

Design And Development Of Automated Car Parking System : A Review

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ABSTRACT

In the light of number of vehicles consistently rising and parking space is becoming a major issue in urban and semi urban cities so there is a need to design a parking system which will reduce manual work as well reduce the problem of cars parking on streets. The problems associated with parking are common to most of us, we always face difficulty while searching for a safe parking space. This paper attempts to review globally implemented parking management strategies using different technologies. Further by examining a variety of parking management solution from around the world this paper aims to examine the shift in focus of modern parking management strategies. The motivation for this research paper is to identify the positive points of the innovative approaches, which will aid in designing an automatic car parking system.

Keywords — Automatic Parking System (APS)

INTRODUCTION

Over the decades our country has been developed drastically, now we are in this state that we have a lot of well contacted roads, commercial building and increasing number of automobiles. While parking these automobiles in parking space we use the manual procedure of parking. Which most of the cases is unplanned and lack of discipline due to this, people can park their cars anywhere they want to, which creates a mess as people do not follow the particular cue most of the time. As a result of this, a huge traffic jam takes place in that place. While parking in and retrieving car due mismanagement cars can get dent by bumping with each other as there is lack of sufficient space. This leads to arguments, fights among people which sometimes makes huge traffic jam. This is also an economical loss as we need to repair our damaged car and also cars consumes extra fuel while parking in or out. Traffic jam is an issue here as it kills our precious time. Due to this chaos in parking our valuable time gets wasted. It harms the students, office going staffs and emergency patients to a great extent.

It also causes economical loss to commercial places like shopping malls, amusement parks as people are more likely not to visit these places due to this parking hazard. As we are advancing with time, the manual car parking system in commercial spaces is creating hurdle which is causing wastage of time and some economic losses as well. Therefore we need a solution which can overcome these problems. Here we are introducing Automated Parking Systems as a solution of these problems as well as car parking system in commercial spaces is creating hurdle which is causing wastage of time and some economical losses as well. Therefore we need a solution which can overcome these problems. Here we are introducing Automated Car Parking Systems as a solution of these problems as well as a replacement to the manual car parking systems at commercial spaces. This system not only saves time and money, it can also earn money by charging for parking spaces.

1. Problems With Traditional Car Parking System

Traditional or manual car parking system is everywhere in our country but this system is full of problems. They are:

1. We can see in many shopping malls, hospitals huge traffic jam in front of the parking. The parking guard stops the entire vehicle and gives a payment slip, this creates traffic jam.
2. It is difficult and time consuming to find out the parking slot which costs extra fuel and wastes time.
3. Security problem is one another problem in manual car parking, people can enter in parking slot and there snatching, robbery can happen.
4. In manual parking system some guard needs to be appointed for the whole job, it is costly enough.

2. Motivation

The motivation of the project is, we want to digitalize our daily life as well as our country. In many countries this automated vehicle system is available and popular.

3. Background Of Our Project

Over the decades our country has been developed drastically, now we are in this state that we have a lot of well contacted roads, commercial building and increasing number of automobiles. With the increasing amount of roads and highways transportation has

become the backbone of our day to day life. 14 Transportation has also become the backbone of our economy for its wide usage in trade and business. So parking of these transportation or vehicles has become a matter of consideration. While parking these vehicles in parking space we still use the very old fashioned manual procedure of parking. Which are maintained in unplanned manner, without any discipline. Due to this people can park their cars anywhere they want to, which creates a mess as people don't follow any discipline most of the time. While parking in and retrieving car due mismanagement cars can get dent by bumping with each other as there is lack of sufficient space. This leads to arguments, fights among people which sometimes create traffic jam. This is also an economical lose as we need to repair our damaged car. Cars consume extra fuel while parking in or out. Due to this chaos in parking our valuable time gets wasted. It harms the students, office going staffs and emergency patients to a great extent. It also causes economical loss to commercial places like shopping malls, amusement parks as people are more likely not to visit these places due to this parking hazard. Automated car parking systems will provide several benefits. It will save time and fuel cost. In manual parking system it is too hard to find out the empty space for parking, it is very much time consuming. Sometimes it causes late in meeting or other important works. It will save fuel as in this system an automatic tray will take the vehicle into the required slot. This will reduce the fuel cost of searching for parking space, parking in and out. Here we do not need to lighting all over the parking space all the time. It will only have the lights on when it moves and where is the path and it is very much electricity saving also. It provides security from theft of vehicle and it can earn revenue. It can introduce us to advanced digitalized systems which show us the Engineering excellence in our country.

4. Survey

Our group members have overseen extensive research work , investigating and analysing the parking habits, attitudes of drivers and parking situation throughout Pune. The work involved Questionnaire, market research and Telephonic survey with key interest groups and the results have produced a vast range of information related to parking issues in Pune. The following sections give a brief outline of the work done and a summary of some of the results.

A sample of 50 individuals was taken into account at various locations of Pune city. The analysis of questionnaire is given below.

1) How do you travel to your workplace?

- By Private Car
- By Public Transport

- By Motorcycle
- Transport facility of the organization

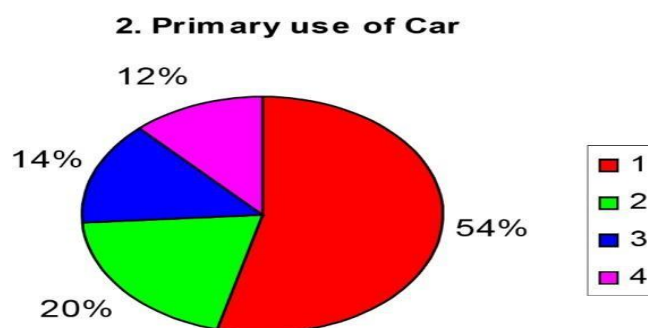
The analysis of this question suggests that in Pune most of the people travel through their own cars. Out of 50 individuals, 56% use their own cars, 22% use public transport, 12% use their motorcycles and only 10% individuals use their organization transport facility.



2) Please indicate the primary use of your car?

- Work
- Shopping
- School
- Social

The analysis shows that most of the people use their cars for working purpose. It is found that 54% people utilise car for work, 20% people For shopping, 12% people for social purpose and 14% people use cars to pick up their kids from school. This suggests that, Pune, the city of India is now emerging as a business centre.



3) Where do you normally park your vehicle?

- Parking lot
- Parking ramp
- On the road
- On the street

The results shows that 30% people mentioned that they park their cars in parking lot, 14% park their cars in parking ramp, 34% park their cars on roads and 22% people park their cars on street. This analysis shows the shortage of proper car parking lots in Pune.

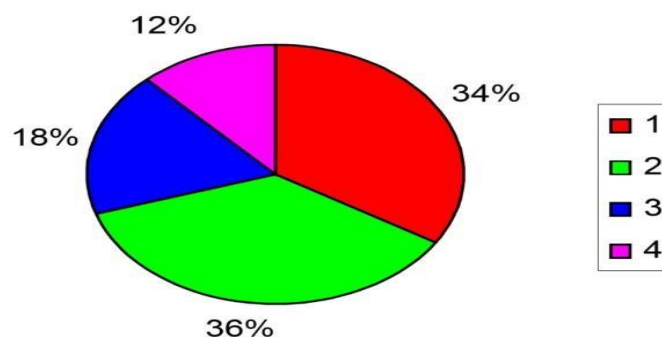


4) If driving or being driven, how long does it take you to find a parking place?

- Straight away
- 5-10 minutes
- 15 minutes or longer
- Quite Difficult

34% respondents mentioned that they find car parking straight away, 36% respondents take 5-10 minutes to find a car park space and 18% respondents take 15 minutes or longer to find a car in key locations of Pune and remaining 12% respondents it is quite difficult to find a car parking place.

4. Time required to find car park



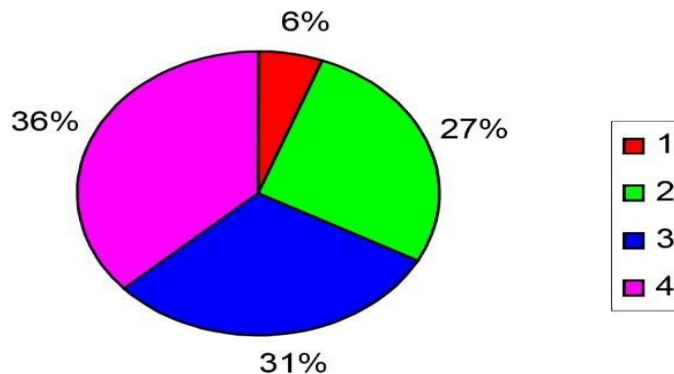
5) How would you rate the current parking facilities in Pune?

- Excellent
- Good
- Fair
- Poor

Only 6% respondents rate parking facilities in Pune excellent, 27% respondents rate it good, 31% and 36% respondents rate car parking facilities Fair and Poor respectively.

This analysis suggests that most of the people are not satisfied with the current parking facilities.

5. Current parking facility rating



5. Types Of Automated Car Parking System

The following is a list of existing system that is mainly used in urban area.

1. Two step car parking system.
2. Puzzle Car Parking System.
3. Stacker System.
4. Multi Level Car Parking System.
5. Level Car Parking System.

a. Two Step Car Parking System

Features:

- Pallet used for CAR lifting.
- Applicable for In-Door & Out- Door.
- Easy to install.
- Preferred system at residential zones& commercial too.
- Easy to operate.
- Low maintenance cost.
- Operating System is available with both the options Hydraulic & Electro-mechanical.



Fig no.1 Two step car parking system

In the above picture, we can see this type of system features a pallet that is lifted after the car is loaded. Cars can be parked on the upper layer through the lift, but there is also a problem with it, which is that the bottom car must be moved to access the top car.

b. Puzzle Car Parking System

Features:

- Can be installed above ground & Below ground level.
- Two layer puzzle is always preferred.
- Preferred system especially for underground.
- Low maintenance cost.
- Most efficient system can be achieved through combinations of units & functions.
- One empty slot is the key for the working.
- Single Set, Double set Front and back systems connected to monolithic steel structure with multi in – outs.

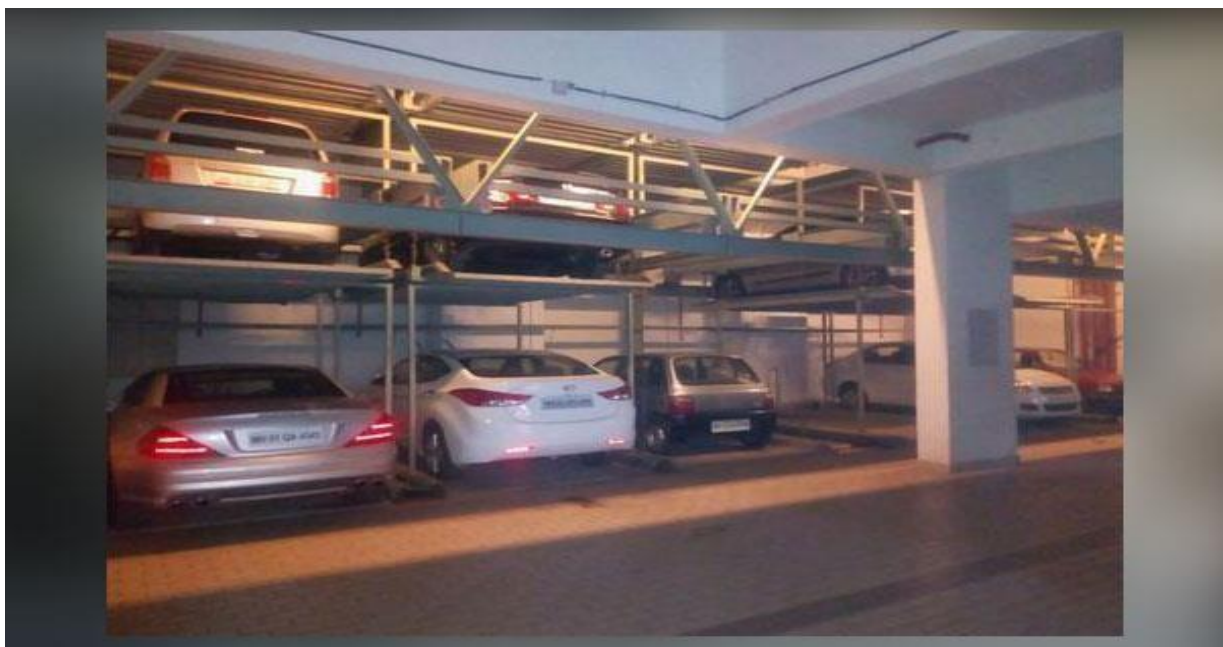


Fig no.2 Puzzle car parking system

c. Stacker Car Parking System

Features:

- Quick In Out by simultaneously moving and lifting the cart while the vehicle wheel is lifted without the pallet.
- Underground big parking system can be installed.
- Parking room is built using the concrete slab structure.
- Strong and easy to maintain.
- Lift can be installed along the entry module.



Fig no.3 Stacker car parking system

d. Multi level Car Parking System

Features:

- Can be installed Underground or out-doors.
- Approx. 60 -70 cars per lift can be accommodated.
- System types Transfer type, longitudinal type, hydraulic type, wire rope type.
- Reduced In Out time for Car
- Turn table parking gives more flexibility to system
- Operating systems are main Lift, Cart, Pallet

Fig no.4 Multi level car parking system



e. Level Parking System

Features:

- Used for large buildings and for superior space efficiency.
- Addition to multi level parking spaces with vertical and horizontal directions to facilitate the entry & exits of cars.
- Operating systems are: lift, side sliding, pallet



Fig no.5 Level parking system

6. Construction And Working Of Automated Car Parking System

- On the ground floor the loading/unloading of vehicle is done.
- On each floor of the rack, there is 1 parking space, which classify this object as a 2 storey hydraulic actuated independent parking system.
- On the ground floor, a hydraulic conveyor system is installed for receiving and returning vehicles.

- Cars is transported on rack by hydraulic elevator.
- Cars are transported down by the same hydraulic elevator, which transports them to the ground floor
- The system's supporting structure is made of rolled or bent steel profiles and is located on a reinforced concrete foundation slab.
- When cars drive onto the hydraulic conveyor, sensors scan the position of the vehicle and send it to the control system.
- When the driver leave the vehicle, the sensor gets actuated and the rack is lifted to the extreme top position.
- The rack moves on rails mounted on the support structure for parking of cars to lift the rack in upward direction.
- Then the cyclic movement takes place upto to definite angle.

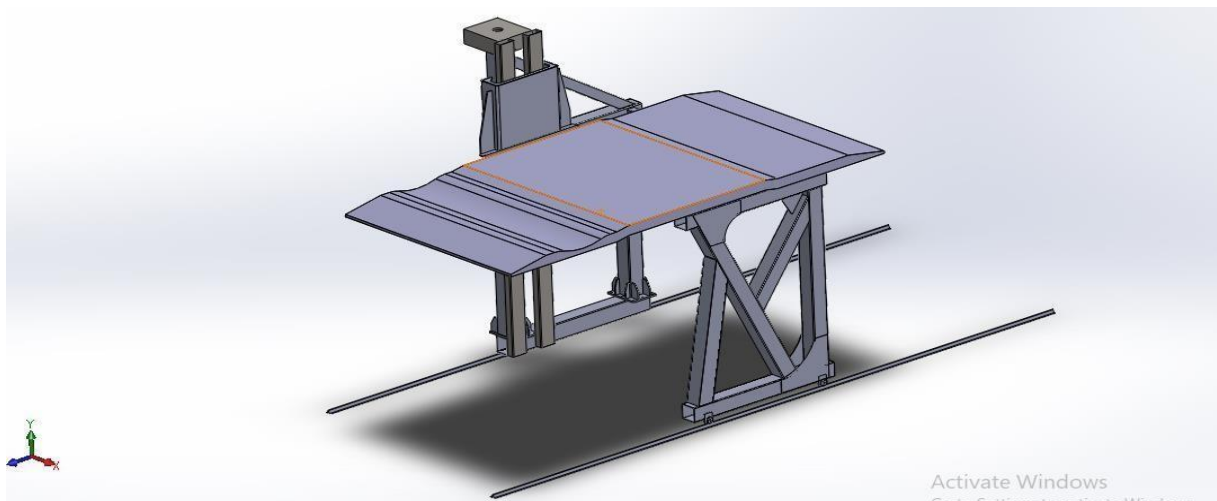


Fig . Assembly Of Automated Car Parking System

7. Modelling

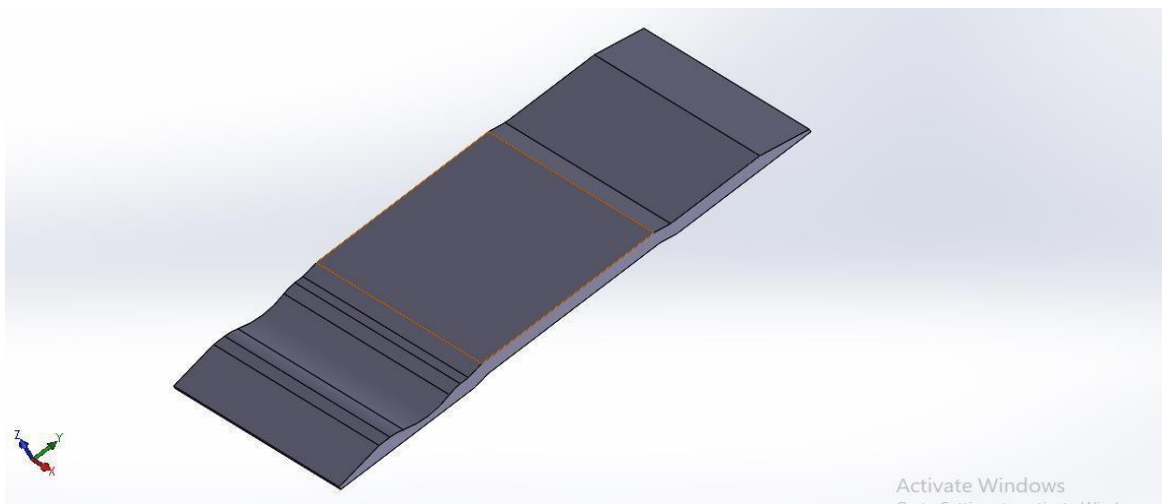


Fig Modelling Of Car Platform

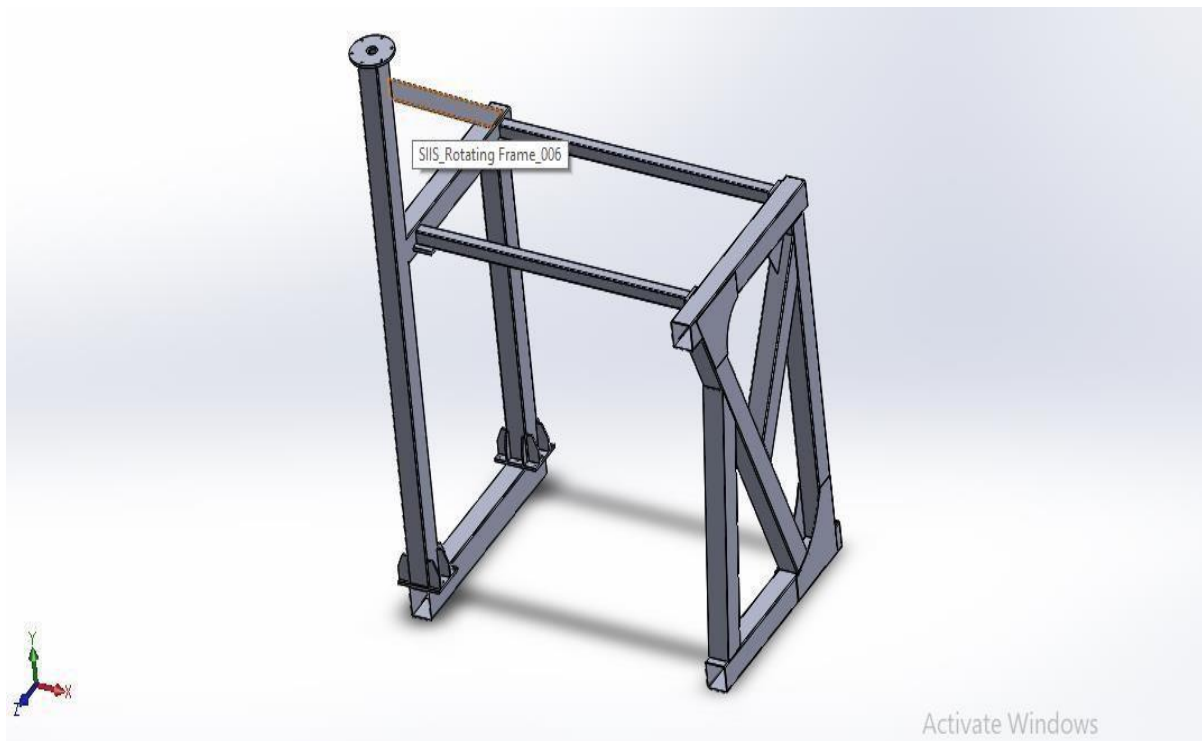


Fig. Modelling Of Opposite Sliding Frame

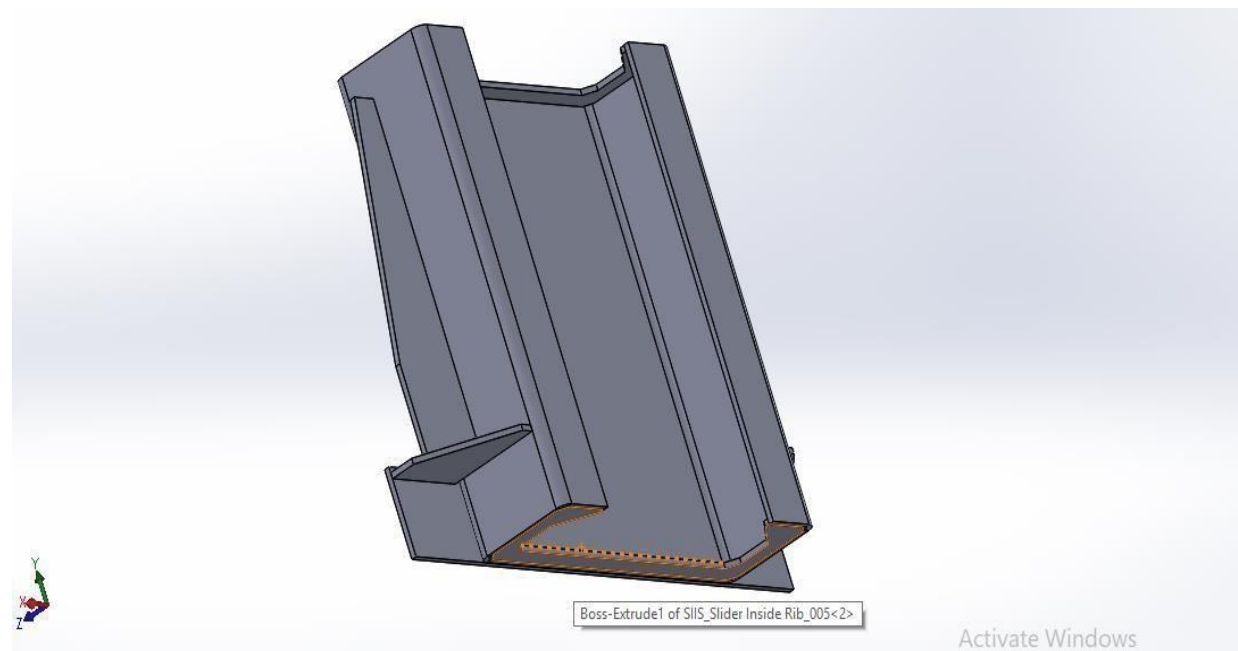


Fig. Modelling Of Bracket

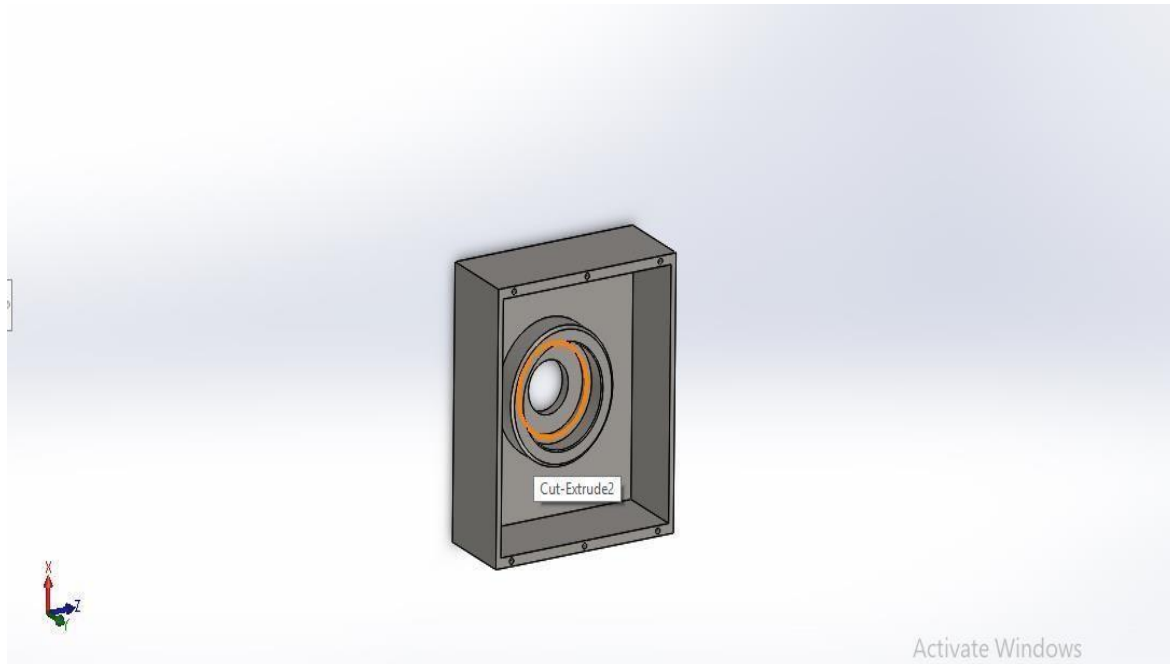


Fig. Modelling Of Wearing Bracket

8. *Applications Of Our Project*

Over the decades with the development of our country we've reached in a situation where the manual car parking system in commercial spaces needs to be replaced. The manual car parking system is causing hurdle and chaos in parking space, therefore resulting in wastage of time and some economic losses as well. Therefore introducing Automated Car Parking Systems in commercial spaces can be replacement to the manual car parking systems at commercial spaces. We can install this system in the places like:

a. **Office buildings:**

It will help the staff to park their car without any hurdle and wastage of time. It will also relieve their mind from the unnecessary parking hurdle. Also if someone is already late he wouldn't be late any further by having to search for the parking space and park his car. It will also provide security to their cars from stealing.

b. **Shopping Malls:**

It will help the customers to park their car without any hurdle, which will give them time to browse for more products. It'll benefit both the customers and the sellers as the customer will have more time to explore their options and the sellers have more product options to sell. It will increase the number of customers coming in the malls. It will increase revenue as the customer has to pay for the parking space. It will also help removing the cars which are kept all day long without shopping purposes as they need to pay for parking their cars. As there is a time limit for the parking space the customers will keep that in mind and they will remove their cars on time. This will help more customers to come to these malls each day. It will also provide security to their cars from stealing.

c. **Hospitals:**

In hospital when there are a lot of emergency cases there are a lot of a cars and ambulances coming in the parking space. This creates jam which cause delay for the patients to receive the medical services, which often can be fatal to them. If we install the automated system, it will take less time to park car and the patients to reach the medical services. Also they can earn revenue for cars other than the

ambulances. It will also provide security to their cars from stealing.

d. Amusement Parks:

If we install automated car parking systems in amusement parks it will attract more people to come to these places. The more the people will come the more revenue will be earned. Moreover these amusement parks relieve us from our dull and monotonous lives, refreshes our mind. The more people can enjoy these places due to the advanced parking facility. It again increases the revenue as people need to pay for parking their cars. It will also provide security to their cars from stealing. Along with these places we can use this system in educational institutes and mosques where car parking area is available. It will help people to park their car easily without making any hurdle. It will also provide security to their cars from stealing.

9. Economic Overview

Economical Benefits of Automated Car Parking System

a. More Profitable Land Use:

APS (automated parking systems) require significantly less area and volume for a given number of parking spaces than other parking options. APS enables the more profitable use of valuable land for tenants, green space etc. and provide property developers various options such as: minimizing the area needed for parking to maximizing the number of parking spaces or some optimum point in between the two.

b. Parking Optimized for Profitability:

Conventional parking solutions are too large or unfeasible whereas the design flexibility of APS allows them to fit in locations or areas. APS can be installed inside, under or between existing structures, very narrow and deep areas and even irregularly shaped spaces: horizontally, vertically or both. APS help increase profitability by using unusable or lower value space for car parking

c. Capital Cost:

The common idea that the APS always cost more than multi-story parking garages is overly simplistic and frequently incorrect. APS can be replacements for conventional car parks APS's substantially smaller size and design flexibility can significantly shift capital cost and project profitability for if the developers incorporate them into preliminary designs.

d. Reduced Fuel & Maintaining Costs:

Operation and maintenance costs are highly specific to each application. APS have the advantage of requiring no or minimal lighting, ventilation, fire suppression, monitoring, clean up, staff and security measures in the unoccupied parking area unlike the conventional car park.

e. Inherent Securities:

The APS concept inherently provides much higher levels of protection and security for cars, their contents and their drivers. Vandalism and theft are virtually impossible in an APS. Personal security is much higher than in car parks since drivers and passengers are always in well-lighted, highly visible/public entry and exit areas at street level. APS are also an ideal solution for the handicapped since entry and exit bays can readily accommodate specific requirements and building codes.

f. Faster Constructions:

APS are typically faster and easier to install because of much smaller and highly pre-fabricated structures, than larger monolithic concrete car parks. There is much less volume to excavate and transport, this leads to reduced construction costs, less interest during construction and a faster start of

revenue generation.

10. Stress Analysis

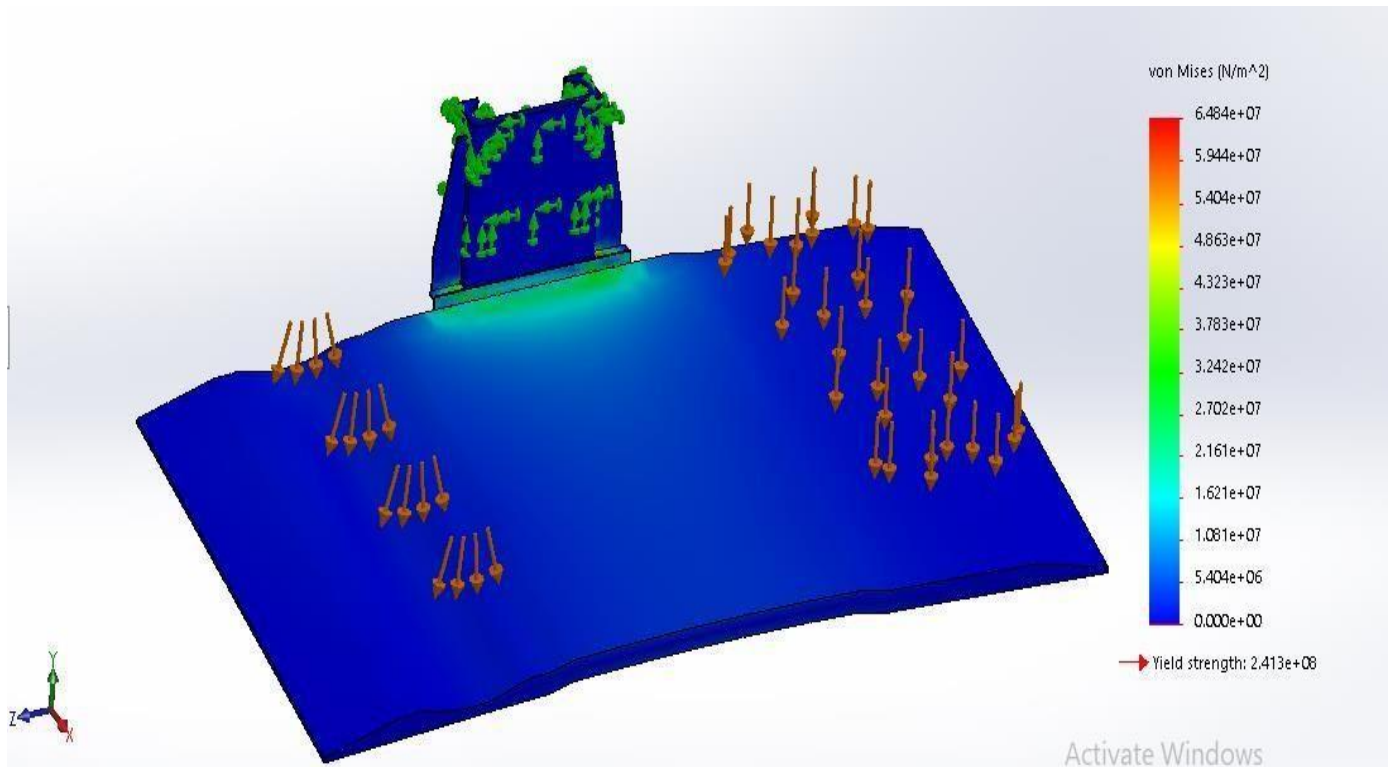


Fig Stress Analysis Of Car Platform

11. Disadvantages Of Manual Car Parking

a. Improper usage of lands:

As the manual car parking systems are unplanned they lack the proper usage of lands, which is unprofitable for property developers. It is unable to use unused property without proper shape which is again wastage of land.

b. Added capital cost:

Manual car parking system adds extra expenditure to capital cost as it is comparatively costlier than the automated car parking system.

c. Risk and liability:

Insurance premium often heavily influenced by the probability of accidents or other events occurring, using manual car parking system may maximize the potential for property damage, theft, personal injury or death. The possibility of dents, scratches, other damage and vandalism to cars, theft of property from cars, car theft, robbery, arson fire, assault, rape, falls and suicide can take place as safety and security of manual car parking systems are that much reliable.

d. Wastage of time:

As manual car parking systems are not planned properly it takes a lot of time for finding parking

space, parking in and retrieving the vehicles

12. Advantages Of Automatic Car Parking

The advantages of automated car parking systems are:

a. Reducing traffic jam:

Automated vehicle system reduce the traffic jam because here we are using a card system for paying the money, punching the card in the payment booth and one tray will place the vehicle in required place

b. Time saving:

It is a time saving system. In manual parking system it is too hard to find out the empty space for parking, it is very much time consuming. Sometimes it causes late in meeting or other important works.

c. Safety in the parking:

Here no people can enter in the parking so that there is no chance of snatching, robbery, stealing, sometimes in silent parking space people are being harassed. This system prevents these problems.

d. Operating cost saving:

Over a period of time, the parking charge collecting cost is reduced. There is reduction in the man-hour required as the system does not require any human interaction for the money transaction.

13. Conclusion

After doing study on ACP project it is found that ACP systems can be introduced in our country and it will be beneficiary in the context of our country. The main benefits are time and fuel saving. It can also provide sustainable parking management in an eco-friendly manner. As the GHG emission will be less in amount and the surroundings will be clean. There is less maintenance cost for this system so it helps the property developer in cost saving. It provides security to the parking ground. ACP systems reduce the hassle in parking grounds and traffic jam. It will benefit the property developer to increase their revenue which will add to the government tax revenue. So in a way it is also helping the government by increasing tax revenue. It will also encourage Automation Engineering in our country which will make advancement in increasing usage of technology. Therefore we should introduce ACP systems and enjoy the benefits.

14. Future Ideas

a. Smart recognition of cars:

We can recognize the cars by their number plates with the help of image processing in ACP system. By using this type of technology users can directly pay for their car parking using mobile phone's prepaid balance or car parking account balance.

b. Updating Users about available slots and account balance:

User can get updates about available slots of a particular parking space and account balance by sending a simple SMS to the data base.

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