Design of Intelligent Reservation Parking Platform System Based on Microcontrollers

Zi-xuan WANG and Ling LONG*
Shuangliu, Chengdu, Sichuan, China
*Corresponding author

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Abstract. This article proposes an “Intelligent reservation parking” platform for car owners to choose and reserve their parking spaces in advance. The system uses the low-power STM32F103VBT6 microcontroller as the master chip, by setting the pressure sensor on the parking space judges whether the vehicle has stopped on it. The detected data is passed through GPRS communication to the web server built under Linux system, later the data will be presented on the mobile APP terminal after processing. The program is designed to improve the utilization of parking spaces. Besides, it also creates a new management of the parking by the owners’ reservation.

The Status of Vehicles and Parking Spaces
Take the Chengdu as a reference background: According to the data from Chengdu Municipal Transportation Commission, Chengdu Traffic and Chengdu housing administration, there are around 1.345 million parking spaces in the central area of Chengdu. By December 2015, there are 1.62 million cars in the central area of Chengdu (the total number of cars in Chengdu is 3.69 million)[1]. In the recent three years, the total number of new cars in Chengdu central area has been close to 490,000 vehicles (totally 1.25 million units in the city). 2013 average growth rate from 2015 to 30.6%. We have drawn the total number of parking Spaces in central Chengdu (Figure 1) and the growth trend of the new vehicles per year (Figure 2).

![Figure 1. The total amount of parking spaces in central Chengdu](image1)

![Figure 2. The Growth Trend of Automobile in Chengdu](image2)

Take Beijing, Guangzhou and other cities into account, comparing China's current prevailing standards (1: 0.8) with the international standards (1: 1.3), 8 million parking spaces are in need. So, we wish the intelligent navigation can help the car owners find the closest parking space to increase the utilization of urban parking spaces.

Technical Realization
• The overall handling of the circuit: STM32F103VBT6 microcontroller is the core of the circuit [2], but also the master chip, it does system programming and mobilization of another modules work.
• Using SiRF chip to do GPS, in the mobile phone APP to achieve the specific location of parking spaces for the owner to navigate [3].
• In the parking area of the system layer to install the pressure sensor, according to the size of the pressure to determine whether the parking spaces at the car parked.

As shown in the left side of Figure 3, the system is divided into lifting layer and circuit layer. Lifting layer can move up and down, the circuit layer storage microcontroller, pressure sensor, GPRS communication module, power, etc. When the owner has been booking to reach the parking spaces, the use of verification code or license plate number certification, etc. As shown in the right side of Figure 3, to verify their identity, the information is correct when the rise and fall.

![Figure 3. Parking frame.](image)

The owner can drive the vehicle into the reserved parking space. At the same time, when the pressure sensor at the circuit layer senses that the vehicle is stopped, it will feed the signal back to the STM32F103VBT6 microcontroller, and then the signal is transmitted to the web server via GPRS communication.

- Background server: Linux system to build web server. Specific steps are as follows: Install the MySQL database → install the Nginx reverse proxy server → install PHP → start the service.
- The terminal: The intelligent phone will access web pages built with web server.

The application of the entire system block diagram shown in Figure 4.

![Figure 4. System circuit.](image)

**Specific Steps of the Platform**

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- Register the account with the user’s mobile phone number, and select the third-party payment (Alipay, Wechat, etc.).
- Enter the parking location, GPS system positions the owner of the geographical location and begins to search the nearby parking lot, and recommends best three results to the owner intelligently.
• Owners freely choose the parking lot and select the intention of the parking spaces, booking succeeds. System plans maps and navigate for the owner, finally reach the destination safely.
• After arriving at the parking space, the APP button will unlock the parking space, and the vehicle will start charging after entering the parking space.
• The system detection module is responsible for detecting whether there is a vehicle on the parking space. When the vehicle is detected, the system calculates the parking fee and automatically deducts it from the account. After the parking space is locked, the parking is completed and the parking space is updated again.

**Actual Validation**

Mobile phone APP screenshot as follows, Figure 6 is the parking space booking interface.

Thus, it shows that through the above methods users can use smart phones to complete the terminal booking parking process, which greatly reduces the time to find proper parking lot personally, it is more convenient and time-saving.
Conclusions
This paper proposes a system design of intelligent reserved parking lot combined with wireless sensor network technology and mobile Internet technology [7]. The new intelligent parking system will give people a more convenient and efficient parking experience.

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