Co-designed Citizen Observatories Services for the EOS-Cloud

H2020 programme: Research and Innovation action

MOBIS Deliverable 4.5

29 dec 2022, Version 0.9

EUROPEAN COMMISSION

Project funded by the European Commission within the Horizon 2020 Programme (2014-2020)

Grant Agreement No.	863463

Type		
R	Document, report excluding the periodic and final reports	
DEM	Demonstrator, pilot, prototype, plan designs	
DEC	Websites, patents filing, press & media actions, videos, photos, etc.	
SOF	Software, technical diagrams, etc.	X
OTHER	Flyers, etc.	

Dissemination level		
PU	Public, fully open.	X
CO	Confidential, restricted under conditions set out in Model Grant Agreement	
CI	Classified	

Revision history

R#	Date	Description/Reason of change	Deliverable contributors
R0.1	28-02-2022	Initial document	Norbert Schmidt / Joep van der Heiden
R0.8	28-12-2022	Minor revisions, added multilanguage	Norbert Schmidt
R0.9	29-12-2022	For review	Norbert Schmidt / Review: T.B.A.
R1.0	03-01-2022	Minor revisions	Karen Soacha

Authors

NSC: Norbert Schmidt JH: Joep van der Heiden

Citation

Cos4Cloud consortium (2022). Schmidt, N. Heiden, J.. MOBIS (4.5)

Licence

Table of contents

Table of contents 3

Introduction 4

Executive Summary 4

MOBIS DEVELOPMENT 6

MOBIS REQUIREMENTS 6
- Hardware and software 6
- Front end 6

MOBIS EXAMPLE / SAND BOX BACK END 6
- Parse mobile backend 7
  - Mobis Dashboard 7
- Interoperability: OGC SensorThings API 7
  - Interoperability: Authenix integration 8

MOBIS FRAMEWORK (Front end) 8
- Introduction 8
- Main features 9
- Supported COS4CLOUD CO'S 9

MOBIS use cases 12
- Seeing stars leiden 12
- Run4Science 12
- Mobis demonstration app 15
  - Mobis App screenshots. 15

Appendices 20
- MOBIS Infographic 20
- Codesign Digest tables 21

Introduction

Introducing MOBIS, the ultimate tool for citizen science app creators. The MOBIS software development kit includes a robust and open sourced back end, front end software, and an example app using popular development tools.

The service is designed to bring together a wide range of citizen observatories, from biodiversity to environmental, and provide common functions such as single sign on and interoperability standards.

With Mobis, you'll have everything you need to create a successful citizen science app. Our service is targeted towards developers looking to create innovative and impactful citizen science apps. Whether you're a seasoned developer or new to the field, Mobis is the perfect tool to help you achieve your goals.

Executive Summary

D4.5 (MOBIS) Is a software framework that allows developers and CO owners to create integrative citizen science applications. Citizen science involves the participation of members of the general public in scientific research, often through the use of technology.

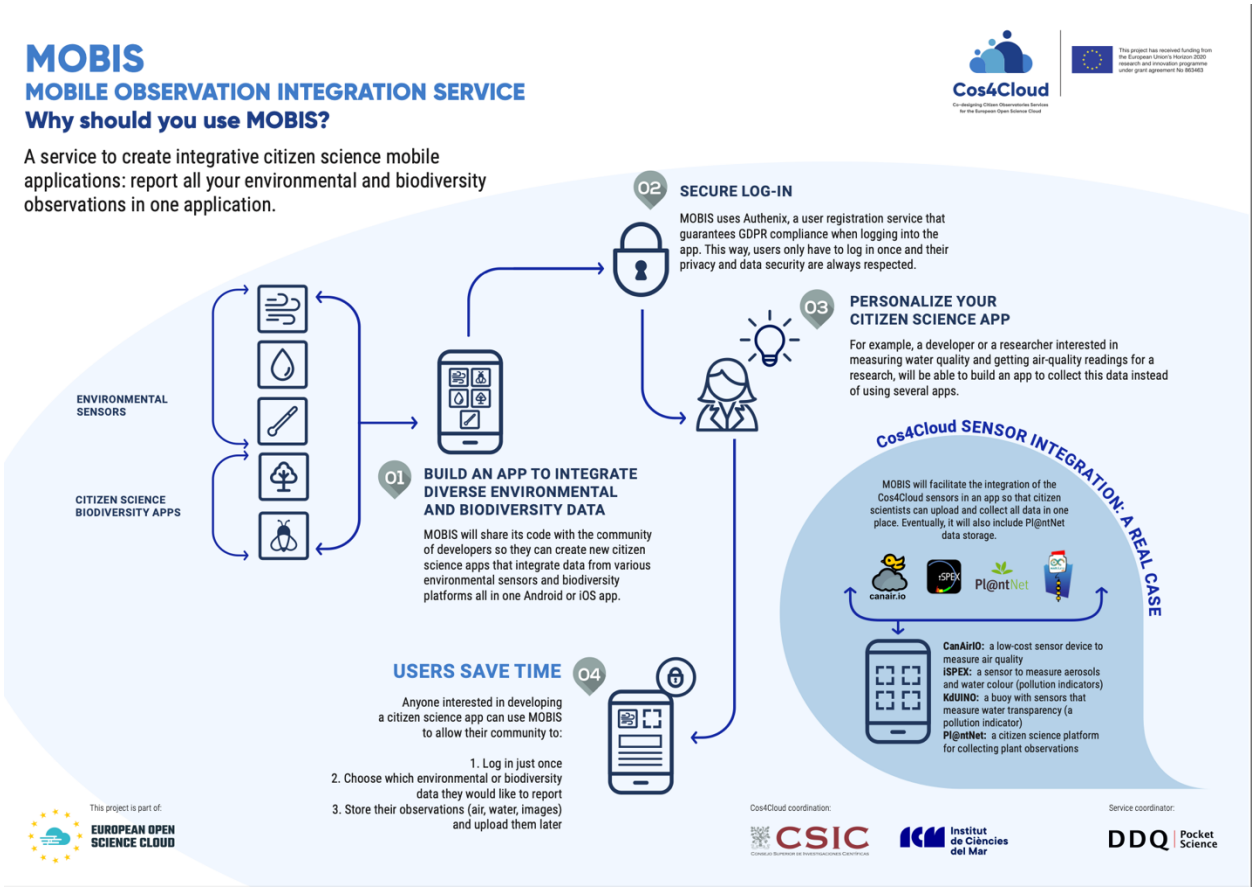
The Mobis Framework enables developers to build applications that allow citizens to contribute data, observations, and other information to scientific research projects in a seamless and intuitive manner.

One of the key benefits of the Mobis Framework is that it is built on top of the well known Ionic Framework along with the PARSE back end server, which is a popular and widely-used framework for building mobile applications. This means that developers can leverage the power and flexibility of the Ionic Framework to create robust and feature-rich citizen science applications that can be used on a variety of devices, including smartphones and tablets.

In addition to its built-in support for the Ionic Framework, the Mobis Framework also includes a number of other features and tools that make it easy for developers to create integrative citizen science applications. We integrated Cos4Cloud observatories for

example, Canair.io CO2 and PM25, iSPEX and PlantNet are in. All the code is open source and documented.
More information and full source code for example apps are available in the following repository: https://github.com/DDQ-NL/MOBIS_PUBLIC

The MOBIS service is available through the EOSC marketplace and our landing page: https://marketplace.eosc-portal.eu/services/mobis-mobile-observation-integration-service



MOBIS DEVELOPMENT

Mobis can be separated in two parts:MOBIS back end and MOBIS framework.

- Server side Mobis server: the mobile Back end As a Service (BAAS)
- Client side (front end) framework: a set of scripts and plugins for generating citizen science apps with one codebase

-

MOBIS REQUIREMENTS

Back end

Hardware and software

For the demonstration back end we use an Ubuntu server with NodeJS, Parse server, Express and Docker CE for the Sensor Things API

A running instance of Parse server (www. parseplatform.org). Back4App provides a possibility to create servers on the fly, but you can always setup your own using the guides on https://www.parseplatform.org

Front end

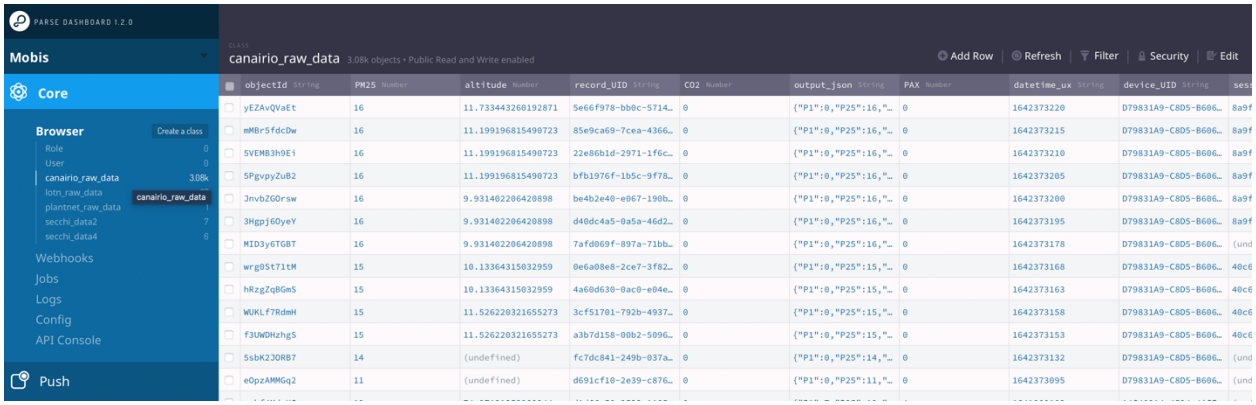
Ionic is a free, open-source framework for building mobile applications with web technologies such as HTML, CSS, and JavaScript. It allows developers to build cross-platform mobile apps for iOS, Android, and the web with a single codebase. MOBIS uses the Ionic framework to develop the front-end of the mobile application, which is then integrated with sample MOBIS plugins such as iSPEX, Mini Secchi, Canair.io, and PlantNet. The code for the MOBIS is available on GitHub and can be used to generate apps for iOS, Android, and the web (limited to Google Chrome).
The code is available and maintained on https://github.com/DDQ-NL/MOBIS_PUBLIC

MOBIS TESTING ENVIRONMENT

The MOBIS testing server resides on the EGI (IFCA) and consists of an Ubuntu Virtual Machine with Parse Server as the mobile back end and MongoDB for data storage. It also hosts a Fraunhofer Sensor Things API instance.

Parse mobile backend

All data are stored in the MOBIS parse back end. Parse is an open source framework. It can be accessed trough REST/JSON calls on this endpoint:
https://mobis.pocket.science/parse/
For user convenience we have a sample dashboard to look up data:



Interoperability: OGC SensorThings API

The OGC SensorThings API provides an open, geospatial-enabled and unified way to interconnect the Internet of Things (IoT) devices, data, and applications over the Web. It is less used in the biodiversity domain so far, but it has the advantage of making biodiversity data more interoperable with other types of geo-spatial data (e.g. air quality measurements, sound environment measurements and weather sensors).

The API is accessible through the following end-point:

https://mobis.pocket.science/sta/

We are still experimenting with sta plus, because of performance issues we keep offering V1.1

Example sta record (Pm2.5) coming from a canair.io device

*(Note that the server mentioned here is our own development server, not the mobis one)

Interoperability: Authenix integration

We have implemented generic OAUTH2/PKCE support for our mobile back end (Google/Apple tokens). We decided to integrate with Authenix on the server-side to facilitate secure login and ensure interoperability with this COS4CLOUD service.

Design

We provided an app icon, styling and theming are not taken into consideration, but it is relatively easy to implement using the ionic framework css and resourcing.

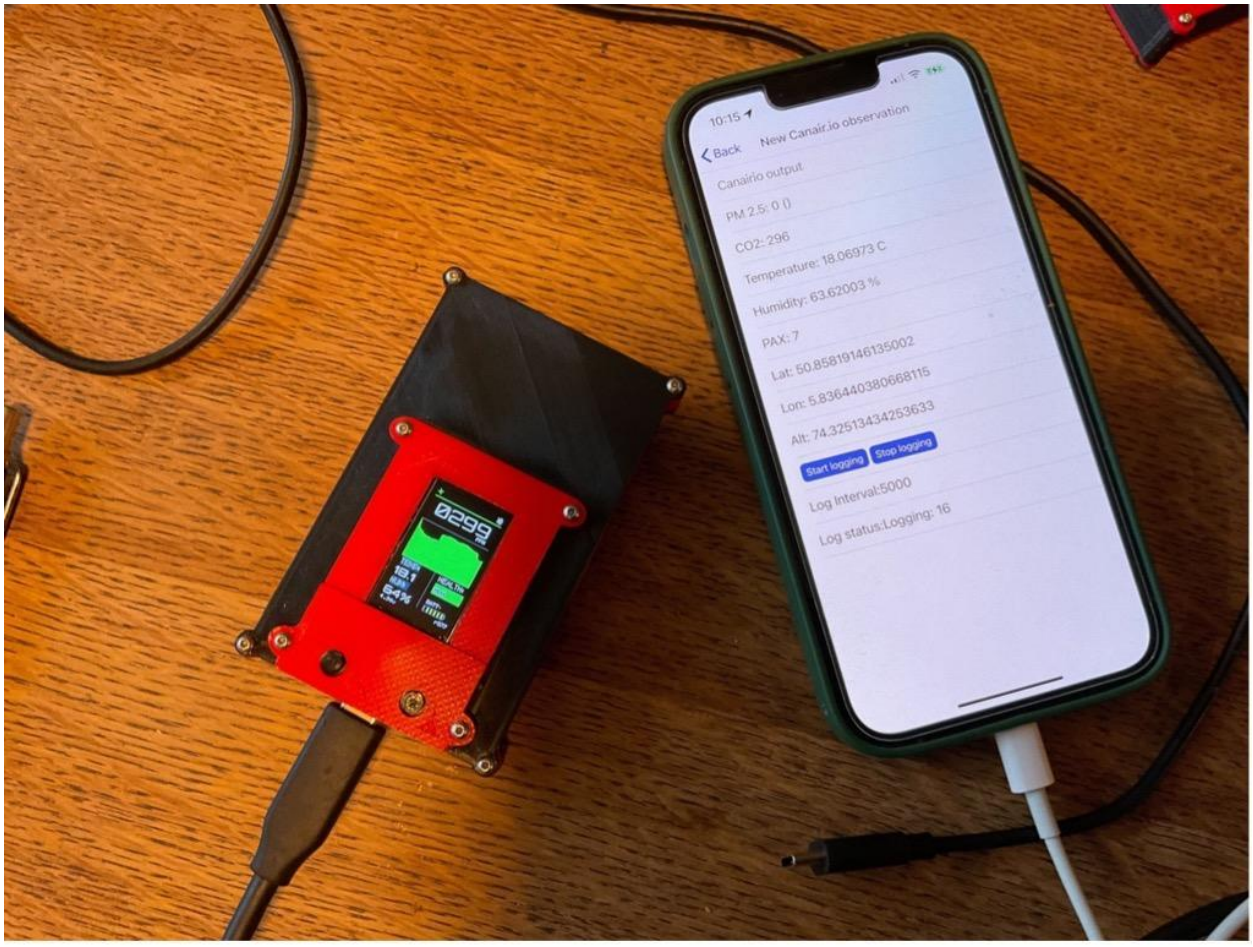
Implementation

User authentication (Oauth2/Email/Google/Apple sign on)

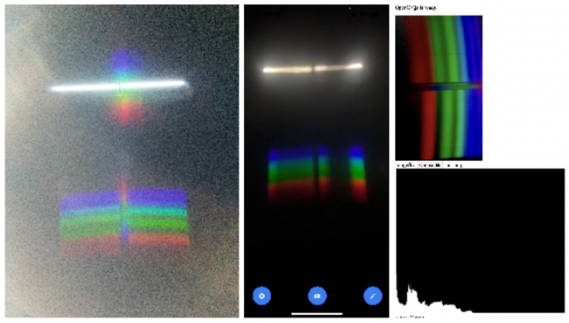
Push notifications
Back end connectivity
Offline support/sync
Geolocation
Multilingual

Supported COS4CLOUD CO'S

From left to right: Pl@ntNet, Mini Sechi, Canair.io

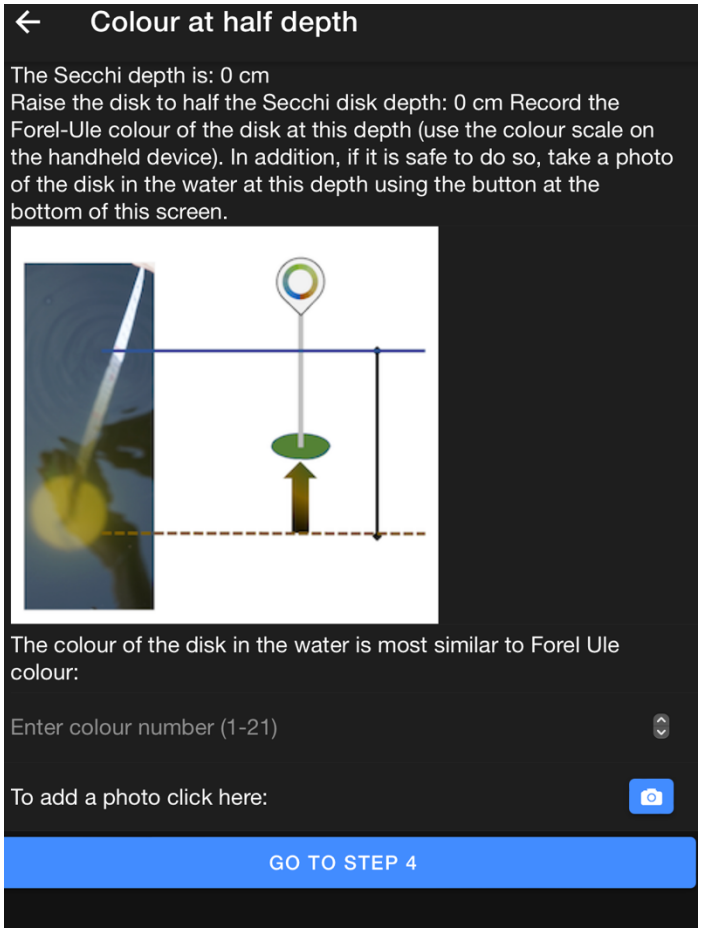


iSPEX water



d + Write	90.07	Fri Sep 23 2022 04…	(undefined)
d + Write	89.01	Wed Sep 07 2022 12…	50.8581154960645

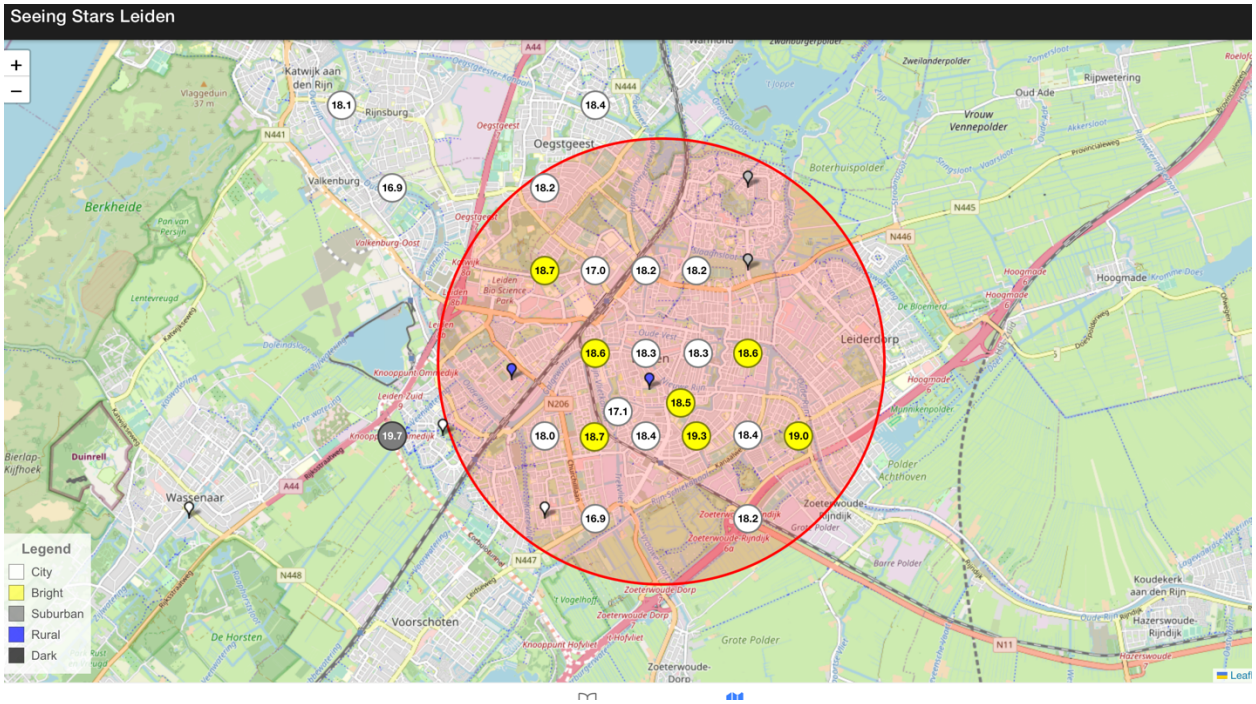
Mini Secchi (Note: this is a CO outside COS4CLOUD, but a nice addition for environmental monitoring)



MOBIS use cases

Seeing stars leiden

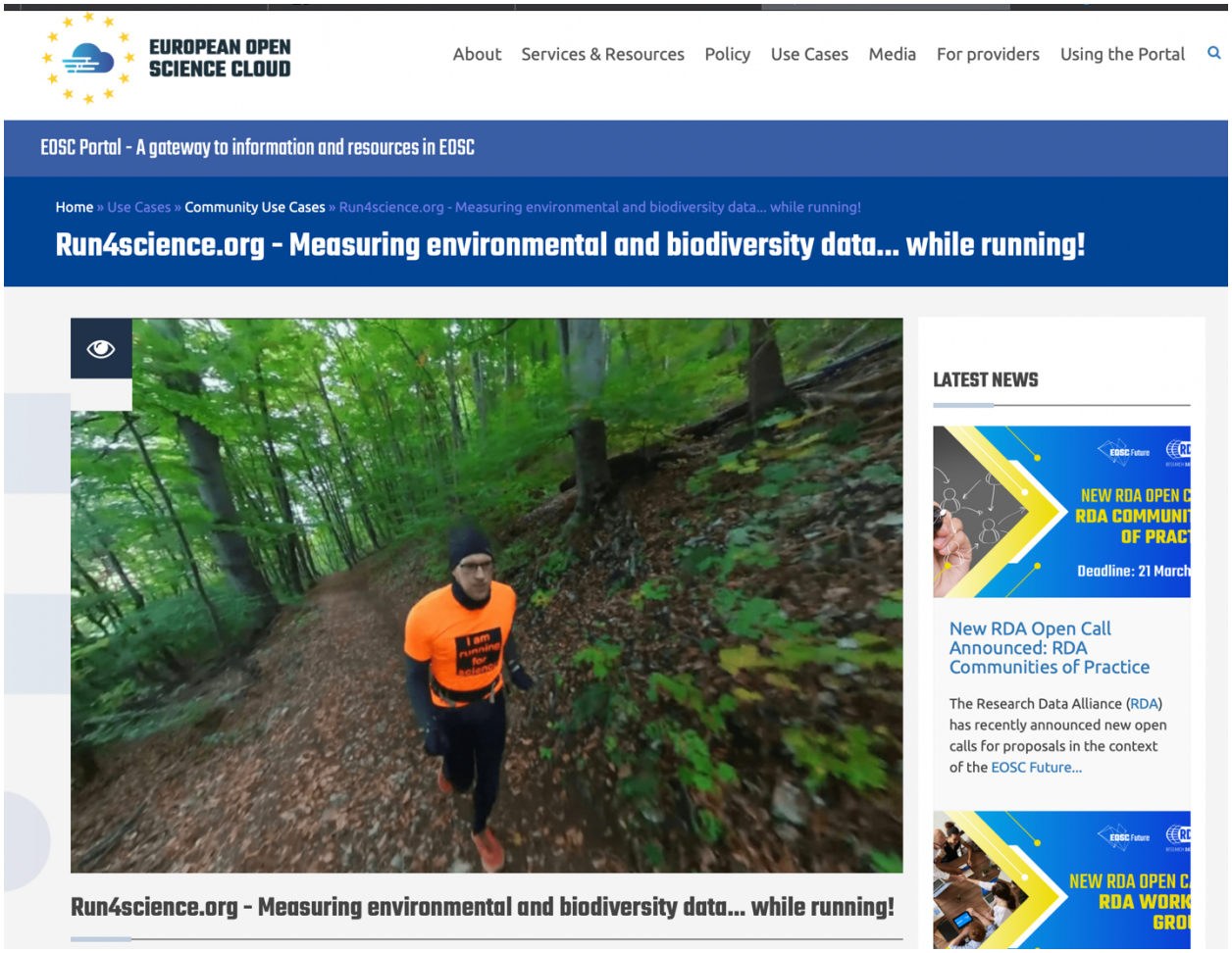
We combined data from two apps recording light pollution at the time all the city lights went out (on purpose) and collected it trough the MOBIS back end.



Run4Science

To demonstrate MOBIS we took a few of the supported sensors (Mini Secchi, Plant@Net, Canair.io) and shot a video showing our colleague Joep running and measuring. Results are available trough the Sensor Things API.
https://youtu.be/UFmR-my1fZM

Run4Science / MOBIS in practice! Doing multiple o...
Share
MOBIS
use cases
Watch on YouTube
DDQ Pocket Science


EUROPEAN OPEN SCIENCE CLOUD
About
Services & Resources
Policy
Use Cases
Media
For providers
Using the Portal
EOSC Portal - A gateway to information and resources in EOSC
Home » Use Cases » Community Use Cases » Run4science.org - Measuring environmental and biodiversity data... while running!
Run4science.org - Measuring environmental and biodiversity data... while running!
I am running for science
Run4science.org - Measuring environmental and biodiversity data... while running!
LATEST NEWS
Deadline: 21 March
New RDA Open Call Announced: RDA Communities of Practice
The Research Data Alliance (RDA) has recently announced new open calls for proposals in the context of the EOSC Future...

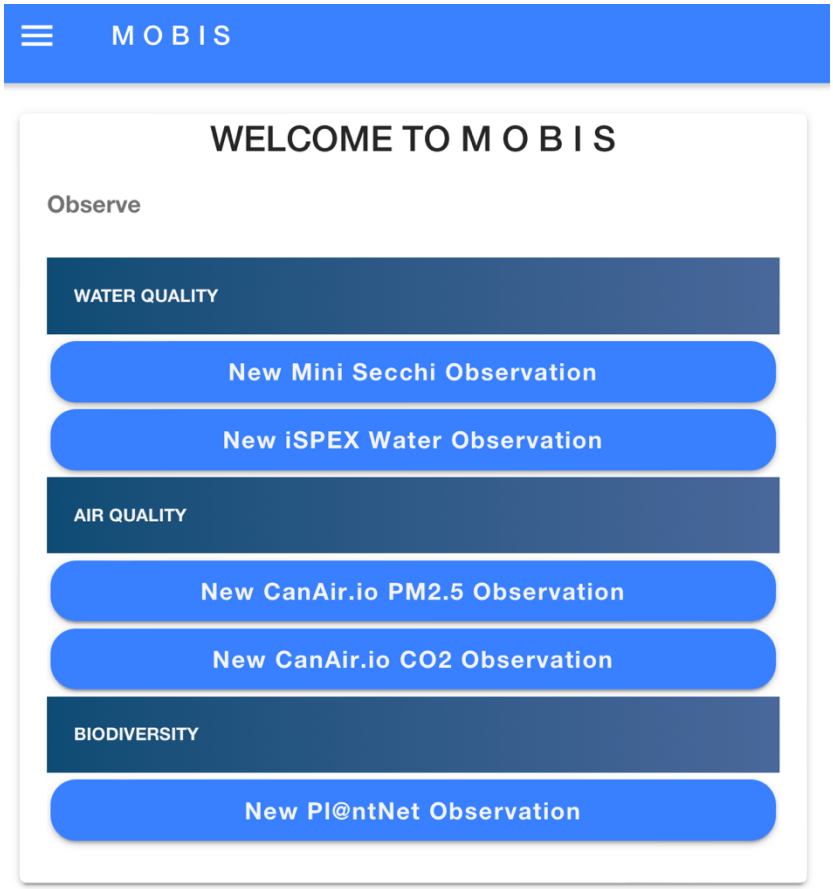
Mobis demonstration app

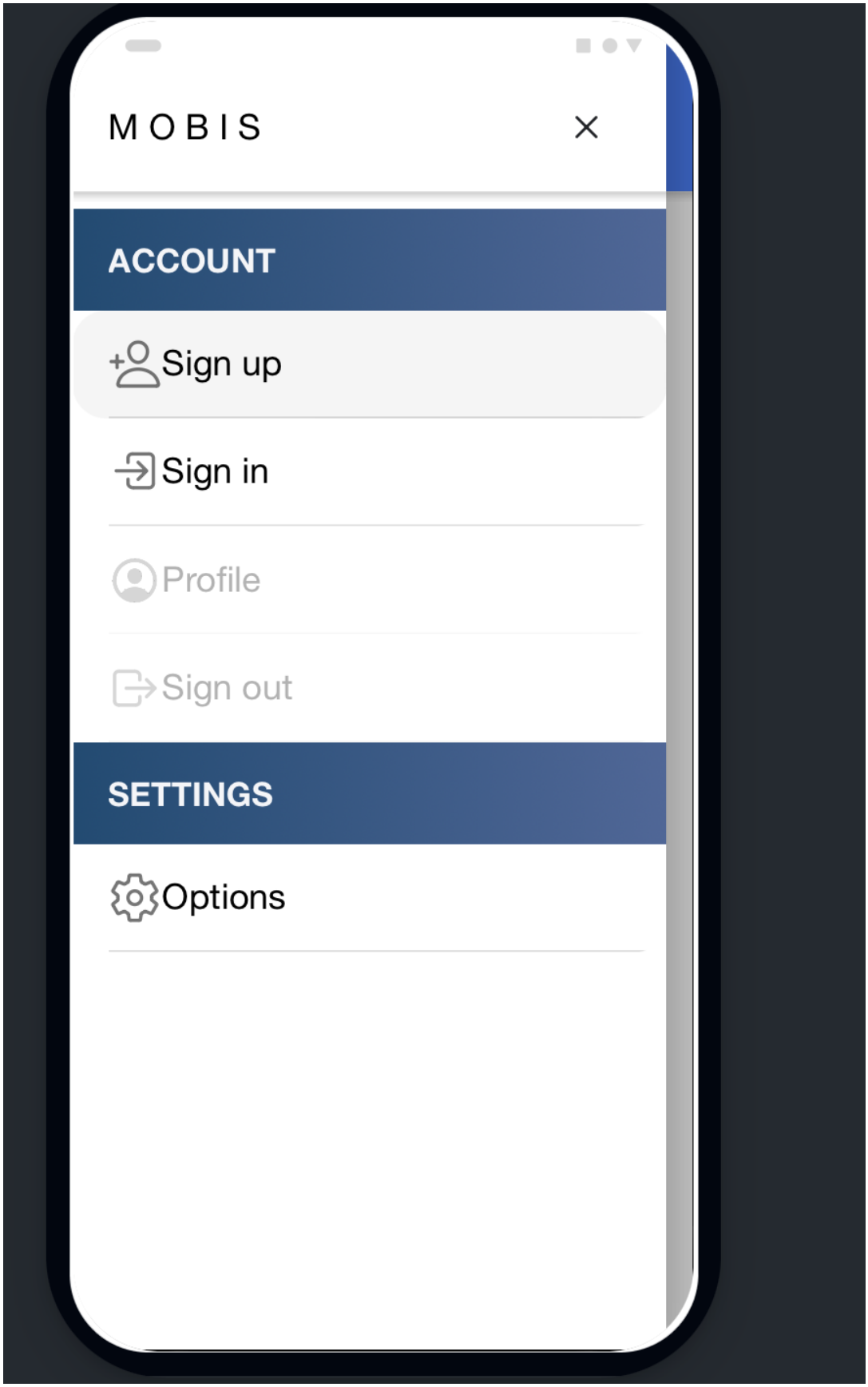
Although not a deliverable the mobis app integrates all these plugins. At the time of writing, we are integrating two environmental and one biodiversity CO's.

Mobis App screenshots.

The (basic) mobis app combines the Mobis plugins and will provide a single sign on in later versions as well as a nice map interface for user feedback. Note that the screenshots here show the iOS app, but we have an Android version available too.

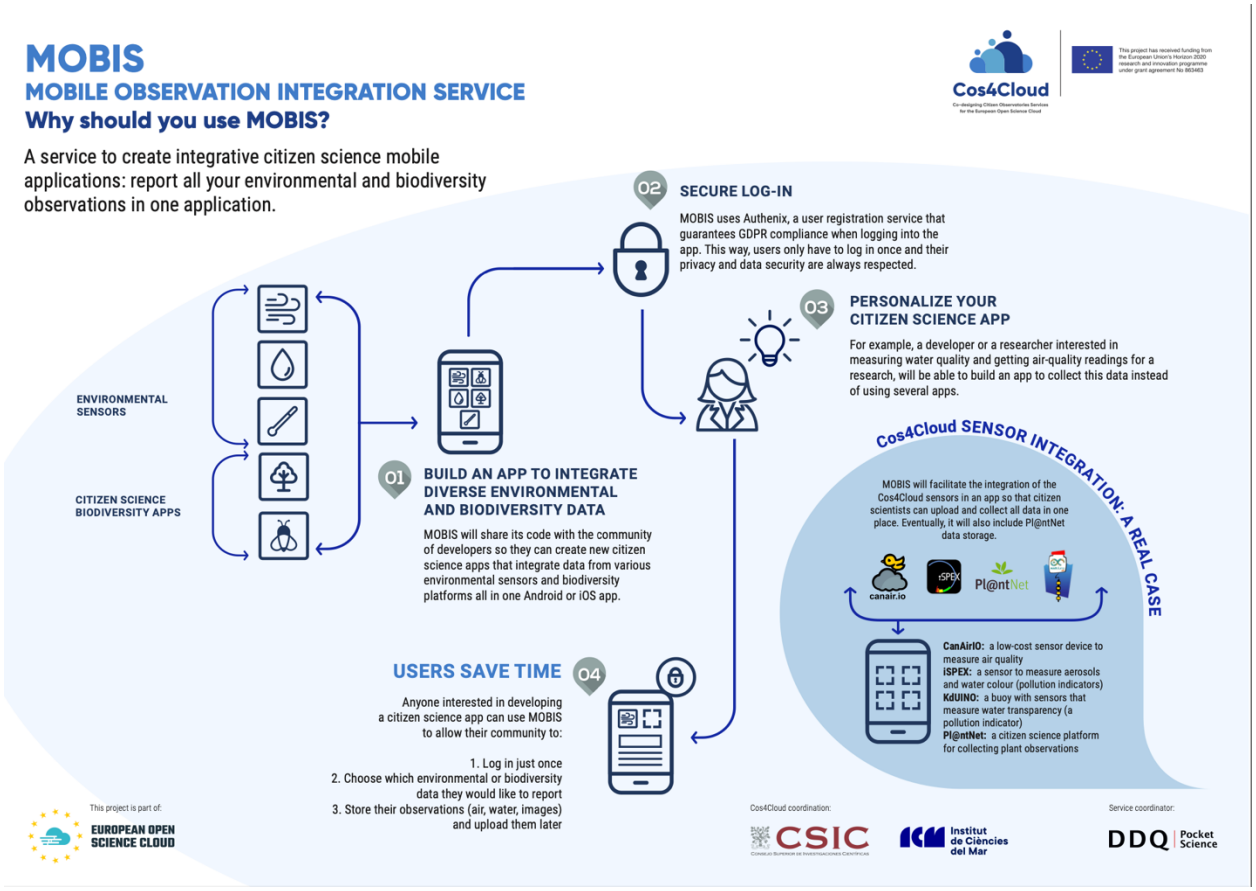
12:03
TestFlight
Spectacle
MiniSecchi
Mail
mobisapp


MOBIS
WELCOME TO M O B I S
Observe
WATER QUALITY
New Mini Secchi Observation
New iSPEX Water Observation
AIR QUALITY
New CanAir.io PM2.5 Observation
New CanAir.io CO2 Observation
BIODIVERSITY
New Pl@ntNet Observation


MOBIS
ACCOUNT
Sign up
Sign in
Profile
Sign out
SETTINGS
Options

Appendices

MOBIS Infographic



Codesign Digest tables

MOBIS co-design digests
Short description of expected content:

- User's input: Short description of the user's feedback
- Description (optional): More detailed description (max. 3 sentences)
- Relevance: Determined priority (high, medium, low)
- Decision: To be implemented?
- Status: Development Status
- Comment: e.g. why not implemented?

Workshop details		
Link to PDF Report	https://confluence.cos4cloud-eosc.eu/download/attachments/23888073/210317_Report_WS1_MOBIS.pdf?api=v2	
Link to online interactive boards	1st workshop Group A https://miro.com/app/board/o9J_lSzLWEU=/ Group B https://miro.com/app/board/o9J_lQFEurM	2nd workshop Group A https://miro.com/app/board/o9J_lICUJoo=/ Groups B&C (first part separately, second part together in B) https://miro.com/app/board/o9J_lICSGoc=/ https://miro.com/app/board/o9J_lICS1Qk=/

Output					
User's input	Description	Relevance (low, medium, high, very high)	Decision	Status	Comment

Systematic sampling protocol	Be able to define measurements protocols (visual guidelines)	Medium	Measurement protocols are defined in collaboration for each data set / sensor with the scientists	On demand (in use for ongoing projects)	Users make correct measurements
Customization	Define the parameters I want to measure (by the volunteers) Make custom and/or new projects, select sensors from existing pool.	Very high	Scientists decide which data sources are selected (not the end users), however in the future a custom/free app where users select from a list of sensor options could exist	Available MOBIS offers far going customization, from light pollution to black hole detection. It can accomodate completely new Citizen Science requests	MOBIS offers a base set of functionalities (data storage, login, data visualization) on top of that adding customization for project specific requests is easy.

Single source of truth	Have one location which contains the correct and most recent data	High/Low Depending on the needs of customization	At this point data is still largely stored in multiple locations. Needs agreement for use	Available Can be used in MOBIS	From a data management view this is very complex. At this point the data is still stored in the databases for each individual measurement/sensor project. However, for MOBIS we have created a new fast database which can combine all types so MOBIS CAN be used for this purpose (if the various data source owners agree to use MOBIS as SSoT).
Data quality module	Possibility for users to review their data	Low	Desired functionality	Available We offer a data review and simple filtering table	Data is also grouped by location on a map, where outliers can be easily identified. Data offered

			rules to account for the lack of a standard.	currently lacking	
Open source	Code is available for review and inspection so it's not a black box	High	Desired functionality	Planned Delivered in December 2022 on Github	From the EU funding point of view MOBIS should be open source to make it easy for other people to benefit from what was developed
Opportunities: community contribution, making the project a reference		Very high		Planned Every new campaign is planned to include MOBIS	We expect that as data sources are combined into MOBIS it might become a reference method or service in the future
Multilanguage	Offer multiple language support so the application can be used across the world.	Very high	Desired functionality	Done	Some CS projects have suffered from not having multiple language support. Now

					possible to translate to any language
Privacy	Allow users to contribute while respecting their privacy and offer privacy related options	High	Desired functionality	Available User has the option how they will login and IF they share private information with us. Log in and out can be done anonymously	By using existing authentication providers and offering an anonymous login we feel the privacy requirement has been fulfilled. When Authenix is ready for mobile, it will be integrated into MOBIS
Acknowledgment / reward	Stimulate end users to contribute more/better by giving them potential rewards	Low	Optional functionality Facilitated by project leaders.	In Progress We are still developing a user ranking system but struggle with the requirements from the Science	Based on the project, users can be acknowledged, become co-author or get rewards (travel). To be done in the future

				leaders, as they usually don't know themselves when the citiezen	
Save observations without internet connection	Allow users to contribute anywhere they are on the globe. Store the measurements on the mobile device first and upload later when internet connection is restored.	Very high	Desired functionality	Test complete Need to be built into service	Offline functionality is currently being tested on marine ships. It should work as expected, however the final version/functionality is not built into the service (yet)
Ability to provide feedback to users	Engage them, improve the way users collect data if we detect any error	Very high	Desired functionality	In Progress Sending push notification is in development right now	
Interactivity	Possibility to interact between citizen science experts, other citizen scientists, external people and society in general	Low	Not developed.	N/A Scientists can use MOBIS	Interaction is not that evident. What is made

					throug deskboard
Potential for future extensibility	MOBIS started out with a selection of sensors/data sources, this should be possible to expand	High	Desired functionality	Available MOBIS can be (quite) easily adapted to include new data sources	Being able to make custom projects, or improve projects and CS measurements as more Observatories or sensors improvements become available to come to new conclusions
Many different types of observations are supported (image, text, value, etc.)	Several measurements options in the same app (air quality, biodiversity).	Very high	Desired functionality	Available MOBIS offers support for images, plain text, XML, JSON	At this point MOBIS is not the limiting factor
Possibility to combine heterogeneous data in a single project	Multiple Citizen Science Observatories and source data can be stored in 1 single (big) project	High	At this point we still query each data source individually with custom	On hold due to dependency This data storage/field standard is	We have prepared the MOBIS backend to facilitate this single project nature. Once agreement is reached it is ready for use

			We feel that existing platforms like forums, social media work better for this.	for outreach, for rewarding users, and involving users.	available in the app is usually only scratching the surface of the science. So while users might be engaged and feel that they are experts for the part they are contributing, what happens after that is much more nuanced, and complicated.
Metadata and related information	See the associated information to the data available in the mobile app like: methodological approach, context of the project	High	We don't feel that the app should be the location where this is presented. The science leader can elaborate on this at a given	Completed	Metadata of measurements is stored in the database, as localization information is essential for CS data of course

			location of their choice (like a project website)		
Manual and guidelines	Nice tutorial to use the app, with short and useful information, ideally some examples	Low	Desired functionality	On Demand Based on science leader requirements	This is where an app really shines. There will be a demonstration app of MOBIS

Will DDQ use co-design methodologies? Yes, it gives a lot of useful information.
MOBIS (1-10) how co-designed the service was? The co-design sessions led to MOBIS, so 9.

Any future that co-designed helped to develop? Most of them, for example, we included the end-users point of views.

Seeing Stars Leiden: 50-60 people continue measuring. 150 people participated . Validation more than testing, no user inputs directly.

Plankton campaign: they're validating iSPEX, but they’re using MOBIS backend. The event is taking place this year in ? They’re taking measurements with spectrometer (iSPEX) - validation campaign - MOBIS will store these data (not now, once they have internet connexion)
Offline collection that will be uploaded to MOBIS backend.

In the future CanAirIO and schools will promote it...