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[ijirset@gmail.com](mailto:ijirset@gmail.com)

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# STUDY OF MULTILEVEL VEHICULAR PARKING

Abhishek Malik<sup>1</sup>, Lovepreet Kaur<sup>2</sup>, Neeraj Kumar<sup>3</sup>

M.Tech Scholar, Dept. of Civil Engineering, SRMIET, Bhurewala, Ambala, Haryana, India<sup>1</sup>

Assistant Professor, Dept. of Civil Engineering, SRMIET, Bhurewala, Ambala, Haryana, India<sup>2</sup>

Assistant Professor, Dept. of Civil Engineering, SRMIET, Bhurewala, Ambala, Haryana, India<sup>3</sup>

**ABSTRACT:** Multilevel parking is necessary for managing number of vehicle in minimum space within minimum time. It help in reducing the traffic jam and to maintain inflow and outflow of number of vehicles. In this vehicle by online review system can fix the position of vehicle according to their requirement and also reserve space. In this study, a simple multi-level automobile parking system consisting of three levels has been taken into consideration to demonstrate the use of control systems in parking systems. When it comes to the organization of the entrance and exit procedures for the parking lots, the control system will play a significant role. In addition to this, it describes the construction of multi-level parking lots, which take up less space on the ground but may accommodate a greater number of vehicles. In today's world, when finding a parking spot has become an extremely challenging endeavor, it is of the utmost need to avoid squandering any available space in today's megacities. Automated parking on many levels may assist reduce the amount of space needed for vehicle parking at businesses and residential complexes. The parking lots are equipped with an elevator that transports vehicles to various levels according on the number of available spots. In addition to the assistance of a few sensors, the elevator is managed by a programmable logic controller (PLC).

## I. INTRODUCTION

The expansion of vehicle traffic in today's metropolitan urban centers has been taking place at an astonishingly rapid rate. As the economy of the nation attains the stage of takeoff, it is now prepared for developments of a more incredible kind. In recent years, numerous of new companies have started manufacturing automobiles in India with the intention of catering to the Indian cultural market [1]. The current scenario is one in which an ever-increasing number of persons now have the opportunity to acquire automobiles. Staggered vehicle exits have become a need as a result of the rise in the number of cars, which has made exiting particularly difficult in congested commercial and office districts [2]. As a result of this rise, staggered vehicle exits have become a necessity. The multi-story vehicle exit is an excellent method of construction since it exposes all components of the structure to the environment in a natural manner. It is important to keep in mind that these vehicle exits should completed in a timely manner and without creating a significant amount of backup in the heavy traffic [3]. Parking is the act of putting a car to a stop, moving it to a different location, and then leaving it there unattended. Parking is often permitted on one or both sides of a street, however sometimes there are restrictions placed on this privilege. It is common practice to include parking garages into the design of some buildings in order to enable customers to move about the surrounding area freely. Equal parking, opposite parking, and point parking are the three primary ways that most mechanized vehicles may be parked, taking into consideration the movement of the vehicles. Equal parking is the approach in which two spaces are parallel to one another. These are designs that allow the driver of the car to exit on their own and freely access the parking area.

### On street parking

The term "on street parking" refers to the practice of parking automobiles on the roadway itself, as seen in figure 1. In most cases, authority for this aspect will rest with the respective government agencies. The following is a list of common kinds of parking that may be found on the street. The IRC specifies that the standard measurements for a vehicle are 5 meters in length and 2.5 meters in width, while the normal specifications for a truck are 3.75 meters in length and 7.5 meters in width.



**Figure 1. On street parking  
Off street parking**

When automobiles are parked off street, it indicates they are not parked on the street itself. In most cases, this will be under the authority of the commercial agency themselves, as seen in figure 2.



**Figure 2. Off street parking  
Multi-level car parking system**

When distinguishing between a residential "carport" and a commercial "parking garage," the phrase "parking structure" is often used. Various regional expressions reference to outdoor multi-level parking garages, but "parking carport" only refers to an enclosed, usually underground building. Parking facilities are buildings or sections of buildings that are designed specifically to house automobiles, and sometimes have many floors for this purpose.



**Figure 3. Multi-level car parking system  
Other parking methods**

In addition to these fundamental approaches, there are circumstances requiring for a more expressly appointed manner of dealing with arranging engine vehicles. Some large cities, like Chicago, have parking lots specifically for engine vehicles, where the driver leaves the keys with a specialist who organizes vehicles in order to increase the number of vehicles that can be left in the part. This is because land is expensive and parking space includes some hidden costs. Up to five cars may be grouped together someplace low, preferably in different opposite arrangements.

## II. REVIEW OF LITERATURE

**Padiachy et al., (2015) [4]** examined that The present investigation provides and investigates the potential for an engineering application to alleviate or mitigate the issue brought up by the construction and implementation of an automated multi-level automotive parking system. An increasing number of mechatronics systems are being developed, and there is a limitation of land area. This article presents and discusses the possibilities of an engineering application to accommodate both trends. The study history, a short model technique, software implementation, design analysis, and suggestions are included in this work. In order to realize the most effective parking solution feasible, a multilevel parking garage provides the largest degree of flexibility conceivable.

**Nagajyothi et al., (2016) [5]** studied that multi-level parking systems have provided provided relief for some time as well because they have a number of benefits, such as optimal utilization of space, lower maintenance and operational cost. Multiple Level Vehicle Parking Systems are becoming more popular as a method for quickly parking and recovering vehicles. These systems normally make use of a system of pallets and lifts in addition to signaling devices in order to retrieve parked vehicles. With the aid of this specific project, an excellent, well-organized, secure, and space-saving Parking Area could be constructed, which would be useful for the university in the long run as well. This gives a chance to park the majority of cars, and the spots are adequate on daily college business days in addition to being sufficient on practically any other days.

**Crisostomo et al., (2019) [6]** analyzed that a smart parking system that is based on image processing was created for use in multi-story parking garages as part of this research project. When parking spots are dispersed over numerous floors, motorists have to spend a significant amount of time searching for one that is free. This contributes to longer lines and increased congestion in the surrounding area. The suggested system architecture makes use of the Python IDLE and the Open CV library to determine if a parking spot in the captured video is occupied or not. This is done by combining edge detection and coordinate bound pixel sections. Sample footages taken from real indoor parking garages were used for the purposes of validating the system's precision and dependability throughout the testing phase of the parking spot identification project. Based on the findings of this research, implementing real-time image processing and updating of the parking slot availability results in a parking system that is both more effective and less expensive than the alternative of putting individual automobile sensors in each parking spot.

**Hanzl et al., (2020) [7]** stated that the purpose of this paper is to acquaint the reader with the fundamental possibilities of directing vehicles to parking spots in metropolitan areas, as well as the clever technologies employed in multi-story parking garages that are designed to make it simpler for drivers to find their way about while they are parked. Every technology that was addressed was shown using real-world examples. A summary of the particular benefits and drawbacks of utilizing these systems in metropolitan areas is presented, as well as an analysis of the positive contributions that these machineries make to the transportation and logistics procedures.

**Gindullina et al., (2021) [8]** examined an intelligent autonomous cars that are travelling in a smart city environment need to locate a parking place, and they often turn to multi-story parking facilities for this purpose. The competitive character of autonomous cars acting in a self-centered manner is in direct conflict with the objective of utilizing parking resources in an effective manner. In this article, we use a game-theoretic approach to modeling the issue at hand and analyze how well a decentralized decision-making system can function. At the same time, we acquire new understanding of the complexities involved in finding solutions that are efficient, and we get a sense that it might be challenging to find a solution to the entire issue that does not involve jeopardizing the naturally egocentric goals of each individual car. In addition, we offer several scenarios for distributed simulation in order to capture certain characteristics of the rivalry, which hints to the possibility of additional analytical research.

**Kavitha et al., (2022) [9]** studied the primary objective of this study is to make use of the ETABS program to develop the structural system, perform seismic analysis, and design a multi-level vehicle parking structure. The Multilevel Car Parking is comprised of the Ground Floor and the Following 6 Floors. It has been determined that the kind of foundation will be a pile foundation with a pile cap. The design of the multilevel parking garage took into account dead loads, live loads, wind loads, and seismic loads. RC structure is studied with the help of the integrated building design software ETABS 2016. The model of the superstructure is made up of the frame parts in the right places. As part of the modeling process, beams and columns are regarded to be frame components, while a standard slab is treated as a membrane element. As a means of providing resistance to the lateral stresses, the floor slab has been modeled at each floor level as a diaphragm. In the course of the investigation, seismic zones are taken into consideration, and the

behavior is analyzed making use of a moment resistant frame with a response reduction factor of 5. In accordance with the codal requirements of IS 456:2000 and IS 1893, loads and their combinations are taken into consideration throughout the design process. The program will not affect the size of the beams and columns that are being used. Both the crack width and the beams' degree of deflection are within the allowable parameters.

**Alapure et al., (2023) [10]** examined the similarities and differences between plc-based and microcontroller-based parking systems. The rising number of cars on the road has made it more challenging to find a spot to leave a vehicle in a public lot or garage. To counteract this growing problem, many innovative parking systems have been designed to accommodate the growing number of cars on the road. In this work, we report the results of our investigation on the advantages of PLC-based parking systems over those based on microcontrollers. We compared the computing power, inputs and outputs, connection, controller programming, data security, working environment, scalability, and flexibility of plc and microcontroller parking systems. There are a few disadvantages to using a microcontroller system, such as the need for regular maintenance and the need of some familiarity with programming. Due to the PIC microcontroller's limited power, additional interfacing circuitry was needed. does not work well at peak pick-up times, etc. When compared to microcontrollers, PLCs excel in areas such as processing speed and precision. Capacity to expand for sustained efficiency, Modularity, Safety, Rigidity, and Stability in Design. reliable and simpler to use. It's simple to set up. Fixing issues with the parking garage's PLC-based system is a breeze.

### III. PROBLEM STATEMENT

The majority of the time, drivers look for a parking spot by wandering aimlessly around the parking lots. The number of people living in urban areas led to a growth in the demand for cars and other forms of transportation. It creates difficulties with parking, which in turn contributes to increased levels of traffic congestion, dissatisfaction among drivers, and air pollution. The most recent study discovered that it takes the average nearly about 8 minutes to park their car because they spend so much time looking for an available parking spot.

### IV. RESEARCH METHODOLOGY

The purpose of this study was to build a multi-level parking system for a vehicle parking facility that consists of three levels and executes the entrance and departure of vehicles by an elevator that is controlled by a programmable logic controller (PLC). In order to put the multi-level vehicle parking system into action, one must first build a software to operate the multi-level vehicle parking system, as well as set up and assemble the various components of the necessary hardware. Figure 4 presents an illustration of the configuration of the multi-level parking garage system.



Figure 4. Multi-level vehicle parking system layout

#### 4.1 Construction of the system

Throughout the course of this study, we explored through a few components that contribute to the formation of a compact system for the three-floor vehicle parking. The following is a list of the items that were selected;

- Relay
- DC motor
- Limit switch
- Sensor

• Lamps

The process of lining up the vehicles on each of the three floors begins as soon as the first car enters the main gate. Two lights indicate the availability of parking spots: a green light means that spaces are plentiful throughout the parking garage, while a red light means that no parking spaces are available on any of the three floors. Figure 5 indicate the flow chart of the overall process as shown below.

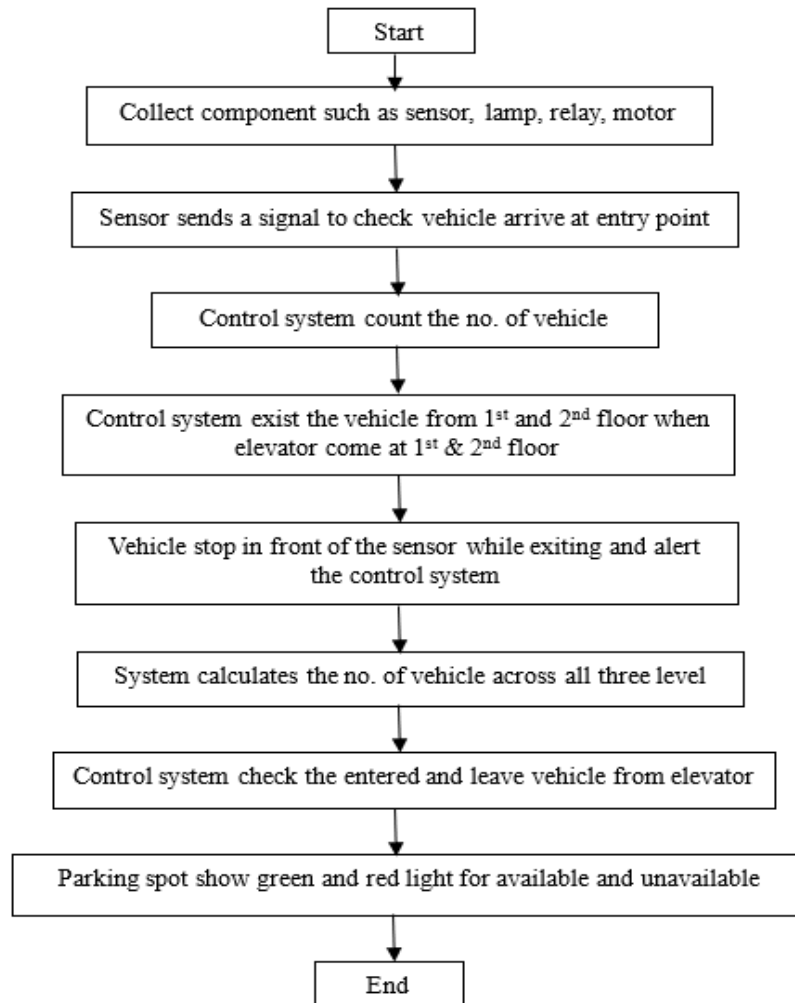


Figure 5. Flow chart

The following order of the directions on how to enter a vehicle is used by the system while it is in its initial condition:

**Step 1:**The sensor on the elevator sends a signal to the system telling about the presence of the vehicle when a vehicle arrives at a certain entrance point. Subsequently, the control system informs the elevator about the right level according to the availability of any empty area.

**Step 2:** After the elevator has arrived at the correct level, the vehicle will enter the parking area directly, and a sensor at the gate will send a signal to the control system to confirm the entrance. The control system will then count the number of vehicles that have entered the parking area. In the event that the elevator comes to a halt in front of the first or second level, the control system will direct the vehicle toward the exit where the vehicles from the first and second floors leave the building.

**Step 3:**In the event of an exit, the vehicle stops in front of the sensor, which alerts the control system that a vehicle is ready to leave; the next steps in the procedure rely on the elevator's availability in priority order. In the event of an elevator breakdown in front of the bottom level, for instance, exiting vehicles would be given preference. Priority for the outgoing vehicles on the other two levels will depend first on available space in the elevator and then on the amount of time to leave.

**Step 4:**Based on inputs from each floor's sensor, the system will calculate the establish number of vehicles that need access and exist across all three levels.

**Step 5:**The control system will provide the elevator instructions for the appropriate level based on the difference in the number of vehicles entering and leaving the elevator

**Step 6:**The warning lights for the parking situation are located on each level. For instance, a parking spot with a green light shows its availability, whereas a red light indicates its unavailability.

The whole diagram of the multi-level vehicle parking control system is seen in Figure 6.

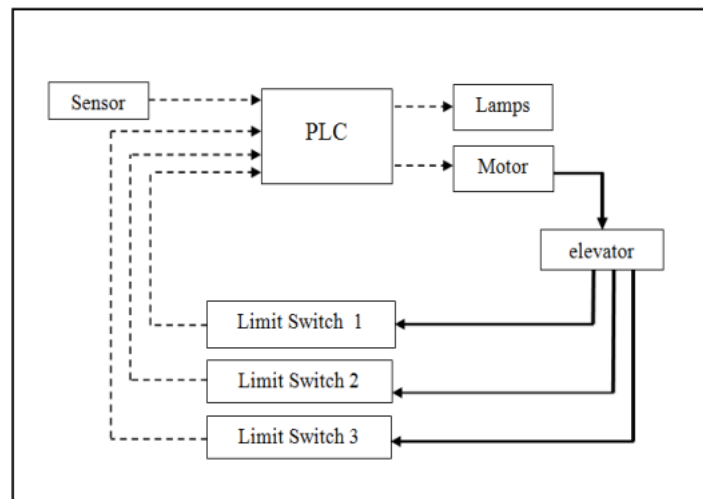


Figure 6. Vehicle exit from the parking space.

#### 4.2 Objectives

- To study the parking demand, characteristics, and space inventory.
- To reduce the parking area by providing multi-storeyed parking building.
- To provide the safety and secured environment for the parked vehicles.

#### V. SCOPE OF THE STUDY

The number of people looking for intelligent parking systems is rapidly growing. This gives users the option to get information in real time about the availability of parking spaces. This study is to make the parking space readily available to all users, as well as to cut down on the amount of time and money spent by users. It also helps to minimize the space that is necessary for vehicle parking, and it reduces the total fuel energy that is spent by the vehicle while it is searching for a parking spot, which is a significant benefit.

#### VI. EXPECTED OUTCOME

The control system for the multi-level the vehicle parking system is capable of achieving the performance that was expected in order to correctly regulate the entrance and departure of vehicles to and from several levels. The entrance and exit phases of the vehicles will be contingent on the accessibility of the elevator as well as the amount of time necessary for exist. In the meanwhile, the preference for exist from other levels will first be determined by the amount of space available, and then it will be determined by the amount of time that is required for exist.

#### REFERENCES

1. Polinar, Mark Anthony N., and Ronald B. Payao. "Multi-level Car Parking as a Viable Solution to Traffic Issues in Davao City." *International Journal of Multidisciplinary: Applied Business and Education Research* 3, no. 11 (2022): 2191-2197.
2. Padiachy, Vadan, Jagdish Kumar, Amitesh Chandra, Krishneel Prakash, Parsant Prasad, Henal Prasad, U. Mehta, K. A. Mamun, and Praneel Chand. "Development of an automated multi-level car parking system." In *2015 2nd Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE)*, pp. 1-7. IEEE, 2015.

3. Choudhary, Rahul, and Er Neeraj Kumar. "Study on Parking-Review." (2021).
4. Padiachy, Vadan, Jagdish Kumar, Amitesh Chandra, Krishneel Prakash, Parsant Prasad, Henal Prasad, U. Mehta, K. A. Mamun, and Praneel Chand. "Development of an automated multi-level car parking system." In *2015 2nd Asia-Pacific World Congress on Computer Science and Engineering (APWC on CSE)*, pp. 1-7. IEEE, 2015.
5. Nagajyothi, M., S. MADAN MOHAN, and M. VASUDEVA NAIDU. "Fuel and energy efficient multi-stage parking structure for optimum space." *ijitr* 4, no. 5 (2016): 4203-4206.
6. Crisostomo, Chyn Ira C., Royce Val C. Malalis, Romel S. Saysay, and Renann G. Baldovino. "A multi-storey garage smart parking system based on image processing." In *2019 7th International Conference on Robot Intelligence Technology and Applications (RiTA)*, pp. 52-55. IEEE, 2019.
7. Hanzl, Jiří. "Parking information guidance systems and smart technologies application used in urban areas and multi-storey car parks." *Transportation Research Procedia* 44 (2020): 361-368.
8. Gindullina, Elvina, Sebastian Mortag, Maxim Dudin, and Leonardo Badia. "Multi-agent navigation of a multi-storey parking garage via game theory." In *2021 IEEE 22nd International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM)*, pp. 280-285. IEEE, 2021.
9. Kavitha, R., M. C. Sundarraja, M. Ram Vivekananthan, C. Vinodhini, P. Thiruvishnu, and P. Deepan. "Seismic analysis and design of multilevel car parking using ETABS." *Materials Today: Proceedings* 62 (2022): 2351-2356.
10. Alapure, Kiran, Sahil Chalke, Rutvik Khadape, and Jyoti Gole. "Analytical Study of PLC and Microcontroller Based Parking System." In *2023 9th International Conference on Electrical Energy Systems (ICEES)*, pp. 221-225. IEEE, 2023.





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