REVA UNIVERSITY
Bengaluru, India

Mini - Project REPORT

BACHELOR OF TECHNOLOGY
in
ELECTRICAL AND ELECTRONICS ENGINEERING

Report submitted
by

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6TH SEMESTER

Vehicle Parking System

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CERTIFICATE

This is to certify that the "**Mini Project Report"** submitted by **Hemanth H K (R22EM032)** is work done by him and submitted during 2025 academic year, in partial fulfillment of the requirements for the academics of **BACHELOR OF TECHNOLOGY** in **ELECTRICAL AND ELECTRONICS** at **REVA University**

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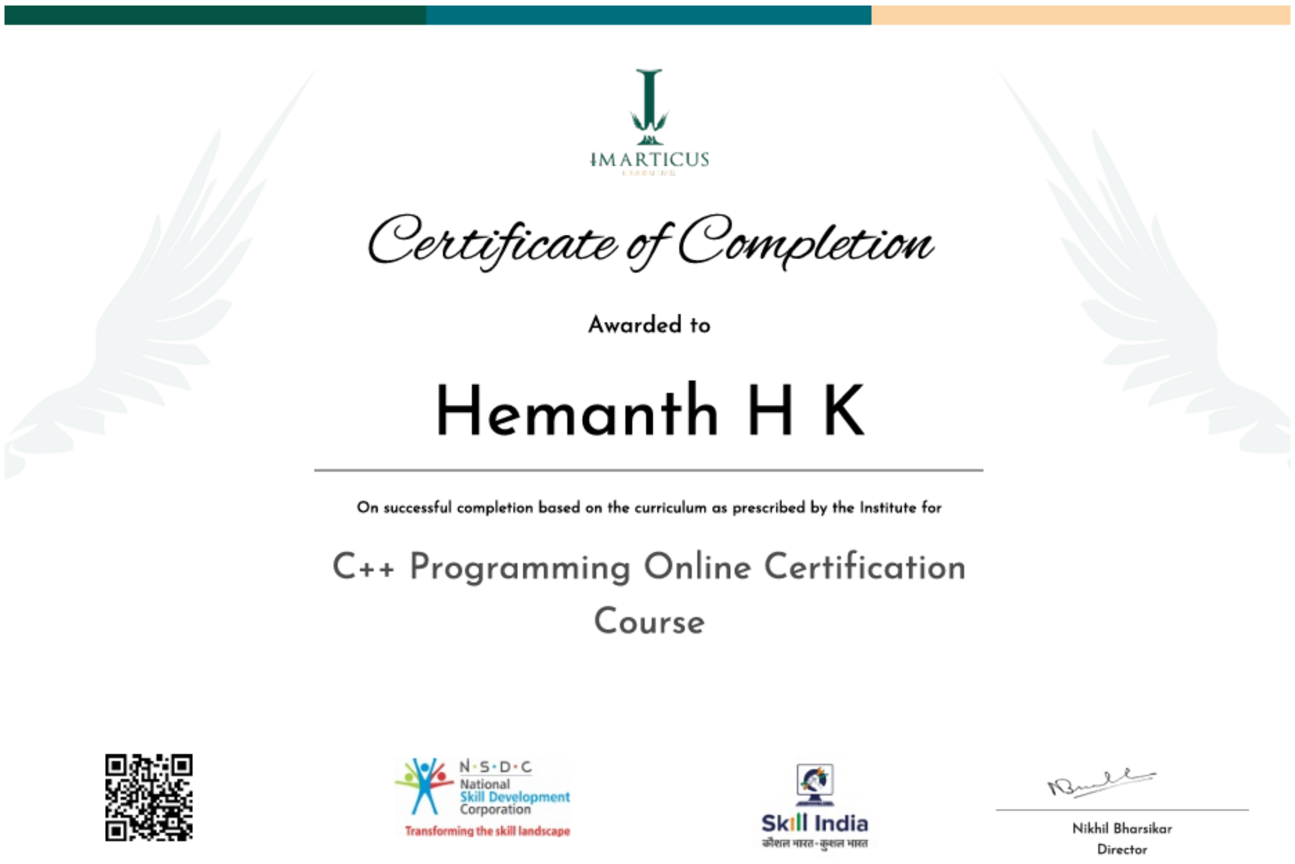

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ABSTRACT

The Vehicle Parking System project aims to provide an efficient solution for managing vehicle parking using C++. The system enables users to park and remove vehicles while maintaining a structured record of vehicle details. The project is developed to streamline the parking process and reduce human intervention.

The system operates with a menu-driven approach where users can perform operations such as vehicle entry, exit, and status checks. The methodology involves defining Vehicle and ParkingLot classes that handle the parking functionalities. The project ensures optimal space utilization and prevents overcrowding. Testing confirmed that the system effectively registers and removes vehicles while maintaining records.

The project successfully demonstrates a practical parking system with scope for future enhancements, such as database integration and RFID-based authentication for better security and long-term data management

INTRODUCTION

Parking management is crucial in urban areas where space is limited. With increasing vehicle numbers, it is essential to have an automated system that helps in the efficient management of parking spaces. Traditional parking systems require manual tracking, which can be inefficient and prone to errors.

The **Vehicle Parking System** is designed to automate the process of vehicle parking using **C++**. This system helps keep track of parked vehicles, ensures optimal utilization of available spaces, and facilitates easy vehicle entry and exit. The system also reduces human intervention, thereby improving efficiency and minimizing parking-related issues.

This project aims to provide a simple yet effective system that allows users to add, remove, and view parked vehicles through a menu-driven interface. It is designed for small to medium-scale parking areas, such as office complexes, shopping malls, and residential communities. By implementing basic functionalities like space tracking and vehicle registration, this system improves the overall parking experience.

Objectives:

- To develop a user-friendly parking management system.
- To ensure efficient space utilization.
- To track vehicle entry and exit records.
- To minimize manual intervention and improve parking efficiency.
- To provide a scalable solution for small to medium-sized parking lots.

METHODOLOGY

1. **Requirement Analysis**: Understanding parking requirements by surveying parking spaces, user needs, and challenges in traditional parking systems.
2. **System Design**: Developing detailed flowcharts, defining system requirements, and outlining the functionalities required for an efficient parking system.
3. **Software and Hardware Considerations**: Identifying the software tools used (C++ compiler, IDE) and considering potential hardware integrations such as RFID, sensors, or camera-based monitoring systems.
4. **Implementation**: Writing the C++ code to handle parking operations using Object-Oriented Programming concepts to ensure modularity and scalability.
5. **Testing & Debugging**: Running test cases to ensure efficiency and reliability of the system, including boundary testing, error handling, and stress testing for handling multiple vehicle entries and exits.
6. **Performance Evaluation**: Analysing the system performance under various conditions to determine responsiveness, efficiency, and user experience.
7. **User Feedback & Optimization**: Gathering user feedback and making necessary improvements to enhance usability and effectiveness.

IMPLEMENTATION

The implementation of the **Vehicle Parking System** is carried out using **C++** with Object-Oriented Programming concepts. The system is designed to be modular, efficient, and user-friendly.

1. **Defining Classes and Objects**:
   - Vehicle class to store vehicle details such as number plate and type.
   - ParkingLot class to manage parking slots, add/remove vehicles, and display the parking status.
2. **Creating a Menu-Driven Interface**:
   - A user-friendly menu to perform parking operations such as adding, removing, and displaying parked vehicles.
3. **Data Storage and Management**:
   - Using an array or vector to store parked vehicle data dynamically.
   - Ensuring efficient searching and deletion of records.
4. **Error Handling and Validation**:
   - Implementing boundary checks to ensure vehicles are added only when space is available.
   - Providing appropriate messages for incorrect or unavailable vehicle numbers.
5. **Testing and Optimization**:
   - Running various test cases to check the system's stability under different conditions.
   - Optimizing data handling for better performance.
6. **Future Enhancements**:
   - Implementing a database for long-term storage.
   - Enhancing user experience with a graphical user interface (GUI).
   - Integrating RFID or camera-based vehicle recognition for automation.

RESULTS

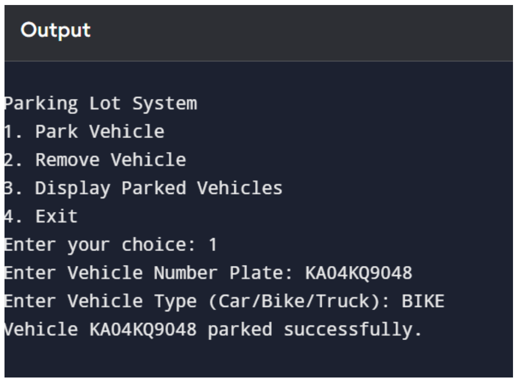
The system was tested with different inputs, and it successfully performed parking operations within a set capacity. Outputs include:

1. **Adding a Vehicle:** Successfully registers vehicle entry.
2. **Removing a Vehicle:** Deletes vehicle records from the system.
3. **Displaying Vehicles:** Lists all currently parked vehicles.
4. **Parking Lot Capacity Handling:** The system prevents additional vehicles from entering when the lot is full.
5. **Invalid Entry Handling:** Ensures that incorrect or duplicate vehicle entries are not recorded.
6. **Performance Efficiency:** The system processes vehicle entries and exits in real time without significant delay.
7. **User-Friendly Interface:** The menu-driven interface simplifies interactions for users, ensuring ease of operation.
8. **Future Scalability:** The project lays a foundation for further enhancements such as database storage, automated ticketing, and mobile app integration.

CODE

```
#include <iostream>
#include <vector>
#include <string>
using namespace std;

class Vehicle {
public:
    string numberPlate;
    string type;

    Vehicle(string num, string t) : numberPlate(num), type(t) {}
};

class ParkingLot {
private:
    vector<Vehicle> vehicles;
    int capacity;
public:
    ParkingLot(int cap) : capacity(cap) {}
    bool addVehicle(string numberPlate, string type) {
        if (vehicles.size() >= capacity) {
            cout << "Parking is full!\n";
            return false;
        }
        vehicles.push_back(Vehicle(numberPlate, type));
        cout << "Vehicle " << numberPlate << " parked successfully.\n";
        return true;
    }
    bool removeVehicle(string numberPlate) {
        for (size_t i = 0; i < vehicles.size(); ++i) {
            if (vehicles[i].numberPlate == numberPlate) {
                vehicles.erase(vehicles.begin() + i);
                cout << "Vehicle " << numberPlate << " removed successfully.\n";
                return true;
            }
        }
        cout << "Vehicle not found!\n";
        return false;
    }
    void displayVehicles() {
        if (vehicles.empty()) {
            cout << "No vehicles parked.\n";
            return;
        }
        cout << "Currently Parked Vehicles:\n";
        for (const auto& v : vehicles) {
            cout << "Number Plate: " << v.numberPlate << ", Type: " << v.type << "\n";
        }
    }
};

int main() {
    ParkingLot lot(5);
    int choice;
    string numPlate, type;

    do {
        cout << "\nParking Lot System\n";
        cout << "1. Park Vehicle\n";
        cout << "2. Remove Vehicle\n";
        cout << "3. Display Parked Vehicles\n";
        cout << "4. Exit\n";
        cout << "Enter your choice: ";
        cin >> choice;

        switch (choice) {
            case 1:
                cout << "Enter Vehicle Number Plate: ";
                cin >> numPlate;
                cout << "Enter Vehicle Type (Car/Bike/Truck): ";
                cin >> type;
                lot.addVehicle(numPlate, type);
                break;
            case 2:
                cout << "Enter Vehicle Number Plate to Remove: ";
                cin >> numPlate;
                lot.removeVehicle(numPlate);
                break;
            case 3:
                lot.displayVehicles();
                break;
            case 4:
                cout << "Exiting...\n";
                break;
            default:
                cout << "Invalid choice, try again!\n";
        }
    } while (choice != 4);

    return 0;
}
```

0UTPUT:



```
Output

arking Lot System
. Park Vehicle
. Remove Vehicle
. Display Parked Vehicles
. Exit
nter your choice: 1
nter Vehicle Number Plate: KA04KQ9048
nter Vehicle Type (Car/Bike/Truck): BIKE
ehicle KA04KQ9048 parked successfully.
```

CONCLUSION

The **Vehicle Parking System** successfully manages parking operations using C++. The system efficiently tracks vehicle entry and exit while maintaining a user-friendly interface. The project provides a robust and structured approach to vehicle management and has the potential to be expanded with additional features.

Future improvements could include:

- Implementing a **graphical interface** to enhance user experience.
- Adding a **database** for long-term storage and retrieval of parking records.
- Enhancing security features such as **RFID-based authentication** and **license plate recognition** for automated access control.
- Integrating **mobile application support** to allow users to check parking availability in real-time.
- Developing an **automated payment system** for parking fees, integrating digital wallets and card payments.

The project highlights the importance of efficient parking management and demonstrates how a structured system can streamline operations. With further research and technological integration, this system could serve as a foundation for a smart parking solution adaptable to large-scale urban environment

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