DEVELOPMENT OF AN INDOOR MAPPING SYSTEM WITH IMES

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Abstract: When we go shopping in a large shopping mall with friends or family, we often act separately from one another and want to know where they are. In this paper we present an indoor mobile mapping system that assists users in shopping in commercial complex. First, we developed an indoor mobile mapping system that can provide your current location on floor maps with IMES positioning system. Secondly, we developed a message system such as twitter to take notes and communicate with your companion. Thirdly, we developed an ad-hoc grouping system to share location and messages with just your companion in the shopping mall. If users act separately, they can know each location, status and interests with this system. Finally, we developed a real-time monitoring system which shows anonymous visitors' traffic line in the shopping mall. Then, we conducted a verification experiment for this system.

INTRODUCTION

 We have been able to understand the behavior of people and large real-time distribution of people such as the congestion map of "itsumonavi" and study of person flow with person trip investigation (Usui, et al, 2010) by spread of smart phone and GPS mobile phone. With the popularity of SNS and Twitter, it has been able to figure out what people are interested in and where they tweet from. (Fujita, 2011) (Fujita et al, 2011). However, such studies have been primarily intended for outdoor. It is not enough to study on human behavior and interests for indoor.

OBJECTIVES

  This study aims to develop the system to monitor behavior and interests of visitors who permit the use of their logs in the facility in real time.
  We will develop the system not only to obtain logs of visitors for experiments but also to support them for go around the facility.

DEVELOPMENT OF INDOOR POSITION SYSTEM "TomoCoco"

Overview
  In order to know the behavior of visitors in a facility, it is necessary to periodically obtain the location information of the visitors. In order to know the interests of the visitors, we have decided to handle messages (free text) logs between visitors.
  Next, it is necessary to develop the system to support the visitors while we obtain these information. We considered that it is very useful for the visitors in the facility to prevent lost children and to meet with companion such as family or friends by sharing location and message between companions.

Recently, there have been already many services to share the position such as Foursquare, Facebook, Google Latitude and so on. However, these services are necessary to register personal information. Furthermore, friend request and publicity of settings are very complicated.

Then, in this study, we developed an application for supporting visitors in the facility such as shopping mall. The requirements of this system are the following three.

・It is not necessary to register personal information.

・Your location can be shared with only companion such as family or friend who come together in a facility.

・Your location can be shared with companion in only facility on the day.

System Overview

Figure 1 shows an overview of the system.

Indoor positioning system and IMES Watcher

For indoor positioning technology, there are a variety of techniques. In this study, limitation of this experimental environment, we've used the IMES (Figure 2). IMES stands for Indoor Message System. As a feature, it is possible to send position information with the same signal as the GPS.

Since there is no smart phone with built-in IMES receiver at present, we've used the IMES receiver. IMES transmitter which is arranged in the facility sends latitude and longitude coordinates. IMES receiver receives the signal, and then transmits the location information and the reception status of IMES to smart phone with Bluetooth. We have developed an application"IMES Watcher" running on smart phone to always observe the reception status from IMES receiver. Then, IMES Watcher sends the received information to the application "TomoCoco".
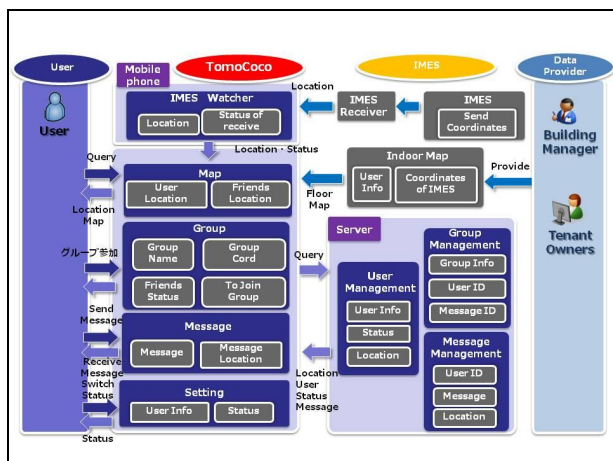
Figure 1: System overview   **Figure 2: IMES receiver and transmitter**

"TomoCoco"

"TomoCoco" consists of four functions "Group", "Map", "Message" and "Setting" in order to share your location and messages in the buildings.

(1)Group

We took in a group system to share the location and message easily between companions only in the facility.

When users create group, they get a group cord. If companion input the group code or read the QR cord, they can join the same group and share their location and messages.

In group screen, we can see names, images and status of users who joined the same group (Figure 3).

(2)Map

We created an indoor map with coordinates by overlapping and image processing floor maps based on the pixel value on the base map and the coordinates of the IMES transmitter which IMES Consortium was set up.

The map on the screen, your location is displayed in blue icon. Present locations of users who join the same group are displayed in yellow icons (Figure 4). Users can know the present location of other users with switching user focus button. Users can switch a floor map, an enlarged floor map and building map with + or - button.
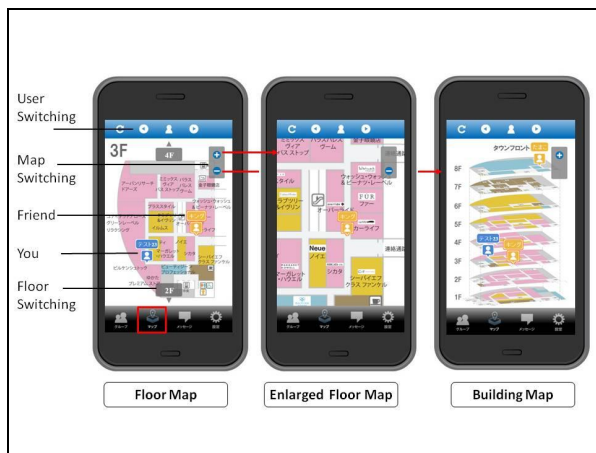
Figure 3: Map screen
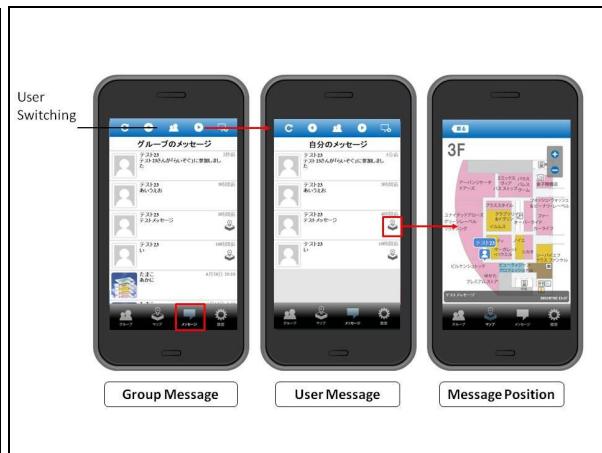
Figure 4: Message screen

(3)Message

In the message screen, users can see the message of the users who are in the same group in the time series. They can see messages of each user with switching a user focus button (Figure 5).

Locations of the messages when the users write are displayed on a map with selecting a map icon next message.

(4)Setting

In the setting screen, users can change the each profile such as a nickname and an image. They can switch a user status too (Figure 6).

As for the status, we prepared three kinds of status in order to control the publicity of users' location and message even if they are in the same group (Table1).
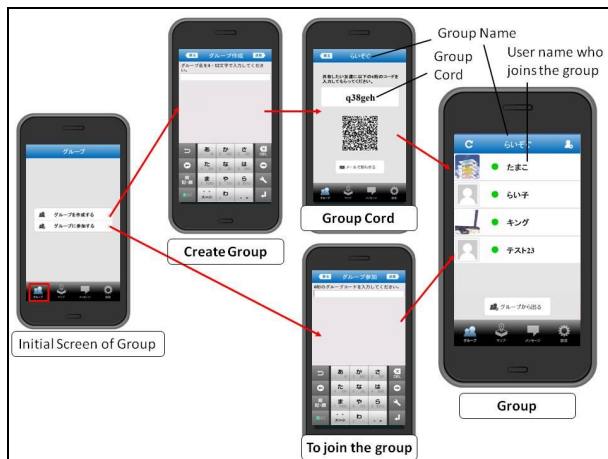
Figure 5: Group screen

Figure 6: Setting screen

Table 1: Status and publicity

	Your location	Group members' location	Your location from group member
On Site	○	○	○
Busy	○	○	×
Off Site	×	○	×

RESULTS
Method
We validated application "TomoCoco" which shares the location indoor in the following environment.

(1)Experiment environment

・Environment: G-Spatial EXPO at Pacifico Yokohama

・IMES Sender: 10 IMES transmitters in the floor

・Mobile client: Galaxy S Android OS2.3

・Network: WiMAX mobile router

(2)Experiment Description

　　Examinees go around the G Spatial EXPO with "TomoCoco" in Galaxy S.

Results
We obtained users' logs such as time, coordinates, message and group in the experiment. As for example, Figure 7 shows the visualized results of history of movement and message of two users.


Figure 7: Results

CONCLUSIONS & RECOMMENDATIONS

We have developed a system to support the visitors, and can understand the movements and interests of the visitors in the facility. We have conducted an experiment in the environment that installed only ten IMES transmits in only one floor.

In the future, we will conduct an experiment in the facility that installed the IMES transmit closely in multi-floor such as shopping mall. We will evaluate the effectiveness of the application by the users and will analyze the movement trajectory and interests of the users.

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