

Development of a Health Care Assistant App for the Seniors

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Abstract: Taiwan's advanced health care system is one of the world's best health care services. Elderly citizen and chronically ill patients benefitted from this system the most. However, under this system, patients can only get brief description about drugs and directions of their usage printed on the medicine bag. With rapidly development of mobile devices, helping patients to obtain critical medication information with mobile technology is an important issue. Currently, medical-related Apps on the App marketplace only allow user to query general drug information. Furthermore, for patients have two or more drugs, they need to inquiry drug information one by one, which is quite troublesome for the elderly patients. Therefore, the objective of this study is to solve the above problems by developing a "Health Care Assistant" App. It can provide personal medication care, food care, as well as drug information for the patients. This App has nine functions with amazing images and vibrant colors including: making an appointment, recommended pharmacies, health news, personal settings, diet lights, medical records, scanning prescriptions, transfer prescriptions, drug information. The distinguishing feature of this App is integrating with the national health insurance (NHI) declare system and health care system of Taiwan, so users can get the latest personal medical information without complicated process.

Keywords: App; health care; prescription.

1. Introduction

Medication care is an indispensable part in daily life. Before the information age, handwritten prescriptions were used by the physicians and these documents cannot be shared or stored electronically. The contents are not structured data thus cannot be processed by computers. The patients get very few information about the usage of drugs from the prescriptions and thus resulted in many wrong medication situation. The electronic health records (EHRs) contain standard medical and clinical data gathered from all the health care providers that include more comprehensive medical history of a patient. All the personal information and medical records (including prescription time, physicians, drug records, etc.) of a patient are stored electronically. Therefore, the EHRs allow easy navigation through the entire medical history of a patient and are available whenever and wherever.

According to the survey Figure 1 done by iThome, a lot of App inventors are needed in 2014. In addition to science and technology industry, healthcare, financial and services industry offer App development job openings. The medical industry along requires 33.7% of the demand. It's evident that medical industry needs remarkable potential App inventor [1]

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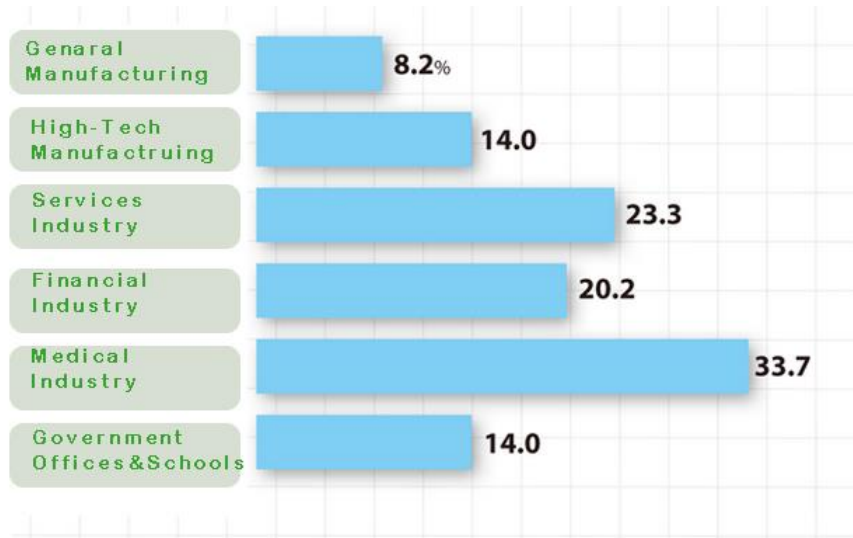


Figure 1. 2014 App development needs of each industry [1]

In 2014, about 65 percent of Taiwanese own smart mobile devices (including smart phones and tablet PCs) [2]. These mobile device users spend more time on their apps than ever before. Therefore, the objective of this study is to develop a Health Care Assistant App which can scan the QR Code on the medicine bag to access all the medical information stored in clouding system. Users can check their medication record, dosage, side effects or drugs, and clinical use of medicine. Moreover, the App can remind users to take their medicine in time. For the patients with chronic disease, the App can also help them to find a nearby drugstore to get their prescribed medicine conveniently. Furthermore, the pharmacist can also utilize this App to inform the patients to get their medicine [3]. The architecture of this study is shown schematically in Figure 2.

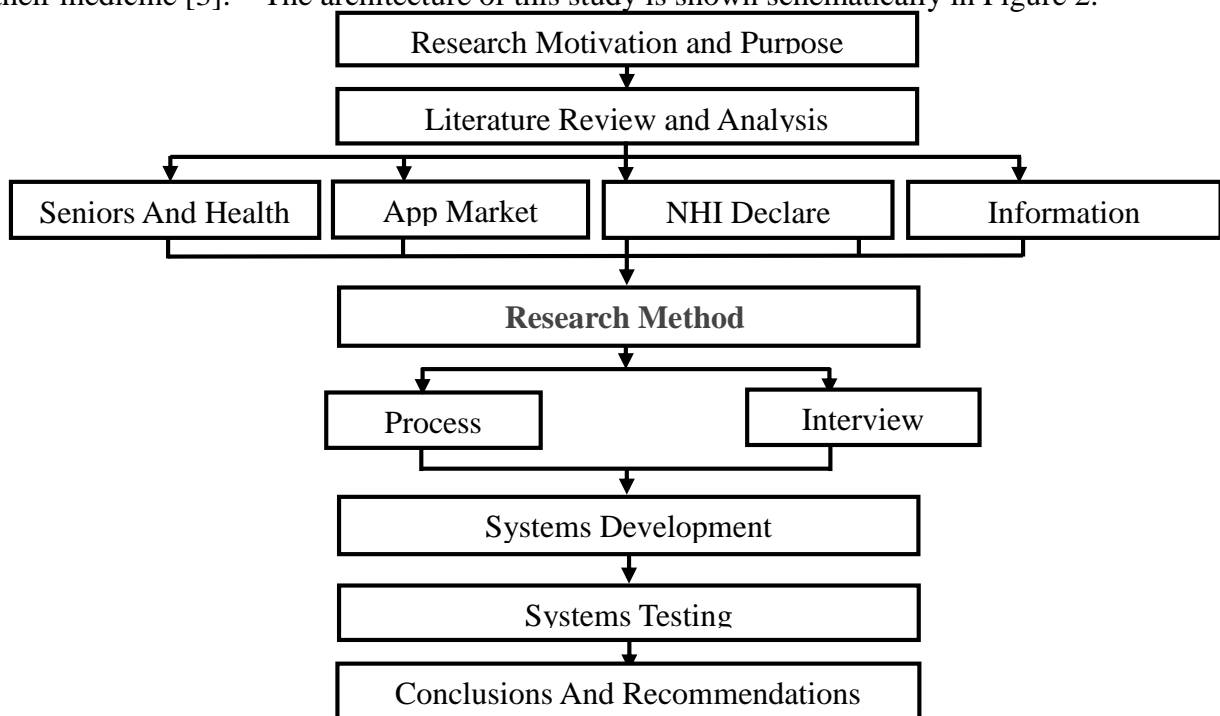


Figure 2. Flowchart of this study

2. Literature Review

2.1. Seniors and Health Care

There is no precise way to define the exact age to be called as seniors. In the United States, those who are more than sixty years of age are commonly referred as senior citizens or seniors. According to Senior Citizens Welfare Act in Taiwan, elder people are defined as those aged above 65 years old. Various definitions of seniors by several scholars are compared in Table 1. People are said to be senior citizens when they reach the age of sixty or sixty-five because these are the ages in which most people retire from the workforce.

Table 1. Various definitions of seniors

Scholar	Definition
Shiu (1983)	People who are over 65 years old [4]
Whitford (1998)	The elderly people can be classified into pre-seniors and seniors. "Pre-seniors" refers to those who are between 50-64 years-old and "Seniors" refers to those who are over 65 [5].
Wu (2005)	People who are 50 to 75 years old are called the elderly and the age range is in accordance with the World Health Organization (WHO) which also defines a pension payment standard that is currently applied to retirement or pension specified age range [6].

Declining birthrate and aging population are two sides of the same problem. An aging population will cause a gap in labor force. Taiwan's population structure has been showing rapid aging problem. By the end of 2015, elderly people in Taiwan will reach 2.82 millions, about 12% of the total population, and will become an "aging society" by the definition of United Nation's World Health Organization (WHO). The National Development Council (NDC) of Taiwan estimated that the population of elders is expected to exceed 14% by 2018 and exceed 20% in 2025; By 2050, elderly citizen will be amounted to 7.46 millions, about 39% of the total population.

The main causes of death in Taiwan are cardiovascular disease (22.1%), diabetes (6.1%), chronic lower respiratory diseases (3.9%) and kidney disease (2.9%) and other chronic diseases [7]. Therefore chronic disease prevention is an important issue for the public health. But most of these diseases occur in older people, so the World Health Organization consider the elderly people living alone as a high risk group. Most of the elderly people live alone and for those with health problems or sensory deficits, new or worsening symptoms may be unnoticed. Therefore, developing a health care app to help the elderly people live healthier, safer independently becomes the purpose of various industry-university cooperation project.

2.2. Medical App Market

There are numerous medical apps which fall into the categories of medical applications. The majority of these apps on the market only provide medicine search, pharmacies query. There remain several deficiencies in these apps including:

- (1) They cannot provide medicine information for patients individually.
- (2) The medicine information and pharmacy are updated once a month on the NHI's system, but are not updated immediately on the App market.
- (3) They do not explain the usage of drug for patients individually.

Most of the medical and drug-related apps available through Google Play or Apple Store only provide drug search, drugstore search and medication reminder. The users need to input their own information to activate the medication reminder. It is not very convenient for the elder people. Current medication apps available on the App market and their main functions are compared as follows:

1. Medicine Elementary School App (Figure 3)

This App is designed by Healthy Life Inc. which provides three functions: drug search, drug bureau inquiry and medication tips. Drug Search provides classified drug information in accordance with letters A~Z. It also checks the Chinese and English name of the drug, ingredients and the permission number from the Health and Welfare department. It also provides indications and common side effects and other information. Drugstore Search can find a hospital, clinics and pharmacies nearby, or specified county hospitals, clinics and pharmacies. Medication Tips provides drug-related articles with basic knowledge of medication to the user [8].



Figure 3. Medicine Elementary School App

2. Mobile Dr. Pharmaceutical App (Figure 4)

This App is designed by Taida Medical Info Technology Co, most of the functions are similar to Medicine Elementary School App. Drug Search can obtain the detailed information of prescription. This App provides up to twenty thousands of prescription medication approved by the Department of Health. By using camera to take a picture on the name of medicine, it can transform the picture into text and conduct drug search, eliminating the need for the user to enter the text by typing. Looking Dr. Drugs can find a hospital, clinics and pharmacies nearby, or specified county hospitals, clinics and pharmacies [9].

3. Medication Reminder App (Figure 5)

This App is designed by E-TEN Information Systems Co, Ltd.. The main function is to provide users with records of drugs and medication reminders by using this App to add time record, or taking pictures of the drug appearance [10].



Figure 4. Mobile Dr. Pharmaceutical App



Figure 5. Medication Reminder App

4. Healthy Secretary Medication Reminder (Figure 6)

The major advantage of this app is a more user-friendly and cute interface. The users can add three meals medication reminder of their own. In addition, the users can use the health diary to record personal health conditions by text or pictures. Health History provides various personal health records, such as health log, BMI, body weight, blood pressure, heart rate, blood glucose...etc. Medication Reminder allows the users to set the self-medication reminder by themselves and the use of those drugs. Medical Maps provide users to find nearby hospitals and clinics and plan their path through GPS. Medical Search can search hospitals, clinics, pharmacies, smoking cessation clinics and other information. Clinic Schedule enables the patient to query their schedule of seeing a doctor. Self-test detect a possible disease states through its own App scale system, allowing users to get medical treatment early. Health News contain interview of the excellent doctors, health talks and health news. Health & Fitness inquire the term of health check and the knowledge of common disease [11].

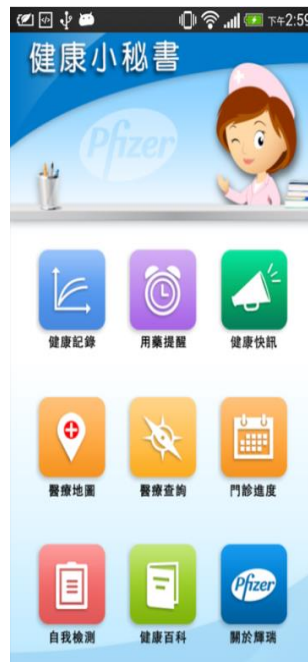


Figure 6. Healthy Secretary Medication Reminder App

The medication assistant apps mentioned above provide only the functions of drug search and medication reminder. They require the users to input all of the medication information or the keyword of medicine. They are inconvenient for user to query multiple individual drugs or medication time. For senior citizens, their interface is not user friendly enough.

3. Methodology

3.1. User Scenario

A user scenario assumes how a user will interact with an application. This information assists in defining the structure and interface design to obtain the best possible experience for the users. The target users of “Health Care Assistant” App are patients and pharmacists. It’s user scenario is as described below:

- (1) Patients visit doctors and hand in health insurance card.
- (2) Doctors write prescriptions and return health insurance card.
- (3) Patients deliver prescriptions and health insurance card to pharmacists.
- (4) Pharmacists prepare drugs for packing up inside medicine bag with QR-Code printed and return health insurance card.
- (5) Patients begin to use the following functions of “Health Care Assistant” App:
 - Scanning QR-Code on the medicine bag to get medication record and information.
 - Push message to notify patient to take medicine by timetable.
 - Pharmacists send notifications to the chronic patient’s mobile phone to get their drugs for the next month.
 - Using camera to take a picture of drug information transmit to the cloud system.
 - Inquiry pharmaceutical information, such as side effects, the English name, icon, etc. which can replace the 500,000 drug search engine used in hospital. For those medical-related teachers and students and the general public, “Health Care Assistant” App can help them to search drugs information immediately.

3.2. Integrating with Existing System

“Prescription 2.0” (Figure 7) is a healthcare prescription declaration software developed by Yun Yang technology based on the specifications made by Department of Health's Central Health Insurance Bureau. It provides general declaration, long-term chronic prescription reporting, restrictions medication reporting, complete medicine bag treatment, diverse analysis reports, support for smoking cessation plan. Furthermore, “Prescription 2.0” combines POS inventory management software to simplify inventory management and achieve cost benefit.

The “Health Care Assistant” app developed by this study integrates existing “Prescription 2.0” systems to generate QR Code on the medicine bag (Figure 8) so the user can access to their medical information by scanning this QR Code

3.3. System Architecture

The architecture of “Health Care Assistant” App is shown in Figure 9. It uses Microsoft Azure as cloud platform. The underlying technology is as follows:

- (1) Data Layer: SQL server and Microsoft Azure’s cloud database are implemented in data service layer.
- (2) Business Logical Layer: Microsoft Azure Website, ASP.NET, ADO.NET Entity Framework and Web API in JSON format are implemented in business logical layer. The ADO.NET Entity Framework is a powerful object relational mapping (ORM) tool to convert database into object-oriented programming languages (Figure10). The background managing module which includes hospital appointment registration, good pharmacy, the latest news, member profiles, drug information and personal diet warning list, is the managing and maintaining environment for system developers and managers.
- (3) Presentation Layer: Windows Phone mobile system is used in the presentation layer. Since new Windows 10 can support Android App and IOS App [12] , all the functions in the “Health Care Assistant” App will be shifted to Android and IOS platform after Windows 10 is released.

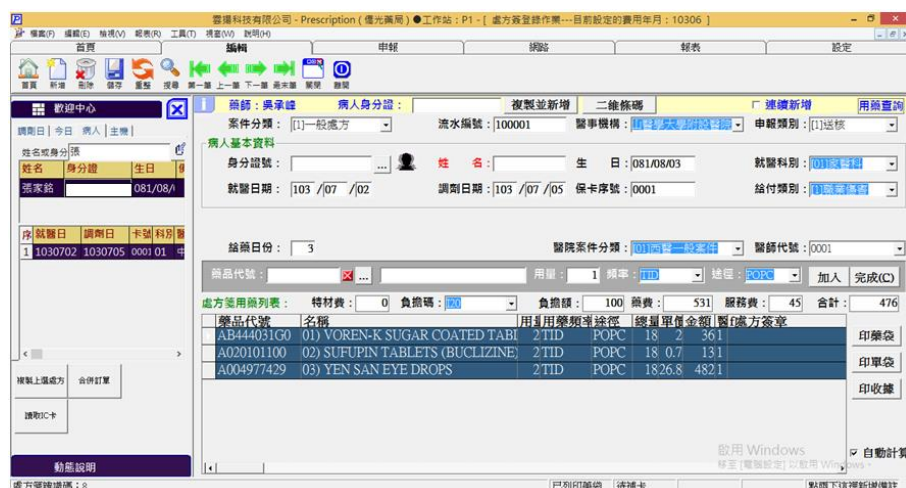


Figure 7. Prescription 2.0: a healthcare prescription declaration software



Figure 8. Medicine bag with QR code printed

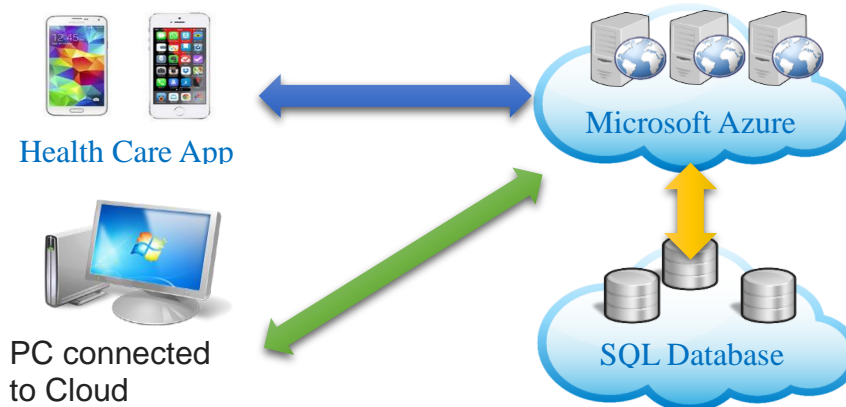


Figure 9. System architecture of the "Health Care Assistant" App

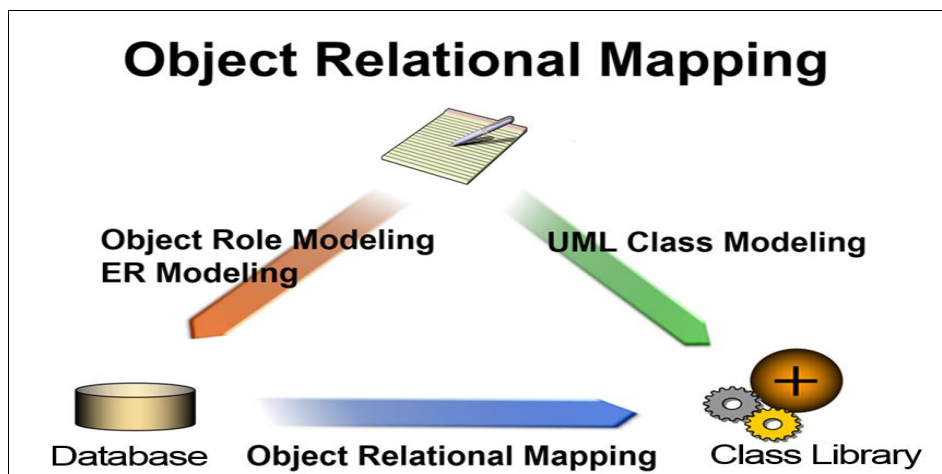


Figure 10. Object relational mapping

4. The “Health Care Assistant” App

The structure of “Health Care Assistant” App is shown in Figure 11. It provides personal medication care, food care and drug information. For anyone looking to review these information, they must be registered as a member at first. After users log in, there are nine icons with amazing images with vibrant colors (Figure 12). The main functions are: making an appointment, recommended pharmacies, health news, personal settings, diet lights, medical records, scanning prescriptions, transfer prescriptions, drug information. These functions are as follows:

- (1) Making an appointment: provides the user to links to hospital registration system.
- (2) Recommended pharmacies: provides excellent pharmacy information close to the user.
- (3) Health news: provides the user to understand the current food security, medical and other health-related news.
- (4) Personal setting: set the personal medication data and health information (Figure 13).
- (5) Diet light: analyze the ingredients of food that will cause deterioration of health and issue warning to alert the patients.
- (6) Medical records: Once upon the medication records stored successfully, the “Health Care Assistant” App or web site can access to personal medication data, such as the drug indication, the dosage and other information (Figure 14).
- (7) Scanning prescription: By integrating “Prescription 2.0” software with “Health Care Assistant” App, the software will generate a QR Code on medicine bag. The patient can use the “Health Care Assistant” App to read QR Code and transfer medication record to the cloud system.
- (8) Prescriptions transfer: There are two convenient way to get the medication information and send to the cloud system: (1) By scanning QR Code on medicine bag (2) Using camera to take a picture of drug information and designate to which drugstore. All of the medication information recorded will be more accurate than by key in the name of drugs through mobile phone. Pharmacists can then log into the system to check up what kind of drugs needed for patients (Figure 15). After finishing the preparation of drugs from the picture of patient’s prescription, Pharmacists can push notifications to the patient's mobile phone to remind the patient to get the drug instead of waiting for user to make a request (Figure 16).
- (9) Drug information: allows the patient to check personalized drug usage, or search for another drug information.

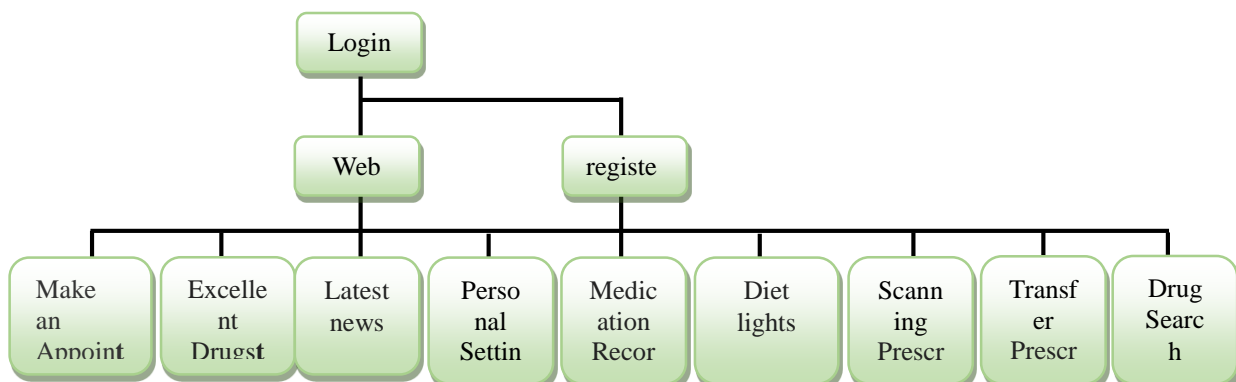


Figure 11. Structure of the “Health Care Assistant” App



Figure 12. Layout of the “Health Care Assistant” App

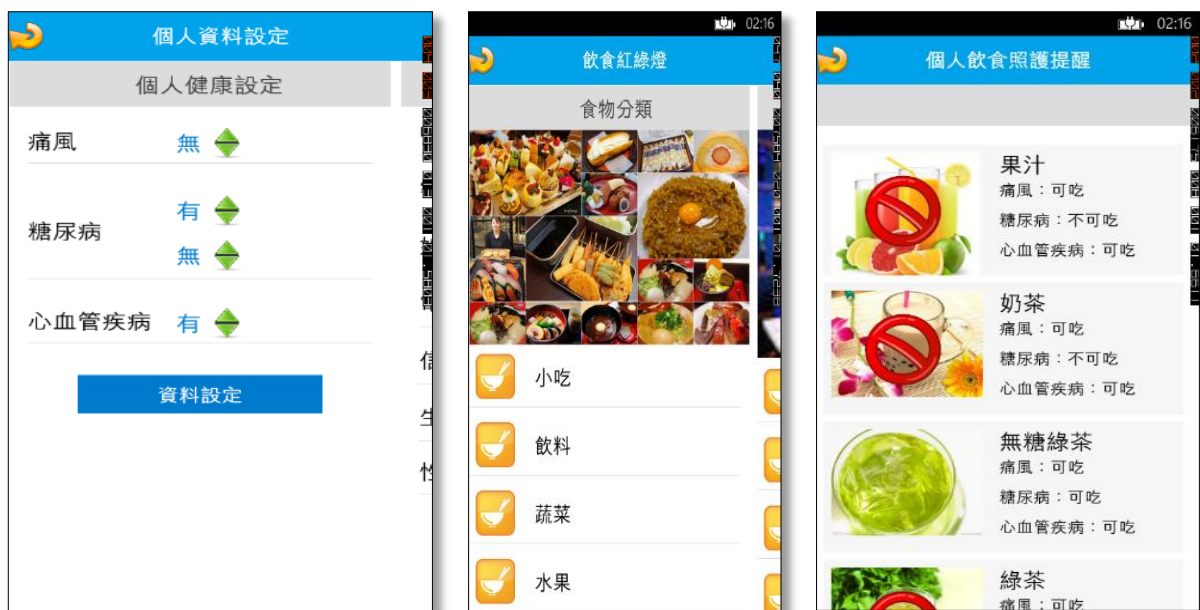


Figure 13. Personal setting, food category, and food lights

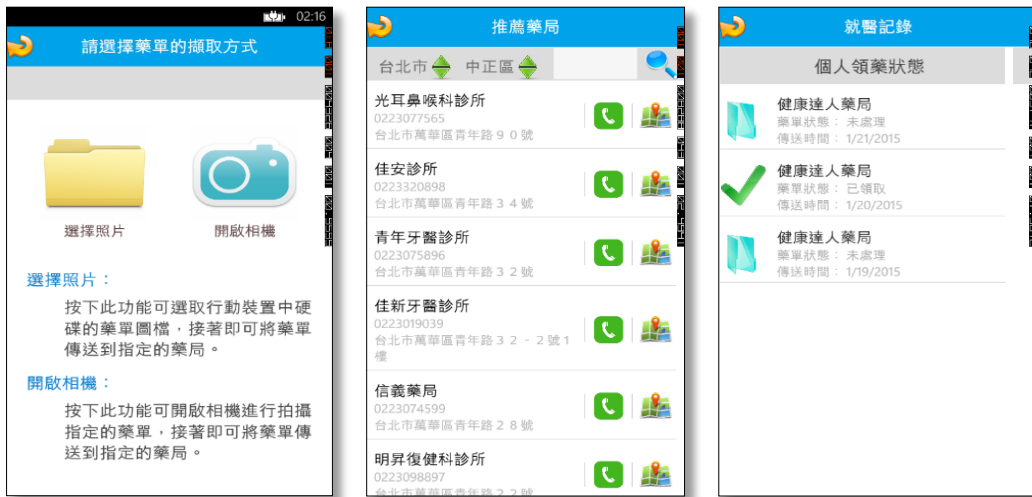


Figure 14. Taking picture of prescription, designating pharmacy, and personal medication records

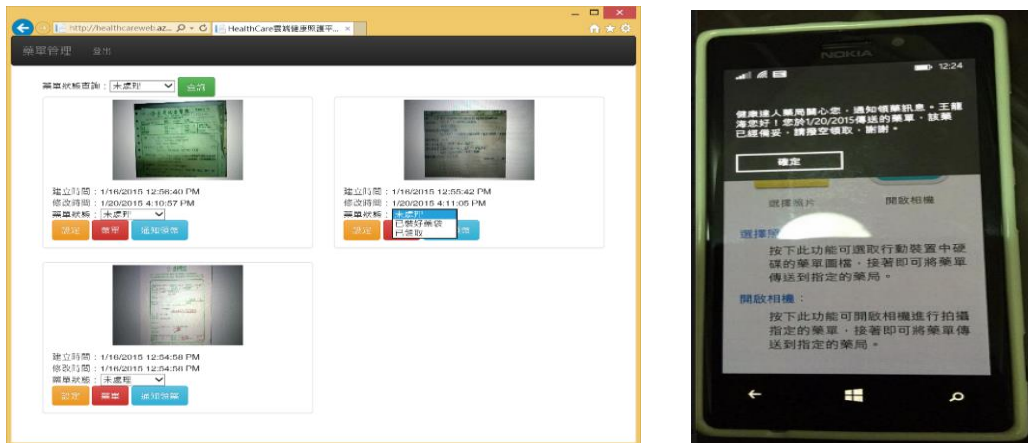


Figure 15. Management of prescriptions of pharmacy and push notification to patient



Figure 16. Scanning prescription and personal medication information

5. Conclusions

Most of the medical-related apps on Google Play App marketplace only provide drug search, hospital-related registration function and hospital location query etc. These are confined to a single function without integrating with NHI declare system and health care system. The “Health Care Assistant” App is designed to develop innovative functions to solve common problems patients currently have, such as the integration of NHI declare system and health care system, personal medication reminders and personal medical records.

The feature of this study is the integration of Yun-Yang technology companies' “Prescription 2.0” to generate personal medication QR Code on the medicine bag. The users can utilize “Health Care Assistant” App to scan the QR Code to transmit personal medication information to cloud database system.

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