Smart Buoys for Marine Environment Monitoring: The Case of MARIABOX Project

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Lloyd's List Awards Global | 2014 Winner Innovation Award

CYPRUS innovation award

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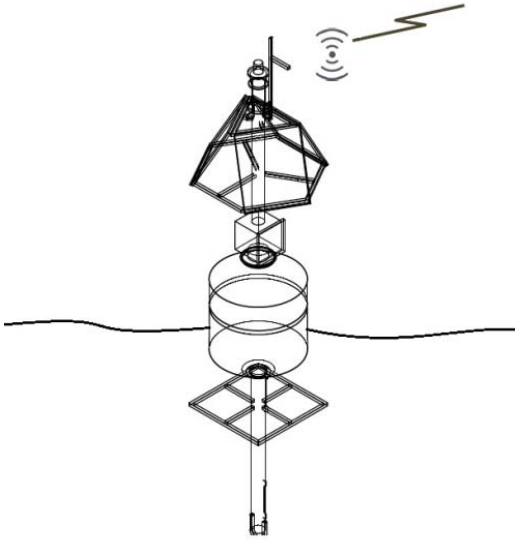
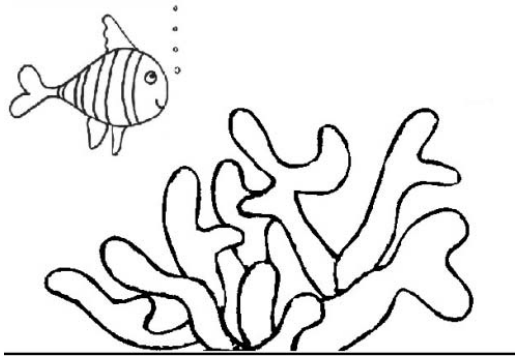
Marine environmental monitoring





- Vital problem
  - Research and development attention
- Monitoring using research vessel
  - Expensive, time-consuming, low resolution both in time & space
- Sensors
  - Promising alternatives for monitoring
  - Unmanned operation, easy deployment, real-time monitoring, low cost, etc.
  - Physical & chemical parameters
    - water temperature, pressure, wind direction, wind speed, salinity, turbidity, pH, oxygen density, chlorophyll levels, etc.
  - Application areas
    - Water quality monitoring, ocean sensing and monitoring, coral reef monitoring, marine fish farm monitoring, etc.

Why Smart Buoys?

- Flexibility
  - Buoy sensors are fully customizable
  - Monitoring platforms can be adapted and modified as monitoring priorities change
  - Buoys can house from one to hundreds of sensors, meeting the needs and applications
- Data Streaming
  - Sampling can occur as frequently as every minute
  - Providing data 24 hours a day, 7 days a week
- Independency
  - Wind /solar power or battery power options

Smart Buoys

Necessity:

- Wireless marine environment monitoring
- Long-term data collection at scales and resolutions that are difficult, if not impossible, to obtain otherwise

Merging technologies:

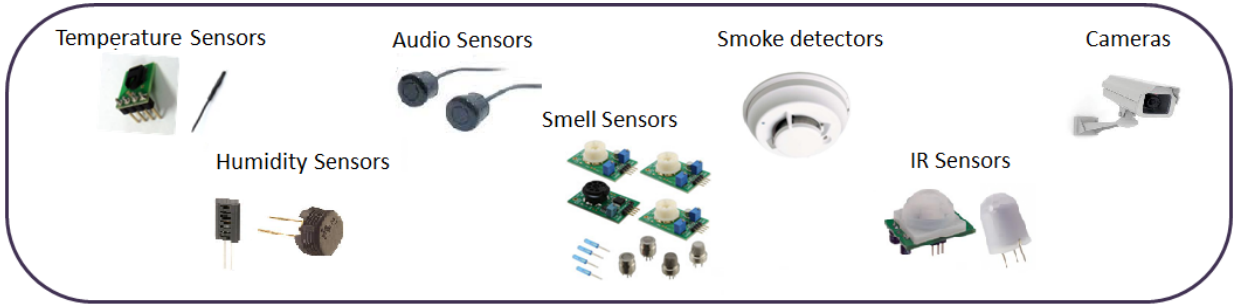
- Sensing
- Cellular communications
- Internet-based information sharing

Structure / basic components:

- Sensing and analysis system
- Modular communication system
- Power system
- Software platform
- Cell phone application

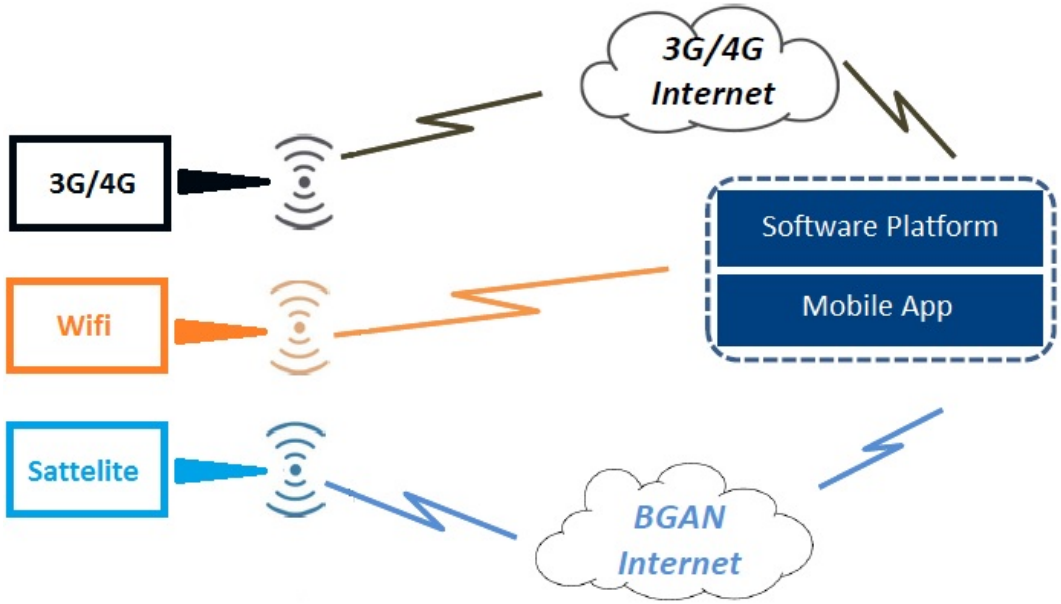
Sensing and analysis system

- General
  - Audio sensors
  - Smell sensors
  - Infra-Red (IR) sensors
  - Cameras
  - ...
- Water Quality
  - Dissolved oxygen
  - pH
  - Conductivity
  - Salinity
  - Turbidity
  - Temperature
  - Depth
  - ...
- Air Quality
  - Wind speed, direction, etc.
  - Humidity
  - Barometric pressure
  - Precipitation
  - ...



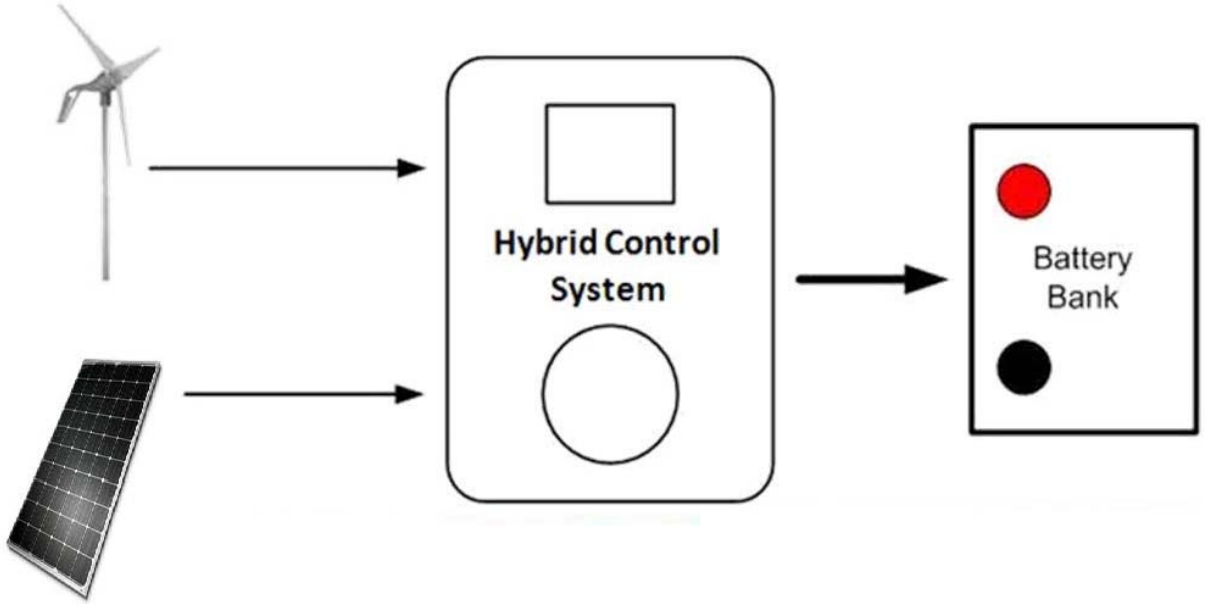
Communication system

- Short Distance
  - Wifi/Bluetooth
- Middle Distance
  - 3G/4G
- Long Distance
  - Satellite



Power system

- Get the energy from the environment by a harvesting system
  - Solar
  - Wind
- Batteries



Software platform / Mobile Application

- Marine environmental monitoring
  - Data view monitoring /Real-time data display
  - Data Analysis
  - Notifications/Alerts

- Buoy Management
  - Health and condition of each sensor
  - Configuration parameters
  - Power administration
  - ...

The MARIABOX case

- SignalGeneriX has developed 2 smart buoys which will be used for marine environment monitoring in the framework of FP7 EU funded Research Project MARIABOX
- The buoys will be used for the pilot demos of the MARIABOX system in Cyprus and Spain

MariaBOX Project(1)

- MariaBOX: Marine environmental in situ Assessment and monitoring tool BOX
  - Call: FP7-OCEAN-2013
  - Topic: OCEAN 2013.1 - Biosensors for real time monitoring of biohazard in the marine environment
  - Duration: 48 months (2014-2018)
  - Consortium: 13 beneficiaries from 6 countries
  - Total budget: 7.1M €

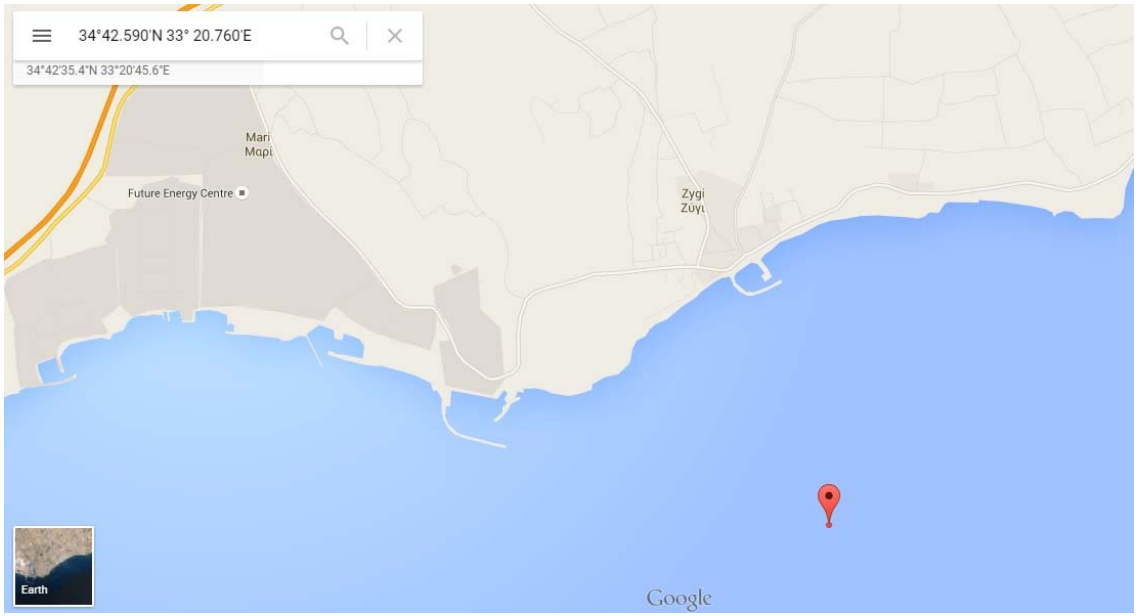
MariaBOX Project(2)

- Development of a wireless marine environment analysis device for monitoring chemical and biological pollutants

- Objectives
  - The device will be of high-sensitivity, portable and capable of repeating measurements over a long time, allowing permanent deployment at sea
  - Biosensors will be developed for man-made chemicals & microalgae toxins relevant to shell fish and fish farming
  - The system will be demonstrated and validated in four different scenarios in selected locations in Cyprus, Norway, Spain, Ireland

Pilot demonstration: Cyprus

- Leader: Department of Fisheries and Marine Research of the Republic of Cyprus (DFMR)
- Location: Between Vassilikos Bay and Zygi fishing shelter
- Depth: ~30m



Pilot demonstration: Spain

- Leader: Institute of Marine Sciences (CSIC)
- Location: A micro-tidal estuary located in the Ebre river Delta, in the North-western Mediterranean Sea (Alfacs Bay)
- Depth: ~6 m

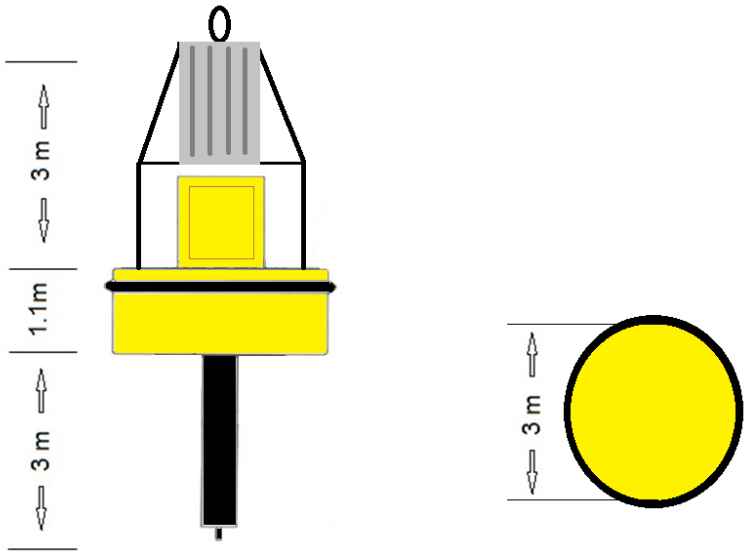
Buoys' Requirements

- Anchorage
  - Cyprus: ~30m
  - Spain: ~6m
- Payload
  - MariaBox System
  - Water Tanks
  - Power Equipment
  - Communication Equipment
- Daily Power Consumption: 3000Wh

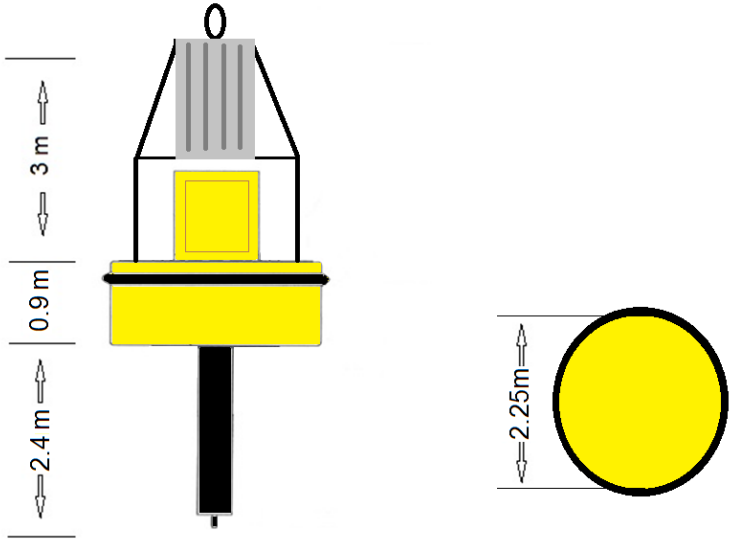
Buoys Dimensions

Pilot Case	Height (m)	Weight (Kg)	Base's Dimensions (m)	
			Diameter	Height
Cyprus	7.1	950	3	1.10
Spain	6.3	750	2.25	0.90

Cyprus



Spain



Total Payload

a/a	Description	Weight (Kg)
1	MariaBox System	142
2	Batteries	408
3	Solar panels	72
4	Water tanks	105
5	Communication Module	1
6	Power Module	10
7	Charger Controller	5
	Total	**743**

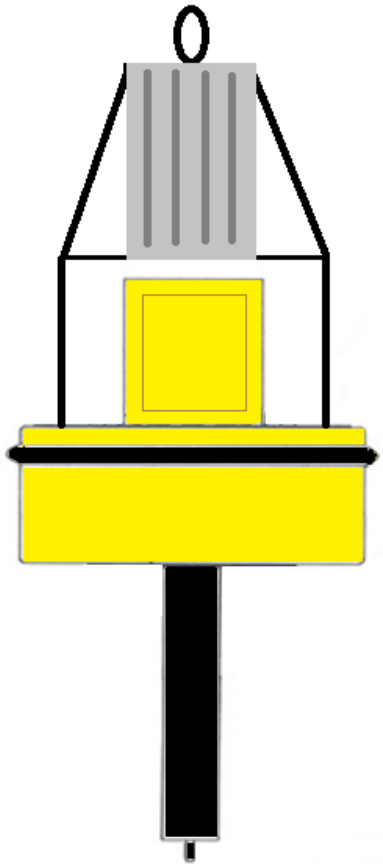
Power Equipment

- Daily Power Consumption: 3000Wh
- Power System Components (Autonomy: 4.5 days)

Item	Quantity	Dimensions HxWxD (cm)	Weight	Remarks
Solar Panels (250W)	4	1665 x 991 x 38 mm	72Kg	
Batteries (2V, 550Ah)	12	502x206x145 mm	408Kg	Total 1100Ah
Solar Charge Controller	1	128x165x315 mm	4.5 Kg	
Voltage Stabilizer	1	64x163x160 mm	1.4Kg	

Buoys Structure

- **Base** (main part)
  - Includes the **waterproof box** for hosting the MARIABOX system, and space for hosting battery compartments, water tanks, power module and communication module
- **Iron tube** (bottom part)
- **Iron construction** (top part)
  - Hosts the solar panels, marine lantern and radar reflector

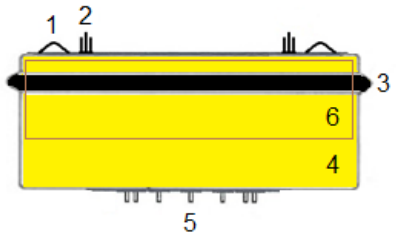


Buoys Base(1)

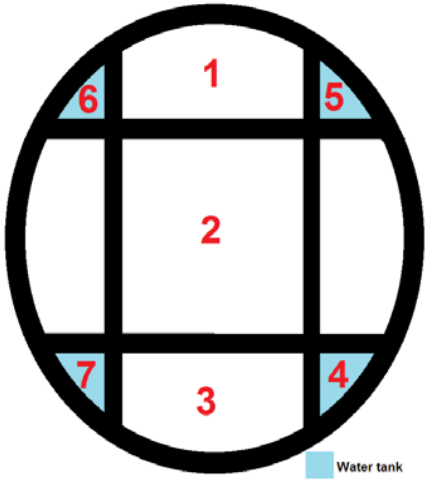
- Made by marine plywood and covered by fiberglass
- The solid part of the buoy is closed, watertight and filled by polyurethane foam
- Steel pipes under the base which are used for the connection of the Iron tube
- Protective Fender Rubber is placed around the buoy
- Carrying handles are placed to allow the safe transportation of the buoy
- 4 connector-handles are placed on the top of the base for the connection of the iron structure

Buoys Base(2)

- The inner space of the base hosts
  - 12 battery pockets which are accessible through the watertight doors of the base
  - 4 water tanks of total weight of 105 Kg which are accessible through the watertight doors of the base
  - The power and communication modules which are accessible through the watertight doors of the base



1. Carrying handles
2. Connectors of the iron construction
3. Rubber fender
4. Solid part of the buoy
5. Connectors of the iron tube
6. Inner space



Waterproof Box

- Made by marine plywood and covered by fiberglass
- 4 doors, one at each side
  - Allows full access to MARIABOX system
- System Ventilation

Pilot Case	Length (m)	Width (m)	Height (m)
Cyprus	1	1.28	1.22
Spain	0.9	0.84	1.22

Buoys Development(1)

Buoys Development(2)

Buoys Development(3)

We will be happy to answer any question and demonstrate our technology to potential collaborators and partners.

For Further Information Contact
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