

Intelligent Parking Space Sharing System Based on Internet of Things

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Abstract

In view of the increasing number of cars owned by urban residents and the limited parking space resources, this paper proposes an intelligent parking space sharing system based on Internet of things technology, which can facilitate people to share their idle parking spaces by designing an intelligent pile and combining with popular WeChat applet. This system will help us rationally use parking resources and effectively alleviate the problem of parking spaces..

Keywords

Parking Sharing; Smart Pile; WeChat applet.

1. Introduction

With the improvement of people's living standards, the number of cars is increasing rapidly. The problems of disorderly parking and difficult parking have become the difficult problems faced by many cities. As of 2014, the proportion of cars and parking spaces in big cities is about 1:0.8, that of small and medium-sized cities is about 1:0.5, while that of developed countries is about 1:1.3^[1]. It is conservatively estimated that there are more than 50 million parking spaces in China. The gap of parking space not only increases the cost of travel, but also aggravates air pollution. The phenomenon of disorderly parking also hinders the traffic and affects the appearance of the city. In addition, car owners competing for parking spaces will also lead to friction and conflict. However, according to the big data report of China's smart parking industry in 2017, the average utilization rate of large public parking lots in China is less than 30%, that of private car parking spaces is less than 30% in the daytime and less than 80% in the evening^[2]. How to effectively schedule the parking space resources and share the idle parking space will become an effective measure to solve the parking problem. In recent years, Beijing, Shanghai, Guangzhou and other cities have proposed to encourage the development of "shared parking" mode. It will be a trend that parking lots are developed and shared by the society. It will be a trend to encourage the owners and users of parking spaces to carry out the sharing with compensation at wrong time.

This paper studies the intelligent parking space sharing system based on Internet of things technology, designs a reasonable, safe and stable system, intelligently manages and shares idle parking spaces. Users who use the system can effectively find the nearest available parking space, and realize the reasonable scheduling of urban parking space resources. The system can effectively alleviate the problems of disorderly parking and environmental pollution caused by the shortage of parking spaces, which is conducive to improving the city's appearance.

2. System design

Regarding shared parking spaces, many domestic scholars have also conducted related research. Xie Sijia studied the value of the Internet of Things to online parking space sharing systems^[3]. Zhang Lunlun proposed a STM32-based shared parking lock system to solve the current private parking

space sharing^[4]. Xie Xingyu proposed the development of a parking space sharing platform in a mobile cloud environment^[5].

At present, many parking space sharing systems are not equipped with smart parking space locks, which rely heavily on closed parking lots and on the initiative of the owners, and are not suitable for open parking space systems. In addition, some sharing systems do not provide paid car rental functions, and many parking space owners are unwilling to share parking spaces. In addition, many shared systems do not have effective communication and interaction platforms for property and landlord, landlord and tenants. Therefore, this article will build a complete, safe, stable, and interactive intelligent parking space sharing system. The smart parking space sharing system should include three parts, smart parking locks, front-end design for interaction with users, and a background management system that processes and manages the entire shared parking system information. Below we will discuss each aspect of the design.

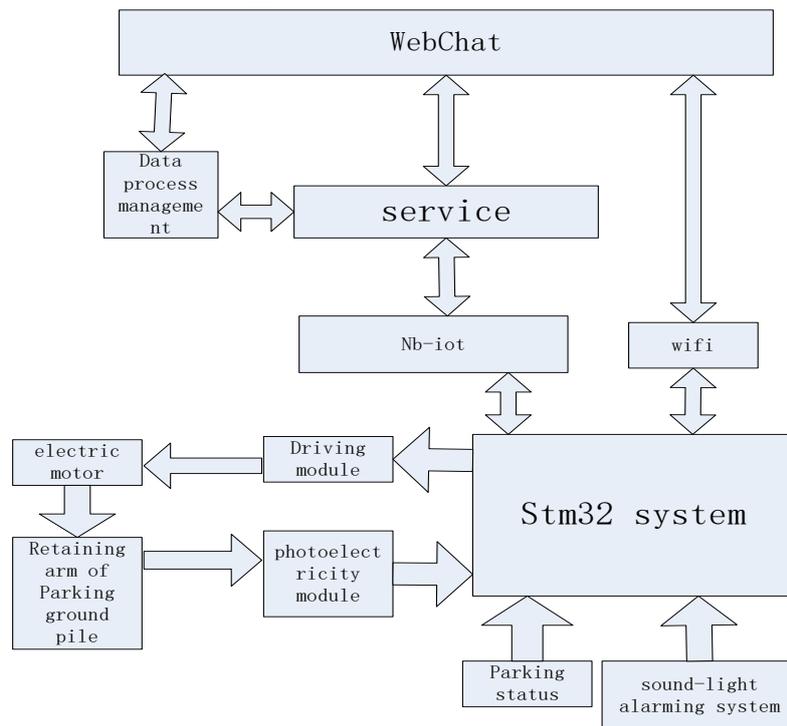


Fig. 1 Intelligent Parking Space Sharing System

2.1 Hardware solution

The hardware scheme is mainly composed of STM32F103 main controller, GPS positioning model, WiFi module, NB-IOT module, motor drive module, and geomagnetic detection module. GPS positioning module is used to obtain parking position information and track the position of the lock in real time. Wifi module of the ESP8266 serial port is selected to realize fast unlocking and short-distance communication. NB-IoT technology in the Internet of Things communication technology is suitable for medium and long-distance communication. To meet the requirements of low power consumption, the BC95 based on NB-IOT technology is selected to communicate with the server. The motor drive module is mainly used to drive the stop arm of the parking space lock. The geomagnetic detection module mainly determines the parking information of the parking space^[7]. Through the ADC checks the battery level. In addition, an audible alarm and a light alarm (day/night) are added to the design to assist in reminding users of the location of specific parking spaces. The ground lock uses the technology of the Internet of Things to better share resources.

2.2 Front-end design

The front-end design mainly realizes the interaction with the user. This design is to obtain the relevant information of the user through the WeChat applet, which is a popular user interaction method. You

only need to open the small program for sharing parking spaces on WeChat, and you can log out directly if you don't want to use it. You no longer need to download an APP or enter a URL to find related web pages^[6], which also saves phone memory. In the WeChat applet, it is necessary to interact with users in different situations. In the first case, users can add their own parking spaces to the sharing system, which can ask whether users need to purchase smart parking locks for renting and how to release parking spaces after purchase. In the second case, users who already have smart parking locks and rent them out need to display the status of their personal parking lock, as well as the time when the lock was purchased and the rental status. The third case is for user who needs to rent a parking space, which will show the user's geographic location and nearby shared parking space information. If the user wants to use the shared parking space released by other users, the user can click the marked point on the map to make an appointment and navigate to the target parking space. Therefore, the WeChat applet in this solution includes user information acquisition, user selection interface, user lock interface, map interface, parking space release interface, user lock interface, user home page, user wallet information interface, billing interface, switch lock interface, etc.

2.3 Backstage management design

The back-end data processing system mainly realizes the data management of the shared parking space system. The back-end system adopts the MVC design mode, uses html markup language, JavaScript, css and bootstrap framework. back-end data processing system mainly divided into user data management, intelligent parking lock information management and administrator management. User data includes reserved parking spaces, released parking spaces, feedback information, billing information, etc. Parking lock information management is divided into parking lock registration information, power information, location information, etc. The administrator can add users, delete users, register car locks, monitor user usage, and monitor car lock usage in the background to provide better services.

3. Summary

In the experiment, we first simulate a user to purchase and register a parking lock, and then publish the parking information. GPS module obtains the current position and uploads the coordinate information. Simulate another user to make a reservation for the user's parking space through the WeChat applet. When the user approaches the parking space, the NB-IOT model accepts the instruction and unlocks. If the user leaves, the car lock receives the command and the blocking arm is raised. In addition, through the geomagnetic detection module, the car lock can automatically detect whether there is a car in the parking space. System operation can achieve the expected results.

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