

# Open Walkers' Eyes to the Possibility of Communication with RFID

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## Abstract

In this paper, we focus on the situation of the real space in which a chance of communication is lost by a little time lag. We observe and analyze the situation by the experiment with using Radio Frequency Identification (RFID). In addition, we propose the system that makes the walkers know the possibility of communication with their friends near them, with RFID and mail-system on mobile phone.

## 1 Introduction

People are good at thinking about what is there, but they do not easily notice what they cannot see. Thinking about “what is not here” is imaging unlimited possibilities, and we hardly do that. However, sometimes a clue remained at a place makes us realize the existence of what is not there. When we feel a clue left by someone, for example, a slight warmth on a chair or scent of perfume in a room, we awake the existence of someone who was in a place just before. Therefore, we can imagine the past, so to speak, “the memory in a place” by these clues. However, we usually do not imagine “the memory in a place”, because these clues are unperceivable in many cases. If we get a perceivable clue, how possibilities we can get? In this paper, we focus on that point.

We awake latent possibilities by thinking about what is not there deliberately. Shigeki Noya, Japanese philosopher, expresses this matter as follows: “We can find the existence of what does not exist, from a negative description like ‘There IS what is NOT there.’ It is a mystery of negation.”(Noya, 2001). On the basis of such an idea, in this paper, the situation in which “there is NO communication.” described as the situation in which “there IS the lost communication.”.

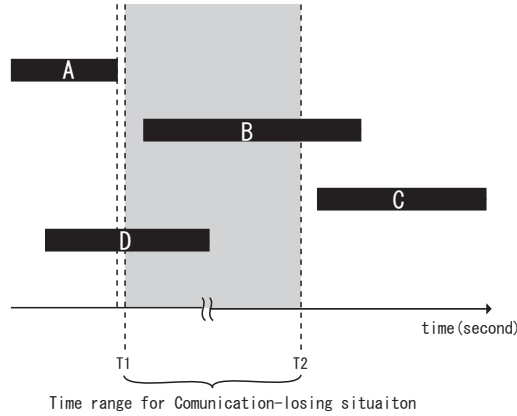


Figure 1: Communication-losing situation in the real space.

## 2 Synchronous communication and “Communication-losing situation”

Some types of communication on the Internet, such as E-mail, BBS and SNS, are stored as “information”<sup>(1)</sup>. By the information, we can see the traces of communication, which lead us to the communication without accessing to the Internet at the same time. That is, we can join in communications asynchronously, so these kind of communication is called “asynchronous communication”.

In a real place, however, a chance of communication is lost at once because there are generally no traces of people who were in a place. Therefore, we can only communicate with others by sharing the same time and place. We call this kind of communication “synchronous communication”. Synchronous communication is lost by a little time lag; besides, we don’t notice that.

In this paper, we focus on the situation in a real space in which a chance of communication is lost by a little time lag. We call this situation “communication-losing situation”. We can regard the situation where NOTHING happens as the situation where communication-losing situation happens. Figure 1 explains the situation. When person *B* comes a place after  $T_1$  seconds within  $T_2$  seconds after person *A* leaves there, we can say that person *A* and person *B* are in the communication-losing situation. On the other hand, person *C* (who comes after  $T_2$  seconds) or person *D* (who share a part of time with person *A* in a place) is not in the situation.



Figure 2: RFID tag.

### 3 Experiment on communication-losing situation

How people lose a chance of communication by a little time lag? We carried out an experiment on our campus and observed the situations in the real place.

#### 3.1 Overview of the experiment

This experiment was carried out on Shonan Fujisawa Campus, Keio University. In the experiment, we used the Radio Frequency Identification (RFID) system provided all over the campus<sup>(2)</sup>. We can know the location of a tag every second by interaction between tags (Figure 2) and readers. There are 67 readers on the campus and a reader can sense a tag which is from 5 to 10 meters away from a reader (Figure 3). We carried the experiment two times in different periods; from November 13th to November 16th, 2007, and from May 1st to May 14 except the holidays, 2008. Subjects in the former period are 19 undergraduate students, and in the latter period 17 undergraduate students, both of whom belong to the same laboratory. During the experiment, subjects live in their usual ways on campus with RFID tags.

#### 3.2 Result of the experiment

Figure 4 shows the trajectories of subjects in November 13th. We cannot know the route they actually moved because there are no readers on passages. Therefore, we draw the line straightly between the locations where tags are sensed.

In this paper, we set  $T1$  at 1 second and  $T2$  at 600 seconds. Two people in this range are interpreted as a combination of people losing communication with each other. From the data of tag numbers and the time when friends go in and out the room<sup>(3)</sup>, we extract the combinations of tag numbers meet the condition and count the number of the combinations. The results are showed in Table 1 and 2.

First, we find that the situation often happens except in a class room, for example in the library, laboratories and coop. The situation happens in a class room to people who take each class before and after a break, but these cases do not occur so many times. However, in the library, laboratories and coop, people can go in and out there

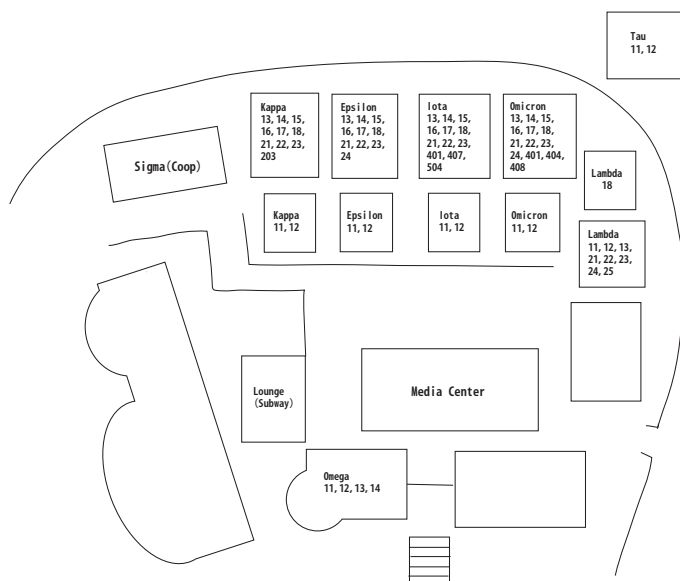


Figure 3: The location of RFID readers on campus.

freely, regardless of class hour, so that the situation often happens.

Second, when we focus on the subjects, as we know by Figure 5, they differed widely in frequency of being in communication-losing situation. The network shows the relationship between subjects who were in communication-losing situation on November 13th, 2007. A node expresses each of subjects and two nodes which were linked together means being in communication-losing situation.

## 4 Proposing System for open walkers' eyes

We propose the system that makes walkers know the possibility of communication with their friends near them and supports more communication<sup>(4)</sup>(Figure 6).

Before using this system, users need to resist the E-mail address of their own mobile phones and the tag numbers of their friends. When users enter rooms where RFID readers are installed, the system check whether their friends was there or not from  $T1$  seconds to  $T2$  seconds before, by searching the history of tag IDs of the room to find tag IDs meet conditions for communication-losing situation. If the system find the friends in the history, users get the information of the friends, such as tag numbers, tag names, the time when friends go in and out the room, that is, "the memory of a place" from an E-mail on mobile phone. If there are no friends in the history, the system do nothing.

The notable point of this system is using a mobile phone. A mobile phone can inform us immediately. It is important to inform immediately because the friends whom the system make known are near users in most cases. Moreover, with the

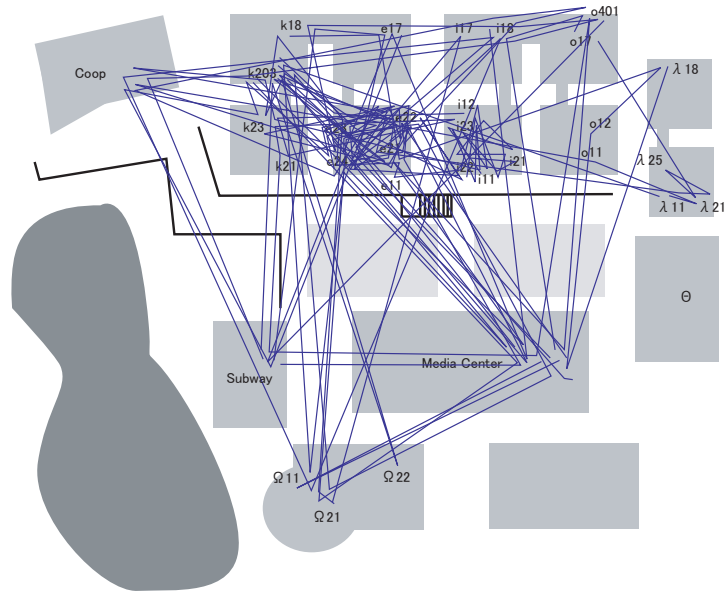


Figure 4: The Trajectory of ‘Subjects’ in November 13th.

Table 1: Result of the experiment in the first period

Date	Frequency (times)	Number of subjects on the day
11/13/2007 (Tue)	52	13
11/14/2007 (Wed)	2	11
11/15/2007 (Thu)	13	8
11/16/2007 (Fri)	11	10

Table 2: Result of the experiment in the second period

Date	Frequency (times)	Number of subjects on the day
5/1/2008 (Thu)	1	6
5/2/2008 (Fri)	7	11
5/7/2008 (Wed)	5	7
5/8/2008 (Thu)	0	8
5/9/2008 (Fri)	5	12
5/12/2008 (Mon)	8	8
5/13/2008 (Tue)	14	11
5/14/2008 (Wed)	1	7

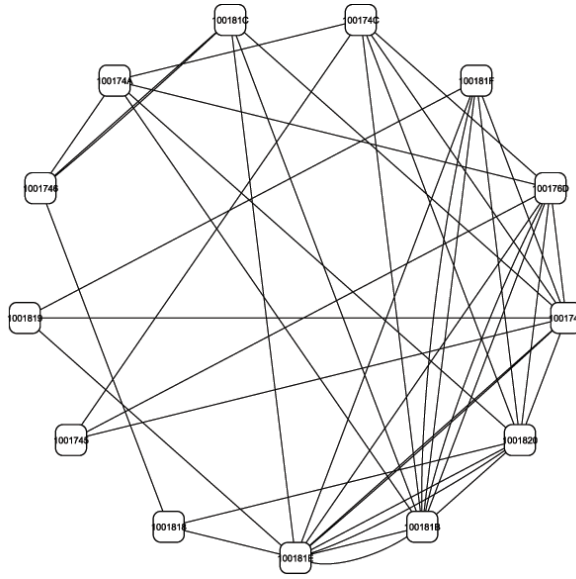


Figure 5: Network of Subjects who are in the communication-losing situation

mobile phone in their hands, users can call the friends or sent mails at once. Perhaps, users can meet the friends thanks to this system. Although this system has just basic functions, we expect that users can resist their friends easily and automatically by linking with SNS.

By knowing “the memory in a place” with this system, we find the situation where the possibility of sharing time and place with our friends is lost by a little time lag. In other words, the system gives us a clue remained at a place in perceivable form.

## 5 Conclusion

In this paper, we focused on communication in a real place and the situation in which a chance of communication is lost by a little time lag. We gave the idea, “communication-losing situation”, and observed how the situation occurs in a real place through the experiment.

These days, we spend too much time on the Internet and communicate with people through the network. Network communication flood our life, and communication in a real place is put aside by the stream. Though people share the same place, they communicate with someone in a mobile phone, not in the place. For the people, the meaning of a place is nothing any more. The idea, “communication-losing situation” and the system we proposed in this paper regain the meaning of a place and expand the possibility of fortuitous communication in a real place. The new system, which makes walkers’ eyes open to the new possibilities, creates the

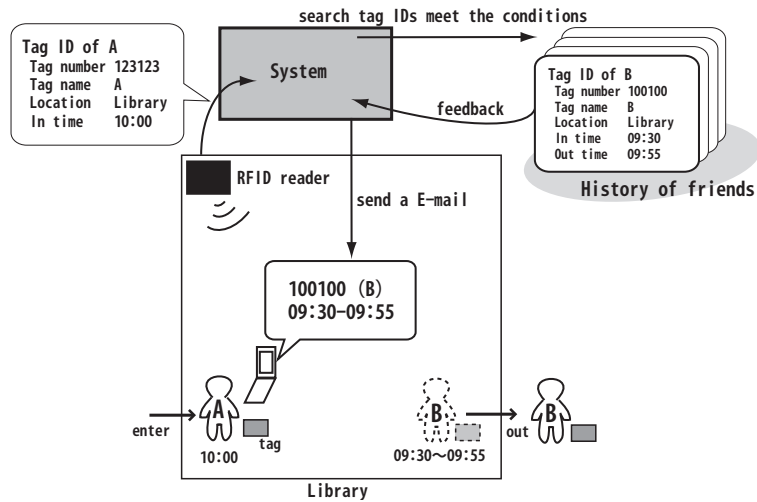


Figure 6: Proposed System to make known walkers “the memory in a place”.

future of communication in a real place.

## Acknowledgment

We would like to express a lot of gratitude to Masaki Minami and the members of Beluga Project, for providing RFID tags, system and services and also supporting the experiment in this research. We also thank to Satowa Naka for discussing several points in this paper with us.

## Notes

- (1) There are two kinds of architecture, synchronous and asynchronous architecture, on the Internet. Refer to the article (Hamano, 2007) for further details
- (2) The RFID system and other related services are provided for supporting research and education by Beluga Project (Tani et al., 2004; Hatano et al., 2007; Minami, 2007). Refer to the booklet (SFC DNP Project, 2007) for other approaches with this system.
- (3) Data of a tag is sometimes taken intermittently although the tag is in the same room continuously, because of sensitivity of the readers and tags. Therefore, data which seem to be continuous is dealt with as so.
- (4) This system is developed with using PHP library provided by Beluga Project.

## References

- [Hamano, 2007] S. Hamano (2007). *Hamano Satoshi no 'jyouhou kankyou kenkyuu note' [Hamano's Note of Information Environment]*, Wired Vision. in Japanese.
- [Hatano et al., 2007] T. Hatano, Y. Okumura, R. Sato, Y. Obara, F. Kato, and M. Minami (2007). “Construction and Operation of Position Information Services Supporting Research and Education” in *Multimedia, Distributed, Cooperative, and Mobile Symposium (DICOMO2007)* pp. 1275–1280, in Japanese.
- [SFC DNP Project, 2007] . SFC DNP Project (2007). *Guzen ! Hitsuzen: Souhatsu wo yuuhatu suru tameno hint [Accident ! Nessecity: Hints for Inducing Emergence]*, Keio Research Institute at SFC. in Japanese.
- [Minami, 2007] M. Minami (2007). “Beluga Project: Construction of Middleware and API for Real Space Apprication” in *SFC Open Research Forum 2007*, in Japanese.
- [Noya, 2001] S. Noya (2001). *Hajimete kangaeru tokino youni: 'wakaru' tameno tetsugakuteki michiannai [As if you thought for the first time: Philosophical Directions for 'Understanding']*, PHP. in Japanese.
- [Tani et al., 2004] R. Tani, K. Hashimoto, Y. Suko, M. Minami, and J. Murai (2004). “Plan and Inplementation of API for the System Distributing Information as to a place with RFID” in *IEICE Technical Committee on Mobile Multimedia Communications (MoMuC 2004)* pp. 31–36, in Japanese.

\* *This paper is for Fourth Joint Japan-North America Mathematical Sociology Conference, May, 2008. (Contact Us: E-mail to Corresponding Author, Takashi Iba at [iba@sfc.keio.ac.jp](mailto:iba@sfc.keio.ac.jp))*