## ABSTRACT

Wireless multimedia sensor networks (WMSNs) involving camera sensor (CS) and scalar sensor (SS) nodes provide precise information of events occurring in the monitored region by transmitting video packets from the event area to the base station (BS). Topology management in WMSNs differs from that in ordinary wireless sensor networks (WSNs) due to factors such as continuous sensing of the environment for retrieving video data, transmission of large-sized payload of video packets, and specific requirements with respect to event coverage. Consequently, energy efficiency, routing, sharing of limited bandwidth, and security provisioning emerge as new challenges for distributed topology management in WMSNs. In this work, we focus on achieving improved event coverage, efficient energy usage of the nodes for enhanced lifetime, increased packet delivery ratio, increased throughput, and efficient resource allocation among the competing links.

We address some of the above issues by first proposing a distributed topology management scheme, named T-Must, to ensure improved event coverage, enhanced lifetime of the CS nodes, and optimized connectivity between the CS nodes.

The deployment of WMSNs in unattended environment makes the nodes vulnerable to node replication attack. This security issue is considered here along with topology management in WMSNs. Next, by exploiting the received signal strength of the control packets exchanged between nodes, we propose a trust-based distributed topology management scheme, named TRAST, to provide efficient coverage of an event and maintain inter-node connectivity, even in the presence of malicious entities.

Upon occurrence of an event, when the data sent by the associated SS nodes in the event area exceed a pre-configured threshold, the CS nodes start sensing the event and send the corresponding video packets to the BS. Therefore, in addition to the lifetime of the CS nodes, the lifetime of the SS nodes and their data reporting latencies play pivotal roles in distributed actuation of the CS nodes. In order to prolong the lifetimes of both the CS and the SS nodes, and to reduce the data reporting latency, while ensuring event coverage and reliable event reporting, we propose a topology management-based distributed camera actuation scheme, named TADA.

Finally, by considering the possibility of occurrence of multiple concurrent events in the monitored region in an environment affected by shadow fading, we conclude our work by proposing a cooperative communication and resource allocation scheme, named CRAQ, for quality of service (QoS) support. CRAQ offers enhanced lifetime of the CS nodes, increased packet delivery ratio, and increased throughput with fair resource allocation among the contending links of multiple flows.

Results of performance evaluation obtained from extensive simulation-based experiments indicate that T-Must, TRAST, TADA, and CRAQ help in distributed topology management and resource allocation in WMSNs.



**Keywords**: Wireless sensor networks, Wireless multimedia sensor networks, Topology management, Trust, Cooperative communication, Resource allocation