Proposition de recherche doctorale

3D Underwater Wireless Sensor Network Deployment

Mots clés :

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- **Domaine scientifique principal**: Divers

Résumé du projet de recherche (Langue 1)

Wireless Sensor Network (WSN) is a set of nodes deployed over an area and intended to monitor, supervise, and detect an event (e.g. intruder, chemical weapon, etc). When an event is detected, the network must be able to forward the detection measurement to the base station (sink) in order to inform the end-user and to execute the associated procedures. For example, if the chemical substance within the monitored lake exceeds a predefined threshold, the sink will send an alarm to the room control so that the pollution can be easily stopped. WSN are confronted with many challenges [1] such as routing and MAC protocols, security, energy saving, etc. Indeed, WSN performance strongly depends on the successful of deployment stage. Note that i) target deployment coverage, ii) quality of monitoring, iii) network connectivity, iv) network lifetime and v) deployment cost are correlated to the deployment process. The offline deployment of static WSN has been studied in the literature and many deployment algorithms have been proposed [2-4]. The main problematic, which will be tackled in the thesis, is the 3D underwater WSN deployment problem [5][6]. It is worth noting that the underwater WSN deployment stage is complex and requires an underwater human-intervention. Besides, the network performance depends strongly on the network topology. Indeed, the objective is to generate the best underwater wireless sensor network topology that i) guarantees the desired Quality of Monitoring, ii) reduces the cost of deployment, and iii) maximizes the network lifetime. The above deployment problem is a multi-objective optimization problem and it is NP-Hard. The deployment process must take into account the chemical sensors with 3D coordinates and the sinks deployed at the surface and/or lake's borders. Besides, the physical layer (acoustic and/or RF) [7][8] will be considered during the deployment process. The challenge is to make use meta-heuristics and standard optimization algorithms to propose new underwater WSN deployment strategies ensuring the desired QoM, connectivity and maximizing lifetime. References: [1] J. Yick, B. Mukherjee, and D. Ghosal, "Wireless sensor networks: a survey," Computer Networks: The International Journal of Computer and Telecommunications Networking, vol. 52, no. 12, no. 12, pp. 2292–2330, 2008. [2] Nadjib Aitsaadi, Nadjib Achir, Khaled Boussetta and Guy Pujolle,"Deployment in Wireless Sensor Network", RFID and Sensor Networks : Architectures, Protocols, Security and Integrations, Wireless Networks and Mobile Communications, Auerbach Publications, CRC Press, Taylor & Francis Group, May-2009. [3] Nadjib Aitsaadi, Nadjib Achir, Khaled Boussetta and Guy Pujolle, "Virtual Force approach to Ensure Quality of Monitoring and Connectivity in WSN Deployment", Computer Networks journal - Elsevier, August 2010. [4] Nadjib Aitsaadi, Nadjib Achir, Khaled Boussetta and Guy Pujolle, "A Tabu Search WSN Deployment Method for Monitoring Geographically Irregular Distributed Events". MDPI Sensors journal, Special issueWireless Sensor Technologies and Applications,March 2009. [5] Pompili, D. and Akyildiz, I. F., "Overview of Networking Protocols for Underwater Wireless Communications," IEEE Communications Magazine, January 2009. [6] Akyildiz, I.F., Pompili, D., and Melodia, T., "State of the Art in Protocol Research for Underwater Acoustic Sensor Networks," ACM Mobile Computing and Communication Review, October 2007. [7] Ghalib Asadullah Shah , "A Survey on Medium Access Control in Underwater Acoustic Sensor Networks", International Conference on Advanced Information Networking and Applications Workshops 2009. [8] Akyildiz, I. F., Pompili, D., Melodia, T., "Underwater Acoustic Sensor Networks: Research Challenges," Ad Hoc Networks (Elsevier) Journal, March 2005.