Physical AI Hackathon: Problem Statement

IEEE Robotics and Automation Society
and Prof. Nippun

Introduction

This communication is issued by the IEEE Robotics and Automation Society in collaboration with IEEE RAS with the help of Prof. Nippun Kumaar The purpose of this notice is to share the official problem statement for the Physical AI Hackathon 2026. The initiative has been proposed by xpskills, an initiative under Eksaathi Foundation, a Section 8 company and not-for-profit entity in India. As the world enters the era of *Physical AI*, intelligence is moving beyond software into robotics, automation, and embodied systems. The future workforce must be trained in a multidisciplinary skill set including:

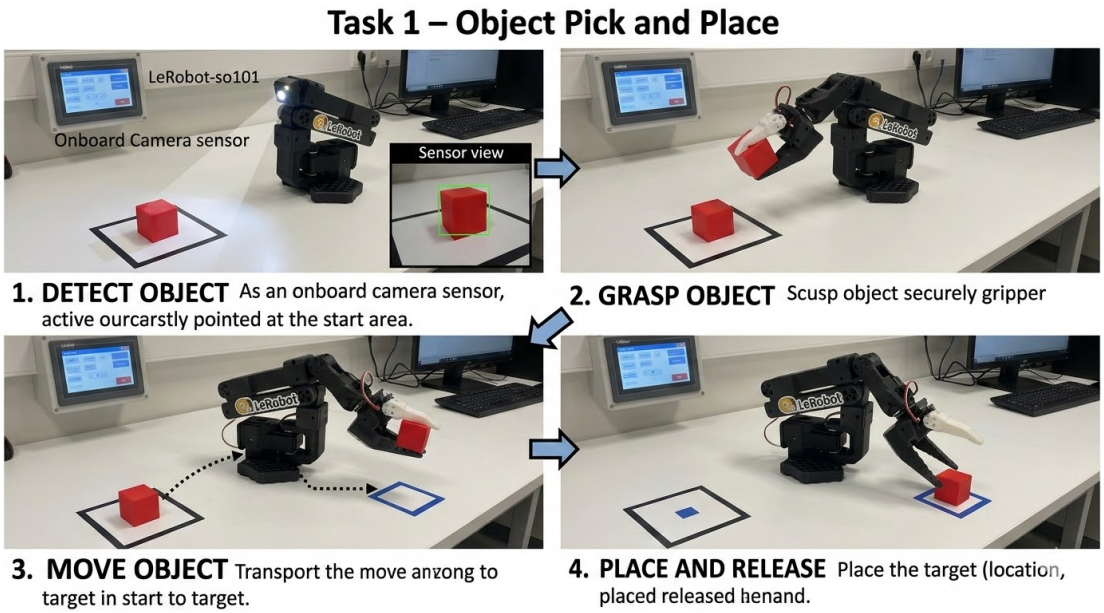
- Embedded AI
- Vision-Language-Action (VLA) models
- Physical AI system design
- Simulation to real-world transfer
- Reinforcement learning for robotics

The challenge is focused on skill development and technology-driven livelihood creation.

Semifinal Round

During the semifinal stage, each team will tackle three independent tasks. Points are awarded for successful completion of each task. The tasks are defined as follows.

Task 1 – Object Pick and Place



The robot must:

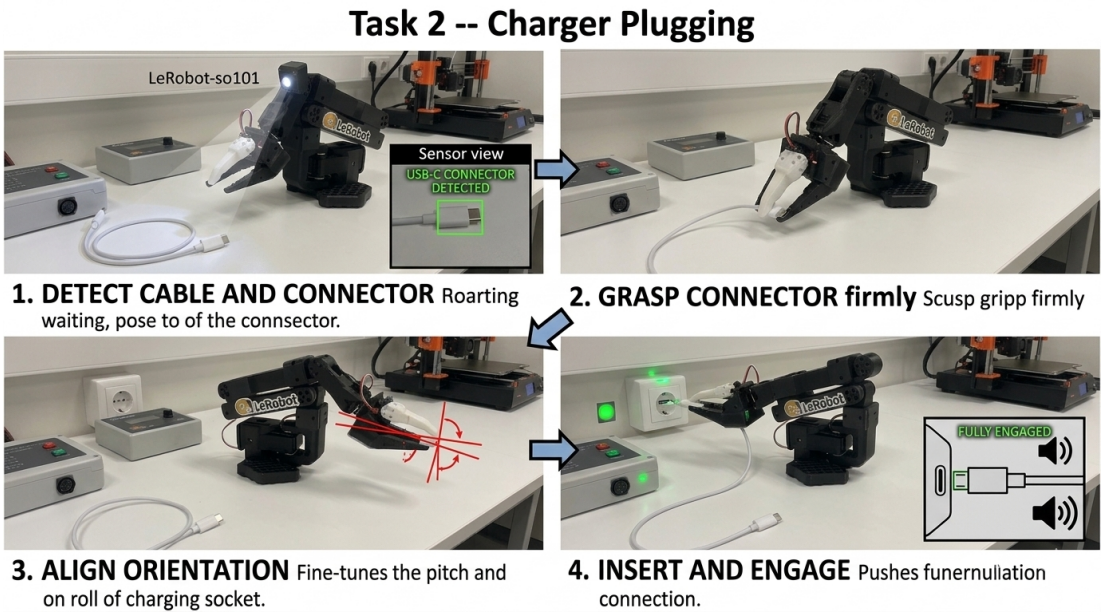
1) Detect an object at a known location using onboard sensors.
2) Grasp the object securely with the end effector.

3) Move the object to a specified target location.
4) Place the object precisely at the target location and release the grasp.

Challenge: Achieving consistent detection and grasp under varying poses while maintaining precision during transit.

Success Metric: Object is delivered within a tight tolerance of the target position without being dropped; completion time may serve as a secondary metric.

Task 2 – Charger Plugging



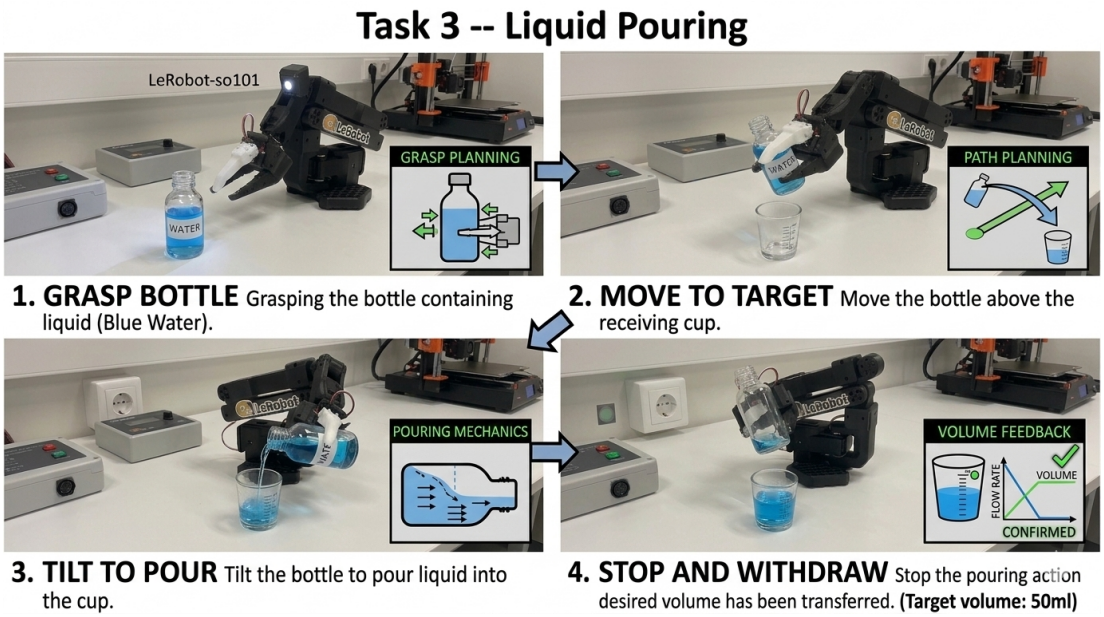
The robot must:

1) Detect a cable and connector within its workspace.
2) Grasp the connector firmly.
3) Align the orientation of the connector with the socket.
4) Insert the cable into the socket until fully engaged.

Challenge: Precisely orienting and inserting a flexible connector while compensating for compliance or minor misalignments.

Success Metric: Successful insertion on the first attempt with minimal orientation error; the connector must remain secured during a pull test.

Task 3 – Liquid Pouring



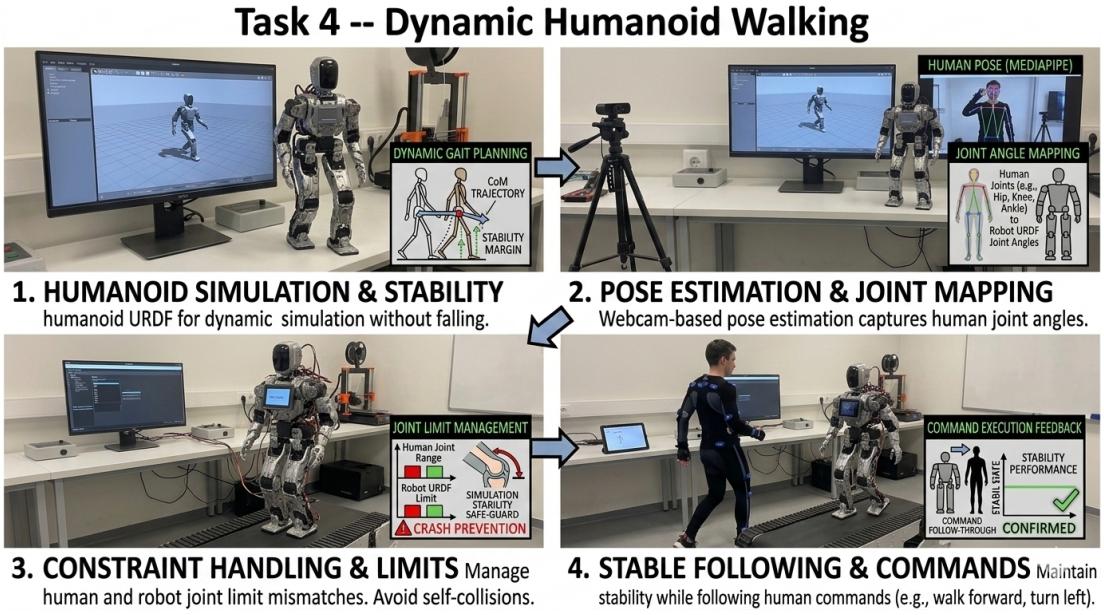
The robot must:

1) Grasp a bottle containing liquid.
2) Move the bottle above a receiving cup.
3) Tilt the bottle to pour liquid into the cup.
4) Stop the pouring action when the desired volume has been transferred.

Challenge: Controlling the pour rate and angle to avoid spills while accurately measuring transferred volume.

Success Metric: The volume poured must match the target within a specified tolerance and no liquid may escape the receiving container.

Task 4 – Dynamic Humanoid Walking



The robot must:

1) Use the provided humanoid URDF to perform dynamic walking in simulation without falling.
2) Incorporate a webcam-based pose estimation library (e.g., MediaPipe) to capture human movements and translate joint angles to the humanoid model.
3) Manage mismatches between human joint limits and the robot's URDF limits to avoid self-collisions or simulation crashes.
4) Maintain stability while following human-derived commands.

Challenge: Discrepancies in joint ranges between the human pilot and robot must be handled carefully to prevent simulation errors.

Success Metric: Joint-angle error between the human pilot and the robot will be used to evaluate pose accuracy.

Final Round – Multi-Task Challenge

Teams advancing to the final round will be required to execute all three tasks in sequence without human intervention. Refer to the following procedure:

1) Perform the Object Pick and Place procedure.
2) Execute the Charger Plugging procedure.
3) Carry out the Liquid Pouring procedure.

Success in the final challenge demands smooth transitions between tasks and robustness against variances in object positions.

Robot Platform Specification

The semifinal round will be a purely software competition; no physical hardware will be provided and teams are expected to develop and test in simulation only. For the final round, eligible teams will receive access to a physical robot platform (LeRobot SO101) for on-site evaluation.

URDF (Unified Robot Description Format) files and accompanying world environment models will be distributed to all registered teams prior to the commencement of the challenge.

Simulation Environment

To facilitate development and testing, the competition supports the following simulators:

- MuJoCo
- Webots
- Gazebo

Each team will receive the robot URDF, a baseline policy implementation, and example tasks to bootstrap their efforts. Participants are free to develop their own control algorithms and perception pipelines within these environments.

Conclusion

We encourage all registered members to participate in the Physical AI Hackathon 2026. This event represents an opportunity to advance the state of Physical AI while building valuable skills that will shape the workforce of the future. For any queries or further information, please contact the challenge organizing committee at `raushan@xprobotics.ai`.