

Information Distributing System Based on User Behavior

A system providing a more convenient information distributing service was developed by modeling user behavioral patterns in department stores and other such commercial facilities, capturing user behavioral routes by active RFID and matching the patterns and routes together. Furthermore, a service based on this system was actually provided at stores on a trial basis.

*Atsuki Tomioka, Kunihiko Fujii,
Yuichiro Miyazaki and
Tomoko Moriya*

1. Introduction

Linkage with infrastructure and services used in real life is being advocated as a new attempt to expand the service domain beyond mobile communication services. In conjunction with the improved performance and sophistication of mobile terminals in recent years, the scope of application of the linkage is expanding as well. One example is the information distributing service aimed at assisting user purchasing behavior in department stores, theme parks, museums, and other such commercial facilities. Information distributing services using mobile terminals in commercial facilities have conventionally resorted to distributing information depending on the location of the user. However, this method had an issue that the same information was consistently being distributed regardless of what the user had been doing before, resulting in no variation in information received by the user.

To address this issue, an information distributing system in which distribution

conditions and timing could be set more flexibly than in conventional methods was built by modeling user behavioral patterns in department stores and other such commercial facilities, capturing the user behavioral routes by active Radio Frequency Identification (RFID), and then matching the patterns and routes together. The information distributing service was actually provided in a commercial facility on a trial basis.

This article explains the overview of the newly developed system, its configuration, and the information distribution process.

2. Service Overview

Figure 1 shows the image of the newly developed information distributing system based on user behavior in use. This system was developed to provide information that assists the purchasing behavior of users in commercial facilities. In this system, information that assists purchasing behavior can be broadly divided into two groups: “information such as

advertisements distributed from a commercial facility (hereinafter referred to as “content”),” and “map information and the user’s current position inside the commercial facility.” The user shows purchasing behavior in the commercial facility while holding a mobile terminal with the active RFID reader attached. The mobile terminal displays a map screen and the user’s current position, and as the user moves, the current position displayed changes as well. Moreover, when the user’s behavior matches a predetermined behavioral pattern, the mobile terminal’s screen displays the corresponding content. For example, it displays a guide to resting places and catering facilities to a user who has been walking around for many hours in stores, a guide to shoe stores yet to be visited by a user who has visited a number of shoes stores, or a guide to underground floors for a user who is about to leave after only visiting the aboveground floors. The system is capable of distributing information in such a flexible manner.

The distribution conditions can be set,

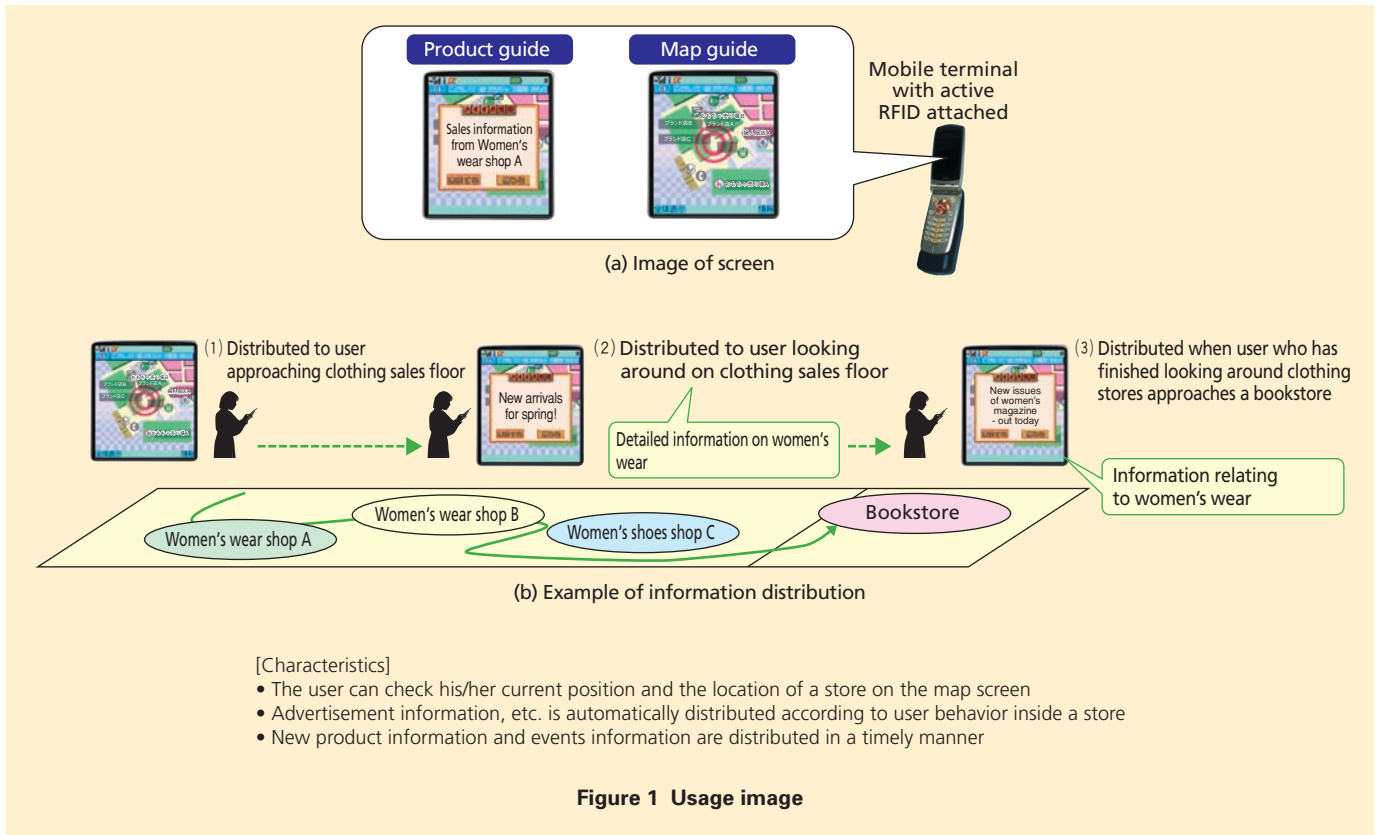


Figure 1 Usage image

including the time, date, and distribution frequency. It is also possible to control the system in such ways as distributing a guide to limited-time sales at a certain time and distributing one-off content. Content can also be added at any time even during system operation. Since added content is immediately downloaded onto the mobile terminal, it is possible to distribute such real-time content as “time when bread will be available fresh from the oven,” “restaurant table availability,” and “lost child announcements.” The mobile terminal accumulates distributed content that can be checked at any time. It is also possible to check the location of the content distributor in the commercial facility by referring to the map screen.

The mobile terminal accumulates and

the server stores information on what kind of route the user had previously taken, in addition to the user’s behavioral patterns, content distribution log, browsing log, and other such information. To protect personal information, the system stores such log data while maintaining anonymity.

3. System Configuration

Figure 2 shows the system configuration. There are three system components: the server, client, and active RFID tags installed in the commercial facility. Attaching an active RFID reader to a mobile terminal configures the system here, with the mobile terminal storing most of the data such as the rules required for distributing information and the content for the following reasons:

- 1) A configuration where the user holds the RFID tag with the reader installed on the commercial facility side requires such work as network construction and server installation in the commercial facility, leading to higher installation costs than in a system configuration that only involves the placement of tags.
- 2) A configuration where content and other such data are placed on the server side to be acquired by the client side prompts communication with the server every time information is distributed, resulting in the possibility of not being able to respond immediately in such instances as “distributing information about a shop that the user has just walked past.” At the same

time, there are concerns over frequent communication between the client and server that could deplete network resources in some places.

- The entire commercial facility is not necessarily within the communication range of mobile terminals. An architecture that requires successive communication with the server may pose uncertainties in providing the service.

Overall system operation involves, except for downloading data when i-appli is activated, the repetition of RFID tag

reception (Fig. 2 (1) and (2)), position information and conversion into user behavior patterns (Fig. 2 (3) and (4)), matching process (Fig. 2 (5)), content display (Fig. 2 (6) and (7)), log uploading (Fig. 2 (8) and (9)), and downloading of newly added content (Fig. 2 (10) and (11)).

The components are described below.

3.1 Active RFID Tag

RFID is a technology whereby a reader reads the ID of an ID-embedded tag via short-range wireless communication using

radio waves. A tag that has its own power supply and emits radio waves is referred to as “active RFID tag,” whereas a tag without its own power supply and driven by radio waves received from the reader is called “passive RFID tag.” Active RFID tags were used in this system. The tag unit has external dimensions of 4.5 (D) × 10.5 (W) × 1.0 (H) cm, and can run for a long time when cable-connected to an external power supply such as a battery. This unit transmits a 128-bit ID at a frequency band of 314 MHz or 315 MHz, and its maxi-

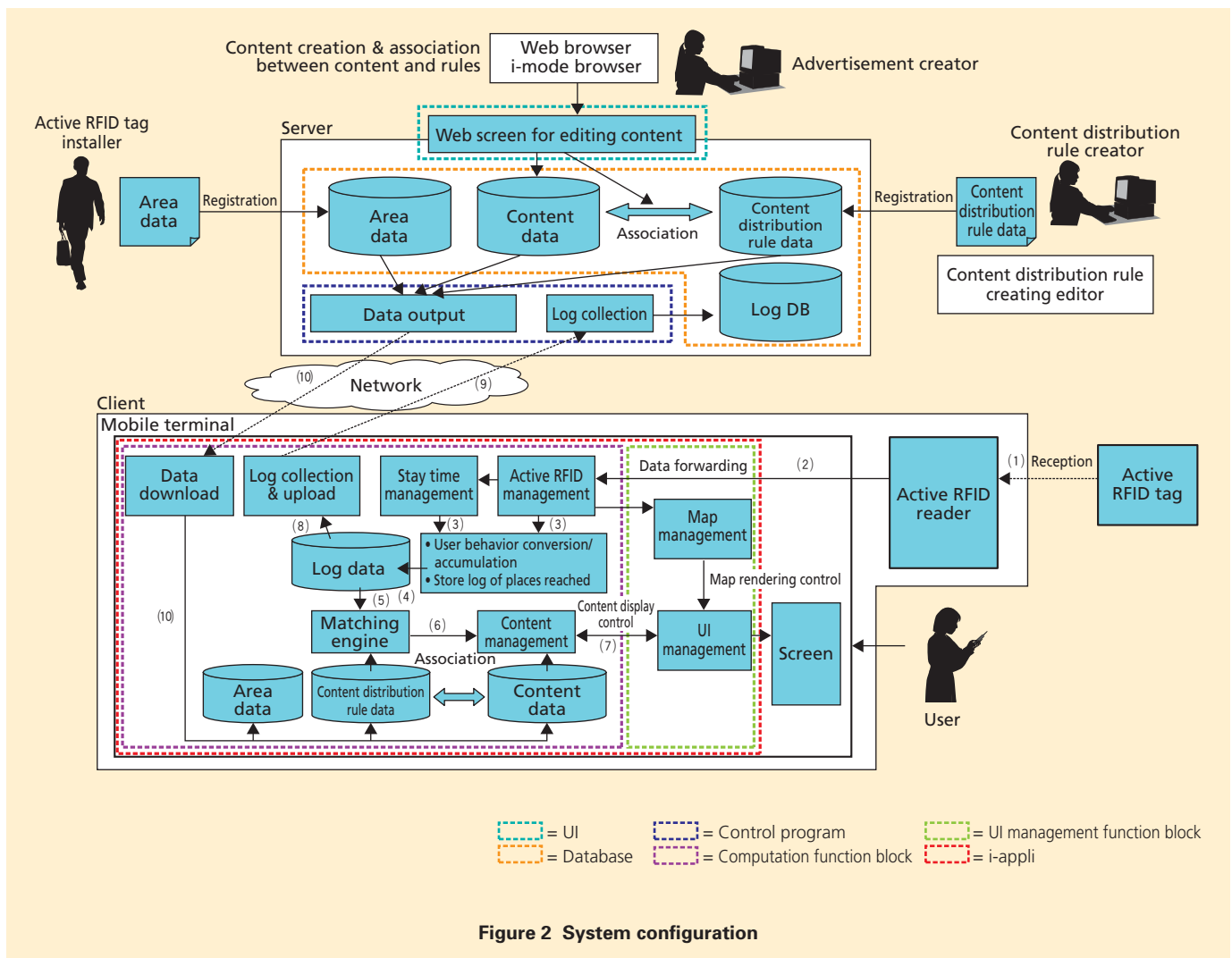


Figure 2 System configuration

mum range is about 10 meters.

3.2 Server

The server consists of a database for storing data downloaded into the client and such log data as user behavioral route data uploaded from the client, a control program for sending/receiving data to and from the client, and a User Interface (UI) for editing content. Content can be edited on a computer's Web browser and the mobile terminal's i-mode browser. Content can also be easily registered by having the server receive e-mail with an image attachment.

3.3 Client

The client consists of a mobile terminal, i-appli running on the mobile terminal, and an active RFID reader connected to the mobile terminal via Universal Asynchronous Receiver Transmitter (UART)^{*1}. Only mobile terminals capable of communicating with UART-linked external devices and i-appli can be used in this system.

i-appli that runs on the mobile terminal can be broadly divided into two blocks: a functional block that manages the UI in general, and a functional block that performs such computation processes as recording position information and matching content. The UI mainly switches between the map screen (for displaying/ updating current position) and the content display screen (for listing/browsing). When content is distributed during map screen display, a dialog pops up showing the content title and name of the content-distributing store, and through user opera-

tion, the screen is switched to one where the details of content can be checked. On the screen that displays content information, both text and images of the content are displayed, with a function made available to check the location of the content-distributing store. The location of the content-distributing store is displayed on the map screen through user operation.

4. Information Distribution Process

Figure 3 shows the information distribution process based on user behavior in a commercial facility. ID in the active RFID tag placed at the entrance to the sales floor of women's clothing is read by the active RFID reader attached to a mobile terminal, and the user's presence at the entrance to the sales floor of women's clothing is acknowledged. The time data is also recorded simultaneously with tag reception and depending on how long the user stays in the area where the tag is placed, the user's behavior is recognized as such specific user behavior as "approached the sales floor of women's clothing." For example, the content of "women's wear shop A" on the sales floor of women's clothing is distributed when there is an information distribution rule for distributing content in response to such user behavior as "approached the sales floor of women's clothing." This kind of distribution rule is referred to as a "behavioral pattern rule." While the example shows a rule defining single behavior, it is also possible to define such sequential user behavioral patterns as

"approached the sales floor of women's clothing but did not enter and moved to another sales floor" in the context of the rule. If the received ID has changed, the user is deemed to have moved from one place to another and a record of the number of times the user has arrived at the place indicated by the newly received active RFID tag is incremented by one. Since the number of times the user has arrived at a place indicated by an active RFID tag is recorded on the mobile terminal, this information can be used to set an information distribution rule such as "distribute content on books relating to women's wear at a bookstore to a user who has visited women's wear shops A and B at least once." Such an information distribution rule is referred to as a "place-dependent rule." Both a "behavioral pattern rule" and "place-dependent rule" can be combined to form a rule called a "complex rule." The conditions of information distribution rules can also be set in terms of distribution frequency, distribution time, and distribution period, thus making it possible to finely control the timing of distributing information by combining these conditions.

5. Overview, Results, and Discussion on Trial Service

According to the results of a questionnaire survey conducted when a trial service based on this system was provided to more than 600 users at a shopping center for a two-week period in September 2006, more than 80% of the users found the system convenient, and thus confirmed user need

*1 **UART:** A generic term or connection interface standard for communication control circuits that mainly perform parallel-to-serial and serial-to-parallel data conversion between computers and external devices connected to them.

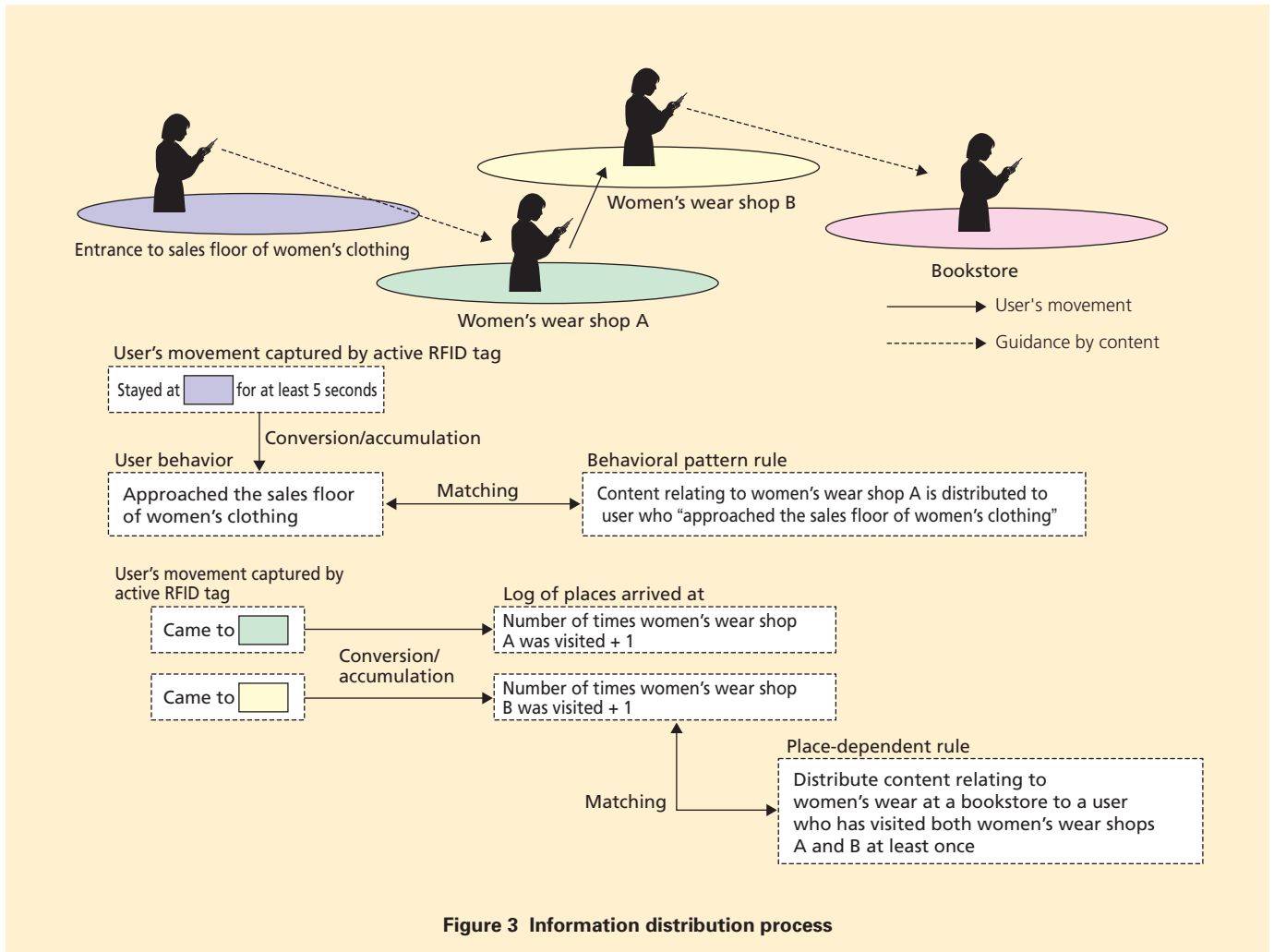


Figure 3 Information distribution process

for “a service that distributes selected information at the right time.” On the other hand, more than half the users wanted a function to actively search content, which suggested that users seek assistance not only in unplanned purchasing behavior but also in planned purchasing behavior.

6. Conclusion

A system was developed that, unlike conventional information distribution methods, enables the distribution of information based on user behavior in commercial facilities, and a service based on

this system was provided. As a result of providing the service on a trial basis, the convenience of the system and extent of user need for such a system were confirmed through user evaluation.