

An Energy-Efficient Data Collection Scheme for Wireless Sensor Networks

Zhidan Liu^{*†}, Wei Xing^{*†}, Yongchao Wang[†], Dongming Lu^{*†}

^{*}College of Computer Science and Technology, Zhejiang University, Hangzhou, 310027, China

[†]Cyrus Tang Center for Sensor Materials and Applications, Zhejiang University, Hangzhou, 310027, China

{danielliu,wxing,ychwang,ldm}@zju.edu.cn

Abstract— Keeping data collecting while preserving the scarce energy of sensor nodes is always one of the most crucial problems in wireless sensor networks. In this paper, we propose the DCS scheme to effectively exploit the ubiquitous temporal-spatial correlation in most natural phenomena for energy-efficient data collection of wireless sensor networks. Specifically, for temporal correlation, we build lightweight AR model locally to capture data distribution at sensor node; for spatial correlation, by making use of our novel definition of similarity measure between sensor nodes, we perform centralized model clustering, which is a kind of clustering that emphasizes data similarity between nodes but ignores geographical distance, to group sensor nodes with similar data distribution on both magnitude and trend into the same cluster. Then through scheduling sensor nodes to report readings alternately and performing dual-prediction at both sensor nodes and Sink, DCS acquires sensing readings without compromising too much data accuracy loss. Simulation results illustrate the efficiency of DCS scheme on a data set synthesized from real-world temperature data, i.e., 82.94% communication overhead reduction while keeping data error as low as 0.0456°C when user-provided error-tolerance threshold sets as 0.2°C.

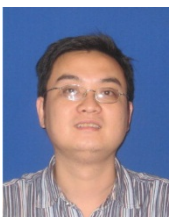
Keyword—Data Collection, Energy Efficient, Time Series Analysis, Wireless Sensor Network



Zhidan Liu received the B.E. degree in Computer Science and Technology from Northeastern University, Shenyang, China, in 2009. He is currently a PhD student in College of Computer Science and Technology at Zhejiang University, Hangzhou, China. His research interests include data management and wireless communication in sensor networks.



Wei Xing received the B.E., M.E. and Ph.D. degrees from Zhejiang University, Hangzhou, China in 1989, 1992, and 2009, respectively. He joined Department of Control in College of Information Technology, Zhejiang University, in 1992. Since 2002, he has been with the College of Computer Science and Technology in Zhejiang University, where he is currently an Associate Professor. His research interests cover computer network, multimedia technology, Internet of Things.



Yongchao Wang was born in China in 1975. He received the B.E. degree from Zhejiang University of Technology and M.E. degree from Zhejiang University, China, in 1997 and 2004, respectively. He joined Wireless and Next Generation Network Corporation, Hangzhou, China in 2005, where he is currently a Senior Engineer. His main areas of research interest are IPv6 network and Internet of Things. Mr. Wang is a member of the Innovation Alliance of the Internet of Things in Zhejiang, and the Computer Association of China in Zhejiang.



Dongming Lu received the B.E., M.E. and Ph.D. degrees from Zhejiang University, China, in 1989, 1991 and 1994, respectively. He is currently a Professor in the College of Computer Science and Technology at Zhejiang University. His research interests include Internet of Things, multimedia technology, and digital protection of cultural relic, virtual reality and digital museum. Prof. Lu is the Director of Professional Committee of Network Technology in Zhejiang, and the Standing Director of the Computer Association of China in Zhejiang.