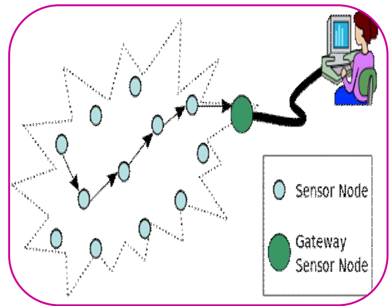
REVIEW OF RESEARCH
IMPACT FACTOR : 5.7631(UIF) UGC APPROVED JOURNAL NO. 48514 ISSN: 2249-894X
VOLUME - 8 | ISSUE - 2 | NOVEMBER - 2018

COMPOSITE AND HYBRID ROUTING PROTOCOL FOR WIRELESS SENSOR NETWORKS BASED ON NODE STATUS



Mohd Rafi Ahmed[1] and Dr. Syed Abdul Sattar[2]
[1]Research Scholar, Department of Computer Science, Rayalaseema University, Kurnool , A.P.
[2]Professor, Director (R&D) & Principal, Nawab Shah Alam Khan College of Engg. & Tech., Hyderabad.

ABSTRACT

The energy efficiency and load balancing is one of the important considerable factor to extend the network performance in Wireless Sensor Networks (WSNs), as it has constraint resources particularly battery and buffer. The routing protocols are used to enhance the network performance by extend the network lifetime, packet delivery and reduce the packet loss. Energy efficiency greatly affected by packet loss and overhead. In literature lot of routing protocols developed to address the energy efficiency. Out of these protocols, reactive energy aware routing protocol is more suitable in terms of small energy density. However these protocols reserve some nodes, which interns increase the load on that node, which leads to packet loss. Thus in this work we propose a hybrid routing protocols to select the path between communication entities. Routing path is selected based on the reactive status of node with respect to load and energy. Proposed routing protocol performance validated through simulation and compared with energy aware routing protocols in terms of packet delivery and network lifetime.

KEYWORDS: *Energy efficiency, WSN, Network lifetime, Hybrid routing protocol*

INTRODUCTION:

Due to its characteristics Wireless Sensor Networks (WSNs)are having applications like health-care and military [2]. Sensor nodes are deployed in large numbers in a diversity of physical environments for perfect monitoring. Data communication plays a vital to get monitored information accurately from monitoring nodes, as some monitored information is sensitive. There should be a strong mechanism at sensor nodes end for giving monitored information. One of the challenge of providing accurate monitored information is to keep every time all the nodes alive i.e., battery powered. One of the ways of achieving this factor is through routing.

In literature lot of routing protocols [5] have been proposed to extend the lifetime of network. One such routing protocol is energy aware routing protocol. In which routing path is selected based on higher energy nodes routing path. Source sends the information to destination by sending the data to higher energy neighbor nodes. However these types of routing protocols reserve a particular node for communication purpose. If a node is receiving packets from multiple sources due to its higher energy drops the packets due to insufficient buffer space. Thus these routing protocols creating a load balancing issue, which interns causes the packets drop.This type of situation in network known as bottleneck [6]. From above discussion we needs a routing protocol which address the two issues

- Energy efficiency
- Load balancing

While selecting the neighbor node of sender it needs to check the two factors namely energy and load. Thus in this paper we develop a routing protocol which selects a routing path by considering the energy and load of the neighbor nodes. In order to achieve our goal, we first calculate the reactive status of node regarding buffer and then we calculate proactive status of node regarding energy. Thus our proposed routing protocol is hybrid routing protocol as it is a combination of reactive and proactive status of energy and buffer of an intermediate nodes.

Proposed Protocol

The aim of proposed routing protocol selects the neighbor nodes, which should not drops the packets due to either energy or buffer. Two issues are merged in a single process to calculate the routing path between communication entities. Every node in network needs to calculateits status regarding energy. In this work we computed it proactively as, maximum number of packets it can process (receive, proceed and transmit) with in its available energy. Every node in a network needs to calculate its load status. In this work we computed it reactively as the queue present in a node is less than or greater than predefined threshold value. Two factors are used to remove node to become bottleneck intermediate node there by reducing packet loss.

Proactive status of node regarding energy

The reducing the packet drop by an intermediate node due to its constraint energy is overcome by the multi objective optimization process. That is capacity optimized maximum packets can be processed by an intermediate node in its current battery of energy. Let us consider that an intermediate node equipped with battery capacity (E) joules, and it can be processed maximum of $'n'$ number of packets in its current battery of energy.

Multi objective optimization

1. Energy of node
2. Energy is required to process the packet

Energy consumed by an intermediate node for processing one packet let $'P_1'$ is computed by, equation 1.

$E(P_1) = E_r(P_1) + E_p(P_1) + E_t(P_1)$..................................(1)

Where,

$E_r(P_1) = \text{energy require to recive the packet } 'P_1'$

$E_p(P_1) = \text{energy require to process the packet } 'P_1'$

$E_t(P_1) = \text{energy require to transmit the packet } 'P_1'$

Now remaining energy of node after processing $'P_1'$ packet is given in equation 2.

$E(\text{residual}) = E - E(P_1)$..................................(2)

In order to compute the capacity optimized maximum packets can be processed by an intermediate node in its current battery of energy is achieved by two dimensional array with entries, as given below.

$K\,[P_i\,, E(\text{residual})\,]$..................................(3)

Where,

$$i = 1,2, \ldots .\text{number of packets}$$

$E(\text{residual}) = \text{enrgy required to process the packet}$

Computation of capacity of optimized maximum packets can be processed by an intermediate node in its current battery of energy is given in equation 4

$$K\,[P_i\,, E(\text{residual})\,] = \max(K\,[P_i - 1\,, E(\text{residual})]\,,\; K_i + K\,[P_i - 1\,, E(\text{residual})])\ldots(4)$$

$$\forall\; 1 \leq P_i \leq n$$

$$\text{and}$$

$$0 \leq E(\text{residual}) \leq E$$

Here$K\,[P_i\,, E(\text{residual})\,]$, provides the capacity of optimized maximum packets can be processed by an intermediate node in its current battery of energy.

REACTIVE STATUS OF NODE REGARDING LOAD

The reducing the packet drop by an intermediate node due to its buffer overflow is overcome by the queuing mechanism.An intermediate node reactively calculates its buffer status by number of packets arrived in current interval of time as well as number of packets departure from node. If packet arriving rate is greater than its departure rate then packets will get drop from an intermediate node. If the arrival rate is less than departure rate then queue is created at node buffer based on difference between arrival and departure rate.Node compute arrival and departure rate using exponential moving average method [3].

Average Packet arrival rate =

$$(\text{Weighted constant}) * \text{Average number of packets arrived in previous timeinterval} + (1 - \text{Weighted constant}) * \text{Average number of packets arrived in current timeinterval} \quad \ldots\ldots(5)$$

Similarly

Average Packet Departure rate =

$$(\text{Weighted constant}) * \text{Average number of packetsDeparturedin previous timen interval} + (1 - \text{Weighted constant}) * \text{Average number of packets Departured in current time interval} \quad \ldots\ldots(6)$$

The packet arrival or departure at time zero or no packet arrival or departure in previous time interval as event zero . Weighted constant values are decided based on time constant of receiving circuit. Number packets queued at an intermediate node is computed by queuing theory [4], given in equation 7.

$$\text{queue size} = \text{Average Packet Departure}/(\text{Average Packet Arrival rate} - \text{Average Packet Departure rate}) * \text{bytes} \quad \ldots\ldots(7)$$

If queue size is greater than the buffer packet holding capacity then packet drop from node.Thus while selecting an intermediate node; source node must consider the two factors such as buffer and energy so as to reduce the packet loss in network there by enhance the network performance and efficiency. Our proposed work is an extension of existing routing protocol “An energy aware WSN geographical routing protocol [1]” . In our routing protocol node select its neighbor based on its residual status regarding energy and buffer, remaining things are followed by existing protocol.

PERFORMANCE ANALYSIS

We used the NS2.34 [7] simulator to evaluate the performance of our model and compare it with existing algorithms with respect to throughput, delay and routing overhead. In our simulation we consider the variable number of nodes with random way point mobility model with 20 m/s pause time. Every node equipped with battery of 10j energy initially and fixed radio transmission range of 250m andIEEE 802.11 MAC card with data rates of 2 Mbps. The receiving power is 300mW and transmission power is 600mW. Finally, source nodes generate CBR traffic with a packet size of 512 bytes. Simulation duration is 1000s, we took the average of 3 scenario performances. In order to measure the performance, we considered the following performance metrics.

Throughput: It is a network performance metric to calculate how much data packets transmitted from source to destination in a particular amount of time.

Delay: It is calculated as the average time take to reach the packet from source to destination

Overhead: It is the ratio of amount of control packets are transmitted for routing (including routing path finding, maintaining the route) to actual data transmission in the network.
Simulation parameters are shown in table1.

Table1. Simulation parameters

Network Parameters	Values
Simulation Time	1000 s
Number of Nodes	10-100
Link Layer (LL)Type	Logical Link (LL)
MAC	802.11
Radio Communication	Two-Ray Ground
Queue Type	priority Drop-Tail
Routing	Proposed
Traffic	CBR
Area of Network	1500m x1 500m
Mobility Type	Random Way point

Figure 2: - Comparison of proposed work with existing work in terms of delay

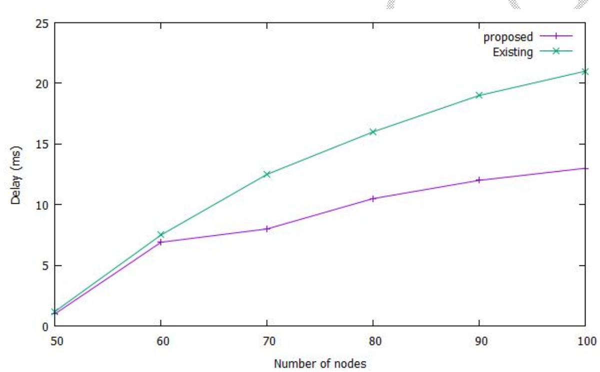
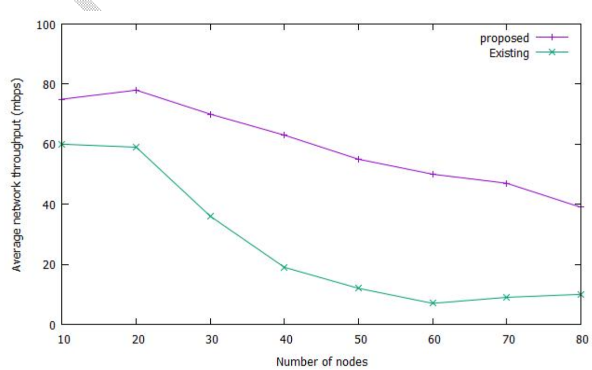


Figure 3: - Comparison of proposed work with existing work in terms of Throughput



Results are clearly show that proposed work extends the network throughput and reduce the delay. It extends the energy efficiency as packet loss is very less in our proposed work.

CONCLUSION

The existing routing protocols designed for WSN reserve some nodes, which interns increase the load on that node, which leads to packet loss. Thus in this work we propose a hybrid routing protocols to select the path between communication entities. Routing path is selected based on the reactive status of node regarding load and energy. Proposed hybrid routing protocol performance validated through simulation and compared with energy aware routing protocols in terms packet delivery and network lifetime.

REFERENCES

1) Elrahim, A.G.A., Elsayed, H.A., Ramly, S.E. and Ibrahim, M.M., 2010. An energy aware WSN geographic routing protocol. Universal Journal of Computer Science and Engineering Technology, 1(2), pp.105-111.
2) Akyildiz, I.F., Su, W., Sankarasubramaniam, Y. and Cayirci, E., 2002. Wireless sensor networks: a survey. Computer networks, 38(4), pp.393-422.
3) Mohammad, A.A.K., Mirza, A. and Vemuru, S., 2016. ENERGY AWARE ROUTING FOR MANETS BASED ON CURRENT PROCESSING STATE OF NODES. Journal of Theoretical & Applied Information Technology, 91(2).
4) Gnedenko, B. and Kovalenko, I.N., 1989. Introduction to Queuing Theory. Mathematical Modeling. Birkhaeuser Boston, Boston.
5) Singh, S.K., Singh, M.P. and Singh, D.K., 2010. Routing protocols in wireless sensor networks–A survey. International Journal of Computer Science & Engineering Survey (IJCSES), 1(2), pp.63-83.
6) Mohammad, A.A.K., Mirza, A. and Vemuru, S., 2016. Analytical Model for Evaluating the Bottleneck Node in MANETs. Indian Journal of Science and Technology, 9(31).
7) Simulator, N., 2014. 2. Network Simulator 2.

Mohd Rafi Ahmed
Research Scholar, Department of Computer Science, Rayalaseema University, Kurnool , A.P.

Dr. Syed Abdul Sattar
Professor, Director (R&D) & Principal, Nawab Shah Alam Khan College of Engg. & Tech., Hyderabad.