

A Study on Membership Certification and Customized Information Service Using RFID Tag

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Abstract. The system proposed in this paper is to provide customized information to member users using RFID. Using RFID tags, the system provides customized services to member users as well as various information including disaster or danger-related information, via an information and communication device. UID, ID, and key values are encrypted/decrypted via a simple XOR computation, and the processing speed has been verified to be excellent.

Keywords: RFID System, Context-aware .

1 Introduction

Today, across the entire world, advancements in telecommunications and transportation have not only resulted in the rapid increase in the speed of information exchange and spatial movement but also the environment in which we live is evolving into a ubiquitous computing environment in which desired information can be exchanged anytime anywhere in real-time. Accordingly, RFID (Radio Frequency Identification) systems and context-aware services are receiving the attention.

Context-aware services are a computing technology with communication and computing capabilities which incorporates information about the current location of a mobile user (the context) to provide valuable services to the user. Context-aware services and RFID systems have similar functionalities, and are used and researched in similar fields. Context-aware services communicate wirelessly, the same way as RFID, and transmit information that the user needs or information about disaster or rescue to the user via an AP.

2. Related Research

2.1 RFID system

Using RFID technology, a reader can automatically identify, using wireless frequencies, data stored in tags, labels, or cards containing a microchip. RFID systems are a next-generation core technology that have overcome the shortcomings of barcode or self-identification devices and which have been improved to provide convenience of use and storage of large amounts of information. A RFID system is made up of three components: tag or transponder, reader or interrogator, and back-end server.

2.1.1 Tag

A tag is a device attached to a person, object, or animal in order for transmission of direct or indirect identification information. Generally a tag is made up of a single IC chip and a single antenna. A tag has a unique information ID (TID) and broadly classified into an active tag and a passive tag. An active tag has its own computing capabilities and is powered by an internal battery. It can transmit data up to few tens of meters. However, it is expensive because of the internal battery, and its life is dependent on the life of the battery. A passive tag doesn't contain a battery but rather gets its power by way of electromagnetic induction using the radio waves sent by the reader. As the transmission power of the tag is weak, its transmission range is shorter compared to an active tag. As such, it is mostly used for short distance information communication.

2.1.2 Reader

A RFID reader is a device that communicates with a tag in order to collect information from it, which it sends to a middleware. It is made up of a RF analog component and a digital signal processing controller. The RF analog component performs such functions as power transfer and analog signal processing while the digital signal processing controller is made up of a decoder and an encoder. The RFID reader can be classified into fixed and mobile types. The fixed type receives tag information wirelessly and sends that to a server. The mobile type contains a wireless network interface in order to send tag information received wirelessly to the server. The principle role of a reader is to transmit tag information so that a sub system or back-end server can analyze it.

3. Proposed System

The system proposed in this paper uses RFID tags to distinguish between members and non-members. It provides differentiated and customized services according to whether the mobile user is a member or a non-member. For members, the system searches member information stored in the database and provides customized information services on their smartphone, PDA, tablet PC, or some other information communication device based on the user's tendencies, type, or shopping information so that they can do shopping more quickly or handle dangerous situations.

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A reader installed in a shopping mall or at the entrance of a store reads and transmits all identifiable tag data to the server, which queries the database with the tag data in order to distinguish between a member and a non-member. The configuration of the system proposed is shown in Fig. 1.

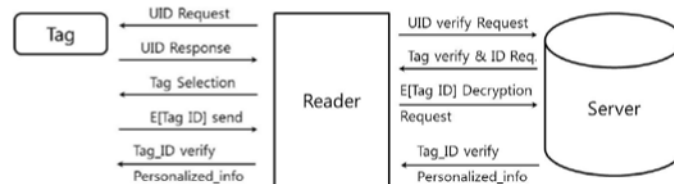


Fig. 1. Proposed system

In the proposed system, there is a separate individual server for each shopping mall or store. The reader reads the UID of all tags within its range and sends them to the server. The server queries the database with the ID received from the tag in order to distinguish between a member and a non-member by whether or not the ID exists in the database and provides differentiated information.

3.1 RFID tag

The tag is a 2.4GHz active tag. Tags and readers can communicate using various RF outputs via the air interface and the distance can be adjusted. The tag contains two values, the UID inputted at the time of manufacturing and the ID assigned when the user became a member. The UID is used when selecting a desired tag among several tags within the identification range of the reader. Only the selected tag transmits the ID when requested by the server. Also, if the user is moving within a store, the tag periodically sends a signal to the reader in the area within range of the reader, in order to track the user location as well as the movement path.

3.2 RFID reader

A reader is installed at every entrance so that when a mobile user enters the store it can be checked whether they are a member or not. If they are, customized shopping information and various data are requested from the management server and transmitted to the user. The reader can select only a member's tag using UID values of all tags within the identification distance. The ID is requested from the selected tag and sent to the management server, which determines whether the user is a member via an authentication step. If the user is a member, signals are received periodically from the tag in their possession to track their movement path, and this data is sent to the management server and stored in the database.

Also, a computer with the reader connected can store various information including the member list, non-member list, and product list. It can request information from the management server in real-time to keep the information up-to-date.

3.3 Management server

The management server searches the database with the UID and ID transmitted by the reader and if there is matching data, transmits to the user context information after analyzing the user's shopping information, type, and tendencies. The server can transmit special information to the user in real-time, and transmits information with which dangerous situations can be handled immediately. The RFID tag and server distinguish between members and non-members by sending ID encrypted via mutual authentication. For members, the server provides customized services. Different keys are generated for different users for the encryption, and the keys can change at regular intervals to prevent the problem of key inference. The reader requests the user's tag UID using the server's certificate, and the user sends their certificate and UID to the reader. The reader requests the user for the ID and the user sends it. The reader sends the ID to the server again to check whether the user is a member, and if so provides to the user through the reader customized shopping information and other useful information.

4. Conclusions and future work

In this paper a RFID system is used to distinguish users and predict information necessary for the user in advance to provide services. For members, the ID is issued using a membership card or an information communication device that contains a tag, and when the user approaches a shopping center or a specific building, the tag information is recognized and the user is provided with differentiated information including customized shopping information and information regarding disaster or rescue in the case the user is a member.

For future work, context-aware services and a RFID system can be linked together to provide advance information regarding travel agencies, missing child prevention, protection of elderly suffering from dementia and disaster and rescue, so that the system can be extended to one that can prevent accidents.

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