Location-Based Social Network Services Employing Student Cards for University

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ABSTRACT

This study proposes a novel social networking service based on the locations of students. Since many existing social networking services do not consider the locations of users, in general, they can only support communication via the Internet. In order to acquire the locations of users and utilize them, the proposed system has the following functions. (1) It can acquire information regarding when and where the students are located by using both the attendance records of classes and the login records of educational computers. These records are automatically recorded by a student card mounted on a noncontact-type IC. (2) Since our system supports Web access from mobile phones, users can also access it from outdoors. Since these functions enable users to find the locations of friends in the vicinity anytime and anywhere without special terminals, we expect that our system can support communications not only via the Internet but also in the real world. Moreover, we have managed and evaluated this system as a Web service for over one year in our university.

Categories and Subject Descriptors

H. Information Systems [**H.4 INFORMATION SYSTEMS APPLICATIONS**]: General

General Terms

Human Factors

Keywords

Web Service, SNS, Education

1. INTRODUCTION

In recent years, social networking services (SNS) such as Facebook[1] have become available. By applying for the friendship relation with each other, these SNS enable users to support not only communications but also make new friends that have common interests.

On the other hand, lack of communication skills in the real world is one of the major obstacles encountered by young people. Since it is difficult for some students to make friends or develop friendships at the university, it is particularly observed that some of these students withdraw from school in the worst case. However, many of these students can make friends and develop friendships by using SNS. Therefore, there are some studies that encourage communication between students by adopting a SNS for a university[6]. However, since these SNS adopt a conventional SNS system available as open source software, they are not necessarily suitable for a university. In particular, since students can meet other students face to face at the university campus, it is important to support communications not only via the Internet but also in the real world.

This study proposes a novel SNS based on the locations of students; we call this SNS system *Nitwho*. Unlike many existing SNS systems, this system can increase the opportunity for communication between students in the real world. Nitwho has the following features:

Feature 1 A student card mounted on a noncontact-type IC enables a user to register attendance records and login to educational computers. By using attendance records and login records, we can acquire information regarding when and where the students are located.

Feature 2 Since Nitwho supports not only PC but also mobile phones, users can access it from classrooms and outdoors.

Feature 3 Users can find the locations of friends in the vicinity anytime and anywhere by combining features 1 and 2.

We have managed this system for every student as a Web service provided by the Information Technology Center at the Nagoya Institute of Technology, for more than a year.

2. STUDENT CARD AUTHENTICATION

At the Nagoya Institute of Technology, all students have a student card mounted on a noncontact-type IC. The student card enables users to support many authentication services such as the attendance system that manages attendance records of classes, the campus pay system that enables users to pay by card at refectories and campus shops, the security gate system at libraries and buildings, and the login system of educational computers. Therefore, by analyzing the records of student card authentications, we can acquire information regarding when and where the students are located..

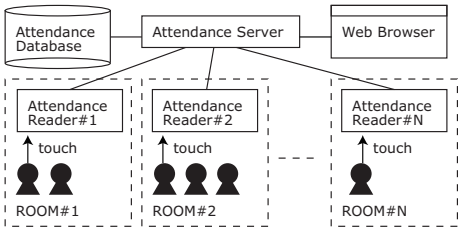

Figure 1: Architecuture of the attendance system.

Figure 2: Attendance reader and smart card.

Let us describe the action of a student for a particular day. The student swipes his/her student card over the attendance reader, as shown in Figure 2, at the beginning time and end time of each class in order to register his/her attendance. The student pays by his/her student card at a refectory at lunch break. The student enters the library by swiping his/her student card at the gate after school in order to study. These authentication records are accumulated in a central server.

Generally, we believe that the attendance records obtained from an attendance system are sufficient for acquiring the locations of students. An attendance system is a system that manages the attendance of students for each class. By recording the attendance properly, this system can provide the detailed attendance of all students for each class. Figure 6 shows the system architecture of the attendance system. As shown in Figure 2, all the classrooms have attendance readers near the doorway. Students swipe their student cards over the attendance reader at the beginning time and end time of each class in order to register their attendance. We call this action *clock-on*. These records (student ID, room ID, and timestamp) are accumulated in a central server that manages all the attendance readers. We can acquire the attendance information by comparing these records with syllabus databases. Students and teachers can confirm their attendance information anytime in the Web browser. Because many teachers give grades based on the attendance records also, many students positively use this system for all classes. Therefore, we believe that we can acquire the locations of students with high reliability by analyzing these records.

Since students login to educational computers using their student cards, their locations can be acquired by determining the IP address of their computers and their student ID.

Although we can also acquire the locations of students by referring to their purchase records at refectories and campus shops and the admission records of the library, as of now, we cannot use these information because of the protection of personal information.

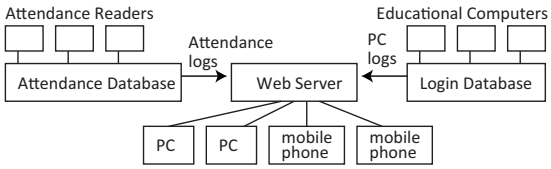

Figure 3: System architecture.

3. IMPLEMENTATION

3.1 System architecture

Every student must be able to use Nitwho easily anywhere and anytime. Therefore, we developed Nitwho as a Web service that can be accessed from both PC and mobile phones, as shown in Figure 3. We adopt Java servlet on the server and a conventional Web browser as a client.

Since the access frequency of SNS is very high in general, the cost of login is high. Since many Web services at our university have already adopted a single sign-on environment, we also adopted this environment for Nitwho in order to reduce the procedure of user login. Moreover, users can skip the login procedure while accessing Nitwho from mobile phones by using a personalized URL. The personalized URL is automatically generated at a PC Web page of Nitwho, and users can easily bookmark this personalized URL on their mobile phones by using a QR cord.

3.2 Estimation of location

A method based on the location of the base station of wireless LAN[5] is used to determine the user location. Unlike GPS, this method can also be used indoors such as in subway stations[4]. Another method used to determine the user location is based on the ultrasonic sensors[7]. However, these methods have a disadvantage in that users must have a special terminal that is equipped with both the sensor and the feature that uploads the sensor data to the central server at all times. It is not financially feasible to provide special terminals for all students.

Therefore, we adopt the *IP address method* and the *attendance method* to determine the user location, instead of providing terminals to all the students.

The IP address method is based on a dictionary that associates the IP addresses of computers with the names of rooms. We have recorded the user IDs, IP addresses, and timestamps of all educational computers every 10 min. Although this method can determine the location of a user from these records, it cannot acquire the location of users who do not login to educational computers.

The attendance method is based on the attendance records accumulated by the attendance system. The attendance records are accumulated in the central server. Since students can use the attendance system for all classes, we expect that this method can determine the locations of students with higher frequency than the IP address method.

Names of locations have been stored in a dictionary in advance, in the form of a sentence such as #204 (2F, No. 20 Bldg.), Auditorium (1F, No. 51 Bldg.).

4. FUNCTIONS

Nitwho enables users to register friendship relations and update profiles, as in the case of existing SNS. On the other hand, unlike existing SNS, Nitwho enables users to display

Figure 4: List of friends with places and messages

Figure 5: Twitter-like communitcation page.

locations of friends. We describe these functions in this section.

4.1 Friends list function

Nitwho enables users to confirm not only names and comments of friends but also determine the amount of time for which the friend stayed at a particular location, as shown in Figure 6. Users can find friends in the vicinity from the friends list.

Privacy problem may be of concern when the locations of all the students are known to everybody. Therefore, the location information of a user is accessible to only the registered friends of the user, as in the case of conventional SNS. Moreover, users can decline friendship relations anytime.

4.2 Twitter function

Recently, Twitter[2] has become a popular Web-based communication tool. Twitter enables users to communicate with other users by sending short comments known as tweets. Therefore, we developed a function similar to Twitter, as shown in Figure 5. In this function, users can communicate with each other as in the case of a chat system.

5. EXPERIMENTAL RESULTS

5.1 Results of acquiring locations of students

Figure 6 (a) shows the clock-on records of the attendance system and login records of educational computers obtained every 10 min on June 30, 2009. All first-year students are considered to be targets (1096 students). Clock-on records of the attendance system have six peaks. These peaks show a situation that students clocked on at the beginning time and end time of each class. This result suggests that many students use the attendance system for every class. On the other hand, educational computers are often used from 13:00 to 14:30 and from 14:30 to 16:00. Further, the number of users of educational computers is less than that of the attendance system. Since educational computers are only used for a few classes, we cannot acquire the current login statuses of all the students. In addition, records of total in June 2009

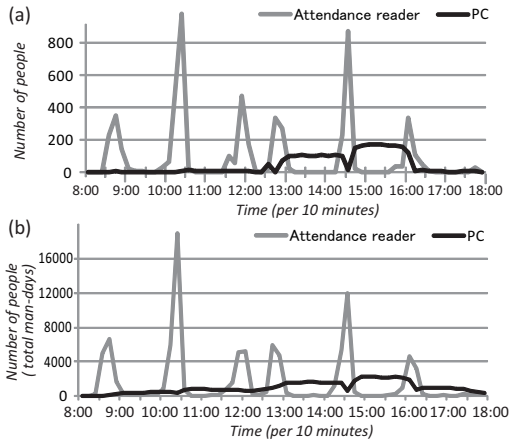

Figure 6: Number of people that clock on and login per 10 min. (a) One day. (b) Total in June 2009.

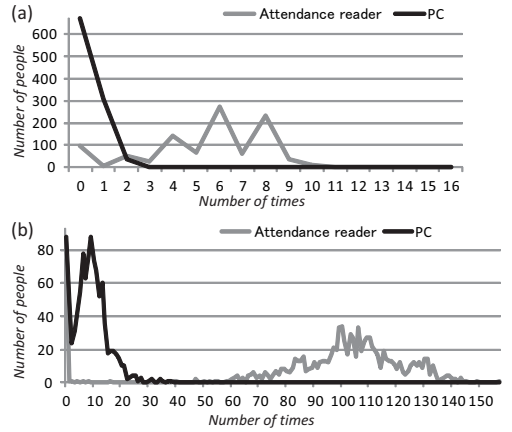

Figure 7: Number of people that clock on and login. (a) One day. (b) Total in June 2009.

have same trend as this day, as shown in Figure 6 (b).

Next, Figure 7 (a) shows the number of clock-ons and the number of logins to the educational computers every 10 min on June 30, 2009. On this day, 700 students did not use the educational computers. In addition, only a few students used the educational computers more than once. Therefore, it is difficult to determine the current locations of students by referring only to the login records of educational computers. On the other hand, although 99 students did not clock on for the attendance system, 917 students clocked on. Among the students who did not clock on for attendance, many were absent; therefore, we assume that nearly every student clocked on. Moreover, although the average number of logins to educational computers for each person on this day is 0.38, the average number of clock-ons is 5.50. Moreover, the average number of clock-ons for each person in June 2009 (94.9) is 10.8 times greater than that of logins (8.78), as shown in Figure 7(b). Therefore, the attendance method can acquire the locations of students with 10.8 times higher frequency than the IP address method.

5.2 Access records of Nitwho

Figure 1 shows the access records of Nitwho from October 1, 2008 to June 30, 2009. Since all the students can access Nitwho from educational computers without registration by

Table 1: Access records.

	apply friends	access	Twitter	user
Mobile	23	2410	21	48
PC	295	10420	669	542

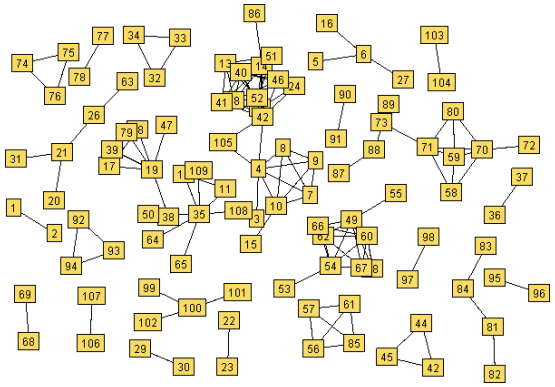

Figure 8: Network of the friendship relations.

using the single sign-on environment, more number of users access Nitwho from PCs than mobile phones. However, although 9 users access Nitwho from PCs more than 100 times, 10 users access Nitwho from mobile phones more than 100 times. Since this difference is small, we assume that enthusiastic users also use Nitwho from mobile phones.

Twitter has been accessed from PCs many times. Although many users use the Twitter function from educational computers during classes, these tweets include many irrelevant chats. Therefore, in future, we have to limit the use of Twitter function during classes.

Figure 8 shows the network of friendship relations. This network shows that friendship relations are developed as in the case of conventional SNS.

5.3 Questionnaire results

We asked the following questions to the 40 users that use Nitwho often. We obtained valid responses from 8 users. We evaluated their responses based on 5-point Likert scales. Here, 5 is strongly agree, and 1 is strongly disagree.

Interest Is Nitwho interesting?

Usability Is Nitwho easy to use?

Friendship Can Nitwho strengthen friendship?

Security Are you apprehensive about submitting your location information to Nitwho

Location Do you use the locations of friends?

Figure 9 shows the average responses of these questions. In terms of interest, usability, and friendship, the results of are between 3 and 4. These results are positive but not so good. We think that this is because Nitwho has less number of functions than the existing popular SNS. The result of security (2.3) suggests that students are quite comfortable with providing their location information to friends. In another questionnaire, since two users answered that they found the truant students, the Nitwho is effective to share and solve the problem concerning the truancy of friends voluntarily. Therefore, we believe that it is effective to share the locations of friends with each other.

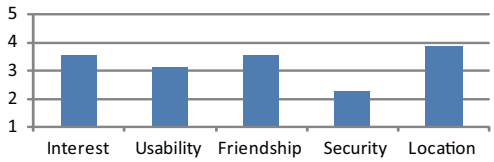

Figure 9: Questionnaire results.

6. RELATED WORK

Some SNS have already been developed for universities. For example, Facebook[1] was originally developed for American university students. In Japan, Nagoya University allowed the access of a novel SNS[6] on a trial basis. Unlike these SNS, Nitwho has an advantage in that it promotes the chance of communication in the real world by acquiring the location of students.

In addition, there are already some location-based SNS[3]. Since these services adopt existing Web map services such as Google Maps, we cannot use these services in the classrooms of buildings of the university. Although Nitwho cannot be used in a wide area, it is effective for students within a university.

7. CONCLUSION

This study proposes a novel social network service based on the locations of students. In order to acquire the locations of students, we analyzed both the login records of educational computers and the attendance records of classes. We found that the attendance method could acquire the location information with 10.8 times higher frequency than the IP address method, when educational computers were used to access Nitwho. In addition, we have made available the proposed system for more than a year and confirmed its availability.

In future, since Nitwho does not have a community function, i.e., the function that shows the profiles of friends of friends and an instant mail function unlike existing SNS, we have to develop these functions. We expect that these functions can increase the number of friends and friendship relations. In addition, we have to confirm the educational advantage of Nitwho.

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