

# Exploration and Analysis of Private Parking Space Sharing Models

Yue Liu<sup>1</sup>, Junfei Xu<sup>2</sup>, Roula Chen<sup>3</sup>

<sup>1</sup> School of Chemistry, North China University of Science and Technology, Tangshan 063000, China

<sup>2</sup> School of Measurement and Control, North China University of Science and Technology, Tangshan 063000, China

<sup>3</sup> School of English, North China University of Science and Technology, Tangshan 063000, China

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## Abstract

At present, "parking pain" has become a common problem in cities, which has caused frequent parking disputes. Parking difficulties are not only found in large and medium-sized cities, but also in counties and towns with populations of tens of thousands or hundreds of thousands, thus causing a series of problems for urban traffic. However, as the number of cars per capita continues to increase, the parking problem will continue to worsen. So, there is an urgent need for a way to alleviate the parking problem. This project proposes a private parking space sharing model and develops a shared parking "Smart Parking" mini program to achieve a win-win situation for both the supply and demand of parking spaces without increasing land occupation. The business model is based on direct communication between the publisher and the demander. Moreover, a credibility system is established to effectively maintain the order of the system; the technology is based on the use of the WeChat platform and Beidou navigation system, through which parking positions and route guidance are provided directly. The sharing model of private parking spaces effectively reduces the volume of traffic caused by parking problems, thus reducing traffic congestion. It not only avoids the idle waste of parking resources, but also reduces the burden of insufficient public parking spaces in the whole city, so that urban parking difficulties can be effectively relieved, while also achieving the effect of relieving urban traffic pressure and reducing urban pollution.

## Keywords

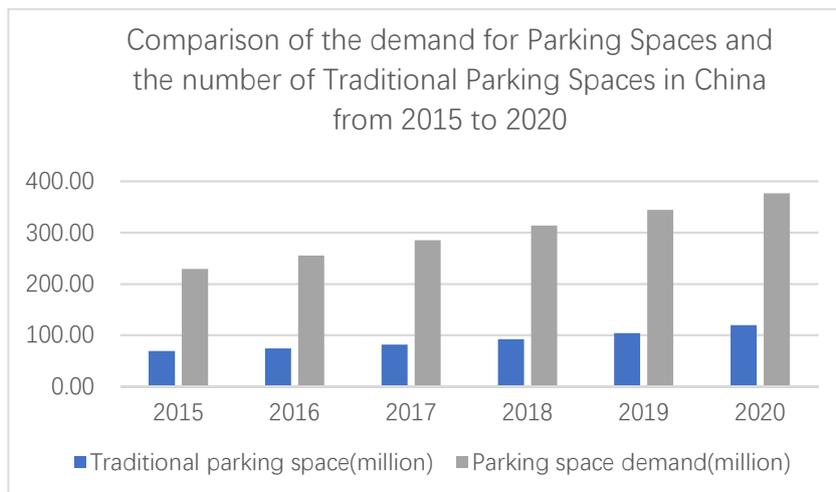
Sharing Economy; Shared Parking Spaces; Mini Programs; Precise Positioning.

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## 1. Background of the Study

### 1.1 Pain Point Analysis

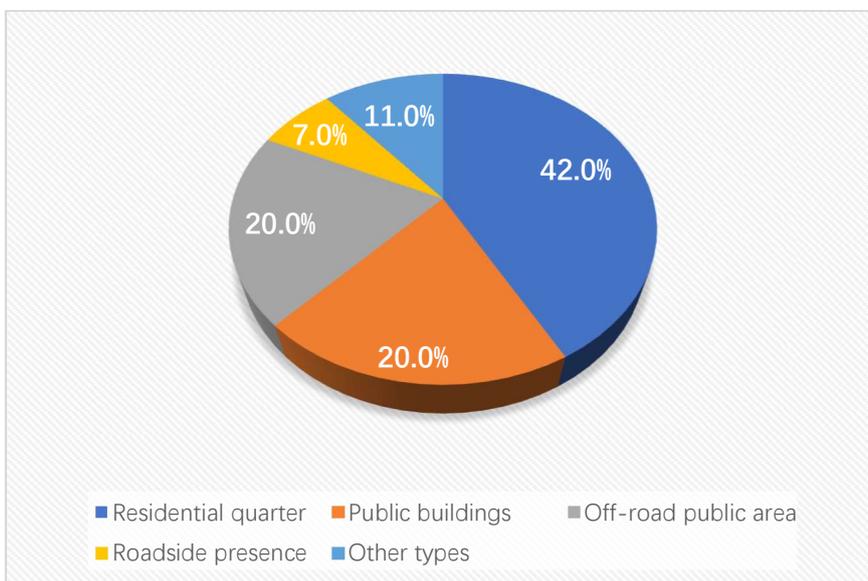
With the rapid increase in the number of motor vehicles and the rising standard of living in China, the demand for parking in cities and tourist destinations is increasing rapidly, and most cities lacked adequate anticipation of urban parking problems in their early planning. As a result, parking problems (as shown in Figure 1) are particularly pronounced in cities or regions with a long history. So much so that today, with the national average motor vehicle fleet increasing at a rate of approximately 15%, many cities in China have successively experienced the serious traffic problem of parking difficulties. Many cities have adopted on-street parking to alleviate the problem, but on-street parking can reduce road capacity by 10% to 20%, and in highly urbanised areas road capacity may be reduced by 20% to 30%.



**Figure 1.** Demand for parking spaces in China versus the number of conventional parking spaces, 2015-2020 (in million)

### 1.2 Parking Supply and Demand Issues

As shown in Figure 2, parking spaces in China today are mainly located in residential areas, while public building areas and off-street public areas also account for a certain proportion. The difficulty of parking in many cities in China is not only influenced by the increasing growth of private cars, but also by the imbalance between the supply and demand of parking spaces, such as uneven distribution and insufficient use.



**Figure 2.** Distribution of parking spaces in China today

Analysis of the city's parking difficulties is mainly located in central business districts, school districts and some entertainment areas. Due to the limited number of parking spaces in these areas, during peak hours parking spaces are in short supply due to increased traffic, leaving residential parking spaces empty. The emergence of parking difficulties not only causes the phenomenon of indiscriminate parking to arise (as shown in Figure 3), blocking traffic, making it difficult for car owners to find a location to park and congestion, increasing the length of vehicle emissions, and also exacerbating environmental pollution. The idea of "shared parking" has been developed in order to improve the demand and supply of parking spaces in the "sharing economy".

### 1.3 Current Status of Shared Parking Research

"Shared parking" started early and developed quickly abroad. At present, shared parking management systems in some developed countries have basically entered the unattended stage, using the Internet to complete a series of parking and payment processes. Many parking management systems are equipped with space guidance systems, enquiry systems and so on. The United States' smart parking industry chain and ecosystem; Singapore's EPS system and EPR system; and the UK's online booking system for parking spaces are among the various different shared parking solutions. All of them have unique parking management solutions of their own abroad. Not only that, but they are constantly improving their own solutions, adding all kinds of high technology to their solutions today.

Shared parking in China already has a certain foundation in theory, institutions and applications. In terms of theory, Manzhen Duan [1] has developed a model for assessing the external sharing capacity of parking spaces in residential areas, and has calculated that when a parking space sharing policy is implemented, residential areas can provide parking resources equivalent to approximately 55% of their own proportion to adjacent and neighbouring buildings. From an institution-building perspective, Yansheng Li suggests linking parking management data and other sectors of traffic to integrate parking management issues and other traffic issues in the city centre as well as on the periphery of the city centre. In terms of application, Anjubao's dynamic preferential parking model and shared parking model have already achieved revenue generation. The country is still dominated by traditional parking models, but shared parking is well established under the concept of sharing economy.

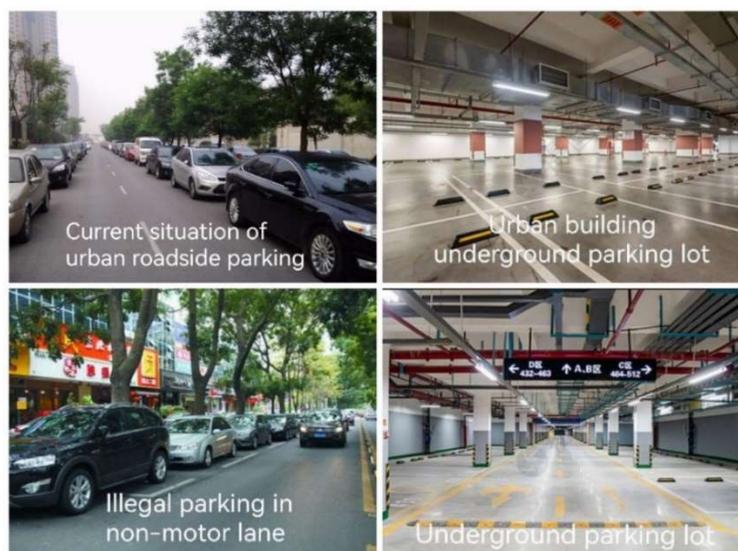


Figure 3. Unreasonable parking

## 2. Project Description

### 2.1 Overview

Shared parking is the efficient use of unused parking spaces to share parking spaces and alleviate the problem of parking difficulties[2]. The project is designed as a "Smart Parking" mini program. The project is designed as a "Smart Parking" mini program, which uses the WeChat platform and adopts a sales model of direct communication between publishers and demanders, and establishes a credibility system for transactions[3]. It is clear to understand (as shown in Figure 4), and can be developed in a modular way. It has seven main parts: real name authentication, accurate positioning, real-time parking, extremely fast transactions, points rewards, after-sales guarantee and contract cooperation. The platform proposes a solution for private parking sharing, has a systematic planning of the shared parking process, effectively maintains the system order, and provides a broad platform for shared parking.

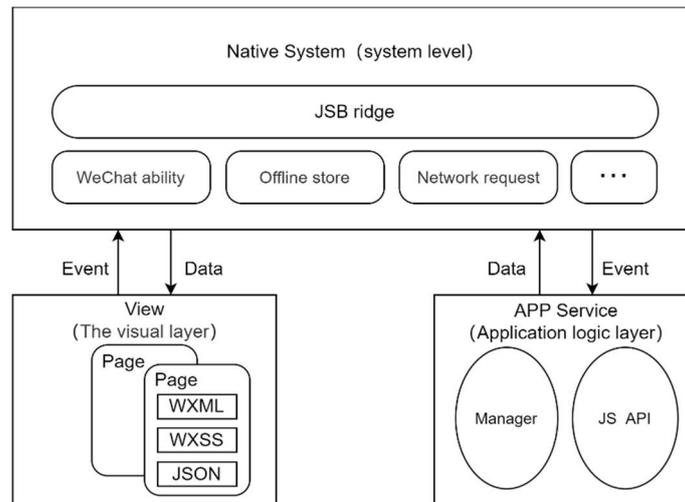


Figure 4. Structure of the WeChat MINA framework

## 2.2 "Smart Parking" Mini Program

(1) Real-name authentication: Register an account using the "Smart Parking" mini program, carry out real-name authentication, improve the owner's information, register the car's license plate information and get an account after the platform's information verification. Through real-name authentication, a complete Internet credit foundation and protection is established.

(2) Precise positioning: Cooperate with WeChat map and with Beidou Navigation System to connect the user's mobile phone to open the automatic positioning function. Under positioning, customers upload their personal shared parking space through 3D video and show proof of parking space. The platform enters the information and visualises it in the applet area, where users can see the precise location and use of the parking space. Interfaced with the Beidou Navigation System, customers can be guided directly through this program for route guidance.

(3) Real-time parking: The mini program mainly uses photo uploads, which are transmitted to the shared owner with the platform for backup, to prove the time and duration of parking. The platform encourages cooperation with residential communities to share parking space monitoring equipment. Its monitoring equipment involves user and community privacy and is only open to some workers of the platform. Demanders of parking spaces can find the best parking spots and parking information "online" in just ten seconds through their mobile phones, and make reservations and transactions for parking spaces; suppliers of parking spaces can see the use of their own spaces in real time, safeguarding their private property.

(4) Speedy transaction: Users bind their WeChat accounts and indirectly bind WeChat pay with their bank cards, and can set up secret-free payment for speedy transaction. When the user makes a payment, the owner will receive the user's payment result in real time. Meanwhile, the platform's transaction process can be monitored and protected using a real-time voice call function. When problems arise from the rental and sale of shared parking spaces and the need for cash flow, the transaction is negotiated after the sale is processed with the platform's rules and regulations, etc.

(5) Reward points: A reward mechanism is used for users of shared parking spaces to reward them with points for their usage and credibility. Points incentivize customers to use shared parking spaces because parking coupons, merchandise and other product coupons can be redeemed, which boosts the platform's business.

(6) After-sales guarantee: A perfect after-sales management system is established to provide a reassuring, efficient and convenient after-sales service and guarantee system. After-sales service personnel are arranged in each region and there are robotic replies on the platform in addition to manual services to protect all the rights and interests of consumers.

(7) Contracted cooperation: Expand the visibility of the mini program through media campaigns and so on, cooperate with enterprises related to car rental and parking to learn from experience and methods. Secondly, cooperate with various WeChat shops to sell other products on the platform and expand business. Later cooperate with more e-commerce platforms, build an independent APP to develop the scale of shared parking.

### **2.3 Shared Parking Business Model**

The "Smart Parking" mini program will involve multi-departmental collaboration and will require the joint efforts of all departments to develop policies based on different management lines to open the door to the arrival of shared parking. Additionally, policies and publicity must be made available to residents and reach out to the public in order for shared parking to flourish.

(1) Policy standards: Relevant national departments should develop industry standards for shared parking. IOT(The Internet of things) sensor devices should be installed for public and private parking spaces and used to detect the use of parking spaces. At the same time, incentive mechanisms can be set up to motivate communities to cooperate with shared parking businesses and eventually establish systematic urban construction of shared parking spaces. In addition, a policy of opening up unused parking resources should be developed to maximise the use of resources.

(2) Local governments: Local governments should form a sharing model based on market allocation of resources in accordance with local economic development and forms of social development. Flexible pricing mechanisms are supposed to be adopted to maximise social benefits by increasing the public benefits to residents.

(3) Public Security Department: The public security department should introduce a policy of tasting open use of parking resources and develop public standards for parking management sharing, in response to the policy of opening up unused parking resources to the community by governments at all levels and some state-owned enterprises under the condition of ensuring public safety.

## **3. Project Advantages and Innovations**

### **3.1 Innovation Highlights**

This project is the first to combine the idea of sharing private parking spaces with information technology networks to develop the "Smart Parking" mini program, which socialises the sharing of private parking spaces, easing the pressure on urban parking and achieving social goals such as energy saving and emission reduction. This is a very meaningful innovation.

### **3.2 Competitive Advantage**

As an online service, parking space sharing can be invested in the mini program upfront to reduce costs. Users of the "Smart Parking" mini program require real-name authentication, but in contrast to other APPs where the privacy of users is uncertain and insecure[4]. We have signed a confidentiality agreement with our users to ensure that their private information is not leaked. With the upgrades to the mini program, we have improved the accuracy of parking spaces and vehicle location, and are able to update the information in a timely manner, providing users with zero deviation in the availability of parking spaces. The fast transactions with encrypted and facial recognition payments have improved the bike-sharing experience. Reward points encourage users to use the mini program more often. The after-sales guarantee can solve users' usage problems in a timely manner.

### **3.3 Market Advantages**

The boom in the sharing concept has led to a great development of the sharing economy, the success of bicycle sharing provides a good example of the market for the sharing economy and the universality of the customer use segment of the mini program. Parking is a rigid demand in most developed and more developed areas of China and the market demand is very high. Parking space sharing can solve traffic congestion problems without the need to develop new land and can be strongly supported by

the government. We have promoted the mini program extensively in outdoor and new media to raise awareness of the shared parking spaces.

### 3.4 Social Significance

The operation of this mini-program can ease the contradiction between parking supply and demand, relieve urban traffic pressure, balance urban parking resources, and solve the problem of traditional parking difficulties and parking chaos. It can also reduce environmental pollution, beautify the urban ecological environment, improve the livability of the city, make full use of idle land resources and time resources, facilitate the life of consumers and help social harmony.

## 4. Market Development Potential

By the end of 2021, there will be 302 million civilian vehicles in the country, with 26.22 million new vehicles registered nationwide, an increase of 1.98 million compared to 2020. Of these, 17,736,400 are private cars, an increase of 1,037,000. With the increase in the number of private cars, parking spaces are in short supply. The mini program called "Smart Parking" is easy to use and takes only ten seconds to complete the sharing of parking spaces, which not only alleviates the difficulty of parking caused by the lack of parking spaces, but is also convenient and efficient, in line with the theme of high-speed and convenience in today's information age.

In terms of social resources and market prospects: the "Smart Parking" mini program can make rational use of parking resources, allowing users to find parking spaces shared by others around them and sharing their own parking spaces on the APP. The sharing of parking spaces does not involve waste of resources or disturbance of traffic order, and is more in line with the current concept of "sharing". The "Smart Parking" mini program has accurate positioning of parking spaces, and a series of operations such as booking and payment can be completed on the APP, which is more convenient than traditional parking.

Social benefits: Sharing parking spaces allows the publisher to earn a certain amount of revenue and the demander to find a suitable space to save time on cruising. At the same time, with the emergence of the "Smart Parking" mini program, traffic order is maintained to a certain extent, reducing traffic pressure and the waste of idle resources, improving parking space utilization during the day.

Shared mode improvement: As the economy continues to develop and people gradually move into a well-off society, private car ownership is increasing, public parking spaces are in short supply and the sharing economy is booming, making the shared parking mode come into being. However, the shared parking model is still in its infancy and there are many problems, such as the inability to protect user privacy and the imperfection of the APP, which makes it more difficult to promote. If it is improved in all aspects of its operation, it can eliminate consumers' concerns about their privacy and security, and it can also unite multiple parties to promote and help share parking. If diversified publicity is achieved, it can make the idea of shared parking deeply popular and stimulate consumer use.

In the future, as the total number of cars increases, shared parking will make full use of land resources, ease urban traffic pressure and promote the development of the sharing economy, while people will have a deeper understanding of shared parking. Our "Smart Parking" mini program will continue to be optimized and improved, and eventually create an app that everyone knows, so that the potential of shared parking is endless and everything is bright.

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