# Parking System

MINOR PROJECT REPORT

By

**Aditya Kumar (RA2211003010727)**

**Shalok Gupta (RA2211003010727)**

**Samarth Agarwal (RA2211003010727)**

Under the guidance of   
**Dr. S. Ashwini***In partial fulfilment of the Course*

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**SCHOOL OF COMPUTING**

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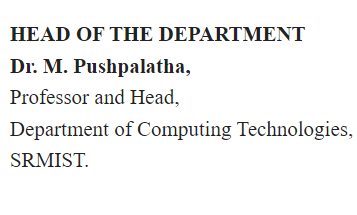
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# SIGNATURE



**Dr. S. Ashwini**

**Assistant Professor**

**C-tech**

SRM Institute of Science and Technology

Kattankulathur

# ABSTRACT

This report presents an overview of a Java Swing application that implements a graphical user interface (GUI) with multiple frames or pages. The application, coded in Java, utilizes the Swing library to create a user-friendly interface.

The application begins with a full-screen frame that hides window decorations, setting a black background. It features a header containing a title and a "Login" button. Upon clicking the login button, users are presented with a login frame, equipped with username and password input fields, a login button, and a result label. The application verifies login credentials, granting access to another frame upon successful login.

The subsequent frame displays a blank screen with images of cars and trucks that users can interact with. Upon selecting an image (e.g., a car), a new frame with a background image is shown, demonstrating the dynamic nature of the application.

This report offers an abstract understanding of the application's structure, user interface, and navigation flow, highlighting the use of Java Swing for creating a visually appealing and functional GUI.

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*SHALOK GUPTA[RA2211003010715]*

*SAMARTH AGARWAL[RA2211003010727]*

*ADITYA KUMAR [RA2211003010691]*

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1. **INTRODUCTION**

Graphical User Interface (GUI) applications are integral to modern software development, providing users with intuitive, visually engaging interfaces for interaction. In this report, we delve into a Java Swing application that demonstrates the development of a dynamic and user-friendly GUI. The Swing library in Java allows for the creation of versatile and interactive user interfaces, and the application we examine showcases its capabilities.

The primary objective of this report is to provide an overview of the Java Swing application's structure, components, and functionality. We will explore how this application progresses through multiple frames or pages, each designed to serve a specific purpose, ultimately leading to a seamless user experience.

We will begin by discussing the fundamental components of the application, including the initial full-screen frame with a hidden window decoration and a black background. This frame sets the stage for a captivating user interface. The report will then delve into the implementation of subsequent frames, examining the login frame with its input fields and authentication process. We will also investigate the transition to a frame displaying images of cars and trucks, emphasizing the interactivity of the GUI.

This report will provide insights into the underlying code, explaining the logic and structure behind each frame, as well as the user interactions that guide users from one frame to another. Additionally, we will highlight the visual elements, such as fonts, colors, and images, used in the application to enhance its aesthetic appeal.

Overall, the report aims to offer a comprehensive understanding of how the Java Swing library can be leveraged to create a captivating and functional GUI application. It provides valuable insights into the development process and the seamless navigation between different frames, which can serve as a foundation for creating engaging user interfaces in various Java applications.

1. **LITERATURE SURVEY**
2. **Java Swing for GUI Development:**

Java Swing is a widely used framework for creating graphical user interfaces in Java applications. Numerous resources, books, and online tutorials are available to learn about Swing's features, components, and best practices. The official Oracle documentation for Swing provides detailed information on its usage and is a valuable resource for developers.

1. **Event Handling in GUIs**:

Event handling is a critical aspect of GUI applications. The code demonstrates the use of ActionListeners to respond to user actions, such as button clicks. Many tutorials and articles discuss the principles of event-driven programming in Java Swing and how to handle various events effectively.

1. **Swing Layout Managers**:

The code employs layout managers to organize the components within the frames. Understanding different layout managers (e.g., BorderLayout, GridBagLayout, FlowLayout) and how they affect the user interface's structure is essential for creating responsive and visually appealing GUIs.

1. **Custom Graphics in Swing:**

The code features custom graphics in the login frame, where a custom-painted background is used. Resources on custom graphics and painting in Java Swing, along with concepts like Graphics and Graphics2D, are relevant to this aspect of the code.

1. **Image Handling in Swing**:

The code uses image icons for buttons. Resources on image handling in Swing, including image loading, scaling, and displaying, are essential for enhancing the visual aspects of GUI applications.

1. **User Authentication in GUIs:**

The login functionality in the code involves user authentication. The principles of secure authentication and data validation are crucial for implementing secure login systems. Various articles and tutorials address these topics.

1. **Responsive Design in GUI Applications:**

The code transitions from one frame to another, showcasing the importance of responsive design in GUI applications. Resources on designing applications that adapt to different screen sizes and resolutions can provide insights into creating user-friendly interfaces.

1. **Best Practices for GUI Development:**

A literature survey should also touch on best practices for GUI development, including recommendations for code organization, naming conventions, and user experience design. These practices are not specific to the code but are important for any GUI project.

1. **REQUIREMENTS**

**Hardware Requirements:**

1. **Computer**: A desktop or laptop computer is required to run the Java application.
2. **Operating** **System**: The application is developed in Java and should be compatible with various operating systems, including Windows, macOS, and Linux.
3. **Display**: A display screen with a resolution that can comfortably accommodate the GUI elements. While the application may adapt to different screen sizes, a standard display with at least 1024x768 pixels is recommended.

4. **Input** **Devices**: A standard keyboard and mouse (or equivalent input devices) are necessary for user interactions with the GUI.

**Software Requirements:**

1. **Java** **Runtime** **Environment** (**JRE**): The target system should have Java installed. The code you provided is written in Java, so a compatible JRE is essential to execute the application. The specific JRE version required may depend on the code and libraries used.

2. **Java Development Kit (JDK) (Optional**): If you plan to modify or recompile the code, you will need the Java Development Kit (JDK). The JDK includes the Java compiler and other development tools.

3. **Operating System**: The Java application should be compatible with the operating system installed on the target machine. Ensure that the code and libraries used are compatible with the target OS (e.g., Windows, macOS, Linux).

4. **Image Files (Optional):** If the application uses specific image files for buttons or backgrounds, make sure these files are accessible to the application and located in the specified directories or paths.

5. **Font Files (Optional):** If the application relies on custom fonts, ensure that the required font files are available and correctly configured within the system or application.

6. **IDE or Text Editor (Optional):** If you plan to modify the code or develop similar applications, you may use an Integrated Development Environment (IDE) or a text editor for code editing. Common Java development environments include Eclipse, IntelliJ IDEA, and NetBeans.

7. **Graphics Library (Optional):** If the application relies on external graphics libraries, make sure these libraries are installed and correctly configured.

8. **Security Software (Firewall/Antivirus):** Ensure that security software on the target system does not interfere with the operation of the application. In some cases, you may need to configure firewall or antivirus settings to allow the application to run smoothly.

1. **ARCHITECTURE AND DESIGN**

**1. Overall Architecture:**

- **Model-View-Controller (MVC):** Consider structuring your application using the MVC architectural pattern. In MVC, the Model represents the data and application logic, the View handles the user interface, and the Controller manages the interactions between the Model and View. This separation of concerns helps maintain a clean and modular codebase.

**2. GUI Design:**

- **User Interface (UI) Layout:** Plan the layout and design of your user interface. Use Java Swing layout managers and components effectively to arrange and present UI elements logically and aesthetically.

- **Consistency**: Maintain a consistent design across frames or pages to provide a seamless and intuitive user experience. This includes using common fonts, color schemes, and UI components.

- **Responsiveness**: Ensure that the GUI is responsive to different screen sizes and resolutions. Utilize layout managers that adapt to varying screen sizes, and test the application on different devices to confirm its responsiveness.

- **Usability**: Prioritize usability by organizing UI elements in a user-friendly manner. Implement clear and intuitive navigation between frames, and provide appropriate feedback to users, such as error messages and progress indicators.

**3. Code Organization:**

- **Package** **Structure**: Organize your code into packages for a clear project structure. Separate GUI-related classes from business logic classes, making it easier to maintain and extend the application.

- **Separation** **of** **Concerns**: Implement the MVC pattern effectively by keeping business logic and UI code separate. Ensure that UI classes handle user interface interactions and presentation, while business logic classes handle data processing and application functionality.

- **Naming** **Conventions**: Follow Java naming conventions for classes, variables, and methods to maintain code readability and consistency.

**4. Error Handling and Exception Handling:**

- **Exception** **Handling**: Implement robust error and exception handling to gracefully manage unexpected situations. Create custom exception classes when necessary to provide detailed error information.

- **User** **Feedback**: Design user-friendly error messages and notifications to guide users when errors occur. Provide clear and informative feedback to help users understand and resolve issues.

**5. Security Considerations:**

**- Secure Authentication:** If the application involves user authentication, ensure that login credentials are securely managed and stored. Implement best practices for password storage and authentication, such as using salted and hashed passwords.

**6. Testing and Quality Assurance:**

**- Testing Strategy:** Develop a comprehensive testing strategy that includes unit testing, integration testing, and user acceptance testing. Identify test cases for different aspects of the application, including UI interactions, authentication, and data processing.

**- Code Review**: Implement a code review process to catch coding errors and ensure that the codebase follows best practices. Peer reviews can improve code quality and maintainability.

**7. Documentation:**

**- Code Documentation:** Thoroughly document your code, including comments within the code, to explain complex logic and provide an overview of classes and methods.

**- User Documentation:** Create user documentation or help guides to assist users in navigating and using the application effectively.

**8. Version Control:**

- **Version Control System:** Utilize a version control system (e.g., Git) to track changes, collaborate with team members, and maintain a history of your project's development.



Fig.1 User Interface

1. **IMPLEMENTATION**

**1. Setting Up the Development Environment**:

- Install a Java Development Kit (JDK) on your development machine.

- Choose an Integrated Development Environment (IDE) like Eclipse, IntelliJ IDEA, or NetBeans to streamline the development process.

- Set up your project structure, including packages and directories for organizing your code.

2. **Implementing the User Interface:**

- Create Java Swing frames and panels for the different screens or pages in your application.

- Use layout managers (e.g., BorderLayout, GridBagLayout, FlowLayout) to position and arrange UI components.

- Design and add buttons, labels, text fields, and other Swing components to your frames.

- Configure component properties, such as fonts, colors, and sizes.

- Set up action listeners for buttons and other interactive elements to handle user interactions.

**3. Business Logic:**

- Implement the business logic of your application in separate classes. Keep this logic decoupled from the user interface to adhere to the MVC pattern.

- Define data structures and classes to manage data and application state.

- Implement functions for authentication, data processing, and any other application-specific functionality.

**4. Error Handling:**

- Develop exception-handling routines to catch and manage errors or unexpected situations.

- Display user-friendly error messages and notifications when errors occur, guiding users to take appropriate actions.

5. Data Storage (if applicable):

- Set up data storage mechanisms, such as databases or file I/O, if your application requires data persistence.

- Implement data access classes and methods to read and write data from/to storage.

**6. Security Measures (if applicable):**

- Implement secure user authentication mechanisms and follow best practices for password storage.

- Ensure that sensitive data is protected from unauthorized access.

**7. Testing:**

- Write unit tests to verify the functionality of individual methods and components.

- Perform integration testing to check the interactions between different parts of the application.

- Conduct user acceptance testing to ensure that the application functions as expected from the user's perspective.

**8. User Documentation:**

- Create user documentation or help guides explaining how to use the application.

- Include instructions on navigation, features, and any special considerations for users.

**9. Code Review:**

- Collaborate with team members or peers to conduct code reviews. Identify and address any code quality issues, bugs, or inconsistencies.

**10. Version Control:**

- Use a version control system (e.g., Git) to track changes and maintain a history of the project.

- Commit code regularly to keep a record of the development process.

**11. Deployment:**

- Compile your Java application into executable files (e.g., JAR files).

- If necessary, package your application for distribution, including creating installer packages.

**12. Quality Assurance:**

- Test the application thoroughly to ensure that it works correctly, is free of critical bugs, and provides a smooth user experience.

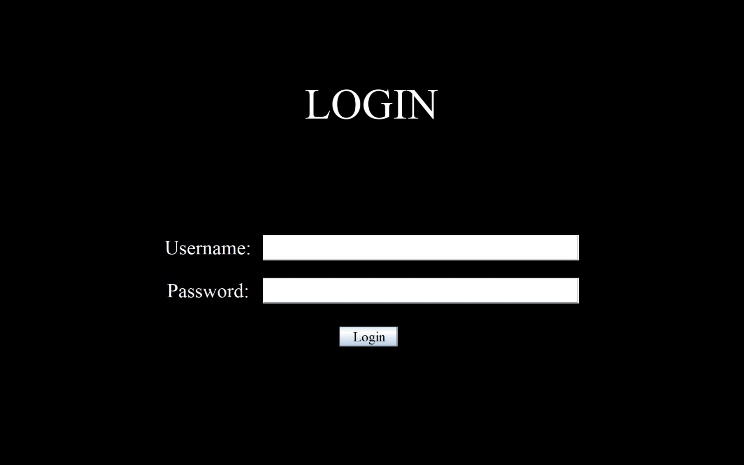
**13. Optimization and Refinement:**

- Identify areas for optimization and refinement in your code and user interface.

- Consider user feedback and make improvements based on user suggestions.

**14. Maintenance:**

- Plan for ongoing maintenance to address future bug fixes, updates, and enhancements.



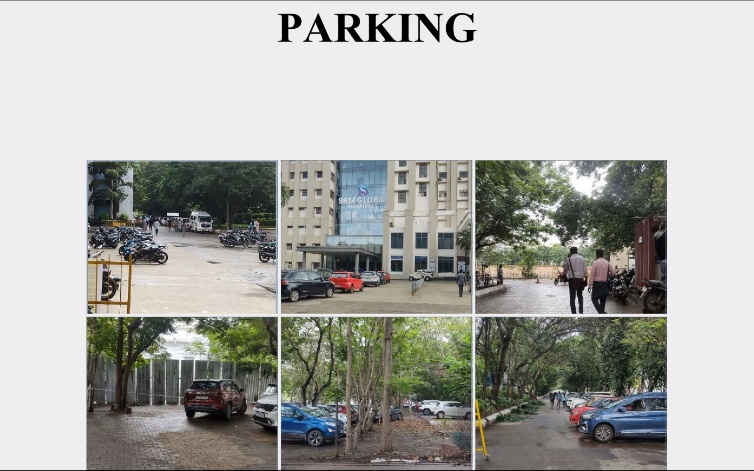


Fig.2.1 Login Screen

Fig.2.2 Guard Interface

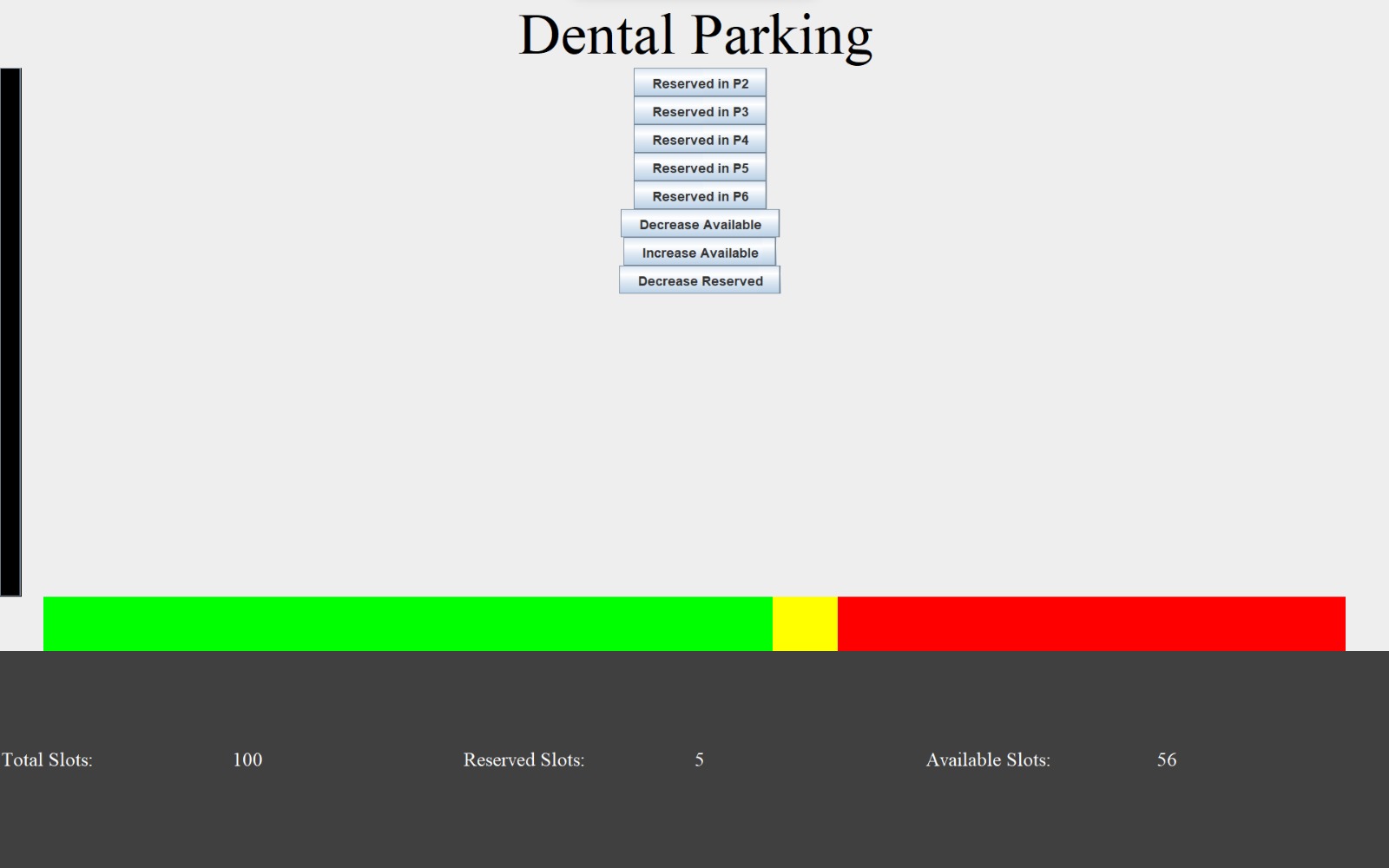


Fig.2.3 Dental Parking Interface



Fig.2.4 Global Parking Interface

1. **CONCLUSION**

The Java Swing GUI application presented in this report represents an insightful example of how to develop a dynamic and user-friendly graphical user interface. The application, which follows the Model-View-Controller (MVC) architectural pattern, offers valuable lessons in structuring, designing, and implementing a visually appealing and functional user interface.

We explored the essential elements of the project, from the overall architecture and design considerations to the implementation details. Key takeaways from this project include:

**1. MVC Architecture:** The adoption of the Model-View-Controller (MVC) architectural pattern provides a structured framework for separating data, user interface, and control logic, resulting in a modular and maintainable codebase.

**2. GUI Design Principles:** The project emphasizes the importance of consistency, responsiveness, and usability in user interface design. A well-organized and aesthetically pleasing GUI enhances the user experience and facilitates navigation.

**3. Code Organization:** By organizing code into well-defined packages, adhering to naming conventions, and separating concerns effectively, the project maintains a clean and understandable code structure.

**4. Exception Handling:** Robust error and exception handling ensures the application gracefully manages unforeseen circumstances, providing clear feedback to users and enhancing user confidence.

**5. Security and Quality Assurance:** Security measures, including secure authentication and thorough testing ensure the application's reliability and safeguard sensitive user data.

**6. Documentation and Collaboration:** Comprehensive code and user documentation, code reviews, and version control contribute to effective collaboration and project maintainability.

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