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Design of a vending machine control system

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Abstract. The vending machine is the commercial automation equipment which can complete the vending without people. It is a production of social transformation from the labor-intensive to technology-intensive industry structure. This topic using Mitsubishi PLC FX2N - 32 MR controlled the vending machine control system, improved the stability of the vending machine system, make sure the vending machine can long-term and stable operation.

Introduction

The vending machine is a kind of brand-new commercial retail forms. It was developed in the 1970 s in Europe and the United States. The vending machine is commercial automation equipment, who concentrated the optical, mechanical and electrical. It can be completed without vending. The vending machine worked without any space limitation, convenient and quick, selling many different kinds of goods, such as soft drinks, snacks, cigarettes, candy, automatic toothbrush, instant noodles, and camera and so on. And can work 24 h a day, so is popular among office workers. Many cities' public places are placed a vending machine. The world famous beverage maker Coca-Cola Company has 500000 drinks vending machine in the world. The vending machine started in 1999 in the Chinese market. This fast and convenient way of shopping more and more get the favor of people, and is also the demand of the modern city facilities. Especially in recent years, vending machine industry in China's development by leaps and bounds: In the bus station, shopping malls, hospitals, communities, schools and other regions can find traces of the vending machine. In China, the vending machine will be a huge potential industry, She will set off for the third time retail revolution after department store, supermarket. The prospects are very broad. Selling the goods can be customized according to the display place, Including hot and cold drinks, snacks, phone CARDS and foreign imports of goods, etc. And through the intelligent vending system, inventory, sales, logistics information can be accurate and timely feedback to customers and managers. In addition, support for multiple payment transaction mode, and convenient to realize large amount of payments and transactions. The vending machine in addition to more convenient to sell goods also is regarded as a kind of widespread advertising media. Through the interest in the vending machine or in use process, promoting a product.

The vending machine control system mainly has three ways: Relay control, microcomputer control and PLC control, they each have advantages and disadvantages.

The mode with a core of relay control, Is to use hard wiring way connect all kinds of relays, timers, contactor and contact according to certain logical relationship. Control related production machinery.

Give priority to single chip microcomputer control system is based on the chip level, Design and develop a microcontroller system, need to design the hardware system, Draw the hardware circuit diagram, make printing circuit board, Purchase all kinds of the electronic components, Purchase all kinds of the electronic components, weld circuit board, debug hardware, To work anti-interference design and test ; Need to use special device's development and low level programming language control program for system alignment. The traditional vending machine is controlled by single chip microcomputer as the core, but that on the input/output interface consumption is very large.

Control thoughts which give priority to with programmable controller is to use programmable memory, is used in its internal to storage logic operation, sequence control, timing, counting and

arithmetic operations and so on instruction, And through the digital and analog input and output, control various types of mechanical's production. PLC is an industrial control computer, so its working principle is based on the working principle of the computer. PLC can realize not only the similar control function, but also has high reliability, simple programming, strong function, low energy consumption, convenient debugging.

Design of a vending machine control system

The vending machine working principle

(1)From the slot into the currency, and then through the sensor acquisition data, recognizer distinguish authenticity and discriminated value of the Yuan.

(2)Recognizer pass this information to the communication module.

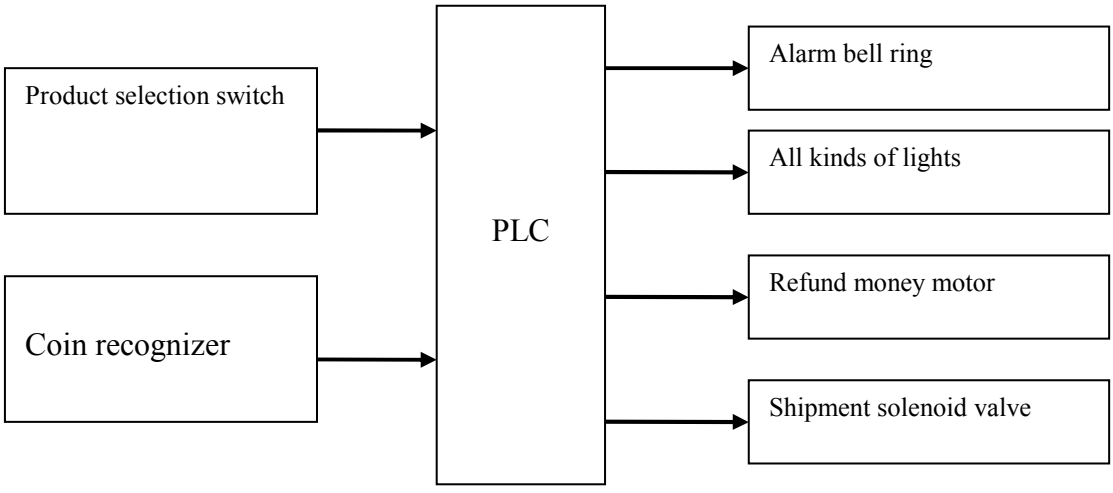
(3)Communication module and the master control system of vending machine communicate the information, The master control system shows that value, Start the panel key of vending machine, Shows which aisle in stock, which aisle has been sold out, and wait for the customers to choose goods.

(4)Customers choose goods, according to different types of packaging ,adopt different drive technology put the goods out. The design mainly sell cans of drinks, is driven by using electromagnetic valve drive version.

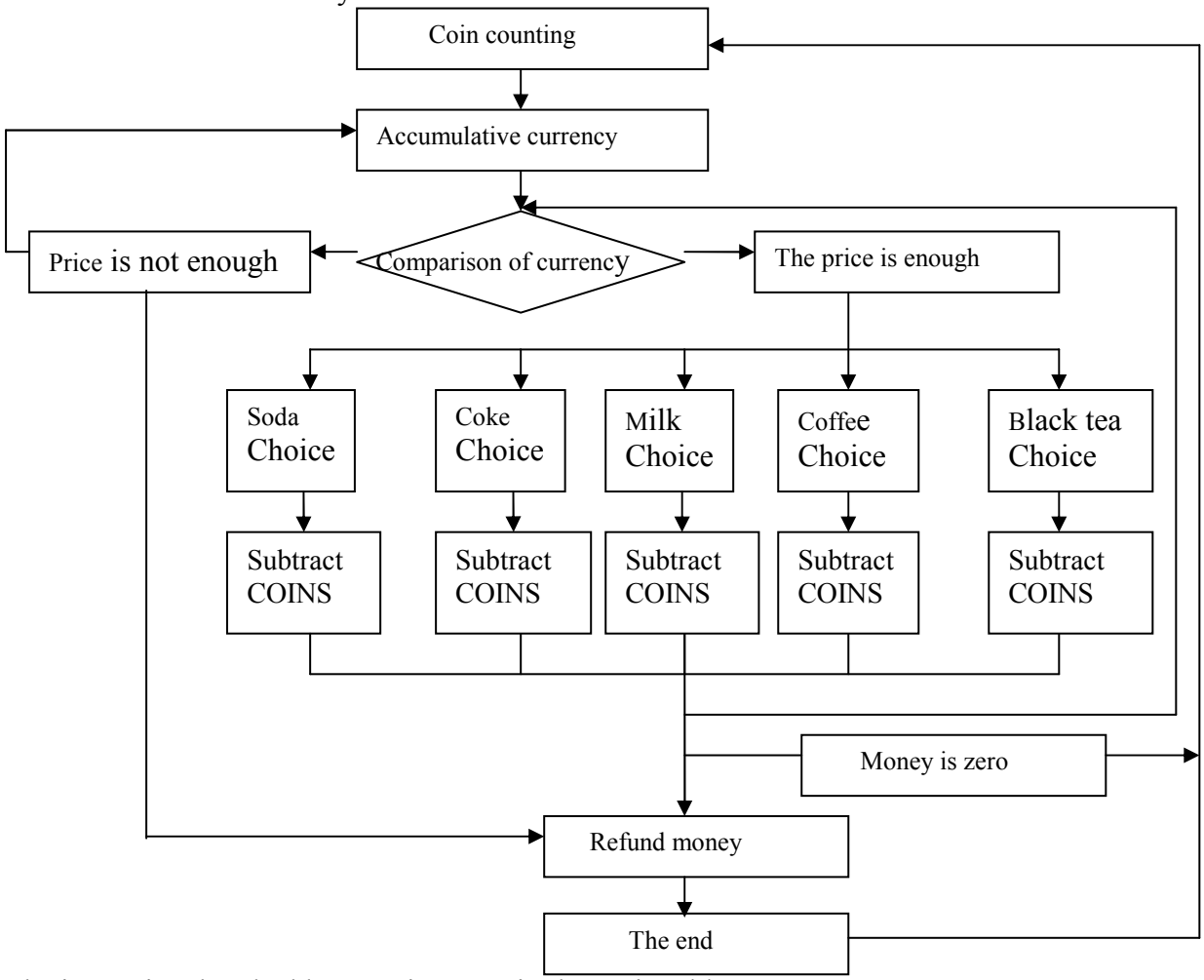
(5)According to balance, If the amount is enough, the customer can choose to look for money or continue to buy goods; If the amount is insufficient, vending machine refund money after a delay. Work in two situations: One is made by paper money recognizer, back notes, and another is completed by the communication module of the coin, return COINS.

(6)System to zero, complete the sales.

In this control system, the vending machine sold only five kinds of drinks: Carbonated drinks, cola, milk, coffee and black tea, Price is 3 Yuan, 4 Yuan, 5 Yuan, 6 Yuan and 7 Yuan. The vending machine can recognize 1 Yuan, 5 Yuan, 10 Yuan, 20 Yuan, 50 Yuan. The vending machine can refund $1 COINS. The control principle is: First the customer input money, after money recognizer send signals to the PLC. PLC program Written by the user run ,can identify the authenticity of a coin and currency, and display the value of money, compared with the prices of the goods at the same time, When the amount is more than 3 then soda lights; When the amount is more than 4 ,soda and coke light; When money is greater than 5, carbonated drinks, cola and milk, the light is bright and so on. Then the customer press commodity selector switch. Through calculation the PLC can also shows the balance, after Goods drive mechanism receive the control signal, the shipment solenoid valve work, Send out the goods, If have balance, Refund money motor work. Numerical COINS can be dropped out, at the same time complete the internal reset process. This completes a goods delivery process. The whole process is controlled by one PLC. The vending machine control principle diagram as shown in figure 1:



The flow chart of control system



The input signal and address assignment is shown in table 2-1:

Table 2-1 The input signal and address assignment

	symbol	function	address
Input	SB1	1Yuan	X0
	SB2	5 Yuan	X1
	SB3	10 Yuan	X2
	SB4	20 Yuan	X3
	SB5	50 Yuan	X4
	SB6	Soda button	X5
	SB7	Coke button	X6
	SB8	Milk button	X7
	SB9	Coffee button	X10
	SB10	Black tea button	X11
	SB11	Refund COINS button	X12

The output signal and address assignment is shown in table 2-2

Table 2-2 Output signal and address assignment

output	HL1	Soda display lamp	Y0
	HL2	Coke display lamp	Y1
	HL3	Milk display lamp	Y2
	HL4	Coffee display lamp	Y3
	HL5	Black tea display lamp	Y4
	YV1	Soda solenoid valve	Y5
	YV2	Coke solenoid valve	Y6
	YV3	Milk solenoid valve	Y7
	YV4	Coffee solenoid valve	Y10
	YV5	Black tea solenoid valve	Y11
	YV6	Refund money solenoid valve	Y12

Conclusion

The popularity of the vending machine, can reflect a country's level of development of science and technology to some extent, is a national symbol of civilization degree. Practice and intuition tells us, Self-service was born in China, will certainly brings new opportunity to domestic telecommunications, utilities, food, cigarettes, drinks, and many other industries development, China's modern civilization will start a new milestone to the application and popularization of self-service equipment!

References

[1] He yong yi. A Control System of Material Handling in FMS. Journal of shanghai university. Vol.1.No.1.1997.

[2] Ren Sheng-le. Development of PLC-based Tension Control System. Chinese Journal of Aeronautics20 (2007) 266-271.

[3] R. Hatch, "The synergism of GPS code and carrier measurements" International Geodetic Symposium on Satellite Doppler Positioning, vol. 1, pp. 1213-1231, May 1983.

[4] K. Bore, D. M. Akos, N. Bertelsen, A software-defined GPS and Galileo receiver. Birkhhauser, pp. 109-123. 2007.

[5] Altera Corporation. Video and Image Processing Suite User Guide[Z].2010.7.

[6] O. Montenbruck, T. V. Helleputte, K. Remco, "Reduced dynamic orbit determination using GPS code and carrier measurements," Aerospace Science and Technology vol. 9, pp. 261-271, April 2005.
[Z] Unitrode Application Note.1999.