

CURSOR: COORDINATED USE OF MINIATURIZED ROBOTIC EQUIPMENT AND ADVANCED SENSORS FOR SEARCH AND RESCUE OPERATIONS

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ABSTRACT

The CURSOR project aims at developing new and innovative ways of detecting victims under debris. This includes the coordinated use of miniaturized robotic equipment and advanced sensors for achieving significant improvements in Search and Rescue (SAR) operations with respect to: (a) the time used to detect trapped victims after a building structure has collapsed, and (b) an informed and accelerated decisionmaking by first responders during rescue operations allowing for the deployment of expert personnel and, in particular for operations in hazardous environments, suitable equipment at prioritized locations. CURSOR is proposing a system consisting of several integrated technological components. It includes Unmanned Aerial Vehicles (UAVs) for command & control, 3D modelling and transportation of disposable miniaturized robots, that are equipped with advanced sensors for the sensitive detection of volatile chemical signatures of human beings. Information and data collected are transferred in real time to a handheld device operated by first responders at the disaster site.

Keywords: search and rescue, crisis management, security, robotics, UAVs.

1. INTRODUCTION

Due to climate change, global society will have to face a severe increase of natural disasters in the future. Therefore, strengthening societal resilience against disasters like flooding, droughts, forest fires but also earthquakes has been declared as a priority also for the European Union, which became evident in recent years through the adoption of a new Civil Protection legislation with a strong focus on disaster resilience and response and the reinforcement of the Emergency Response Coordination Centre (ERCC). In May 2018, the European Parliament decided to upgrade the EU civil protection capacity by establishing RescEU, a reserve at European level of civil protection capabilities, including urban search and rescue [1]. At international level, the International Search and Rescue Advisory Group [2] facilitates the coordination between the various international USaR teams who make themselves available for deployment to countries experiencing devastating events of structural collapse due primarily to earthquakes.

In a disaster situation, the goal of SaR operations is to find the greatest number of people in short time, while minimizing the risk to rescuers. Natural or man-made disasters often result in difficult working conditions for Urban Search and Rescue (USaR) teams [3] and other First Responders (FR), such as

police, medical services and civil protection units not specialized in SaR. FRs are often exposed to high risks during response due to structural instability of the disaster site and/or because of hazardous environments. Under such conditions FRs must take quick decisions to determine the location of trapped victims as swiftly and as accurately as possible.

Today, FRs still rely on technologies of the past in conducting their USaR tasks in search of victims. They face the (current) limitations of conventional telescopic-pole visual and IR cameras, time-consuming laser scanners for detecting removable structural elements without causing cascading collapses, the limited use of UAVs in the field as well as heavy and difficult to move THz/GPR scanners for detecting voids. Therefore, they prefer to trust their senses and those of their SAR companions, i.e. the K9 (canine) units. Even though, more technology and tools are not by default the solution, the field of USaR activities requires modernisation, exploiting technological advances to its fullest as human life is at stake. CURSOR builds strongly upon previous and connects to ongoing research into rescue technologies for FRs.

CURSOR [4] will develop and promote the use of novel technologies by USaR teams reducing the time for detecting survivors trapped in damaged and collapsed buildings. The project will deliver the innovative CURSOR SaR Kit, an integrated system of various technological components and platforms, that allows USaR teams to a) work efficiently and safely on the disaster site, while detecting and locating survivors and b) enable collaborative response, by sharing information and accurately visualizing the disaster scene and associated notifications across all levels of command.

2. METHODS

The main operational challenges for USAR teams include insufficient situational awareness causes lengthy SAR processes, while working in hostile and uncharted environments. According to statistics, uninjured survivors can survive up to around 72 hours, which is called the Golden 72 hours. As losing time in USAR operations costs lives, it is essential to quickly detect and localise trapped victims. To do so and to use the available, often scarce resources for search and rescue most efficiently, it is of utmost importance to have an accurate overview of the current disaster scene at any point in time during the operation and to efficiently manage the information exchange between responders in the field and the team command, UCC (USAR Coordination Cell) or OSOCC (On-site Operations Coordination Centre).

In addition, CURSOR [4] will deepen the shared understanding between First Responders and (technological) solution providers on the operational needs, along with requirements during USaR operations and the technological possibilities and features matching them. During complex and challenging disaster situations CURSOR will reduce the time needed for deployment of Search and Rescue personnel with their equipment by developing an USaR Kit that is highly mobile, easy to set up and user friendly. CURSOR technologies will also reduce the time needed for Situational Assessment (SA) during USaR operations, where an improved collaborative and shared operational picture of the affected area is needed to allow a more efficient triage, e.g. through faster identification of confined spaces with potential for trapped survivors. Decreasing the time needed for onsite disaster response, where the exact position of victims within the debris cone must be determined most accurately and by considering safety and security aspects for the victim and the First Responders to take informed-decisions for the rescue operation. Improving the protection of First Responders' health and safety during USaR operations, by developing a system with unmanned robotic platforms allowing for highly remote operations.

Finally, CURSOR technologies will ensure the uptake and sustainability by transfer of results and lessons learnt collected during specification, development and (field-)validation of the CURSOR SaR Kit. Through close collaboration with other practitioner organisations and networks (such as INSARAG) through CURSOR's First Responder Board, the project will not only be guided with respect to hands on experience from past missions and policy requirements currently relevant to the development of the CURSOR SaR Kit, but also allow the project to contribute to standardisation activities and the improvement of guidelines and Standard Operating Procedures (SOP) for USaR teams.

3. CONSORTIUM

Coordinated by THW, CURSOR involves four more FR organisations from France, UK and Greece; their operational know-how and network will guide the development and sustainability of results. Leading-edge technologies will be provided by research partners, whereas key innovative components will be developed by SMEs, which will commercialise CURSOR SaR Kit. Other practitioners will participate throughout the development process, during technology validation and in standardisation activities as members of the project's FR Board (INSARAG secretariat, Regione Liguria, USaR NL, Japan NRIFD).

4. PROJECT TIMELINE

CURSOR is part of the initiative "*H2020-EU.3.7.5: Increase Europe's resilience to crises and disasters*" and specifically the topic "*SU-DRS02-2018-2019-2020: Technologies for first responders*" (H2020-SU-SEC-2018). It is a Research and Innovation Action (RIA) with a total budget of €7.4 mn and duration of 36 months, starting from September 2019.

5. CONCLUSION

The overall aim of CURSOR is to provide search and rescue teams with an easy and fast deployable system (CURSOR SaR Kit) which significantly reduces the time to detect trapped people and to provide sufficient information for prioritisation of actions during search and rescue operations according to the operational needs of the First Responders (FRs). CURSOR's mission and objectives address this directly by proposing the specification, the development, the evaluation, and validation of the CURSOR SaR Kit. Developing such a system requires the development of technological challenges that achieve very specific results.

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