Intelligent Medication Management System with Voice Reminder

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Abstract: The health problems of the elderly are becoming more and more serious. They need to take a lot of drugs. It is of great significance to design the intelligent medication management system for the elderly based on virtual instrument technology, and it realizes the intelligent management of daily medication. In this paper, radio frequency identification technology (RFID) is used to automatically identify target objects and obtain relevant information through radio frequency signals. The whole system adopts RFID and virtual instrument technology to manage daily medication. According to the time of the system, the reading time is compared to the time of medication, and the voice prompts are given in advance. The RFID card reader is used to read the drug label, and the information of the medicine is obtained through the RFID reading and writing module. The correctness of the medicine is checked and the wrong medicine is prevented. Meanwhile, renewing and preserving the medicine records after taking the medicine. The advantage of this medication system is that it is simple to use and the user just needs to scan the code. Moreover, the system adopts audio-visual dual information, which has both voice prompt and text prompt.

1. Introduction

At present, the health problems of the elderly are becoming more and more serious, they need to take a large variety of drugs. Many elderly people will have the symptoms of forgetfulness as they get older, it is difficult for them to take medicine on time, and failing to take medicine on time is very bad for the health of the elderly. They sometimes remember to take their medicine on time, but the wide variety of drugs can lead to another safety hazard: taking the wrong medicine. In this case, it is very necessary to apply virtual instrument and RFID technology to develop an intelligent medication management system aiming at the drug safety of the elderly[1]. Both the reminder of medication time and the check of drug types, the intelligent medication management system has played a huge role that cannot be ignored, which is of great significance for the intelligent management of daily medication[2].

The Intelligent Medication Management System based on the virtual instrument technology can realize the management of the daily medicine of the old people. It can read the period of the medication according to the system time, so as to make voice hint ahead of taking medicine. Mnagement system can use the RFID card reader to read the related drug labels, and compare it with the drug prescription, so as to check that whether the quantity and name match correctly, and greatly prevent from taking the wrong medicine[3]. Moreover, the medicine management system can update and save the record after taking medicine.

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2. System Structure

The intelligent medication management system for the elderly is designed on the basis of radio frequency identification (RFID) technology and virtual instrument technology, and it realize the intelligent management of daily medication. The intelligent recognition technology applied to this project is a radio frequency identification technology (RFID). It uses the spatial coupling transmission characteristics of radio frequency signal and the non-contact two-way channel between the reader and the electronic label, and automatically identifies the target object and obtains the related information through the radio frequency signal[4]. The whole system adopts RFID and virtual instrument technology to manage daily medication. According to the time of the system, the reading time is compared to the time of medication, and the voice prompts are given in advance. The RFID card reader is used to read the drug label, and the information of the medicine is obtained through the RFID reading and writing module[5]. The correctness of the medicine is checked and the wrong medicine is prevented. Meanwhile, renewing and preserving the medicine records after taking the medicine.

In the process of system design, it is used G Language which is a Graphical Programing Language. LabVIEW is a development environment similar to VisualStudio in which the code is also written. G language not only has a graphical interface (front panel) of its program, but also its code is written graphically (block diagram). A graphical programming language is driven to do its job by data flow. In this software environment, The intelligent medication management system module diagram is shown in figure 1. It is divided into the following modules: date and time acquisition module, drug checking, feedback module, intelligent voice broadcast module, RF card reading module and record module. The main function of the date and time acquisition module is to obtain the system's time, date and other parameters, and display them according to the set string format. The drug check and feedback module is to realize the drug judgment in each time period. The intelligent voice broadcast module realizes the voice and text prompts for drug information, while the RF card reading module only reads the electronic label information, which serves for drug checking and feedback module to compare drug information.

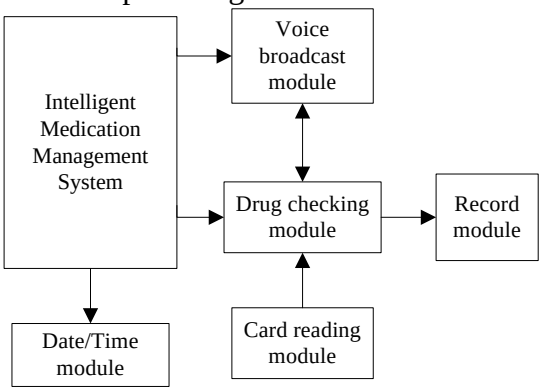

Figure 1 System module diagram.

3. System Hardware Part

The hardware part of the system uses the card reader to read the information in the electronic tag and transmit the read information to the system through the serial port line, and this function is realized by radio frequency identification (RFID) technology.

3.1. IC Card reader

IC card reader is a device for reading and writing IC cards. The function of the card reader is realized by connecting various communication lines to the computer. The card reader can transmit signals to the label or the RF card, read data information from it, and complete the information processing of the read data and realize the application operation. The IC card reader of the

intelligent medication management system uses the 14443A protocol, which reads the IC physical card number and the default value of 10 digits with USB interface[6]. Its working frequency is 13.56 MHz, the communication speed is 106Kbit/s, the serial port rate is 9600Kbit/s, and the effective distance of reading card is 100mm. When installing, connect the end of the line to the corresponding interface of the computer, and the other end is connected to the card reader.

3.2. IC Electronic tags

Electronic tags are used to store the identity and attribute information of the identified items, belonging to the identification equipment of the identified items. It is used the FM1108 non-contact electronic tag in the system, and the label access capacity is 8Kbits. The working frequency is the same as the read-write module of 13.56 MHz, which is the standard of the ISO15693 protocol[7]. The electronic tag of the model is divided into 16 sectors, which has two sets of codes and four blocks each and every block has 16 bytes of storage capacity[8]. The fourth block of each sector is a password block that cannot be used to store data. The electronic tag is inlaid in the bottom of the relevant drug packaging, and the basic information of the drug is stored in the label, such as the number, name, composition and taking time of the drug. Among them, the first nine items stored in the information are designated by the supplier in the electronic label before the relevant drugs are shipped out of the factory. The information contained in the tag is a numeric string in this system. According to the different information in each tag, it can be used as the basis for code scanning.

4. Software Part of the System

The overall idea of the software process is that when the master control module is initialized, the system will get the time of taking medicine and the name and dose of medicine to be taken. It needs to set the time of taking medicine in advance. When the system time is the same as the setting time, the system will issue the reminder of taking medicine. In the sub-process of judging drug, a drug check interface is set to obtain drug information so as to compare the obtained label information with the information entered in advance to achieve the effect of drug judgment. If the information is correct, it indicates the success of taking medicine, otherwise, the system will issue a warning, and the user should scan other electronic tags. Every time the old person takes the medicine successfully, the system will automatically update and save the medication record.

4.1. Barcode recognition module

The barcode recognition module is used to input the data, and then store it under the file as TDMS format. The front panel includes barcode generation and barcode recognition. The block diagram of barcode recognition is shown in figure2. In order to generate bar codes, functions need to be called with the help of VI tool to meet the requirements. In the front panel, it needs to choose VI to open the function library, select LLB file and sub.LV function, which is named bar code generation tool. Where, Barcode type is used to represent the category of the barcode, and barcode picture is the Barcode image entered.

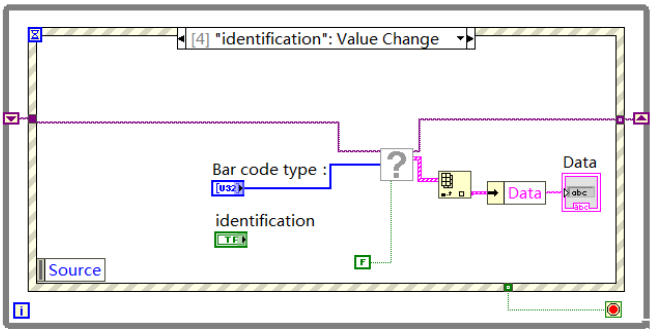

Figure 2 Block diagram of barcode recognition module.

The recognition of Barcode needs to use visual module of image processing and recognition. There are more than twenty Barcode encoding methods, which belongs to the one dimensional code.

A kind of common coding method of commodity bar code is EAN 13 which is used to encode the drugs in this system. It is used Image Readers in Machine Vision of the NI Vision and motion module which contains an image input while reading datas. It is a data stream similar to a pointer.

4.2. Data input module

In Labview, the virtual instrument software, the data storage methods are mainly as follows: binary format, TXT format, Excel format, word format, SQL/Access format and TDMS format. Among them, SQL/Access is the most widely used. The main feature is that it is more convenient to call and more compatible with other platforms. But it is slower to store because it has to be converted to binary before it can be stored, and it has less running memory. Binary storage format is the fastest, and TDMS is somewhere between them: faster and takes up less memory. So TDMS storage is adopted here.

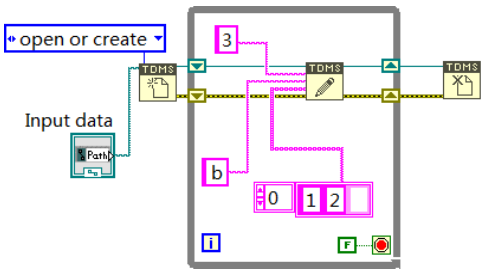

Figure 3 Block diagram of data input module.

4.3. Reminder module

The reminder module includes date, time acquisition and voice reminder. The time module is assisted by the comparison of medication time and current time in the medication judgment module. Several terminals of the format date/time string function in the module represent the time format string, the time identifier and the date/time string, respectively. It displays the data read from the current time at the function time string in the format required by the time format string. The block diagram of time acquisition module are shown in figure 4.

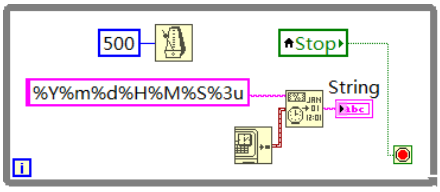

Figure 4 Block diagram of time module.

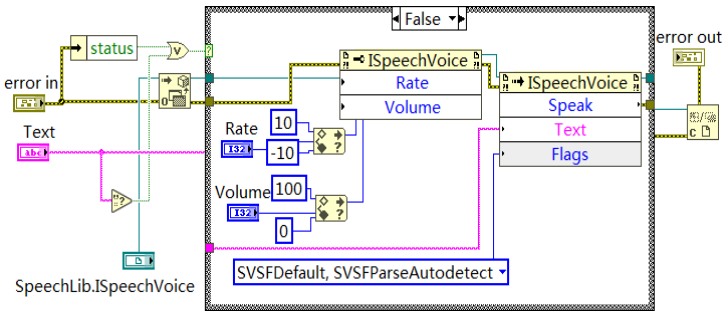

Figure 5 Block diagram of voice reminder module.

Intelligent voice broadcast is an indispensable part of the whole system, which plays a great role in reminding users of medication and warning users of medication errors. It actually uses Windows' voice broadcast feature that is, LabView calls Active X, which is Microsoft's tool. Rate refers to the frequency of voice broadcasting, Volume is used to adjust the sound size, and the Text box is the content of voice broadcasting. In fact, the function of this module is not only reflected in the voice broadcast function. According to the theory of human factors engineering, human auditory response

is faster than visual response. The hearing ability of the elderly has decreased, so the system uses audio-visual dual information for drug reminder. The audio-visual reminder function of the module can remind people to take medicine intelligently and prevent them from forgetting to take medicine.

5. System Testing and Results

In the system test, you need to set the time you want for each medication. According to the set time, the system began to remind the corresponding drug. The electronic tag data on the drug is read through the card reader, and reads the data compare the drug Settings in the signal and system, if the data is correct, it would be stored directly with tdms format, otherwise it would emit an alarm to read data again. After setting the prescription for all kinds of drugs, the general ebugging and operation of the system are carried out, and the main interface of the system is shown in figure 6. It contains serial port set and control plate.

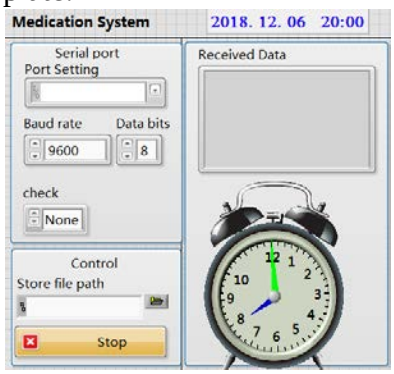

Figure 6 Main interface of system.

In order to realize the function of intelligent drug administration, in addition to RF card reader, electronic tag and other hardware devices, it must also have good software programs to control it. The hardware part only has the ability to read electronic tag information. The software part can be divided into date, time acquisition module, drug verification, feedback module and intelligent voice broadcast module during program editing. In the debugging process, as long as the date and time acquisition module can read and display the time string as required, the intelligent voice broadcast module needs to call the Windows function module, and the most critical is the drug check and feedback module. During the debugging, the drug judgment function of each period should be realized. Only three modules are fully implemented. During the system test, you can set each medication time to the time you want, and then according to the set time, the system starts to remind you to take the corresponding drug. If the wrong drug is taken, the system will issue an error alert. After scanning the code again, if the drug is taken correctly, the system will not issue an error alert and the drug is taken successfully.

6. Conclusion

Older people tend to have a memory slump, because it's easy to miss the time to take medicine or take the wrong medicine, and the safety of the medicine is very important. This paper is dedicated to provide old people with help, using RFID technology and the LabVIEW virtual instrument technology to manage daily medication, using the LabVIEW visual module (vision) technique to read bar code of related medicine, through comparing the indicators, such as information parameters and take guidance medicine in time for the old man's health, and make usage of empty nest elderly safe and infirm to provide a full range of support and help. The advantage of this medication system is that it is simple to use and the user just needs to scan the code. Moreover, the system adopts audio-visual dual information, which has both voice prompt and text prompt.

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