Fault Tolerant Sensor Networks for Border Activity Detection

Bojan Cukic
West Virginia University

When monitoring activities at national borders, distributed sensor networks can provide sensing for a large area. By integrating the information obtained from all sensors, sufficient and precise information about the environment can be collected. Robustness and reliability are crucial parameters in the effective operation of distributed sensor networks. We strive to determine factors influencing the robustness and fault tolerance of large scale sensor networks and explore the applicability of new sensor fusion algorithms robust to sensor failure to new sensor platforms.

Project Description

Distributed multi-sensor networks must be designed in order to ensure adequate performance is maintained through the occurrence of natural and unnatural faults. Traditional definitions of reliability in fault tolerant sensor network applications address (a) the incidence of outages in nodes (hardware issues), (b) the ability to incorporate a large number of sensors in a region (scalability), and (c) the need for ad-hoc sensor associations and communication protocols between sensor nodes (quality-of-service).

In this project, emphasis will be placed on the assessment of the network's ability to acquire data from different sensing modalities deployed across multiple platforms and to succinctly interpret the ensuing information in order to analyze the intent of individuals and groups through the development of sophisticated identification and/or intent profiles. Thus, notions of reliability and robustness depart from the traditional definitions and will be used to describe the success in delivering the aforementioned service to the users (stakeholders) of border surveillance systems. In addition to hardware and protocol issues, this service is characterized by the system's ability to coordinate information capture across nodes while filtering out noise and performing intelligent fusion of sensed data that would enable the successful characterization (command, control) of border activities.

This project's activities are intertwined with several related projects which are developing unique types of sensors and algorithms for identification of intent and identity. Its contributions, while having "stand-alone" research relevance, will be closely related to the outcomes of related project.