


PROJECT / SIGAPANO - Sensor Information Gathering with Patrol Nodes

SIGAPANO

Main Objective:

The main goals of the SIGAPANO (Sensor Information GAThering with PATrol NOdes) research project are to contribute to a fundamental understanding of wireless sensor networks with mobile patrol nodes, provide an appropriate middleware design for this class of communication networks and develop a state-of-the-art sensor network prototype to demonstrate their applicability for tasks as critical as forest monitoring and fire detection. Wireless sensor networks made of tiny, low-cost devices capable of sensing the physical world and communicating over radio links, are significantly different from classical wireless networks like GSM or wireless LANs: (a) the design of a sensor network is strongly driven by its particular application, (b) sensor nodes are highly constrained in terms of power consumption and computational complexity, and (c) since the network is dense and the nodes share a common objective -- to gather and convey information -- cooperation can be used to enhance the network's efficiency. Previous work on the communications aspects of wireless sensor networks has focused on mostly static models, in which the sensor nodes keep their positions, and transmit the picked-up data to a central base station in a fixed location. Under this scenario, the sensor nodes are expected to store and process the data, coordinate their transmissions, organize the routing of messages within the network and relay the data to a remote receiver -- a challenging set of tasks which might prove impractical given the power constraints on the sensor nodes and the expected size of the network. We propose to investigate an alternative approach, based on a limited set of mobile ad-hoc nodes with increased processing and communication



capabilities, which are placed e.g. on a robot, a jeep or a helicopter and are thus able to move as a patrol around the wireless sensor network and, thus, relieve the sensor nodes from power-consuming networking tasks by collecting the required data in loco with less and more reliable transmissions. The project will be divided in three complementary

parts: (1) Fundamental performance limits of sensor networks with patrol nodes (DCCFC, Porto): we will define adequate models for this class of wireless network and investigate the impact of the patrol nodes' mobility on the connectivity, the capacity and the average lifetime of the network using elements of information theory, graph theory and

stochastic processes. (2) Network architecture and middleware for sensor networks with patrol Nodes (CRI, Lisbon): is to study and propose a protocol stack that provides an interface between the sensor networks and adhoc patrol nodes based on the theoretical results of part 1. (3) Development of a prototype sensor network for forest monitoring

and fire detection. (DCC-FC + CRI): we will use two wireless sensor network kits to implement the sensor network architecture investigated in part 1 and the middleware package developed in part 2, and conclude with lab demonstrations and field tests in Portuguese forests.

Reference: POSC/EIA/62199/2004, Funding: FCT/POSC, Start Date: 01-06-2005

Team: João Francisco Cordeiro de Oliveira Barros, João Paulo Vilela, Rui Costa

Partners: UNINOVA

Local Coordinator: João Francisco Cordeiro de Oliveira Barros
