OKEANO

Supporting the
All-Atlantic Ocean Research
and Innovation Alliance

All-Atlantic Intergenerational Hackathon

Challenge 2:

Low-Cost Technologies for Ocean Observations

Testing and Documenting Affordable Sensors for Non-expert Ocean Observation

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1. Context & Problem Statement

Coastal ocean observation remains highly uneven across the Atlantic basin, particularly in under-resourced regions where access to operational monitoring infrastructures is limited. During the All-Atlantic Intergenerational Hackathon, the “Low-Cost Sensors Challenge” addressed a critical gap identified by CoastPredict, LandSeaLot, and the Ocean Best Practices System (OBPS). While low-cost sensors are increasingly available, their operational use by non-expert users remains poorly documented and difficult to scale.

The challenge, therefore, focused not on inventing new technologies but on improving the usability, accessibility, and operational readiness of existing low-cost ocean observation tools. The team was tasked with testing sensors from a non-expert perspective along specific stages of the ocean data value chain, including assembly, deployment, data collection, quality control, visualization, and interpretation.

Field testing conducted during the hackathon highlighted several practical barriers, including unclear setup procedures, calibration difficulties, inconsistent documentation, language limitations, and challenges in interpreting collected data. As emphasized by participants, the issue was less about access to technology than about ensuring that these technologies can be effectively used in real operational conditions by Early Career Ocean Professionals (ECOPs), citizen scientists, educators, and coastal communities.

The Hackathon solution, therefore, aimed to transform existing low-cost sensors into operational, well-documented, and scalable tools that support more inclusive and sustainable coastal observation practices across the All-Atlantic region.

2. Added Value of the Solution

The proposed solution adds value by bridging the gap between technological availability and practical operational use. Existing low-cost sensors offer significant opportunities for expanding coastal monitoring, but their adoption remains limited by usability constraints and insufficient guidance for non-specialist users.

The solution developed during the Hackathon focused on creating modular, user-oriented operational support materials that improve accessibility and deployment readiness. These include:

- Step-by-step operational guidance for sensor deployment and use
- Step-by-step operational guidance for sensor deployment and use;
- Basic data visualization and interpretation workflows;
- Identification of common deployment and calibration issues;
- Recommendations for best practices in coastal and nearshore environments.

By focusing on knowledge sharing for better usability rather than hardware development, the solution supports rapid scalability and transferability across different Atlantic regions. It also directly contributes to capacity-building objectives by enabling ECOPs, citizen scientists, educators, and local communities to participate more actively in ocean observation activities.

The approach aligns with the objectives of LandSeaLot WP4 and the OBPS Task Team on coastal observations for under-resourced countries. In addition, the collaborative and intergenerational nature of the hackathon demonstrated the value of combining scientific expertise, local knowledge, and practical field experience to co-design more inclusive observation practices.

3. Prototype

The prototype developed during the hackathon consisted of an operational support framework designed around existing low-cost ocean sensors provided through the LandSeaLot project. Rather than producing a new sensor, the team developed a practical, usability-oriented prototype composed of several interconnected elements:

Operational Documentation

A modular guidance package was drafted to support non-expert users during:

- sensor assembly and configuration;
- deployment in coastal environments;
- first-level quality control;
- basic data visualization and interpretation.

User-Centered Workflow

The prototype emphasized a simplified operational workflow adapted to users with limited technical expertise. This workflow was tested during field activities conducted near the hackathon venue.

Multilingual and Accessible Approach

Recognizing the diversity of Atlantic coastal communities, the prototype included recommendations for multilingual guidance and context-specific adaptation.

Data Visualization Support

Simple visualization concepts were proposed to help users rapidly interpret collected environmental data and identify anomalies or deployment issues.

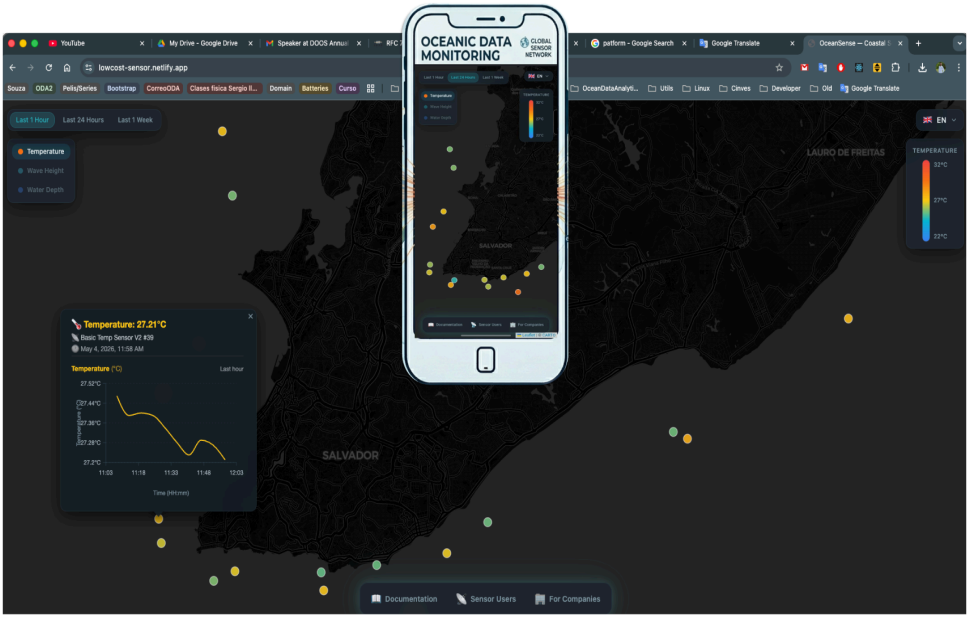

Figure 1. Simple data visualization of the platform interface.

Knowledge-Sharing Dimension

In addition to fostering the exchange of knowledge and expertise within the team, a pilot survey was conducted with local fishers to understand better their perspectives on access to ocean state information and the potential use of low-cost sensors. The survey results can be accessed here.

Furthermore, the team expanded the project's outreach efforts through active social media engagement during the event, sharing the testing process, preliminary findings, and key lessons learned with a broader audience beyond the hackathon community. This helped increase the project's visibility while encouraging broader discussion of accessible ocean monitoring solutions and community-driven innovation.

Although still in its early stages, the prototype demonstrated the feasibility of transforming existing low-cost technologies into more operational and scalable observation tools through improved usability and documentation.

4. Limitations

As the solution was developed during a 24-hour hackathon format, several limitations remain.

First, the prototype was tested under limited field conditions and over a relatively short period of time. Further testing across a wider range of environmental, climatic, and socio-economic contexts is needed to assess its robustness, reliability, and adaptability throughout the Atlantic basin.

Second, the current documentation framework remains preliminary and would require further technical validation, user feedback, and standardization before broader operational deployment.

Third, language accessibility and inclusivity still need to be strengthened by developing professionally translated materials and culturally adapted communication approaches.

Another limitation concerns long-term sustainability. While the proposed framework improves operational usability, sustaining sensor networks in under-resourced regions may still require reliable access to equipment, ongoing maintenance and calibration, data management capacity, training programs, institutional support, and sustained funding.

Finally, the hackathon format itself constrained the level of technical integration achievable during the event. Several promising ideas related to interoperability, automated quality control, and integration into larger observation networks could not be fully explored within the available timeframe.

5. Plans for Promotion and Future Development

The solution developed during the hackathon presents strong potential for expansion within the wider All-Atlantic context. Future development could occur progressively across local, regional, and international scales.

Local Scale

At the local level, the solution could support:

- community-based coastal monitoring initiatives;
- educational activities within Blue Schools and universities;
- citizen science programs involving fishers and coastal communities.

Pilot deployments could be implemented through partnerships with local research institutions, NGOs, and community organizations.

Regional and All-Atlantic Scale

At the regional scale, the framework could contribute to:

- harmonized low-cost observation practices;
- ECOP training activities;
- South-South and North-South knowledge exchange initiatives;
- broader coastal observation capacity building efforts.

The solution could also be integrated into existing initiatives such as CoastPredict-labelled activities, COLAB Atlantic, GlobeCoast, SCOOP, and OBPS working groups.

Resources and Support Mechanisms

One of our main aspirations was to ensure that this idea would continue growing beyond the hackathon and reach as many communities and spaces as possible, as we mentioned during our final presentation at the All-Atlantic Forum. Since then, we have already shared our project idea with the CoastPredict community in Mexico and with the Accessible Ocean Technology (AoT) community within the Deep Ocean Observing Strategy (DOOS).

And so moving forward, we hope that the AAORIA and OKEANO team can continue supporting the development and visibility of this great idea through:

- communication and dissemination through AAORIA and OKEANO networks;
- technical mentoring and scientific coaching;
- pilot funding opportunities through European and international cooperation projects;
- integration into training workshops and hackathon follow-up activities;
- partnerships with coastal observation initiatives and regional marine institutions.

A **key recommendation** emerging from the hackathon is the importance of establishing structured post-hackathon continuity mechanisms to allow promising solutions to mature into operational initiatives.

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