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# The use of Design Thinking in the innovation of artificial reefs

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## 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 ?

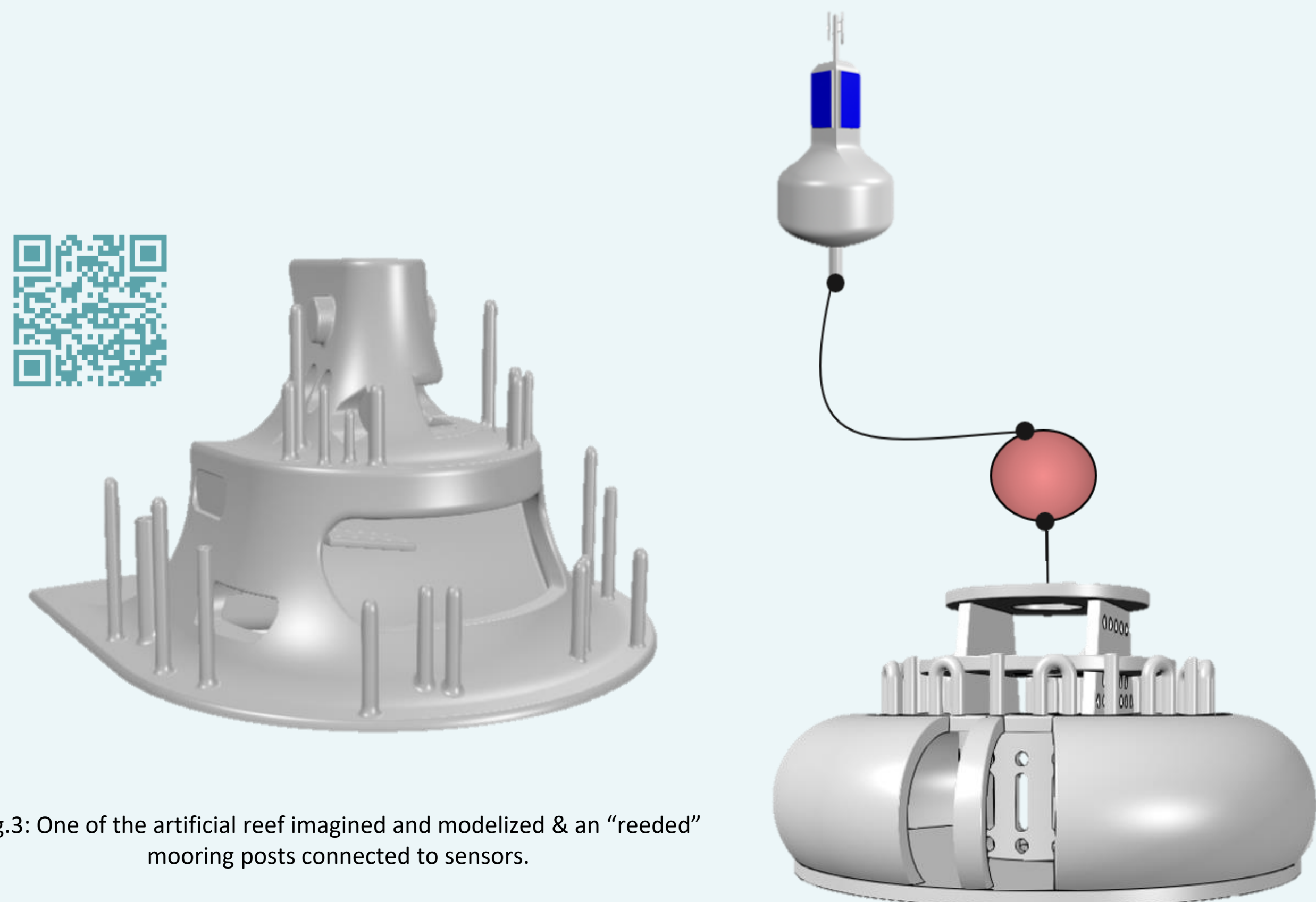


Fig.3: One of the artificial reef imagined and modeled & an "reefed" mooring posts connected to sensors.

## 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.

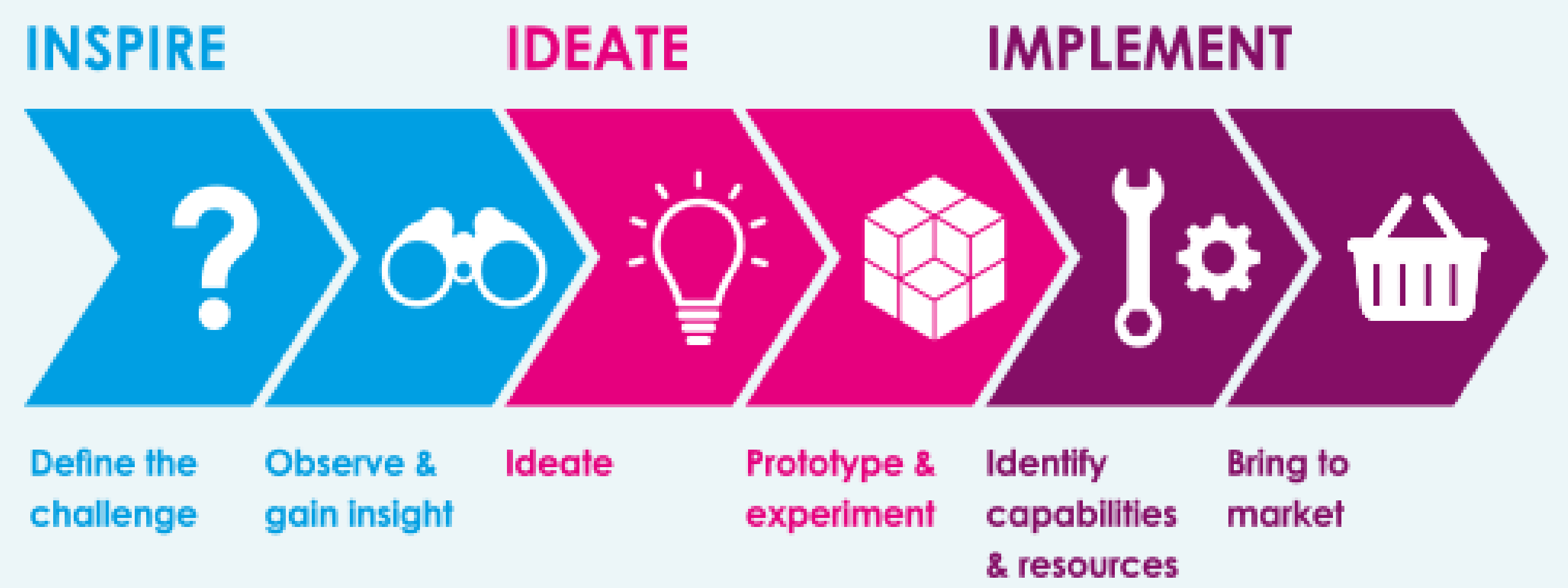


Fig.1: Three steps to simplify the process (Usabills, 2018)



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)

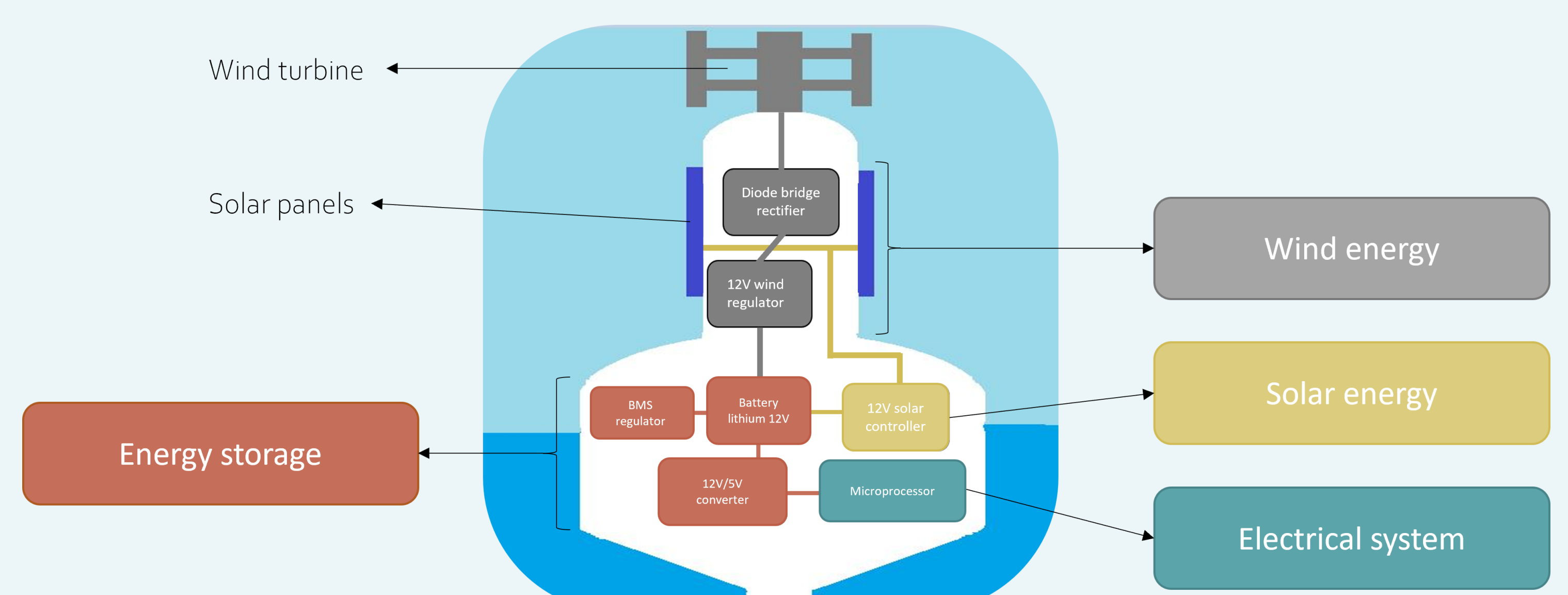


Fig.5: Sensors that are connected to these intelligent structures