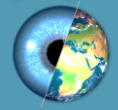
Geoinformatics and UAVs in natural disasters.

SenseLAB Research
Laboratory of Geodesy and Geoinformatics
Technical University of Crete

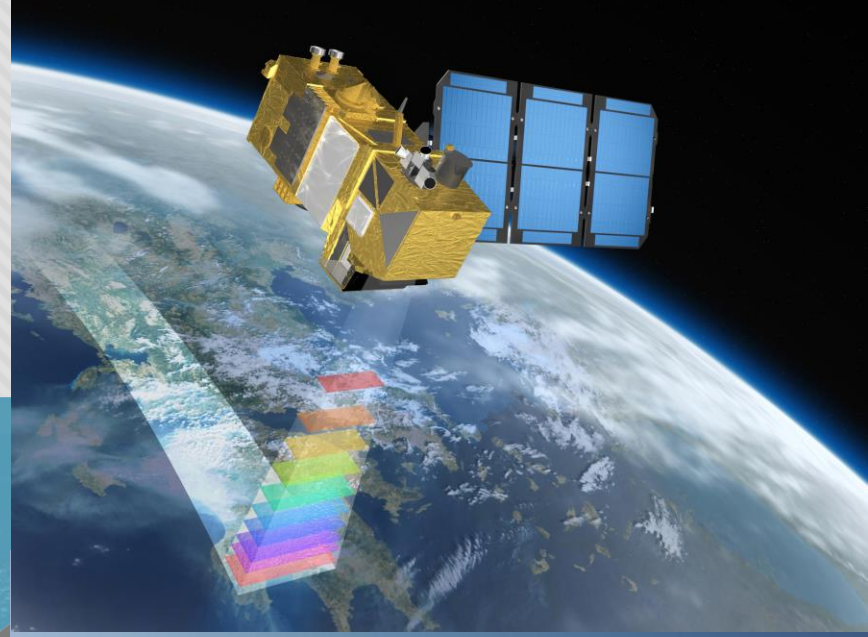
Asst. Professor Panagiotis Partsinevelos
ppartsi@mred.tuc.gr



SenseLAB Research

Senselab Research

- Spatial information systems, GIS,
- Remote Sensing, Earth Observation,
- Unmanned Aerial Systems,
- Tangible GIS, Smart Cities, Crowdsourcing,
- Gestural interfaces,



SenseLAB Research

Technical University of Crete

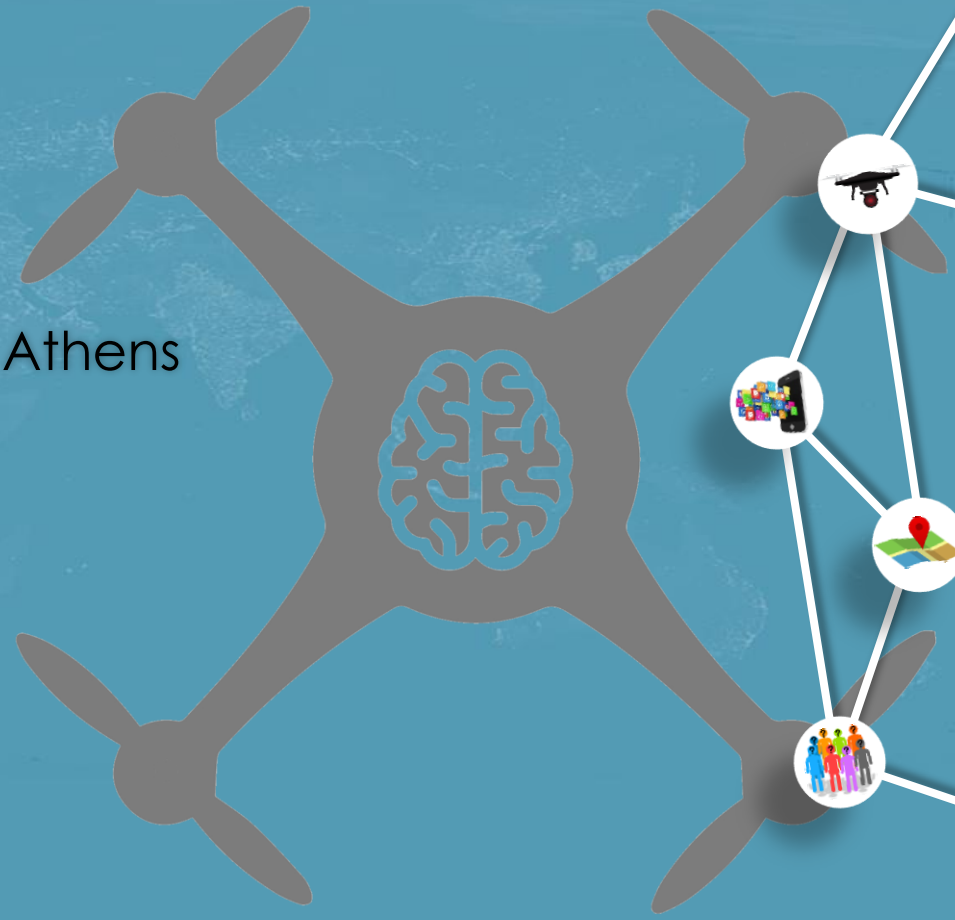
SenseLab: Spatial Informatics Group

Asst. Professor Panagiotis Partsinevelos

- PhD, University of Maine, USA
- NASA center of Excellence in Remote Sensing
- National Center of GIS of USA
- Dipl. Surveying Eng., National Technical University of Athens
- Post-Doc, Institute of Computer Technology, Patra
- Fellow, GFZ, Berlin, Germany

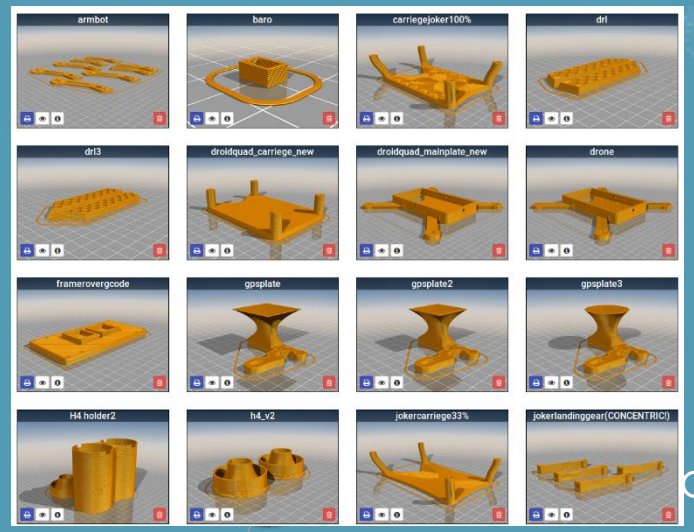
Multidisciplinary team:

- Electronics Engineering/Computer Science
- Mineral resources Engineering
- Mechanical Engineering



SenseLAB Research

UAVs: design, construction, hardware programming, applications



Autonomous

Collision - proof

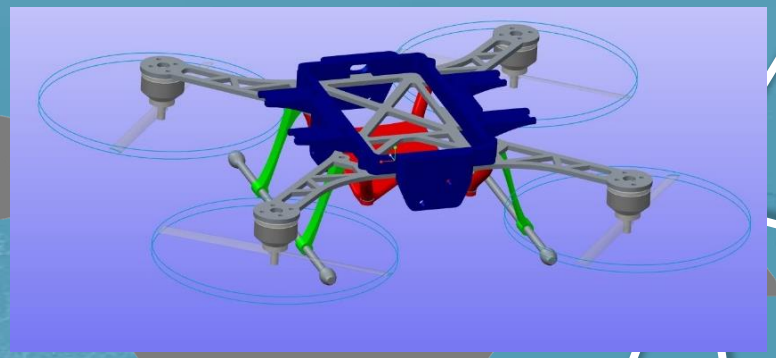
Cooperative

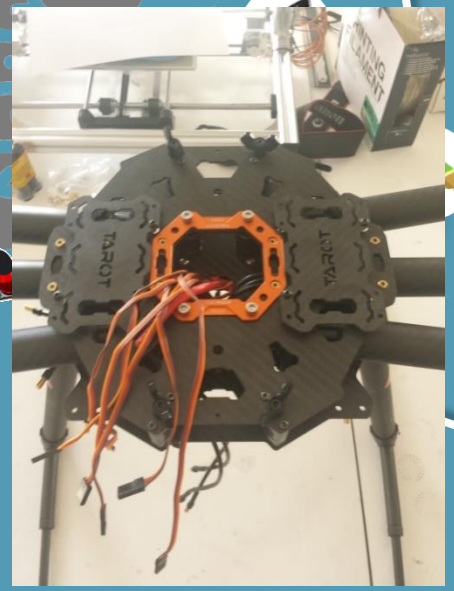
On-board processing

Flying attitude

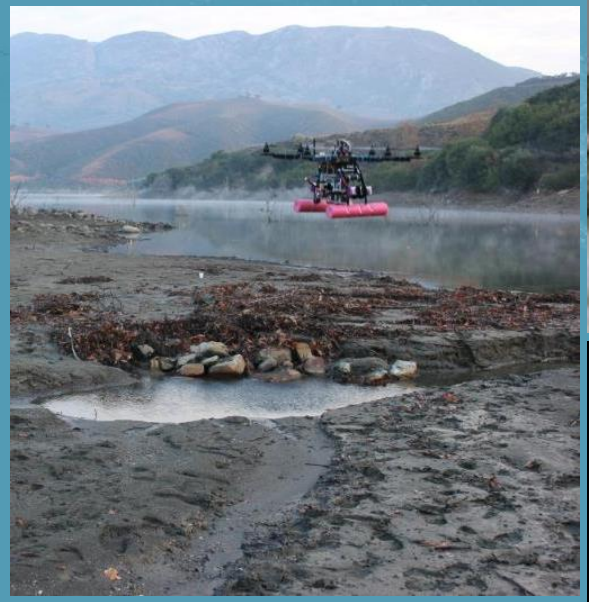
Autonomy

Smart



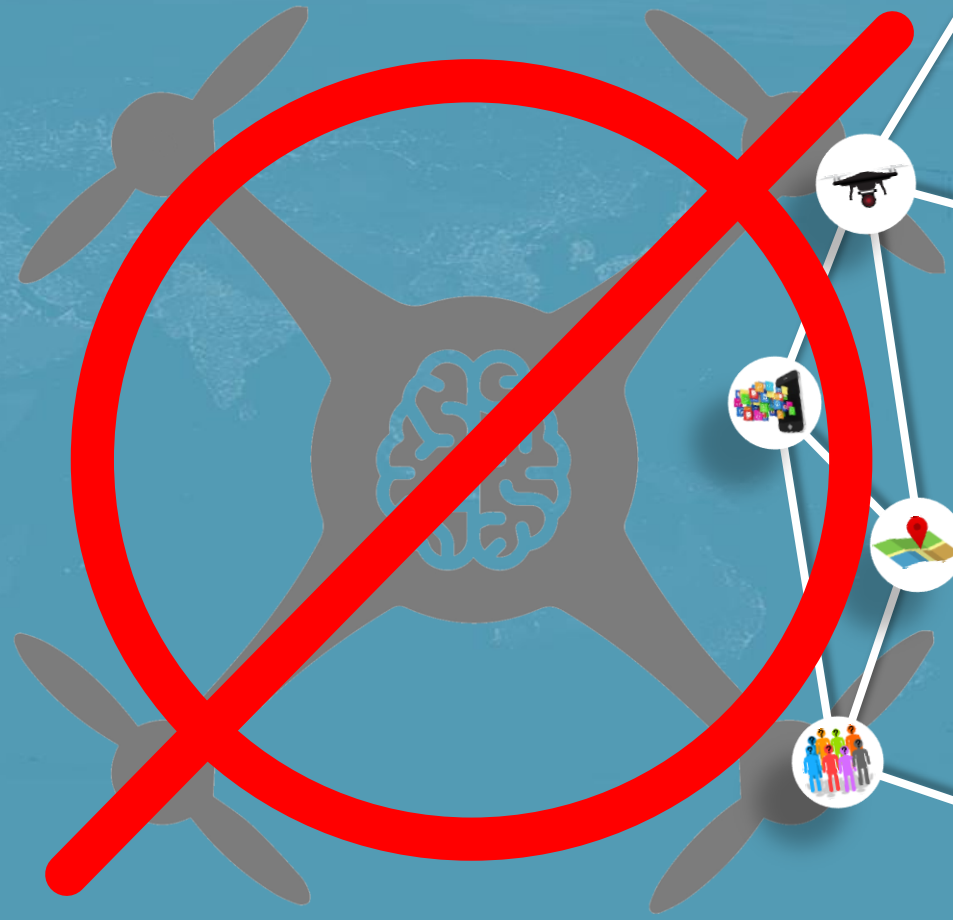


Mapping: 3D, thermal, multi-spectral



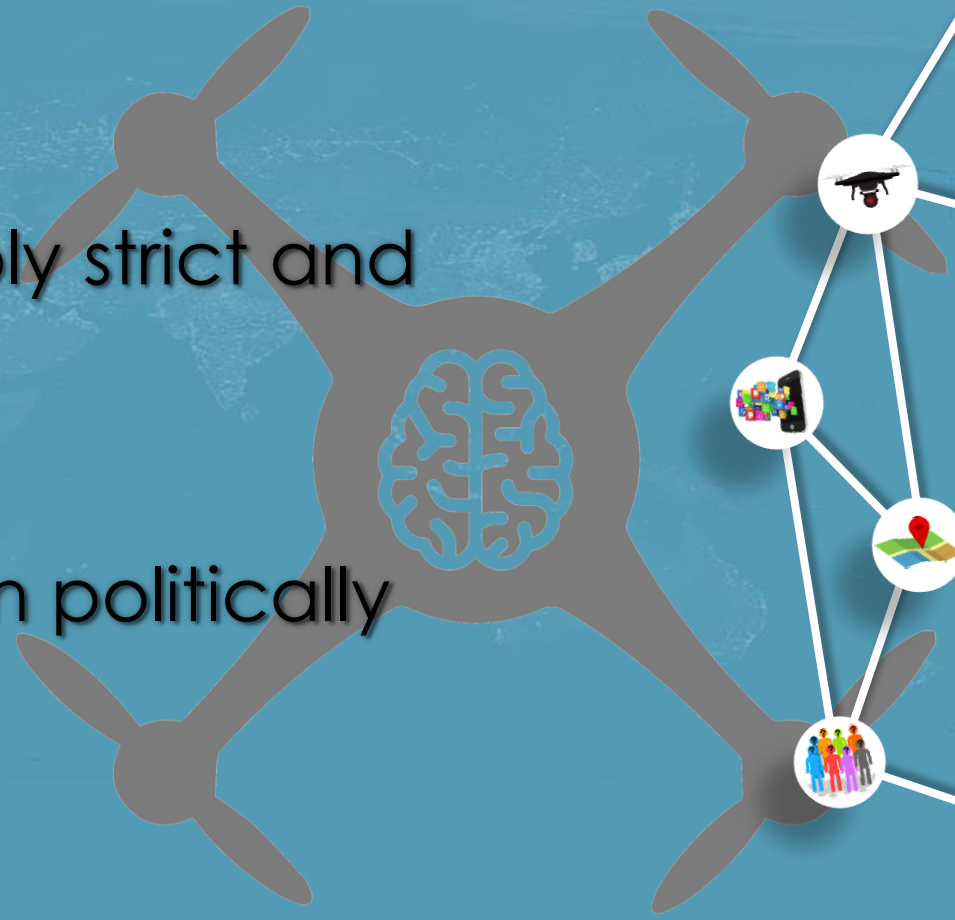
Re-Research in UAS

- Simple visualization,
- Combination of commercial hardware,
- 3D modelling,
- Sensor integration and mapping,
- Reinventing the wheel in Greece and EU



Vicious circle of Legislation

- Privacy & security are threatened,
- thus legislation becomes unreasonably strict and horizontal,
- meaning that research is obstructed,
- and a few entities will survive that can politically influence legislation.



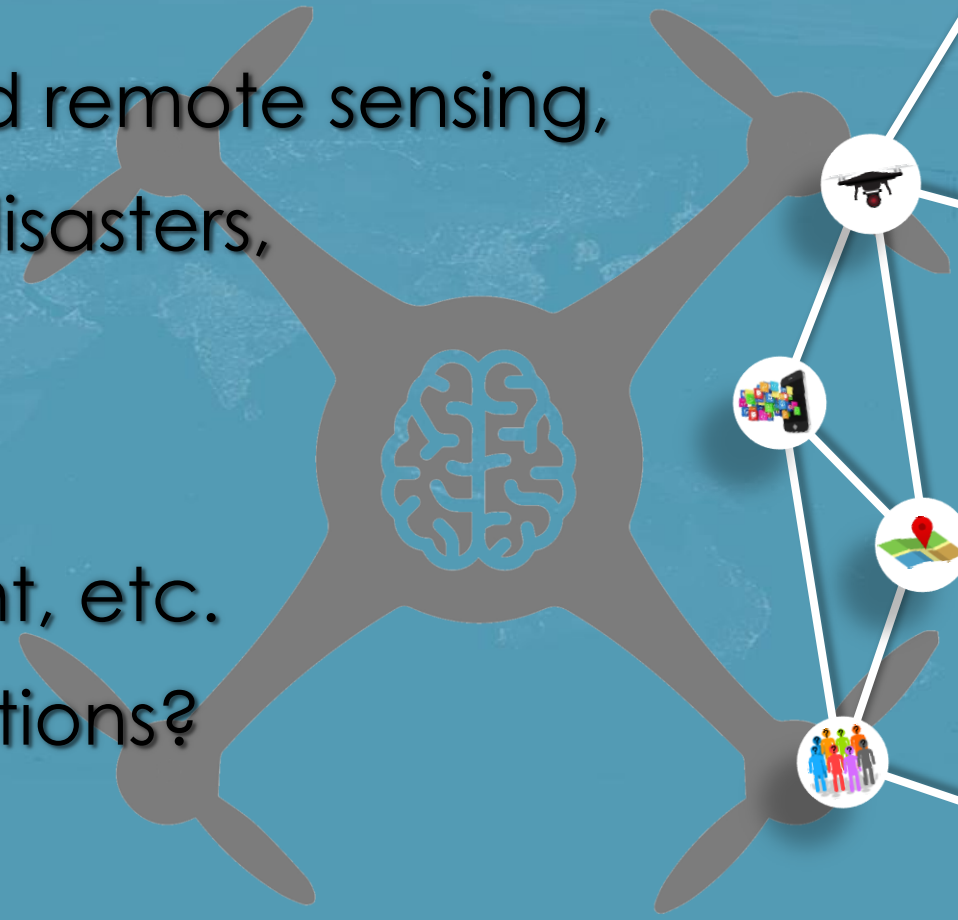
Vicious circle of funding

- Most researchers are just users (UAVs, GIS),
- Attract multi-million funding on redoing things,
- Have become reviewers of proposals & papers,
- Obstruct funding on innovation and horizontal, basic research,
- They promote mimicking, science becomes flat…

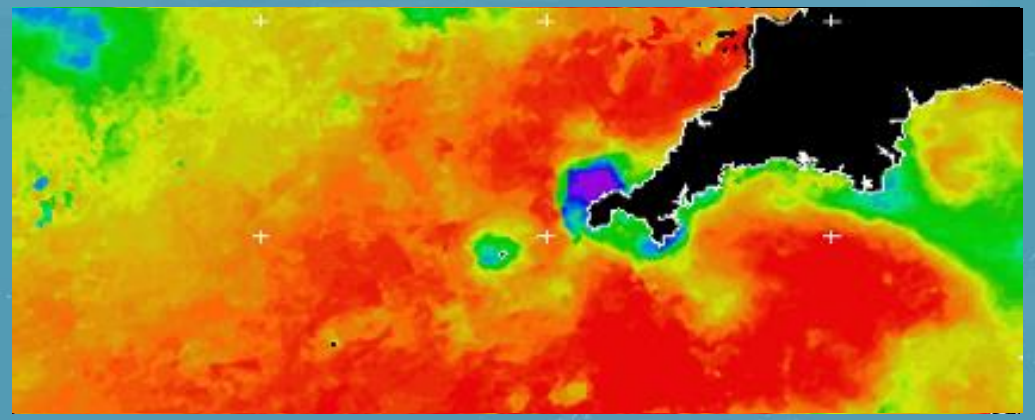
- Review paper on UAVs and slope monitoring…

Vicious circle of ignorance

- 15 years ago on data integration and remote sensing,
- 8 years ago on forest fires & natural disasters,
- 7 years ago on energy and mining,
- 5 years ago on precision agriculture,
- on defense, surveillance, environment, etc.
  - What were their questions?



Real time animated maps
Modular sensor integration



e.g. Provides best routes
through smoke,
Becomes your eyes.

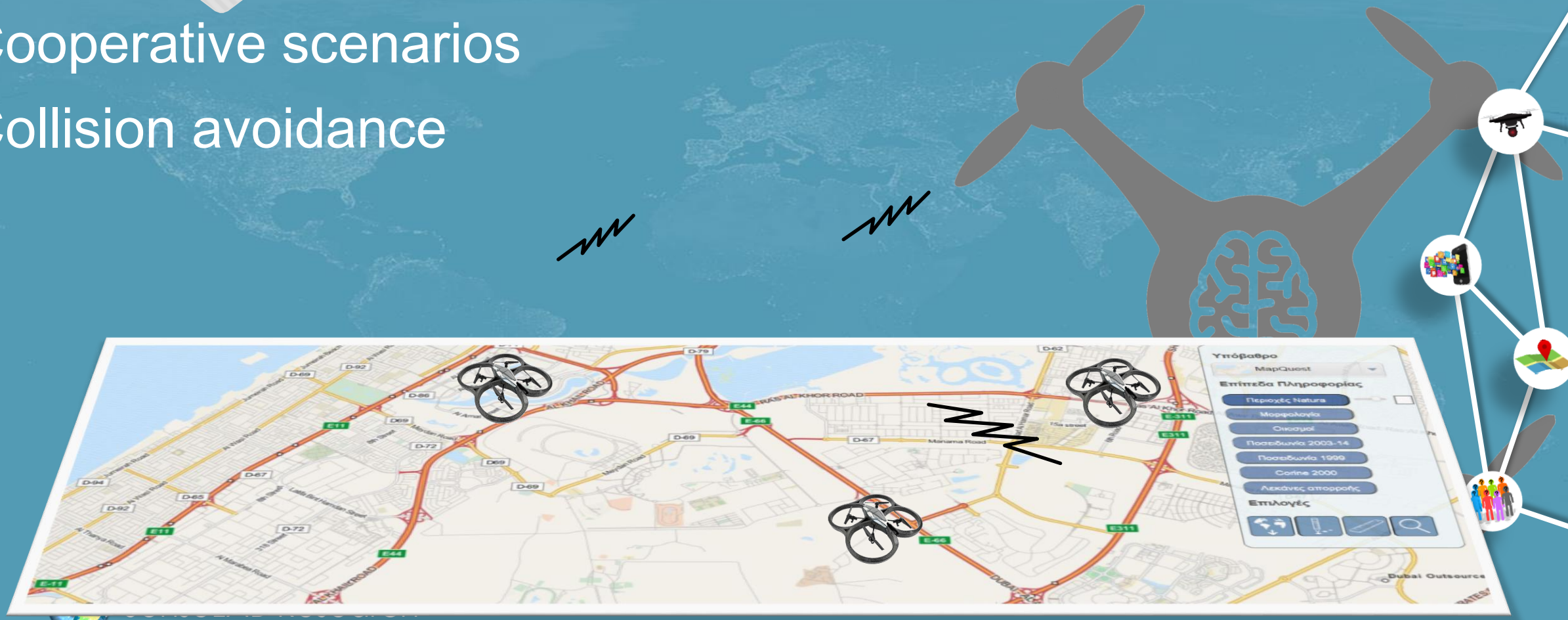
- Thermal mapping for fire disaster evacuation.

SenseLAB Research

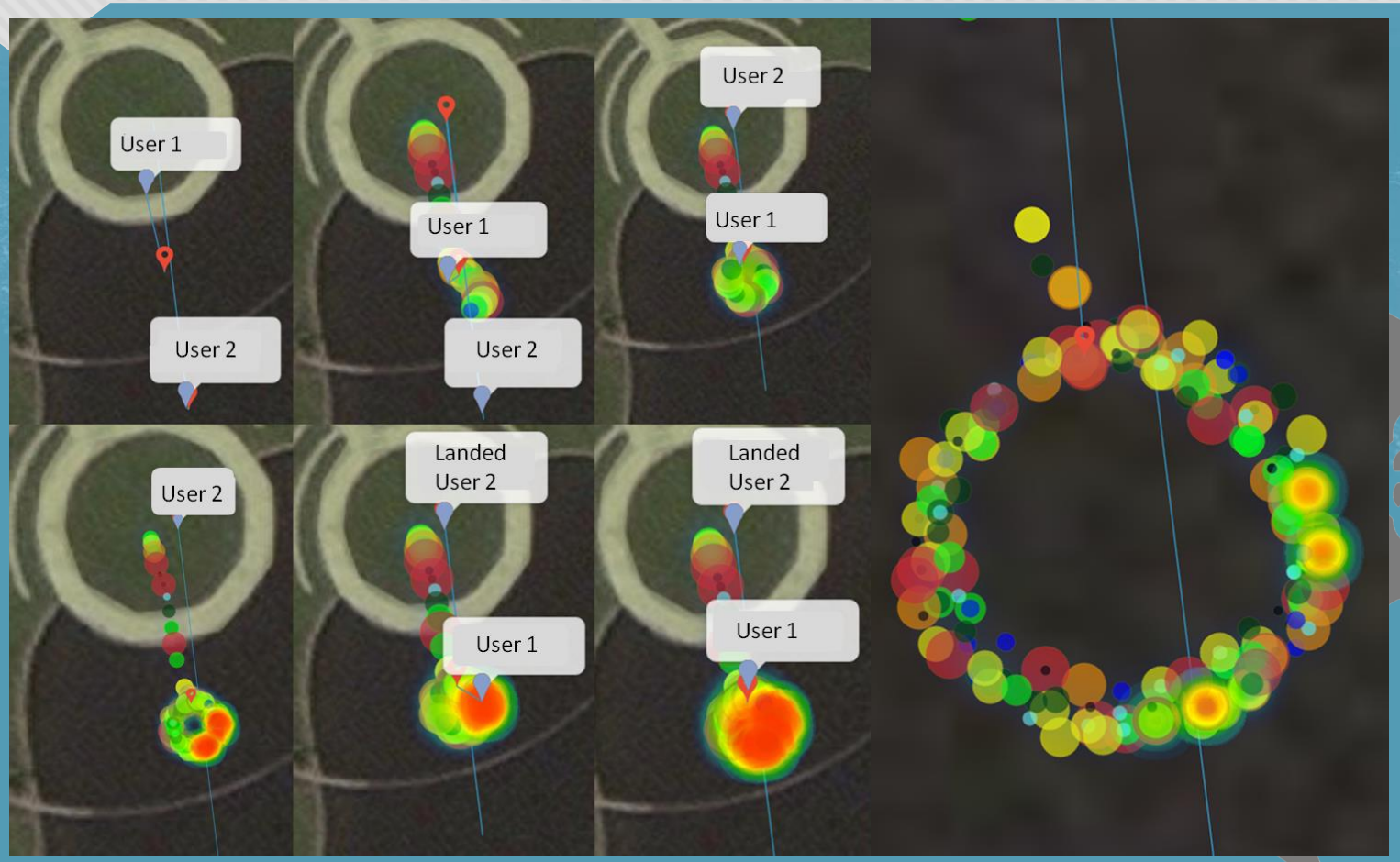
Fleet management

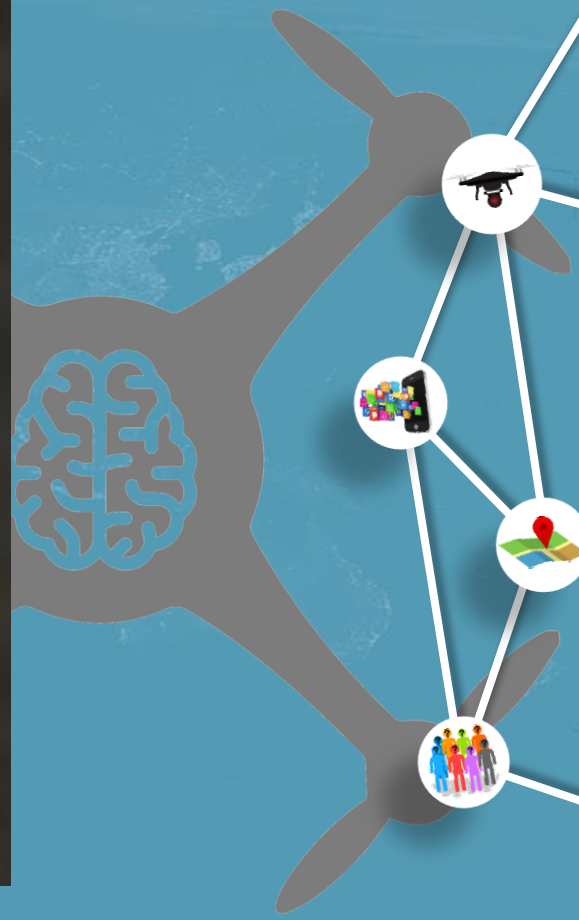
Cooperative scenarios

Collision avoidance



Real time mapping - coordination

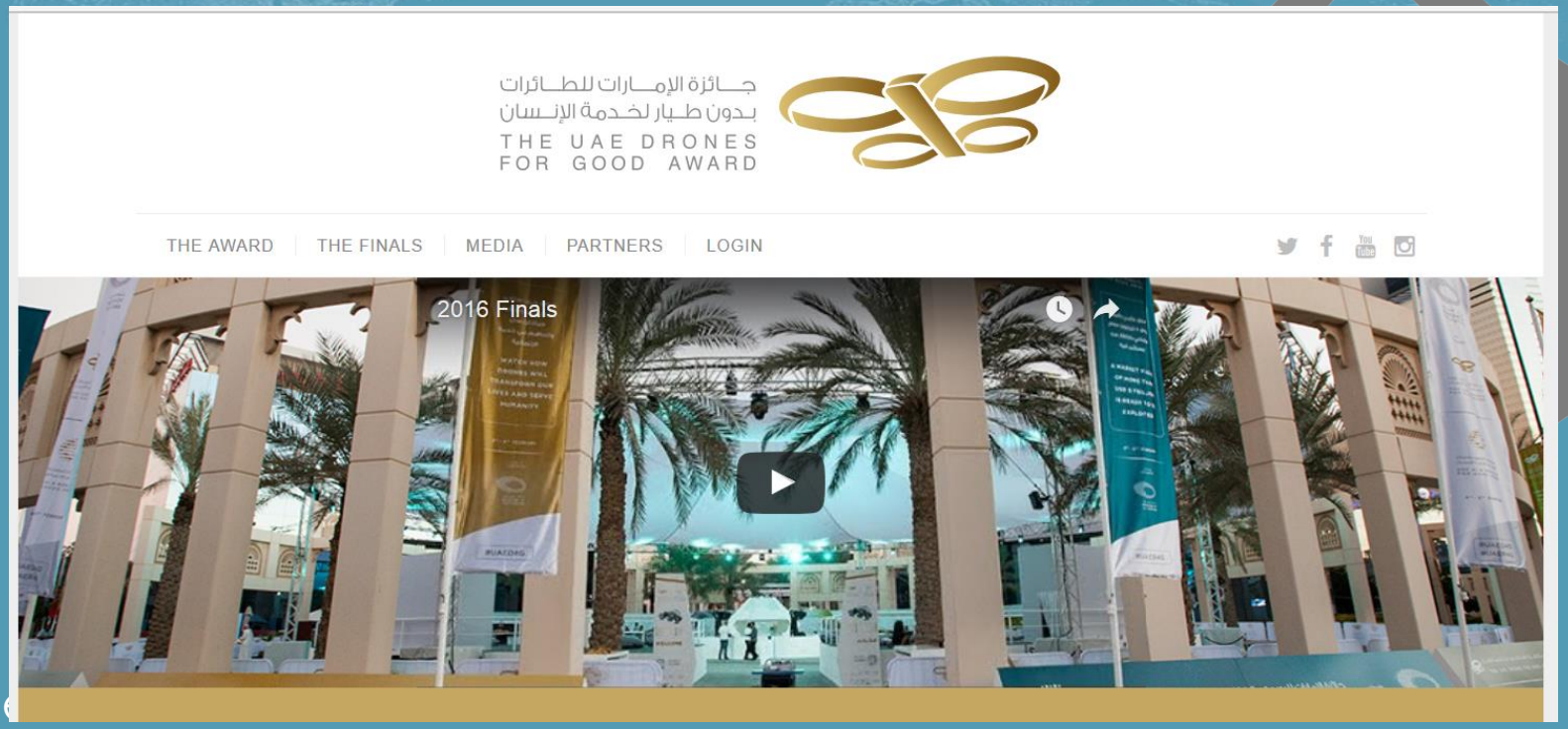




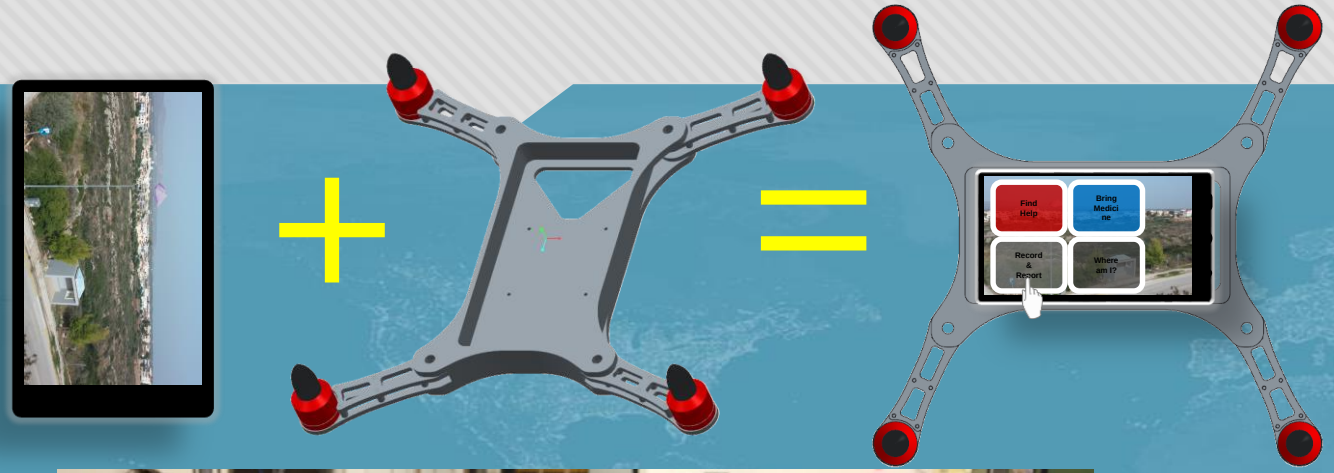
SenseLAB Research

Drones for Good

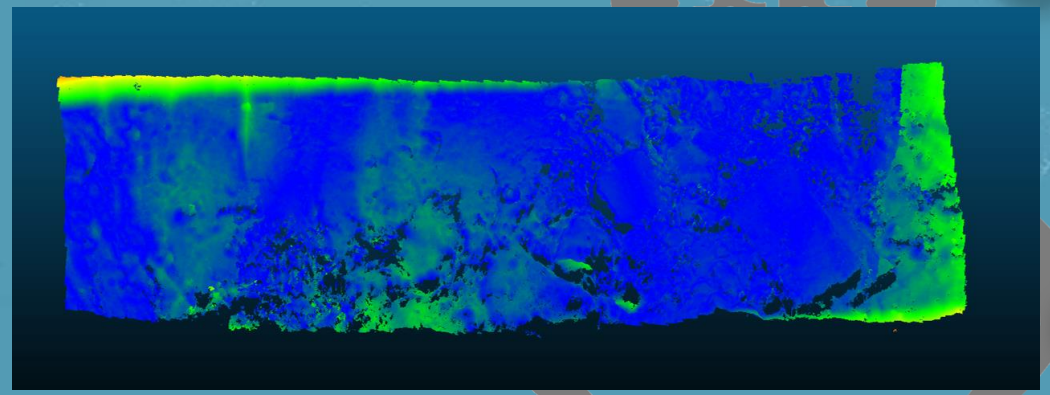
- SenseLAB 1st in EU, 3rd in the world,
- 1017 teams from 165 countries
- Harvard, MIT, Oxford, London Business School, RMIT, University of Toronto, Seoul National University.



Smart-drone



- Personal SAR drone
- Carrying medicine
- Communicate if no network
- Surveying



Functionality

Find Help

- Fly to **find mobile services**,
- Provide your location/message/status to authorities.

Bring Medicine

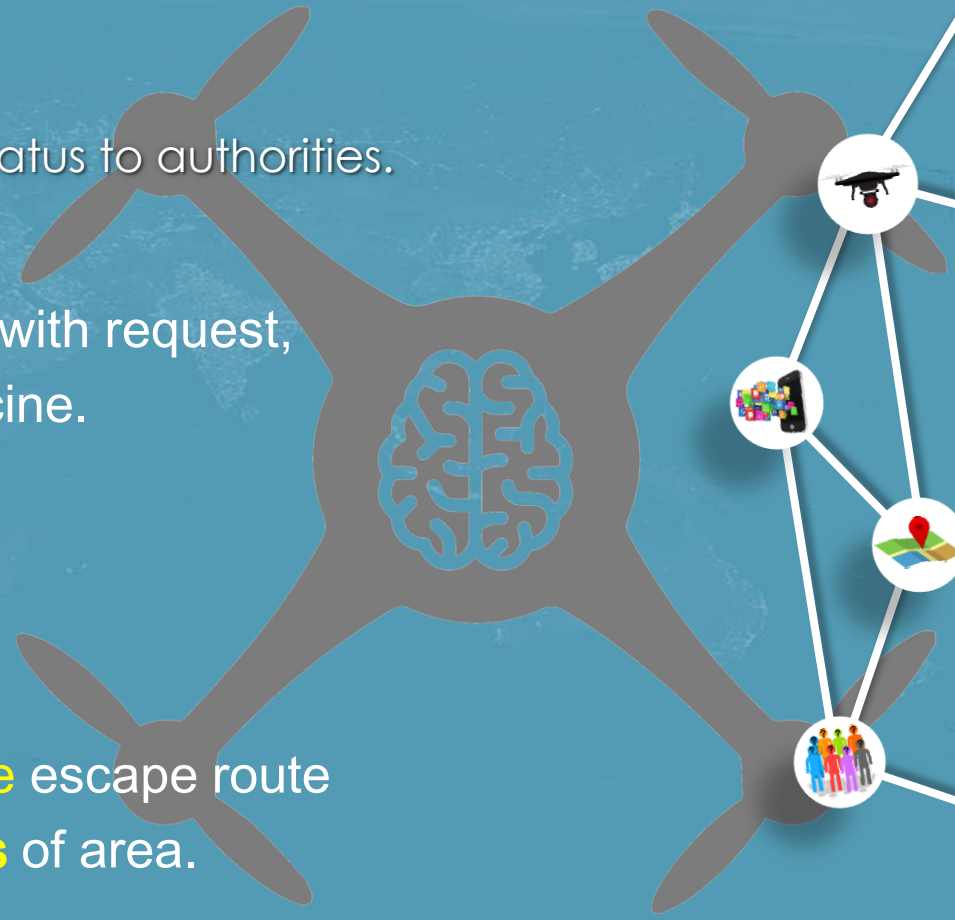
- Fly to pharmacies in the area with request,
- **Carry-deliver** back your medicine.

Record & Report

- **Throw**, fly and **record** situation,
- Navigate to e.g. Police & report.

Where am I?

- Fly above & scan area, **decide** escape route
- Return & provide **map-images** of area.



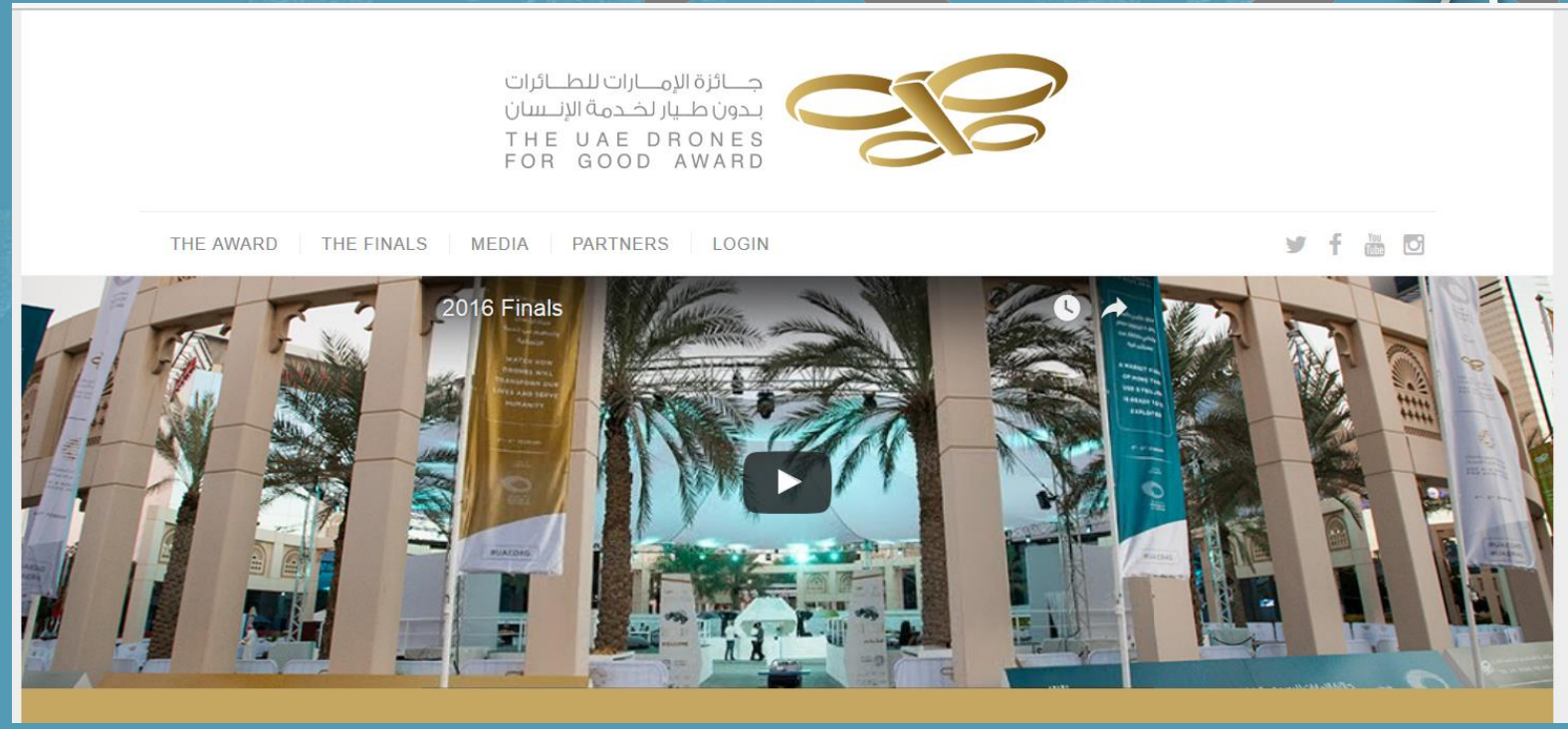
SenseLAB Research

Drones for Good

1017 Teams, 165 countries

Harvard, MIT, Oxford, London Business School, RMIT, University of Toronto, Seoul National University.

Smartdrone



SenseLAB Research

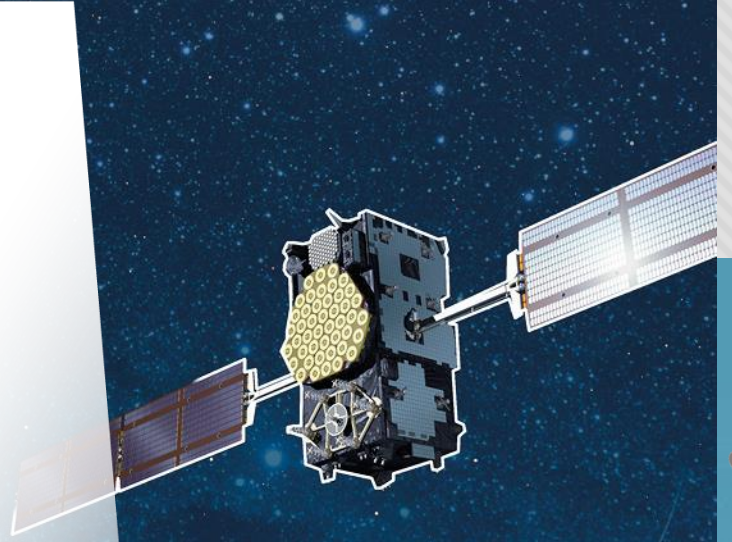
special prize partners

in cooperation with

EUROPEAN
SATELLITE NAVIGATION
COMPETITION 2016

GSA Challenge

droneS2GNNS: UAV enabled precision measurements in obstructed environments



NORWAY SWEDEN
IRELAND UK LITHUANIA
THE NETHERLANDS POLAND
FLANDERS HESSE
BADEN-WÜRTTEMBERG BAVARIA CZECH REPUBLIC
FRANCE SWITZERLAND AUSTRIA
GALICIA BASQUE COUNTRY ROMANIA
MADRID VALENCIAN COMMUNITY
ANDALUCIA CATALONIA
ISRAEL ASIA

a brand by AZO Space of Innovation

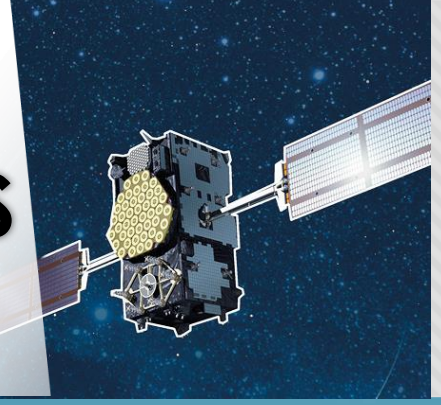
special prize partners

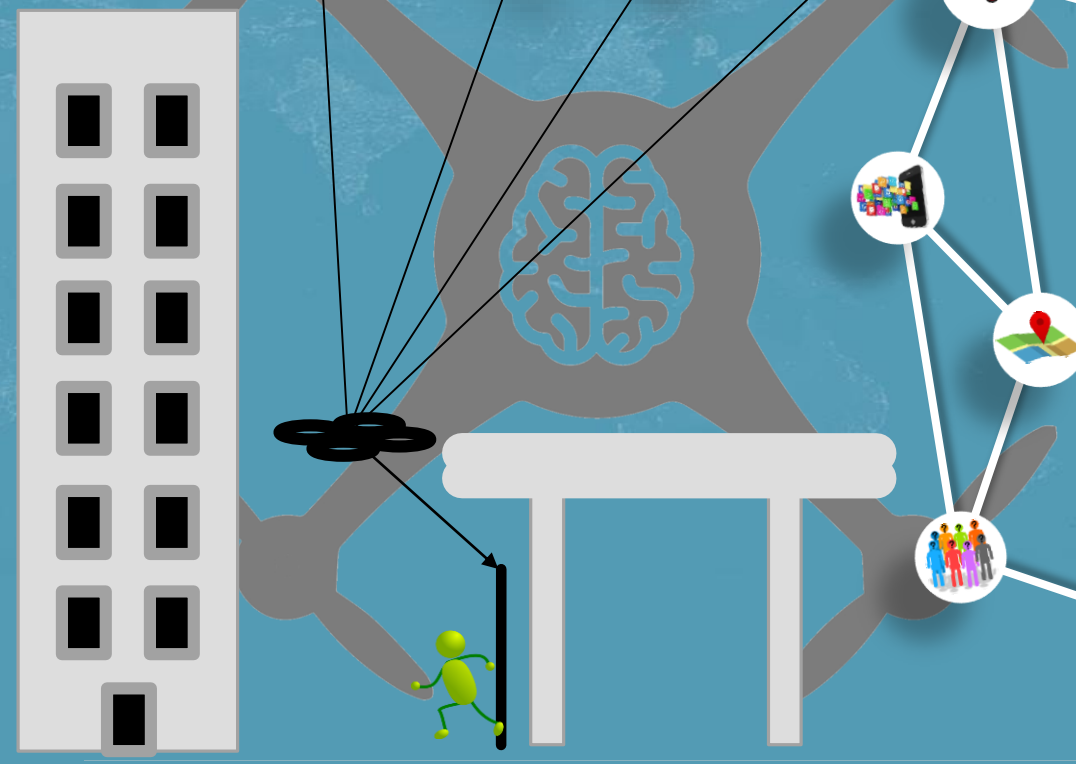
in cooperation with

EUROPEAN SATELLITE NAVIGATION COMPETITION 2016

Drones2GNSS

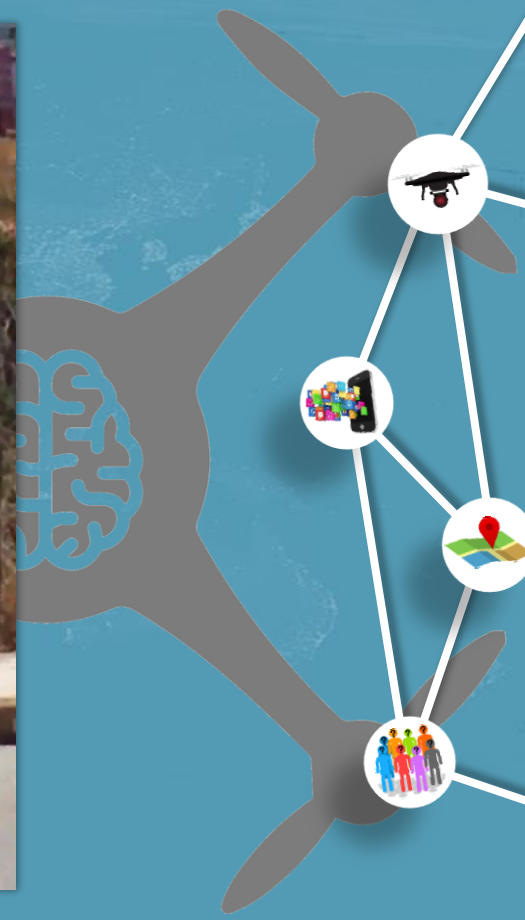
GSA Challenge





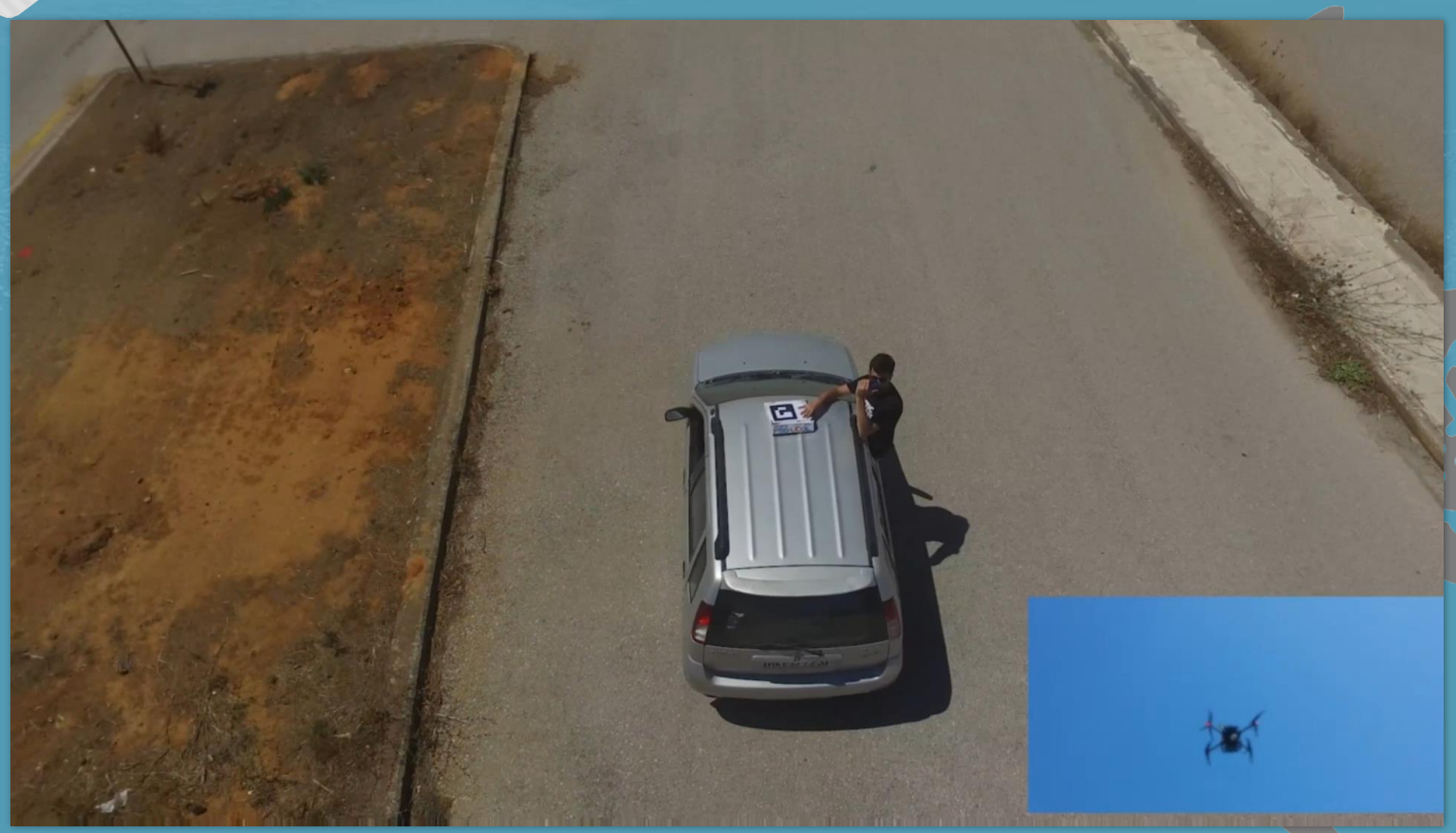
SenseLAB Research

Real time geo-location search & rescue



SenseLAB Research

Follow



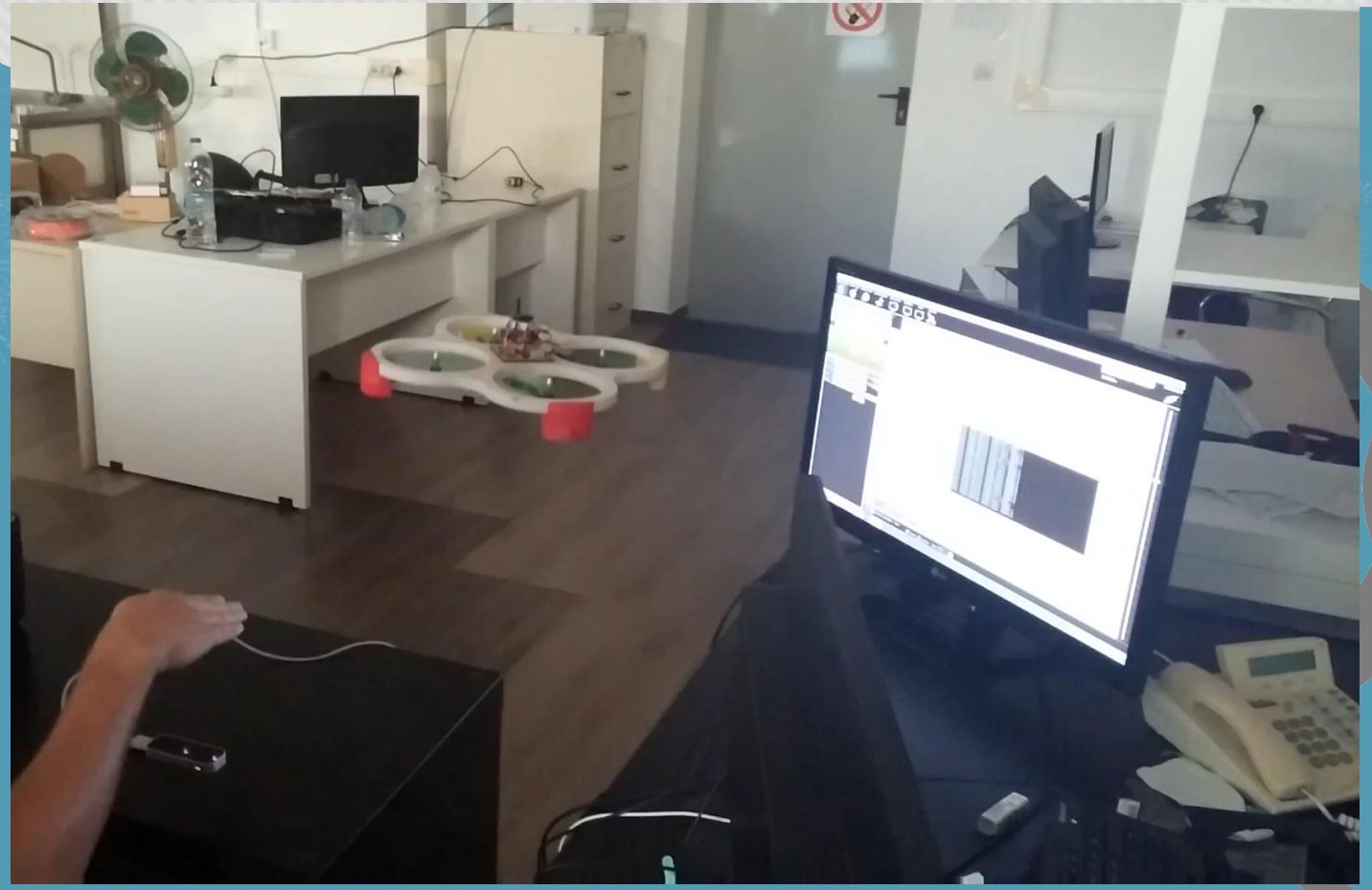
SenseLAB Research

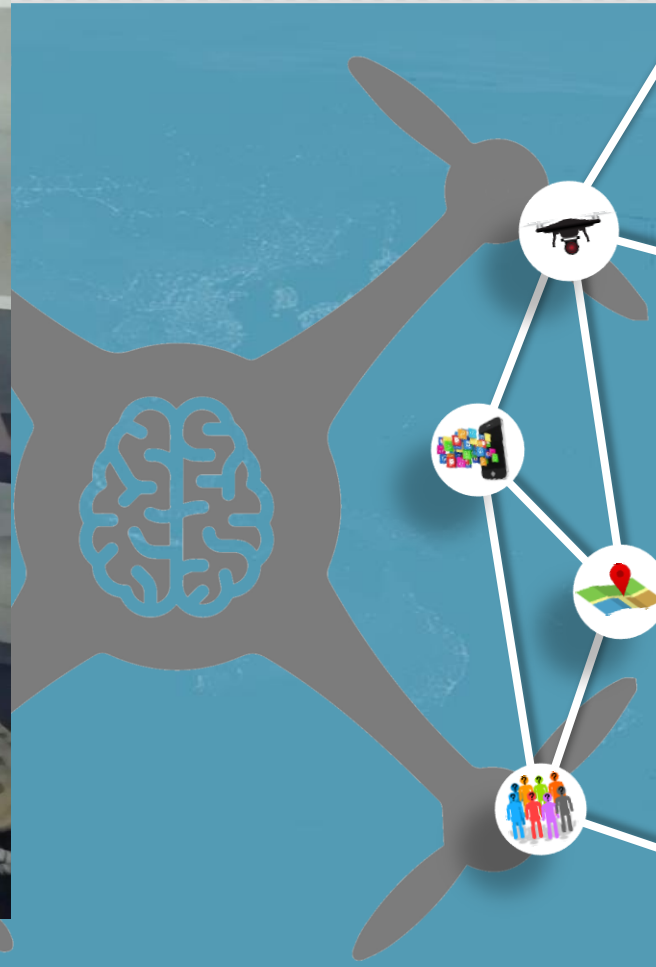
Autonomous landing

Geo-locate

SenseLAB Research

Gestural navigation

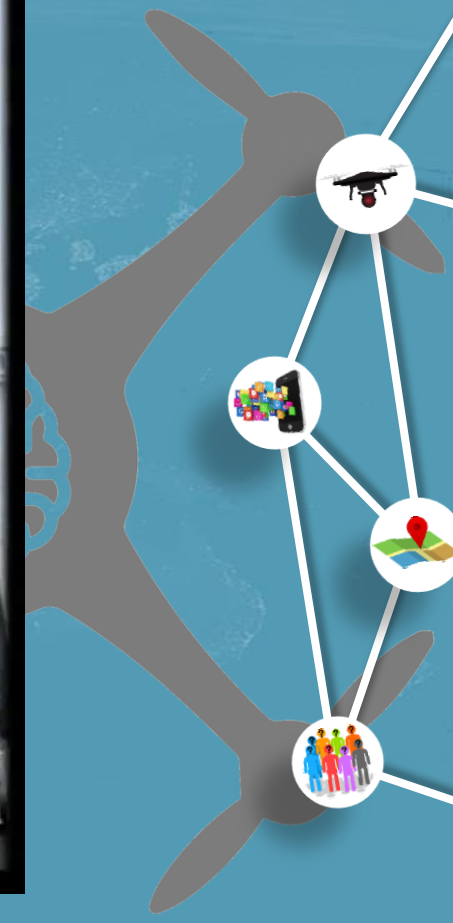




Sense & avoid

SenseLAB Research

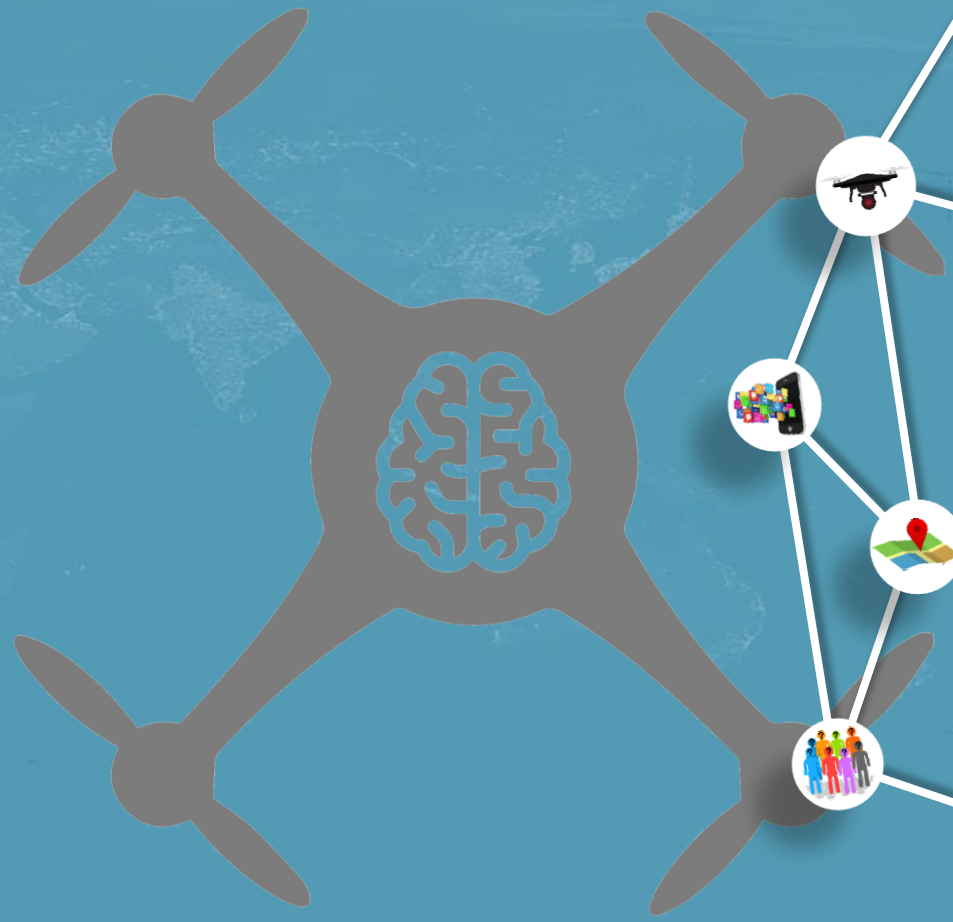
Head camera control



SenseLAB Research

IoD concept

- Internet of Drones



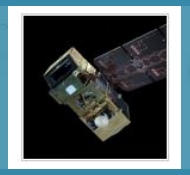
Satellite Remote Sensing

- Sensor type: electro-optic, SAR,
- Spatial resolution: km to cm,
- Spectral sensitivity: visible, IR, Thermal, Microwave,
- Temporal periodicity: 20 days, continuous, ordered,
- Radiometry: grayscale levels.

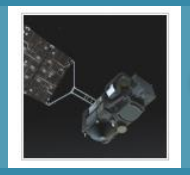
SenseLAB Research

EU EO Programme

- SENTINEL 1
  - SAR, land and ocean

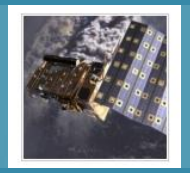


- SENTINEL 2
  - Optical for land monitoring



- SENTINEL 3
  - Altimetric + more, sea topography, marine, SST, LST, etc

- SENTINEL 4, 5, 5P
  - Air quality monitoring in high resolution, UV, climate change



- urban area management,
- sustainable development & nature protection,
- regional and local planning,
- agriculture, forestry and fisheries,
- health,
- emergency management,
- infrastructure, transport and mobility,
- tourism,
- renewable energies

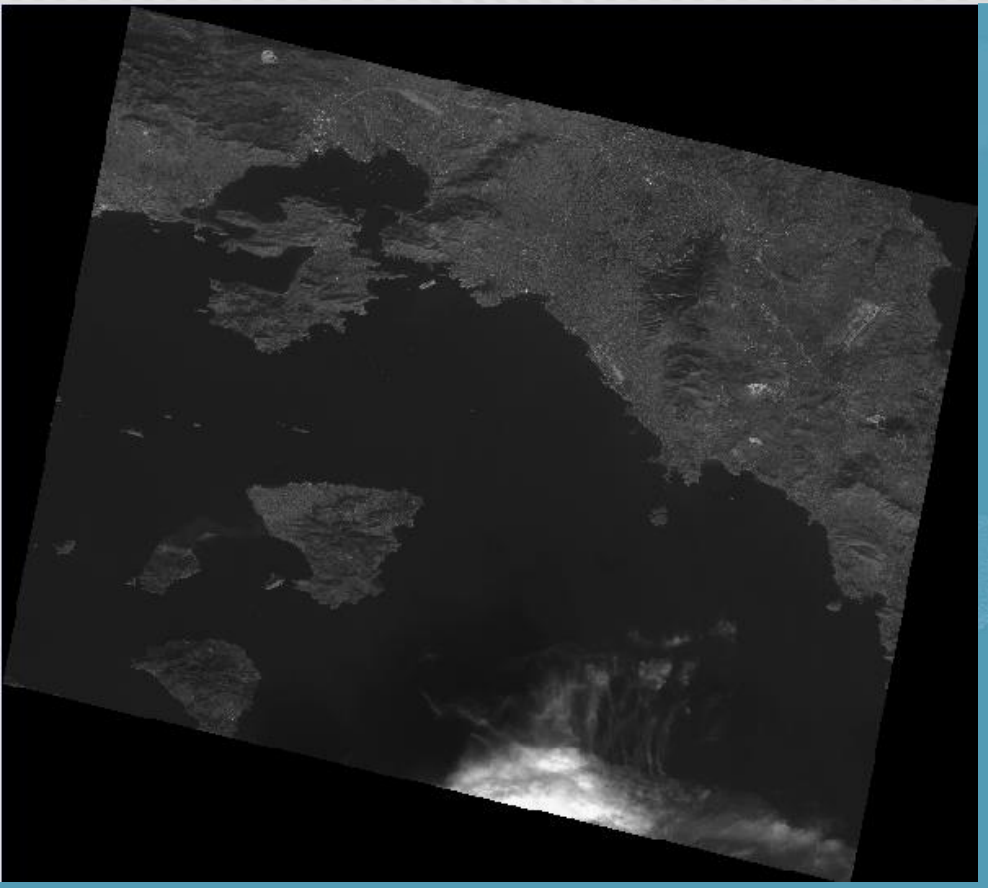
SenseLAB Research

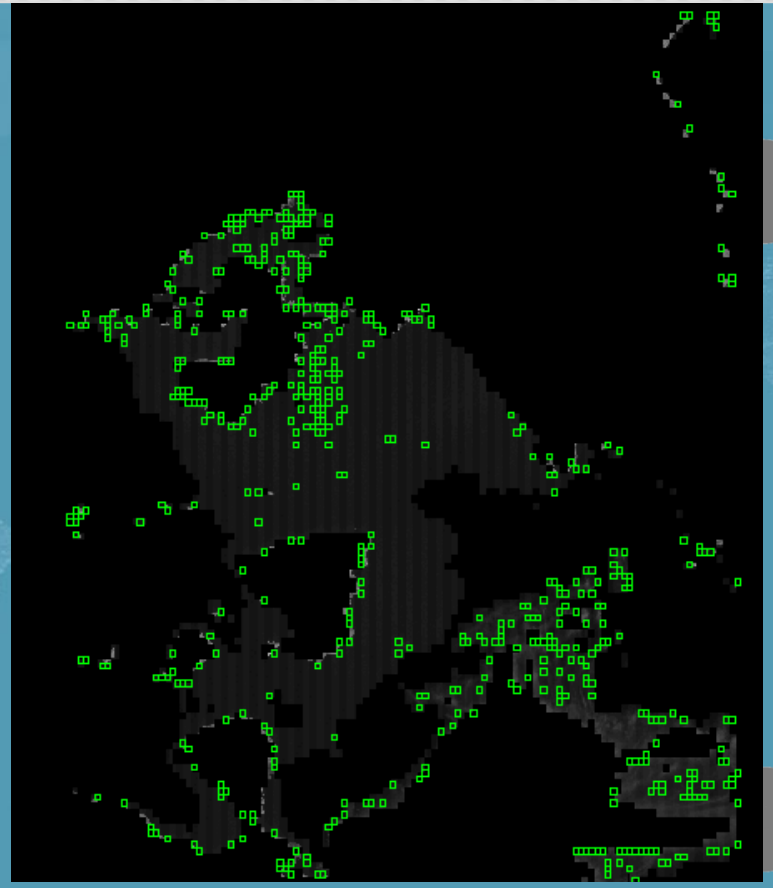
Galileo Mission

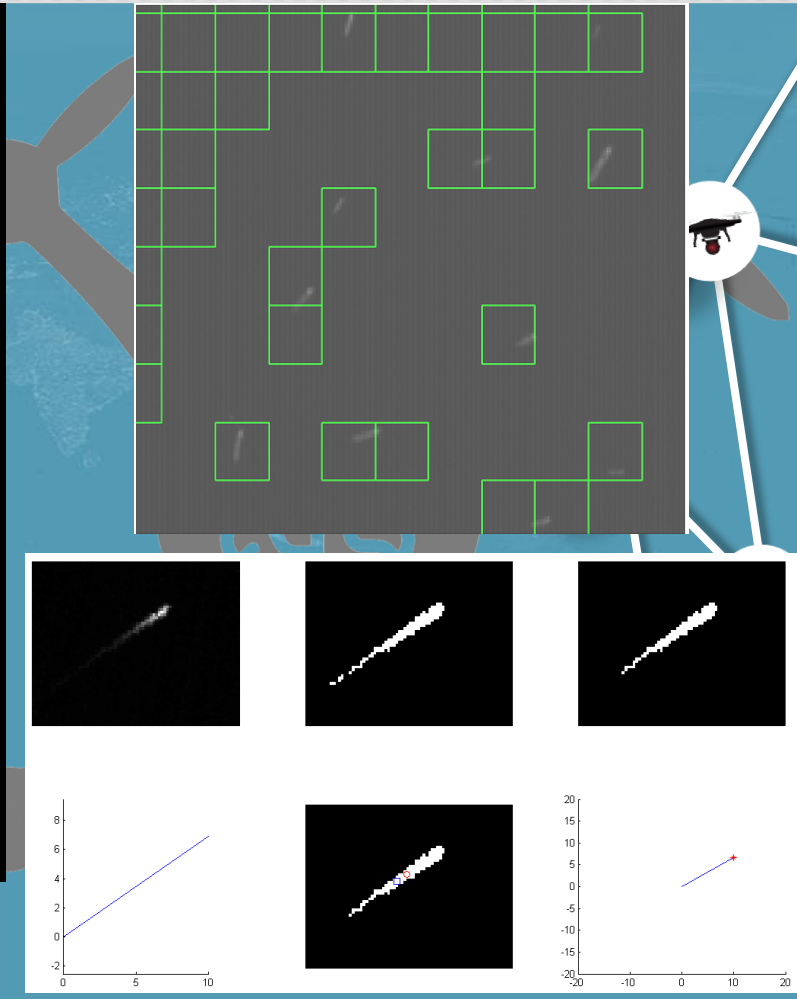
- global navigation satellite system,
- global positioning service under civilian control,
- interoperable with GPS and Glonass,
- deliver real-time positioning 1 m. accuracy
- 24 operational satellites at 23000 km

AGRICULTURE | AVIATION | LOCATION BASED SERVICES (LBS) | MAPPING & SURVEYING | MARITIME | RAIL | ROAD

Sea traffic extraction, inference

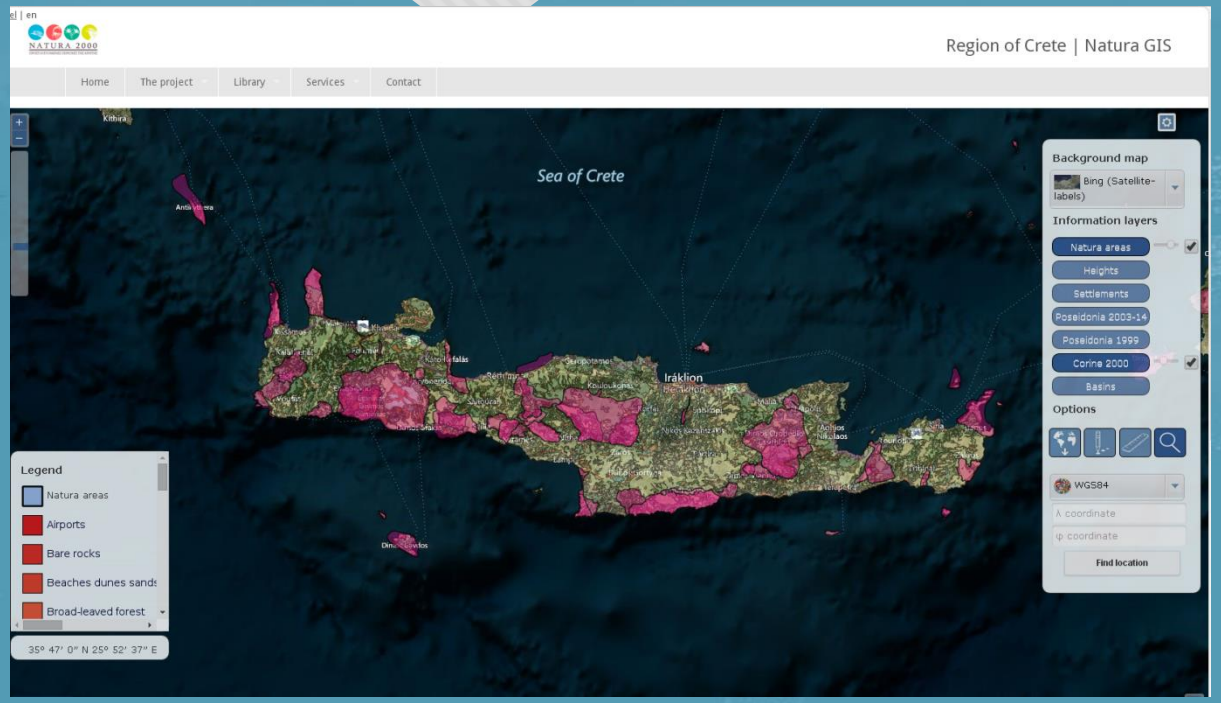






SenseLAB Research

GIS, Location Based Services, Mobile apps, Smart Cities

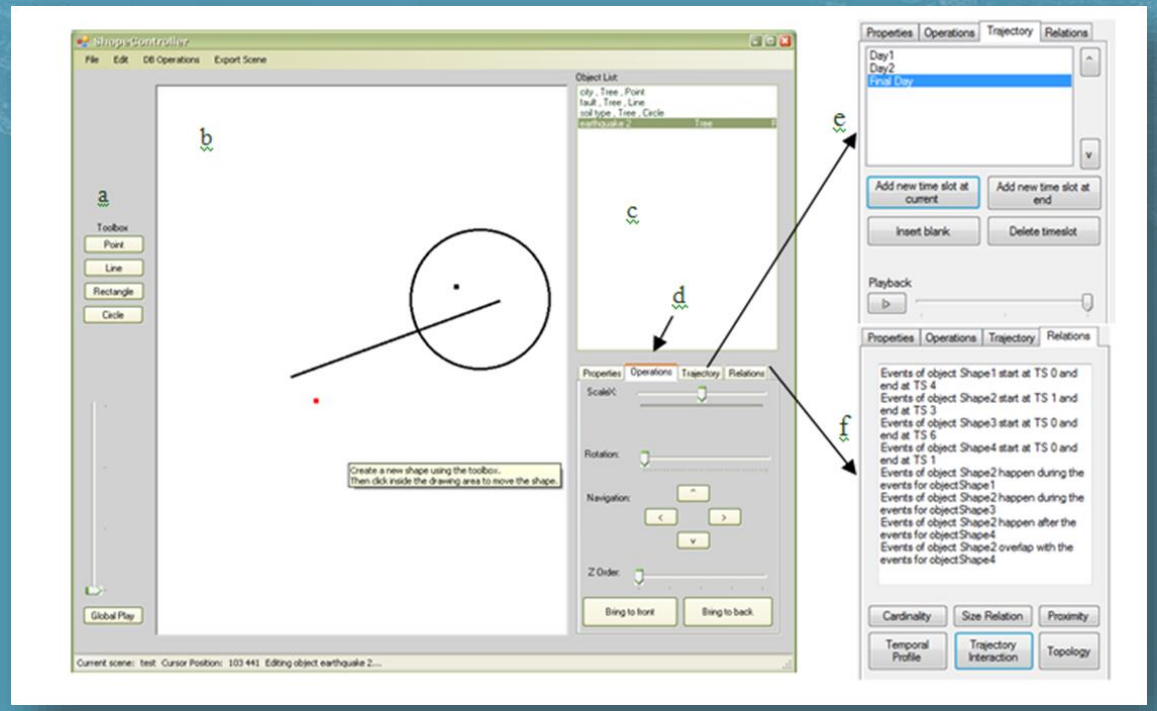


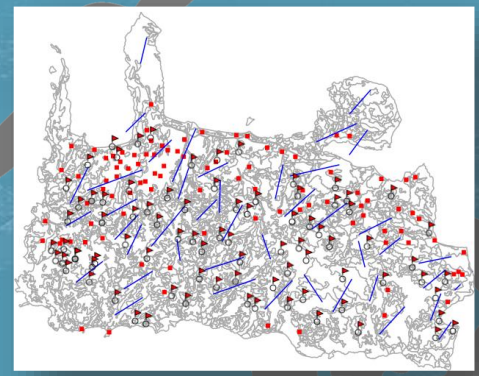
NATURA 2000

ΠΡΟΣΤΑΤΕΥΟΜΕΝΕΣ ΠΕΡΙΟΧΕΣ ΤΗΣ ΚΡΗΤΗΣ

SensoLAB Research

Data Querying
Query by user graphs - windows





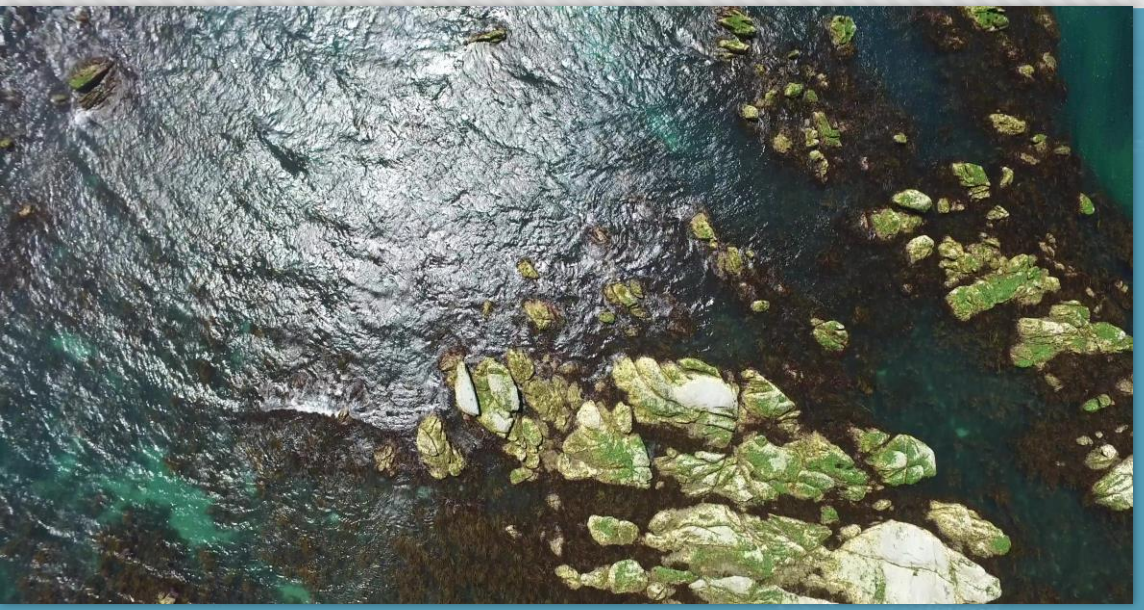
SenseLAB Research

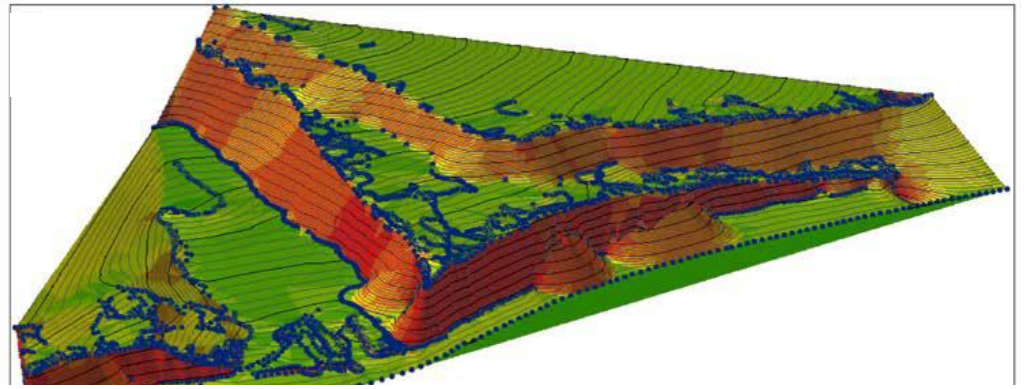
Location Based Services

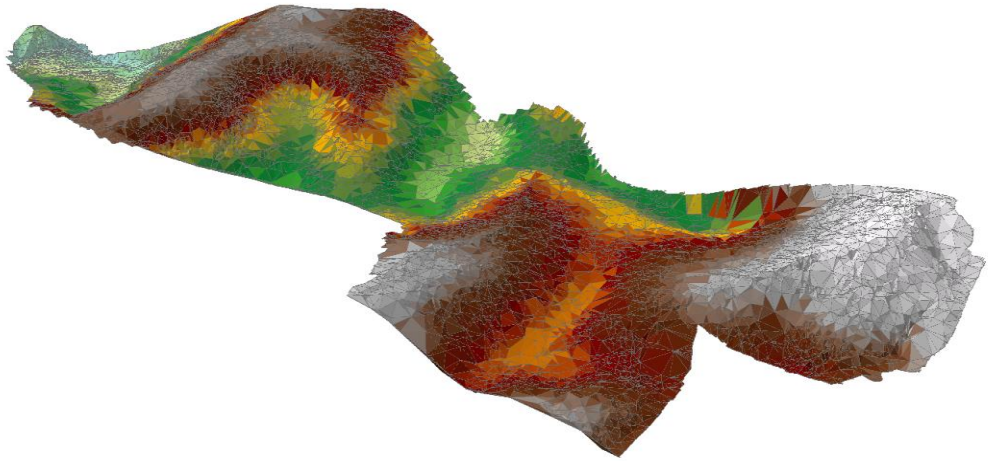
- RescueNET: Natural disaster coordination
- CybEARTH: Augmented visualization
- MiaB: spatiotemporal chat

SenseLAB Research

New Zealand earthquake - Crete



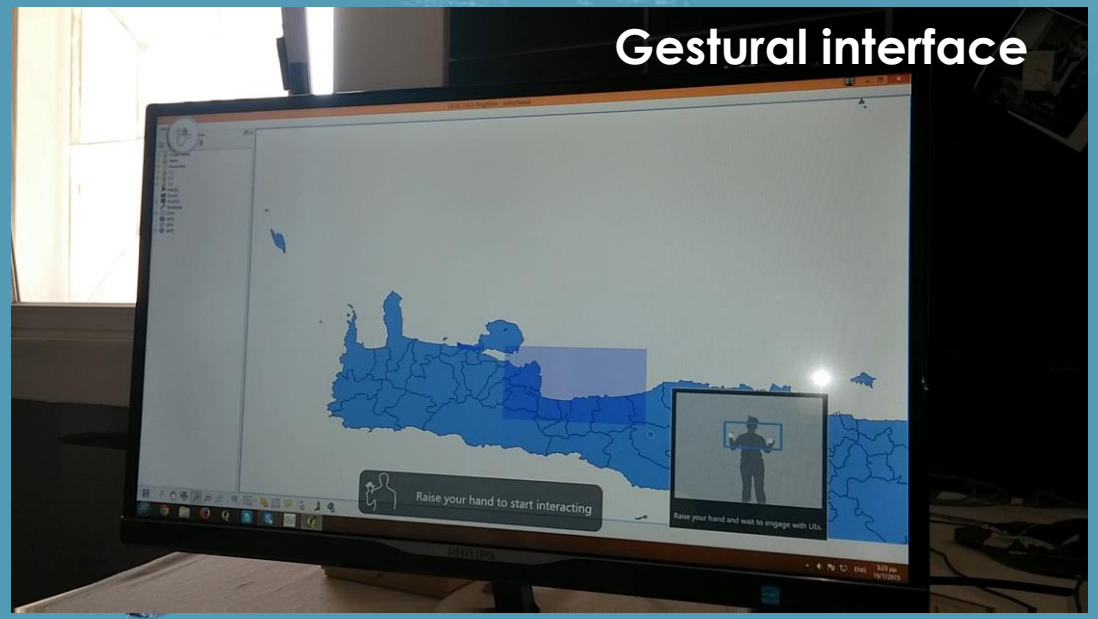


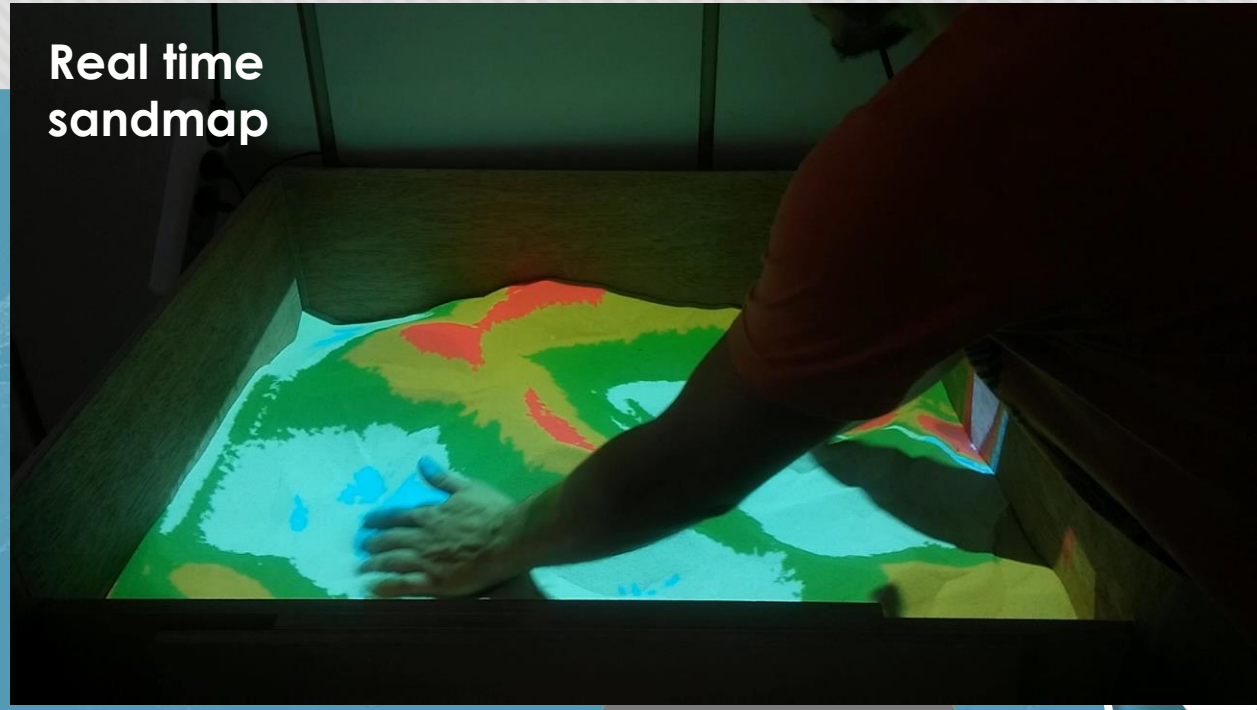


SenseLAB Research

3D Interaction

- Real time scenario monitoring





Selected Awards

Berlin, Madrid, Dubai, Hague, Brussels, …

- 2016, **ESNC**, 2nd Overall winners (400 teams),
- 2016, **GSA**, European GNSS Agency, 1st place,
- 2016, **Satellite Masters**, University Challenge, 1st place,
- 2016, **DJI – Ford** challenge,
- 2016, **Drones for Good**, 1st place in Europe, 3rd Globally, (1000 teams-165 countries),
- 2016 Winner, MyGEOSS, **Joint Research Center** EU,
- 2016, Health Business Awards, Gold Medal,
- 2015, 1st Winner, **Copernicus Masters** & NCMA Spatio-temporal data visualization Challenge,
- 2015, **European Space Agency** Earth Monitoring Finalists.

SenseLAB Research

SenseLab Awards

1st place Copernicus masters

space time spectrum CybEaRth www.senselab.tuc.gr

winner MYGEOSS APPS FOR YOUR ENVIRONMENT

RescueNET

natura2000.crete.gov.gr Web-GIS

NATURA 2000 PROTECTED AREAS OF CRETE

CGI U 2016

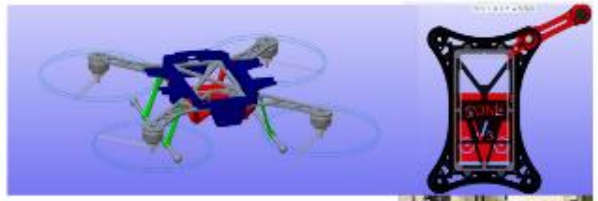
CropDrone

جائزة الإمارات للطائرات بدون طيار لخدمة الإنسان

THE UAE DRONES FOR GOOD AWARD

1st place EU

3rd globally



SenseLAB: Drone design, manufacture, program, personalize, applications

Thank you

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