STRATEGIC PARTNER: COSMOTE

ORGANIZER: STEM education

SPONSOR: Knowledge Research

Introduction

In my presentation today I will try to briefly describe our key teaching objectives in the Panhellenic STEM and educational robotics competition for the elementary school
we will refer to the historical evolution of the requested automations evaluated in the students' projects in relation to the evolution of the educational tools that were available per year
and we will end up with the automations requested in this year's panhellenic STEM competition

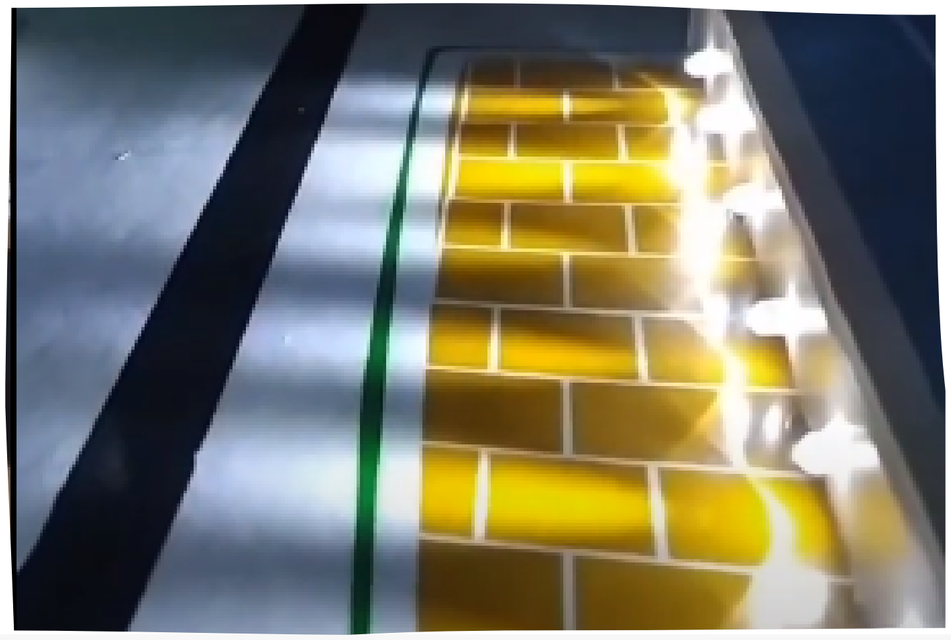
Deliverable Project

The children participating in the competition are asked to create a complete project related to the theme of the competition, present it in operation and document it.

Project construction materials

In the panhellenic STEM and robotics competition there is no restriction regarding the construction materials that can be used in the construction of the projects.

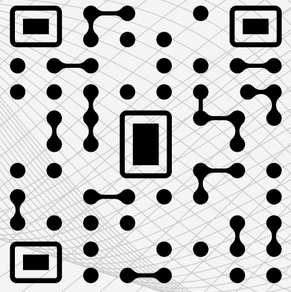
Plastic construction materials from various companies, paper, wood, or any other construction material that is appropriate for the age of elementary school children are allowed for the construction of the projects.



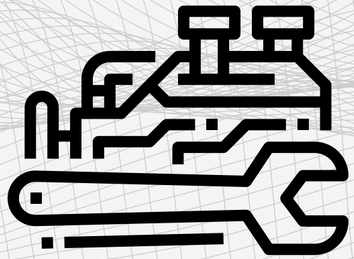
Project construction materials

The perfection, the functionality and the beauty of the final result are what determine the construction materials of the projects. Children's involvement with these materials expands their skills and the possibility of their artistic expression.

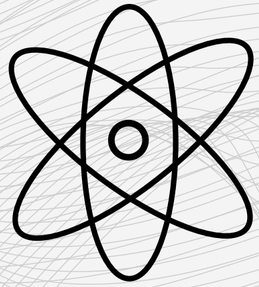
Our philosophy:
learning pathways



Coding



engineering



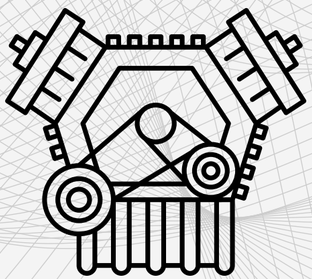
science

Our philosophy:
learning pathways

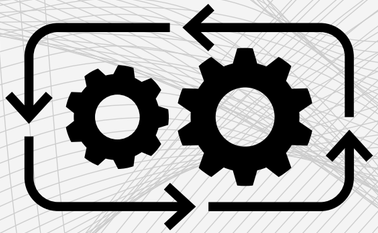


One of the primary objectives
We hope that the competition will encourage students to consolidate their primary school knowledge, always in accordance with their age level. This understanding is directly tied to engineering, programming, and science.

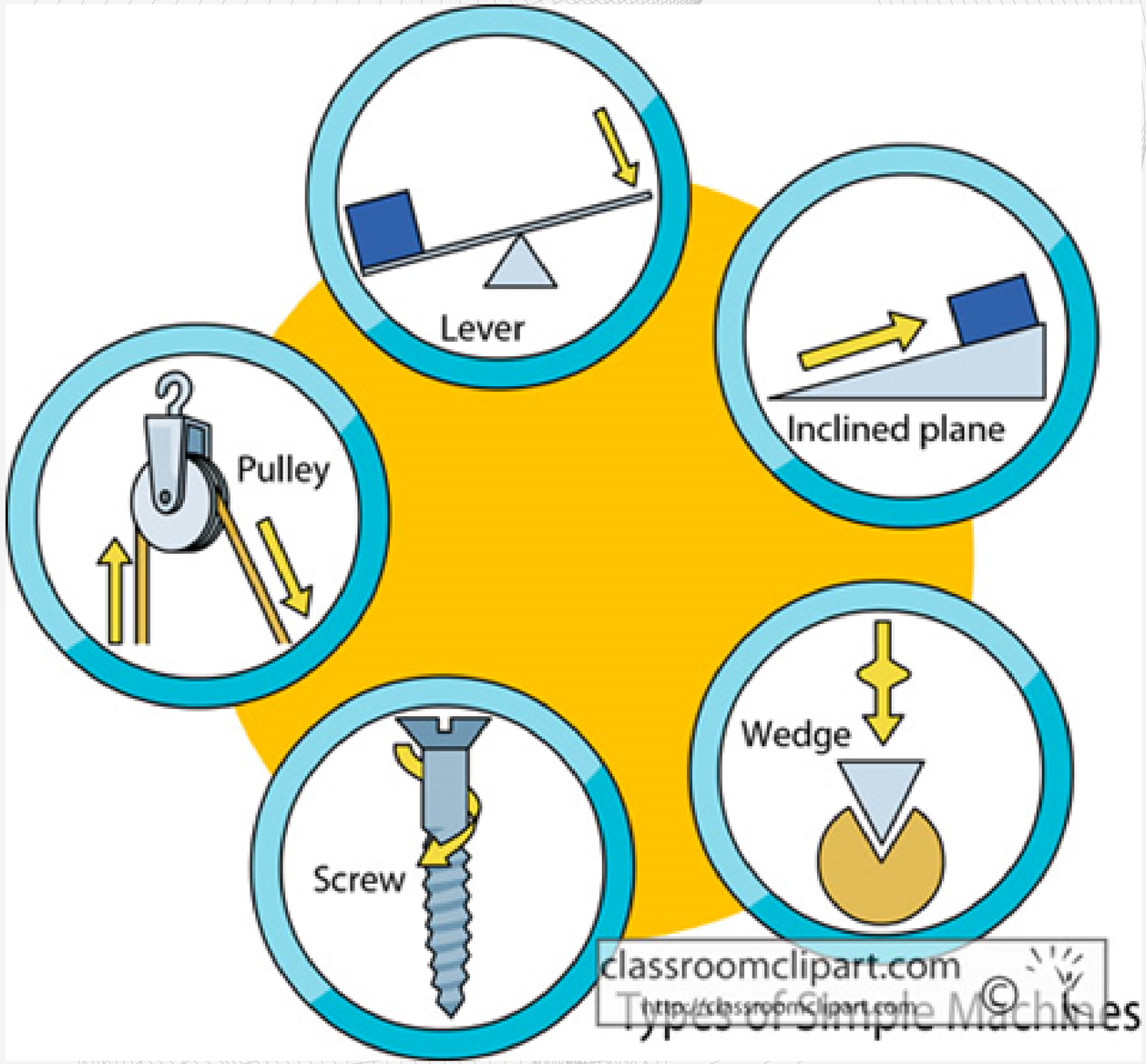
Children are divided into two large age groups

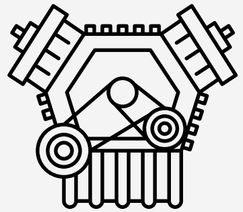


Power Engineers



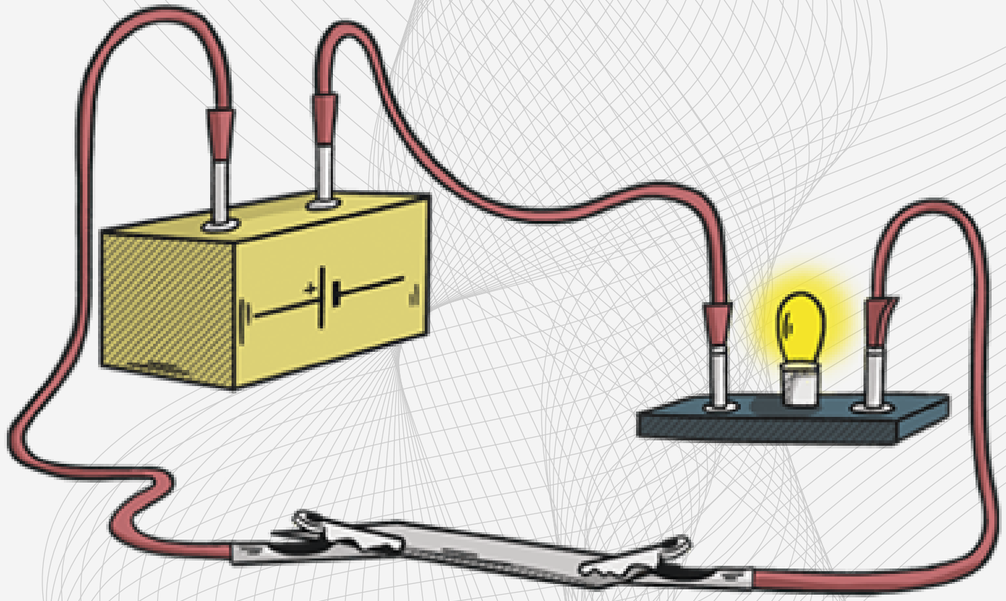
Automation Engineers





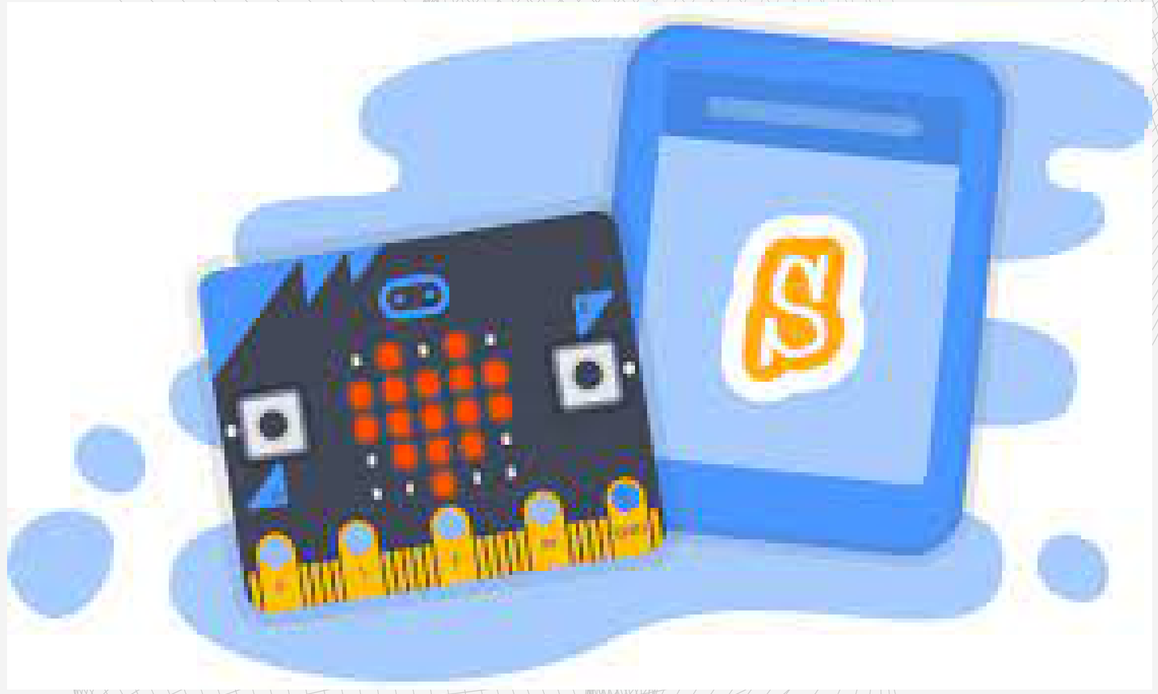
Power Engineers
ages:6-10

Pupils must incorporate in their projects the physics of simple machines and their applications. (lever, gear, pulley, shaft, screw, wheel).
Human is the original cause of movement.
The movement can be given either by the children's hand or by an electric motor which is activated by a switch controlled by the children's hand



Power Engineers
ages: 6-10

Automations if incorporated into the project are only mechanical automations.
The technology used in the project concerns even simple electrical circuits, without these being a mandatory requirement of the competition.
For which small elementary school Mr. Bakaloglou will present our proposal to you



Automation Engineers
ages:9-12

Programming logic and the concept of electronic automation are introduced. Based on the theme and the criteria of the competition, we encourage the children to integrate in their projects

- The technology of simple machines
- Electronic automations related to programming
- Electronic measurements of physical quantities
- Simple robotic autonomous systems.

Automation Engineers
ages:9-12

A key objective of this category is to consolidate the knowledge that children acquire at school about basic physical quantities and their measurement.

These quantities concern time, distance, speed, mass, volume, temperature, light intensity, sound, electricity and magnetism.

Automation Engineers
ages:9-12

We encourage children to measure physical quantities using sensors, apply the mathematical concept of proportion to create measurement scales and create graphs to understand the concept of change in physical quantities and the parameters on which this change depends.

For the upper elementary school I will present in more detail the proposed implementation materials and the way they are related to the requirements mentioned above

Historical evolution of Panhellenic STEM contest Demands

Historical evolution of Panhellenic STEM contest Demands

STEP 1

The first electronic automation

WeDo 1.0 (2009) was the first robotics system used in the Panhellenic STEM and educational robotics competition in 2015 and the WeDo 2.0 system (2016) was soon incorporated.

From the beginning of the Panhellenic competition (2015) these systems were used and programmed with the MIT Scratch software

Historical evolution of Panhellenic STEM contest Demands

STEP 1

MIT Scratch software is:

- Friendly and enjoyable for elementary school age children
- It is a programming environment with great potential
- It offers good features for generating well-structured code that helps with evaluation.

Demand

The request from the children was at least, one automation using the above educational tools

Historical evolution of Panhellenic STEM contest Demands

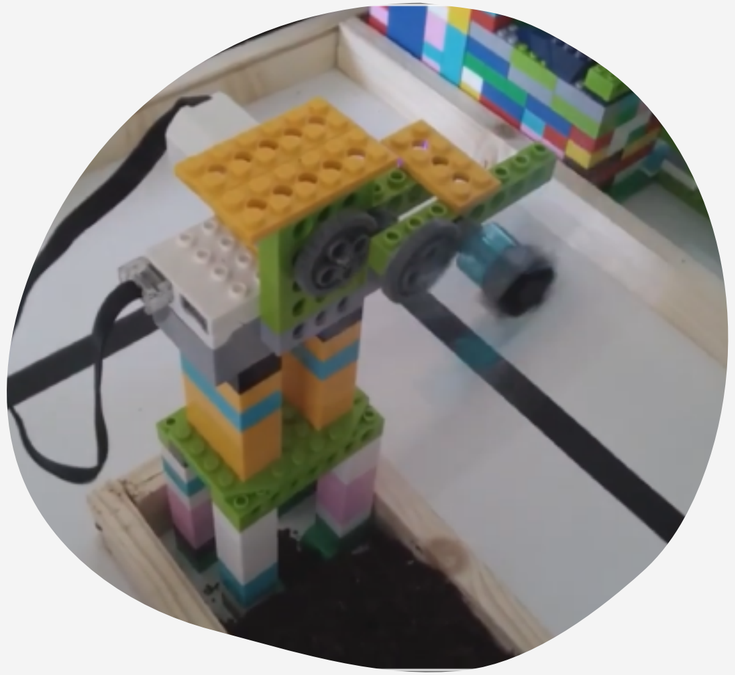
STEP 2

Scratch Scene: Synchronised Graphic Animation

We've always tried to maintain a close relationship between the physical world and the computer.

We also wanted the children's crafts to be as enjoyable and creative as possible.

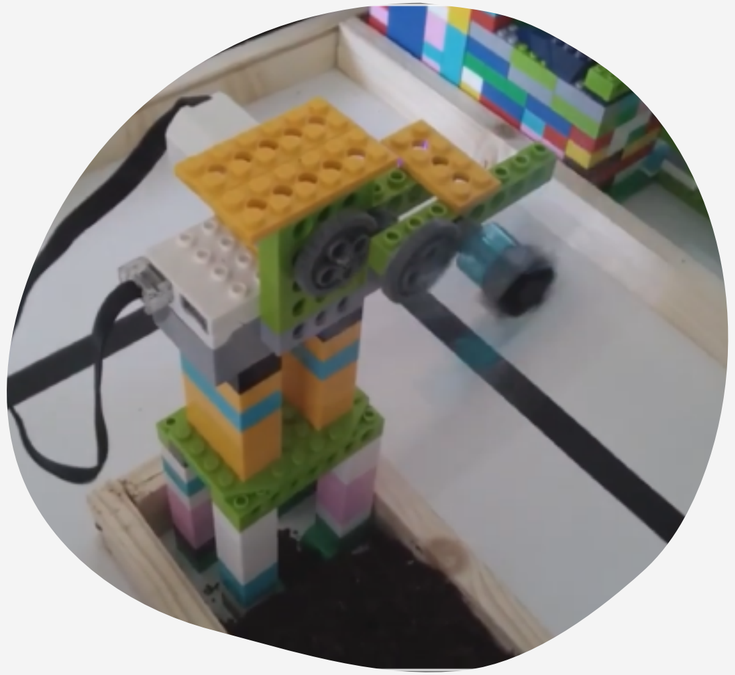
We wanted to introduce youngsters to the graphical user interface (GUI) technology used in modern IT applications.



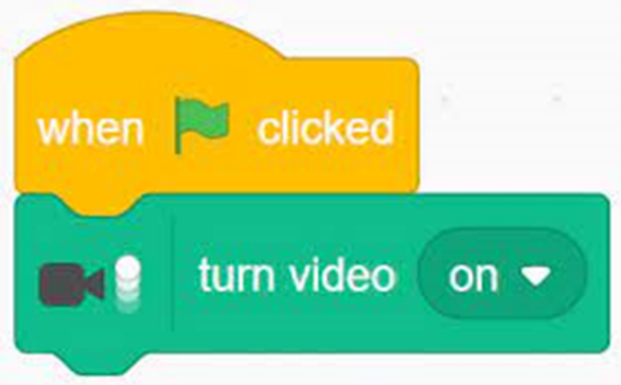
Historical evolution of Panhellenic STEM contest Demands

Demand
To accomplish the objectives, we asked the teams to design an animation on the Scratch scene that is synchronised with the project's automation and refers to and describes the automation.

STEP 2



Historical evolution of Panhellenic STEM contest Demands



STEP 3

Second automation using a USB computer camera through Scratch software

Advances in artificial intelligence technology and the increased use of cameras in image recognition applications, have led us to include the computer camera as an optical sensor in the competition projects.

Historical evolution of Panhellenic STEM contest Demands

Hybrid watermill. The camera measures the rotation speed of the mill The water flow is regulated according to the speed of the mill

STEP 3

Demand

The teams were asked for a second automation that uses the computer camera as a sensor in the MIT scratch environment

Historical evolution of Panhellenic STEM contest Demands

SHORT PAUSE

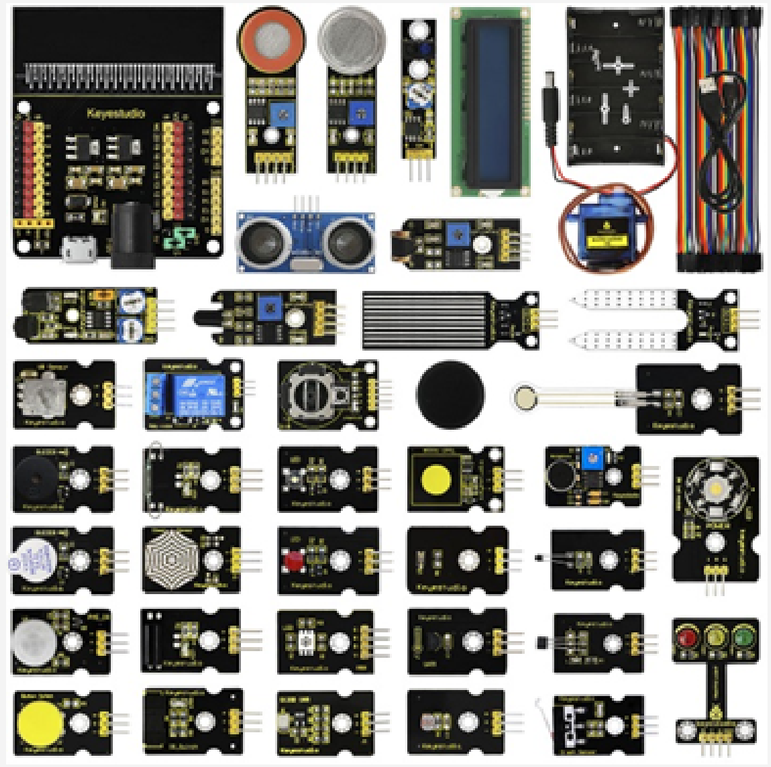
The science teaching, regarding the experimental process, for the last 20 years has not been enriched and has not kept pace with the corresponding technological progress in computing and electronic sensor systems

Students in their daily lives use devices equipped with sensors that measure the physical quantities that we try to teach in elementary school

At the school, however, even today there is no mention of these electronic sensors and no use of them in the curriculum.

So we decided to ask the participants of the competition to combine in their projects the teaching of physical quantities through the measurements from electronic sensors.

Historical evolution of Panhellenic STEM contest Demands



STEP 4

Third automation using measurement of a physical quantity with BBC micro:bit processor and internal or external sensor.

In 2022 we are introducing the BBC micro:bit processor to the competition for the first time.

Historical evolution of Panhellenic STEM contest Demands

STEP 4

- It's a powerful elementary school-friendly processor at a low cost
- it is programmed with tile language (Makecode)
- it has internal sensors that measure the physical quantities taught in elementary school

It is also programmable with Scratch programming language (familiar for teachers and students).

Historical evolution of Panhellenic STEM contest Demands

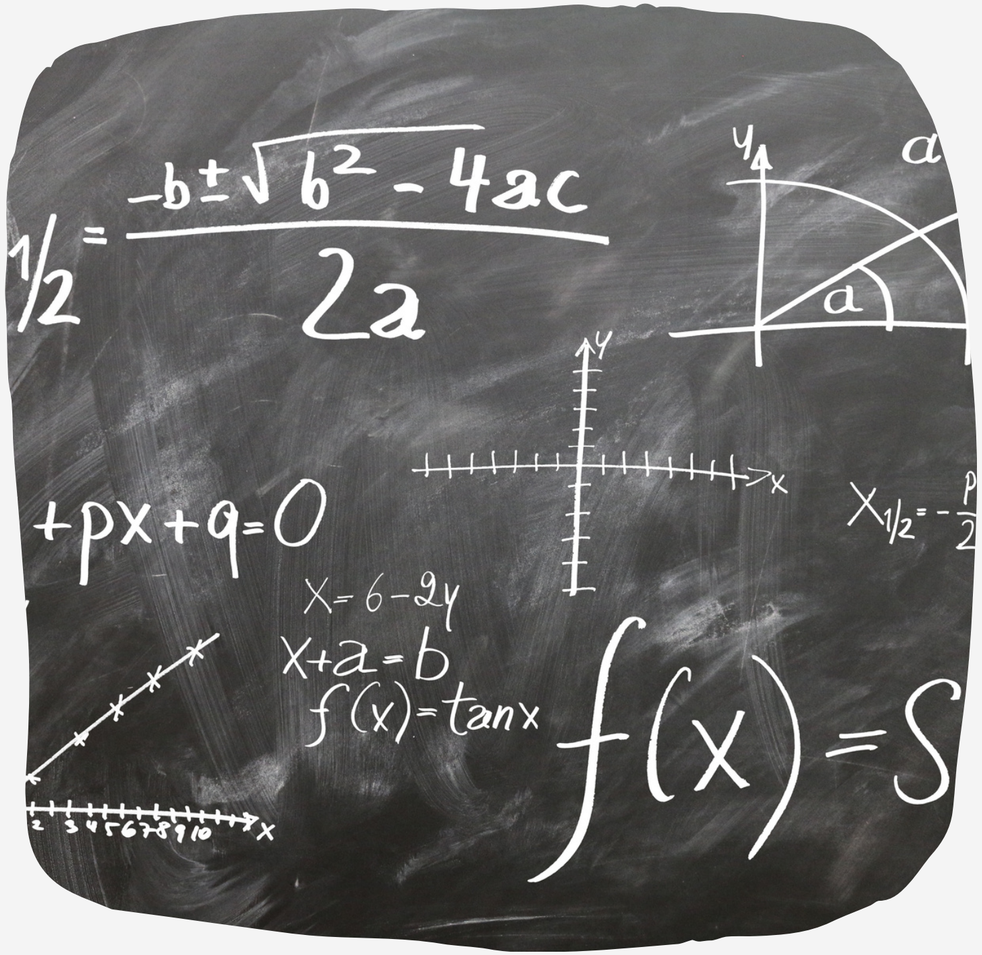
STEP 4

Demand

In 2022, for the first time, the teams were asked to integrate into their project the measurement of a physical quantity by a microbit sensor and the activation of an automation with it.

The children measure with modern means a physical quantity that is taught at school and use these measurements to ignite one automation in their project.

Historical evolution of Panhellenic STEM contest Demands

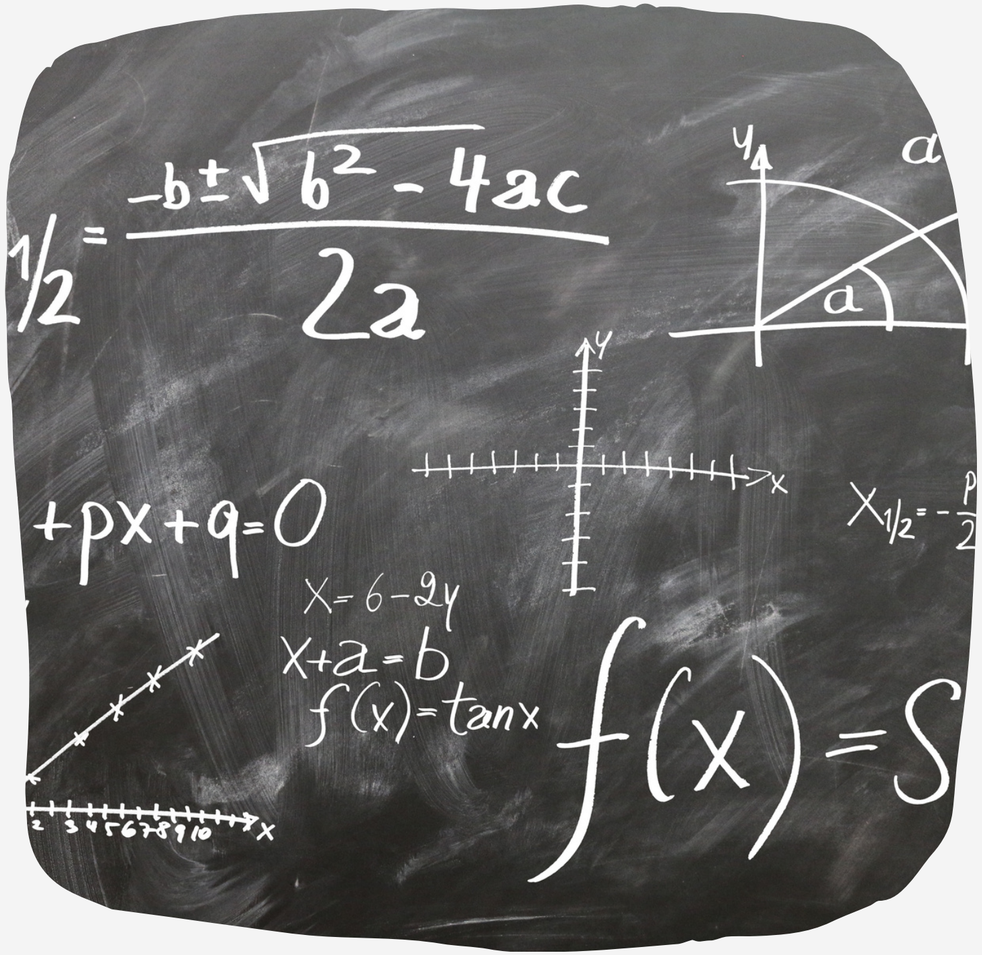


STEP 4

The benefits of using electronic measurements of Physical quantities

- A very good opportunity is presented to teach the concept of analog and digital signal and how a digital system measures quantities in the analog world we live in
- Understanding the concept of a measurement scale
- Using the concept of proportional values which is taught in elementary school
- understanding the concept of measurement, the concept error in measurement and the concept of electronic noise

Historical evolution of Panhellenic STEM contest Demands



STEP 4

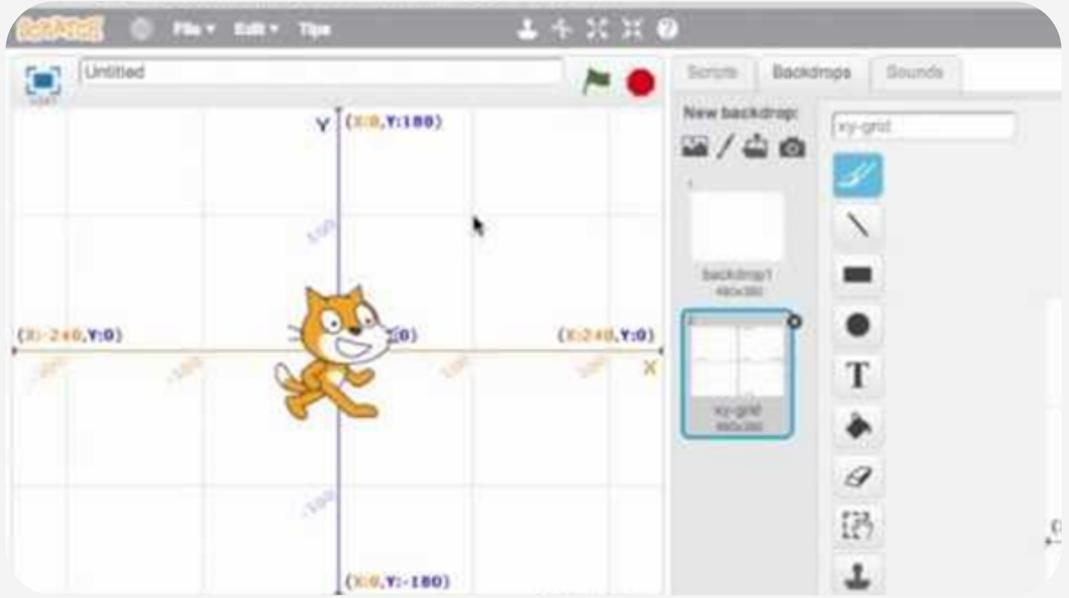
The benefits of using electronic measurements of Physical quantities

- understanding the change of a physical quantity as a function of time
- understanding the dependence of a physical quantity on other physical quantities
- in-depth understanding of how the electronic devices around us, use the electronic sensors, to examine the space around them and make decisions

Historical evolution of Panhellenic STEM contest Demands

Graph of the physical quantity value (measured by the micro:bit processor)
Demand
In the 2023-2024 competition, in order to better understand for children the concept of the change of a physical quantity, we request the graphical representation of the values measured by the micro:bit.
Creating mathematical graphs is possible in both Scratch and Make code environments.

STEP 5

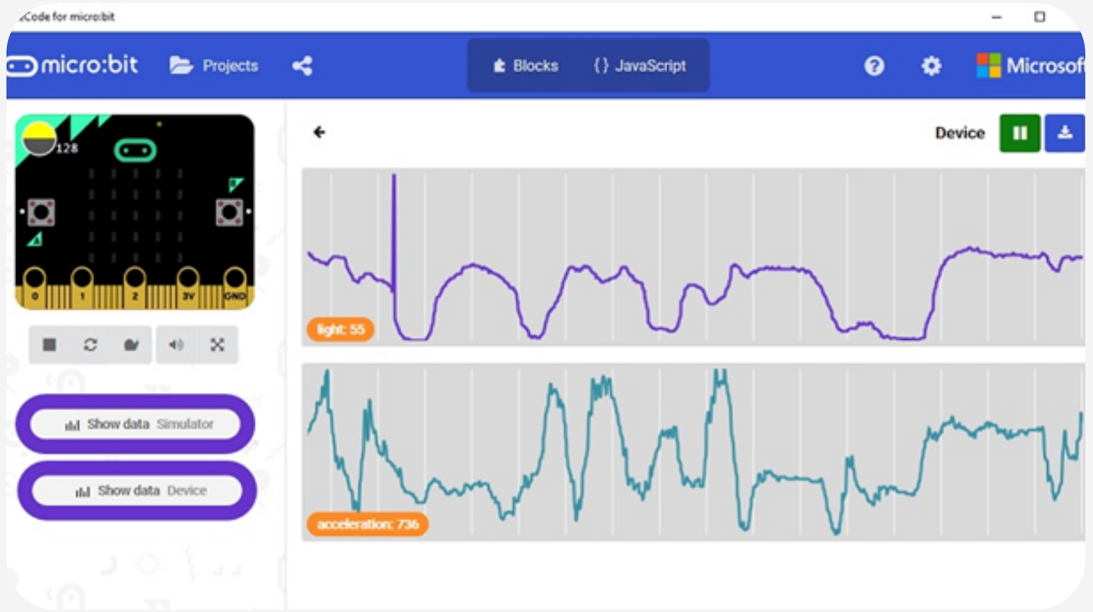


Historical evolution of Panhellenic STEM contest Demands

Expected benefits

Pupils learn about the Cartesian reference system and the graphic representation. These tools are also material of the new analytical curriculum of the public school in Greece and they properly prepare the students for high school.

STEP 5



Historical evolution of Panhellenic STEM contest Demands

STEP 6

Sequential Automations, The concept of Goldberg Machines and the Chain Reaction

In the 2023 2024 competition, for the first time, we introduce the concept of the sequential automations

Demand

Participating teams are asked, to use the automation associated with the micro bit, to activate a second electronic automation.

Historical evolution of Panhellenic STEM contest Demands

STEP 6

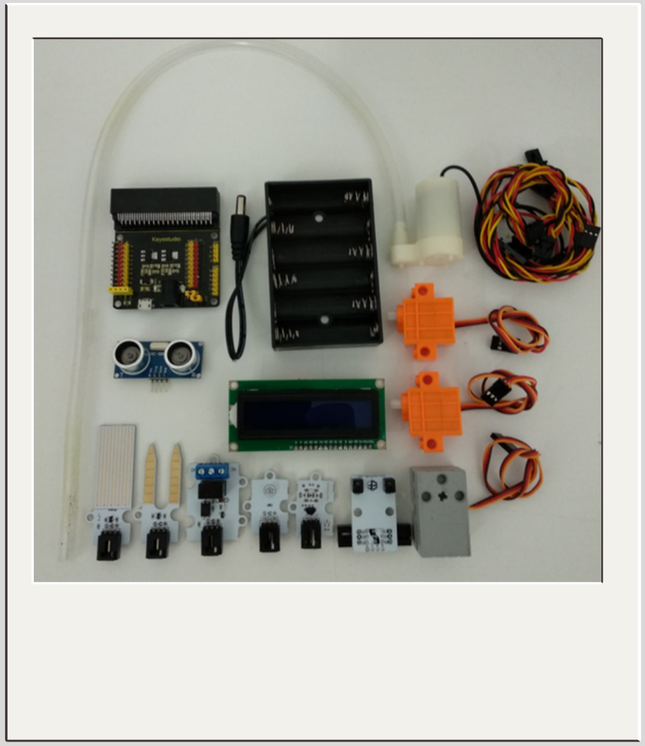
Expected benefits of automation sequencing
It will increase the complexity of student projects and simulate the complexity of modern technology systems
Projects will become more playful and students' interest will skyrocket

Project building electronics and plastic parts

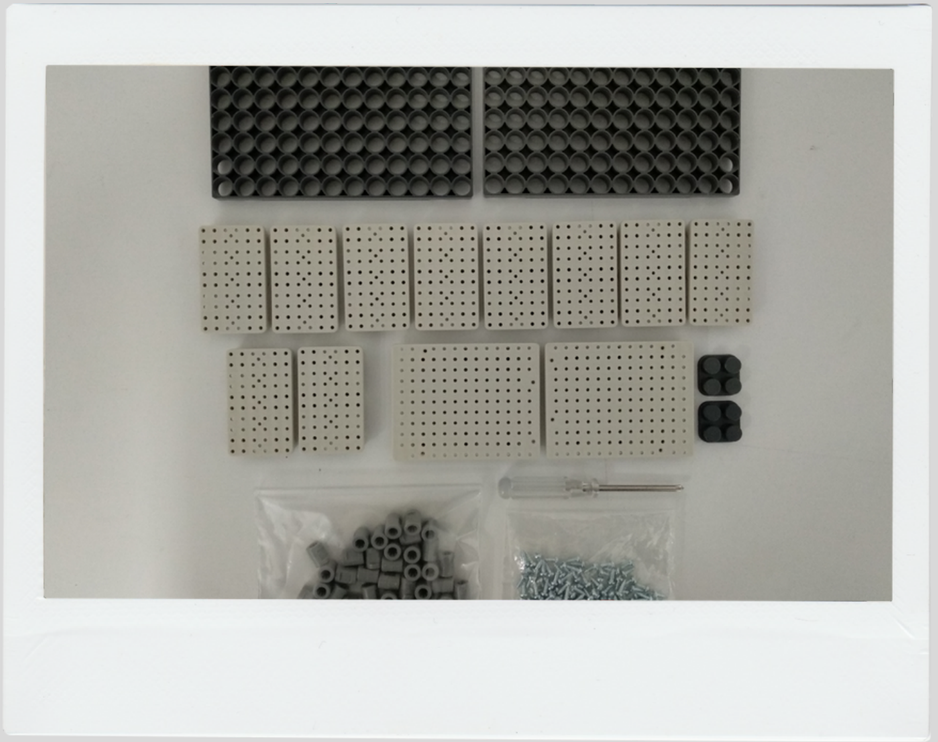
The introduction of the micro:bit in the panhellenic STEM and educational robotics competition automatically introduces the need to support the micro:bit with building parts, compatible motors and in general actuators that have the micro:bit as a central programming system or that can support the correct placement of the electronic components in the project.

Integrating automation sequencing requires also building parts that can support it. Thus, new systems of building materials such as the microbit GiGo robots and the Nezha system of Elecfreaks are introduced and proposed in the competition.

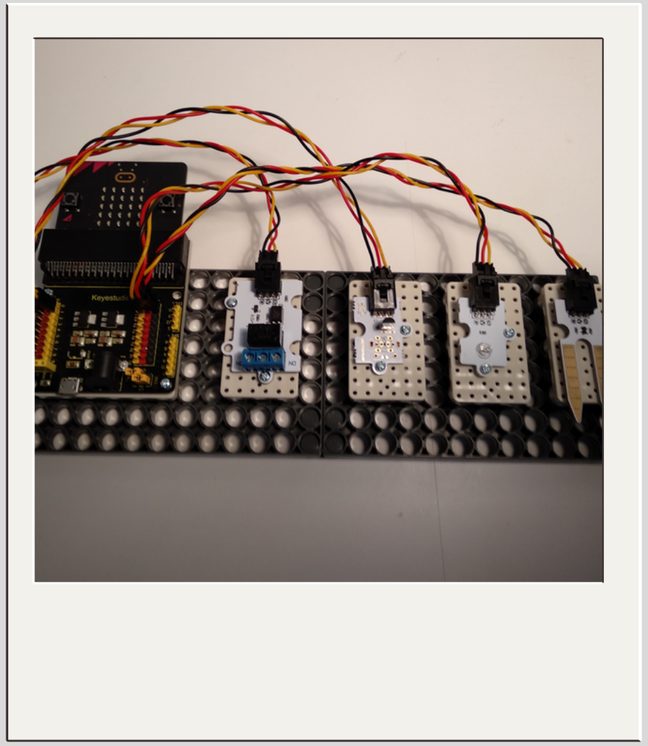
Project building electronics and plastic parts



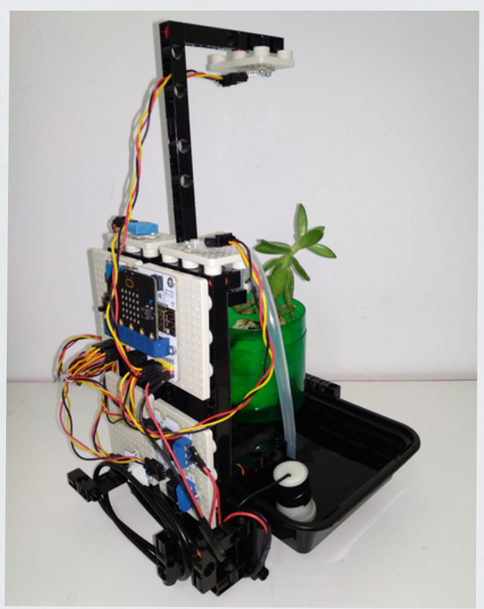
External Electronic sensors
Proposed Electronics package for Panhellenic contest

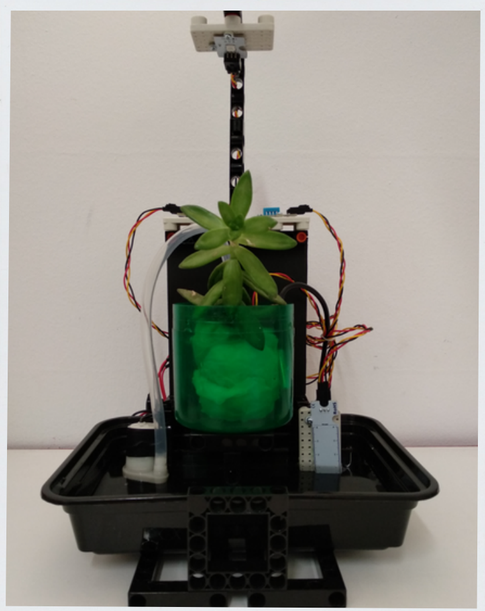


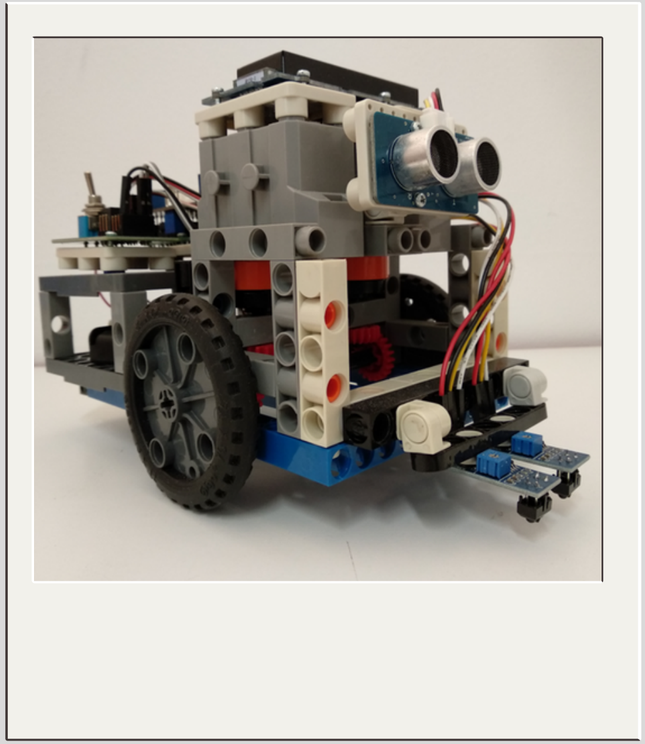
Sensor adaptation system
example to plastic construction materials

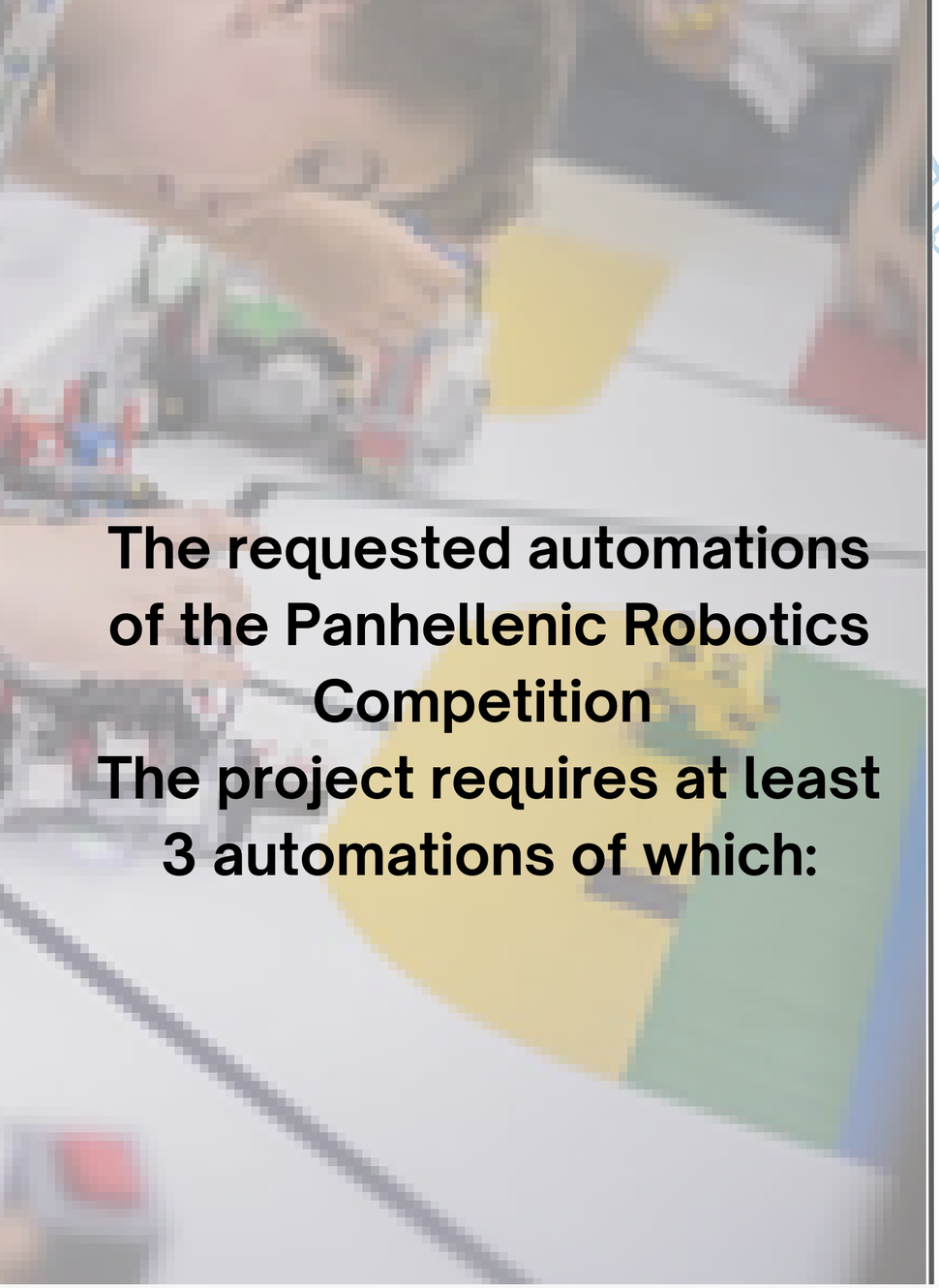


Project building electronics and plastic parts









The requested automations of the Panhellenic Robotics Competition
The project requires at least 3 automations of which:

- **The first automation (We will call it Alpha), is necessarily related to programming and simulating it, in a Scratch environment, uses as hardware an electronic automation robotic kit like WeDo or a micro:bit robotics kit like microbit Gigo robots.**

- **The second automation (We'll call it Beta) uses at least one internal or external Micro:bit sensor to take measurements of at least one basic physical quantity. It requires real-time graphical representation of the value of the physical quantity.**
  In addition, there will be an extension of the automation (We will call it Beta plus, which will be a chain continuation of Beta), this automation can be programmed in Scratch based software (e.g. MindPlus) or in Makecode.

- **The third automation (We'll call it Gamma) uses the computer's USB camera for image recognition through the Scratch environment. In addition to the USB camera, it can involve any other (from allowed) triggers.**

Thank You