**Robot Grid Simulator Task - AI & ROS2 Integration Training**

### **Task Title:**

**Robot Grid Simulator in Python**

### **Objective:**

Develop a structured Python simulator that simulates basic robot movement in a 5x5 grid. This will serve as a foundational exercise before integrating with ROS2.

### **Task Instructions:**

#### **1. Build the Python Simulator**

* Create a Python class called RobotSimulator.
* The robot should start at position (0, 0) facing NORTH.
* Allowed commands: forward, left, right, report.
* Prevent the robot from moving outside the grid boundaries.
* Handle all invalid commands or errors in a clean way (exception handling).

#### **2. Customize the Project (Optional Enhancements)**

* Add custom features such as:
  + Battery level simulation.
  + Diagonal movement.
  + Obstacles in the grid.
  + Grid expansion.

#### **3. GitHub Upload Requirements**

* Create a public repository named: robot-grid-simulator.
* Upload the Python code with appropriate file and folder structure.
* Include a README.md with the following:
  + Project title and purpose.
  + Clear instructions on how to run the code:  
    python3 robot\_simulator.py
  + Brief description of each feature or method.
  + Suggestions or roadmap for integrating with ROS2.

#### **4. Documentation Report (PDF)**

* Create a short PDF file named report.pdf with:
  + Description of the project.
  + Summary of the approach.
  + Lessons learned.
  + Ideas for future improvement (especially with ROS2 integration).

### **Technical Requirements**

* Programming Language: Python 3
* Programming Concepts to Apply:
  + Object-Oriented Programming
  + Error Handling (try/except)
  + Input parsing
  + Simple command execution logic

### **Deliverables Checklist**

### **Learning Outcomes**

* Understand the logic behind controlling a simulated robot.
* Gain experience with structured Python programming.
* Practice proper code documentation and project organization.
* Learn how to publish and share open-source work on GitHub.
* Prepare for more advanced work integrating ROS2 topics, services, and actions.

This task is designed to encourage clean coding practices, critical thinking, and a foundational understanding of how robot control systems are developed.

**Trainer Note:** You may provide a simple base implementation or helper code to students who need support. Encourage students to build enhancements or improvements independently.