Design and Manufacturing of Rotary Automatic Parking

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Abstract: In metropolitan cities, vehicle parking has become a major concern in all busy areas and a good traffic system needs a good parking system. Different types of vehicle parking are applied worldwide namely Multi-level Automated Car Parking, Automated Car Parking System, Volkswagen Car Parking, etc. The present project work is aimed to develop a reduced working model of a car parking system for parking 6 to 24 cars within a parking area of 32.17 m². The chain and sprocket mechanism is used for driving the parking platform and a one fourth hp brake motor shall be implemented for powering the system and indexing the platform .The platform is fabricated to suit the working model. The procurement and manufactured items are in hand and are ready to be assembled with the structure. This model is further useful for different branches of engineering in order to develop different types of automations like PLC, Micro controller and computerization etc. By testing analyzing the working model we can defiantly get the view to develop the parking lots at difficult and busy commercial places. The present project work is completed upto fabrication of different parts and the structure and is ready to be assembled. The final assembly is going on and would be completed shortly.

Keywords : Chain and sprocket, Motor, PLC, Micro controller, computer.

1. INTRODUCTION

It is simple to operate with the driver parking and leaving the vehicle in the system at the ground level. Once the driver leaves the incorporated safety zone the vehicle is automatically parked by the system rotating to lift the parked car away from the bottom central position. This leaves an empty parking space available at the ground level for the next car to be parked on. The parked car is easily retrieved by pushing the button for the relevant position number the car is parked on. This causes the required car to rotate down to ground level ready for the driver to enter the safety zone and reverse the car out of the system. Except Rotary Parking System all other systems use a large ground area, Rotary Parking System is developed to utilize maximum vertical area in the available minimum ground area. It is quite successful when installed in busy areas which are well established and are suffering with shortage of area for parking. Although the construction of this system seems to be easy, it will be par from understanding without the knowledge of materials, chains, sprockets, bearings, and machining operations, kinematic and dynamic mechanism.

The Rotary Automated Car Parking System (RACPS) belongs to the class of rotary smart car parking systems. The traditional parking systems such as multilevel or multi-stored car parking systems (non-automated), robot car parking systems, automated multilevel car parking systems etc. have been implemented on a huge scale. But these systems have a major disadvantage of large space consumption which is successfully eliminated with the use of a rotary car parking system [2]. Moreover, the latter provides the added benefits of flexible operation without the need of an attendant and added security and least chances of vehicle damage. Since the model makes use of composite parts, it is easy to assemble and dismantle and is thus more convenient than the traditional car parking systems. The rotary model is specifically designed to accommodate multiple cars in the horizontal space of two. The structure can accommodate six cars in the space of two and can even be customized to hold a greater number depending upon the requirements of the user and can be efficiently put to use in much space crunched areas. Parking spaces cannot cope with the growth of the number of vehicles. In many urban housing societies, the parking space ratio is 1:1. The vehicles parked randomly, cause the major problem faced in most of the metropolitan cities. The basic structure of the RACPS can be described with the help of following block diagram. Fig.1 depicts the interconnection between the various subsystems of the project. Mechanical parking equipment is also called stereo garage. As compared to the existing parking arrangements, the most obvious advantage is maximum space utilization; it is safer and more convenient. The RACPS is totally automated with the user being given a unique ID corresponding to the trolley being allocated to him/her. This kind of equipment is useful to solve the issue of limited parking space available in busy cities. Evidently, it can be seen that the number of private cars is increasing every year. Private garages, where only a single car can be housed at a time, do not provide a feasible solution to the problem since many families own more than one car. So the task was to design mechanical equipment that can store 6 cars in one normal garage. It is called a rotary parking shaft. The idea is to park and move cars with no disturbance to the already parked cars in RACPS.

Objective:

- To survey existing parking system
- To achieve Safety and security
- To achieve Save in time, money and fuel .
- To achieve Environment-friendly
- To achieve Systematic parking
- To minimize Valuable investment
- To achieve Modernization.

Literature review:-

1)Chandni Patel, Monalisa Swami, Priya Saxena ,Sejal Shah. Rotary Automated Car Parking System. The present project work is aimed to develop a reduced working model of a car parking system for parking 6 to 24 cars within a parking area of 32.17 m². It is an amalgamation of the already developed parking systems with the added advantage of

reduced space occupancy by the design of a simpler and compact parking system that is rotary and occupies vertical parking space. The chain and sprocket mechanism is used for driving the parking platform and a one fourth hp brake motor shall be implemented for powering the system and indexing the platform. The platform is fabricated to suit the working model. The procurement and manufactured items are in hand and are ready to be assembled with the structure. This model is further useful for various branches of engineering in order to develop different types of automations like PLC, micro controller and computerization.

2) **Rahul J.Kolekar,S.S.Gawade** Design and development of lift for an automatic car parking system. Metropolitan cities strongly need advanced parking systems, providing drivers with parking information. Existing parking systems usually ignore the parking price factor and do not automatically provide optimal car parks matching drivers' demand. Currently, the parking price has no negotiable space; consumers lose their bargaining position to obtain better and cheaper parking. This dissertation study gives an automatic car parking system, and considering negotiable parking prices, selects the optimal car park for the driver. The autonomous coordination activities challenge traditional approaches and call for new paradigms and supporting middleware.

3)**A.M.S. Freitas, M.S.R. Freitas, F.T. Souza.Analysis of steel storage rack columns.** Storage rack systems are structures composed of cold-formed steel structural members that are used as columns, beams and bracing. The rack columns present peculiar features in their design because they have perforations to facilitate assemblage of the system, which makes them more difficult to analyze by cold-formed steel structures design codes. There are several design codes proposed by the manufacturers associations, as the specifications of Rack Manufacturers Institute (RMI), applied in the USA along with the specification of the American Iron and Steel Institute (AISI). These codes propose experimental stub columns tests for the determination of their resistance. In this work, the commercial software, ANSYS, is used for material and geometric nonlinear analysis of these columns, and the results are compared with experimental data obtained by
stub column tests, for a typical section of racks manufactured in Brazil.

Components of the system

1)Chain And Sprocket mechanism:

A chain is used to connect two sprockets. One sprocket is the driver sprocket. The other sprocket is the driven sprocket. Motion and force can be transmitted via the chain from one sprocket to another, therefore from one shaft to another. Chains that are used to transmit motion and force from one sprocket to another are called power transmission chains.An advantage of chain drives over most belt drives is that the chain cannot slip on the sprocket, so the chain and sprocket provides a positive, non-slip drive, i.e. the chain cannot slip on the sprocket because the sprocket teeth prevent the chain from slipping.

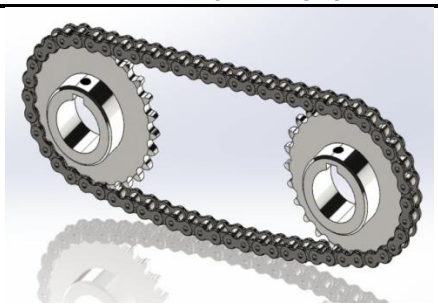


Fig.no.1

2)Linear Control System

The linear control system controls the relay which directly has control on the motor. The compartment movement of storing is dependent on the movement of the motor shaft. This movement can be clockwise as well as anticlockwise in both the directions according to the users' requirement. Not only the relay operation but also the Radio Frequency Identification (RFID) controls the users' details and sensors.All these systems are controlled by the microcontroller.

[A] Infra-Red (IR) Sensor -The infrared sensor allows detecting an object's distance.

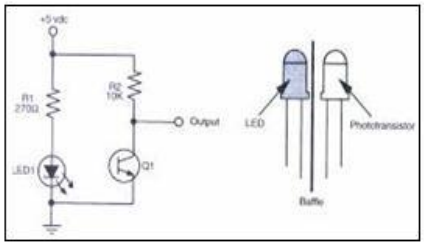


Fig.no.2 Infrared Sensor

Every compartment is fitted with a Light Emitting Diode (LED) and an IR sensor at the opposite ends on the inner side. This combination is used to check the status of the compartment, i.e., whether or not it is occupied.

B) RFID Tag/Reader

RFID is an abbreviation for Radio Frequency Identification. An RFID system consists of two parts .i.e., a reader, and one or more transponders, which are also known as tags. RFID systems have evolved from barcode labels as a means to automatically identify and track products as well as people. In the rotary storage system, the user is assigned a unique ID corresponding to the specific compartment. This helps in quick identification and movement of the same.

C)Microcontroller

The IC AT89S51is a low-power, high-performance CMOS 8-bit microcontroller and has 4K bytes of in-system programmable flash memory. This chip is manufactured using Atmel's high-density non-volatile memory technology and it is compatible with the industry- standard 80C51 instruction set and pin out. The on-chip flash memory allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. Microcontroller 89S51 is preferred over 89C51 in this project due to the fact that the former requires 5V for its operation whereas the latter needs to be supplied with 12V.

4) DC motor

Fig.no.3 motor

Every DC motor has six basic parts -- axle, rotor (armature), stator, commutator, field magnet(s), and brushes. In most common DC motors (and all that beams will see), the external magnetic field is produced by high-strength permanent magnets. The stator is the stationary part of the motor -- this includes the motor casing, as well as two or more permanent magnet pole pieces. The rotor (together with the axle and attached commutator) rotates with respect to the stator. The rotor consists of windings (generally on a core), the windings being electrically connected to the commutator with the rotor inside the stator (field) magnets.

CAD MODELING

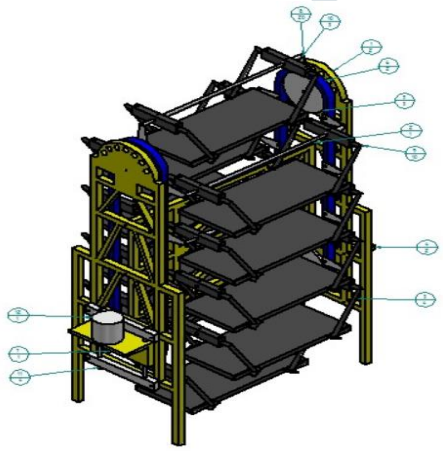
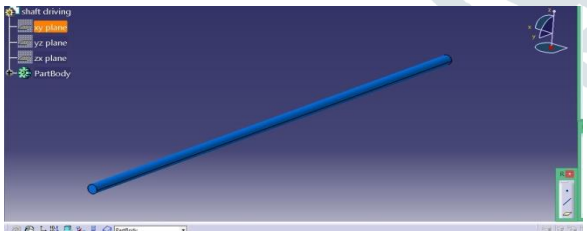


Fig.no.4model

PART DETAIL



1)shaft

Fig.no.5

2) Motor

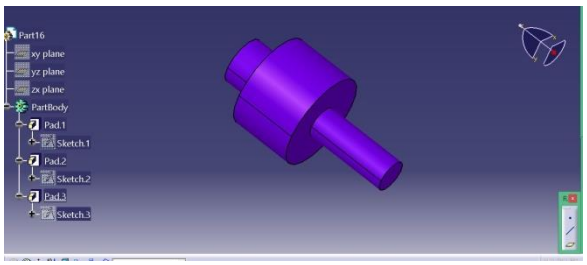


Fig.no.6

ADVANTAGES

- It ensures quick and automated parking and easy retrieval of vehicles.
- Up to 8 cars can be easily and safely parked in the designed model.
- The surface space required is equivalent to the parking space of two cars only.
- Most suitable for parking in offices, malls and similar places .
- The RACPS is engineered to ensure driver safety by use of an electronic safety zone.
- Low maintenance levels are required by the system.
- Does not require any parking attendant

CONCLUSION

Our Smart Car Parking model has been designed; all the parts in it are manufactured and we are under assembly which will be completed soon. Analysis of the model has to be done when developing a life size model. As the life cycle model involves huge money, proper design and advanced methods are to be used to meet the requirements of the customers. Although we developed working model of the original one, we tried maximum to develop a replica of original and we were compromised only in those stages where the work cannot be completed by assuming or neglecting few factors.

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