Spot Information Navigator

Hiromitsu Tanabe†, *Tamio Kihara, and Takashi Honishi*

Abstract

To provide advertising information effectively, one must consider when it is provided, as well as where and how many times the customer encounters it. In the future ubiquitous society, the systems using various kinds of sensors connected to the network will be needed. Spot Information Navigator gathers data about shopping conditions in real time through radio frequency tags, camera images, and other types of sensors, and provides appropriate advertising information to customers accordingly.

1. Effective advertising

In the field of marketing, one growing area is recency effects (recency is the property of having happened or appeared not long ago). For example, purchasing decisions often depend not on the number of times the customer encounters an advertisement, but on the timing of the encounter. Average spending per customer can be increased by expanding customer traffic in a store using "cross-merchandising", in which information is provided across several sales locations and in relation to multiple products. One example of this would be attempting to increase sales of both beer and snacks by placing advertisements for the snacks where beer is being sold. (In Japan, people often drink beer when eating *yakiniku* (grilled meat), so placing posters advertising *yakiniku* as well as beer in beer shops might be effective.)

Putting this type of co-marketing into practice requires an information providing technology that focuses on the sales location (referred to here as a spot), and the system should adapt to the circumstances of the individuals or groups in that spot, as well as the products and other objects present.

2. Outline of Spot Information Navigator

Spot Information Navigator, which is undergoing research and development at NTT Cyber Space Laboratories, is a system for providing information to the individuals or groups in that spot. It gathers situation data about the conditions in a given spot in real time and performs appropriate actions. As a result, the people in the spot notice the information and their behavior is affected by it. Service providers or the parties providing the spot can expect to enjoy a range of benefits including increased purchase rates and a rise in the popularity of these sales spots.

Here, we use the term "spot" to refer to a region of space where the situation is understood and information control is conducted. Examples of such spots might be sales locations within a shop, or the shop itself within a shopping mall. Stations, concourses, and train platforms are other examples.

3. Approach

Figure 1 shows the concept of a service in which the Spot Information Navigator is applied in a shop. When a customer approaches Spot A, the system begins to play back an audio/visual advertisement, presenting attractive sound and images that catch the customer's attention. In this way, the customer can be made aware of the advertisement, and recency effects can be expected. Besides simply playing standard advertisements when the customer arrives at the spot, if the system can access the customer's profile via the shop's frequent customer programs, it can present customized advertisements directed at that individual, thus enabling even more effective marketing.

† NTT Cyber Space Laboratories
Yokosuka-shi, 239-0847 Japan
E-mail: tanabe.hiromitsu@lab.ntt.co.jp

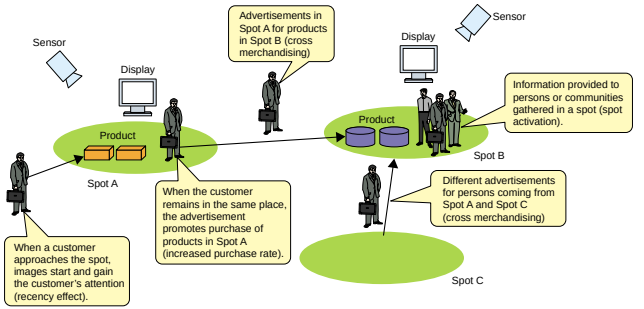

Fig. 1. Service image for Spot Information Navigatior.

Furthermore, if the customer stays for longer than a certain period of time, the system interprets this to mean that the customer is interested in that spot and provides relevant information.

Advertisements for a product placed in a given spot can be shown in the same spot or in a different spot (Fig. 1). In this way, the customer can be encouraged to move from Spot A to Spot B, thus enabling cross-merchandising. Moreover, the system can change the advertisements displayed in Spot B depending on whether the customer comes from Spot A or C.

When there is more than one customer in a given spot, information control is required to maximize the effects for both individual customers and all the customers in that spot. There are a few different methods of providing this information navigation. For example, individual advertisements with a short playback time can be played one after another, advertisements can be directed at "excellent customers" who have made large purchases before coming to the spot, or advertisements can be directed at the decision-maker among the group, such as the mother rather than her children.

4. System configuration

Figure 2 shows the system configuration of Spot Information Navigator. Each spot is equipped with sensors geared toward the type of data to be gathered and output devices (such as displays and speakers) for providing information to the customers. A Spot Information Navigator server is installed on the center server side. It consists of an "actual space metadata allocation mechanism" for creating the metadata about the actual spot space, a "metadata matching mechanism" for monitoring the spot situations, and an "action execution mechanism" for executing the actions when a specified situation occurs in the spot.

The sensor server must be connected to the sensors and output devices in each spot via a network. This sensor-based configuration can provide information tied to multiple spots and can provide information based on past history data. Below, we explain the various elements of the system.

4.1 Gathering data about conditions at a spot

Figure 3 shows an example of the space configuration when the sales location in a shop is considered as a spot. The display and speakers required to play back information are installed in the product shelves where customers can see them easily. Sensors are installed according to the situations to be monitored. In this example, radio frequency (RF) tags and video cameras are used as sensors.

Each RF tag contains a unique ID. These IDs are picked up by a receiving antenna and individually identified. There are two types of RF tags: active and passive. We used active tags, which have internal batteries and transmit their unique IDs at regular intervals.

Antennas are installed at the spot to pick up the radio waves transmitted by the RF tags, and the sen-

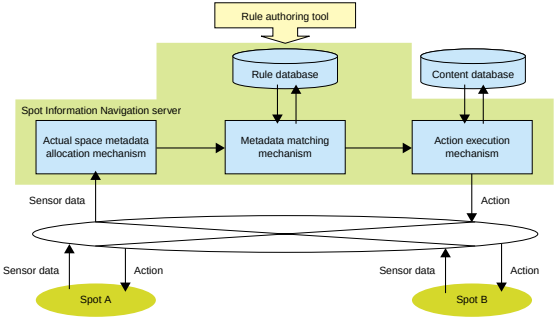

Fig. 2. System configuration.

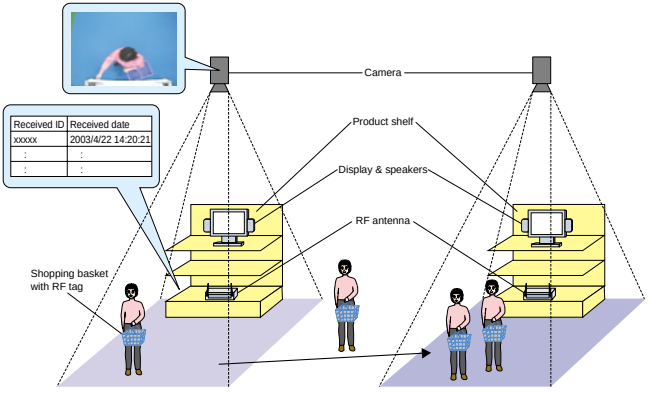

Fig. 3. Configuration of spot spaces.

sitivity of the antennas is adjusted to roughly match the area of the spot. An RF tag is installed on each shopping basket and cart in advance. In this way, ID reception begins when a person with an RF tag enters the reception range of the antenna. It is possible to obtain information such as the movement history of each RF tag between spots or how long each RF tag remained in each spot. By establishing a connection in advance between the tag's ID and a frequency program or other customer information, we can identify the individual based on a customer profile.

A video camera installed above the spot monitors the user behavior. It captures images of people in the spot, distinguishes people from the background, and extracts the human forms. The central coordinates for each human form are calculated for each frame of the video. Then, by calculating the changes in central coordinates for each video frame, the system can calculate, in real time, the speed and acceleration of the human figures etc. In this way, we can obtain a wide range of information related to customer behavior, including how many users are in which position within the spot or whether the users are facing the shelves or facing away from the spot. Two sensors can also be combined to gain a complete understanding of the situation: for example, we could recognize that "a person who approached the shelves in Spot A has reached Spot B".

4.2 Creation of actual space metadata

The sensor data obtained in each spot is gathered in the sensor server. In order to convert this into information that expresses the spot situations, meaning must be assigned to the gathered sensor data. Here, we refer to this sensor data with attached meaning as "actual space metadata". When a video camera is used as the sensor, the actual space metadata is created from the information obtained from the video images, such as the number of people and direction of movement. Converting the situations into metadata simplifies the process of rule description, as explained below, and also facilitates referencing after this information has been stored in a database.

4.3 Metadata matching

According to the situation in the spot, an action is performed. For example, "the advertisement is played back on the display when the customer comes to the spot". The relationships between these situations and actions are described in rules. We have provided a "rule authoring tool" for describing these rules.

The rules describe the conditions that must be fulfilled, including actual space metadata, history information, and sensor information. They can also describe multiple actions, such as creating a playlist that contains the optimum contents and playback order for a given spot.

Sensor information from the spot is continually sent to the server, where it is converted into actual space metadata. The metadata matching function monitors whether the actual space metadata created fulfills the conditions described by the rules—that is, whether a specified situation has occurred in the spot. This does not necessarily mean that only one situation will occur in a given spot at one time; two or more situations may occur simultaneously. The question of which situation takes precedence can be resolved by establishing a "rule priority" when the rules are described.

4.4 Action execution

When it is determined through metadata matching that a specified situation has occurred, an action is executed according to the relevant rule. The action execution function controls the actions for a given spot. When an action is to be executed in that spot, optimum timing must be used to ensure that the effects obtained are those intended by the spot or service provider. Examples of timing are immediate execution, execution after completing the currently playing contents, and execution after a specified period of time. The timing can be specified when the action for the rule is described.

When the timing for action execution is controlled, there may be cases in which several actions could be executed at the same time, so it is necessary to control the order in which actions are executed. This order is controlled by the action execution function.

5. Action execution status and usual status

It is important to ensure that people in the spot get the impression that there has been a dramatic change in status before and after the execution of a particular action. For example, contents must be adjusted to impress upon a person in a given spot that playback has begun: quiet contents are played back under usual conditions and more upbeat contents are played back when the action is executed. We have prepared a tool for scheduling usual conditions in the spots to define actions in the context of usual status.

6. Future developments

Spot Information Navigator executes actions in spots, but the contents determine whether the action will affect people there or not. Furthermore, because the intentions of the spot or service providers must be expressed in the form of rules, rule creation is a burden for them. We will continue to promote research and development on rule creation mechanisms by developing authoring tools for creating contents that will maximize the effects of Spot Information Navigator and by describing services that can be provided in spots.

References

[1] J. Novo, "Drilling Down: Turning Customer Data into Profits With a Spreadsheet," Booklocker. com., 2002.

[2] T. Kihara, "Multi-user Navigation System Manipulating Real Video Images," DICOMO2002 Symposium, IPSJ, Nishi-Izu, Shizuoka, Japan, July, 2002 (in Japanese).

[3] T. Kihara, M. Kusahara, and H. Yasuda, "Spatial Artworks and Networking Artworks," IPSJ Journal, Vol. 44, No. 2, pp. 212-222, 2003 (in Japanese).

[4] H. Tanabe and T. Kihara, "Information Navigator making Real World Meta-data," DICOMO2003 Symposium, IPSJ, Akan, Hokkaido, Japan, June, 2003 (in Japanese).

Hiromitsu Tanabe

Information-Base Project, NTT Cyber Space Laboratories.

He received the B.E. and M.E. degrees in industrial systems engineering from Tokyo Institute of Technology, Tokyo in 1996 and 1998, respectively. In 1998, he joined NTT Information and Communication Systems Laboratories. He has been researching geographical information systems and database management systems and is currently researching metadata management systems. He is a member of the Information Processing Society of Japan (IPSJ).

Tamio Kihara

Senior Research Engineer, Information-Base Project, NTT Cyber Space Laboratories.

He received the B.E. and M.E. degrees in industrial and systems engineering from Aoyama Gakuin University, Tokyo in 1989 and 1991, respectively. He joined NTT in 1991. He has been engaged in the research and development of interactive media systems. He is also an Associate Researcher in the Research Center for Advanced Science and Technology of the University of Tokyo.

Takashi Honishi

Senior Research Engineer, Supervisor, Information-Base Project, NTT Cyber Space Laboratories.

He received the B.E. degree in electronic engineering from Kyushu Institute of Technology, Fukuoka in 1981 and the M.E. degree from the Interdisciplinary Graduate School of Science and Engineering of Tokyo Institute of Technology, Tokyo in 1983. In 1983, he joined the Communication and Information Laboratories, Nippon Telegraph and Telephone Public Corporation (now NTT), Kanagawa, Japan. He has been engaged in the research and development of multimedia database management systems and is currently researching metadata management systems. He is a member of IPSJ and IEEE.