

FASTER TECHNOLOGIES TO ENSURE THE SAFETY OF FIRST RESPONDERS

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ABSTRACT

The aim of the paper is to present a set of modern technologies and tools developed by an international consortium within the FASTER project - First responders Advanced Technologies for Safe and Efficient Emergency Response. Solutions, which are being developed, are addressed to first responders who undertake high-risk rescue operations in hazardous environments. The use of FASTER technologies and tools (e.g. smart textiles, AR tools, drones) in emergency situations is expected to provide greater safety for responders and increase the effectiveness of actions taken. First responders from different countries have been involved in the development of the technology from the beginning, sharing their experience and practical tips.

Keywords: FASTER project, first responders, technology, safety

1. INTRODUCTION

FASTER- First responders Advanced Technologies for Safe and Efficient Emergency Response is an international project implemented under Horizon 2020 by a consortium of 23 partners [1]. The team members include scientific, technical, social partners and rescue entities. The main objective of the conducted research is to create a set of innovative technologies that will benefit first responders in emergency actions undertaken in dangerous and difficult conditions (e.g. earthquake, flood, terrorist attack) [2]. First responders from different countries have been invited to collaborate in order to develop tools whose use will help keep rescuers safe and make their actions more effective. From the beginning, they have participated in identifying the needs of first responders, designing the tools and evaluating their usability and efficiency. In addition, a group of stakeholders has been created who also share their experiences and participate in the different stages of the project. The solutions developed in the research are currently being tested in pilot field trials based on different emergency scenarios.

2. THE FASTER TECHNOLOGIES AND TOOLS SYSTEM

The paper illustrates a system consisting of technologies and tools developed for those involved in emergency operations. Complex emergency operations require the use of data, communications, unit positioning, mapping and scene imaging technologies. These functions are for more effective management of the forces and technical resources at the scene. They also improve commanding and direct actions of emergency services (see Figure 1). The system includes tools dedicated to first responders directly rescuing victims. The structure of the system is schematically presented in Figure 2. It is worth to underline that the tools presented in the graphics can be used in different configurations depending on the needs and nature of the disaster, also independently from other components of the system. This is their versatility, however, they are the most effective in a system combination, cooperating with supporting technologies.

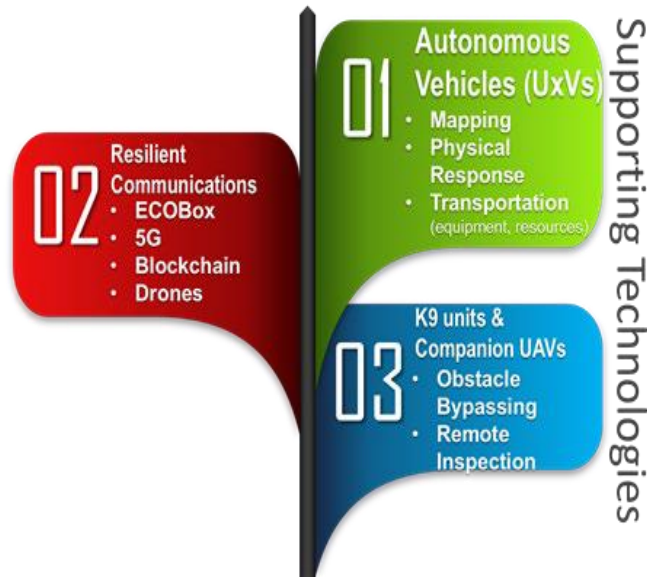


Figure 1. Illustration of the FASTER technologies for crisis management
Source: The FASTER project consortium materials

3. SELECTED COMPONENTS OF THE FASTER SYSTEM

A key component of the FASTER technology system is the Control Centre (see Figure 2), which provides a Common Operational Picture. In real time, various data are transmitted to the command centre from other FASTER components, which are processed and visualised using a special application developed as part of the research. This creates a Common Operational Picture, which is made available to first responders taking action in the field. This allows the responders to be updated with various important information about the operation. It is worth mentioning that they are provided in a visual form and easier to perceive (e.g. map view, alerts, location of units and deployment of resources).

An important tool of the FASTER are smart textiles designed to be worn by rescuers (see Figure 2). These are equipped with sensors designed to collect data on the rescuers' physical condition as well as detectors for collecting data on environmental conditions. Sensors monitoring the first responder's basic vital functions (e.g. body temperature, heart rate, saturation). They are placed in the rescuer's underwear, while detectors are placed in his jacket [3]. The purpose of detectors is to measure, among other things air temperature, air humidity, oxygen content, carbon monoxide content or to detect the presence of poisonous substances. The collected data are automatically transmitted to the command centre using a smartphone to be available in both visual and digital form for the commanders and other first responders via the Common Operational Picture module.

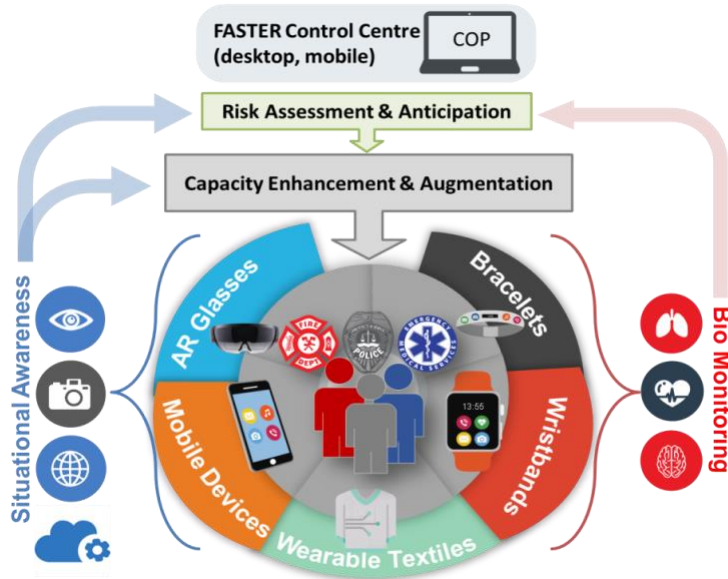


Figure 2. Structure of the FASTER technologies and tools
Source: The FASTER project consortium materials

It is worth mentioning other wearable devices wristbands, bracelets, smartwatches and mobile devices - smartphones (see Figure 2). Their application in emergency operations can be very broad. They can be used to provide efficient communication and transfer of data between first responders and commanders using COP. For example in the MORSE system developed for communication in conditions when the use of other communication channels are not available due to failure. The system uses a specially designed smartwatch application that records and identifies a rescuer's arm movements. These are transformed into messages and send to other partners devices present in the in the area of the incident [4]. MORSE warning messages are transmitted using IoT communication protocols (e.g. Bluetooth Low Energy; BLE).

A further solution is to equip first responders with augmented reality technology which is provided to them via appropriate glasses (see Figure 2). This allows first responders to access important information in real time (e.g. geolocation of units on a 2D map, safe evacuation routes, marking of danger zones with holograms), which is sent to the device and displayed in its field of vision using the glasses. Importantly, the glasses enable hands-free viewing of the transmitted information, as they interact with the rescuer through gestures and voice commands. In addition, augmented reality technology has also been used in conjunction with small drones equipped with cameras, which can be deployed in places inaccessible to humans. The use of advanced algorithm of analysis with 3D scene modelling enables visualisation of rooms located behind obstacles [5]. This will allow, for example, a more appropriate choice of tactics for anti-terrorist units before entering and taking action against criminals.

Unmanned aerial vehicles are a very important component of the FASTER technology and tools system. In the course of consultations with representatives of the security services, many creative applications were found. Drones are to be used to take photos and videos of the scene of an incident also as network relays or to provide light the rescuer's workplace. They can deliver equipment: first aid supplies, batteries, communication means, or to remove small obstacles (see Figure 2). Drone swarms have been adapted for more complex operations mapping terrain (2D, 3D), finding people, places or objects, using temperature sensors, gas and hazardous substance detectors, LIDAR technology.

The project has also developed robotic vehicles both autonomous and remotely controlled. They can perform various tasks thanks to their equipment: carrying rescuers, transporting injured people, carrying heavier equipment, removing obstacles and setting up network relays. The vehicle platform, for example, can be equipped with a robotic arm with grippers, or adapted as a landing platform for drones.

4. CONCLUSIONS

The FASTER project technologies and tools applied systems-wide way in emergency situations will provide a different kind of perspective on crisis management operations. They will allow both commanders and first responders real-time access to information that was previously unavailable to them. The FASTER tool and technologies will speed up communication and allow important information to be automatically transmitted during operations, such as the location and physical condition of the responder or victim, environmental conditions, hazards, or the location of equipment and vehicles. Fast mapping will give real and actual image of the scene. It will increase the commanders situational awareness. This will optimise decision-making in dangerous conditions and thus enhance the safety of rescuers and the efficiency of rescuing. FASTER technologies create new opportunities for communication between first responders and the command centre. Ongoing recording and transmission of various data and messages will be easy and also possible hands-free. For example, the aforementioned MORSE system in situations where verbal communication is difficult enables the easy and fast transmission of a warning of danger. The multi-purpose use of unmanned aerial vehicles and autonomous vehicles will enable, for example, very fast search for victims, effective and efficient mapping of terrain, reaching dangerous and inaccessible places for rescuers, or will allow for very fast transport of first aid supplies and equipment. The FASTER technologies and tools create new opportunities in effective commanding of the operation and will improve coordination of the actions of first responders. In conclusion, it should be emphasised that application of the FASTER technologies and tools will directly result in safety and efficiency of first responders, and through their improved performance will contribute to saving human lives.

ACKNOWLEDGEMENTS

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