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HANDBOOK OF ACTIVITIES

ReSTEAM

STEM Labs Unlimited!

ECECT

TAL TECH

Scuola di Robotica

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www.restela.eu

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CONTENT

ABOUT THE PROJECT

The ReSTELA - Remote STEM Labs project, funded by Erasmus+, was inspired by the imperative for digital transformation within the education sector and the increasing popularity of STEM (Science, Technology, Engineering, and Mathematics) education methodologies.

A collaborative effort between experts from Cyprus, Estonia, and Italy culminated in the development of the ReSTELA system. This platform serves as a gateway for remote access to five STEM labs (to start with), offering educators and students the equal opportunity to engage with diverse learning experiences from any location. Additionally, the consortium generated a handbook featuring tailored activities for each robot and the platform itself, empowering educators and students with resources to maximize their utilization of the available technologies.

The project employs a hybrid training approach, enabling educators from all three countries to participate physically in the training activities, while other educators can join online and receive certificate upon completion. Subsequent pilot sessions will be conducted with students to implement and evaluate the educational initiatives.

CONSORTIUM

ECECT

www.ecect.eu

The European Centre for Emerging Competencies and Technologies is a non-profit organization in Cyprus, aiming to bridge the gap between actual market needs and job candidates. ECECT organizes and supports seminars, workshops and events related to technology, digital skills, STEM education, robotics and more, targeting all age groups.

TALTECH

www.taltech.ee

TalTech IT College, offers leading IT education in Estonia, with bachelor's programs in IT systems administration, development, and cybersecurity technologies, and master's programs in Digital changes in the company and Information systems analysis and planning. The college focuses its research on IT didactics and the integration of new technologies such as telepresence robots.

SCUOLA DI ROBOTICA

www.scuoladirobotica.it

Scuola di Robotica is a non-profit association in Italy, which fosters culture through education and dissemination of robotics and new technologies. It serves as a national and international reference for research and application of robotics in education, ecology, and disabilities. Recognized by the Ministry of Education, University, and Research, it collaborates on EU projects and offers training for teaching staff updates.

ABOUT THE HANDBOOK

Welcome

Dear teacher / educator,

this handbook is the culmination of dedicated hard work and effective collaborative efforts of the ReSTELA consortium and is designed to support educators in navigating the exciting world of STEM education and robotics through remote access.

The content was gathered and structured in a way that any educator, regardless of background, could understand and use the robotic platform and equipment as well as carry out the activities in their classroom.

The intended audience comprises teachers/educators who wish to implement the activities with students aged 6-18, in both formal and non-formal educational settings.

Structure

This handbook's structure and content are intended to provide the reader with step-by-step instructions on how to choose, get ready, and carry out the activities.

The main body of the handbook, the section with the lesson plans, is divided into the five robotic labs:

- BBC Micro:bit
- Arduino compatible hardware
- Multi axis robotic arm
- Humanoid robot
- Telepresense robot

STEM, STEAM AND ROBOTICS IN EDUCATION

What is STEM education?

STEM education integrates Science, Technology, Engineering, and Mathematics, emphasizing critical thinking, problem-solving, creativity, and collaboration. Through hands-on activities and projects, students apply their knowledge across disciplines to address real challenges.

Through hands-on activities and projects, students apply their knowledge across disciplines to address real challenges.

What is STEAM education?

STEAM education adds Arts to the STEM framework, emphasizing creativity, innovation, and aesthetic appreciation alongside scientific inquiry and technical skills. It encourages students to explore connections between art, science, and technology, fostering interdisciplinary thinking and problem-solving.

What is robotics?

Robotics is a multidisciplinary field that involves the design, construction, programming, and operation of robots. A robot is a programmable machine capable of carrying out tasks automatically and/or with minimal human intervention. Robotics encompasses various subfields, including mechanical engineering, electrical engineering, computer science, and artificial intelligence.

Benefits in education

There are many benefits to using the STEM/STEAM approaches, here are some:

Interdisciplinary and practical learning: STEAM activities help students explore the connections between diverse subjects, promoting a holistic understanding of concepts. They also emphasize on practical, hands-on activities, that help students see the real-world application of what they are learning.

Problem-solving skills and creativity: STEAM activities often involve problem-solving and critical thinking, helping students develop analytical skills, and creativity and also foster innovation and out-of-the-box solutions.

Teamwork and Collaboration: Many STEAM projects involve collaborative work, fostering teamwork and communication skills, which are crucial in professional settings.

Adaptability: STEAM education teaches students to be adaptable, as they often need to apply knowledge across different domains and adjust to evolving technologies.

Career readiness and global competitiveness: is aligned with the skills needed for many 21st-century careers, preparing students for jobs in science, technology, engineering, arts, and mathematics fields, while also enhancing a country's competitiveness in the global economy by producing a skilled and innovative workforce.

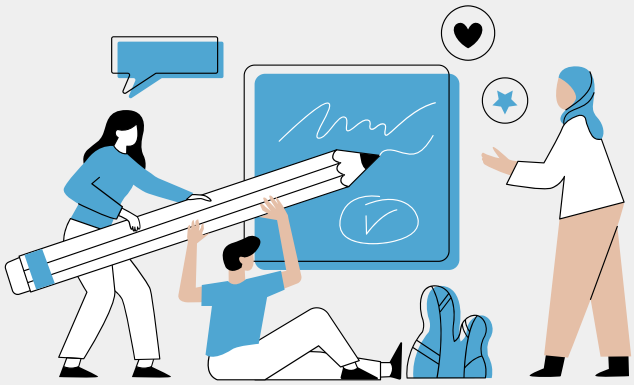
In other words, STEM/STEAM education aim to equip students with the necessary skills required in the fast changing world and enhance their success in many professional fields.

LESSON PLAN

STRUCTURE

The purpose of the lesson plan is to present a new subject and robotic equipment and motivate students to actively engage in learning new information. They encourage investigation, deep understanding, practical skills, as well as reflection and evaluation.

The lab activities are organized into topic-based units, each with clear learning objectives that are easily adaptable for teachers and students of all experience levels. While these lesson plans are specifically designed for use with the ReSTELA system, they can also be modified and extended for use without it. The suggested timeframes are flexible and can be adjusted based on the student age group.



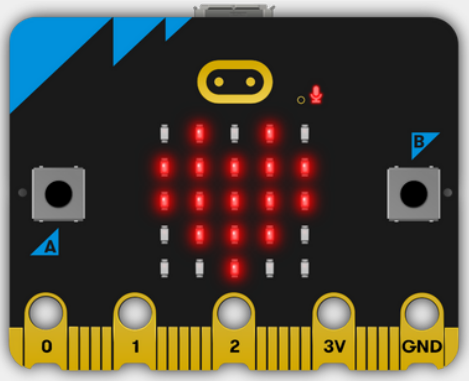
IMPLEMENTATION

Teachers may choose to use and combine additional educational materials to the lesson plans for maximum impact. Such materials include:

- Presentations, pictures, educational videos
- Worksheets
- Quiz, assessments
- References for further study

ROBOTIC LABS

01 BBC MICRO:BIT



Unit #1: Pixel Play

Unit #2: Melody Maker

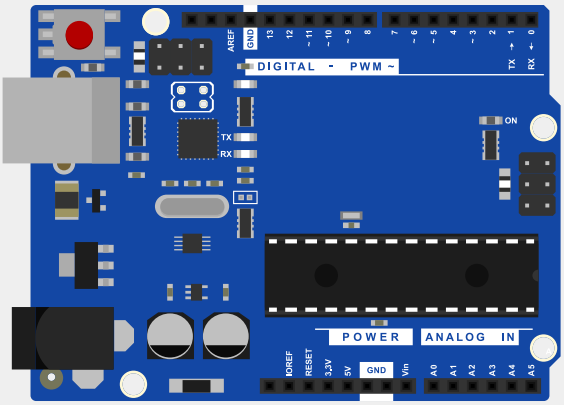
Unit #3: Eco Robo

Unit #4: Robo Move

02 ARDUINO BOARD

Unit #1: Introduction to outputs

Unit #2: Introduction to inputs



03 DEXARM ROBOTIC ARM

Unit #1: Robot Move

Unit #2: Robot Artist

Unit #3: Pick, rotate, place

ROBOTIC LABS

04 NAO HUMANOID ROBOT

Unit #1: Exploring movements with NAO

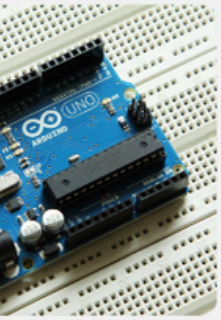
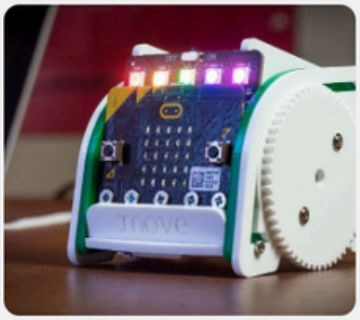
Unit #2: Crafting smart dialogues with NAO

Unit #3: Telling stories with NAO

05 OHMNI TELEPRESENSE ROBOT

Unit #1: Introduction to the telepresence robot

Unit #2: Robot Rally

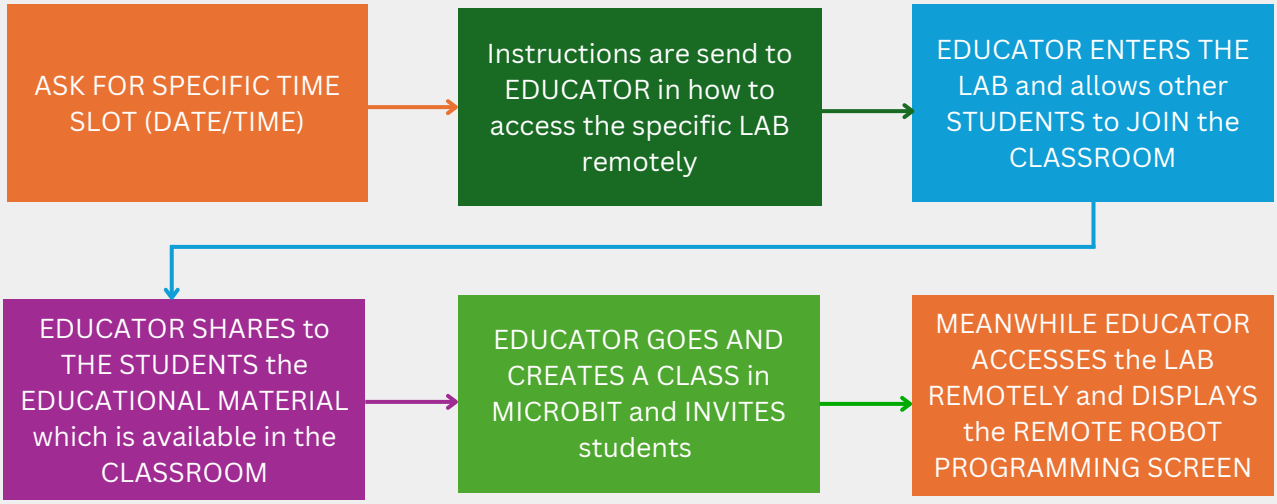




RESTELA SYSTEM

Introduction: How to access it

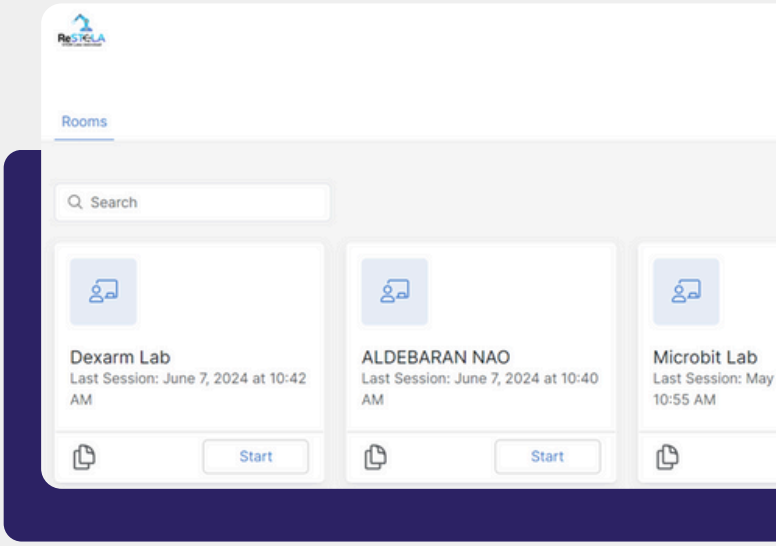
A platform has been created that allows educators to access a specific classroom through a **dedicated online system**. This system is based on Big Blue Button which allows educators to share screen, communicate with students online, edit their code and upload it to the hardware.

Administrator has the ability to create more rooms based on the number of experiments, equipment that are available at a time. Each hardware set-up could have its own room therefore educators will be given **access credentials and code** to a **specific room** and thus have access to a **specific experiment** and hardware. It has to be noted that each of the rooms can have a dedicated presentation (educational material) – therefore educators will have direct access to the latest presentation as soon as the log-in in the **ReSTELA Meet platform**.



RESTELA SYSTEM

PLATFORM

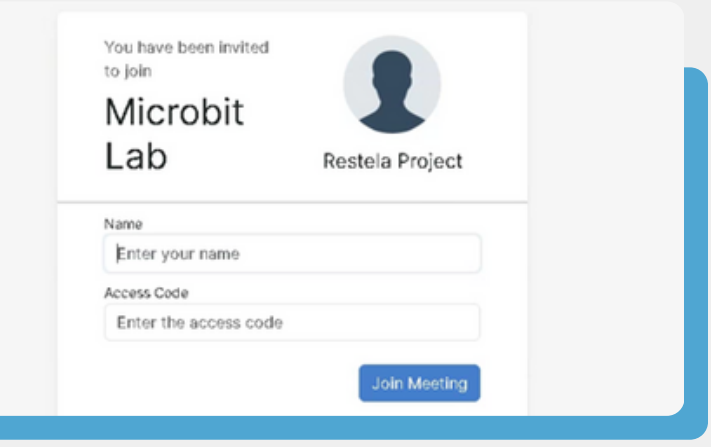


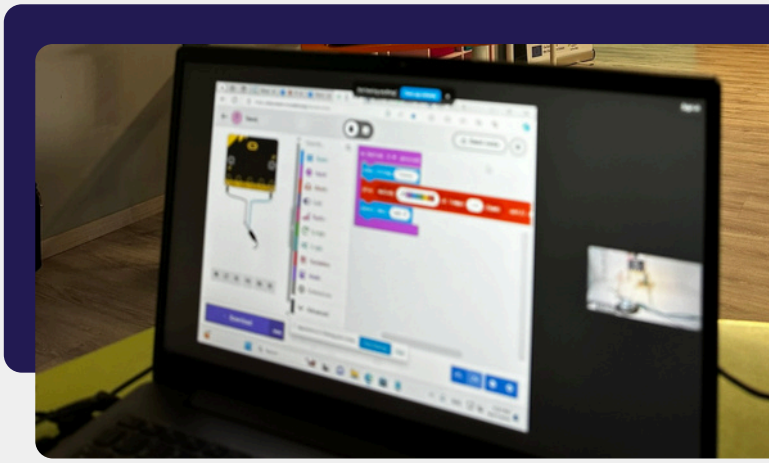
The educator needs to:

- Request for access to a “room” and the **specific experiment** on a **specific time slot**;
- Administrator will provide the educator with the **access codes**, who will then give it to his students;
- Administrator will start the meeting;
- Educators can **remotely access** the robot and operate it through the platform, while simultaneously sharing the **robot's screen** and a **high-definition video** stream of its movements with all students in the classroom, by a sending an invite link.

Two methods of accessing and controlling the screen of the remote labs.

- Using Google remote desktop
- Using other tele-conference platforms e.g Zoom or BigBlueButton





An educational platform for easy remote access to different labs

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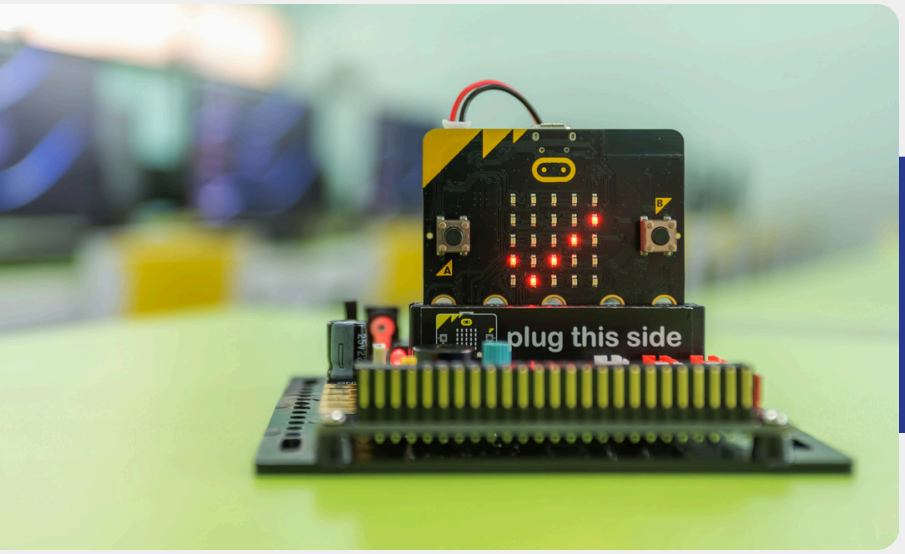

01. BBC MICRO:BIT

Introduction: What is a BBC Micro:bit?

The BBC micro:bit is a small, open-source, programmable microcontroller (ARM - based embedded computer system). It was designed with the goal of introducing young students to computer programming and digital technology. The micro:bit provides a simple and accessible platform for learning about coding, electronics, and creative problem-solving and activities related to Science, Technology, Engineering, Arts, and Mathematics (STEAM).

Key features:

- **Compact size** - small, approximately the size of a credit card
- **LED display**: 25 programmable LED's in 5x5 grid
- **Microphone and speaker**
- **Built-in sensors**: accelerometer and magnetometer, light and temperature sensor
- **Buttons:** two programmable buttons (A and B), a touch logo
- **Connectivity**: wireless communication via Bluetooth
- **Programming languages:** block-based (e.g MakeCode) or text- based (MicroPython and JavaScript).
- **Accessories**: pins on the bottom allow accessories to be connected.

The mico:bit can be plugged into a computer via USB or accessed via an online app. To make it portable a battery pack can be connected.

Sources:
https://microbit.org/teach/featured/
https://makecode.microbit.org/

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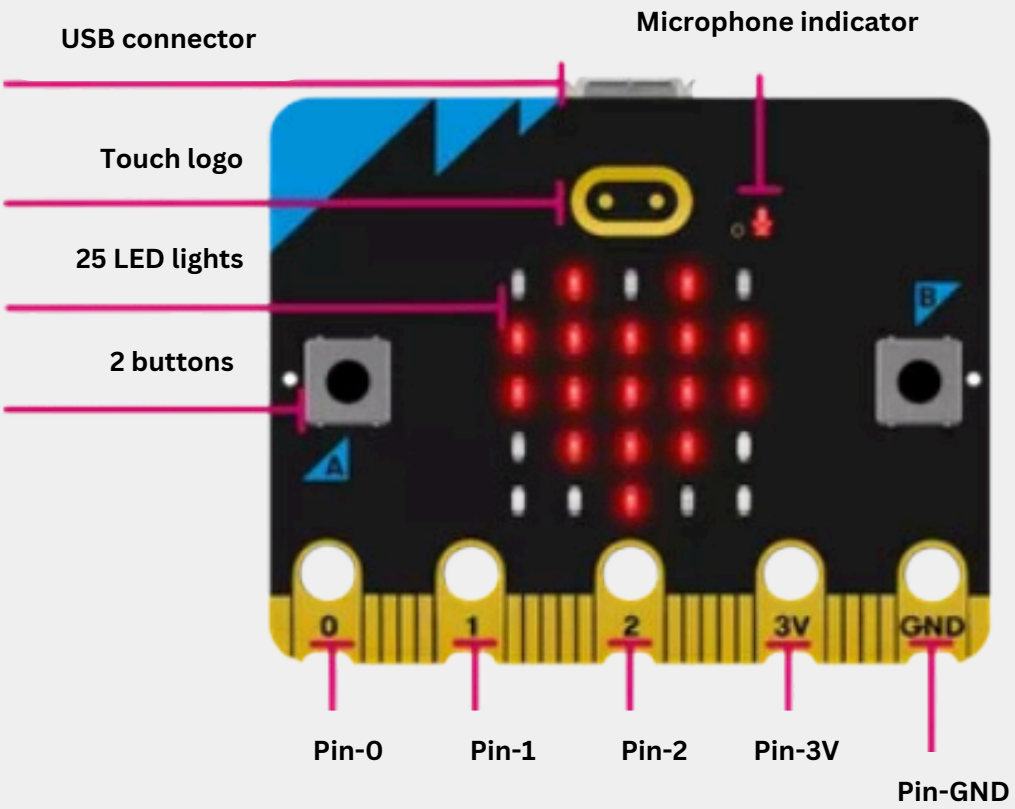
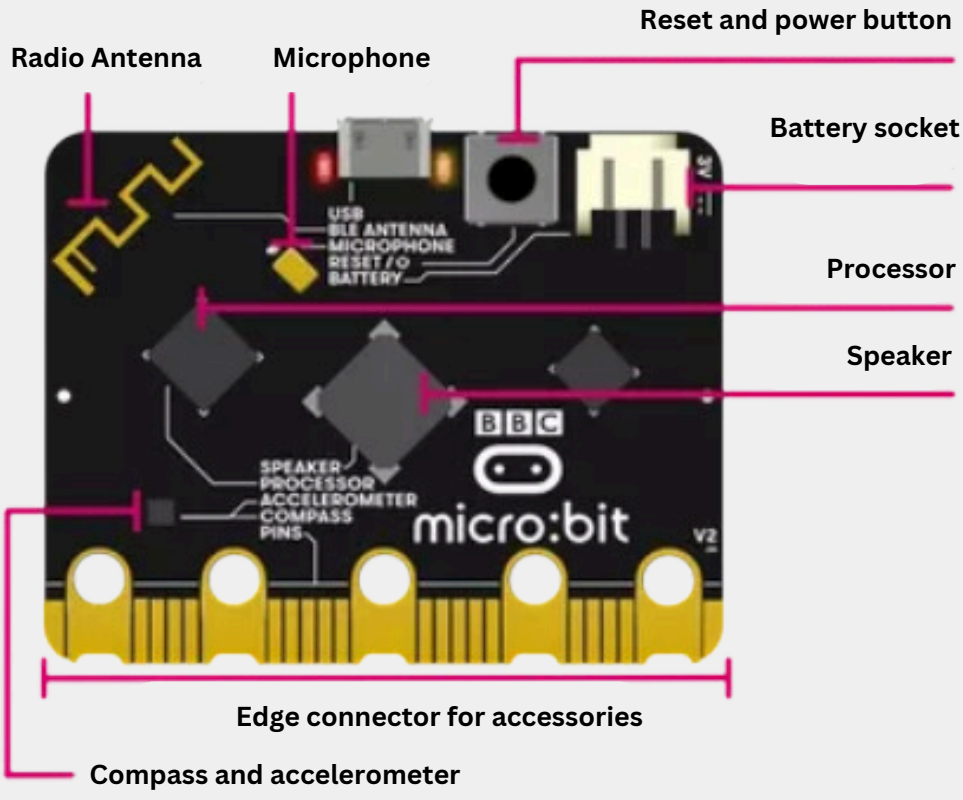
PARTS GRAPH



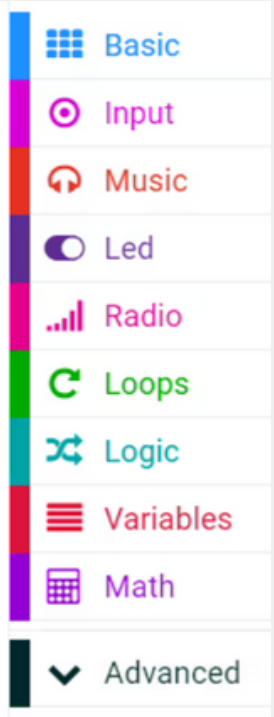


SOFTWARE ENVIRONMENT

Microsoft MakeCode:

is a user-friendly, web-based platform (www.makecode.microbit.org) designed for coding and programming education. It offers a **block-based** coding interface where users can **drag and drop** visual code blocks to create programs.
The platform supports various devices, including the BBC micro:bit, and features **online simulators** for virtual testing. MakeCode includes a **JavaScript editor** for users interested in transitioning to text-based coding. It also allows for the **extension of functionality** through additional blocks and features.

Microsoft MakeCode blocks categories:



access to basic micro:bit functionality

events and data from sensor

generation of music tones

control of the LED screen

communicate using radio packets

loops and repetition

logic operators and constants

variables

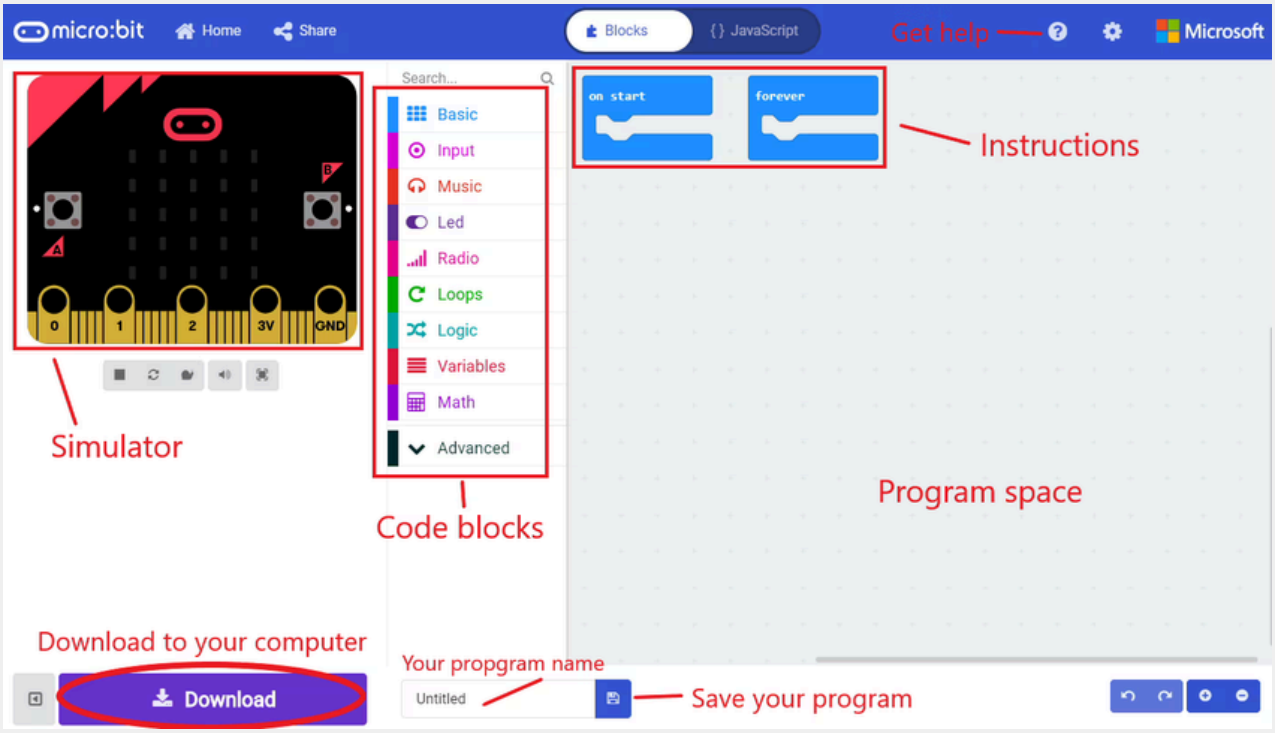
more complex operators

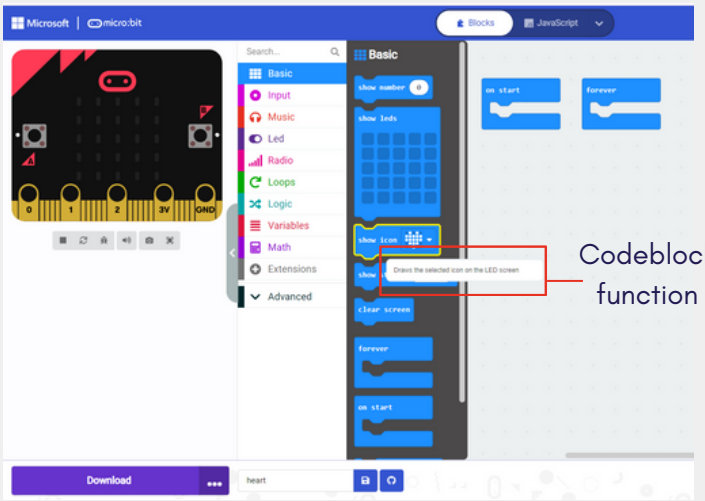
functions, arrays, text, game, images, pins, serial, control

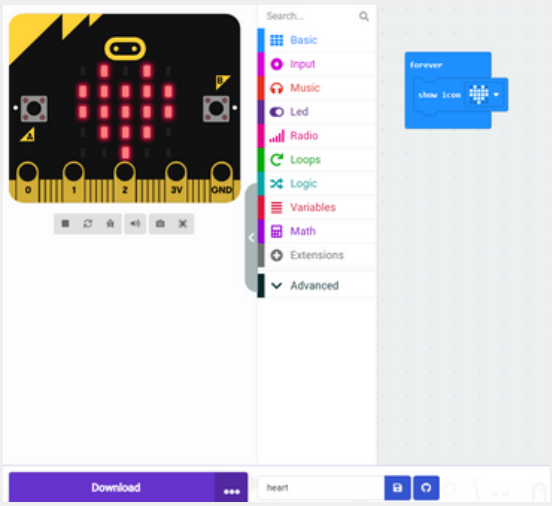
Sources:
www.makecode.microbit.org
www.classroom.microbit.org
www.microbit.org/teach/teaching-tools

SOFTWARE ENVIRONMENT

Microsoft MakeCode software:



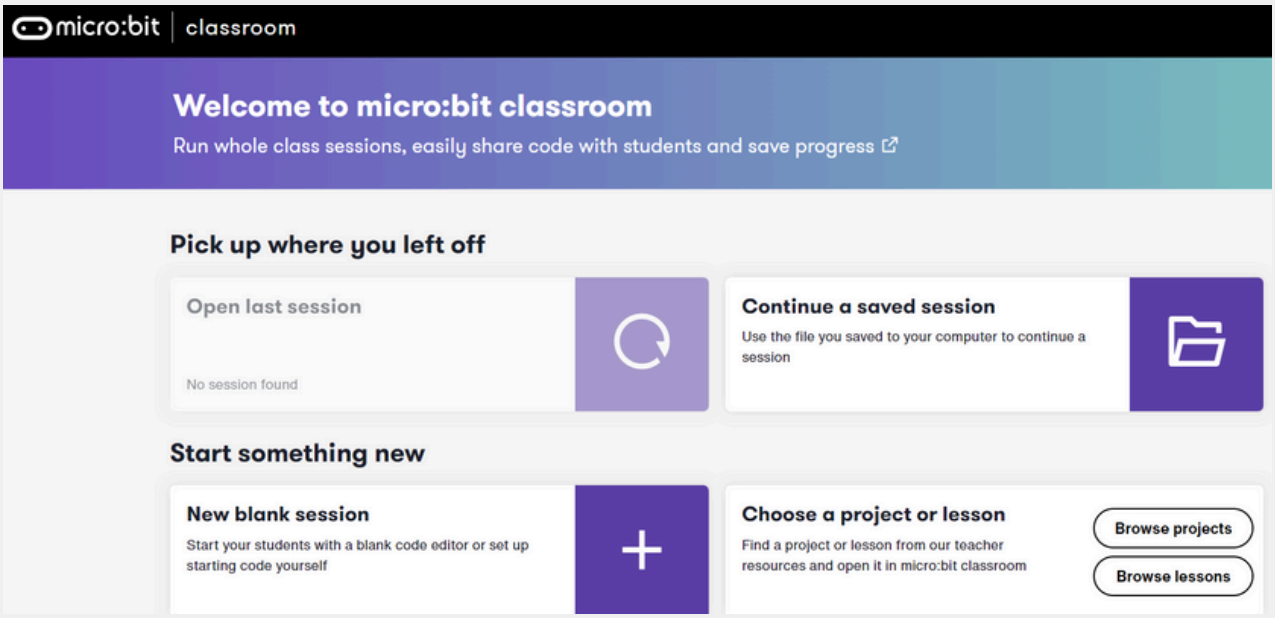


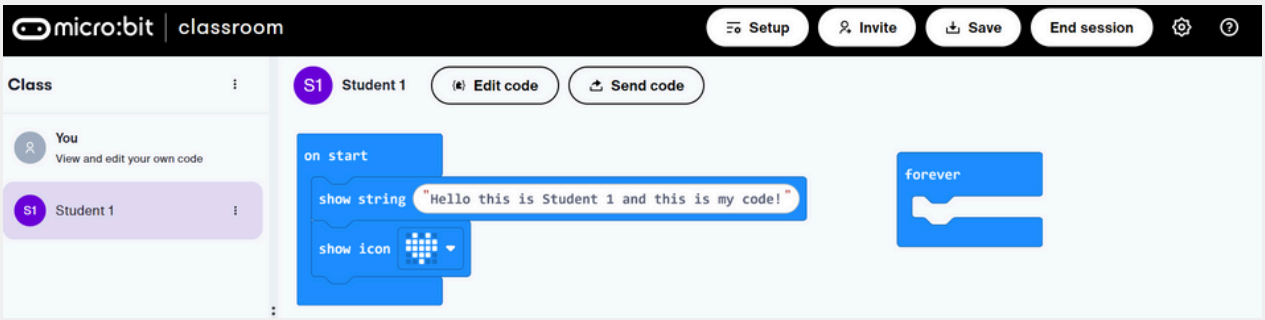


To write your code, select the appropriate code block category and code block (hovering over it, it will explain its function), then drag it to the program space, placing it precisely between the instructions (e.g., "on start," "forever"). Use the simulator on the left to test how your controller functions. Once satisfied, download your code and upload it to the ReSTELA system, hence the physical Micro:bit to see it in action.

SOFTWARE ENVIRONMENT

How a teacher can create a classroom:





Educators can create a classroom and grant access to their students by first visiting www.classroom.microbit.org. They start by selecting "**New blank session,**" naming the classroom, and choosing a code editor (MakeCode or Python). When the session begins, the educator can share an invite link or joining instructions with the students. Once the students join, the educator can view, edit, and send the students' code directly to the robot.

MICROBIT ACTIVITIES

Unit #1: PixelPlay - Creating with Micro:bit

Activity purpose - summary :

This interactive activity aims to enhance students' proficiency in using Micro:bit remotely, focusing drag and drop coding and the creation of pixelated drawings using the 5x5 LED matrix.

Target group:

6+

Duration:

2x 45' sessions

Setup:

- BBC Micro:bit
- Computer/Laptop
- Microsoft MakeCode

Objectives

Cover fundamental concepts by working with :

- Drag and drop coding
- 5x5 LED matrix

Activity #1: Practical demonstration and Programming

Conduct a live demonstration using screen sharing with both the real Microbit and the simulator. Present code examples illustrating how to use the following blocks:

- **show number** - they can write their favourite number or age
- **show icon** - they can choose an icon they like
- **show string** - they can write their name or a message for the partners in other countries to see, such as “Hello!”
- **show leds** - they can draw their own icon

Activity #2: Create their own animation

The students by using the “forever” instruction and using multiple code blocks can develop an animated image e.g a dog moving its tail, or a man dancing, they can use their imagination!

MICROBIT ACTIVITIES

Unit #2: Melody Maker: Creating with Microbit

Activity purpose - summary :
This interactive activity aims to enhance students' proficiency in using Micro:bit remotely, focusing on drag and drop coding, and create music using the speaker and microphone.

Target group:
6+

Duration:
2x 45' sessions

Setup:
- BBC Micro:bit
- Computer/Laptop
- Microsoft MakeCode

Objectives
Cover fundamental concepts by working with :
- Drag and drop coding
- Speaker and microphone

Activity #1: Practical demonstration and Programming

Conduct a live demonstration using screen sharing with both the real Microbit and the simulator. Present code examples illustrating how to use the following blocks:

- **play melody** - they can choose their own melody and tempo
- **play tone** - they can choose their own tone and beat
- **show icon** - they can choose an icon they like
- **show string** - they can write their name or a message for the partners in other countries to see, such as “Hello!”
- **show leds** - they can draw their own icon

Activity #2: Combine audio and visual

The students can use the plot bar graph of the sound level up to 255 (the loudest) in order to visualize the music or sound from the in-built microphone, or measure the noise of the room.

MICROBIT ACTIVITIES

Unit #3: Eco Robo: Environmental monitoring with Microbit

Activity purpose - summary :

This interactive activity aims to enhance students' proficiency in using Micro:bit remotely, focusing drag and drop coding and how to monitor the environment using the temperature sensor.

Target group:

6+

Duration:

2x 45' sessions

Setup:

- BBC Micro:bit
- Computer/Laptop
- Microsoft MakeCode

Objectives

Cover fundamental concepts by working with :

- Drag and drop coding
- Temperature sensor

Activity #1: Practical demonstration and Programming

Conduct a live demonstration using screen sharing with both the real Microbit and the simulator. Present code examples illustrating how to use the following blocks:

- **show string** - they can display the temperature value
- **temperature (input)** - they can read the value from the sensor

Activity #2: Combine audio and visual

The students can combine the melody maker activity along with logic blocks, in order to create a smart eco alarm e.g when the temperature is too high,play one tone and when the temperature is too low, play a different tone. They can use the following logic block:

- **if and else statement**

MICROBIT ACTIVITIES

Unit #4: Robo Move: Movement with Microbit

Activity purpose - summary :

This interactive activity aims to enhance students' proficiency in using Micro:bit remotely, focusing drag and drop coding and how to manipulate a two - wheeled robot's movements.

Target group:

6+

Duration:

2x 45' sessions

Setup:

- BBC Micro:bit
- Computer/Laptop
- Microsoft MakeCode

Objectives

Cover fundamental concepts by working with :

- Drag and drop coding
- Two -wheel robot motion

Activity #1: Practical demonstration and Programming

Conduct a live demonstration using screen sharing with both the real Microbit and the simulator. Present code examples illustrating how to use the following blocks (using the servo:lite code blocks):

- **turn left** - they can turn left from 0-180 degrees
- **turn right** - they can turn right from 0-180 degrees

Activity #2: Make the robot dance

The students can use the combine the two command blocks and make the robot dance, by alternating movements left and right.

Note: You should only use these two commands, as the robot cannot move forward and backward in the specific lab setting.

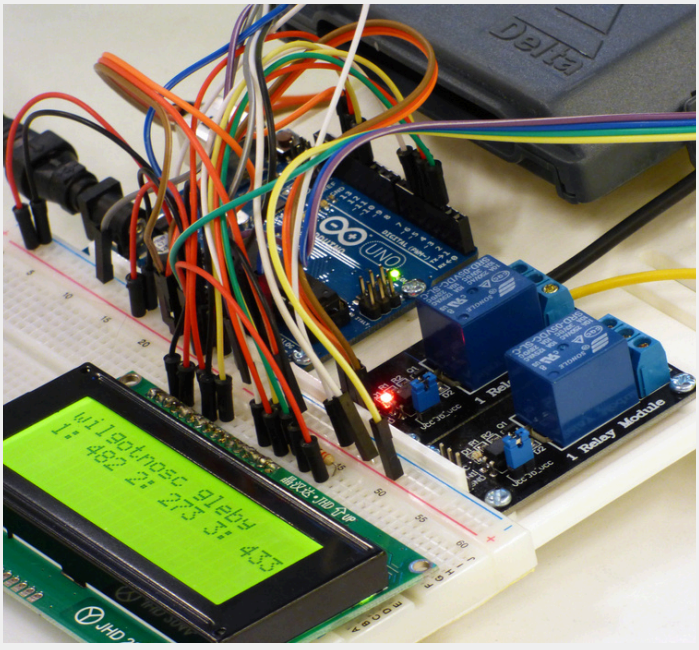
02. ARDUINO BOARD

Introduction: What is an Arduino?

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs (from sensors, buttons, cameras, etc.) and turn them into an output (display, LED, buzzer, motors/actuator), either digital or analogue. You can tell your board what to do by sending a set of instructions (coding) to the microcontroller on the board. To do so you use the **Arduino programming language** and **the Arduino Software (IDE).**

Arduino use can be used for multiple and versatile projects from everyday objects to IoT applications, wearable, 3D printing, and embedded environments, and can be used by students, hobbyists, artists, programmers, and professionals.

This is feasible due to Arduino-compatible boards (e.g UNO), and expansion boards (e.g motor shield), which are integral components of the Arduino ecosystem. Also, there are many Arduino compatible kits e.g Grove Beginner Kit, which is ideal for beginners.



Sources:
www.docs.arduino.cc
www.wiki.seeedstudio.com

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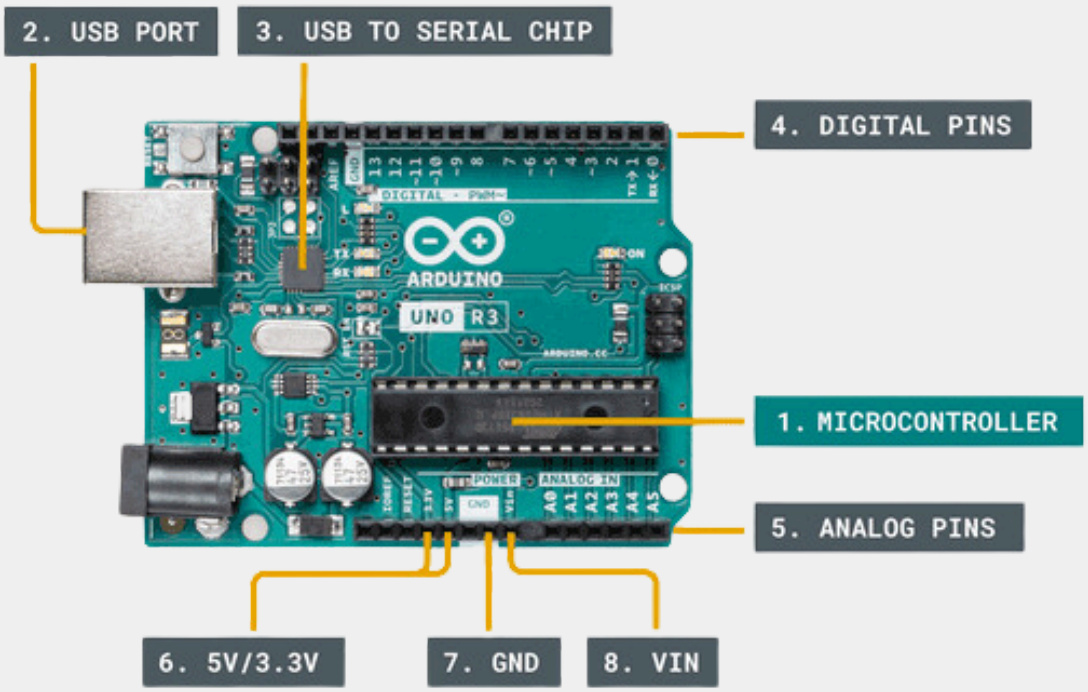
PARTS GRAPH

Key features of an Arduino board (UNO):

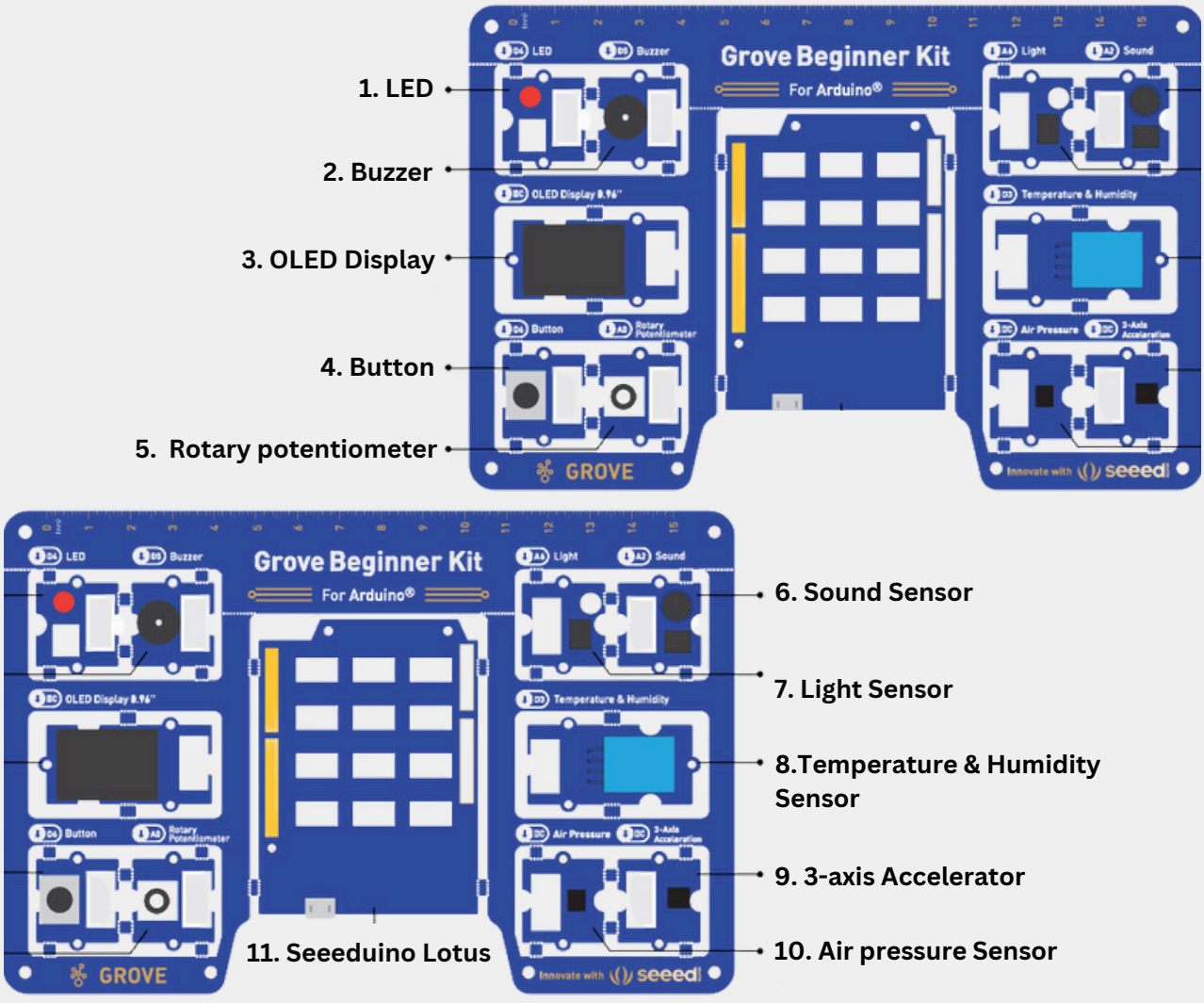
1. **Microcontroller:** the brain of an Arduino, and is the component that we load programs into. Think of it as a tiny computer, designed to execute only a specific number of things.
2. **USB port:** used to connect your Arduino board to a computer.
3. **USB to Serial chip:** this is an important component, as it helps translate data that comes from a computer to the on-board microcontroller.
4. **Digital pins:** that use digital logic (0,1 or LOW/HIGH). Commonly used for switches and to turn on/off an LED.
5. **Analog pins**: that can read analog values in a 10 bit resolution (0-1023).
6. **5V / 3.3V pins:** used to power external components.
7. **GND:** also known as ground, negative or simply - used to complete a circuit, where the electrical level is at 0 volt.
8. **VIN:** stands for Voltage In, where you can connect external power supplies.



PARTS GRAPH

Key features of the Grove Beginner Kit for Arduino:

1. **LED:** Simple LED module
2. **Buzzer:** Piezo Buzzer
3. **OLED Display 0.96":** 128×64 dot resolution
4. **Button**: Momentary Push Button
5. **Rotary Potentiometer**: Adjustable Potentiometer
6. **Sound Sensor:** Detects surrounding sound intensity
7. **Light Sensor:** Detects surrounding light intensity
8. **Temperature & Humidity Sensor:** Detects temperature, humidity values
9. **3-Axis Accelerator:** Detects object acceleration
10. **Air pressure sensor:** Detects surrounding atmospheric pressure
11. **Seeeduino Lotus:** Arduino Compatible Board with Grove Ports (additional compatible inputs/outputs)



ARDUINO ACTIVITIES

Unit #1: Introduction to OUTPUTS

Activity purpose - summary :

The focus is on introducing output devices and providing hands-on activities to familiarize users with controlling different components using the Grove Kit modules.

Target group:

13+

Duration:

3x 60' sessions

Setup:

- Grove Kit for Arduino
- Computer/Laptop
- Arduino IDE Software

Objectives

Cover fundamental concepts by working with :

- an LED,
- a buzzer,
- an OLED display.

Activity #1: Blinking LED

Students are first introduced to the basic Arduino IDE coding, covering the basics of program structure, setup and loop functions and pinMode() and digitalWrite(), and delay(). The teacher should introduce the concept of digital signals and digital output, focusing on LOW (0V) and HIGH (5V) states. Students should then engage in programming the LED to blink, by experimenting with the delay() function for timing adjustments.

Note: The delay() function uses milliseconds (1000 = 1 second)

Activity #2: Make music using the buzzer

The teacher introduces the concept of (frequency, duty cycle and pulse width modulation) explaining how it influences the pitch of the sound produced. The tone() function is introduced to control the frequency and duration of the sound, while notone() is introduced to stop the sound.

Note: The minimum frequency to generate tones is 31kHz.

https://www.arduino.cc/reference/en/language/functions/advanced-io/tone/

Activity #3: Draw using the display

The teacher introduces the concept of coordinates (x,y,z), degrees and the parameters of shapes (e.g circle - radius), and then explaining that by modifying the variables can it move or change the shape and or text displayed on the display. The u8g2.drawStr() function is introduced to display text, u8g2.setFontDirection() to change the text direction, u8g2.drawBox() and u8g2.drawCircle() to draw a box and circle accordingly.

Advanced: The use of symbols - ASCII and HEX code
Note: the example code uses the " U8g2 2lib.h" library. In order for the code to run it must be installed on your computer.

Advanced activity: Party at the disco!

The students can used the previous activities and combine them and create a visual and audio output using different tones and displays.

ARDUINO ACTIVITIES

Unit #2: Introduction to INPUTS

Activity purpose - summary :

The focus is on introducing input devices and providing hands-on activities to familiarize users with reading different values using the Grove Kit modules.

Target group:

13+

Duration:

3x 60' sessions

Setup:

- Grove Kit for Arduino
- Computer/Laptop
- Arduino IDE Software

Objectives

Cover fundamental concepts by working with :

- an air pressure sensor
- a soil moisture sensor
- a light and sound sensor
- a temp& humidity sensor

Activity #1: Read the air pressure sensor values

The teacher explains what an air pressure sensor is and the values and units it reads: Temperature (C), Pressure (Pa), and Altitude (m). Then the students are introduced the concept of Serial Monitor, the Serial.begin() and Serial.print() functions for real-time data observation.

Note: the students can change the delay() function value, to print the sensor values faster/slower.

Activity #2: Warn the gardener of a dry or wet plant

The teacher explains the moisture values range(see table onenote) and similarly to the previous activity uses the serial monitor to view the input values. In addition the student can add an if statement that based on the input value will turn on an led and/or buzzer when the plant is too wet or too dry to warn the gardener.

Activity #3: Plot the temperature and humidity values

The teacher must introduce the environmental concepts of temperature and humidity. The students will then read the sensor data and visualizing it in real-time using the Serial Plotter. The teacher must explain the connection between the physical world (sensor data) and the graphical representation in the Serial Plotter.

03. DEXARM

Introduction: What is a DexArm?

DexArm is a lightweight desktop robotic arm, that features a versatile design with 4 degrees of freedom (DOF) and has multi-modular structure that ensures high repeatability, making it ideal for diverse applications in education, research, and industry. DexArm accommodates various modules and accessories, including:

- 3D Printing Module and Kit
- Laser Engraving Module and Kit
- Pneumatic Kit (Rotary Soft Gripper Module, Rotary Suction Cup Module)
- Pen Holder Module
- 3.5-inch Touchscreen
- Computer vison Kit (USB High res camera for AI projects)

These modules can be effortlessly attached and interchanged, transforming DexArm into a desktop plotter, laser engraver, 3D printer, and more.

Control and programming are facilitated through the user-friendly Rotrics Studio Software interface and Scratch programming, a visual language. DexArm's compatibility extends to multiple programming environments and languages, encompassing C, C++, Python, Java, JavaScript, G-Code, and ROS (Robot Operating System).

Source:
www.manual.rotrics.com

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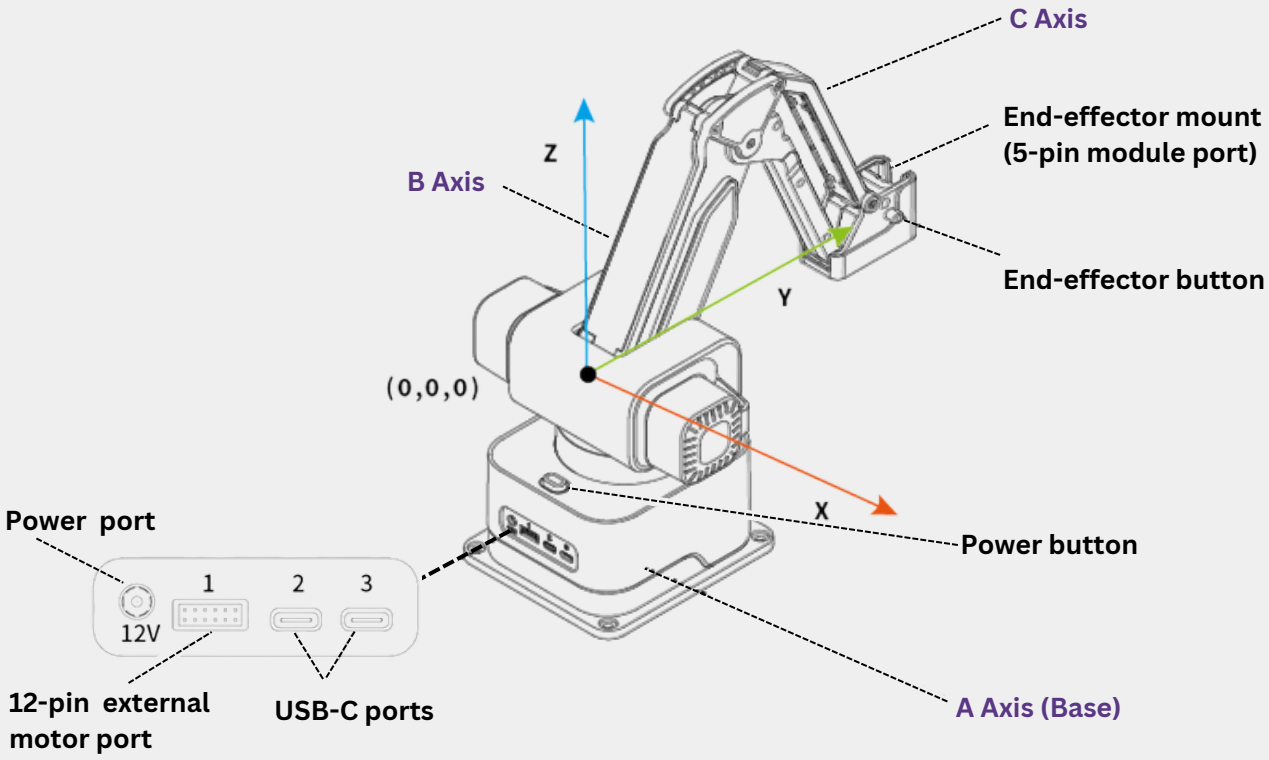
PARTS GRAPH

Key features of the DexArm:

- 4-Axis, 3DOF + 1 DOF with the rotary module
- End-effector mount (5-pin module port)
- End-effector button
- Power button
- Power port
- 12-pin external motor port
- 2x USB-C ports



End-effectors:

Pen-holder module

Pneumatic softgripper module

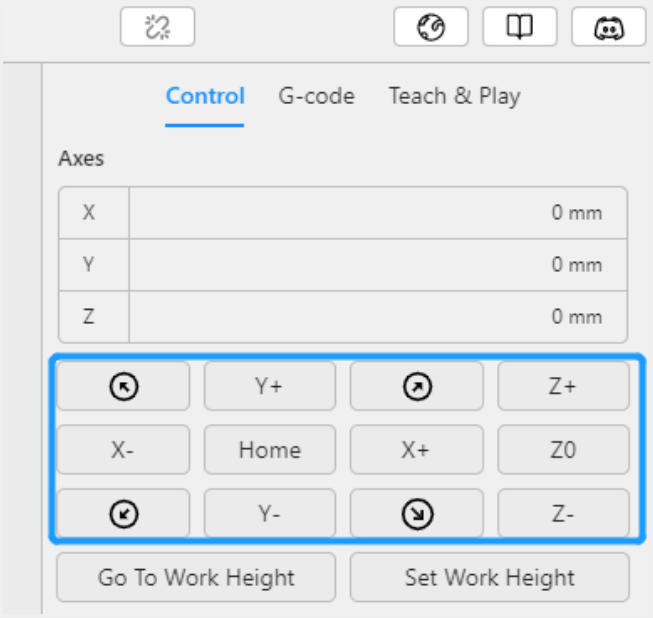
Pneumatic Suction cup module

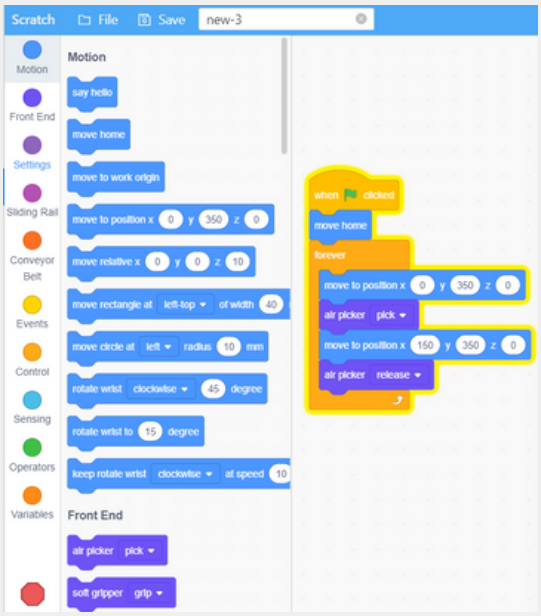
2.5 laser module

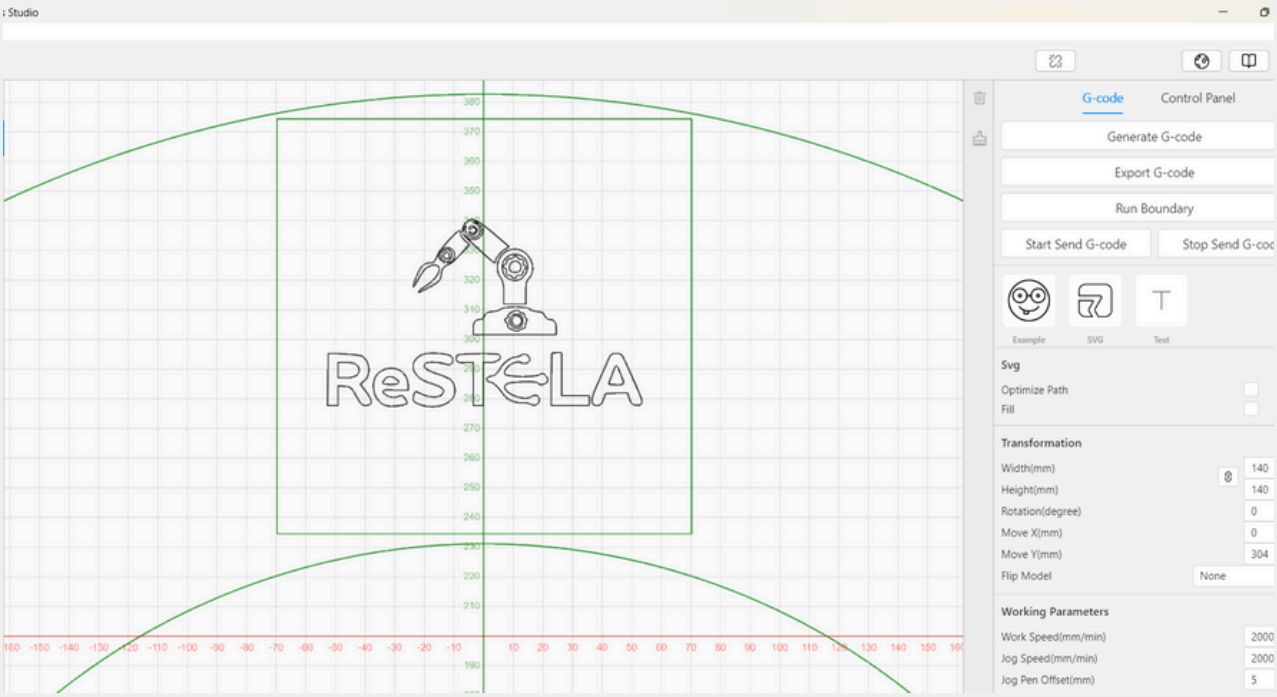
3d printer module

SOFTWARE ENVIRONMENT

Rotrics Studio software:







You can control the robot in several ways:

1. Manual Control: Using the control panel.
2. Scratch Coding: Utilizing drag-and-drop coding with Scratch .
3. SVG Image: Upload it, generate commands (G-code), send them to the robot. It is used for tasks like drawing, laser engraving, or 3D printing.

DEXARM ACTIVITIES

Unit #1: Introduction to Robot movements

Activity purpose - summary :

The focus is on introducing the robot's joints and end-effectors and understanding the concept of coordinates, movements and programming sequences via hands-on activities.

Target group:

13+

Duration:

3x 60' sessions

Setup:

- DexArm
- Computer/Laptop
- Rotrics Studio Software

Objectives

Cover fundamental concepts by working with :

- pen module
- soft gripper module
- suction cup module

Activity #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 and 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?

Activity #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) in order 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

Activity #3: Pick, rotate and place

The teacher must introduce the rotary air picker/soft gripper module, which is a part of the pneumatic kit, 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.

04. NAO

Introduction: What is a NAO Humanoid Robot?

NAO represents a remarkable integration of technology and education, offering a unique opportunity to enhance the learning experience in classrooms worldwide. One of NAO's key strengths lies in its ability to tailor interactions to meet the individual needs of students. By leveraging advanced technologies, NAO can adapt its teaching methods, pace, and content delivery to accommodate diverse learning styles and preferences, all through an intuitive drag-and-drop programming environment. This adaptability not only promotes inclusivity but also empowers students to take ownership of their learning journey.

In practical terms, NAO's presence in the classroom opens up new avenues for interactive and experiential learning. Through customizable activities and engaging exercises, students can explore complex concepts in STEM (Science, Technology, Engineering, and Mathematics) fields, develop critical thinking and problem-solving skills, and cultivate a deeper understanding of academic subjects.

Moreover, NAO's role extends beyond traditional subject matter. In special education, for instance, NAO's emotive assistance can support students with disabilities, providing tailored guidance and encouragement to facilitate their cognitive and emotional development. By implementing Individualized Educational Programs (IEPs), educators can leverage NAO's capabilities to create personalized learning experiences that address the unique needs of each student.

Source: https://www.aldebaran.com/en/nao

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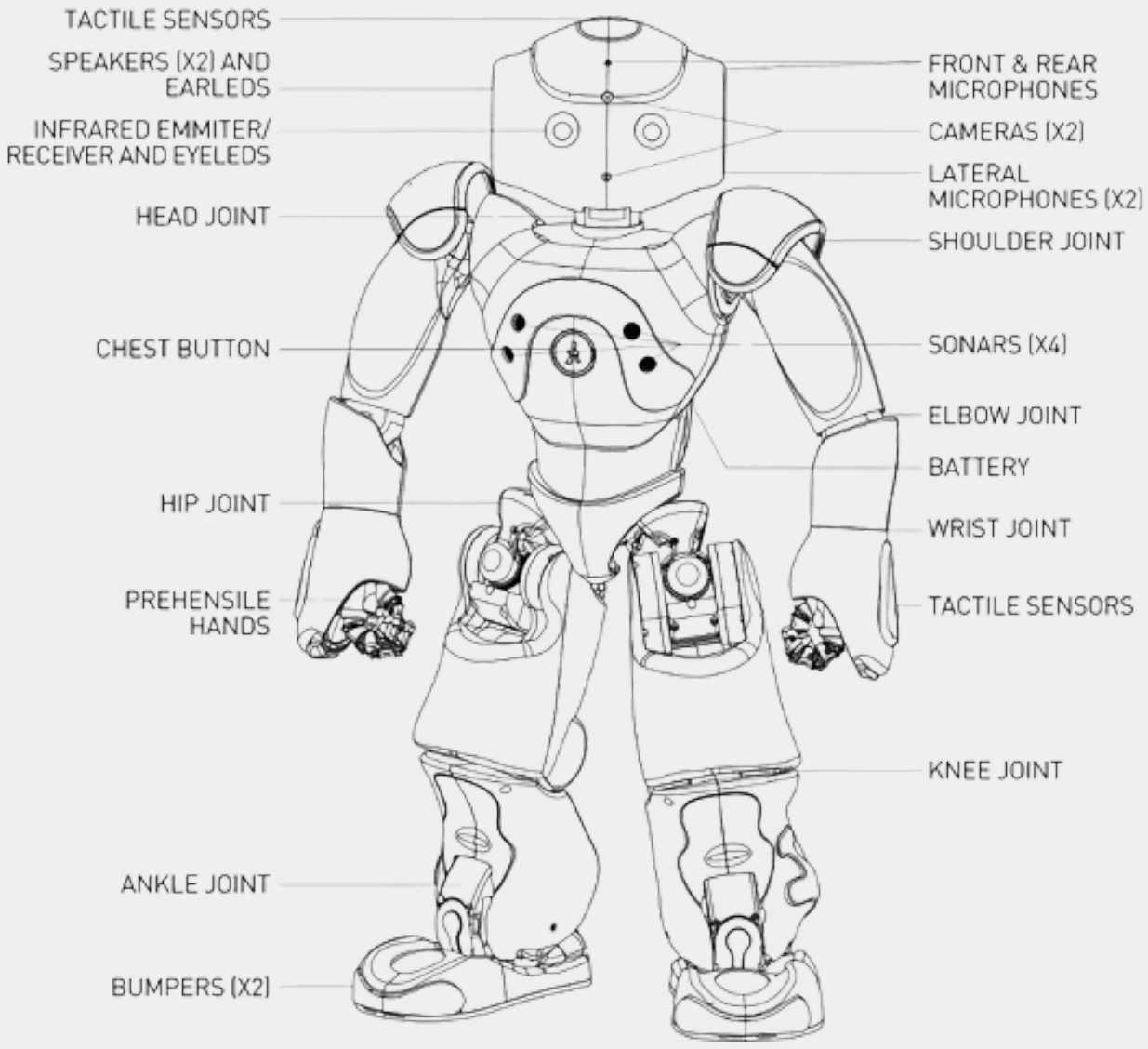
PARTS GRAPH

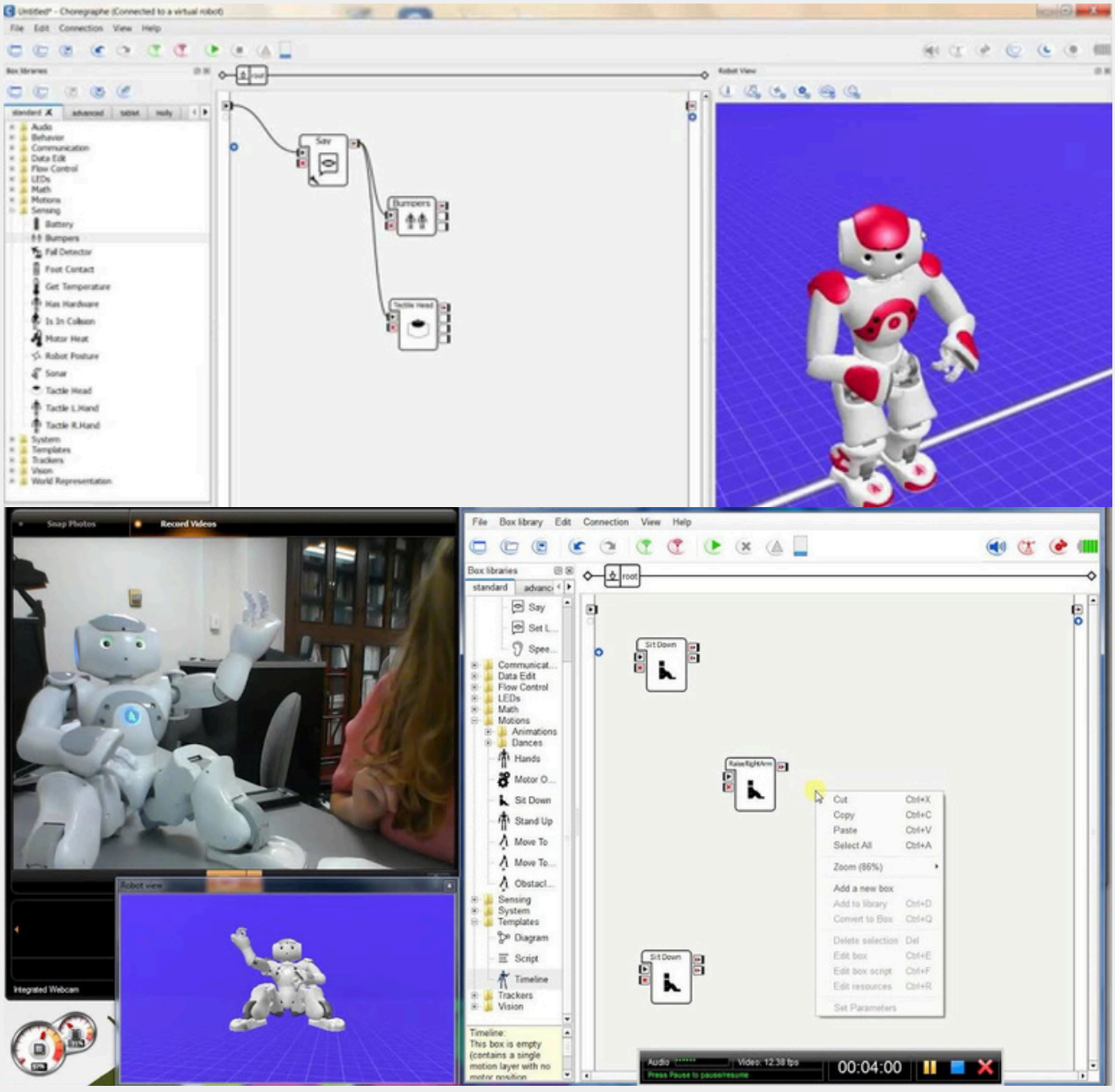
Key features of the NAO robot:

- Speakers (X2) and ears
- Infrared emitter/receiver and eyelids
- Front and rear microphones
- Cameras (X2)
- Lateral microphones (X2)
- Sonnars/ultrasonic sensors (X4)
- Tactile sensors
- Chest button
- Battery
- Head joint
- Shoulder joint
- Hip joint
- Elbow joint
- Wrist joint
- Ankle joint
- Knee joint
- Bumpers (X2)
- Prehensile hands (gripper)



SOFTWARE ENVIRONMENT

Choregraphe software:



You can control the robot by:

- Creating a simple behavior: Drag and drop boxes from the Box Libraries into the Workspace and then connect boxes to define the sequence of actions.
- Running or Deploying Behavior: Click the 'Play' button to execute the behavior on the robot simulation or use the 'Package and Deploy' feature to transfer and install your project on the robot for autonomous execution.

NAO ACTIVITIES

Unit #1: Exploring Movements with NAO

Activity summary :
Students will gain skills in animation and programming movements of the NAO humanoid robot, by using the Coregraphe software to simulate and later connect movements to the real NAO robot.

Target group:
12+

Duration:
2x 120' sessions

Setup:

- Alderbaran NAO humanoid robot
- Computer/Laptop
- Coreographe Software

Objectives

Explore concepts like:

- joints
- degrees of freedom
- movement precision

Activity #1: Introduction

1.1 Setting the Scene (10 minutes)
The teacher will start by explaining the activity, inspired by iconic movie scenes from Rocky or Superman, must note that despite the cinematic inspiration, they will be starting with simpler movements.

1.2 Basic Concepts (20 minutes)
Explain the basic concepts of joints, degrees of freedom, and movement precision. The student should understand how the NAO robot's arm and head motors work to ensure accurate programming.

Activity #2: Practice with the simulator

2.1 Guide to Using Coregraphe (20 minutes)
We'll provide a detailed guide on how to use the simulator in Coregraphe. Students will start with simpler exercises, ensuring a gradual understanding of animation dynamics.

2.2 Practical Exercise (20 minutes)
Next, students will have the chance to experiment, creating more complex animations inspired by reference movies. The teacher will give continuous feedback during the practical activity, addressing questions to ensure effective participation,

Activity #3: Programming Degree by Degree

3.1 Lesson on Joints and Motors (20 minutes)
We'll spend more time on a detailed lesson about the NAO robot's joints and motors. Practical examples of degree-by-degree adjustments will be given, ensuring students have a clear understanding of how to tweak motor parameters.

3.2 Practical Programming Activity (20 minutes)
During the practical activity, students will apply what they've learned. The focus will be on precisely modifying motors to enhance and refine their animations.

Activity #4: Connecting with NAO robot

4.1 Introduction to RESTELA and Robot Connection (15 minutes)
A clear introduction to RESTELA and connecting simulated movements to the real NAO robot will help students understand the transition from simulation to real execution.

4.2 Practical Activity with the Robot (15 minutes)
During the practical activity with the NAO robot, students will be guided through the process of connecting animations and observing real movements. The teacher will assess precision, providing feedback for any necessary corrections.

Activity #5: Discussion and Reflection

5.1 Sharing Experiences (10 minutes)
Students will share their experiences and challenges faced during the activity. A more in-depth discussion about the differences between simulation and real execution will be encouraged, creating a space for doubt resolution and solution sharing.

5.2 Final Reflection (10 minutes)
The concluding discussion will explore more deeply the potential real-world applications of programming movements in humanoid robots. The class will reflect on the acquired skills and how these skills could be useful in various real-world scenarios.

05. OHMNI

Introduction: What is an Ohmni Telepresence robot?

A telepresence robot is a remote-controlled robotic device with audiovisual and sensor technologies, allowing users to virtually be present in a distant location. It facilitates real-time interaction by providing visual, auditory, and sensory feedback, extending the user's presence beyond physical limits. Its primary function is to enable remote presence and interaction through cameras, microphones, speakers, and other sensors.

Telepresence robots are utilized in education for diverse purposes:

1. **Remote Learning:** They enable students facing barriers like illness or disability to attend classes online, ensuring continuity in their education.
2. **Teacher Training and Professional Development:** These robots facilitate sessions led by experts located elsewhere, enhancing teacher training and professional development opportunities.
3. **Inclusive Education:** By allowing students with disabilities to participate in classroom activities remotely, telepresence robots promote inclusivity in education
4. **Access to Specialized Education:** Students in remote or underserved areas gain access to specialized courses and resources, bridging educational disparities based on location.

Source:
www.ohmnilabs.com/products/ohmni-telepresence-robot

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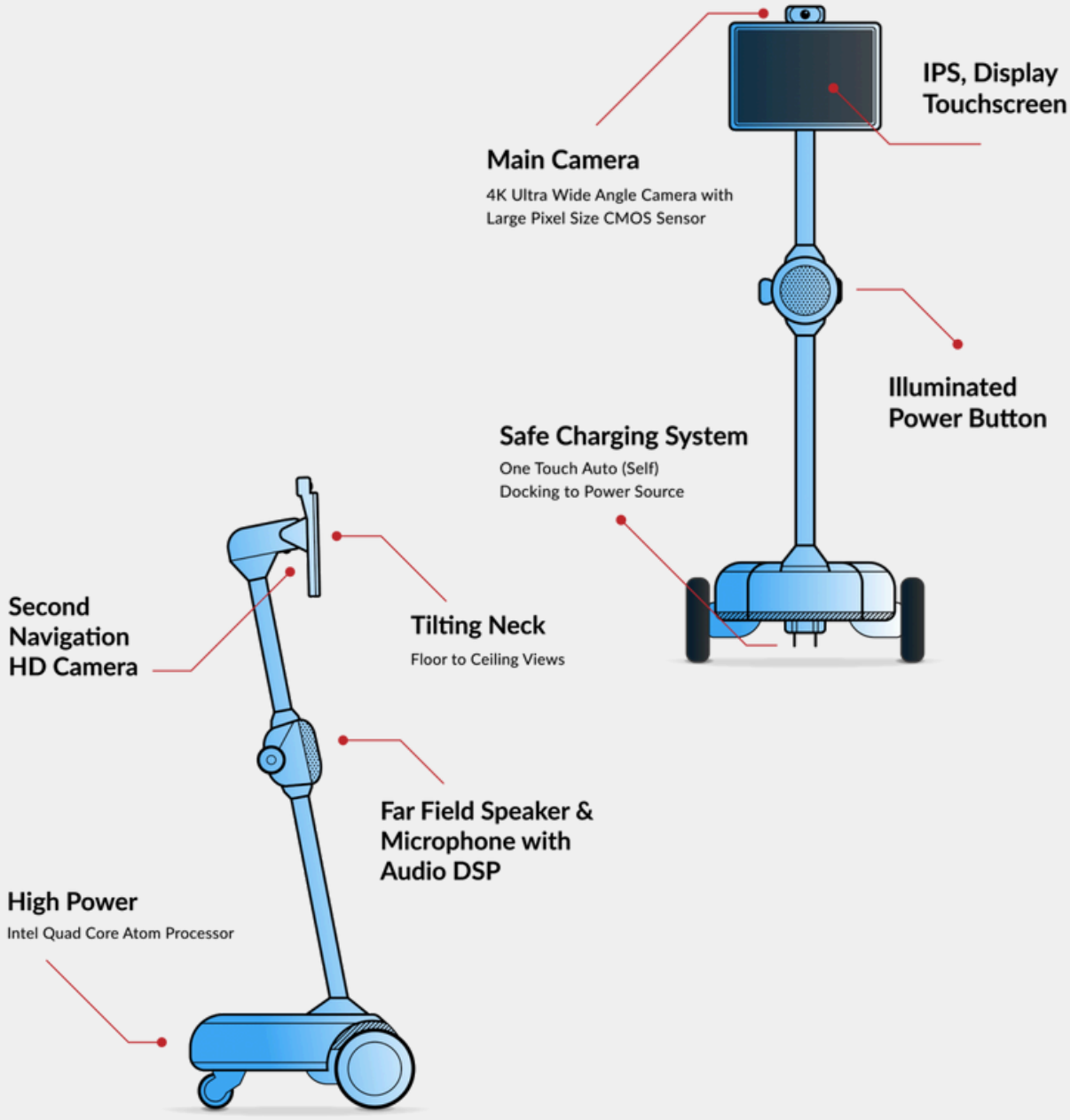
PARTS GRAPH

Key features of the Omhni telepresence robot:

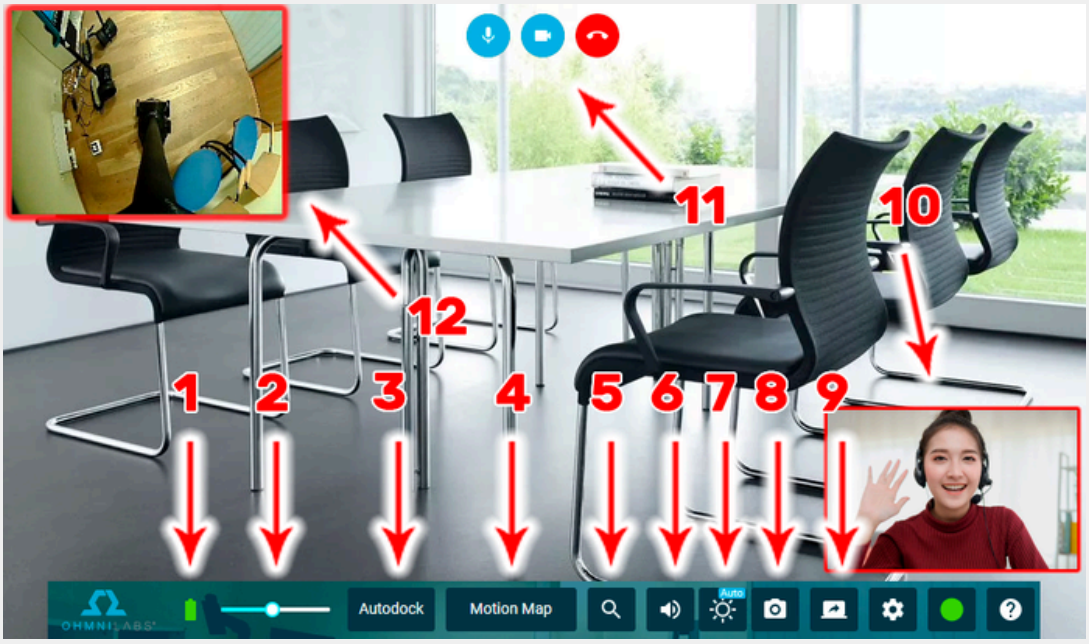
- Main 4K ultra wide angle camera
- IPS, touchscreen display
- Illuminated power button
- Safe charging system (Docking to power source)
- Second navigation HD camera
- Tilting neck
- Far field speaker & microphone with audio DSP
- High power

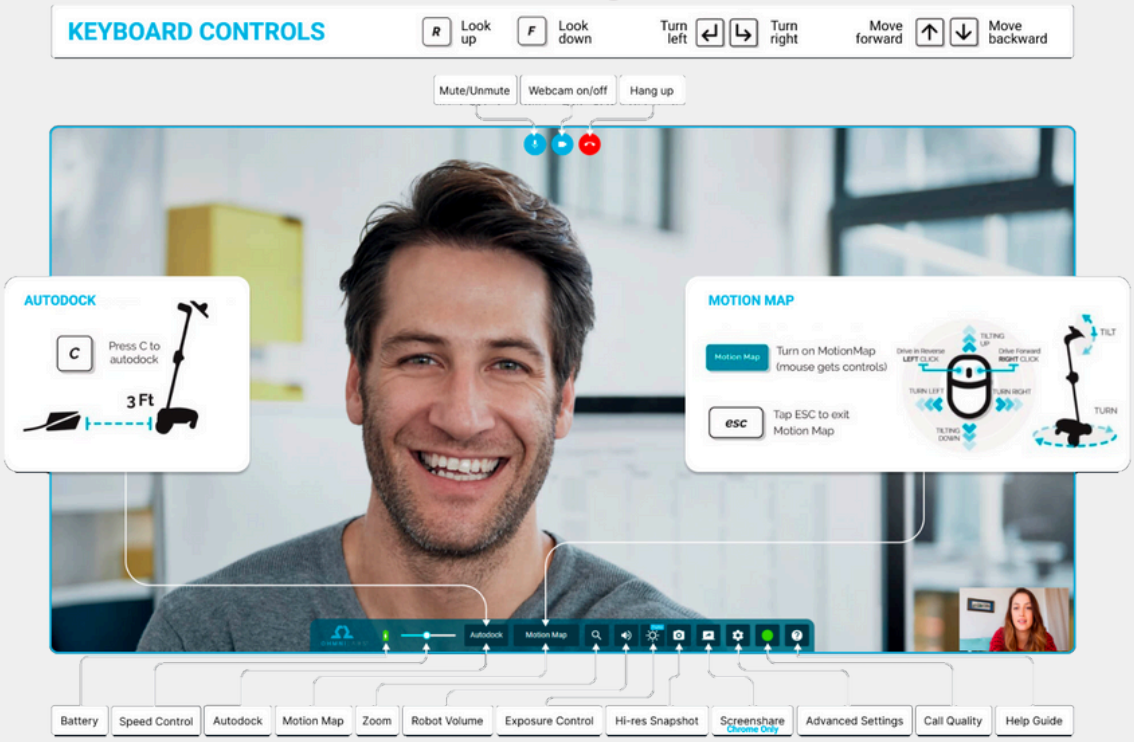


INTERFACE

Interface elements:

1. Battery level indicator
2. Speed control
3. Initiate autodocking
4. Motion map, camera tracks the mouse
5. Image zoom
6. Speaker volume
7. Image adjustments
8. Full-resolution camera
9. Screenshare
10. Self-view
11. Call controls
12. Foot camera





OMNHI ROBOT ACTIVITIES

Unit #1: Introduction to Ohmni telepresence robot

Activity purpose - summary :

Participants will be introduced to the telepresence robot, and with hands-on engagement, they will become familiar with manipulating the robot's movements, exploring its interface, and controls.

Target group:

15+

Duration:

2x 20' sessions

Setup:

- Ohmni telepresence robot
- Computer/Laptop
- Web interface

Objectives

Cover fundamental concepts such as:

- Telepresense robot components
- Connection and settings
- Remote control driving

Activity #1: Understanding the interface

Students are first introduced to what a telepresense robot is, its applications and benefits. Then they will access the web interface which will allow the robot remote control and establish connection by allowing permission of their camera and microphone. Once they establish the connection they can adjust the sound and image settings to their liking (image lightness, volume, zoom menu etc).
Finally, once they master the driving they should drive up to a mirror in orded to take a look at the robot. They should be able to name all ttelepresense robot main parts, sensors and control organs .

Activity #2: Robot rally

Gamification proved to be a fruitful tactic in mastering telepresence robots, so the students can enter the robot rally in order to demonstrate their driving skills - and fight against other students to win the Robot Rally Champion award!

The participants must navigate the robot through the gates (poles) and shoot lightweight balls into a goal area. They become familiar with robot control and obstacle sensors while learning about speed limit functions. The activity combines fun with learning, promoting skill development and understanding of telepresence technology. Through practice and feedback, participants refine their navigation and operation skills.

Note: Some models of telepresence robots have obstacle sensors in the front, therefore uncapable of playing this game – they will automatically stop in front of the ball.

For more information:

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