

# Design and Application of Intelligent charging pile system based on Cloud platform

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**ABSTRACT.** *Electric vehicles use electricity to replace the traditional gasoline energy, which effectively alleviates the current energy shortage and implements the strategy of sustainable development. However, the lack of the ability of battery life still seriously restricts the promotion and development of electric vehicles, so speeding up the research and development of intelligent charging piles is also the focus of attention of the scientific community and the electric vehicle industry. The intelligent charging pile is equipped with a perfect remote communication monitoring system, which can realize the rapid charging of electric vehicles and effectively solve the problem of poor endurance of electric vehicles. Taking the intelligent charging pile system of Bohai passenger station as an example, the design and application of intelligent charging pile system based on cloud platform are described in detail in this paper.*

**Keywords:** *Electric vehicle, Intelligent charging pile, Internet, Cloud platform*

## 1. INTRODUCTION

Energy and resources shortage, greenhouse gas emissions increasing climate change, heavy air pollution haze has become a social issue of great concern. Then, with the depletion of fossil energy and the rapid deterioration of the environment, energy conservation and emission reduction are paid more and more attention. More than 1 billion vehicles in the world consume 30 percent of the fuel consumption. According to the forecast of the International Automobile Federation, the fuel consumption of cars will account for more than 50 percent of the total fuel consumption by 2030, which is undoubtedly a great challenge and a severe threat to

the world's energy supply and security.

As the main charging equipment of electric vehicle battery, the charging station of electric vehicle is a new way to provide power for electric vehicle. As the charging infrastructure of new energy steam "gas station", the construction speed of charging pile has always been the weakness of the development of new energy vehicle. Electric vehicles in the future will accelerate the introduction into the market in 2020-2030 will take shape; Body lightweight, power cleaning, price earthing and easy charging will be the development trend of electric vehicles in the future. This is the new energy car has been accepted by more and more people, and has been well integrated into our daily life. With the popularization and application of electric vehicles, charging facilities, such as power stations, are being built step by step.

Nowadays, with the rapid development of Internet technology, the definition of Internet almost includes all the information technologies, such as wireless sensor network technology, embedded system technology, communication technology and so on, which are combined with Internet and computer technology. Its scope is wide. Internet technology uses local area networks or the Internet to connect sensors, embedded microprocessors, controlled devices and personnel in a new way, forming objects and objects, connecting people and objects, building intelligence and information, A network that can be remotely managed and controlled.

On April 1, 2017, the CPC Central Committee and the State Council decided to establish Xiong'an New District, which includes Xiong County, Rongcheng County and Anxin County in Hebei Province. Xiong'an New District held high, strategic significance is prominent. It is the most strategic step in the development process of Beijing, Tianjin and Hebei. Exploring the optimal design of clean energy and the application of the Internet is also of great significance. This paper takes the Bohai passenger station project as the research background. The project is located in the new area of Bohai Sea, Hebei Province, and is also an important project in the overall situation of the cooperation between Beijing, Tianjin and Hebei. Through the research on the intelligent charging pile of Bohai passenger station, the construction of Internet and cloud platform is integrated into the construction of charging pile, and a perfect intelligent charging system is realized to protect the trip of electric vehicle.

## **2. PROJECT OVERVIEW**

It is very important for the passenger car, the charging time and the cruising ability. According to the type and quantity of the operation vehicles of the Bohai Passenger Station, the intelligent charging pile is built to guarantee the time and order of the departure , and the passenger transport efficiency is improved by 30 % on the basis of the traditional charging mode .

Improve the traditional single pile charging mode, realize intelligent charging, scheduling charging, timing charging and app charging, car charge identification and other charging methods on the basis of cloud platform. Jointly create an operating platform that supports multiple pricing strategies by operator, power station, customer group, time, and terminal type.

To set up a monitoring platform, we can view the general situation of power station operation on the map, can also monitor the power station in real time, know the details of the equipment operation, and can also check the historical operation situation of the power station, which is convenient for passenger transportation dispatching.

project overview: this project is the charging project of Bohai passenger station in Cangzhou. In order to meet the demand of charging for the development of new energy electric vehicle, the project is reformed. It plans to plan 8 charge parking spaces in the parking lot, install the intelligent charging equipment of the electric vehicle group, and provide the charging service for the parking lot electric vehicles.

## **3. CONFIGURATION SCHEME**

This project is equipped with 2 car charging boxes. This project is designed to use 150KW DC charging cabinets and two DC charging cabinets to achieve fast charge of double guns with a total of 8 terminals with DC charging. This charging mode can realize high power and rapid daytime filling, meet the demand in the daytime, and can also be recharged in the late days.

## **4.CLOUD PLATFORM CONSTRUCTION**

Charging platform is responsible for providing charging business support, intelligent charging, scheduling charging, timing charging app charging, car charge identification and other charging methods. At the same time, the equipment produced by the third-party manufacturer can also be connected to the platform for operation and management as long as it conforms to the manufacturer's equipment communication specification.

The operation platform is responsible for managing the operation attributes of the power station, supporting the determination of charging strategy according to the operator, power station, customer group, time, terminal type, and can manage the terminal operation state of the power station, and complete the daily refunds business. Issuance and tracking of coupons, posting of content on official websites and app, tracking of social comments, and functions such as corporate customer management, customer card management, user management, account management, etc. The monitoring platform can view the general situation of power station operation on the map, can also monitor the power station in real time, know the details of the equipment operation, and can also check the historical operation situation of the power station. Use the thermal chart to view the national equipment investment and construction situation, the application of the situation.

Operation analysis can not only analyze the data of power stations throughout the country, but also analyze the operation of a certain area or a certain power station. The data include the number of power stations and terminals operated, the operating income, the charging behavior of users, the behavior of consumer consumption, and so on. By analyzing the operation of the power station, we can understand the charging demand of the market, and plan the construction and operation of the power station in the next step.

Through the operation and maintenance index monitoring, the operation and maintenance status of the power station is fully understood. In the early warning process, different problems are dealt with at different levels. Operation and maintenance platform provides operation and maintenance work order management module, tracking the completion of the task.

System management supports a hierarchical authorization system in which each operator can manage the authority of its own internal manager.

Through the open platform to achieve the interconnection between the platform, as well as government monitoring platform supervision. The open platform docked the data and services of the whole platform to other business systems, broke the information island between the original systems, and integrated charging services into other services, such as: government monitoring platform, Industry partners (Intelligent parking platforms) and third-party internet public service platforms (map vendors, etc.)

The open platform provides two interfaces, one is that the open platform provides the interface implementation, which is called by the third party platform, the other is the open platform providing the interface definition, which is implemented by the third party platform and registered with the open platform. The interface implemented by the corresponding third party is invoked by the open platform when the third party needs to be notified.

In order to ensure the security of the interface, we should consider adding signature to prevent the data from being tampered with in the process of data transmission. All transmission parameters and return values are required to be encrypted during transmission.

The open platform can monitor the interface access of each partner, understand the running state of the open platform in real time, and find out and deal with the abnormal situation in time to ensure the stability of the open platform.

## **5. BENEFIT ANALYSIS**

Using standardized and modular design to change the disordered state of charging products, it is convenient to realize centralized monitoring from distribution to charging equipment, which ensures the whole access, and can be well isolated from other electrical equipment. Also for the future efficient maintenance and operation lay the foundation.

Through the integrated equipment, the cluster control of the equipment is realized, and the management level is implemented at different levels. Through the advantages of the charge and discharge quantity group of electric vehicles, the reasonable load dispatching principle is used to achieve the power dispatching strategy of cutting the valley and filling the peak. Because of the cluster control, the

particle size of the model is increased, the reliability, research and controllability of the model are enhanced, which is convenient for the overall load regulation and control, and also provides a favorable condition for the power grid to accept the collective discharge. Thus bring economic benefits for the enterprise, the overall efficiency of the promotion of 25.

During the peak period of the power network, the connection of a large number of charging piles will obviously impact the power grid in a region, which is not conducive to the power consumption of residents and the safety of car charging. The intelligent charging pile system is based on the modular group control of the equipment, in the case of a large number of vehicles, according to the charging needs of customers and power grid requirements, the priority order will be arranged to meet the demand for vehicle charging in turn. This will greatly reduce the impact on the grid and achieve the function of security regulation.

The self-protection model and fault tree of the charging system are established to compare the parameters of the real-time charging system with the flexible charging curve and to detect the problems of the charger itself during the charging process. The charger communicates with the BMS of the vehicle and interacts with the BMS of the electric vehicle in real time. The real-time charging data of the BMS power battery is obtained. The alarm value and the threshold value are combined to judge whether the BMS and the power battery are abnormal during the charging process. Make the electric vehicle charging process realize the safe and redundant design, prevent the charging process overcharge and accident, maximize the guarantee of BMS, power battery in normal charging state, improve the electricity Safety of motor vehicle charging process.

According to the traditional disordered charging mode, the use of large area charging piles will have an obvious impact on the power grid in the whole area during the peak hours, which is not conducive to the residents' electricity consumption and the safety of car charging. One of the contents of flexible charging technology for intelligent charging pile system is to realize the function of flexible control of power network based on the hardware of modular cluster control of equipment. When the number of vehicles is large, the intelligent charging pile system will arrange the order of priority according to the charging demand of customers and the demand of power grid, and meet the charging demand of the

vehicle in turn.

The realization of equipment flexibility is also based on the hardware of group control. Through the unified scheduling of intelligent equipment management system and cloud platform, the real-time scheduling and distribution of power modules can be realized within the charging system. According to different charging strategies, the system can distribute the power module according to demand. When the power demand of the vehicle is reduced and the power module is idle, the free power module can be allocated to the next vehicle to be charged in real time. At the same time, when the total power requirement of the vehicle is fixed and all the modules do not need to work simultaneously, the system will schedule the idle module to sleep and according to the frequency of the running module, In order to balance the working intensity of each module, the module with low frequency is used. The flexible realization of the equipment will improve the efficiency of the whole group charging system and effectively guarantee the service life of the equipment.

The most important feature of flexible charging technology is to realize the battery flexibility when the vehicle is charged . The charging process of the battery is a complicated electrochemical reaction process , such as the big size of the charging current , the difference between the working range of the SOC , the difference of the battery environment temperature , the unbalance between the battery life and the battery life , the contradiction balance between the battery life and the cruising range , etc . The ultimate aim of the flexible charging is to analyze the current characteristics of the battery, the customer demand (charging time, and the required mileage of the automobile, etc. ) . The most suitable charging method for battery life is to make the battery delay its aging as far as possible during battery charging and improve battery life.

According to the needs of all parties, the intelligent charging pile system will rely on the cloud platform and equipment management system to form the flexible charging curve of the battery. The generation of the curve takes into account the cell's ambient temperature SOC range, cell voltage, total voltage and so on. In the initial charging stage, the voltage platform stage and the charging end phase, the different currents are adjusted, and the temperature rise of the battery is strictly controlled. The battery can be recharged in depth under optimal operating conditions,

and sufficient time for internal equalization is provided at the end of the battery. The realization of this function avoids the static charging mode of on-board BMS and makes the battery available in each charging cycle. Good maintenance.

The application software of the intelligent control subsystem of the charging system supports the remote upgrade function, which can be used to upgrade the application remotely through the cloud platform. The remote upgrade has the anti error and verification mechanism. When the upgrade is not successful, the system can automatically return to the last health mode.

All charging equipments have the condition of intelligent management, fault information can not only be uploaded in real time, but also can be analyzed and applied according to big data to realize fault self-diagnosis and pre-judgment, and greatly reduce the fault time.

The distribution circuit of all charging equipment is equipped with remote power outage technology. When flood disaster or other dangerous situation occurs, the station can be cut off at the first time through the backstage, no need to wait for a person to come to the scene.

## **6. RESULTS AND CONCLUSIONS**

The increasingly mature Internet technology has brought unprecedented development to the electric vehicle charging pile data acquisition system, which can provide wireless network communication platform and complete framework for the system, and strengthen the connection between the various local systems. Enhance the administrator's control of the whole system, improve the real-time operation of the system. In order to ensure the effective maintenance of charging pile and the safe operation of electric vehicle charging system, the technology of Internet of things is applied to improve the response ability of electric vehicle charging pile system. After that, we will continue to track the operation of the established projects, expand the monitoring data, and improve the intelligent charging piles by comparing the design conditions with the practical ones. The system provides technical support for further popularizing the application of this technology.



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