

AI Rental Plant Keeper

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Abstract: *The automatic watering system can be easily obtained in the market, however it is impossible to control the illumination, temperature and humidity of plants at the same time, and it is also not suitable for the modern small-sized homes. The device is a public rental flower cabinet which is capable of personalizing the flower growing environment and satisfying people's individual requirements, and aimed to overcome the defects such as high cost and low intelligence of the prior art. Moreover, the device is not only highly automated and intelligent, but also no supervision, low cost, wide applicability, easy to use, and rental for all users who need temporary care flowers has profound and lasting application prospects. Furthermore, the big data processing can be performed based on the cultivation parameters uploaded by the user, and various types of flower planting schemes are continuously improved. Data can also be provided to the development of plant health status recognition functions based on artificial intelligence.*

Key words: *Home automation; Flower intelligent management; Intelligent temperature control; Intelligent humidity control; Artificial intelligence interface call; Lifting lighting platform; Bluetooth*

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I. Introduction

With the improvement of contemporary people's life, planting some potted plants is becoming a kind of hobby, since they can add color to the home and purify air. However, people usually face the heavy work pressure, and they often arrive early and have no time to manage their plants. Especially some plants are extremely easy to death without loving care. Sometimes, the white-collar will have a long business trip which may cause the plant's death. Even if they can timely watering, fertilizing too much or little will make plants yellowing.

Now on the market only a small part of the device can be intelligent with plants, and it is usually small potted plants and large-scale management of machine. There are no machines suitable for centralized management of large plants in cities, so the focus of this study is on how to reduce the growing pains of urban residents. Having searching literature and market research, we found that the intelligent breeding machines and plants are mainly divided into three types at present: drip irrigation automatic flower watering machine, "greenhouse" and cabinet household intelligent machine. Drip irrigation automatic watering system, cannot control the plant light and temperature, humidity, and it only gives flower water supply. "Greenhouses" can be planted with seasonal plant on a large scale, but it lacks an electronic control system to regulate the wet temperature. And it covers an area of large. Cabinet household intelligent machine is only applicable to small plant. It can only control the light and humidity for fresh vegetable or be used in a short period of time to watch, so it can't really breed plants which are also very expensive. Therefore, it is of great practical significance to develop a kind of public rental flower cabinet with low cost, high intelligence and the ability to breed different kinds of flowers.

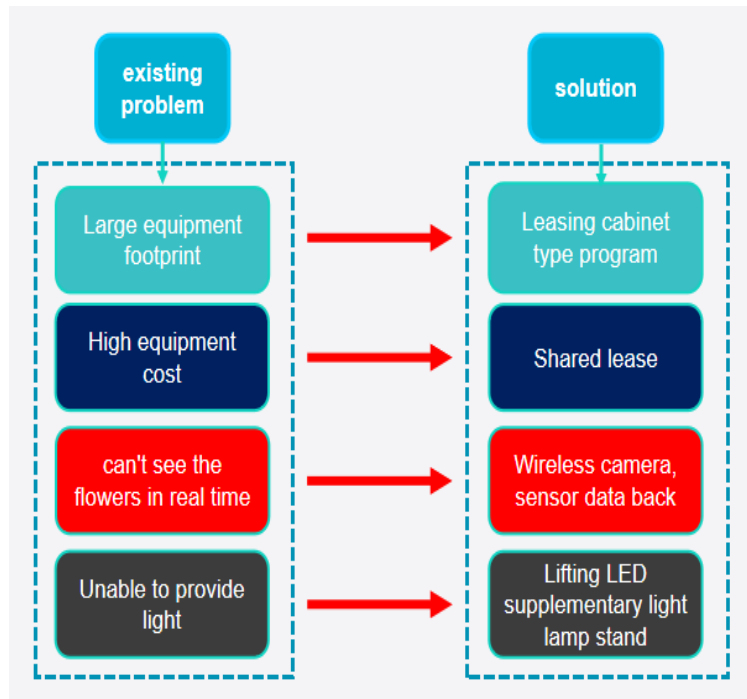


Figure 1. overall design

In view of the problems existing in the plant planting machinery in the current market, our device has these advantages (described in Fig.1). The device doesn't take up any the living area of the family; have lower cost than other similar goods; can know the situation of flower plants in real time; provides appropriate light and water supply for plant to grow. Next, the device can be used in community or campus, and the weight of it is about 5kg, and the most important function is that there is no limited flower types to place in the cabinet which means people can put whatever into the keeper.

Description of the keeper

A. How to work --Workflow

The device is easy to operate. The working process of the keeper is described with Fig. 2.: After the flower plants are placed, the user first affirms the flower information through the APP or input the information by himself, and then the user affirms the plant parameters (Including: temperature and humidity, sunshine duration, frequency of watering flower). Finally, the user will confirm the period of service. Among them, there is a camera in the box which can capture real-time images of flowers and transmit the image information to Baidu's artificial intelligence server through the network for identification. Then terminal will obtain the information of flowers and send the information to the planting keeper server for the retrieval of plant parameters, which will be sent to the user's mobile phone for modification and confirmation. And the sensors installed in the flower cabinet are connected with the controller, the instructions of the terminal automatically control electromagnetic water valve opening and closing, screw stepper motor forward or reverse the platform lift, opening and closing of the pump, blue and red double color LED, adjusting brightness, spraying fog, switching fans, semiconductor chip cooling and heating.

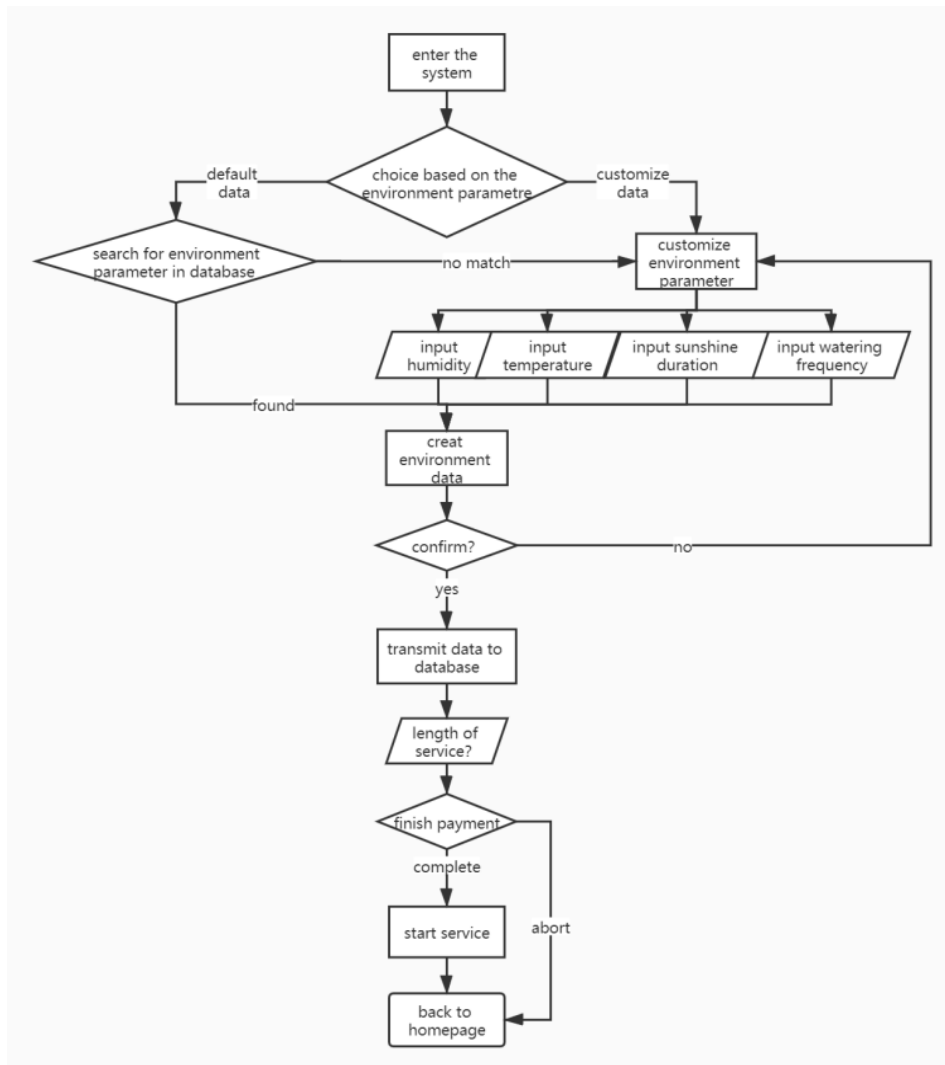


Figure 2. workflow

B. How to create -- Structure design

Figure 3 is the sketch map of the keeper. It shows the appearance of our device, including the frame of the flower cabinet and the modules installed in it. Camera module is installed on the roof of the keeper above the lighting module. The lighting module (16~18 in Fig.7) is placed on a board above the target plant which is drive by a step motor through the screw row, realizing the vertical movement of the lighting module. The watering module (22~26 in Fig.7) combined with the humidity sensor (26 in Fig.7) is hung on the side board of the keeper which is needed to be set it into the soil of target plant manually. Also, the water tank (22 in Fig.7) which supplies water Is placed on the head part of the keeper. The main control module including watering control, data acquisition module, humidity control, temperature control, lighting control, and communication control, security module is also placed in the head part beside the water tank. The semiconductor chilling plate and drier is placed at the bottom of the keeper, connecting with the controlling module through wires hidden in the frame of the keeper. The frame (2~4,10 in Fig.7) is composed by aluminium alloy profile which is cheap, strong and light. PMMA is chosen to be the material of the side board (6,7,8,12,19 in Fig.7) which strike a balance between beauty and strength. We install four wheels under the keeper in order to achieve satisfactory mobility.

5 in Fig.7 is the aluminium corner fitting we use to stabilize the overall structure.

13 in Fig.7 is a door handle.

14 and 15 in Fig.7 is magnetic door lock controlled by the security module.

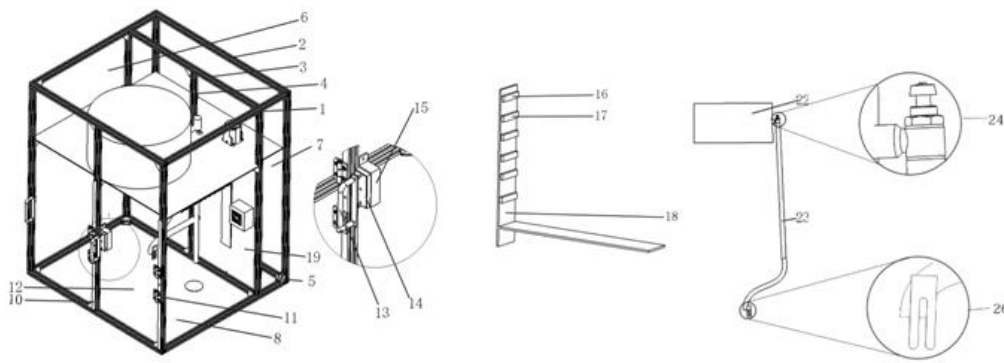


Figure 3. structure design

C. How to create -- Electrical design

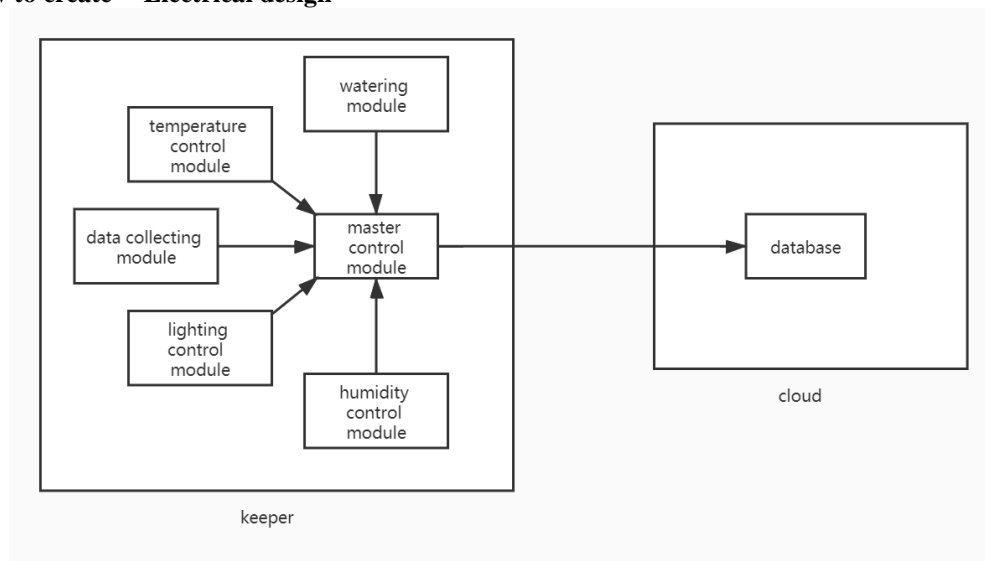


Figure 4. Electrical module design

1. Temperature controller

In the process of flower cultivation, the temperature control of the environment is very important. The temperature control section includes semiconductor sheet, heat sink and H-bridge. The bilateral connection of the semiconductor sheet has a heat sink. Using the H-bridge drive circuit can change the current direction of the circuit and then control the refrigeration or heating of the semiconductor sheet. The semiconductor sheet is connected with the control module (as shown in figure 4). The advantages of using semiconductor chips to control temperature are low cost, simple structure, high precision temperature control.

2. Humidity controller

In the process of flower cultivation, the humidity control of the environment is also very critical. The humidity control section comprises an atomizing sheet assembly for water atomization, an exhaust fan and an exhaust pipe connected to the outside. The exhaust direction of the exhaust fan is from inside to outside, and the exhaust fan is connected with the control module. When the environmental humidity is small, the control module opens the atomizing sheet assembly to start humidification, and when the environmental humidity is large, the control module opens the exhaust fan to the outside to reduce the environmental humidity.

3. Lighting controller

The lighting device and step motor are connected with the control module. It can automatically adjust the distance between the lamp and the plant, and its adjustment range is accurate. Choosing the red and blue LED stripe as the lighting device, and the stripe has multiple advantages such as high safety factor, stable light intensity, easy adjusting and soon. The device can not only on-off control the lamp, but also modify the brightness and color of the LED light, thereby simulating the best light for plants to absorb. The reason choosing the color blue and red is that these two lights fit the light wavelength range which the chlorophyll mainly

absorbs (mainly 400nm~520nm and 610nm~720nm), using red and blue light can remarkably reduce power use and raise energy efficiency. This device also adjusts the distance between light and plant smartly through the cooperation of camera and control module. By the same method it can also modify the light strength to maximize the light usage.

4. Watering controller

In the process of flower cultivation, the watering control is very important. When the soil moisture sensor reports that the flowers need watering, the pump starts to draw water from the tank. The soil moisture sensor also knows when to turn the pump off. So, this kind of real-time control drip irrigation watering method can avoid the plant root rot and water resources waste.

5. Master controller

Master controller is an important part of flower cultivation. It has overall control over all information and connects with users. The design of electronic control module requires the user to enter data on the mobile phone to control the management of flowers. Therefore, according to the functional requirements of the design, the electronic control core control board is designed with the processor model ATMEGA328. It includes communication module for communication with cloud and intelligent terminal; the smart terminal is a mobile phone or a computer through which the actual growth conditions of the regulated flowers can be set. Through the intelligent terminal, users can not only observe the growth of flowers in real time, but also set the actual growth conditions of flowers.

II. Conclusion

The main idea of the design is through the sharing economy idea of leasing to reduce the use cost of intelligent furniture and make flower cultivate more intelligent. This product combines the camera and the artificial intelligence to implement real-time monitoring of the flower, display the temperature and humidity sensor on the internet so that users can check the situation of their flowers at anytime and anywhere. The data collected by the cabinet can contribute to the development of plant health status recognition functions based on artificial intelligence. In addition, the LED is used to adjust different light intensity on the basis of flower demand and Watering quantity is automatically controlled without manual intervention. Finally, it has great application prospect on promoting the quality of people's life.

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