CMR-E1

Teaching Practice Platform

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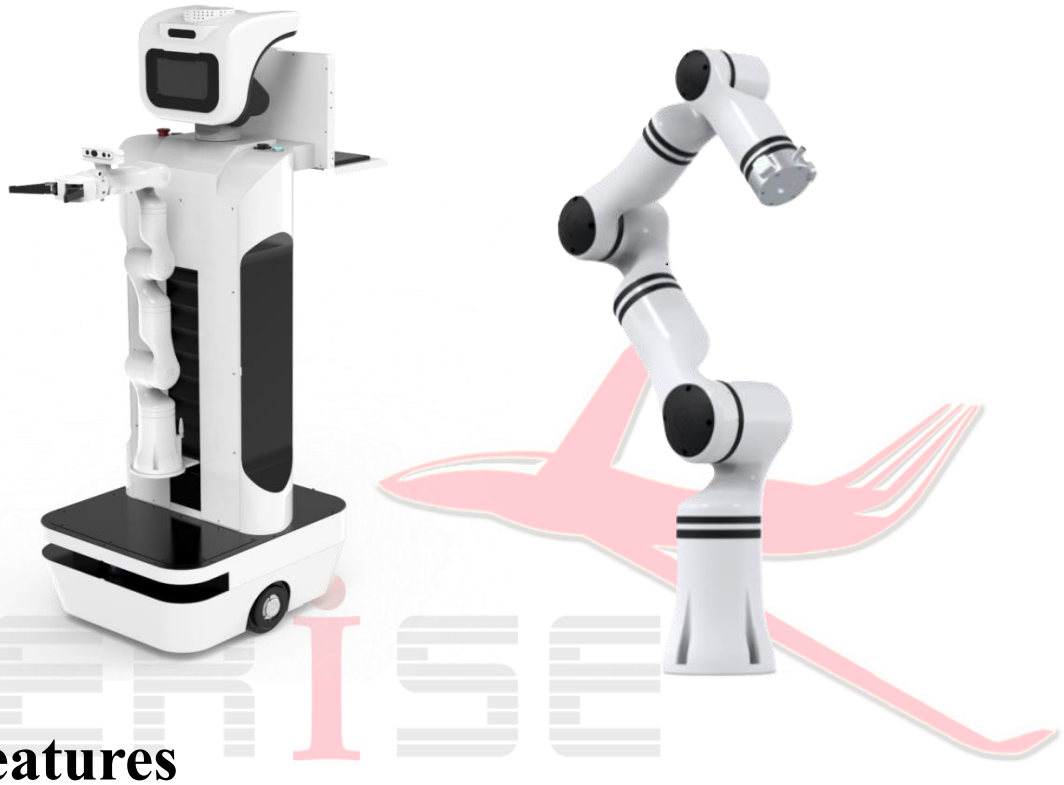
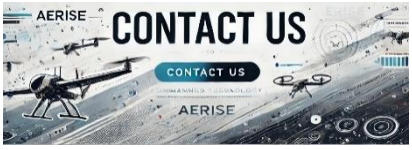


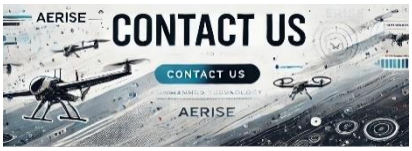
Key Features

- Comprehensive Teaching Practice Platform
- High-performance sports chassis
- Compact design with high machine power
- Automatic charging system
- High-performance lightweight collaborative robotic arm
- Flexible Adaptive Clamping Jaws
- Modular connectivity design
- SLAM technology fusing vision and laser
- Sensor Fusion Positioning and Navigation
- Efficient dual master control unit



1 Introduction

CMR-E1 Collaborative Mobile Robot is a comprehensive teaching platform for indoor and outdoor service-oriented collaborative mobile robot teaching and practice, which contains four major components: intelligent mobile chassis, artificial intelligence head unit, flexible collaborative actuating robotic arm and adaptive lifting platform. The platform is suitable for teaching robotics and AI applications such as electromechanical system assembly, mobile chassis control, collaborative robotic arm control, flexible gripping technology, whole body control (WBC), robot operating system, positioning and navigation, intelligent collaborative control, embodied intelligence, and large models. The collaborative mobile robot is accompanied by a complete curriculum and practical training cases, making it an ideal platform for teaching and practicing service robotics.



2 Teaching and Research Functions

☑ Mobile robot communication and control practice
☑ Communication and control practice for collaborative robotic arms
☑ Sensor unit data control
☑ Control practice for chassis motion
☑ Sensor fusion practice
☑ Robot operating system ROS practice
☑ Gazebo simulation practice
☑ Collaborative robotic arm application practice
☑ Flexible gripping technology practice
☑ SLAM positioning and navigation practice
☑ Path Planning Development Practice
☑ Vision Application Practice
☑ Speech Semantic Recognition Practice
☑ Human Machine Interaction Practice
☑ Possessive Intelligence Application Practice

3 Functionality

3.1 Comprehensive Teaching Practice Platform

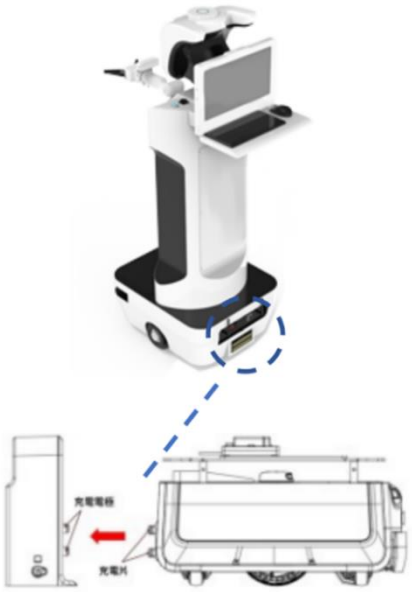
CMR-E1 collaborative mobile robot platform covers four major components commonly used in service robots: intelligent mobile chassis, artificial intelligence head unit, flexible collaborative actuator arm and adaptive lifting platform, which can be used flexibly and conveniently to carry out scientific research and teaching activities related to service robots, and it is a very comprehensive and strong practical platform.

3.2 High performance sport chassis

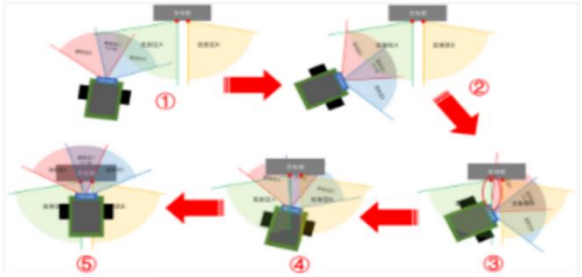
The CMR-E1's chassis has a two-wheel differential structure, and the whole set of structure adopts a pendulum independent suspension. Not only can it balance the landing of the front and rear castors, but also can greatly prevent skidding. The drive motor adopts a DC brushless servo motor and is installed with a high-precision encoder and an ARM-based VCU control board, which enables both real-time motion control closed-loop and real-time monitoring and uploading of wheel speed information for high-precision odometry.

3.3 Automatic charging system

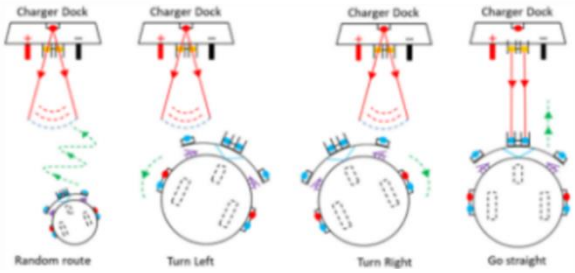
The CMR-E1 Intelligent Mobile Robot is equipped with an automatic charging system that enables it to automatically range charging stations to recharge when the battery is too low.



Auto Recharge Module



Auto Recharge Process



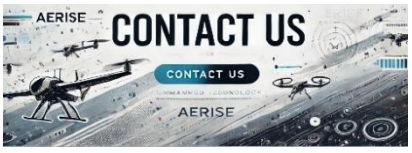
Auto Recharge Detection

3.4 High-performance lightweight collaborative robotic arm

CMR-E1 adopts a collaborative robotic arm with a working radius of 610mm, an end load of 5kg, and a weight of only 7.8kg. the end of the robotic arm can be flexibly fitted with a wide range of actuating accessories for different functional needs, and provides a wealth of development software and hardware support for common software systems, programming languages, and hardware platforms.

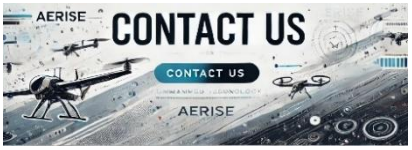
3.5 Flexible adaptive jaws

CMR-E1 adopts the flexible adaptive gripper installed at the end of the collaborative robotic arm, which has the characteristics of gripping diversified objects and softness, not only can flexibly use different sizes and shapes of objects, but also can be combined with algorithms to accurately control the gripping force, which ensures the reliability of gripping without damaging the surface of the object to be gripped.



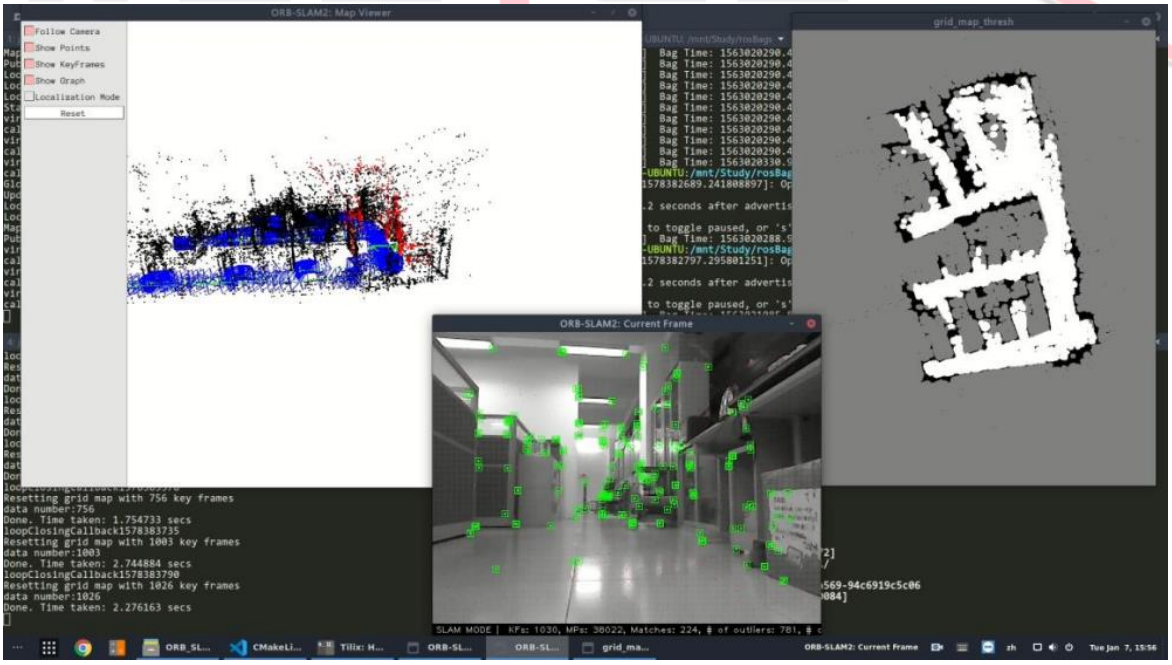
3.6 Modular connection design

The CMR-E1's ground and upper units (head, lifting platform, and collaborative robotic arm) all adopt a modular connection design. This is the flexibility for the CMR-E1 to replace different forms of chassis modules to adapt to the environment and the needs of the task.



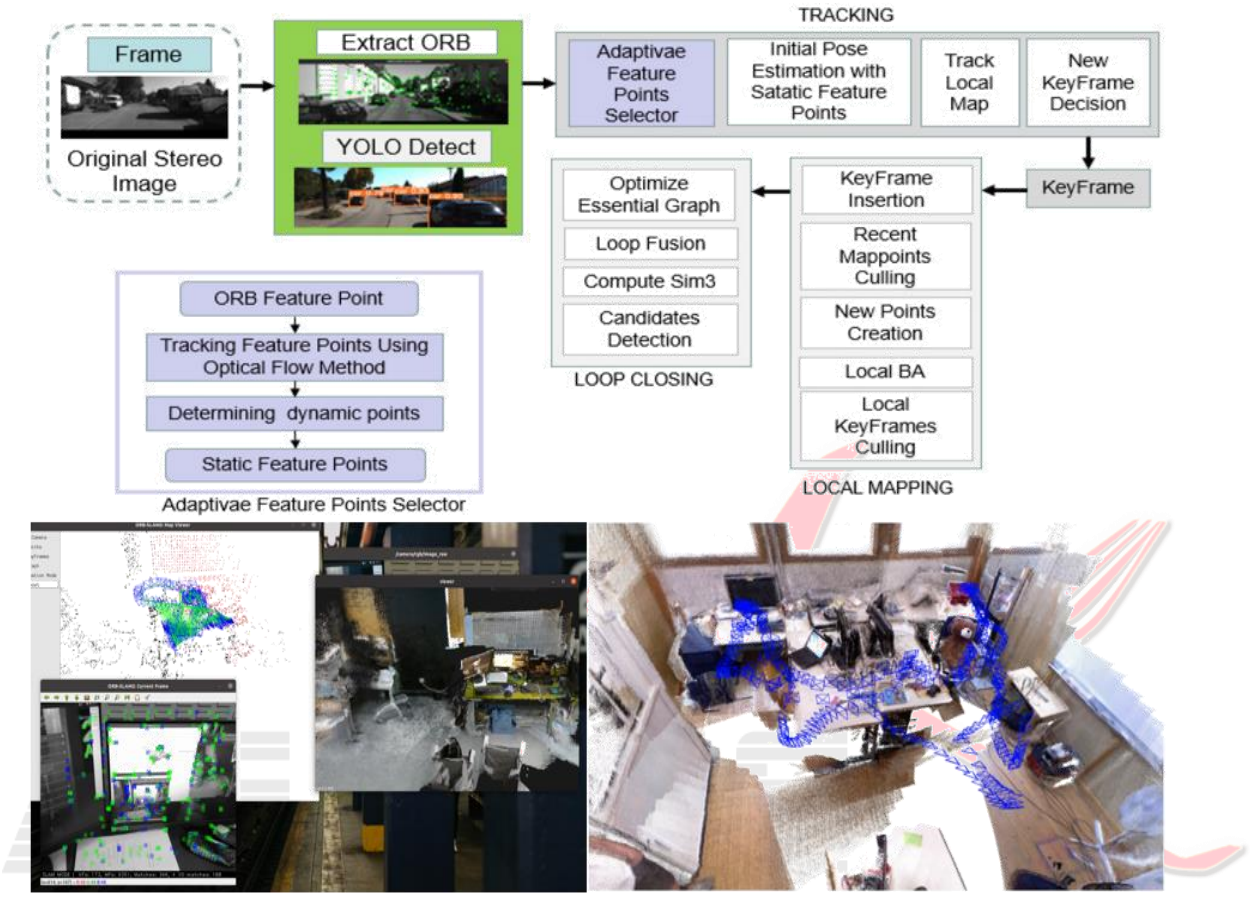
3.7 SLAM technology fusing vision and laser

The CMR-E1 chassis is equipped with LIDAR, IMU and odometer, and a depth camera is mounted on the head, which fuses the radar, IMU and visual depth information with the help of multi-sensor fusion algorithms, such as ORBSLAM, for SLAM map building.



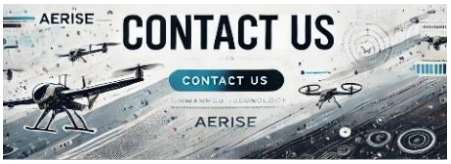
3.8 Sensor Fusion Positioning Navigation

Fusion of LiDAR, odometer, IMU attitude unit, RGBD depth vision information and other data, combined with AMCL and MOVEBASE methods to achieve map positioning, path planning, navigation and autonomous obstacle avoidance.



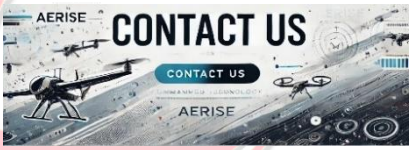
3.9 Efficient dual master unit

CMR-E1 chassis is equipped with a high-performance master control unit, which is used to complete the robot's whole-body motion control, functional unit management, task scheduling and other functions related to the operation logic, in addition, the head of CMR-E1 is equipped with a high-performance artificial intelligence computing unit, which is used to complete the human-computer interaction, recognition, embodied intelligence and other functions related to artificial intelligence, the cooperation of the dual-master control ensures that the robot's tasks are carried out efficiently.



Artificial Intelligence Unit

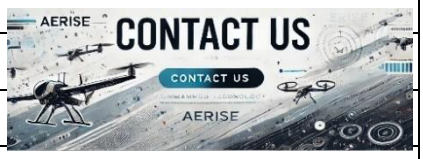
Logical master control unit



4 Parameter Table

Name	Name	Parameter
Chassis parameters	Dimension (L*W*H) (mm)	600*550*(1000~1350)
	Chassis mass (kg)	70
	Chassis structure	Dual-wheel differential (can rotate in place)
	Braking method	Motor brake
	Maximum speed (m/s)	1
	Motor power (W)	60*2
Battery	Battery Voltage (V)	24
	Battery capacity (aH)	20
	Ground clearance (mm)	30
	Suspension	Independent
	Payload (kg)	50
	Wheel diameter (mm)	150
	Charging duration (h)	2-3
	Charging method	Manual charging/automatic charging

	External power supply (V)	24/12/5
Emergency Stop	Emergency Stop Button	Supported
	Turn signal strip	Supported
Protection level	Protection level	IP54
	Operating system	Linux Ubuntu + ROS
	Controller	NUC
	Lidar	High-precision LiDAR
Collaborative robotic arm	Degrees of freedom	6
	Max. working radius (mm)	610
	Maximum payload (kg)	5
	Net weight (kg)	7.2
	Repeatable Positioning Accuracy (mm)	±0.05
	Lifespan (h)	2000
	IP level	IP54 (Robot arm body)
	Operating temperature (℃)	0 - 50
	Material	Aluminum alloy
	Maximum joint speed	J1, J2 ≥180° /S J3, J6≥225° /S
	Control method	Scratch/API/JSON
	Maximum end speed (m/s)	0.6
	INPUT	DC 48V
	Supply Voltage	DC20-30V Rated DC24V
	Angle of rotation of joints	（1） J1≥±178° （2） J2≥±130° （3） J3≥±135° （4） J4≥±178° （5） J5≥±128° （6） J6≥±360°
3-D Camera	Dimension (mm)	90*25*25
	FOV	87° * 58°



	Maximum depth stream output resolution	1280*720
	RGB Sensor Resolution	1920*1080
	RGB Sensor Frame Rate (fps)	30 fps
	Depth accuracy error (%)	2（<2m）
	RGB color video streaming	Supported
	Depth Data 3D Point Cloud	Supported
Motorized Flexible Clamping Jaws	Control interface	RS485
	Grip Size (mm)	10-120
	Weight (g)	625
	Grab Weight (g)	700
	Material	Aluminum alloy, flexible silicone
	Operating voltage (V)	12
	Grabbing frequency (times/min)	30
Linear lifting platform	Power (W)	280
	Voltage (V)	24
	Repeatability (mm)	0.1
	Max speed (mm/s)	50