proceedings

Abstract

Distributed Water Pollution Source Localization with Mobile UV-Visible Spectrometer Probes in Wireless Sensor Networks †

Junjie Ma [1], Fansheng Meng [1], Yuexi Zhou [1], Yeyao Wang [2,*] and Ping Shi [3]

[1] Chinese Research Academy of Environmental Sciences, Beijing 100012, China; majunjie85@gmail.com (J.M.); mengfs@craes.org.cn (F.M.); zhouyuexi@263.net (Y.Z.)
[2] China National Environmental Monitoring Centre, Beijing 100012, China
[3] Yiwen Environmental Science Technology Co., Ltd., Guangzhou 510663, China; shiping@yiwenkeji.com
* Correpondence: yeyaowang@163.com
† Presented at the 5th International Symposium on Sensor Science (I3S 2017), Barcelona, Spain, 27–29 September 2017.

Published: 6 December 2017

Pollution accidents that occur in surface water, especially in drinking water source areas, greatly threaten the urban water supply system. Focused on the challenge of localizing the water pollution source under complicated pollutant spreading conditions, this paper investigates a distributed localization method in wireless sensor networks equipped with mobile UV-visible spectrometer probes. A wireless sensor network is defined for water quality monitoring, where unmanned surface vehicles and buoys serve as mobile and stationary nodes respectively. Both types of nodes carry UV-visible spectrometer probes to acquire in-situ water quality multi-parameter measurements, in which a self-adaptive optical path mechanism is designed to flexibly adjust the measurement range. A novel distributed algorithm, Dual-PSO, is proposed to search for the water pollution source, where one particle swarm optimization (PSO) procedure computes the water quality multi-parameter measurements on each node, utilizing UV-visible absorption spectra, and the other one finds the global solution of the pollution source position, regarding mobile nodes as particles. Besides, this algorithm uses entropy to dynamically recognize the most sensitive parameter during searching. Experimental results demonstrate that online multi-parameter monitoring of a drinking water source area with a wide dynamic range is achieved by this wireless sensor network and water pollution sources are localized efficiently with low-cost mobile node paths.

Conflicts of Interest: The authors declare no conflict of interest.