Throughput Inferred Adaptive Multiple Mobile Sink Routing Protocol in Low Duty Cycle Wireless Sensor Network

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Abstract

Energy Efficient Balanced routing protocols have been widely deployed in network architectures to improve the performance of a flooding process in low-duty-cycle wireless sensor networks (WSNs).However existing protocols generate high flooding delay and network over head due to scheduling and balancing of the hop entities. Flooding delay and throughput degradation is considered as Hotspot issues. In order to tackle those challenges, a novel Throughput Inferred Adaptive Routing protocol has been proposed on dynamic multiple mobile sink on the data monitoring. Initially Node density of each sensor node has been computed along establishing the cluster of the sensor nodes for effective data transmission using particle swarm optimization technique. It computes the cluster head and cluster node on basis on dynamic propagation of the multiple sink towards monitoring and data collection. Network coding is integrated with scheduling of the mobile sink to disseminate the encoded packets as Markova process. Further it employs the trajectory computation for gathering the transmission information of the mobile sink and sensor node at varied time duration. Additionally, trajectory information produces efficient path prediction for further transmission to attain the effective energy utilization of the low duty cycle sensor node architecture. Extensive simulation analysis of the energy efficient routing protocols with respect to dynamic mobile sink has been evaluated with throughput, packet delivery ration and overhead. It proves that proposed approaches out performs the state of art approaches on all specified performance measures.

Keywords: Cluster based Wireless Sensor Network, Multiple Mobile Sink, Low Duty Cycle , Trajectory Data , Particle Swarm Optimization

1. **Introduction**

Wireless Sensor Network disseminate the multiple message throughout the entire network with help of mobile sink on utilizing the route discovery, path selection and data transmission on configured network architectures[1]. Multiple

message propagation may lead to flooding in the network. In addition, low duty cycle Wireless Sensor Network, Periodically switches between active and dormant states to save energy and prolong the network lifetime which leads to throughput degradation and large delay in the network[2]. Moreover much energy efficient routing protocol has been established due to lossy nature of the network and no of packet retransmission through mobile sink. On realizing process of wireless nodes with static mobile sink, it generates multiple collisions and redundant transmission with large hop count and hop distance. However it significantly increases the total flooding delay[3].

Data Collection and Data Dissemination using multiple mobile sink has been analysed to eliminate the flooding delay and to increase throughput. In this work, Trajectory based throughput inferred adaptive routing model has been proposed to eliminate the critical issues in terms of data redundancy and hop count. Additionally Network coding is incorporated to particular architecture to enhance the performance in terms of security. Successful decoding of the message has been attained on the receiver end as it is markov process[4]. Finally optimal trajectory for data transmission on the multiple mobile sink has been effectively computed and leads to high throughput and low flooding delay of the architecture.

The rest of paper is organized as follows; Section 2 describes the related work. Section 3, design architecture of the proposed protocol with multiple mobile sink has been defined. Section 4 presents the simulation results of the proposed model on various measures. Finally section 5 concludes the work.

2. Related work

In this section, Energy efficient balanced routing protocol with multiple mobile sink has been analysed on various aspects has detailed below

2.1. Energy Efficient Balanced Routing

In this Method, cluster has been established consisting of the member nodes which route the routing information to the high density node in the cluster[5]. Cluster provides the routing data to the multiple sinks propagating for data collection and packet header to establish the data transferring path in either single hop or multihop on available mobile sink trajectories to attain energy efficient path. Scheduling constraints employed on the Sink has been used to determine appropriate end nodes with sufficient residual energy whereas to eliminate the packet loss due link destruction.

3. Proposed model

In this section, architecture of the proposed protocol is described in detail along multiple mobile sinks and sensor nodes on cluster based structure. Among this network establishment along each node has been defined with routing characteristic on basis on trajectory data in form trace files

3.1. Network Model

Wireless sensor node is multifunctional and energy efficient wireless device deployed with fixed trajectories for data collection and communication in multihop manner in the specified monitoring region to disseminate the sensed information in monitoring region to base station[6].

3.2. Multiple Mobile Sink

The sink has been used to collect the sensed information from the sensor node and disseminate the information to base station at certain locations[7]. The mobile sink is to improve the overall performance of the network on careful selection of the trajectories on the data collection for effective throughput and delay. Architecture of the proposed work has depicted in the figure 1
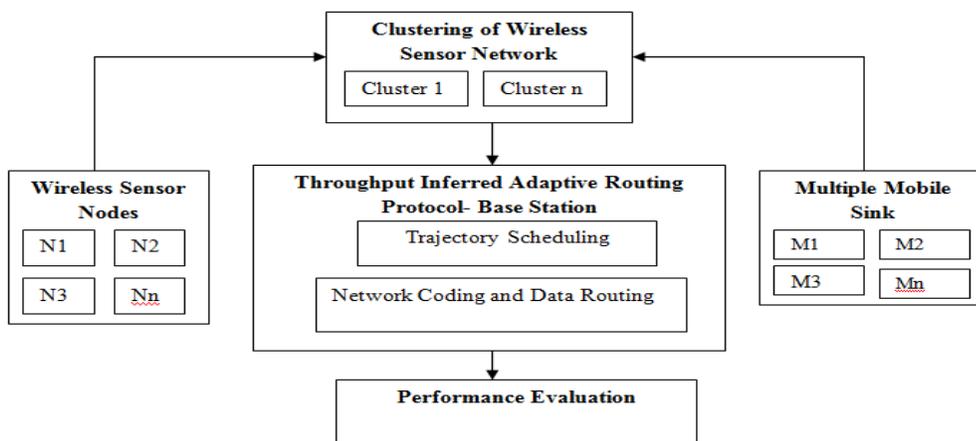

Figure 1: Architecture of Proposed model

3.3. Clustering of the wireless Sensor Network

Clustering is the most well-known topology management method in WSNs, grouping nodes to manage them and/or executing various tasks in a distributed manner[8]. Clustering of the sensor nodes is established using particle swarm optimization in order to decrease the volume of inter-node communication and to increase the energy consumption.

3.4. Throughput Inferred Adaptive Routing Protocol

Adaptive routing protocol is employed to efficiently manage the mobile sink for large amount transmission in low duty cycle wireless sensor Network. Trajectory data from mobile sink on data transmission is further used to schedule the sensor node to the base station for improved throughput on data transmission[9]. Further redundancy in the data transmission due to flooding has been computed to eliminate those constraints.

Algorithm 1: TIAR protocol

Input: Low Duty Cycle Sensor Node N={N1,N2,N3....Nn}

Multiple Mobile Sink M={M1,M2,M3.....Mn}

Output: Clusters containing High Energy Conservation Sensor Node

Process

Compute Node Density N_d of N and M

Cluster ()

Group Node with Similar Characteristics in terms of Velocity and Energy

If Node Density of Sensor Node > Threshold

Route Discovery ()

High Throughput Efficient Path Selection ()

Transmit Data on effective path ()

Network Coding ()

Sink Trajectory ()

Else

Convert Node to Sleep

End if

The above mentioned algorithm eliminates the redundancy and increase the energy utilization on throughput computation on the each trajectory of sink.

4. Simulation Results

In this section, simulation result of the proposed Throughput inferred adaptive mobile sink routing and existing Energy Efficient Dynamic Mobile Sink based Balanced Routing towards data collection and data transmission is carried out on dynamic multiple mobile sinks[10]. Its performances analysis is computed using throughput, packet delivery ratio and Network overhead. Simulation has been carried out using NS2 simulator
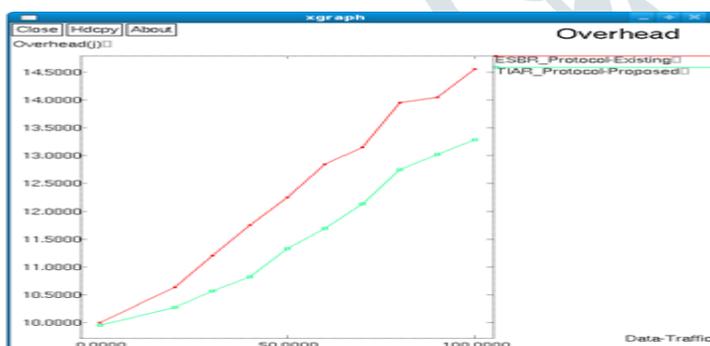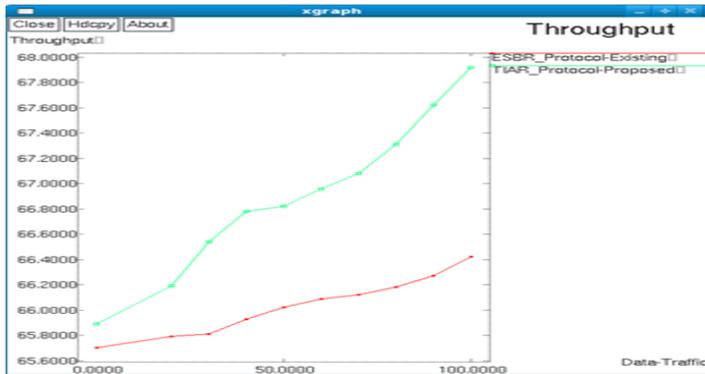

4.1. Overhead Analysis of the proposed Protocol against existing protocol via the Data Traffic

The Overhead is Reduced as the malicious node is dropped to much extent by flooding strategies .The System also achieves high detection rate. Packets are exchanged over an end-to-end path to maintain channel synchronization between consecutive hops via dynamic multiple mobile sink. The performance in depicted in the figure 4.1

The proposed work estimates data transmission rate on flooding constraints using throughput analysis on the efficient data cluster. Hence this evaluation is considered during routing process which optimizes route selection there by

increasing the throughput of the data collection through dynamic multiple mobile sink on scheduling with hop measures as described in the figure 4.4.

4.4. Throughput Analysis of the Proposed Protocol against Existing protocol through the Data Traffic

Also results shows the high performance is reached against most standard technique on varying working cycles. As mentioned above, the number of neighbors depends nodes depends on speed of the mobile sink and node density of the node during flooding process to achieve effective energy utilization
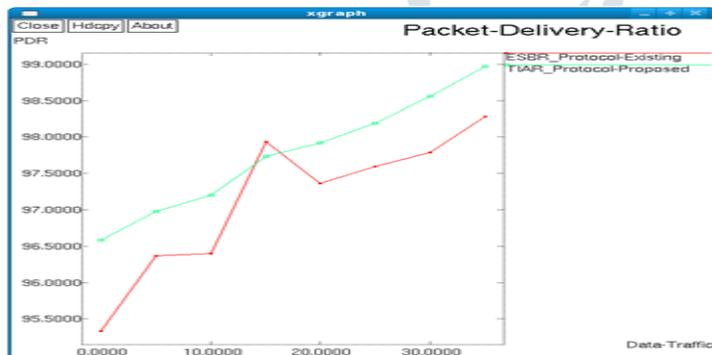
4.3. Packet Delivery Ratio Analysis Proposed Protocol against Existing protocol via the Data Traffic

The packet delivery ratio of transmitting packet on the specified network depends the transmission speed of dynamic mobile sink in the specified flooding topology. The impact is much reduced in the proposed model as collaboration of sink node and sensor node at short span of time towards effective data collection

Table 4.2 – Performance Evaluation of the ESBR and TIAR protocols against data traffic of the network

Technique	Throughput in mbps	Overhead in mbps	Packet Delivery Ratio	Packet loss in Percentage of data lost
ESBR Protocol – Existing	66.42	14.56	98.28	0.29
TIAR Protocol – Proposed	67.92	13.29	98.97	0.27

The overhead analysis suggests that, to maintain a good transmission rate of the dynamic mobile sink, Throughput inferred adaptive routing approach has been carried out to various distance placement of the mobile sink.

Conclusion

Throughput Inferred Adaptive Routing Protocol for Low Duty Cycle Wireless Sensor Network has been designed and implemented. Trajectory of the Mobile sink has been captured in this work to efficiently schedule the data transmission sensor node on high throughput paths. Sensor node transmits the data using network coding in encode format with less hop count and hop distance path. Further cluster based Wireless Sensor Network has been achieved with effective path for transmission on eliminating the data redundancy and inferences.

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