2025年臺灣國際科學展覽會
優勝作品專輯

作品編號　130012

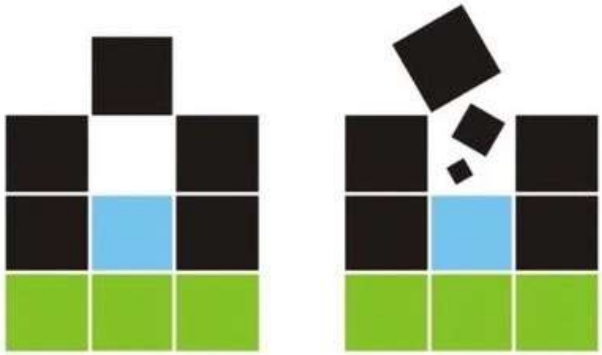
參展科別　行為與社會科學

作品名稱　DIVE&CLEAN - Intervention Possible

得獎獎項　四等獎

就讀學校　The British International School, Budapest
指導教師　Gabor Laszlo Ivanka
作者姓名　Laura Ivanka

作者照片



DIVE & CLEAN

INTERVENTION POSSIBLE

The Movement to Protect Our Oceans
Innovating for a Pollution-Free Ocean Floor
The Initiative for a Cleaner Ocean Floor
Underwater Bins for a Healthier Planet
Dive In, Clean Up, Make a Difference
Act Now: Protect What Lies Beneath

Category: Behavioral & Social Sciences

Table of Contents

1. Introduction

2. Background and Inspiration

3. Technological Components

4. Campaign for Behavioral and Social Impact

5. Educational and Scientific Integration

6. Achievements and Recognitions

7. Future Roadmap

8. Facts: Raising Awareness

9. References and Inspirations

10. Conclusion

1. Introduction

The DIVE&CLEAN project is an educational and innovative initiative aimed at addressing a significant environmental challenge: marine pollution. With oceans covering over 70% of the Earth's surface and providing a home to 50–80% of life on the planet, their health is critical. However, marine ecosystems are under threat due to plastic pollution, which impacts wildlife, coastal communities, and global biodiversity.

This project centers around the idea of introducing underwater trash bins, especially in areas frequented by recreational divers. While most divers explore the seas without specific tools to collect trash, they could contribute significantly with the right infrastructure. The vision of DIVE&CLEAN is to inspire behavioral change, encourage collaboration, and promote actionable solutions to reduce ocean pollution.

Using interactive robotics and storytelling, the project tells the story of divers rescuing animals entangled in plastic and collecting trash from the ocean floor using underwater bins. Through creative performances, it seeks to educate and motivate individuals, resorts, and authorities to adopt sustainable practices.

> ***DIVE&CLEAN is not just a technological display; it is a call to action for a cleaner, healthier planet.***

The DIVE&CLEAN project represents a unique blend of innovative technology, environmental education, and social impact. Its primary objective is to address ocean floor pollution by promoting the idea of underwater trash bins, using robotics and interactive storytelling as tools for education and advocacy.

> ***The project inspires individuals, communities, and policymakers to act towards a sustainable marine ecosystem.***

2. Background and Inspiration

The inspiration for DIVE&CLEAN comes from my passion for marine biology and robotics. Witnessing the devastating effects of ocean pollution, I felt the need to develop a solution that combines technology with environmental activism. The project also draws from real-world examples of marine animals like octopuses, which exhibit remarkable intelligence and adaptability. Could they one day mimic us, the divers, by collecting trash into underwater bins? Will they begin cleaning their environment on their own?

> ***The idea of marine life mimicking human actions to clean their environment forms a central theme of the story.***

DIVE&CLEAN builds on the foundation of my earlier projects, such as KIND&CLEAN which focused on city cleanliness and kindness. It evolves these concepts into a marine conservation framework by inventing the concept of underwater bins, emphasizing the need for collaboration and sustainable solutions.

> ***While trash bins are common in urban areas, there are no similar solutions for the ocean floor.***

This project aims to fill that gap by introducing underwater bins and encouraging recreational divers to play a role in marine conservation.

Real-world challenges, such as the absence of trash bins in underwater environments, provided the practical motivation for this project.

3. Technological Components

The technological setup of DIVE&CLEAN includes dancing robots powered by Micro:bit controllers, an interactive wall with moving parts controlled by a single NEZHA board, and unified coding for synchronized operation. These elements create a very cheap compelling interactive performance that educates audiences about marine conservation.

> ***DIVE&CLEAN integrates advanced robotics and engineering to create a compelling, interactive performance that highlights the importance of cleaning the ocean floor.***

Key technological features include:

a) Dancing Robots

The project features three primary robots: a fish, an octopus, and a crab. These robots symbolize marine life thriving in a clean environment. They are constructed using Micro:bit controllers and Kitronik Move Mini platforms, with added paper and wooden elements for aesthetic representation. Their movements are synchronized through a unified codebase to dance in harmony, celebrating a clean ocean.

Challenges Overcome:

- Balancing the robots to ensure smooth movement required extensive testing and adjustments to their center of gravity.
- Creating lightweight but durable designs to maintain stability during performances.

b) Interactive Wall

The interactive wall is a centerpiece of the project, showcasing moving marine animals controlled by a single NEZHA breakout board and a single Geek servo. Audience engagement by making noise triggers faster movements, symbolizing collective action leading to a healthier ecosystem.

How It Works:

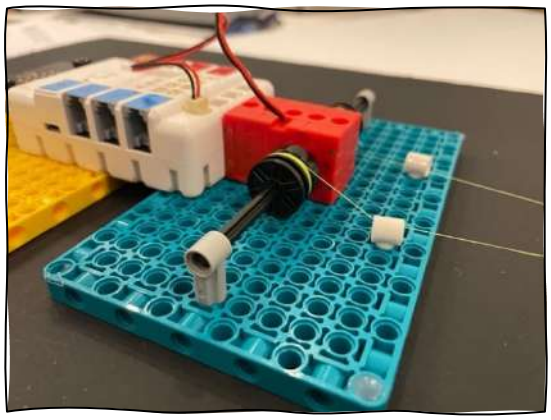
- A fishing line mechanism allows the animals to move across the wall, powered by servo motors and magnets.
- Micro:bit V2 is used for sound recognition, enabling the wall to respond dynamically to audience applause or cheering.

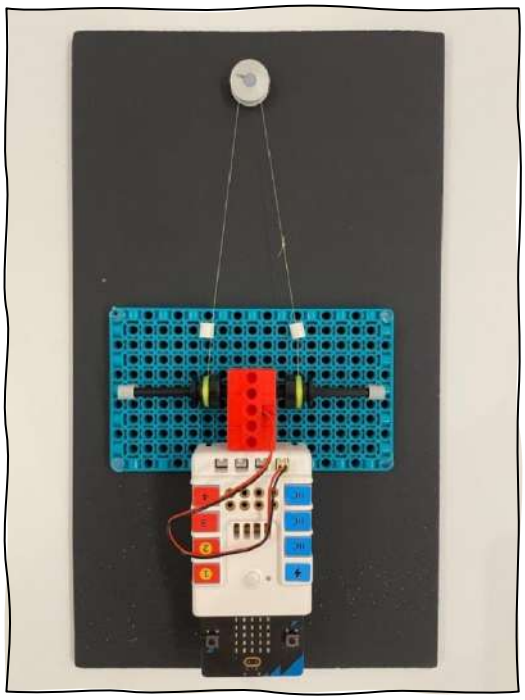
Challenges Overcome:

- Stronger magnets caused resistance, while weaker ones couldn't hold the animals.
- Early versions had desynchronized movements with other robots. A unified code was developed to ensure seamless operation.
- The wall initially sagged, affecting functionality. Lightweight reinforcements and precise adjustments resolved the issue.
- Fine-tuning the Micro:bit V2 sensor ensured the wall reacted only to audience applause, avoiding false triggers.

Key Versions:

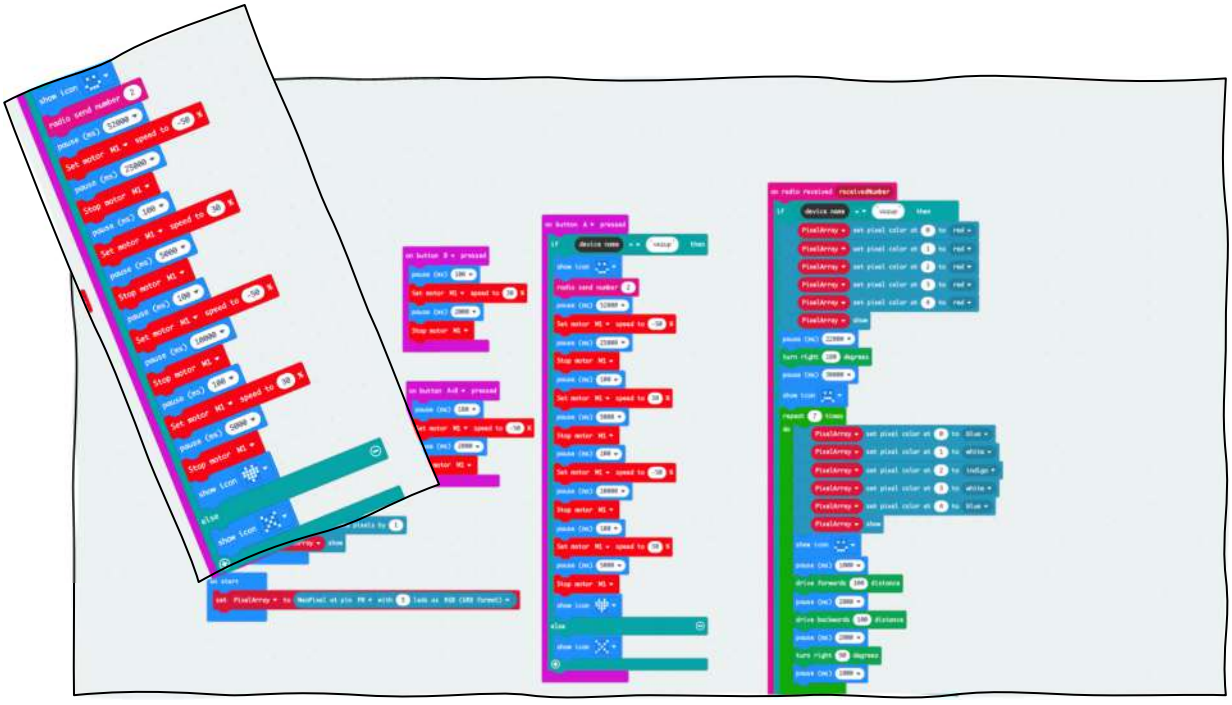
1. Version 1: Developed for initial testing, featuring basic functionality.
2. Version 2: Optimized for international competitions with enhanced movement precision and better equipment.





c) Unified Coding System

All robots and the interactive wall operate on a single codebase, ensuring synchronization. By naming individual Micro:bits, specific functions are assigned to each robot, allowing seamless interaction. The code also integrates sound recognition, further enhancing the interactive experience.



d) Additional Technical Features

- **NEZHA Breakout Board:** Acts as the control hub for the interactive wall, managing multiple servos and sensors.
- **Micro:bit V2:** Powers the robots and wall with advanced features such as sound stabilization and movement calibration.
- **Geek Servo Motors:** Ensure precise and consistent movements of the animals on the interactive wall.
- **Autonomous Operation**
- **Robot-Robot and Human-Robot communication**

4. Campaign for Behavioral and Social Impact

A robust marketing strategy is integral to DIVE&CLEAN. Interactive performances, collaborations with global initiatives, roadshows, social media engagement, and merchandise sales drive awareness and action.

> ***The DIVE&CLEAN project goes beyond technological innovation to act as a catalyst for behavioral and social change.***

The campaign's goal is to foster awareness, inspire action, and influence policies that support sustainable marine practices.

a) Core Objectives

1. **Promote Underwater Trash Bins:**
    - Advocate for installing trash bins in diving hotspots to make trash collection a routine part of recreational diving.
    - Collaborate with authorities, resorts, and eco-tourism initiatives to ensure long-term maintenance and adoption.
2. **Encourage Behavioral Change:**
    - Highlight the role individuals can play in ocean conservation by integrating small actions, such as collecting trash during dives, into their routines.
    - Create emotional connections through storytelling and interactive performances.
3. **Link to Global Initiatives:**
    - Work with the Blue Flag program to include underwater trash bins as a certification requirement for sustainable tourism.
    - Partner with platforms like Booking.com to highlight DIVE&CLEAN-certified locations.

b) Marketing and Outreach

The project's success depends on its ability to engage diverse audiences, including divers, environmentalists, policymakers, and the general public. The marketing strategy includes:

- **Interactive Shows:**
    - 24/7 automated displays at high-traffic locations, such as bus stations and global events like the Osaka World Expo.
    - Performances featuring robots and the interactive wall to captivate audiences and promote marine conservation during roadshows, conference opening ceremonies, political events, in zoos, museums, and aquariums.
- **Social Media Campaign:**
    - Active presence on Instagram, TikTok, and Facebook with engaging content, live Q&A sessions, and community challenges.
    - Use of hashtags like #DiveAndClean and #SaveOurOceans to amplify reach.
- **Merchandise:**
    - Branded T-shirts, hats, bracelets, and stickers with slogans like "Clean Oceans, Happy Oceans."
    - Proceeds will fund the installation of underwater trash bins and community cleanup drives.
- **Educational Outreach:**
    - Workshops and school programs to educate children about marine ecosystems and the impact of pollution.
    - Interactive sessions with the robots to demonstrate the importance of collective action.

The project uses positive reinforcement (e.g., the dancing robots) to demonstrate the benefits of clean oceans, tapping into human emotions to drive behavioral change.

c) Surveys and Data Collection

To measure the campaign's impact and refine its strategies, I am doing:

- Pre- and post-event surveys to assess audience awareness and attitudes.
- Data collection on the number of participants, social media engagements, and merchandise sales.

5. Educational and Scientific Integration

Workshops, data collection surveys, and collaborations with schools emphasize the project's focus on education and public impact.

a) Focus on Behavioral and Social Sciences

The project explores how storytelling, visual elements, and interactivity can effectively influence public attitudes toward environmental issues. Key aspects include:

- **Storytelling:** The narrative of divers saving marine life fosters empathy and inspires action.
- **Interactive Design:** Audience participation by "making noise" enhances engagement and demonstrates the power of collective effort.
- **Data Analysis:** Surveys and statistics provide insights into the effectiveness of educational campaigns.

b) Collaboration with Schools and Communities

- Organize educational workshops in schools, focusing on robotics and environmental science.
- Partner with community organizations to conduct beach cleanups and underwater trash bin installations.

> ***"Education is the most powerful weapon which you can use to change the world."***
> ***— Nelson Mandela***

c) Integration with the Blue Flag Program

- The Blue Flag initiative, which certifies sustainable tourism locations, inspired the idea of linking underwater trash bins to eco-tourism.
- Propose adding underwater trash bins to the Blue Flag criteria for eco-certified beaches and resorts.

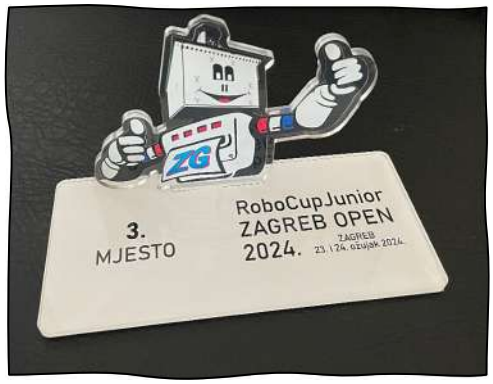
- Develop a logo and flag for "DIVE&CLEAN Certified Locations," encouraging resorts to adopt sustainable practices.

6. Achievements and Recognitions

The DIVE&CLEAN project has already garnered recognition for its innovative approach, including:

- **RoboCup Junior Zagreb Open (2024, Croatia):** 3rd Prize.
- **RoboCup Junior Austria Open (2024, Graz - Austria):** 1st Prize.
- **RoboCup Junior European Championship (2024, Hanover - Germany):** 2nd Prize.

These accolades validate the project's potential to make a meaningful impact on marine conservation.



7. Future Roadmap

Future plans include expanding technological features, introducing autonomous trash collection robots, and collaborating globally to certify clean marine locations.

> ***The DIVE&CLEAN project envisions a long-term impact on marine conservation and environmental education.***

The following steps outline its future development:

a) Technological Advancements

- **Expanded Interactive Wall:**
    - Add more animal models and enhance their movement complexity using advanced servo motors and sensors.
    - Incorporate more LED lighting for a more visually striking performance.
- **Autonomous Trash Collection Robots:**
    - Develop larger, more robust robots capable of navigating underwater and collecting trash autonomously.
    - Integrate cameras and sensors for real-time monitoring of marine pollution.
- **Underwater Trash Bin Prototypes:**
    - Design and test durable, eco-friendly trash bins for ocean floors.
    - Collaborate with manufacturers to produce scalable models.

b) Global Campaign Expansion

- **International Collaborations:**
    - Partner with environmental organizations, tourism boards, and global events to promote the DIVE&CLEAN mission.
- **DIVE&CLEAN Certification:**
    - Establish criteria for resorts, dive centers, and beaches to become DIVE&CLEAN-certified locations, highlighting their commitment to sustainability.
- **Community-Led Initiatives:**
    - Train local communities in setting up and maintaining underwater trash bins.

- Organize volunteer programs for regular ocean cleanups.

c) Research and Data Collection

- Conduct studies on the long-term effectiveness of underwater trash bins.
- Publish findings to encourage widespread adoption of similar initiatives.

8. Facts: Raising Awareness

Facts about marine life and pollution highlight the importance of ocean conservation, serving as a foundation for educational campaigns.

> ***"The greatest threat to our planet is the belief that someone else will save it."***
> ***— Robert Swan***

Happy Facts

1. The oceans provide 99% of the living space on the planet, containing 50-80% of all life.
2. Many fish exhibit remarkable adaptability, such as sequential hermaphroditism, where they change sex to maintain population balance. Clownfish, for instance, adapt by having the largest male become female to ensure reproduction.
3. Parrotfish produce 85% of the sand that builds up reef islands, like those in the Maldives.
4. Moray eels are not aggressive when they open and close their mouths; they are simply breathing.
5. Marine creatures like mimic octopuses can imitate other species (flounder, jellyfish, stingrays, sea snakes, lionfish, or even rocks and coral) to adapt and survive.
6. Whales make the loudest underwater sounds at 188 dB, with their whistles traveling up to 500 miles.
7. Coral reefs support over 25% of all marine life, providing shelter, food, and breeding grounds for countless species, while also protecting coastal communities from erosion and storms.
8. Boxer crabs carry two anemones, resembling pom-poms, as a defense mechanism.
9. Seahorses are the only animals where males give birth.
10. Sea sponges are older than dinosaurs.

Sad Facts

1. Over 8 million tons of plastic enter the oceans annually, impacting marine life.
2. Animals often mistake plastic waste for food, leading to fatal consequences.
3. Around 100,000 animals die from entanglement in plastic waste each year.

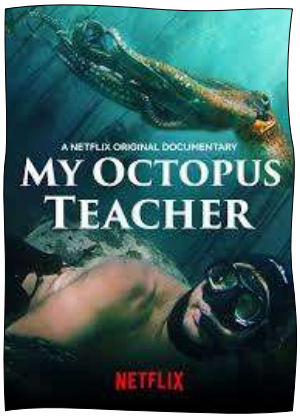
4. Three billion people worldwide depend on fish as a primary source of protein.
5. Plastic waste facilitates the transport of marine animals, plants, and microbes to non-native regions, disrupting ecosystems.
6. Plastic pollution increases the effects of climate change by releasing harmful greenhouse gases.
7. Plastic breaks down into microplastics, which contaminate water and food chains.
8. Fifty percent of all plastics produced are designed for single use.
9. Ocean plastic pollution is projected to triple by 2060 without significant intervention.
10. The ocean absorbs 30% of global carbon emissions, playing a critical role in regulating the Earth's climate.

These facts are integral to the DIVE&CLEAN educational campaign, fostering empathy and urgency among audiences.

9. References and Inspirations

The DIVE&CLEAN project draws heavily from real-world challenges and inspiring media (click on the images below to view the movie trailers):

- *My Octopus Teacher* (Netflix): A personal exploration of marine life intelligence and ecological balance.



- *Seaspiracy* (Netflix): A documentary highlighting the devastating impacts of ocean pollution and overfishing.

- *The Cove* (Netflix): A groundbreaking film exposing dolphin hunting and advocating for marine conservation.

- *The Big Blue*: A cinematic homage to the beauty and fragility of the ocean.

- *My Penguin Friend:* A touching film based on a true story, showcasing the extraordinary bond between a fisherman and a penguin while advocating for compassion and environmental stewardship.

"Look deep into nature, and then you will understand everything better." — Albert Einstein

These references have shaped the project's narrative, emphasizing the urgency of marine conservation.

10. Conclusion

DIVE&CLEAN merges technology and education to inspire action for a cleaner, healthier planet.

DIVE&CLEAN is more than a science project—it is a movement.

By merging technology, education, and behavioral science, it seeks to inspire a global shift in attitudes and actions toward marine conservation. The project demonstrates that even "small efforts", like installing underwater trash bins or supporting sustainable tourism, can lead to significant environmental benefits.

Through interactive storytelling, performances, and innovative technology, DIVE&CLEAN serves as a beacon of hope for a cleaner, healthier ocean. Its vision is to create a world where marine ecosystems thrive, free from the burden of human pollution.

Together, we can make this vision a reality.

【評語】130012

The project aims to address a significant environmental challenge, namely, marine pollution, via an educational and innovative initiative. The multi-facet attempt is impressive, but might not fit the scope of the science fair. The specific questions and suggestions are listed below:

1. No specific research questions are identified, rendering it difficult to evaluate the scientific merit of the project.
2. The technical components of the initiative of the project (i.e., the dancing robots, the interactive wall, and the unified coding system) per se are not directly relevant to behavioral/social science. If the project aims to evaluate the effectiveness of these components, how these components might exert their effects, and how they are administered should be clearly described. In addition, direct and relevant measurements of the effectiveness of these components need to be introduced and justified.
3. It is stated in the project report that data from pre- and post-event surveys to assess audience awareness and attitudes are collected. However, the nature of the data

seems to be subjective and qualitative. What are the contents of the surveys? What are the results?

4. Similarly, the project seems to conduct "data collection on the number of participants, social media engagements, and merchandise sales." What are the results?

5. It is suggested to compare the results in this study with that from a control group (e.g., data from participants who did not have access to the design, or data from participants who only received other types of educational materials).

Overall, this is an ambitious and meaninful attempt to improve people's awareness of marine pollution. However, a science fair might not be the most suitable venue to acknowledge its achievements.