Explore of Teaching Practice on Programmable Logic Controller

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Abstract. Aiming at the teaching status of Programmable Logic Controller (PLC) in college, provides an improved method of teaching. Practice has shown that it can significantly enhance the effect of classroom teaching and develop students' practical abilities.

Keywords: PLC, Ladder diagram, Simulation

Programmable Logic Controller (PLC) is in the relay control and computer control developed on the basis of integrating microelectronics technology, computer technology, communication technology, automation technology [1]. It has a strong practicality, and it has been applied more and more in the field of automation industries. At present it has become an important professional course of automatic control in college.

Through many years' teaching practice, we realize that understanding PLC instruction system is crucial. It is important for students to master the design method of PLC ladder diagram. We must foster the students' practical ability [2]. The traditional "teacher speak, students listen to" mode of Curriculum teaching method has been unwell; teachers should go through the examples to lead students to design a system, cultivate the ability to analyze and solve problems. Examples design and Synchronous demo should be used throughout the teaching process. The use of PLC simulation tools can easily achieve this new teaching mode.

Most current products have its simulation software, which need not the actual PLC physical device, can broaden the scope of teaching. This paper takes Siemens S7-200 as examples, and tells its use in teaching methods.

1. Siemens S7-200 Profile

The Siemens S7-200 series is adopted in many domestic universities. It is a small programmable controller, applicable to various occasions of monitoring and control of automation. S7-200 series has powerful function, it can be used in independent operation, or complex control function by network. S7-200 series PLC can provide four different basic type and eight kinds of CPU for you. Therefore s7-200 has extremely high performance/price ratio.

S7-200 series PLC' programming software is STEP 7-Micro/WIN, it can program all CPU function.

Figure 1 shows us the gramming window,we design the ladder programe to realize function.

You must pay attention to save file by "export" menu, it can create an "awl" file for simulation software.

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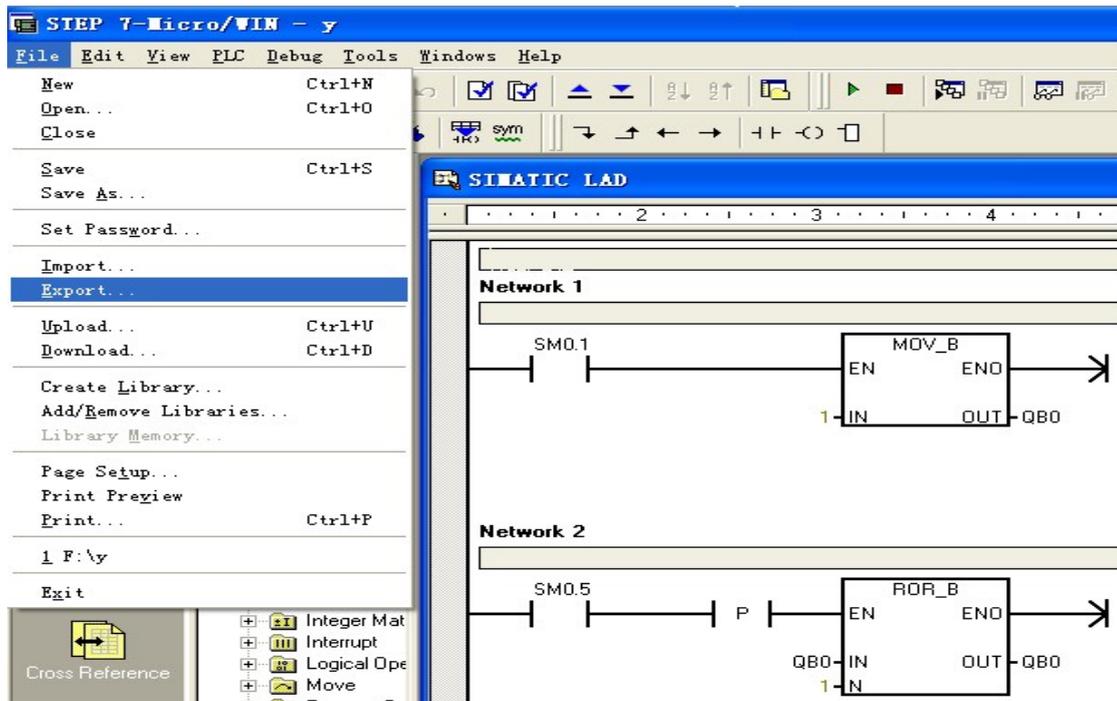
Figure 1 STEP 7-MICRO/WIN programming window

2. The Simulation Software Profile

Its simulation software is compact and can be easily used in multimedia teaching. The software running interface as shown in figure 2. It can be divided into two parts. It is the function menu on top: " Program " menu for loading a program, the program is created by the programming software- microWIN STEP7 , called the AWL program; "PLC" menu is used for selecting PLC type, such as CPU224, you must pay attention to the different type of instruction system. Through the function menu can run and monitor program's running state. It is host panel and the simulation button in the bottom of the Interface, The panel is Consistent with real-world equipment, with run/off indicators and input/output indicators, CPU224 14DI/10DO simulates 14 inputs and 10 outputs.

In addition, the system can be extended according to need. For example, we can extend analogue inputs module EM231: double-click right margin of the CPU module, then select the EM231 in module menu, now we increased 4 analogue inputs, and provides the corresponding input scroll bars, which can simulate various types of voltage or current input. It is very convenient for analogue control relevant procedure design and commissioning.
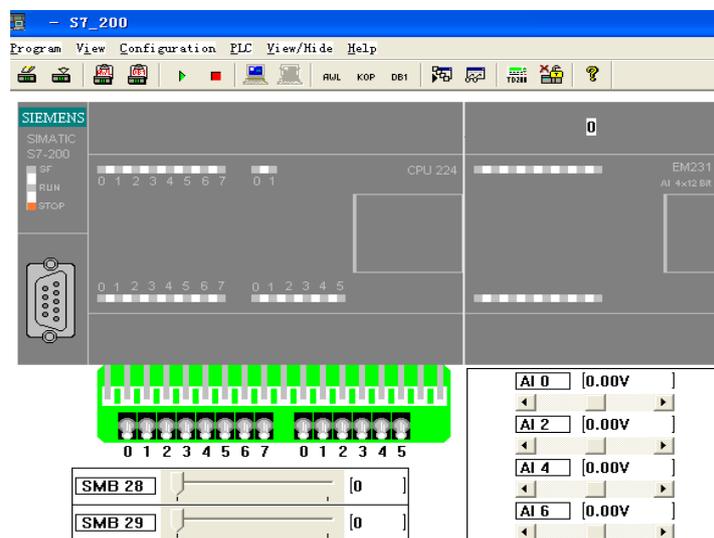

Figure 2 simulation program interface

3. A Simulation Example

"Horse race lamp" program is a typical PLC application, which can demonstrate the function of shift instructions. There are two network structure, the first network MOV_B instruction transmits initial value 1 to QB0 (Q0.0 = 1).The second network uses special register SM0.5 to produce 1 second periodic signal, which triggers a right shift per second by ROR_B instruction. By Selecting QB0 as output, we can see the running effect on simulation CPU panel indicators.

Figure 2 for program running status of ladder diagram, now triggered signals can be seen on SM0.5, QB0 current output is 16 (binary00001000), Q0.4=1 for the corresponding output lamp. Through the cycle shift from right to left, indicator lamps are lighted circulating and looks like moving, it is called "Horse race lamp".

Practice has proved, it is very vivid and intuitive in explaining cycle instruction of PLC. Using this program demonstration, it helps the students to understand and recall cycle instruction, greatly improves the teaching effect.
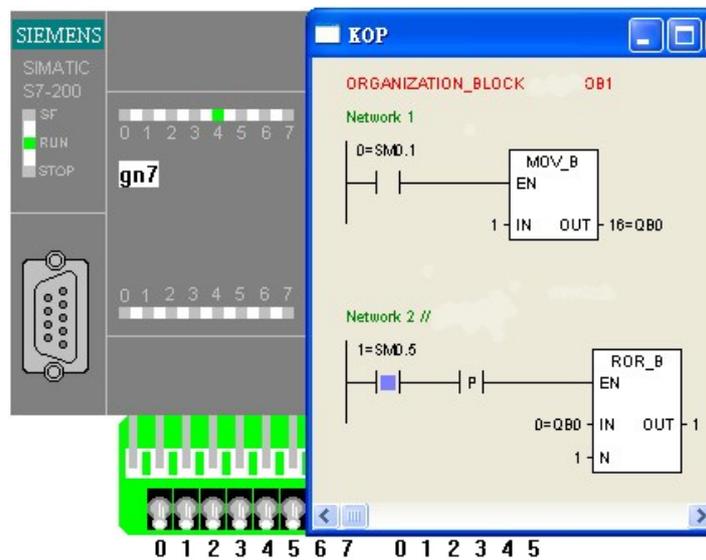

Figure 3 " Horse race lamp " program simulation result

4. Anolog Control Example

Now we take a example of analog control system-"air conditioner", our task is control the temperature of a room between 10~30℃, we use aiw0 to represent temperature signal coming from sensor. Table 1 is the relationship of various signals.

Table 1 the relationship of various signals

Temperature range(℃)	Sensor output(v)	Aiw0 range
0	0	0
10	1	3200
30	3	9600
100	10	32000

The program shows in figure 4, the function:

If aiw0>9600(30℃), open cooling system (Q0.0=1);

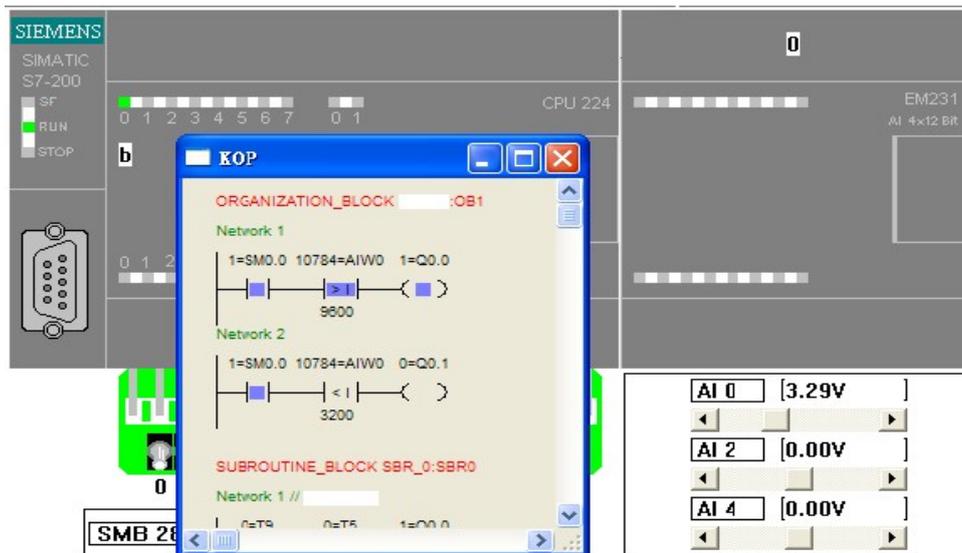If aiw0<3200(10℃), open heating system (Q0.1=1);

Figure 4 " air conditioner " program simulation result

Run the program, we move the input scroll bars of EM231 simulation module to change input signal. Now the input is 3.29v, more than 3v, means the temperature is more than 30℃, so the cooling system runs and the indicator lamp lights (Q0.0=1).

The example is a complete feedback control system. The students not only learn the instruction usage, but also establish a system concept. The program is simple and intuitive. It has a good teaching effect.

5. Closing

PLC is a practice-needed curriculum, besides theoretically study, students have to take exercise in practice. So we break the conventional teaching method, use many kinds of teaching methods to improve classroom teaching. Experiment teaching cultivates the students' practical ability and creative spirit. Teaching with simulation demo in classroom, we make classroom teaching and practice teaching connected organically. After several years teaching practice in different majors, the teaching method can effectively improve the learning interest of the students, active classroom atmosphere, strengthen the teaching interaction, and increase the overall effect of classroom teaching. It lays a good theory base for subsequent experiment. The method is worthy to be popularized.

6. References

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