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Citizen Science App Guide

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LIST OF ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
CS	Citizen Science
ESPCE	European Strategy for Plastics in a Circular Economy
GUI	Graphical User Interface
GPS	Global Positioning System
GDPR	General Data Protection Regulation

I. INTRODUCTION

This document represents a short reference guide for version 1.3 of the Citizen Science developed App. The smartphone interface, realised in Task 8.4, is described in more detail in the deliverable D8.8.

The CS App is one of the tools and services developed and dedicated to supporting the Citizen Science (CS) campaigns. Initially, a deeper analysis of the end-users requirements was performed because of the different fields that the application was intended to be used for.

The document is structured as follows: Section II recaps the analysis and drafting of the requirements of the App, as they were collected with the help of end-users. The final requirements document is then reported.

Section III briefly describes how the application has been designed and its structure following the different requirements emerging from the different types of usage, focusing on the various use-case scenarios.

Finally, in section IV, practical examples are presented concerning the use of the App.

II. END-USER REQUIREMENTS

This section describes one of the outcomes of Task 8.5, defining the end-users requirements that have been discussed and presented in more detail in D8.8. The CS activities are distributed into two different Work Packages, WP10 and WP12. For WP10, Task 10.4 is devoted to the underwater campaigns, while for the activities in WP12, Task 12.2 will be devoted to the plastics-related campaigns in the context of the European Strategy for Plastics in a Circular Economy (ESPCE).

Each Citizen Science activity has different needs; thus, the end-user requirements needed to cover all possible scenarios and data retrieval have been discussed and agreed upon among diverse partners.

As a preliminary recap, the following constraints were decided during the discussions and have been taken as the primary basis during both the drafting of the requirements and the development of the application:

- Development of a mobile application for the CS web-based platform since CS will be mainly collecting their data on the beach;
- Give the option to the users to collect data (e.g. underwater or on the beach) and upload them later (when an internet connection will be available);
- Allow for either automatic GPS positioning or manual insertion of close-by position;
- Creation of a map where each entry will appear as a 'pin';
- Possibility of assigning colour-coded status to a location, also depending on the different types of CS campaigns;
- Tool for correcting mistaken entries;
- Support for the creation of personal accounts to identify registered users' entries (taking into consideration ethical issues and GDPR);

- Avoid duplication of other similar initiatives.

The primary goal of the developed App is to support various CS activities arranged by different partners in the NAUTILLOS project and with different focuses. 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.

III. DESIGN OF THE CS APP

The application has been designed and structured starting from the final requirements document. Due to the difference occurring in the fields proper of each identified scenario, the application manages each insertion form separately from the others.

Following the different scenarios, the app comprises five sections: the first four are relative to the earlier scenarios, while the last one is dedicated to viewing the inserted reports.

The following subsections describe the application's typology of use and the arrangement of each scenario.

1. TYPOLOGIES OF USE

The application is designed to provide two main usages: storing and visualisation.

The storing typology is composed of four independent main sections (i) Plastic Campaigns, (ii) Diver campaigns, (iii) Image Annotation and (iv) Algal bloom; on the other hand, the visualisation is composed only of one section (View Map). Each section can be accessed from the main page by simply pressing the dedicated button and, depending on its type, is composed of one or more screens.

The storing sections offer the user the possibility, through their screens, to compile a set of dedicated fields that will be used to generate a record to be stored in the data server. These sections and relative screens are similar and offer a set of drop-down menus and text fields that can be optional or mandatory. The mandatory fields vary depending on the selected scenario. Along with drop-down menus and text fields, the application manages special values: (i) latitude and longitude and (ii) images. Indeed, for each scenario, the user can specify the coordinates of interest; in this release version, the application automatically acquires and uses the GPS position of the device as a report referencing coordinates, but they can be edited manually. Moreover, each scenario offers the possibility to enrich the report with a significant image (the image is mandatory in the case of Image annotation and Algal bloom reports); thus, each section provides two more screens to allow the user to take a picture through the device camera or to pick an existing one from the device gallery. Once all the data are compiled, the application can store them on the data server.

On the other hand, the visualisation section offers the user a quick look at the previously stored reports. The application has to query the data server to obtain all the reports sent by the user. These reports, characterised by different colours depending on the belonging scenario, are displayed on a map; upon selection, it is possible to obtain further information such as the report type and the referenced date. The application will show a restricted set of the available data focusing only on the ones sent by the operator using the application; this strategy has been adopted to avoid an excessive burden on the application. From this visualisation section, only a few further information will be prompted to the user leaving a complete and detailed view of the reports to the Graphical User Interface (GUI) described in deliverable D8.7 and available from the project website (<https://www.nautilus-h2020.eu/data-portal/>).

2. ARRANGEMENT OF EACH USE-CASE SCENARIO

For each possible use case scenario (plastics, diver campaign, image annotation, algal bloom), application sections and subsections are briefly described enlightening their peculiarities. Each scenario is described independently in a dedicated sub-section.

2.1. Plastic Campaigns

Plastic campaigns are devoted to identifying and classifying the presence of plastics in coastal areas. For each campaign a record is stored into the proper dataset and contains information about the location and the date where and when the campaign occurred and, if there were present, the adverse weather condition. The location where the campaign took place is, by default, the geographical coordinates (mandatory field) acquired by the GPS, but the users can modify it. Users can also add optional information such as the location and the beach name; it is also possible to specify the portion of the beach surveyed by the campaign. Other managed details are the description of the beach sediment and its surroundings and the possible adverse weather conditions that took place during the campaign.

Information about the plastic collected during the campaign and pictures about them are stored into two separate datasets both related to the campaign.

Regarding the presence of plastics, users have to add the quantity found for each available type.

Users can enrich the report by adding a representative image that could be acquired directly from the camera or picked from the device's gallery.

2.2. Diver Campaign

During these campaigns, divers receive one or more sensors, some of them developed among the project activities, that will be tested. These sensors can usually acquire information about the water (e.g. temperature, salinity and chlorophyll in the current release). Once the campaign is over, the diver will download the data acquired from the sensors and upload it through the application to the data server.

Thus, each report must specify the measured parameter and its value; in the case of multiple measured parameters, it is necessary to insert as many reports as measured parameters. Along with the measured parameter, it is mandatory to specify the geographical coordinates and the date when the campaign occurred. Coordinates and date, by default, assume the actual position (retrieved by the device's GPS) and date. Still, users can specify a different date or coordinates, for instance, in the situation of data uploaded after the conclusion of the campaign. Moreover, a button for picking a position from the map is present.

Like the previous scenario, the user can enrich the report by adding a representative image that can be picked from the device's gallery.

Along with the mandatory data, the user can also optionally specify the geographical area where the campaign took place and other details such as the depth where the parameter was measured, the sea bottom type (i.e.: Mud, Sand, Rocky, Meadows), the level of water visibility (i.e.: Visibility, Turbidity) and the weather conditions (i.e.: Wind, Rain, Snow, Ice, Fog, Sand Storm, Exceptional High Tide, Sun, Other).

2.3. Image Annotation

Image annotation is based on crowdsourcing to collect many images related to information about the species identified in it. The images can come from divers, environmental operators or volunteers.

In this scenario, the image is a mandatory field. As in the previous scenarios, the user can capture a photo through the device camera or pick one from the device's gallery.

The user must specify each image's identified species (or its taxon name) and a numerical value representing the number of occurrences or the percentage of the acquired area covered. Also, the coordinates and date fields are mandatory and follow the same logic as the previous use case scenario. The same button, as in the previous case, for picking a position from the map is present.

The user can also optionally specify the geographical area where the campaign took place and other details such as the depth of the picture, sea level (i.e.: Intertidal, Subtidal, Deep Sea), sea bottom type (i.e.: i.e.: Mud, Sand, Rocky, Meadows), and weather conditions (i.e.: Wind, Rain, Snow, Ice, Fog, Sand Storm, Exceptional High Tide, Sun, Other).

IV. USE OF THE SMARTPHONE APP

This section describes the use of the developed smartphone app. Examples and figures will show all the usage typologies and identified scenarios.

The application interface has been kept very simple and straightforward to promote its usage among the general public. The app can be downloaded through the NAUTILOS website (<https://www.nautilus-h2020.eu/nautilus-cs-app/>), clicking on “Download App”. Currently the download is only achievable after authentication with the NAUTILOS ownCloud credentials. The downloaded file is an “apk” that can be installed on Android smartphones. After the installation, the icon to launch the CS App is added to the smartphone. Clicking on the icon the CS App can be started.

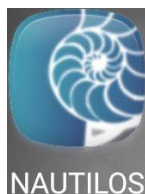


Figure 1 NAUTILOS CS App icon on the smartphone.

After the project logo splash screen, the user must insert his username and password to authenticate inside the system (see Figure 2). Then, the application connects with the data server, exploiting a dedicated API, to verify user credentials. Then, the user id is reported in each report sent by the user. In the forthcoming release, the application will keep track of user groups providing different insertion forms depending on user belonging groups.

Considering the current use of the App, the request for a new username or password change/reset, should be made directly via email. In case of a future extension of the App for the general public (e.g. publication on Google Play Store), a registration page will be set up also containing a button for resetting the password.

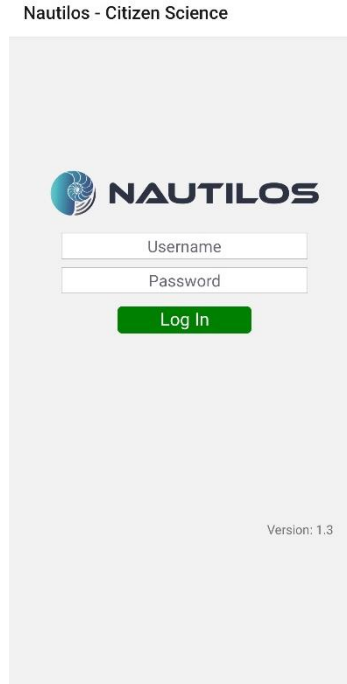


Figure 2 Initial screen with authentication.

Once the user is authenticated inside the system, the application's main screen will be displayed (Figure 3). As it can be seen, in the interface, the anonymous user id is shown, along with the number of reports that the user has shared (i.e. submitted to the data server) so far. Moreover, above the buttons, the geographical coordinates are automatically retrieved (if the smartphone GPS is activated and working).

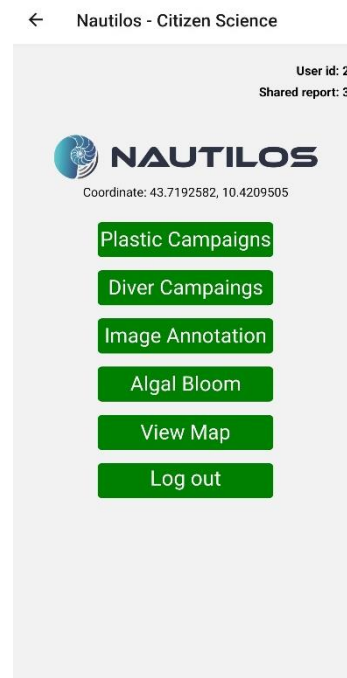


Figure 3 Main page of the application

From this screen, the user can access all the functionalities and options provided by the application. The main screen comprises six buttons: the first four are used to send a report to the system regarding one of the four identified scenarios; the fifth button is used to view all

the previous reports sent to the system by the user; the final button is the Log-out button to go back to the initial screen.

By selecting the “*Plastic Campaigns*” button, initially a screen will appear allowing for the possibility of either selecting one of the existing campaigns or adding a new campaign (Figure 4). This latter possibility is permitted only to users having an administrative role.

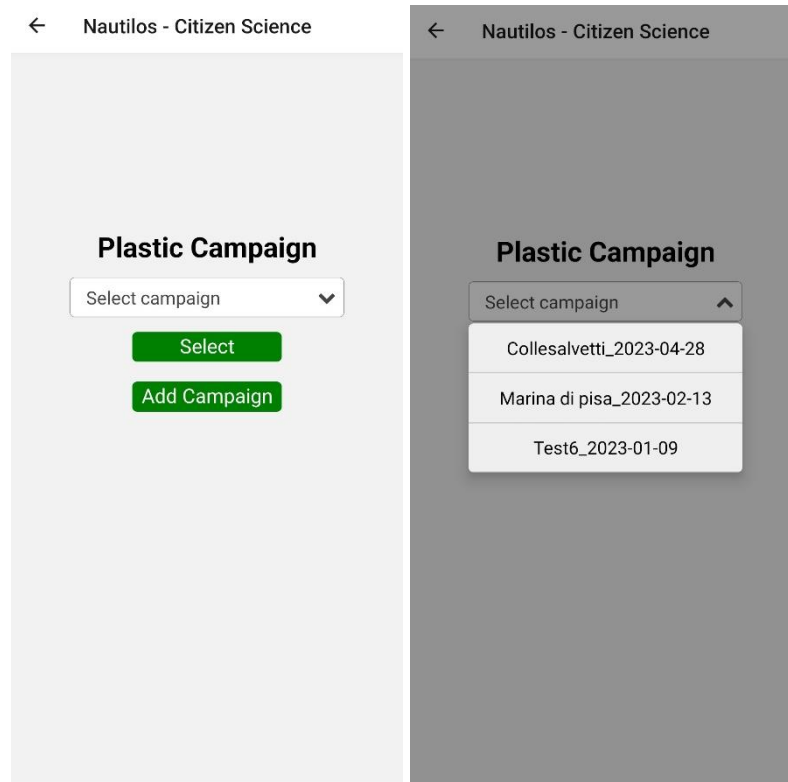


Figure 4 Initial screen for Plastic campaign selection or new insertion (left); example of possibility for selecting an existing campaign.

If the user is allowed to add a new campaign the screen will show the set of values to be inserted like in Figure 5.

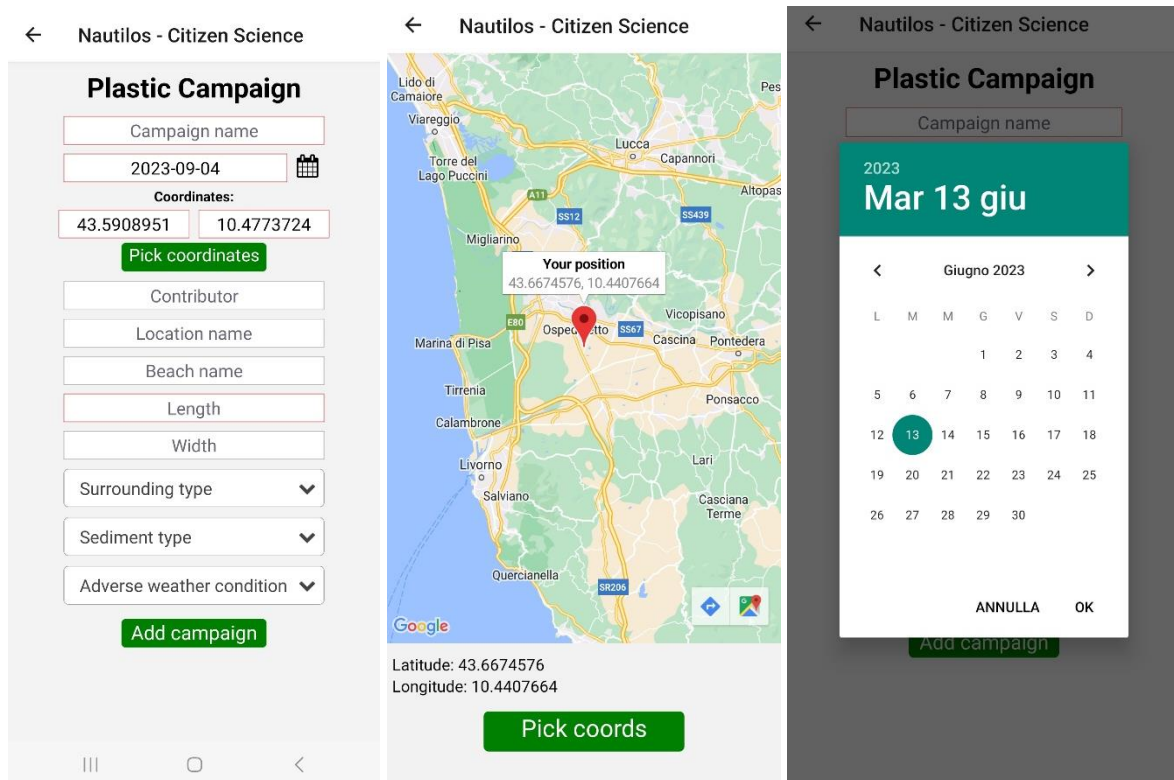


Figure 5 New Plastic campaign addition screen (left); the pick cords screen from map (center); and detail of the calendar form (right).


While if an existing campaign is selected, the successive screen will show the form for the addition of collected litter (Figure 6).

The categories appearing in this list come from the EMODnet guidelines. Adopting such guidelines helps the data export to major European aggregators. Also the available options, in case of fields with predetermined values, are specified by these guidelines

← Nautilus - Citizen Science
← Nautilus - Citizen Science

Plastics

Bags:	-	0	+
Bottles:	-	0	+
ContainersAndBoxes:	-	0	+
BottleCaps:	-	0	+
PlasticCups:	-	0	+
LidsForPlasticCups:	-	0	+
BottleRings:	-	0	+
Gloves:	-	0	+
Lighters:	-	0	+
Straws:	-	0	+
CigaretteButts:	-	0	+
Pens:	-	0	+
FoodPackaging:	-	0	+
SingleUseCutlery:	-	0	+
SingleUseDishes:	-	0	+
EarSwabs:	-	0	+
NetsAndRopes:	-	0	+
FishingLines:	-	0	+
PlasticBucketsAndLargeContainers:	-	0	+
Styrofoam:	-	0	+
SurgicalMasks:	-	0	+
Other:	-	0	+




Pick an Image
Take a Photo

Send data

Plastics

Bags:	-	0	+
Bottles:	-	0	+
ContainersAndBoxes:	-	0	+
BottleCaps:	-	0	+
PlasticCups:	-	0	+
LidsForPlasticCups:	-	0	+
BottleRings:	-	0	+
Gloves:	-	0	+
Lighters:	-	0	+
Straws:	-	0	+
CigaretteButts:	-	3	+
Pens:	-	0	+
FoodPackaging:	-	8	+
SingleUseCutlery:	-	0	+
SingleUseDishes:	-	6	+
EarSwabs:	-	0	+
NetsAndRopes:	-	0	+
FishingLines:	-	3	+
PlasticBucketsAndLargeContainers:	-	0	+
Styrofoam:	-	0	+
SurgicalMasks:	-	0	+
Other:	-	0	+



Pick an Image
Take a Photo

Send data

Figure 6 Form for adding collected litter data in a campaign. On the left the empty form, on the right example of a filled form with some data and a selected image.

As an example of the appearance of the report on the map is shown in Figure 7. It is to be noted that, the count on the map takes into account all the different reports belonging from the same campaign and the visualized data is the aggregation of the various reports (i.e. the summation of all data in each category).



Figure 7 Plastic collection report appearance on the map. The aggregated count from all reports in the same campaign are shown.

Once the submission will be achieved, the application's main screen will be loaded with a message confirming the operation's success (see Figure 8). The number of shared reports will be updated accordingly (note: it may require a few seconds to be updated).

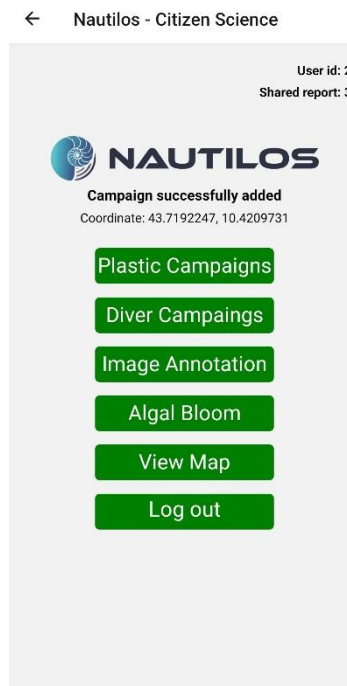


Figure 8 Initial screen reporting "Report successfully added" after insertion of a report.

Figure 9-a is an example of the **Image Annotation scenario**. The image selection/capture is placed as the first field in this form because this is a mandatory field. Pressing “Take a Photo” will load the camera screen (Figure 9-b). The camera screen is straightforward and shows the camera output with two sensitive areas on it: (i) “Flip” to switch from the rear to the front camera and vice versa and (ii) the button to take a photo. After taking the picture, the previous screen will be loaded back, and, as can be seen in Figure 9-c, a thumbnail of the image selected/captured will be shown.

Again, the mandatory fields are framed in red, with the species/taxon name field set as free text.

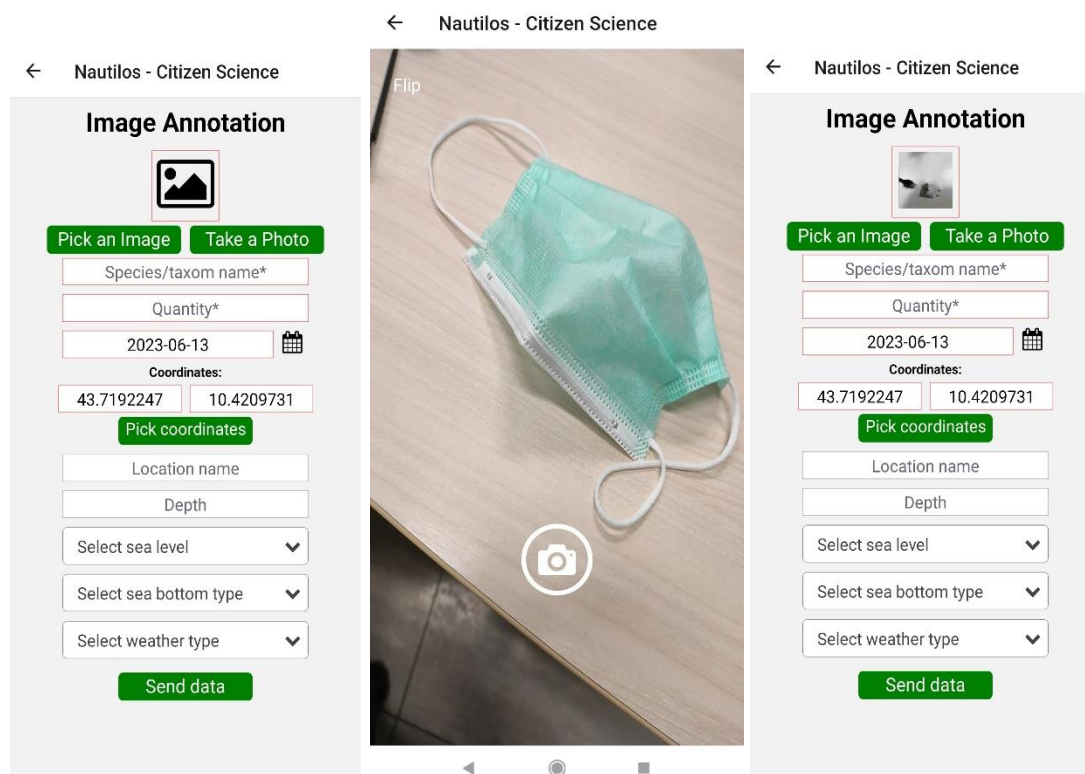


Figure 9 Example of Image Annotation form: (a) complete view on the left; (b) image capture in the centre; (c) complete view with a thumbnail of the captured image on the right

The **Diver campaign** and **Algal bloom** scenarios are similar to the Plastics and Image Annotation ones. Figure 10 shows the two different forms for these scenarios. The main difference between the two is the position of the image/photo buttons. The image is a mandatory element for the Algal bloom scenario, while it is only optional for the Diver campaigns.

In the Diver campaign, the measured parameter field is a drop-down menu containing the possible parameters that can be measured through available sensors developed in Nautilus. While for the Algal bloom, the species/taxon name is a free-text field.

← Nautilus - Citizen Science

Diver Campaign

Select measured paramet... ▼

Measured value*

2023-06-13 📅

Coordinates:

43.7192247 10.4209731

Pick coordinates


Location name

Depth

Select sea bottom type ▼

Select weather type ▼

Select sea status ▼




Pick an Image Take a Photo

Send data

← Nautilus - Citizen Science

Algal Bloom



Pick an Image Take a Photo

Species/taxom name*

Sample Volume*

2023-06-13 📅

Coordinates:

43.7192247 10.4209731

Pick coordinates

Description

Location name

Depth

Select sea zone ▼

Select sea bottom type ▼

Select weather type ▼

Send data

Figure 10 (a) Diver Campaign and (b) Algal bloom scenarios

Finally, by selecting the “**View Map**” button, the user can access the previous stored reports. This screen, shown in Figure 11, can be used by the user to view all the reports already sent to the data server by the authenticated user. It is composed of a full-screen map populated by sets of markers, where each is characterised by colour depending on the type of the report. Selecting a marker, the user can access further information such as the report type, the date of acquisition and a few other data among the inserted ones.

The idea behind showing only reports submitted by the currently authenticated user is to simplify and reduce the loading and visualisation burden on the App. The complete visualisation of the CS data can be performed on the web portal through the GUI and its tools and services.

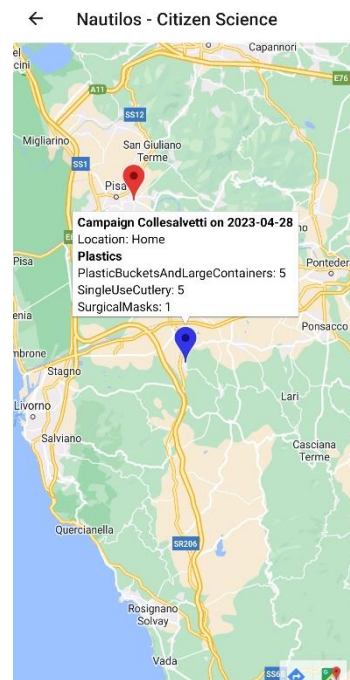


Figure 11 Example of View Map screen

V. APPENDIX 1: REFERENCES AND RELATED DOCUMENTS

ID	Reference or Related Document	Source or Link/Location
1	D8.8 Citizen Science tools and interface	NAUTILOS OwnCloud