A Intelligent Portable Manager for Health: Study Design

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Abstract. The immune function of the middle-aged and elderly groups is decreased, and they are easy to be infected with the virus, and once infected, they are easy to be turned into acute and critical patients with a high mortality rate. In addition, China’s aging population is becoming more and more serious, and the middle-aged and elderly population is a high incidence of all kinds of respiratory or cardiovascular system diseases. Most middle-aged and elderly people have more than one chronic disease at a time and need medication to treat it, and the type and amount of medication taken daily is often variable. However, due to the common problems of memory loss and blurred vision among middle-aged and elderly people, the various number and types of medication may lead to the possibility of the elderly taking it by mistake, missing or wrong, which may easily lead to the hidden danger of medication safety. This design will be health inspection management, medical interconnection, pharmaceutical affairs management, three main feature set in one, its realization storage service remind, interactivity, and index detection, do medicine detection and the sharing of data, realize the visualization of medical Internet, providing personalized family health management services, and the spread of interactive public medical basic knowledge.

1. Introduction
Nowadays, more and more people suffer from chronic diseases, such as hypertension, hyperglycemia, hyperglycaemia, because of irregular work and rest or excessive fatigue. And the elderly immune function decline, which are easy to be infected with viruses, or because of the bad habits of life and diets, leading to a variety of chronic diseases. After these chronic diseases, if not effective treatment in time, the condition will further deteriorate. The bad condition will cause a series of complications, until death [1]. These middle aged and elderly people suffering from chronic diseases need to take a variety of drugs in different quantities, and the deterioration of visual and visual senses and memory in middle-aged and elderly patients make them have a low cognition of drugs, and there are hidden risks of taking drugs by mistake, missing food and forgetting food, so it is difficult to accurately complete the task of taking drugs every day. In addition, elderly patients often have poor medical compliance in life, rest and diet, and are prone to the risk of potential complications.

In order to avoid the hidden danger of taking medicine for the elderly and find the potential complications in advance, relying on the box body, integrating the body health index detection module (detecting oxygen saturation, pulse, blood pressure and heart rate), intelligent reminder module and human-computer interaction module, the intelligent home health accompanying housekeeper system is built to serve the elderly [2]. The diversified functions of this design can meet the needs of the physical health detection and management of the elderly, and provide chronic disease management. On the basis of detecting their own health data at any time, they can take medicines on time and in quantity, and can be bound with family doctors. At the same time, if the elderly are inconvenient to operate, they can make
an appointment for consultation by their children or caregivers. Doctors can also make appropriate adjustments to the dosage of drugs according to the test data of users, which improves the treatment effect of original diseases and the quality of daily life.

2. Market analysis
Electronic medicine box is an emerging product in the market of family medical supplies. Currently, there are many kinds of household medicine boxes in the market. For this purpose, we searched and compared many brands, as shown in Table 1. It is found that the brands generally have the functions of drug storage and alarm clock reminding. The key point is that they all lack the functions of physical index detection, medical interconnection, voice interaction, etc., which cannot provide valuable detection data and human-computer interaction effect for the human body.

Table 1 Function analysis of brand medicine box

| Brand       | Classification Function | Remind function | Medication Management | Monitoring Function | Detection Function |
|-------------|-------------------------|-----------------|-----------------------|---------------------|-------------------|
| Adhere Tech | drug bottle             | Yes             | Yes                   | Yes                 | No                |
| Med Minder  | scale division          | No              | No                    | No                  | No                |
| Pillsy      | drug bottle             | Yes             | Yes                   | Yes                 | No                |
| Xiaomi      | scale division          | Yes             | No                    | No                  | No                |

With the improvement of living standards, people's health awareness has also been significantly improved, and the requirements for intelligent medical service products such as home diagnosis and monitoring have been continuously improved. Therefore, a market survey related to the intelligent medicine box on the market was made, from which it was found that people not only have the need to store medicine and remind medication in their daily life, but also have more needs to check the basic health data of their own body. The specific situation is shown in Table 2.

Table 2 Residents' demand for function of medicine box

| Function                  | Amount(person) | percentage (%) |
|---------------------------|----------------|----------------|
| Drug store                | 143            | 52.38          |
| Detect health condition   | 207            | 75.82          |
| Applet binding            | 113            | 41.39          |
| Drug combination          | 151            | 55.31          |
| Remind medication         | 152            | 55.68          |

3. The design of function
The TFT-LCD display is embedded in the lid of the box. It can touch the screen to set medication parameters, alarm clock, emergency contact person and bind the family doctor, as well as set selective or automatic uploading of physical index test data and medication data. The interior of the box body is separated by PP environmental protection material partition board, forming multiple drug storage areas, and equipped with inner box cover to reduce the possibility of drug contamination. A health detection device with a ring opening is arranged on the outer right side of the box body, and a built-in PPG biometric tracking optical sensor can be used to detect oxygen saturation, body temperature, pulse and blood pressure. By clicking "Test" on the TFT-LCD display, the test can begin in 5 seconds. The results of this or previous body indicators can be viewed by clicking on the TFT-LCD display screen. The left outer side of the box body is also provided with an external interface, which can be connected with the external inspection equipment for relevant detection. The battery inside the box can power the device.
4. The design of structure
As shown in Figure 1, the main control chip of this device adopts STM32F103ZET6 chip, which is composed of human-computer interaction module, indicator detection module, intelligent voice module, response module, drug taking detection module, short message GSM module and other part. Human-machine interlocution of Smartpanda System is implemented by means of speaker independent continuous speech recognition technology and dialogue model.

![Figure 1 Module analysis](image)

4.1. Test management
Right side of the box body is not closed loop design health indicators of detecting device, the ring with PPG biological tracking optical sensor detection equipment, will place the index finger root inside the ring, by clicking on the display "start test" for health indicators (including blood oxygen saturation, pulse, blood pressure and heart rate) detection. Blood saturation of the test index in chronic disease management and personal health diagnosis has a very important position, the indicators of the test results can not only reflect human tissue oxygenation function, at the same time in the prevention of various cardiovascular diseases, respiratory diseases, and other fields has a very important detection of diagnostic value. Therefore, in addition to real-time detection of general vital signs, the detection of blood oxygen saturation is also very important in daily life.

After each health test is completed, the system will automatically generate a basic health report, which can be displayed on the TFT-LCD screen of the box body and broadcast by voice at the same time. The test results and health reports will also be fed back to the WeChat applet bound with the device to realize the family sharing of data for children to track the physical health status and medication of elderly parents.

If the device has been bound to the family doctor, the user's medication data and test data will also be fed back to the doctor, who can give clear medical advice or health guidance of daily life style according to the user's health status. If the user's physical health test index is abnormal or the need for a family doctor to visit, the user can make an appointment through the TFT-LCD screen. Considering that the operation ability of the elderly is sometimes insufficient, they can make an appointment by calling the power-on instruction of the little voice assistant and by dictating, or the nursing workers and their children can make an appointment on the mobile phone. When the appointment is made, the family doctor will come to check the user's body according to the time of the appointment.

4.2. Drug management
The interior of the design box body is a number of drug storage silo formed by partition, each drug storage silo is installed in the inner box cover, can be sealed again to prevent cross-contamination between different drugs, to avoid the effect of the drug. In addition, in consideration of the cognitive difficulties of middle-aged and elderly groups, the inner box cover is marked with numbers and
breathing lights respectively, and the storage is reminded according to the medication parameters set on the user's mini-program.

When the medication time is reached, the device will automatically trigger a buzzer to respond, as well as a voice broadcast reminder. When sensing that the user has opened the lid of the outer box, the alarm clock will be stopped, and at the same time, the corresponding medicine storage room that needs to take the medicine will turn on the green light. The green light, in the order in which it is set, first lights up the storage bin containing the first dose to be taken. After sensing that the user has opened the inner box cover of the first drug storage bin, taking drugs and closing the inner box cover, the green light of the drug storage bin goes out, and the next drug storage bin is opened accordingly. In this way, we can avoid the hidden danger of taking medicine by mistake and forgetting to take it. If the medicine taking action detection module controlled by infrared sensor detects that the elderly did not open the box cover to take medicine or opened the wrong box cover, the green light will turn to red, triggering the vibrating buzzer again and triggering the SMS GSM module. If the alarm clock responds to an automatic shutdown within 2 minutes, the SMS GSM module will be triggered to send the preset information to the reserved mobile phone number to remind the user to take medicine in time.

5. System Implementation

5.1. WeChat applet
This equipment has set up a number of databases, including personal and family information database, drug database and hospital database. At the same time, Huawei EVS cloud hard disk is used for safe transmission and storage of information, and users' daily medication data, test data and data analysis results are stored in it. A large amount of data can be continuously stored to ensure the security of users' information.

By binding the WeChat small program at the mobile end to the device at the physical end, the children or nursing workers of the elderly can set personal or family members' medicine-related parameters on the small program or on the TFT-LCD display, and place the corresponding medicine in the corresponding medicine storage bin. If the device does not sense the action of "opening the lid to take medicine" within the specified time, it will send a message to the bound WeChat applet to remind the user to take medicine in time again. After children receive the information, they can call their parents to remind them to take their medicine on time, to show that they care about their parents' health. Children can also check the daily, weekly and monthly medication reports and physical index test reports on the WeChat small program. They can also sign a medical contract with the community doctor, make an appointment in advance, and have online or offline consultation.

5.2. Wireless communication
Bluetooth, WIFI and GSM are used in this design. First, Bluetooth is a short distance limited area connection mode, children or caregivers at home can quickly connect to the device to obtain relevant data and program Settings. Secondly, WiFi can use the Internet to achieve long-distance information exchange. This design sets the WIFI wireless communication module, through a series of connection and transformation, the device connected to the Internet through a router, mobile phone to realize remote control of equipment through the Internet and the information transmission, children can real-time data to check whether patients with medication and the blood oxygen, and the system will also push data to avoid forgetting to its. Thirdly, GSM is a long-distance wireless communication technology. Under the control of STM32, relevant information is transmitted to the user terminal through GSM module, so that the children can receive the information of whether the patient is taking medicine and the blood oxygen test results even in the environment without network.

The combination of the three technologies can finally realize the long-distance or near-distance setting connection and communication between terminals, so that users of mobile phones can quickly obtain drug information and test data of devices.
6. Software design

6.1. TFT -- LCD display screen

TFT-LCD display is composed of the ILI9341 chip with display function and the XPT2406 chip with touch function, which can set the alarm clock time, edit the number of receiving SMS, display and switch the data of physical examination, medication parameters and some basic page functions.

As shown in figure 2, reaches the preset duration, TFT-LCD display will first of all, face recognition, and then according to the user's identity, according to the corresponding to the required amount and type of medication and voice broadcast to remind, if the elderly in the alarm clock stopped after two minutes did not open the equipment lifted the lid, the trigger message GSM module, send text messages to the preset number. Remind again timely medication. If the elderly opens the box cover of the device, the device senses that the user has completed the preset action of taking medicine, and sends the medication information to the WeChat small program, indicating that the medication is completed.

Considering that some elderly people have certain operation ability, they can set the medication parameters and alarm clock by themselves by touching the screen. If they don't have operation ability, they can also set the system parameters and store drugs by their children and caregivers. When you need to use the health detection device, you can click on the "detection" area on the screen and place the finger root into the ring opening ring within 20 seconds. When the finger root is sensed, the green light will light up and the detection will begin. The green light flashes for three times and then goes out, indicating the completion of the detection. At the same time, the detection results will be uploaded to the database and broadcast by voice.

![Figure 2 Display command processing diagram](image-url)
6.2. Intelligent voice interaction

Interoperability of intelligent speech communication is an interactive mode of speech recognition input and feedback results, mainly involving speech recognition, natural language processing, man-machine dialogue, speech synthesis and other aspects.

Automatic Speech Recognition (ASR) is a process that converts voice into text by input speech and output text through extraction and interpretation of coding on the basis of establishing acoustic model and language model of training data. The translated text is automatically searched and deleted in the Baidu search database to select the best answer, and then through processing and coding, speech synthesis sends speech signals, and the speech sounds feedback the specific content to the elderly, so as to achieve the purpose of interaction.

This design reference intelligent speech technology, its accuracy of speech recognition has reached more than 96%, can call through a fixed text, start the intelligent voice dialogue function, convenient man-machine dialogue in the form of the elderly medication for personal information and more medical life little common sense, it also bring the special groups of life convenient and more interesting.

7. Conclusion

The physical condition of the middle-aged and elderly population is not optimistic, and the function of the autoimmune system is decreased, and it is easy to be infected by the virus, and once infected, it is easy to turn to the acute and critical patients [5]. In addition, middle-aged and elderly people are also the population with a high incidence of various chronic diseases, and they generally have physical problems such as memory and vision deterioration, and most of them need to take a variety of different doses of drugs every day, which may lead to drug safety risks such as mistaking and missing taking [3]. To this end, the design thought that the elderly health management tips, health detection and visual family medical service for the purpose, design a set of health detection, medical interconnection function and three main functions of pharmaceutical affairs management in the integration of health with butler, children or can use according to the needs of the elderly care personnel of the corresponding set. In order to reduce and even avoid the appearance of the elderly by mistake, leakage of safety hidden trouble. And the intelligent voice interaction system is added into the device, which is more practical and convenient, and increases the operability of the middle-aged and old users. This design can realize multi-function, network, intelligence and visual community, can protect the public health to a certain extent, relieve the public medical pressure, can better meet the challenge of intelligent home medical devices.

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