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Parallel Parking: A Review

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***Abstract* -Parallel parking is a method of parking a vehicle in line with other parked cars. Cars parked in parallel are in one line, parallel to the curb, with the front bumper of each car facing the back bumper of the adjacent one. Parallel parking requires driving the car in reverse gear into the parking space. Roads that facilitate said parking have an extra lane or a large shoulder for parked cars. It is also employed anytime parking facilities are not available—usually in large metropolitan areas where there is a high density of vehicles. Parallel parking is considered to be one of the hardest skills for new drivers to learn. Parallel parking allows a vehicle to park in a smaller space than would be true of forward parking. Driving forward into a parking space on the side of a road is typically not possible unless two successive parking spaces are empty. Reversing into the spot via the parallel parking technique allows one to take advantage of a single empty space not much longer than the car (in order to complete the parking within three wheel-turns the parking space would generally need to be about one and a half car-length long).**

Key Words: Parallel parking, angle parking, ad-hoc parking, driver's fatigue, smart parking, parking sensors

1. INTRODUCTION

The vehicle during to be parked in cities in the congested area is very tricky, since the space is very congested and to have the parallel parking in the space available in between two vehicles, is very difficult. For parallel parking of our vehicle in such congested area, we propose to make all wheels rotating to 90 degree by the switch activation, which will be effective by the hand lever operating to rotate all the four wheels to tilt to 90 degree to have the lateral drive to be able to effect the parallel parking, the vehicle will be sliding in lateral direction. Again when we need it in normal, we operate the lever to have the normal drive which will have normal front and back drive, steering left and right drive as normal vehicle will have.

In the modern world, where parking space has become a very big problem and in the era of miniaturization, since everybody wants to have a car and the space required to park is getting shorter. Proper visualization of the parking space required is not been given importance due to which the driver strive to have the parking space for his vehicle. The strain on the driver is to park the vehicle in the available space safely without touching the already parked vehicle.

Normally the four wheel vehicle will have drive and steering mechanism. Normally the parking space is in parallel to the moving vehicle and the vehicle to be parked has to be positioned within that parallel space in line to the road. For doing this, the vehicle has to be moved ahead, reversed back in opposite direction, and again steered to position it with front and back drive. These many stages are involved in positioning the vehicle in that parallel space. While doing so the driver is in strain to avoid the touching of the already parked vehicles.

India is having very ancient and old unplanned roads which are built very long back without considering the fast urbanization and increase in the road vehicles. Even in the congested roads and small roads, to turn the vehicle is not possible.

2. MODES OF PARKING

For most motorized vehicles, there are three basic modes of parking, based on the arrangement of vehicles — parallel parking, perpendicular parking, and angle parking. These are self-park configurations where the vehicle driver is able to access the parking independently.

2.1 Parallel parking

Parallel parking is considered to be one of the hardest skills for new drivers to learn. Parallel parking allows a vehicle to park in a smaller space than would be true of forward parking. Driving forward into a parking space on the side of a road is typically not possible unless two successive parking spaces are empty. Reversing into the spot via the parallel parking technique allows one to take advantage of a single empty space not much longer than the car (in order to complete the parking within three wheel-turns the parking space would generally need to be about one and a half car-length long).

Beginning drivers learn to use reference points to align themselves in relation to the car in front of the space, to determine the proper angle for backing, and to determine when to turn the steering wheel while backing. They may find it easier to briefly stop at each reference point and turn for the next step.

Two major types of parallel parking technique differ in whether they will use two or three positions of the steering wheel while backing. A skilled driver may be able to parallel park successfully by backing with the steering wheel turned all the way to the right and then immediately cranking the wheel all the way to the left at a critical point.

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For beginners or learners, those with larger cars or bad sight lines, this may risk collision with either the car in front of or behind the parking space, or it could also result in the car being parked too far away from the curb[1]. Such drivers may find it easier to include an intermediate step, where after having achieved the ideal angle for backing up they back up with the wheels straight until the rear end of the car is far enough back to allow them to make their final reverse turn. While steering wheel positions in between full-right, straight, and full-left are possible to use, beginners may be able to gauge their progress more effectively by turning the wheel all the way to the right or left.

To overcome all these above difficulties, we are proposing to make mechanisms to make it possible to slide the automobile parallel to the parking space through the main drive itself.

Parking facilities include indoor, outdoor, private property belonging to a house, the side of the road where metered or laid-out for such use, a parking lot (American English) or car park (British English), indoor and outdoor multi-level structures, shared underground parking facilities, and facilities for particular modes of vehicle such as dedicated structures for cycle parking.

Capacity increased through multiple level stacked parking using mechanical lifts.

Multi level parking arrangement for cars

With parallel parking of cars, these are arranged in a line, with the front bumper of one car facing the back bumper of an adjacent one. This is done parallel to a curb, when one is provided. Parallel parking is the most common mode of street-side parking for cars. It may also be used in parking lots and parking structures, but usually only to supplement parking spaces that use the other modes.

Parking in central Rome, Italy. Although the cars leave a space, this is soon filled with a scooter or motorcycle making it near-impossible for the cars to leave

2.2 Perpendicular parking

With perpendicular parking of cars, these are parked side to side, perpendicular to an aisle, curb, or wall. This type of car parking is more scalable than parallel parking and is therefore commonly used in car parking lots and car parking structures.

(Perpendicular) back-in parking style

Often, in car parking lots using perpendicular parking, two rows of parking spaces may be arranged front to front, with aisles in between.

Sometimes, a single row of perpendicular car parking spaces is marked in the center of a street. This arrangement eliminates reversing from the man oeuvre; cars are required to drive in forwards and drive out forwards.

2.3 Angle parking/echelon parking

Angle parking of cars is similar to perpendicular parking for these vehicles, except that cars are arranged at an angle to the aisle (an acute angle with the direction of approach). The gentler turn allows easier and quicker parking, narrower aisles, and thus higher density than perpendicular parking. While in theory the aisles are one way, in practice they are

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typically wide enough to allow two cars to pass slowly when drivers go down the aisles the wrong way.

Angle parking

Angle parking is very common in car parking lots. It may also be used in street side car parking in the U.S. Some cities have utilized angled parking on-street. Some cities have utilized angled parking on-street.

This has been done mostly in residential, retail and mixed use areas where additional parking compared to parallel parking is desired and traffic volumes are lower.

Angle parking, known as echelon parking in Britain, is considered dangerous by cycling organizations, especially in the head-in configuration, but unwelcome in either form. When comparing to parallel parking:

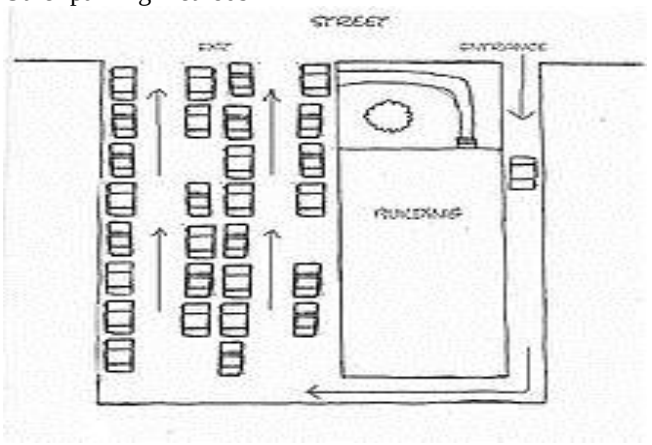
There is a significant risk to cyclists from vehicles reversing out, as approaching bicycles are in the blind spot of the reversing and turning vehicles.

Longer vehicles project further into the road; this can inconvenience/endanger other road users,

The "surplus" road space which enables angle parking could also be used for bicycle lanes.

Hence organizations such as the Cyclists Touring Club are usually opposed to all proposed echelon parking schemes.

Other parking methods



An illustration of Anderson ad-hoc parking method,

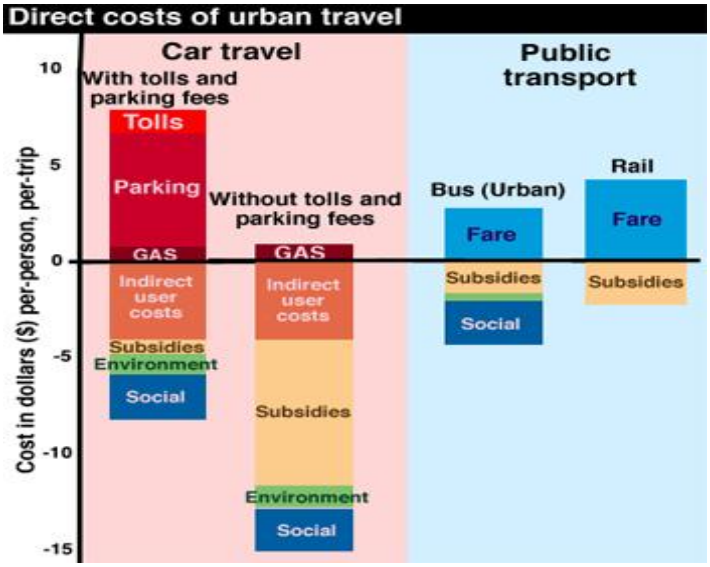


Illustration of Anderson ad-hoc parking method.

Anderson ad-hoc parking method, not only saves space, but allows all the vehicles to leave simultaneously.

3. OTHER PARKING METHODS

Besides these basic modes of motor vehicle parking, there are instances where a more ad hoc approach to arranging motor vehicles is appropriate. Vehicles may be packed up to five vehicles deep in combinations of perpendicular and/or parallel parking with limited circulation aisles for the parking attendant. Such arrangements are known as attendant parking. When the lot or facility is provided to serve the customers of a business, it is considered valet parking.

Inner city parking lots are often temporary, the operators renting land which is vacant pending the construction of a new office building. Some inner city lots are equipped with individual lifts, allowing cars to be stored above each other.

Economics of parking

In congested urban areas parking of motor vehicles is time consuming and sometimes expensive. Urban planners must consider whether and how to accommodate or 'demand manage' potentially large numbers of motor vehicles in small geographic areas. Usually the authorities set minimum, or more rarely maximum, numbers of motor vehicle parking spaces for new housing and commercial developments, and may also plan its location and distribution to influence its convenience and accessibility. The costs or subsidies of such parking accommodations can become a heated point in local politics.[2]

The cost of motor vehicle parking plays a major role in transportation choices.

In the graph to the right the value above the line represents the out-of-pocket cost per trip, per person for each mode of transportation, the value below the line accounts for subsidies, environmental impact, social and indirect costs. When cities charge market rates for on street parking and municipal parking garages for motor vehicles, and when bridges and tunnels are tolled for these modes, driving

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becomes less competitive in terms of out-of-pocket costs than other modes of transportation.

Cars parked on the sidewalk in Moscow

Where car parking spaces are a scarce commodity, and owners have not made suitable arrangements for their own parking, ad hoc overspill parking often takes place along sections of road where there is no planned scheme by a municipal authority to formally allocate roadspace to the car. For example, during the winter of 2005 in Boston, the practice of some people saving convenient overspill roadway for themselves, became controversial. At that time, many Boston regions had a tradition that if a person shoveled the snow out of a road space, that person could claim ownership of that space with some kind of marker in the space [3].

3.1 Self Parking System

A Self Parking System is a technology that allows a car to park itself. It is available on some Lexus and Ford models.

Self Parking System was first designed by Mukhtar Oudeif at The University of Michigan. The idea behind the Self Parking System project is to design and build an autonomous automobile robot that can find a handicap parking space and then park into the space effectively. This project was chosen because of its potential applications in the real world. At a larger and more practical level, this system would be implemented in automobiles to find an empty spot and direct the driver to park.

3.1.1 How Self-parking Cars Work

Parallel parking is an ordeal for many drivers, but with parking space limited in big cities, squeezing your car into a tiny space is a vital skill. It's seldom an easy task, and it can lead to traffic tie-ups, frazzled nerves and bent fenders. Fortunately, technology has an answer - cars that park themselves. Imagine finding the perfect parking spot, but instead of struggling to maneuver your car back and forth, you simply press a button, sit back, and relax. The same technology used in self-parking cars can be used for collision avoidance systems and ultimately, self-driving cars.

Automakers are starting to market self-parking cars because they sense a consumer demand. Parallel parking is often the most feared part of the driver's test, and it's something almost everyone has to do at some point. People who live in big cities may have to do it every day. Removing the difficulty, stress and uncertainty of this chore is very appealing.

The British Toyota Prius with Intelligent Parking Assist has a Dash board screen to tell the driver what to do.

Self-parking cars can also help to solve some of the parking and traffic problems in dense urban areas. Sometimes parking a car in a space is restricted by the driver's skill at parallel parking. A self-parking car can fit into smaller spaces than most drivers can manage on their own. This makes it easier for people to find parking spaces, and allows the same number of cars to take up fewer spaces. When someone parallel parks, they often block a lane of traffic for at least a few seconds. Finally, the difficulty of parallel parking leads to a lot of minor dents and scratches. Self-parking technology would prevent many of these mishaps. It can also save money, since you won't have to worry about insurance claims for parking-related damage.

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3.2 Automatic parking

Automatic parking is an autonomous car maneuvering from a traffic lane into a parking place to perform parallel parking, perpendicular or angle parking. The automatic parking aims to enhance the comfort and safety of driving in constrained environments where much attention and experience is required to steer the car. The parking maneuver is achieved by means of coordinated control of the steering angle and speed which takes into account the actual situation in the environment to ensure collision-free motion within the available space.

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One of the first semi-automatic systems developed and tested was in 1934 in which four jacks with wheels raised the car and moved it sideways into the parking space. It was never offered on any production model.
Next was an experimental prototypes of automatic parallel parking was developed at INRIA on a Ligier electric car in the mid 1990s. It was extended to an automatic perpendicular parking in the early 2000s.
Automatic parking systems are being developed by several automobile manufacturers. A commercial version of automatic parallel parking was introduced by Toyota Motor Corporation in Toyota Prius in 2003. BMW recently demonstrated its Remote Park Assist system on a 750i. This system initiates parking by keychain remote. Lexus also debuted a car, the 2007 LS, with an Advanced Parking Guidance System.

Intelligent Parking Assist System
Intelligent Parking Assist System (IPAS), also known as the Advanced Parking Guidance System (APGS) for Lexus models in the United States, is the first production automaticparking system developed by Toyota Motor Corporation in 2004 initially for the Japanese market hybridPrius models and later Lexus models. The technology assists drivers in parking their vehicle.[2][4] On vehicles equipped with the IPAS, via an in-dash screen and button controls, the car can steer itself into a parking space with little input from the user.

4. AUTOMOBILE SAFETY

Automobile safety is the study and practice of vehicle design, construction, and equipment to minimize the occurrence and consequences of automobile accidents. (Road traffic safety more broadly includes roadway design.)
Improvements in roadway and automobile designs have steadily reduced injury and death rates in all first world countries. Nevertheless, auto collisions are the leading cause of injury-related deaths, an estimated total of 1.2 million in 2004, or 25% of the total from all causes.[1]Risk compensation limits the improvement that can be made, often leading to reduced safety where one might expect the opposite.

4.1 Parking sensors
Parking sensors are proximity sensors for road vehicles which can alert the driver to unseen obstacles during parking maneuvers.
The ultrasonic sensors are currently available in several brands of cars, with a variety of brand names such as Parktronic and Parking Aid. Some systems are also available as additional upgrade kits for later installation.
Description:
Parking sensor systems use ultrasonic proximity detectors embedded in the front and/or rear bumpers, to measure the distances to nearby objects at low level. The sensors measure the time taken for each sound pulse to be reflected back to the receiver.

4.2 Development of Advanced Parking Guidance System
The initial version of the Intelligent Parking Assist System, launched in 2003, was designed for reverse parallel parking. Driver intervention was not required, as the system estimated the size of the parking space and maneuvered the vehicle appropriately. This was done by an onboard computer which used a camera built into the forward and rear of the car. Using the arrows, the user would set the location of the vehicle in the space. When satisfied, the user pressed the "Set" button, which then activated the IPAS [5]. The system then took over steering control to maneuver the vehicle. This latest version could calculate the steering maneuvers needed for parallel or reverse parking, and help determine that the car has enough clearance for a particular space with colored screen displays which indicated adequate or inadequate space.

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