DIONE: an integrated EO-based toolbox for modernizing CAP area-based compliance checks and assessing respective environmental impact

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No.870378 .

DIONE FACTS & FIGURES

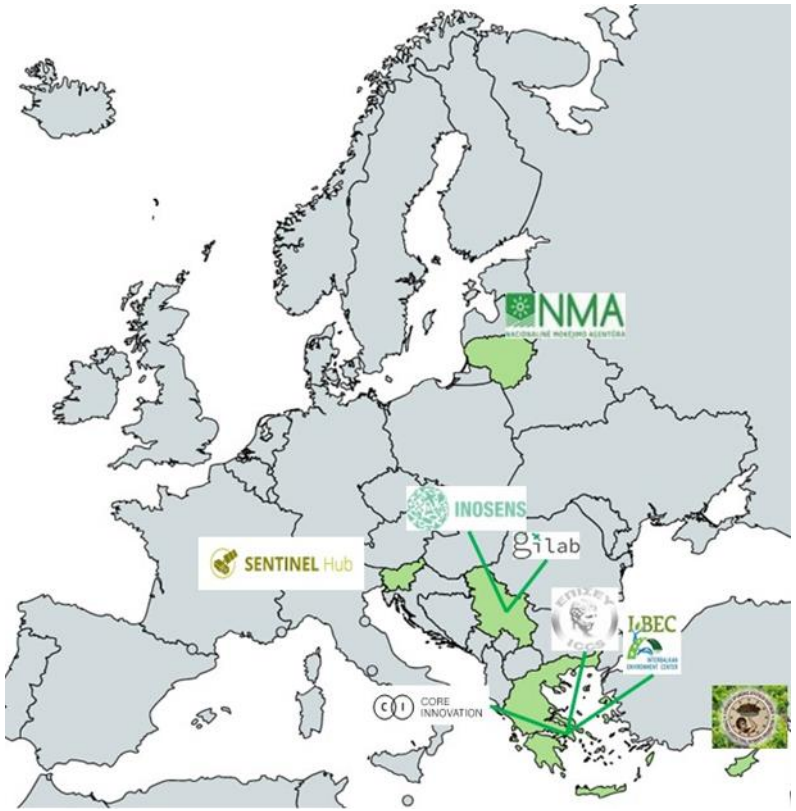
Implementing an integrated EO-based toolbox for modernising CAP area-based compliance checks and assessing respective environmental impact

8 partners from 5 countries

- Institute of Communication and Computer Systems (Project Coordinator)
- 2 Paying agencies (NPA (Lithuania), CAPO (Cyprus))
- 4 SMEs (SINERGISE, GILAB, CORE, INOSENS) with orientation to EO, ICT fields & agriculture domain
- 2 Research institutes (ICCS, i-BEC)

Duration: 30 months (01/2020 - 06/2022)

EU funding: 1,999,837€

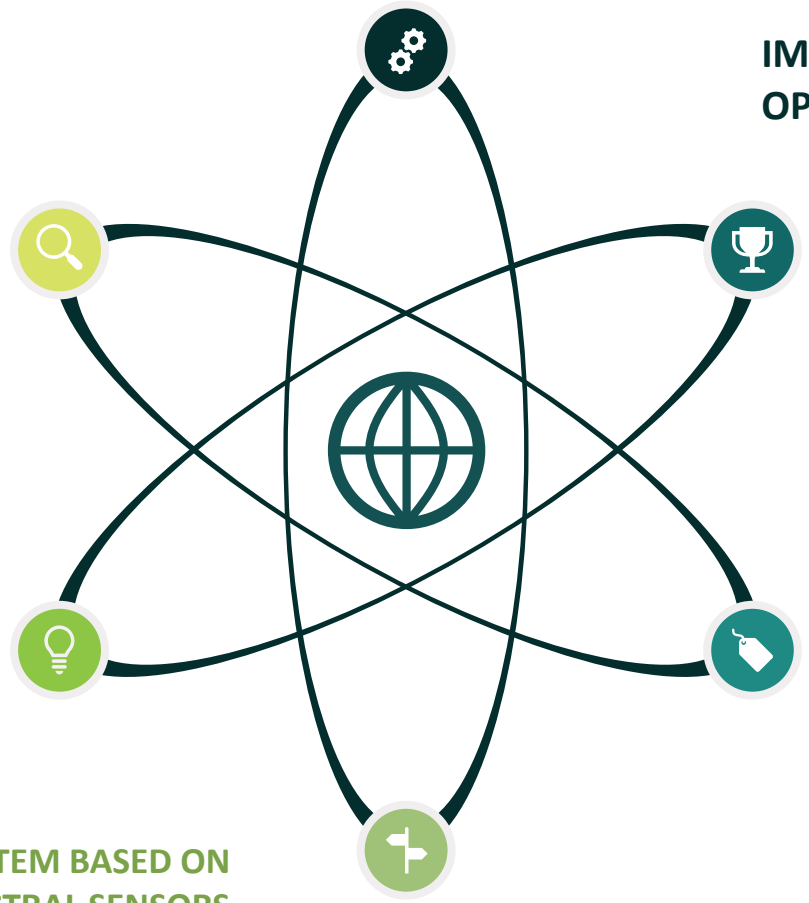


DIONE OBJECTIVES

BUILDING EO-BASED SYSTEM FOR THE AUTOMATED MONITORING OF GREEN DIRECT PAYMENTS

DEVELOP AND DEMONSTRATE A - COMPLEMENTARY TO THE EO DATA- SYSTEM OF GROUND-BASED GEO-TAGGED PHOTOS

IMPLEMENT A LOW-COST SYSTEM BASED ON SPECTRAL SENSORS

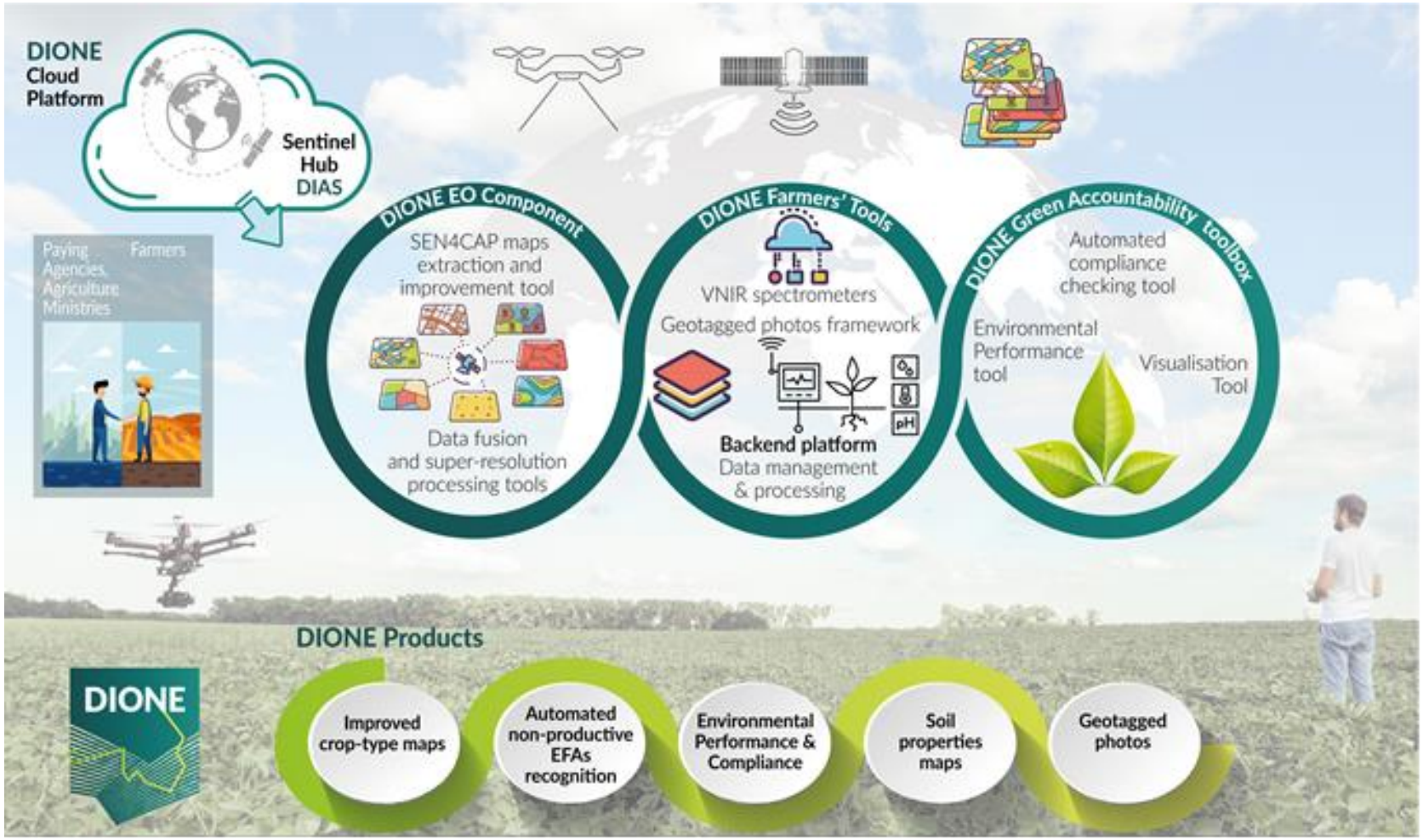


IMPROVE RESOLUTION OF FREE AND OPEN SENTINEL DATA

INTEGRATE THE RESULTS INTO DIONE COMPLIANCE MONITORING TOOL

DESIGN AND IMPLEMENT AN ENVIRONMENTAL PERFORMANCE TOOL

DIONE CONCEPT

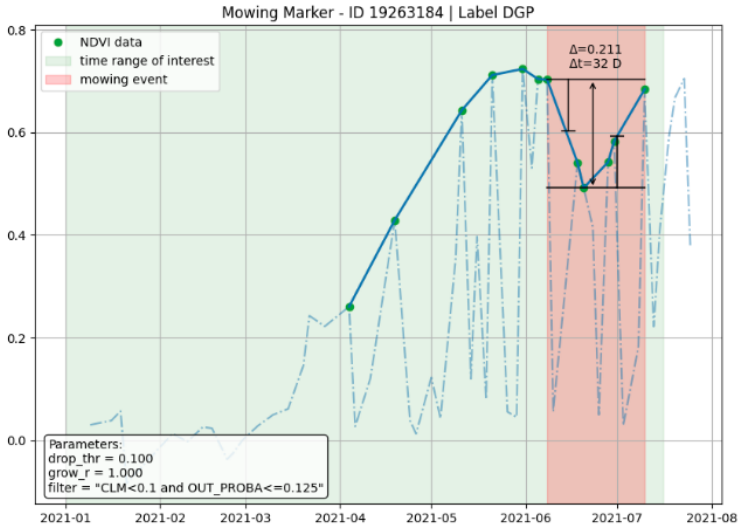


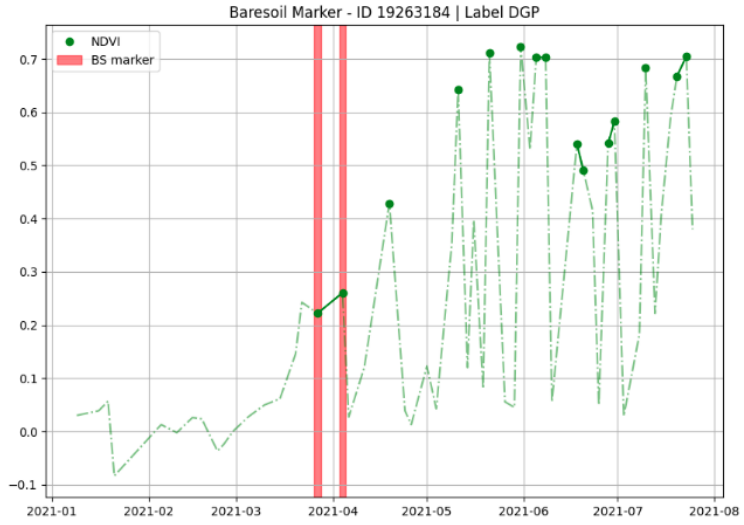
EO BASED AREA MONITORING SYSTEM

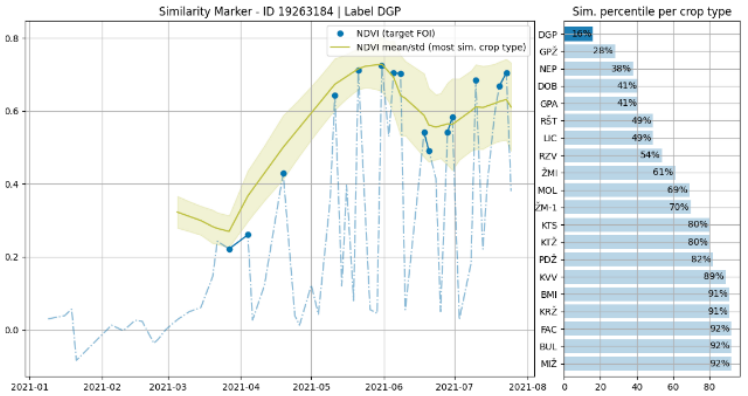
Utilize Sentinel signals towards the identification of various crop types, land types (including permanent pastures and Ecological Focus Areas) as well as the detection of agricultural activity (mowing, ploughing, harvesting) at several times during the growing season.

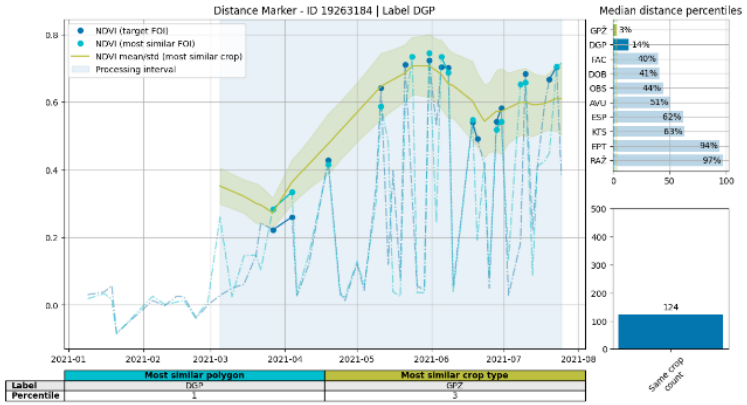
- **Homogeneity** - used to determine if a parcel geometry really consists of a single crop or if there are multiple things growing on the parcel.
- **Similarity score** - used to give additional context to the crop classification and to detect erroneous claims.
- **Bare soil marker** - used to detect observation where bare soil is present on the feature of interest. This indicates agricultural activity on the feature of interest (plowing, harvest).
- **Mowing marker** - used to detect mowing events on meadow/grass like features of interest.
- **Crop marker** - used to detect the specific crop growing on the feature of interest.
- **Land marker** - used to detect the land type and non-productive EFAs of the feature of interest.

EO BASED AREA MONITORING SYSTEM



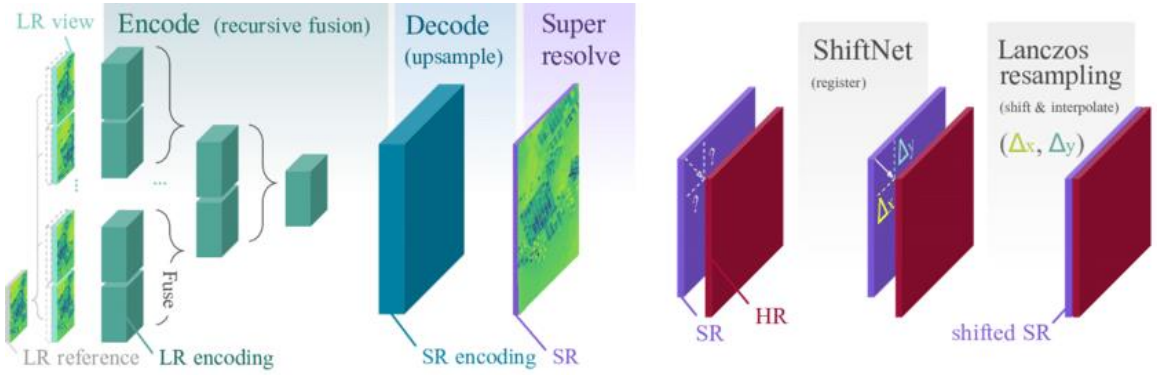




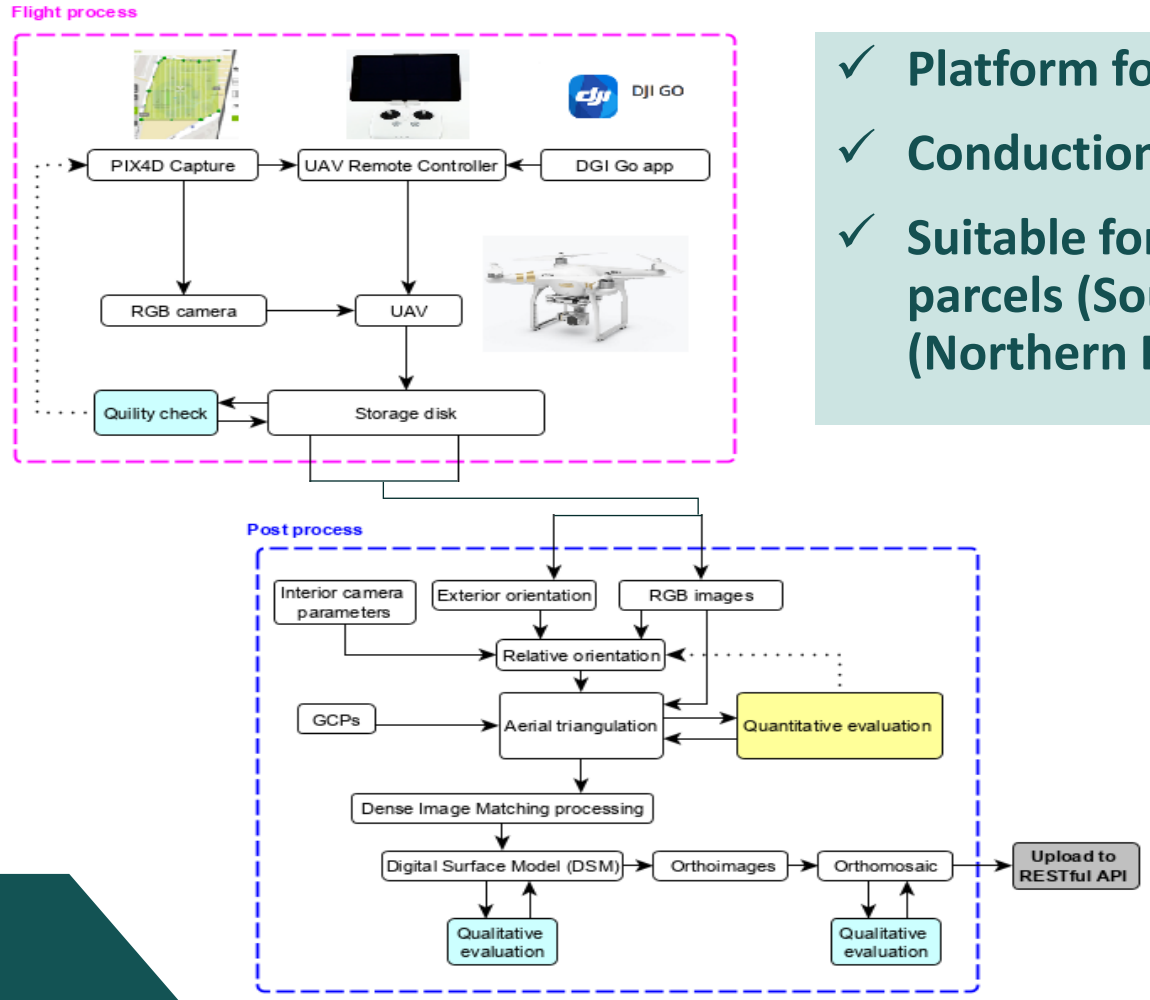


EO BASED AREA MONITORING SYSTEM

- ✓ **Deep learning network architectures that enable the augmentation of the coarser resolution bands of Sentinel 2 bands (20, 60m) to the resolution of the finer bands (10m);**
- ✓ **Combine free and open Sentinel data with high resolution drone and commercial data, using data fusion and super-resolution technologies so that EFA types of increased environmental impact are considered.**



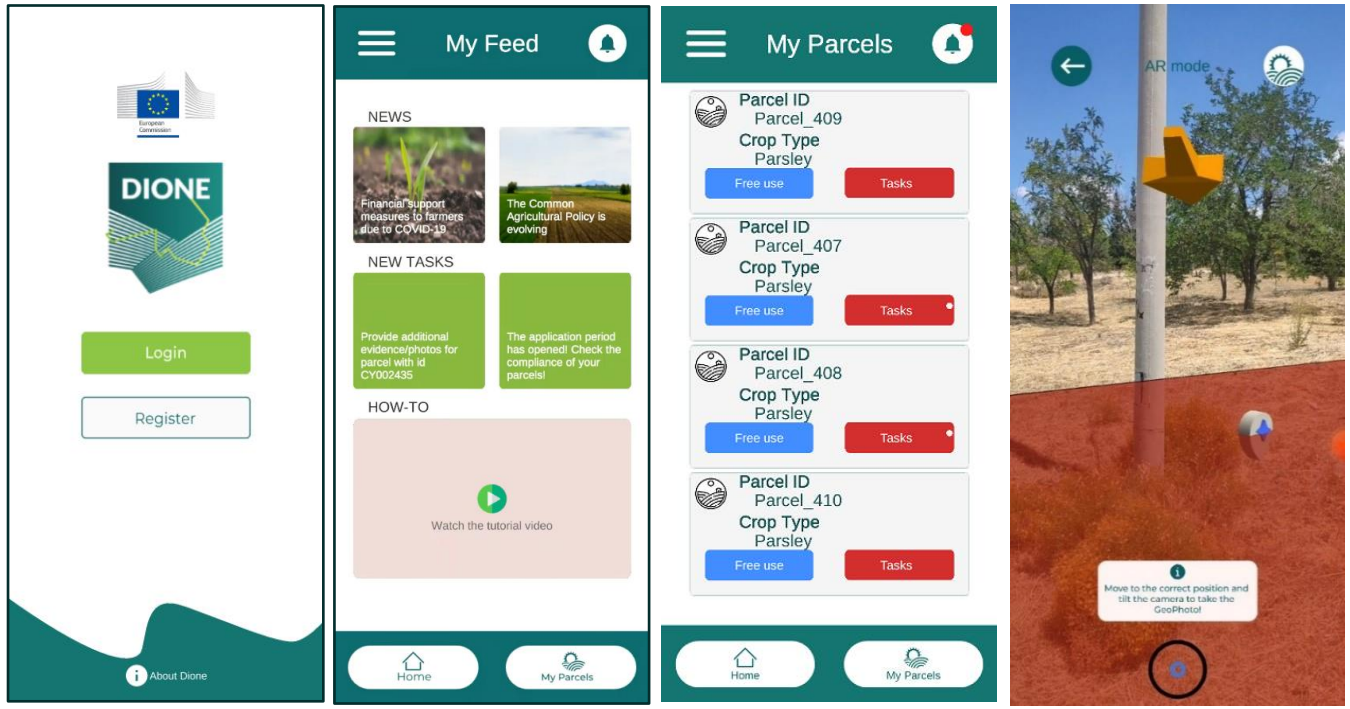
DRONE PLATFORM



- ✓ Platform for end-to-end drone operations
- ✓ Conduction of targeted flights and generation of VHR orthomosaics
- ✓ Suitable for problematic cases, such as over regions of small land parcels (Southern Europe) or where significant cloud cover (Northern Europe)

GEOTAGGED PHOTOS FRAMEWORK

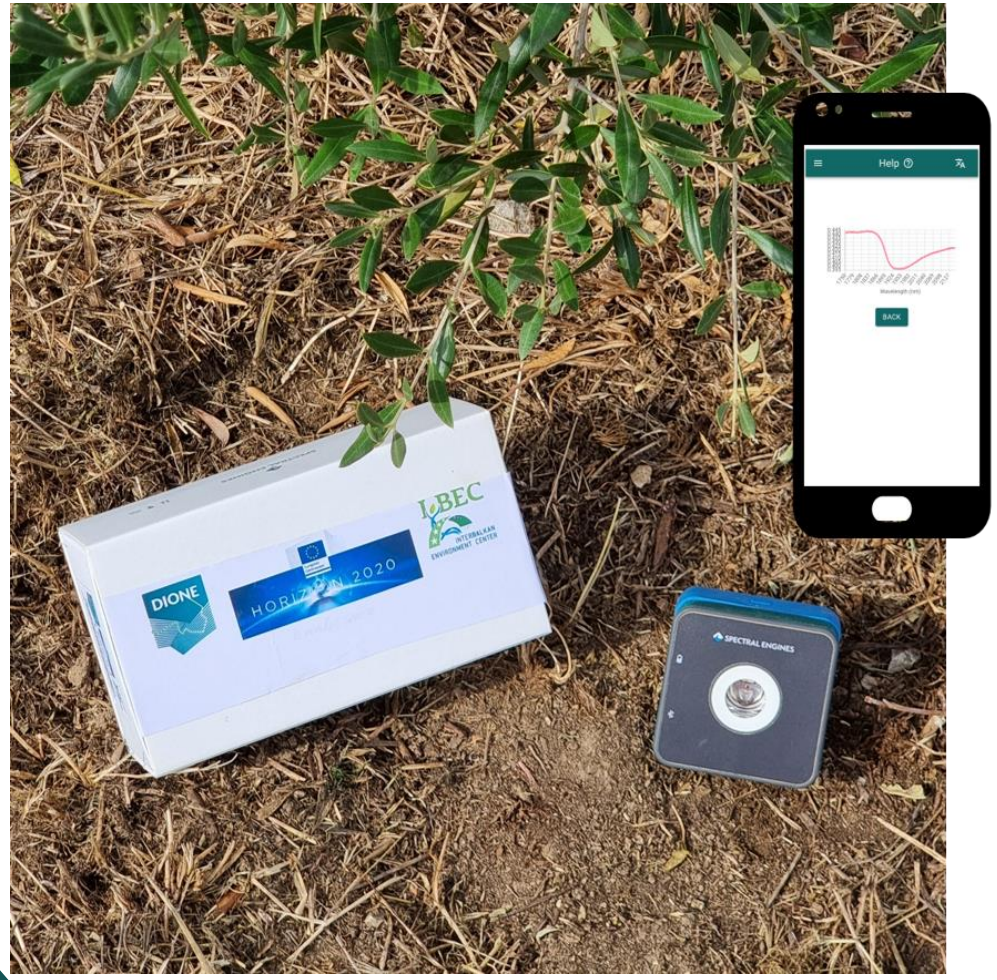
- ✓ Navigation to parcel and defined spots
- ✓ Augmented Reality based user guidance
- ✓ Improved location accuracy (i.e. multiple location differentiators, EGNOS Data Access Service)
- ✓ Direct communication with PAs via push notifications - Supporting offline operations
- ✓ Lightweight digital signature scheme, image forensics (i.e. steganography, etc)
- ✓ Time and location integrity (EGNSS clock, OSNMA)
- ✓ Anonymisation of private data in the photos



ANDROID APP ON Google play

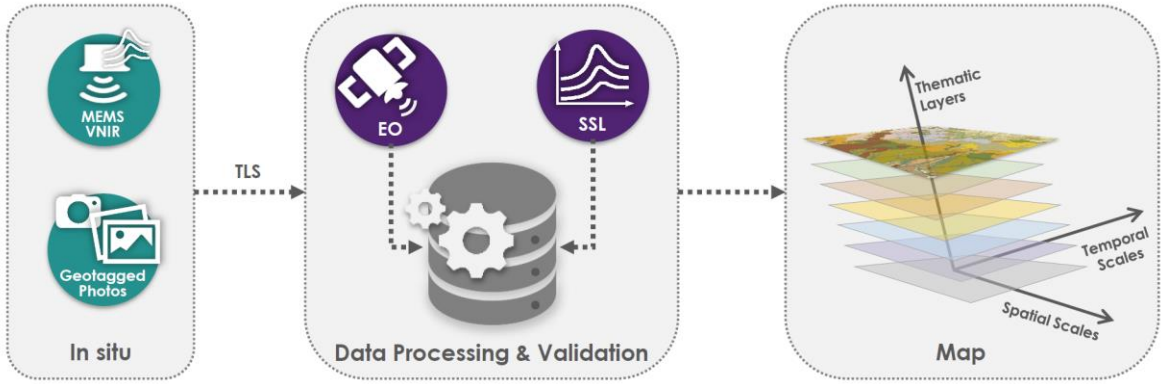
https://play.google.com/store/apps/details?id=com.isense.dione

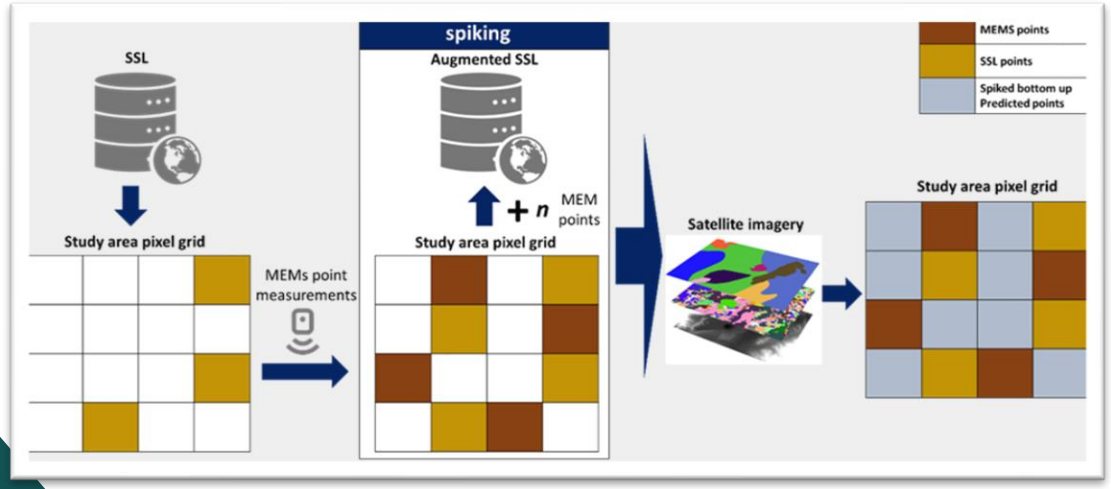
PORTABLE SOIL SCANNING SYSTEM



- ✓ Low-cost & portable spectral sensor (1750 to 2150 nm)
- ✓ Spectrometer is operated through an Android application via a Bluetooth connection.
- ✓ Preprocessing od collected spectra including spectral standardization and outlier and novelty detection
- ✓ Video: https://youtu.be/T-VLhK2HoyY

SOIL PROPERTIES MAPS





- ✓ **Machine learning tools which will transform the raw data collected through the in-situ soil scanning system to appropriate soil properties: SOC, clay, pH and CaCO3**
- ✓ **Combination of point measurements with EO imagery towards the delivery of spatially explicit maps (spiked bottom-up approach)**

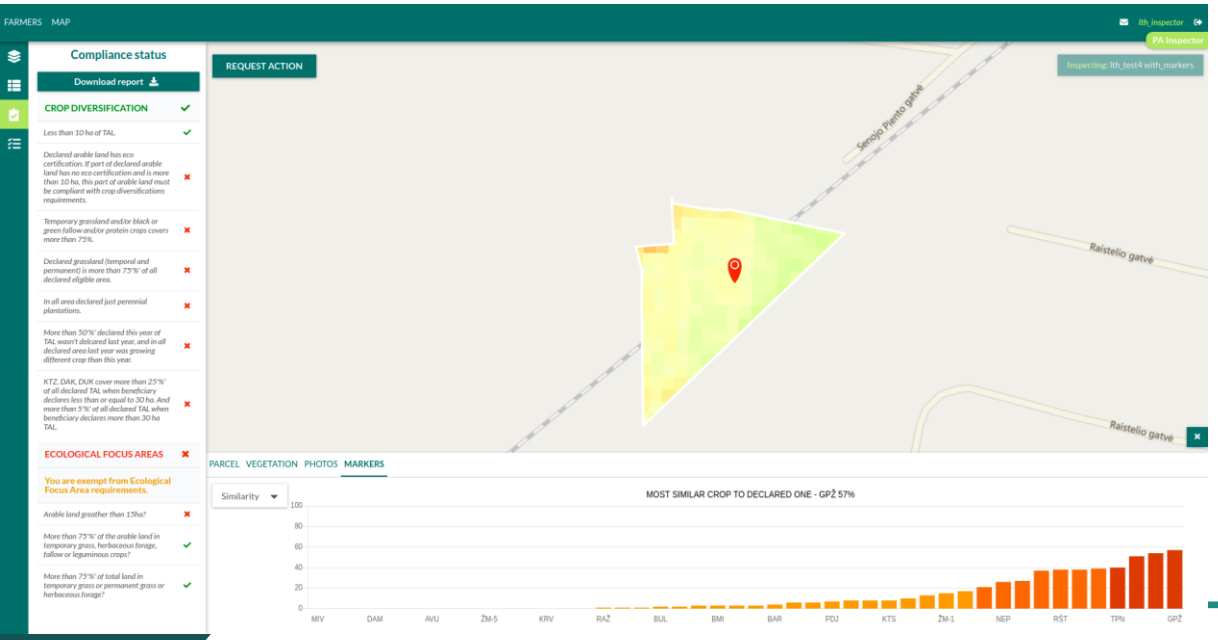
COMPLIANCE MONITORING TOOL

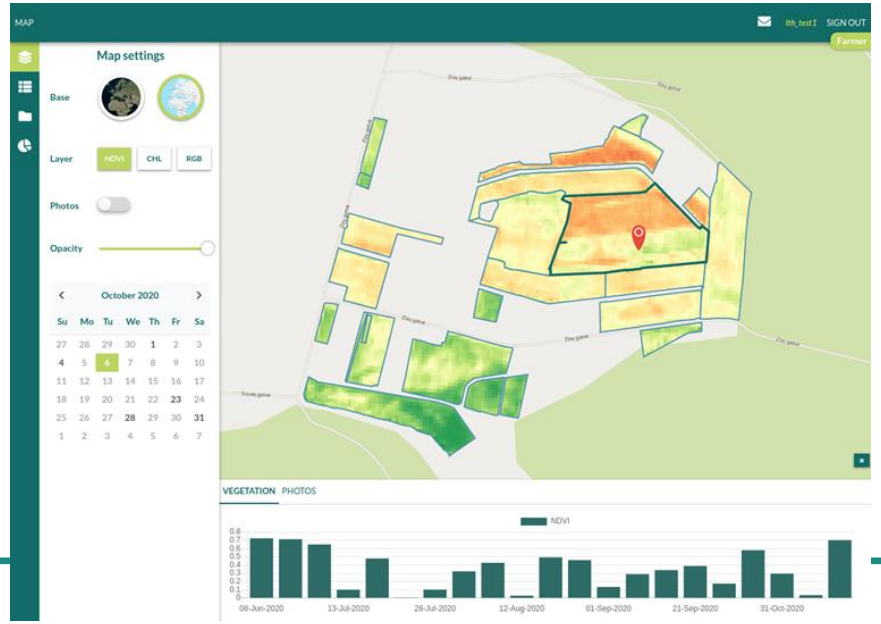
- ✓ Visualisation of parcel boundaries, geotagged photos, biophysical indices (i.e. NDVI, CHL) and markers;
- ✓ Generation of reports on compliance monitoring

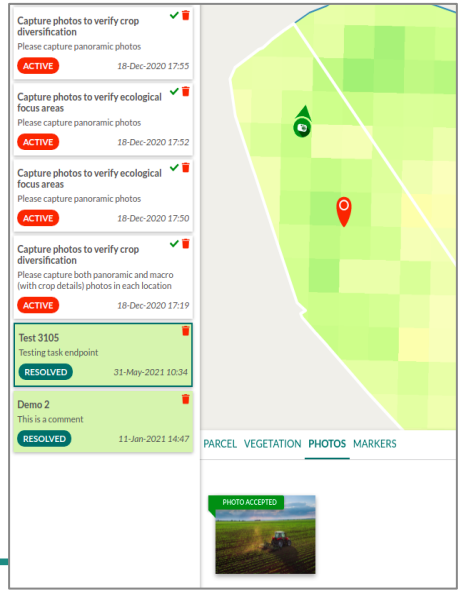
- ✓ Showing parcel information in tabular form; request geotagged photos through dedicated forms

- ✓ Layer management, displaying charts for selected location/parcel on the map regarding area monitoring markers

https://compliance.dione.gilab.rs/

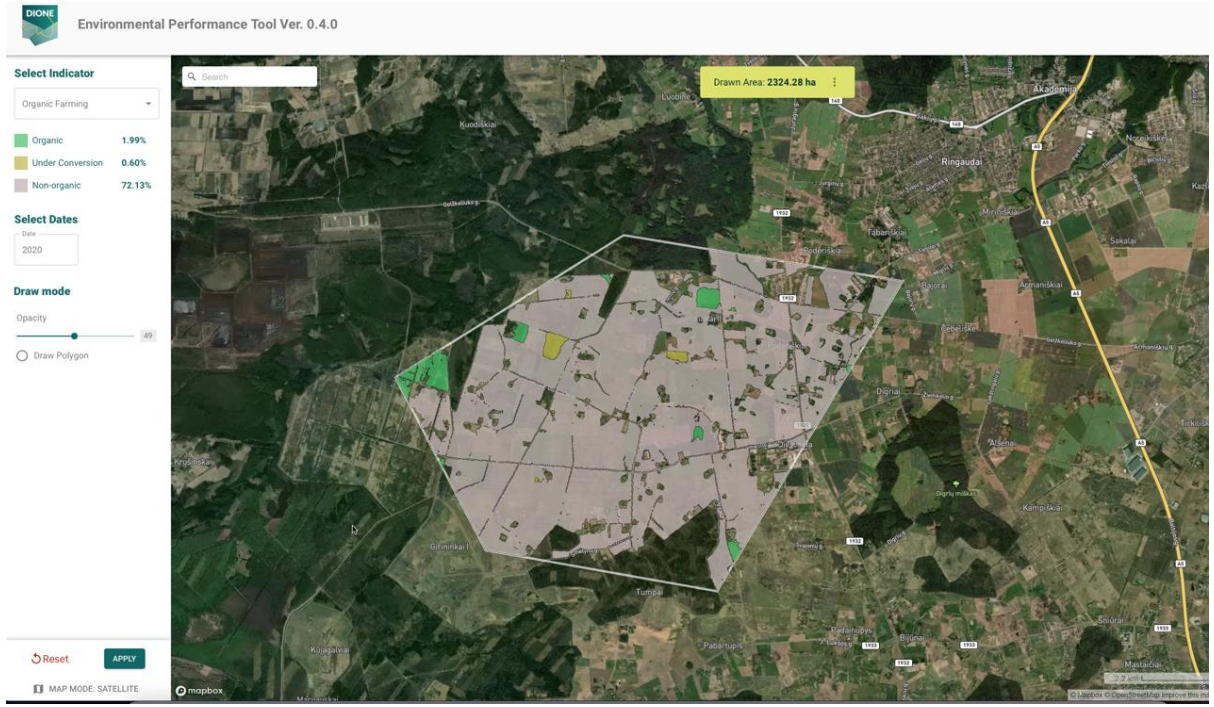






ENVIRONMENTAL PERFORMANCE TOOL

Environmental priorities	Agri-environmental indicators	Short definition (unit)
Land and soil	Land cover change	Changes in land cover classified by type and size (%)
	Soil erosion	Estimated mean soil erosion rate in (t ha^{-1} yr^{-1})
	Soil organic matter	Mean organic matter concentration in arable land (g/kg)
	Organic farming	Area under organic farming as a ratio of the total utilized agricultural area (UAA)
Water	Water quality	Chl- α, TSM, Temperature (°C)
	Land irrigation	Irrigated land (ha)
Air quality and climate change	Greenhouse gases emissions	methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2)
Protected/ vulnerable	HNV farmland	Agricultural areas (ha) under HNV areas
	Natura 2000 areas	Agricultural areas (ha) under Natura 2000 areas



The selected indicators can be used to show progress towards fulfilling the EU standards on good agricultural and environmental condition of land (Good Agricultural and Environmental Conditions)

DIONE PILOTS

LITHUANIA – NPA | CYPRUS - CAPO

CREATION OF A PAYING AGENCY-INTEGRATED TOOL FOR COMPLIANCE MONITORING

REDUCED CONTROL COSTS FOR THE PAYING AGENCY

ENVIRONMENTAL PERFORMANCE OF GREEN DIRECT PAYMENTS IN THE PA JURISDICTION

INCREASED PERCENTAGE OF FARMERS PROVIDING GEO-TAGGED EVIDENCES

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