

Intelligent Parking Device in Urban Community

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Abstract

With the improvement of people's living standard, in order to travel conveniently, almost every family has a family car. The rapid growth of automobiles has brought serious pressure to urban traffic, while parking spaces have become a major problem. In many big cities, there is a dilemma of "no parking space with cars". For this reason, we design a parking device in intelligent community, which is mainly composed of mechanical frame, single chip control module and motor drive module. Among them, the mechanical frame is made of aluminium profiles to make the frame safe and stable; the single-chip control module is composed of 32 single-chip computer, driver, switching power supply and so on, to control the motor and steering gear; the transmission module is composed of motor, arc track and so on, which has the functions of accepting the command of single-chip computer and controlling the elevation and elevation of the platform. The equipment is low-cost, safe and reliable, and uses the second floor space to increase the original parking space, thus solving the problems of small number of parking spaces and parking difficulties. At the same time, it has the advantages of manual control, storage and extraction of cars, marking the available parking space with horse-running lights, helping the car owners to park at the designated position with buzzers, and simple platform lifting control.

Keywords

Residential Parking; Unutilized space ; Safety; reliability; low cost

1. Introduction

With the popularity of the Internet and the rapid development of society, all walks of life have begun a new trend. Various automobile trading platforms make it easy to buy cars and difficult to park cars. This makes intelligent parking become a popular product.

Although the traditional flat parking lot is convenient for parking, such parking equipment covers a large area and has a low land use rate. There are few matching parking spaces in old and old residential districts built in the city. The parking demand of residents is huge. The surrounding buildings are dense and can not be excavated to construct large parking garages. The contradiction between supply and demand is more serious. In addition, flat parking lot does not have a perfect locking system, and can not give the vehicle a sound protection device. Therefore, it is particularly important to develop a new type of intelligent urban residential parking device to solve the parking problems in some cities.

2. Design objective and implementation scheme

2.1 Design objective

The control chip is used to control the whole situation, and the three-dimensional motion is completed by gear transmission and arc track. Then the parked vehicle is automatically parked in the new parking space in the air and the vehicle is automatically sent to the designated position on the ground when the owner picks up the car. It is mainly composed of mechanical frame, single chip control module and motor drive module. Aluminum profiles are used as the basic framework of the parking device to realize one-stop, convenient parking, automatic integrated parking, and one-button parking with fingerprints.

2.2 Implementation scheme

Intelligent double-deck parking space is built on the original plane parking space on the ground. When the owner arrives at the community, unused parking spaces can be found through the horse-running lights installed on the platform. The car owner first lowers the parking panel through a button set next to the equipment, and then parks the car on the parking panel. The buzzer will alarm until the car owner stops at the appropriate location. If the buzzer always alarms, it shows that the car model is not suitable for the parking space. At this time, the owner should go online to find a suitable parking device for the car model. After parking the car, the owner can get off the car and control the parking board to ascend to the designated position by pushing a button. When the owner needs to use the car, he still lowers the parking plate through the button, and then drives the car away. After the vehicle is driven away, the parking plate can automatically sense the gravity of the board, and it can be re-elevated without manual operation, which subtracts many steps of the owner and brings more convenience[2].

3. Detailed design and production description

3.1 Mechanical frame part

The mechanical frame is constructed of aluminium profiles with high hardness, stable structure, low cost and easy installation, cutting and drilling. The aluminium profile in the upper frame also has the function of fixing the arc track. The frames on both sides are connected by aluminium profiles to stabilize the arc track. In this way, even if the motors on both sides are not synchronized, the parking plate will not bump up and down. Aluminum profiles are connected by corner codes, which is simple and convenient. The left and right ends of the frame are driven down into the foundation and connected with the earth. The lifting structure is composed of four improved parallel four connecting rods, which ensures the stability of the parking plate in principle. The upper part of the parallel four connecting rod is connected with the parking plate through a 4mm shaft, and the lower part is connected with the shaft and the bearing seat and the bottom plate. It guarantees the safety and stability of the whole equipment.

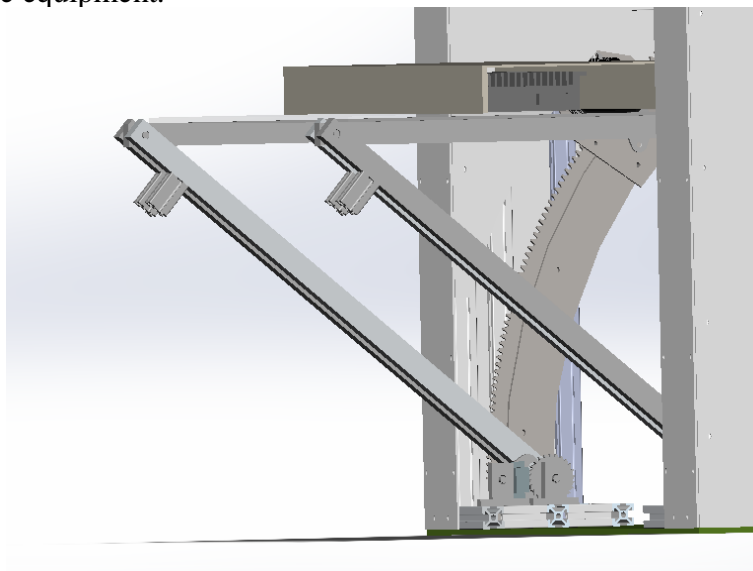


Fig. 1 Parallel four-bar structure[3]

The left base of the equipment is equipped with ratchets and pawls to prevent sudden power failure and fall. The connecting rod and ratchet are fixed and connected to the bearing seat through the shaft. A spring is connected between the pawl and the base, and its action is controlled by the steering gear. The steering gear does not issue instructions and the pawls do not move during the rising process of the parking plate. If the parking plate falls suddenly, the pawls will be inserted into the ratchet wheel and the connecting rod will be locked so that it can not fall again. During the falling process of the parking plate, the steering gear controls the opening of the pawls and the spring is stretched to make

the ratchet rotate normally. At this time, if the power is suddenly cut off, the rudder will rotate normally. When the machine loses control of the pawl, the spring pulls the pawl back and inserts it into the ratchet wheel again, locking the connecting rod so that it can no longer fall. In this way, it has the function of power-off protection in the process of rising and falling. In this model, the ratchet and pawl are cut by acrylic plate, and the hardness is not high. In order to prevent the ratchet and pawl from being damaged by excessive force, the metal material with higher hardness should be selected.

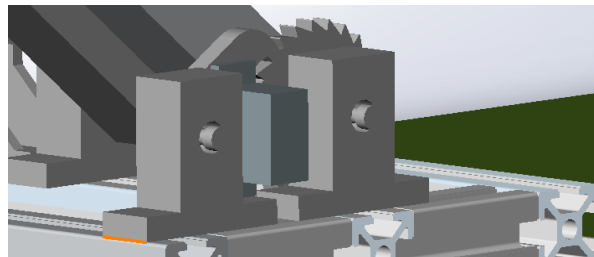


Fig. 2 Ratchet and pawl[4]

3.2 The Control Part of Single Chip Microcomputer

The main body of this system is to control the whole system with Mini32 single-chip computer as the main control chip. It uses its own wiring and design board to control the whole system. All motor and rudder signals are controlled by this single chip computer. At the same time, the signal collected by the gyroscope can be received, and the parking plate can be precisely controlled to make it parallel to the ground, so as to prevent the rollover of the car caused by the tilt.

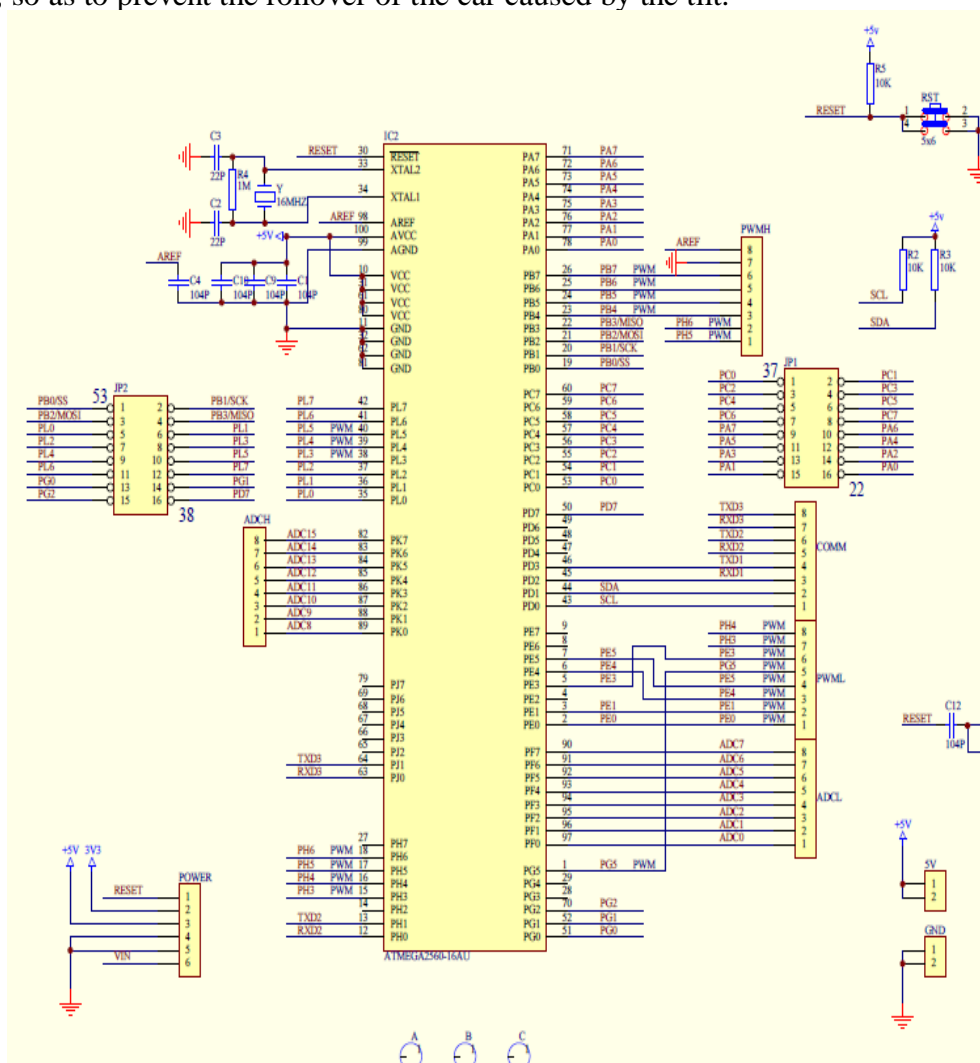


Fig. 3 Some Principles of Mini32 Single Chip Microcomputer Control Board[5]

3.3 Motor drive part

The drive part of the motor is composed of decelerating motor, supporting plate, bearing, steel wire, arc track and other accessories. The motor is fixed with the mechanical frame. The motor shaft is provided with a sleeve. The outer side of the sleeve is wrapped with adhesive tape to prevent the steel wire from falling off. Five holes are punched evenly on the arc track, and one bearing is fixed in each hole. One end of the wire is wrapped around the bearing sleeve, and five bearings mounted on the arc track are used to provide trajectory support points for the wire. Four holes are punched in the support plate and four longer screw rods are installed respectively. Four bearings are clamped on the arc track and then connected to the support frame to make the four bearings become a whole in motion. Holes are punched in the center of the support frame and bolts are installed. The other end of the wire is wound around the bolts. The steel wire drives the bolt in the center of the support frame, so that the four bearings slide up and down along the arc track. The bolts are located in the center of the bracket, and the bearings are evenly distributed at the four corners of the bracket, so that the four bearings can be stressed evenly and the sliding of the parking plate is smoother.

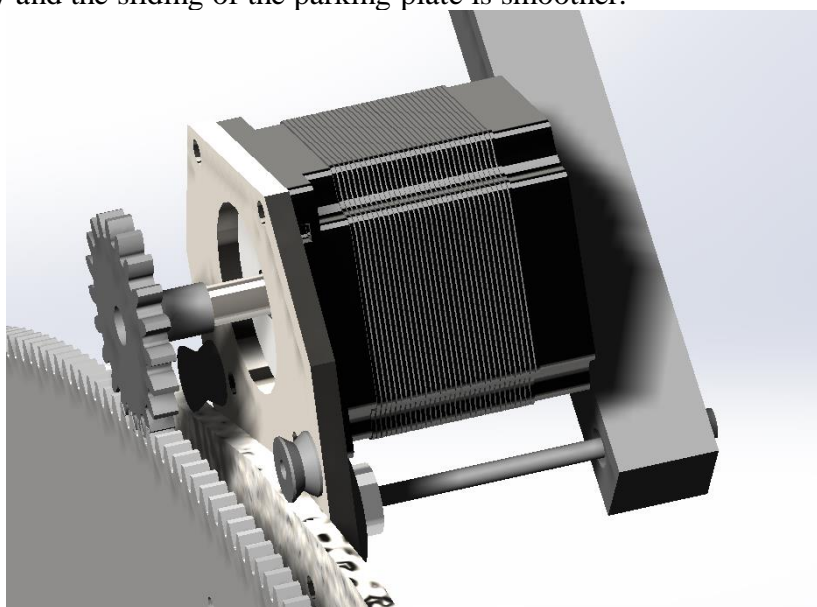


Fig. 4 Assembly Drawing of Motor Drive Part

4. Expected application scenarios

4.1 Applicability

Intelligent urban residential parking device is an automatic three-dimensional system, which saves occupied land area, makes rational use of space, has high storage rate, is safe, stable, convenient and efficient. It is helpful to solve the problems of lagging construction of urban parking facilities, shortage of land resources and difficulty in parking. It is an intelligent parking scheme to solve the contradiction between supply and demand between the high-speed development of automobile industry and market parking spaces. The improved parallel four-bar structure is adopted as the basic framework of parking spaces to realize double-deck parking. Once parking, convenient parking, fully automatic integration to achieve parking, great use of space.

4.2 Great market demand

According to the data released by the National Development and Reform Commission, the ratio of cars to parking spaces in big cities is about 1:0.8, that in small and medium-sized cities is about 1:0.5, and that in developed countries is about 1:1.3. Conservatively, it is estimated that there are more than 50 million parking space gaps in China. With the rapid increase of real estate prices, the price of parking spaces in urban residential areas is also rising. If the price of parking spaces is calculated according to the price per square metre, the price per square metre has reached more than three times of the price of residential housing, some even more than 10 times, and a parking space in Beijing is

as high as 4.75 million [5]. Therefore, this work has broad application prospects in market demand, economic benefits and social and people's livelihood, and has great potential for development, high cost-effective, and high promotion value.

4.3 Wide range of applications

This product has good modularity, so it can be used not only in the old urban districts, parks, green areas, commercial areas and other small surrounding areas, but also in relatively spacious areas; it can be used in public facilities, units, shopping malls, the World Trade Area and so on.

4.4 Applied Advantage

The material of the whole system is easy to obtain, the integration and connection of each component is easy, and the technology is mature; the cost of the product is low, the area occupied is reduced, while the cost of land occupied is reduced, and the cost of production is reduced; the size design is in line with the space between the buildings in the district, and the size can be adjusted to facilitate the construction or renovation of the parking lot in the district. It has the advantages of variable scale, strong adaptability, fast access, simple operation, good protection, safety and stability.

5. Summary

This project analyses the existing parking problems in China, and finds out the causes and the ways to solve them, that is, building a three-dimensional garage to alleviate or even eliminate the parking problems. This paper analyses and understands the types of three-dimensional garage, its advantages and disadvantages, and investigates the current situation of parking difficulties at home and abroad and their solutions. Based on the actual situation in China, through functional analysis, several schemes are designed independently. According to the comparative analysis of its advantages and disadvantages, a specific design scheme is obtained. Then the corresponding structure and size are obtained by optimizing the design of each part, and the optimum design scheme and material selection of each component are selected by checking. Finally, the actual product is produced and debugged.

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