Project Number: 2022-1-CY01-KA210-SCH-000081449

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DexArm robotic arm

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What is a robotic arm?

A robot manipulator/arm is a **programmable mechanical device** that simulates the movement of **a human arm**. It is capable of **performing tasks** with precision and consistency, often used in industrial, medical, and research applications.

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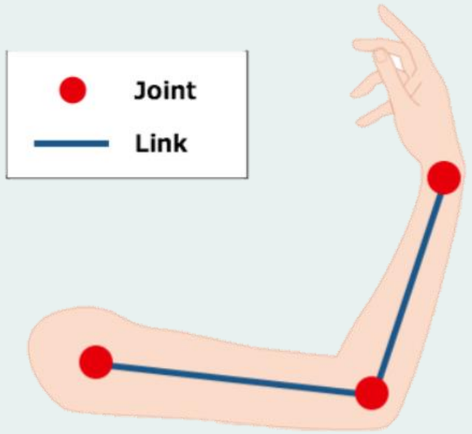
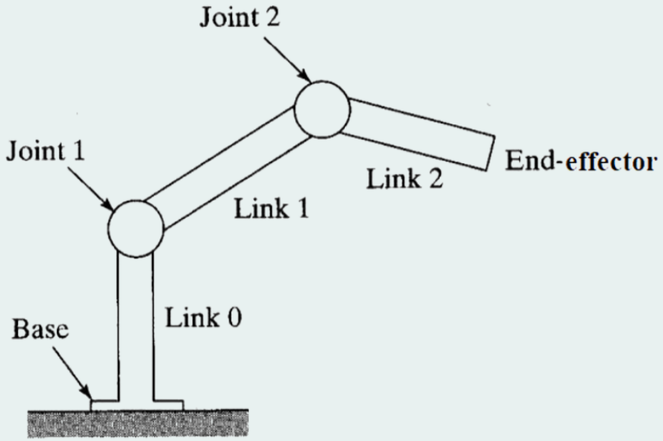
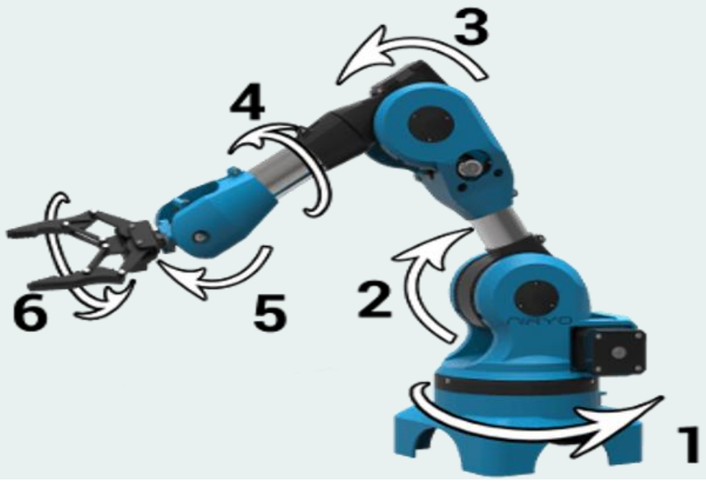
What is a robotic arm?

Key components:

- **Base** - a fixed part that anchors the arm (can be stationary or rotate)
- **Joints** - points of rotation or translation that allow the arm to move in multiple directions
- **Links** - sections between joints, similar to human arm bones.
- **End effector** - tool or device attached to the end of the arm, such as a gripper, welder, or sensor.







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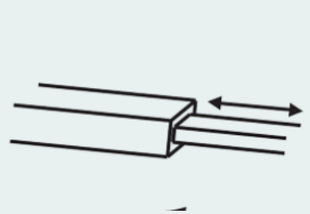
Robotic arm movement

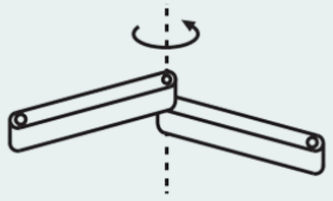
Degrees of Freedom (DOF), refer to the number of independent movements a robotic arm can perform. Each DOF corresponds to a joint or axis along which the arm can move, allowing for complex and precise positioning.

Depending on the joint types:

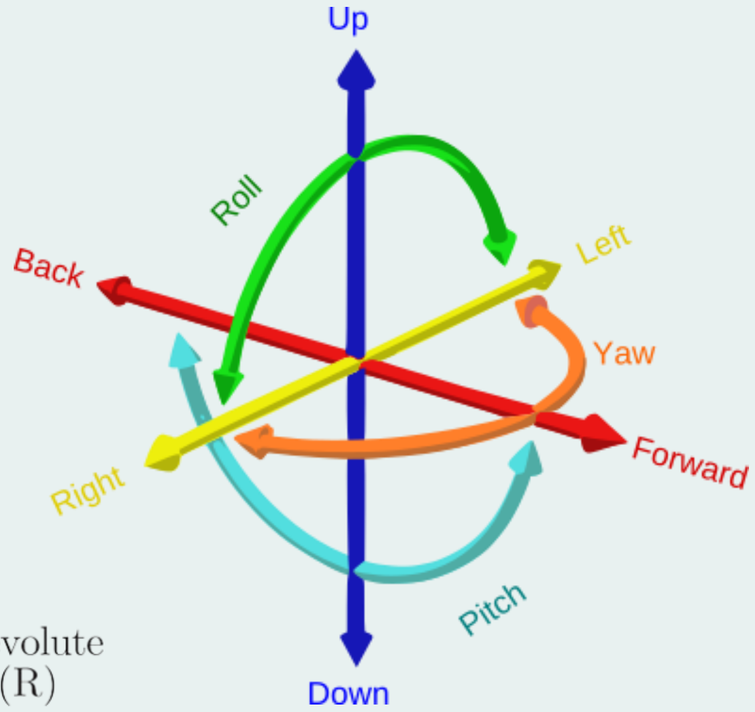
- **Translational DOF:** Movement along the X, Y, and Z axes (linear motion)
- **Rotational DOF:** Rotation around the X, Y, and Z axes (angular motion)



Prismatic
(P)



Revolute
(R)



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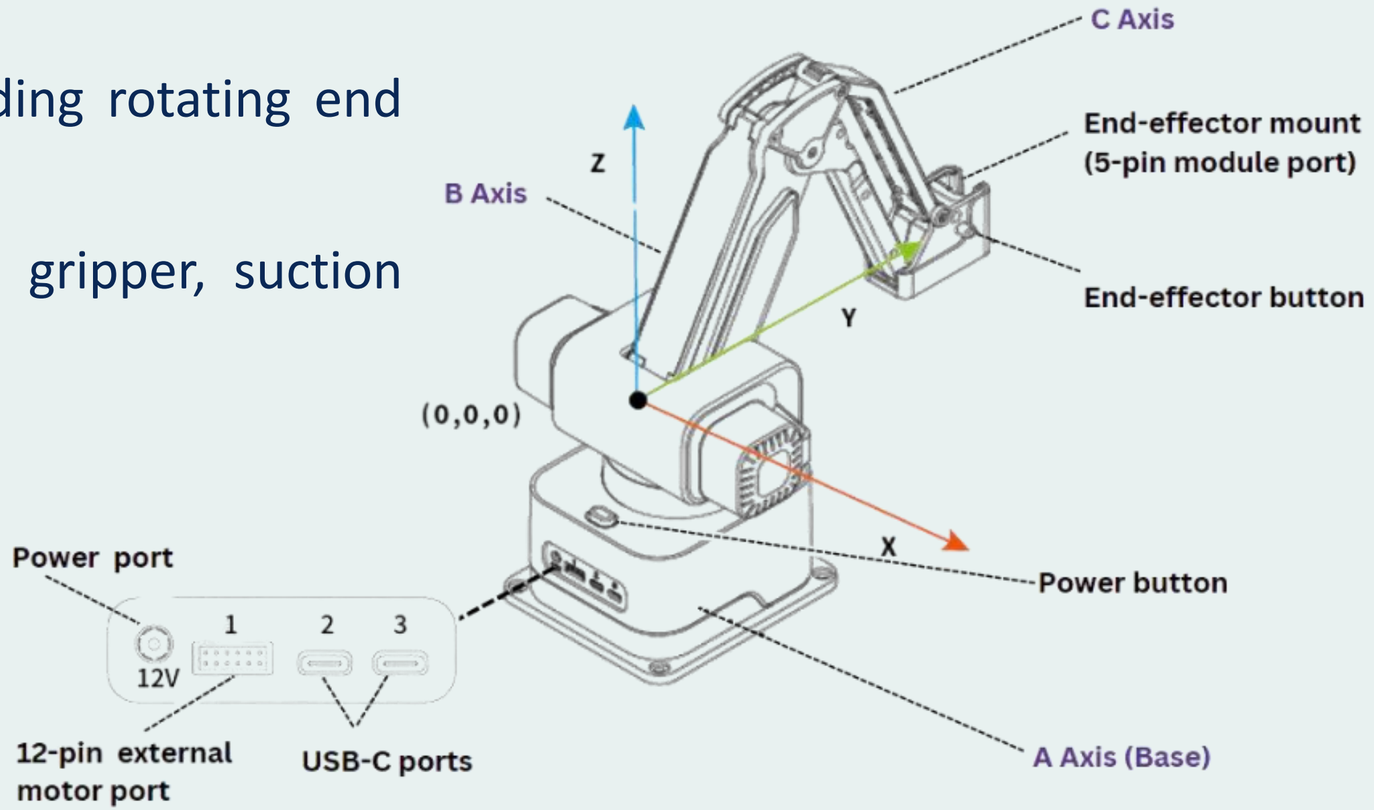
DexARM robotic arm

- lightweight desktop robotic arm
- 4 degrees of freedom (DOF) – including rotating end effector
- multi-modular structure (pen-holder, gripper, suction cup, laser 3d printer etc)
- high repeatability



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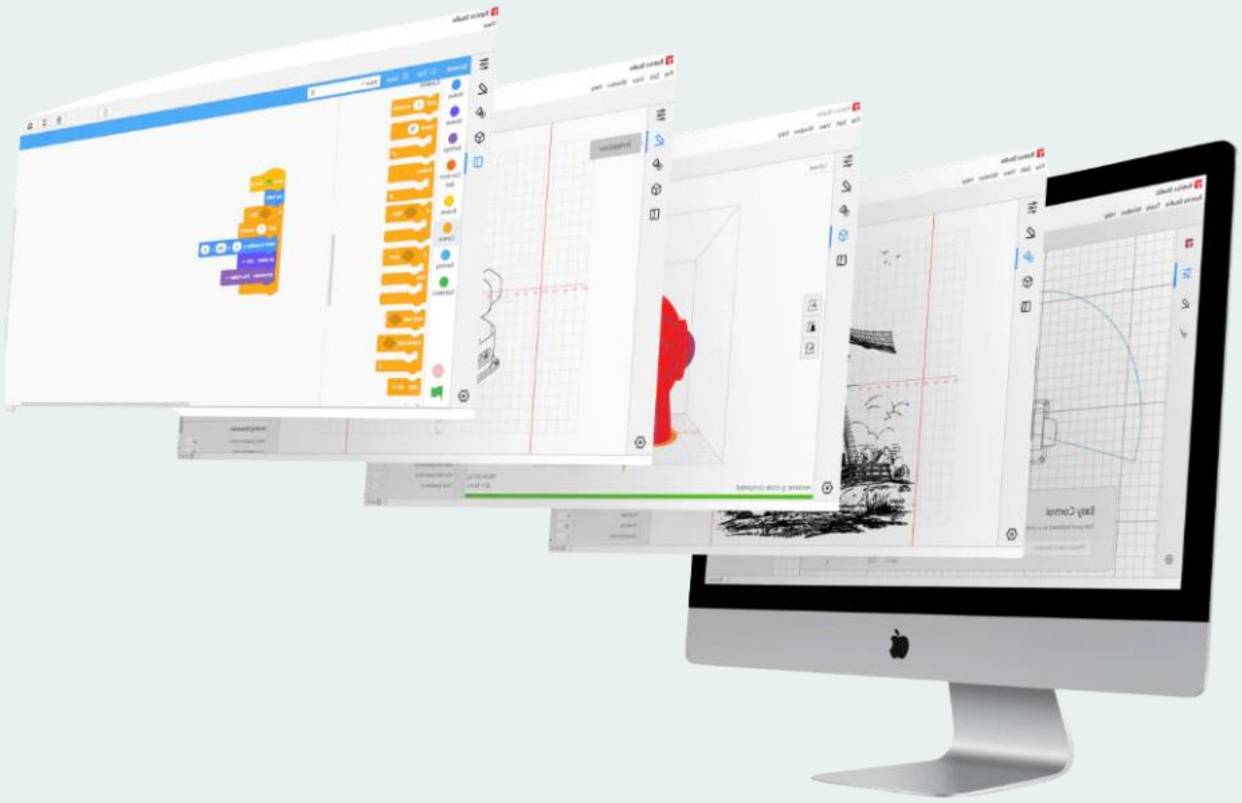
Programming and controlling DexArm

- **Rotrics Studio Software**: User-friendly interface for easy control and programming.
- **Scratch Programming:** Visual language for intuitive programming.
- **Multiple Programming Environments**: Compatible with C, C++, Python, Java, JavaScript, G-Code, and ROS (Robot Operating System)



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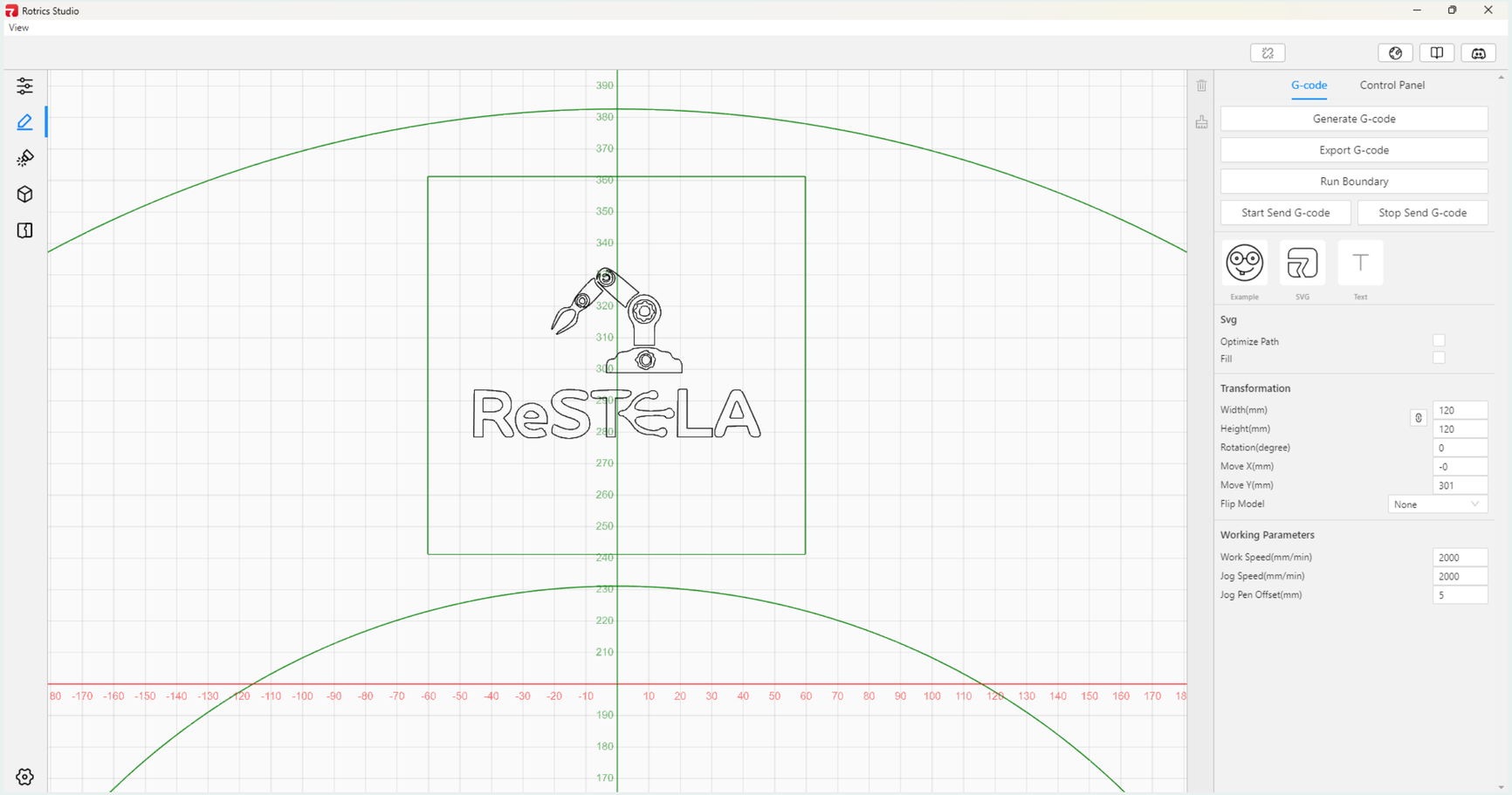
Rotrics Studio Software – Pen module



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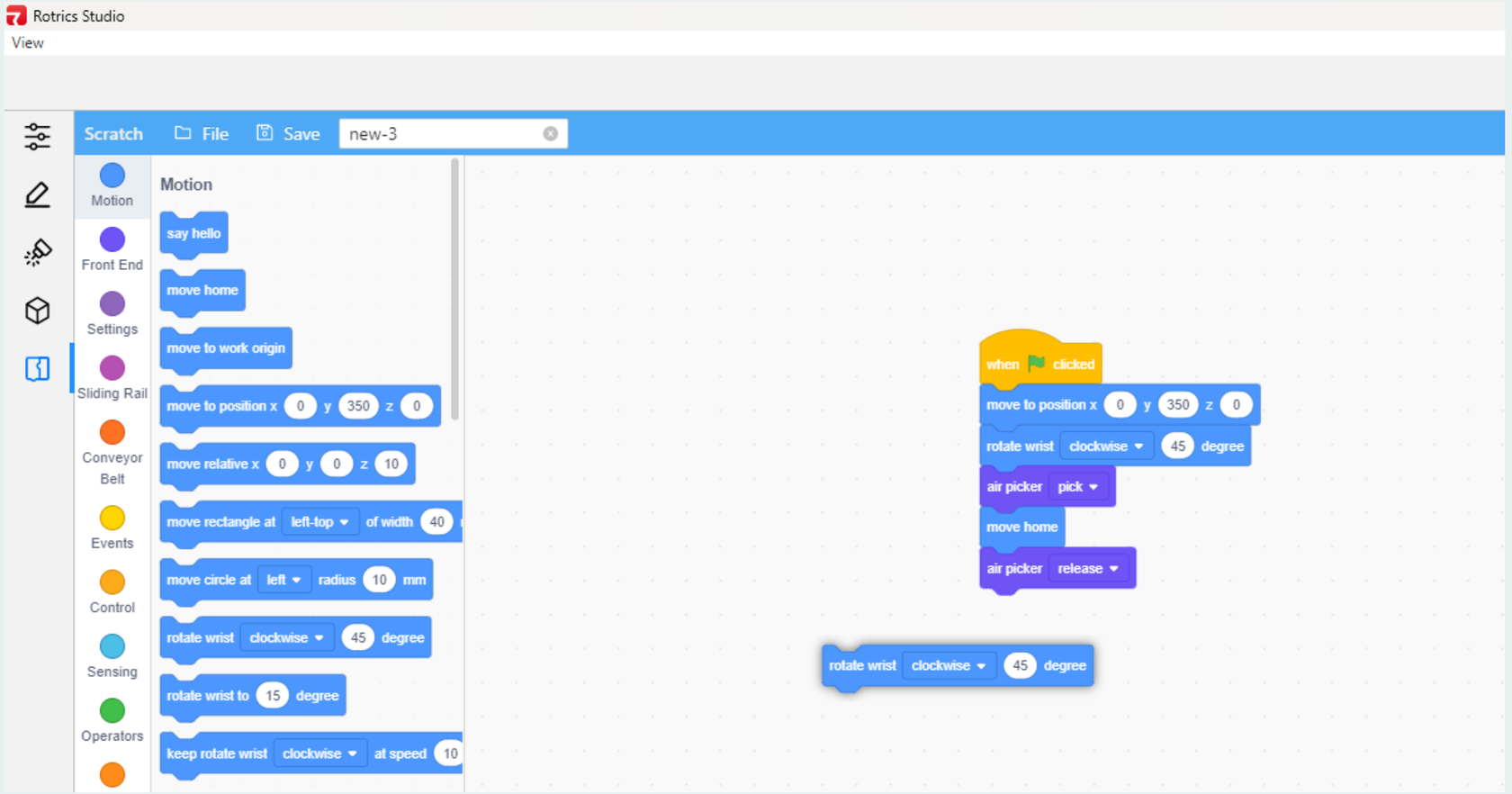
Rotrics Studio Software – Air picker module



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DexArm benefits in education

Key benefits:

- **Hands-On Learning:** Provides students with practical experience in robotics and automation
- **Multi-Disciplinary Tool:** Integrates into various subjects such as STEM, computer science, and engineering.
- **Engaging and Interactive:** Enhances student engagement through interactive and hands-on activities.
- **Develops Critical Skills:** Encourages problem-solving, critical thinking, and creativity.
- **Accessible Programming:** Supports visual programming (Scratch) and text-based languages (Python, C++, etc.)

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DexArm applications in education

Applications:

1. Robotics Classes

- Teach fundamentals of robotic movements and control
- Demonstrate kinematics and mechanics

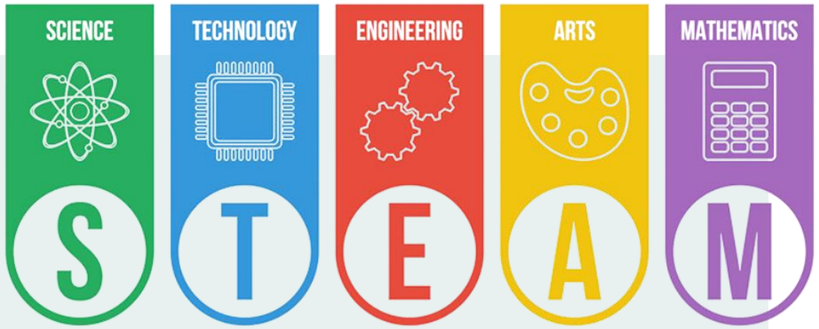
2.Programming Courses

- Introduce coding through Scratch and advanced languages
- Show real-world applications of code through robotic actions

3. 3D Printing Workshops

- Teach the basics of 3D modeling and printing.
- Allow students to print their designs and prototypes

DexArm applications in education



Applications:

4. STEAM Projects:

- Enable interdisciplinary projects combining science, technology, engineering, arts and math
- Support project-based learning initiatives

5. Research and Prototyping:

- Assist in developing student-led research projects
- Facilitate prototyping and testing of innovative ideas

6. AI and Computer Vision:

- Integrate computer vision projects using the USB high-res camera
- Develop AI-based applications and experiments

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DexArm activities

Unit #1: Robot axis and movements

Unit #2 Robot arm artist

Unit #3 Pick, rotate and place

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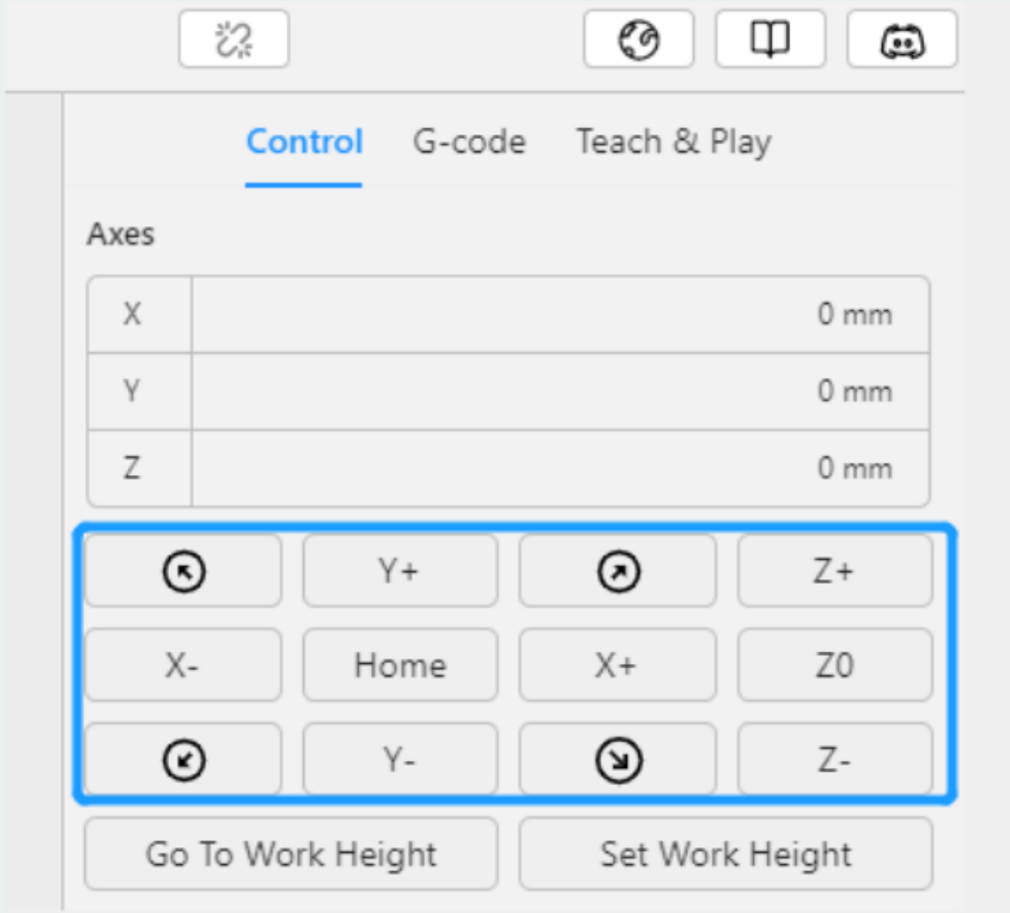
Unit #1: Robot axis and movements

The teacher should introduce the concept of **coordinates** (x,y,z), angles, and other **movements** and **boundaries**. Students should then engage with the robot arm, move it around and see how it behaves.

- What are the coordinates?
- What are degrees of freedom (DOF)? How many does the robot have?
- Which one is the end effector? What is the purpose of each end effector?



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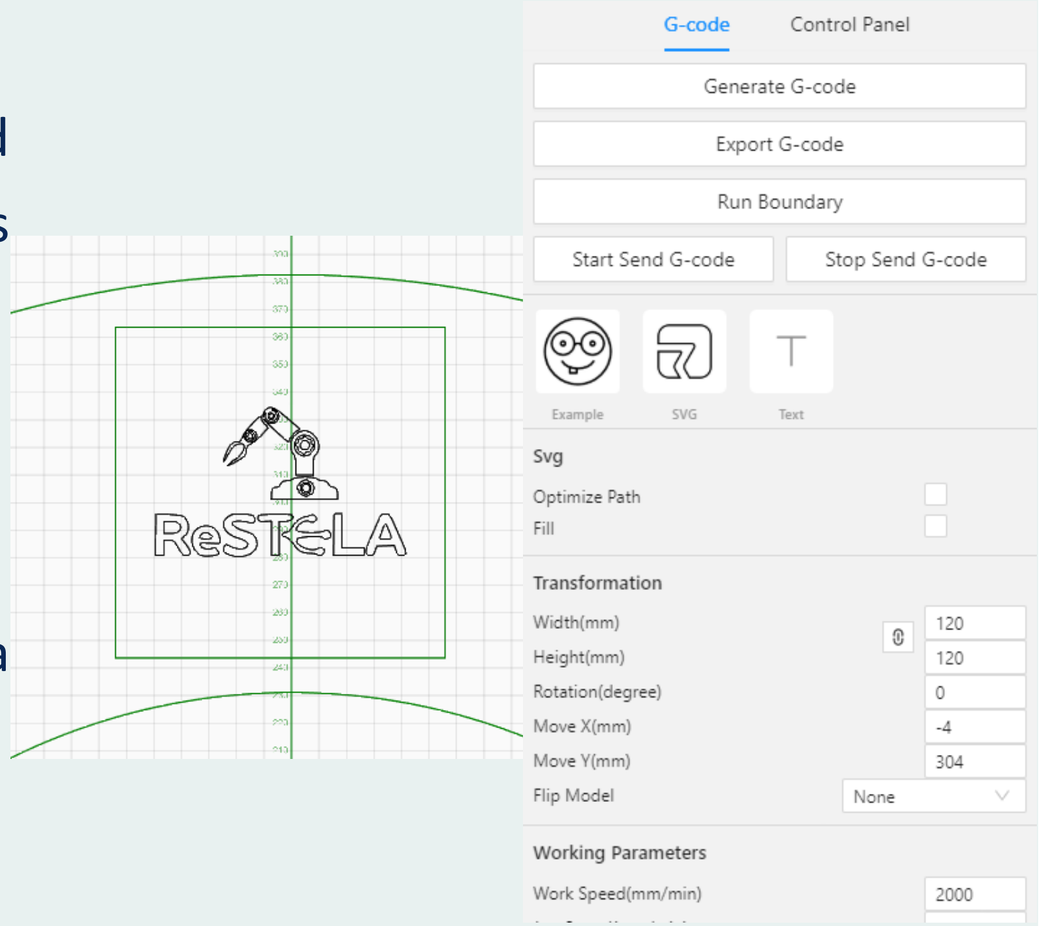
Unit #2 Robot arm artist

The teacher must introduce the drawing options and buttons (G-code, run boundary, start send). The students have 3 options:

- Text
- select an emoji
- or upload their own image (SVG file) to draw

Once they select they must convert the text/image to a **g-code** and then **send it to the robot.**

Note: suggested speed for write/draw is 4000mm/min



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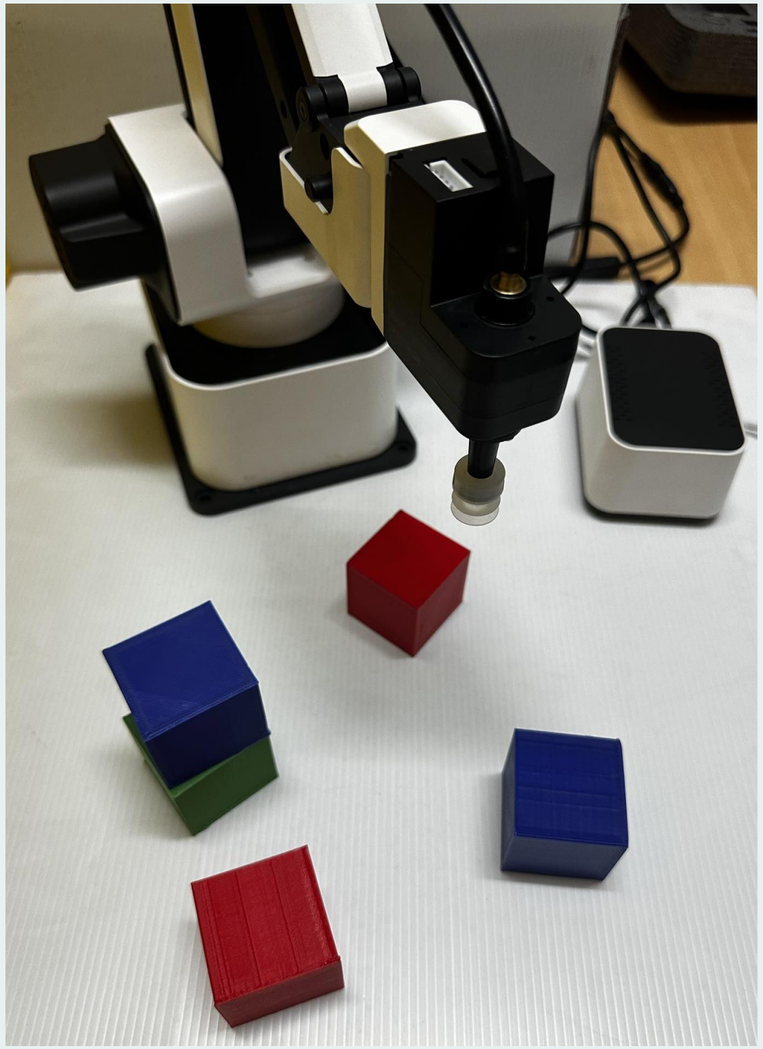
Unit #3 Pick, rotate and place

The teacher must introduce the rotary air picker/soft gripper module, which is a part of the pneumatic kit, and explain how it works and what actions it can perform. Students must write a scratch code or control the robot manually and pick a colored object, rotate it (if needed), and place it on top of the corresponding colored object.

Note: students should not attempt to go out of the boundaries.



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www.restela.eu
@RESTELAproject

ecect.projects@gmail.com
+357 96520112 (Cyprus)

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