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# Bridging SNS ID and User Using NFC and SNS

## Design of NFC and SNS based event attendance management system

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**Abstract**— A smart phone and a tablet terminal with a NFC function are spreading by standardization of NFC technology. The authors are interested in the exchange support between the participants in the off-line meeting. The authors focus on participants' mutual communication in off-line meetings. It is rare to perform exchange in an actual meeting place, although there is a relation called a friend or a follower on on-line. This will be because of gap between identity on SNS and identity in the real world. The authors are interested in bridging the gap between the online identity and the identity in the real world. The authors are developing a system, which matches human on on-line SNS ID and a real person, using a smart phone or a mobile terminal with NFC technology. Our system will display the human relations on the on-line SNS, and connect a meeting and a meeting participant.

**Keywords**- smart phone; NFC; tablet; SNS; identity bridging;

### I. INTRODUCTION

A smart phone and a tablet terminal with a NFC function are spreading by standardization of NFC technology [1, 2]. Use of the contactless IC card is progressing in the world. The contactless IC card has spread through traffic freight management, an electrical money card, an identifier card, etc. in Japan. Many of them are implanted using FeliCa standards. The mobile phone equipped with FeliCa function is also popular in Japan. IC card is good for anti-counterfeit and is tamper resistant. So it is used for a traffic fare or an identifier card. An identifier card needs not only user identification function but also to be secured.

We are interested in the exchange support between the participants in the off-line meeting. We focus on participants' mutual communication in off-line meetings. There are big differences of the exchange at a real meeting and on SNS. These days, many of us are enjoying active communication using SNS. SNS is not only used for private information exchange, but also used for notification of a meeting, like a small seminar, an academic conference, and an enterprise event.

Recently, many meetings are notified in SNS, such as Twitter and Facebook. A user tweets meeting information on Twitter, and there are several re-tweets by receivers. Friends in Facebook may share meeting information. So, meeting participants may be related each other, if the meeting information is notified in SNS. Some of participants may be near friends if you trace links of follower or friends on SNS.

However, it is rare to perform exchange in an actual meeting place, although there is a relation called a friend or a follower on on-line. This will be because of gap between identity on SNS and identity in the real world (conference venue, in this case).

We are interested in bridging the gap between the online identity and the identity in the real world. We are developing a system, which matches human on on-line SNS ID and a real person, using a smart phone or a mobile terminal with NFC technology. Our system will display the human relations on the on-line SNS, and connect a meeting and a meeting participant.

To realize our idea, we propose a simple concept, that is, to bind SNS ID of on-line service and NFC tag of off-line real meeting using mobile NFC terminal such as smart phone and web based DB system, which manage meeting participant. Firstly, we formalize the model of conference participant management. Secondly, we analyze the ideal goal of software system, which realize our idea. Finally we describe the detailed design of our system. This system helps transfer the on-line environments of exchange into the off-line exchange and in the actual meeting room. Participants of an off-line meeting can share and enjoy the on-line linkage.

The rest of the paper is organized as follows. Section 2 shows brief summary of related work. Section 3 describes the model of participant management. Section 4 and 5 describes the design of our system based on SNS, mobile terminal, and NFC. We conclude this paper in section 6.

### II. RELATED WORK

Laukkanen mentioned feature of NFC, and he discussed NFC based services, such as personalized smart posters, target advertisement, mobile payment with NFC, NFC-based tickets, at the time of 2007 [3]. Some of services like mobile payment or NFC-based tickets are already realized at present. However, services like target advertisement is not realized, because user, online social identity (SNS ID) and real world services are not binded. Our research will realize bridging the gap.

Yamashita proposed a detection system to find persons in rooms using sensors, and this system may be applicable for conference participant detection [4]. His system may be expensive because it needs multiple sensors, so it is not good for small seminar.

Ozdenizci proposed a room navigation system using NFC technology in [5].

Kamei and others has proposed a system, which supports the community construction of people named community organizer [6]. This system aims at that a user finds an interesting person and ties people among communication for new community construction. They also propose some methods of human network visualization, and evaluate them. Their methods and evaluation are greatly consulted for our human-relations display application, which we implement as an application of NFC smart phones and tablet terminals.

Hrastinski et.al. are arguing the effect of social media for in higher education by interview investigation [7]. In this paper, they have pointed out that many students use SNS. Probably, our assumption of this research that meeting participant has SNS ID will be appropriate.

### III. MODELING OF CONFERENCE PARTICIPANT MANAGEMENT

This section defines the model of meeting and participants of a meeting. The process of meeting on the day and the process of participating check work to each session are described.

#### A. Entities of conference

The entities of a conference are people, that is, the organizer and the participants. The organizer may be a person or an organization, and the organizer sets a conference.

Let  $C$  be a conference proposed by a organizer, and let a conference consists sessions, participants, and metadata. Let  $S$  be the sessions, let  $P$  be the set of participant, and  $M$  is the metadata of the conference. A conference and sessions may have the program and the meta-data, such as, the name of the conference, the date and time, the venue, the name of the organizer and the registration fee. So, we represent a conference  $C$  as a triple as follows;

$$C = \langle S, P, M \rangle, S: \text{Sessions}, P: \text{Participants}, M: \text{Metadata}.$$

Let  $m$  be the number of sessions, and let  $n$  be the number of sessions, then we can represent  $S$  and  $P$  as follows:

$$S = \{s_1, s_2, \dots, s_m\}, s_i: \text{session}.$$

$$P = \{p_1, p_2, \dots, p_n\}, p_j: \text{a participant}.$$

We can define the set of participants of session  $s$ , and represent it as  $P_s$ .  $P_s$  is a subset of  $P$ .

$$P_s: \text{the set of participants of session } s.$$

#### B. Pre-Registration

A conference requires some procedure of the registration. It is not concerned with no charge or the charge, Web-based registration system are popular. The registration proceeds as follows:

- Registration by participants
- Confirmation by organizer
- Fee payment in case of charged conference

### IV. MEETING PARTICIPANT EXCHANGE PROMOTION SYSTEM USING NFC AND SNS

This section describes the meeting participant exchange promotion system using NFC and SNS.

As we said in the previous section, some off-line meetings are not so successful compared to the on-line discussion. Even if there are many exchanges between members of an on-line meeting, the participants require some ice break to start communicating with each other. One reason is that they do not recognize each other by their online ID (SNS ID) and that they have difficulties in binding the real person and the SNS ID. Therefore, in spite of being acquainted on on-line, the distance will be kept until they have the opportunity of conversation or self-introduction. This psychological distance bars the promotion of the exchange between participants.

The present paper proposes a method to use NFC to connect on-line SNS IDs, on-line meetings, off-line meetings and actual people. Figure 2 shows the workflow of the proposed system. We assume that most of the participants of the meeting have smart phones or tablet terminals with NFC function. We assume that all participants have their SNS IDs (twitter or Yahoo account). This assumption is not idealistic one. In fact, most ICT specialists satisfy the above assumptions. We can imagine the situation where most students and active workers have their own smart phones and SNS IDs in a few years [6].

#### A. Workflows

The organizer of the meeting prepares the NFC tags assigned with the name of the meeting and the session. The tag informations are kept in a DB. The participants fill in their SNS ID on the pre-meeting registration Web site. They attend the meeting with their mobile terminal (NFC terminal) that has NFC reader. They are required to install application software to promote communication between participants. Each participant has to set their SNS ID, the meeting name and the session names in his/her application. Figure 1 shows the workflow for preparation before conference.

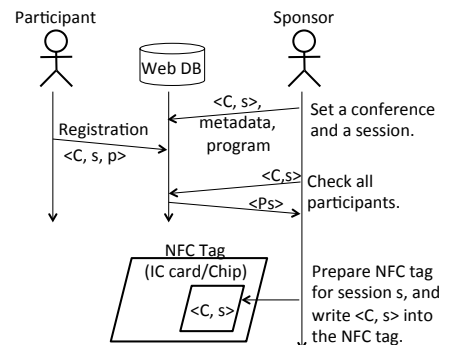


Figure 1. Workflow of before conference.

On the day of the meeting, the organizer sets NFC tags at the hall of the sessions. If the session is in a round table, the tag

can be put on the table. In the sessions with a large number of participants, the NFC tag can be set at the front door of the hall.

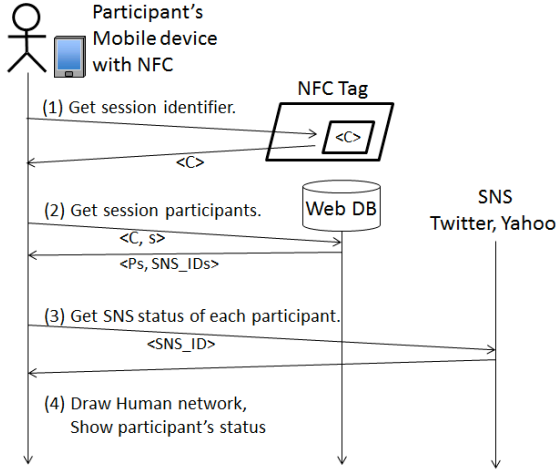


Figure 2. WorkFlow at conference

Participants at a session can read the NFC tag of the session by their NFC terminals. The application of the NFC terminal sends a message to the management server telling that the user is in the session. At the same time, the NFC terminal receives SNS IDs who are attending the session and who are expected to attend the session. The management DB server notifies to other participants the SNS ID of the participant. The application software of NFC terminal can ask the SNS server about the status information of any participant by specifying the SNS ID. The status information in SNS can be used to draw a linkage diagram of participants. A participant may find his acquaintance or find someone who has the common acquaintance. Such suggestion and advice on time is useful to promote communication between participants. Figure 2 shows workflow at the conference, and dataflow between participants, and servers.

### B. Binding

The exchange promotion system of the previous section requires three kinds of bindings between the actual entities and the identifiers of virtual space. The first binding connects a participant to the SNS ID of the participant (Figure 3(1)). The second one connects the meeting, or the session to a NFC tag (Figure 4(2)). The third one connects a NFC terminal of a participant to the SNS ID of the participant (Figure 3(3)).

The first binding between a participant and his SNS ID is relatively easy to realize. For example, the SaaS type meeting management system ATND, which we discuss later, realizes a user authentication using twitter account and Yahoo account. Preparing special accounts for a temporary meeting is awkward and troublesome task for the organizer and the participants. The exiting accounts of twitter ID or Yahoo ID are available on the Web and have the biding to actual users. If the identification of participants were the main concern, identification by outer IDs such as twitter or Yahoo would be enough. We can apply the OAuth technology to for appropriation restrictions of personal information.

The second binding connects the meeting or the session to a NFC tag (NFC chip). The organizer has to prepare NFC tags before the meeting. NFC writer makes the bindings.

The third binding connects NFC terminals and SNS IDs. The application software of mobile terminal can realize the biding of a NFC tag and the participants. Each participant needs to install the application on his mobile terminal and need to set his SNS ID in the application. For most of the participants, the mobile terminal, the application software in the mobile terminal and his SNS ID are uniquely connected.

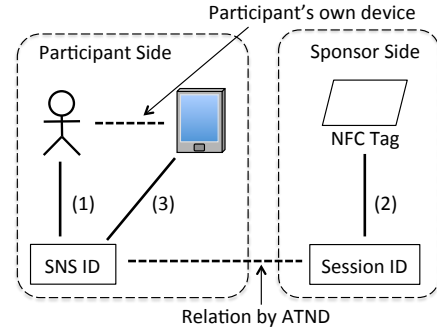


Figure 3. Bindings

## V. DESIGN OF EVENT ATTENDANCE MANAGEMENT SYSTEM USING NFC AND SNS

In this section, we describe the design of a development system. As we mentioned in above sections, our system consists of a WebDB system and applications for NFC terminals. Next subsection 5.1 describes the detail design of a WebDB system. Section 5.2 describes the application in a NFC mobile terminal below. We consider, how to display profile and human relations-network of all participants on the application in a NFC mobile terminal, in the conference in section 5.3. This function is the most important point of promotion of exchange between meeting participants.

For the simplification for building a prototype, we limited only to twitter as the SNS of the back end used as each individual's profile and sources of information of human relations. Moreover, a Web DB system is considered as a mash-up with ATND. ATND is a SaaS type meeting participant managerial system of the Web base used at the small-scale seminar etc., and its use in Japan is increasing. ATND is so reliable that, implementation of basic functions of meeting participating registration and management is omissible.

### A. Design of Web DB system

The following four functions are required as an on-line system on Web. Functions (1) and (2) are already realized by the ATND system. To realize the function (3) and (4), we implement a mash-up system between ATND and the Web DB system. Hereafter, each function is described in detail.

#### 1) Entry of meeting by organizer

This function is already realized by ATND system. At first, organizer must sign-up to the meeting management system ATND. Next, the organizer setup a meeting on ATND system.

He/she also inputs the meeting metadata such as the meeting name, date and time, meeting venue, and so on.

#### 2) Prior participating registration by participants

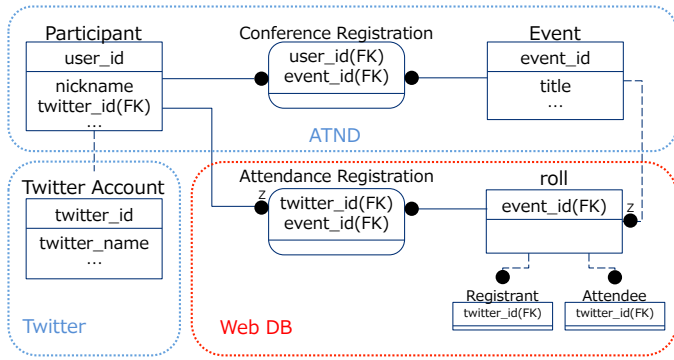
The organizer advertises his meeting to public, and interesting person will register to the meeting using ATND system. Twitter ID is possible as a user ID at the time of registration on ATND system. We assume that all participants register using twitter ID.

#### 3) Management of meeting metadata and participants

This function manages the metadata and participants of meeting using DB. If it receives a query about meeting metadata or participants, then it replies data. This function needs user authentication mechanism.

#### 4) The attendance checking at the day

This function is used at the meeting venue at the meeting day. To keep each participant's meeting attendance and session participating condition, this function sends query periodically to the Web DB system and gets up-to-date information.



An ER diagram between Web DB system, ATND and Twitter

### B. Design of NFC terminal application

We describe the application on a NFC smartphone/tablet terminal. There are two application software, one is for meeting organizer, and the other one is for meeting participants. We assume that both application are worked at a mobile terminal with a NFC function such as smart phone or slate tablet terminal.

#### 1) Application for meeting organizer

Meeting organizer prepares the NFC tags for each sessions, and allocate them to appropriate place at the day of meeting. On this application, the software gets meeting metadata and the list of participants from Web DB. The organizer selects a session, and writes the data into a raw NFC tag. The data format is not still specified but the data is consists by pair of meeting name (meeting ID) and a session name (session ID).

#### 2) Application for meeting participants

The application of meeting participants consists of two components, data management component, and human relation display component.

The data management component holds the list of participants the meetings or the session, and each participant's

SNS ID. It also holds information about who is attendant or absentee. Since the information of attendant (absentee) changes at any time, it is periodically asked for Web DB and is updated to the latest information. Moreover, it gets the information on the human-relations link on SNS based on participant's SNS ID. When SNS is twitter, human-relations are represented by follow link and list of followers. Twitter link data can obtain using twitter Web API.

The human relation display component displays the simple list of attendant (or absentee). And then, this component draws graph of the related participant using human-relations data. We discuss about graph drawing method in the next sub section.

### C. Study of human relation display method

Various methods can be considered about how to display those related. In this subsection, we discuss about the method of the human relations display component.

#### 1) Hop by hop

Naïve graph representation is mapping a link on SNS to human network graph. Graph node is human, and graph branch is link on SNS.

First method shows one hop graph. User specifies a person as a starting point by click, and then, it is the method of displaying people with the link relation to the specified person on the surroundings of those who become a starting point.

This method can be easily implemented, but only one hop point (person) is displayed. The computational complexity is  $O(n)$  even when it is the worst, where  $n$  is the number of participant in the session. Generally, there may be few link relations, then computational complexity become low.

#### 2) Full mesh

Next method is making the graph of all session participants' link relation. In this case, the number of branches of the human relation graph is  $O(n^2)$  in worst case. However, the possibility that all session participants are generally acquaintances is very low. When all participants are already acquaintance, this system is less useful. It may be able to draw human relation graph, if  $n$  is about 50.

In the case of this method, the form of the graph will become interesting. The person of the session chair will be drawn as the Hub of the graph, since he has many link relations with participants of a session, and other participants may become leads of the Hub. It may appear clusters Hub(s), if strongly connected persons are exist.

#### 3) List of link ranking

Graph of the human relations described for the foregoing paragraph may become an uncomfortable gathering for newcomers, because newcomer may not have links to other participants. Then, we consider the ranking view of participants, which consists of a degree of a link is made and how to display it in a list is also considered to be a Hub degree in all session participants. What is necessary is just to define the degree of a link using in-degree and out-degree.

## VI. CONCLUSION

In this paper, we show a design of NFC and SNS based event attendance management system, and this system can bridge SNS ID and User using NFC and SNS. Participants mutual communication in off-line meeting is not often successful as they are expected compared to those in on-line. This will be because of gap between identity on SNS and identity in the real world. We believe that our developing system binds SNS ID and NFC tag of participants, and display human relations on display of smart phone or slate terminal. And it may encourage communication between participants in meeting. In the future, we will complete development of our system and evaluate effectiveness of our system.

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