SUMMER TRAINING REPORT
on

AUTOMATED PARKING SYSTEM

at

Chandigarh College of Engineering & Technology

A Project Report submitted in partial fulfillment of the
requirements for the award of the

Bachelor of Engineering
In
COMPUTER SCIENCE ENGINEERING

Submitted by
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Under the supervision of
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CHANDIGARH COLLEGE OF ENGINEERING AND TECHNOLOGY (DEGREE WING), CHANDIGARH
(Affiliated to Panjab University, Chandigarh)
August, 2019

DECLARATION

I hereby declare that the work, which has been presented in this Training Report entitled AUTOMATED PARKING SYSTEM, in partial fulfillment of the requirements for the awards of degree of Bachelor of Engineering in Computer Science Engineering submitted to the Computer Science Engineering Department, CCET, Chandigarh, is an authentic piece of work carried out from 1st June 2019 to 30th June 2019 under the supervision of Dr. Sunil K. Singh (HOD, CSE Department at CCET Sec 26, Chd).

The matter in this Training Report is not submitted by me for the award of any degree elsewhere.

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ACKNOWLEDGEMENT

I would like to put forth my regardful thanks to all those who had helped me in guiding me to get the most out of this golden opportunity to learn the most during such a period of my training at Chandigarh College of Engineering & Technology Sec-26, Chandigarh.

I pay my special thanks to **Dr. Sunil K. Singh** (HOD, CSE in CSE Department**),** who gave me chance to work with him and gave me excellent knowledge. Also, I put my special regards to the management, workers and co-trainees who have always been so supporting and ready to help.

I also put forth my special thanks to all the concerned persons as well as Dr. Sunil K. Singh, **(**HOD, CSE), Dr. Ankit Gupta(Training In-charge, CSE) and Dr. Manpreet Singh, Principal C.C.E.T. (Degree Wing), Chandigarh, who have enabled me to have an opportunity to work at the prestigious organization.

Thankful,

Puru Verma

CERTIFICATE

This is to certify that the Project work entitled AUTOMATED PARKING SYSTEM, submitted by Puru Verma(LCO17374), in fulfillment for the requirements of the award of Bachelor of Engineering Degree in Computer Science & Engineering at Chandigarh College of Engineering and Technology(Degree Wing), Chandigarh is an authentic work carried out by him/her under my supervision and guidance.

To the best of my knowledge, the matter embodied in the project has not been submitted to any other University/Institute for the award of any Degree.

Date:

Place:

Dr. Sunil K. Singh.

Head of Department(CSE),

CCET(Degree Wing),

Chandigarh.

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ABBRIVIATIONS:

- **APS**: Automated Car Parking system
- **AGV:** Automated Guided Vehicle
- **RGC:** Rail Guided Cart
- **LCD:** Liquid Crystal Display
- **GSM:** Global System for Mobile Communication

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CHAPTER 1
INTRODUCTION

1.1 INTRODUCTION TO AUTOMATED CAR PARKING SYSTEM:

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 consume 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.

Figure 1.1: Existing car parking system

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.

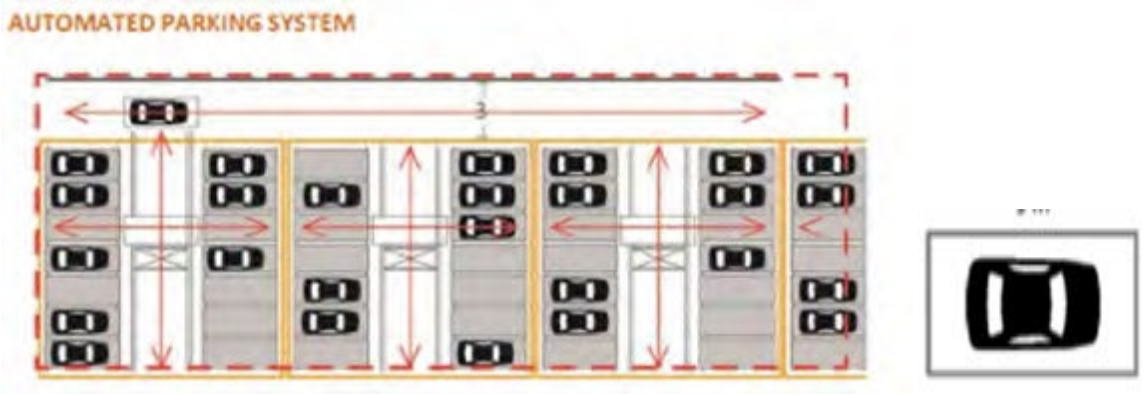


Figure 1.2: Proposed Automated Car Parking System

1.2 PROBLEMS WITH THE 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.

1.3 ADVANTAGES OF AUTOMATED VEHICLE SYSTEM:

The advantages of automated car parking systems are:

1. Reducing traffic jam:

Automated vehicle system reduces 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.

2. 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.

3. 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 peoples are being harassed. This system prevents these problems.

4. Fuel saving:

In this system we are using an automatic tray which will take the vehicle into the parking space and place it in required slot. This will reduce the fuel cost. Here we do not need to lighting all over the parking space. It will on the light when it moves and where is the path and it is very much electricity saving also.

5. 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.

1.4 MOTIVATION AND OBJECTIVES:

1.4.1. 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.

1.4.2Objectives:

The objectives are:

1. Introducing automatic vehicle parking system in Bangladesh and get benefited by it.
2. To compare various aspects of this manual parking system with the automated parking system.
3. To find out the economic benefits of introducing automated vehicle system.

1.5 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. 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.

1.6 DIFFERENT TYPE OF AUTOMATED CAR PARKING SYSTEMS:

There are mainly seven different types of automated car parking system:

- AGV systems
- Crane systems
- Puzzle systems
- RGC systems
- Shuttle systems
- Silo systems
- Tower systems

1.6.1 AVG Systems:

Automated Guided Vehicle known as AGV technology has been introduced in automated parking system most recently though AGVs has been used in automated warehousing for decades. The vehicles are parked on pallets in the parking space which are collected from the parking entrance by the AGVs driving beneath the vehicle pallet, lifting it and then parking it in the parking space. The number of AVGs in the system is flexible and can be based around the client's requirements. Generally, AVG systems operate on solid finished concrete floors that can move in both lengthways and sideways directions along fixed paths and are able to rotate on the spot. This allows the vehicle pallets to be collected by an AGV from any direction and with several AGVs operating on a floor. It also allows for multiple, simultaneous parking and retrieval movements along multiple paths. To move the vehicle pallets with or without an AGV, vehicle elevators are used within the system.

Figure 1.3: AVG Systems

1.6.2 Crane Systems:

This system is used utilizing a single mechanism that is to simultaneously perform the horizontal and vertical movements of the vehicle to be parked or retrieved in the parking system. This mechanism allows the vehicle platform to move to and from one parking spot to another very quickly. The crane mechanism has a vertical elevator platform fitted and it moves horizontally on rails, typically located on the floor and ceiling of the parking system, where vehicles to be parked and retrieved are placed, which means that a floor-to-ceiling opening in the center of the system is required for the crane for the crane(s) to operate.

Figure 1.4: Crane Systems

This mechanism can move in line with the normal direction of a vehicle or orthogonal to it depending on the site constraints. The crane system also has two cranes running parallel to one another should the site constraints allow it, if higher throughput or redundancy is required. The system redundancy is potentially low but back-up motors; switches, etc. can be installed to increase the system's redundancy as there is typically only one mechanism for the parking and retrieval of vehicles and turning devices can be fitted under the vertical elevator platform.

1.6.3 Puzzle Systems:

Puzzle systems offer the densest form of automated parking as it utilizes around 95% of the floor area and often used in smaller systems. A grid of pallets covers a solid floor or steel frame, and each pallet is supported by a set of rollers and belts that are driven by motors fitted to the support frames underneath each pallet location in a horizontal puzzle system. Until the pallet with the required vehicle on is maneuvered to the desired location, the rollers and belts maneuver the pallets. The frames, supported by the pallets are installed in all possible parking positions. Typically, there are two fewer pallets than support frames per floor that provides the necessary free spaces to maneuver the pallets.

Figure 1.5: Puzzle System

Puzzle systems provide flexible layout options as the system configuration is highly adaptable because a pallet can be moved in any directions. The system shape can vary greatly, such as: rectangular or square, “T” shaped, “U” shaped, “H” shaped, etc. in puzzle systems scissor lifts are typically used as they allow the pallets to move on and off the lift platforms in all directions. We can also use electrical cantilevered lifts but the pallet movements on and off the lift platform are more restricted, turning the vehicles can be done in the parking module, on an elevator or within the parking system.

1.6.4 RGC Systems:

Rail Guided Cart known as RGC technology operate in a similar way to AGVs except the RGCs are less complex and more robust than AGVs and therefore more cost effective and more reliable. The RGCs park the vehicles on pallets in the parking modules which are collected from the parking modules by driving beneath the vehicle pallet, lifting it then moving it out of the parking module into the system. The number of RGCs in the system is flexible and can be based around the client's requirements.

Figure 1.6: RGC System

Generally, RGC systems operate on solid concrete floors and can move in both lengthways and sideways directions along small guided rails fitted to the floor. Elevators are used within the system to move the vehicle pallets with or without an RGC.

1.6.5 Shuttle Systems:

The shuttle systems utilize autonomous shuttles and elevators to park and retrieve vehicles. The number of shuttles in the system is flexible and is based around the client's requirements. The shuttle moves horizontally to a designated location in a shuttle lane, which is either a set of rails in a steel or concrete structure or recess in a solid floor. A vehicle is parked or retrieved at the designated location by a robot, or parallel exchanger or conveyor belts, located on the shuttle by moving the vehicle from or to the shuttle and the parking space. Generally, there is a single row vehicle either side of the shuttle lane but if needed more rows of vehicles can be added. The retrieval process of vehicle for the second row and onwards is slower than for the first row of the robot has longer distance to travel to retrieve the vehicle and there may be a vehicle parked in the front of the vehicle to be retrieved, which has to be removed before the vehicle in the second row can be retrieved. When a vehicle is required to be moved from one

level of the system to another there are two options for achieving this, one option is with vehicle elevators and the other one is with shuttle elevators.

Figure 1.7: Shuttle Systems

A shuttle moves adjacent to a vehicle elevator and deposits the vehicle on the vehicle elevator platform when vehicle elevators are used. A shuttle collects the vehicle from the vehicle elevator when the vehicle elevator then moves the vehicle to the designated parking space. In this option shuttles remain on their assigned levels, therefore at least one shuttle is required per parking level which can make redundancy an issue if only one shuttle is used per level, so this can be costly. When shuttle elevators are used the shuttle moves with the vehicle on to a shuttle elevator located at either end of the shuttle lane. The shuttles are free to go to and from any level in the system allowing for fewer shuttles than parking levels and greater redundancy, in this option. We can say that the shuttle elevators are often the system bottlenecks and throughput is much lower than with vehicle elevators.

1.6.6 Silo Systems:

The silo systems are cylindrical systems with a single, centrally positioned mechanism used to park and retrieve vehicles. The central mechanism allows the vehicle platform to move to and from one parking spot to another very quickly by moving vertically and rotating simultaneously. Typically, they are installed underground and are most suitable where soil conditions are particularly unfavorable. It can also be installed above ground. In silo systems typically only one vehicle can be parked or retrieved at one time. System redundancy can be issue as issue as there is only one mechanism for parking and retrieving vehicles.

1.6.7 Tower Systems:

This system is typically consisting of a vehicle elevator with a parking space either side of the elevator shaft. To complete a parking tower, this configuration is repeated over a number of levels. The vehicle elevator simply rises to one of the parking levels of the tower and deposits the vehicles sideways into a parking space. A vehicle is retrieved in a same way. System redundancy is an issue with tower system as there is single mechanism to park and retrieve vehicles.

1.7 SUMMARIZATION OF OUR PROJECT:

Here we are trying to build a suitable computerized Automated Car Parking System with manual payment system. An assessment of the existing system would be made including the operating system being made as a prototype, the efficiency of car parking system, problem faced during operating the prototype etc. An in depth analysis of the Automated Car Parking System would then be made. Various aspects of these two systems would then be compared and the benefit of introducing the AUTOMATED CAR PARKING System would be found out in terms of saving in time, fuel and emission reduction.

CHAPTER 2

OVERVIEW OF PROJECT

2.1 APPLICABILITY 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:

- **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.

- **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.

- **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.

- **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.

2.2 COMPARISON BETWEEN THE EXISTING SYSTEM AND PROPOSED SYSTEM:

In present days we are facing many problems with the existing car parking system. As we need to park our car manually and there is no discipline in this process it creates a huge hurdle. People can park their cars anywhere they want to, which creates a mess as people don't follow a 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 create traffic jam. This is also an economical lose as we need to repair our damaged car. This chaos also leads to cars consuming extra fuel.

- Figure: Existing car parking systems in our country:

Figure 2.1: Existing car parking system in India

Traffic jam is an issue here as it kills our precious time. Due to this chaos in parking our valuable time gets wasted. For places like shopping malls or amusement parks it causes economical loss, as due to this chaos a lot of people are unwilling to visit these places which decrease the number of the customers in these places. Again the customers get less time to browse for options through these places which can again lessens the opportunity to selling the products. Sometimes the customers cannot enter in these places due to this parking chaos. This car parking hazard causes problem for the student and office staff as they cannot reach their destination on time which sometimes causes huge loss in their respective career. It can cause fatal damage to the patients as it can cause delay for them to reach the medical services may

be just a few floor away in the hospital building. Moreover, there is no payment system for car parking in most of the parking spaces in our country. So by introducing the automated car parking systems we can handle the mismanagement of parking space save time and recover losses caused by the existing system and also earn money by charging money for car parking.

2.3 WORKING PRINCIPLE OF OUR PROJECT:

Our project will work as follows:

The LCD display will display the number of available slots and price. When a car will come the operator will send instruction through Arduino to open the gate. DC motor helps the gate to open up when it gets the signal from Arduino, Arduino will only get the signal to DC motor using RF module. The operator will send a SMS containing the code to the user's mobile phone using Arduino& GSM module. This code will be saved in the system against a slot which will be sent to the car parking tray using RF Module. The user will have to provide the registration number of the car and mobile number. The car parking tray will also be called by using RF module and Arduino. The car parking tray will park the car and will come out to park the next car. The wheels of the car parking tray will be controlled by Arduino so that it reaches the particular slot. For parking out the user will have to give the provided code to the operator at the exit gate. The user will receive a SMS stating the amount to pay for the parking again by using Arduino and GSM Module. After the user makes payment the operator will give command to park out the car. The car will be parked out the way as it was parked in.

CHAPTER 3

PROJECT ALGORITHM AND WORKING

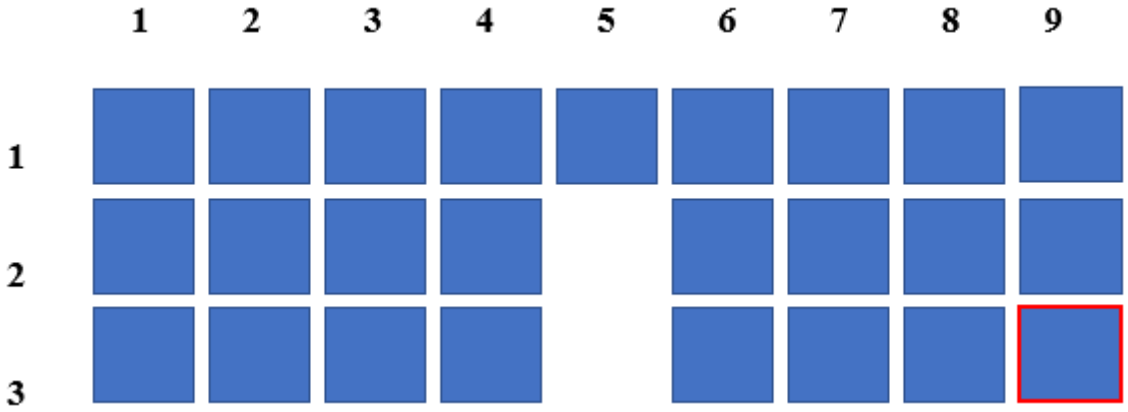
3.1 Project Working

Working of the Algorithm:

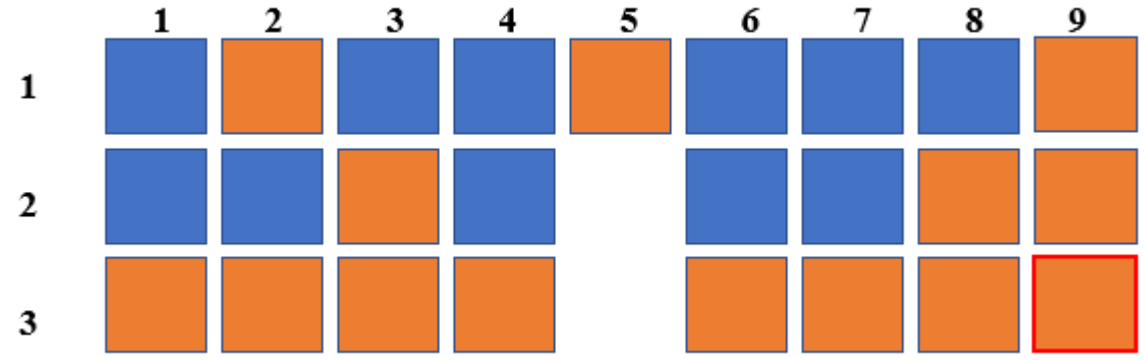
The following diagram shows the parking system with approx. half of the platforms filled. The filled platforms are color coded by the color orange. The empty platforms are color coded by the color blue. There are two empty spaces i.e. the middle platforms of level 1 and level 2 that are represented by white blank space for no platforms.

The bottom level is level 1. The middle level is level 2. The top level is level 3.

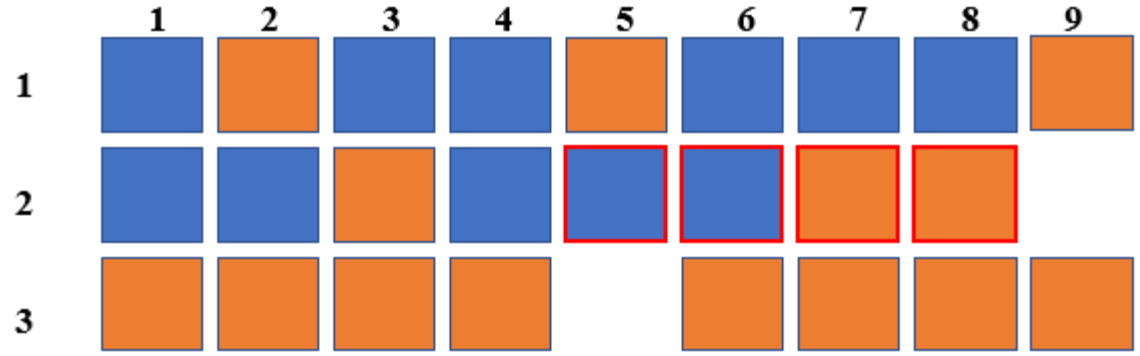
In this algorithm, the row/level number is represented by "**i**", and the column number is represented by the letter "**j**".



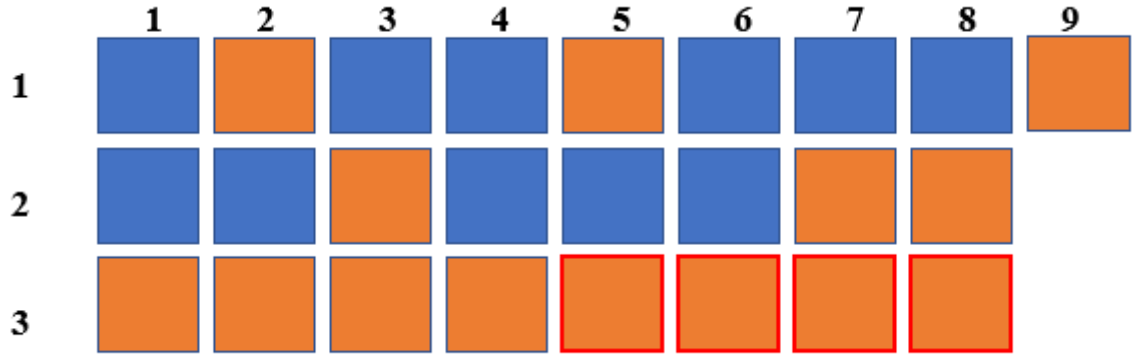
When a new vehicle enters, the vehicle will be placed in level 1 if a space is available in level 1. In this example the level has a free platform(blue) so the vehicle will be placed in the platform [1][9] meaning the platform number 9 of level 1.



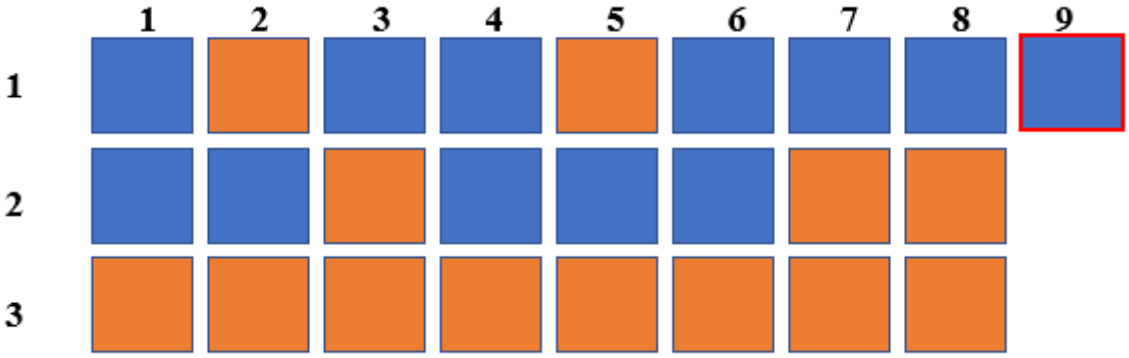
Now, If a user wants to retrieve their vehicle that is placed at the 9th platform on level 3 meaning i=3 and j=9 i.e. platform [3][9], First the platform [2][6] to platform [2][j] i.e. platform [2][9] will be transferred to the left as shown in the following figure,

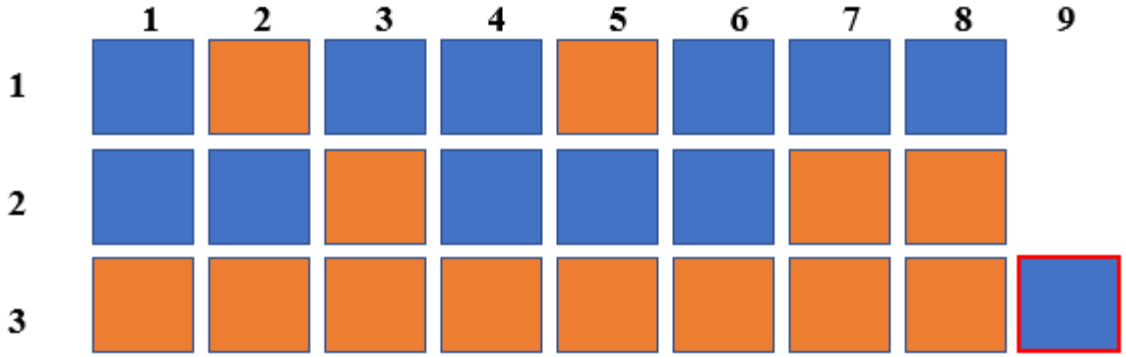


Secondly the platform [1][6] to platform [1][j] i.e. platform [1][9] will also be transferred to the left as shown in the following figure,

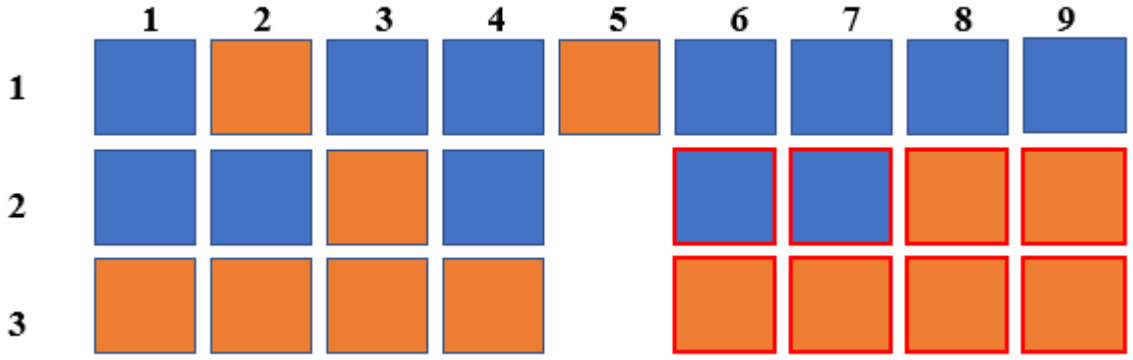


Now, the platform [3][j] i.e. platform [3][9] will be descended to level 1 and the vehicle will be removed, then the platform will return to its former position.





The platform [2][5] to platform [2][8] & platform [1][5] to platform [1][8] will shift to the right.



NOTE: If a level is filled completely then the platform to be filled next will be the first platform that is empty on the upper level.

Algorithm for DST Parking Project:

1. **Filling:**

If level 1 is consisting of an empty platform then,

Fill platform [1][1…4,6…9] and Mark the platform as filled.

Else /*Meaning level 1 is filled completely*/

If level 2 is consisting of an empty platform then,

Fill platform [2][1…4,6…9] and Mark the platform as filled.

Else /*Meaning level 2 is filled completely*/

If level 3 is consisting of an empty platform,

Fill platform [3][1…9] and Mark platform as filled.

Else/*Meaning level 3 is filled completely*/

No More Space.

2. **Withdrawing:**

If desired vehicle is on level 1

Withdraw vehicle from platform and Mark the platform as Unfilled.

Else /*Vehicle is not on level 1*/

If desired vehicle is on level 2

Withdraw vehicle from platform and Mark the platform as Unfilled.

Else /*Vehicle is not on level 2*/

If desired vehicle is on level 3

Withdraw vehicle from platform and Mark the platform as Unfilled.

Else /*Vehicle is not on level 3*/

Vehicle Not Found.

3. **Removing Vehicle:**

a. **Removing** Vehicle from level 1:

Remove the vehicle directly and Mark the platform as Unfilled.

b. **Removing** Vehicle from level 2:

- **If** column number(j) is less than 5
  - move platform[1][j…4] to the right.
  - move platform[2][j] to level 1 and remove vehicle.
  - move platform[1][j] to level 2.

        - move platform[1][j+1…5] to the left.
    - **If** column number(j) is greater than 5
        - move platform[1][6…j] to the left.
        - move platform[2][j] to level 1 and remove vehicle.
        - move platform[1][j] to level 2.
        - move platform[1][5…j-1] to the right.

c. **Removing** Vehicle from level 3:
    - **If** column number(j) is less than 5
        - move platform[1][j…4] to the right.
        - move platform[2][j…4] to the right.
        - move platform[3][j] to level 1 and remove vehicle.
        - move platform[1][j] to level 3.
        - move platform[1][j+1…5] to the left.
        - move platform[2][j+1…5] to the left.
    - **If** column number(j) is greater than 5
        - move platform[1][6…j] to the left.
        - move platform[2][6…j] to the left.
        - move platform[3][j] to level 1 and remove vehicle.
        - move platform[1][j] to level 3.
        - move platform[1][5…j-1] to the right.
        - move platform[2][5…j-1] to the right.
    - **If** column number(j) is equal to 5
        - move platform[3][5] to level 1 and remove vehicle.
        - move platform[1][5] to level 3.

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