

6th Infocom Mobile World 2016
Conference

Spatial informatics in the mobility era

Επ. Καθ. Παναγιώτης Παρτσινέβελος

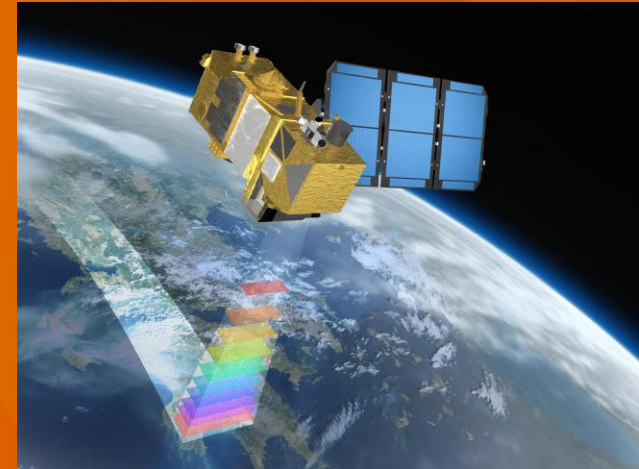
PhD University of Maine,
Spatial Information Science & Engineering

SenseLab research team
Technical University of Crete



1. Χωρικά δεδομένα

- **Όγκος δεδομένων:**
 - Petabytes εικόνων ανά ημέρα,
 - 5 million data resources in the GEOSS Data-CORE
- **Δορυφορική Τηλεπισκόπηση,**
- **Κατανόηση δεδομένων: Μόνο εξειδικευμένο προσωπικό μπορεί να επεξεργαστεί τα δεδομένα,**
- **Interoperability: Δομή ανοικτή και επαναχρησιμοποιήσιμη.**

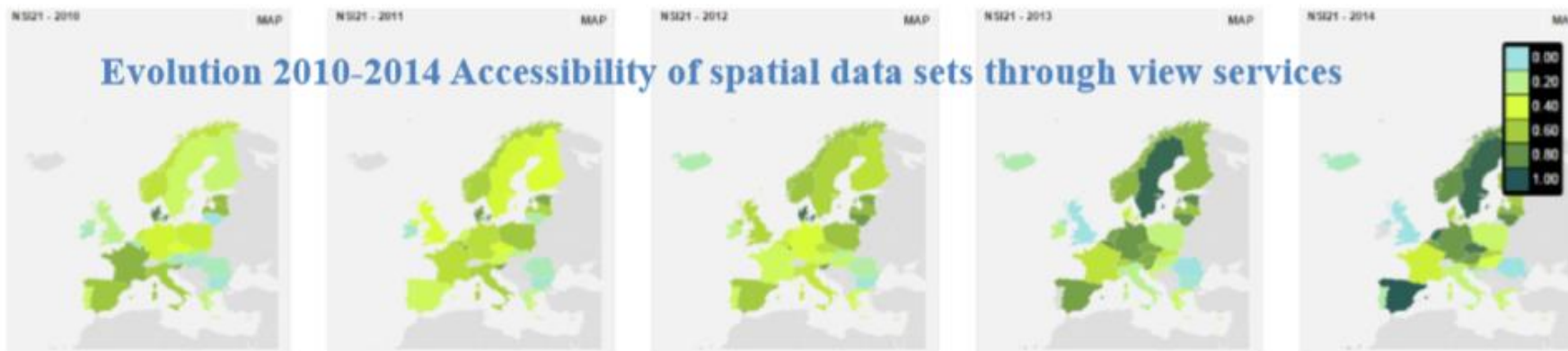


Εφαρμογές

- Ο χώρος ορίζει ιδιοκτησίες, σχέσεις, διεκδικήσεις, συμπεριφορές,
- Copernicus,
- GNNS,
- Διαστημική οικονομία 250 billion \$ in 2013.



Δομές στην Ελλάδα



2. Crowdsourcing

- Κοινωνική συνεργατική επιστήμη
 - Citizen Science
 - Όλοι αποτελούμε δυνητικούς «αισθητήρες» λήψης δεδομένων
 - Συλλογή και αποτίμηση
- Ηλεκτρονική-δημοκρατία
- Ηλεκτρονική-διακυβέρνηση



3. Μη επανδρωμένα ιπτάμενα οχήματα/ drones

\$8-10bn USD

Projected economic impact of the drone industry by 2025.

100,000+

Anticipated international job creation directly related to the drone industry.



10x less...

... Than a helicopter to operate, drones provide affordable solutions.

5cms - 50 metres

Drones can be as small as 5cms and as large as 50 metres.



Rescue NET

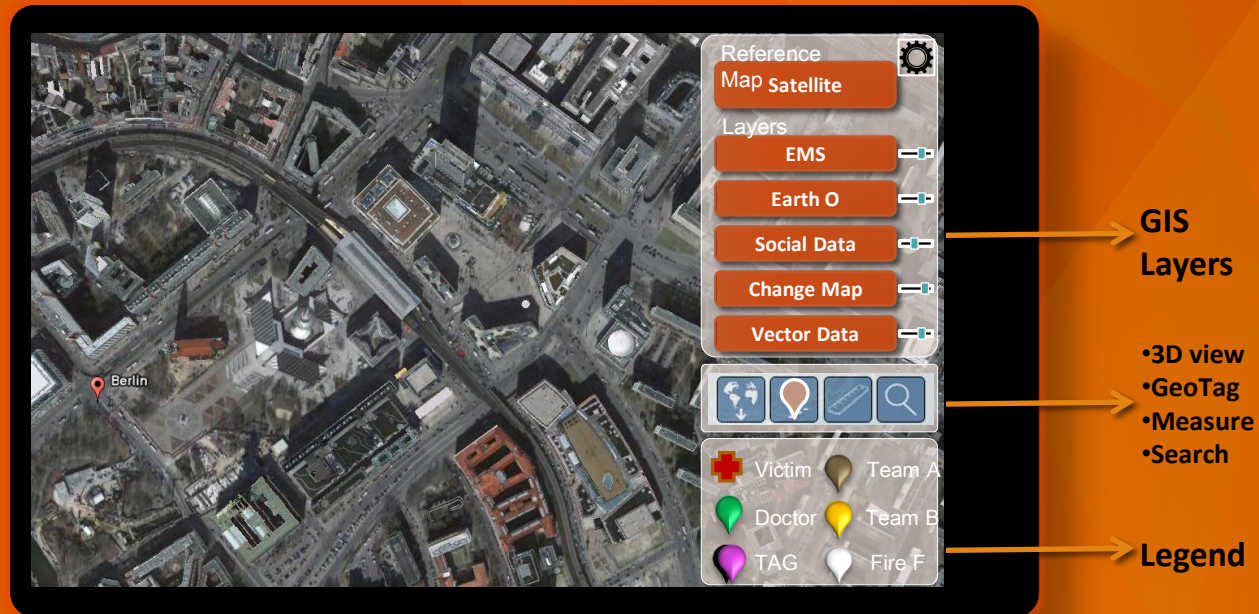


MYGEOSS 2016

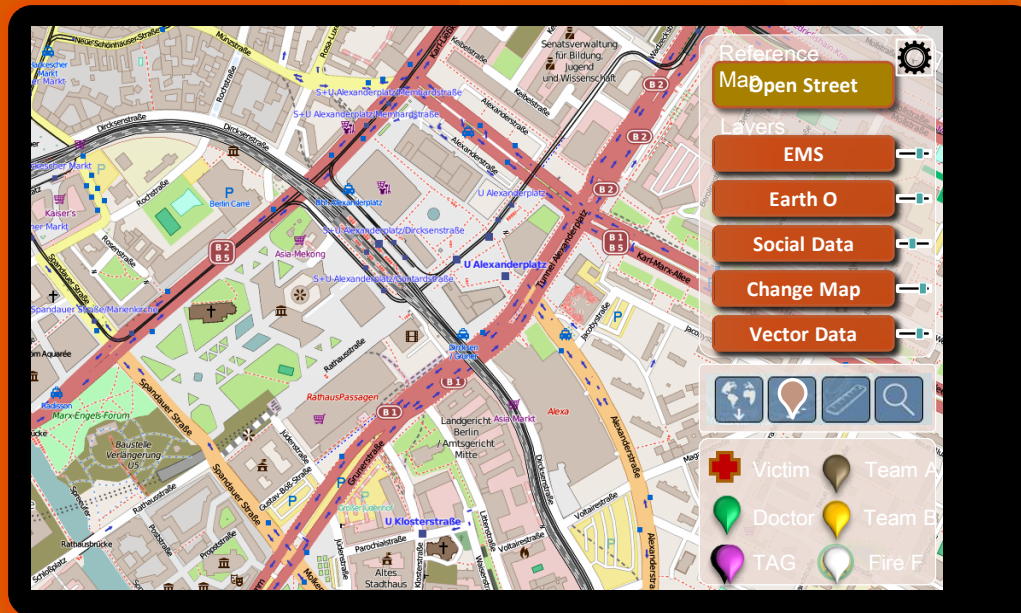
EO & social data integration
for management in emergency
& collaborative environments



Functionality: Application paradigm



Change of background map

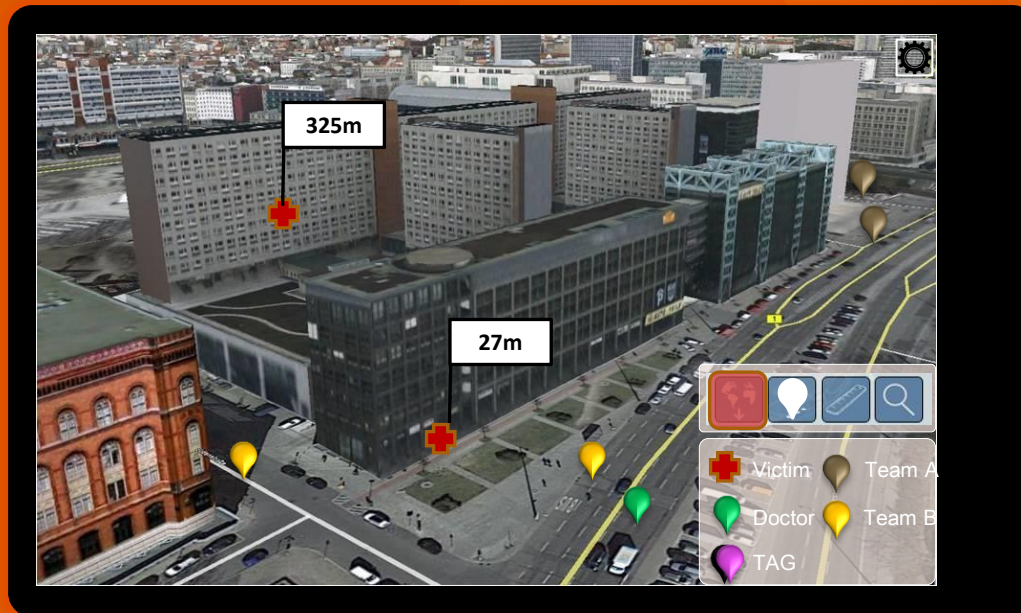


User types



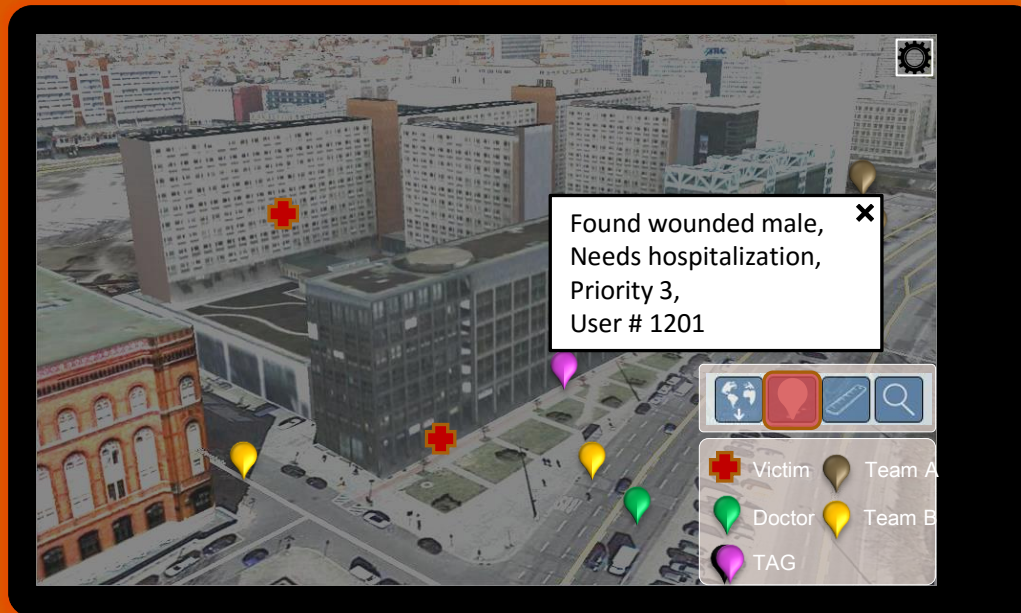
- Dynamic movement of users and people in need

3d view



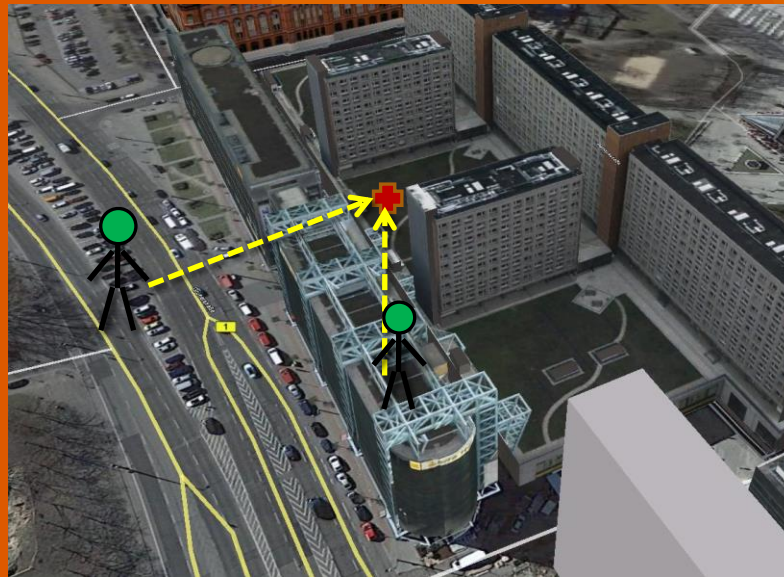
- Perspective view with annotated information

Geo-tag



Occlusion, visual sharing

- When a user recognizes an important feature, it becomes visually available to the rest of the users

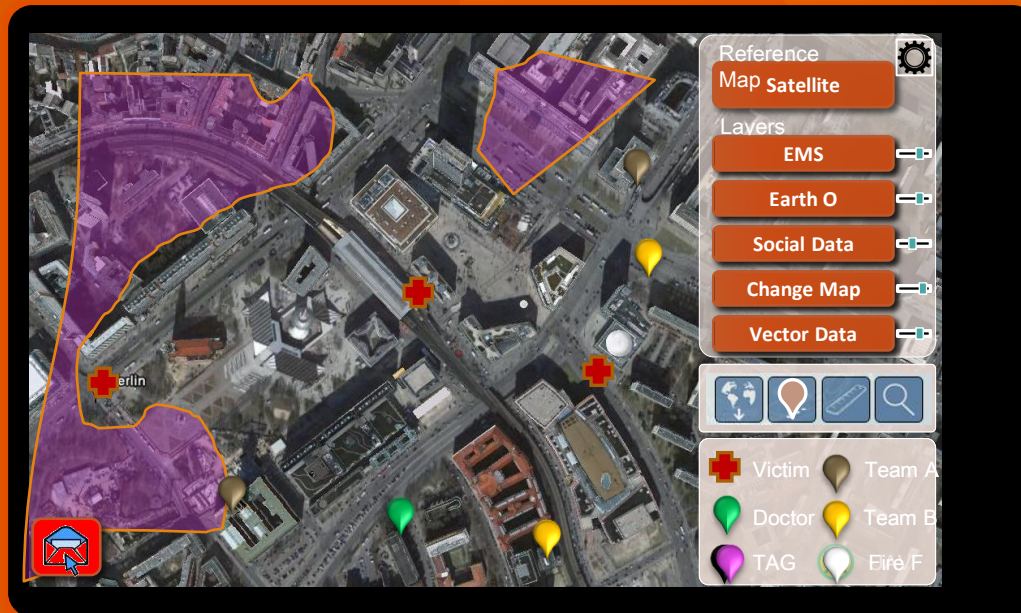


New message, new data



- The users or operation center may send messages to users,
- When new data from EO or user integration becomes available new data button blinks to inform the users.

Non covered area



- Shaded colors indicate automatically which areas are not yet covered while urging users to visit them.



Cybearth



National Cadastre &
Mapping Agency

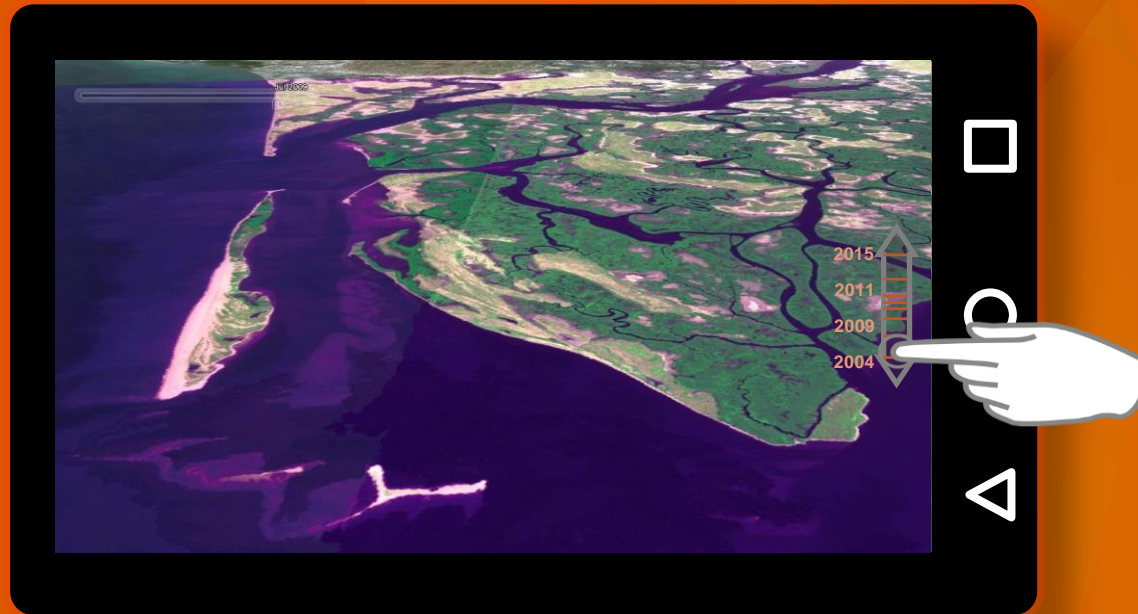
ADAPTIVE AUGMENTED VISUALIZATION
OF SPATIAL, TEMPORAL & SPECTRAL
EO DATA UPON
DYNAMIC MOBILE DEVICE VIEWS



www.senselab.tuc.gr

LULC - change detection

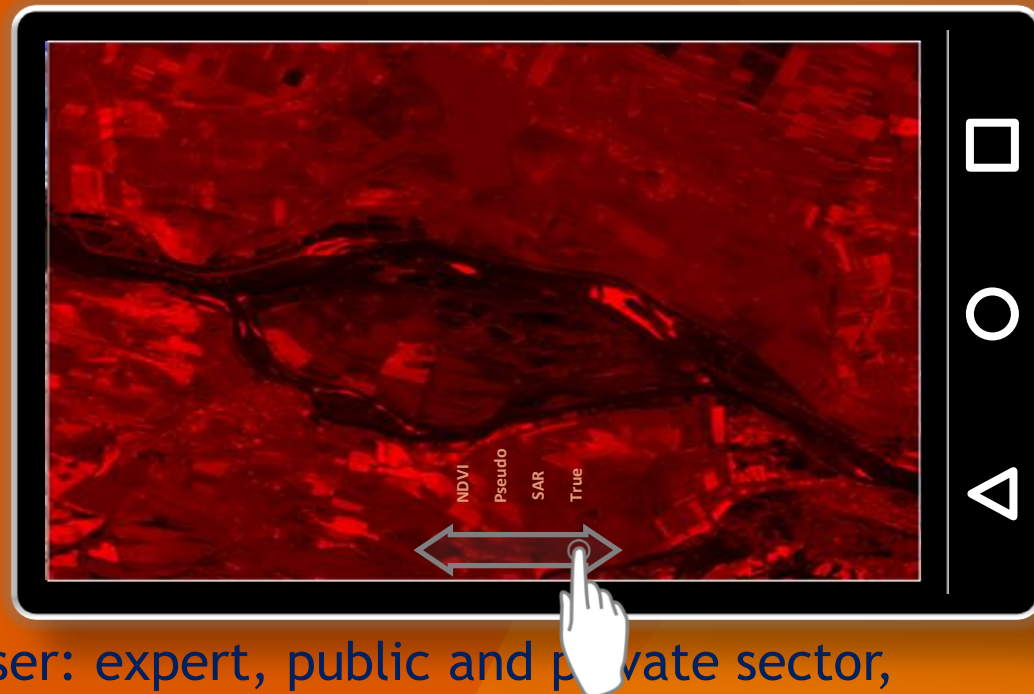
- application: marine monitoring, climate change
- demonstration: **navigation in time**



- user: non-expert, expert, public authorities, interpretation of change
- data: Sentinel 1-2-3, contributing

Environmental monitoring

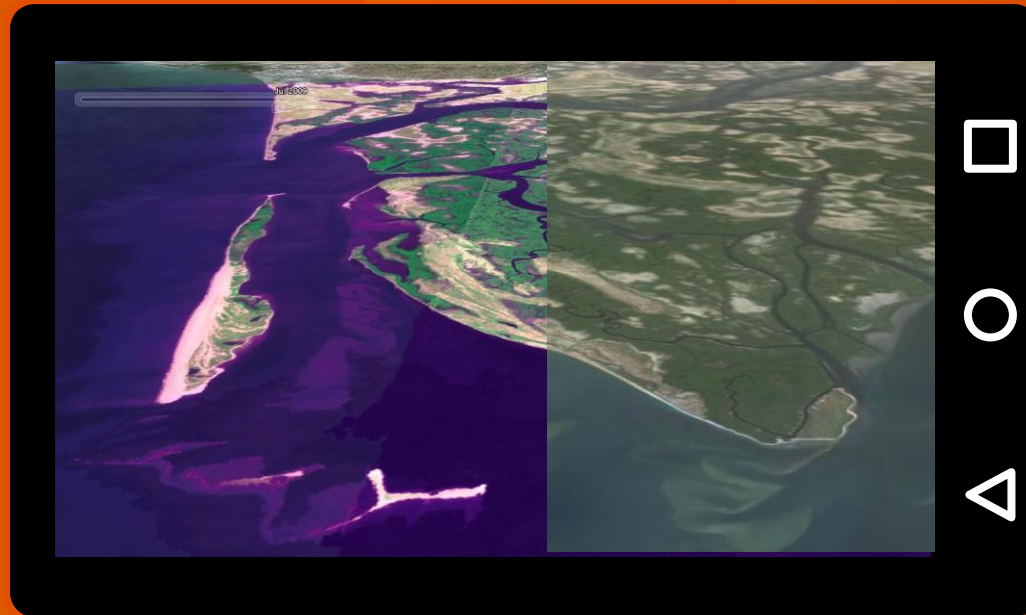
- application: agriculture, geology interpretation
- demonstration: **navigation in spectrum**



- user: expert, public and private sector,
- data: Sentinel-2 multi-spectral & NDVI, Sentinel-1 SAR.

Disaster management

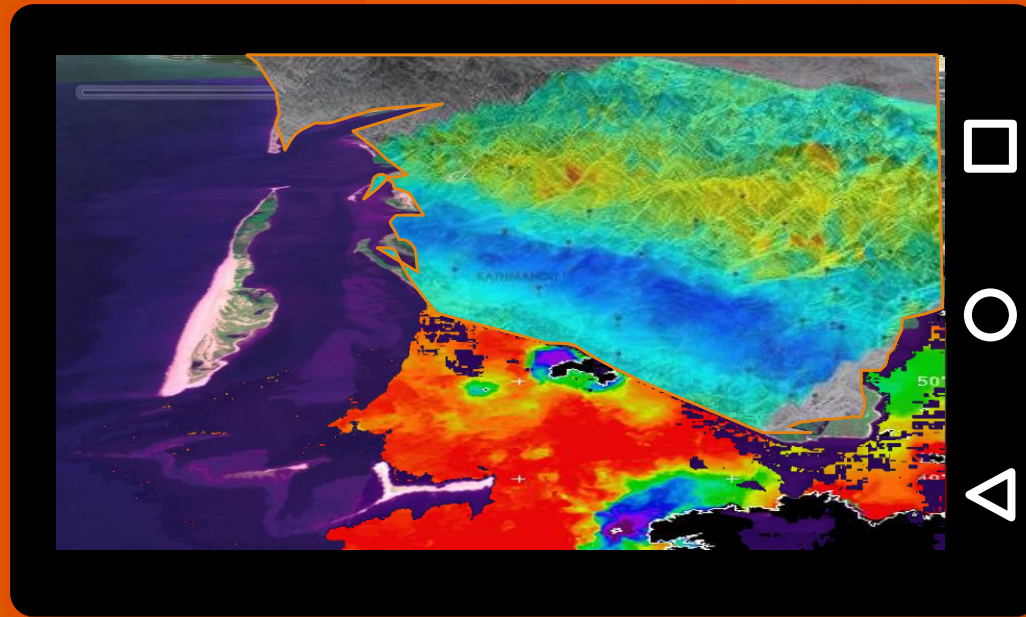
- application: flooding, wildfires
- demonstration: **comparison** pre-post assessment



- user: expert, public authorities,
- data: Sentinel 2-3, contributing platforms

Disaster management

- application: earthquake, geomorphology, oceans, ...
- demonstration: additional processed EO data,



- user: expert, public authorities, private companies,
- data: Sentinel-3 SST, Sentinel-1 DinSAR, Sentinel-1 SAR, EMS

Augmented, annotation

- application: all
- demonstration: vector data, change maps, ST data,



- user: non-expert, expert, public, private,
- data: all.



smartdrone

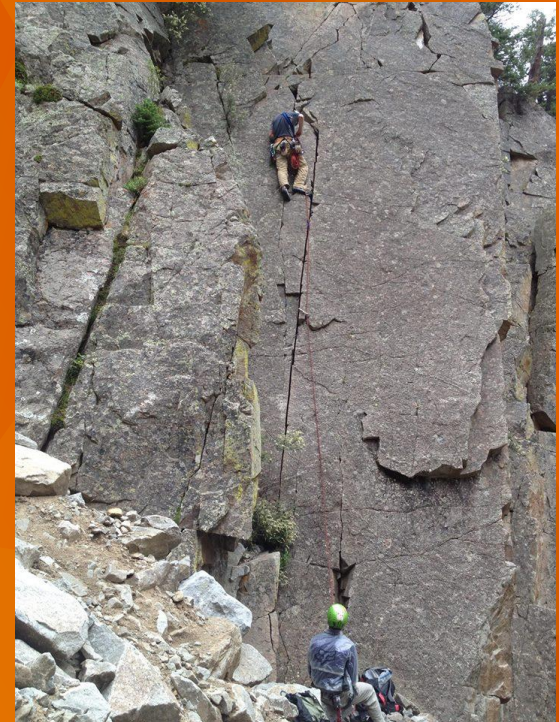
Drones for Good

- 1017 προτάσεις από 165 χώρες
- Harvard, MIT, Oxford, London Business School, RMIT, University of Toronto, Seoul National University.



Σενάριο Α

- Ορειβάτης χάνεται ή τραυματίζεται χωρίς υπηρεσίες κινητής τηλεφωνίας...



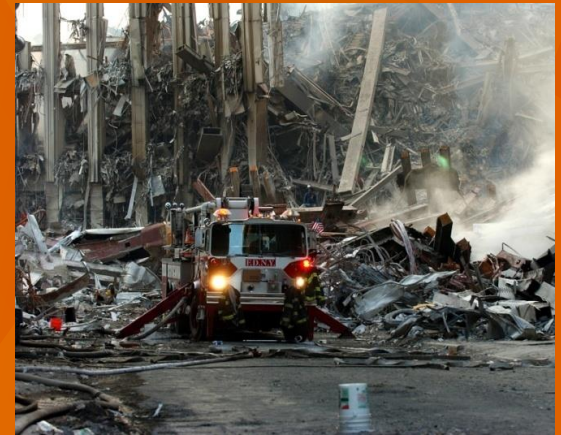
Σενάριο Β

- Καρδιοπαθής χρήζει άμεσης φαρμακευτικής αγωγής...



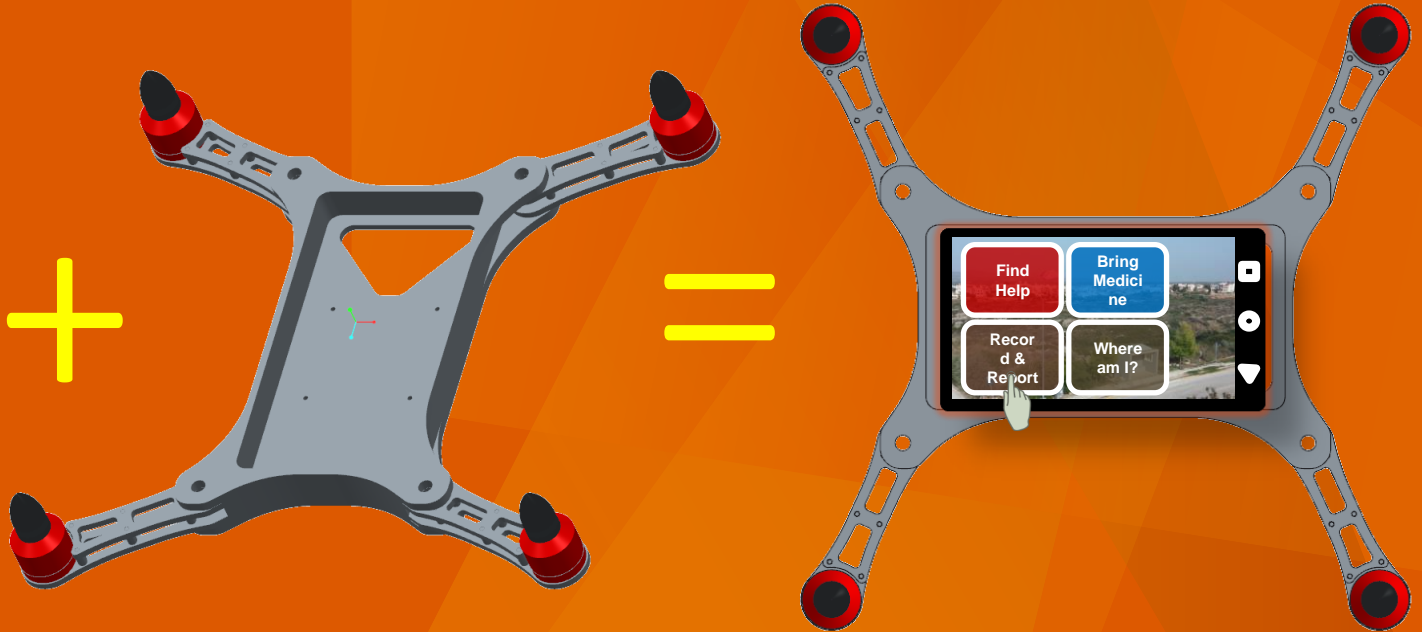
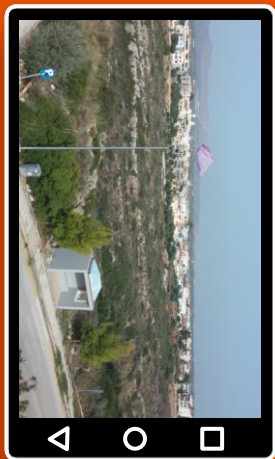
Σενάριο Γ

- Φυσική καταστροφή με επίδραση στη μορφολογία της περιοχής...



smart-drone

- Λύση: Σύζευξη του κινητού επί ενός μη επανδρωμένου ιπτάμενου οχήματος στο μέγεθος μιας θήκης κινητού!



Αυτονομία - αυτοματισμός

- One button system



Λειτουργίες

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.

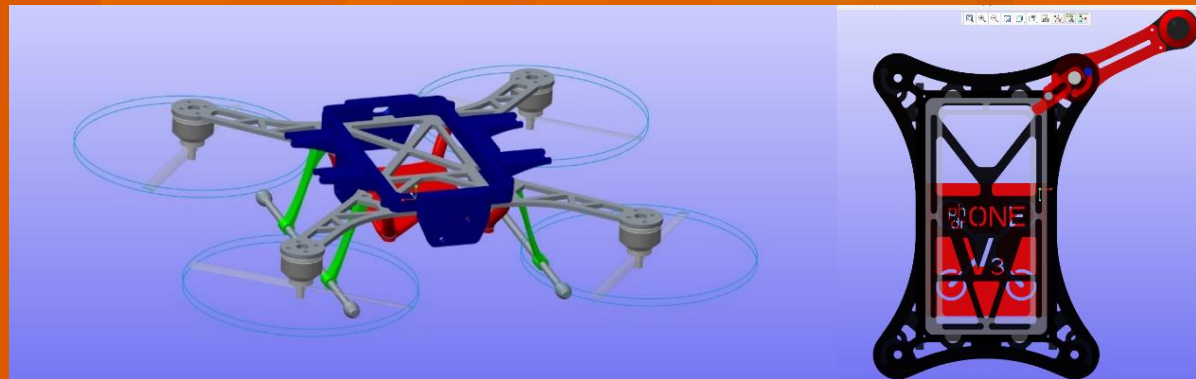
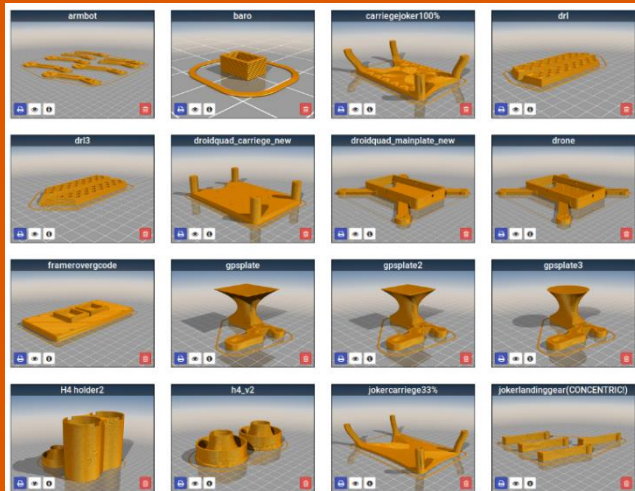
Σχεδιασμός

- Εκμετάλλευση των πόρων του κινητού,

- Αισθητήρες
- Επεξεργαστής
- Επικοινωνία



- Τρισδιάστατη εκτύπωση

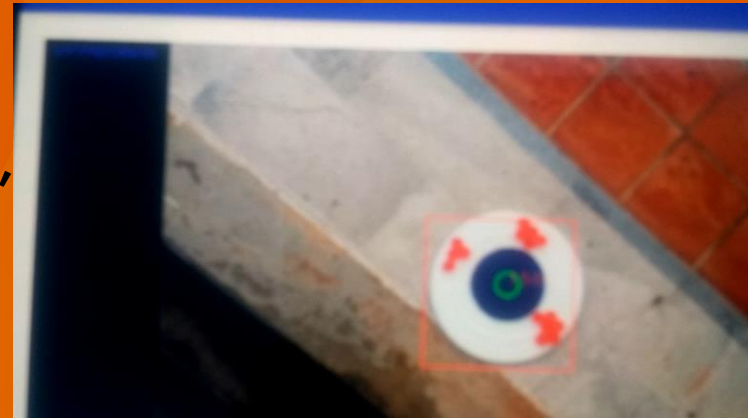




Πυλώνες έρευνας & καινοτομίας

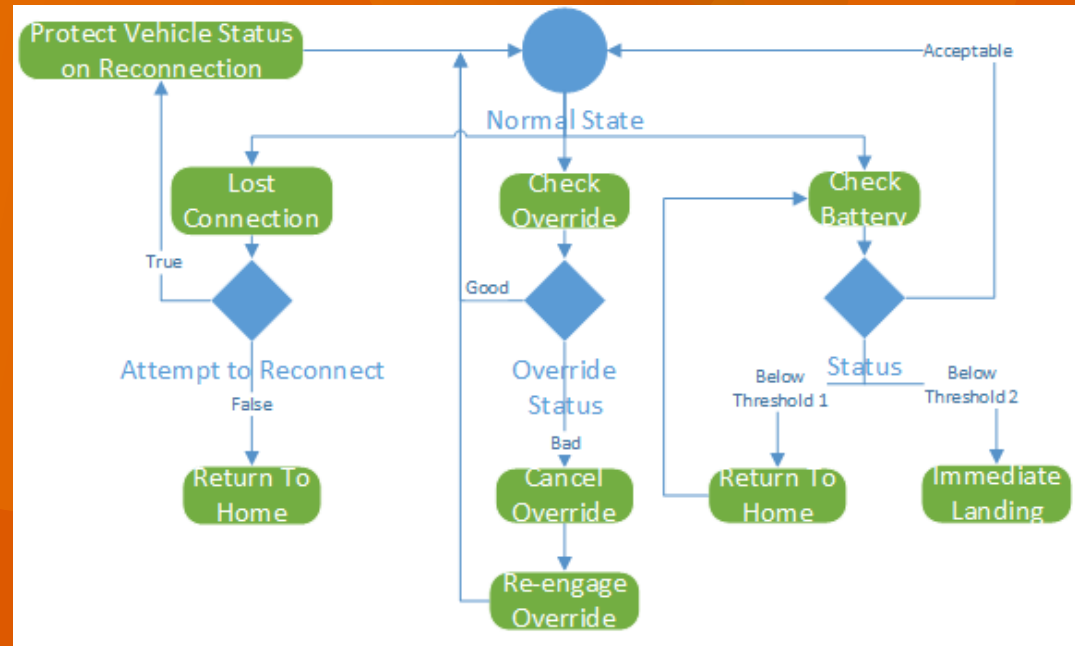
Αυτονομία - Αυτοματισμοί

- One button system/ No button system,
- Easy to operate,
- Modular architecture,
- On board processing – embedded,
- AI and image processing features,
 - Find best route,
 - Precision landing,
 - Obstacle avoidance and handling,
- Mapping: 3D, Satellite, real-time sensor, assessment.



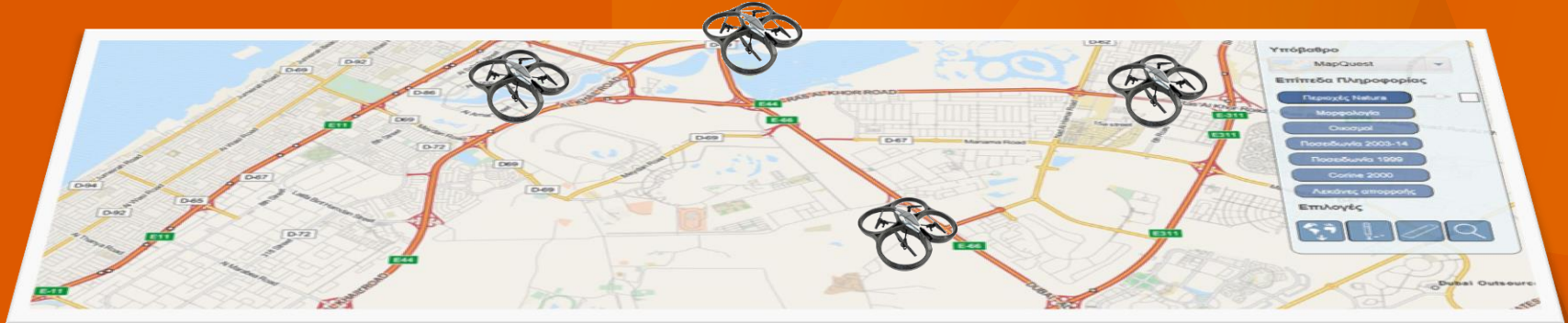
Ασφάλεια – Εφεδρείες

- Less than 1kgr, compliance with regulations (EASA),
- Used in life threatening occasions,
- Decisions based on:
 - Flight controller,
 - Phone processor,
 - Image Processing,
 - Phone sensors,
 - External sensors,
 - Swarm information.
- Collision avoidance,
- Communication:
 - MAVlink over ssh protocol.

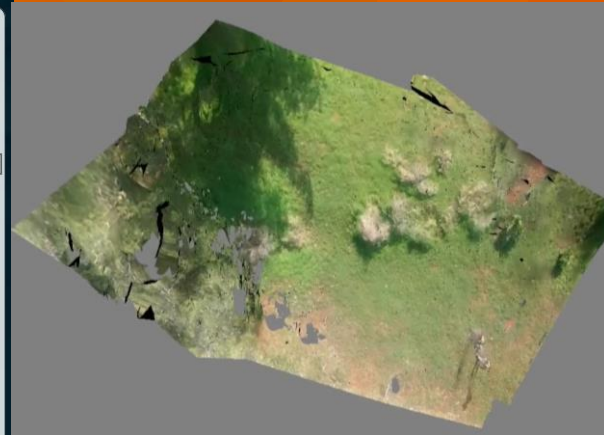
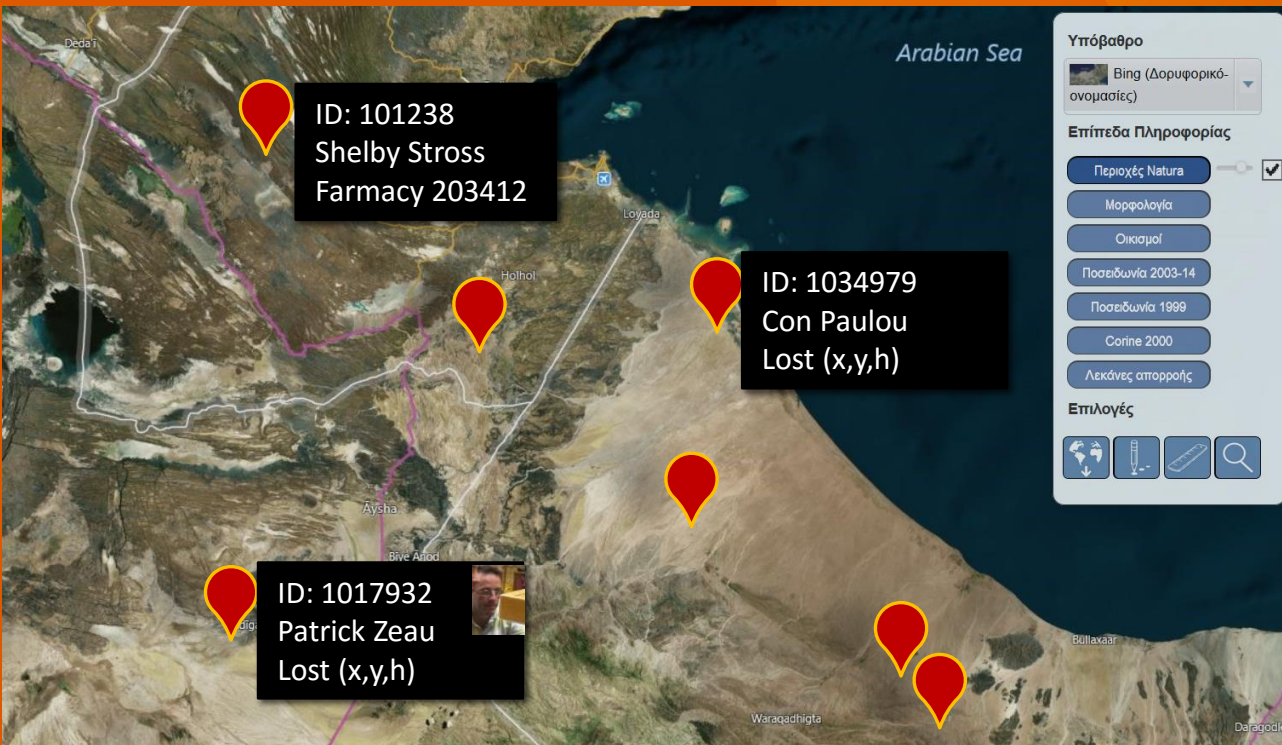


Διαχείριση σμήνους

- Έλεγχος εναέριας κυκλοφορίας,
- Συντονισμός, Προτεραιότητα, Αποφυγή σύγκρουσης,
- Απομακρυσμένος έλεγχος,
- Ζώνες,
- Υποδομές κινητής.



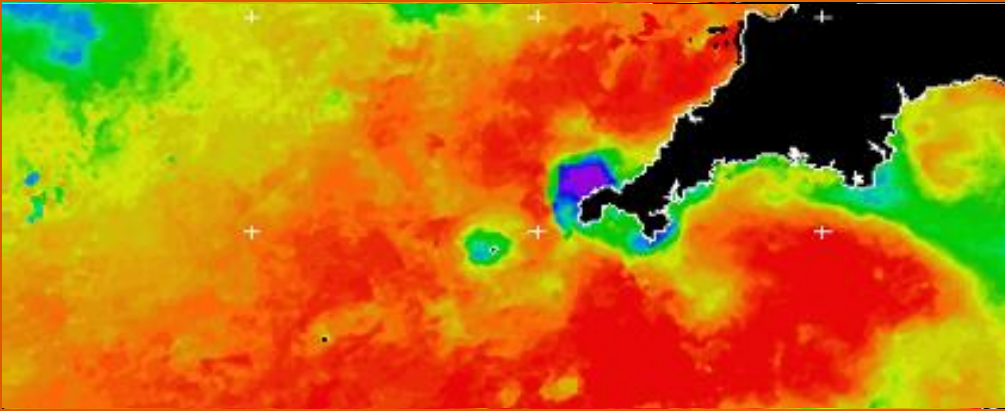
Υπηρεσίες



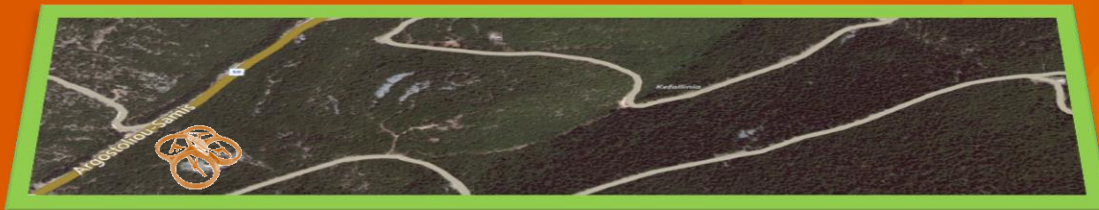
**Photogrammetric
3D models**

Χάρτες πραγματικού χρόνου

- Thermal mapping for fire disaster evacuation.



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



Κοινωνικές εφαρμογές

- **Education – write your own drone mobile App,**
 - Open software, open hardware,
- **Environmental monitoring, atmosphere, dust,**
- **Mobile phones rise in developing countries but not health level:**
 - Medicine distribution, physical medical samples, remote diagnosis,
- **Aid non-profit organizations.**



Vision

- Life saving,
- Safe,
- Portable,
- Affordable,
- Personalized,

Vision:

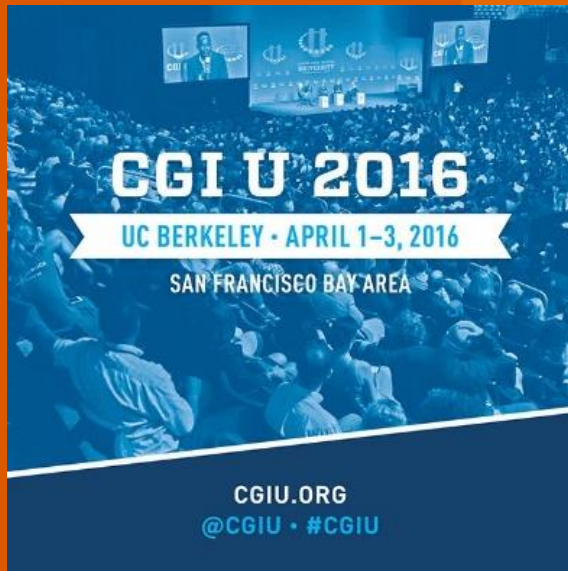
Low Price
Unlimited Value



**ONE DRONE FOR ALL
ONE DRONE PER PERSON**

Operation Paradiam

CropDrone





SenseLAB

The Team

Areas of research

- Χωρικά Πληροφοριακά Συστήματα,
- Δορυφορική Τηλεπισκόπηση,
- Μη επανδρωμένα ιπτάμενα οχήματα,
- Απτά GIS,
- Visualization,
- Gestural interfaces, Επικοινωνία χρήστη - υπολογιστή



Selected Awards

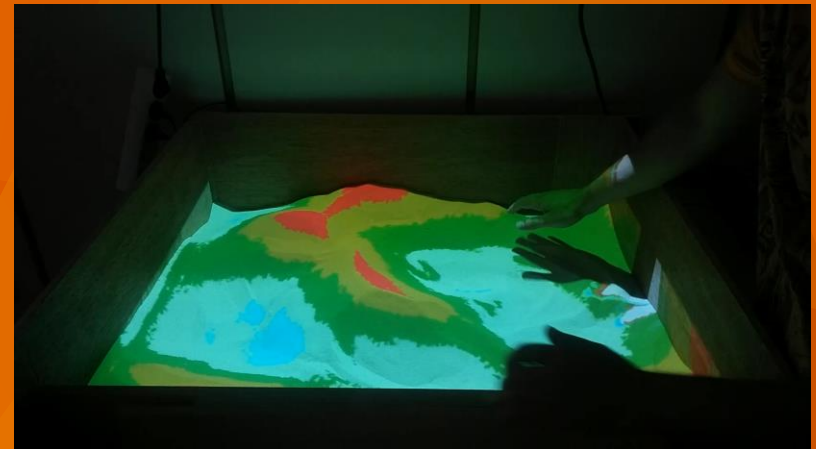
- 2016, DJI – Ford challenge, first round, winners TBA
- 2016, Drones for Good International Award, 1st place in Europe, 3rd Globally, Save_ME smartDrone,
- 2016 Winner, MyGEOSS, Joint Research Center EU, Global Earth Observation System of Systems, smart internet applications, RescueNET,
- 2015, 1st Winner, Copernicus Masters & National Cadastre and Mapping Agency (NCMA) Spatio-temporal data visualization Challenge, CybEarth,
- 2015, European Space Agency and Copernicus Earth Monitoring Competition Finalist.



SenseLab Research Group



- 20 Undergraduate & Graduate students.



Thank you



Image References:
ESA Sentinel 1 & 2,
SenseLab,
Wikipedia commons,
Bing, Flickr