BEST IZMIR
EBEC

MARINE POLLUTION

SIRIUS PROJECT
SHINING STARS TEAM

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1. What is our problem?

We can define marine pollution as: Particules, chemicals, worldwide waste, agricultural and industrial waste seeping into the oceans; thus, the spread of invasive species.

The oceans which cover 70% of our planet's surface not only satisfy the needs of organisms living in it, but also provides the fundamental needs of humans. 70% of oxygen produced comes from ocean creatures. Contrary to popular belief, the "lungs of our planet" are not forests, but oceans. Prochlorococcus bacteria living in the ocean use photosynthesis, and provide oxygen. Chlorococcus bacteria, similarly, produce 20% of oxygen in our atmosphere. This ratio equates to more than all of our forests combined. The reason our Earth is such a rich oxygen source is these bacteria and thus our oceans. Oceans do not only produce oxygen. Carbon Dioxide, one of the main reasons of climate change, gets absorbed in billions of tonnes each year by the oceans. Hence, oceans clean the atmosphere for us to be able to live. For these reasons, marine pollution is a problem we can not afford to underestimate.

2. What causes it and what contributes the most to it?

We can examine the causes of marine pollution under three main headings;

- **Air pollution of the seas:**

  Oily wastes of airlines are generally dumped into the open sea. Another cause of air pollution of the sea is air pollution created by industries or residences. For example, toxic gases released into the atmosphere mix with sea and fresh waters in the form of acid rain.

  Atmospheric pollution is the pollution caused by the transport of plastic waste and garbage to the seas by the wind. In addition, climate change increases sea temperatures and increases the carbon dioxide content in the atmosphere, causing the oceans to become acidic. This indirectly affects the distribution and life of sea creatures in the water.

- **Pollution of the seas from the sea:**

  Oil spills are the leading cause of such pollution. Although the hydrocarbons in crude oil endanger the life of sea creatures, they remain on the seafloor for many years. Moreover, contrary to popular belief, these oil spills are not mostly due to accidents; It comes from many different sources, such as tankers dumping ballast water into the sea, leaking pipelines, engine oils pouring into sewers.

  Wastes arising from maritime transport constitute an important group such as wastes generated during loading, unloading or cleaning operations, wastes generated during the fueling of ships, wastes arising from unloading into the sea, especially from degassing operations of tankers, or wastes arising from the spilling of hazardous wastes carried by ships into the sea or as a result of accidents. In addition, oil produced from seabed resources,

wastes generated as a result of seabed research and excavations or military activities are also included in this group.

- **Pollution of seas from land:**

Domestic wastes (garbage, sewage and sewage) and industrial wastes: It is reported that thermal and nuclear power plants installed on sea coasts cause imbalances in the marine ecosystem. In addition, agricultural pesticides are transferred from the soil to the sea by mixing with the water. Tourism activities also constitute an important component of this group.

Waste water discharge: Bacteria such as typhoid, paratyphoid, bacillus dysentery, gastroenteritis, cholera as a result of not treating the wastewater; microscopic parasites, health problems such as hepatitis A occur. In addition, untreated wastewater may contain harmful chemicals and heavy metals, and their direct transport to the sea can pollute the sea and damage life.

Surface runoff: Surface runoff, which occurs in cities, agricultural areas, port and canal constructions, carries particles consisting of carbon, nitrogen, phosphorus and many other minerals to the sea. This mixture causes what we know as an algae explosion to increase excessively on the coasts and indirectly to a decrease in oxygen.

3. What is our solution?

Marine pollution is a vast problem that cannot be solved with one simple project or solution. Since we cannot achieve total success in terms of eliminating marine pollution, we plan to attack only one sub-problem directly and help solve the others indirectly by gathering and providing critically important information like water quality and the spreading rate of pollution over time. The one sub-problem we attack directly is the problem of solid waste.

The vast majority of underwater pollution is deep and inactive. There are dangers that cause serious damage to life, such as chemical wastes. Since most of the waste in the deep is chemical-based, it is predicted that trying to clean it with current or recent technologies will cause more harm. Our most effective approach is to prevent further contamination. We can achieve this with this project, which we divide into two groups: social and technical.

- **Social Campaign:** We plan to design and distribute somewhat disturbing and shocking posters around residential areas that force people to think emphatically and in terms of the lives of animals living in the ocean. It is important that the posters are out of the ordinary since we aim to get people's attention and have them spread the campaign through social media by their own will and amazement. This will provide an easy way to spread information without spending much money. By getting people's attention, we can make them realize the destructive effects of marine pollution.

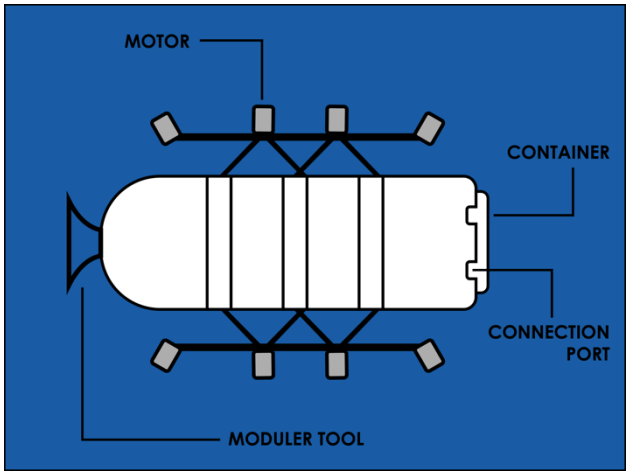
- **Technical Campaign**: We will produce unmanned underwater and surface vehicles equipped with IOT and AI technologies in a fully autonomous manner. The vehicles

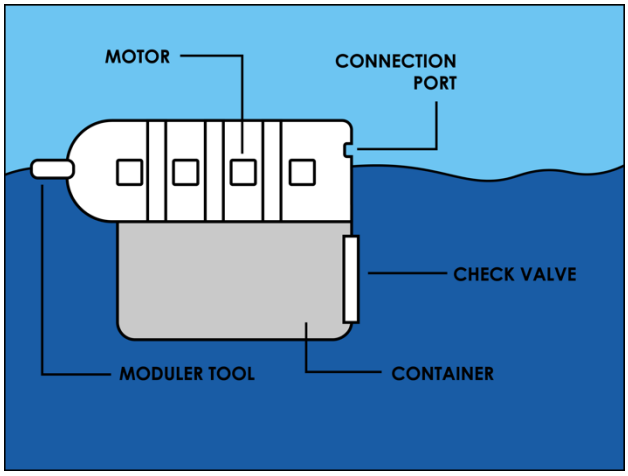
will be sent to cleaning missions in areas where heavy pollution is detected as a result of the analysis. There will be 2 basic methods of the cleaning process. These methods are: to carry plastic and similar elements in solid form first to the platforms and then to the garbage facilities, and to collect data from the sensors in order to detect chemical pollution. The collected data will be reported to support the intervention or interpretation of the source of the chemical pollution. In order not to pollute while cleaning, the sun will be our main energy source. Our fully autonomous vehicles that do not require manpower will be able to operate 24/7. Since autonomous vehicle systems are one of the agenda topics of the media and current society, we will use this situation to our advantage. In order to create social resonance, vehicle designs will be created with psychologically impressive designs that will prevent further pollution.

4. Our Design

- **Hardware**

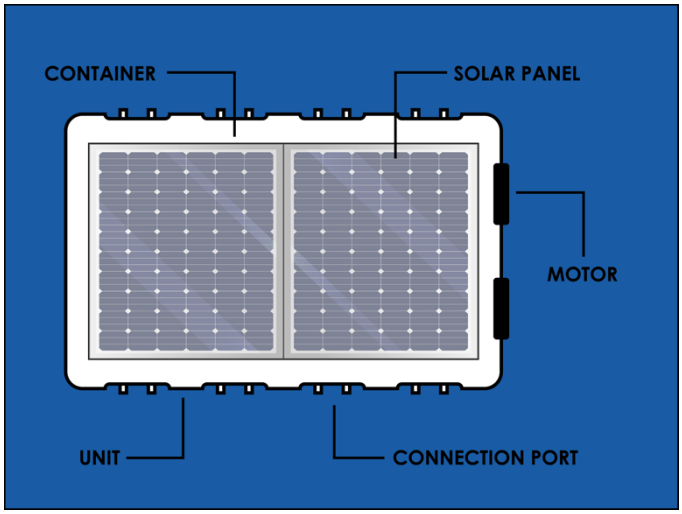
AUV (SIRIUS)

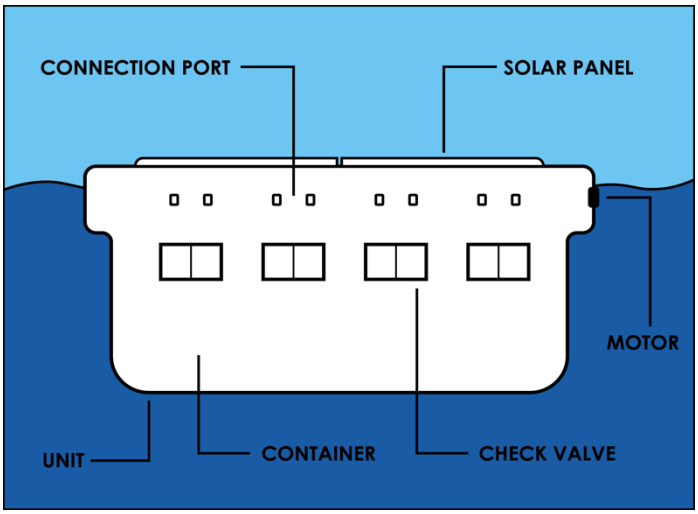




- 1m x 1m
- 8 motors
- Pressurized hardware capsule (For pressure resistance)
- Fully autonomous artificial intelligence system
- Power system: Platform power and internally stored batteries
- Fundamental components: Water pollution sensor, simple SONAR, GPS, pressure sensor, camera and lighting
- Modular system: Interchangeable working arms
    - Pile collection for bigger pieces: Web
    - Detailed collection for smaller pieces: Pincher system

Platforms:





- 10m x 10m
- Solar panels
- Garbage storage
- Fossil fuel unit for backup
- SONAR and GPS systems

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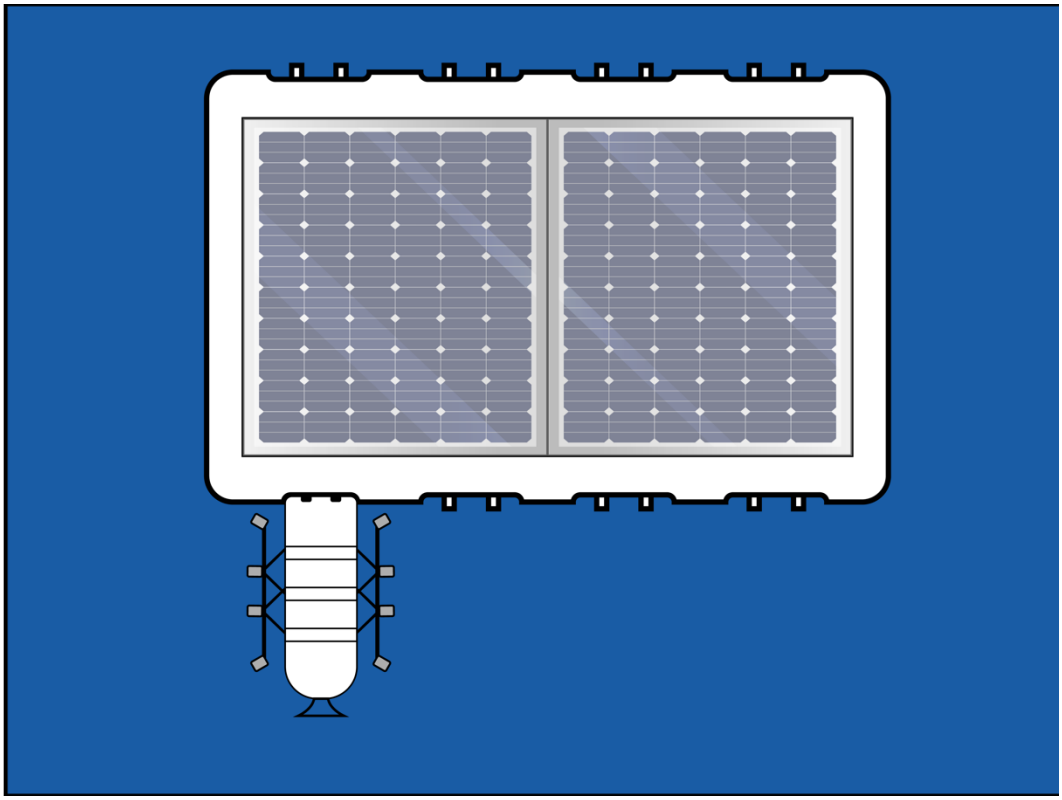
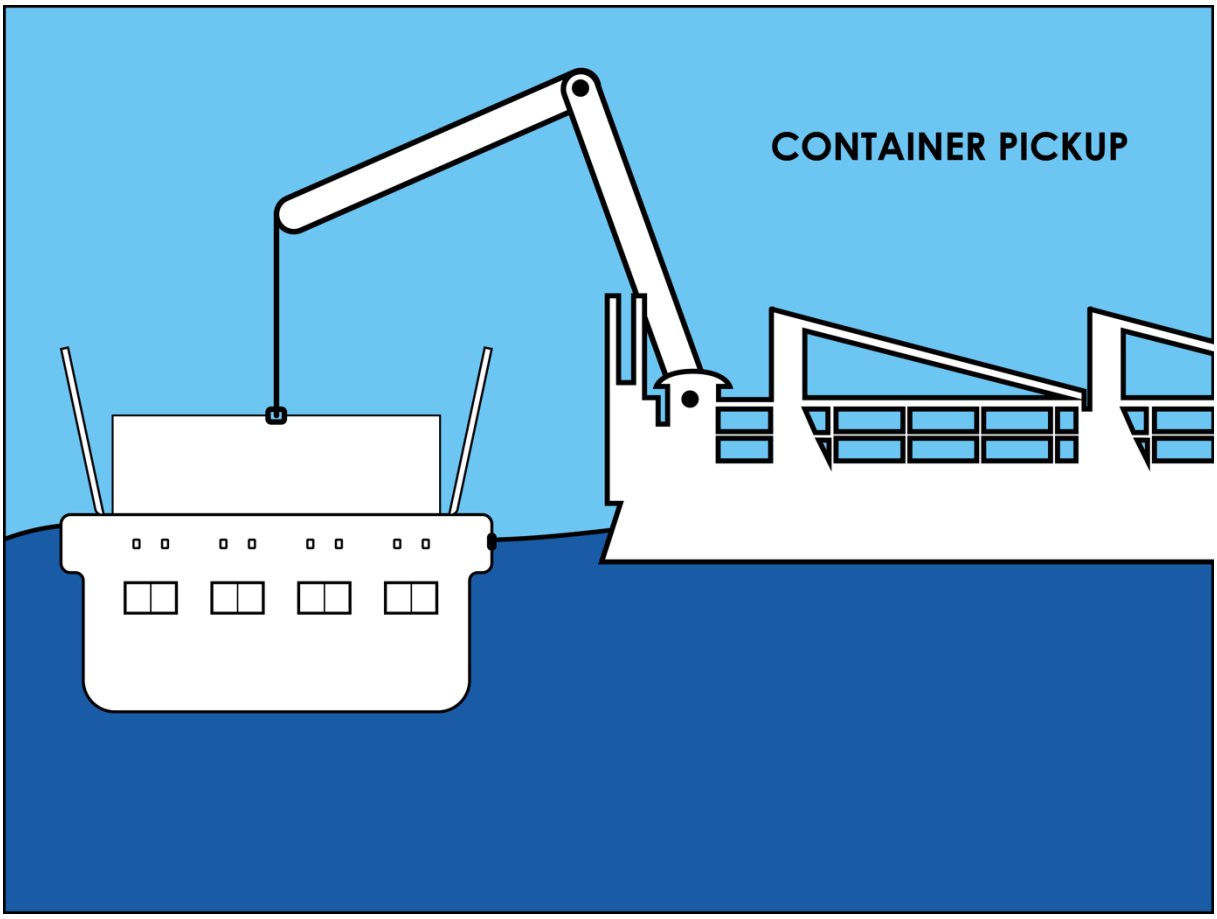


Ships (Minimally modified)

- In order to preserve efficiency and allow going into open seas, ships can collect the waste that the AUVs gathered from the platforms by installing a small component on the deck.



- **Software**

  - Reinforced learning and deep learning methods
  - Image segmentation
  - SONAR
  - Communication between the platform and the AUVs
  - Data visualization in order to analyze chemical pollution and determining coordinates
  - Using all the information, chemical pollution can be mapped and published open-source

5. Our work plan

First, the prototypes will be put into operation in the regions determined as a result of the pollution analysis. Following the monitoring process, optimal modular equipment and work areas will be determined with the findings obtained, and a continuous mission plan will be drawn up.

5.1 Budget

Based on our previous project experiences, a Sirius is produced for an average of 2500 dollars. A fully autonomous and renewable energy platform and the average cost of 8 Sirius vehicles would be equivalent to $30,000.

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