

A RFID/NFC Fusion based Smart Refrigerator for Wellness Service

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Abstract. In recent, the diet is one of a trend of the world for making a wellness life. However, the diet management depending on the characteristics of each person has a limitation. Thus, in this paper, we propose a smart dietary management not only patients but also regular users for supporting a wellness service. And then, we develop a smart phone application for providing a wellness service to each person. According to the experiment results, we can improve the utility of common smart refrigerator.

Keywords: RFID, NFC, Fusion, Smart Refrigerator, Wellness Service.

1 Introduction

Currently smart refrigerator's diet management is fitted on users that need special management. But these diet management services are provided comprehensively to special patients according to nutritionist's opinion without patient's circumstance. It can make numerous difficulties in using the general person. Therefore we propose a new method that all users receive the proper diet management according to user's circumstance. For instance, we will construct the system using the fusion of RFID and NFC. The proposed system is automatically saving the item list. In addition, we create the smart phone application that is connected with smart refrigerator. The smart phone application will receive the database from the smart refrigerator. Finally, we provide the diet management service through the received database.

2 Smart Refrigerator / Application / Diet Management

The smart refrigerator is operated by using the integration of RFID system and NFC device. Basically the RFID system recognizes the tag and saves the item information as database. Also, we use additional NFC device for operating the RFID system whenever smart refrigerator's door is opened. As shown in Fig. 1, we propose and develop a smart refrigerator operation algorithm under the assumption 1) and 2).

1) The tag information can be rewritten. In general, a tag is attached on the item directly. However, sometimes a tag is attached on the container that has items. In this

case, the tag information should be rewritten. Thus, we develop our software that can rewrite the tag information using the correction function.

2) We assume that the smart refrigerator door is operated by the NFC device. For checking the status of the items, we use the NFC for the smart refrigerator door. In particular, the radio frequency wave of RFID can be harmful if RFID system operates continuously. Thus, the RFID system can operate when the users open the door.

For instance, in our system, the NFC reader is connected with NFC tag by default. When the connection is cut off, the NFC reader decides that the door is opened and then the server of our system (e.g., Personal Computer) operates the RFID system. The RFID system recognizes the tag information of the item. When the NFC reader is connected with NFC tag again, our system decides that the door of smart refrigerator is closed. The RFID system stops the operation of the antenna. Finally the recognized tag information is sent to the server of our system.



Fig. 1. Smart refrigerator operation algorithm

The smart application is a mobile application that gives the item information to the user. Particularly, if the user selects the recipe, this smart application informs whether goods are saved in the refrigerator or not. For example, the smart application shows database information of our system such as item name, expiration date and time of recognition. In addition, the smart application pushes notification to the user in order to notify the expiration date of goods.

For diet management, we classify of the recipe. For supporting a proper service to the user, we compose the diet depending on the disease. Especially, we compose the diet database of our system by referencing the researches [5-7]. For example, we divide the diet as breakfast, lunch and dinner as shown. This means that the internal circumstance of a smart refrigerator can be changed at any time. Also the diet will be changed by the need of ingredient depending on the disease.

3 Smart Refrigerator H/W, S/W, and Smart Recipe

In section 3, we show the developed prototyping system based on the integration of RFID system and NFC device. In addition, we propose the algorithm to operate smart refrigerator software and smart phone application. The proposed algorithm is helpful to recommend the recipe to the user. Fig. 2 shows the prototype of smart refrigerator

hardware for our research work. We install the RFID antenna that can recognize the tag at the upper side of the table. And we install the NFC reader and NFC tag at the door side of the table. For instance, the door of the table is opened and the connection of the NFC reader and tag is cut off. In this case, the RFID antenna operates to reader the tag information of the item. Particularly, we use the foil inside the table and RFID reader for reducing the range of RFID wave.

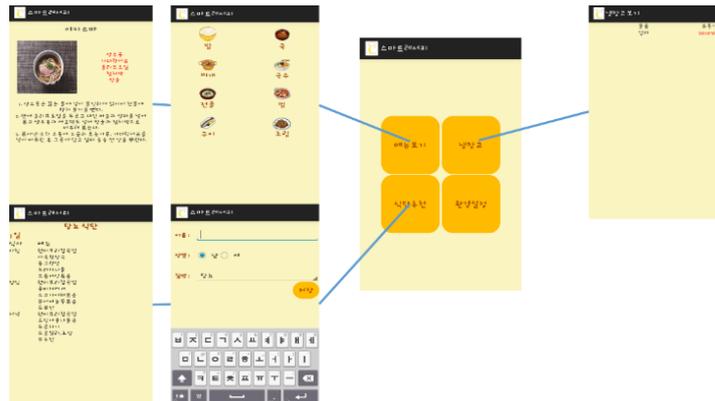


Fig. 2. An example of the smart phone application for supporting a diet recipe

In addition, the smart refrigerator is consisted of two functions such as NFC operation and RFID operation. NFC decides whether the tag is connected to the reader or not. RFID controls the RFID antenna and it can rewrite the tag information of the selected item.

In case of smart mobile application, it has function of offering the recipe information to the user. As shown in Fig. 2, smart mobile application offers a smart refrigerator's internal list through the server. It simply shows the list and expresses the expiration date of the item using different color.

In addition, the smart mobile application shows the ingredient list depending on the existence of ingredient inside the refrigerator. Particularly, it offers the information to the user whether the user buys the ingredient or not.

3.1 The diet management Recommendation

In order to recommend the appropriate diet to the user, the user registers the personal information of the user. Depending on the registered personal information, the smart mobile application confirms each user's health condition and the existence of disease. So, the smart application recommends the diet based on the information made by the classification of diseases that is already stored in the database of our server system.

4 Conclusion

Most of them provide service to specific patients depending on the nutritionist's opinion without considering actual patient's circumstance. To solve the problem, we suggest the diet management service based on the patient circumstance using the integration of smart refrigerator and smart application. Compared to the existing smart refrigerator, our proposed system can make a new solution to the user. However, we can't increase the NFC's utilization in this research. In addition, it is not enough to the all patients' circumstance.

In the future, we will continuously work to improve the utilization of NFC device in smart refrigerator. Also, we will extend the volume of the database for all disease and patient's circumstance to offer the appropriate diet recommendation based on user's preference.

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