Text highlighted in Green is new (introduced by the framework). Uncolored text was in the participant's original requirements.

1. TITLE: Stability Violation Handling

SYSTEM_REQUIREMENT: When the robot's roll or pitch exceeds ±30°, the system shall immediately initiate a reset procedure to restore stability.
IMPLEMENTATION_DETAILS:
* Integrate high-accuracy IMUs and sensor fusion algorithms for continuous orientation monitoring at a 20Hz update rate
* Execute threshold-based interrupts within the control loop to trigger a reset sequence
* Log event data (e.g. sensor readings timestamp error state) for subsequent analysis
* Implement a large negative reward (-100) in the RL agent for exceeding stability limits.
RATIONALE: Ensures the robot maintains balance and stability by penalizing unsafe orientations and triggering recovery mechanisms.

2. TITLE: Torque Limit Enforcement

SYSTEM_REQUIREMENT: When motor torque measurements exceed predefined safe limits, the system shall actively reduce torque output to prevent damage and overheating.
IMPLEMENTATION_DETAILS:
* Continuously monitor motor current torque and temperature via embedded sensors
* Implement dynamic torque-limiting algorithms using real-time thermal and mechanical models
* Provide alerts for maintenance if over-torque conditions persist and log all related events
* Apply a proportional penalty (-10 per 1% over limit) in the RL reward function.
RATIONALE: Protects the robot's actuators from excessive stress and ensures safe operation by enforcing torque constraints.

3. TITLE: Policy Safety and Reversion

SYSTEM_REQUIREMENT: When the RL policy's performance degrades (e.g., increased falls or torque violations), the system shall revert to a stable baseline policy.
IMPLEMENTATION_DETAILS:
* Track policy performance metrics (e.g. gall rate reward trends)
* Maintain a fallback policy (e.g pre-trained gait) for emergencies
* Validate new policies in a simulated sandbox before deployment
* Implement auto-revert if average reward drops >20% or resets increase >50% in 1 hour.
RATIONALE: Prevents unsafe behaviors from spreading by maintaining stable and validated policies.

4. TITLE: Safety Metrics and Logging

SYSTEM_REQUIREMENT: The system shall continuously log safety-related metrics and review performance periodically to ensure compliance with predefined thresholds.
IMPLEMENTATION_DETAILS:
* Log the following:
    ** resets/hour (≤5)
    ** torque violations (≤1% of actions)

** OOD detections (≤2/hour)
* Review logs weekly to ensure ongoing safety
* Trigger alerts when safety thresholds are exceeded.
RATIONALE: Provides a mechanism for ongoing monitoring and ensures safety metrics remain within acceptable ranges.

5. TITLE: Exploration Safety Constraints
SYSTEM_REQUIREMENT: During RL-based exploration, the system shall constrain actions to safe joint/torque limits and adaptively adjust exploration magnitude based on recent reset history.
IMPLEMENTATION_DETAILS:
* Constrain exploration noise within predefined safe joint/torque ranges
* Reduce exploration magnitude if recent resets exceed thresholds
* Use Monte Carlo dropout to estimate policy confidence and disable exploration when confidence is below 70%.
RATIONALE: Ensures that policy adaptation does not compromise safety during deployment.

6. TITLE: OOD Detection and Response
SYSTEM_REQUIREMENT: When the system detects out-of-distribution (OOD) inputs or anomalies, it shall trigger conservative behavior or alert operators.
IMPLEMENTATION_DETAILS:
* Use Kalman filter innovations to detect sensor inconsistencies (e.g. >3σ residual errors)
* Deploy terrain classifiers to detect unfamiliar surfaces via vibration patterns triggering a conservative gait.
RATIONALE: Enhances safety by detecting and responding to unfamiliar scenarios that might lead to failures.

7. TITLE: Sanitization and Anonymization of Sensitive Data
SYSTEM_REQUIREMENT: During data preprocessing, the system shall strip GPS and other identifying metadata to ensure anonymization.
IMPLEMENTATION_DETAILS:
* Remove GPS coordinates and any identifying metadata from training data before storage and processing
* Ensure no personally identifiable information (PII) is included in datasets.
RATIONALE: Removing identifying metadata reduces the risk of data exposure and ensures privacy compliance.

8. TITLE: Data Privacy in Model Training
SYSTEM_REQUIREMENT: When training reinforcement learning models, the system shall prevent raw data leakage by ensuring on-device training and utilizing federated learning for policy updates.
IMPLEMENTATION_DETAILS:
* Perform all training processes directly on the robot to avoid transmitting raw data externally
* Use federated learning to aggregate policy updates instead of sharing raw data

* Prevent any sensitive data from leaving the device during training and inference.
RATIONALE: Preventing raw data from leaving the device minimizes privacy risks and reduces exposure to potential data breaches.