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Enhancing Electric Vehicle Charging Control Systems through PLC Technology: Design Principles and System Integration

Xintan Chen[1],Jessica Williams[2]

Bethel University[1],Bethel University[2]

Chenxintan@bethel.edu[1],jessicawilliams@bethel.edu[2]

Abstract:

This study focuses on the design scheme for an automobile charging control system, highlighting the advantages of Programmable Logic Controller (PLC) technology in project design and application. Based on the overview of the electric vehicle charging scheme, it investigates the significance and challenges of the design, clarifying the requirements of PLC technology within this context. The goal is to enhance the automatic charging module of electric vehicles, thereby demonstrating the feasibility of the charging solution through the application of PLC technology.

Keywords:

PLC technology; Electric vehicle; Charging control; Design.

1. Introduction

In the context of sustainable development of the current social ecological environment, the emergence of electric vehicles has achieved environmental protection. Electric vehicles can be powered by batteries to achieve zero emissions. With the construction of large-scale electric vehicles and charging infrastructure, the design of the device must not only conform to the model of the charging car, but also meet the needs of scientific power supply to improve the efficiency of the electric vehicle charging control system. Combined with the advantages of PLC technology, the design of the electric vehicle charging scheme is analyzed. The purpose is to define a scientific charging management scheme based on the design characteristics of the electric vehicle charging control system, standardize the system operation process, and meet the charging needs of different electric vehicles. In the study, the design of PLC technology in the electric vehicle charging control scheme is analyzed, and the results are as follows.

2. PLC technology and its advantages

2.1 PLC technology

PLC technology refers to power carrier communication, which is connected to the power line through the coupling processing of data signals, and then the obtained power line acts on the communication propagation medium to improve the efficiency of information transmission and system operation. In PLC communication, communication information can be processed through the existing transmission medium. The entire process does not need to be rewired. Moreover, the technical operation is simple and the setting method is flexible, which can fully meet the different needs of people [1].

2.2 Principles of using PLC technology

When applying PLC technology to the electric vehicle charging control scheme, the following principles should be clarified: First, the usability principle, guided by this principle, can ensure the fast and stable operation of the power supply system, and provide stable operation support for electric vehicles. Meet the needs of users for the charging system. Second, the principle of security. After the electric vehicle charging system is put into use, the safety of the electric vehicle charging system is improved through the comprehensive design of electrical protection devices, error prevention devices, and explosion-proof devices. Third, the principle of intelligence. According to the characteristics of the use of PLC technology in electric vehicle charging control schemes, the use of PLC technology can ensure the automation and intelligence of the charging and charging system operation, and meet the needs of people's operation and use.

2.3 Advantages of PLC technology in electric vehicle charging control scheme

Integration of PLC technology with the electric vehicle charging control system can achieve the following advantages: First, improve the design quality of the hardware model. In the design of the electric vehicle charging

control scheme, the modules should mainly include the main control module and the communication module. During the operation of the main control module, the entire operating system is controlled. In the integration with the PLC technology, the operating cost of the system can be reduced. Improve the overall efficiency of system operation. In addition, the application of PLC technology in the electric vehicle charging control scheme can take the independent power supply and speed of the electric vehicle charging control system as the core to ensure the effective connection of various equipment and improve the operating efficiency of the electric vehicle charging control system. Second, enhance the processing effect of software modules. Combining the design of the electric vehicle charging control system and incorporating PLC technology into it can improve the setting efficiency of software modules. The serial port parameters of the PC are designed, and the serial number design, the baud rate, and the determination of the setting parameters are determined to achieve the integration with PLC technology to ensure the safety of the electric vehicle charging control system operation[2].

3. Project Features

3.1 Invention projects

Combined with an electric vehicle charging control system, the system operation scheme is analyzed. The core purpose is to realize the information collection and signal control of each charging pile under the same charging station in the use of PLC technology. Develop a detailed communication flow diagram according to the charging scheme and requirements, as shown in Figure 1.[3].

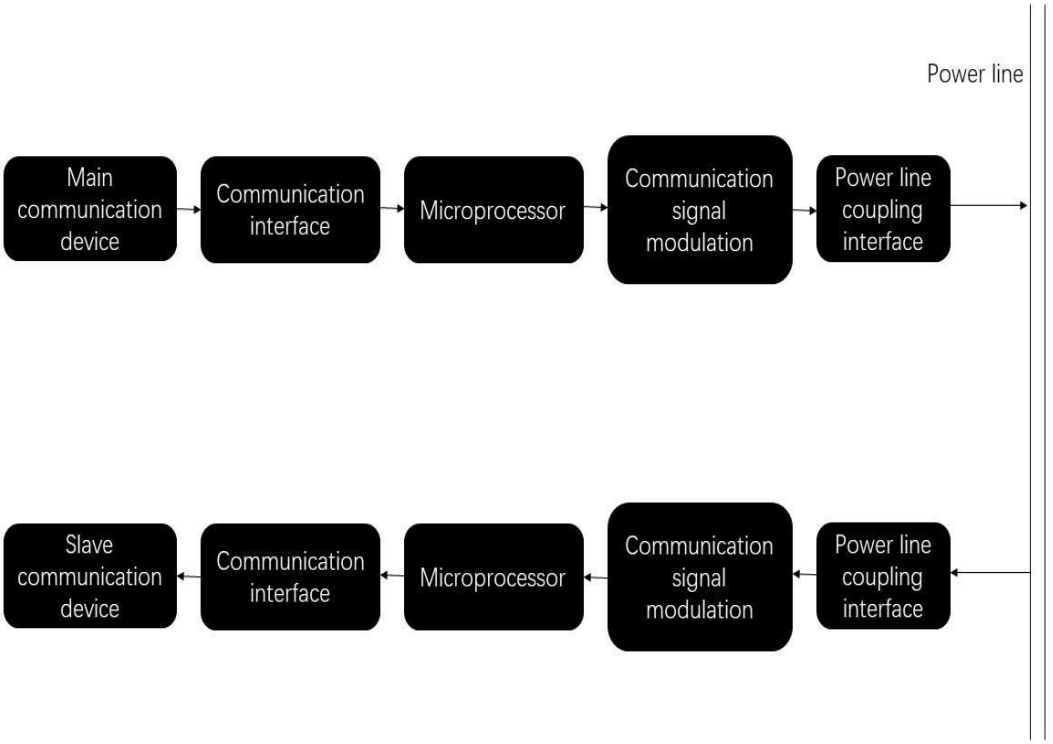

Figure 1.Communication flow chart of power line carrier communication system

3.2 Difficulties

We plan to use PLC communication over long distances in the laboratory. But due to unrestricted factors, we can only limit data transmission and reception in one room. And due to the limitation of the computer and experimental conditions, we only completed the control of one charging pile, and did not conduct more experiments. There are many battery models for charging cars on the market today, and it is impossible to take into account the issue of diversity.

3.3 Project innovation technology

First, power line carrier communication technology is applied to the charging pile management system to realize intelligent management and humanized service. Secondly, optimize efficiency, apply power line carrier communication technology to the charging pile management system, realize intelligent management and humane

service. Third, save costs. The two major functions of charging and communication can be completed by using cables, which are not only beneficial to networking but also saves engineering costs [4].

4. Electric Vehicle Charging Control Solution Based on PLC Technology

4.1 Setting up an experimental environment

4.1.1 Host system

In the design of the electric vehicle charging control scheme, the Linux system is set in a suitable device, and the PLC technology and electric vehicle charging control virtual system can be operated. Due to the embedded features of electric vehicles and electric pile systems, the integration of the Linux system and the design scheme can improve the purpose of consistent system operation and meet the operational requirements of the electric vehicle charging control scheme.

4.1.2 Development environment design

Through the analysis of the design status of the electric vehicle charging control scheme, in the use of PLC technology, the development environment should be innovative: first, install a compiler. After the system is deployed, the development environment needs to be designed. Through the use of the C ++ compilation system, specific command operations can be performed in accordance with programs for preprocessing, generating files, converting files to assembly language, and linking machine code. Second, install MySQL. For this system, as a database management system, there are advantages of taking up less memory and running faster. Installing MySQL in the electric vehicle charging control system can avoid installation errors and improve the overall efficiency of the electric vehicle charging control system operation [5].

4.1.3 PLC communication module

In the design of the PLC communication module, data transmission between the electric vehicle and the electric pile can be maintained. For example, when two PLC regulators are located between virtual machines, they are connected to Ethernet and PC, and they are connected and adjusted through PLC to form an ad hoc network. During system operation, when the indicator is green, the network connection is successful.

4.2 Application layer communication protocols

4.2.1 Communication protocol software

In the design of electric vehicle charging control scheme, the communication protocol software composition is shown in Figure 2.

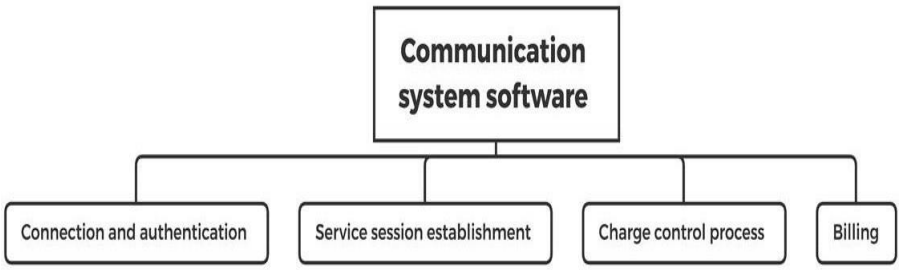

Figure 2.Communication system software structure

4.2.2 Connection, authentication

Through the design of the electric vehicle charging control system, the connection and certification operations are as follows: First, connection. After the electric car is connected to the electric pile, the two systems will automatically connect at the physical layer and the data link layer to provide support for subsequent charging operations. Second, authentication. After the connection of the physical layer and the data layer is completed, the system will perform related parameter authentication according to the connection procedure of the communication protocol application layer.

4.2.3 Select service

Before charging the electric vehicle, the user can use the client's instruction to select the program. In general, the charging pile module includes the same-day electricity price query module, the charging mode selection module, and the payment mode selection module.

4.2.4 Charging arrangement

In the charging arrangement, the system will formulate the charging curve according to the provided battery parameters, and then use the data and voltage sent by the pole to ensure the coordination between the pole and the electric vehicle charging.

4.3 Database Design

Combined with the use of PLC technology in the design of electric vehicle charging control solutions, the server generally receives user requests, and the system analyzes and processes various messages, adjusts the underlying database, and performs system operations in accordance with user needs. In the operation of the database, important data is selected through data addition, deletion, and inspection techniques, and the used data is backed up. In general, the following schemes should be specified in the database design of the electric vehicle charging control scheme: First, design the database access method. In the database system, the design of the QT system can ensure the efficient processing of various parameters of the PLC technology in the electric vehicle charging control scheme. After the database connection is completed, SQL will display the operation results in accordance with the standard operating language to improve the overall system efficiency of database operations. Second, the design of the data table. In the database design, it is necessary to design an authentication module and a charging record module for the charging parameters of the charging vehicle. In parameter authentication of the charging vehicle, the model and identity of the electric vehicle are analyzed and the charging record is saved.

4.4 User interfaces

Through the analysis of the design status of the electric vehicle charging control scheme, in the integration with PLC technology, the following software design structure should be clarified: First, the EV side software settings. In the design of the login interface of the user operating system, it is necessary to design a connection platform between the electric car and the charging pile. After the electric car is connected for charging, the system will display whether to charge and the current power of the car. Second, the service selection platform. After the connection between the electric car and the electric pile is completed, the charging pile will automatically provide service information to the car, and the user selects service items according to his own needs, effectively improving the user's experience. It should be noted that in the design of the service list, it is possible to support the query of charging reservations, user usage, etc., so that the user can improve the charging efficiency in a variety of operations. Third, realistic charging process module. In the design of the user operation interface, a charging process display module should be designed, which generally includes charging progress, battery information, and autonomous operation processes. Fourth, the settlement module. In the design of the electric vehicle charging control scheme, the settlement module has a charging end structure. After the user is charged, the system automatically stops charging and displays the amount that the user should pay for charging. Under the guidance of cash payment and WeChat payment, the electric vehicle charging is completed[6].

4.5 Experimental results

In the laboratory environment, the following results were obtained:

First, the connection between the charging station and the background management system is completed by simulation.

Second, the acquisition of signals on the power line connected to the PLC by the voltage sensor is completed.

Third, the processing of the signal on the voltage sensor and the control of the sensor by the single-chip A / D conversion module is completed.

Fourth, in the communication between electric vehicles and electric piles, through electric vehicle connection authentication, service selection, and cyclic charging control, the data exchange efficiency between electric cars and electric piles can be improved, and the user's operating experience is convenient.

5. Conclusions

All in all, in the design of electric vehicle charging control schemes, the use of PLC technology can realize the automation of various system operations. Under this environment, users can operate the electric vehicle charging control system according to their own needs, not only ensuring the overall charging of the system efficiency, and meet user experience needs. In addition, in the design of the electric vehicle charging control scheme based on PLC

technology, the connection between the electric vehicle and the charging pile, the authentication module, the service module, the cycle charging module, the end charging module, and the billing and charging module are generally designed. In China, you can complete the charging of electric vehicles according to your needs.

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