ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 6 | Issue: 8 | August 2020 || Journal DOI: 10.36713/epra2013 || SJIF Impact Factor: 7.032 ||ISI Value: 1.188

A SELF LOCALIZED ALGORITHM FOR PACKET FORWARDING IN SENSOR NETWORKS

Sunita Kumawat[1]
[1]Research Scholar,
Department of CSE,
Bhagwant University,
Ajmer (Rajasthan) India.

Dr. Pushpneel Verma[2]
[2]Associate professor,
Department of CSE,
Bhagwant University,
Ajmer (Rajasthan) India

ABSTRACT

Sensing and monitoring are the main purposeful aspects of wireless sensor networks (WSNs) and since these networks are densely populated in terms of number of sensor nodes, a large amount of redundancy either in terms of data or in terms of sensor nodes is often observed. Redundancy is an inherent feature of WSNs that has to be very carefully examined in order to improve the purposeful aspects of their functioning. This paper briefly explains the existing gossip protocol that aims to control the redundancy during message transmission or packet forwarding in WSNs and presents a novel technique "self-localized algorithm for packet forwarding (SLAPF)". The SLAPF utilizes the existing gossip protocol and helps to achieve an optimum packet delivery ratio (PDR) during message/packet broadcast in WSNs. The proposed technique imbues the aspects of the gossip protocol for forwarding packets. The simulator SNetSim is used to perform the simulation of the proposed algorithm and the end to end performance is evaluated for various values of node densities in the deployment area.

KEYWORDS: ***Redundancy, Node Density, Localization, Packet Forwarding, Wireless Sensor Network.***

INTRODUCTION

WSNs consist of spatially scattered, autonomous sensors that are fabricated using thin film devices to visualize physical or environmental conditions such as pressure, humidity, sound, temperature, volatile organic compounds, light, and many other sensations Are [1–4]. In the network, sensor nodes are designed with transceivers, power sources, a radio frequency, and a memory. They float information wirelessly as messages / packets over a specified protocol [5]. Packet forwarding is a common way for sensor nodes to share their packets with each other. The packet sharing mechanism can serve as an efficient technique to localize sensor nodes. [5] The simplest way to forward packets is flooding, under which each sensor node resets the packet when it is first received. It is a very simple technique, but has high redundancy, bandwidth dissipation and packet collision [7]. So, an efficient packet-forwarding technique is necessary to reduce packet-forwarding redundancy [8]. Several prospective broadcast protocols have been anticipated in the literature as flood amendments. Gossiping is one of the basic extensions of flooding [9, 10], where every sensor node forwards a packet in a possible routine. The proposed technique avoids the above mentioned problems and provides alternative solutions to flooding.

In this paper, a self-localized algorithm for packet forwarding (SLAPF) for governor redundancy is proposed. The proposed method uses a chat protocol with regularly increasing node density for packet forwarding between sensor nodes and for a changing network topology. The simulator SNetSim is used to perform simulations and is the highpoint that SLAPF operates in a self-localized manner and is lightweight in its approach to the limited resources available with sensor nodes. Self-localization allows sensor nodes to reattach their Ambani, cooperate to form topologies, and acclimatise to environmental changes without human intervention. Position information relative to neighboring nodes (eg, directional estimation or distance estimation or) is required in sensor networks. The basis of the localization algorithm is the ability to derive these estimates. Redundancy is associated with the provision of adding duplicate resources to produce similar results in WSNs, redundancy is both friend and foe, with researchers challenging it to emphasize positive aspects and minimize negative ones [11]. This should be evaluated to increase data accuracy, sensory reliability, system lifetime, and security, taking into

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account the fact that high redundancy indicates poor network utilization and high energy consumption [12].

GOSSIP PROTOCOL ROLE IN WSNs

The basic theory of information propagation was proposed for achieving communication with limited goals and objectives. However the proposed theory opened new areas for one to all communication and was later on implemented by means of protocols like flooding and gossiping. The routing protocols for WSNs are efficient to fuse the data collected from neighbours in order to reduce the communication cost and achieve low end to end delay. Various routing protocols [13, 14, 15] have been proposed for WSNs considering their different application demands. The extensions to the protocols for information dissemination in WSNs have been widely proposed and their importance is well accepted but results often fall short of supporting a persuasive argument in their support for redundancy and localization improvement as these protocols focus mainly on resource discovery, information propagation, packet delay, and PDR in WSNs.

The performance of gossip is promising in WSNs as they are high density networks, the actual quantity of deployed sensor nodes is much higher than the actual need and without certain sensor nodes, and the network can still retain its effective connectivity. Secondly, there exists a large number of analogous or redundant data in WSNs, since the sensor nodes are in close proximity with each other, therefore removing few of them from the network also does not make much difference. The Gossip protocol uses the forwarding rule. Its maintenance does not require an expensive topology or an algorithm for complex routing constraints. If a sensor node is needed to transmit the message, then that sensor node will want to broadcast the message. When it first receives the message it selects a sensor node at random and this node repeats its process. When a message is received twice from the same sensor node, it leaves the message to allow. Each sensor node should keep track of the messages that have been received earlier. This approach avoids implosion problem encountered in flooding but distributes the information slowly but also satisfies a variety of tasks such as inter process interactions, information exchange, maintaining database, and node sorting, it relies on peer-to-peer communication, making it more useful for networks that are completely not connected offering desirable properties like; scalability to large numbers of nodes and resilience to node failures due to redundancy. Most routing protocols follow that approach to cluster nodes. Thereby reducing the amount of data and saving energy. To address the fact of the Gossip protocol, a four-level data descriptor is used to eliminate redundant information through interaction. Conversation messages are sent to nodes to prevent or suppress the exchange of duplicate or unwanted information which ensures that only limited or ideally any unnecessary information can be produced [16, 17]. Apart from this, it can be said that there are fewer bottlenecks in terms of gossip delays and localization, which makes the change in topology stronger. Therefore it is considered more attractive and purposeful for WSNs to cover other issues such as sensing, coverage, communication, measurement and data storage.

SELF LOCALIZED ALGORITHM FOR PACKET FORWARDING (SLAPF)

SLAPF has been proposed for packet forwarding in high-density WSNs with varying numbers of nodes to analyze the detailed effect of scalability. The position of sensor nodes is not known in any arbitrary coordinate system because it is assumed that the neighbors of a particular sensor node are determined only on the basis of packet forwarding decisions. Sensor nodes decide to forward packets locally (act like active nodes) and ignore packets received earlier. The major collision associated with this type of packet exchange lies in the PDR's exact estimate for the number of sensor nodes within the network, which is limited to the total number of packets forwarded. SLAPF does not require any topology information and all sensor nodes are static and have common features (similar communication and sensing limits). SLAPF is based on the assumption that sensor node N is deployed randomly in a specified region A, allowing them to transmit an E message, for an event EN, corresponding to a high-density wireless networked network. With the increase in the number of sensor nodes. The steps of the proposed SLAPF are indicated in Table 1.1.

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Table 1.1: The SLAPF

Algorithm: Self-Localized Algorithm for Packet Forwarding (SLAPF)

1: START
2: Declare A, N and m, where about m and N ⊂ A
3: **Initialize** N = 50, 100, 200 …500 and m = 1,
4: define E_N, deploy N such that N ∈ A
5: Start
6: 6: Packet forwarding and forward initial packet, m
7: Gossip selects the neighboring sensor node as the target which is n.
8: If its neighbor sensor node receives the packet for the first time, we will go to step 9;
9: Else go to step 12
10: End
11: If a neighboring sensor node receives the packet twice
12: 12: then discard packet forwarding; Update, if N gave up his attempt to return the packet
13: Repeat step 6 for N = {100, 200, 300, 400, and 500} with m = 1
14: 14: Then estimate the packet delivery ratio
15: END

The SLAPF incorporates the logic of the Gossip protocol and also guarantees sensor node localization that the sensor node is activated only for message transmission and no node has to localize with respect to the global coordinate system. The proposed algorithm is scalable to an increasing number of sensor nodes and works well for a small network topology with 50 sensor nodes with a large network topology with 500 sensor nodes in the same deployment region. This scheme guarantees that the sensor nodes with the shortest distance from their neighboring sensor node will satisfy the minimum insolation to control the redundancy. This algorithm is useful in networks where small packets dominate network traffic, further employing a localized implementation strategy for packet forwarding. SLAPF employs the concept of active networks with high computing capacity and is useful in reducing packet traffic in WSNs. SLAPF is intended for packet forwarding in high-density WSNs, as scalability is an important issue in sensor networks as hundreds and thousands of sensor nodes are deployed in a single position. The localization of sensor node density increases with the increase in sensor node density as each sensor node decides to forward the packet according to the local information received from its neighboring sensor node. SLAPF incorporates the benefits of the gossip protocol in a self-local way to control redundant packet forwarding and also ensures that any action implemented by the sensor node does not affect the network overall. The simulation parameters are shown in Table 1.2.

Table 3.2: Parameters used in simulation

Parameter	Value
Dimension of Network	550m x 550m
Transmission range of sensor nodes	200 m
Protocol	Gossip
Event	1
Sensor node distribution	Delphi Random

PROPOSED METHOD's SIMULATION RESULTS

Simulators are performed on SNetSim simulators, this simulator has a full stack for the Gossip protocol and provides a central management with functionality to set the deployment area before the sensor area is created. The sensor nodes are randomly placed in an area of 550 m × 550 m, so that each sensor node can communicate with the neighboring sensor node. It is observed that SLAPF promoted efficient packets within the entire network in addition to maintaining a controlled level of redundancy with increasing number of sensor nodes. The stability of the proposed algorithm in high density sensor networks is guaranteed because N has been simulated individually for different values of N ranging from 50 to 500 (in multiples of 50/100 nodes). Simulation results of different values of n. This is shown in Figure 1.1.

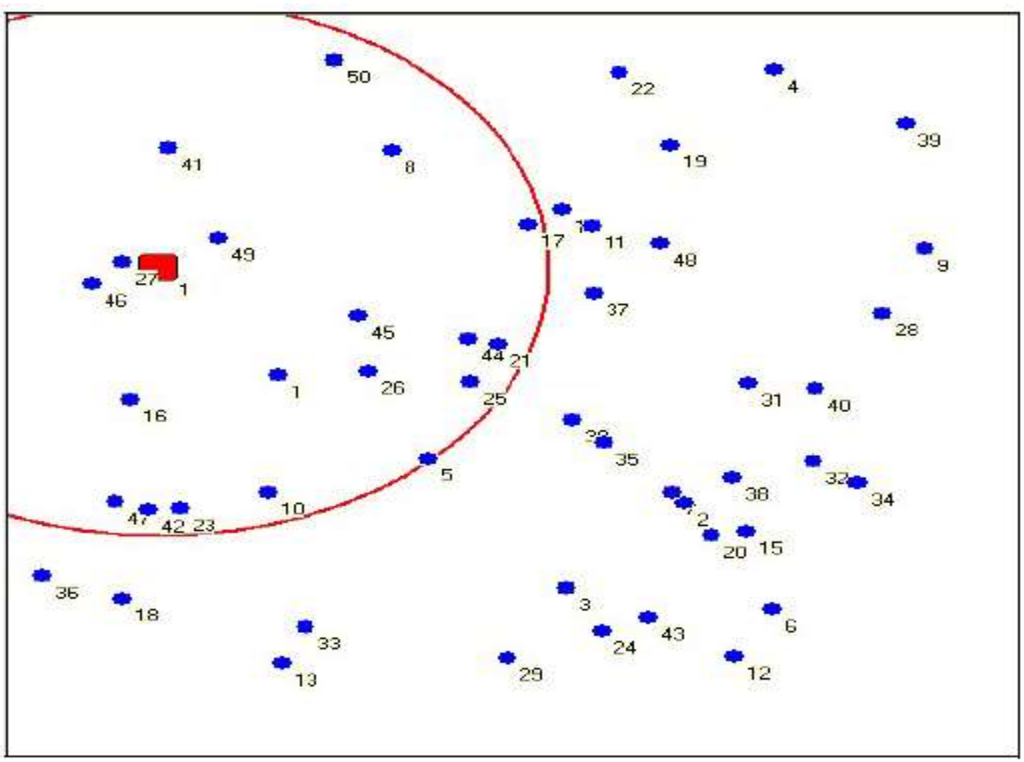

Figure 1.1 (a): Network model (a) *N* = 50, dimension (550m x 550m)

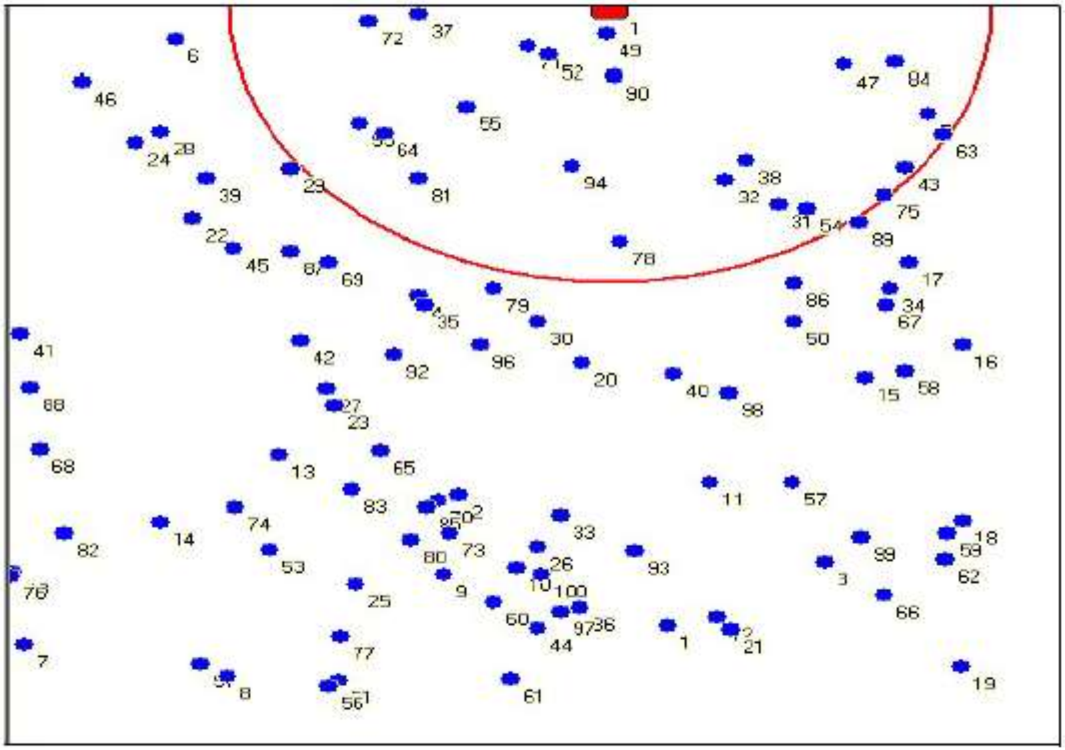

Figure 1.1 (b): Network model (a) *N* = 100, dimension (550m x 550m)

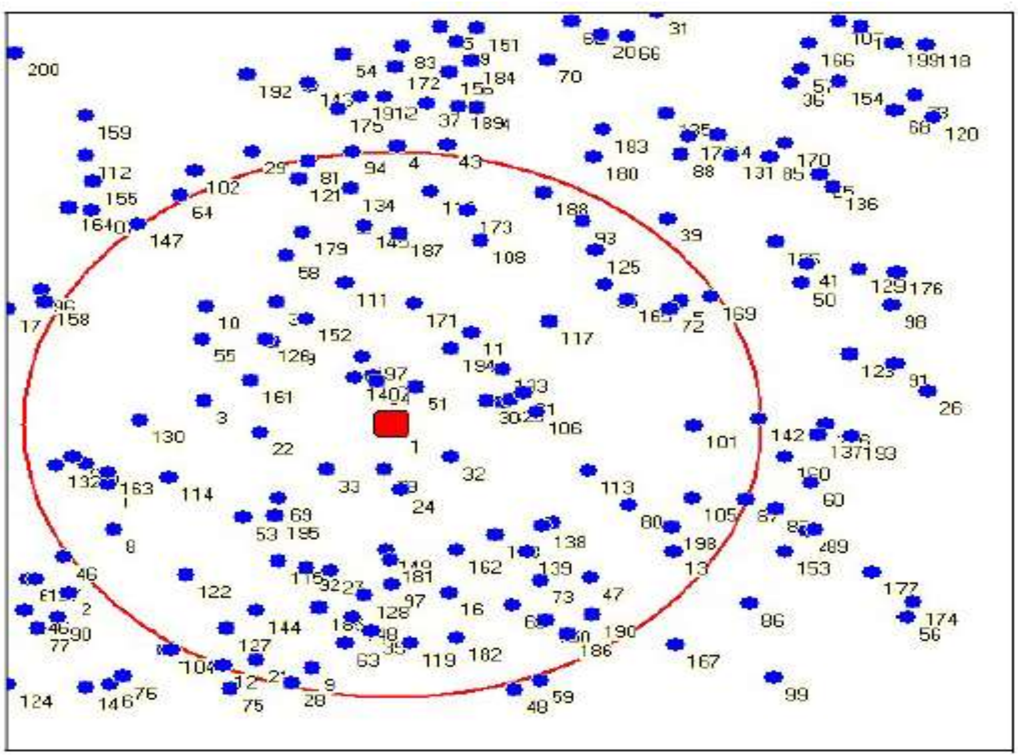

Figure 1.1 (c): Network model (a) *N* = 200, dimension (550m x 550m)

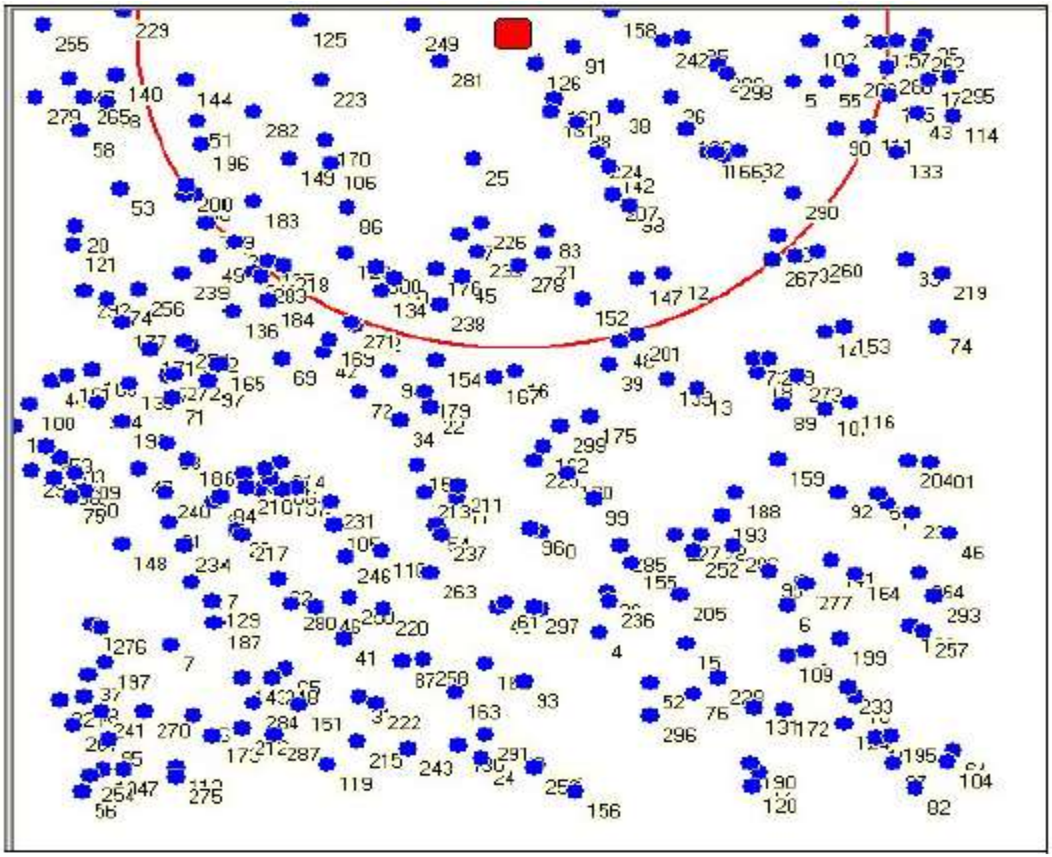

Figure 1.1 (d): Network model (a) *N* = 300, dimension (550m x 550m)

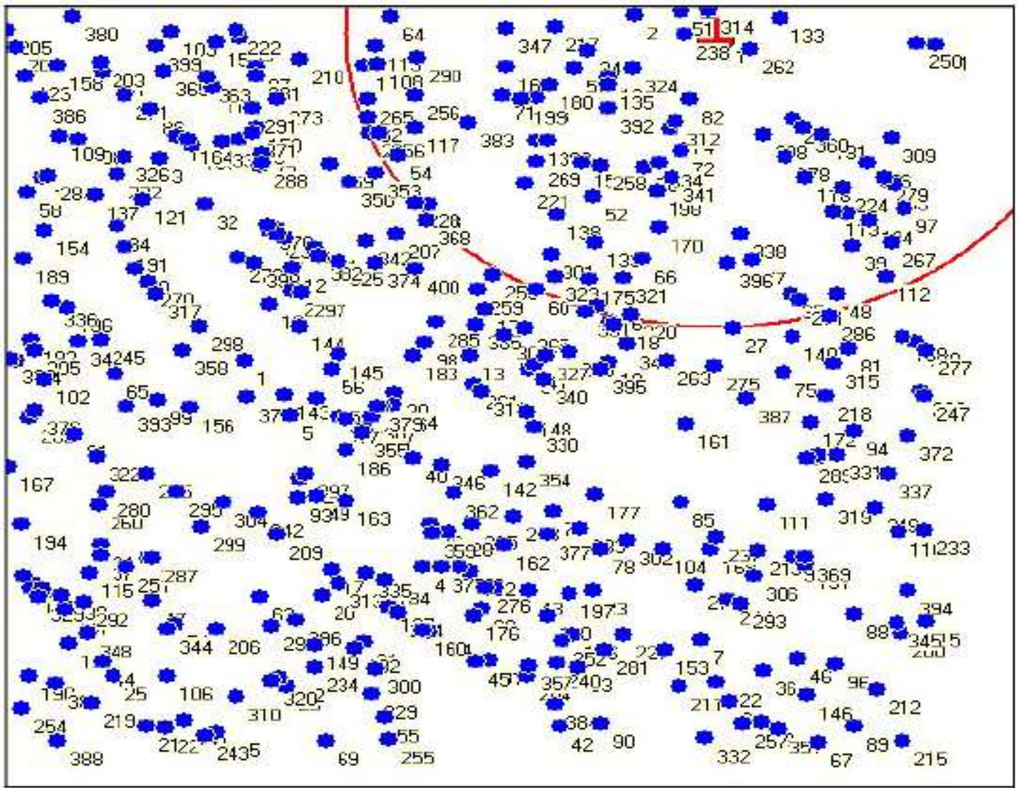

Figure 1.1 (e): Network model (a) *N* = 400, dimension (550m x 550m)

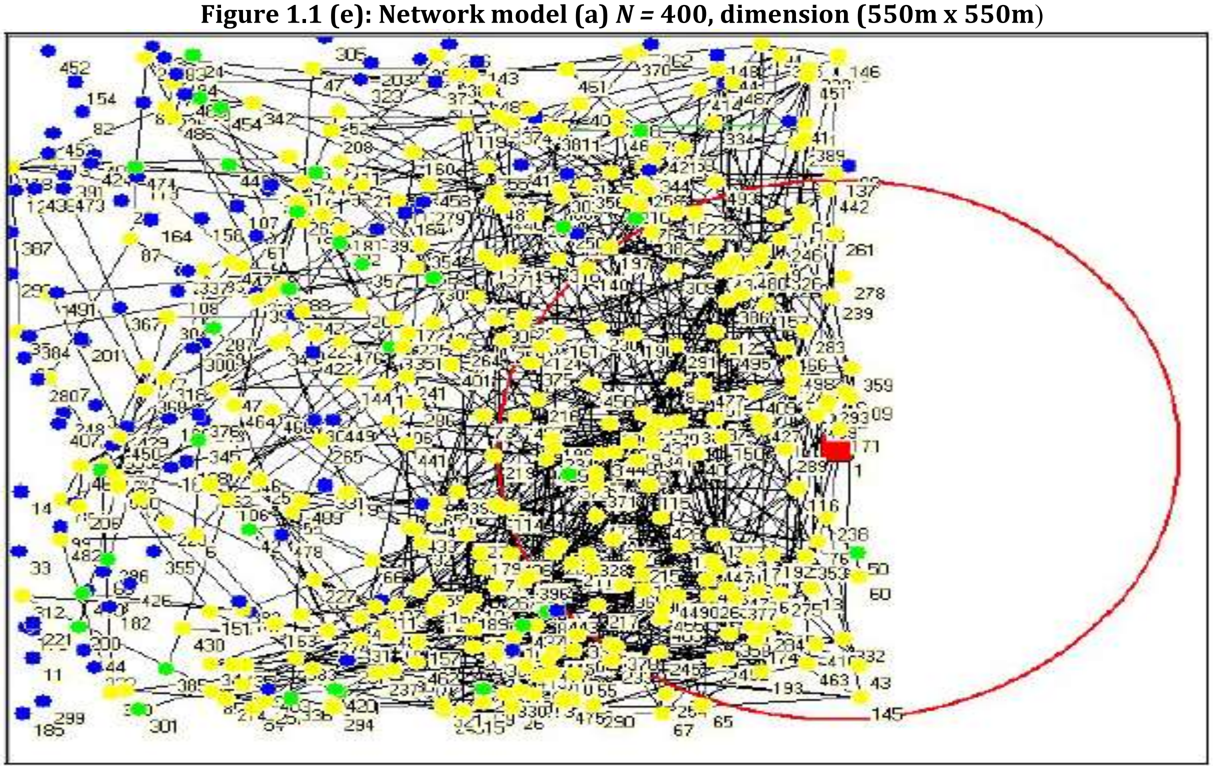

Figure 1.1 (f): Network model (a) *N* = 500, dimension (550m x 550m)

Table 1.3 highlights the estimated PDR with respect to the increasing number of sensor nodes and the throughput of the proposed algorithm is evaluated in terms of number of PDR v/s sensor nodes as shown in Figure 1.2.

Table 1.3: PDR estimated with respect to number of sensor nodes

Sensor nodes	Forwarded packets	Received packets	PDR
50	100	45	0.450
100	200	91	0.455
200	400	161	0.402
300	600	248	0.413
400	800	316	0.395
500	1000	389	0.389

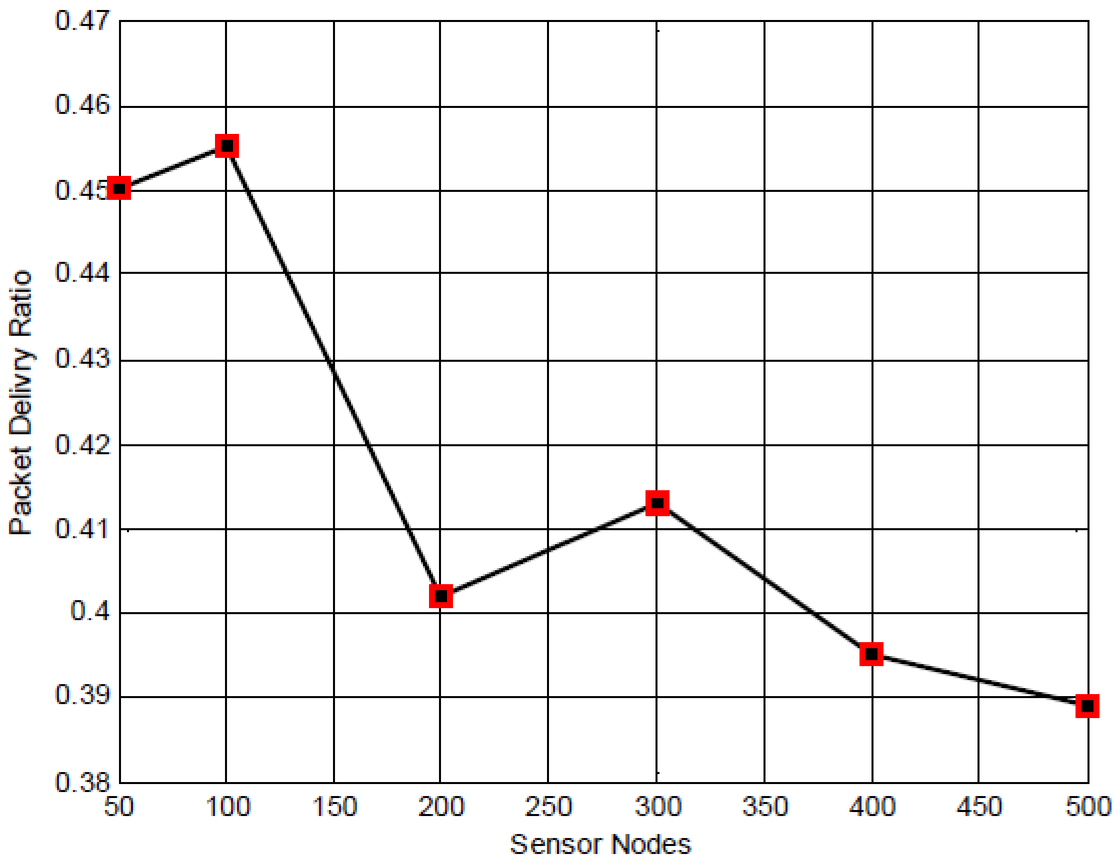

Figure 1.2: Sensor Nodes v/s Packet Delivery Ratio

CONCLUSIONS

The simulation results of the SLAPF show that it effectively utilizes the existing gossip protocol in order to provide an optimum PDR with respect to the increase in number of sensor nodes during message/packet broadcast. SLAPFA uses the gossip protocol in the direction of monitoring the redundancy. It moreover precisely appraisals the received redundant packets without knowledge of neighbouring sensor node's location. SLAPF gives good results for a small network topology of 50 nodes to a large network with 500 nodes over similar deployment area. The proposed approach may be applied to improve the self-localization in dense networks of irregularly arranged sensor nodes.

REFERENCES

1. *H. J. Pandya, V. S. Vaishnav, 2009. Detection and Classification of Volatile Organic Compounds using Indium Tin Oxide Sensor Array and Artificial Neural Network, Vol. 7(1), (pp. 72-79) International Journal of Intelligent Systems Technologies and Applications.*
2. *Pishyar, S., Ghiasian, A., Khayyambashi, 2015. M.R.: Gossip based energy aware routing algorithm for wireless sensor network. (pp. 164–172) J. Comput. Netw. Commun. Secur.*
3. *R.John Stephen, K.Rajanna, Vivek Dhar, K.G.Kalyan Kumar and S.Nagabushanam 2004. Thin film strain gauge sensors for ion thrust measurement. Vol.4 (3), (pp. 373-377). IEEE Sensors Journal.*
4. *Sundaran, K., Ganapathy, V. 2016. Energy efficient wireless sensor networks using dual cluster head with Sleep/Active mechanism. J. Sci. Technol.*
5. *Altoaimy, Lina & Kurdi, Heba & Alromih, Arwa & Alomari, Amirah & Alrogi, Entisar & Ahmed, Syed. (2019). Enhanced Distance-Based Gossip Protocols for Wireless Sensor Networks. (pp.1-4). 10.1109/CCNC.2019.8651701.*
6. *I.F. Akyildiz, W. Su, Y. Sankarasubramaniam and E. Cayirci, 2004. A Survey on Sensor Networks, Vol. 40(8), (pp. 102-114), IEEE Communications Magazine.*
7. *J. N. Al-Karaki and A. E. Kamal, 2004. Routing Techniques in Wireless Sensor Networks: A Survey, Vol. 11(6), (pp. 6-28), IEEE Journal of Wireless Communications.*
8. *Jiang, Zhanhong & Chinde, Venkatesh & Kohl, Adam & Sarkar, Soumik & Kelkar, Atul. (2016). Scalable supervisory control of building energy systems using generalized gossip. (pp. 581-586). 10.1109/ACC.2016.7524976.*
9. *K. Sohraby, D. Minoli and T. Znati, 2007. Wireless sensor networks: technology, protocols, and applications, John Wiley and Sons, ISBN 9780471743002, (pp. 203-209, 2007).*
10. *B. Carbunar, A. Grama and J. Vitek, 2006. Redundancy and Coverage Detection in Sensor Networks, ACM Transactions on Sensor Networks, Vol. 2(1), (pp. 94-128).*
11. *L. Junhai, X. Liu and Y. Danxia, 2008. Research on Multicast Routing Protocols for Mobile Ad hoc Networks, Vol.52, (pp. 988-997) Computer Networks.*
12. *W.R. Heinzelman, J. Kulik, and H. Balakrishnan, 1999. Adaptive Protocols for Information Dissemination in Wireless Sensor Networks, (pp. 174-185). Proceedings of the 5th Annual ACM/IEEE International Conference on Mobile Computing and Networking.*
13. *Z. J. Haas, J. Y. Halpern, and L. E. Li, "Gossip-Based Ad Hoc Routing," IEEE/ACM Transactions on Networking, Vol. 14(3), pp. 479-491, 2006.*
14. *J. Kulik, W. R. Heinzelman, and H. Balakrishnan, 2002. Negotiation Base Protocols for Disseminating Information in Wireless Sensor Networks, Vol. 8, (pp.169-185), Wireless Networks.*
15. *R. Chandra, V. Ramasubramanian and K. P. Birman, 2001. Anonymous Gossip: Improving Multicast Reliability in Mobile Ad Hoc Networks, (pp. 275-283) IEEE ICDCS.*
16. *A.M. Kermarrec and M.V. Steen, 2007. Gossiping in Distributed Systems, (pp. 2-7), Operating Systems Review.*
17. *C.L. Barrett, S.J. Eidenbenz, L. Kroc, M. Marathe and J.P. Smith, 2003. Parametric Probabilistic Sensor Network Routing, (pp. 122-131) Proceedings of the 2nd ACM International Conference on Wireless Sensor Networks and Applications.*
18. *R. Zhao, X. Shen, Z. Jiang, and H. Wang, 2012. Broadcasting with Least Redundancy in Wireless Sensor Networks, (pp.1-23), International Journal of Distributed Sensor Networks.*
19. *Lucia Keleadile Ketshabetswe, Adamu Murtala Zungeru, Mmoloki Mangwala, Joseph M. Chuma, Boyce Sigweni, 2019. Communication protocols for wireless sensor networks: A survey and comparison, Volume 5, Issue 5 Heliyon, ISSN 2405-8440.*
20. *AK Das, R Chaki, KN Dey, 2016. Secure energy efficient routing protocol for wireless sensor network, (pp. 3-27). J Foundations of Computing & Decision Sciences.*
21. *S. Halder, A. Ghosal and S. DasBit, 2011. A Pre-determined Node Deployment Strategy to Prolong Network Lifetime in Wireless Sensor Network, Vol. 34 (11), (pp. 1294 -1306) Computer Communicat*ions.