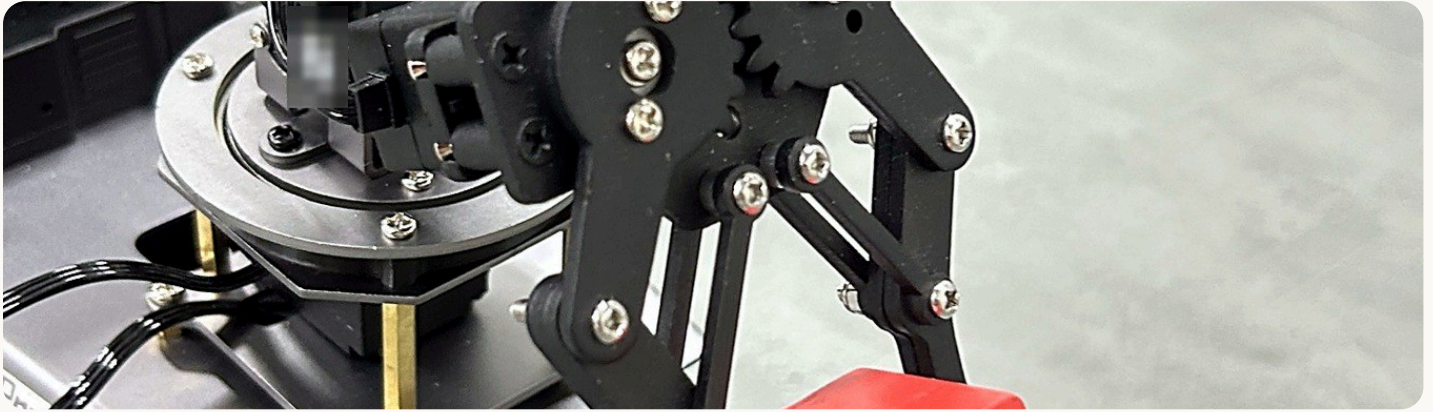


Physical AI Education with the SV Robotics AMR Robot Arm

AMR Robot Arm — an educational robot: a self-driving wheeled robot (AMR) carrying a 5-axis robot arm (gripper included) and a depth camera. Students learn the robot's body, eyes and lidar navigation, then teach the arm and wheels by demonstration (imitation learning), by reward (reinforcement learning) and by words (VLA), and move the AI trained in a virtual world onto the real robot.



Follows the order of robot-learning courses at leading universities abroad (Stanford, Berkeley, ETH and others): imitation learning → reinforcement learning and Sim-to-Real → VLA.

Session	Course	What students learn	Hands-on
1	Foundation Sessions 1–10	What is Physical AI? Starting with the final mission demo	Watch the finished tidy-up robot demo; safety rules
2		Robot structure and ROS 2	Remote control; inspect topics
3		Arm coordinates and motion	Move the arm with joint and end-point coordinates
4		Measuring distance with the depth camera	Measure the distance to an object
5		Mapping with lidar (SLAM)	Map the classroom
6		Lidar navigation: reaching a destination	Drive to a goal on the map autonomously
7		Intro to the virtual world (Isaac Sim, digital twin)	Control the robot in the virtual world
8		First steps in imitation learning: an arm that copies demonstrations	Run and observe an arm that copies a demonstration Trained model provided
9		First steps in reinforcement learning: the arm learns to reach (virtual → real)	Compare results across rewards; deploy to the real robot Trained model provided
10		AI eyes: finding objects and their 3D position	Find blocks with a provided model
11	Advanced Applied AI + Sim-to-Real Sessions 11–20	Naming the target in words (vision-language AI) Optional	Compare recognition results across sentences
12		Imitation learning ①: collecting demonstrations by moving the arm by hand	Record demonstrations by hand-guiding the arm Trained model provided
13		Imitation learning ②: learning from demonstrations to pick by itself	Pick autonomously with a trained model Trained model provided
14		Sim-to-Real ①: shaking up the virtual world for robust learning	Compare results across randomization ranges Trained model provided
15		Sim-to-Real ②: lidar obstacle avoidance with RL (virtual → real)	Avoid real obstacles with a trained model; compare with the virtual run Trained model provided
16		Sim-to-Real ③: real-robot block-picking test + imitation vs reinforcement learning	Record success counts; discuss causes Trained model provided
17		Task planning with a language model Optional	Change the command and check the plan
18		VLA ①: an AI that understands words and acts Optional	Run a trained model; observe the motion for each command Trained model provided
19		VLA ②: fine-tuning for our robot and comparing three methods Optional	Compare models before and after fine-tuning Trained model provided
20		Final mission: a tidy-up robot you instruct by voice — presentation and assessment	Complete the mission with the provided technologies and present it

One session = about 3 hours, adjustable to the school schedule (by consultation). In **Trained model provided** sessions, students practice on the real robot with a trained reinforcement-learning model, with no GPU needed; a school with a GPU PC can also train directly in the **RL training lab**. Optional = sessions to include as the school's level and environment allow (can be run as demos; some need spoken English or external AI services).

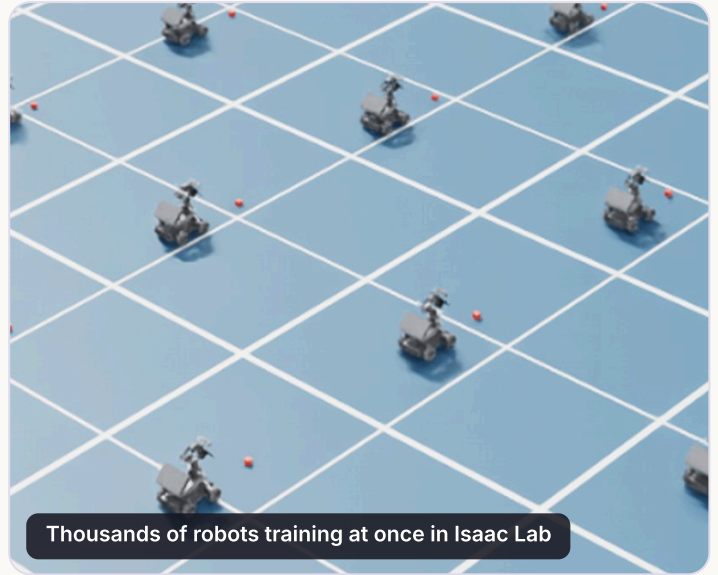
From a virtual world to the real robot

Reinforcement learning and Sim-to-Real at high school level — train in a virtual world, check on the real robot, and compare with records.

Virtual environment



Virtual world built with Isaac Sim (digital twin)



Thousands of robots training at once in Isaac Lab

An AI that learns by itself in a virtual world — four steps for students

1 Build the virtual world

Set up a robot and blocks just like the real ones inside the computer with Isaac Sim.

3 Move it to the real robot

Load the trained AI (the trained model) onto the real robot and watch it move, with no GPU needed.

2 Train thousands at once

In Isaac Lab, thousands of virtual robots practice at the same time and find the method by themselves.

4 Compare with the human method

Do the same task with a hand-coded method and the AI method, and compare the records.

Without a GPU PC, students practice with the trained reinforcement-learning model provided for each session. With a GPU PC, they can also train directly in the RL training lab.

Sample student experiment table — hand-coded vs AI

Stage	Hand-coded Mean of 3 runs (range)	AI method · reinforcement learning Mean of 3 runs (range)	Reading
Find	6.0 s	6.2 s	Same code → no difference
Approach	19.4 s (18.4–19.9)	13.2 s (13.1–13.3)	AI used here · ranges do not overlap → real effect
Align	11.4 s (9.4–13.6)	10.3 s (9.7–11.1)	Ranges overlap → not claimed as an effect
Total	63.3 s	56.3 s	About 88% of the 7.0 s gap comes from Approach

Example built from real experiment records (3 runs each under the same conditions; preliminary comparison).

Evaluation criteria

- Fair conditions** — did you change only one thing?
- Repeated measurement** — 3 or more runs; did you note the range?
- Interpretation** — does the difference exceed the range?
- State limits** — how many conditions were there?

We provide the trained reinforcement-learning model for every session.

SV Robotics technology that lets schools without GPUs start Physical AI education right away. Design → virtual test → real-world deployment → data comparison.

Start right away without a GPU — two options to fit the school's equipment

Trained RL model (no GPU)

Receive the trained reinforcement-learning model for each session, load it onto the real robot with no GPU, compare it with the hand-coded method, and analyze the training records to see how the AI learned.

RL training lab (with GPU PC)

Students train the AI themselves in the RL training lab (Isaac Sim · Isaac Lab) with thousands of virtual robots, then load it onto the real robot.

Everything from the robot to the PC, from SV Robotics

AMR Robot Arm

Classroom robot · 2 students per robot (pairs)

GPU PC for Sim-to-Real practice

Specification and number sized to the class plan (consultation)

Textbook · teacher's guide (PDF)

20-session student textbook and teacher's guide

RL class materials

Per-session explainer videos and slides — provided with or without a GPU

Trained RL model

The trained model each session needs — schools without GPUs can start right away (SV Robotics technology)

RL training lab

Schools with GPU PCs train directly in the virtual world (details by consultation)

Teacher training

Teachers practice with the robot and the virtual world before classes

Technical support · after-sales service

Problem solving and service during classes

Either way, RL class materials are provided. The number of robots and GPU PCs is sized to the number of students and the class plan (2 students per robot); details, schedule and cost are agreed by consultation to suit each school. Some AI practice requires the internet and external AI services.

Final mission — a tidy-up robot you instruct by voice

"Put the red block in the blue box."

① Understand

The AI understands the words and decides what to do

② Approach

Finds the block with the camera and drives to it

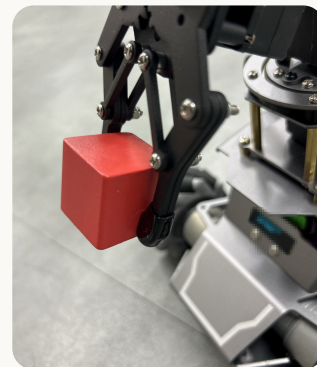
③ Pick with the AI arm

Picks it up with the chosen method: imitation, RL or VLA

④ Place

Carries it to the box and drops it in

Designed, demonstrated and presented as an end-of-semester team challenge.



What students can do after one semester

✓ Design the AI that moves a robot

Connect seeing, thinking and moving in code

✓ Teach the arm by demonstration, reward and words

Teach the same task with imitation learning, RL and VLA, and compare

✓ Apply AI trained in the virtual world to the real robot

Find and close the gap between virtual and real (Sim-to-Real)

✓ Compare with records and present

Explain the hand-coded and AI methods by comparing data

Every lesson is verified on the real robot first.

Getting started

① Consultation

Hear the school's situation and goals

② Course plan

Set sessions, level and quantities

③ Robot & PC setup

Install and check in the classroom

④ Teacher training

Teachers practice first

⑤ First class

With technical support