

Hellenic Rescue Team of Attica (HRTA)

Views and Experiences on the Use of Robotic
Technologies in USAR operations



Humanitarian Networks & Partnership Weeks
5th May 2022

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



Focus points

- Current technologies / under development
- What is needed
- Future trends

Other common tasks (not covered here):

- Indoor positioning (redundant or fused)
- Chemical sensors (toxic gas, victim detection)
- Biometric & environmental sensors
- UxV area search & mapping
- *(many more...)*

Current technologies / Under development: UxV



Credits: CURSOR project

Current technologies / Under development: COP

engage COP Search and Rescue - Crisis Search and Rescue Center

System Users Operational Resources Windows Preferences Help

engage **ASTRIAL**

Pending Events

Type	Information	Resources
[23] Oct 20, 2021 16:44	Crisis (L) Natural Disaster Tsunami (L) 123	[1111] [345FDSFAB9] [DGF0677A9DA]
[25] Dec 1, 2021 14:39	Crisis (L) Natural Disaster Earthquake (L) 112	[Light team 1] [HRTA] [Agapitos Giannis] [Heavy team]

Land Incident Details [25] ID: 25 Date: Dec 1, 2021 Time: 2:39:00 PM

Organization Name: Search and Rescue Organization Legal Name: Search and Rescue Department: Search and Rescue

Type: Crisis (L) Location: Longitude: 23.859333 112 Sub: Natural Disaster E... Latitude: 38.167697

Classification

Severity: Extreme Certainty: POSSIBLE Response type: Evacuate Response Urgency: Immediate Confirmation status: PENDING

of injured persons: 0 # of deaths: 0 Is SAR involved: Has diseases:

Description:

Operational Details

Priority: 1st Level R. Area: Greece Station Phone: Radio: GREECE

Available Assets

Vehicle Personnel Equipment Aircraft

Crisis Search and Rescue Center

Identity Description

SX-U1309 Transport drone UAV TT-01


3D Map 2D Map

Assign Resources Action History Calls Information Stream Locations and Areas

TOTAL (15) NOTIFIED (15) ARRIVED (0) DEPARTED (0) CANCELLED (0)

Call...	Type	Sector	Workst...	Identity...	Compe...	Status	Op. Mode	Notified	Arrival	Departure	Cancelled
1		Sector F...	Workst...	8510SA81...	SMURF01	Alarmed	DEPLOYED	14:48			
2		Sector F...	Workst...	18185D11...	GPHS-01	Alarmed	DEPLOYED	14:48			
3		Sector F...	Workst...	7342343A...	SMURF02	Alarmed	DEPLOYED	14:48			
4		Sector F...	Workst...	64523	SNR-02	Alarmed	DEPLOYED	14:48			
5		Sector F...	Workst...	4123	AXE	Alarmed		14:48			
6		Sector F...	Workst...	53141233	SNR-01	Alarmed	DEPLOYED	14:48			
7		Sector F...	Workst...	SU-1112	GPRD-01	Alarmed	DEPLOYED	14:48			
8		Sector F...	Workst...	SX-U1309	TD-01	Alarmed	DEPLOYED	14:48			
9											

NO RESOURCE (0) IN-PROGRESS (2) PARTIAL CONTROL (0) FULL CONTROL (0) AWAITING RESOURCE (0) TOTAL (2)



Credits: CURSOR project

Current technologies / Under development: ARV



Credits: FASTER project

What is needed: Remote Sensing



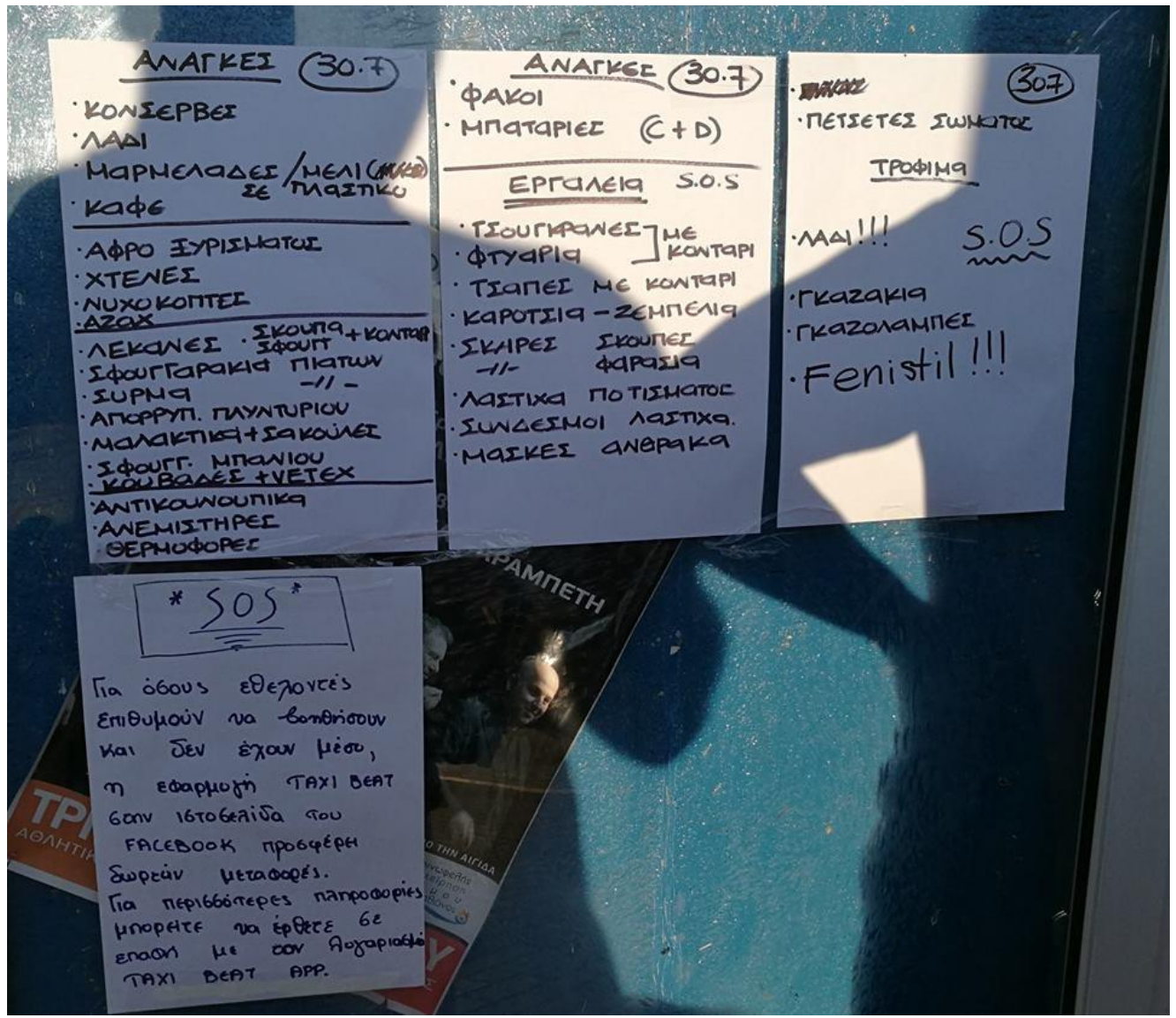
What is needed: Quick & Safe Access



What is needed: Team localization & hazard mapping



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



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)

The present map shows the fire extension in the area of Attica (Greece). The fire has been active for several days and is still active in some areas. The fire has caused significant damage to the area and is still active in some areas.

Attica wildfire overview			
Area	Area (km ²)	Area (mi ²)	Area (mi ²)
Attica	1000	386	150
Attica	1000	386	150
Attica	1000	386	150

Data Sources
 The present map is based on the data provided by the Hellenic Fire Department (HFD) and the Hellenic Republic of Fire Department (HRFD). The data is based on the data provided by the HFD and the HRFD.

Disclaimer
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Future trends: Access routes assessment

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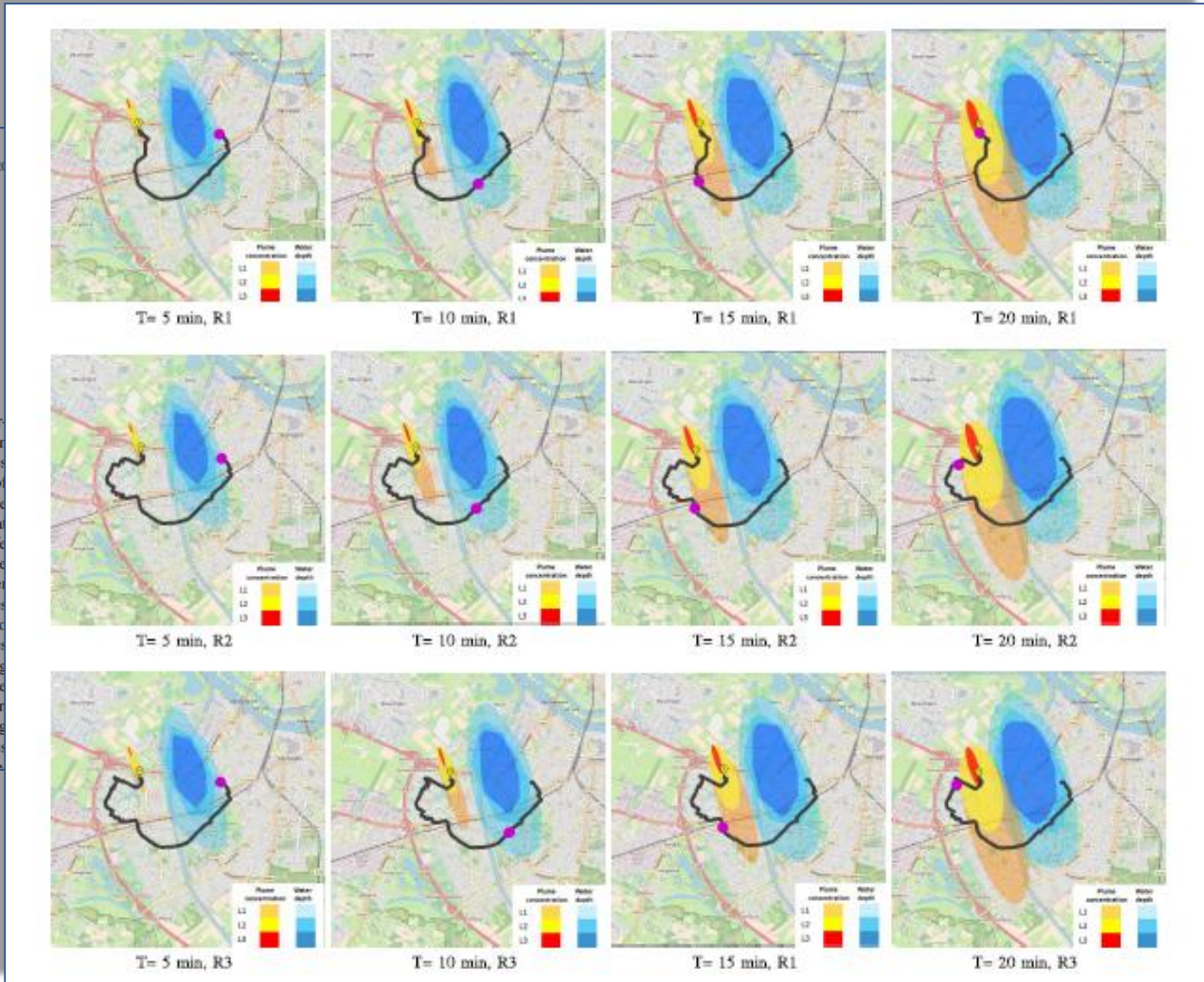
IEEE TRANSACTIONS ON INTELLIGENT TRANSPORTATION SYSTEMS, VOL. 21, NO. 3, MARCH 2020

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

Zhiyong Wang¹⁰ and Sisi Zlatanova¹²

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 information of roads and do not consider the predicted information of obstacles (e.g., position, shape, and properties of obstacles in the near future), which could undermine the feasibility of their route plans and even endanger rescuers when they move through certain types of obstacles. Therefore, there is a great 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 after disasters happen is critical. For example, in many countries (e.g., the Netherlands and Australia), the responders have to reach incident sites within a time limit after emergencies 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 can have some protective equipment that prevents them from being harmed by hazards, they can pass through some obstacles within certain risk levels to facilitate the disaster response



Future trends: Body part detection & assessment

Data-Driven Skin Detection in Cluttered Search and Rescue Environments

Yogeshwar Singh Dadwhal¹, Student Member, IEEE, Satish Kumar, Member, IEEE, and H. K. Sardana², 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 naive 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 previous frames are used to boost the skin objectness windows. It has real-time applications in image retrieval, action classification, and disaster response. The proposed method in cluttered environments.

Index Terms—Distinctiveness, Gabor filters, color image analysis

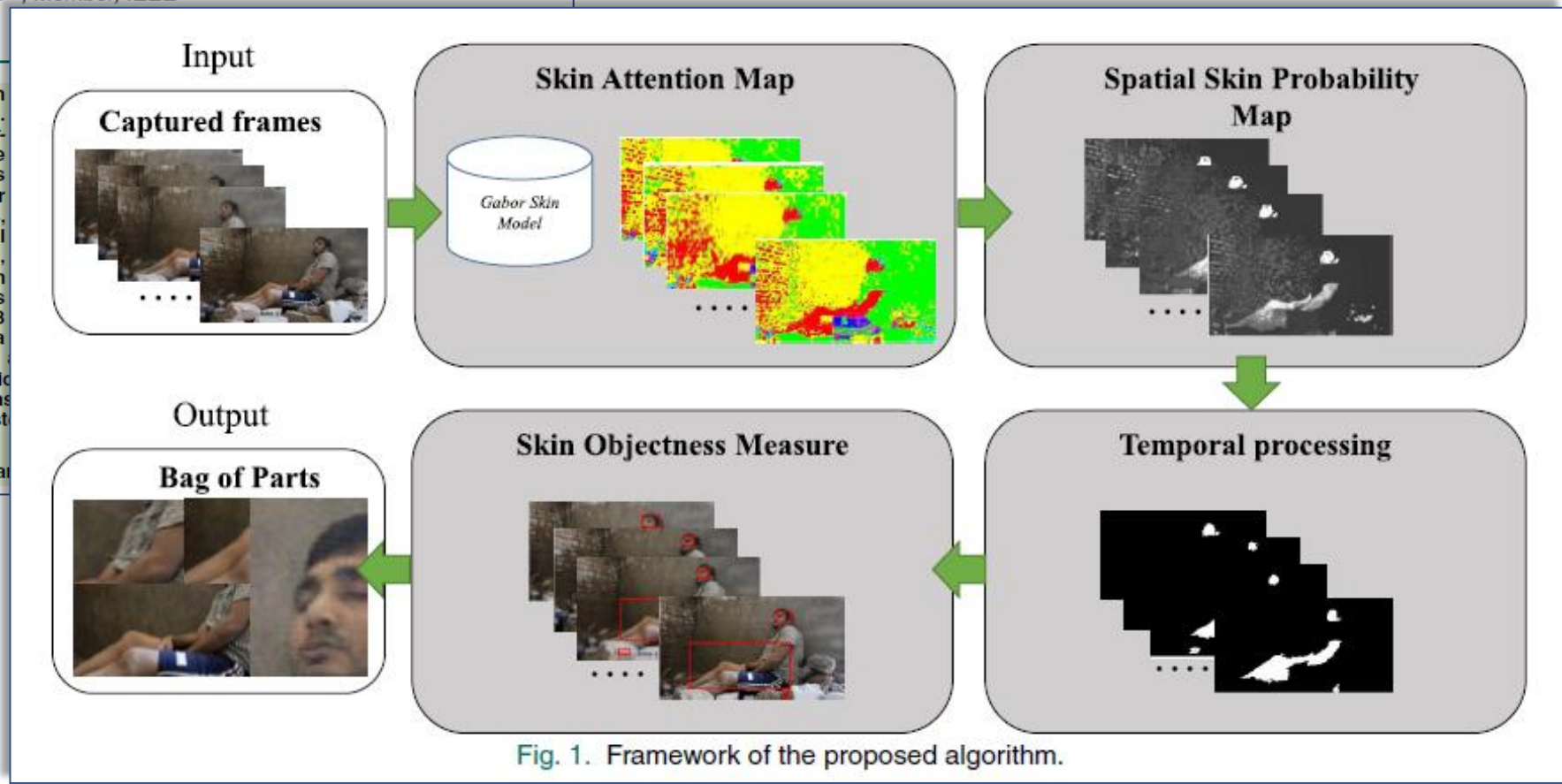


Fig. 1. Framework of the proposed algorithm.

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
- “Prepare for the unexpected”



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



Related paper:

S. Chrysanthopoulos, T. Kapetanakis, G. Chaidemenos, S. Vernardos, H. Georgiou, C. Rossi (2021). *“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 2021), 23-26 May 2021 @ Blacksburg, VA, USA. (Best Practitioners Paper / Murray Turoff Award) – <https://zenodo.org/record/4495196>



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