The SafeShore system for the detection of threat agents in a maritime border environment

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1. Motivation

Recent years have seen the dramatic rise of the use of Unmanned Aerial Systems or drones by governments, consumers and – unfortunately – also by terrorists and criminals. Indeed, whereas there are a great number of very good applications for the use of drones, these new technological tools provide also a threat in the hands of people with bad intentions. Indeed, terrorists and criminals are more and more using new technological tools for their activities. These include the use of unmanned aerial robotic vehicles or drones for operations such as illegal observation and surveillance and drugs trafficking, or even as attack vector. Currently, it is very difficult for law enforcement and border management authorities to deal with these new threats, as the Radar Cross Section of these drones is too small to be detected by regular radar systems.

Several novel detection modalities are being researched to tackle this problem: RADAR [1], LIDAR [2], Acoustic Sensing [3], Radio Sensing [4], Thermal Sensing and Visual sensing. As no individual sensing modality attains satisfying levels of accuracy, generally a combination of approaches is used. The European Commission noted this capability gap and decided to fund the H2020-SafeShore project [5], which has as a main goal to cover existing gaps in coastal border surveillance, increasing internal security by preventing cross-border crime such as trafficking in human beings and the smuggling of drugs. It is designed to be integrated with existing systems and create a continuous detection line along the border.

2. Technology

Focusing on low cost and “green” technologies, the SafeShore core solution is to use a 3D LIDAR that scans the sky and creates above the protected area a virtual dome shield. In order to improve the detection, SafeShore will integrate the 3D LIDAR with passive acoustic sensors, passive radio detection and video analytics in the visual and thermal domain. The boats and humans on shore will be detected by a 2D LIDAR integrated with video analytics. Figure 1 shows a CAD image of the SafeShore detector prototype.

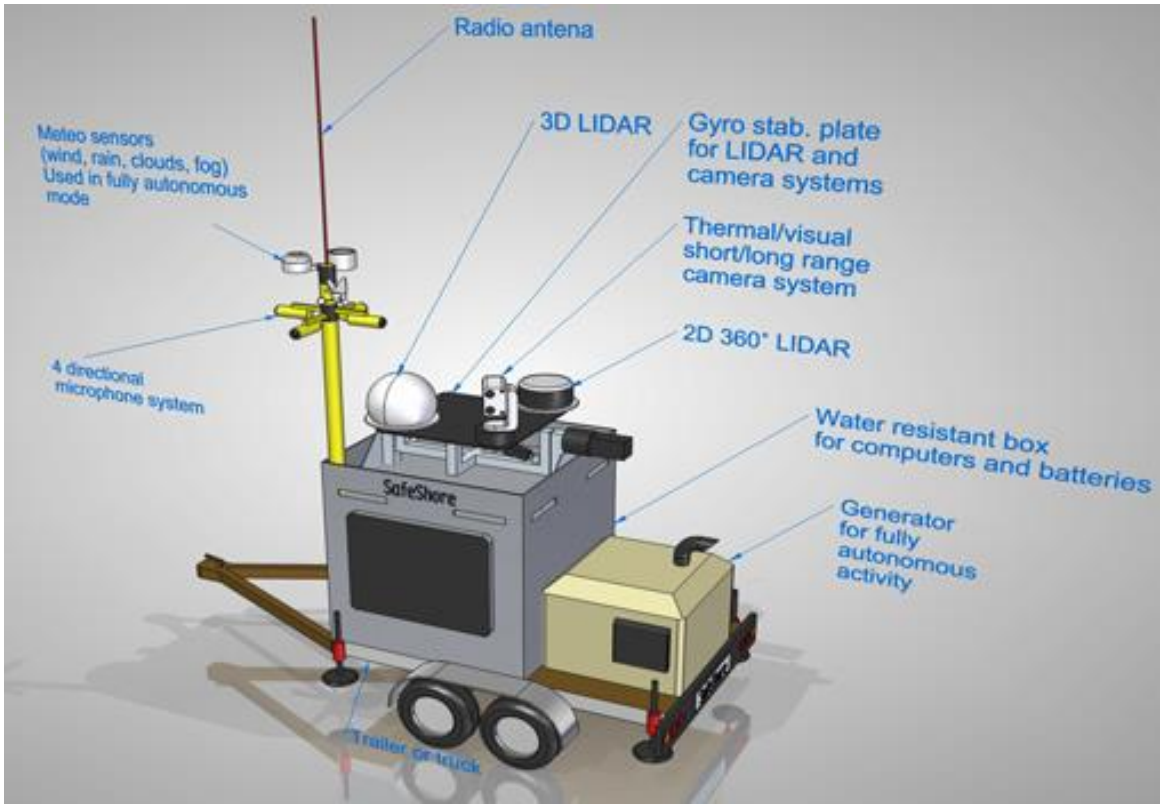

Figure 1: SafeShore detector prototype

Important to note is that instead of focusing on singular detection technologies, which each have their own advantages and disadvantages, SafeShore will concentrate on developing advanced data fusion methodologies, as indicated on Figure 2, for cross-sensor data combination in order to maximize the detection ratio, while minimizing the false positive ratio.

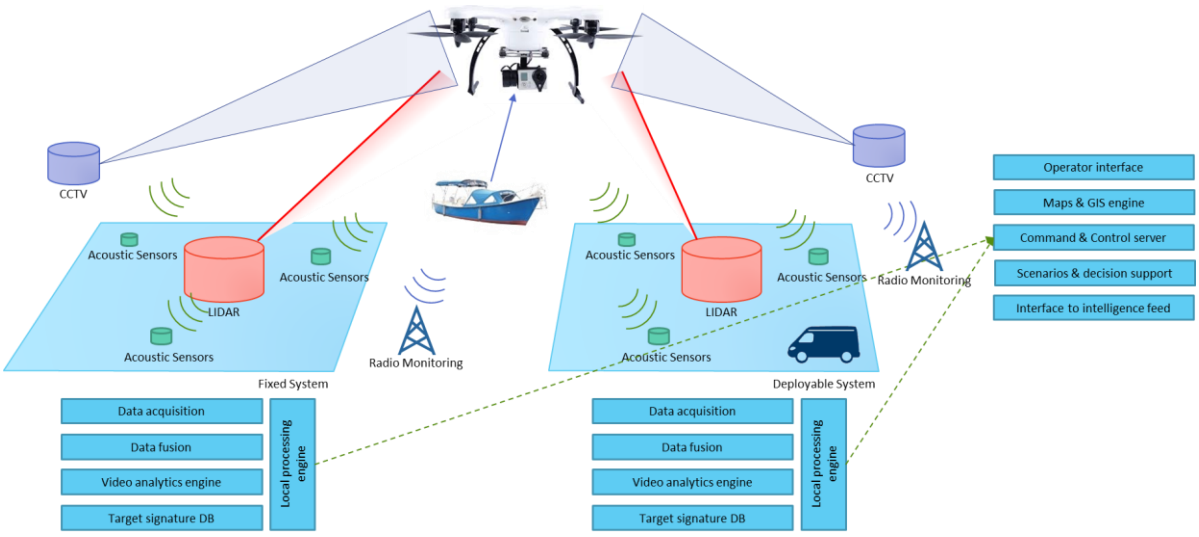

Figure 2: SafeShore system diagram, identifying the data fusion of the different detection mechanisms

The SafeShore objective will be to demonstrate the detection capabilities in the missing detection gaps of other existing systems such as costal radars, thereby demonstrating the capability to detect mini-RPAS along the shore and the sea or departing from civilian boats. All detection capabilities will be demonstrated via a fast deployment mobile platform. Fusion and sharing of resources between separated platforms will be proven by spreading mobile platforms along the shore and chaining them to the main command and control software. As such, by chaining SafeShore detectors, a complete detection coverage of a coastal area will be ensured.

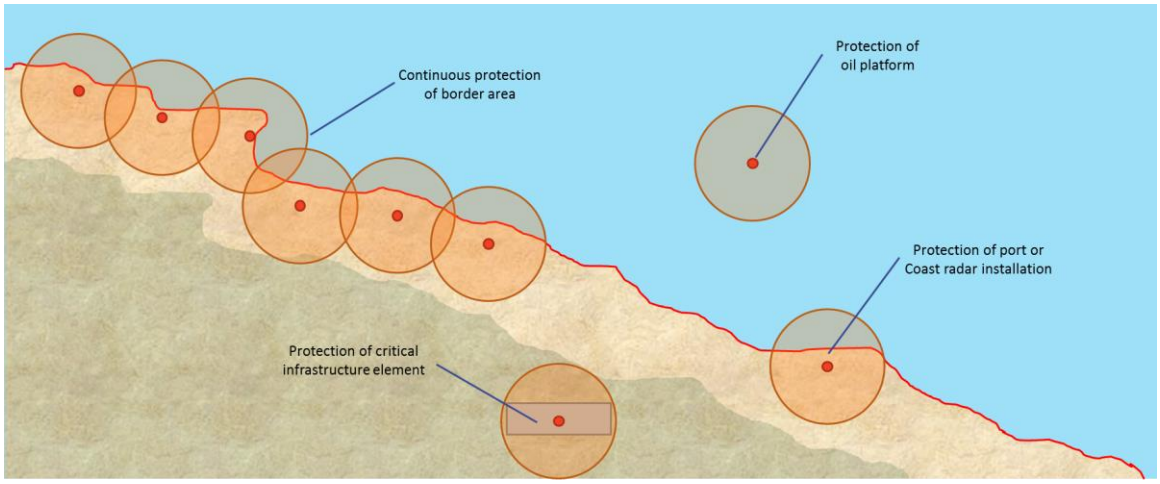

Figure 3: Continuous protection of a shore area by chaining SafeShore detectors

3) Operational integration and validation

An important SafeShore goal will be to ensure fusion of information and increasing the situational awareness and better implementation of the European Maritime Security Strategy [6] based on the information exchange frameworks – EUROSUR and EUCISE 2020 [7] while ensuring the privacy of the data and conformity to internationally recognized ethical issues concerning the safety of the information and the equipment subject of the project.

In order to ensure the integration of the SafeShore solution into the concept of operations of multiple countries, field trials will be organized in three geographically separated areas (North Sea, Mediterranean, Black Sea), following scenarios scripted by end users from these three areas.

Two crucial aspects of obtaining realistic results from validation scenarios are that the scenarios should be as close as possible to operational reality and that the validation tests should be repeated enough to ensure statistical relevance. These two considerations are often in conflict with one another, as operational testing requires uncontrolled environments, whereas statistical relevance of results can only be obtained in controlled settings. Within SafeShore, we have aimed to strike a balance between both aspects, by providing a qualitative and quantitative assessment of the SafeShore system capabilities and by having multiple repeated experiments in realistic environments [8], following scenarios which are described by end users, based upon their needs and their practical maritime border security problems of today.

4) Conclusions

The SafeShore project will address the relevant problem of the detection of small drones in a context of maritime border security. In this paper, we briefly explained the objectives and goals of the project, as well as the technologies which will be employed. A main focus in the project will be on the integration and the intelligent data fusion of detection methodologies. Operational validation tests are foreseen in the year 2018 in order to validate the system in different geographical areas and to ensure the seamless incorporation of the SafeShore detection system into the existing operating procedures of maritime border security management operations.

5) References

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