12TH ICCRTS "Adapting C2 to the 21st Century"

Wireless Sensor Networking Support
to Military Operations on Urban Terrain

Track 2: Networks and Networking
Track 8: C2 Technologies and Systems

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Abstract

Wireless Sensor Networks (WSNs) have motivated intense research, in academia, industry and on the military sector due to its potential to support distributed micro-sensing in environments for which conventional networks are impractical or when the required sensor density demands a robust, secure and cost-effective solution. WSNs rely on large numbers of cheap devices, which are greatly limited in terms of processing, communications and autonomy capabilities. Despite reduced, the capabilities of these devices are leveraged through collaboration in distributed in-network data fusion and processing tasks, with final results that are equivalent to those obtained with centralized processing.

However, these commercial WSN systems still lack the security, reliability and efficiency required for this kind of application. FP6 IST research project Ubiquitous Sensing and Security in the European Homeland (UbiSeq&Sens) tries to overcome these limitations. The overall objective of UbiSeq&Sens is to provide a comprehensive architecture for medium and large scale WSNs, with the full level of security and reliability required to make them trusted and secure for all applications, while considering early-warning and tracking in a Homeland Security/Defense context (e.g., support of anti-terrorist SWAT team operations) as one of the scenarios for system demonstration. This project, which started in the beginning of 2006 has now completed the scenario specification phase, and a prototype system was already developed.

The end of Cold War and the dramatic events of September 11th 2001 have led to a shift of the focus of military operations to Operations Other Than War (OOTW) with emphasis on Peace Keeping, Peace Making and Peace Building. The Rules Of Engagement (ROE) associated with these missions significantly constrain the options available to warfighters engaged on Military Operations on Urban Terrain (MOUT). In such missions, Network Centric Warfare assisted by robust sensor networking is paramount to reduce situation uncertainty, providing early-warning and tracking of unpredicted intrusions in areas considered already cleared, thus denying the intruder the advantage of surprise. In fact, most of the reality experienced by these warfighters bears more similarity with Homeland Security and counterterrorism operations than with traditional military operations. Consequently, many of the operational concepts are common to both types of scenarios, and so are the supporting technologies.

Collaboration between INESC and the Portuguese Military Academy has led to the enhancement of the IST FP6 UbiSec&Sens Homeland Security WSN allowing its applicability in the context of MOUT, the result of which is described in this paper. The paper starts by presenting the MOUT WSN scenario and resulting architecture. It then describes the IST FP6 UbiSec&Sens WSN prototype system, including its functionalities and user interface. It also identifies the main WSN Networking and Security issues and challenges that must overcome in order to provide the assurance and reliability required by the warfighter, which constitute the focus of ongoing work in IST FP6 UbiSeq&Sens. Finally, the paper presents some conclusions and the envisaged way ahead.

KEY WORDS

Wireless Sensor Networks, Network Centric Military Communications, Homeland Security, Military Operations on Urban Terrain, IST FP6 UbiSec&Sens.