Maintenance and Support

The document establishes complete instructions to manage all aspects of maintaining software platforms for the Car Rental Management System including version control and system compatibility with previous releases. The system aims to achieve stability through scalability and maintainability in addition to user and administrative disruption reduction.

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1. Software Maintenance Strategies

1.1. Preventive Maintenance

- **Code Reviews**: The code review process should be performed frequently to find code issues and maintain superior quality standards and adhered coding practices.
- **Automated Testing**: The system will have enhanced quality through automated testing which includes unit tests and integration tests with end-to-end tests to discover bugs during early development phases.
- **Static Code Analysis**: Code inspection through static code analysis provides developers access to pylint or flake8 tools which detect common errors and security weaknesses alongside code odors.
- **Documentation**: The codebase demands updated documentation that consists of API documentation and developer guides in addition to user manuals.

1.2. Corrective Maintenance

- **Bug Tracking**: A bug tracking system like Jira or GitHub Issues serves users for both reporting and prioritizing along with solving bugs which appear through testing or user feedback.
- **Hotfixes**: Critical bugs require immediate hotfix releases to reduce user disruptions.
- **Root Cause Analysis**: Root Cause Analysis should be conducted on repeating problems to eliminate future occurrences.
- **1.3. Adaptive Maintenance**
- **Feature Enhancements**: The system development follows a solution-driven approach through user feedback collection for prioritizing new features and essential improvements.
- **Technology Updates**: The system remains updated through implementing new versions of libraries and frameworks and dependencies.
- **Scalability Improvements**: The system requires continuous performance monitoring to enable required adjustments when handling increased data volumes or user loads.

1.4. Perfective Maintenance

- **Code Refactoring**: The practice of code refactoring takes place repeatedly to enhance code readability and maintainability in addition to performance improvements.
- **Database Optimization**: Optimize database queries, indexing, and schema design to improve performance.
- **User Experience Improvements**: The application will achieve better user interfaces and experiences through continuing development based on user feedback.

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2. Versioning Strategy

2.1. Semantic Versioning (SemVer)

Adopt **Semantic Versioning** (MAJOR.MINOR.PATCH) to manage version numbers:

- **MAJOR**: Incremented for backward-incompatible changes (e.g., breaking changes in the API or database schema).
- **MINOR**: Incremented for new features or enhancements that are backward-compatible.
- **PATCH**: Incremented for backward-compatible bug fixes or minor improvements.

Example: v1.2.3 (MAJOR=1, MINOR=2, PATCH=3)

2.2. Version Control

- Use **Git** for version control and follow a branching strategy such as **Git Flow** or **GitHub Flow**:
    - **Main Branch**: Contains stable, production-ready code.
    - **Feature Branches**: Used for developing new features or enhancements.
    - **Hotfix Branches**: Used for urgent bug fixes that need to be deployed quickly.
- Tag releases with version numbers (e.g., v1.2.3) to easily track and deploy specific versions.

2.3. Release Notes

- Provide detailed **release notes** for each version, including:
    - New features and enhancements.
    - Bug fixes.
    - Known issues.
    - Instructions for upgrading (if applicable).

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3. Backward Compatibility Strategies

3.1. Database Compatibility

- **Schema Migrations**: Use database migration tools to manage schema changes.
    - Always provide backward-compatible migrations (e.g., add new columns instead of modifying existing ones).
    - Avoid dropping columns or tables in production without a proper deprecation period.
- **Data Backups**: Always back up the database before performing schema migrations.

3.2. Configuration Compatibility

- **Configuration Files**: Ensure that changes to configuration files (e.g., config.ini) are backward-compatible.
    - Provide default values for new configuration options.
    - Log warnings for deprecated configuration options and provide instructions for updating.

3.4. Code Compatibility

- **Deprecation Warnings**: Use deprecation warnings in the code to notify developers of upcoming changes.
- **Feature Flags**: Use feature flags to gradually roll out new features without breaking existing functionality.

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4. Implementation Plan

4.1. Phase 1: Initial Setup

- Set up version control (Git) and branching strategy.
- Implement automated testing and static code analysis.
- Document the current system architecture and codebase.

4.2. Phase 2: Maintenance and Monitoring

- Establish a bug tracking system and prioritize bug fixes.
- Monitor system performance and user feedback for potential improvements.
- Regularly update dependencies and libraries.

4.3. Phase 3: Versioning and Backward Compatibility

- Adopt Semantic Versioning and tag the first stable release (e.g., v1.0.0).
- Implement versioned APIs and database migration tools.

- Develop a deprecation policy for APIs, database schema changes, and configuration options.

4.4. Phase 4: Continuous Improvement

- Regularly refactor code and optimize database performance.
- Gather user feedback and prioritize new features or enhancements.
- Continuously improve documentation and user experience.

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5. Monitoring and Feedback

5.1. Monitoring

- Use monitoring tools (e.g., Prometheus, Grafana) to track system performance, errors, and usage patterns.
- Set up alerts for critical issues (e.g., database downtime, high error rates).

5.2. Feedback Loop

- Regularly collect feedback from users and stakeholders through surveys, interviews, or support tickets.
- Use feedback to prioritize maintenance tasks, new features, and improvements.