



Design and Realization of a Lifting Type Wooden Intelligent tea table

Zefang Zhao ^a, Jianhang Huang ^b, Zheyu Zhang ^c, Yifan Wang ^d, Peiwen Luo ^e,
Ying Xin ^{f,*}

College of Engineering and Technology, Northeast Forestry University, No.26 Hexing
Road, Xiangfang District, Harbin, China

^a1106645444@qq.com, ^b1819350851@qq.com, ^c1453029789@qq.com,
^d2096836195@qq.com, ^e812902250@qq.com, ^fxyneu2003@163.com

*corresponding author

Abstract: With the development of multifunctional home products and the emergence of intelligent concepts, the functions and use of traditional household products are changing. Household items is more and more toward the direction of intelligent development, because of wood tea table's green, environmental protection characteristics, it is welcome by people. Based on the traditional household tea table, wood tea table and intelligent, multi-functional combination, This paper puts forward a lifting system combined with intelligent sensors and other functions of the new intelligent tea table. The lifting system can realize the remote lifting of tea table, and the intelligent sensor is responsible for detecting indoor humidity and automatically controlling the humidifier. The experimental research on the wooden intelligent tea table has been carried out. The results show that the wooden intelligent tea table has good intelligent response characteristics and elevating characteristics.

Keywords: Smart tea table; Drop of tea table; Intelligent humidification system.

1. Introduction

Woodiness material because of its green environmental protection, energy-saving the advantage that reduce emission, make the mainstream of furniture gradually, and tea table serves as the indispensable things inside human life space, develop to the direction of green intelligence gradually. The mechanical mechanism of wooden tea table is adjusted and optimized, design a kind of intelligent tea table with intelligent

humidification, remote control of tea table desktop lifting, the use of solar energy to USB socket power supply, electromagnetic heating function of wooden intelligent tea table, realize the organic combination of green environmental protection and intelligent, bring people more intelligent, comfortable, convenient intelligent household.

2. The overall architecture of the lifting device control system

The lifting device control system uses remote infrared to control the rise and fall of the table surface, and controls the rise and fall of the telescopic frame by controlling the motor's positive and negative rotation through the remote control equipment. The system includes infrared receiving system, control system and execution system. Infrared receiving system uses infrared receiving diode to receive the signal from the remote control to control the positive and negative rotation of the motor. The control system is mainly controlled by AT89C51 single chip microcomputer. The implementation system mainly includes motor, chain, telescopic frame and moving axis.

3. Mechanical structure design of wooden intelligent tea table

Structure of woodiness intelligent tea table is shown as Fig. 1, Fig. 2 place, by square tea table one, square tea table two and square tea table three composition.

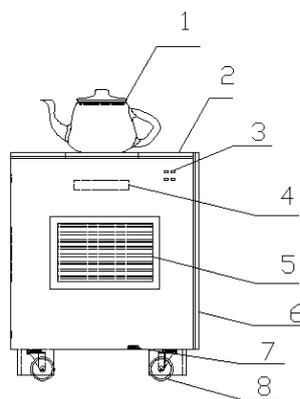
Among them:

Square tea table by roller mechanism, control mechanism composition.

Square tea table two by the roller mechanism, power mechanism, support plate mechanism and control mechanism.

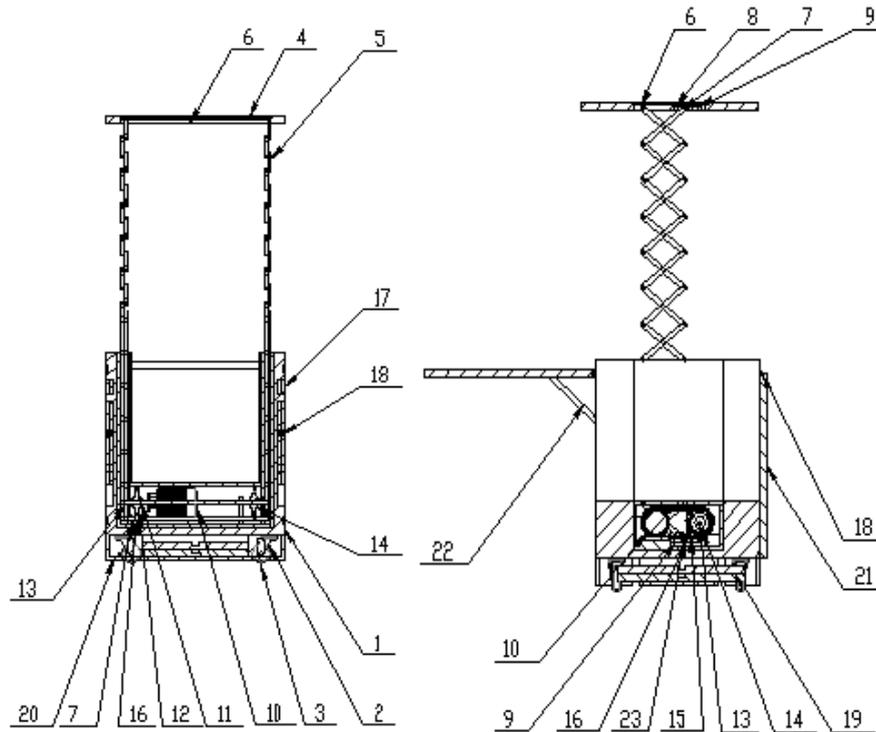
Square tea table 3 and square tea table 2 structure are identical.

(note: tea table room is connected by high strength magnet)



1—electric kettle; 2—Solar panel 1; 3—USB port; 4—high strength magnet; 5—intelligent humidifier; 6—solar panel 2; 7—power plug; 8—move the roller

Figure 1 Square table structure diagram



1—tea table box; 2—mobile wheel bracket; 3—moving round; 4—mesa of tea table; 5—slip plane; 6—fixed axis; 7—the upper moving axis; 8—mechanical button; 9—chute; 10—motor; 11—drive shaft; 12—drive sprocket; 13—driven shaft; 14—driven sprocket; 15—chain; 16—connection; 17—folding stool legs; 18—hinge; 19—bench panel; 20—bench panel groove; 21—tea table side panel; 22—support plate; 23—lower moving shaft

Figure 2 schematic diagram of two square tea tables

3.1 Roller mechanism

The roller mechanism consists of a roller, a holding piece and a connecting part. The roller is covered with rubber to increase friction. The holding piece is close to the roller, which can be pressed to lock the roller when needed; The connecting part is used to connect with the main body of the tea table.

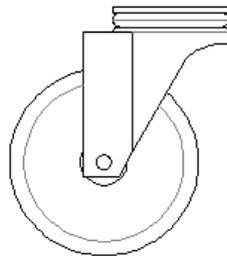
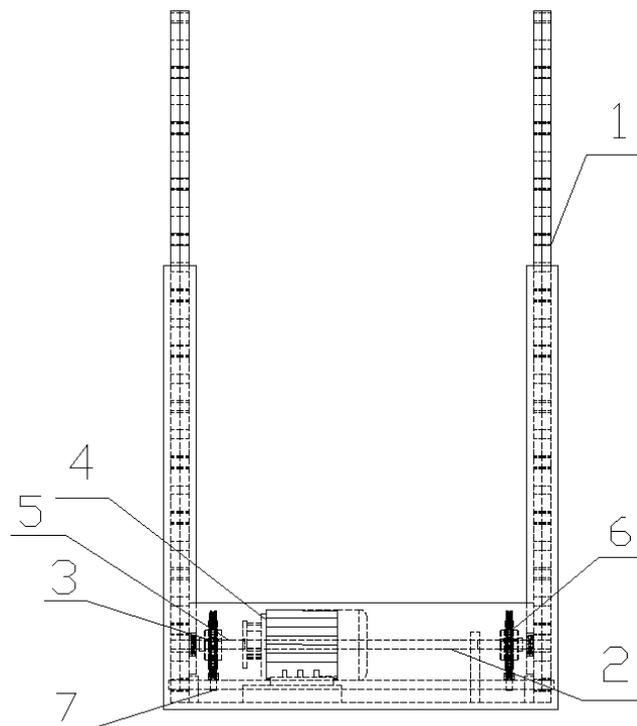


Figure 3 Side view of roller mechanism

3.2 Power mechanism

The power mechanism is shown in figure 5, which is composed of a motor, a moving axis, a chain and a telescopic frame.

The motor is installed on the lower part of the square coffee table, one end of the chain is installed on the motor output shaft, and the other end is connected with the lower moving shaft. The moving shaft is driven by the connecting block to control the expansion and contraction of the telescopic frame. The motor speed is adjustable and the positive and negative rotation is adjustable. The maximum expansion height of the moving optical axis is up to 0.7m.

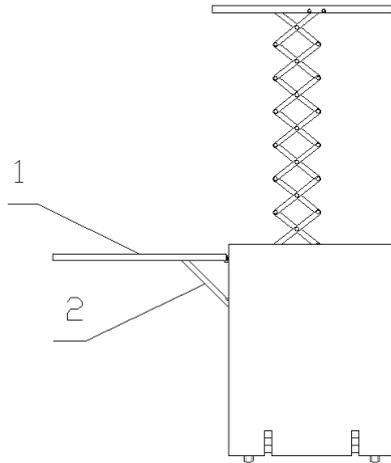


1—telescopic frame; 2—lower moving optical shaft; 3—active sprocket ;4—motor; 5—drive shaft; 6—driven sprocket;7—connection block

Figure 4 The motor structure diagram

3.3 Plate support mechanism

The supporting board mechanism is composed of the side board and supporting board of the tea table. The side board of the tea table is supported by the supporting board and the stage surface of the tea table to form the bigger tea table.



1—tea table side panel; 2—support plate

Figure 5 Board organization structure diagram

4. Control system design

4.1 Intelligent humidifier control system design

The hardware block diagram of the control system is shown in figure 6. The core control device adopted is AT89C51 single-chip microcomputer. The hardware circuit is powered by an external power source, and the humidity sensor is used to collect external information such as humidity and relative humidity. Then the sensor will monitor the environment information to A/D conversion system, A/D conversion system will sensor analog signal into digital signal, and transmitted to the control system, the control system to judge to control the humidifier drive circuit, so as to achieve the humidifier switch.

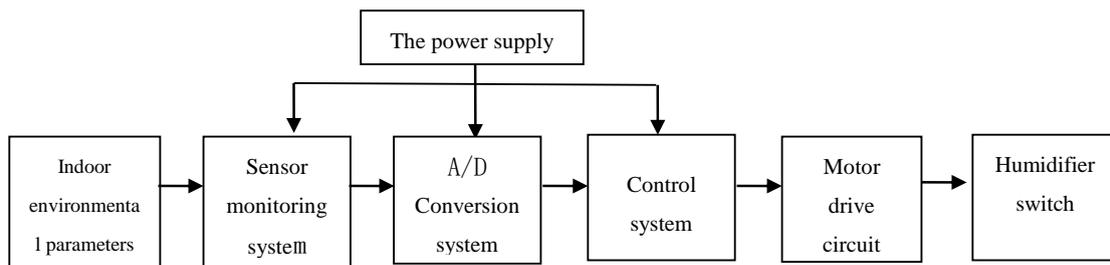


Figure 6 Hardware of control system block diagram

Moisture sensor adopts capacitive moisture sensor. When the ambient humidity changes, the permittivity of the wet-sensitive capacitance changes, so does its capacitance. The capacitance changes are proportional to the relative humidity. This principle is often used to measure humidity. In this paper, HF3223 linear frequency output integrated humidity sensor produced by Humirel company is selected. Its modular structure has the advantages of good linearity, strong anti-interference ability, convenient digital circuit or single-chip microcomputer, low price and so on. When the system works, when the sensor senses the change of indoor humidity, it sends a signal

to the single-chip microcomputer, which controls the humidifier switch. The software design process of intelligent humidifier system is shown in figure7.

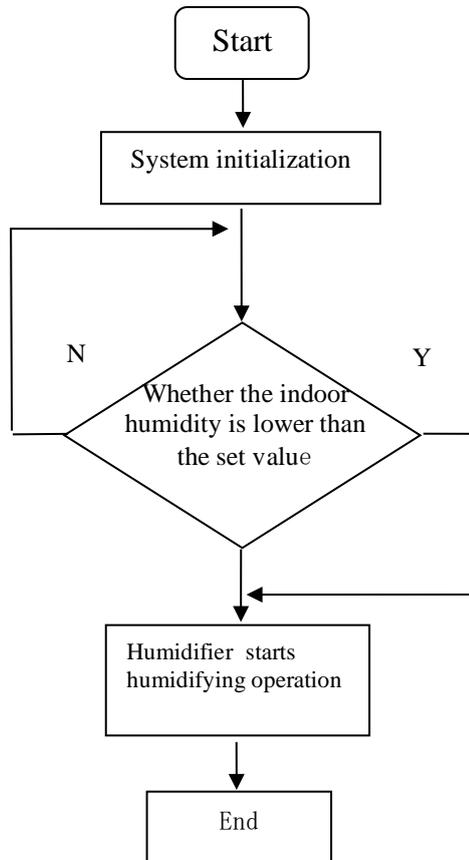


Figure 7 Software design flow chart of intelligent humidifier system

4.2 Hardware circuit design of lifting device control system

The hardware block diagram of the control system is shown in figure 8. The core component is AT89C51 single - chip microcomputer .Hardware circuit by an external power supply, the infrared receiving system to realize the collection of external remote control information, again by the remote control of infrared receiving system will receive the information to A/D conversion system, A/D conversion system converts infrared receiving system of the analog signal to digital signal, and transmitted to the control system of judgment by the control system in order to control the motor drive circuit, so as to realize the positive &negative of motor, and then realize the rise and fall of telescopic frame.

The stepper motor is selected as the driving source, which is easy to control and cheap. The stepper motor is connected with the gear shaft, which is controlled by single chip microcomputer. When the MCU issues the rising instruction, the motor turns forward to drive the gear shaft in the center of the active sprocket wheel to rotate, and the lifting of the telescopic frame is realized through the meshing of the gear and the

chain. When the MCU issues the descending instruction, the motor reverses, and the decline of the telescopic frame is realized through the meshing of the active sprocket wheel and the chain.

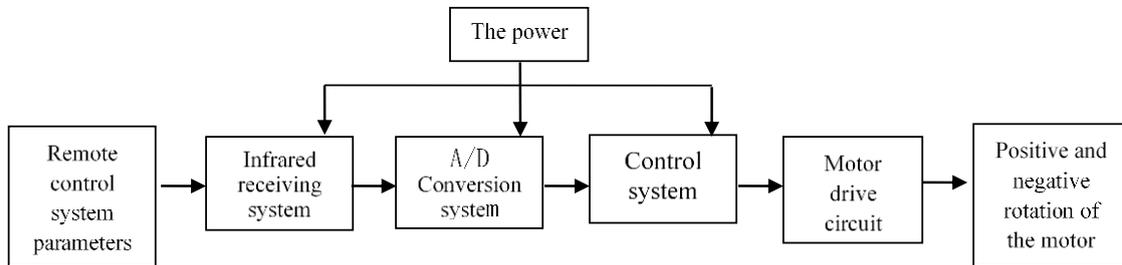


Figure 8 Control system hardware block diagram

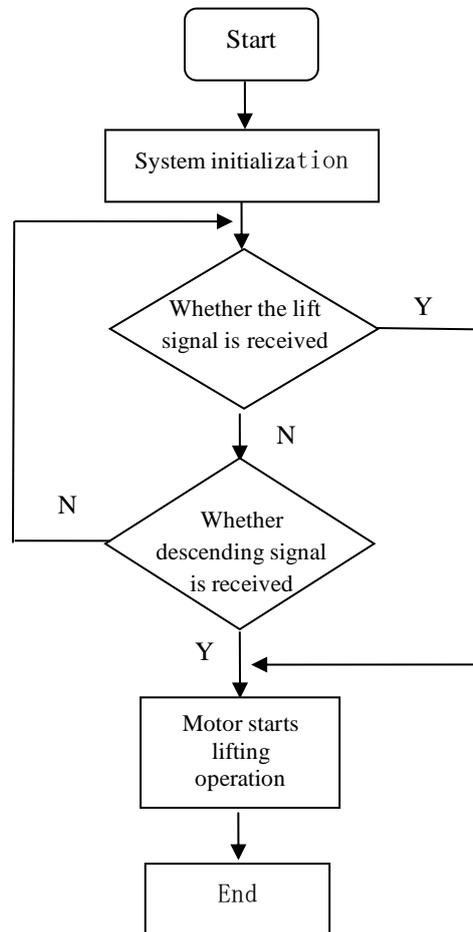


Figure 9 Software design flow chart of motor lifting system

5. Function test of intelligent humidifier and lifting device control system

5.1 Function test of intelligent humidifier control system

After completing the design of the intelligent humidifier control system, the intelligent humidifier function test, according to the investigation of the most suitable humidity

for human body, when the indoor relative humidity in 30%-60% make most people feel comfortable. Therefore, pre-set system monitoring values of 30% and 60%.

The experimental results show that the system can well respond to the switch program of intelligent humidifier when measuring indoor humidity, with response error of 1.5% and response time of 5.2s. When the system is monitoring intrusion, the effective radius of monitoring is 5m. It shows that the intelligent humidifier designed is effective and reliable.

5.2 Function test of lifting device control system

After completing the design of all parts of the control system of the lifting device, the function test of the lifting device was carried out. According to the investigation of the indoor operation height, the preset lifting height of the system was 40cm and 70cm. The experimental results show that when the system responds to the remote control device, the system can better respond to the remote control to open the system switch program, and the response time is 0.8s. It shows that the designed lifting device control system is effective and reliable.

6. Conclusion

Put forward an intelligent can lift the wooden tea table, the wooden tea table is combined with humidity sensor and lifting device. AT89C51 single-chip microcomputer as the main control system, driven by stepping motor as power source, adopt sprocket chain as the main transmission mode. Its main function is to use the humidity sensor intelligent to adjust the indoor humidity, use lifting device to provide high working tools at the same time by the combined power supply, solar energy and traditional power has the advantages of simple structure, the characteristics of energy conservation and environmental protection. Experimental results show that the device is safe and reliable, suitable for modern home use.

Acknowledgments

This paper was financially supported by National innovation training program for college students (201910225020)

References

- [1] Wang chunxia. "A brief analysis of the development of Chinese furniture from the perspective of tradition and modernity", Gansu science and technology, 2008, Vol. 37(1), p21-22
- [2] Qu Luxin, Qu Hangda. "Development and research on Chinese furniture", Forestry Science and Technology Information, 2001, Vol. 33(1), p6-8
- [3] Li Yuhong, Yu Shen. "History of Chinese and foreign furniture", Harbin: Northeast forestry university press, 2000

- [4]Hu Jingchu, Fang hai and Peng Liang. "History of world modern furniture",Beijing: Central Compilation & Translation Press,2009
- [5]Zhang Xin,Lou Junwei. "Study on green furniture development strategy",Journal of zhejiang industrial and commercial college,2006, Vol. 5(4),p14-16
- [6]Duan Haiyan and Wu zihui. "Intellectualization—the development trend of future furniture",Forest product industry,2006, Vol. 33(4),p16-19