Software Requirements Specification (SRS) for Simple Robotics Simulation

1. Introduction

1.1 Purpose

The purpose of this document is to provide a comprehensive overview of the requirements for the development of the Simple Robotics Simulation application. This software aims to simulate the motion of a simple robot with two links, allowing users to visualize and understand basic robotics concepts.

1.2 Scope

The Simple Robotics Simulation app will allow users to input the lengths of two links and observe the robot's motion over a specified simulation time. The application will provide real-time visualization of the robot's movement, enhancing user understanding of robot kinematics.

1.3 Document Conventions

- UI: User Interface
- GUI: Graphical User Interface

2. Overall Description

2.1 Product Perspective

The Simple Robotics Simulation is a standalone MATLAB application developed using MATLAB's App Designer. It provides an interactive GUI for users to input parameters and visualize the simulated motion of a simple robot.

2.2 Product Features

2.2.1 Key Features

1. User Input:
   - Users can specify the lengths of two robot links through numeric input fields.

2. Simulation Control:
   - Simulate button triggers the robot motion simulation.
   - Pause button allows users to pause and resume the simulation.

3. Real-time Visualization:
   - The GUI displays real-time updates of the robot's movement in response to changing joint angles.

4. Error Handling:
   - Input validation ensures that link lengths are within the specified range (0.1 to 5).

- Clear error messages are displayed for invalid inputs.

2.2.2 Future Enhancements

1. Additional Joint Angles:
   - The application is structured to accommodate additional joint angles for future development.

2.3 User Classes and Characteristics

- Novice Users:
  - Users with minimal experience in robotics or MATLAB.
  - Require an intuitive and user-friendly interface.

- Educational Users:
  - Students and educators using the application for learning and teaching purposes.
  - Seek a tool to visually comprehend basic robot kinematics.

3. Functional Requirements

3.1 User Input

1. Link Length Input:
   - Users can input the lengths of two robot links.
   - Input fields should validate and restrict values within the range of 0.1 to 5.

3.2 Simulation Control

2. Simulation Button:
   - Clicking the "Simulate" button initiates the robot motion simulation.
   - Simulation runs for a predefined time span.

3. Pause Button:
   - The "Pause" button allows users to pause and resume the simulation.
   - Pausing should halt the simulation, and resuming should continue from the current state.

3.3 Real-time Visualization

4. Robot Motion Display:
   - The GUI displays the motion of the robot in real-time.
   - Updates occur dynamically during the simulation.

3.4 Error Handling

5. Input Validation:
   - Validate link lengths to ensure they are numeric and within the specified range.
   - Display clear error messages for invalid inputs.

4. Non-Functional Requirements

4.1 Performance

1. Real-time Simulation:
   - The simulation should run in real-time for an enhanced user experience.

4.2 Usability

2. Intuitive Interface:
   - The GUI should have an intuitive layout and component placement.
   - Tooltips and labels provide guidance on component functionality.

4.3 Maintainability

3. Code Comments:
   - The MATLAB code should include comments to enhance readability and maintainability.
   - Comments should explain complex sections and highlight important details.

4.4 Compatibility

4. MATLAB Compatibility:
   - The application should be compatible with MATLAB versions R20XX and later.
   - Any dependencies on specific MATLAB toolboxes should be clearly outlined.

5. Future Enhancements

1. Additional Joint Angles:
   - The application is structured to accommodate more joint angles in the future.
   - Code modularization supports future development and expansion.

6. Documentation

1. User Manual:
   - A user manual will be provided to guide users on app interaction.
   - Includes an overview, instructions, and troubleshooting tips.

7. Conclusion

This Software Requirements Specification outlines the key requirements for the Simple Robotics Simulation application. It serves as a foundation for development, ensuring that the app meets user expectations and provides an effective tool for learning and visualizing basic robotics concepts.