



# Official Portfolio World Robot Olympiad 2017

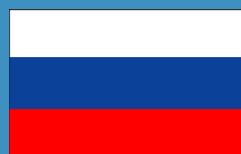
[www.minders.gr](http://www.minders.gr)



Jakarta - Indonesia 2013



Padova - Italy 2014



Sochi - Russia 2014



Doha - Qatar 2015



Costa Rica 2017

# Content

01.	WELCOME	03
02.	THE TEAM 2016-2017	04-05
03.	ROSTER	06-07
04.	THE PROJECT	08-09
05.	THE ROBOT	10-11
06.	DEVELOPEMENT	12-13
07.	MIND THE MINDERS!	14-17
08.	MARKETING	18-19
09.	SPONSORS	20-21
10.	EPILOGUE	22-23

Bonus :  
Technical Report

# Welcome

This is an elaborate presentation of our team who will proudly be participating in the World Robot Olympiad Hellas 2016-2017.



# THE TEAM 2016-2017

## HISTORY

“Minders” is a team established in 2010 by a group of Ekpedeftiki Anagennisi students, a private school, aiming at including and promoting robotics in its curriculum.

Minders is one of the most widely known teams in the Hellenic Contest WRO Hellas, having participated very successfully for the past four years.

Since their inception, the team has aimed at applying techniques of human logic and thought to their creations in order for the “robots” to be able to identify with humans and, therefore, to enhance the standards of living in any field (eg. Project Eurydice, RoboMind Project, RoboHermes Project, ShineSpace Project, Poseidon Project).

With this criteria in mind, the Minders team was established with the goal to further advance and evolve the technology in the field of Robotics, something that has been successfully achieved by each generation of Minders.



Reference from  
WRO HELLAS  
Secretary of the  
Scientific Committee

PROF. DIMITRIS ALIMISIS

“

Minders, being one of the most successful teams in the Hellenic WRO, have continuously achieved to introduce unique innovations, and with their strong presence, raise the bar every single year.

”

## 2016-2017 AWARDS GreenWave :

WRO Hellas 2017 - 1<sup>st</sup> Place

Hellenic Robot Competition - 1<sup>st</sup> Place

## OLD AWARDS

Poseidon Project :

World Robot Olympiad @ Qatar 2015 - 25<sup>th</sup> Place

WRO HELLAS 2015 - 1<sup>st</sup> Place

ShineSpace Project :

World Robot Olympiad @ Sochi 2014 - 7<sup>th</sup> Place

WRO HELLAS 2014 - 1<sup>st</sup> Place

RoboHermes Project

World Robot Olympiad @ Jakarta 2013 - 12<sup>th</sup> Place

WRO HELLAS 2013 - 1<sup>st</sup> Place

Project Eurydice

WRO HELLAS 2012 - 4<sup>th</sup> Place

RoboMail Project

WRO HELLAS 2012 - 5<sup>th</sup> Place

RoboMind Project

WRO HELLAS 2010 - 2<sup>nd</sup> Place

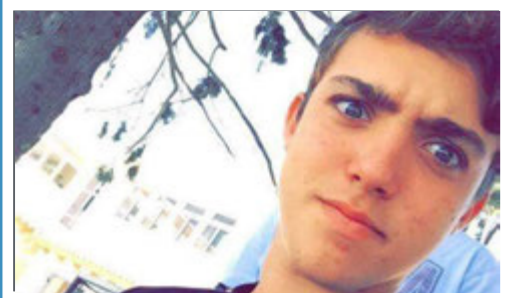


# ROSTER & RESPONSIBILITIES

## DETAILED PRESENTATION OF THE 5TH GENERATION

The 5th generation of Minders has presented the most developed project in the Hellenic Contest and aims higher by introducing breakthroughs in various fields.

The team consists of four Senior students who have been co-operating on different projects for many years and their endeavor has produced impressive results.



**Vasilis Kalamaras**  
Engineer & Programmer

Short bio :

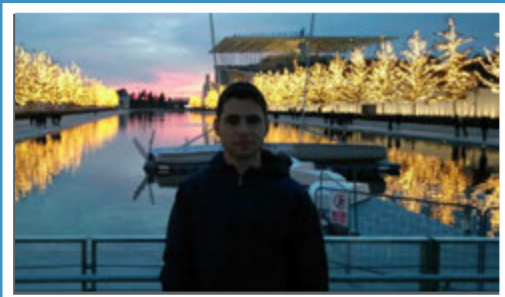
Vasilis is a senior student. He is actively involved in the Programming as well as the building / construction of the Robot and he is the head of the team.



**Polivios Platigenis**  
Marketing & Media Manager

Short bio :

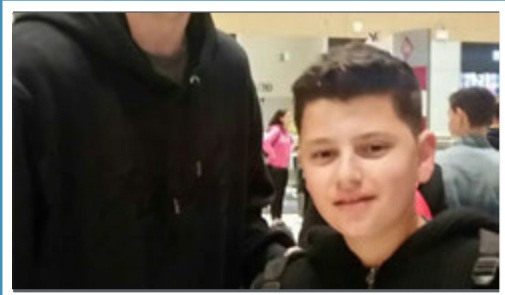
Polivios is a senior student. He is involved in Finance Science and he has a flair for Economics. He is in charge of the accumulation of subsidies as well as the promotion of the team to the public.



**Stavros Tzikas**  
R&D

Short bio :

Stavros is a senior student interested in the field of Electronics. He is responsible for the design and manufacture of the electronic system in our project.

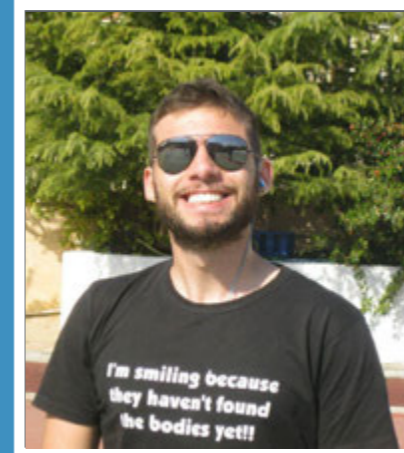


**Aris Angelopoulos**  
Product Development

Short bio :

Aris is a student in the International GCSE programme. He likes to keep the team organised and to push everyone to complete their tasks within the deadlines.

## Mentors



**Timos Trifonidis**

Short bio :

Polytimos is a student at the Metropolitan College, that collaborates with the University of East London. He is engaged in Electronic Engineering. He is responsible for coordinating the group's effort and implementing programming and mechanical techniques.



**Iasonas Taoukis**

Short bio :

Iasonas is a student at the University of Piraeus, and one of the founding members of the Minders group. He is mostly engaged in Computer Science and Robotics Teaching.

## Coach



**Dimitris Moraitis**

Short bio :

Mr. Moraitis is a Computer Science teacher. He has been the team's Director since 2010, and he counts all of the team's successes in his biography.

# THE PROJECT

The reduced industrial development in the field of renewable sources of energy not only makes research hard, but it also financially burdens many countries and organizations. The Greenwave Project provides a solution to this important issue by introducing new technologies and focusing on sources that are environmentally friendly.

## The Basic Idea

Taking into account all the above, we decided to create a model robot that will meet certain criteria:



The results speak for themselves

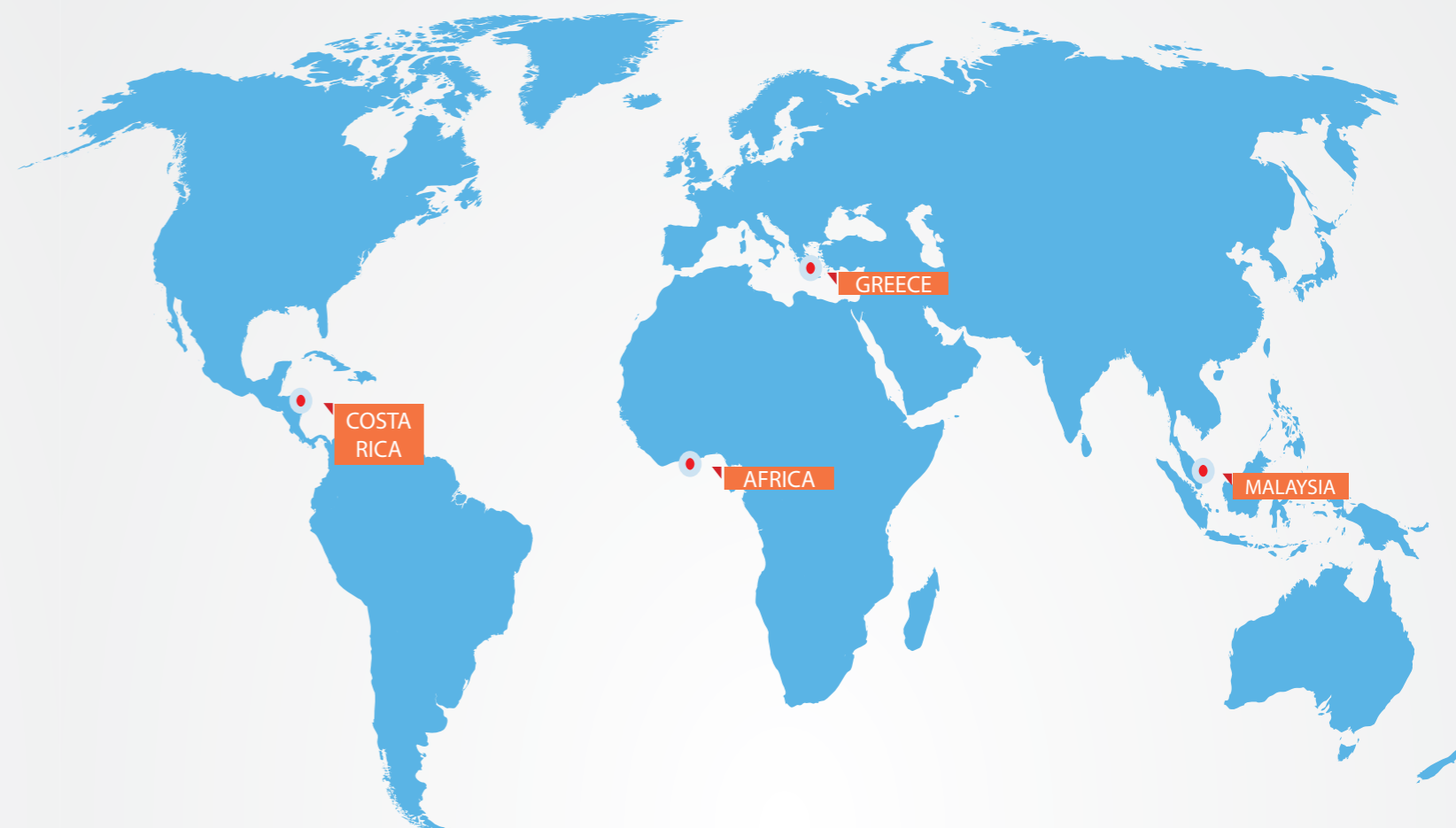
Greenwave is an advanced Robotics system that aims to make full use of solar and kinetic energy from waves and convert it into electrical energy. Moreover, the system aims to wirelessly transfer the stored energy to dry land.

What makes the difference in Greenwave is its practical use and multi-functional design. The manufacturing cost is relatively low, and the practicality of the system is showcased through Greenwave's structure and functions.

Most importantly, the project could benefit third world countries in Africa, where only 30% of the houses have the privilege of electricity. Based on the evidence above, we can conclude that Greenwave is a useful device that can assist the aforementioned underprivileged colonies.



# GREENWAVE'S CONTRIBUTION



After careful study, we came to the conclusion that Greenwave can harmonize perfectly with most of the seaside areas of the world where electricity is needed.

Our Greenwave offers sustainable development in various regions of the world :

Costa Rica

---

Africa Cape Coast Hub

---

Greece, Greek Islands

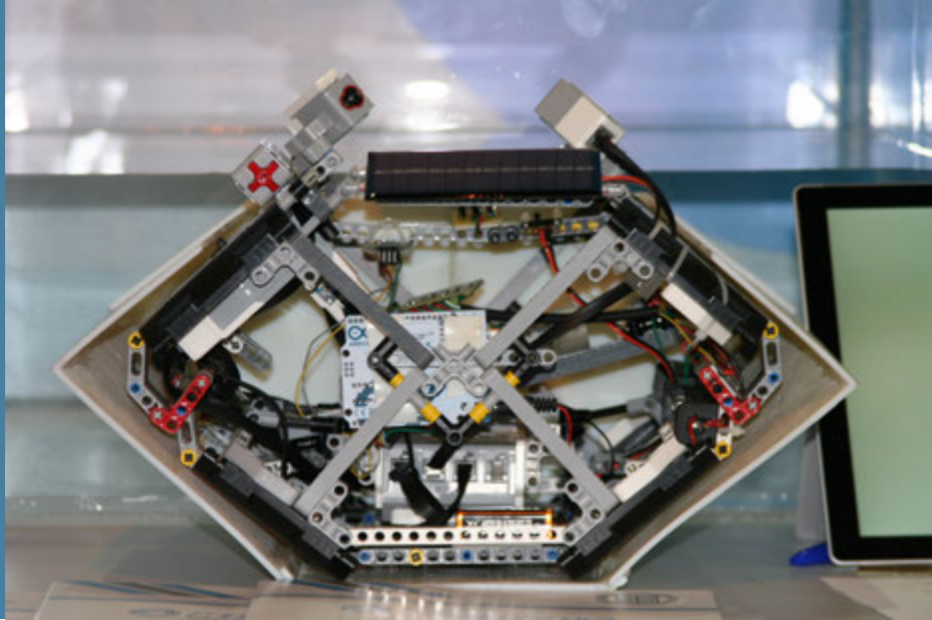
---

Malaysia

---

# THE ROBOT

Version 1



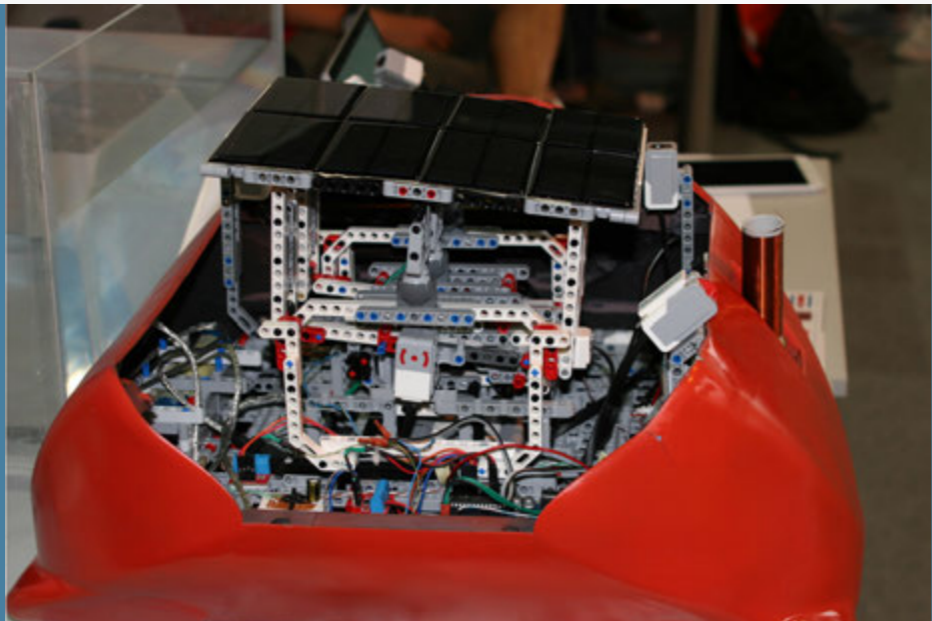
## Innovations & Progress

The design of our robotic system is made in the most elaborate and innovative way. The use of Lego parts in the past rendered our construction unstable. Therefore, we decided to design our own outer shell on which we attached the Lego construction. For the transition from computer design to real parts, we made use of 3D printing. The print involves resin set on the base of the printer which gradually builds each piece of the outer shell.

The aforementioned techniques enabled us to further evolve our robotic system. The initial design consisted of a strong lego construction but which restrained the movement of the robot in the water. Through a lot of research and testing, enhancement of our designs was achieved successfully, rendering it more compact and stable and flexible.

Specs :

Version 2



## Financial Part

We searched for companies, which could invest in our idea. Moreover we created the business plan of our product and sent it to companies with the aim of building professional relationships. In this way we accomplished to cooperate with a non profit organisation in Africa which showed a great interest for our project. One really important feature of the buoy which differentiates it from our competitors is its size and the great amount of produced energy, which corresponds to what Stavros previously said. The original idea was to sell the energy produced. This will help us to widen our target group we have aimed at and the growth of our company. The cost of the buoy will be range from 250 to 350 euros, depending on customer's preferences.



## Working Procedure

A detailed presentation of the function scenario.

Our Greenwave project is a buoy that converts and stores energy inside batteries. That happens with the following ways:

1. Converting wave movement ( kinetic motion ) into electric energy.
2. Using moving solar panels for maximum energy production.

All this production of energy has to be calculated so it sends the values via a bluetooth to an application.

But that is not all it does. As a buoy, it warns about wave movements and it informs about its place to avoid collisions.

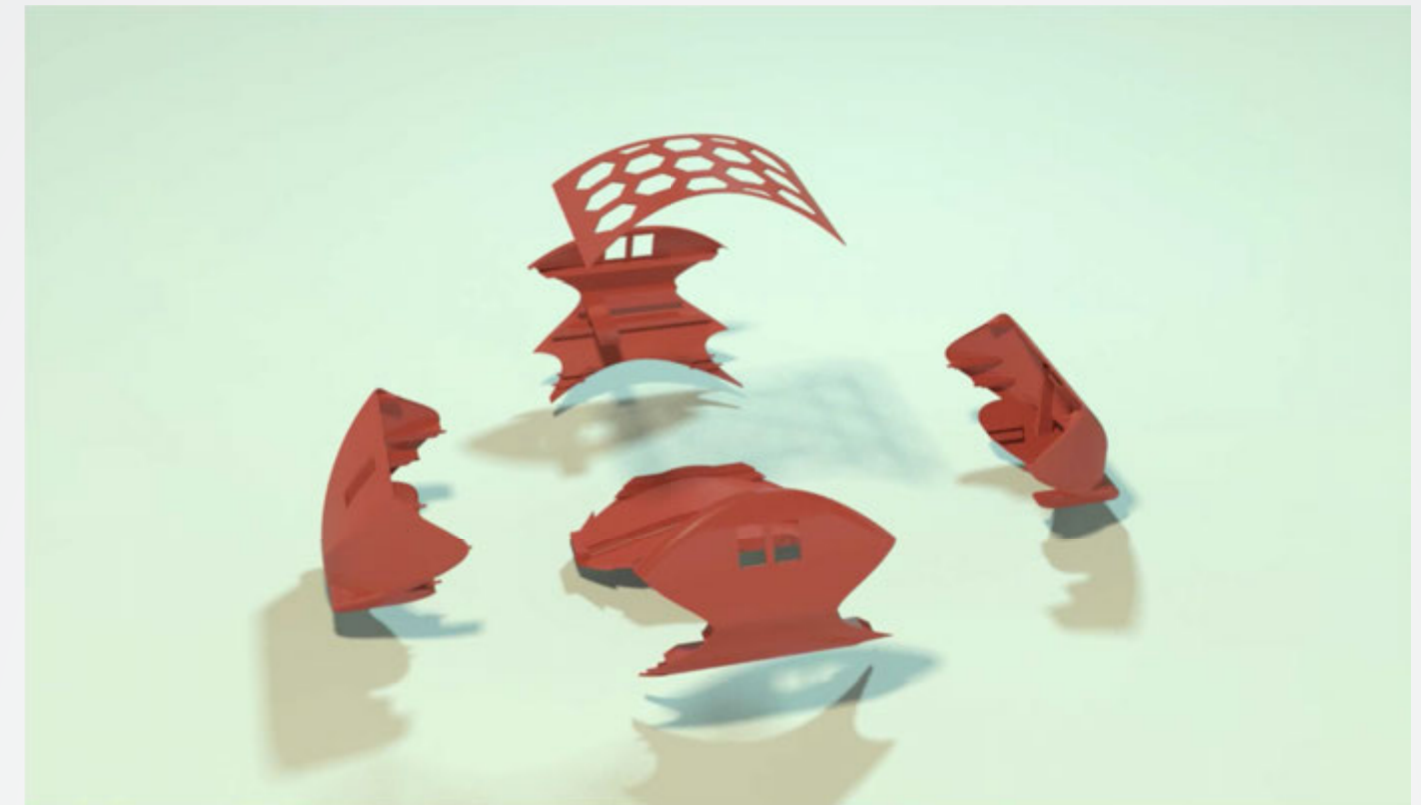
1. An accelerometer to calculate the wave speed
2. An individual warning night light
3. A ring bell



## Hardware Analysis

The system is encapsulated by a 3D shell and has skeleton parts inside it to make it :

- one Arduino Nano
  - two solar panels
  - two coils
  - two generators
  - one Wi-Fi
  - one Slayer Exciter circuit (Tesla coil)
  - voltage regulator (for Tesla coil)
  - one accelerometer
  - photoresistor (LDR) circuit for opening warning LEDs
  - An Ev3
  - Two Ev3 color sensors
  - One Ev3 touch sensor
  - One Ev3 gyro sensor
  - One Ev3 medium motor
- An Arduino Nano to control all the main functions of the sensors in the buoy and for data transmission.
  - A Wi-Fi module for sending data from the Arduino to the user.
  - Two solar panels to exploit the sunlight.
  - Two hollow coils with a strong magnet inside to exploit the kinetic energy and convert it to electric energy.
  - Two generators, with the correct sequence of gears for maximum efficient, to exploit the kinetic energy and convert it to electric energy.
  - A voltage regulator circuit to power the Tesla coil and to protect the system from current return.
  - An accelerometer to calculate the steep acceleration on x, y, z axis to send warning.
  - An photoresistor (LDR) to open the warning LEDs when there is minimum light, to warn the ships about its presence.
  - An Ev3 touch sensor to initialize the calibration.
  - An Ev3 gyroscope sensor to calculate the angle of the panels.
- An Ev3 microcontroller to calculate, with the help of color sensors (in ambient light mode), the best place for the maximum efficiency for the solar panels.
- An Ev3 medium motor to move the panels.



## GREENWAVE IN OPEN SEA!





## Software Analysis ( EV3 & Arduino )

Greenwave's softwares are made in the following platforms :

1. Arduino's IDE

2. Lego Mindstorms EV3

EV3 controls the panels and Arduino sends the produced values to an application

-Automated programs ( EV3+Arduino )

-Less energy consumption ( Arduino )

-Sensors transmitting signal to application ( Arduino )

-Warning indication sent to application ( Arduino )

- Maximum energy production with light detection ( EV3 )

The solar panels rotate, depending on the position of the sun for maximum productivity. For less power consumption the panels rotate to their initial position when there is no sunlight.

To be able to exploit kinetic energy, we have placed two coils and two generators in the buoy.

The two generators are placed with sequences of gears, so we can get the maximum efficiency.

The generators are connected to a system of gears that transforms the motion of a hanged mass to them in order to increase their efficiency. The two coils have a strong neodymium magnet inside them.

This magnet is moving back and forward inside the coils so an electric potential is induced on it. Both of them produce alternating current, which passes through diode bridges and becomes direct current. As a result, it can be stored.W

In order to store the produced electrical energy we use four batteries (LiFePO4) at 3.2V, which have a capacity of 3Ah. That kind of batteries have a great capacitance, small mass, small internal resistance and can withstand about 2000 charge-discharge cycles. All these characteristics make this kind of battery ideal for the buoy since they can supply a big electrical current at the peaks of current consumption. This way the electric energy can be consumed later on from any user that is able to be electrically connected with the buoy.

Furthermore, in the part of the sensors, we have installed an accelerometer. This measures the change of the gradient of the buoy. Thus, in case where there are very big waves these changes become greater. So when they go beyond a limit a warning is sent to the user.

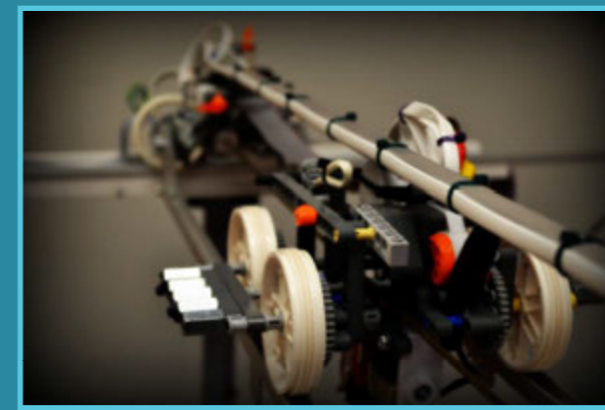
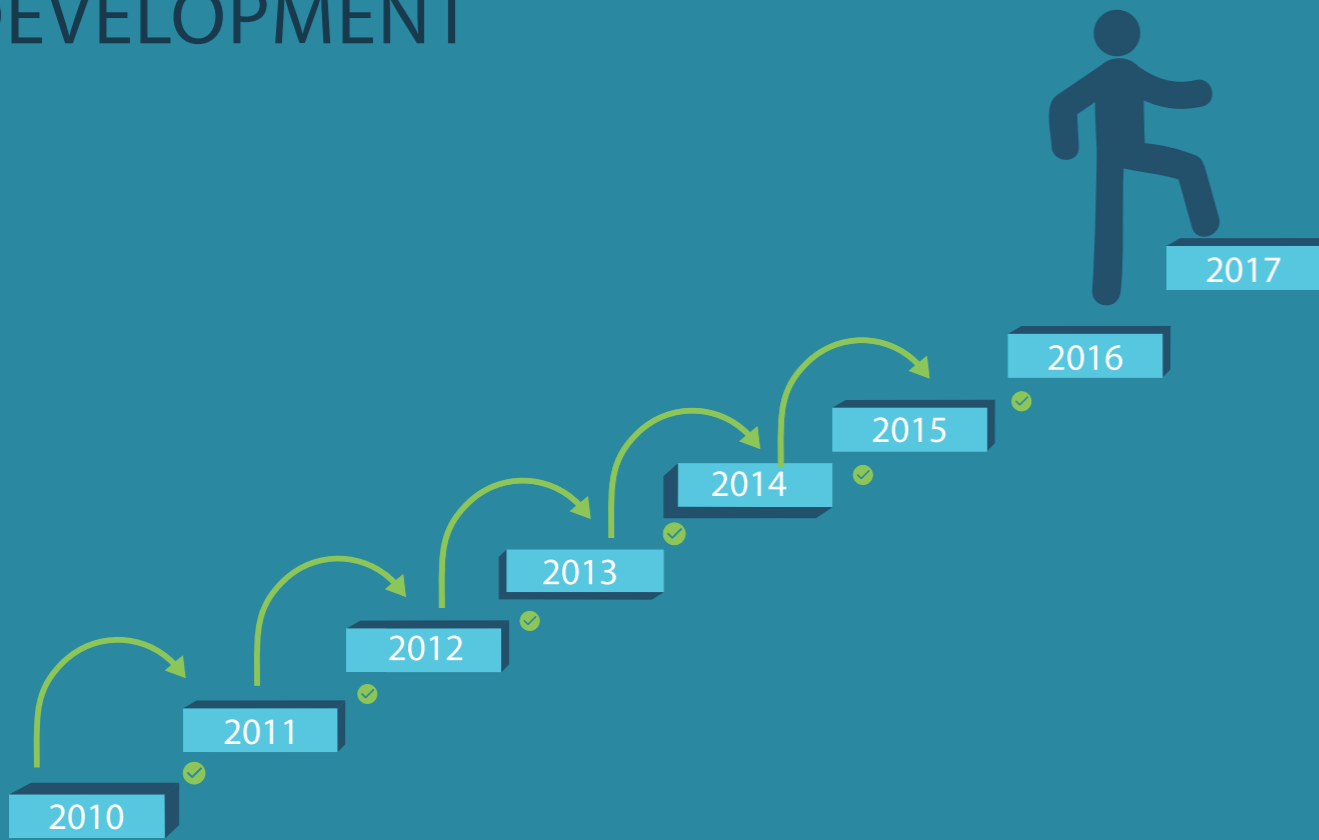
All the sensors are connected to Arduino Nano board. This board is programmed to control the function of all the sensors. It also acquires all the data from them and sends these data through a serial port to a Wi-Fi board. This board functions as an information sender. So if somebody knows the IP address of the module he is able to have access to the data of the buoy. However, in order to create a more user friendly environment we've created a smartphone app, which connects automatically with the buoy. It is responsible for presenting the data to the user, informing him about high waves. Also it allows him the remote control of the circuit, which transforms the electric energy to electromagnetic. This app was created using the MIT App Inventor 2 platform.

In its current form, the project is able to produce 10 Watt of power from waves and 10 Watt from the sun. So the daily production of energy is about 200 to 300 Watt-hours of energy. In the worst case, the buoy is able to supply six 3-Watt LED lamps for about 12 hours. Its batteries will need about 2-3 hours to be fully charged.

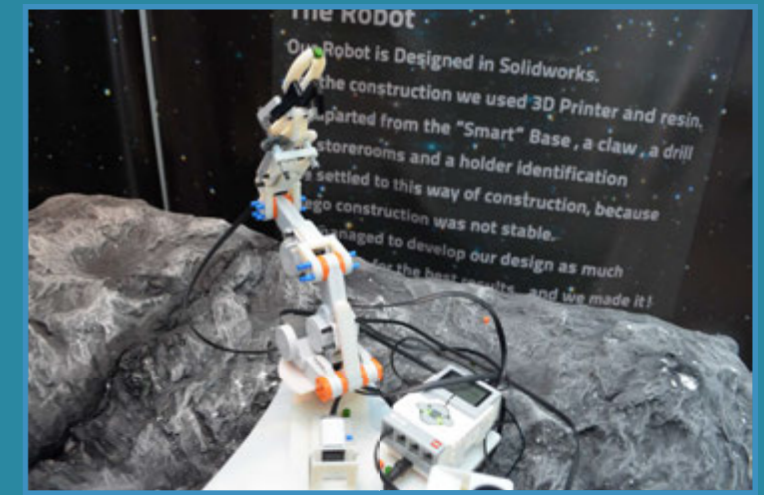
In the future the buoy, which will be built at a bigger scale, will be able to produce at least a mean power of 100 Watt from the waves during all day and 240 Watt of solar energy. This is possible since more efficient solar panels will be used along with bigger generators. With this power production, the charging process of a batteries series with capacity of 1.5 kWh will last about 5 hours. In total, the daily production of energy will reach 4 kWh. This amount of energy is not able to power a modern house. Yet is able to provide the electric energy needed for a 100-Watt fridge and at least twenty 3-Watt LED lamps for a day. In the end more sensors could be added as temperature and pressure sensors, which will give a second experimental use to the buoy.



# DEVELOPMENT



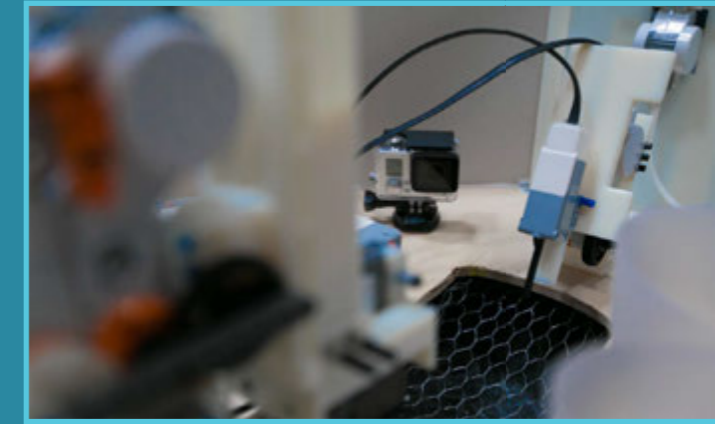
2012 - WRO Jakarta Indonesia



2014 - WRO Sochi Russia

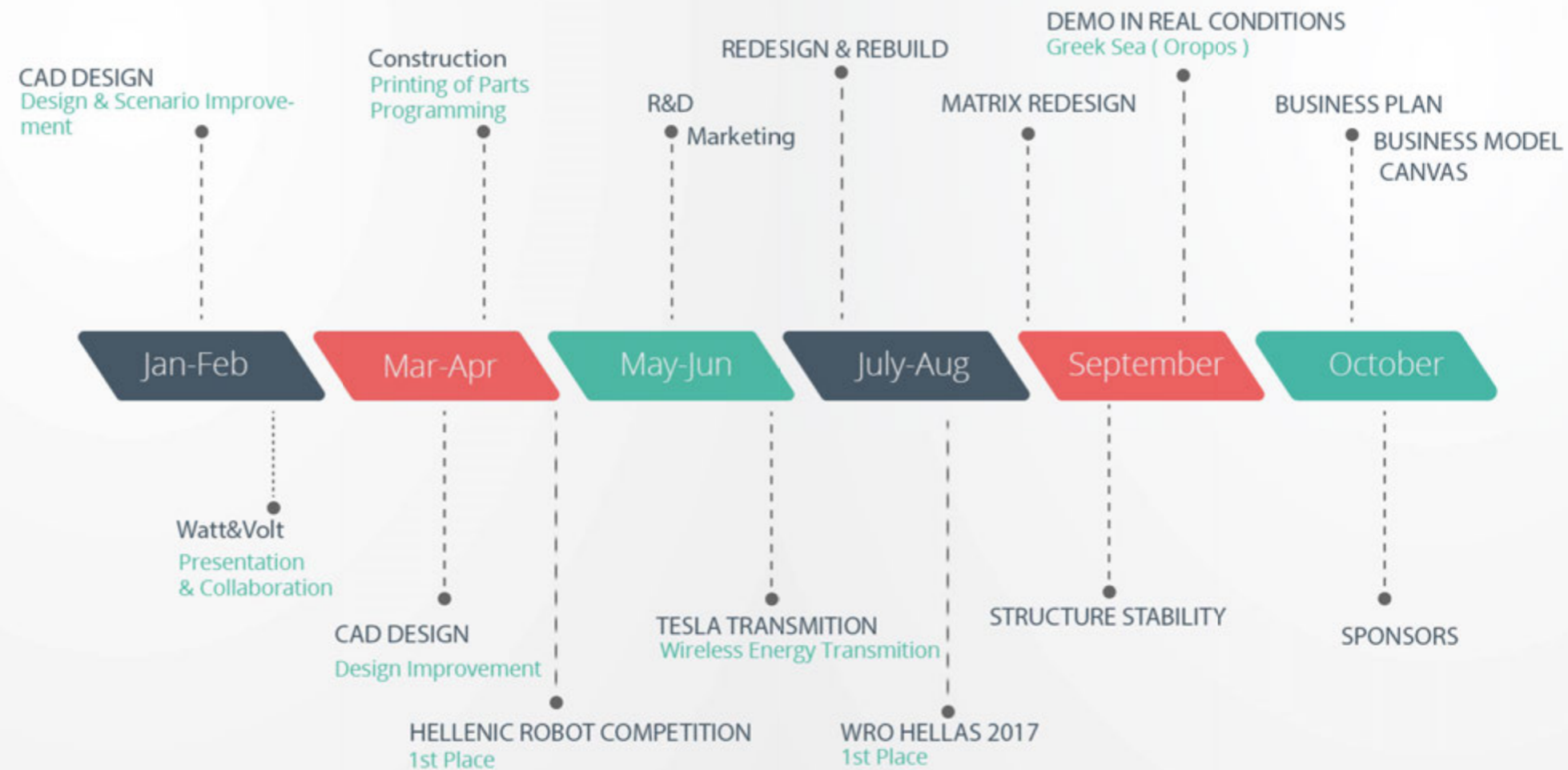


2010 - WRO Hellas



2014 - WRO Hellas

# TIMELINE



# MIND THE MINDERS! (THIS YEAR)

Our passion for robotics fills our desire for another visual issue

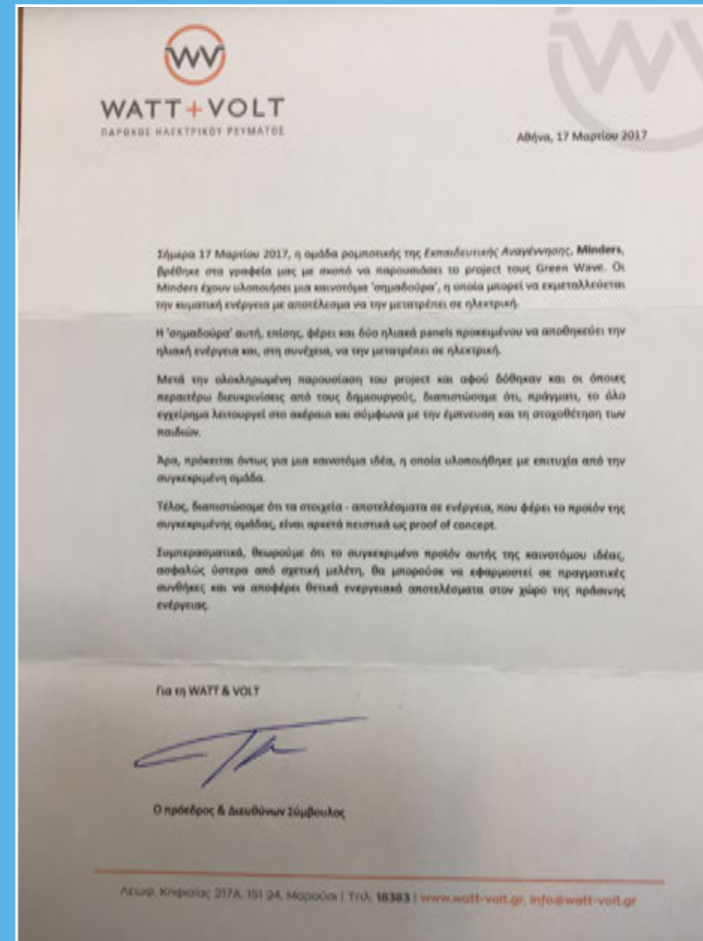
## WATT & VOLT

In light of our success in the Panhellenic 2017 Teaching Robotics Competition, our team was invited to present our idea to a major energy company, Watt & Volt. The aim of this presentation is to bring us in touch with and help the coastal villages of Africa and Cape Coast Hub with the buoy.

Our collaboration with W&V, gave us the chance to present our robotic system before an audience of experts at robotics and autonomous systems. It was definitely a memorable experience, through which we gained knowledge, which helped us achieve our goal in the 2017 WRO Hellas Competition.

## ATHENS MINI MAKER FAIR

We were given another chance to present the first version of our project and it was exhibited in the Athens Mini Maker Faire.



Watt & Volt | Proof of Concept

Minders 5th Gen @ KATHIMERINI



# MIND THE MINDERS!(IN THE PAST)

## Teaching Robotics & Teaching With Robotics 2014

In light of our success in the 2014 Teaching Robotics Panhellenic Competition, our team was invited to participate in the International Conference on Intelligent Autonomous Systems and in the "Robotics in Education 2014" exhibition, which took place in Padova University in Italy, in July 2014.

Our participation gave us the chance to present our robotic system before an audience of experts at robotics and autonomous systems. It was definitely a memorable experience, through which we gained knowledge, which helped us achieve our goal in the 2014 Robotics Olympics.

## TEDx Academy 2014

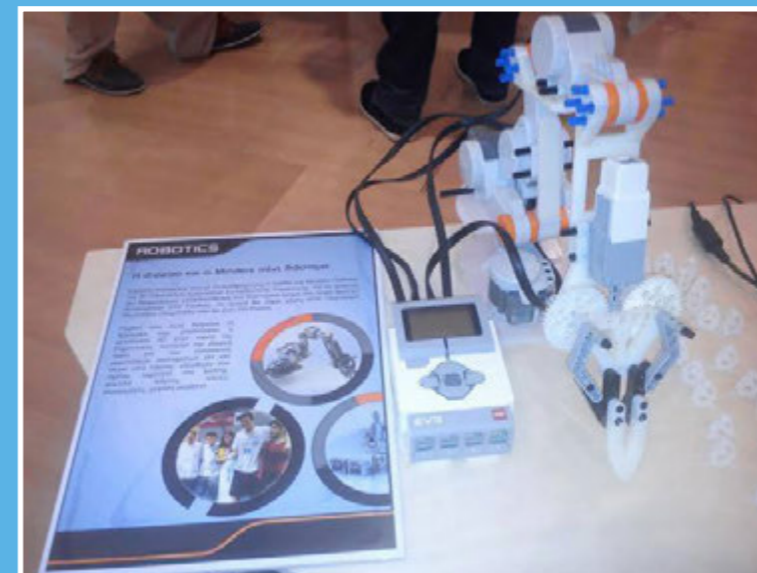
We were given another chance to present our project by Drawlab, the company where we print out the 3D printed parts of our construction. Consequently, one of the parts of our construction was exhibited at the TEDx Academy 2014 stall, in the Opera House of Athens.



Minders at Centro Congressi - Padova "A. Luciani"



Minders after Teaching Robotics & Teaching With Robotics 2014



Part of Minders' Project at TEDx Academy 2014

# MARKETING

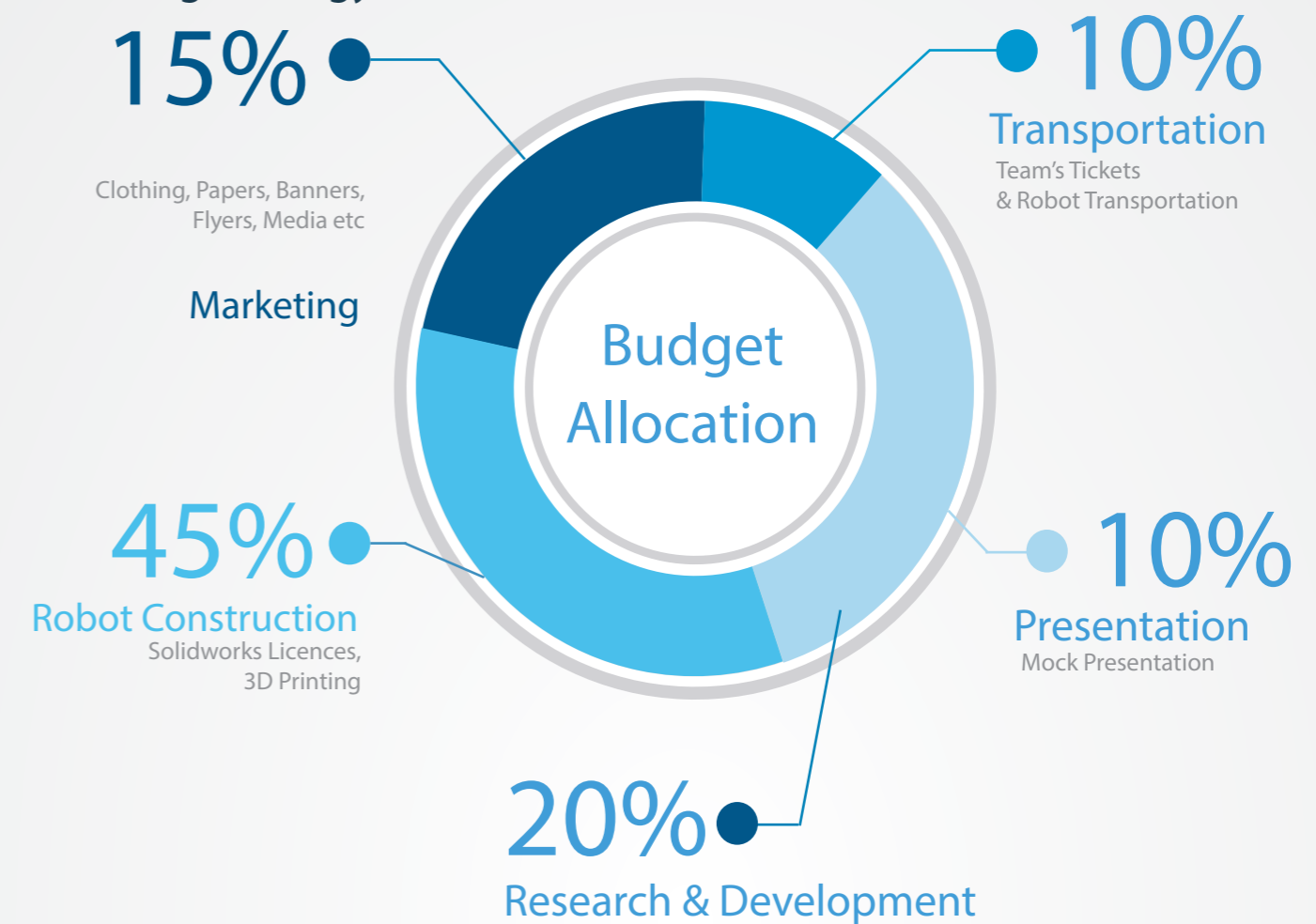
Marketing is essential to the team's orderly function, since it ensures all the necessary funds, not only for our projects and travels, but also for the promotion of our team.

The sponsors on the next page funded our project and helped us realize our travel to Costa Rica.

## The Team Brand Clothing for the Competition

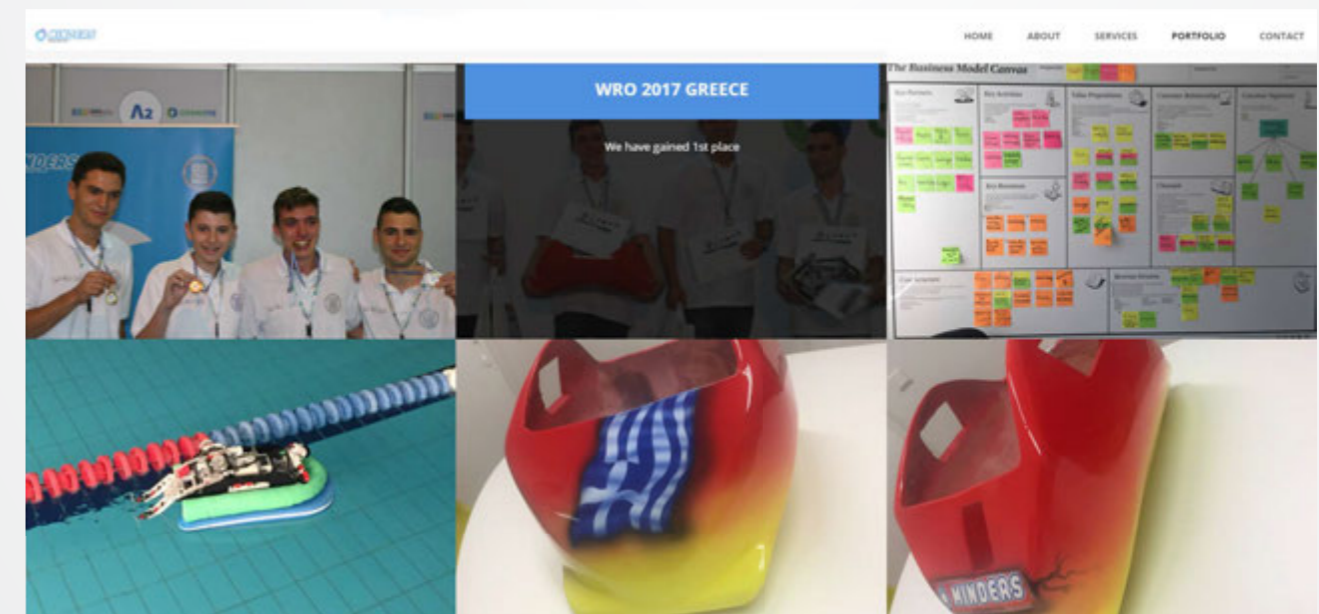


## Marketing Strategy



In order to ensure the aforementioned funding, we approached some companies, with the well-known "Return on Investment" system, which depends on reciprocation, meaning that the company's offers in terms of money, services, e.t.c., are returned in the form of the promotion.

## New Website



# OUR SPONSORS



**WATT+VOLT**  
ΠΑΡΟΧΟΣ ΗΛΕΚΤΡΙΚΟΥ ΡΕΥΜΑΤΟΣ

**drawlab**  
CREATIVE DESIGN AND PROTOTYPING SERVICES

**GARAGE**  
DEVELOPING SKILLS FOR THE FUTURE



**vertitech**  
Vertical IT Solutions & Consulting



**Clever point**



## Team Perspective

In the process of choosing the right sponsor, we aim to find stakeholders that share a common vision and reflect the value that we place importance on. The underlying principle of our team is effective cooperation to bring about scientific breakthroughs, which are applicable and useful.

We constantly try to invest in relations based on trust and interaction with our sponsors with the aim that all parties benefit from it.

Bearing the above in mind, our cooperation with all stakeholders is based on mutual respect and the desire for ongoing evolution is the inherent key to success.





## OUR PASSION IS OUR PATH TO SUCCESS

Throughout the years, the magical world of robotics has been an indispensable part of our everyday life, as well as a long journey with lots of experiences, the climax of which is the International Robotics Olympiad.

Our aim is the best possible representation of our country and the best possible rank.

We would like to thank all those who have supported our project and all those who dedicated their time to observing it.

The generations to come have even greater expectations and ambitions to walk in our path to success.

Minders 2017 - One Team - One Passion



COSTA RICA **2017**

EMAIL:

[info@minders.gr](mailto:info@minders.gr)

PHONE: 22950-29840

[www.facebook.com/MindersGR](http://www.facebook.com/MindersGR)

[www.minders.gr](http://www.minders.gr)