



ROBOFEI



HERA - Home Environment Robot Assistant

Hardware

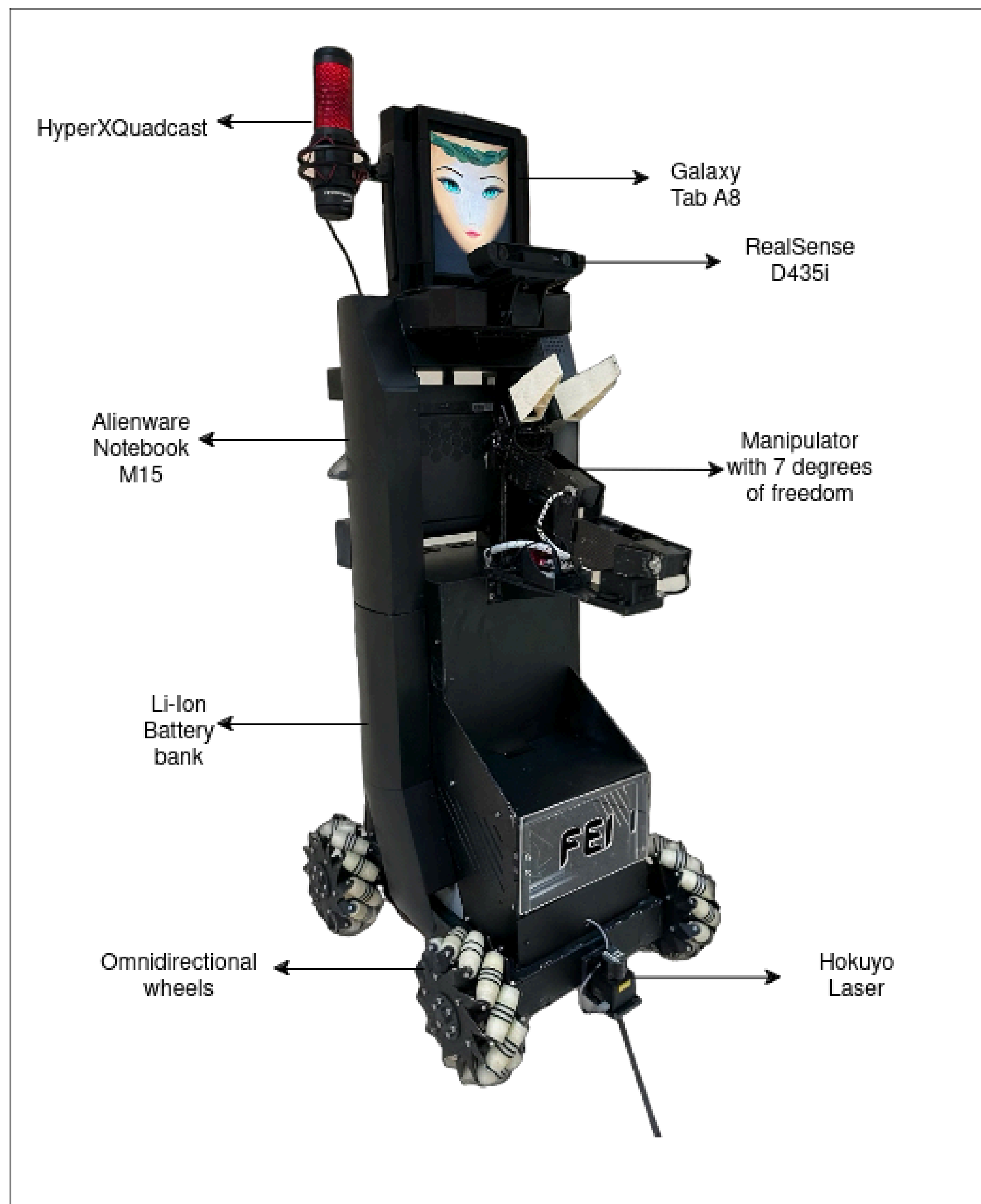


Fig. 1: Hera's hardware diagram

Our Project

The RoboFEI@Home project has been in development since 2015. The team comprises undergraduate and postgraduate engineering and computer science students. Besides technological research, the main goal is to assist individuals with reduced mobility and people of old age.

Packages

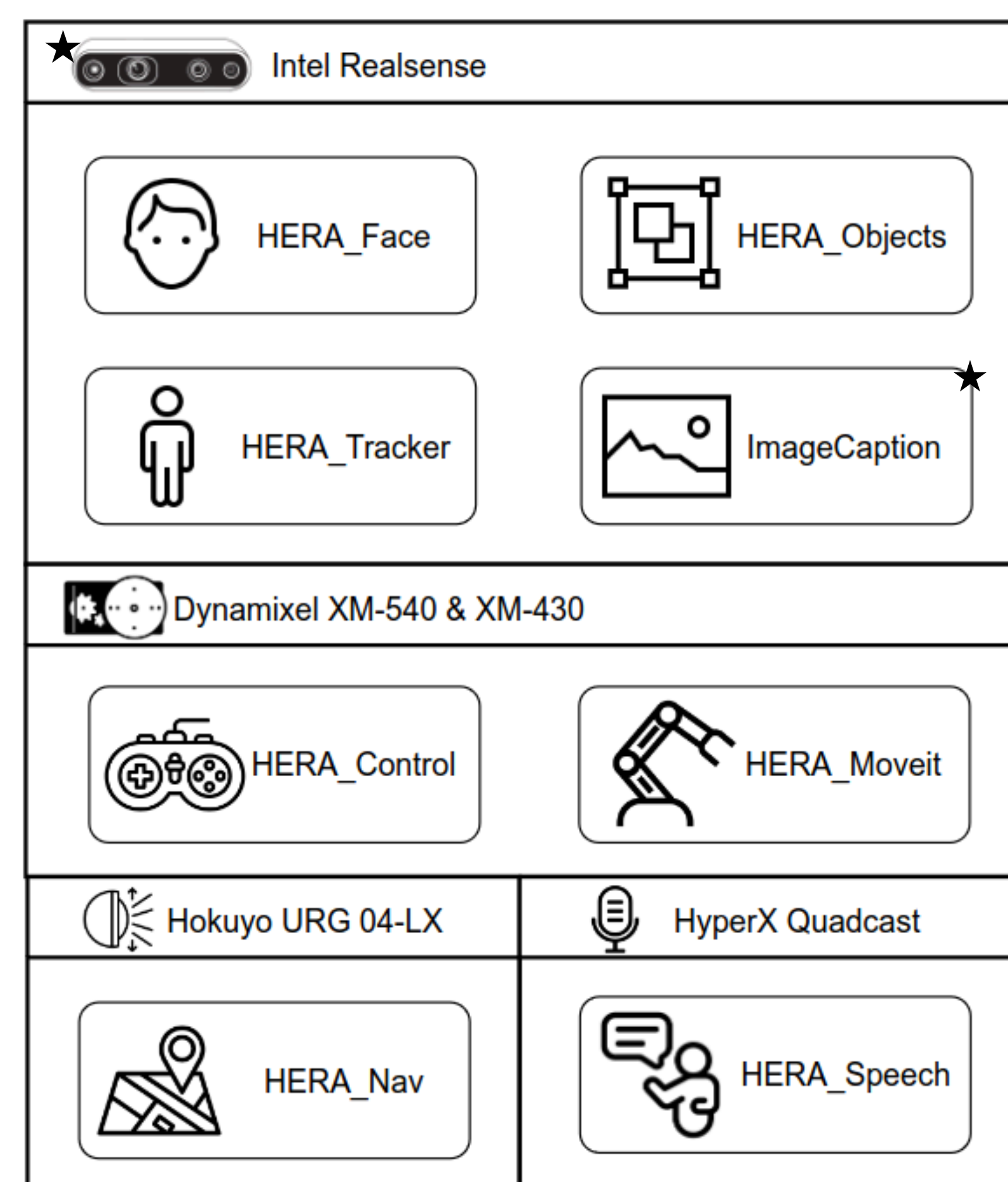


Fig. 2: Hera's packages
<https://github.com/robofeithome>

Software

Vision System
- YOLOv8 - Deep Saliency Object Segmentation - Dlib
Voice Recognition
- Whisper API - Google Speech Recognition
Navigation
- SLAM (simultaneous localization and mapping)
Manipulation
- Moveit - Octomap

Fig. 3: Hera's software

Scientific Research

Object Segmentation Using Point Clouds

Model: CNN for detecting and segmenting objects with LiDAR or RGB-D sensors.
Objective: High accuracy and consistent performance in object manipulation.

Output of the generated metadata:



Fig. 4: RGB Display



Fig. 5: Semantic Segmentation Display



Fig. 6: Bounding Box 2D Display

Restructuring Robotic Systems for Enhanced Maintenance and Travel Efficiency

A research project aims to restructure the robot's mechanical and electronic systems for easier maintenance and modular disassembly for air travel. The new design allows quick changes in onboard computational power and diverse battery configurations, enhancing adaptability and operational efficiency, and ensuring high performance and reliability.



Fig. 7: New structure compared to old robot

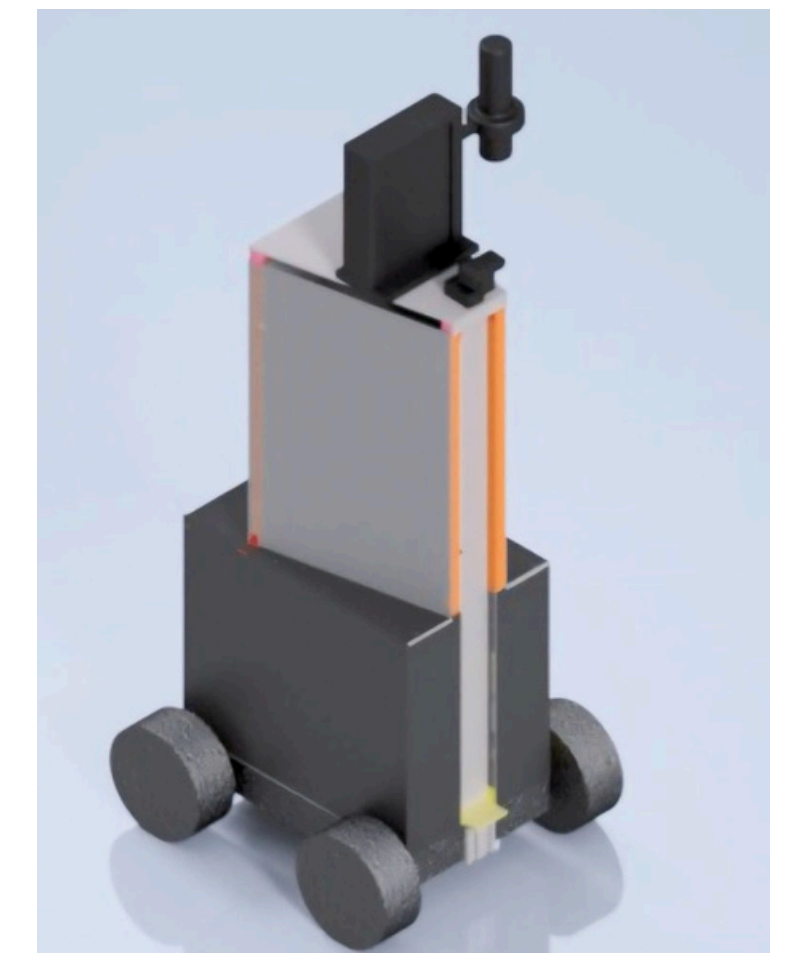


Fig. 8: 3D Project for new HERA

Synergy Between AI and Environmental Perception: GPT Vision and YOLO v8

This study intends to maximize the efficiency and adaptability of robotic systems by combining GPT Vision's advanced contextual understanding of scenes with YOLO v8's real-time detection and tracking capabilities for enhanced autonomous navigation and security monitoring.



Fig. 9: Image Prompt provided to GPT Vision and YOLO v8

GPT Vision	YOLO v8
The photo shows two boys playing with a Rough Collie dog in a green outdoor space, likely a park. One boy, crouched and holding a yellow ball, is ready to play with the attentive dog. The other boy runs towards the dog with excitement. The background features distant mountains and trees, suggesting a scenic location. The soft lighting indicates it might be late afternoon or a cloudy day, perfect for outdoor activities. The image captures the joy and energy of children playing with their pet, evoking the simplicity and pleasure of spending time in nature.	<ul style="list-style-type: none"> • 2 persons • 1 dog • 1 sports ball

Fig. 10: GPT Vision description and YOLOv8 detection for the same image

Work in Progress

Object Perception and Recognition Using Motor Effort and Current
Method: Point Cloud and motor effort feedback for object categorization.
Application: Enhanced adaptability in domestic robots.

Intelligent Battery Management System
Objective: Develop an intelligent system for optimizing battery selection and usage.
Approach: Using a dataset, analyze current consumption and suggest the most efficient battery type.

Robot in the Task of Carrying Objects While Following People
Objective: Start transitioning from ROS to ROS2 with the "Carry My Luggage" task as a base.
Approach: Analyzing ROS2 architecture, integrating ROS2 modules, and conducting tests in a simulated domestic environment.