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EFFECTIVE

PROTECTION AND RESTORATION MANAGEMENT · MEDITERRANEAN MPAS

Enhancing social well being and economic prosperity by reinforcing the eFFECTIVEness of protection and restoration management in Mediterranean MPAs

D.6.1 Citizen science app final release

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SYMBOLS, ABBREVATIONS AND ACRONYMS

D	Deliverable
EU	European Union
T	Task
P	Partner
WP	Work Package
ASO	App Store Optimization
App	Application, mostly used for a mobile application
JSON	JavaScript Object Notation, data format
API	Application programming interface
CMS	Content Management System
CSV	Comma-separated values, Text-based Data Table format
GUI	Graphic User Interface
D	Deliverable
EU	European Union
T	Task
P	Partner
WP	Work Package
ASO	App Store Optimization
App	Application, mostly used for a mobile application
JSON	JavaScript Object Notation, data format
API	Application programming interface
CMS	Content Management System
CSV	Comma-separated values, Text-based Data Table format
GUI	Graphic User Interface

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LAUNCHING AN OPEN PARTICIPATORY PLATFORM FOR MARINE CITIZEN SCIENCE

In the Deliverable 6.1, SPOTTERON (P6) has launched the first finalized version of the project's interactive participatory toolkit for Citizen Science data submission, integrated public engagement functionalities, and project to user communication. The complete Citizen Science App Toolkit consists of mobile applications for Android and IOS (iPhone/iPad), an interactive web-application for contributing to the project in the browser on desktops and laptops, and a secure data administration interface, allowing the project team to access and manage the data, download data exports, use tools for project-to-user communication and work directly with the user community.

A first version of the Citizen Science App Toolkit has been launched already on the 31st of May as a prototype publicly via the App Stores as the project's App "COSEA", including the initial launch of the web-application and the data administration interface setup for data access and management.

Figure 1: COSEA App Image Teaser

Links:

Android: https://play.google.com/store/apps/details?id=com.spotteron.cosea
Apple IOS: https://apps.apple.com/ve/app/cosea/id6503368314
Web-Application: https://www.spotteron.com/cosea

With an active and engaging Citizen Science Application as a core part of EFFECTIVE, the project can work with the local population in and surrounding the pilot areas. Integrating the public on both data submissions and communication/community building, EFFECTIVE can get valuable feedback, observational in-situ recordings and a wider range of supportive data saturation for the research teams in the consortium. Furthermore, the Citizen Science App toolkit also provided a software

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package for on-location monitoring for team members in the consortium and for external stakeholders.

Data

The data from user submissions in the project's Citizen Science App is available for the coordinator, work package leader (WP6) and also for consortium members via the toolkit's data administration interface. This password- and encryption protected section of the toolkit allows the consortium to directly work with the data. The administration interface also integrates communication tools to send media-rich messages with push notification to all participants. Access to the data administration interface can be structured on a per-country or even per-region basis. This allows already in the current version of the toolkit to provide a country or region specific access for consortium partners for independent use of the Citizen Science/Monitoring App for own data recording or first public dissemination and community building in the pilot areas. The workflow of self-managed app use on location to data management/exports and project-to-user communication will be presented right after the deliverable in upcoming works.

Communication/Community Building

The second core component of public engagement in the Citizen Science App toolkit is the digital-social community, integrated directly into the COSEA App. Consisting of communication and appreciation features like user profile, comments and replies on user contributions, like-buttons (heart), and more interactive functionalities, the project's App is not only about one-way sharing of data, but enables user-to-user and project-to-user communication on a deeper engagement level. Building a community in a Citizen Science App is a task over time, in which the EFFECTIVE consortium will take an essential part for dissemination and reaching out to the local population in the pilot areas for app promotion. With the community features present in the COSEA, the toolkit is extending from merely data collection to interactivity, motivation, and participation in the meaning of the word as "being part".

The success of a Citizen Science and Public Engagement application is also fostered by the availability of a wide range participation options for the various target groups and by reaching a high-enough user base active in a toolkit. To maximize impact, the COSEA App Toolkit is designed to be co-used in the projects EFFECTIVE and TRANSEATION, lead also by CTN (P1). With this direct-level of collaboration between the two Horizon Europe projects, efforts and tasks can be optimized, and collaborate on marine observational data collection and community building can be improved for better impact, community reach and app general quality.

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For Deliverable 6.1 in EFFECTIVE, the original prototype App has been further fine-tuned, bug-fixed and finalized, including the integration of 10 additional languages, making a total of 11 languages available in the App:

- English
- German
- Danish
- Greek
- Spanish
- French
- Italian
- Norwegian
- Dutch
- Ukrainian
- Bulgarian

The Citizen Science App Toolkit includes a system functionality to auto-select the best-fitting language based on a device's operating system language setting. If ,e.g. a user has set her or his phone language to Spanish, the App is also automatically displayed in Spanish language.

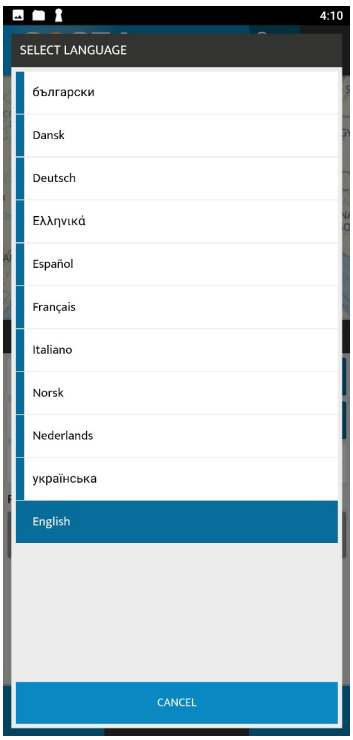

Figure 3: Languages in the COSEA App

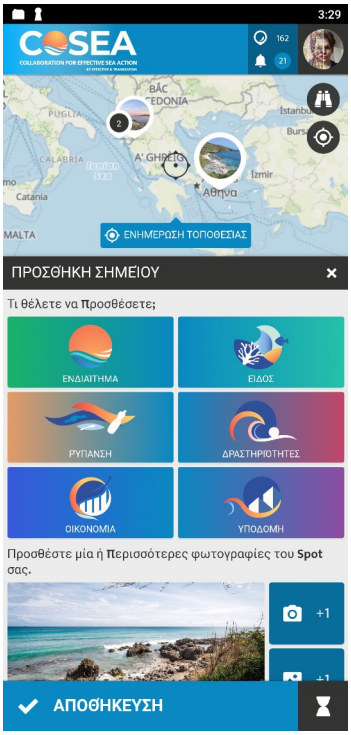

Figure 2: COSEA App in Greek Language

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If the language of the operating system does not exist in the included translations of the App, English is used as a fallback language instead.

This major extension for the final Citizen Science App Toolkit has been achieved with the help of the EFFECTIVE and also the EFFECTIVE consortium, in which project partners have collaborated to check and correct the language of their country of origin and native speakers. In the future, further languages can be implemented into the app when e.g. collaborations or external partnerships emerge.

The update for the final version of the mobile application has been approved by the App Stores and is already available for public download on the App Stores for Android and IOS. Furthermore the project's web-application for browser use has already been updated to the new version.

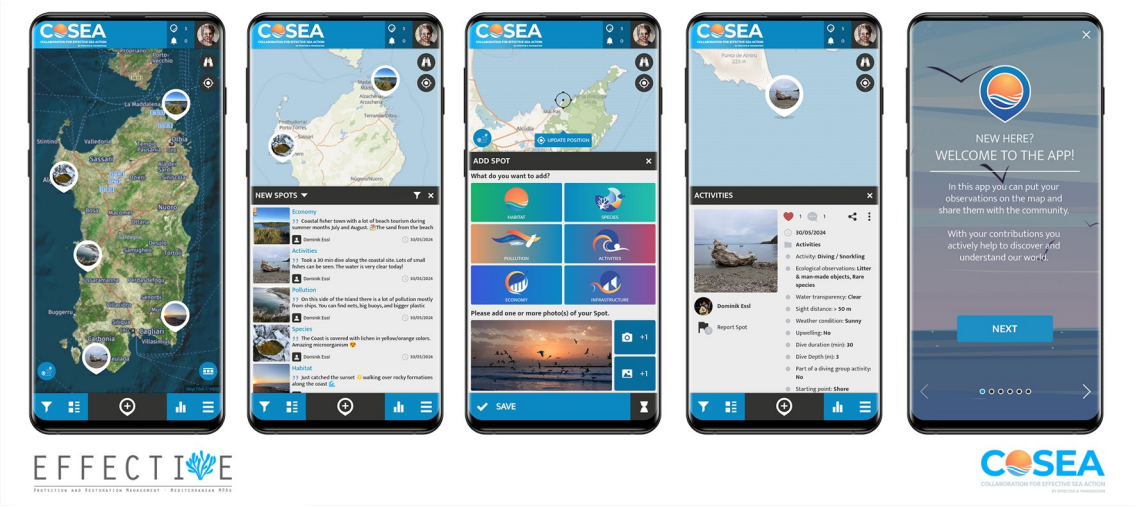

Figure 4: COSEA App Screenshots on a S10 Android Phone

The project's web application allows participation in the project's application simply via a browser on desktops and laptops. This provides an alternative for people who do not want to or can use a mobile application, installed on a smartphone or tablet device. The web-application is also useful for certain use cases, such as participation by school classes on PCs, or by professional photographers or people working in blue infrastructure professions who want to upload observations directly from their work laptop using the installed web-browser.

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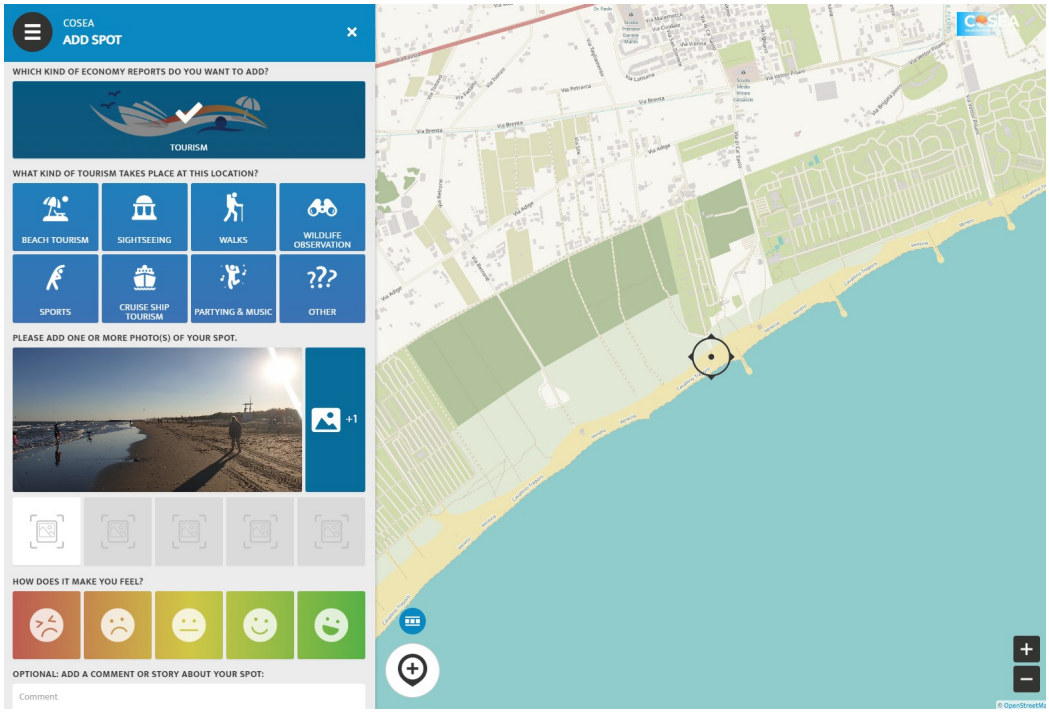

Figure 5: Contribution upload via web-application in a regular browser

DATA & COMMUNITY ADMINISTRATION INTERFACE

For accessing the incoming data the coordinator and WP6 leader have gotten access to the password and encryption protected data administration interface. This component of the Citizen Science App Toolkit hosts various section for managing and exporting data as CSV table format. Further sections in the data administration interface allow the management of user comments in the app, composing project-to-user messages with push notifications or in-app information popups, that can be sent to or enabled for the user community in the app toolkit, and the set up and management of project activities for posting events like workshops on the app's map view.

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Figure 6: Data submission list in the data administration interface

Especially with the integrated communication tools for project-to-user messages and popups, the EFFECTIVE dissemination team in WP9 will be able to reach out to a user community independent from monetized social media channels and to sent messages about project development, research outcomes and news to all app toolkit users.

For independent management of data and user comments and to send project-to-user messages on a per country basis, e.g. for self-managed communication of the pilot areas to their national user base, per-country admin accounts can be set up to be distributed among the consortium members after the upcoming introduction workshops for how-to-use the data administration interface.

This national -based access to both data and communication tools allow an independent workflow with the project's citizen science and monitoring app toolkit and to communicate with the user base in the native language of the country/consortium member.

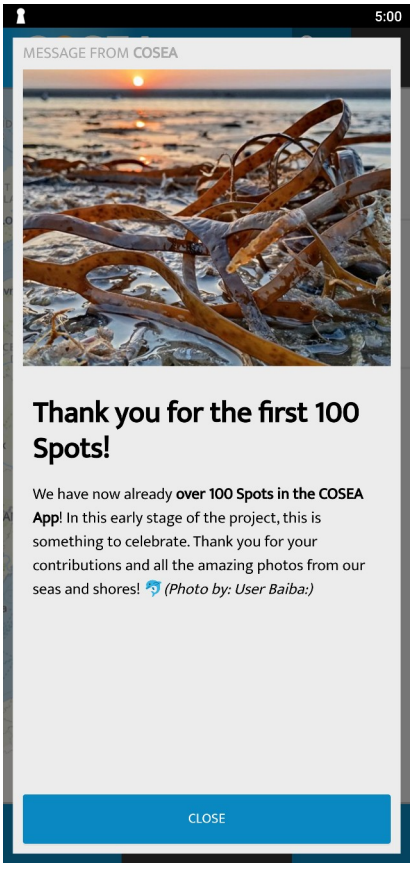

Figure 7: Project-to-user message in the App

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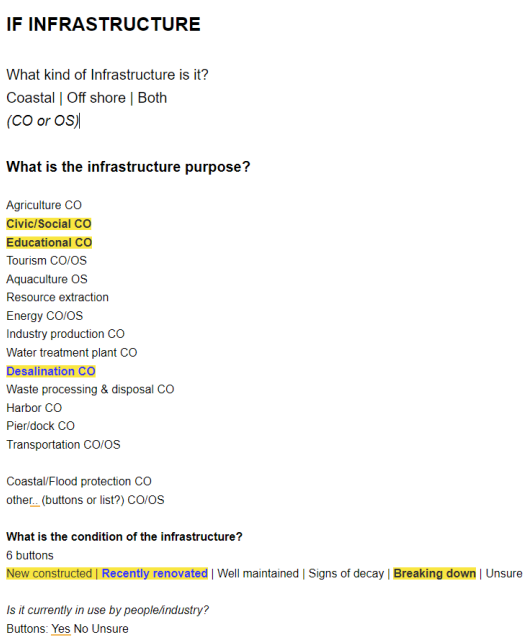
CITIZEN SCIENCE APP PRODUCTION

Prototype development and design is a multi-step process, from working with scientists to define data models and entry points, to designing user interfaces, creating app content and developing the actual apps. Using P6's existing software-as-a-service platform SPOTTERON, a number of features are already available and have been implemented during the initial development process to be ready from the App Toolkit's start.

Preparations & Definitions

P6 has led the work package teams through the process of defining effective data model definitions for the citizen science app through online meetings and workshops, defining content, data categories, and input options available for data submission in the app for future users.

During the data definition workshop, P6 also introduced the fundamental concepts of citizen science and user engagement to the project consortium and presented potential avenues for science communication and user community building to the involved project teams. In regard to the definition phase and the online work document, a draft has been prepared which reflects the inputs from the project team and which will serve as a data input structure tree. This structure reflects the graphical user interface (GUI) options available to users in the application for the submission of data and new observations. In the initial drafting phase, the structure was developed to represent all of the aforementioned options for the final release version of the application in a defined syntax. This includes content elements such as data input field headings, data input field labels, and the conditions under which the field is displayed in the application. The resulting branching data input tree has provided a robust foundation for integrating the app's data model definitions into an app setup on the system. Furthermore, it allows for the extension of this foundation in the future with the addition of further data input options and categories. In the EFFECTIVE project, a number of core data categories have been identified in collaboration with consortium partners. These include questionnaires on topics related to marine protected areas, ecology and human-nature interaction. The questionnaires cover a range of data types and conditions, from feedback from local stakeholders, such as fishers, over habitat and species observations, to detailed categories in related areas like coral populations or diving activities. The centralized online work document will prove a useful tool for adding new data categories in agile collaboration with the work package teams.



IF INFRASTRUCTURE

What kind of Infrastructure is it?
Coastal | Off shore | Both
(CO or OS)

What is the infrastructure purpose?

Agriculture CO
Civic/Social CO
Educational CO
Tourism CO/OS
Aquaculture OS
Resource extraction
Energy CO/OS
Industry production CO
Water treatment plant CO
Desalination CO
Waste processing & disposal CO
Harbor CO
Pier/dock CO
Transportation CO/OS

Coastal/Flood protection CO
other_ (buttons or list?) CO/OS

What is the condition of the infrastructure?
6 buttons
New constructed | Recently renovated | Well maintained | Signs of decay | Breaking down | Unsure

Is it currently in use by people/industry?
Buttons: Yes No Unsure

Figure 8: Screenshot of example section of the EFFECTIVE/COSEA WorkDoc on Cryptpad.fr

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The consortium members of EFFECTIVE have been already able to test the original first prototype app version in the field in pilot areas to gain a more profound understanding of the potentials and use cases, and to identify any further needs and requirements in terms of data submission categories and types for their own scientific and data analysis work. With the fluid workflow via the shared online living document, these emerging requirements can be defined also ongoing in the project runtime, drafted and integrated in a defined process in future app updates and extensions.

For the final app version update, emerging software and content bugs have been addressed to polish the Citizen Science App Toolkit's quality. The team of P6 have created new software versions, that are tested on emulators and mobile devices for bug reproduction and bug reporting to the P6's developer team for fixing in the App platform's code. Such iterations are an important task for especially public applications, which are installed on user operated devices.

Branding and APP Logo Design

As a public participation platform, the Citizen Science App toolkit requires an engaging name branding, that reflects the project's topic as well as generates appeal, interest and communicates the core of the app concept. Further aspects of app branding include App Store Optimization (ASO) with the direct use of a related keyword, app name length considerations for improved home screen display, and the possibility for people to remember the app name and communicate it verbally and in writing to other potential users in their peer group.

The result of the branding process, which P6 carried out at the prototype stage, is "COSEA", which reflects the collaborative approach at both the user-to-user and project levels. The brand name is witty and easy to remember. It also has a clear maritime definition with SEA in the name.

Figure 9: First version of the COSEA logo

P6 created a first version of the logo for internal presentation early in the app development process. It was further revised during the app design phase. The revision implemented the core visual styles that came out of the design process for the data submission dialogues, and added color to the logo to make it more visually appealing. In addition, the second version of the logo incorporates adaptive logo design concepts, allowing the icons of the app for the main observation categories to be used as the letter O. This allows the logo to be used under different aspects and themes of the project, while maintaining its visual identity.

Figure 10: COSEA Logo Final Version, Marker and Adaptive Design Element

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Additional elements of the branding design process include the creation of the app icon, which serves as the primary point of access to the app in both app stores and on the home screen/app drawer on a user's device. The app icon employs the core visual element of the COSEA logo in the form of a marker.

P6 has collate a media package comprising all generated App Store materials, including image teasers, marker icons, app store badges, links, and phone mock-ups. This package has been be delivered to the principal investigator of the EFFECTIVE dissemination work package for utilisation in online distribution. Additionally, instructions on how to embed the project's interactive web application directly via HTML iFrame code on the project's website have been provided.

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Setup and Designing the Data Submission Dialog

With the effective data model and data category definitions finalised for the project's inaugural public version of the app, P6 proceeded to the subsequent phase of transforming the text-based outcome into a functional user interface within the Citizen Science App. Following a comprehensive review and refinement of the data input field and associated options, the P6 team has established these within the project's IT infrastructure, in both the system and database.

Additionally, the team has configured the system to enable a hierarchical display of data input options organised under the various categories. Upon submission of observational data in the Citizen Science App regarding sightings, locations like marine habitats, biodiversity observations, pollution, or other categories, users may select a primary category, from which subsequent branching input options will be available. The principal categories are designed to encompass a comprehensive range of potential avenues for observational data, thereby facilitating sustained engagement and user activity while simultaneously generating project-related data inputs for the scientific teams.

Following the initial setup, P6 initiated the data submission design process and app content creation. The outcome of this procedure is a comprehensive visual representation of all input options in the EFFECTIVE app public version, presented as a vector-based source file. For all buttons, P6 has included icons to convey information visually and developed a colour scheme utilising a gradient colouring for each section.

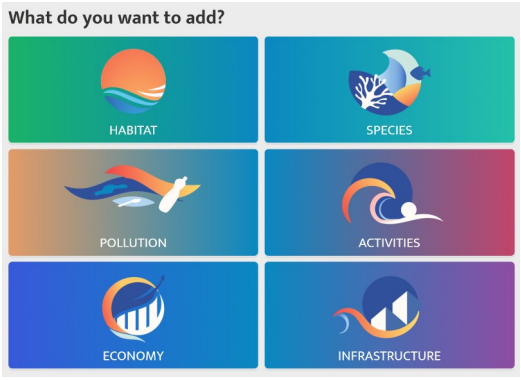

Figure 12: Main category button design

For the main categories, which are the first element the user sees and uses when imputing new data in the app, P6 has created a colorful and vivid visual look, which in the process has been taken over into the 2nd version of the app's branding and logo design.

A total of 100 data input fields have been set up and configured in the system, and the P6 software has also produced the app's language file in English for the purpose of facilitating further translations for the release-final version of the Citizen Science App. The language file encompasses all strings utilized in the projects app, including the title, headlines, and buttons. Following the prototype phase, the language file has

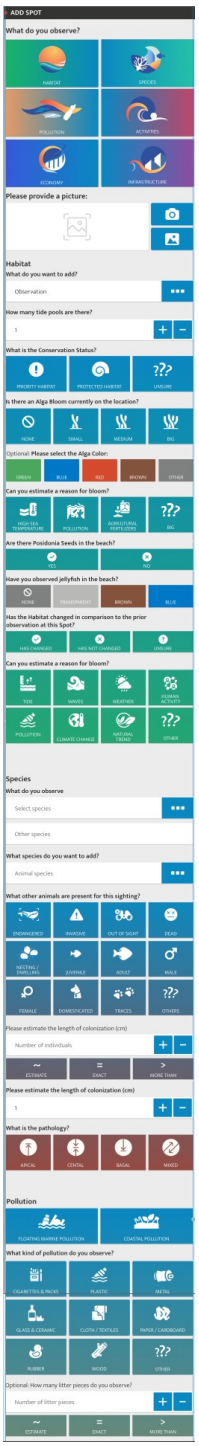

Figure 11: Small section of the Data Input Dialog Design Sheet

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been translated with the assistance of the consortium partners and implemented in final app update release and can be further extended in the future.

Specific questions are associated with a particular user role and level of experience or knowledge. In the context of account creations, users are afforded the opportunity to select a user role that aligns with their background, such as "Regular user," "Fisher," "Science communicator," or "Field scientist." For users who have selected one of these roles, additional data input options are available within the app's categories.

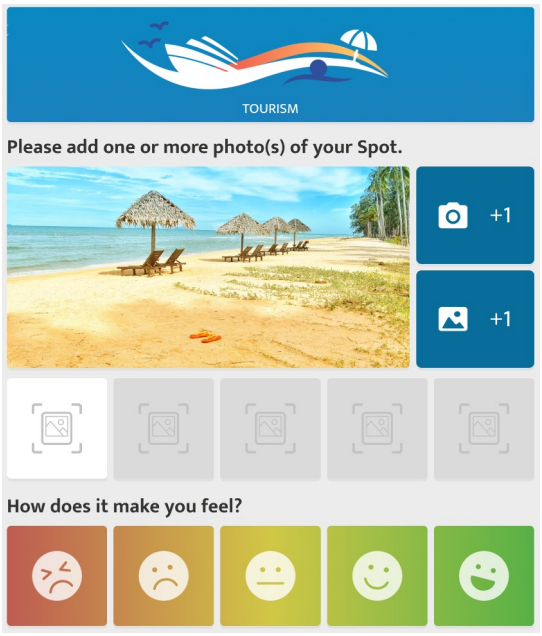

Figure 13: "How does it make you feel" buttons for qualitative feedback

The App follows a responsive and ethical approach to personal data processing and data minimization. User participation is possible with a minimal amount of personal data and just uses an email address as unique identifier. Also the App does not include any permanent user tracking or surveillance scripts, e.g. from external platforms to fulfill its wide scope of features. All data processing and storage of the App Toolkit have a clear focus on European data storage and web-services. For a comprehensive understanding of the data protection measures pertaining to elements that, when combined, may be classified as personal data, we direct the reader to Appendix 1 of this document.

Each main category branch concludes with the standardised question, "How does it make you feel?" This component will facilitate the future utilisation of social science aspects and also ensures a level of respect for the user's perspective on a given situation. An additional feature possible by having the qualitative question in the dialog is the ability of the app to display a custom data visualization, that displays the feedback in a dot-based map overlay. Colored dots from red to green represent a negative-to-positive scale, while the size of dots show the amount of data submissions in the given area. The data visualization is interactive and can be zoomed and scrolled.

A further data feature incorporated into the application is the provision for users to supply information concerning their relationship with the sea or ocean in their user profile. This will assist the scientific team in developing a more nuanced understanding of the relationship between data submission and the personal experience and background of users.

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Implementation of App Features

The input of data can extend beyond the conventional form elements, such as text fields, to encompass buttons and number inputs. The software platform in use provides the opportunity to use existing, and to develop and integrate new app features for high quality, usability and feature richness of the Citizen Science App. The project's app incorporates already a wider range of features into the public release version, with the following core features already active in the live app:

Figure 14: Satellite Map View in the project's App on an android tablet

- Satellite maps: the man map view of the app can be switched to satellite view
- Multiple Images for data submissions and background data upload: users can add multiple images to one submission; data for submissions is uploaded in a background worker process on the users device instead of blocking the app or breaking in low connectivity situations
- Data moderators: enables the set up of user accounts with data moderator permission level to change/edit submissions directly in the fronted of the app
- Spot privacy feature: enables users to choose between keeping a submission public, hide its map coordinates or only show a submission to administrators and moderators of the project
- Project-specific profile questions: users can provide optional feedback on their background in relation to marine aspects and experiences
- User roles: enables the display of selected data input options for only defined user roles in the project

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- User Community: the app is enriched with a range of community options for user to user and project to user communication, form comments, user tagging including push notifications, to like buttons (heart) and user to user following
- Project-to-user communication tools: option to allow project administrators to send custom messages with media, link and titles to all users in the app, or to particular countries and/or user groups
- Data visualization panel: displaying a heat-map as map overlay about the data submission distribution. Additionally a qualitative dot-map is displaying the distribution and ratings of feedback about "How do you feel".
- Data and user statistics: leader board with most active users, and data statistic panels for most contributed categories, including timeline diagram display
- Info panels: Informational/educational content is displayed for habitat types, which can be extended in the future
- User badges: users earn badges for ongoing participation (basic level: amount of data submissions)
- User Profile panels: extend user profile with data submissions collection, message board and awarded badges (gamification)

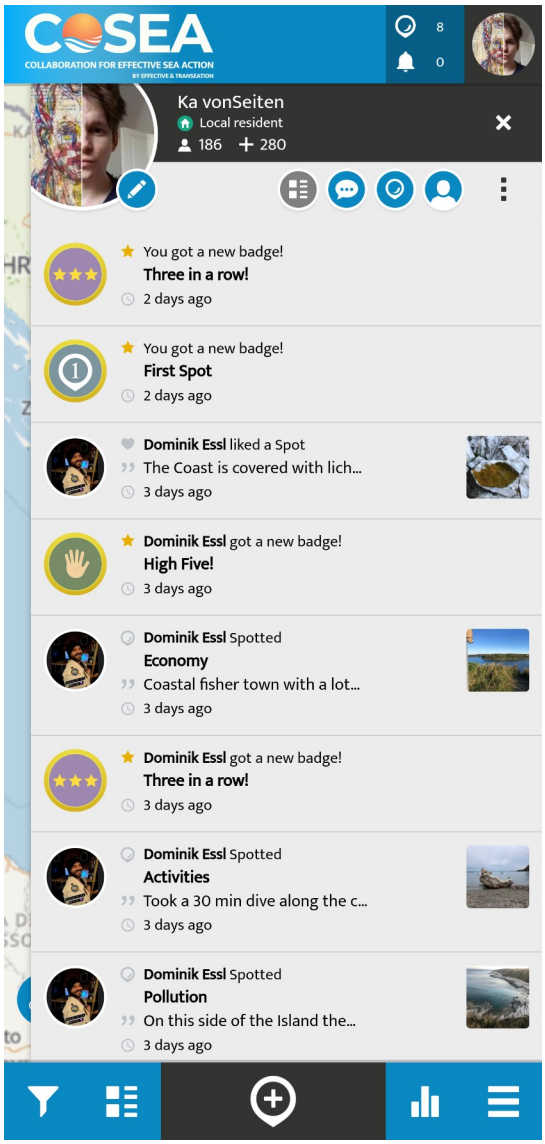

Figure 15: User Community News Feed and Notifications in Project App

- Routes recording: users can record walks on beaches, or fishers can use GPS/Location Service to record routes of fishing tours
- Offline Maps: download of map areas for offline availability
- Species Taxonomy: implementation of the P6's data taxonomy features for submissions about species presence via WikiData API connection

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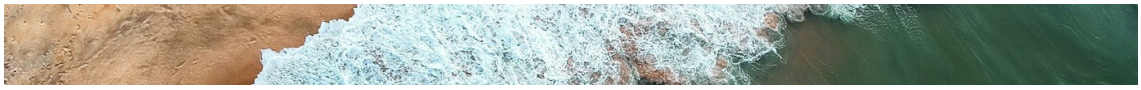
The existing platform features facilitate the enhancement of app quality, user experience, app stability, privacy and data quality. The utilisation of the underlying software platform by P6 enables the incorporation of a comprehensive range of functionalities into the project's app, obviating the necessity for additional development costs and efforts. This benefits not only the scientists involved but also the citizens who participate in the project, as well as the public reception of the project's Citizen Science toolkit.



Next steps

In the forthcoming extension phase, the experiences of using the app and of monitoring and citizen science will be gathered from the consortium members. P6 will extend an invitation to the consortium members to initiate the utilisation of the prototype in the pilot areas under real-world conditions. Additionally, feedback will be gathered to identify further project requirements regarding data categories and data input options. Consortium partners will be able to invite the first public users and stakeholders to download the app and submit observations or data.
The P6 team will continue to work on the development of the app technology and on further fine-tuning and extending the data input options in collaboration with the project's consortium. Additionally, P6 will commence work on the development of project-specific features and the integration of data flows within the project itself, with the objective of providing consortium partners with access to the data via a JSON API, thus enabling the automated transfer of data into repositories. In the pilot areas, national data access to the data administration interface will be provided, and an additional workshop will be held on how to access, manage, and export the data, as well as how to use the integrated communication and user community feature for user engagement, social community building, and science communication/project-to-user dissemination.

A note on “final App”:

The current release version, available to the public via the App Stores for Android and IOS and as the browser-based web application, has reached a final state for release. In addition, a software package, which is also maintained and serviced, is always undergoing further changes, revisions, additions. The app’s data model and data structure is to be further extended and fine-tuned in future revisions of the project's app toolkit as software in general and Citizen Science apps are never a constant state and requirements, research needs or new opportunities for collaborations may arise. P6 will continue to work on the Citizen Science App and develop new functionalities and project-related features, which are integrated into the app toolkit and rolled out via app updates, to fulfill data requirements by the consortium and to extend the quality of the app for both scientists and citizens.

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Appendix 1

Data Protection and Ethics Requirements

This subsection, on 'Data protection and Ethics Requirements', aims to answer some of the most frequently asked questions about data protection law and to clarify the basic principles underlying data protection. This subsection covers the different legal aspects that apply in a data protection context and when they apply. It also aims to explain the need for a 'legal basis' to justify the processing of personal data and to outline the rights that 'data subjects' have and how they can exercise them in the framework of the COSEA app.

1.1 Data Protection Main Concepts

The EFFECTIVE project acknowledges that data protection is a fundamental right, implemented within the Treaties of the European Union: The Treaty on the Functioning of the European Union (TFEU) and the Charter of Fundamental Rights. The European law setting out the new protection of individuals' rights and increasing data controller obligations in the digital era is the General Data Protection Regulation (GDPR). This is the main law that will apply to the COSEA App. The EFFECTIVE Project and specifically, this activity, involves the collection and processing of personal data on a minimized level; and to correctly implement**,** the following definitions will be included within the project's taxonomy as defined in GDPR:

- **Personal data**: "[...] any information relating to an identified or identifiable natural person ('data subject'); and identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.";
- **Data Processing**: "[...] any operation or set of operations which is performed on personal data or on sets of personal data, whether or not by automated means, such as collection, recording, organisation, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction.";
- **Data Controller**: "[...] the natural or legal person, public authority, agency or other body which, alone or jointly with others, determines the purposes and means of the processing of personal data; [...].";
- **Data Processor**: "[...] a natural or legal person, public authority, agency or other body which processes personal data on behalf of the controller; [...]."

1.2 Data protection principles

The GDPR establishes a risk-based approach to data processing and requires data controllers to bear full responsibility for the safety and security of personal data and the protection of individuals' rights in relation to the processing of their personal data. The **EFFECTIVE** project will fully endorse and adopt this approach. In particular, **EFFECTIVE** will strictly adhere to the GDPR framework, which highlights the key principles for collecting and processing data:

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- **Lawfulness, fairness, and transparency**: **COSEA** will only process data for a specific purpose and remain transparent with the users.
- **Purpose Limitations**: **COSEA** will collect and process data for specified and legitimate purposes, following explicit consent from the users. In particular, the specific purposes for which personal data are processed should be explicit and legitimate and determined at the time of the collection of the personal data. However, further processing for archiving purposes in the public interest or scientific research purposes (in accordance with Article 89(1) GDPR) is not considered to be incompatible with the initial purposes.
- **Data Minimisation: COSEA** will limit the amount of data collected and retained where necessary; this requires, in particular, ensuring that the period for which the personal data are stored is limited to a strict mínimum.
- **Data Accuracy: COSEA** enables the users to correct, update and keep the personal data stored accurate and does store it secured safely at industry standard level.
- **Storage Limitation**: Personal data will be kept for as short-term as possible with full control by the user on deletion/erasure; Users can freely choose pseudonyms to protect user identities; Using pseudonyms is officially recommended.
- **Integrity and Confidentiality**: The data processors of the **COSEA** app will protect user data against unlawful processing or loss, using encryption and privacy by design methods.
- **Accountability:** The **COSEA** consortium ensures that all activities comply with ethical principles. This applies both to the use of secondary data and the collection and use of field data.

In the process of technological design, **COSEA** will observe at the same time the principles of both data protection and e-governance. For that purpose, the tool should follow a clear concept with regards to the information required for the functioning of the **COSEA** tool and the compliance with the principles of data minimisation (Art. 5, para. 1, lit. c, GDPR) and purpose limitation (Art. 5, para. 1, lit. b, GDPR).

Privacy and data ethics in COSEA include a no-user-tracking and no-digital-surveillance approach by avoiding third-party listening scripts/analytics or implementation of privacy-unsafe elements from data-harvesting platform for user data monetization. As core principle of the SPOTTERON Citizen Science App Platform, this practice oriented and ethical approach to user data privacy ethics does go beyond the basic requirements of the EU General Data protection Regulation and adds an ethical layer to the COSEA App, that provides a digital safe space for citizen science and use engagement.

In order to do that, the **COSEA** app will take into account that:

- All data collection, processing, storage, sharing, preservation, and archiving will respect ethical research practices and national, EU and international law, including privacy law, and extend to not apply technologies and services, which are built for injecting user surveillance for service provision or data gathering.
- Among the relevant legal and ethical requirements, in the context of **EFFECTIVE** those of privacy and data protection nature are of primordial importance. Every sophisticated information technology system that has the ambition to provide services to natural persons should consider in its very foundation the proper implementation of these notions, in order to guarantee that the quality of the service offered would not compromise individuals' rights, especially in public funded programmes. It is of upmost importance that natural

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persons involved are provided with appropriate safeguards, data protection practises and empowered to exercise their respective rights.

- In order for the **COSEA** system to represent a trustworthy technological tool that is widely used by the target groups, it is of pivotal importance to provide an adequate level of personal data protection to its users and avoid user surveillance by third parties
- The legal definition of consent in its data protection sense is provided for in Art. 4, para. 11, GDPR. As a general rule, it should always be obtained before the processing activity is initiated. In order to be valid, consent must be given freely, be specific, informed and unambiguous.
- Freely given consent must be understood in the sense that the data subject is free to choose and to control the decision whether or not to express consent. If the data subject (or in our case any **COSEA** user) does not have the opportunity to choose whether to share or not their personal data or he/ she is obliged to give consent, then it is presumed that the consent is not freely given.
- Consent may cover more than one data processing operation if these operations are all executed to achieve the same purpose. When the controller must process personal data for different purpose, additional consent must be sought in order for the processing to be lawful.

Finally, the consent must be unambiguous. So that, the data subject must have taken a clear and affirmative action to consent to the particular processing. In terms of COSEA and the creation of a user account on the SPOTTERON Citizen Science App platform, this unambiguous and informed consent is taking place at the registration process via the provided Terms of Use of the Service (https://www.spotteron.net/terms-of-use) and a transparent listing of involved data processing directly in-app in the linked privacy section (https://www.spotteron.net/privacy).

Moreover, the security-oriented approach in designing the tool is a priority for the COSEA app and the underlying platform/Service. The tool will be developed in a way that ensures best possible the trust of all end-users in the security of their information in accordance to industry-standards.. Security (computer security, cybersecurity) is needed to protect the users' data from unauthorized access for viewing, misusing, or altering it. This applies both to data of users and individuals working for organizations as well as the data of the organizations themselves. In terms of roles, a clear separation between "project specific" and "platform specific" aspects for a reliable basis in COSEA. For all platform specific aspects including the processing of user accounts, SPOTTERON acts as "controller", while for "project specific" aspects, the coordinator in representation of the consortium acts as "controller" and have full decision power on data-set ownership of collected observations and recordings.

1.3 Data protection by Design and by Default

The GDPR provides for two crucial concepts for the project: Data Protection By Design and Data Protection By Default. While long recommended as good practice, both principles are enshrined in law under the GDPR (Article 25).

- **Data Protection by design** means embedding data privacy features and data privacy enhancing technologies directly into the design of projects at an early stage. This will help to ensure better and more cost-effective protection for individual data privacy.

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- **Data Protection by default** means that the user service settings (e.g. no automatic opt-ins on customer account pages) must be automatically data protection friendly, and that only data which is necessary for each specific purpose of the processing should be gathered at all. It is linked to the principles of data minimization and purpose limitation.

In the COSEA app, all transfer of sensitive data is protected by state-oft-he-art data encryption (SSL/TLS) by default.

Additional technical organizational measures (TOMs) on the platform include:

- Deletion concepts for project-specific personal data:
  On request, we delete the entire project-specific data-set in the live system within 14 days.

- Deletions are logged in the system with date/time (flag).

- Individual or bulk deletions of data points in the live system can be carried out by the admins/coordinator in the Data Administration Interface. Note: Data in backups are excluded from the immediate deletion procedure according to Art. 5 DSGVO and 32 para. 1 lit. c GDPR.

Measures of implementation of access control:

- Strong password protection with multi-factor authentication incl. app authorization at access on system relevant infrastructure.

- Deployments are located exclusively in the cloud environments with security measures according to industry standards of the cloud hosters and it is ensured that only the necessary services are exposed to the outside.

- All clients with access to relevant systems are protected by hard-drive encryption and firewalls.

- Physical access controls happen on the basis and measures of the cloud hosting providers' data centers.

- Logins to the ICT infrastructure are logged by the system.

- Password policies for project admins: Project-specific access takes place exclusively via provided user accounts for the admin area and are equipped with corresponding passwords. Admin accounts can also change the password independently or upon request after an identity check. Changes to the project-specific data set by admins or users are logged with an extension for this purpose.

Measures of implementation of transfer control of data:

- The transfer of project-specific data (CSV export) is encrypted via SSL/TLS and is only available to the project partner/coordinator after login as admin user. For public open data, an fully anonymized version is optionally possible.

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- It is prohibited to send personal data within the company. Any employee who is authorized to view this data must do so with the appropriate security mechanisms and authentication at the platform's cloud provider.

Implementation of the input control:

- Project-specific personal data can only be entered by registered users. There is a role concept with a distinction between privileged users per project (in-app moderator users with rights to change project-specific data) and project admins (access to the data management interface). For this purpose, there is a clear and strict separation from the system admins, who have access to relevant areas of the infrastructure. Changes to the data set by admins or users are logged with an extension for this purpose. On the infrastructure side, there is an audit log with the cloud provider.

Measures to implement availability control:

- Technical measures are taken on the basis of the data centers of the cloud providers.

- On the system side, there are internal real-time warning systems that warn of failures or irregularities.

Measures to implement the separation requirement:

- The project-specific data can only be viewed in the administration interface by the project admins after logging in and are strictly separated from access by other projects.

Audit of processors with regard to compliance with the data protection principles:

- The platform has standard contractual clauses (SCC) in place with all external project-specific processors. More information and EU legislation on SCC: https://ec.europa.eu/info/law/law-topic/data-protection/international-dimension-data-protection/standard-contractual-clauses-scc_en

Procedures for restoring the availability of project-specific personal data after a physical or technical incident:

- Backups: complete database backups are made daily to provide the ability to quickly restore availability and access to personal data.

- Incident Response Management: Incidents are logged and documented in an internal ticket system. Actions are taken in an appropriate timeframe depending on the severity of the incident.

Substitution arrangements for the IT officers:

- The IT team is well prepared to manage and maintenance the app tool-kit's IT infrastructure and to ensure adequate data protection levels, IT security and availability. If the IT manager is absent, the deputy IT manager can take over his or her duties.

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- Those responsible for IT security are adequately trained and integrated into all company structures that deal with personal data.

Resilience of the systems:

- The cloud provider guarantees the resilience of the systems and services through the infrastructure. Stress tests of the project are carried out exclusively within the framework of the development process on own environments in order not to jeopardize the smooth running at the production level.

Other

- All employees who deal with personal data have been committed to data secrecy and have been trained in the handling of data.

The technical and organizational measures correspond to the current state of technical progress and are appropriate according to the defined protection goals and risk profile.

1.4. Anonymisation

Data will generally be anonymous if they cannot be used to identify a person by all means likely reasonably to be used (Article 29 Working Party on Data Protection, 2007, 2014, 2015). Assessment of all the means reasonably likely to be used must consider not only the data on its own but also the possibility of combination with other accessible data, including by third parties.

For the purposes of the **COSEA** app:

* User-control and full ownership of personal data by user: App users can independently from the project's team delete all personal information stored and anonymize the user account in the app's settings panel. This process is instant and allows full control and ownership by the user over personal data.

* Pseudonymization in user account creation: the COSEA app clearly supports and recommends pseudonyms at account creation for user input of usernames.

* Data export/Open data: when observational data records are provided as open data under the OpenDatabase License OdbL 1.0 as data exports, all user account related data fields are removed.

Anonymized data refers to data where direct and indirect personal identifiers have been removed. Anonymized data poses only a minimal risk of individual re-identification, in considering the context of the data's use and the means reasonably likely to be used to perform re-identification.

1.5. Participants Consent

Consent as a legal basis would be applicable in the scope of the **COSEA** system, in particular when a user would like to use one of the data or services available. It is especially relevant when processing special categories of data. The procedures for valid consent collection will be integrated in the system itself, where the provision of each specific services requires a separate consent by the

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respective user. The platform's system is designed in a way that allows the users to easily withdraw their consent including the instant deletion of the user account and personal data The informed consent for user account creation and services provision is provided at account registration. Terms of Use and a detailed privacy policy are in place to enabling informed capacity. Terms of Use of the Service: https://www.spotteron.net/terms-of-use - Privacy policy: https://www.spotteron.net/privacy

The **COSEA** tool is developed in a way that enables the users to input their data only once for account creation with editing capeabilities and to permit its use by the different groups identified during the implementation of the project. Furthermore, the **COSEA** tool should be developed in a transparent way; it should permit persons to know how their information is used and to whom it is disclosed. CTN and SPOTTERON work together with the consortium to update this information in the course of the project and include it in the app's information section if changed/updated. Additionally, the app allows users to get easy access to their processed data in the app's settings panel with instant export functionalities for a machine-readable copy of all data stored and processed in the COSEA project.

1.6. Ethical aspects in software

Design and usability are intrinsically linked. For example, in relation to the design of a user interface; poor design will render a system, application or device difficult and complicated to use, thereby hindering a successful deployment and uptake of the product. The SPOTTERON Citizen Science App platform provides a reliable and already-in-broad-use framework for quality design and usability, and data processing ethics. The first step in ethical computing is to not sell user data indirectly for the exchange for services, that are provided in form of a surveillance business model. Examples include analytic services or integrated social media buttons, that all are designed completely track user's behavior on the internet. The COSEA app and the SPOTTERON platform is consciously avoiding such harm to visitors and users of the software. Furthermore a defined approach for quality, performance and app safety results in a stable environment for user-driven and community-oriented participatory app platform. For the digital-social platform aspects included in the app, is is crucial to build infrastructure with an European (EU) hosting and service provision focus. SPOTTERON's ICT (Internet & Communication Tech.) infrastructure provides a stable & reliable environment for running interactive, community-driven Citizen Science applications & tools with transparent and strong digital privacy ethics, SSL/TLS encryption, and a focus on EU-based service providers. Service ethics also include not utilize indirect slavery e.g. if AI training tasks are included in projects. An integrated offline mode for both data submissions and map area download enables the use of the app independent from current connectivity in slow internet or no internet situations.

For data moderation and community content moderation, a data administration interface stands ready for the consortium with live data management, including also in-app options for users to report comments and data spots to the admins. In the app's frontend user interface, users can freely decide to block/unblock content and other users to have an instant option for personal preference to have a safe and positive community experience in case of an abuse of the Service by another user. Incidents can be reported additionally via the support channels of the platform.

In terms of design, the COSEA app has a clear icon-supported navigation to best-possible be inclusive for all users. In the upcoming phased of the project, the app will be translated to all pilot area languages with the support of the native-speaking consortium members to enable language accessibility. Accessibility functions on smartphones built into the operating system (Android/IOS)

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can be used to support app usage, readability and more. In the future additional feature development can further support accessibility if additional needs emerge during the project. The apps are openly available on the app stores without cost barriers. For users without mobile devices, the web-application of COSEA allows participation even without smartphone or tablet simply via a browser. This multilevel participation availability reduces entry barriers. For participation, users can choose a user account type, which includes also options for not specified user types and also group accounts. These group accounts enable the use of COSEA on various devices simultaneously without direct identifiable personal data processed of single users. For age-group diversity in the project, the SPOTTERON platform already support parental/guardian consent functionalities with dynamic country-based age level configuration.

SPOTTERON utilizes a modular approach, which enables extending the platform's feature set with new functionalities, developed in projects. New features and functionalities are shared with all other projects on the platform without any extra development costs and can be used by new projects. By that principle, each project's needs and requirements extend the power of digital Citizen Science further, and by sharing developed functionalities, interactive mobile digital Citizen Science is strengthened both for participants and researchers. This digital collaborative "project ecosystem" enables all projects to use advanced features right from the start and empowers the Citizen Science Apps to build on each other to a level which one single project could never reach alone.

With the platforms established and practice-oriented approach on personal data protection and data ethics, the COSEA app is able to run on a user-respecting system with enhanced data privacy and ethics beyond basic requirements by GDPR. Without user tracking/user surveillance. The platform enables users to have full control about their personal data while offering state-of-the-art software as a service (SaaS) for interactive Citizen Science and user engagement with a defined focus on EU based solutions, extended functionality and design quality. Users on the platform are not treated as "products" or their data and their online behavior as payment alternatives for the "free" use of external software tools. With a clear policy for no-user-tracking/no-user-surveillance, COSEA provides a safe digital online space with integrated communication and community tools, that are built without user data monetization or tracking for both scientists, stakeholders and participants alike.

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