**Defined Scenarios and Experiments**

**1.1. Uncertainty in Object Position (X and Y Coordinates)**

* **Objective:** Analyse how positional uncertainties affect grasp success rates.
* **Distributions Used:** Normal and Uniform.
* **Experimental Setup:**
  + **Baseline:** No uncertainty (exact object position known).
  + **Scenarios:**
    - **Scenario 1:** Normal distribution with varying standard deviations (0.005, 0.01, 0.015 and 0.02) and gripper width (0.03,0.031,0.032,0.033,0.034 and 0.035) 🡪 Total 24 experiments
    - **Scenario 2:** Uniform distribution within specified scale (0.005, 0.01, 0.015 and 0.02) and gripper width (0.03,0.031,0.032,0.033,0.034 and 0.035) 🡪 Total 24 experiments

**1.2. Uncertainty in Gripper Width**

* **Objective:** Evaluate how variations in gripper opening width impact grasp stability and success.
* **Distributions Used:** Normal and Uniform.
* **Experimental Setup:**
  + **Baseline:** Fixed gripper width optimized for the object.
  + **Scenarios:**
    - **Scenario 1:** Normal distribution centered around optimal width (0.03) with varying standard deviations (0.0025, 0.005, 0.0075, 0.01) 🡪 Total 4 experiments
    - **Scenario 2:** Uniform distribution centered around optimal width (0.03) with varying scale (0.0025, 0.005, 0.0075, 0.01) 🡪 Total 4 experiments

**1.3. Uncertainty in Motion Parameters (Velocity and Acceleration)**

* **Objective:** Determine the effect of dynamic uncertainties on trajectory accuracy and task completion time.
* **Distributions Used:** Normal and Uniform / **predefined array**
* **Experimental Setup:**
  + **Baseline:** Fixed velocity and acceleration as per manufacturer's recommendation or default values defined in code
  + **Scenarios:**
    - **Scenario 1:** Velocity uncertainty modelled with Normal distribution; acceleration kept constant.
    - **Scenario 2:** Acceleration uncertainty modelled with Uniform distribution; velocity kept constant.
    - **Scenario 3:** Both velocity and acceleration uncertainties applied simultaneously.

**1.4. Combined Uncertainties**

* **Objective:** Investigate cumulative effects when multiple uncertainties are present simultaneously.
* **Scenarios:**
  + **Scenario 1:** Combine position and gripper width uncertainties.
  + **Scenario 2:** Combine position, velocity, and acceleration uncertainties.
  + **Scenario 3:** Comprehensive scenario with all uncertainties applied together.

**2. Data Collection and Analysis**

**For each scenario:**

* **Number of Trials:** 50 iterations
* **Data Logging:** Record detailed logs including parameter values, outcomes, error measures, and system responses.
* **Statistical Analysis:**
* **Graphs and Charts:** Success rates, error distributions, performance metrics.
* **Discussion:**
  + **Interpretation of Results:** Understand how each uncertainty affects performance.
  + **Comparative Analysis:** Between different distributions and scenarios.
  + **Insights:** Derive practical implications for robotic system design and operation.