NAUTILOS Citizen Science App

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Citizen Science projects including crowd-sourcing of plastic litter data have been implemented successfully in many countries and within several long-term monitoring projects. The involvement of local communities in the collection of data allows them the opportunity to actively participate in the problem's solution and has the potential to raise environmental awareness. The engagement of citizens in everyday science may ultimately inspire public and even political change [1]. Citizen science can be a useful approach to increase the available information on environmental problems such as the investigation of marine litter sources, distribution and ecological impacts [2].

Within the NAUTILOS Project, many different partners are involved in Citizen Science (CS) campaigns. Each one does not necessarily perform the same type of activities or focus on the same kind of citizens or citizen organisations. The primary goal of this activity is to develop an App which can support various CS activities arranged by different partners in the NAUTILOS project and with different focuses. Still, the goal is not to provide general tools that anyone could use to increase and collect information. The heterogeneity of CS activities in NAUTILOS entails the need to deliver a broader instrument that allows to acquire data more homogeneously and export them to the web platform, which also provides for the sharing of data collections in a standardised way. Aiming to guarantee more straightforward access to all scientific data collected inside the project, the data resulting from the CS activities will be compliant with the ERDDAP data format.Four main scenarios, following from the project's activities, have been identified which are covered by the developed App: CS plastics-related campaigns; divers' campaigns; crowdsourcing for visual marine image annotations; and, algal bloom-related campaign. In this paper we will present the design and structure of the CS App, along with a specific use case of the application concerning the plastic collection campaign scenario.

NAUTILOS Application and Use Case

In order to allow crowdsourcing campaigns as requested from some scenarios such as the plastic/litter collection campaigns, the application has been designed and developed to be accessible from the majority of devices, and people. Thus, the React Native framework has been adopted to develop the application that allows to develop an application that can run both on Android and iOS devices without any code adjustment or rewriting. The application is able to send the reports, resulting from the campaigns, to the NAUTILOS ERDDAP data server through a set of dedicated HTTP services. Indeed, the application provides two main typologies of usage: (i) storing, (ii) visualisation.

Storing usage is focused on the generation of the reports for the identified scenarios that will be stored in the ERDDAP data server; due to the heterogeneity of the scenarios and the differences that occur between them, the application manages them separately. For each scenario, the application provides the user with a set of dedicated textual fields, dropdown menus and three special fields (i) coordinates, (ii) date and (iii) picture. The coordinates are, by default, taken from the GPS sensor of the device but users can select a different pair by selecting from a map or directly editing the values; the date field, by default, takes the actual date and offers a calendar view to change the date; finally, a picture can be chosen from the device gallery or, otherwise, directly taken from the device camera (Figure 1, right).

On the other hand, the visualisation modality retrieves the coordinates from the GPS sensors, is used to center the map on the actual location, and, directly querying ERDDAP data server, retrieves all the

reports sent by the user and displaces them on the map. Users can have a brief view of the sent reports and, from here, edit or delete them.
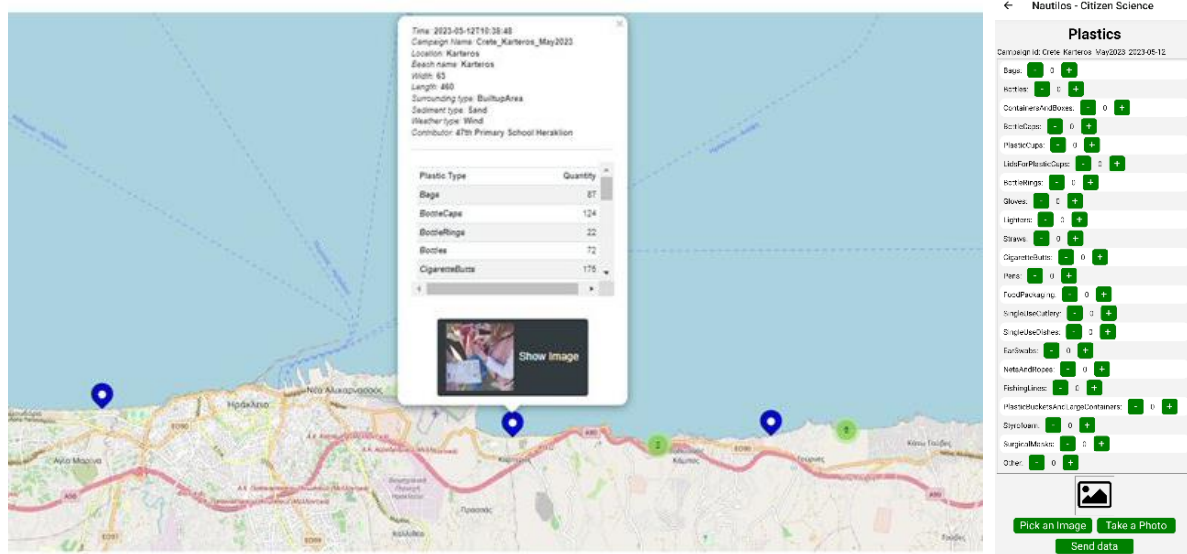

Figure 1: Map of Citizen Science plastic litter campaigns and format of data display (left); Appearance of the CS App (right)

Within the framework of the NAUTILOS project 12 Citizen Science field campaigns have been performed which involved the collection of plastic litter from 6 beaches in Heraklion (Greece) during the period May 2022 - May 2023, and they are still ongoing. A total of 231 primary and secondary school students of all grades (ages 7-18) were involved in the campaigns and recorded the plastic litter they collected on the beach on forms with predefined categories while working on the field. The students categorised the plastic litter into 22 types according to the J code list of the official EMODnet Chemistry Thematic Lot n°4 vocabulary. These categories included mainly single-use plastics such as bags, bottles, containers, and cutlery, remains from fishing equipment and small plastic items (lighters, pens, straws, cotton bud sticks), while also large quantities of unidentified plastic fragments were found. Other data collected during the campaigns include contributor, date, location name, coordinates, width and length of the sampled area, surrounding type, sediment type and weather conditions. While on the field or upon return to their classroom the students can add the data and relevant photos to the NAUTILOS Data Portal using the Citizen Science App of Nautilos. The data are mapped and their graphical representation is possible, while a data report can be also produced (Figure 1, left).

Conclusion

The NAUTILOS Citizen Science application is a new tool to measure and share information about chemical, biological and deep ocean physics variables with a focus on places and parameters that are still missing in the standard "networks" and programs. To enhance data distribution and information accessibility, plastic reports are also ingested to the European Marine Observation and Data Network (EMODnet) under the Chemistry section; indeed, the mandatoriness of the fields and the values of the dropdown menus follow the EMODnet guidelines.

References

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2. HIDALGO-RUZ, V., & THIEL, M. (2015). The contribution of citizen scientists to the monitoring of marine litter. Marine anthropogenic litter, 16, 429-447.