Energy Aware TPGF Protocol in Wireless Multimedia Sensor Networks

R Guru
Dept. of Computer science and Engineering,
Sri Jayachamarajendra college of Engineering, Mysuru, karnataka
guruirg@rediffmail.com

Dr. Siddaraju
Dept. of Computer science and Engineering,
Dr. Ambedkar Institute of Technology, Bangalore.
Siddaraju_b@yahoo.co.in

Abstract— Currently one of the hottest trending topics is a Wireless Multimedia Sensor network that has attracted many researches in the area of networking. Multimedia data transmission should achieve QoS parameters such as high packet delivery ratio, reduced delay and energy consumption. Even though existing geographical routing protocol achieves lesser delay, remaining energy of the node is not considered. A protocol is proposed that overcome the aforementioned problem known as routing protocol named TPGF in which multimedia streaming data is transmitted over node-disjoint path. Every path's transmission capacity by choosing node-disjoint path and does not allow sharing the capacity of the currently used path thereby reducing the delay of data transmission. Proposed TPGF routing protocol is enhanced with energy feature of the node by selecting the router which has sufficient residual energy. Metrics for measuring performances like remaining energy, delay, packet delivery ratio of every node on end of communication are measured and compared with existing protocol AODV to evaluate the QoS in each protocol.
Keywords-component; Multimedia Sensor Networks, Multipath Packet Delivery ratio, Remaining Energy, Quality of Service**.**

I. INTRODUCTION

The availability of inexpensive hardware such as CMOS cameras and microphones has fostered the development of Wireless Multimedia Sensor Networks (WMSNs), i.e., networks of wireless interconnected devices that are able to ubiquitously retrieve multimedia content such as streams of audio and video, images and also scalar sensor data from the environment. Here, we shall first survey the state of the algorithm, hardware and protocols for the wireless multimedia sensor networks and identifies open research issues. In course of this process, we shall evaluate existing solutions and open research issues at the layers such as application, transport, network, physical layer of the communication stack, which has possible cross layer synergies. The first step in creating a WMSN is equipping a single sensor device with audio and visual information collection modules. Wireless multimedia sensor networks will not only enhance existing sensor network applications such as, automating home, and monitoring environment, tracking, it also enables several new applications such as: Multimedia Surveillance Sensor Networks. Sensors of audio and video is used to enhance and complement existing surveillance systems against crime and possible attacks of terrorists. Video sensors of the large scale networks can extend the ability of law enforcement agencies for area monitoring and borders. The integration of machine vision systems with WMSNs can simplify and add flexibility to systems for visual inspections and automated actions that require much high-speed, very high-magnification and operation that will be continuous.

II. RELATED WORK

Collection of mobile nodes without any intervention of any existing infrastructure or centralized access point forms an adhoc network [1]. While repairing links also loop free route is provided by AODV. As global periodic routing advertisement are not provided by protocol, demand for overall bandwidth available is very less for mobile nodes in such protocol which has such advertisement necessity. Source to destination routes are found is prime advantage and not providing optimum path while selecting route between source and destination.

Various new routing protocol [2] for sensor nodes are been designed specifically due to many recent advances. Due to video and image sensors introduction that is supporting multimedia data, for the Wireless Multimedia Sensor Networks (WMSNs), routing has been one of the important challenges. Because of the computational capabilities and energy constraints of sensor nodes along with acquiring of the global network knowledge for disseminating packets to nodes. Here, it's proposed an online multipath routing protocol for use in WMSNs. The proposed protocol uses position of the sensor nodes to decide at every hop about forwarding of packets. Performance comparison of the proposed protocols with Greedy Perimeter Stateless Routing (GPSR) and Two-Phase Geographical Greedy Forwarding (TPGF) shows that they: (a) By not exhausting energy from some specific nodes, overall network lifespan is been maximized (b) By influencing the best node along the route to destination quality of service delivery for video streams is provided and (c) better scale in densely deployed wireless sensors network has posed additional challenges.. Advantages includes minimizing the delay and help in removing overhead and complexity problem.

Greedy Perimeter stateless routing (GPSR)[3] is one of the protocol used to route in network by considering the router's position along with destination of packets. Thus involves in decisions for forwarding that are greedy is been taken care by GPSR considering immediate neighbours of router in network topology. Greedy forwarding is impossible if packets is in area where recovery done by algorithm through routing along the perimeter of the area. Advantages are GPSR's consider only information of immediate-neighbours in forwarding decisions.

Usage of Video Sensors [4] in wireless multimedia sensor networks for enhancing event description capability, as sensor nodes transmission capacity is limited. Requirement of video transmission cannot be met by the single path. Consequently, multipath transmission is needed. Important stream must be given higher priority just to ensure usage of bandwidth that is limited and energy in wireless multimedia sensor networks.

A large number of sensor nodes is been used in Wireless sensor networks [5], which must meet specific requirements, that includes simplicity and lower power consumption. To ensure the energy efficiency of the access methods, it is necessary to guarantee:-Minimum collisions by the transmission media access; -Optimal transmit power - the minimum value of power at which the communication is successful. Mutual collisions by the transmission media access can be minimized as follows:-Reasonable number of participants that share the same transmission channel; -Reducing the volume of transmitted data; -Optimization of the frame length (packet length); -Reducing unwanted interference between neighbouring clusters by controlling the broadcast power; -Frequency FDMA or CDMA code division channel utilization, so that neighbouring clusters use different transmission channels and thereby minimize unwanted interference.

Because of the scarcity of accuracy in deployments of real world [6], network simulators are required to test algorithms for wireless sensor networks on large scale. To make environment more realistic real test bed is deployed for wireless sensor network, hence users are benefitted to get test results accurately. When test needs a large scale WSN environment, due to highly constrained availability of budget, real test bed deployment is not recommended.

To support multimedia applications in Wireless Multimedia Sensor Networks (WMSNs) routing has been one of the key challenges [7] because of constraints on energy and computational capabilities of sensor nodes, along with acquiring of the global network knowledge for disseminating packets to nodes. Here, it's proposed an online multipath routing protocol for use in WMSNs. The proposed protocol uses position of the sensor nodes to decide forwarding of packets at every hop. Performance comparison of the proposed protocols with Greedy Perimeter Stateless Routing (GPSR) and Two-Phase Geographical Greedy Forwarding (TPGF) shows that they: (a) Total network lifespan is to be maximized from some certain nodes not exhausting energy (b) For video streams delivery of the quality of service is influenced by the best node through route to destination, and (c) Better scaling in densely deployed wireless sensors network.

The efficient transmission of multimedia streams [8] in WMSNs is an important issue to handle, as sensor nodes have limited bandwidth and energy resources. For common wireless sensor networks routing protocols designed are not suitable for WMSNs since they lack support transmission features of multimedia streaming and do not satisfy the constraints of such networks. There are several kinds of routing protocols for WMSNs in particular gradient routing protocol and geographic routing protocol. TPGF protocol [8] is based on geographical greedy forwarding technique

III. PROPOSED SYSTEM

Considering end-to-end delay, algorithm of TPGF focuses on finding and the establishing of best disjoints routes to maximum number. The first part of the algorithm is responsible to find a path that offers guaranteed delivery, while avoiding the holes. This part has two methods:

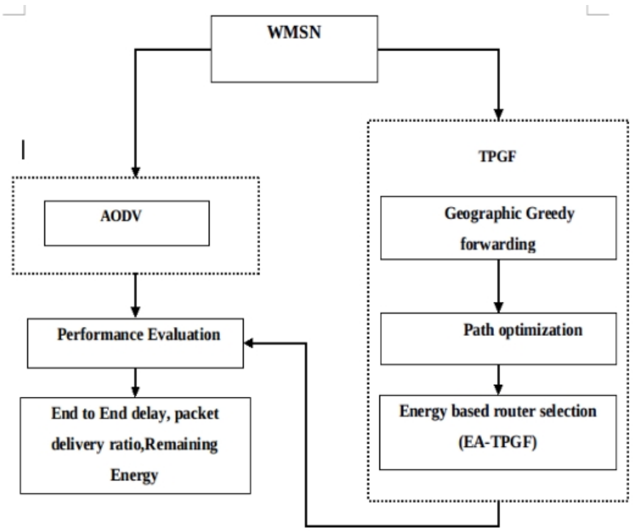
– **Greedy forwarding`** Considering all neighboring nodes, the node transmitting the information always chooses the next hop node that is the closest to the base station.
– **Step back & mark**, this second step handles the problem of blocking nodes. The Routing protocol's second phase aims at optimization of paths that are identified by reducing the number of hops. **Label based optimization** is done, which is responsible in removing all cycles that can appear in a path routing.

Repeated execution of TPGF algorithm helps to discover several disjoint paths. It can support three features which generally must be included in any routing protocol for multimedia transmission in WMSNs which are: (i) the use of multi-path for transmission, (ii) avoiding the holes (iii) choosing the shortest path. Advantages are i) End-to-end transmission delay is minimized ii) For transmitting multimedia streaming data TPGF is more suitable iii) In both 2D and 3D sensor networks TPGF provides a better solution for hole-bypassing.

Flow diagram Proposed Module is shown in figure 1 as follows**:**

1. TPGF: Geographic Greedy forwarding
2. TPGF: Path optimization
3. Energy Aware TPGF (EA-TPGF)
4. Performance Evaluation

Fig 1: Block diagram of proposed system



TPGF: Geographic Greedy forwarding

Input: Data from source

Output: Transmission through least distance next hop

TPGF protocol for wireless datagram network ,uses router's position and destination of packet to make forwarding decision of packets forwarding decision are greedy are taken care by TPGF by getting information about immediate neighbors of router in network topology. If there is situation where there is no possibility of greedy forwarding when the packet reaches area, recovery is done through algorithm by performing routing along perimeter, by retaining state information of the topology that is local, TPGF scales better in per-router than shortest-path and adhoc routing process as destination number increases. To find new routes topology that is local that information is used. If there exists frequent changes in topology considering mobility, under TPGF, respectively mark packets by respective originator with respective location of destination is considered. Thus node which is forwarding chooses packet's next hop can decide greedy choice, that's optimal locally. Specifically position of radio neighbours are known by node, neighbour which is geographically closest for destination of packet will be optimal choice for next hop, until destination is reached, successively closer geographic hops it's forwarded.

TPGF: Path optimization

Input: Agent from source

Output: Data transmission through node-disjoint path

. To find a path, an agent is triggered at the source node, this agent executes the TPGF algorithm at each node to choose the next hop until it reaches the destination node. At this stage the choosing process avoids a busy and locked node (a locked node is used in another path). Each node which receives the agent, marks itself as a locked node, once the agent arrives to the destination, the optimized reverse path is traversed by a backward agent. In the case where the first agent fails to find a path due to non available free nodes, a second one is launched and can choose a busy node to build a route to the destination node from the source node. Hence path for the routing table is set up. From the base station to the source node a successful agent is sent back. Once the successful agent is received, to the successful path with the pre-assigned path number the source node then starts to send out multimedia streaming data.

Energy Aware TPGF (EA-TPGF)

Input: Node Energy

Output: Transmission through high least distant, high energy node-disjoint path

In Wireless Sensor Networks if forwarding nodes (next hop) have low energy, hence there could be chances for inaccuracy in the topology that is local. Suppose node along the forwarding path has low energy, that node will not participate in the packet transmission and the node will have packet drop. Hence it is required to select the nodes with high energy to reduce the packet loss in the network. Hence the next hop selection in TPGF is based on distance and energy and it is known as Energy Aware TPGF (EA-TPGF).The ratio of Distance to the energy is been used to consider the next hop.

Next Hop Selection Factor = Distance / Energy

IV. Performance Evaluation

We compare the performance of each one regarding various metrics such as:

a. Packet Delivery Ratio: The packet delivery ratio is the total number of data packets received by the destination over the total number of data packets transmitted by source.

b. Delay: The average time taken by a data packet to arrive in the destination is referred as delay. It also includes the delay caused by route discovery process and the queue in the data packet transmission. Only the data packets that successfully delivered to destination are counted for delay.

c. Remaining Energy: It is the average of remaining energy on all nodes of the topology which participate at least in one communication from a source node to destination node.

Data transmission is carried out for the three flows between 3 pairs of source and destination. Nodes are varied from 50 to 90. Each node is assigned with random initial energy. Protocols AODV, TPGF and EATPGF are applied over the network with same scenario. The proposed protocol is simulated using NS2 simulator with the following parameters as shown in below table 1.

Table 1: Simulation parameters

SIMULATOR	Network Simulator-2
NUMBER OF NODES	Random
TOPOLOGY	Random
INTERFACE TYPE	Wireless
MAC TYPE	802.11
QUEUE TYPE	Queue/Drop tail/priority queue
QUEUE LENGTH	50 Packets
ANTENNA TYPE	Omni Antenna
PROPAGATION TYPE	Two ray Ground
ROUTING PROTOCOL	AODV, TPGF, EA-TPGF
TRANSPORT AGENT	UDP
APPLICATION AGENT	CBR_500 bytes
SIMULATION TIME	50seconds
INITIAL ENERGY	10J
TOPOGRAPHY	600*600

In Fig 4.1, PDR of TPGF and EATPGF are nearly almost same. In some topologies (70 and 80 nodes), AODV produces better result in terms of PDR at the cost of reduced remaining energy. In remaining topologies, TPGF and EATPGF produce better result in terms of PDR.

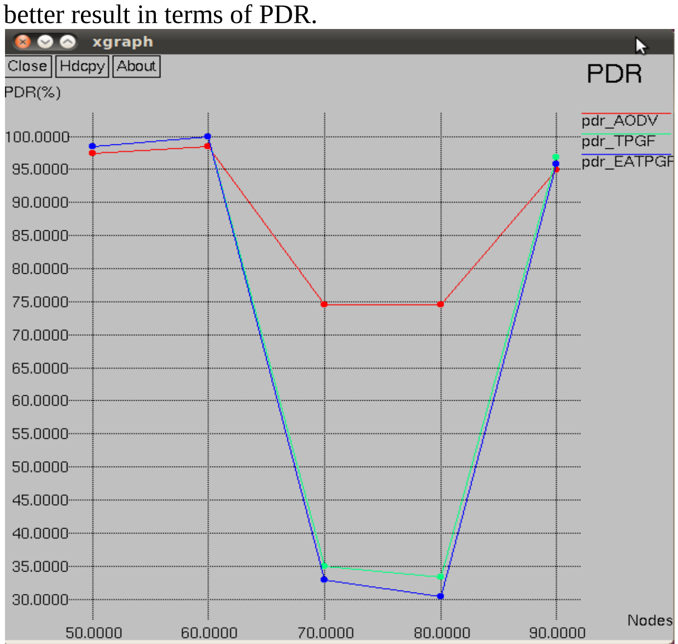


Fig 4.1: Packet Delivery Ratio Comparison

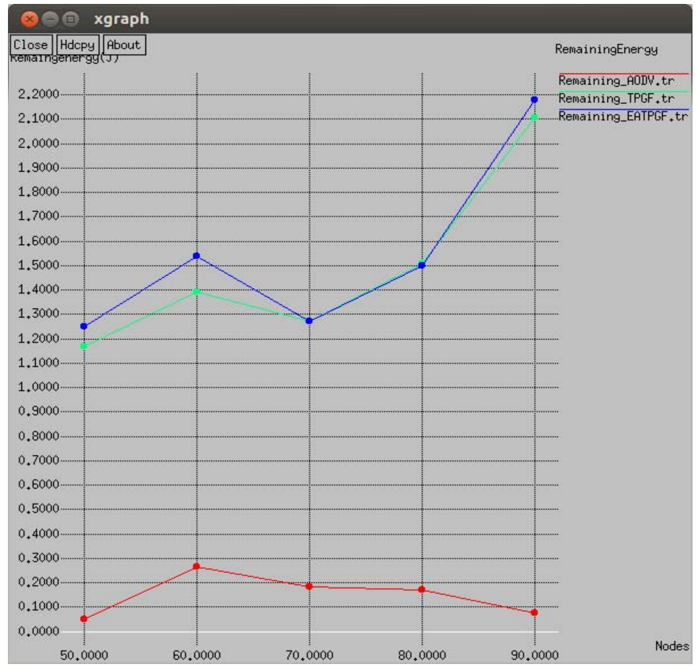


Fig 4.2: Remaining Energy Comparison

The Fig 4.2 shows that the Remaining Energy Factor is much better in EA-TPGF when compared to the TPGF and AODV. TPGF's remaining energy factor is much better when compared to AODV during the simulation of nodes

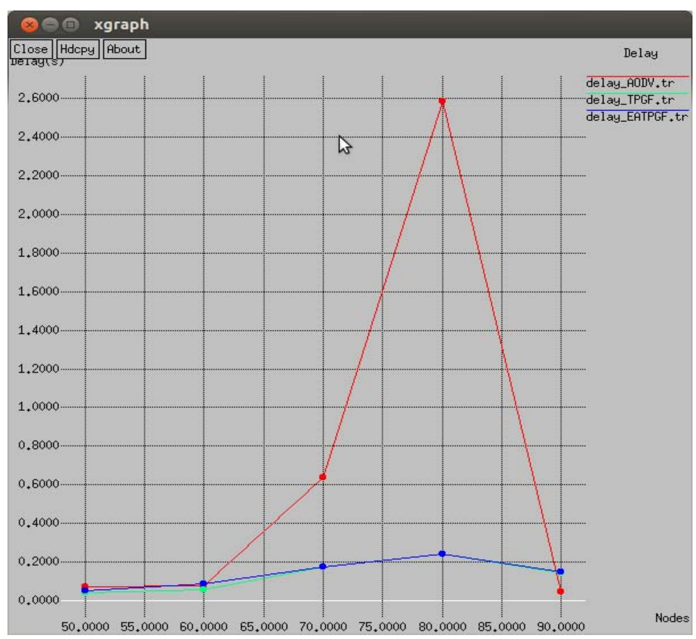


Fig 4.3: Delay Comparison

From Fig 4.3, delay in both protocols TPGF and EATPGF is reduced due to their disjoint path selection for data transmission of multiple flows when compared to AODV. TPGF protocol is used based on the distance factor of the

nodes involved whereas EA-TPGF considers remaining energy along with the distance of the nodes involved.
Further TPGF will chose same path for fixed source and destination which may cause overload on some nodes thus leading to early shutdown of nodes and reducing network lifetime. Hence using both distance and remaining energy factors EA-TPGF is useful in improving efficiency as remaining energy is also considered.

V. CONCLUSION

QoS of the proposed work is evaluated by implementing the protocols using the NS-2 simulator. This evaluation has used two major scenarios. The first one is to prove that the basic version of TPGF needs some improvements to handle a complex scenario where there are more than one communications on the topology. According to this result the notion of node-disjoint routing path in the basic version of TPGF must be revised. The second scenario is to evaluate the performance of TPGF with EA-TPGF and AODV through the metrics such as delay, PDR and also the remaining of energy of the nodes. Future enhancement can be done considering speed parameter of the mobility nodes in which the fastest mobile node in the network will be chosen as a hop for the transmission of packets.

6. REFERENCES

[1] C. Perkins, E. Belding-Royer, and S. Das. Ad hoc on-demand distance vector (aodv) routing. 2003.

[2]. Kemal Akkaya and Mohamed Younis. An Energy-Aware QoS Routing Protocol for Wireless Sensor Networks.2002.

[3]. Brad Karp and H. T. Kung. Gpsr: greedy perimeter stateless routing for wireless networks. In Proceedings of the 6th annual international conference on Mobile computing and networking, MobiCom00, pages 243–254, New York, NY, USA, 2000. ACM.

[4]. Lin Zhang, Manfred Hauswirth, Lei Shu, Zhangbing Zhou, VinnyReynolds, and Guangjie Han. Multi-priority multi-path selection for video streaming in wireless multimedia sensor networks. In Ubiquitous Intelligence and Computing, volume 5061 of Lecture Notes in Computer Science, pages 439–452. Springer Berlin Heidelberg, 2008.

[5]. J. Micek and M. Kochlan. Energy-efficient communication systems of wireless sensor networks. Studia Informatica Universalis, 1:70–89, 2013.

[6]. Lei Shu, Chun Wu, and Manfred Hauswirth. Nettopo: A framework of simulation and visualization for wireless sensor networks, ad hoc networks, elsevier, 2010.

[7]. Samir Medjiah, Toufik Ahmed, and Abolghasem (Hamid) Asgari. Streaming multimedia over wmsns: an online multipath routing protocol. CoRR, abs/1205.2357, 2012.

[8] R.S. Sreyas Kumar, and R. Guru: Energy efficiency and Multi-path routing using Two Phase Geographical Greedy Forwarding Protocol in WMSN, International Journal of Emerging Technology in Computer Science & Electronics (IJETCSE) ISSN: 0976-1353 Volume 13 Issue 1 –MARCH 2015.