.

Direct sharing of multimedia enables people to share a broader range of experience with others at an opportune occasion; it also provides rich content for people to use. However, the two advantages, grounding in multimedia and flexibility of occasion, that can take place in the sharing of digital viewable media often cannot be achieved at once.

As good and novel solutions are created to enhance people's sociable-rich life quality, seminal work suggests that the integration of current technology should deliver "the right thing at the right moment" [23]. FlickerThis pays attention to grounding that

viewable media sharing can provide in communication. It also attempts to achieve the flexibility of remote sharing at the same time for people to have grounded communication right at the desired moment.

3.3 Remote Collaboration with the Flexibility in Time and Space

As the use of technology with communication has become more widespread, it has also become flexible yet detaching for people to collaborate under delayed time and/or at a distance. Therefore, many solutions are proposed to overcome the problems that come with flexibility in remote collaboration.

VideoWhiteboard [24] is a tool to support remote shared drawing activity. The setting of the tool is a shared drawing space for collaborators located in remote sites to see each other's drawings and shadow of gestures. What a user sees using VideoWhiteboard is a composite image of another site, and the image is calibrated to seem like drawing with another person. The technology allows both people to work on the same drawing at the same time without worrying about getting in each other's way. The close interaction that is impossible even when the collaborators are in the same space is achieved by the use of technology.

While most solutions are getting ingenious to allow their users to collaborate remotely, collaboration that extends over longer periods of time remains largely reliant on intermittent channels such as email and wiki. Being a tool as well as a medium for the collaborative task of communication, FlickerThis focuses on the smooth switching of synchronous and asynchronous communication and turns the limitation caused by flexible time into a manageable function resulting in better communication.

Chapter 4
FlickerThis - Application Design

The design of FlickerThis primarily attempts to look at how integration of technology can turn limitations into useful features in remote communication.

4.1 Design Considerations

The design choices of the FlickerThis service are in response to the four research questions raised in Chapter 1.

4.1.1 The Manipulation of Both Synchronous and Asynchronous Communication

Andrea and Helen are roommates. This morning Andrea just got back from her trip and arrived at their apartment at 4AM while Helen was still asleep. Andrea was very eager to share details of her trip with Helen. But, she decided not to wake Helen and instead left her a gift from the trip and a note in the living room. It was a local artist's lovely carving and the note talked briefly about how she haggled her way through the purchase from an unyielding street vendor as well as asking Helen to wake her up before she left home.

But when Andrea woke up in the afternoon, Helen had left for school already. On the refrigerator was a note from Helen saying that she had an urgent meeting in the morning. She also said that she loved the carving and wished to have dinner with Andrea and hear about her trip.

That evening after Helen went back to their apartment, Andrea had ordered pizza from their favorite pizza house. During dinner, their conversation extended from Andrea's exciting trip to possible options for their Spring break vacation spot. They talked all night before going to bed.

Normal communication between people switches between synchronous and asynchronous constantly. In the above example, the communication channel switches from leaving notes (asynchronous) to face-to-face chatting (synchronous) smoothly. A good communication medium supports both synchronous and asynchronous, so FlickerThis is designed to provide this flexibility for its users.

4.1.2 Media for Remote Communication

When distance is a factor in determining effective communication, the use of media becomes necessary to convey what people may want to express. Words, in the form of text or voice, are the most general media, and hence mails and phone calls have been used for a very long time.

However, it is relatively difficult to communicate through words alone. Explanation of the context can easily make the content rather long, but insufficient context could lead to improper grounding of the communication.

Given that visuals are important for human to build a representation of surroundings, the design of FlickerThis enables its users to ground their remote communication by manipulating viewable content.

4.1.3 Sharing and Interaction

Communication is a two-way process of imparting or exchanging information rather than one-way expression. In terms of behavior, communication is more like interaction instead of unilateral sharing. However, with distance, the condition of having interaction in communication is less adhered to; it is too common that people do not response to a friend's newly-uploaded online album or even email, instant message or SMS.

The design of FlickerThis encourages interaction by enhancing the way of sharing, making it very intuitive to share and respond.

4.2 FlickerThis

FlickerThis comprises three applications, SnapThis, Flip This and PlayThis. This section gives an overview of how the service actually works with the three applications.

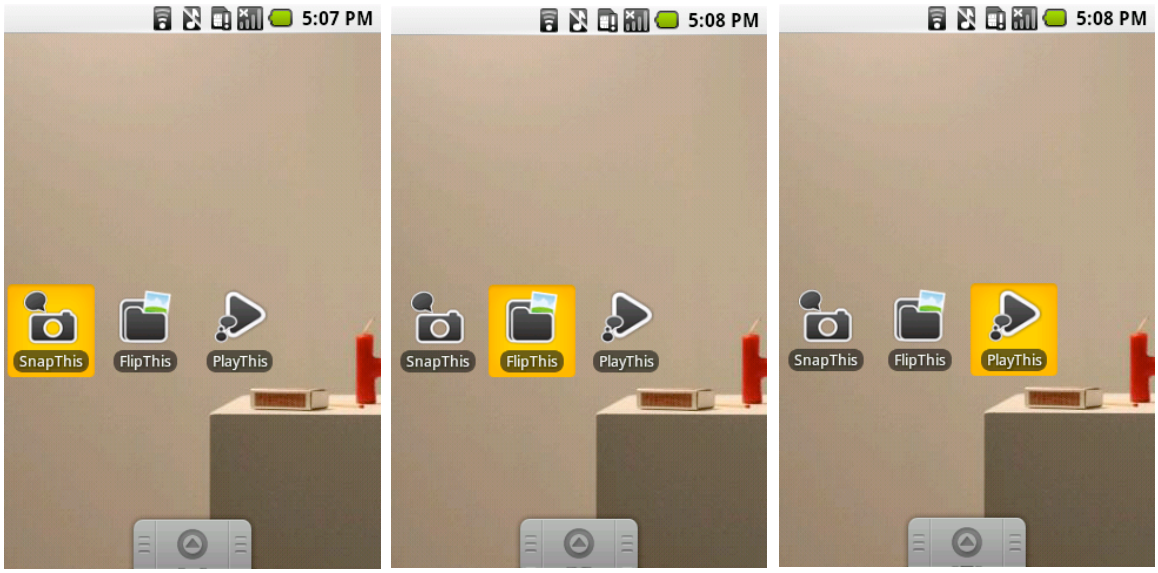


Figure 4-1. Screenshot: the three applications in FlickerThis.

4.2.1 Capture of Life – The Enhanced Camera Application

SnapThis is an enhanced camera application in FlickerThis. Taking advantage of the camera on mobile devices, the application provides quick life-capturing and life-sharing capability.

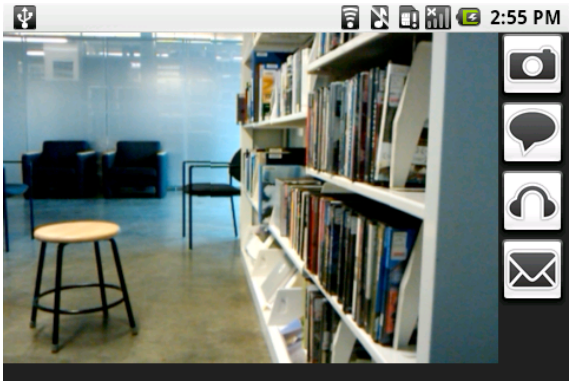


Figure 4-2. Screenshot: the viewfinder in SnapThis.

Like every camera, SnapThis allows the users to capture anything in the viewfinder and make a snap of a picture as shown in **Figure 4-2** and **Figure 4-3**. At the same time, what is different in SnapThis is that the application enables users to voice annotate these life slices directly (**Figure 4-4**) using a push-button.

Figure 4-3. Screenshots: capturing in SnapThis.
(Left – finding a desired view. Right – taking a picture.)

Figure 4-4. Screenshots: annotating in SnapThis.
(Left – starting an annotation. Right – during the annotation.)

After recording an annotation, the users can choose to (1) review the annotation as in **Figure 4-5**, (2) replace the annotation with a new one by redoing the recording step, or (3) send the life slice as a message to friends as in **Figure 4-6**.

Figure 4-5. Screenshot: reviewing an annotation in SnapThis.

Figure 4-6. Screenshot: sending a single-picture FlickerThis message in SnapThis.

4.2.2 Connection – Sending and Receiving Messages in FlickerThis

A FlickerThis message is like an audio slideshow in which clips of annotations form a story along with their associated pictures. Either SnapThis, for sending single-picture messages as described in section 4.2.1, or FlipThis, for sending multi-picture messages, can use to compose and send a FlickerThis Message to others.

FlipThis is a photo gallery as well as a storytelling message composer. On launching FlipThis, users can browse pictures taken by SnapThis in a gallery (**Figure 4-7**). Users can select a series of pictures from the gallery to build a multi-picture FlickerThis message. As shown in **Figure 4-8** and **Figure 4-9**, it is intuitive to select or deselect a picture with just one touch.

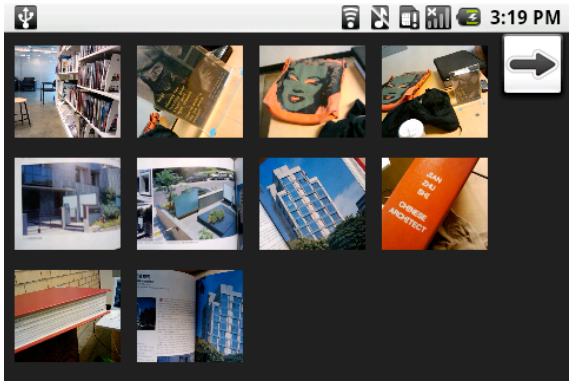


Figure 4-7. Screenshot: browsing photos in FlipThis.

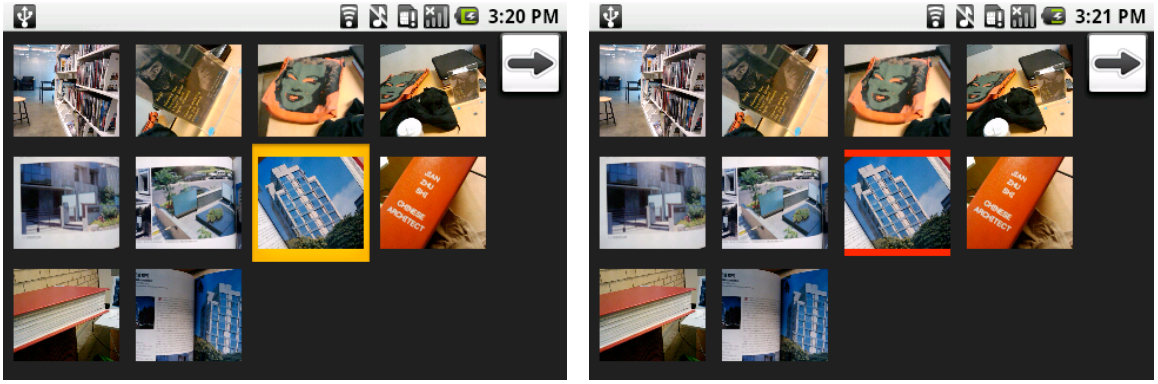


Figure 4-8. Screenshots: selecting a picture in FlipThis.
(Left – a picture being highlighted with a touch. Right – a red frame marks the selected picture.)

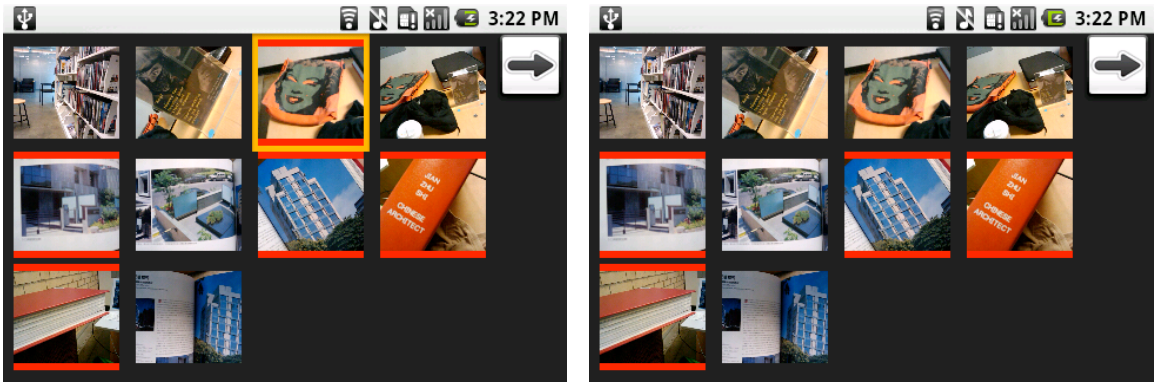


Figure 4-9. Screenshots: deselecting a picture in FlipThis.
(Left – a previously selected picture being highlighted with a touch.
Right – the picture has been deselected after the touch.)

After selecting pictures from the FlipThis gallery, a push-button brings the users to the next stage of voice annotating the pictures (**Figure 4-10**). The next stage is a horizontal display of the selected pictures as shown in **Figure 4-11**. During the recording, FlipThis will also record the timing interval as a user flips from one picture to another, so when playing the message the annotating process will be completely replayed. Once annotating is done, as shown in **Figure 4-12**, **Figure 4-13** and **Figure 4-14**, the users can choose to (1) review the message as an auto-played audio slideshow, (2) replacing the whole annotation with a new one by redoing the recording step, (3) replacing a section of annotation for a picture by sliding to the specific picture and recording as if it were a single picture, or (4) send the FlickerThis message to friends.

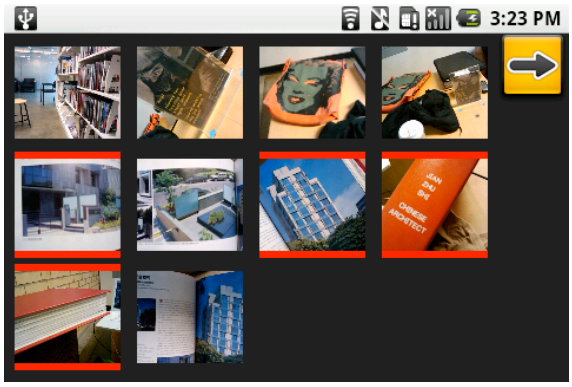


Figure 4-10. Screenshot: a push-button to next stage after selecting wanted pictures in FlipThis.

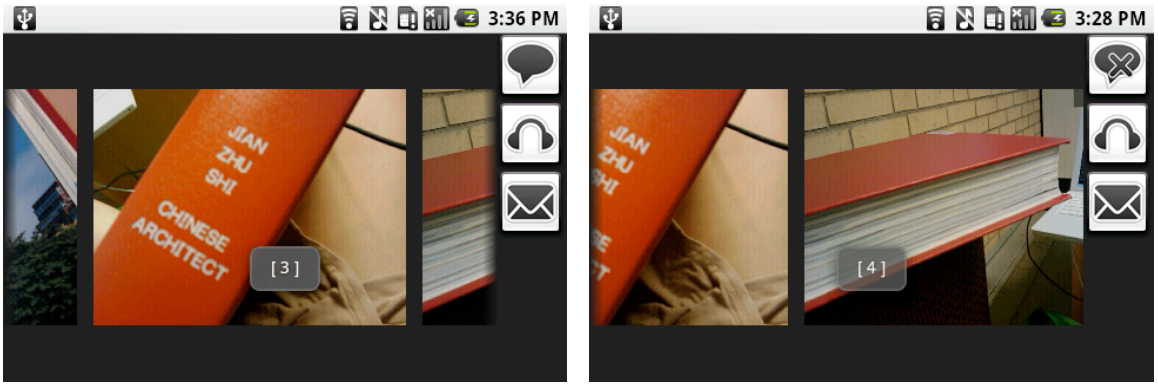


Figure 4-11. Screenshots: scrolling horizontally to browse the selected pictures in FlipThis. The user will be hinted on the position of a picture in the selected series.

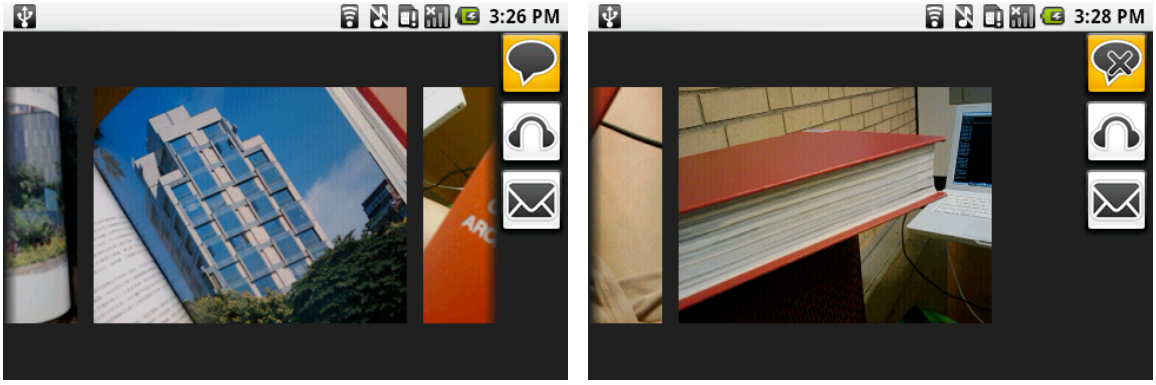


Figure 4-12. Screenshots: recording and finishing voice annotation in FlipThis. (Left – starting to voice annotate the series of pictures. Right – finishing the recording.)

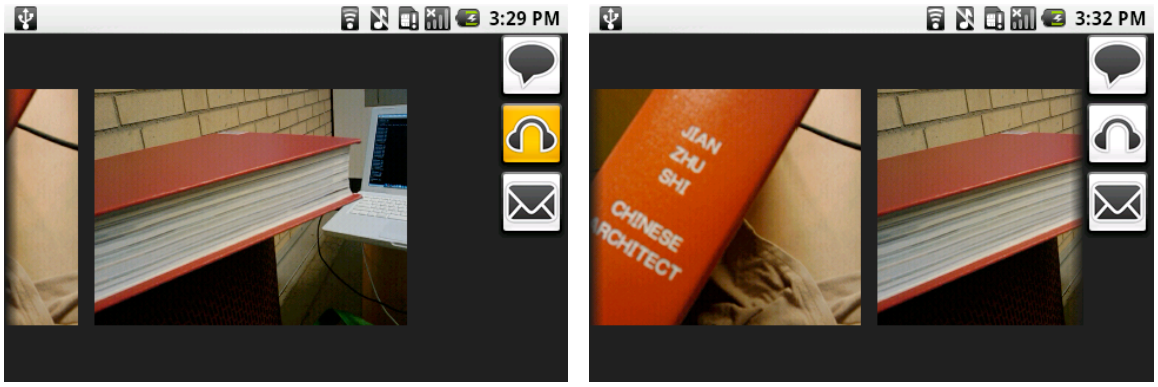


Figure 4-13. Screenshots: reviewing the whole message in FlipThis.
(Left – starting to play the message. Right – the auto audio slideshow.)

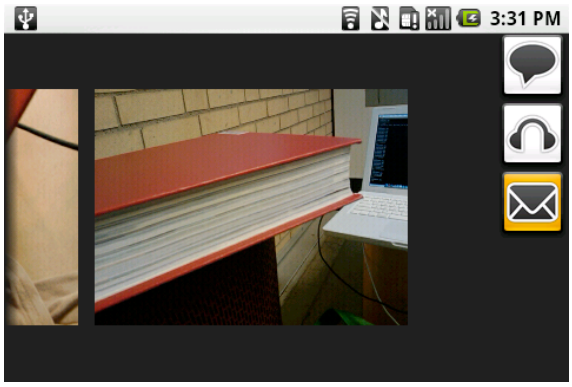


Figure 4-14. Screenshot: sending the FlickerThis message in FlipThis.

4.2.3 Asynchronous Communication

FlickerThis messages and feedback are received in PlayThis, which is designed to encourage interactive remote communication.

After being notified about the arrival of a new message, PlayThis is launched. PlayThis first plays the message automatically as an audio slideshow and then switches to the review mode so the user can flip and review multiple pictures manually (**Figure 4-15**). While PlayThis is playing the story in the message, the user can push the speak button at the top right corner, as shown in **Figure 4-16**, to add audio feedback anytime. When done recording one's feedback, one can either send it to the message creator or trash it (**Figure 4-17**).

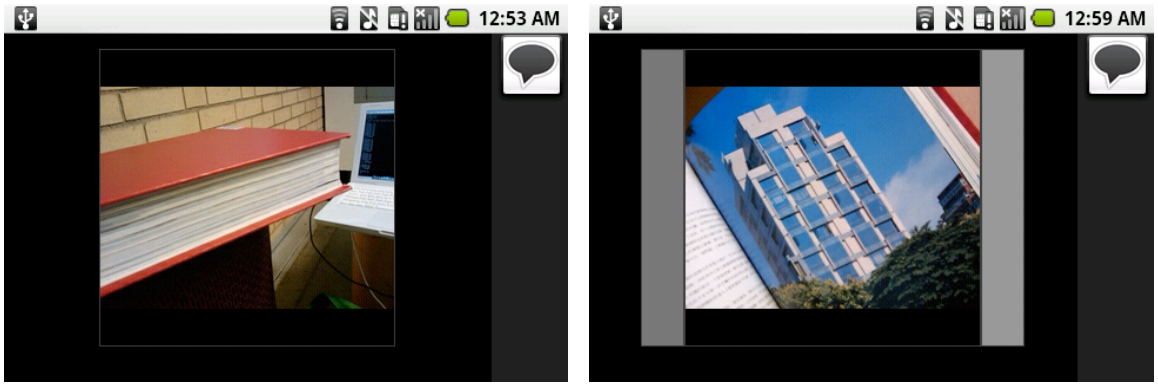


Figure 4-15. Screenshot: showing a FlickerThis message in PlayThis.
(Left – playing a message automatically. Right – reviewing a message manually.)

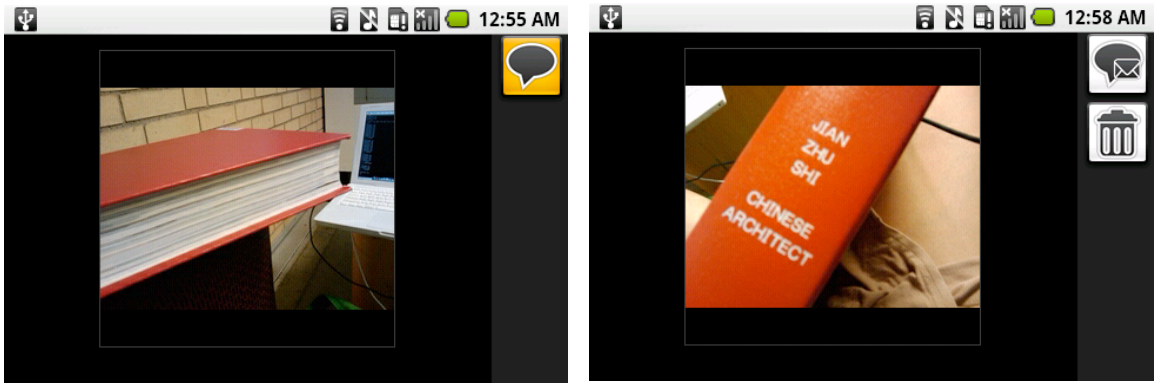


Figure 4-16. Screenshots: a push-button to give feedback anytime in PlayThis.
(Left – a push-button to give feedback. Right – PlayThis is recording the feedback.)

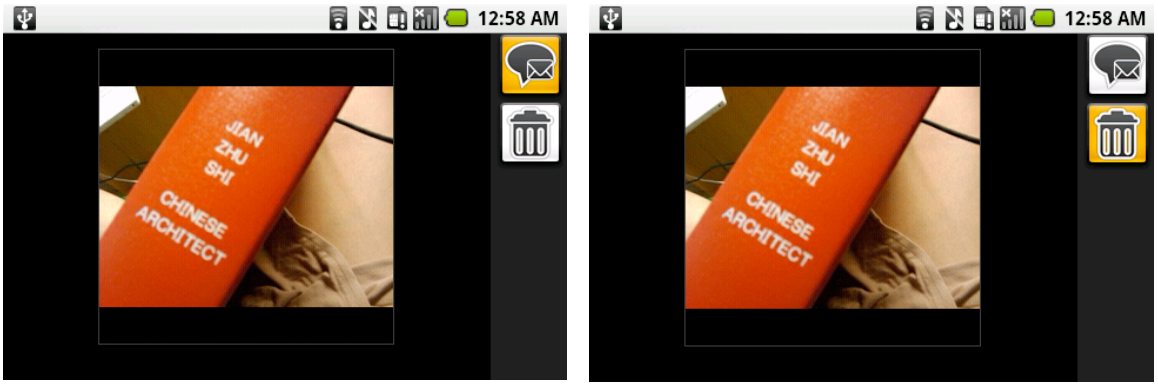


Figure 4-17. Screenshots: dealing with a feedback in PlayThis.
(Left – sending the feedback. Right – trashing the feedback.)

To a message creator, feedback is noted as shown in **Figure 4-18** on the timeline and the playing feedback is highlighted. The position where a feedback is noted represents the corresponding timing of the original message where the feedback is given.

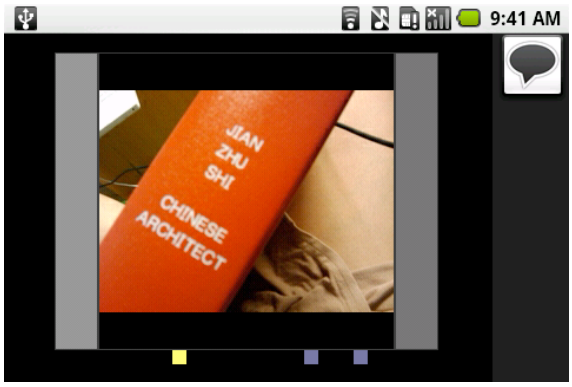


Figure 4-18. Screenshot: feedback is noted on the timeline in PlayThis.

4.2.4 Synchronous Communication

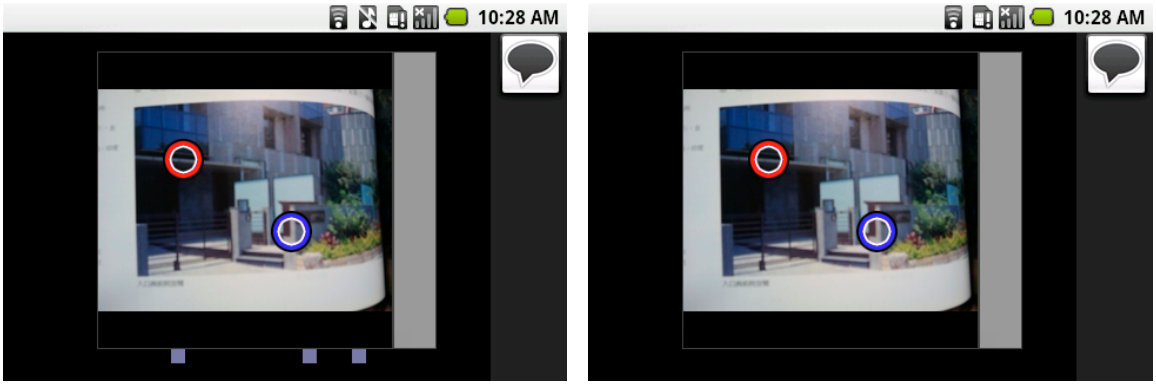


Figure 4-19. Screenshots: synchronized screens showing synchronized finger point positions on different devices in PlayThis.

With PlayThis, the users can also make phone calls to the message sender or receiver. Given that messages are available to each other, the two screens will be

synchronized during the phone call as in **Figure 4-19**, **Figure 4-20** and **Figure 4-21**, along with finger point positions and pictures shown on the display.

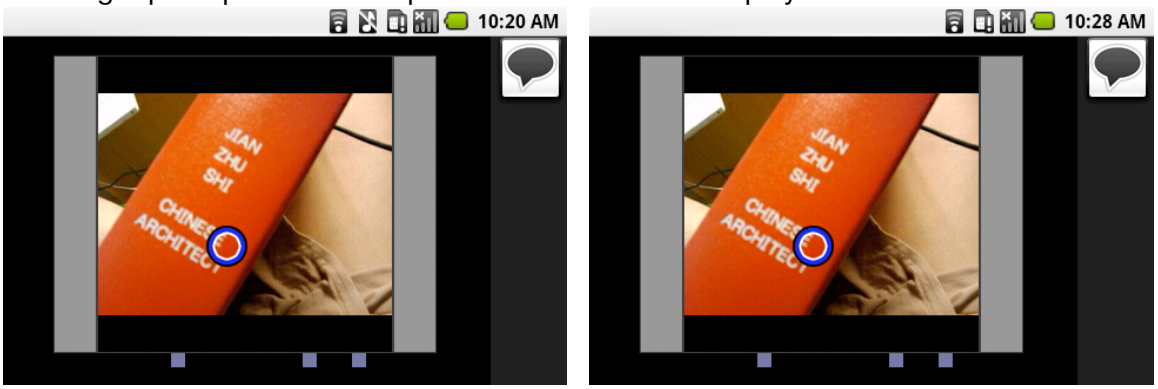


Figure 4-20. Screenshots: synchronized screens showing the same picture on different devices in PlayThis.

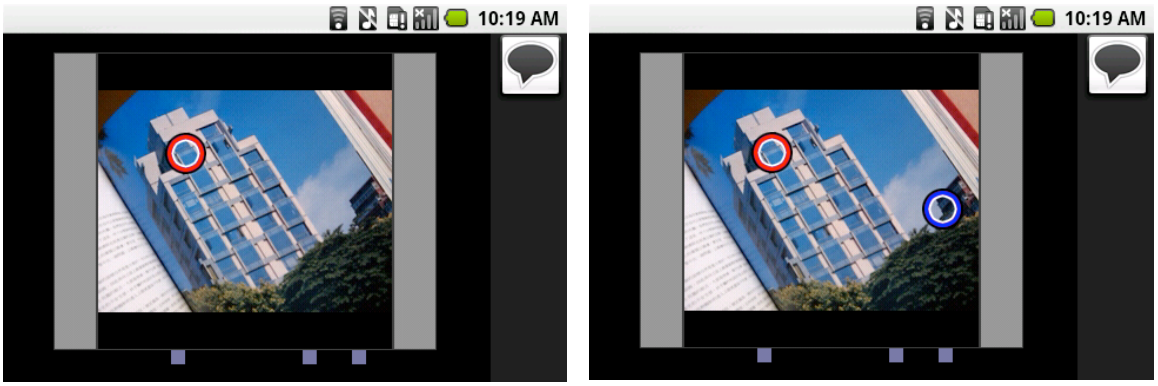


Figure 4-21. Screenshots: finger point position of the other person being shown on screen during synchronous communication in PlayThis.

4.3 Service Design and Functions

4.3.1 Cloud Computing for Portable Service

FlickerThis connects its users through FlickerCloud, a public web. FlickerCloud maintains all messages/feedback sent from FlickerThis, notifies clients of new updates and synchronizes participants.

The design helps make the FlickerThis service portable. As FlickerCloud uses the general Hypertext Transfer Protocol (HTTP) to connect clients, it remains device-

agnostic. Users can choose to run FlickerThis as a phone-to-phone or phone-to-computer service.

4.3.2 Viewable Content and Effective Communication

In face-to-face communication, it is common for people to use sketches or physical items to help articulate ideas and express thoughts. Similarly, in FlickerThis, pictures along with narratives make the message more meaningful.

In remote communication it is difficult to describe a scene effectively through text or voice alone. A picture of a scene from one's own perspective can help a remote viewer perceive the scene better, sometimes even without words. This makes photo sharing an effective method for grounding.

4.3.3 Story as Communication Media

The users of FlickerThis use stories from pictures as messages to mediate communication.

A story contains a sequence of events that blends a narrator's experiences and thoughts, so a story itself as a kind of communication medium is more interesting than detached information. FlickerThis is a channel in which a narrator can share stories with the audience easily and get direct feedback even at a distance. When a story and its feedback go back and forth between a narrator and an audience, the increased level of interactivity makes communication between participants richer.

Moreover, since FlickerThis connects a narrator and an audience peer-to-peer, the roles of narrator and audience become easily interchangable, so the sharing is no longer a one-way action.

4.4 Interaction Design

Traditionally, sharing a photo with others through email is a complicated process. One needs to first transfer the photo from a camera to a device or a web service where one can access when composing email. Then, before sending the email, one should attach the photo in the email as an attached file or a URL to a web service. It takes some indirect steps and need several intermediate devices/services to complete a photo-sharing task. The inconvenience is the obstructer for people to interact with their remote friends and family.

The interaction design of FlickerThis wants to provide its users an unhindered experience of sharing and interacting.

4.4.1 Simulating Face-to-face Interaction through Intuitive I/O on mobile devices

Narrations in FlickerThis messages are carried in audio form. The design takes advantage of familiar human behavior and currently available mobile devices.

Users of FlickerThis perform any action in one push-button. This is an approach to the nature of face-to-face interaction where people start talking with an eye contact or interrupt others by a gesture.

4.4.2 Grounding in Remote Synchronous Communication

As described in Chapter 2, it is known that grounding in communication is an important process. However, quite unlike face-to-face communication that people share the same space with the same sensory inputs, remote communication is limited by media and grounding, to share mutual knowledge, mutual beliefs and mutual assumptions.

FlickerThis is designed to ground synchronous remote communication by synchronizing viewable content. Synchronizing the screens makes users aware of the content the other person is viewing at any given time and thus helps establish mutual knowledge. Interactions based on viewable content can help the users better understand each other and, most importantly, establish common ground for communication.

The ease of use and ground-rich design of FlickerThis promotes remote communication far removed from presently used methods for sharing at a distance, e.g. email, online albums, etc. This design imparts the face-to-face communication model to remote communication applications by integrating sharing and interaction into one service.

Chapter 5
System Design

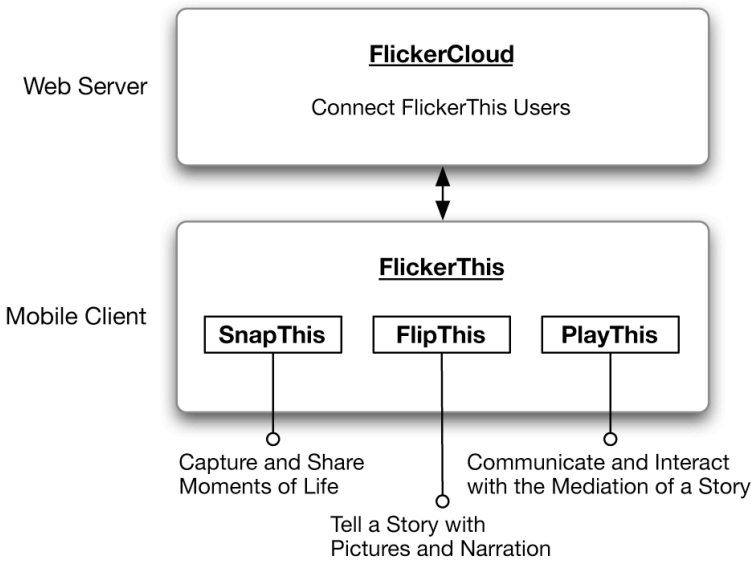


Figure 5-1. System overview.

As described in Chapter 4, the system consists of two parts – mobile clients and a web server. **Figure 5-1** is an overview of the system - FlickerThis is a set of applications on a

mobile phone and FlickerCloud is a web server. Most functions, including capturing pictures, recording narratives, creating and playing messages, are provided in FlickerThis on a Wi-Fi enabled mobile phone equipped with a touchscreen. The main roles of FlickerCloud are to coordinate FlickerThis users when they are having synchronous interactions and to maintain messages for the purpose of asynchronous communication.

5.1 System Architecture

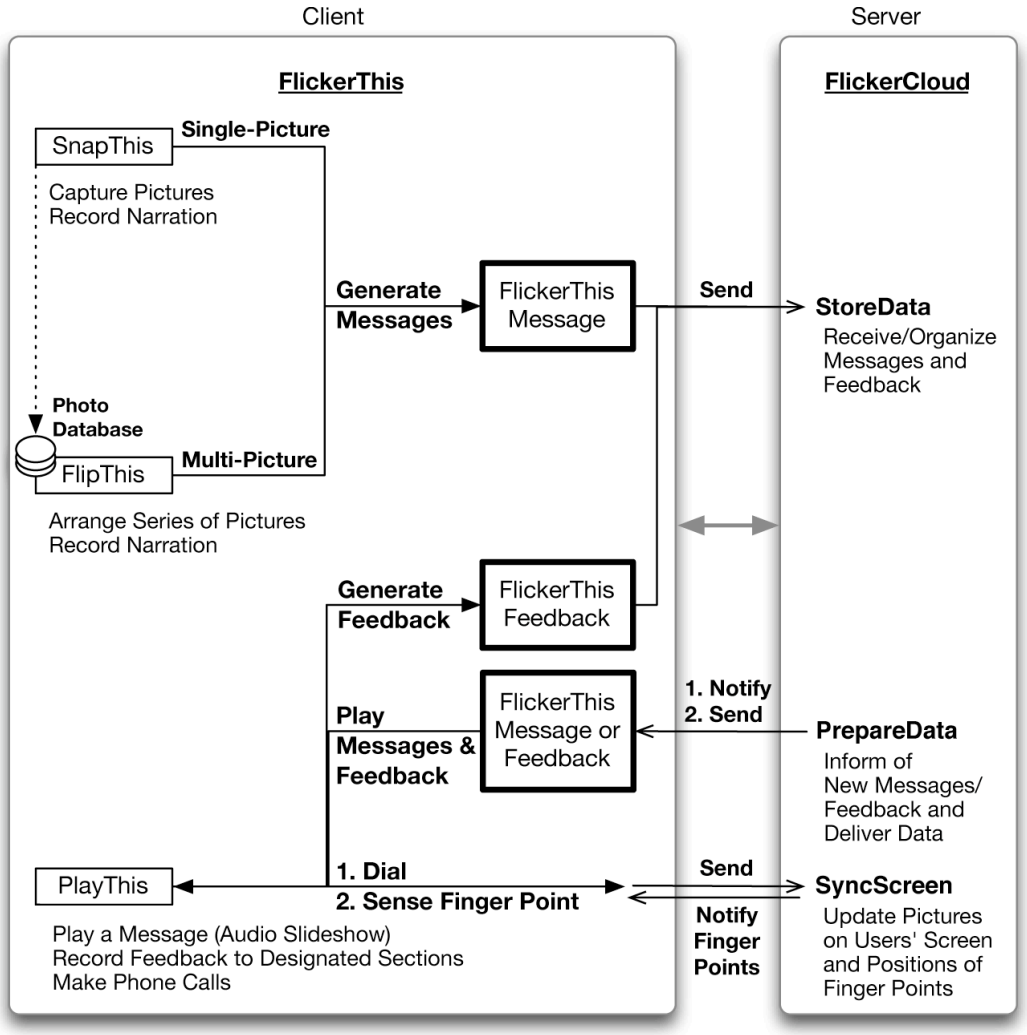


Figure 5-2. System architecture.

The system architecture is shown in **Figure 5-2**. Pictures are taken using SnapThis on a camera phone and are filled into a photo database; FlipThis reads photos from the database and displays them as a gallery.

SnapThis generates a single-picture message, in which the narration associated with a photo can be recorded right after snapping a picture. Alternatively, multiple pictures can be selected and narrations can be recorded to create a story, as a multi-picture message, using FlipThis. The message is then sent to FlickerCloud with information about the sender and receivers, so that FlickerCloud can set up appropriate flags for the receivers' PlayThis to query.

PlayThis repeatedly queries FlickerCloud to learn updates of communication. When PlayThis observes corresponding flags on FlickerCloud indicating new messages or responses, it notifies its user and downloads the message. After a user responds to a message, PlayThis sends timing information along with audio feedback to FlickerCloud indicating where in the original message one's response is desired. If one dials to another in PlayThis, FlickerCloud will synchronize the two people's screens once connected; in other words, the two phones now show the same picture and the users' finger point positions on the picture.

5.2 The Client - FlickerThis

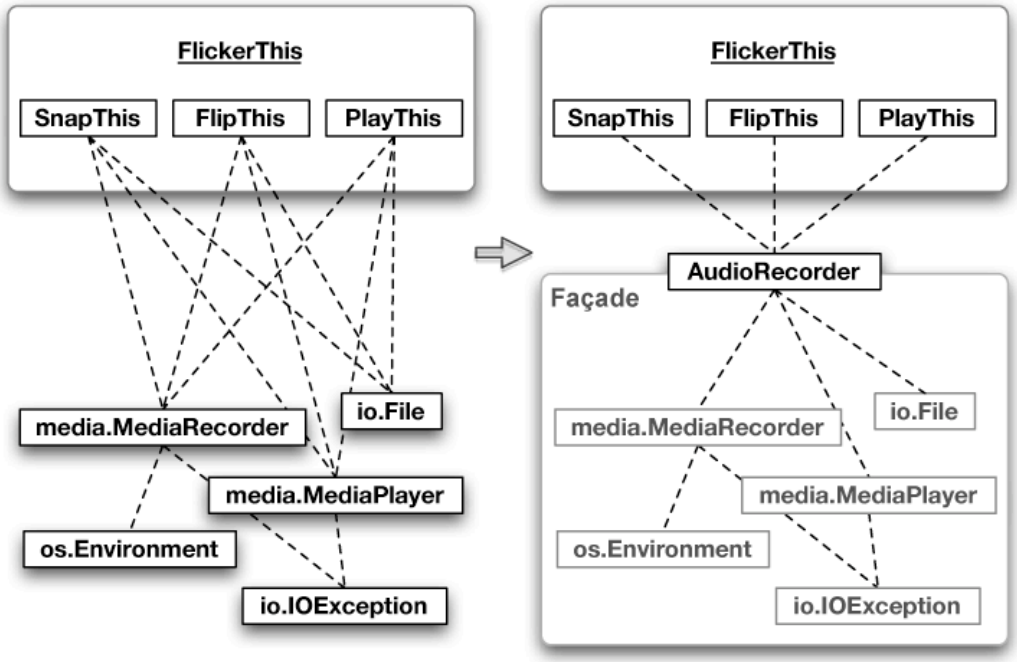


Figure 5-3. The AudioRecorder class as an example of the Façade pattern.

In FlickerThis, functions are grouped into several isolated classes applying the Façade design pattern. **Figure 5-3** shows the schematic diagram of the Façade pattern. The main classes are: the FileSystem class, the GenuineCamera class, the AudioRecorder class and the MsgUploader class.

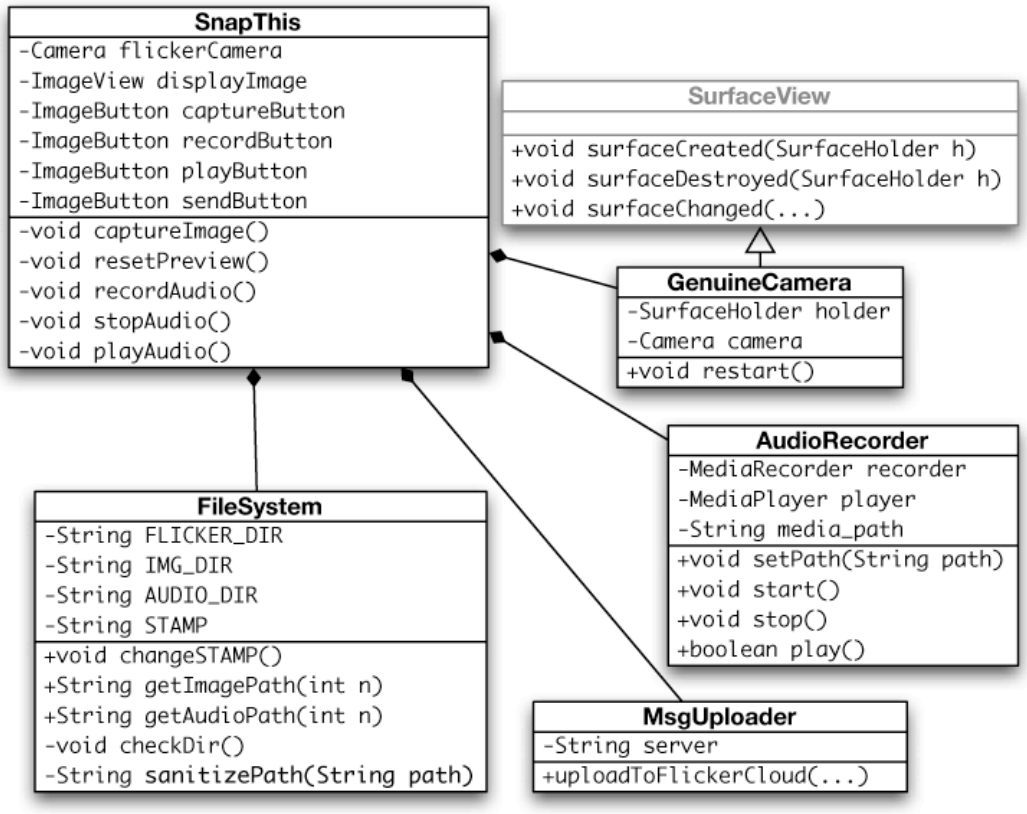


Figure 5-4. Class diagram of SnapThis.

The FileSystem class manages the database of photos and audio files and ensures the availability of needed system resources. In addition to the FileSystem, the FlickerItem class is used in FlipThis to record information corresponding to a photo to the FileSystem; an array of FlickerItem is maintained in FlipThis to register the selected photos in the gallery to generate a FlickerThis message.

The GenuineCamera class and the AudioRecorder class handle message composition. While the GenuineCamera class provides FlickerThis a reusable camera object for taking multiple photos and being able to preview them, the AudioRecorder class enables an application to record and play audio files. The AudioRecorder also needs to arrange all the playback events to avoid concurrent use of the microphone and speaker.

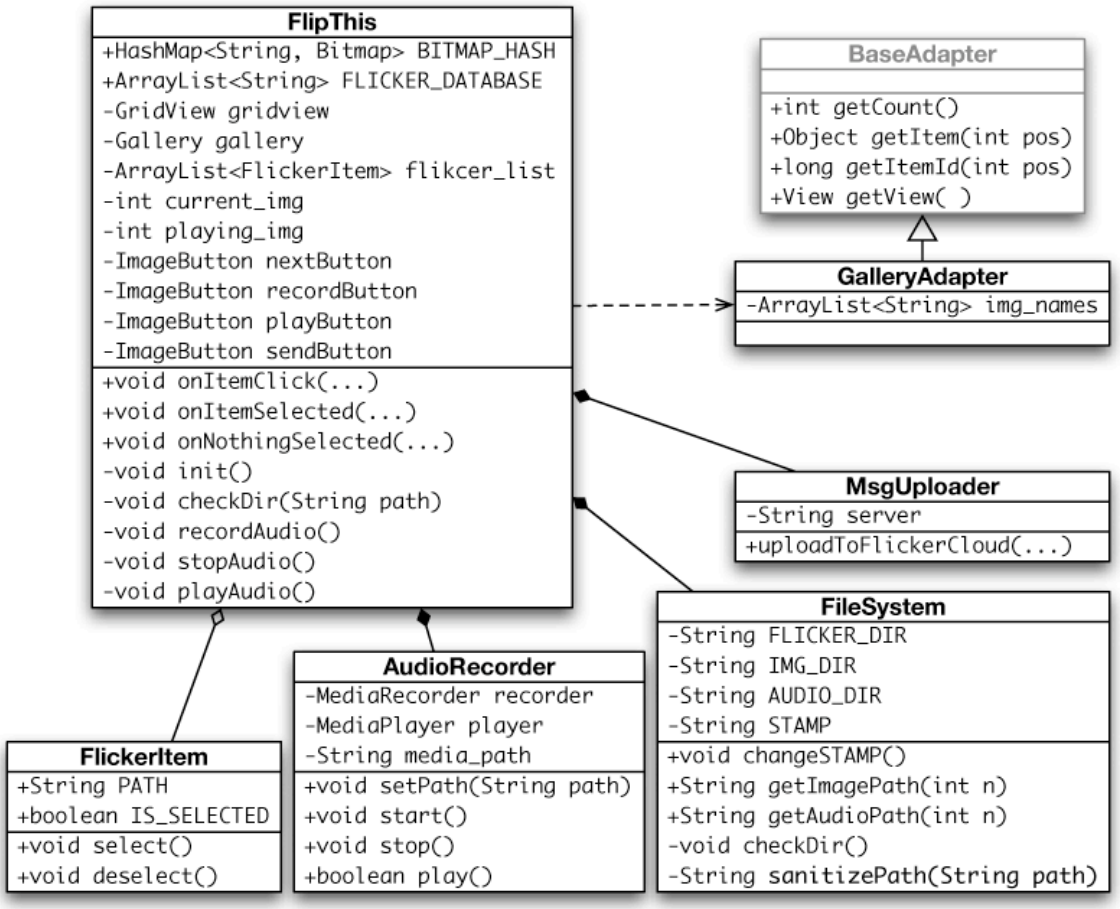


Figure 5-5. Class diagram of FlipThis.

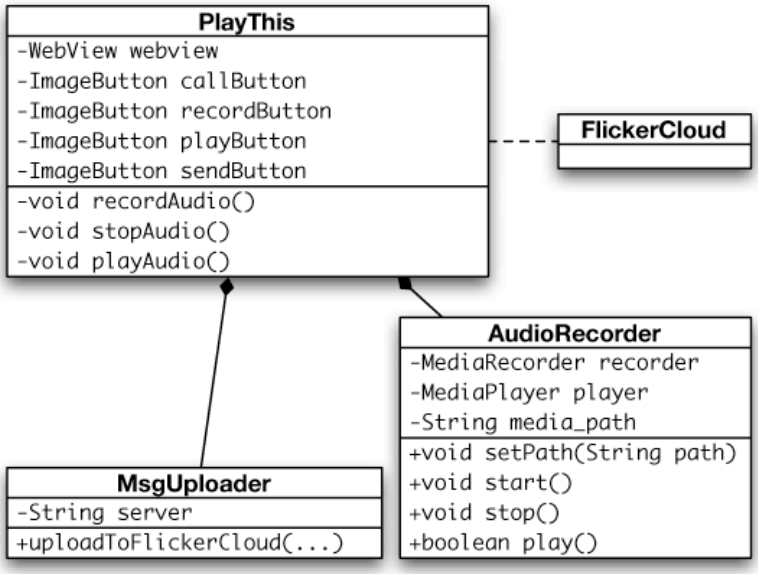


Figure 5-6. Class diagram of PlayThis.

Finally, the MsgUploader class records the FlickerCloud server IP and handles the transfer of messages and feedback between FlickerThis and FlickerCloud. Moreover, the MsgUploader would constantly query the server to keep track of a user's new messages or feedback.

Built onto these classes, SnapThis, FlipThis and PlayThis are designed as shown in **Figure 5-4**, **Figure 5-5** and **Figure 5-6**. SnapThis and FlipThis share the same FileSystem, so the photos taken in SnapThis can readily be used in FlipThis. The bitmap data of photos in the database is maintained separately in FlipThis as a HashMap to reduce the memory burden on mobile phones.

5.3 The Server - FlickerCloud

Three programs, StoreData, PrepareData and SyncScreen as shown in **Figure 5-2**, support the FlickerCloud service.

StoreData allows its clients to upload FlickerThis messages/feedback to the server and organizes the data to a database.

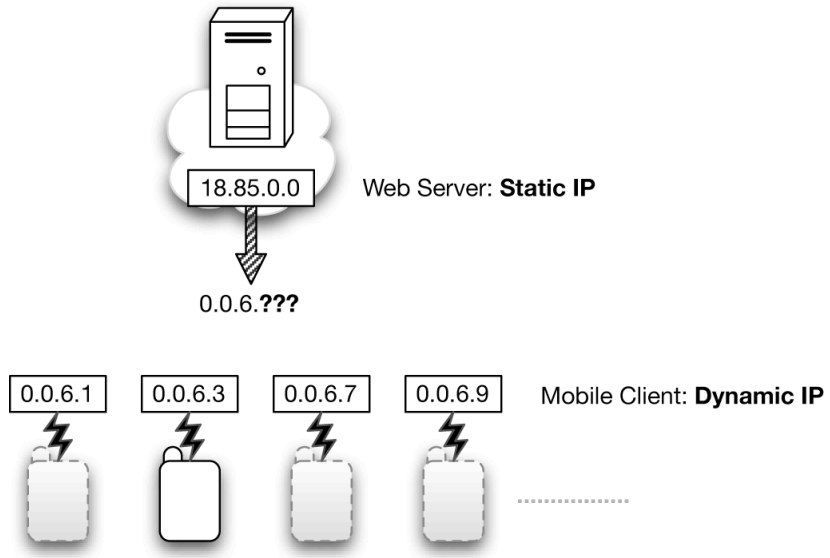


Figure 5-7. It is difficult for a server to find a mobile device under dynamic IP.

Mobile devices usually are assigned Dynamic IP, thus it is more difficult for FlickerCloud server to connect FlickerThis clients actively (**Figure 5-7**). Therefore, when there are new messages or feedback coming to FlickerCloud, PrepareData is responsible to set up corresponding flags for particular FlickerThis clients to query. PrepareData also

allows authorized clients to download the updates after the clients are notified of new data by finding a corresponding flag in one of their repeated querying.

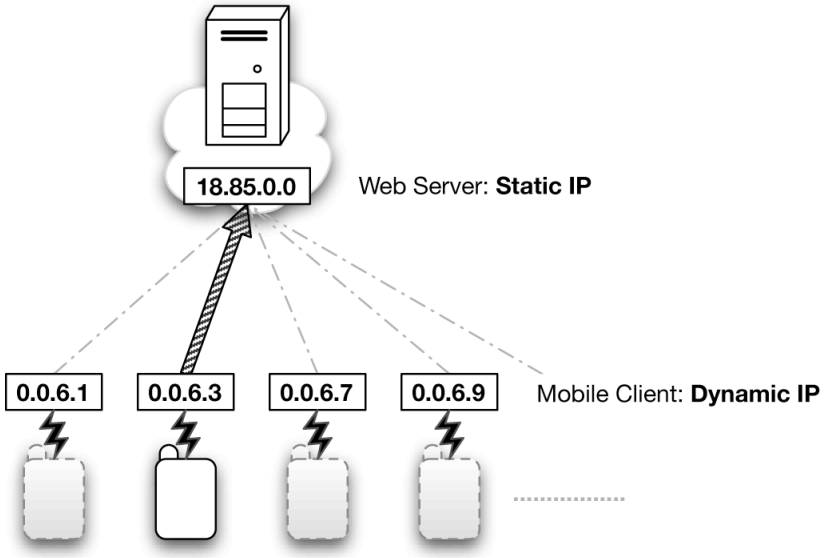


Figure 5-8. A mobile device connects to a server with static IP.

At last, SyncScreen coordinates all the information for a synchronous communication between FlickerThis clients, including the update of current photo on each other's screen and the positions of physical finger points on the screens.

The FlickerThis service is completed by the coordination of FlickerThis clients and FlickerCloud.

Chapter 6
Evaluation

Effective remote communication is important for friends, family and collaborators to keep in touch with each other. FlickerThis attempts to facilitate life sharing, and uses stories as media to ground remote communication and also reinforce the depth of interaction between people.

To understand how the design of FlickerThis works in practice, a study of evaluation was conducted.

6.1 The Goal

The goal of the evaluation study was not only to understand how the design of FlickerThis has fulfilled the original idea to ground remote communication and enhance remote interaction, but also to try to understand how the FlickerThis service meets or does not meet people's genuine need of communicating with others.

6.2 The Evaluation

The evaluation was designed in three phases and applied to a group of 8 participants.

The participants were all living away from their hometowns for work or study. The composition of the group is listed in **Table 6-1**.

Table 6-1: Composition of Participants in the Evaluation Study Group

Participant	Gender	Age	Time Length Leaving Home	Self-evaluation on Familiarity to Technology (Low to high = 1-5)
A	Female	26-30	26 months	3
B	Male	26-30	97 months	4
C	Female	51-55	18 months	1
D	Male	26-30	11 months	5
E	Male	31-35	47 months	2
F	Female	26-30	28 months	3
G	Female	21-25	12 months	4
H	Male	21-25	8 months	2

The first phase was a pre-questionnaire that surveyed the participants' experience and needs for sharing and communication. Some of the questions required the participants to make observations about their communication patterns, so they were given one week to fill out the questionnaire.

The second phase of the evaluation was a task for each participant to complete using FlickerThis.

Finally, there was a post-questionnaire to collect the 8 participants' experience and thoughts on remote communication with and without FlickerThis.

6.2.1 Pre-questionnaire

The pre-questionnaire (**Table 6-2**) consisted of 12 questions to gauge the participants' thoughts about sharing (including their sharing patterns), the insufficiencies they feel and upshots of current sharing methods.

The first 3 questions in the pre-questionnaire are about behavior using current sharing methods. They provide options of simultaneous, co-located and/or grounded sharing methods as listed in **Table 6-3**. Each option branches into different content-mediated methods if applicable. The questions surveyed how the participatns use current methods and further understood the methods that they prefer and use the most.

Table 6-2: The Pre-questionnaire

#	Question	Answer Form
Q1	How do you perform life-sharing / storytelling. (Please select all that applied.)	Checkboxes: ☐ Face-to-face Interaction ☐ Face-to-face Interaction with Paper-based Content (text, pictures, drawings, etc.) ☐ Face-to-face Interaction with Content on the Internet (online album, web pages, etc.) ☐ Face-to-face Interaction with Content in Your Computer (PC, laptop, etc.) ☐ Face-to-face Interaction with Content in Your Handheld Device (cell phone, digital camera, etc.)
Q2	Which way(s) do you prefer to use in Q1?	☐ Phone Call ☐ Text Message (SMS) ☐ Web Service: Integrated Online Content, e.g. Blog Posts ☐ Web Service: Online Album (Flickr, Picasa, etc.) ☐ Web Service: Online Video (YouTube, Vlog, etc.) ☐ Email with Pure Text ☐ Email with Links to or Attachments of Articles
Q3	Which way(s) do you use the most in Q1?	☐ Email with Links to or Attachments of Images (including online albums) ☐ Email with Links to or Attachments of Audio (music, online broadcast, etc.) ☐ Email with Links to or Attachments of Video (movie, youtube, etc.) ☐ Instant Messenger: Messaging (MSN, AOL, Google Talk, etc.) ☐ Instant Messenger: Audioconferencing (Skype, Google Voice, etc.) ☐ Instant Messenger: Videoconferencing (Skype, MSN, etc.) ☐ Instant Messenger with File Transfer ☐ Others: [ ]
Q4	You have the need of life-sharing/storytelling.	Scale: Disagree << 0 1 2 3 4 << Agree (2 = Neutral)
Q5	To you, what are the main insufficiencies of current tools/solutions. (Please select all that applied.)	Checkboxes: ☐ Loss of timing. ☐ Hard to express completely what I want to share. ☐ Complication - too many steps that need to be performed. ☐ Unfamiliarity with technology. ☐ Others: [ ]

Q6	If your intimate device/application can provide you the following functions: 1. Taking picture(s) of what you see, 2. Recording your narration(s) to picture(s) by only one button push, 3. Sending the picture(s) with narration(s) to your friends/family by only one button push followed by name selection(s), 4. Reviewing the picture(s) with narrations(s) that your friends/family sent you, 5. Letting you talk to your friends/family remotely when seeing the same picture, and being able to see where they are point at on the picture (namely, they can also see where you are pointing at), 6. Being able to interrupt a received narration at any timing and attaching your response to a specific piece of it, would it meets your needs more or conquers (some of) the insufficiencies in Q5?	Scale: No << 0 1 2 3 4 << Yes (2 = Neutral)
Q7	How many times approximately in this week you thought of sharing your life/story with others?	Choose from a list: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, more than 30.
	And you think the number is…	Choices: under average, about the average, above average, I don't know.
Q8	How many times in this week you actually shared your life/story with others? And you think the number is…	Choose from a list: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, more than 30.
	And you think the number is…	Choices: under average, about the average, above average, I don't know.
Q9	How many times in this week that your life/story sharing was aided by technology? (phones, the Internet , camera, etc.) And you think the number is…	Choose from a list: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, more than 30.
	And you think the number is…	Choices: under average, about the average, above average, I don't know.
Q10	How many times in this week that you expected follow-up interaction with others after you shared things with them? And you think the number is…	Choose from a list: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, more than 30.
	And you think the number is…	Choices: under average, about the average, above average, I don't know.
Q11	You have follow-up interaction with others after you share life/story with them face-to-face.	Scale: Never << 0 1 2 3 4 << Always (2 = Neutral)
Q12	You have follow-up interaction with others after you share life/story with them through media. (handwriting mail, email, online album, etc.).	Scale: Never << 0 1 2 3 4 << Always (2 = Neutral)
Q13	Any opinion.	Paragraph text: [ ]

Table 6-3: Features of Remote Sharing Methods

Sharing Methods		Simultaneity	Co-location	Groundedness
Face-to-face Interaction	**A**. itself **B**. with Paper-based Content (text, pictures, drawings, etc.) **C**. with Content on the Internet (online album, web pages, etc.) **D**. with Content in Your Computer (PC, laptop, etc.) **E**. with Content in Your Handheld Device (cell phone, digital camera, etc.)	√	√	√
Phone Call		√		√
Text Message (SMS)				
Web Service	**A**. Integrated Online Content, e.g. Blog **B**. Online Album (Flickr, Picasa, etc.) **C**. Online Video (YouTube, Vlog, etc.)			
Email	**A**. with Pure Text **B**. with Links to or Attachments of Articles **C**. with Links to or Attachments of Images (including online albums) **D**. with Links to or Attachments of Audio (music, online broadcast, etc.) **E**. with Links to or Attachments of Video (movie, YouTube, etc.)			√ If email goes back and forth.
Instant Messenger	**A**. Messaging (MSN, AOL, Google Talk, etc.)	Messaging is similar to email if using offline messages.		
	B. Audioconferencing (Skype, Google Voice, etc.) **C**. Videoconferencing (Skype, MSN, etc.) **D**. with File Transfer	√		√

The result of the first three questions (shown in **Figure 6-1**) shows that the most general life-sharing methods are the methods that afford grounding. The following 4 options were most commonly used: (1) face-to-face interaction with content on the Internet, (2) messaging via Instant Messenger (IM), (3) face-to-face interaction itself, and (4) audioconferencing through IM. Other than these 4 most general methods, it was found that methods not constrained by simultaneity and co-location, such as email and web services, are used more than phone calls. Participants did not raise any other methods in the questionnaire. Moreover, the participants prefer face-to-face interaction itself and videoconferencing through instant messenger, but only face-to-face interaction ends up being used the most.

Questions 4, 5 and 6 are to observe the need for sharing. **Figure 6-2** shows that all participants have the need of sharing events from their lives and **Figure 6-3** shows the insufficiencies of current sharing methods. The main insufficiencies the participants consider are the loss of timing and the complication (too many steps to perform before sharing).

The participants knew nothing about FlickerThis during the first phase of evaluation, yet most considered the functions of FlickerThis as being able to make up the insufficiencies in question 6 (**Figure 6-4**).

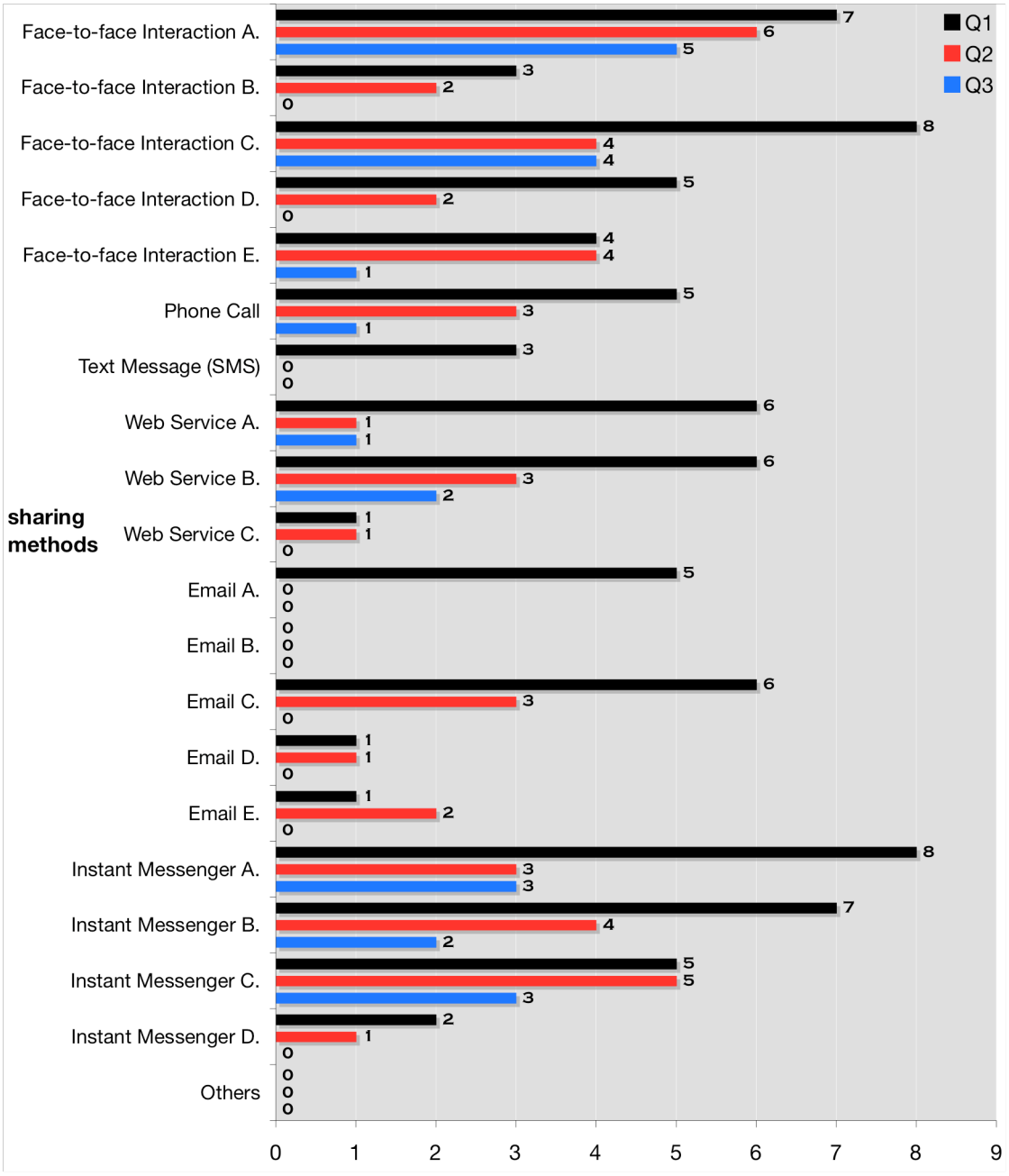


Figure 6-1. Statistics for pre-questionnaire Q1, 2, 3 showing participants' behavior on different sharing methods.

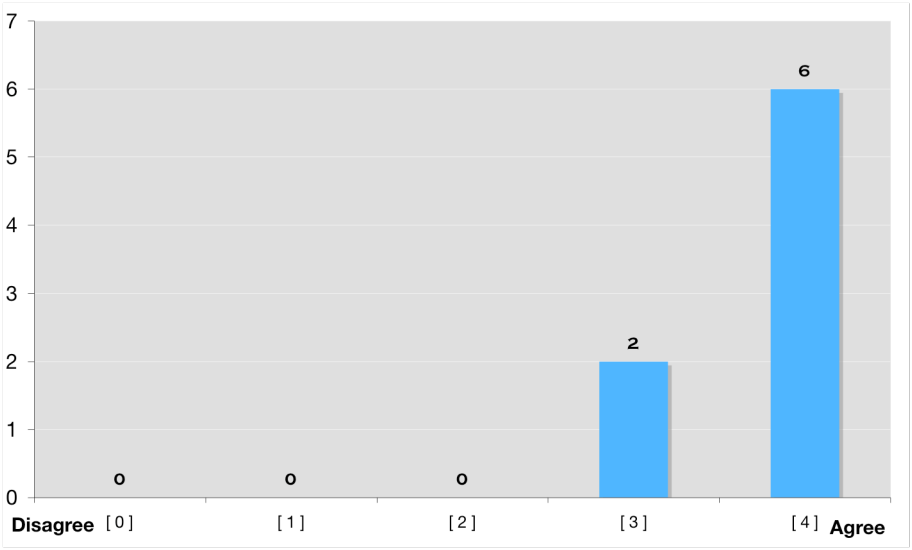


Figure 6-2. Statistics for pre-questionnaire Q4 showing that participants need to share with others.

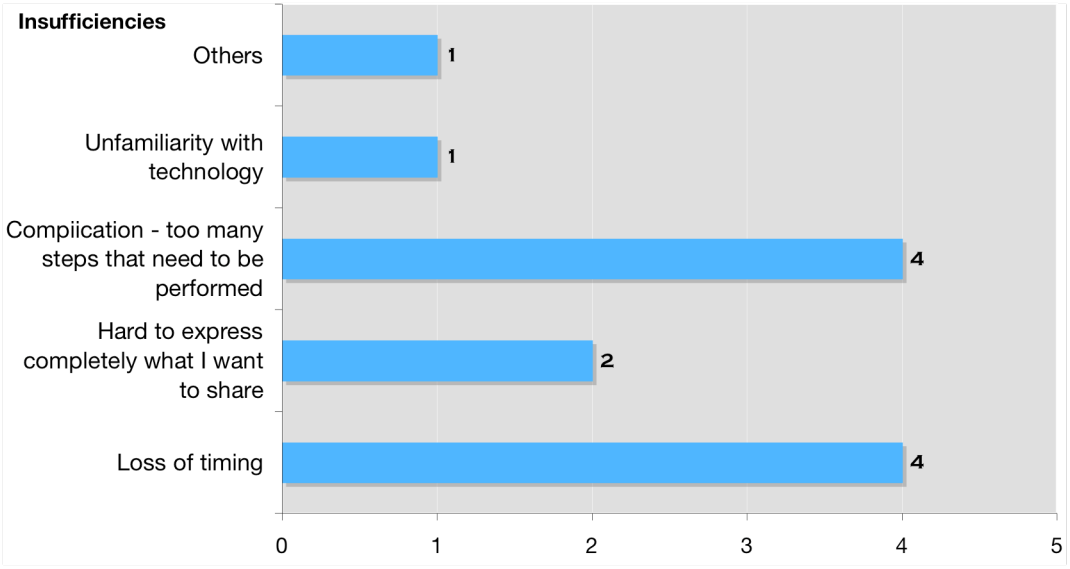


Figure 6-3. Statistics for pre-questionnaire Q5 showing insufficiencies of current sharing methods.

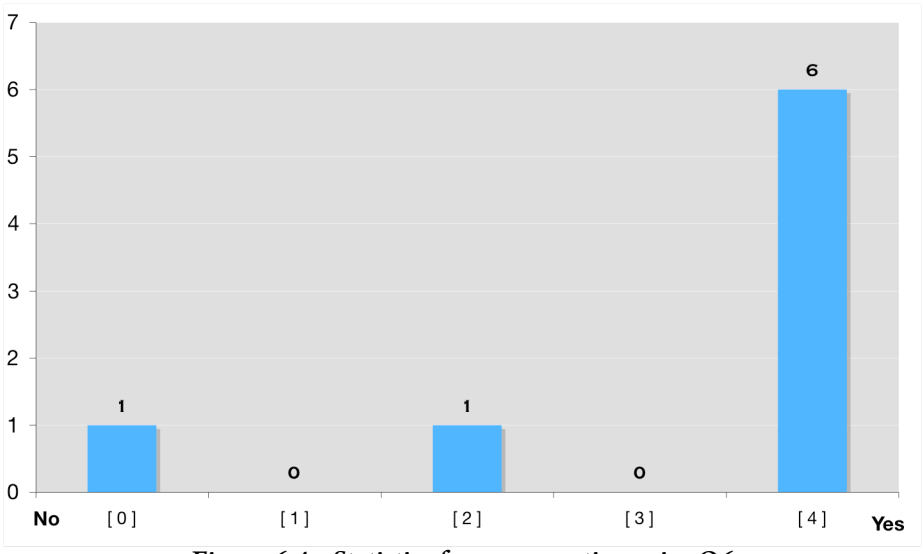


Figure 6-4. Statistics for pre-questionnaire Q6 showing participants' feelings on functions of FlickerThis.

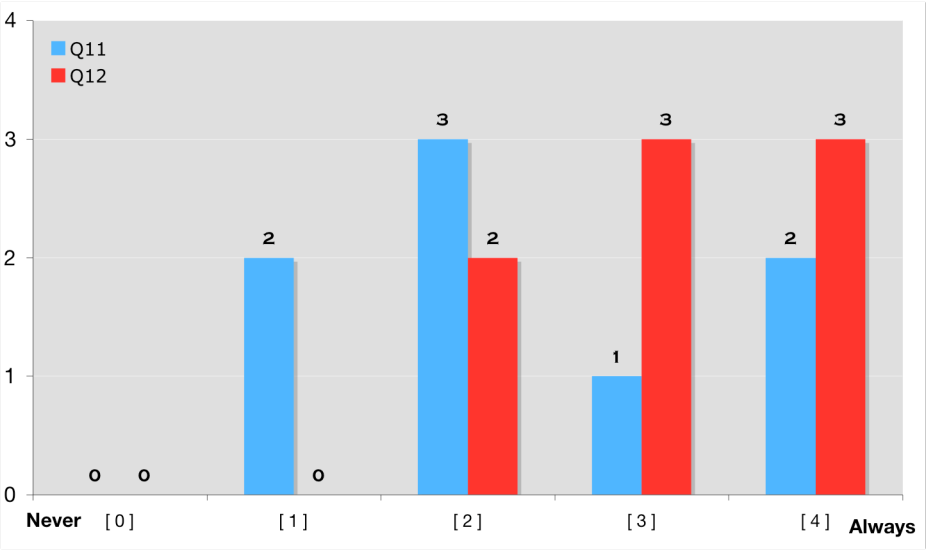


Figure 6-5. Statistics for pre-questionnaire Q11 and 12 showing follow-up interaction after face-to-face or technology-aided sharing.

Questions 7 through 12 aim at understanding the frequency of follow-up interaction in real-life sharing scenarios. According to the statistics in **Table 6-4**, the frequency of participants' actual sharing behavior is far less then they would expect themselves to share with family and friends. Also, three out of four times a participant's actual sharing is aided by technology, and slightly less than three times on average there were follow-up interactions after the sharing (**Table 6-5**).

However, **Figure 6-5** shows that the participatns actually tend to have more follow-up interaction after face-to-face sharing than technology-aided sharing.

Table 6-4: Statistics for Pre-questionnaire Q7, 8, 9, Participants' Sharing Behavior over One Week

Number of Time	Q7 **thinking of sharing**	Q8 **actual sharing**	Q9 **technology-aided sharing**
0	0	3	3
1	0	0	0
2	0	0	1
3	1	0	0
4	0	1	1
5	0	0	0
6	1	1	1
7	2	1	1
8	0	2	1
9	0	0	0
10	1	0	0
11-13	0	0	0
14	1	0	0
15-22	0	0	0
23	1	0	0
24-30	0	0	0
more than 31	1	0	0
Total	8	8	8
Average Times	**> 12**	**> 4**	**> 3**

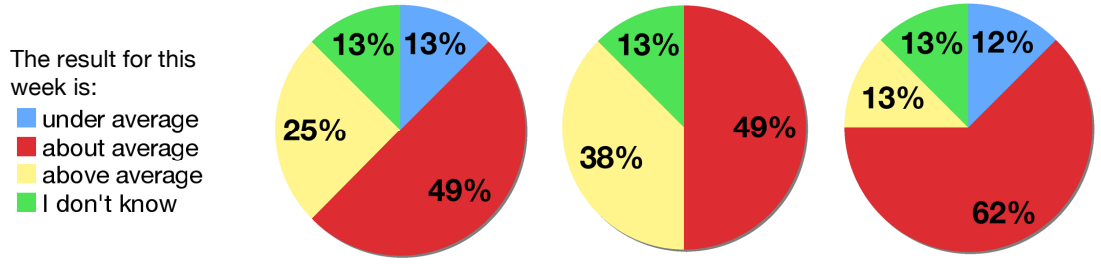
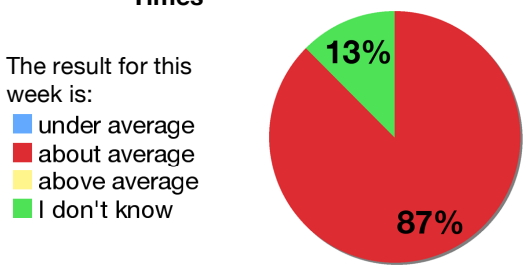


Table 6-5: Statistics for Pre-questionnaire Q10, Participants' Follow-up Interaction over One Week

Number of Time	Q10 follow-up interaction
0	3
1	0
2	1
3	1
4	1
5	0
6	1
7	1
8-30	0
more than 31	0
Total	8
Average Times	**< 3**



6.2.2 A Task

The second phase asked the group of 8 participants to use FlickerThis to fulfill a task. The purpose of the simple task was to give participants a more direct and clear sense of how the FlickerThis service works compared to current remote sharing tools.

The task was assigned individually to each participant. Before getting to know about FlickerThis, the following context was described to the participant (and a coffee cup as a property):

> *You drop by a colleague's office. Your friend is not there, but there is a take-out coffee cup that you have never seen before. Its shape is like an ordinary coffee cup with lid, however, there are some LED lights blinking on it. You soon figure out that the lights indicate how hot the coffee in the cup is and this suggests to its user the best taste temperature. You like the novel design of the cup and think of someone in the hometown. You feel like sharing this to him/her so…*

and the participant was then asked to describe how he/she would perform the task with existing tools. The result is shown in **Table 6-6**.

Table 6-6: Participants' Feedback on Fulfilling the Task by Current Tools

Participant	To Fulfill the Task by Current Tools
A	" *I would call the person right away and use oral description to illustrate the object in detail.* *I'll say, "it is a general white take-out coffee cup but there are 5 LEDs blinking aside; I figured that the hotter the coffee is, the more LEDs will blink," and, "it also points out the best taste temperature by the middle 3 LEDs."* *I will illustrate more if the person cannot understand.*"
B	" *I'll use my digital camera to snap a picture of the cup, upload the picture to Picasa and notify my friend to go to my Picasa album by email.* *I will call the person to visit my Picasa album instead of email if I wish him/her to see it right away.*"
C	" *I would try to memorize the detail of cup. When I meet the person on Skype, I can talk about the cup and at the same time try to find more detail online.* *If I never meet the person online, I will just surf on the web to find information about the cup and email links about it to my friend (if I do remember).*"
D	" *I would then take a picture of the cup using my iPhone, upload to my online album and send an URL to my friend.*"
E	" *I would want to buy a same cup and keep it. One day, when I can, I will take a digital picture of it and send to the person by email.*"
F	" *I would use my camera phone to take some pictures of the coffee cup and transfer the pictures to my laptop later at home via Bluetooth connection. I will keep the pictures on my Desktop, so when I meet the person someday on IM, I won't forget to talk about the cup and send him files.*"
G	" *I would take a picture of this smart coffee cup and send it across to the person via email, probably upload it to Facebook and tag my friend (the person who likes it).*"
H	" *I will post an article on my blog regarding to my new finding after I can access to my own computer. I will try to find a picture of the cup online and put the picture in my article.* *After finishing the blog article, I would email the person and ask him/her to visit my blog.* *If I don't find any picture of the cup online, I might call my colleague to email a picture of his/her coffee cup to me.*"

Following the question the participant was given some time to get familiar with FlickerThis. The process included an overview of FlickerThis applications and some time to play with FlickerThis on a mobile phone and ask questions, if any. Then, the participant was asked to perform the same task again but with FlickerThis this time.

6.2.3 Post-questionnaire

The purpose of the questions in the post-questionnaire was to gauge if FlickerThis met the participants' expectations of remote communication tool and if the FlickerThis messages served as a medium of interaction. The questions are listed in **Table 6-7**.

Table 6-7: The Post-questionnaire

#	Question	Answer Form
Q1	How would you answer Q6 in pre-questionnaire now?	Scale: No << 0 1 2 3 4 << Yes (2 = Neutral)
Q2	You would share your life with others more using FlickerThis.	Scale: Disagree << 0 1 2 3 4 << Agree (2 = Neutral)
Q3	You have a better experience using FlickerThis in terms of convenience of sharing.	Scale: Disagree << 0 1 2 3 4 << Agree (2 = Neutral)
Q4	You have a better experience using FlickerThis in terms of immediacy of sharing.	Scale: Disagree << 0 1 2 3 4 << Agree (2 = Neutral)
Q5	You have a better experience using FlickerThis in terms of completeness of sharing.	Scale: Disagree << 0 1 2 3 4 << Agree (2 = Neutral)
Q6	You anticipate having follow-up interaction with others after you share things with them via FlickerThis.	Scale: Disagree << 0 1 2 3 4 << Agree (2 = Neutral)
Q7	Any opinion.	Paragraph text: [ ]

Figure 6-6 is the result of question 1 (post-questionnaire) in comparison to question 6 (pre-questionnaire). It shows that the participants still think FlickerThis can overcome the insufficiencies that current tools have after using FlickerThis.

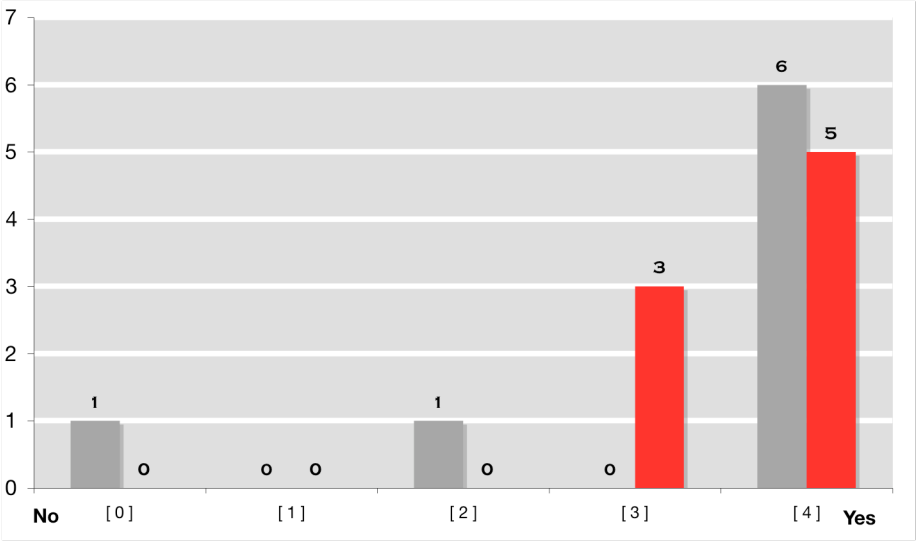


Figure 6-6. Statistics for post-questionnaire Q1 showing participants' feelings on functions of FlickerThis after using it.

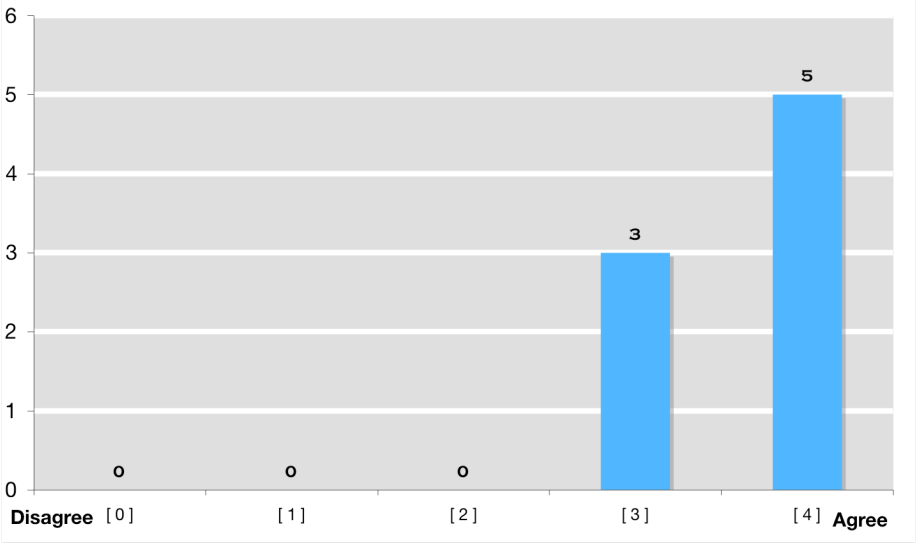


Figure 6-7. Statistics for post-questionnaire Q2 showing if FlickerThis motivates sharing behavior.

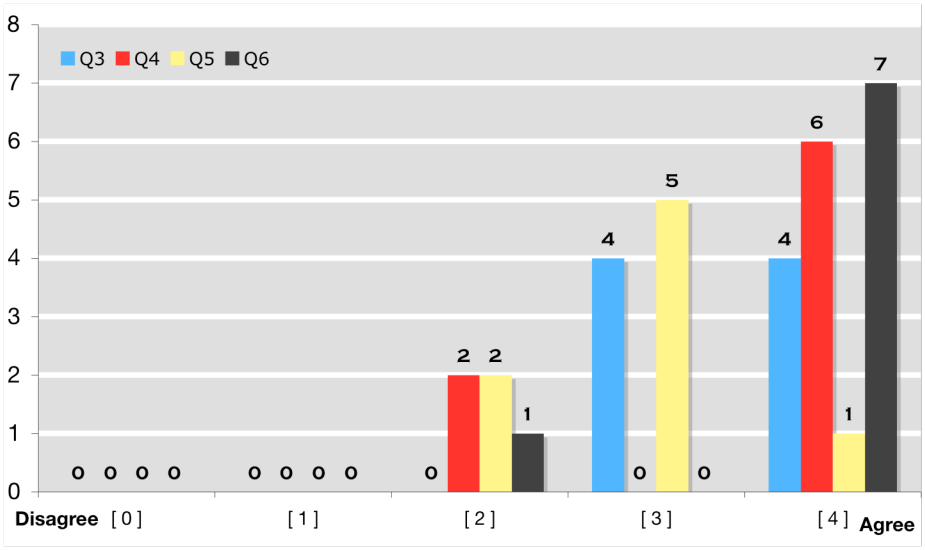


Figure 6-8. Statistics for post-questionnaire Q3, 4, 5 and 6 showing how FlickerThis can make up for the insufficiencies the participants experienced in existing remote communication methods.

Question 2, as shown in **Figure 6-7**, found that a more easy-to-use media would motivate participants to communicate with others. **Figure 6-8**, the result of question 3 through 6, visualized the participants' feedback on using FlickerThis. The result of question 3 and question 4 shows that FlickerThis can facilitate real-time remote communication efficiently. The result of question 5 and question 6 shows that the participants felt that they can express themselves with others more often using FlickerThis. These interactions in turn would help establish common ground.

6.3 Summary

The result of the pre-questionnaire show that the participants preferred communication tools that providing grounding. However, even though the participants of this evaluation study were participants who have a need to maintain remote relationships, they still engaged in face-to-face communication more often then any remote communication options. Preference for a particular communication method does not change as the media gets richer – participants prefer grounded media but the choice of any communication method is still decided by how accessible a method is. Even participants who care about sharing events from their lives with others at a distance would skip remote communication if it is inconvenient.

The same trend of sharing was also seen in the second phase of the evaluation. Participants tended to ground their experience with pictures, but when it was not convenient to take pictures, they would give up and just try to explain it in words

instead. Further more, some participants would even memorize the event and bring it up when they get a chance to talk to the intended person. It also turned out that deferring sharing of such events was a main reason people communicated less.

After applying FlickerThis to real users and having them try to fulfill a task by both current tools and the proposed tool, the post-questionnaire shows an increase in willingness to share when an easily accessible method of sharing is provided for people to ground their experience with viewable content using an intuitive I/O.

Chapter 7
Conclusion and Future Work

In this study, a mobile service, FlickerThis, is proposed to facilitate grounding in remote communication through viewable content. It is anticipated that a more grounded communication experience can bring about more interaction and willingness to share life between friends and family.

7.1 The Success of FlickerThis

The results of the evaluation study revealed that FlickerThis succeeded in two main points: providing grounding in communication and motivating follow-up interactions.

7.1.1 Grounded Communication in FlickerThis

Feedback from almost every member in the evaluation group indicated that FlickerThis messages conveyed what they really meant to share.

When used in synchronous or asynchronous communication, the information carried with a message is not the only important aspect, rather, FlickerThis allows for the message itself to serve as the medium of communication. Conversations and

interactions happen around the message and this results in better grounding via viewable content.

"*Even when I use Skype to engage in a video call with my parents, I seldom get a very clear picture of what they really experienced only from their descriptions of events. My parents like to share with me their everyday life - maybe a festival in my hometown, maybe a tree in full bloom on the path that I used to ride to school. But almost always I usually rely on my imagination to recreate the scene. Often they take pictures, but pictures always remain in the camera when we talk. Once in a while they upload pictures to their online album, but the amount of pictures is usually so large that I can't locate the picture they refer to fast and easily. So, to me and my parents, the idea of synchronous viewable content is absolutely great.*" (Commanded by one of the participants in the evaluation group.)

The function of seeing what the other person is looking at during communication actually helps not only to ground the conversation but also to keep the communication active.

7.1.2 Follow-up Interaction through FlickerThis

Unlike face-to-face communication that naturally constrains its participants to interact with each other, people usually need stronger motivations so they will interact with others when communication happens remotely. And in remote communication, grounding in communication and the follow-up interactions are usually enhancement of each other. With mutual understanding, grounded communication encourages its participants to interact with each other; at the same time, with follow-up interactions to a topic, two or more people can establish common ground accordingly.

Having interaction through FlickerThis, synchronously or asynchronously, is not much more than talking. Participants in the evaluation group reflected a more eager anticipation to engage in follow-up interactions, and were also more willing to share and interact with others given the intuitive interacting channel.

7.2 The Insufficiency of FlickerThis

While the FlickerThis service gained positive feedback on its grounding feature with viewable content and intuitive audio input/output, the design still has its insufficiencies.

7.2.1 Buttons on the Interface

The current interface design of FlickerThis put graphical buttons on the interface to let its users find the available functions easily. To approach the ease of communication in

face-to-face interaction, FlickerThis is designed to need at most two choices at each stage of use of an application.

However, some participants in the evaluation group mentioned about the confusion they had when seeing 3 or 4 buttons all at once. For example, after taking a picture in SnapThis, the only two functions that should be provided are to discard the current picture and to record narrations for the current picture. It is impossible to review a narration before recording one and is also unreasonable to send out a message before making a narration.

Figure 7-1. Screenshots: buttons on the interface of SanpThis application. (Left – current buttons. Right – simplified buttons.)

As shown in **Figure 6-1**, the interface could be simplified and made more intuitive.

7.2.2 Making a Multi-Picture Message

The method of making messages in FlickerThis is that SnapThis produces single-picture messages and FlipThis, which collects pictures taken in SnapThis, produces multi-picture messages.

FlickerThis runs this simple logic to make the service easy-to-use. However, according to feedback from the evaluation study, the logic applied could be refined.

When using SnapThis, some users would expect that their sequential single-picture message should have the potential to become a multi-picture message. Similarly, some users expected the default narration for each picture they chose in the FlipThis gallery to be what they have recorded in SnapThis.

Users' expectations mentioned above are reasonable and fit well with the communication needs FlickerThis attempts to satisfy. However, the current design has not yet implemented these specific needs.

7.3 Future Work

Since the growth of remote communication seems to be an upward trend, it is necessary to continue on the study and enhance the quality of communicating at a distance. The future direction for the research and design of FlickerThis is more than maintaining the successful elements and catching up on the insufficiencies.

FlickerThis aims at grounding remote communication by letting the users see what each other is looking at. It is a different aspect from videoconferencing, which lets its users see others when communicating. During synchronous communication, seeing others provides grounding by human expression and indirect awareness of surroundings, while seeing what others are looking at grounds communications soundly by visualizing the context of an event. Either aspect contributes to grounding and the preference changes according to the purpose of a communication. To respond to the theme of FlickerThis, it should be desirable to provide the freedom of switching the aspect in the service for remote communication.

Further, the usage of FlickerThis is a valuable issue to discuss since a good service would rely on an even better interface to popularize. The future interface should provide the flexibility to personalize according to different needs in life sharing since sometime a person would have a particular sharing habit unique to them. As a communication media, it is essential to keep the usage simple and handy.

Moreover, the file system in FlickerThis should be further designed. In FlickerThis, one single picture could be a story, a set of pictures and narratives could absolute be a story, and stories might even grow from another story. It is challenging to design a file system that can organize and manipulate different levels of media sets, reuse stories and, at the same time reflect these capabilities to the users of the service.

Last but not least, FlickerThis should be able to mediate multi-user remote communication in the future although he interaction design and file system design may get more complex as the number of participants increase.

Face-to-face communication may not be easily replaced, but it is not always an option for people to choose when communicating. Thus, FlickerThis is not designed to be a replacement of any communication channel but should be a combination of channels to meet people's instinct of life sharing, making remote communication grounded, intuitive and interactive.

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