

# Design of the Control System of Tea vending machine Based on PLC

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**Abstract**—With the continuous progress of the times, urban groups are more keen on a fast and convenient lifestyle, and tea vending machines are also the most bright selling tools. It can not only liberate manpower, but also bring convenience to life and create more benefits. This paper designed a tea vending machine control system, the system can purchase a specified variety of tea, recognize coins, change zeros and other functions. The control system of vending machine is simulated by Siemens PLC simulation software. The simulation results are: All the functions of the system are realized and the system is running well.

**Keywords**—Tea vending machine, Programmable controller, Echelon

## I. INTRODUCTION

It was the first country in the world to discover and use tea trees. In ancient times, the people had discovered and used tea trees, such as the Shennong "Ben Cao Jing": "The Shennong tasted a hundred herbs, met 72 poisons on a daily basis, and got tea to solve it. "In 1122-1116 BC, China's Bayu had a record of tea as a "tribute. " In the long river of history, tea nourishes our long generation of Huaxia people. To this day, tea culture still has an important influence in people's fast-paced life. And more and more young people are beginning to join the army of tea lovers. In this way, traditional sales in the fast-paced modern life seems to be a bit overwhelmed. Therefore, the appearance of tea vending machines is urgent.

The vending machine is a fast and convenient way of shopping and selling and is currently widely used in more than 50 countries. In the Chinese market, listening drinks sold through vending machines account for 40 % of the market sales, and vending machines have always occupied an important position in the retail industry. Therefore, for the sale of tea, vending machines are very important.

## II. WORKING PRINCIPLES OF TEA VENDING MACHINES

The working principle of the tea vending machine: First, coin the slot, the calculation logic in the program identifies the coins and accumulates the total amount. When the input amount is greater than the purchased product, the corresponding green light of the corresponding product is on. When pressing the purchase button, the goods are exported and the balance is returned; If the purchased commodity is out of stock, the commodity corresponds to a red light, press the button, do not reduce the balance, do not produce the commodity, and automatically return the balance after a certain period of time; If there is no operation for 20 seconds after the coin is put in, the system automatically returns the balance. The goods sold in this vending machine are tea A tea B tea C, and control systems are designed according to different tea types and different purchase methods[2]. The structure of the system is shown in Figure 1.

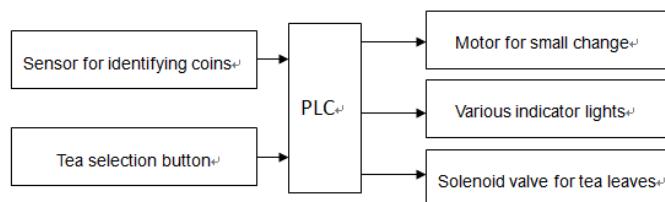


Figure 1 Structure of tea vending machines

### A. External Wiring of Vending Machines

The external wiring diagram of the control system hardware circuit is shown in Figure 1. When the coin is invested equal to or more than the commodity price, the corresponding commodity indicator lights the green light and presses the selection button. The contactor coil corresponding to the commodity is energized, the motor rotates, and the corresponding commodity output is when the commodity is sold out. The internal control stroke switch is automatically disconnected, the commodity indicator light is red, and the goods sales shortage data is sent to the headquarters at the same time; When the value of the purchased product is less than the total value of the input, you can press the SB7 button to choose to look for zero, the contactor coil is energized, and the motor rotates to implement the zero search procedure [3]. The external wiring diagram of the system is shown in Figure 2.

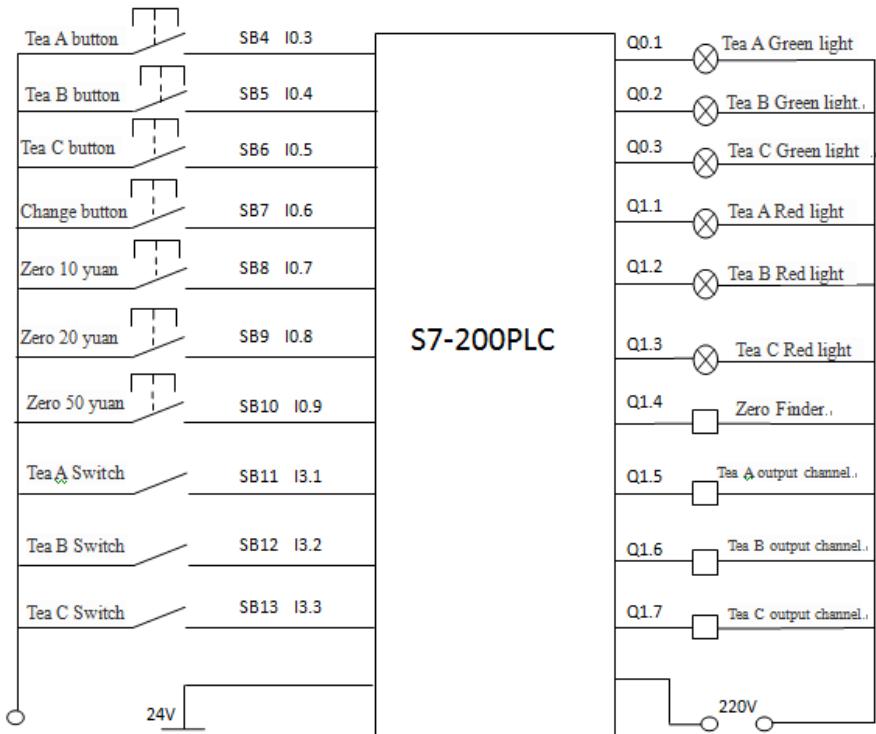


Figure 2 External wiring of tea vending machines

#### B. I / O Address Allocation Form for Vending Machines.

The I/O interface is an important bridge between PLC to realize the connection between the control system and the actual production. The system's I/O address allocation table is shown in table I.

TABLE I TEA VENDING MACHINES I/O ADDRESS ALLOCATION FORM.

Input signal			output signal	
5 yuan coins	I0.0	SB1	Currency instruction	Q0.0
10 yuan coins	I0.1	SB2	Tea A Green Light ( Available for Purchase )	Q0.1
20 yuan coins	I0.2	SB3	Tea B Green Light ( Available for Purchase )	Q0.2
50 yuan coins	I2.0	SB13	Tea C Green Light ( Available for Purchase )	Q0.3
100 yuan coins	I2.1	SB14	Tea A lights red ( sold out )	Q1.1
Buy Tea A Button	I0.3	SB4	Tea B lights red ( sold out )	Q1.2
Buy Tea B Button	I0.4	SB5	Tea C lights red ( sold out )	Q1.3
Buy Tea C Button	I0.5	SB6	Zero	Q1.4
Change button	I0.6	SB7	Tea A outlet channel	Q1.5
Zero 10 yuan	I0.7	SB8	Tea B outlet channel	Q1.6
Zero 20 yuan	I1.1	SB9	Tea C outlet channel	Q1.7
Zero 50 yuan	I1.2	SB10		
Tea A travel switch	I3.1	SB11		
Tea B travel switch	I3.2	SB12		
Tea C travel switch	I3.3	SB13		

#### C. Design of Tea Vending Machine Software

STEP7-Micro/WIN 32 is a programming software developed by SIEMENS for the SIMATIC series S7-200. It is based on Windows platform applications. STEP7-Micro/WIN 32 can use a personal computer as a graphics editor for online or offline user program development[4] and can monitor the execution status of user programs online and in real time.

### III. SIMULATION OF TEA VENDING MACHINES

The PLC control system of tea vending machine can verify the operation of the system by using the simulation software. The simulation system is running well to meet the design requirements.

#### IV. CONCLUDING REMARKS

When designing the tea vending machine, the choice of the appropriate controller is mainly considered performance, reliability and other factors. After the system adopts PLC, it is not necessary to adjust the hardware circuit wiring. As long as the software is slightly adjusted, different functions[5] can be completed to meet the market demand.

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