

Research and Implementation of the Chinese Herbal Medicine Intelligent Breeder

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Abstract— There are many Chinese herbal medicines in the family plant, such as aloe, cactus, cycads, etc., which not only have ornamental value but also medical value, and study an intelligent cultivation machine, which makes the intelligent cultivation of Chinese herbal medicine possible. Through further exploration of domestic Chinese herbal medicine solutions, the development and design of Chinese herbal medicine cultivation machines combining software and hardware. The model is designed using Solid work and is 3D printed with resin material. The hardware is mainly equipped with soil temperature and humidity sensor, protection grade IP68, the relevant soil detection information 4G synchronization to the cloud. The software uses Android Studio 3.1.22, which uses the platform's own SQLite database and applies the generally accepted mvc framework. The combination of hardware and software has strengthened the control of the cultivation environment of Chinese herbal medicine and extended the range of herbal medicine in domestication.

Keywords— Android Development, 3D Printing, Home-Based Chinese Herbal Medicine, Chinese Herbal Cultivation Machine.

I. INTRODUCTION

After the residents' quality of life has gradually improved, planting flowers and plants at home has become a family habit and social norm. With the improvement of family home standards and quality of life, ordinary families are no longer satisfied with simply planting flowers and plants at home, and gradually prefer green plants with practical value. Many potted green plants in daily life belong to Chinese herbal medicine, not only for viewing, but also for daily use. Raising "Chinese herbal medicine" may become a new pilot mark for home interiors. The "Chinese herbal medicine cultivation machine" in this article is mainly designed for the development and design of indoor domestic Chinese herbal medicine. Chinese herbal medicine is a treasure left by Huaxia Civilization Medicine. It is a medicine that is guided by traditional Chinese medicine theories to collect, process, and prepare, explain the mechanism of action, and guide clinical application. It has high cultural and medical value. "Nurturing Chinese herbal medicine" undoubtedly provides a new realistic and feasible carrier for inheriting and developing Chinese traditional Chinese medicine.

Whether it is Ms. Tu Youyou's discovery of the mystery of artemisinin or the research and implementation of one Chinese herbal medicine intelligent breeder^[1], it fully illustrates the

value of Chinese herbal medicine. Chinese herbal medicine is not useless in the family, on the contrary, it is a beneficial value-added product that can be "harvested" for a long time. Moreover, the applicability is strong, and it can walk into thousands of households, so that ordinary people can reach it, and the Chinese herbal medicine cultivation machine can play a positive role in it.

II. RESEARCH VALUE

A. Research Background

The traditional Chinese medicine industry has a long history of development and embodies the vast medical wisdom of the Chinese nation for thousands of years. Moreover, it has been constantly developing and improving, and it still occupies an important position in the world pharmaceutical industry. The future development of the Chinese medicine industry has attracted much attention from the Chinese people. Accordingly, the current status of the cultivation of Chinese herbal medicines as raw materials cannot be ignored. According to Figure 1, from 2018 to 2020, the market scale of the Chinese herbal medicine industry has continued to expand.

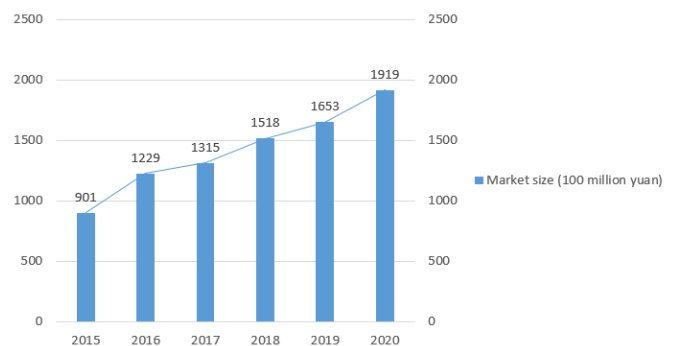


Fig. 1. Statistics on the Market scale of Chinese Herbal Medicine in China from 2015 to 2020.

However, there are many problems in the development of the Chinese herbal medicine planting industry, such as the lack of leading enterprises to lead the development, and the slowdown in the export growth of Chinese herbal medicine, but the rapid increase in the number of imports and the increase in planting scale, but the lack of source supervision.

Based on this, the application of U-Health intelligent Chinese herbal medicine cultivation machine combined with software and hardware has great room for expansion. The Chinese herbal medicine cultivation machine can alleviate a certain demand gap, adopting a combination of software and hardware for standardized planting, and has a high survival rate.

B. Research Objectives

The research object is a multifunctional Chinese herbal medicine planting machine that helps people cultivate Chinese medicine in a pot with a combination of software and hardware. Through the independent selection of the cultivation container style and the hardware of the cultivation mode: Chinese herbal medicine cultivation machine, adaptive adjustments are made, and the product blueprint is shown in Figure 2. The developed software can wake up the intelligent assistant service, and the combination of software and hardware enables the cultivated Chinese herbal medicine to grow virtually in real time. At the same time, you can view relevant Chinese herbal medicine cultivation and family use information on the software.

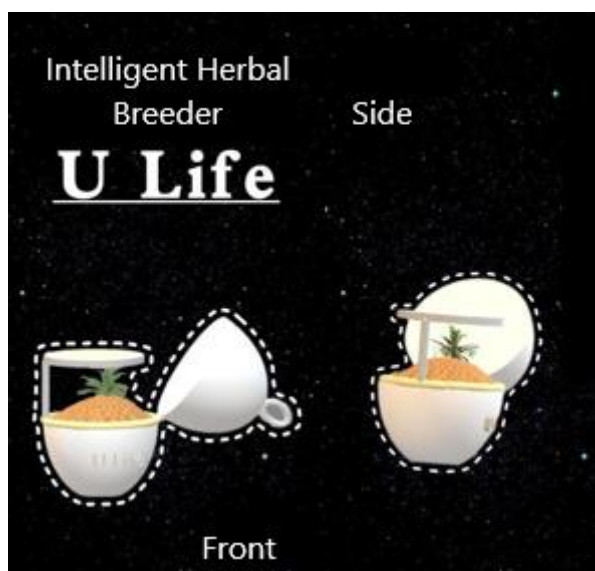


Fig. 2. Product expectation blueprint.

The product changes the traditional medium and large planting places and effectively solves the problem of Chinese herbal medicine cultivation that has geographical, time, and temperature restrictions. According to needs, large, medium and small pots are used, and various types of Chinese herbal medicine cultivation machines such as "egg-shaped", "bowl-shaped" and "bottle-shaped" are expected to be easily configured. Mainly for family health preservation, small drugstore groups, according to personal needs or social needs, to achieve anytime cultivation, remote control, mobile phone viewing, virtual conversation, etc.

C. Intended to Generate Value

The positioning group of Chinese herbal medicine cultivation machine is small and middle-class families, and the

products have the advantages of forward-looking and advanced nature. After many experiments and improvements, we explored intelligent farming. The Chinese herbal medicine cultivation machine can not only reduce the dependence of Chinese herbal medicines on growth conditions to a certain extent, but also strengthen soil detection through intelligent monitoring; it can also provide learning materials and related log records for the cultivation of Chinese herbal medicines.

The proportion of consumers who prefer medical treatment in 2020

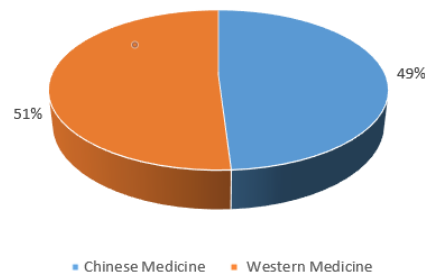


Fig. 3. Proportion of consumers inclined to medical treatment in 2020.

The purpose of Chinese interviewees to buy Chinese herbal medicine in 2020

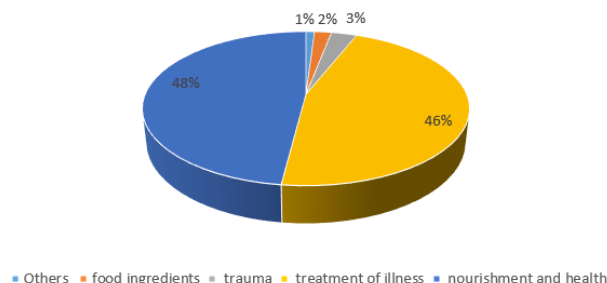


Fig. 4. The purpose of Chinese interviewees to buy Chinese herbal medicine in 2020.

The Chinese herbal medicine cultivation machine is mainly aimed at small-scale family cultivation of Chinese herbal medicine, so the target market is positioned at the family. Although it is impossible for everyone to be familiar with the pharmacology of traditional Chinese medicine, it is possible to use modern medical and health knowledge to understand the effects of traditional Chinese medicine, for example, according to their own physical symptoms to evaluate whether they are suitable for the indications of taking traditional Chinese medicine tonics^[2]. According to Figure 3, consumers tend to have the same importance as Western medicine in terms of medical treatment methods, that is, the use of Chinese herbal medicine is very common in daily life. According to Figure 4, the survey of the main purpose of purchasing Chinese medicinal materials by Chinese respondents shows that the scope of application of Chinese medicinal materials is wide, and the demand for Chinese medicinal materials has the potential to grow. Among the use of Chinese herbal medicines, nourishing health and treating illnesses are the most common. At the same time, it also

explains the important role of Chinese herbal medicine in the daily life of the people.

The tense rhythm of modern life makes a considerable part of people in a sub-healthy state, coupled with the aging of the population, people have an increasing demand for health medicines and foods with anti-fatigue, anti-aging, brain-building effects. Chinese herbal medicines as supplements for green health foods and health beverages are widely respected. Many manufacturers have seen business opportunities from this, and have developed and launched products such as "Ginseng Royal Jelly", "Cordyceps Chicken Essence", and "Ganoderma Capsules" that use Chinese herbal medicines as gimmicks, and their sales are very impressive. According to the analysis in Figure 5, the domestic health industry market is large in scale and showing a steady growth trend, and its growth is very impressive. Chinese herbal medicines have a large audience as production auxiliary materials. The market capacity is large, the market has not reached saturation, and the future development trend is good.

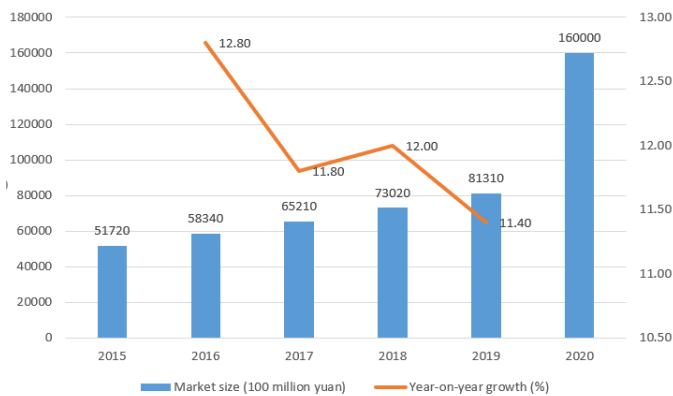


Fig. 5. Scale trend of large-scale health industry from 2015 to 2020.

III. DESIGN PRINCIPLE

The overall framework of the system composed of upper computer, cloud service, transmission layer and lower computer [3] is shown in Figure 6.

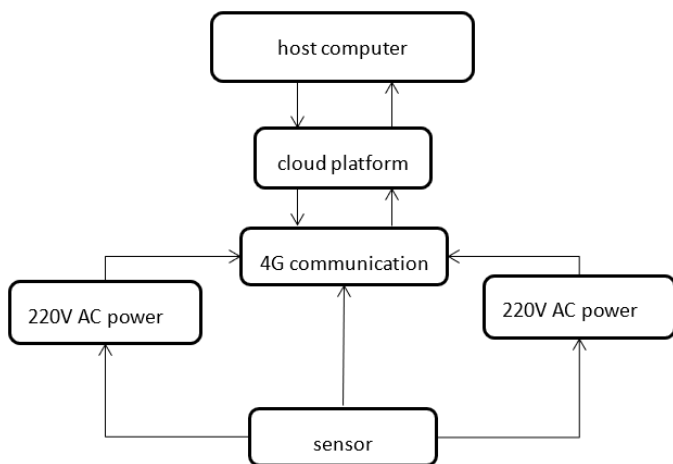


Fig. 6. Overall framework design of the system.

A. Host Computer

Use Android Studio 3.1.22 to develop Android system mobile APP, the visual operation end is on the APP, and the data and services are on the back end. The backend connects to the cloud platform service page to crawl relevant data.

B. Cloud Service

Use the Internet of Things platform to connect to the domestic environmental monitoring cloud platform. Use Jingxun Cloud to deploy on Alibaba Cloud server, which can be accessed by customers anywhere in the country. Use the platform to collect and store data, record the change curve, and provide timely feedback.

C. Transport Layer

The SIM card is used as the transport layer of 4G communication, and the data interacts with the cloud platform through the TCP/IP protocol and network signals.

D. Lower computer

The soil test data is collected by sensor equipment, mainly soil moisture, pH, temperature, etc. Upload the data signal and monitor the soil environment in real time through the APP terminal.

The overall design consists of two parts, software and hardware, which interact through 4G signals. The upper layer of the software part is the developed configuration software app, and the lower layer is the cloud service platform. The hardware part is composed of communication and sensing, SIM card 4G Internet of Things communication, the sensor collects the signal and transmits it to the communication device through the bus. The energy of the hardware module comes from household 220V AC.

IV. HARDWARE SYSTEM DESIGN

A. Model 3D Printing

Use Solid work for modeling as shown in Figure 7. The model is simply evaluated and then 3D printed with resin materials. The egg-shaped Chinese herbal medicine cultivation machine contains precision parts, and the high precision requirements make 3D printing requirements high and impossible to complete. This article uses a simplified model for 3D printing, which provides reference value for this article.

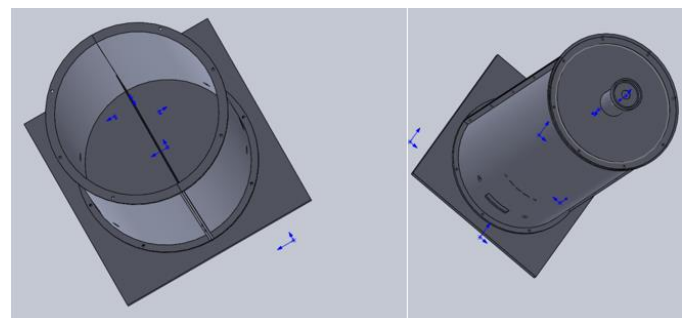


Fig. 7. Prototype shell.

The model includes shell, planting fixture, water pump, etc.,

as shown in Figure 8. The model simplifies the shell and internal circuit design, and the materials, interfaces, sensor circuit design, etc. can be further modified through direct trial testing. The design of the water pump can be improved into a side chamber, the internal carrier does not leak and there is no interface to connect the sensor and other details.



Fig. 8. Print model.

B. Hardware Design

Lower computers include GPRS/4G network sensors, high-precision soil detection sensors, aerodynamic water pumps, etc. According to the established agreement, the device has an embedded network module for the Internet of Things. This module can transmit data through 4G Internet of Things. The network topology is shown in Figure 9. The network module communicates with the high-precision sensor through the serial port, so that the precision sensor data is directly sent to the network module through the serial port,

and then transmitted to the service cloud through the network module for processing.

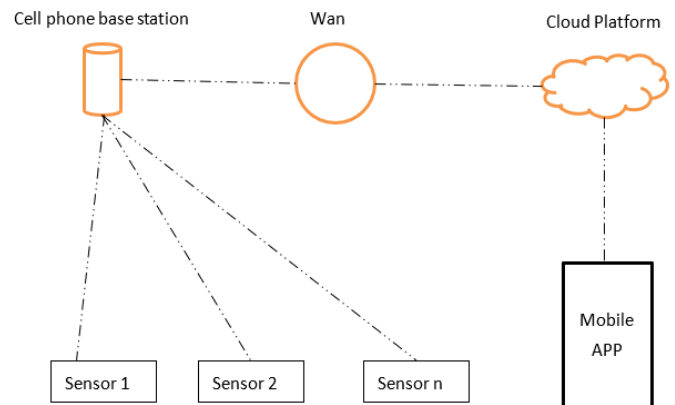


Fig. 9. Topology diagram of the Internet of things.

The soil accuracy sensor adopts a specific communication protocol, the baud rate is 2400bps, the data bit is 8 bits, and the stop bit is 1 bit. No parity check, using CRC lengthy cyclic code for error checking. At the same time, the sensor is directly connected to the network module, and the protocol format is as follows.

TABLE I. Data frame format.

Interrogation frame	Address code	Function code	Register start address	Register length	Check code low bit	High bit of check code	Without
	1	1	2	2	1	1	0
Reply frame	address code	function code	Number of valid bytes	First data area	Second data area	Nth data area	function code
	1	1	1	2	2	2	2

TABLE II. Register address.

Register address	PLC Configuration address	content	operate
0012H	40013(40019)	Soil humidity (unit: 0.1%RH)	Read only
0013H	40014(40020)	Soil temperature (unit: 0.1°C)	Read only
0015H	40016(40022)	Soil conductivity (unit 1us/cm)	Read and write
0100H	41001	Device address (0-252)	Read and write
0101H	41002	Baud rate (2400bps)	Read and write

In the design, send 00 01 04 11 0C 0D 0E 0F. It can be displayed in the APP through formula processing in the cloud, where the temperature and humidity must be divided by 10, and if the temperature is lower than 0°C, the complement is used.

Temperature calculation: FFF5H (hexadecimal) = -10 (decimal) = -1°C.

Humidity calculation: 235H (hexadecimal) = 565 (decimal) = 56.5%RH.

V. SOFTWARE DESIGN

A. Feature Design

When designing this APP for analysis, first of all, it can be expanded according to two different modules [4]. One is the design of the client system. The user only needs to download the app to obtain information about the operations required to complete the planting. Users can query the required services through the menu bar. Mobile phone can view, virtual and talk anytime, anywhere. Understand soil information such as humidity, acid-base, temperature, etc. through commands. At the same time, you can manage your own account information and record the log of the situation on the day. The second is the merchant maintenance terminal, which puts the merchant terminal and the maintenance terminal together, which is convenient for designing and changing forms and information. In this procedure, data can be collected based on numerous client information. According to the user's situation, the program's label picture can be slightly modified, and at the same time, excessive useless memory can be cleaned up. The maintenance program can update and check the entire program. And manage users, delete bad information and users, and play a role in maintaining the operation of the system.

B. Database Design

In the Chinese herbal medicine cultivation machine app, in addition to filling in user information and uploading data, there are practical methods for raising Chinese herbal medicines and Chinese herbal medicine families. A lot of the information includes pictures, introductions of Chinese herbal medicines, personal log uploads, etc. Use the lightweight open source embedded relational database SQLite database. The memory is small, and the accessibility to the database is very high, which meets the needs of users. Secondly, it has strong portability to computers and mobile phones, and supports both 64-bit and 32-bit. Considering the needs of database expansion and data accuracy, the database adopts certain measures to ensure the safety of operations and prevent misoperations, such as restricting ordinary users to modify the database, and performing operations such as data modification and addition through user authorization [5].

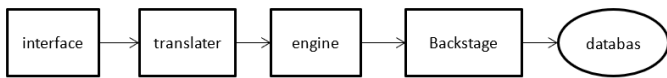


Fig. 10. SQLite structure hierarchy.

1) Compiler: The compiler is composed of three modules: lexical analysis, syntax analysis and intermediate code generation. Among them, the lexical analysis module and the syntax analysis module are responsible for checking the grammar of the SQL statement, and then pass the generated syntax tree to the intermediate code generation module. The intermediate code generation module is responsible for generating intermediate codes that can be recognized by the SQLite engine.

2) Database engine: The database engine is the core of SQLite, responsible for running the intermediate code and directing the specific operations of the database.

3) Background: The background consists of three modules: B-tree, page cache and system call. Among them, the B-tree is responsible for maintaining the index, the page cache is responsible for the transmission of page data, and the system call is responsible for interacting with the operating system, and finally realizes the access to the database.

Obtain an operable database through UserDataHelper and rewrite the context. Use insert to insert and add, and the user name and password are submitted in the put method. The cursor method is used to query the data. The cursor obtained by the query points to the first record before, so the first call to moveToFirst or moveToNext after the cursor is queried can move the cursor to the first record.

This article analyzes the correctness, security, performance, usability and accessibility of the Android project. It uses the static checker Lint. The objects it checks around it include XML resources, ProGuard configuration files, source files and even compiled bytecodes. SuppressLint includes features such as API version checking and performance checking. When using the methods of Plant Application and its subclasses, they will be called in real time to update the interface, which will cause frequent object creation and garbage collection, etc., which will obviously affect the display performance of the UI.

At the same time, a smoothly displayed user interface will temporarily stagnate due to some garbage collection mechanisms caused by object allocation. The solution is to change the object to a member variable of the class, and then use @SuppressWarnings("StaticFieldLeak") to eliminate the stagnation.

C. System Implementation

The main function of the APP application is to learn relevant knowledge, view the soil condition of Chinese herbal medicine and personal information. The menu bar at the bottom of the software interface is divided into three functional menus: homepage, traditional Chinese medicine and user, corresponding to related functions.



Fig. 11. APP software page display.

1) Knowledge of Chinese herbal medicine. Users can enter the user interface by downloading a designated APP through a mobile phone. There is a homepage menu in the user interface, through which users can learn the knowledge of Chinese herbal medicines and specific practical methods of Chinese herbal medicines, including specific weighing grams and additions that can be added when cooking. The top-level pictures are scrolled to show users related pictures and data of Chinese herbal medicines in the form of Baidu Baike. Then there are multiple blocks, which introduce the various uses of commonly used Chinese herbal medicines from a comprehensive, multi-level, and wide-ranging field, to meet actual needs and supplement the knowledge about the use of Chinese herbal medicines.

2) The "Chinese medicine" menu of Chinese herbal medicine soil provides users with the planting status of Chinese herbal medicines. The upper part is further subdivided into plant name, plant type, plant growth time and plant status. In combination, the cultivated plants can be recorded in real time, and the physical Chinese herbal medicine can also be monitored through the operation of the software to realize remote viewing, such as humidity, acid-base, temperature, etc.

3) User homepage In the "User" menu, at the top is an interface for registering personal information and displaying personal information. Through this interface, you can change your personal information and adjust various functions of the software. The main part of this menu can be divided into my plants, history and dynamics. You can get a clearer understanding of the plants being planted, and you can also see the records of the plants that have been planted. The history contains the pages browsed by the user, including the relevant pages of Chinese herbal medicine study on the

homepage. Dynamic is a log interface, share cultivation diary, and leave messages with friends who grow Chinese herbal medicines together, and exchange experiences about Chinese herbal medicines.

Establish the Gallery control in Android, and use the Adapter interface to implement the control zoom animation. The Gallery is a draggable list, and the Adapter is an intermediate bridge to help fill in the data. The homepage uses GalleryAdapter to play pictures in a loop, and urls are configured so that the picture can be clicked to jump. Then create a structure, put the pre-selected URL into it, and set the gallery to play content. Finally, use getItemCount(); to get the number of items in the current edit list box, return the number of items, and then achieve unlimited carousel.

Figure 11 also shows the interface diagram of the soil detector. The task bar at the bottom is divided into real-time monitoring, equipment control, and notification announcements. Real-time monitoring is further subdivided into list viewing, classification viewing and real-time map. The combination of the three can control multiple soil detectors by classification, laying the foundation for mass production; there are multiple relay control states in the equipment control, and automatic isolation function. The switch element can carry out remote control, remote measurement and automatic control of current, making the soil detector more intelligent; the notification announcement is mainly responsible for conveying information to users and detecting soil dynamics in all directions, so that users can understand the specific conditions of soil in real time.

VI. CONCLUSION

Using high-precision sensors and a 4G Internet of Things network module as the lower-level computer, the SIM card on the control unit can be directly connected to the cloud service platform, and the Android-based APP can be connected through the cloud platform. This article finds some difficulties in domestic Chinese herbal medicines through examples: Chinese herbal medicines require high temperature and humidity, and are dependent on suitable pH and trace elements in the soil. The intelligent Chinese herbal medicine cultivation machine can monitor the environment in real time and manually control the environment, and the handheld APP provides practical information such as Chinese herbal medicine planting and Chinese herbal medicine home use.

The combination of offline cultivation and planting with online learning records has slowly lifted the mystery of Chinese herbal medicine, allowing Chinese herbal medicine to enter daily life.

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