Ένωση Πληροφορικών Ελλάδας

Νέες τεχνολογίες και ρομποτική στην Έρευνα και Διάσωση

Χάρης Γεωργίου (MSc, PhD)

Ένωση Πληροφορικών Ελλάδας

Στόχοι:

- Πρώτος "καθολικός" φορέας εκπροσώπησης πτυχιούχων Πληροφορικής.
- Αρμόδιος φορέας εκπροσώπησης επαγγελματιών Πληροφορικής.
- Αρμόδιος επιστημονικός "συμβουλευτικός" φορέας για το Δημόσιο.
- Αρωγός της Εθνικής Ψηφιακής Στρατηγικής & Παιδείας της χώρας.

Τομείς παρέμβασης
Ποιοι είναι οι κύριοι τομείς παρεμβάσεων της ΕΠΕ;

1. Εθνική Ψηφιακή Στρατηγική & Οικονομία
2. Εργασιακά (ΤΠΕ), Δημόσιος & ιδιωτικός τομέας
3. Παιδεία (Α′, Β′, Γ′)
4. Έρευνα & Τεχνολογία
5. Έργα & υπηρεσίες ΤΠΕ
6. Ασφάλεια συστημάτων & δεδομένων
7. Ανοικτά συστήματα & πρότυπα
8. Χρήση ΕΛ/ΛΑΚ
9. Πνευματικά δικαιώματα
10. Κώδικας Δεοντολογίας (ΤΠΕ)
11. Κοινωνική μέριμνα (ICT4D)

Harris Georgiou (MSc, PhD) – https://github.com/xgeorgio/info

- R&D: Associate post-doc researcher and lecturer with the University Athens (NKUA) and University of Piraeus (UniPi)
- Consultant in Medical Imaging, Machine Learning, Data Analytics, Signal Processing, Process Optimization, Dynamic Systems, Complexity & Emergent A.I., Game Theory
- HRTA member since 2009, LEAR / scientific advisor
- HRTA field operator (USAR, scuba diver)
- Wilderness first aid, paediatric (child/infant)
- Humanitarian aid & disaster relief in Ghana, Lesvos, Piraeus
- Support of unaccomp. minors, teacher in community schools
- Streetwork training, psychological first aid & victim support
- 2+ books, 160+ scientific papers/articles (and 5 marathons)

Επισκόπηση – Πηγές

- Περιεχόμενα:
  - Τεχνολογίες USAR επόμενης γενιάς (UAV, COP, AR, remote sensing, ...)
  - “Detection of victims with UAVs during wide area Search and Rescue operations” (SSRR’22)
  - “Emergency response in recent urban/suburban disaster events in Attica: Technology gaps, limitations and lessons learned” (ISCRAM’21)
  - Future trends / “Moving forward”

- Πηγές:
  - EU H2020 projects (SCENT, FASTER, CURSOR, INGENIOUS, INTREPID)
  - INSARAG Guidelines for USAR Operations (2020)

Hellenic Rescue Team of Attica – H.R.T.A

- Independent NGO, participate in field-specific & first-aid training, about 800 members in Attica
- Certified experts in various topics & environments (wilderness, urban, river, scuba, ...)
- Active since 2000, part of the Greek Civil Protection's general plan when needed, as well as internationally in large events in close collaboration with other H.R.T branches in Greece
- Respond in emergency/disaster events, medical first-responders in the scene, SAR missions, humanitarian aid & relief in disaster zones
- Provide training and medical/safety coverage, specialized or general-purpose, to the public

LAND SAR: Wilderness, non-urban
(mountain, canyon/river, forest)

WATER SAR: Surface, underwater, shore
(sea, large river, lake)

URBAN SAR: emergency response, disaster relief
(earthquake, flood, fire, large-scale accidents)

Hellenic Rescue Team of Attica – H.R.T.A

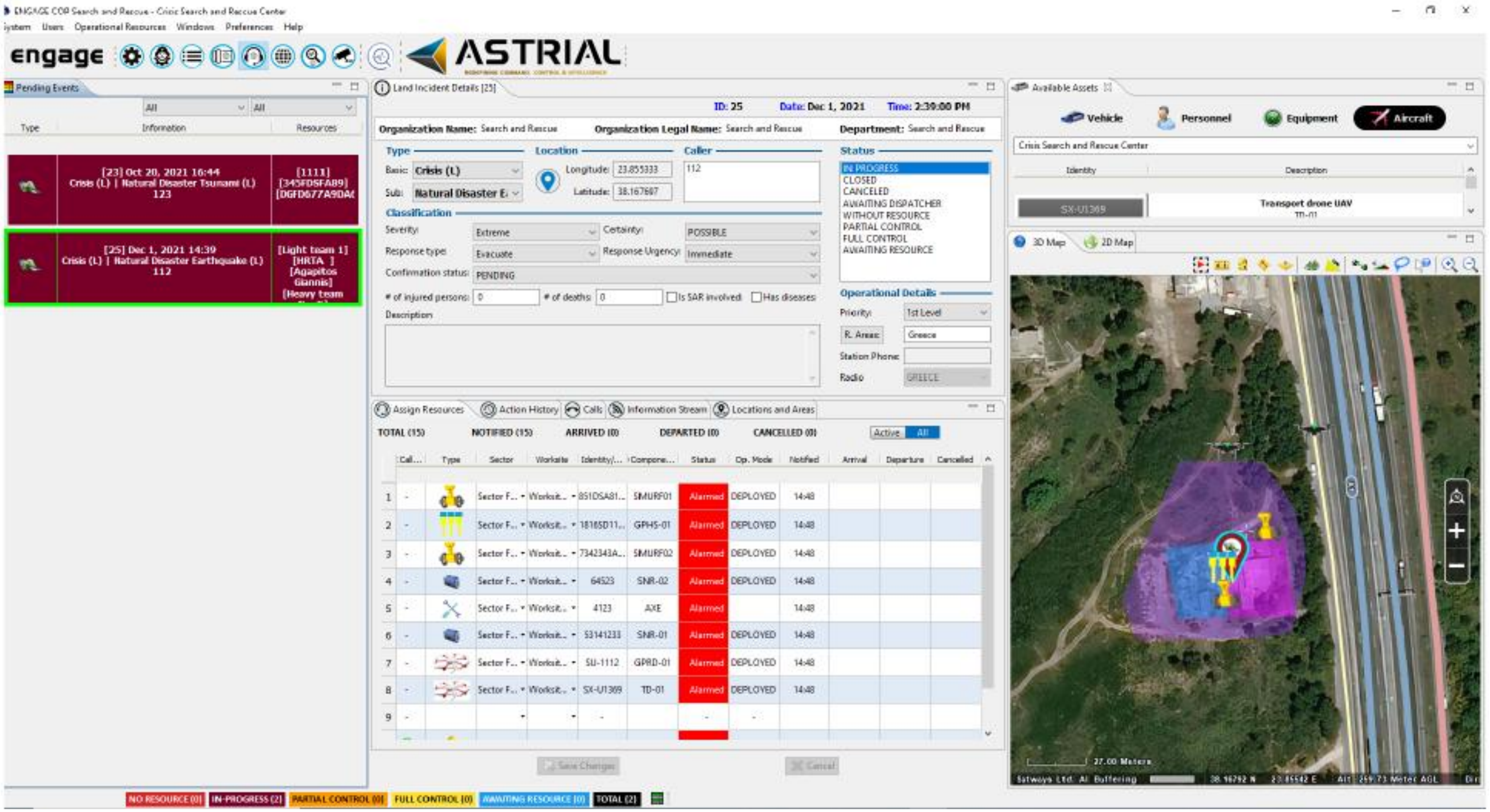
- Participating in EU-funded R&D projects since 2016
- Primary role as domain expert (SAR), technology demonstration, field testing, dissemination in domain
- Already hosting large-scale field events in HRTA Training Center at Afidnes (Attica) since 2019
- Related large-scale missions in Attica disaster events, in flash floods (Mandra, 2017) and rapid wildfires (Mati, 2018), for SAR, missing persons, humanitarian aid

These projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreements n688930, n833507, n.832790 and n.833435, n883345

Current technologies / Under development: UxV

Credits: CURSOR project

Current technologies / Under development: COP



Credits: CURSOR project

Current technologies / Under development: ARV

Credits: FASTER project

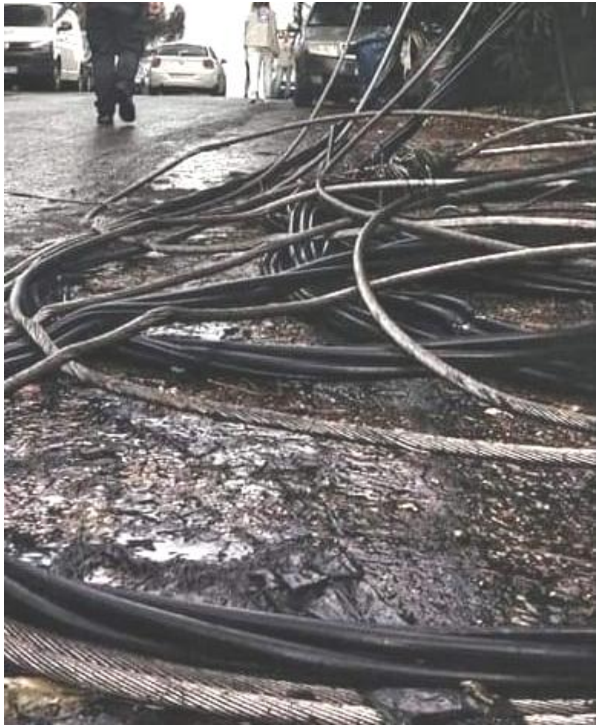
What is needed: Remote Sensing

Credits: FASTER project

What is needed: Quick & Safe Access

What is needed: Team localization & hazard mapping

Mati, 2018

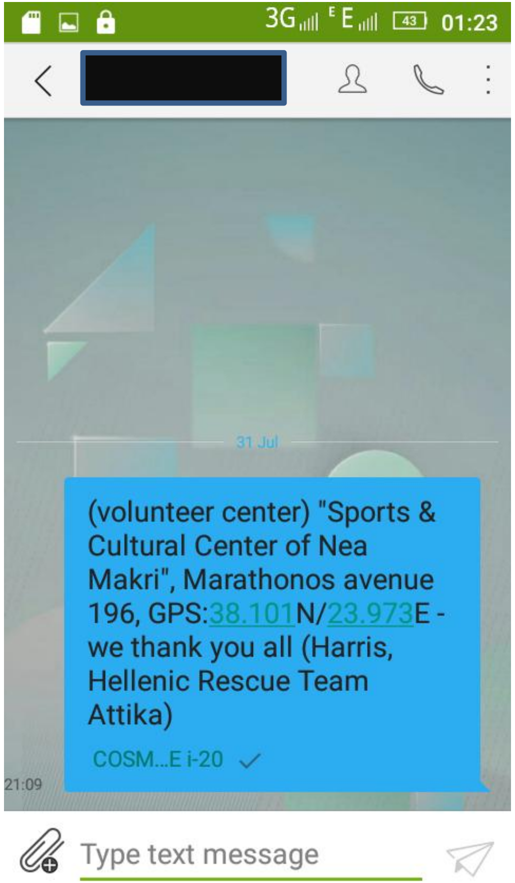


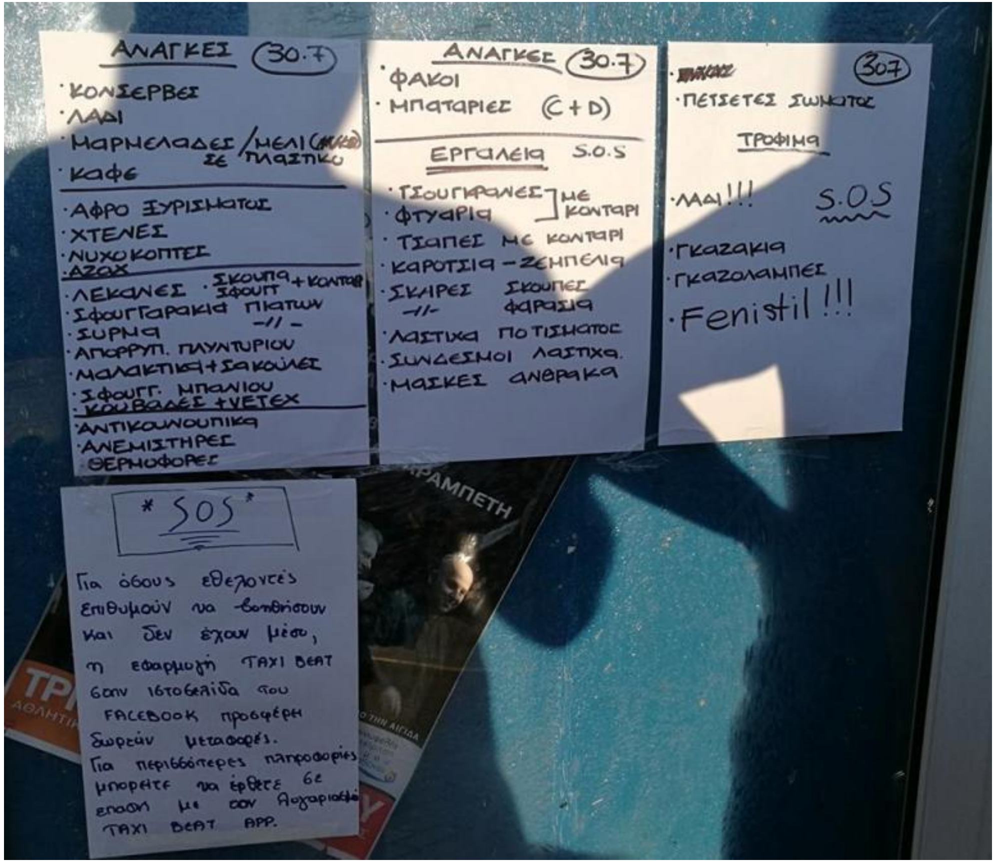
Mati, 2018

Mandra, 2017

Mati, 2018

What is needed: Last-mile gap & self-organization





Mati, 2018

Future trends: Live event monitoring (floods)

Mandra flash flood overview, western Attica,
Greece (Nov. 2017)

Future trends: Live event monitoring (fires)

Mati wildfire overview, eastern Attica, Greece (Jul. 2018)

CURSOR
Accelerating Search and Rescue operations

Detection of victims with UAVs during wide area Search and Rescue operations

Harris V. Georgiou, *Hellenic Rescue Team of Attica (HRTA, Greece)*
Friedrich Steinhäusler, *International Security Competence Centre (ISCC, Austria)*

SSRR 2022 Special Session Paper 74

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 832790 and from the Japan Science and Technology Agency.

CURSOR DRONE FLEET

Current configuration of the CURSOR drone fleet:

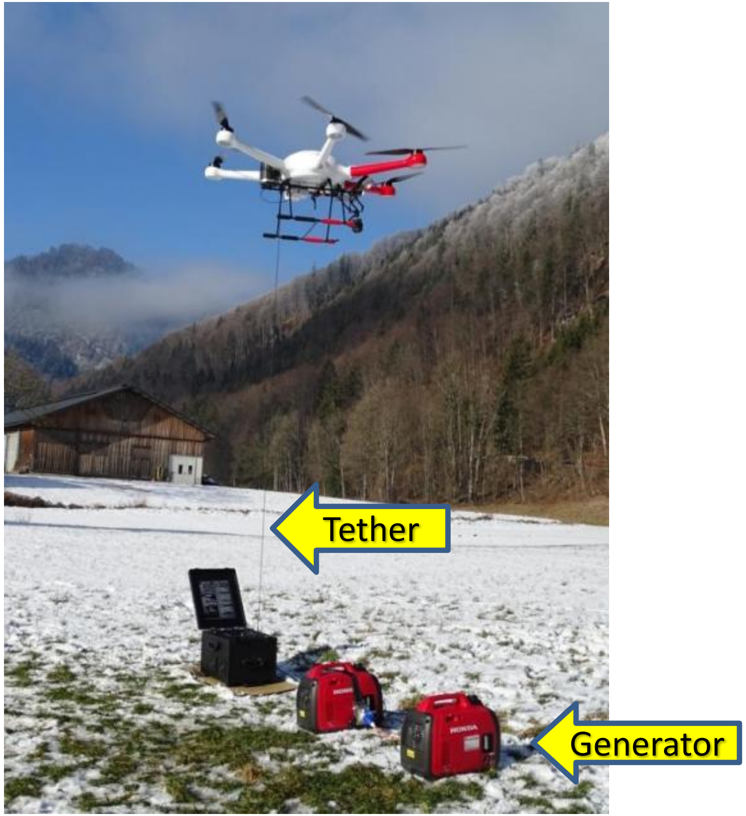
- ✓ Mothership drone (MD)
- ✓ 3D modelling drone swarm (MOD)
- ✓ Heavy-load transport drone (TD)
- ✓ Advanced situational awareness drone (ASAD)

Main responsibilities and mission:

- ✓ Wide-area search and worksite monitoring 24/7
- ✓ Worksite 3D mapping for mission planning
- ✓ Aerial transportation platform (e.g. for SMURFs)
- ✓ Aerial communication relay, illumination, audio alerting

Mothership Drone:

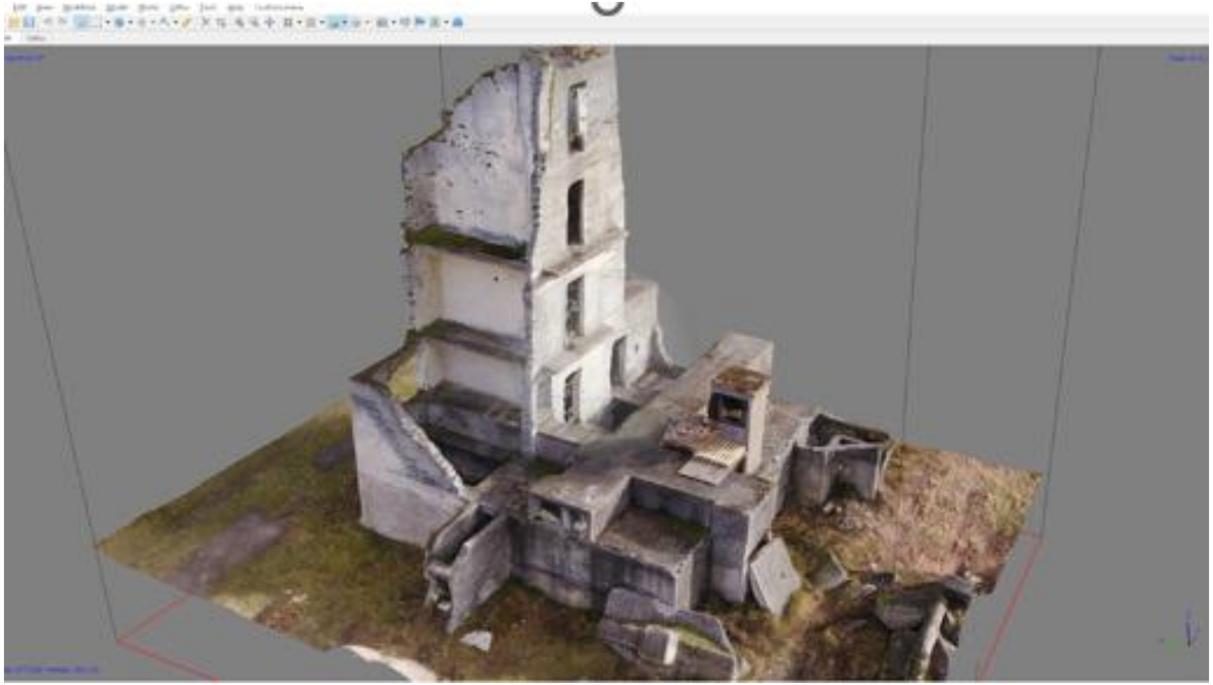
Non-stop situational awareness;
Communication between crisis management and first esponders;
Spot light illumination of site



- ✓ Drone tethered with cable for:
  - Electric power transmission from mobile electric generators to drone
  - Signal transmission from drone to base station on the ground
- ✓ Drone can stay in the air 24/7*
- ✓ LED flood lights
- ✓ Special megaphone (125 dB)
- ✓ WiFi contact point

Modelling Swarm Drones:

Creation of orthophoto and 3D model of disaster area with 5 pre-programmed drones



3-D model

Transport Drone:

Transporting & unloading SMURFs;
Video of unloading site

Sensor Platform:

- ✓ Remotely controlled heavy-load transport mechanism (electric winch + laser-guided distance sensor)
- ✓ Payload release under remote radio-control

Advanced Situational Awareness Drone

Sensor platform:

- ✓ HD video camera
- ✓ Thermal camera
- ✓ LED lights

CURSOR DRONE SENSORS

Depending on the drone type, the following sensors are installed on the standardized drone platform:

- ✓ HD video-camera
- ✓ 30x optical zoom video-camera
- ✓ Thermal-camera
- ✓ Radio-controlled winch for lowering and lifting payload (maximum payload: 5 kg)
- ✓ Radio-controlled, laser-guided release mechanism for SMURFs
- ✓ Aerodynamically shaped megaphone
- ✓ LED flood light
- ✓ WiFi access point
- ✓ Parachute for emergency landing of drone (optional)

CURSOR DRONE FLEET – Results

Advantages:

- ✓ Wide range of COTS flying platforms available
- ✓ Low purchasing cost for UAV as compared to aircraft
- ✓ Low operational costs (negligible cost of fuel, service and maintenance)
- ✓ UAV availability at short notice in a crisis
- ✓ Small-sized, lightweight, portable deployment package
- ✓ Take-off and landing at user-selected locations (designated LZ)
- ✓ UAV equipped with a wide range of sensors and instruments
- ✓ Safe, remote operation in an uncontaminated / hazardous area
- ✓ Easy field training of FRs as UAV operators
- ✓ Estimated average cost reduction for purchase and operation
- ✓ Estimated average time to start SAR missions: 10 min

Hellenic Rescue Team of Attica – H.R.T.A.

“Emergency response in recent urban/suburban disaster events in Attica: Technology gaps, limitations and lessons learned”

Related paper:
17th ISCRAM Conference, Track 14: Technologies for First Responders (ISCRAM 2021), 23-26 May 2021 @ Blacksburg, VA, USA.

(Best Practitioners Paper / Murray Turoff Award)

H. Georgiou, A. Vlachopoulos, A. Tzeletopoulou (Sept. 2020)

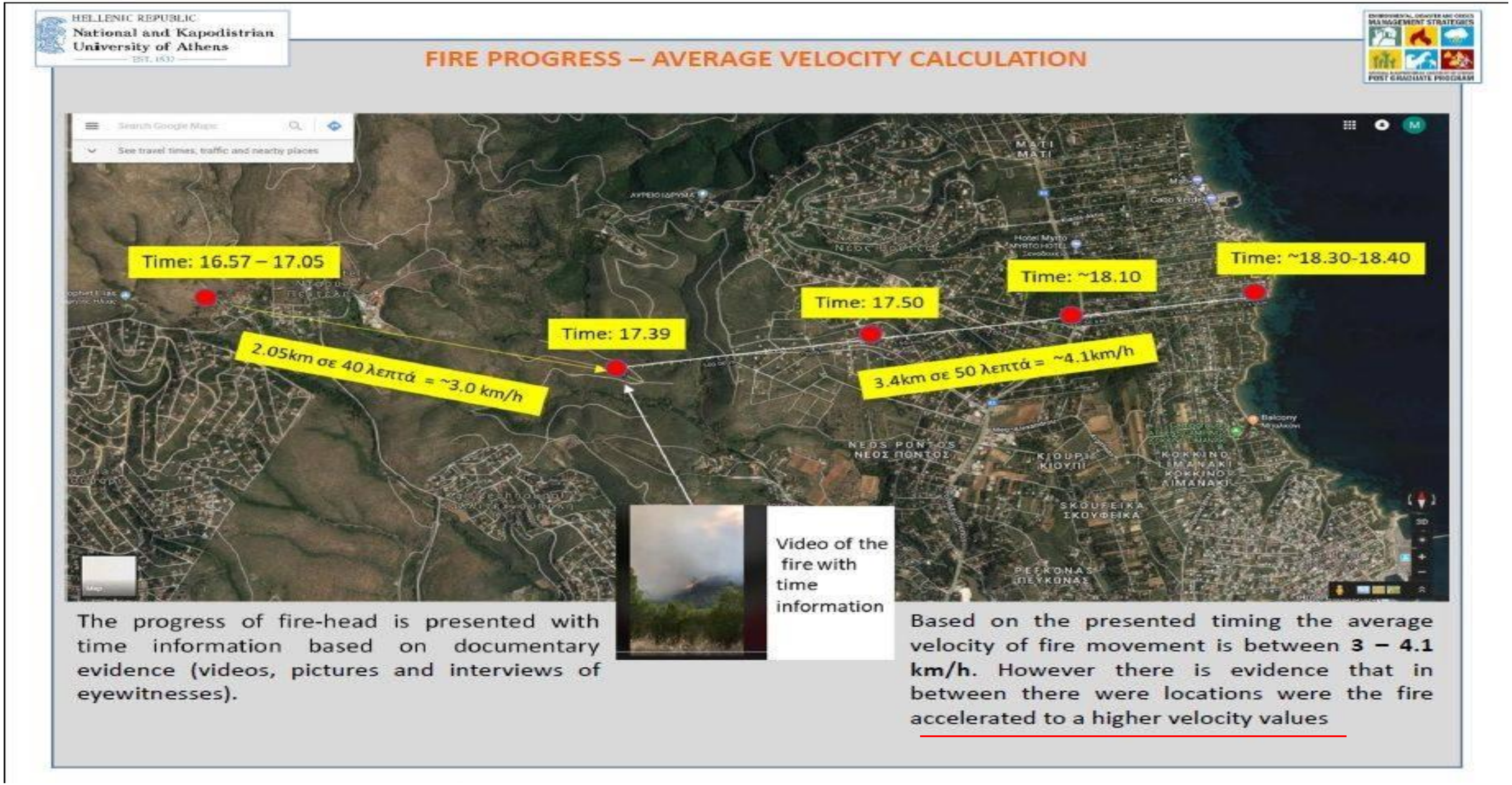
Hellenic Rescue Team of Attica – H.R.T.A.

- Mandra, Attica (Nov/2017):
  - Flash flood event in western Attica
  - Associated to local wildfires a few months before
  - 23 dead, major urban damages

- Mati, Attica (Jul/2018):
  - Wildfire crossing into urban/mixed area
  - Unique local weather conditions (downhill winds)
  - 102 dead, several people in ICUs (burn treatment)

H.R.T.A. at Mati, Attica (Jul/2018)

H.R.T.A. at Mati, Attica (Jul/2018)



Source: E. Lekkas, P. Carydis, K. Lagouvardos, et.al. (2018). The July 2018 Attica (Central Greece) Wildfires – Scientific report (v1.3). Newsletter of Environmental, Disaster and Crisis Management Strategies, Issue 8.

H.R.T.A. at Mati, Attica (Jul/2018)

Hellenic Rescue Team of Attica – H.R.T.A.

Operational assessment:

- **Reliable, multi-aspect communications** and continuous flow of information between field teams and C&C is imperative.
- A **rapid deployment "scout" team** into the hotzone very early on provides invaluable information for preparing the main teams.
- Central organization and guidance from the authorities is expected, but must not be a prerequisite – **decentralized and autonomous deployment plans** should always be available.
- **Prepare for the unexpected** – no way to have 100% knowledge of access routes, severity of the situation, number of casualties, evacuation options (Mati: by sea, via small shallow-hull boats)
- **Multi-aspect SAR** may be required (Mati: urban, coastal, sea).
- Other important factors in multi-day operations in the disaster area: (+) **volunteers**, (-) **journalists/cameras**.
- **PFA debriefing** is necessary, more sessions may be required for team members involved in specific events or scenes.

Hellenic Rescue Team of Attica – H.R.T.A.

Technology gaps / limitations:

- Fixed-line, cellular networks down for hours during the events.
- In some cases, even R/F comms were difficult for various reasons.
- **Text messaging via Internet** seems to be mostly reliable.
- Open technologies & platforms heavily used by the field teams, e.g. Google Maps and hourly weather forecasts.
- Photographic material need to be sent to **forensic experts** to verify findings (bone fragments), while teams were still in the field.
- Very difficult to do exact orientation, mapping, search plans for the field teams when the level of damages has changed the entire area.
- Very difficult to perform house-by-house search when the disaster area is extensive or/and when **access is denied** or too dangerous.
- Simple improvised solutions, like **paper notes** outside destroyed houses (“we are ok”), are also invaluable in terms of safety & time.

Hellenic Rescue Team of Attica – H.R.T.A.

Future prospects / focus points:

- **Safety**: The field teams need to have minimal exposure to hazards in terms of time and area. Remote sensing, rich information flows, as well as personal biometrics are very valuable assets.
- **Communications**: Reliable links between team members and between teams and C&C are imparative in the field.
- **Situational awareness**: The C&C needs to have real-time perception of the field and needs to push it to the deployed teams.
- **Logistics & preparedness**: Every asset needs to be easily maintenable, ready to be deployed, easy to incorporate in current operational plans and field equipment (especially when carried).
- **Missing persons / victim identification**: In large-scale disaster events with a large number of "unknowns" (missing/victims), swift identification or at least registry is important (very limited now).
- **Last-mile information gap**: Affected population inside the disaster area usually does not have access to vital information.

Search and Rescue operations in urban environment: Lessons from disaster events in Attica

Spyros Chrysanthopoulos
Hellenic Rescue Team of Atica (HRTA) *
President of AC board

Theofanis Kapetanakis
Hellenic Rescue Team of Atica (HRTA)
Chief of Operations

Giannis Chaidemenos
Hellenic Rescue Team of Atica (HRTA)
Chief of USAR Operations sector

Stelios Vernardos
Hellenic Rescue Team of Atica (HRTA)
Deputy Chief of USAR Operations sector

Harris Georgiou[†]
Hellenic Rescue Team of Atica (HRTA) [‡]
R&Dadvisor, LEAR

v1.0.0
March 26 , 2020

ABSTRACT

Emergency response operations in large-scale urban/suburban disaster events is often addressed by the standard protocols and international guidelines for collapsed buildings, heavy debris, etc (INSARAG). However, a wide range of First Responder (FR) operations need to address various other contexts, work environments and hazards. In this paper, two real disaster events are explored as use cases for such urban/suburban FR operations, namely a flash flood and a wildfire, both in Atica, Greece (2017-2018). Based on our team's experience from these mobilizations and active participation in both these events as FR actor in the field, we present the challenges, the complexity of such multi-aspect disaster events, the limitations of emergency response, the technology gaps of the FR teams, as well as the lessons learned during these deployments. Finally, we make some notes on future prospects and possible advancements in tools and technologies that would greatly enhance the operational safety and readiness of the FR teams in such events.

Keywords

First Responders, Search and Rescue, Flash Flood, Urban Wildfire, Urban Operations.

INTRODUCTION

Today's emergency response operations need to address a very wide range of missions, from localized accidents with very few victims to large-scale disaster events with hundreds of known and unknown victims. The context of such operations also ranges wildly in terms of working environment (open/closed spaces), hazards, weather conditions, time constraints, medical emergencies, evacuation routes, etc. It is imperative that the First Responder (FR) teams and the Communication & Coordination Center (C3) have the necessary resources to operate with safety ,

*This work was partially supported by the projects *FASTER* (https://www.faster-project.eu/), *CURSOR* (https://cordis.europa.eu/project/id/832790) and *INGENIOUS* (https://ingenious-first-responders.eu), which have received funding from the European Union's Horizon 2020 (H2020) programme under grant agreements No:833507, No:832790 and No:833435, respectively.
†Corresponding author – mailto:harris@xgeorgio.info
‡http://www.eodathens.gr/

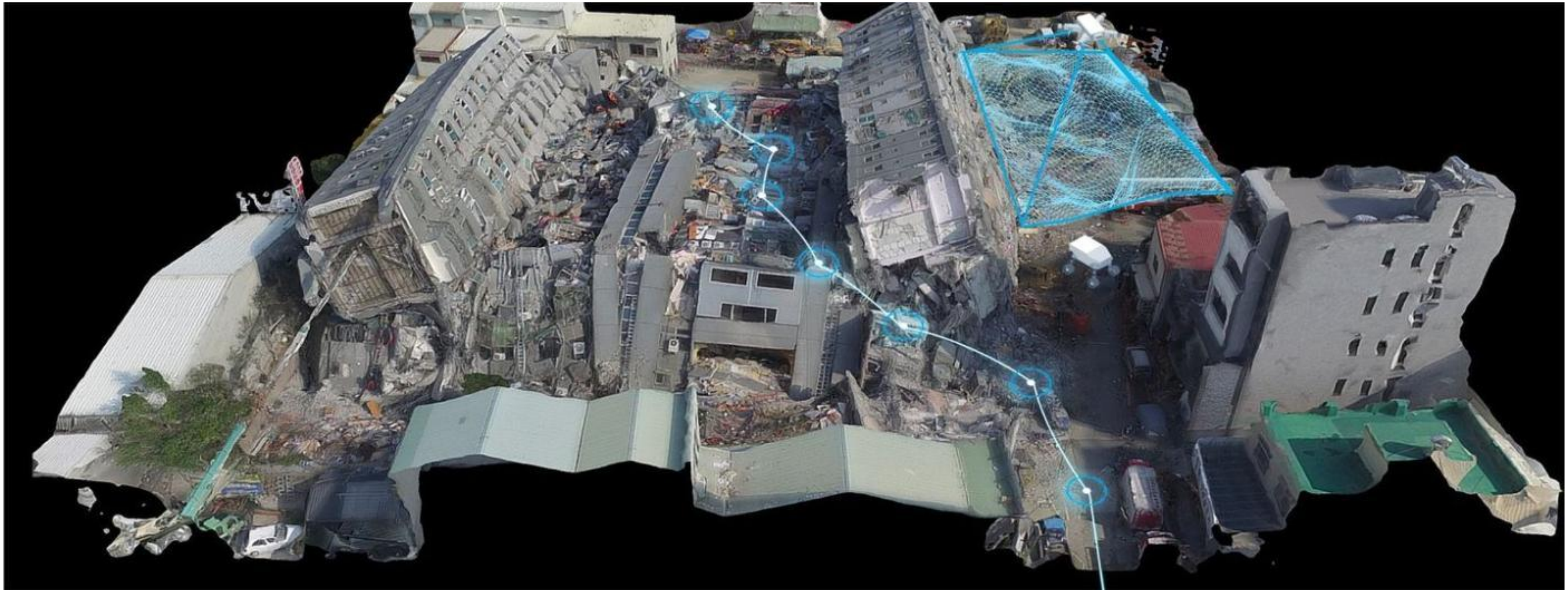
(a)

(b)

Figure 1. Mandra areas affected by the flood (source: Copernicus)

(a)   (b)

Figure 2. Mandra center (a) during and (b) after the flood (source: local media)

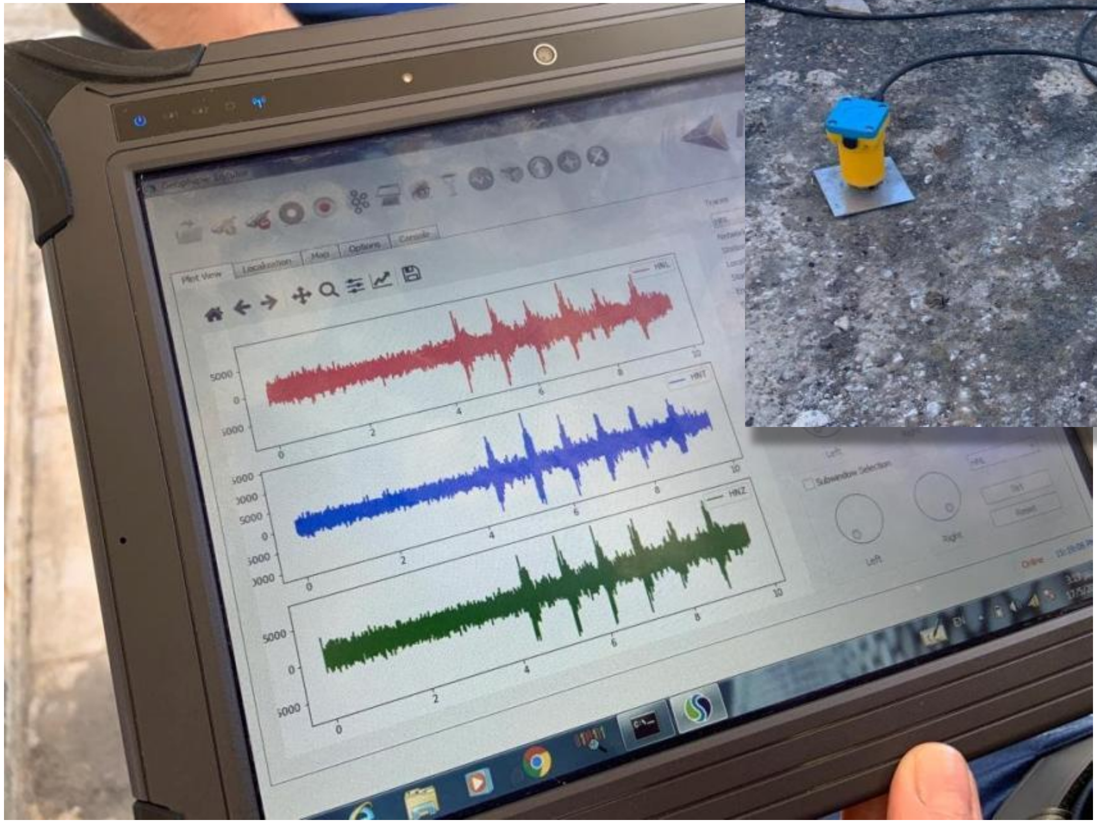


Credits: INTREPID project

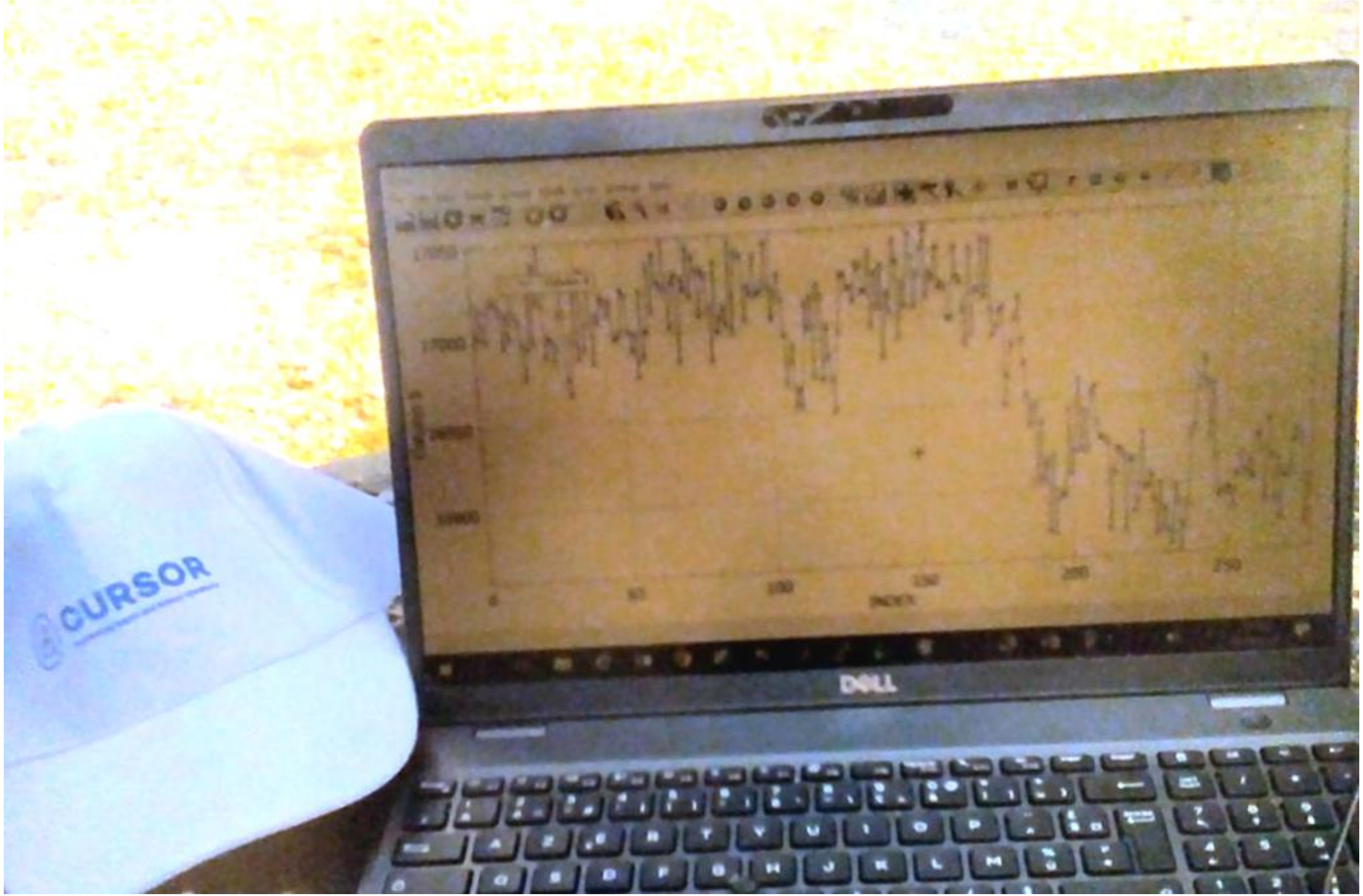
Credits: FASTER project (Madrid, Apr.2022)

Hatay (Turkey), Feb.2023

Adiyaman (Turkey), Feb.2023



Credits: CURSOR project



Credits: *CURSOR project*

Future trends: Access routes assessment

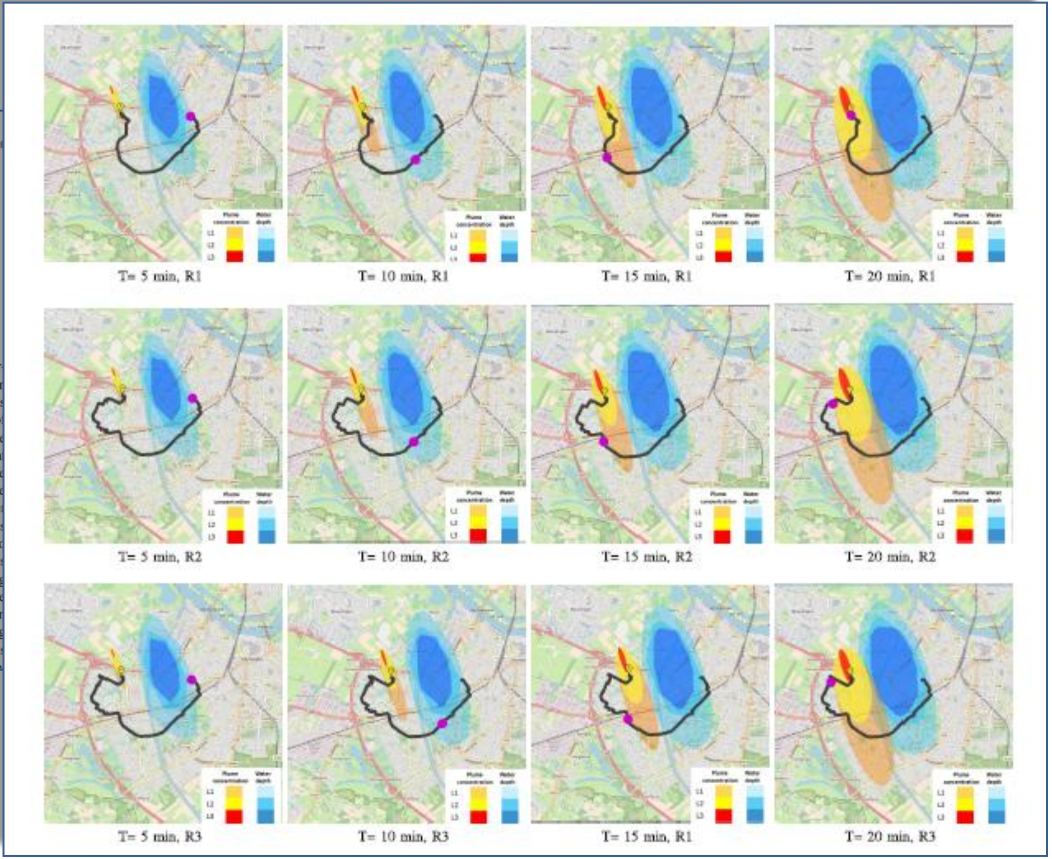
1044 IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, VOL. 21, NO. 3, MARCH 202

Safe Route Determination for First Responders in the Presence of Moving Obstacles

Zhiyong Wang and Sisi Zlatanova

Abstract—**Determining safe and fast routes for first responders is an important issue in a disaster response. Especially when different types of disasters (e.g., toxic plumes, fires, and floods) occur and affect transportation networks simultaneously, special routing strategies (e.g., detour) would be needed to ensure the safety for responders. On the other hand, after disasters happen, a quick response time is required, and the responders should move as fast as possible and even go through certain obstacles to reach the disaster sites to deliver emergency services. In this paper, we study path planning through moving obstacles, taking into account the influence of obstacles on the status of road networks and the speed of rescue vehicles. A set of algorithms is proposed to deal with not only geometries but also the properties of moving obstacles to support route generation. Based on the Dijkstra algorithm, a new routing algorithm is designed and developed, which aims at minimizing the risk while constraining the travel time of routes. We validate our approach with a set of experiments on some navigation cases. The experimental results show the promise of the algorithm in the generation of feasible and safe routes for first responders to pass through moving obstacles.**

for disaster situations, they rely only on the real-time infor-
mation of roads and do not consider the predicted informatior
of obstacles (e.g., position, shape, and properties of obstacles
in the near future), which could undermine the feasibility o
their route plans and even endanger rescuers when they move
through certain types of obstacles. Therefore, there is a grea
necessity for new approaches to provide responders with safe
routes that guide them in the road networks considering the
moving obstacles. Another issue is that the response time afte
disasters happen is critical. For example, in many countrie
(e.g., the Netherlands and Australia), the responders have to
reach incident sites within a time limit after emergencie
occur [7]. Although in some cases conversely avoiding moving
obstacles would ensure the safety of responders, they lose
their time needed for their rescue missions. As responders car
have some protective equipment that prevents them from being
harmed by hazards, they can pass through some obstacle
within certain risk levels to facilitate the disaster response



Future trends: Body part detection & assessment

IEEE Sensors Council IEEE SENSORS JOURNAL, VOL. 20, NO. 7, APRIL 1, 2020 3697

Data-Driven Skin Detection in Cluttered Search and Rescue Environments

Yogeshwar Singh Dadwhal, *Student Member, IEEE*, Satish Kumar, *Member, IEEE*, and H. K. Sardana, *Member, IEEE*

Abstract—Locating human victims in cluttered urban search and rescue (USAR) environments is still a challenge. In this paper, we present an approach to generate *skin objectness* windows to assist human rescuers. We introduce the term *skin objectness* to denote the task of extracting windows in the scene with a high probability of skin presence for locating victims. Unlike naïve skin segmentation approaches, the presented algorithm accounts for both color and spatial information to extract regions of interest and at the same time, rejects the background clutter. We use temporal information of the video sequence to make the skin objectness windows more reliable. To selectively boost skin regions, the RGB skin pixels are transformed to Gabor space to generate a transformation matrix. The matrix is used to generate skin
Further, the Bayesian inference and temporal cues from previ
It has real-time applications in image retrieval, action clas
demonstrates quantitative and qualitative results on a disast
proposed method in cluttered environments.

Index Terms—Distinctiveness, Gabor filters, color image a

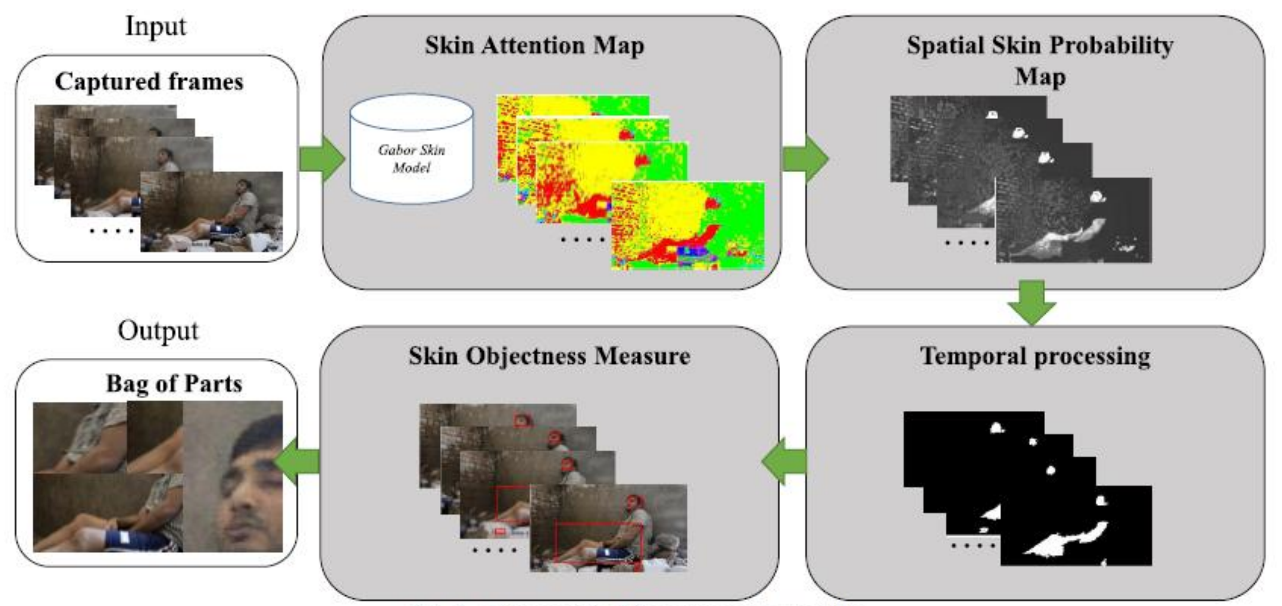


Fig. 1. Framework of the proposed algorithm.

Last thoughts: Small steps, simple lessons

PROACTIVE EU @PROACTIVE_EU · 3h

Testimony by #CSAB member Luca Rotondi from @EmergenzaSordi on the valuable contribution of deaf volunteers in our #CBRNe exercise. Their participation exposed communication challenges. This experience helps grow the knowledge on the needs of deaf persons during a #CBRN incident.

Moving forward

- First Responder safety enhancement
- Situational awareness, hazards, area mapping
- Rapid-deployment scout team
- Adapt & solve – e.g. USAR evacuation via sea
- Live forecasting of local weather conditions
- Accurate localization inside disaster area
- Missing/found persons registry & tracking
- Open standards & interoperability for tools
- Forensic tools in the field for non-experts
- Underwater voice/data communications
- Simple tools may be vital (maps, translate, ...)
- “Prepare for the unexpected”

Σύνοψη

- Περιεχόμενα:
  - Τεχνολογίες USAR επόμενης γενιάς (UAV, COP, AR, remote sensing, ...)
  - “Detection of victims with UAVs during wide area Search and Rescue operations” (SSRR’22)
  - “Emergency response in recent urban/suburban disaster events in Attica: Technology gaps, limitations and lessons learned” (ISCRAM’21)
  - Future trends / “Moving forward”

- Πηγές:
  - EU H2020 projects (SCENT, FASTER, CURSOR, INGENIOUS, INTREPID)
  - INSARAG Guidelines for USAR Operations (2020)

- Error-correction codes (comms)
- Optimization algorithms
- Optimal-path algorithms
- GZteam repository (ERC)
- ...

YouTube:

@ApneaCoding

https://www.youtube.com/@apneacoding

Github:

@xgeorgio

https://github.com/xgeorgio

Αναφορές

- F. Steinhausler, H. Georgiou (2022). “Detection of victims with UAVs during wide area Search and Rescue operations”, IEEE Intl. Symposium on Safety, Security and Rescue Robotics (SSRR 2022), 8-10/11/2022 @ Seville.
- S. Chrysanthopoulos, T. Kapetanakis, G. Chaidemenos, S. Vernardos, H. Georgiou, C. Rossi (2020). “Emergency response in recent urban/suburban disaster events in Attica: Technology gaps, limitations and lessons learned”, 17th ISCRAM Conference, Track 14: Technologies for First Responders (ISCRAM 2020), 24-27 May 2020 @ Blacksburg, VA, USA [Best Paper / Murray Turoff Award] ISSN:978-1-949373-27-88, s/n:2289, pp. 984-989.
- “First responder Advanced technologies for Safe and efficienT Emergency Response”. FASTER Project (GA-833507), EU Horizon H2020, CORDIS, E.C. – https://www.faster-project.eu
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- “Coordinated Use of miniaturized Robotic equipment and advanced Sensors for search and rescue OpeRations”. CURSOR Project (GA-832790), H2020, E.C. – https://cursor-project.eu
- “Intelligent Toolkit for Reconnaissance and assessmEnt in Perilous Incidents”. INTREPID Project (GA-883345), EU Horizon H2020, CORDIS, E.C. – https://intrepid-project.eu
- “Smart Toolbox for Engaging Citizens into a People-Centric Observation Web”. SCENT project (GA-688930), H2020, E.C. – https://scent-project.eu
- INSARAG Guidelines for USAR Operations (2020) – https://www.insarag.org/methodology/insarag-guidelines/

Ερωτήσεις

Χάρης Γεωργίου (MSc,PhD)
https://www.linkedin.com/in/xgeorgio/
https://twitter.com/xgeorgio_gr