

WHEN SCIENTISTS GO UNDER THE WATER
BİLİM İNSANLARI SUYUN ALTINA İNDİĞİNDE

Robot Fish - RoboFISH

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The Motivation of SCIENCE in BLUE

- to raise awareness of underwater research
- to bring together researchers working in the area of underwater science and technology and K12 students

Galatasaray University
Akdeniz University
Boğaziçi Sualtı Araştırma Merkezi

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EUROPEAN RESEARCHERS' NIGHT

Every Year In The Last Week Of September All Over Europe

27-28 September 2024
Galatasaray University

26-27 September 2025
Akdeniz University



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MAVİ
HACKATHON
Denizin derinliklerinde teknoloji macerası başlıyor!
Mavi Hackathon, lise öğrencilerini İstanbul Boğazı'nı keşfetmeye ve kodlama becerilerini geliştirmeye çağırıyor. Galatasaray Üniversitesi'ndeki etkinlikte öğrenciler, boğazın verilerini toplayacak bir cihaz geliştirecek. Tasarlanan ürün bir ROV'a monte edilecek ve öğrenciler, kendi kodladıkları cihazın dalışını kamplerden izleyebilecekler.
MAVİDE BİLİM
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KÖPRÜÜSSÜ
SİMÜLATÖRÜ
27 Eylül 2024
09:00 - 18:00
Denizciliğe yelken açmaya hazır mısın?
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TEA TALK
27 Eylül 2024
AYDIN DOĞAN SALONU
16:00 - 17:00 Çay/Kahve İkramı
17:00 - 19:00 Sunumlar
The Science of Diving
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BOĞAZDA
GECE
DALIŞI
27 Eylül Cuma
17:00 - 23:00
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ARAŞTIRMA
VE
DALIŞ
ARAÇLARI
27 Eylül 2024
10:00 - 18:00
Cuma
SARAY BİNASI
SERGİ SALONU
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BOĞAZDA
SATIH
DESTEKLİ
BİLİMSEL
DALIŞ
28 Eylül Cumartesi
10:00 - 12:00
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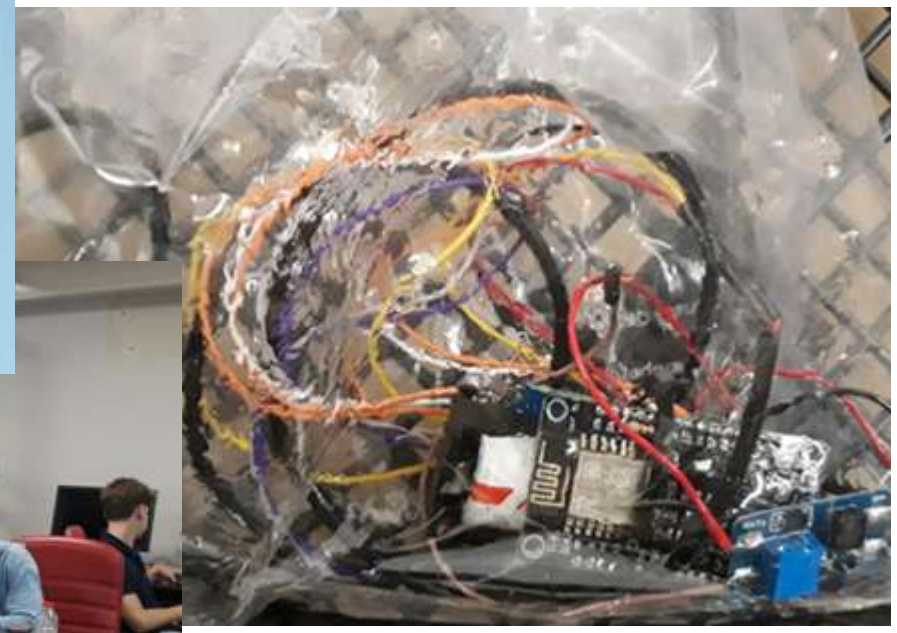

DENİZLERİN
MİRASI
Okyanuslar ve sualtı kültür mirası hakkında ne kadar bilgiye sahibiz?
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ROBOTLAR
SENİ ÇAĞIRIYOR!
28 Eylül Cumartesi
13:30 - 18:00
Bu etkinlik, Boğaziçi Sualtı Araştırma Merkezi (DURC) tarafından sağlanan üç sualtı robotunun desteğiyle düzenlenecektir.
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EUROPEAN RESEARCHERS' NIGHT









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RESEARCHERS @ SCHOOLS

7 Bölgede

140 Okulda



In 7 Regions, 140 Schools

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BLUE ECONOMY

Oceans and its conservation is critical to human existence; oceans are still waiting to be explored; underwater environment is an important playground for STEM activities; innovation and economic potential of underwater technologies are important for our country.

Blue Economy has rapidly evolved over the years, creating 5.4 million jobs and generating almost €500 billion gross added value annually.

This sector is characterized mainly by a great rise in underwater scientific activities, creating a promising new sub-market of BlueTech and Scientific Diving. Manned and unmanned diving appears in different forms all over the Blue Economy with the diving sector emerging, creating opportunities for growth and jobs.

Scientific divers are qualified scientists, who use diving equipment and techniques to perform underwater tasks for their fieldwork. Thanks to the recent advances in robotics, scientist also uses tethered and autonomous robots for underwater explorations. SCIENCE in BLUE aims to meet the citizens, in particular children and young minds with researchers working in the area of underwater science and technology.

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RESEARCHERS @ SCHOOLS



Dr. Pınar ULUER
Burak TEKDAMAR
Eda BAHAR
İsmail Ozan ÇELİKEL

Robots in Education



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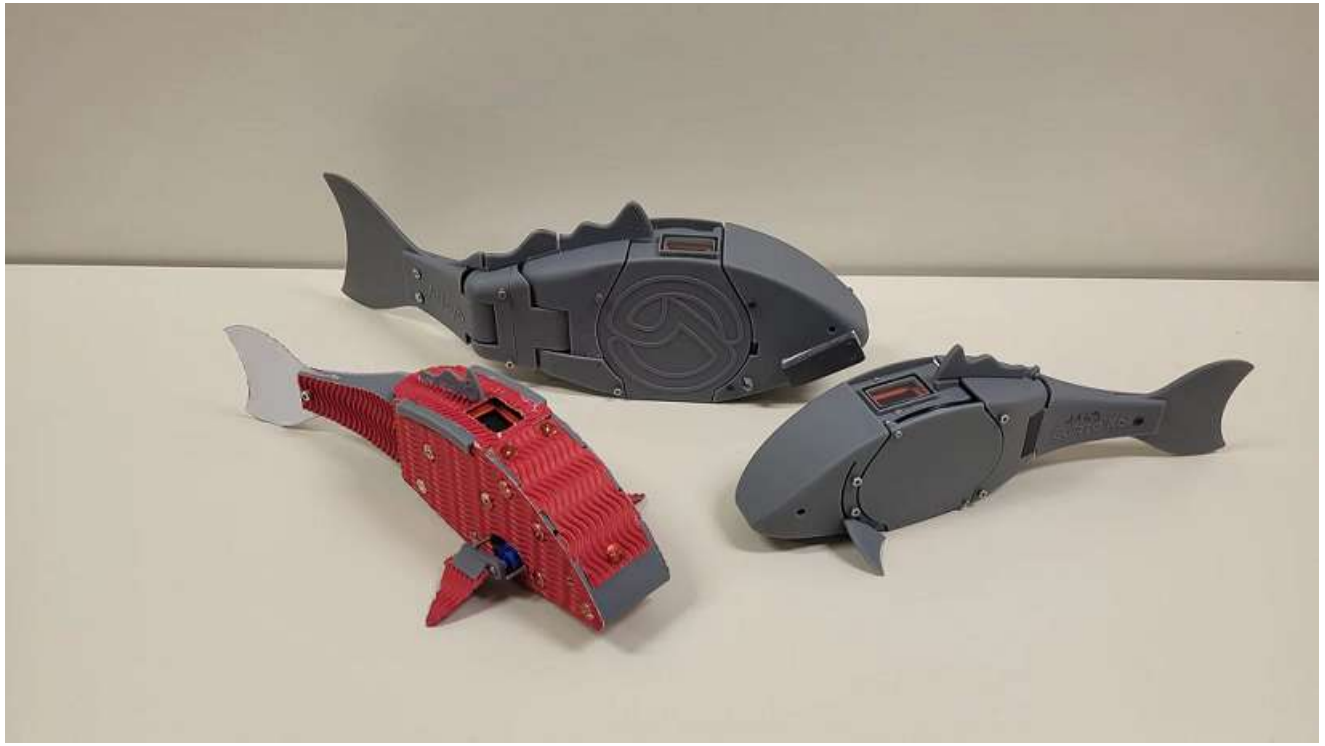
Robots in Education

RoboPisces Project:

- to bring digital skills and STEAM knowledge through Educational Robotics in schools.
- to improve their knowledge and motivate the students about the field of robotics.
- to create and program a robot fish using the kit provided in order to encourage students to use their imagination and technical skills.

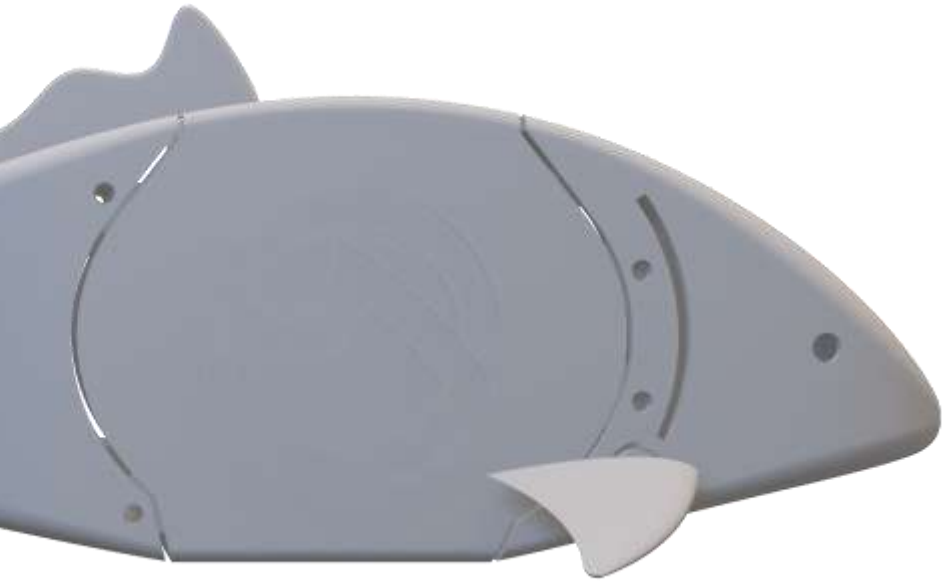
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RoboFISH & PaperFISH



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RoboFISH



Part 1 – Technology

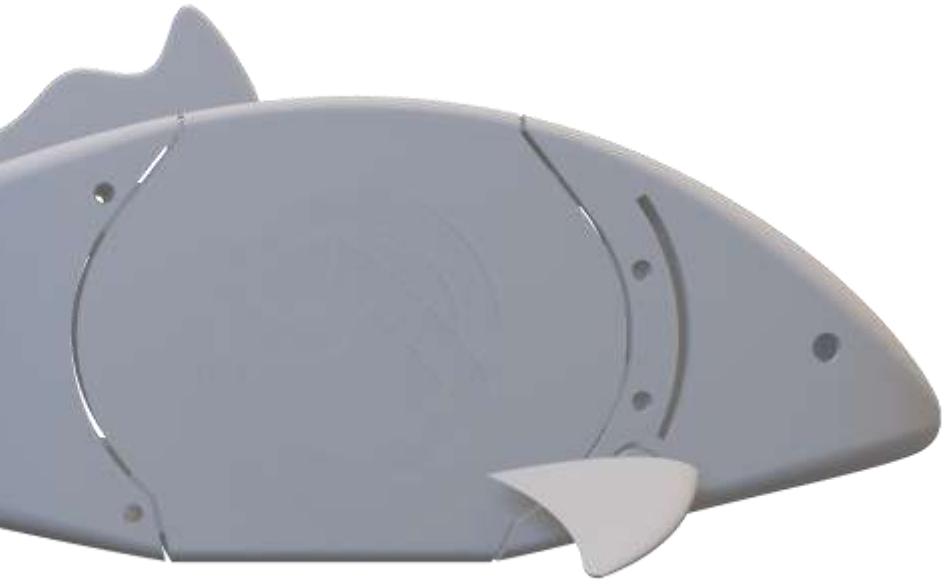
- Is it a machine? Or a robot?
- Robotics

Part 2 – Science

- Let’s meet the RoboFISH!
- Let’s start programming!

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Part 1 – Technology

- Is it a machine? Or a robot?
- Robotics

Part 2 – Science

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- Let's start programming!

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Question









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What is a machine?



A. A device that only uses electrical components to function.

B. Purposefully organized set of components makes mechanical work easier.

C. A device that converts thoughts into actions.

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What is a machine?

A. A device that only uses electrical components to function.



B. Purposefully organized set of components makes mechanical work easier.

C. A device that converts thoughts into actions.

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What is a machine?

EXAMPLE



Objective:

To make the fan spin to move the air and keep the room fresh.

Structural elemants:

- Fan
- Metallic rod to set the fan at the desired height
- Circular base structure to make the rod stand in an upright position
- Grid to protect the fan motion from any object of finger

ON / OFF / CONTROL

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What is a machine?

EXAMPLE



Objective:

To clean the room by sucking the dust from the floor.

Structural elemets:

- Floor nuzzle
- Tube and suction hose
- Buttons
- Wheeled-body

ON / OFF / CONTROL

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What is a machine?

Objective:

Going from home to school

Yapısal elemanlar:

- Steering wheel
- Engine
- Electrical System
- Wheels
- Transmission
- …

ON / OFF / CONTROL

EXAMPLE



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What is a machine?

1. A fan
   It turns on only when the human decides it is hot.

2. A vacuum cleaner
   It goes around but only where the human decides to go.

3. A car
   It relies on the humans' capabilities to avoid obstacles.

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What is a machine?

Autonomy: the freedom from external control or influence; independence

Automation: a self-operating machine, or a machine or control mechanism designed to automatically follow a predetermined sequence of operations



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What is a machine?

Humans vs Machines:

- Humans can adapt to environment making decisions

- Machines are programmed to interact in a certain way with the environment, they cannot adapt by themselves. Humans take decisions for them.



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What is a robot?

A robot is an intelligent machine that can adapt autonomously to its environment.

A robot is programmed to be autonomous, i.e. capable of achieving its purpose without human intervention.

Humans program robots in the production phase; in an operational context, robots make decisions autonomously.



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What is a robot?

A robot is an intelligent machine that can adapt autonomously to its environment.

Just like humans, robots need their senses and muscles to adapt to their surroundings:

- Senses = Sensors: Allow the robot to perceive its surroundings.
- Muscles = Actuators: Enable the motion and interaction of the robot.



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What is a robot?

To move, the robot must activate its mechanical structure based on the data received from its sensors, ensuring it can perform its tasks efficiently and effectively.

Examples of sensors
- ✓ Sound sensor
- ✓ Light sensor
- ✓ Button
- ✓ Angle sensor
- ✓ Temperature sensor

INPUT

Information from sensors

Robot's brain

OUTPUT

Information for actuators

Example of actuators
- ✓ LED
- ✓ Display
- ✓ Motor
- ✓ Speaker
- ✓ Buzzer



Senses



Brain



Muscles

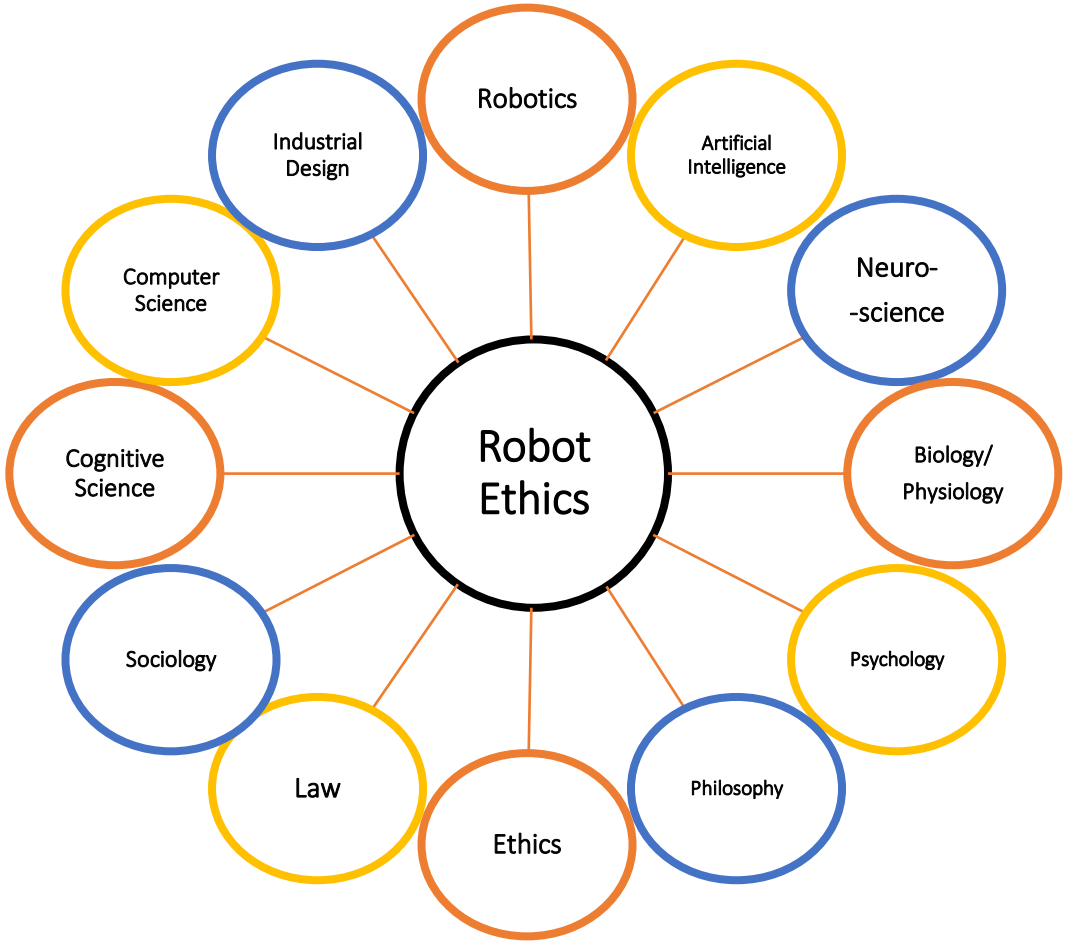
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What is robotics?

It is an interdisciplinary science, dealing with the **design**, **programming** and **development** of robots.

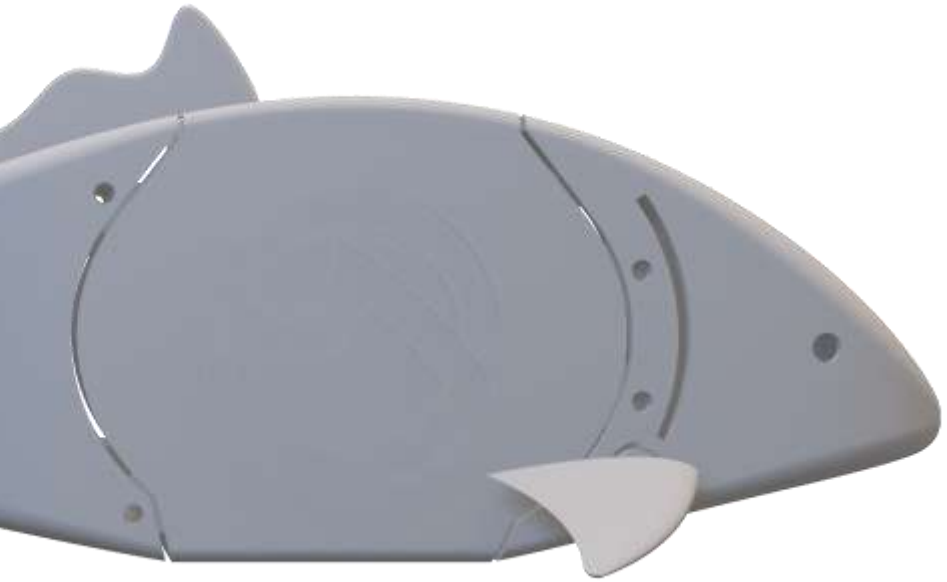
Interdisciplinary: the need to incorporate knowledge from multiple domains.

Although robotics is a branch of engineering, it combines approaches from many disciplines in both the humanities and the sciences.



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RoboFISH



Part 1 – Technology

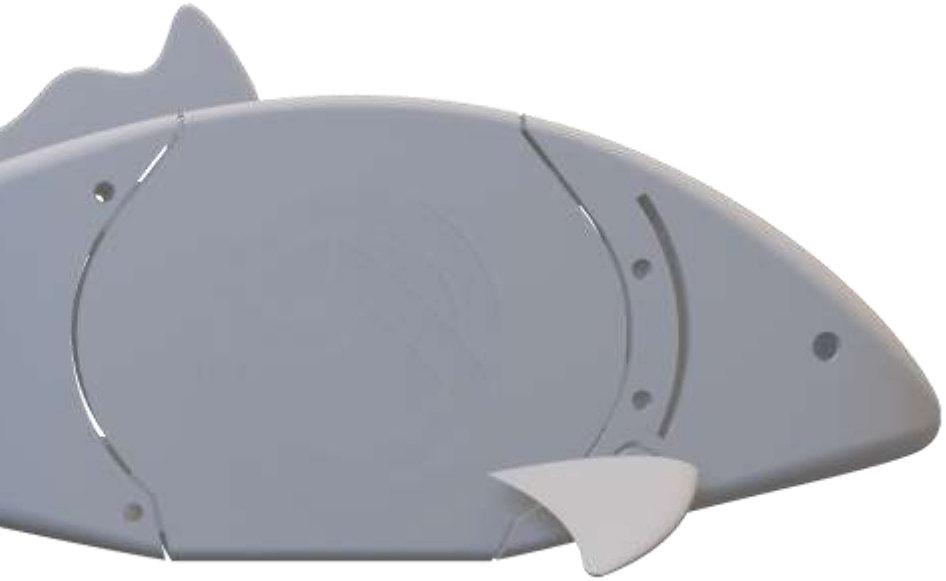
- Is it a machine? Or a robot?
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Part 2 – Science

- Let's meet the RoboFISH!
- Let's start programming!

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RoboFISH



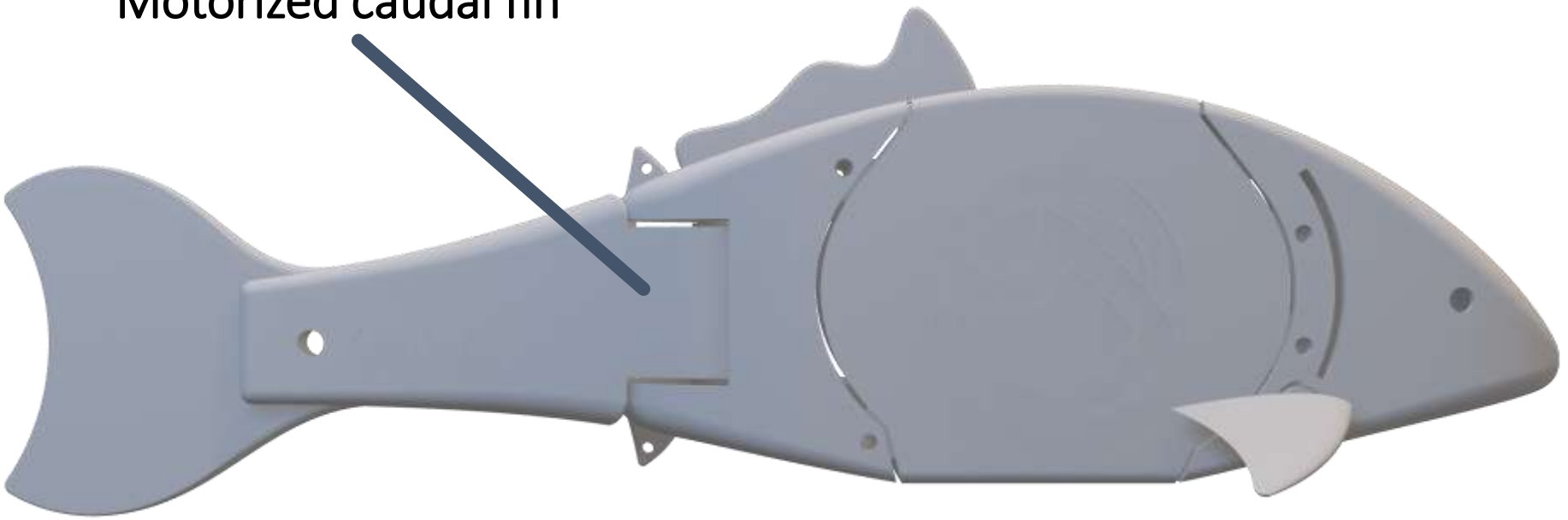
RoboFISH is a **bio-inspired** and **fish-shaped** robot.

Bio-inspired: designed based on principles and structures found in living organisms, mimicking their natural solutions to improve efficiency and effectiveness

Fish-shaped: has the shape and characteristics of a fish, often used to describe robots or underwater vehicles designed to move through water like a fish

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RoboFISH

- Microcontroller
- Display
- Magnetic Buttons

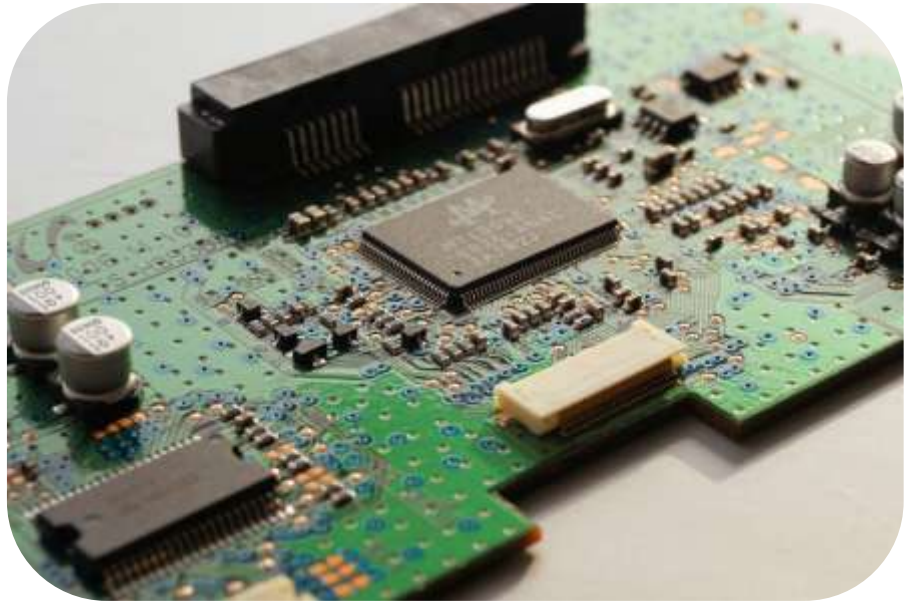


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Microcontroller: the Robot’s brain

Just as robots have sensors instead of senses and actuators instead of muscles, the brain of the robot is often a microcontroller.

The **microcontroller** is considered **the "brain" of the robot** because it manages real-time operations. This includes processing data from the sensors and controlling the actuators.



1. It receives information from the sensors.
2. It processes this information to decide what to do.
3. It sends commands to the actuators to move the robot or perform other actions.

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Microcontroller: the Robot's brain

On robot's back, you can see a small display in an orange brick.

This orange brick is its brain, a microcontroller.

This microcontroller controls the robot's tail, the display, and many other sensors that will be used in various activities.



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how does a microcontroller do what we want it to do?
Telepathy? Luck?

No, the answer is: **programming!**





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Question









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What is programming?



A. It's the skill of juggling while riding a unicycle.

B. It's the practice of creating visual representations of concepts through illustrations.

C. It's about writing instructions for a computer to do specific operations.

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What is programming?

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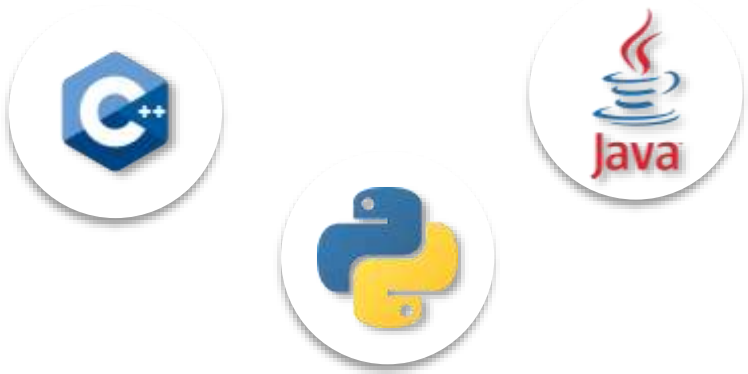
C. It's about writing instructions for a computer to do specific operations.

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What is programming?

Programming is the process of creating precise and sequential **instructions** for a computer to execute certain **operations**.

These instructions guide the behavior of a device and determine how to perform certain actions. They can be written in **programming languages**, which can be of different types.



...any many others!

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@var boolean
define('PSI_INTERNAL_XML', false);
if (version_compare("5.2", PHP_VERSION, ">")) {
die("PHP 5.2 or greater is required!!!");
}
if (!extension_loaded("pcre")) {
die("phpSysInfo requires the pcre extension to php in
properly.");
}
require_once APP_ROOT.'/includes/autoloader.inc.php';
// Load configuration
require_once APP_ROOT.'/config.php';
if (!defined('PSI_CONFIG_FILE') || !defined('PSI_DEB
$tpl = new Template("/templates/html/error_config
echo $tpl->fetch();
die();

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Don’t panic :)



Textual programming is something usually done by expert engineers. It's complex to understand because it's like speaking in another language, but using textual programming allows us to solve complex problems.

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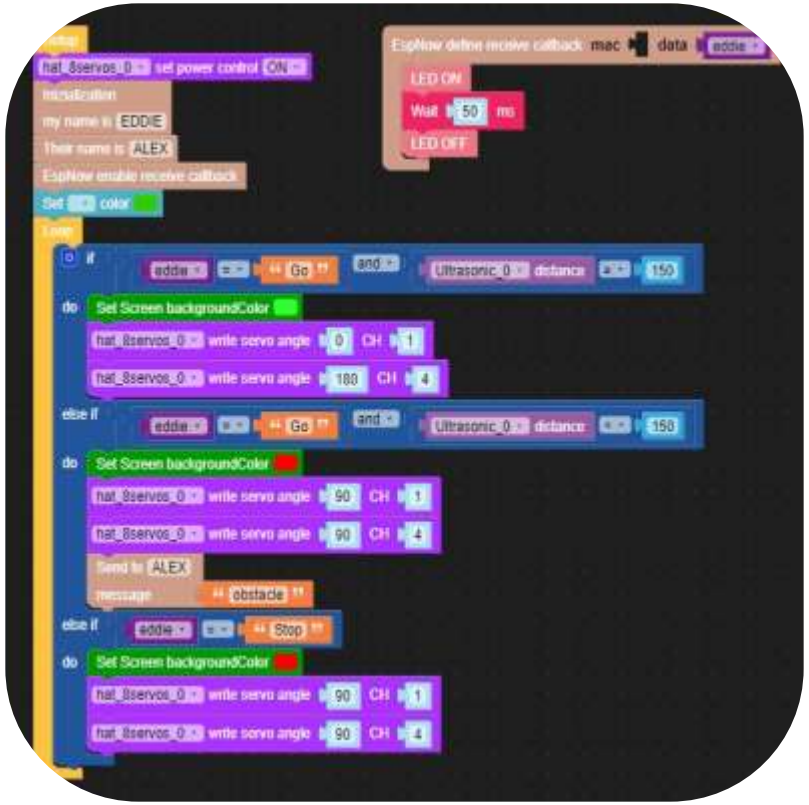
Robot Balık : RoboFISH

Visual programming

Visual programming involves creating software using visual representations such as diagrams or graphical blocks. It's often used to introduce programming concepts to beginners.

Visual programming is much simpler and more intuitive.

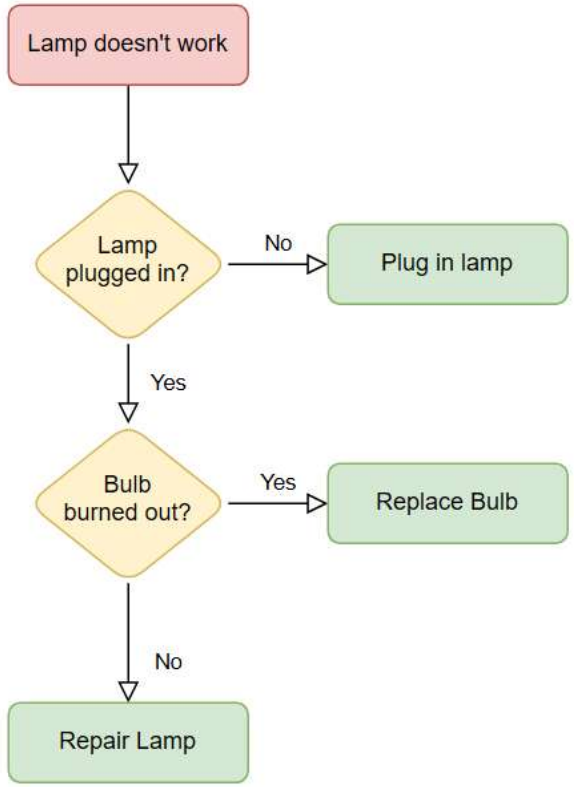
It allows us to create programs by using blocks and assembling them together, like a puzzle.



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Algorithm

Description of the procedure to solve the problem. An algorithm is a finite series of instructions that must be executed to achieve the result. We are designing new algorithms every day without realizing it.



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QUESTION





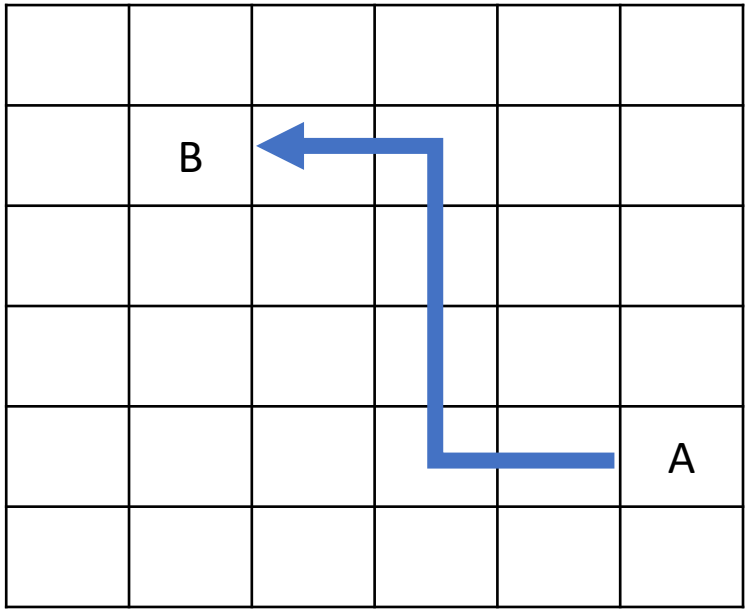




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Which steps to take to go from A to B?



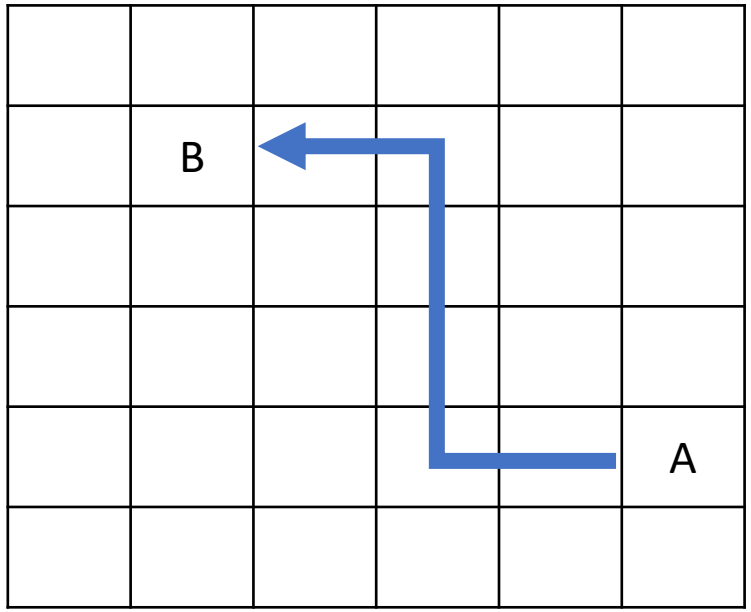
At each step of your algorithm you can choose between:

- Go forwards/backwards
- Turn right/left

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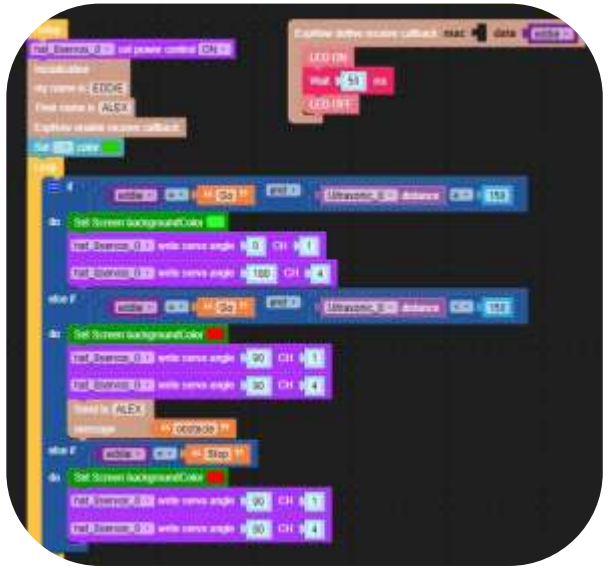
Which steps to take to go from A to B?



1. **START**
2. Move forward 1 square
3. Move forward 1 square
4. Turn right
5. Move forward 1 square
6. Move forward 1 square
7. Move forward 1 square
8. Turn left
9. Move forward 1 square
10. Move forward 1 square
11. **END**

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Where can I create my program?
How can I tell the robot to follow the desired instructions?

Integrated Development Environment (IDE)



An **Integrated Development Environment (IDE)** is software designed for program development.
It is very useful because it aggregates the necessary tools for program development into a single graphical user interface.
It is used for both text-based code development and the development of programs written in visual languages.

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Programming

To program Guizzo, you can use the UIFlow development environment (© M5Stack). UIFlow allows you to create programs intuitively using colorful blocks that represent different commands, much like a puzzle.



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How to install

1) https://flow.m5stack.com/
2) Select UIFlow 1.0 and "Confirm"
3) Select "Skip"

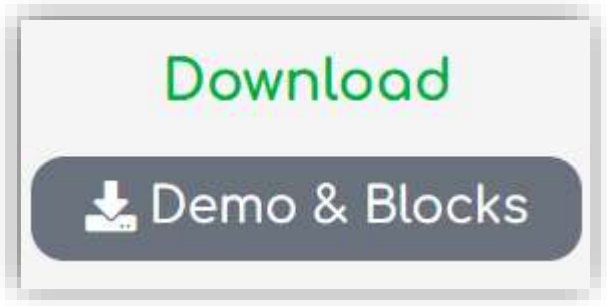


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How to install

We need to download the blocks to program the robot:

1) https://www.ancybernetics.it/en/guizzo-3/ go to Download Demo & Blocks
2) Download Guizzo.zip to Desktop
3) Right click on the zip file «Extract Here»
4) Go to UIFlow interface and select «Custom»
5) Click on «Open *.m5b file» (second one on top)
6) Select Desktop > Guizzo > Custom Blocks > «Guizzo_v4.m5b» and click «Open»



Now, we are ready to program the robot!

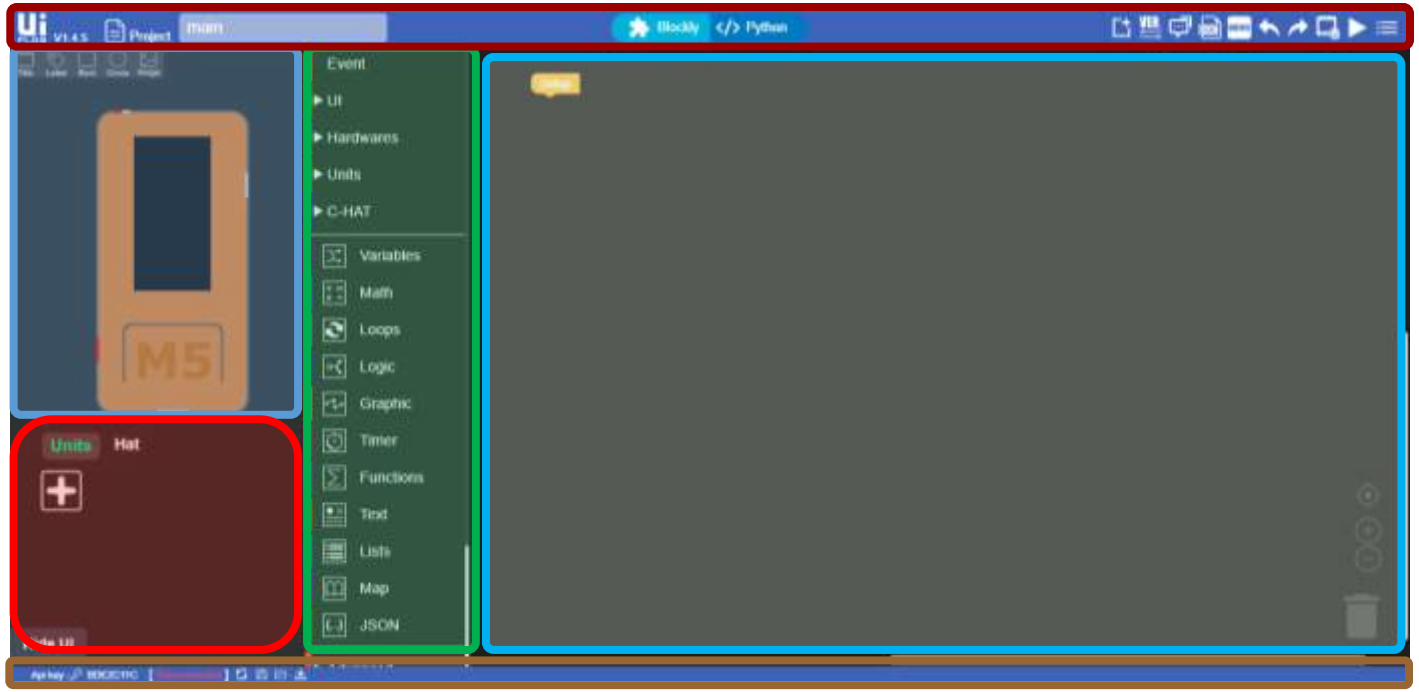
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Visual Programming Interface

IDE sections:

- Coding area
- Coding blocks
- UI Manager
- Units and HAT
- Top Bar
- Bottom Bar



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Visual Programming Interface

Instruction blocks



Event blocks



Loop blocks

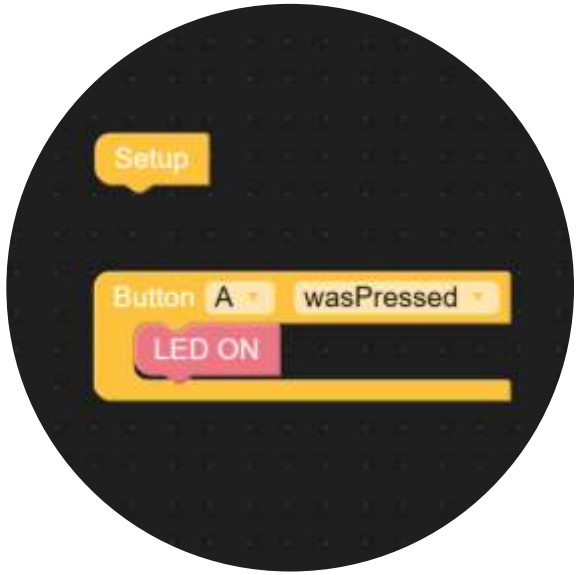


Function blocks



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Visual Programming Interface



What is an «event» block?

An event is something that happens that we can use to trigger actions. For example, pressing a button is an event.

Example

When the “A” button is pressed, LED is on.

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Visual Programming Interface



What is a «delay»?

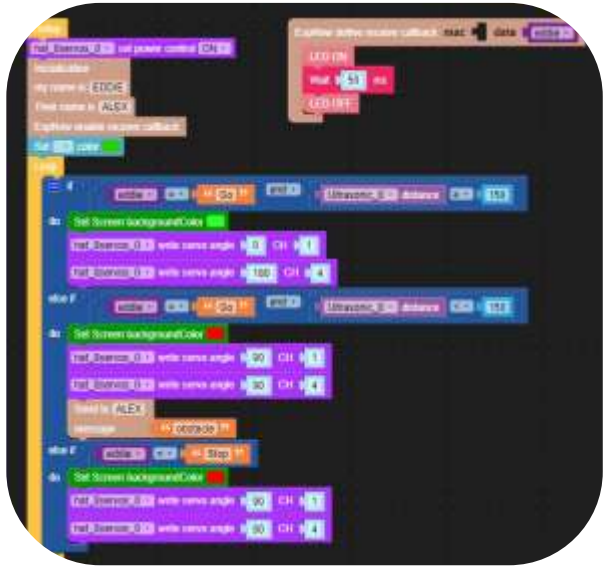
A delay is like putting the program on pause for a little while. It's like counting to 10 before doing something.

Example

We turn on the LED for 1 second, then turn it off.

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Programming Guizzo without turning it on first is impossible!

It's like trying to talk to someone who is sleeping – they won't hear you, and you won't get a response.



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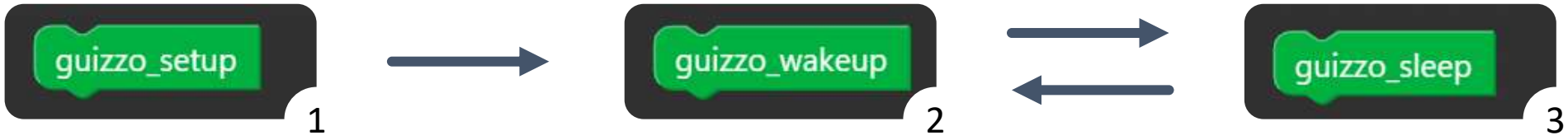
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Setup **Wake up** **Sleep**

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Purpose: Prepares Guizzo for movement.

Usage: Always place this block right under the yellow "setup" block.

Explanation: This block is used only once, at the very beginning of your code, to set up Guizzo. It's like getting Guizzo ready to start swimming.

Purpose: Activates Guizzo's motor.

Usage: Always place this block above any movement block.

Explanation: This block "wakes up" Guizzo, making it ready to move. Think of it as waking Guizzo up before it starts swimming.

Purpose: Puts Guizzo to sleep.

Usage: Always place this block below a movement sequence.

Explanation: This block "puts Guizzo to sleep," which is useful when Guizzo is not supposed to be swimming, helping to save energy.

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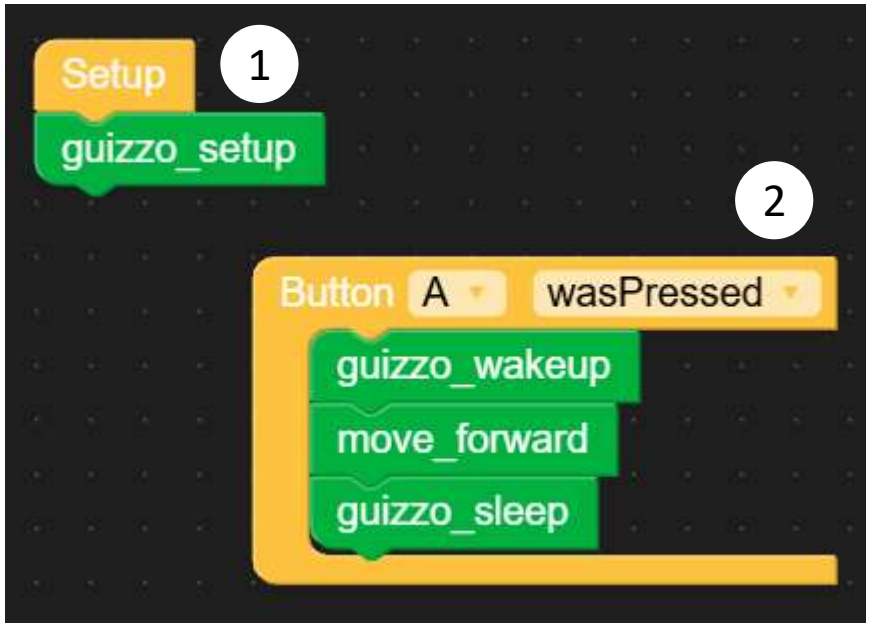
RoboFISH

Attention please!

To program the robot:

(1) You have to place the “guizzo_setup” block after the “setup” block.

(2) You have to place first “guizzo_wakeup” block before the robot’s movement. Once the robot stop moving, you have to place “guizzo_sleep” block for the robot to sleep.



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Let’s start programming!







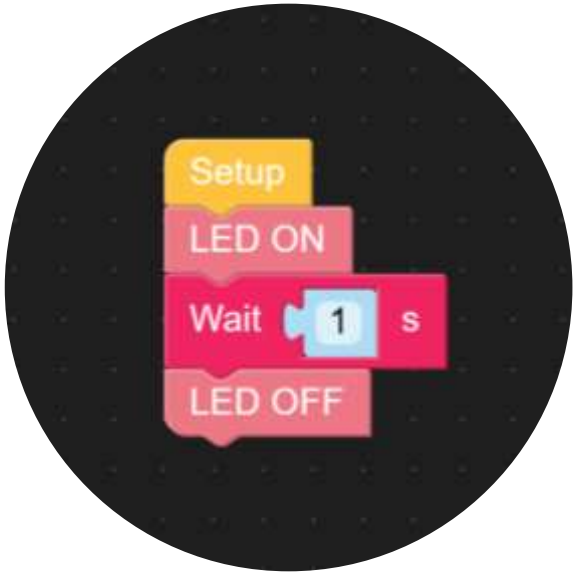


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RoboFISH



Let’s write a program to turn on the LED on the robot



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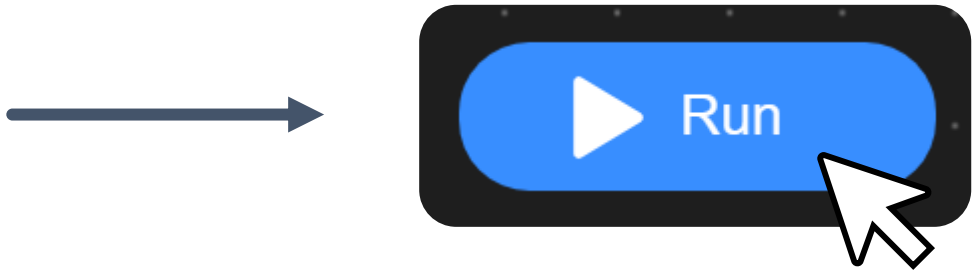
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Let’s run the program!

Once the program and Guizzo are ready, **click the "Run" button in the bottom** right corner of the development environment to execute your code on Guizzo.







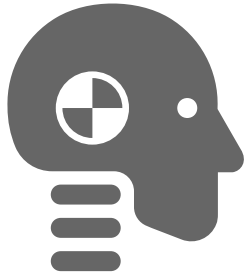
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Now it’s time to test!



Great Job!
You've completed the programming task.



Test Your Code
See how Guizzo responds.



Work Together
Everyone in the team has a role.

Embrace Challenges
Mistakes are part of learning and improving.

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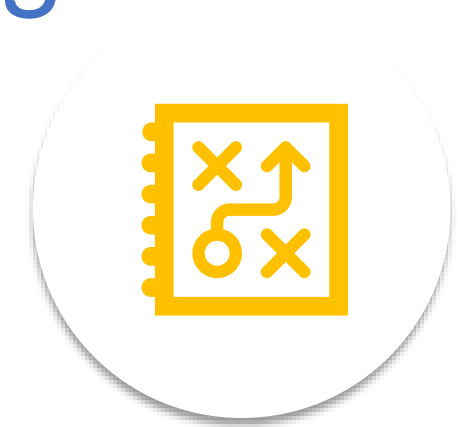
RoboFISH

Let’s keep programming!









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Let’s write a program to move the tail of the robot



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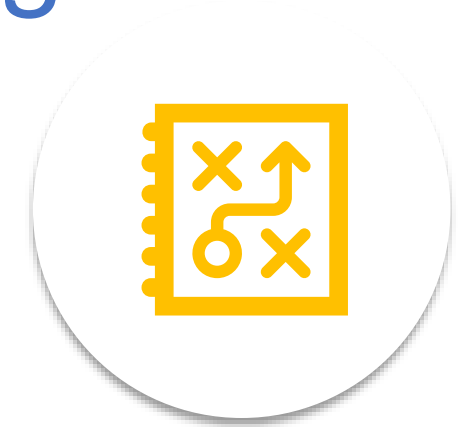
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Let’s keep programming!









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Let’s design a face for the robot. Let’s write a program to turn on the LED for a second and change the background color when we press the button A, and doing the same thing but with different colors when the button B is pressed.



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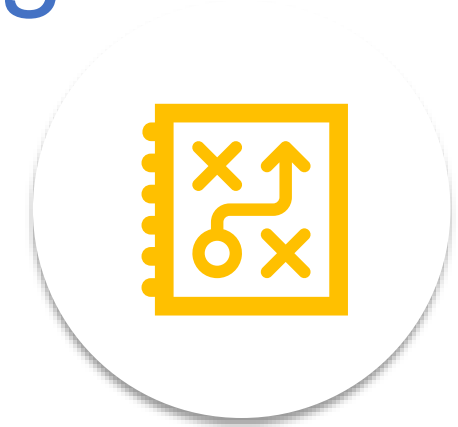
Robot Balık : RoboFISH

Let’s keep programming!









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Marine Pollution and Sustainability

Marine pollution comes in two types, chemical contamination and trash, from various sources:



Industrial runoff



Agricultural runoff



Plastic waste

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Marine Pollution and Sustainability

This pollution poses many consequences including:

- Habitat degradation, promoting the growth of algaes toxic to wildlife
- Threats to biodiversity
- Health risks for humans, since people may consume seafood containing microplastics and associated toxins





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Avoid the plastic island!

Guizzo is a robot, and in order to do its job, he has to overcome various obstacles in the water, such as plastic islands, on which Guizzo could get stuck. These are huge accumulations of debris that form at the convergence zones of ocean currents.

CAUSES

Litter dumping;
Marine activities;
Durability of plastics.



IMPACT

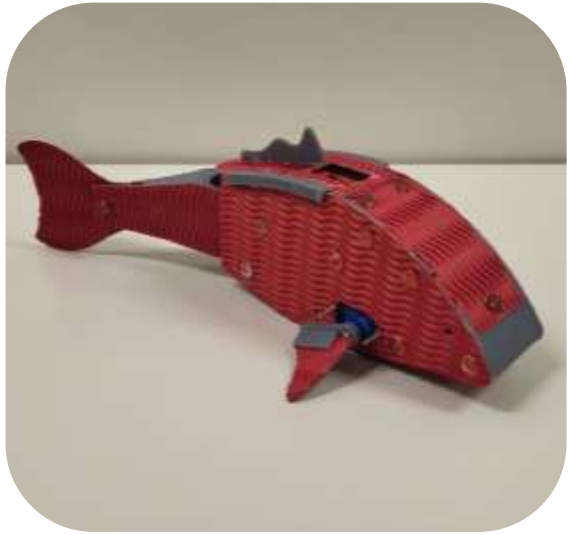
Damage to marine fauna;
Contamination of the food chain;
Chemical pollution.

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Avoid the plastic island!

Guide the robot from the starting point to the goal on a grid, avoiding plastic islands and overcoming plastic waste.







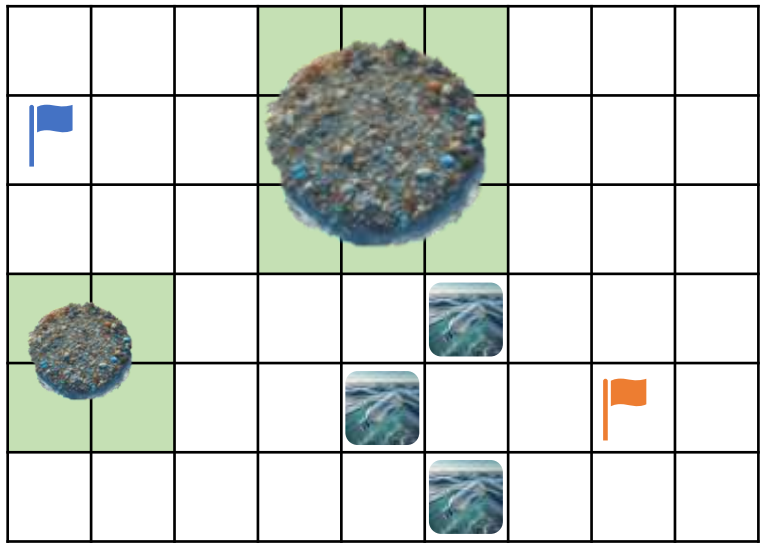
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Avoid the plastic island!

What steps are needed to get from to in the grid?





Start

Goal

Plastic waste

Plastic island

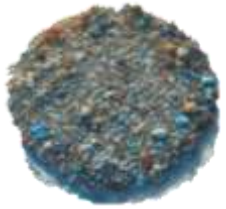
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Avoid the plastic island!



Plastic waste → The robot can move through squares with plastic waste by shaking its fins to clear the path.



Plastic island → Plastic islands are completely impassable, meaning the robot cannot move through these squares.

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Avoid the plastic island!

To control Guizzo's movements, we will use the following blocks:

move_forward
Makes the robot swim forward. This block allows the robot to move forward by the number of squares set.

move_right
Makes the robot turn right. This block allows the robot to turn right while staying on the same square.

move_left
Makes the robot turn left. This block allows the robot to turn left while staying on the same square.

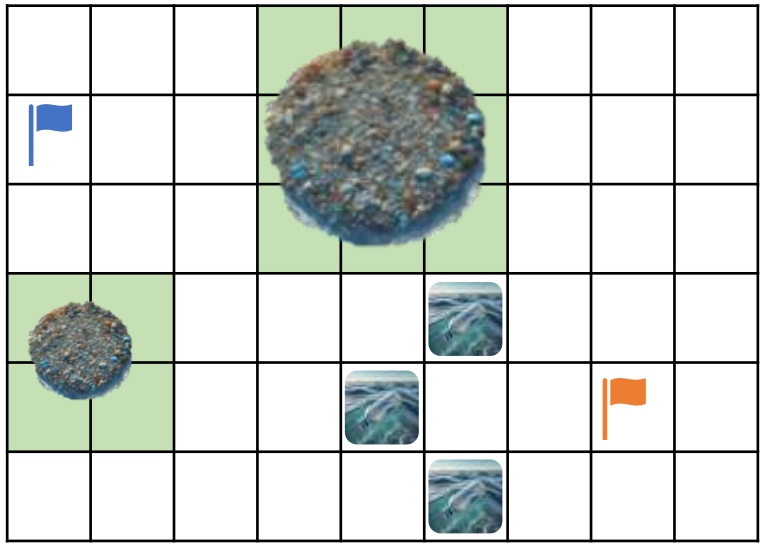


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Avoid the plastic island!







Start



Goal



Plastic waste



Plastic island



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