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Original Article

The Interaction Inquiry System among Chinese medicine, Western medicine, and Food in the smartphone

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Today, medication gradually increased the proportion of the world, and people pay more attention to the problem of medication safety. Moreover, medication error is the most common type of negligence. In addition, medication error extends another medication worries that is the interactions between food and medicine, such as interactions between Chinese and Western medicine. Hence, we propose a system reminding of taking medicine and interaction between food and medicine, and it is developed on the android platform.

We use voice mode and pull down menus to enter these information of medicine bag. Next, the system plan out medication schedules, and realize the medicine effects and side effect from medicine bag. User can use the information to understand whether an interaction between the food and drug or drug-drug is produced or not. Finally, the important character we needed will be extracted and recognized with our proposed method. All of information about medicines will be stored in the medicines database within smartphone, and then it will trigger the function of taking medicine reminding and the function of interaction food and medicines. Finally, we also use the medicine ontology to make users know the relationship between food and medicines.

We use questionnaire survey for testing the efficiency of system. The results can be divided into two categories questionnaire. The first is the general user and the other is some medical personal. It shows that users have 83% satisfaction. Actually the rate of people who have smart phones, and willing to install this system in smart phones reached 89%.People are busy to forget to take the medicine or eat some food with interactions, and it lead to reduce the efficacy of medicines. From the experimental results, in terms of medication, our system for people who take long-term medicine is very helpful.

Our system not only has a basic reminder but also have interactions inquiry among Chinese medicine, Western medicine and food. In addition, our system allows users to feel comfortable to take medicine, and avoid interactions between medicine and medicine. Our system will automatically plan out the right medication schedule, and achieve the effect of reminding. In diet and medicine analysis, our database is built up based on the lunar calendar of food-drug interactions and Chinese Medicine Interaction of Chi Mei Medical Center. The query of good and medicine interactions have high accuracy, and low error rate. Using our system can enhance and improve the effect of taking medicine, and avoid diet and medicine user-generated conflict situation. We hope that our system can alleviate the suffering of other patients and toil of the disease.

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Introduction

Today, medication gradually increased the proportion of the world, and people pay more attention to the problem of medication safety[1-2]. Moreover, medication error is the most common type of negligence. In addition, medication error extends another medication worries that is the interactions between food and medicine, such as interactions between Chinese and Western medicine[3-4]. Due to the interactions is too complicated, resulting in regularly the user ignored, for example, milk, bananas and grapefruit, these foods may affect the absorption and metabolism of drugs during the medication. It can impact the effect of the drug, and may accelerate or reduce the efficacy of the medicine.

By the Bankole A. Johnson[5] et al, published in Alcohol-medical drug interactions know that alcoholic drinks and drugs can cause serious medical incident. In order to prevent the occurrence of serious interaction, it hopes to achieve the best defense effect. Hence, this paper proposes a website-way reminder, and specifies in detail the severity of interactions between the different drugs and alcoholic drinks. Moreover, the paper hopes to enhance our current knowledge of alcoholic drinks and drug interactions.

The experimental results discovered that it can reduce the incidence of alcoholic beverages and drug interactions for users it lacks the usage convenience. Besides, Sun Kim[6] proposed extracting drug-drug interactions from literature using a rich feature-based linear kernel approach to identify DDI information. The extraction method is support vector machine (SVM). The result will know whether information will produce interaction or not. Here in the datasets uses the Drug-Drug Interaction corpus. The identification rate of this system achieves an F1 score of 0.670. Information for interactions between drugs is not perfect. In addition to interactions between drugs and medicines, we also consider the interactions between food and drugs, according Herb- Pharmacology for Health Professionals[7] proposed nutrient- and food-drug interactions. This paper mention many health food and drug interactions between the impact resistance, but this paper has a few mention in drugs, and did not provide a source labeling, difficult as a reference value. In addition to food and drug interactions, we also refer to the wisdom medication reminder. It not only prevents interaction outside but also to achieve the effect of drugs. According to M. Vervloet[8], who proposed SMS reminders improve adherence to oral medication in type 2 diabetes patients who are real time electronically monitored, and use SMS to remind users to take medicine. This paper is used in patients with diabetes. The results has a significant improvement and through smart phones to remind increased convenience. Finally, it hopes that this system can be used into the smart phone. We search some Apps like as our proposed App from google play store. We discovered that there is only one function in a lot of Apps. Hence, we hope to integrate all the functions, which can provide users with a perfect use of the system. In the literature review, we refer to the Bankole A. Johnson[5] et al. The interaction between the severity of alcoholic drinks and drugs do as the basis to establish the impact of each drug interactions, according to the severity of the alert the user. And we also consider using SVM to identify drug-drug interaction[9-11], but we discovered that the process is too complicated and cannot be reached nearly one hundred percent successful classification rate, but no medical basis for the more sources of information. Hence, we use the lunar calendar of interaction published by Chi Mei Medical Center's drug interactions provide food calendar, the Department of Health in Western medicine committee interaction Information Network[14] and the Ministry of Health and Welfare Department of the Food and Drug Administration Food and Drug open data platform[15] to be as a basis, in addition to ensure medically information, but also can accurately learn relevant interactions. In addition, medication reminder part of our considerations to the newsletter may not be immediate but missed medication reminder, we use the system itself and can be a reminder and a reminder of the process, once again remind the user of possible food and drug interactions, repeated confirmation in order to achieve a sound preventive.

This system mainly hope that it can to improve the currently inconvenient in system, and past studies through continuous improvement, increase medical accuracy and convenience, strengthen the system combines a wide range of use, the development of more practical system. Next we will introduce our proposed method in detailed.

Materials and Methods

The overall system architecture of our proposed system is shown in Figure 1. It is divided into four parts: "the entering of medicine bag and user's personal information", "interaction inquiry", "search a nearby pharmacy", and "systems analysis and database management".

(1)The entering of medicine bag and user's personal information

The user will be reminded to fill in the information base on the medicine bag and personal related information when entering the system. Users can use voice mode to enter these information. The system uses google voice recognition tool to achieve voice recognition task. Because some information is too long to difficultly distinguish, such as medicine name. The system use pull down menus to easy for entering medicine information. We hope that it reduce inconvenient and mistake made by manual input. After fill in the information, the system will automatically be stored them to the database. The stored information can provide users to control and understand themselves health. And, it can plan out medication schedules, and realize the medicine effects and side effect from medicine bag. Finally, user can use the information to understand whether an interaction between the food and drug or drug-drug is produced or not.

(2)Interactions inquiry

When eating food or taking medicine, user can use "Interactions inquiry" to avoid interaction between food and medicine, or between medicines. The part of the interaction of the query is divided into two parts. One is "food-drug interactions inquiry" and the other is "drug-drug interactions inquiry". We will describe them in detailed as follow.

A.Food-drug interactions inquiry

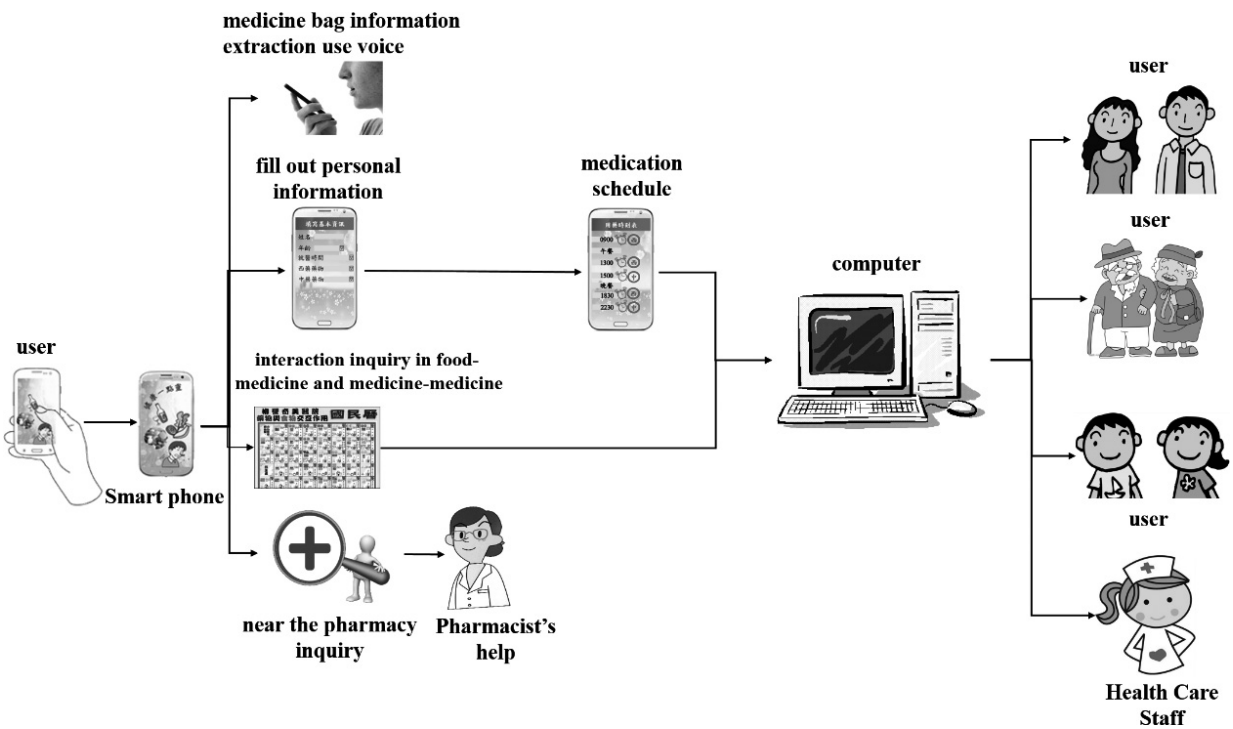

Fig. 1. The system architecture diagram.

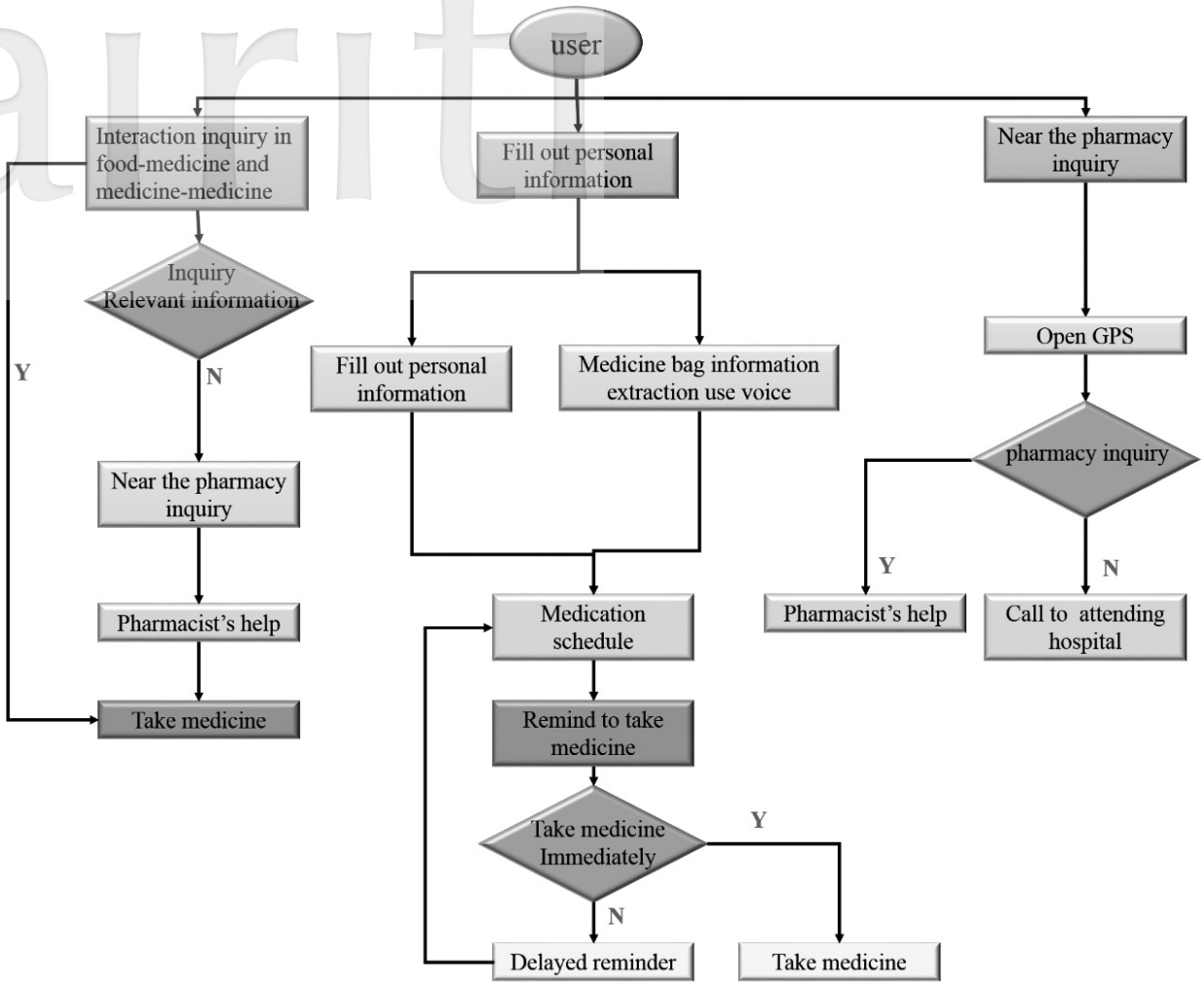

Fig. 2. Shows the processing flowchart of our proposed system. First, users are able to input the medicine bag information through voice mode and manual after receiving medical treatment. Next, through the interaction inquiry of our proposed system, users can understand whether it produces the interaction between food and medicine, or between medicine and medicine. And the system will determine whether there is cross-interaction at user taking medicine or not. Meanwhile, it can plan out the properly taking medicine time, and remind user to take medicine on time. Finally, all data are stored to database in the server. The detailed explanation will be described as the follows.

First, the function is Food-drug interactions inquiry include Chinese medicine with food and Western medicine with food. In order to ensure the information on medicine correctly, we use the lunar calendar of food-medicine and medicine-medicine interactions in Chi Mei Medical Center of Taiwan. Drug herb interactions when obtaining drug information or food information, the system will be able to use two methods to inquiry interactions correctly. For example patients need to take antibiotics, and that patient drink milk for breakfast, the interactions will be produced between antibiotics and milk. Therefore, users can use the system to check the situation of interaction, when interactions are occurring, the system will start sound the alarm and warnings to alert to stop patients taking it. As a result, it can solve the food and drug interactions accidents arising. This paper is the use of off-attached library to build our query function. Fig. 3 shows the relational database tables. In addition, users are also able to experience their own food and drug interactions, input this into App. In this way, it has been able to increase the accuracy of the judgment.

Fig. 3. The interaction relation database in food and drug.

B.Drug-drug interactions inquiry

After that, we considerate many patients are not consumed by only a single drug. They may also take Chinese medicine and Western medicine, or more of the categories of medicine. Hence, it often occur interactions between medicines. Such as stomach and headache medicine eating together will reduce the efficacy of headache medicine. To avoid user generated interaction, the user will be asked fill in the information on the medicine bag and the system will plan out medication schedules. To produce drug interactions take two to three hours interval, not only to ensure medication safety but also to enhance the accuracy of medication. In Chinese medicine, it is very different with Western medicine. Therefore, this paper also use Chinese Medicine interactions provided information network interaction as the basis of our established relational database, and we are using the data capacity of a large and convenient features in mind to build Chinese medicine and Western medicine associated database, use this library to check out whether it will produce traditional Chinese medicine and Western medicine interactions. Figure 4 shows the correlation graph data table.

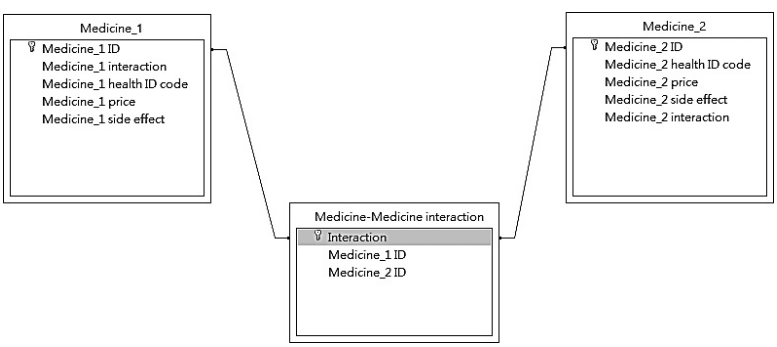

Fig. 4. The interaction relation database between food.

(3)Search a nearby pharmacy

In this function the system provides three ways to search a nearby pharmacy, for example, within one kilometer search, Regional search, and GPS positioning search. We hope that users can search a nearby pharmacy or hospital quickly, and deal with related problem. The system employs GPS and Google Map convenience, and allows users to interact in the production before or after finding a nearby pharmacy or hospital quickly. Besides, the system also uses GPS to indicate the location of the user nearby pharmacy or hospital, and can find the relevant position quickly and accurately through map guide. In order to enhance the system more accurate query location, we use the food and medicine Open data about Ministry of Health and Welfar to set up within one kilometer search and Regional search. After inquiry, the system provides, pharmacy phone functionality, user can resolve current problems quickly by phone, such as interaction, and reduce more serious effect from each problem. Finally, using different way to search a nearby pharmacy and hospital can increase user's usage interaction besides providing search services accurately.

With the user through voice and pull down menus to fill in the medicine information combining the food-medicine interactions lunar calendar of Chi Mei Medical Center in Taiwan, with the food and medicine Open data about Ministry of Health and Welfar, we will build up the database and do a comparison between food and medicine. When producing a interaction between Chinese medicine and food, Western medicine and food, Chinese medicine and Western medicine and Western medicine and Western medicine, the system will alert the bell to remind the user to be careful. Hence, users can avoid health hazards to the seriousness of the interaction.

(4)Building database

We use the SQLite database on the smartphone to store all information. Because SQLite database has cross-platform features and supports most operating systems. SQLite database occupied few resources and it will run fast in the embedded system. We build up Western medicine database, Chinese medicine database, food database and medication information database, according to the lunar calendar of food-medicine interaction of Chi Mei Medical Center in Taiwan, Drug Herb Interaction, and the food and medicine Open data about Ministry of Health and Welfar. At the same time establish a relationship between the four databases.

The following are described in detail in this paper using these datasets, and on the main data capture technology.

A.Food and medicine Open data about Ministry of Health and Welfar

The information about medicine in our system is based on the food and medicine open data about Ministry of Health and Welfar in Taiwan (FDA). Through data collection, we can retrieve the name of western medicine, use way, side effects of medicine and health code. The data collection and medicine card business management system

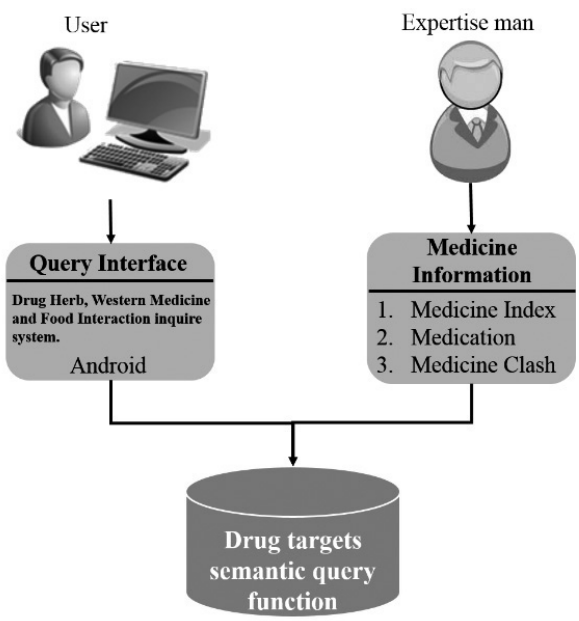

Fig. 5. Drug targets semantic query function

synchronized weekly, and provide nurses and patients to reference. Besides, the information of pharmacy locations is also captured by this platform. The database provided drugstore name, address, telephone and other basic information. The system can facilitate the location of new pharmacies, and provide user to ask the relevant information any time.

B.The interaction between Chinese and West medicine

According to related research understand that some of the herbs in Chinese medicine can interact with medicine, have serious side effects, or be unsafe for people. Here, the interaction about Chinese medicine and food are built base on Chinese Medicine Interaction. Chinese Medicine Interaction database provided Chinese drug name, the English name of medicine, consumption mode, side effects and interaction. We use the information to build up our database.

We let user use voice recognition of Google API and pull down menus to fill out personal data. Voice recognition through Google API can achieve optimization, and can reduce the time spent on the input. Then system provide pull down menu to avoid some problems caused by

Finally, in the medicine information, there are many correlation properties. It often occur with queries not related to information in query step, for example, query aspirin and want to know which foods produce interaction. Unfiltered information will be displayed medicine health code, English name, side effects and interactions form. The information is very important for taking medicine. Hence, user can obtain accurate and relevant information through our system. This paper use semantic web technology to establish the drug ontology-based semantic query function and food ontology-based semantic query function. The semantic web technology allows the system to be able to interpret ontology for semantic information, enhance the accuracy and efficiency of information search. The main purpose of the drug and food index semantic query function is to help people to have a complete medication semantic query. Users can quickly and accurately inquiries related to medication and diet information self-health

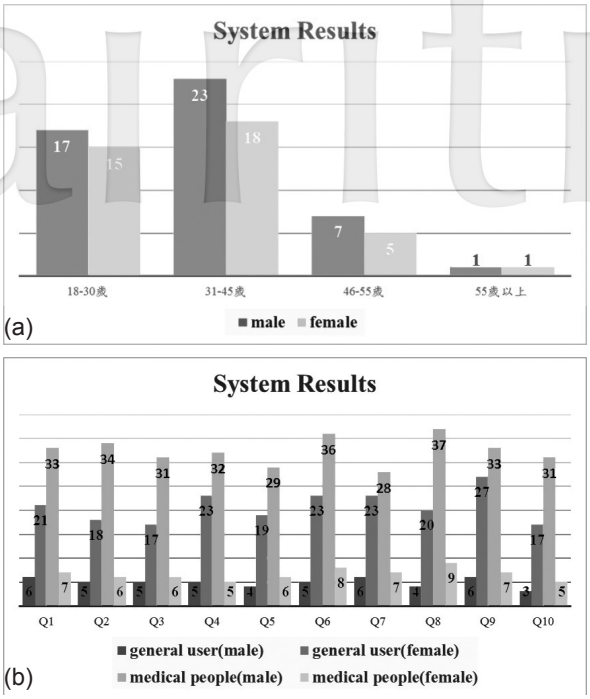

Fig. 6. (a) and (b) the results of questionnaire

Next, we will introduce the system uses the process. Before entering the system, the system will require the user to fill in his name. To ensure that the information is the same message each time user input. Here, user can use voice mode to fill in personal information.

management. To medicine for example, Fig.5 shows a diagram of the drug index of semantic inquiry function.

Results

The system is implemented on smartphone. This smartphone is HTC Sensation XE Z715e, it has 4.3-inch touch screen, resolution is 540 × 960 qHD, processor 1.2 GHz, dual-core, and RAM is 768 MB. The phone built-in storage space: 1GB. Next, we use an electronic questionnaire and provide program to let users test it.

We put this system on Google play to let people download it. And, there is electronic questionnaire within this system. The usability and convenience of the system can be analyzed through the electronic questionnaire.

We issued 100 questionnaires to let users fill in. There are 87 valid questionnaires and 13 invalid questionnaires in 100 questionnaires. Hence, the response rate is 87%. These invalid questionnaires include incomplete or repeat fill in questionnaire. The ratio of male to female is 16:13. The results are shown on Fig.6. It can be divided into two categories questionnaire. The first is the general user and the other is some medical personal. According to statistical analysis, there are 44 questionnaires to the general user. It has effective recovery of 37, and there are 8 males and 29 females to fill in questionnaire. The system satisfaction rate reaches approximately 78% (29/37). Actually, the rate of people who have smart phones, and willing to install this system in smart phones reached 89% (33/37); and there are 56medical people to fill in our questionnaire, effective recovery is 50, and there are 40 males and 10 females. The system satisfaction reaches approximately 88% (44/50). Actually the rate of people who have smart phones, and willing to install this system in smart phones reached 89% (46/50). Other from advice. Most users agree that the runtime of this system is very quick, and it is easy to use. It can be effective in helping them to take drugs and healthy eating.

(1)The system main interface

In our system, the interface is divided into six parts, including the emperor system interacted inquiries, personal information, schedule, pharmacy queries, related medication history information and questionnaire.

A. Interaction inquiries: After Click to enter the system, user can search the interaction of the relevant food or Chinese and Western medicine.

B. Personal information: Users fill in personal information using voice mod or pull down menus.

C. Schedule: Through personal information in personal information part, the system will produce medication schedule according to taking medicine time.

D. Pharmacy queries: User can choose within one kilometer to search, Regional to search, and GPS positioning to search.

E. Medication history information: Through this function, users can better understand

their medication habit aspect, and prevent the occurrence of interactions.

F. Questionnaire to fill in: We collate feedback from users fill in electronic questionnaire to improve or modify the system. It can make this system more perfect.

(2)Interactions inquiry

Users use it to know what their own medications and foods interaction, after entering the keyword. The system can obtain relevant information immediately. In this part, it offer western medicine inquiry, Chinese medicine inquiry and medicine with medicine inquiry, hope to reach several inquiries. The system provides the user much more important information.

(3)Fill in profile

After medical treatment, users can use smart phones through voice mode in the smartphone and pull down menus to fill in the personal information within the medicine bag. Next, the medication schedule planning will use the information.

(4)Medication schedule

According to the user's personal information on the medicine bag, system will plan out a personal medication schedule to provide users with reference and remind user to take medicine in time. Schedule the exclusion of Chinese medicine with Western medicine, Chinese medicine with Chinese medicine and Western medicine with Western medicine some interaction can plan out the good taking medicine schedule. When the alarm of our system woke up to remind users to take medicine, the system is according to medicine information filled in by the user to remind what foods should not be eating. If eating foods will cause interactions, users can delay the time to take medicine through our system. In addition to avoiding the interaction between food and medicine, our system ensures that users can take medicine to achieve therapeutic effect.

(5)Search nearby pharmacy

In search nearby pharmacy part, we use the food and medicine open data about Ministry of Health and Welfare and GPS to build up pharmacy inquiry. There are three ways to search the nearby pharmacy: within one kilometer to search, regional to search, and GPS positioning to search. Through the food and medicine Open data about Ministry of Health and Welfare, we have established the most comprehensive nearby pharmacy query system. There are some reasons for using this function. First, when users taken medicine, medication can produce interaction. Next, users want to perform medication consultation and buy some medicines. When users start this function, they can use google map to find the nearby pharmacy. Or, they can search the pharmacy with one kilometer. Finally, they can click the pharmacy phone number to directly call pharmacy. The directly calling function avoid inconvenient for inputting phone number. And, it can avoid many dangerous for taking medicine or interaction. Final, the system allows users to get the right medical information in a short time.

Conclusions

With the growing number of elderly and medication, the right time and taking medication safety is an important issue. If users take medicine absolutely, not only control the disease early but also reduce the time spent on medical costs. On the other hand, while taking the medicine does not based on the diet, it may produce interaction and lead to take medicine dangerous, and there is no food and medicine interactions instantly alert the App now. Let our system becomes more importance. About references, we can know when the food and medicine generates interactions, possible happen to life dangerous. To avoid more dangerous medication we propose a smart Chinese medicine, Western medicine and food interactions query system. It hopes that users are able to grasp their diet and medication safety anywhere.

Our system not only has a basic reminder but also have Chinese medicine, Western medicine and food interactions query. In addition, our system allows users to feel comfortable to take medicine, and avoid interactions between medicine and medicine. Our system will automatically plan out the right medication schedule, and achieve the effect of reminding. In diet and medicine analysis, our database is based on the lunar calendar of food-drug interactions and Chinese medicine interaction

of Chi Mei Medical Center. The query of good and medicine interactions have high accuracy, and low error rate. We will also be uploaded to the system available for download on Google Play. The download rate is up to 500 people. Finally, using our system can enhance and improve the effect of taking medicine, and avoid diet and medicine user-generated conflict situation. We hope that our system can alleviate the suffering of other patients and toil of the disease.

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