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Benshun Yi [a,b], Mian Xiang [a*], Taiqi Huang[c], Haojun Huang[a], Kang Qiu[a,b], Weizhong Li[a,b]

[a] Electronic Information School of Wuhan University, Wuhan, 430072, China
[b] Shenzhen Institute of Wuhan University, Shenzhen, 518057, China
[c] The 28th Research Institute of China Electronics Technology Group Corporation, Nanjing 210007, China

First author: Benshun Yi, Ph.D., yibs@whu.edu.cn
*Corresponding author: Mian Xiang, Ph.D., xiangmian@whu.edu.cn

Abstract:

A distributed rateless coding scheme is proposed in this paper for reliable data gathering over wireless sensor networks (WSNs), where multiple source nodes communicate with a single destination node through a relay node in a two-hop fashion. First with the objection of ensuring the optimized coding strategy in the build-up stage of the conventional online fountain codes, we propose an enhanced online fountain coding scheme. Then a distributed rateless coding scheme based on the enhanced online fountain codes is designed for reliable sensed data gathering over WSNs. Moreover, the upper bound for coding redundancy is derived over binary erasure channel using the analysis of random graph process. We perform simulations to evaluate the performance of the proposed distributed fountain codes. Simulation results show that the proposed data gathering scheme can introduce performance improvement in terms of coding overhead, coding/decoding complexities and feedback cost.

Keywords: Rateless codes; Distributed rateless coding; Online fountain codes; Wireless sensor networks.

1. Introduction

With the recent development of Internet of Thing (IOT), Cyber-Physical System (CPS) has been studied and applied in many potential applications including security monitoring, smart home system and industrial process control [1-2]. Through the sensors deployed in the CPS, information of the physical world are obtained and analysed to impact the environment. Thus reliable and efficient data collection is very important for the CPS [3-4]. Wireless sensor networks, which consist of a number of spatially distributed sensor nodes, are considered to be a vital component of the emerging CPS. In WSNs, the distributed sensor nodes are usually scattered in a geographical area to monitor hash environments and cooperate in a two-hop