

Question answered by this presentation :

1. What is the problem and why do you need IoT?

The problem consists in monitoring the quality of water in which takes place the fish farming. There are many kinds of fish farming depending on the dimensions, localization, and intensivity of the farming. For all of these kind of farming the main important variable to take under control is the quality of water, where quality is a general topic under which they are included:

- A. Percentage of fitoplancton and zooplankton (food)
- B. Percentage of oxygen
- C. nitrogen dioxide, nitrogen catabolites, ammonia, droppings (dejections produced by fishes)
- D. percentage of Ph and Salinity
- E. bioaccumulation of heavy metals, dioxins, polychlorinated biphenyls

2. What are the connected components, the protocols to connect them and the overall IoT architecture?

Main Components

- A) Telos B base station
- B) Telos B sensor node
- C) AS7265x Smart Spectral Sensor
- D) 3.6V NiMH rechargeable battery
- E) Small 5V solar panel

<https://www.thethingsnetwork.org/labs/story/a-cheap-stm32-arduino-node>

Protocols

The protocol which connects the two Telos B is hence Zigbee which is a low-power, low data rate, and close proximity (i.e., personal area) [wireless ad hoc network](#).

The AS7265x is connected as an external sensors to Telos B sensor node through I<sup>2</sup>C . This protocol is widely used for attaching lower-speed peripheral [ICs](#) to processors and [microcontrollers](#) in short-distance, intra-board communication.

Architecture

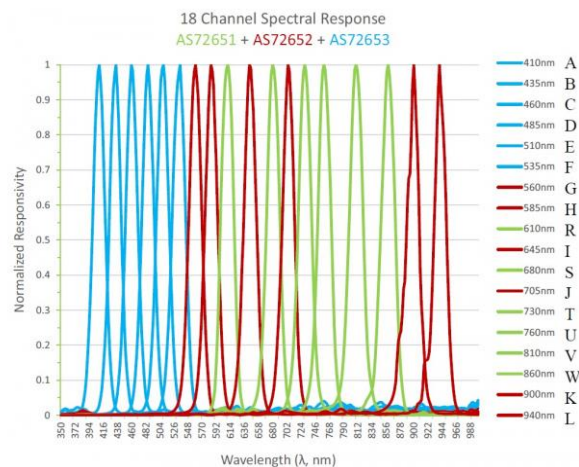
The sensor node is integrated to internet through the base station attached to a PC by USB and served by a MQTT broker infrastructure to the AWS IOT cloud.

3. What data are collected and by which sensors?

Three AS7265x spectral sensors are combined alongside a visible, UV, and IR LEDs to illuminate and test various surfaces for light spectroscopy. The Triad is made up of three sensors; the AS72651, the AS72652, and the AS72653 and can detect the light from 410nm (UV) to 940nm (IR). In addition, 18 individual light frequencies can be measured with precision down to 28.6 nW/cm<sup>2</sup> and accuracy of +/-12%.

4. What kind of collective intelligence do you expect will emerge?

We can take a readings from an unknown thing and using the **Pocket Geiger Counter** to test the material. Each material sample (water) should have a different signature that can be analysed according intelligence available on machine learning of AWS IOT platform.



<https://learn.sparkfun.com/tutorials/spectral-triad-as7265x-hookup-guide/all>

5. What are you going to learn and how will you act into the environment by what actuators?

This monitoring will be useful to understand the level of the main quality variables of water in order to actuate an adjustment of some environment parameters. For example the actuator could activate fitoplancton and zooplankton dispensers, or Ph corrector , or alerts which warn that water or location should be changed.

<https://acquariocomefare.com/fitoplancton-e-zooplancton-in-acquario-marino/>

6. How are you going to measure the effectiveness of your actions into the environment?

The effectiveness of actions into the environment could be easily measured by the same monitoring system historical data stored into the cloud Db.

7. What are the constraints? How often? Bandwidth? Latency? Energy? Duty Cycle?

The Telosb B could send relatively small packets of information, since its wireless bandwidth is small. However, since we do not deal with heavy packets (such as the images), but only series of data readings from the spectrometers, this is not a constrain. Besides the bandwidth the energy could represent a major constraint. Since our Telos B is provided with 2 1.5 V batteries, their duration should be estimated in order to plan a periodical substitution. That is why we have taken into consideration solar cell rechargeable batteries.

8. What is the plan and what are the metrics (quantitative, not qualitative) to evaluate the performance

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