e3e Monitor

White Paper
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Contents

1. Introduction / Background

The use of explosives is the defining phenomenon of the last and current century. The e3e Monitor project aims to reduce such excesses of violence by making available the technological means to monitor explosions and other extreme energy events in real time, objectively and with open access.

2. Abstract / Business Case

The e3e monitor project primarily aims to improve the security of populations, facilities and response teams in conflict zones and areas at risk, by making real-time information about explosions and extreme energy events (e3e) accessible.

The use of explosive ordinances in populated areas is a war crime and major humanitarian problem. The e3e Monitor innovation aims at improving the speed and accuracy of humanitarian response to victims of such explosions. Additionally, it also contributed to deterrence against such use of explosive ordinances by creating objective and empirical evidence on the use of explosive ordinances on civilian areas and buildings.

In its subsequent stage of development, it is also intended to function as a "blackbox" analogous to flight recorders on commercial aircraft to provide supplemental forensic evidence for accountability against the use of explosives in populated areas.

3. Problem Statement / Introduction

The reporting of explosions in conflict zones is today still a narrative domain. Journalists, peace keepers, international organizations and the general public aim to move this to a more objective domain by photos, satellite image analysis and rapid reporting over social media. Several conflicts in the recent years support the assumption that the rapid attention of the watching world reduces the excess of violence. Accelerating this process to real-time and providing hard scientific information brings this to the next necessary level.

4. Proposed Solution(s)

a. How is our solution innovative?

The solution is a breakthrough in (i) function, (ii) user autonomy, (iii) cost effectiveness, and (iv) scalability:

(i)   The e3e Monitor innovation allows for subjective reports from parties involved in a conflict to be replaced by objective and empirical information that can be

hardware verified and peer reviewed across network modules that have built-in encryption and highly tamper-resistant;

(ii)   By being based on Open Source hardware and software, users and participants of the network based solution are empowered to further customize and improve the hardware as well as software; this allows for the solution to progressively evolve in effectiveness and specificity to the areas it is deployed in;

(iii)   The solution innovatively connects six off-the-shelf components that cost no more than US$150 in total. Based on triangulation and trilateration calculations of the functioning prototype, only 50 modules would be required to cover a city the size of Damascus in Syria, *i.e.* for less than US$10,000.

(iv)   The hardware and software of the innovation allows for near unconstrained further scaling in terms of both sensory parameters, *e.g.* temperature or photo-spectrography. This would allow the device to be scaled and adapted into a full range of other contexts, particularly because the whole innovation is robustly open source.

Amongst other elements, the innovation encompasses:

- Simultaneous and real-time detection of sound, ground vibration, light, air movement in order to identify time, location, size and type of the event.

- Environmental monitoring before/after events.

- Multi-filtering and triggering system in order to provide very low false detection rate. - Data analysis and transmission system.

- Data storage system.

- Web-based data presentation system.

b. What can it improve?

Our final product is a web-based interface to access the e3e data. It has the potential to empower people by providing real-time reliable scientific information. Target end-users and improved outcomes are:

- Humanitarian / relief organizations will be able to use the information to assess damage, needs of civilians and their own operational security.

- The general population will know what is happening and where and so be able to make their own security decisions if, for example, they are moving from one town to another.

- Airlines will be able to verify areas of active conflict and so change flight schedules, paths and their knowledge of secure airports.

- Lawyers will be able to use the information as supplemental "evidence" for the prosecution of war crimes.

- The media will have a more accurate and non-biased picture of events relying less on "reports."

- Peace-keeping / enforcing bodies will be able to reliably monitor conflicts and cease-fire agreements.

- Academic and organizations including those orientated around conflict and peace-building will be able to use the information for a wide variety of research projects.

c. How does it compare to existing solutions?

Real-time objective monitor have already been implemented to public areas, for instance in the United States, a "shooter detection system" is pending installation in schools and sensitive areas. The system contains multi-detectors such as acoustic sensors and infrared cameras, and will automatically alert authorities.

This kind of real-time detection and alert systems are also developed for seismic monitoring as well as radiation monitoring. In terms of gathering information of events of excesses of violence, existing means are evidence gathering by reporting agencies, conflict monitoring by peacekeeping operations, and also by social media posted by general population.

Multi-sensor technologies are widely used and developed in the domain of fundamental scientific research. One of the world-leading facilities of that domain is hosted by the European Centre for Nuclear Research (CERN) in Geneva, Switzerland.

The technological part of the project is led by scientists working at CERN who are world-class specialists in multi-detection and triggering, big data handling and hardware design. Those technologies available at CERN have been directly applied to the e3e monitor development.

5. Future Direction / Long-Term Focus

Our goal will be making publicly available the capacity to:

- Detect the nature and extent of active hostilities involving explosions and extreme energy events.

- Provide means of monitoring ceasefires.

- Facilitate needs assessment and security requirements for humanitarian organizations with respect to explosions and extreme energy events.

- Provide accurate reporting of explosions and extreme energy events on an objective basis.

- Provide affected populations and organisations, schools, companies etc. with objective information pertinent to their own security and well-being.

- Provide the basis for evidence collection for crimes including war crimes.

- Carry out research with respect to explosions and extreme energy events.

With a view to the long term, e3e Monitor technology and networks should become part of the essential infrastructure of any urban environment.