FIELD TRIALS OF EMERGENCY ALERTING, AD-HOC NETWORKING AND SMART TEXTILES AT THE AFIDNES TRAINING CENTER (ATC) – FASTER (EU HORIZON 2020)

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ABSTRACT

On October 21st and 22nd a piloting field activity for FASTER project (EU H2020)[1] took place at HRTA's training facilities in Afidnes (ATC), Attica region. FASTER is about enhancing safety and effectiveness of First Responders during emergency situations and large-scale disasters. Several technical partners from the consortium participated as developers of these technologies, as well as first responders from other countries as observers. Three scenarios were executed regarding team deployment in the disaster area and search & rescue of victims after a large earthquake. Results showed that Technologies are easy to integrate within existing USAR procedures; the project's components (MORSE, RESCUE, STF) are small and durable enough to be incorporated in existing First-Responder field gear. Future USAR operations will integrate and use Next-gen technologies in order to ensure safety of FRs and citizens, as well as to provide faster and more efficient results for assessment and decision making.

Keywords: Search and Rescue, field tests, crisis managment, security and safety, First responders

1. INTRODUCTION

First Responders (FR) around the globe share a common mission to ensure the safety and security of the people they serve and protect. Due to the nature of their work, FR are often operating in high-risk and hazardous conditions, disaster areas, fire fronts, flooded districts, or exposed to non-visible threats such as very high temperatures and toxic gases. Furthermore, FR may experience incidents (e.g. sudden illness, dizziness or exhaustion) during operations, which can prevent them from completing their mission, but, more importantly, put their own health at risk.

The FASTER project has a clear vision of going well beyond the current state-of-the-art, providing cross-discipline tools to assist FR in all aspects of their work. In order to create tools that match FR needs, FASTER is establishing new ways of involving them very intensely in the development, as well as the evaluation phases of these novel technologies. The consortium's FR organizations participate in a continuous usability and performance assessment program of the toolkit, with the goal of monitoring the progress of key technologies and components. All solutions are designed for specific scenarios and use cases that simulate actual operational scenarios. As a result, FASTER delivers specific, validated solutions that address current and future FR operational needs.

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2. BACKGROUND INFORMATION – MORSE, STF, ResCuE

The FASTER integrated toolkit involves designing and developing innovations regarding the use of sensors in wearable textiles, equipped inside the FR uniform, capable of collecting biometric data (i.e., body temperature, heart rate). Additionally, sensors are deployed externally attached on the FR uniform for measuring the external environment (i.e., temperature, humidity).

As part of the integrated FASTER toolkit, the FR use wearables in order to communicate with gestures in the field of action [3]. An Artificial Intelligence (AI) smart wearable framework named *MORSE (MOvement Recognition for firSt rEsponders)* is implemented for using hand gestures to generate alert messages for immediate danger or when environmental noise is too high for voice communications. The *Smart Textile Framework (STF)* solution, together with a mobile application, enables the collection data from a smart textile prototype, providing continuous monitoring of the FR biometrics, as well as environmental data from many sensors embedded on the FR undergarment and outside of their uniform. The *ResCuE (Resilient Communication Equipment)* is also developed as part of the FASTER toolkit, providing an additional communication asset for supporting the first few hours or days of FR operations inside the "hot zone", before any other power or networking infrastructure is available, i.e., without depending on any other technology.

3. METHODOLOGY – DESCRIPTION OF THE FIELD TRIALS

On October 21-22 2021 the second iteration of the Greek piloting activities took place at the Afidnes Training Center (ATC) of HRTA in Athens, Greece. The purpose of this field activity was to present the project's technology demonstrations and conduct field tests in realistic operational conditions (simulated) during Urban Search and Rescue (USAR) deployments of FR teams, according to the INSARAG guidelines and procedures [2]. The location of the ATC site is about 20 km to the north from Athens Centre (Omonia square) near the Afidnes village.

3.1. Scenario A: Wide area search

Upon arrival, the team leader gathered information from locals, while the USAR Coordination Cell (UCC) was set up at some distance from the worksite. Power grid and the local mobile network were unavailable or highly volatile, due to damages and saturation. A few minutes later, the FASTER toolkit infrastructure was fully operational and received information given by the field operation leader. First information reported two missing people in the surrounding area, one female and one child (small body shape), as well as others inside the damaged building after the earthquake. The chief of operations ordered the drone pilot to fly a camera-equipped UAV over the area of interest, in order to subsequently perform SAR level 2 (ASR2) actions for locating possible victims.

Subsequently, drones located the two victims, one at the hill (child) and the other one (female) trapped inside a water pipe near the gorge. Two teams of four FRs wearing STF each were assigned to operate in the specific areas with the corresponding equipment, using FASTER tools in addition (MORSE, RESCUE). During the operation one FR fell down in the gorge and asked for help using the MORSE. Assistance was provided to the FR by team members, there was no major injury and the mission continues. One RESCUE device was set up in the location near the gorge in order to provide texts regarding the danger of falling down the gorge slopes (loose ground and gaps after the earthquake). The FR team located the victim, performed preliminary medical assessment and assisted the person moving out of the gorge. For fast and safe extrication, the victim was secured and moved uphill and out of the gorge using rope lines that were set up for this purpose by another specialized FR team. The second team wearing STF was directed

uphill where the UAV had spotted the second victim, in order to assess the health condition of the person and offer First Aid if needed. The team informed that the victim suffered from tibial fracture in both legs and needed immobilization. Stretcher was used in order for the victim to be transported back to the FR medical tent for further treatment and psychological aid.

Figure 1. Victim recovery, movement and evacuation during Scenario C (southern basement).

3.2. Scenario B: Search around the building and easily-accessed floors

The operations continued around and inside the building area where the drone pilots located two more victims, one on the 1st floor's porch (rooftop) and the other under the ground floor's eastern porch. An FR team wearing STF performed SAR level 2 (ASR2) and transferred the data collection to the UCC for further annotation (possible dangers, e.g. instance shafts). No additional victims were located on the ground floor. Moving on the 1st floor, the victim was located unconscious. An FR team went to the point of interest and set all the necessary equipment and stretcher for victim evacuation, while the EMT of the team checked and prepared the victim. The second victim was accessed via the ground floor and was carried away from the building by the FR team wearing STF and to the FR medical tent.

3.3. Scenario C: Search deep inside the building and basements

Operations continued with an FR team descending into the northern basement using the UAV's thermal camera in manual mode, as the conditions of the (northern) basement were visually impairing due to no lighting and the presence of smoke. Additionally, thick reinforced concrete walls and floors prevented all medium/long-range communications via R/F or WLAN. The FR sent alert signals via MORSE to stop all activities (silence), because there were sounds possibly from a victim hitting a rock. The FR team wearing STF approached the victim and was informed that there was another person trapped and possibly hurt somewhere inside the same area. Thus, two FRs continued the search with the thermal camera and inside the northern basement. As they were moving, the field operation leader sent an emergency signal via MORSE (vibration) for immediate evacuation from the building due to an aftershock. Internet access was only partially available around the worksite, so the UCC received the information and the emergency message *"STOP ALL ACTIVITIES – EVACUATE IMMEDIATELY"* was relayed immediately via all possible means of communication (R/F, WLAN, MORSE) to ensure no missed FR reception due to obstacles. All FRs evacuated the building area and rallied to the designated area outside. After the clearance to continue activities, the FR team wearing STF was re-deployed inside the building to continue the SAR operations. They located the second victim as they searched the southern basement, injured and incapacitated. The victim was trapped under the stairs with debris in front of it. Due to the injury mechanism (possible neck/head/spine injury) and limited access routes for the

stretcher, the victim was secured and evacuated horizontally via one of the windows at the south side of the building, moving it to the FR medical tent for further treatment and psychological aid.

Figure 2. Victim recovery, movement and evacuation during Scenario C (northern basement).

4. CONCLUSIONS

Given the nature and challenges of the work of FR teams in the field, it is clear than modern autonomous technologies like wearable devices, ad-hoc portable networking and sensor integration in the suits can provide extremely valuable modalities in their existing capabilities. During the recent field testing activities at HRTA's ATC site these FASTER tools were successfully deployed and evaluated in realistic operational conditions. It was a great opportunity for FR teams to provide actionable feedback to the technical partners, who in turn could see how their developed tools are functioning in practice.

Figure 3. Overview of victim movement and recovery during Scenarios A and B (open field and building area).

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