

An Overview of Intelligent Parking Systems

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Abstract: With the development of Internet technology, intelligent parking system has been developed. China's intelligent parking management platform has been connected to the front-end parking points, integrating the parking points of the original information island into a parking network. Gather parking point data into a data center to comb and comprehensive data application provide parking operators scheduling management, financial management, operation analysis, marketing management, advertising management and parking service for owners to provide parking query parking reservation, parking path navigation, electronic payment, monthly, bill inquiry, convenient parking services. The MIT study leverages third-party services to parking recommender systems and provide personalized parking space recommendations for users according to past experience of the user Telecom Research Institute. Users are able to receive parking recommendations while maintaining privacy, because parking measurements weigh practicality against privacy. An intelligent multistory management system in parking depended on RFID technology and user preference review has been studied abroad, which effectively solves the problem of parking lot.

Keywords: Intelligent parking; Internet of Things; Parking management system.

1. Introduction

With the combination of artificial intelligence technology and the Internet of things, all kinds of industries in our country have been developing rapidly. Intelligent parking is also an important product of the combination of artificial intelligence and the Internet of Things. At present, the intelligent parking system is promoted gradually. A variety of new technologies and the application of new materials make the intelligent parking system perfect gradually. Many cutting-edge technologies in the field of modern control and intelligent transportation are in intelligent parking systems. [1] In this article, we review the recently published articles, mainly from the last 5 years, on intelligent parking systems with sensors, embedded systems, context-aware capabilities and IoT enhancements, which save time, fuel, energy, and reduce drivers' stress. [2] To achieve this goal, we review different model intelligent parking solutions based on algorithm-based formalism, theoretical frameworks, formal models, prototypes based on smart devices, and real-time applications. It is based on intelligent parking agent guidance system, intelligent parking reservation system, intelligent parking algorithm solution for parking guidance and information system and automatic parking system.

2. Historical development

In 1995, the concept of the Internet of Things was first mentioned in a book by Bill Gates, who described the Internet of Things using the camera as an example, but the concept was not accepted in the environment at that time.

In 1999, MIT's Auto-ID Center proposed the "Internet of Things" based on RFID logistics networks. But the technology hasn't yet arrived in China or spread globally.

In 2005, the International Telecommunication Union mentioned in the Internet report that the concentric era of the Internet of Things is coming, and at this time some technologies of the Internet of Things are also playing an initial role in China's parking system. After 2006, with the rise

and maturity of machine learning, especially deep learning and front-end embedded deployment technologies, as well as the substantial improvement of core force, Great progress has been made in license plate recognition technology.

In 2009, IBM put forward the concept of Smart Earth, and since then, the concept of Internet of Things has been recognized globally. At the same time, Shenzhen An Expo Jieshun exhibited a mobile phone card function of the parking lot equipment, that is, when entering the parking lot, the mobile phone distance from the card reader 5-10 cm range can be identified. [1] It was also during this period that China Mobile piloted the first smart community in Shenzhen, and realized applications such as micropayment and unlimited video surveillance at home. This is the equivalent of embedding RFID services into a mobile phone SIM. In 2016, the national 13th Five-Year Plan for Development proposed the development of the Internet of things open-loop application.

In 2017, the Ministry of Industry and Information Technology proposed to build a IoT infrastructure with wide coverage, large connectivity and low power consumption, and develop NB-IoT-based technology applications. B-IoT technology uses narrowband communication with low power consumption, wide coverage and dense. [2]

High degree advantage, so that parking equipment directly networking, geomagnetic, ground lock, charging pile, LoRa technology has made it possible for community networks to form a large network due to its industry norms. At the city level, parking equipment data is uploaded via the Internet of Things, so checkpoints set up on the road can continuously transmit information to the platform.

For the city platform, the municipal government and the online parking enterprise platform are connected to obtain parking lot location data, so as to grid the data of the city parking lot, and then share these data with customers, so as to facilitate the public to find parking Spaces and solve the problems of some parking users. NB-IoT technology and Lora technology are mainly used.

In 2018, Alibaba fully entered the Internet of Things area,

China is thus entering a period of comprehensive application of the Internet of Things and intelligent parking system. The scene of license plate recognition landing technology is constantly subdivided, and there are many complex scenes of intelligent parking. In recent years, many people have been financially supported, and many people want to have their own private garage, so now intelligent development is a big trend. Many people have garage doors connected to license plate recognition. You just drive up to the door and the garage door will open automatically, which is a very easy way. The most common are garage sliding doors or roll-up doors that use a turbine in conjunction with license plate recognition.

In 2019, the National power grid was built into the electric Internet of Things, and geomagnetic technology has gradually come into the public eye. Current technology is based on the fact that the ferromagnetic material contained in the vehicle itself affects the geomagnetic signal in the area where the vehicle is located, so the Earth's magnetic field lines near here bend. When the vehicle passes near the sensor, the sensor can receive the signal and analyze it to obtain the relevant data of the detection target. At present, the market of geomagnetic vehicle detector mainly adopts wireless transmission. This method has the advantages of high detection accuracy, stability and reliability, convenient installation and maintenance, so it quickly occupied the market and achieved great success.

In recent two years, Information technology continues to advance, machine learning model has been used in parking prediction, especially in urban areas. Huge progress has been made in parking prediction methods based on machine learning. The characteristics and techniques of neural networks, combined with the characteristics and challenges of parking problems.

The development of the Internet of Things has experienced two waves, one is the active guidance from China and the United States since 2009, and the other is from 2016 till now. Under the influence of the Internet of Things, the intelligent parking system has made great progress. Great breakthroughs have been made in the following aspects in China. About the time-consuming access to the parking lot. Second, special parking Spaces are provided, such as large parking Spaces, simple parking Spaces, parking Spaces with charging piles and other services of different consumption levels. Third, park a large number of cars in the same space. For example, a three-dimensional parking garage allows cars to park at different levels of the same space; To solve the problem of spaced parking, a shared parking garage can be established.

At present, intelligent parking mainly includes parking guidance, parking lot management, reverse car search and other main functions. Some intelligent parking lots also add special vehicle management functions, using parking perception, video recognition, intelligent card reading and other technical means, to provide exclusive rights for special vehicles, automatic guidance into exclusive parking.

3. Analysis of the current situation

At present, intelligent parking in China refers to the comprehensive application of wireless communication, mobile terminal, GPS positioning, GIS and other technologies in information collection, comprehensive management, data query, booking and navigation services of urban parking Spaces, and real-time update of parking resources. [2] Maximize the use of parking resources, maximize the profits of the parking lot, convenient car owners parking services.

Simply put, the "wisdom" of intelligent parking is reflected in: "intelligent parking + automatic parking fee payment". To provide owners with peacetime parking, off-peak parking, parking space rental, parking car after-sales service, parking search, parking navigation and other services. The purpose of smart parking is to allow car owners to find the right parking space faster, including both offline and online smart ways. Online intelligence is reflected in the owners' mobile phone APP, WeChat, Alipay, access to the designated location of the parking lot, parking vacancy information, charging standards, can book and other services, and realize payment in advance, online payment and other functions. Offline intelligence is reflected in making it easier for parkers to park their cars in parking Spaces. At present, there are many researches on advanced technology of intelligent parking system. In recent years, the main research has the following three kinds.

3.1. Electronic parking system

The electronic parking system is based on a web app on a smartphone. This is a system that you can use remotely, as long as you download the APP you need to your phone and use the app to operate remotely. [3] First, in order to use the smartphone app, users need to register the required personal and vehicle information. Once registered, users have access to electronic parking facilities. [2] The electronic parking system provides users with a variety of facilities, such as providing information on the occupancy of different parking locations located in other parking lots, vehicle transfers to the nearest parking lot, booking services, multiple payment methods, vehicle security, parking lot retrieval facilities.

3.2. Automatic parking system

APS is a mechanical automatic control system, meaning that it stops automatically without human intervention. The first is an automated parking facility (APF), where users register their vehicles and drop them off at designated locations. [4] From there, a mechanical system can automatically park the vehicle in a specific parking space. If the user wants to retrieve the vehicle, he must first log into the system and pay for parking. After a fee is paid, the vehicle is automatically removed from its parking space. And the system uses a digital display to provide users with information about the number of available parking Spaces. In addition, APS classifies vehicles by model and places them in different types of parking lots. APS provides for the highly efficient use of parking Spaces without damaging any vehicles.

3.3. Intelligent payment system

The intelligent parking system allows users to schedule a device that they can pay for in advance rather than a traditional device that keeps time during parking. By arranging convenient payment facilities, the system contributes directly to fast and easy collection. The time it takes to collect parking fees, fines and the like, has fallen. Moreover, when operating in the system, fast access to incoming users is guaranteed. As a result, the amount of time the parking lot is empty is greatly reduced. The system can use NFC, RFID, induction card and other non-contact mode. The system can also arrange a variety of secure online payment methods, such as parking fees can be directly deducted from the APP. [4] To calculate the cost, the system uses the same sensors to measure the probability of the garage being used.

4. Conclusion

In recent years, as the Internet continues to improve, machine learning models are being used in parking prediction, especially in urban areas. Parking prediction methods using machine learning have been practiced.

Combined with the characteristics and skills of neural networks, combined with the characteristics and difficulties of parking fault problems, we have great expectations for the future of intelligent parking data. The first component we'll look at is one that handles data. After the sensing part sends the occupied state to the local server, the post-processing process begins to prepare the input sequence. Generally, the scattered perceptual states and the concentrated perceptual conclusions are evaluated as the overall summary of parking occupancy. Then, two sequences are calculated to be short-term real-time state sequences and long-term historical state occupancy sequences, and both sequences are ready for use. We can also predict the impact received, parking activity is highly influenced by the state of the property, including different times of day, the overall weather of the week, weather conditions, where the parking is located, etc. This information needs to be collected continuously and fully integrated into the forecasting system. [5]

Here, we can build a collection attribute information

component that collects the necessary factors, The multiple types of parking lots (business, work, shopping, rest areas, etc.), weather conditions (sunny, cloudy, rainstorm, cloudy, etc.), different time periods of the day, number of sunny days of the week, different types of roads (highways, trunk roads, local streets, etc.) are then processed as input to the forecast component[5privacy].

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