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# Automatic Car Parking By Using PLC

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***Abstract*: *Parking management has become a significant challenge in modern urban environments due to the rapid increase in the number of vehicles and the limited availability of parking spaces. In densely populated areas such as shopping malls, hospitals, educational institutions, business complexes, and residential buildings, drivers often face difficulty in finding vacant parking slots, which results in unnecessary fuel wastage, traffic congestion, time loss, and poor utilization of available space. To solve this problem, this paper proposes an automatic car parking system based on a Programmable Logic Controller (PLC), designed to automate the monitoring and control of vehicle parking operations. The system uses a set of sensors placed at the entry gate, exit gate, and individual parking slots to detect vehicle movement and slot occupancy in real time. The PLC continuously receives input signals from these sensors and executes the control logic required to regulate the parking process. If a vacant slot is available, the PLC automatically opens the gate and allows the vehicle to enter; if all slots are occupied, the system blocks entry and displays a full indication on the monitoring unit. The proposed model also updates the parking status dynamically so that drivers and operators can easily know the number of available spaces at any moment. This reduces human intervention, improves safety, and increases the efficiency of parking operations. The use of PLC makes the system highly reliable, flexible, and suitable for both single-level and multilevel parking structures. In addition, the system can be expanded in the future by integrating features such as digital displays, remote monitoring, billing control, RFID access, and IoT-based supervision.***

***Therefore, the proposed PLC-based automatic car parking system offers a practical, economical, and intelligent solution for modern parking management problems.***

***Keywords:** PLC , Automatic Car Parking , Sensor-Based Control , Ladder Logic , Parking Automation , Smart Parking*

## I. INTRODUCTION

In modern cities, the number of vehicles is increasing at a very fast rate, while the availability of parking spaces remains limited. This imbalance has created serious parking problems in commercial areas, residential complexes, hospitals, shopping malls, colleges, office buildings, and other crowded places. Drivers often spend a considerable amount of time searching for a vacant parking slot, which leads to traffic congestion, fuel wastage, unnecessary stress, and poor use of available space. In many places, parking is still managed manually, which makes the process slow, inefficient, and dependent on human supervision. Because of this, there is a strong need for an intelligent parking management system that can automatically control the entry, exit, and occupancy of vehicles.

To overcome these difficulties, automation has become an effective solution. An automatic car parking system is designed to detect available slots, guide vehicles properly, and control parking operations without continuous human intervention. Among different control technologies, a Programmable Logic Controller (PLC) is widely used because it is reliable, durable, and suitable for sequential control applications. PLCs are commonly used in industrial automation because they can handle multiple inputs and outputs, process logic quickly, and operate safely in demanding environments. In a parking system, the PLC receives signals from sensors placed at the entry gate, exit gate, and parking slots, and then makes decisions based on the parking status.

The basic idea of this system is to monitor the number of available parking spaces in real time and regulate the movement of vehicles accordingly. When a vehicle arrives at the entrance, the sensor sends a signal to the PLC. If parking space is available, the PLC activates the gate and allows the vehicle to enter. If all slots are occupied, the system prevents entry and displays that the parking area is full. At the same time, the system updates the slot count so that the current parking status is always known. This reduces confusion for drivers and helps parking operators manage the area more efficiently.

The use of sensors and PLC together makes the system highly effective for automation. Sensors help in identifying the presence or absence of vehicles, while the PLC performs the control logic and decision-making process. This combination reduces manual errors, increases accuracy, and improves the overall speed of parking operations. It also makes the system suitable for small parking areas as well as large multilevel parking structures. In addition, the system can be expanded with features such as digital displays, alarms, billing units, RFID access, and remote monitoring, making it more useful in smart city applications.

Another important aspect of the system is that it provides a structured way to manage parking space without relying on manual supervision. By using PLC control and sensor-based detection, the system can respond quickly to vehicle movement and maintain the correct parking status at all times. This makes the parking process more efficient, reduces waiting time at the gate, and improves the overall user experience.

## II. MATERIAL AND METHODS

### *A. Delta DVP-ES2 Series*

The main controller used in this project is the Delta DVP-ES2 series PLC, which is a compact programmable logic controller designed for basic sequential control applications. It is suitable for automation projects that require reliable input and output handling, such as vehicle detection, gate control, counter operation, and status indication in a parking system. The ES2 series is economical, efficient, and widely used in small industrial and educational automation projects.


Figure Delta PLC

The Delta DVP-ES2 PLC supports a variety of I/O configurations, which makes it flexible for different project needs. It provides enough digital inputs and outputs for connecting sensors, indicators, relays, and gate control devices. This flexibility is useful in a car parking system because the controller can easily process entry and exit signals and operate the required outputs according to the programmed logic.

Another important feature of the Delta DVP-ES2 series is its fast execution speed and reliable ladder logic performance. Since parking automation depends on quick response to sensor signals, the PLC must be able to process inputs without delay. The ES2 series is well suited for such applications because it is designed for sequential control and can handle timer and counter-based operations effectively.

The PLC also supports communication and expansion features, which make it useful for future upgrades. If additional sensors, modules, or monitoring functions are needed later, the system can be expanded without replacing the entire controller. This makes the Delta DVP-ES2 series a practical choice for both prototype development and future improvement of the parking system.

### *B. DC Motor*

The DC motor is used in the project to operate the parking gate or barrier mechanism. It converts electrical energy into mechanical motion, which helps in opening and closing the gate automatically when the PLC gives the control signal.

In a PLC-based parking system, the DC motor is generally selected because it is simple, easy to control, and suitable for low-speed, high-torque applications. A geared DC motor is especially useful for gate movement because it can provide smooth motion with enough force to lift or lower the barrier.

When the entry sensor detects a vehicle and the PLC allows access, the motor rotates in the required direction to open the gate. After the vehicle passes, the PLC stops or reverses the motor command so that the gate returns to its closed position.

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Figure DC Motor

The DC motor is an important part of the Material and Methods section because it represents the actuator of the system. Without this component, the parking system would only detect vehicles but would not be able to physically control entry and exit.

*C. Proximity Sensor*

The proximity sensor is used in the parking system to detect the presence of a vehicle without physical contact. It sends a signal to the PLC whenever a car comes near the sensor range, so the controller can decide whether to open the gate, count the vehicle, or update the parking status. In automation projects, proximity sensors are preferred because they are fast, reliable, and suitable for repeated operation.

For a PLC-based car parking system, a proximity sensor is important because it helps in accurate vehicle detection at the entry and exit points. Depending on the type used, it can detect metal objects, moving vehicles, or nearby obstacles. This makes it useful for controlling the parking sequence and preventing incorrect counting or gate operation..

Figure Proximity Sensor

A proximity sensor works by detecting the presence of a nearby object and sending an electrical signal to the PLC. In this project, it helps identify when a vehicle reaches the entry or exit point, allowing the controller to perform the next action in the sequence. Because it does not require direct contact, the sensor reduces wear and improves the reliability of the parking system.

The proximity sensor is an important part of the material list because it ensures smooth automation and accurate detection. In a parking system, even a small delay or wrong signal can affect the gate operation and vehicle count, so using a proper sensor improves the overall performance of the project.

*D. SMPS*

The SMPS or Switching Mode Power Supply is used in the project to provide a stable DC voltage required for the PLC and other control components.

It converts the available AC supply into a regulated DC output so that the electronic parts of the system can operate safely and reliably. In automation projects, a stable power source is very important because fluctuating voltage may affect the performance of the controller and sensors.

Figure SMPS

In the PLC-based car parking system, the SMPS supplies power to the PLC, proximity sensors, relay modules, and indicator devices. Since these components need a consistent voltage level, the SMPS helps maintain proper working conditions throughout the operation. It also improves the overall safety of the system by reducing the risk of voltage variation and component damage.
Another important advantage of the SMPS is its high efficiency and compact size. Compared to traditional power supplies, it generates less heat and takes up less space, which makes it suitable for project models and control panels. This makes installation easier and helps keep the control circuit neat and organized.
The SMPS is an essential part of the material list because it ensures uninterrupted power delivery to the system. Without it, the PLC and connected devices may not function properly, leading to incorrect sensor response or gate operation. Therefore, the SMPS plays a key role in the smooth and reliable functioning of the automatic car parking system.

*E. LED INDICATOR*

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## III. PRACTICAL IMPLEMENTATION

The practical implementation of the PLC-based automatic car parking system begins with assembling all the required hardware components on the prototype model. The main controller, which is the Delta DVP-ES2 PLC, is connected to the input sensors, output indicators, gate motor, and power supply unit. Proper wiring is done to ensure that each device receives the correct signal and works in coordination with the programmed logic. This forms the basic structure of the parking automation setup.
After assembling the hardware, the ladder logic program is written according to the required parking sequence. The program is designed to detect vehicle entry and exit, count the number of occupied slots, and control the gate movement based on the availability of parking space. If a vehicle enters and parking space is available, the PLC gives a signal to open the gate and allow the vehicle to pass. Once the vehicle crosses the sensor, the gate closes automatically and the count is updated

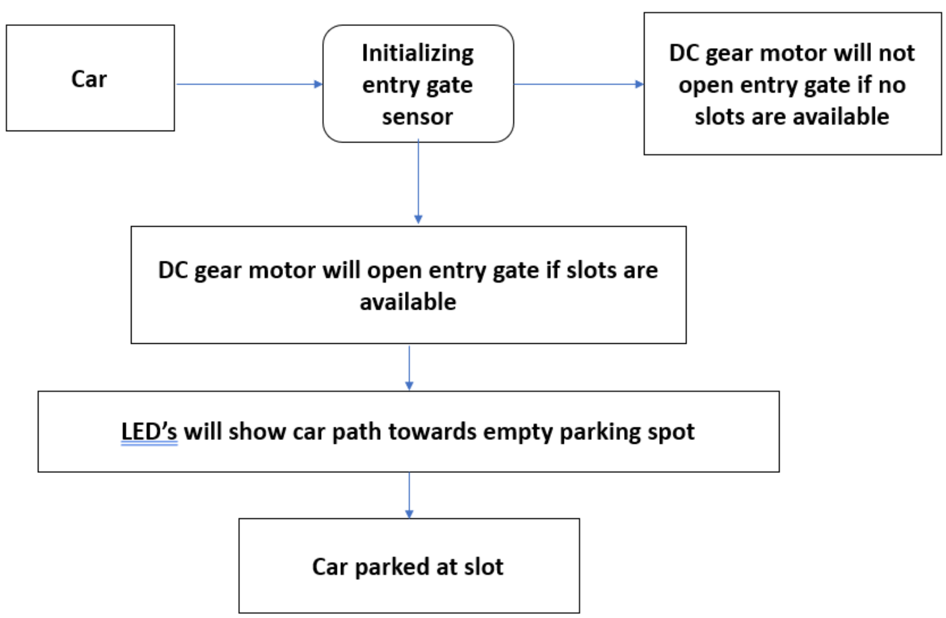

Figure Block Diagram of Entry Mechanism

The input section of the system mainly consists of proximity sensors placed at the entry and exit points. These sensors detect the presence of a vehicle without physical contact and send signals to the PLC. The controller processes these signals instantly and decides the next action according to the logic programmed in the ladder diagram. This makes the system more accurate and reduces the chance of human error.
The output section includes the DC motor for gate operation and the LED indicators for displaying parking status. The motor is used to open and close the gate whenever a vehicle is allowed to enter or leave the parking area. The LED indicators show whether the parking space is available, occupied, or full. These visual signals help drivers understand the parking condition easily.

A stable SMPS is used to supply regulated DC power to the PLC and other electronic components. The power supply is important because all control elements need a constant voltage to work properly. If the supply is unstable, the sensors and controller may not operate correctly, which can affect the performance of the parking system. Therefore, proper power management is essential in practical implementation.

Once the wiring and programming are completed, the entire system is tested step by step. The entry and exit conditions are checked, and the output response is observed to confirm proper operation. If the count changes correctly and the gate moves as expected, the system is considered ready for use. This testing phase helps identify and correct any wiring or logic errors before final deployment.

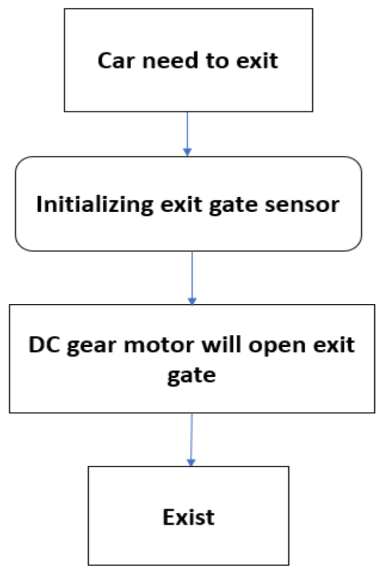


Figure Block Diagram Of Exit Mechanism

The exit mechanism in the PLC-based automatic car parking system is used to detect when a vehicle leaves the parking area and to update the parking count accordingly. It works with a sensor placed near the exit point, which senses the movement or presence of the vehicle and sends a signal to the PLC. Based on this input, the PLC activates the required output logic to allow the vehicle to leave safely and to reduce the occupied slot count by one.

When a vehicle approaches the exit sensor, the PLC receives the signal and checks the current parking status. If the system is operating normally, it allows the exit sequence to continue and updates the counter after the vehicle crosses the exit point. This helps maintain accurate record of how many vehicles are currently inside the parking area. The exit process is important because it ensures that the parking availability is always shown correctly.

The exit mechanism also works with the gate or barrier control system. If a barrier is used at the exit, the PLC can command the gate to open for a fixed time and then close automatically after the vehicle has passed. This improves safety and prevents unnecessary delay for the driver. It also keeps the flow of vehicles smooth and organized.

In the practical implementation, the exit mechanism is an essential part of the overall parking automation process. Without it, the system would not be able to reduce the occupied count correctly, and the parking status would become inaccurate over time. Therefore, the exit mechanism plays a key role in ensuring reliable operation of the automatic car parking system.

## IV. SIMULATION AND TESTING.

Simulation and testing are important stages in the development of the PLC-based automatic car parking system. In this project, WPLSoft software is used for programming and simulating the Delta PLC. It helps in creating the ladder logic, checking the operation of timers and counters, and verifying whether the inputs and outputs work correctly before the actual hardware implementation.

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During simulation, the ladder program is tested step by step to observe the response of the entry sensor, exit sensor, gate control, and parking indicators. WPLSoft makes it possible to check the logic for vehicle entry, vehicle exit, full parking condition, and available slot indication. This helps in identifying and correcting errors in the program at an early stage.

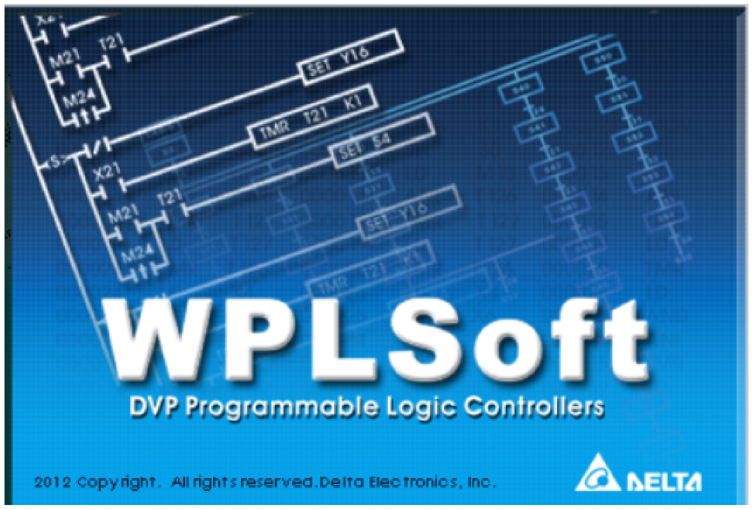


Figure WPL Software

The software is also useful for monitoring the working of the Delta DVP-ES2 PLC during testing. It allows the user to confirm whether the PLC receives the input signals properly and gives the correct output response according to the programmed sequence. This improves the reliability of the system and reduces mistakes during practical implementation.

Therefore, WPLSoft plays an important role in both simulation and testing of the automatic car parking system. It ensures that the PLC program is accurate, the control logic is working properly, and the final hardware setup will perform as expected.

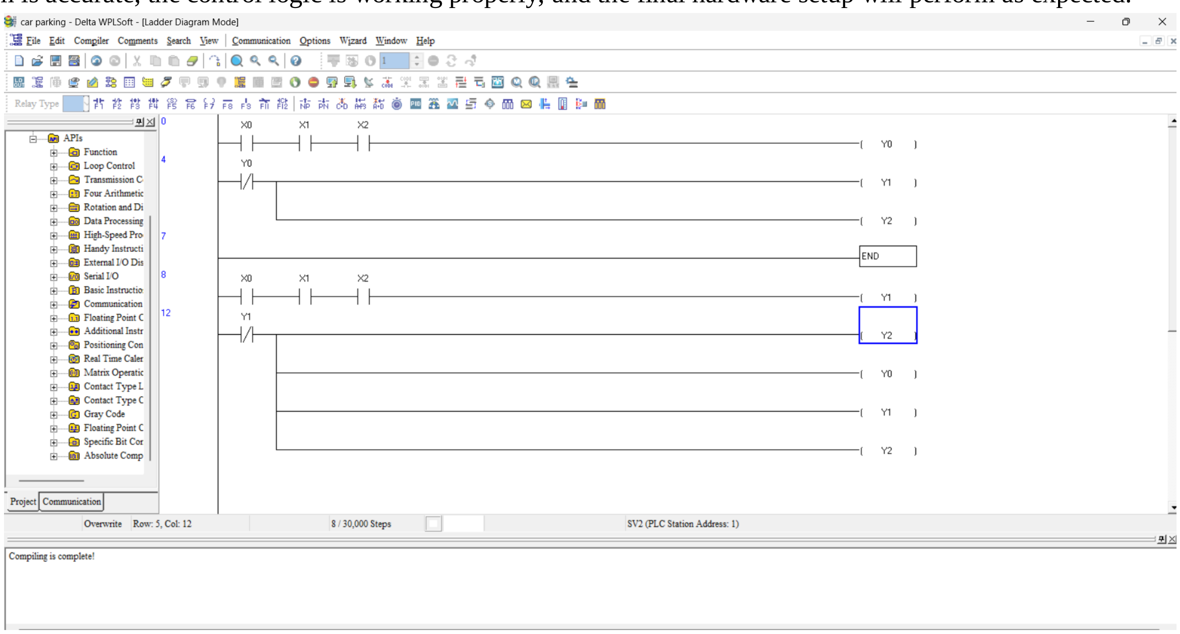


Figure Ladder Logic Programming

In the simulation stage, the program is loaded into WPLSoft and checked for correct ladder logic execution. The software allows the user to observe how the PLC responds when the entry and exit sensors are activated. This helps confirm that the gate opens and closes at the right time and that the parking count changes properly according to the input signals.

Testing is also carried out by applying different conditions such as vehicle arrival, vehicle departure, full parking, and empty parking. WPLSoft makes it easier to verify whether the PLC gives the expected output in each case. If any error is found in the logic, the program can be modified immediately and tested again until the desired result is achieved.

The use of WPLSoft in simulation and testing improves the accuracy and reliability of the whole project. It reduces the risk of mistakes in the final hardware setup and gives confidence that the automatic car parking system will work correctly in real operation.

## V. RESULTS AND DISCUSSION

The results and discussion of the PLC-based automatic car parking system show that the system worked effectively during simulation and testing. When a vehicle entered the parking area, the sensor detected its presence and sent a signal to the PLC, which opened the gate and increased the parking count correctly. After the vehicle passed through, the gate closed automatically, proving that the entry sequence was functioning as intended. Similarly, when a vehicle exited, the system reduced the occupied slot count and updated the parking availability properly, which confirmed that the exit logic was also working correctly. The full parking condition was tested successfully as well, and when the preset limit was reached, the system blocked further entry and activated the full indication. This showed that the PLC program was able to manage the parking area in an organized and reliable manner. The discussion of these results also highlights the advantages of using PLC control in parking management because it is simple, efficient, and reduces manual effort and human error. Since the logic is based on sensors, counters, and timers, the parking process becomes more accurate and faster than a manual system. The simulation also showed that the design can be modified easily if the parking capacity or control requirements change in the future. Overall, the results confirm that the PLC-based automatic car parking system is a successful automation project that meets its objectives and provides a practical solution for modern parking control.

The results and discussion of the PLC-based automatic car parking system show that the system performed successfully during testing and simulation. The sensors detected the arrival and departure of vehicles accurately, and the PLC responded by controlling the gate mechanism and updating the parking count in the proper sequence. The system also handled the parking full condition correctly by stopping further entry when the maximum limit was reached. This confirms that the control logic was implemented properly and that the automation process worked as intended.

The discussion of these results indicates that the system is both practical and reliable for parking management. It reduces the need for manual supervision, improves efficiency, and minimizes human error in controlling vehicle movement. The use of PLC, timers, counters, and sensors makes the system easy to operate and modify according to future requirements. Therefore, the project demonstrates that PLC-based parking automation is an effective solution for modern vehicle management.

The results and discussion further confirm that the PLC-based automatic car parking system is efficient, accurate, and suitable for real-time parking control. During operation, the system responded quickly to sensor inputs, maintained proper vehicle counting, and ensured smooth gate control without delay. This shows that the overall design is dependable and capable of handling parking operations in a systematic way.

## VI. CONCLUSIONS

The PLC-based automatic car parking system has successfully shown how automation can be used to manage vehicle entry, exit, and parking slot counting in a simple and reliable way. The project replaces manual supervision with a programmed control system that responds automatically to sensor inputs, making the parking process faster, more accurate, and more organized. By using a PLC, the system is able to handle sequential operations such as gate opening, vehicle detection, slot counting, and full-parking indication in a structured manner. This not only improves efficiency but also reduces the chances of human error, congestion, and delay at the parking entrance. The simulation and testing results confirm that the system performs correctly under different conditions, which proves that the design is practical and dependable for real use. In addition, the project has strong educational value because it provides practical experience in PLC programming, ladder logic, sensor interfacing, timers, and counters. It also creates a good foundation for future improvements such as RFID access, IoT monitoring, digital payment, and smart display features. Overall, the system is a useful example of industrial automation applied to a common real-world problem, and it demonstrates that PLC-based solutions can make parking management more efficient, safe, and intelligent.

## VII. ACKNOWLEDGMENT

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