4^{th} Edition

Emirates Robotics Competition At Mohammed Bin Rashid Library Challenge Overview

1 Introduction

Robotics continues to be recognized as one of the most transformative technologies across a wide range of industries and societal domains. From healthcare and logistics to education and public services, robotic systems are increasingly being deployed to automate tasks, improve efficiency, and enhance human experiences. However, bridging the gap between current robotic capabilities and real-world deployment requirements remains a significant challenge, particularly in environments that demand perception, planning, and physical interaction.

Libraries represent a compelling setting for robotic assistance. As institutions that serve millions of visitors, libraries face operational challenges in book retrieval, shelving, and inventory management. A robot capable of autonomously navigating library aisles, identifying specific books, and retrieving them for patrons would demonstrate the practical integration of mobile robotics, computer vision, and manipulation, which are all core pillars of modern robotics research.

This edition of the Emirates Robotics Competition is hosted at the Mohammed Bin Rashid Library and challenges undergraduate students to develop a software system for a **Library Assistant Robot**: a mobile manipulator that can autonomously locate, pick, and deliver a requested book. By providing a standardized hardware platform with ROS 2 support, the competition allows participants to focus on the key intellectual challenges of perception, decision-making, and system integration, while gaining hands-on experience with industry-standard tools and frameworks.

The purpose of this competition is the following:

- Challenge undergraduate students from local universities with a practical, multi-disciplinary robotics problem that integrates navigation, perception, and manipulation.
- Encourage students to develop hands-on skills with ROS 2, computer vision, and robotic system integration.
- Improve students' practical and critical thinking skills by requiring them to design and implement a complete autonomous pipeline under real-world conditions.
- Inspire the next generation of robotics engineers in the UAE by providing access to professional-grade hardware and a compelling application scenario.

2 Challenge Description: Library Assistant Robot

In this challenge, teams will develop the software stack for a **TIAGo Pro** mobile manipulator platform tasked with retrieving books from library shelves and delivering them to a single collection bin. Each stage of the task rewards points, and the top three teams that deliver the most capable and well-engineered Library Assistant at the end of the competition will be awarded prizes. The competition tests the team's ability to integrate perception, planning, and control into a cohesive autonomous robotic system.



Figure 1: The TIAGo Pro mobile manipulator platform

The competition is conducted in two phases:

1. *Phase 1: Simulation Phase*
2. *Phase 2: Physical Deployment Phase*

The top-performing teams from Phase 1 will qualify to compete in Phase 2.

2.1 Objectives

Teams must complete the following objectives in this competition:

- Identify the target shelf column number using the onboard camera and computer vision.
- Autonomously navigate TIAGo Pro to the correct shelf column.
- Identify the target book on the shelf row based on its colour using computer vision.
- Grasp the book using a single manipulator arm.
- Identify the red collection bin using computer vision and autonomously navigate to the starting point where the collection bin is located.

- Place the target book inside the collection bin.



Figure 2: Visualization of TIAGo Pro in the competition environment

3 Competition Phases

3.1 Phase 1: Simulation Phase

In this phase, all registered teams will develop and test their solution using the Gazebo simulation environment, provided in a Docker image containing the full setup required for this competition. The goal is to develop a solution that accomplishes the objectives outlined in Section 2.1. A companion Phase 1 document is provided that contains full technical and operational details about this phase including the software environment provided in Docker, launch commands, challenge trials, deliverables, scoring criteria, and qualification rubric. Details on how to submit deliverables will be communicated to participants closer to the Simulation Phase deadline shown in Table 1. The top-performing teams from Phase 1 will qualify to Phase 2.

3.2 Phase 2: Physical Deployment Phase

In this phase, qualified teams will compete in the real environment at the Mohammed Bin Rashid Library on the physical TIAGo Pro using the code developed during the Simulation Phase. Teams will need to adapt their solution to account for real-world conditions such as lighting variations, sensor noise, and mechanical tolerances. There will be two opportunities to use the physical TIAGo Pro:

- *TIAGo Pro Trial Sessions*: Dedicated sessions where teams can deploy and fine-tune their solution on the real hardware before Competition Day.
- *Competition Day*: Each team will be given a **10 minute** time slot to complete the challenge trial. Teams will participate in two trials, and the highest score obtained will determine their final ranking.

Full technical details for this phase and the two sessions above will be provided to qualifying teams after the Simulation Phase deadline shown in Table 1. The top three teams on Competition Day will be awarded prizes as outlined in Section 5.

4 Timeline

Phase	**Date**
Registration Deadline	June 30, 2026
Simulation Phase Deadline	September 15, 2026
TIAGo Pro Trial Sessions	October 2026 (TBA)
Competition Day	November 2026 (TBA)

Table 1: Timeline for Emirates Robotics Competition 2026

The schedule and duration of the TIAGo Pro Trial Sessions will be communicated after Phase 1 results are announced.

5 Prizes

The total prize money for the challenge will be AED 30K, distributed as shown in Table 2.

Challenge	**1st Place**	**2nd Place**	**3rd Place**
Library Assistant Robot	AED 15K	AED 10K	AED 5K

Table 2: Prize money distribution

Additionally, winners will be awarded partial scholarships from RIT for master's degrees (subject to GPA thresholds and any additional eligibility requirements to be announced). This competition encourages collaboration and open innovation. As such, a condition for accepting the prize money is that winning teams must open-source and document their code on an online platform (e.g., GitHub, GitLab, etc.) and allow anyone to replicate these systems and build on them.

6 Organizing Entities

The competition is organized and sponsored by:

- Dubai Future Labs (DFL)
- Rochester Institute of Technology (RIT)
- Mohammed Bin Rashid Library (MBRL)
- Khalifa University (KU)
- American University of Sharjah (AUS)

7 Revision History

Version	Date	Author	Description
1.0	05/08/2025	Organizing Committee	Initial draft of Overview document