



HAL
open science

The use of Design Thinking in the innovation of artificial reefs

Justine Michel, Manon Arnaud, Adrien Roudaut, Albane Tenneson, Lucie Mace, April Schaffner, Mame Cheikh Sow, Nicolas Chaton, Nader Wehbe, Paul-Emeric Roger, et al.

► To cite this version:

Justine Michel, Manon Arnaud, Adrien Roudaut, Albane Tenneson, Lucie Mace, et al.. The use of Design Thinking in the innovation of artificial reefs. In the 33rd European Symposium on Computer-Aided Process Engineering (ESCAPE-33), Jun 2023, Athens, Greece. 10.5281/zenodo.8188859 . hal-04351945

HAL Id: hal-04351945

<https://hal.science/hal-04351945>

Submitted on 18 Dec 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

The use of Design Thinking in the innovation of artificial reefs

Justine MICHEL ^a, Manon ARNAUD ^a, Adrien ROUDAUT ^a, Albane TENNESON ^a, Lucie MACE ^a, April SCHNAFFNER ^a, Mame CHEIKH SOW ^a, Nicolas CHATON ^a, Nader WEHBE ^a, Paul-Emeric ROGER ^b, Anne ASENSIO ^b, Arnaud COUTU ^a

^a Institut Polytechnique UniLaSalle, Rue Pierre Waguët, BP 30313, 60026 Beauvais Cedex, France
^b Design Studio, Dassault Systèmes, 10 Rue Marcel Dassault, 78140 Vélizy Villacoublay, France

Context

- The Design Thinking is a way of thinking that permits to raise questions that follow a **precise procedures**,
 - Gathering the skill and values of engineers and designers while using this method permits to develop solution **that are best for people and the environment**.
- In a context of climate change, this project aims to use the Design Thinking methods to **develop solutions** for preserving coastal ecosystems. It consists of **3 mains exercises**.

« Most people mistakenly think that design is about appearance (...) That's not how we define design. (...) **Design is how it works** »
- Steve Jobs in 2003

Step 1

The primordial steps :

It's a process that must be followed to develop successfully a project (Fig.1). It permits to :

- Change the way work is done by asking the **right questions**,
- Determine future problems & needs by following a **precise thought process**,
- Keep in mind during the project's boom how humans and the environment **can be impacted**.

Step 2

The fortress exercise :

- These questions specifies each parameter of the project, they permits to grasp most of the difficulties the team **will encounter in the future** (Fig. 2),
- They follow a pattern that **always involves** actors, priorities, problems and proposed solutions.

Step 3

Miro application:

To complete these exercises, it's recommended answering more **in-depth questions using the "Miro" application**. It allows everyone to express themselves using post-it notes, and thus gather everyone's opinions (Fig.3). These in-depth questions were mainly focused on these subjects

- What is the problem?** Context, understanding of human problems, environmental impact and opportunities
- What solution is proposed?** To do what? At what cost? What is needed to implement it? What will be tested to verify its relevance ?

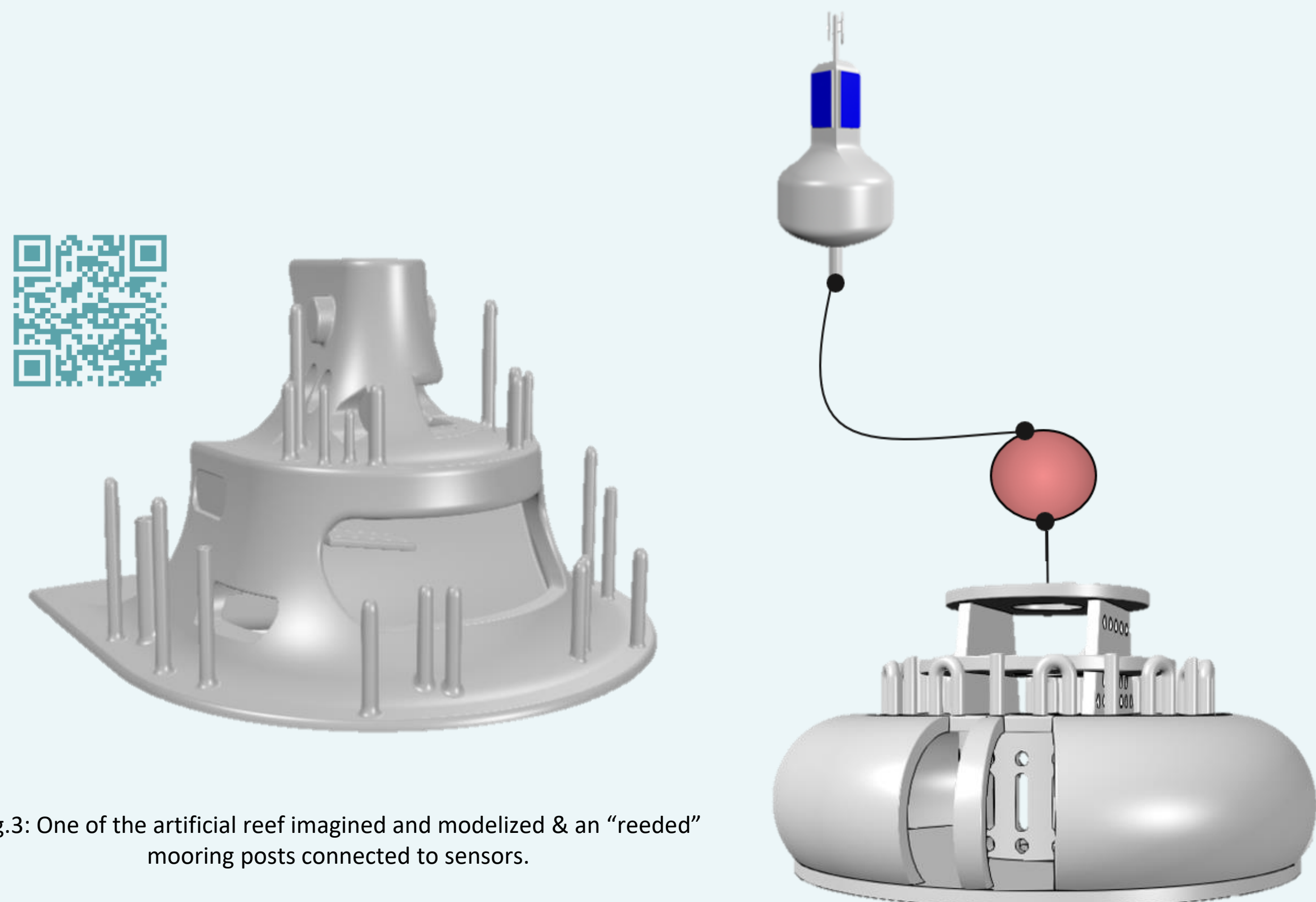


Fig.3: One of the artificial reef imagined and modeled & an "reefed" mooring posts connected to sensors.

Conclusion

- Enables the development of a **structured project** in a **short space of time**,
- Brings together different ways of thinking which permits to **anticipate future problems** as far as possible,
- Permits to develop **optimized processes** for a given problem.

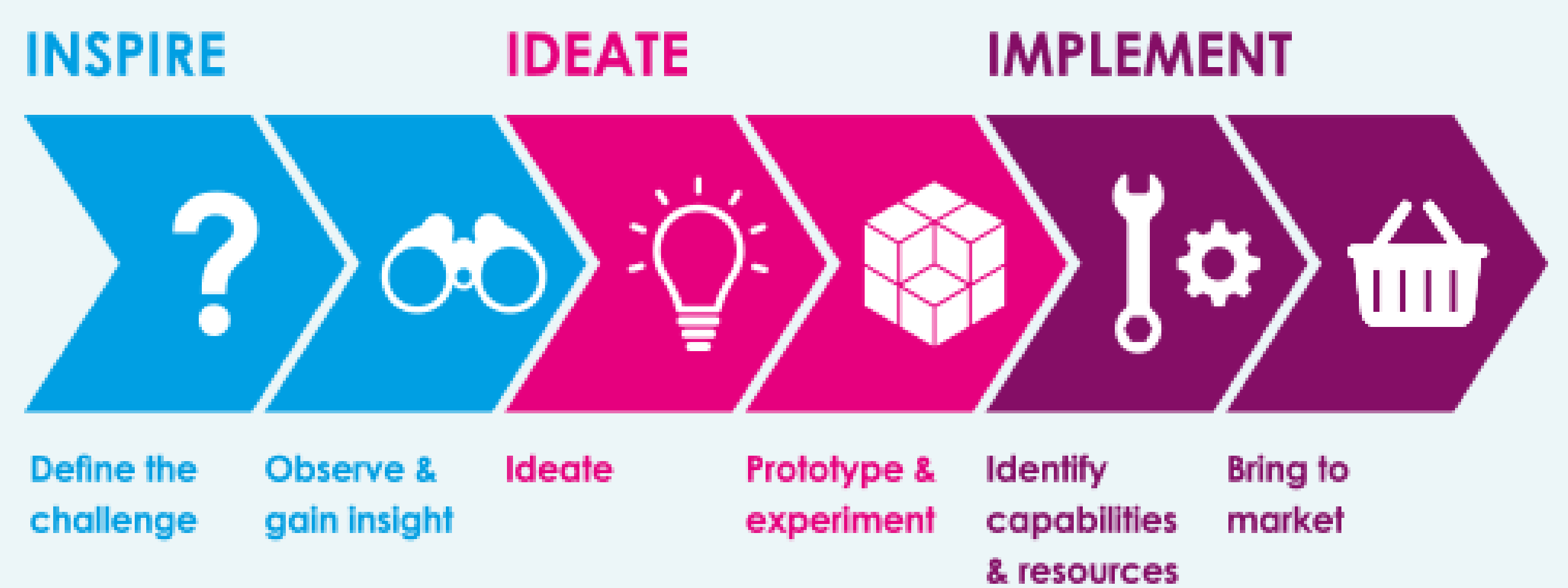


Fig.1: Three steps to simplify the process (Usabills, 2018)



The group work on the determination of the specific part of the opportunity with the helps of the analogy of a fortress:

- The Drawbridge:** The digital innovation possibilities.
- The Walls:** The biggest legacy we'll have to handle.
- The Towers:** Actors who can help to leverage the project.
- The Market:** External data and information needed to trigger the project.
- The Dungeon:** The core mission of the opportunity.
- The Dragon:** What can make us fail? (Competitors, business context...)

Fig.2: Exercise questions of the fortress realized by the Design Studio (Design Studio, 2020)

Results

Through the Design Thinking, 2 scenarios were developed (Fig.4) :

- An **intelligent artificial reef**,
- An **intelligent « reefed » mooring posts**,
- "Intelligent" means connected to **sensors** which permit to follow the development of the environment in which they are located.

Through the Design Thinking, it also permitted to **direct choices** of the structures' **shape** and the types of **sensors** needed for this study (Fig.5)

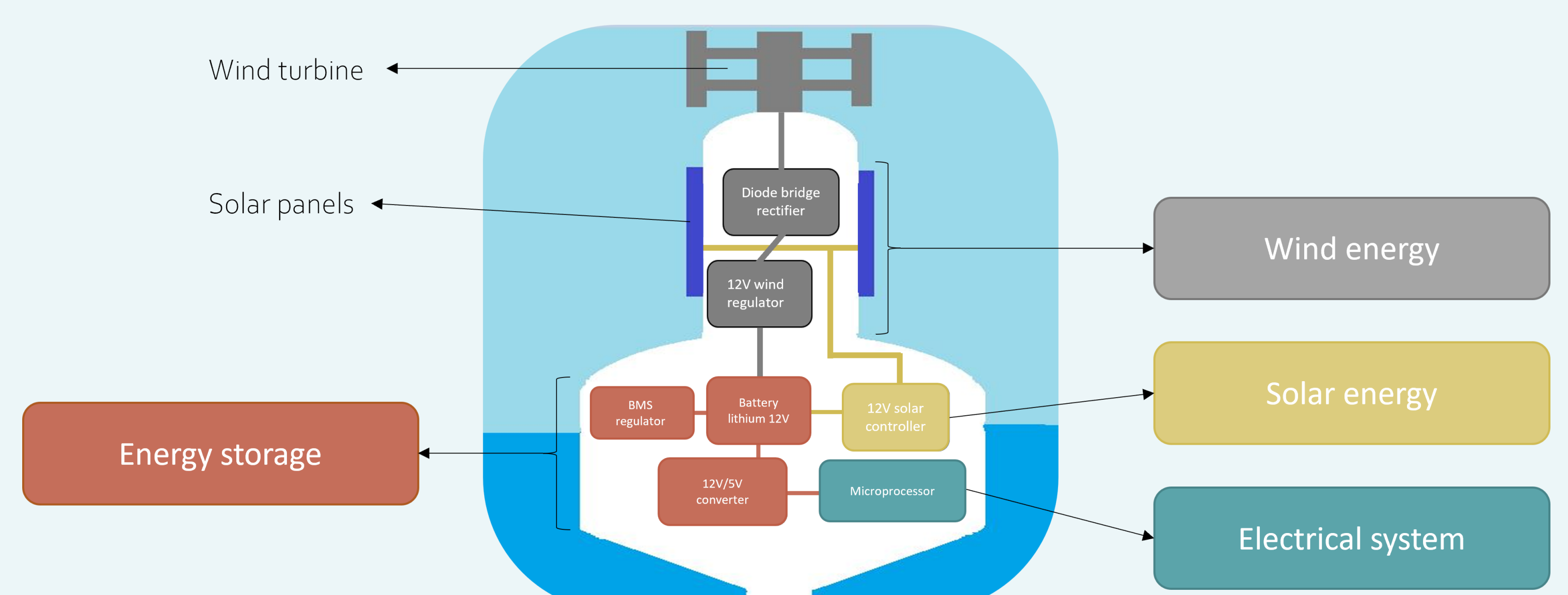


Fig.5: Sensors that are connected to these intelligent structures