

Design of medical monitoring facilities drag control system based on simulation system

Hongbo Fu¹, Sicheng Che² and Fangmei Jiang^{3,*}

¹School of Shenyang Institute of Technology University, Liaoning 110142, China;

²School of Shenyang Institute of Technology University, Liaoning 110142, China;

³School of Shenyang Institute of Technology University, Liaoning 110142, China;

Corresponding Author: Fangmei Jiang

Abstract

Motor drag control system course is the professional course of automation major, is the core professional course of automation major. It is in the electric control system scheme as the core, set motor and drag foundation, power electronic technology and automatic control principle, analog electronic technology in one of the theory and practice of the combination of comprehensive disciplines. The knowledge is applied to the drag control system of medical facilities, and the drag control system of medical monitoring facilities is designed based on PLC simulation system. This paper presents a design method of intelligent control of emergency call based on Siemens PLC control technology and real-time monitoring of call system based on Matlab technology. Based on the step programming control technology of Siemens S7-1200 PLC, the modular programming method is determined, which makes the function expansion and re-line upgrade of the system more convenient. Based on the structure, area, call, alarm, indication and other control functions of ward, nurse station and consultation center, Matlab simulation technology was used to design the motion control system.

Keywords

Emergency call; Monitoring; Drag control system.

1. Introduction

With the development of science and technology, the intelligent and scientific development level of all walks of life has reached a new height, and the medical industry is no exception. Medical monitoring must also be changed from traditional manual measurement to intelligent electronic monitoring, and hospital bed call must also be changed from traditional manual oral call to intelligent call. When patients need to ask for help, they only need to press the call button to call medical staff to deal with it, which brings great convenience to doctors and patients.

With the gradual improvement of the process of automation in Our country, the process of work in all walks of life is gradually developing to automation. The operation mode of the assembly line with a relatively high degree of automation is replacing the traditional manual operation mode, realizing a high degree of automation integration and saving the cost of human and material resources. In the intensive care unit, medical staff need to master the vital signs of patients in real time, which requires the medical staff to manually collect the data of patients. Medical staff need to walk irregularly to observe the parameters of patients' physical signs, so as to master the changes of physical signs. At present, most hospitals at home and abroad require patients to be fixed in one place and cannot move. Medical staff collect and record the specific data of patients in front of each bed, and then input it into the computer for

preservation and analysis. In this way, the manual collection efficiency of medical staff is very low and will occupy human resources. With the development of science and technology, medical monitoring system to achieve call, alarm, monitoring and other functions, can meet the needs of most hospital beds patients.

In order to overcome the problems existing in the system of medical care, reduce the workload of medical staff, improve the efficiency of rescue and nursing, better service for patients, this design from cost, function, operation and so on has carried on the detailed discussion, and to control the reliable, easy to operate, real-time monitoring of intelligent hospital medical monitoring system as the main indicators, A hospital call system with rich functions and easy installation is realized, which can meet the needs of modern medical treatment.

2. Medical monitoring system scheme design

2.1. Design scheme of medical monitoring system

This design from the medical monitoring system hardware control part and software part of the design, the hardware part includes the selection of PLC, software part of the design includes program design, Matlab design.

The controller of the medical monitoring system is S7-1200PLC. The programming software used in S7-1200PLC is TIA Portal V15. The software is powerful, its internal integration of simulation operations and a series of software. The programming software used in S7-1200PLC is TIA Portal V15. TIA Portal V15 provides a general engineering configuration framework for users, which can be used for the programming and debugging of S7-1200 series PLC, hardware parameter setting, fault diagnosis, etc. According to the functional requirements of the medical monitoring system, the system is decomposed into modules, the basic application of modules and the role of modules in the whole are mastered, and the corresponding instructions are selected to write, and the procedures involved are written to control the operation of the medical monitoring system. LAD ladder diagram, a graphical programming language, is used to write programs to realize the general ward call, intensive care ward call, intensive care ward monitoring and other functions. Matlab is a business mathematics software produced by MathWorks. It is used in data analysis, wireless communication, deep learning, image processing and computer vision, signal processing, quantitative finance and risk management, robotics, control systems and other fields.

2.2. Medical monitoring system peripheral equipment selection

Electrical components are used to control the operation of the medical monitoring system. In this design, input signal hardware components are divided into two categories: button and analog input. In the output signal, part of the output signal is connected with the indicator light, the buzzer to achieve the system operation, abnormal alarm, call and other functions. The other output signals are connected to the contactor. LED indicators of Schneider XB2BVM3LC and buzzer of Schneider XB2BSB4LC are selected for this design. Contactor by controlling the intermediate relay to get electricity through the coil, normally open contact closed, to control LED indicators, buzzers, etc. According to the digital input and output address of the medical monitoring system, the PLC peripheral wiring diagram of the medical monitoring system is designed. The input and output components of the whole system involve buttons, switches, indicators, buzzers and other hardware, which are drawn with standard electrical symbols in the figure and connected with the corresponding address. PLC external wiring schematic diagram of the medical monitoring system is shown in Figure 2.1.

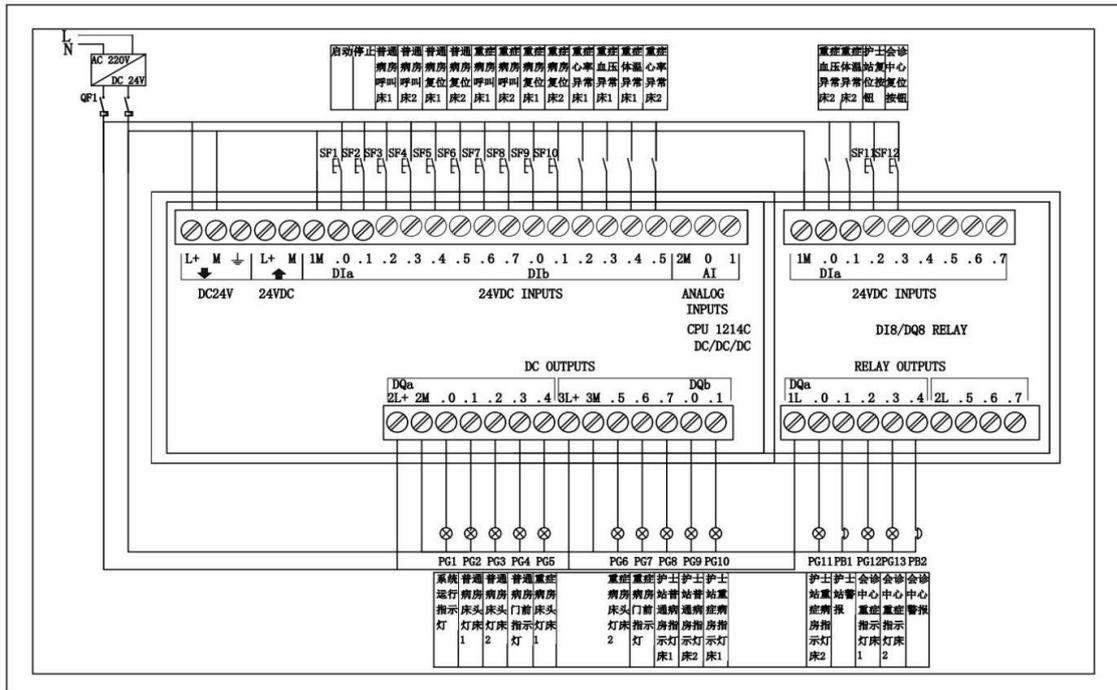


Fig. 2.1 PLC wiring schematic diagram of medical monitoring system

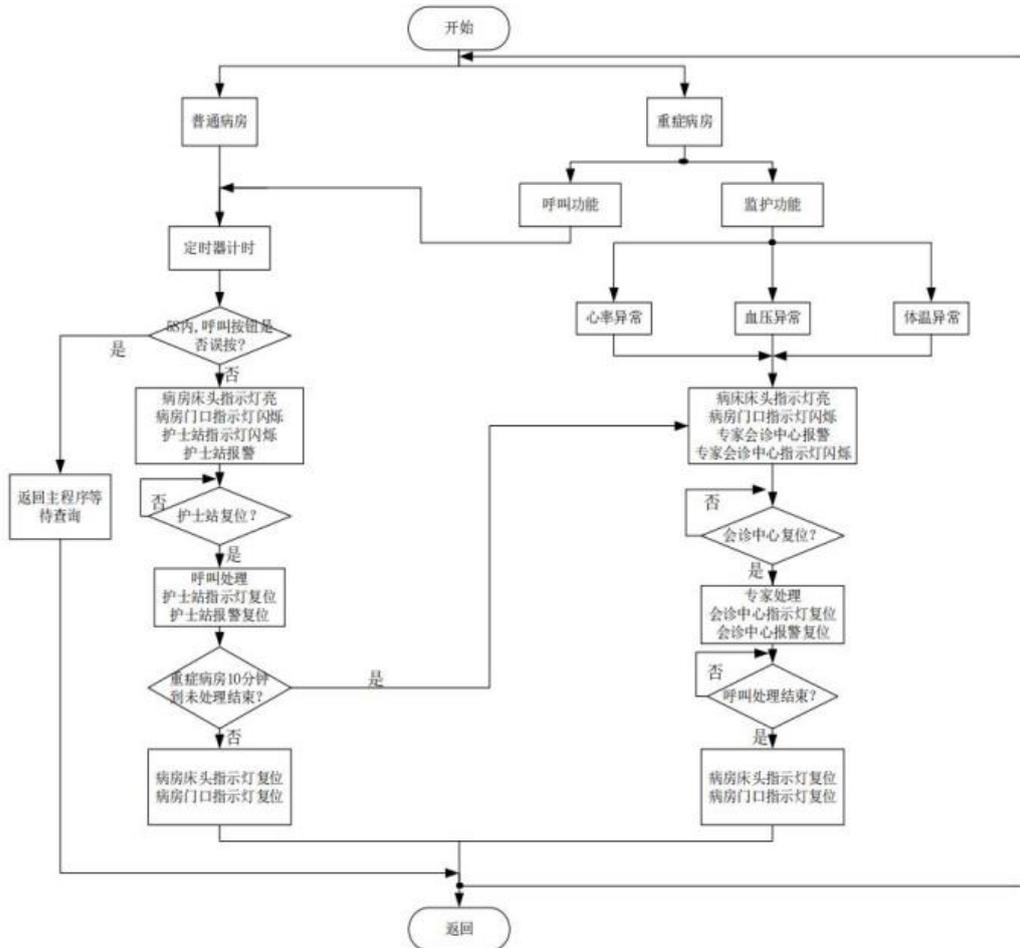


Fig. 2.2 Flow chart of medical monitoring system control

According to the system structure and control requirements, combined with the design scheme of the medical monitoring system, the following general control ideas are determined. In the medical monitoring system, it is divided into general department and intensive care unit. Each ward has two beds, and the head of each bed has indicators, call buttons and reset buttons. The

intensive care unit is equipped with monitoring devices to monitor patients' body temperature, blood pressure and heart rate respectively. The specific flow chart of the medical monitoring system is shown in Figure 2.2.

The drag control system scheme is designed according to the system structure and control requirements, which involves the selection of power electronic devices, the selection of controllers and the simulation model of motor design to provide power to the medical monitoring system. The simulation model is shown in Figure 2.3.

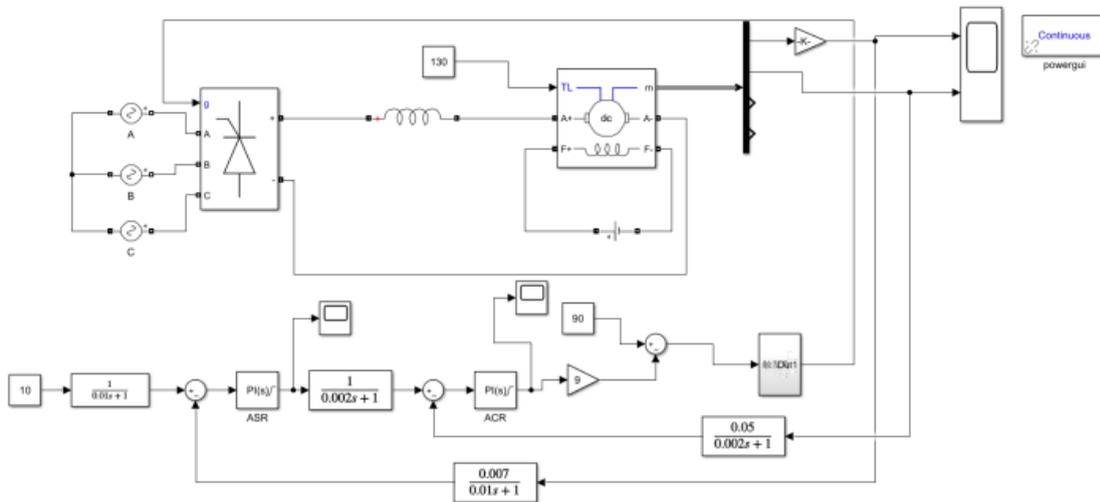


Fig. 2.3 Double closed loop speed control system simulation diagram

Each link is converted into a transfer function, designed into a double closed-loop control system, set its parameters, through the selection of PI regulator to simulate, get the fastest start scheme, so that the medical monitoring equipment in the shortest time to respond. Waveform obtained is shown in Figure 2.4.

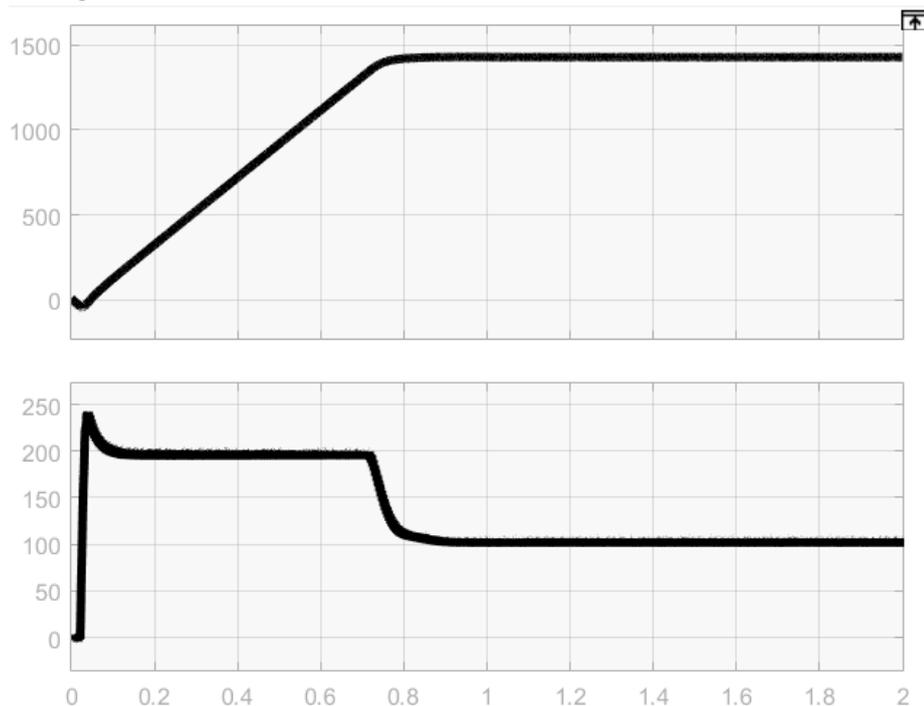


Fig. 2.4 Waveform of double closed loop speed regulation system

3. Summary

In this paper, the medical monitoring system is designed to monitor the running state of the whole system in real time. PLC programming and Matlab simulation design are realized to meet the control requirements of the medical monitoring system and basically meet the expected requirements. The following points are summarized.

(1) This topic has completed the basic functions of PLC medical monitoring system, conducted research on the medical monitoring system, adopted the s7-1200 series PLC with stronger performance, analyzed each link of the medical monitoring system, defined the control category and control requirements, and put forward the design scheme. (2) The equipment used for system hardware design includes Siemens S7-1200 series PLC, SM1223 expansion module, buttons, sensors, buzzers, etc. The design includes PLC external wiring circuit design, the main circuit design. (3) This design adopts Matlab simulation to simulate the control system in the medical monitoring system, making the whole system software easy to operate and modify. It greatly reduces the production cost and improves the efficiency of medical treatment. (4) This topic through the study of PLC in the medical monitoring system practical application, so that the medical monitoring system designed by PLC than the traditional call system has better maintenance and scalability, improve the level of automation of the hospital medical monitoring system, to ensure that medical monitoring is more safe and reliable. The design still has shortcomings, the system can add LCD display part, so that you can see the treatment of each ward more intuitively, so the design as long as a few changes, can achieve visual management, problem alarm and other functions, to meet different needs.

References

- [1]. Wang Xi,Wang Agen.PLC application instruction programming examples and skills. Beijing:China Electric Power Press, 2016.06.
- [2]. Xu Hongyan,Talk about TIA Botu software of Siemens[J].Science and technology Innovation Guide,2018,15(25):127-129.
- [3]. Zhao Lizhi,Optimization design of bed calling system based on PLC[J].Electronic manufacture, 2018(Z2):56-57-53.
- [4]. Zheng Yongyang, S7-1200 control system is implemented in TIA Travel software S7 communication[J].The digital world,2019(05):62.
- [5]. Li Yiqiang,Design and application of hospital bed call system based on PLC control[J].Mechanical and electrical engineering Technology,2020,49(06):109-112.
- [6]. Gu Ruiling,Design of belt conveyor monitoring system based on PLC and MCGS[J].Age of car,2020(15):115-116-12.
- [7]. Shelley E Huguley. ARC/PLC programs mitigate risk, deadline March 15[J]. Southwest Farm Press,2021.