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Design of Multilevel Independent Parking System for Two Wheelers

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***Abstract*: Two wheeler parking system is not well introduced in India, there are lot of issues with the parking system as per survey in Metro Cities so in order to cater those requirements we are designed solution for it and that is multilevel independent two wheeler parking system. This Independent parking system is cost effective solution for metro cities and also Human powered that goals to go green. In Metro cities, two-wheeler parking has become a major problem in all traffic areas. Also problem of two wheeler parking becomes major in Malls, Multiplexes, and picnic places during weekends. By this project maximum space utilization of parking can be done.**

This study presents a simulation based feasibility study for development of fully automated parking structure with a group of plates using electromagnet. There are different types of automated parking structure available such as Rotary parking, Multi Circulation parking, Tower parking, Puzzle parking, etc. From these types present study is about Puzzle parking structure. In this structure there are number of floors and each floor can be divided horizontally and also there are number of sections vertically in each floor. In this Puzzle parking system controller software based computer can be used for controlling all the movements of parking system.

In addition to these two plates mechanism are used in which one plate used for park the two-wheeler and other one is used for providing base for the electromagnet. Each top plate is used to carry two-wheeler between floors. In which electromagnet is used for holding the two-wheeler. Fork Lift will be used for moving two-wheeler horizontally and vertically in the parking system without need of driver while the engine is off. By this parking system there will be good space utilization. By the help of this parking system we can reduce the retrieving time of the vehicle to approximately 3 minutes as compared to manual.

***Keywords*: Parking issues, Independent, Multilevel parking, Human powered.**

1. Introduction

Parking presents a major challenge in metropolitan areas, where the supply of physical parking infrastructure is often constrained by available land the extent of business, commercial, and other activities. As a result, arriving drivers spend many minutes searching for available parking space, which constitutes an important yet often ignored source of congestion. Previous research concludes that the average search time for parking in large cities is 8.1 min per vehicle; in addition, 30Dur-ing the last four decades numerous technical development solutions have been introduced and implemented until so far. Caicedo used two different ways to man-age space availability information in parking facility within park system to reduce search times. Caicedo develops a demand assignment model with the intention of reducing the time and distances involved in finding a parking space. Zhao and Collins developed an automatic parallel parking algorithm for parking in tight spaces using a novel fuzzy logic controller. Space allocation of parking lots was analyzed by Davis et al. to estimate the supply of parking spaces to potential demand. Using a fuzzy knowledge based Decision Making; Leephakpreeda presented a car-parking guidance. Arnott and Rowse developed an integrated model for curb side parking and traffic congestion control in a downtown area. Soup presented a model of how drivers choose between cruising for curb side parking or pay for off-street parking. Teodorovic and Luci c proposed an intelligent parking space inventory system. Feng et al. designed a combined trip network for congested road-use pricing and parking pricing which was based on Logic. Mei et al. using a utility function, combining travel time, search time, waiting time, access time, and parking price, a Profit based parking pricing is formulated for curb parking pricing. Chou et al. presents an intelligent agent system with negotiable parking pricing for optimum car park for the driver.

The first question that we may encounter while explaining our project is “What is the need of multilevel parking system?”So we would like to introduce our project by answering the above question. The answer for above question would be, parking more vehicles in limited available space and space constraint is the major objective of this project. One more advantage of this project would be a mobile parking system if this entire parking system assembly is anchored on a truck or a carrier. We are using the same type of mechanism found for rotary parking system for cars and that is modified to the parking of two wheelers. Below are some of the parking systems available for cars and reasons are quoted why they can’t use for parking two wheelers.

Due to constraints like architectural feasibility, construction cost, floor area consumption and parking efficiency, especially for those projects in metropolitan region with high car parking demands, it becomes impractical to provide required number of two wheeler parking using conventional ways. Multilevel two

wheeler parking systems help cutting down the construction cost and have more user friendly parking facility. In projects planned with multiple parking levels, using correct type of parking system reduces number of parking levels to less than half, making it a green product. Two wheeler Parking System is a term normally used for any mechanical product or system that can either stack two wheeler or make parking user friendly and compact.

Fig. 1. Traffic issues (Courtesy: The Hindu News Paper)

As every project has different architecture, different number of two wheeler parking requirement and priorities, not all parking odds can be tackled using single product. Theoretically, every project needs a different solution and a different kind of parking system to achieve maximum parking efficiency and the most user friendly solution.

Apart from being efficient and user friendly, two wheeler Systems are designed for safe and reliable operations. Unlike other heavy engineering machineries, these are being installed in Commercial and residential buildings, bungalows, shopping malls and other public places. Highest levels of safety and durability standards are observed, in the designing, manufacturing, installation and maintenance of parking systems.

2. Literature review

[1] Jaydipsinh P. Chudasama, L. B. Zala (2012) Rating Parking: A case study of Amul Anand Dairy Road; The author has worked in the volume of parking and parking policies, had taken the study area was the commercial center of the city of Anand. Two types of surveys to count the volume that had been used survey vedio recording, the survey of land use and parking survey that had been used for enrollment recording techniques were conducted. He analyzed the data gave the suggestion Amul Dairy road is the use of mixed territory. The right of way is 30 m. Traffic composition shows the highest ratio of 2 wheels than others. The data analysis shows that parkers car parks are the maximum short-term and long-term Parker are minimal. In the street parking is prevalent throughout the section of the survey.

[2] Deepak Tiwari, Supriti Dubey (2013) "One of Bhopal study with reference to the users' satisfaction with the parking space and the accessibility of the market" His paper concluded that during weekends and public demand for vehicle parking exceeds the supply, and consequently, has a negative impact on retail sales and not only that, but causes severe dissatisfaction while shopping. This paper studies the different aspects of external variables that influence the satisfaction of the buyer for purchasing. The study is descriptive in nature and self-designed questionnaire to collect primary perception was used. In a questionnaire on the road, retailers and consumers were asked their views on the switch in the market area that can be easily done i) the existing policy, ii) Maximum parking, iii) the remote parking iv) study is an attempt to explore matters relating to the above parameters. The questionnaires were developed for the collection of primary and secondary data is collected through books, magazines and surf the network, this is an investigation work for the solution of problems in the design of an optimal place car. parking management and accessibility of the market and its related factors are shopping satisfaction variables to different buyers in different markets. Data collected from the questionnaires are processed using SPSS. This study examined the variables to determine the level of satisfaction among buyers of the commercial city of Bhopal. The parking management is relatively less in the Old than the New Bhopal Bhopal. It suggests that the multi-storey car park would be the best option. The relationship between different factors acquiring satisfaction with overall satisfaction shows that there is a buyer overall satisfaction less positive

[3] Priyanka. Kolhar (2012) Management Plan off street parking for the city of Dharwad, Karnataka, India; In this article the author has investigated the practices of parking survey accumulation and parking provision. The parking demand models have been developed using the SPSS software. He had made three types of survey poll parking space, method of investigation used enrollment accumulation. Interview designed for analysis of willingness to pay. It was found that the maximum accumulation occurs in the morning between 12: 00-14: 00 and 17: 00-8: 00 at night. To solve the parking problems, we recommend a short-term immediate solution to congestion pricing, as the cost of operation and maintenance is much lower for the administration of the parking lot on the way to the road. But, according to the future demand for parking in the study areas, you can implement a long-term management plan (which provides parking garage). [4] Jun Chen, Zhang Hui (2011) Coordination of Planning of Urban Planning Street parking and off-road "The authors studied to optimize the planning design of urban parks, this paper first analyzed the characteristics of street and off street parking. In second, the distribution patterns established street parking and off-road, respectively, with the aim of minimizing the distances cars target driver the corresponding restrictions be combined to determine the coordinated deployment model. Finally, it was shown that in a case has demonstrated the maneuverability of the method. Conclude that there are no discrepancies between the parking needs on the street and off-street parking and the presence of parking durations, factors considered by the parked

parking and impacts on traffic flows. models location are established on the street and off-street parking to meet the short and long term parking requirements, respectively. Parameters such as the upper limit of the distance of walking and impact on traffic flows on the road are used to meet the different needs of Parkers parking and traffic flows. Eduardo Barata (2010) made parking problems in the UC campus: To establish the Research Agenda; This study emphasizes the importance of adopting integrated policies for parking management in order to ensure not only a more efficient use of parking spaces available, by balancing supply and demand and bring revenue to cover the cost of parking, but also the attractiveness of ways alternative transportation. Provision of parking and demand flows within the UC campus is estimated. The results indicate that the parking is inadequate and overcrowded. To think critically about these issues, and identify areas of research to address the socioeconomic implications, some policy proposals, but theoretically engage in a pragmatic way.

3. Objectives

After going through a survey in city like Pune and Looking at present scenario, we have come to conclusion that there is tremendous increase in the number of two wheelers in places like theaters, malls, hospital etc. So, there is intense need of parking system in those places for eradicating parking problems. Therefore, we have decided to design and Develop a two wheeler parking system.

In this city, we have many multilevel parking systems but they all are dependent as we have survey but we want that the system should we independent to access for saving time. Now, we are facing the parking problem for four wheeler parking system by looking at these we will face problem for two wheeler parking system in coming decades.

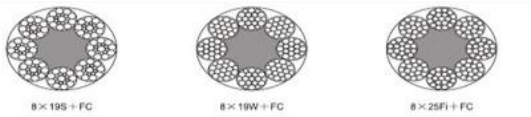
4. Design

A. Design of ropes

Wire rope is several strands of metal wire twisted into a helix forming a composite "rope", in a pattern known as "laid rope". Larger diameter wire rope consists of multiple strands of such laid rope in a pattern known as "cable laid". In stricter senses the term "wire rope" refers to diameter larger than 3/8 inch (9.52 mm), with smaller gauges designated cable or cords. Initially wrought iron wires were used, but today steel is the main material used for wire ropes.

The total load is divided into 2 ropes so also makes lighter the diameter of rope.

Kerb weight of Bike = 150 kg
But There are two platforms so
Total load = 150 x 2 kg = 300 x 9.81 = 2943 N
Total Load is divided into 2 ropes
So load on each rope = 2943/2= 1475 N
So Diameter of Rope
Maximum Allowable tensile strength = Load / Area
Sigma tensile = 1475/A
If we select wire rope



Nominal diameter mm	Approx Weight kg/100m	Min. Breaking Load kN						
		Dual Strength Mpa				Single Strength Mpa		
		1180/1770	1320/1620	1370/1770	1570/1770	1570	1620	1770
8	21.8	25.7	26.5	28.1	30.8	29.4	30.4	33.2
9	27.5	32.5	—	35.6	38.9	37.3	—	42.0
9.5	30.7	36.2	37.3	39.7	43.6	41.5	42.8	46.8
10	34.0	40.1	41.3	44.0	48.1	46.0	47.5	51.9
11	41.1	48.6	50.0	53.2	58.1	55.7	57.4	62.8
12	49.0	57.8	59.5	63.3	69.2	66.2	68.4	74.7
12.7	54.8	64.7	66.6	70.9	77.5	74.2	76.6	83.6
13	57.5	67.8	69.8	74.3	81.2	77.7	80.2	87.6
14	66.6	78.7	81.0	86.1	94.2	90.2	93.0	102
14.3	69.5	82.1	—	—	98.3	—	—	—
15	76.5	90.3	—	98.9	108	104	—	117
16	87.0	103	106	113	123	118	122	133
17.5	104	123	—	—	147	—	—	—
18	110	130	134	142	156	149	154	168
19	123	145	149	159	173	166	171	187
20	136	161	165	176	192	184	190	207
20.6	144	170	—	—	204	—	—	—
22	165	194	200	213	233	223	230	251

Fig. 2. Rope wire selection chart

If we choose 1st wire rope from above table then
29.4 = 1475/A
A = 1475/29.4
A = 50.17 mm^2
D = 7.99 mm which is almost very closer number but for safety purpose we will choose same diameter wire but select more strands of wire in it means 8 mm Dia wire with Maximum allowable strength is 33.2 Mpa

B. Design of gear box (gear trains)

A transmission is a machine in a power transmission system, which provides controlled application of the power. Often the term transmission refers simply to the gearbox that uses. In British English, the term transmission refers to the whole drivetrain, including clutch, gearbox, prop shaft (for rear-wheel drive), differential, and final drive shafts. In American English, however, the term refers more specifically to the gearbox alone, and detailed usage differs.

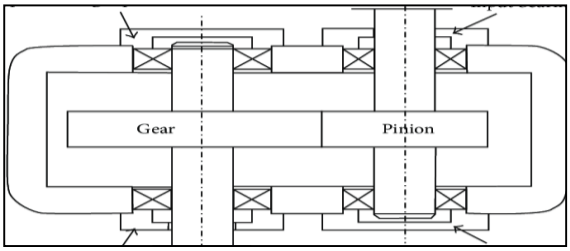


Fig. 3. Gear train schematic representation

Required torque at gearbox output shaft
We know
F = 2943 N
Lets suppose main shaft dia = 40mm
Then Torque at the output shaft = Force x distance
= 2943 x 40/2
= 58860 Nmm
Now we will calculate input torque
From the reference of Ergonomics and asthetic consideration

Normal human can apply force of 440 N
And minimum crank length should be of 100 mm
Then
Applied torque = Ta = 440 x 100
= 44000 Nmm
So gear ratio will be
Gear Ratio = Output torque / applied torque
=58860 / 44000
= 1.33
So we know from the reference of theory of machine to avoid interference minimum number of teeths on pinion is 18.

GR = T2/T1 = Z2 / Z1
1.33 = Z2 / 18
Z2 = 23.94 = 24 teeths
So
Number of teeths on pinion = 18
Number of teeths on gear = 24

C. CAD Model

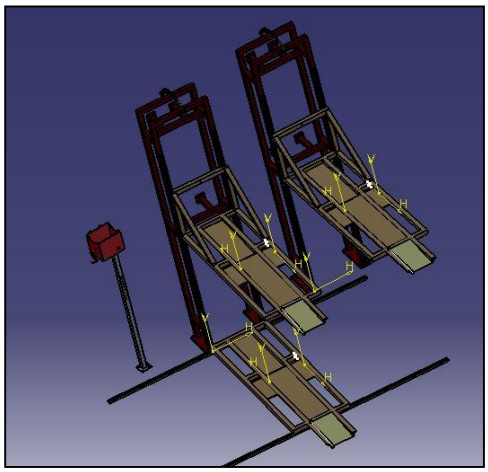


Fig. 4. CAD model (Catia)

The use of computers (or workstations) to aid in the creation, modification, analysis, or optimization of a design. Parametric modeling allows the operator to use what is referred to as "design intent". The objects and features created are modifiable. Any future modifications can be made by changing how the original part was created. If a feature was intended to be located from the center of the part, the operator should locate it from the center of the model. The feature could be located using any geometric object already available in the part, but this random placement would defeat the design intent. If the operator designs the part as it functions the parametric modeler is able to make changes to the part while maintaining geometric and functional relationships.

D. Platform CAD Model and Analysis

Direct or explicit modeling provide the ability to edit geometry without a history tree. With direct modeling, once a sketch is used to create geometry the sketch is incorporated into the new geometry and the designer just modifies the geometry without needing the original sketch. As with parametric modeling, direct modeling has the ability to include relationships between selected geometry (e.g., tangency, concentricity).

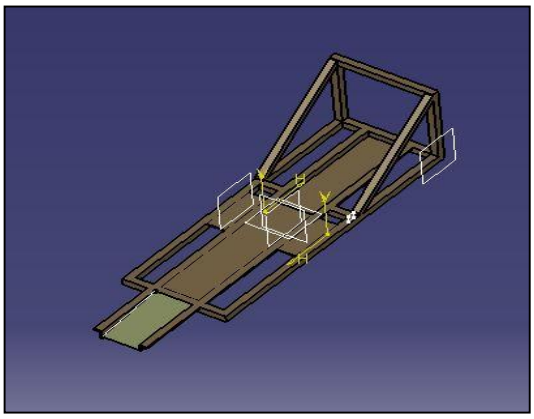


Fig. 5. CAD Model of Platform

3D wireframe is basically an extension of 2D drafting (not often used today). Each line has to be manually inserted into the drawing. The final product has no mass properties associated with it and cannot have features directly added to it, such as holes. The operator approaches these in a similar fashion to the 2D systems, although many 3D systems allow using the wireframe model to make the final engineering drawing views.

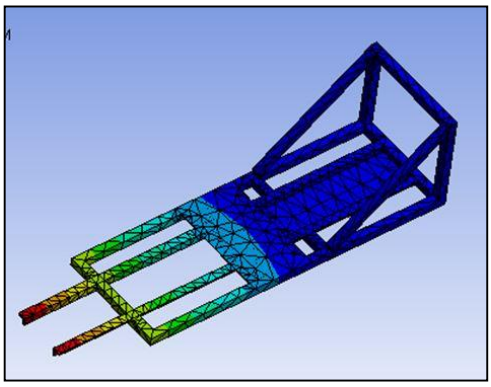


Fig. 6. Platform Analysis on ANSYS

The Finite Element Analysis (FEA) is the simulation of any given physical phenomenon using the numerical technique called Finite Element Method (FEM). Engineers use it to reduce the number of physical prototypes and experiments and optimize components in their design phase to develop better products, faster. It is necessary to use mathematics to comprehensively understand and quantify any physical phenomena such as structural or fluid behavior, thermal transport, wave propagation, the growth of biological cells, etc. Most of these processes are described using Partial Differential Equations (PDEs). However, for a computer to solve these PDEs, numerical techniques have been developed over the last

few decades and one of the prominent ones, today, is the Finite Element Analysis.

E. CAGE CAD model and analysis

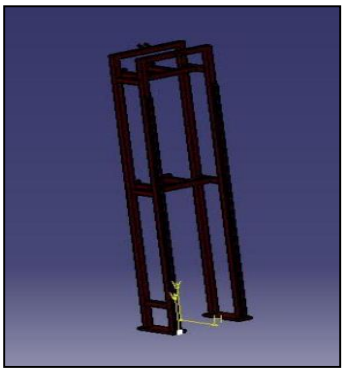


Fig. 7. Cage cad model

Differential equations can not only describe processes of nature but also physical phenomena encountered in engineering mechanics. These partial differential equations (PDEs) are complicated equations that need to be solved in order to compute relevant quantities of a structure (like stresses (єє), strains (єє), etc.) in order to estimate a certain behavior of the investigated component under a given load. It is important to know that FEA only gives an approximate solution of the problem and is a numerical approach to get the real result of these partial differential equations. Simplified, FEA is a numerical method used for the prediction of how a part or assembly behaves under given conditions. It is used as the basis for modern simulation software and helps engineers to find weak spots, areas of tension, etc. in their designs. The results of a simulation based on the FEA method are usually depicted via a color scale that shows for example the pressure distribution over the object.

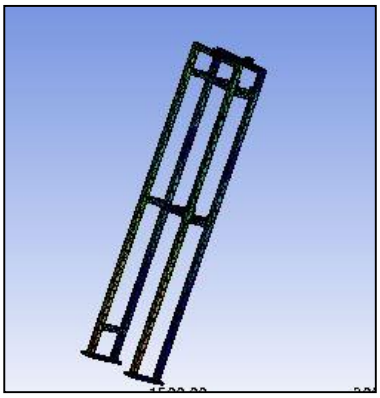


Fig. 8. Cage analysis

5. Conclusion

Multilevel independent parking system which is operated by human power and it is modeled in Catia and Analysis (Stress and strain which is done on ANSYS). All Ansys results come out with the safe from the point of view of Maximum stress and deformation.

The improvement of parking conditions has a direct impact not only on the improvement of traffic conditions and road safety in the area considered, but also on the local economy. Consequently, the use of quantified results from the proposed methodology could assist in improving the design of the appropriate parking programe for a specific area and its implementation. The switch to off-street parking, which can free valuable road space to be better exploited, improving the overall quality of life of an area, can be achieved in a more secure way if the parameters influencing this switch as well as the magnitude of their effects are known.

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