**Model Predictive Control Based Jumping of Robotic Leg on a Particular height using Reinforcement Learning**

**Work Breakdown Structure (WBS) Document**

**1. Project Initiation**

**1.1 Stakeholder Identification**

Identify all relevant stakeholders.

Roles of each stakeholder:

Project Manager: Oversees project progress and resource allocation.

Research Team: Conducts literature review and technical development.

Robotics Engineers: Develops and tests the robotic leg prototype.

Data Scientists: Focuses on Reinforcement Learning algorithm development.

End Users: Provides feedback on functionality and usability.

Investors/Sponsors: Provides funding and monitors project outcomes.

**1.2 Stakeholder Relationships**

Outline the relationship and communication flow between stakeholders.

Define expectations and responsibilities.

**2. Business Goals and Target Users**

**2.1 Business Goals**

Develop a robotic leg capable of controlled jumps to a specified height.

Enhance the capabilities of robotic mobility for practical applications in various sectors (e.g., healthcare, manufacturing).

**2.2 Target Users**

Robotics manufacturers.

Research institutions focused on robotics.

Potential customers in rehabilitation and assistive technology.

**3. Project Features**

**3.1 Key Features**

Adaptive control algorithms using MPC.

Integration of RL for optimizing jumping height.

Real-time feedback mechanisms.

Safety features to prevent failures during operation.

**4. Challenges and Practical Needs**

**4.1 Challenges**

Ensuring precision in jumping height.

Real-time processing constraints.

Stability and safety during operations.

Complexity in algorithm integration.

**4.2 Practical Need**

Enhance mobility in robots for various applications.

Provide a solution for existing limitations in robotic movement.

**5. Alternatives and Competitor Analysis**

**5.1 Suggested Alternatives**

Explore different control methods (e.g., PID control).

Compare various RL algorithms (DQN, PPO).

**5.2 Competitor Differentiation**

Focus on advanced adaptability and precision.

Emphasize integration of cutting-edge technologies.

Highlight the ability to customize solutions for specific applications.

**6. Risk Identification and Management**

**6.1 Key Areas of Risk**

Technical challenges in control and algorithm performance.

Budget overruns and resource allocation issues.

Project timeline delays.

**6.2 Risk Management Approaches**

Regular review meetings to assess progress.

Implementing an agile methodology to adapt to changes quickly.

Setting aside a contingency budget for unforeseen issues.

**7. Scope Management**

**7.1 Client Requests for Scope Changes**

Define a change request process.

Assess impact on timeline and budget before approval.

**8. Investigation Areas and Solution Design**

**8.1 Areas for Investigation**

MPC algorithms and their optimization.

Reinforcement Learning techniques applicable to jumping control.

Simulation environments for testing.

**8.2 Solution Design Requirements**

Develop prototypes.

Conduct simulations to validate the control strategy.

Iterative testing and improvement.

**9. Technology Comparison**

**9.1 Technologies Available**

MPC: Provides predictive control, but computationally intensive.

Reinforcement Learning: Adaptable but requires extensive training data.

Traditional Control Systems: Less flexible for complex behaviors.

**9.2 Pros and Cons**

MPC Pros: Predictive capabilities, precise control.

MPC Cons: High computational cost.

RL Pros: Learns from experience, adaptable.

RL Cons: Requires significant data and time to train.

**10. Goal Definition and Success Measurement**

**10.1 Clear Project Goals**

Achieve a predefined jumping height.

Implement a robust control algorithm.

**10.2 Success Metrics**

Accuracy of height achieved.

System stability during operation.

User satisfaction and feedback.

**11. Vital Business Functions**

**11.1 Importance of Services/Features**

Discuss how features support business objectives.

Illustrate the role of robotics in modern applications.

**12. Release and Deployment Strategy**

**12.1 Deployment Phases**

Prototyping and initial testing.

Pilot testing with real users.

Full-scale deployment.

**13. Project Objectives and Outcomes**

**13.1 Objectives**

Develop a functional prototype.

Validate the control strategies through experimentation.

**13.2 Expected Outcomes**

Publish research findings.

Improve the understanding of MPC and RL applications in robotics.

**14. Learning Statement**

**14.1 Learning Outcomes**

Gain expertise in MPC and RL.

Develop problem-solving and technical skills.

**14.2 Current Capabilities**

Existing knowledge in robotics and control systems.

Importance of learning for career advancement.

**14.3 Team Contributions**

Describe specific roles and contributions to the team.

Emphasize leadership and collaboration skills.