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Editorial

A Breakthrough in Multihop Wireless Multimedia Sensor Networking Protocols

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As technologies on micro-electric-mechanical system (MEMS) have been improved during more than a decade, wireless sensor networks (WSNs), which are composed of sensors equipped with wireless communication functions, have extensively been studied. Even though WSNs can be in a category of ad hoc networks, WSNs were distinguished from ad hoc networks in terms of data size the networks were dealing with. Since WSNs transfer sensed data such as temperature, humidity, pressure, noise level, and mechanical stress level [1], the size of data is smaller than the general ad hoc networks. Therefore, the main focus of WSNs has been on constructing self-efficient network topologies, conserving energy, and designing routing protocols.

Beyond the conventional WSNs transmitting small sensed data, the emerging hardware technologies such as CMOS cameras and microphones have fostered the development of wireless multimedia sensor networks (WMSNs), that is, networks of wirelessly interconnected devices that are able to ubiquitously retrieve multimedia content such as video and audio streams, still images, and scalar sensor data from the environment [2–4]. Because of such enhanced capabilities of WMSNs, tactical communications, public safety, disaster control, and so forth become promising WMSN applications. In addition to researching on how to transfer data, WMSNs focus on how to meet the quality-of-service (QoS) requirements of each of the traffic types.

However, although many wired sensor-based network applications have been implemented and deployed, applications using WMSN, particularly multihop-based WMSN, are barely implemented and deployed yet because of the lack of reliability and efficiency as well as constraint of power consumption. Such shortcomings of multihop WMSNs are blocking expansion of practical implementation and commercialization of WMSN-based networks.

Many researchers study and propose new protocols and research results for efficient and reliable MWSNs.

Afzal et al. [5] propose a medium access control (MAC) protocol to reliably multicast moving picture expert group 4 (MPEG-4) video traffic. In this paper, even though multimedia services are provided in a way of multicast, wireless multicast is not able to cooperate with automatic request (ARQ) based error recovery process. Thus, video packets are differentiated based on frame types and importance, and ARQ is only used for the highest priority packet which mainly affects video quality. In [6], Aziz and Pham also provide a lightweight protocol to reliably transmit image data. The protocol allows only one node to transmit over multihop, so that it reduces collisions. In addition, the proposed system using the protocol adopts object extraction method, so that it reduces the amount of data to be transmitted.

Unlike focusing on how to reliably deliver video traffic over WMSNs, Jo et al. [7] present efficient image compression scheme itself to achieve high energy efficiency in terms of clustering of WMSN nodes. The paper proposes an improved distributed image compression scheme, which is based on lapped biorthogonal transform requiring fewer resources, memory, and processing power as compared with conventional schemes on individual WMSN node. Utilizing available energy level of nodes, they are classified and clustered into computational clusters to distribute computational load for image compression.

Dimokas et al. [8] propose a cooperative caching solution for WMSNs to efficiently distribute data. The authors propose a protocol to detect the most central nodes in the network and to give the role of mediator to them in order to coordinate the caching decisions.

Kandris et al. [9] propose a routing protocol, named power efficient multimedia routing (PEMuR), and video packet scheduling algorithm. PEMuR is energy-aware routing protocol to find a route which has more residual energy, so that the selected path is maintained longer and useless data transmissions are prevented. In addition, a packet scheduling algorithm allows reducing the video transmission rate by using analytical distortion prediction model.

Newell and Akkaya [10] propose a protocol to reduce redundant camera sensor data transmissions maintaining coverage area. The proposed method enables camera sensors to cooperate with each other, so that they minimize the possible coverage overlaps.

Sonmez et al. [11] propose a fussy-based image transmission (SUIT) protocol, to increase frame delivery performance over congestion environments for MWNSs. In congestion, SUIT reduces the frame sending rate by dropping subframes of progressively encoded JPEG without corrupting the image file. It also reduces frame size. That is, by removing some less important frames, it improves the delivery rate maintaining the required image quality.

Military standard has been studied to provide reliable voice transmissions in tactical WMSN. Han and Kim [12] propose a way to provide higher channel-access opportunity to nodes with voice traffic rather than nodes with other traffics in military standard-based MAC protocol.

Some of researches focus on cross layer design for WMSN. Deshmukh and Dhopte [13] present a system of video-traffic-based WMSN using compressed sensing technique. In this work, the compressed sensing sampling rate is varied to control the rate of compressed sensed video, so that by adopting variation of channel conditions, it improves video-based WMSNs' performances.

Multimedia authentication for WMSN is focused on by Wang [14]. Even though image authentication is critical in WMSN, it is hard to be resolved in WMSN because of resource constraints in small sensor nodes and error-prone wireless channels. Therefore, in this paper, a communication-resource-aware and adaptive watermarking scheme for multimedia authentication in WMSN is presented.

In this special issue, we introduce researchers and expertise to contribute original research articles as well as review articles that will enable multihop WMSN to be practical and implementable for many applications. 11 research articles are selected in this issue. We hope many researchers in academia and industries are getting interested in this area by focusing on this issue. Therefore, we hope that somehow more practical and realistic MWSNs are discussed and eventually implemented.

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