International Journal of Recent Technology and Engineering (IJRTE)
ISSN: 2277-3878 (Online), Volume-8, Issue-1, May 2019

Improved PAT Protocol for Data Transmission in Wireless Sensor Network

Devare Avinash S, G Kirshna Mohan

Abstract*: Wireless sensor network is wireless network that communicates the data from different devices through wireless link. The main application of wireless sensor networks is to monitor or observe conditions (physical or environmental) like sound, pressure, temperature and also in real time applications like object tracking, disaster reporting military systems. These real time applications generate urgent and sensitive data which has to be transmitted on time. There are different urgent data transmission protocols available for transmitting urgent data from source node to master node. Path assured transmission protocol is one of such protocol which transfers the urgent data to master node giving it more priority. But it ignores the normal data that needs to be transmitted. The proposed improved path assured transmission protocol transfers urgent data and then it also transfers normal data based on its priority. Results have proved improved path assured transmission protocol is much better compared to path assured transmission protocol in terms of packet delivery ratio, delay and packet drop ratio.

Index Terms*: Keywords— normal data; path assured transfer; urgent data; wireless sensor network.

I. INTRODUCTION

Wireless sensor network (WSN) is wireless network that communicates the data from different devices through wireless link. The main application of wireless sensor networks is to monitor or observe conditions (physical or environmental) like sound, pressure, temperature and also in real time applications like object tracking, disaster reporting military systems, systems, forest fire detection and animal tracking. A device which is called as sensor identifies and responds to input from both the physical or environmental conditions. The output of the sensor is usually an electrical signal which is transmitted to a controller for further processing. Many of these WSN need reliable data delivery system.[1]

The congestion is one of the challenging problems in Wireless sensor network. Congestion mainly occurs when many sensor nodes send data in network to master or destination node at same time. There should be some provision or dedicated path to send critical or urgent data to destination node.

The proposed improved PAT protocol works efficiently for both urgent and normal data. It takes input data from number of sensor nodes. It checks the priority of data. And transmits data to sink node based on priority of data. The paper is organized in different sections. Existing work survey is given in Section II. System architecture, steps involved in proposed improved PAT protocol and algorithm of improved PAT is explained in section III. In Section IV, results and analysis are discussed in section IV. Conclusion is given in section V.

II. LITERATURE SURVEY

R. Beula Jayakumari and S. Vinoth Lakshmi [1] proposed congestion control algorithm that is efficient and based on buffer occupancy to increase the network throughput and efficiency. This proposed algorithm avoids congestion and gives more importance to urgent data by implementing priority assignment mechanism. The steps involved are as follows:

1. Data is sensed.
2. Sensed data is compared with some theoretical threshold value.
3. Priority assignment of data packet.
4. Split queue into two different queues. First one for urgent data and second one for normal data.
5. Intelligent Scheduler: For urgent data queue node selects best path by checking buffer occupancy and shortest path.
6. Buffer occupancy based congestion detection.
7. On demand differentiating routing
8. Data reached to destination node.

Ashwini D. Karanjawane et al. [2] proposed Path Assured Data Transfer (PAT) protocol. The network architecture that used by PAT consists of three tiers master, router and end node [3]. PAT operations are accomplished in three stages:

1. Blocking the network for assured and reliable urgent data transfer.
2. Urgent data transfer with reliability mechanism.
3. Releasing the network for normal operation.

The evaluation matrices are End-to-End Transmission Delay, Packet delivery Ratio and Total Throughput.

Transmission Delay = Time (Master node received data) – Time (Source node sent data)

Average Transmission Delay =

$$\frac{\sum \text{Transmission Delay by all source node}}{Total number of source nodes}$$

Revised Manuscript Received on 22 May 2019.

* Correspondence Author

Mr Devare Avinash S*, Computer Department, Koneru Lakshmaiah Education Foundation, Andhra Pradesh, India – 522502, Guntur, India

Dr G Kirshna Mohan, Computer Department, Koneru Lakshmaiah Education Foundation, Andhra Pradesh, India – 522502, Guntur, India

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$$\text{Packet delivery Ratio} = \frac{\text{Total number of packets received at Master node}}{\text{Total number of packets sent by source node}}$$

$$\text{Total Throughput} = \frac{\text{Total number of packets received at Master node by all source nodes}}{\text{Average Transmission Delay}}$$

Avinash Devare and G. K. Mohan [4] proposed EnOPATr System. This system sends both urgent and normal data. This *EnOPATr* system is independent and distributed. It handles both urgent and normal data at same time.

III. PROPOSED SYSTEM

In WSN, it is very important to transfer sensitive data in time. The transmission time required becomes the challenging issue for urgent data. It is also necessary to transmit normal data. Improved path assured transfer protocol is the modified and improved version of path assured transfer protocol. Data is transmitted from all source nodes to master or sink node. In existing PAT protocol, if urgent data gets detected then only urgent data will be transmitted ignoring the normal data. It's important to give more priority to urgent data but it's also necessary to transfer normal data. Hence, the proposed improved PAT protocol transmits both urgent and normal data. . Normal data is transferred based on priority. In this urgent data will have highest priority and normal data is not discarded, it will be sent after urgent data or by using different path. Apply first come first serve (FCFS) and time-division multiple access (TDMA) scheduling method.[5][6]

A.System Architecture

Fig. 1 shows system architecture. Data transmitted from source node to destination node after checking whether its urgent data or normal data.

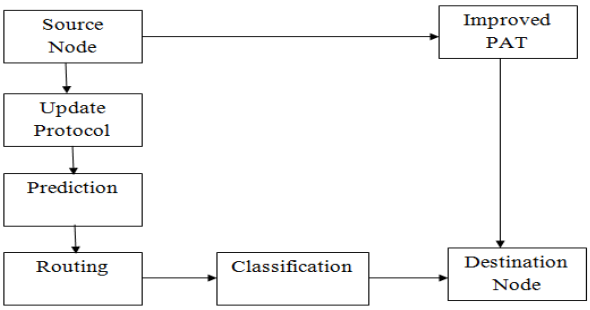

Fig. 1. System Architecture.

The steps involved in improved PAT protocol are as follows:

1. If urgent data detected then, send broadcast urgent data detection message to all other neighboring nodes.
2. If urgent data is detected then path tree will be created specially to transmit urgent data.
3. If normal data is detected then firstly, priority has to be checked of the packet. Packet can be transmitted priority wise.
4. The normal data will be then transmitted by using alternate path nodes which are not in dedicated path for urgent data transmission. Hence, urgent data and normal data will be transmitted by different paths to the next hop towards sink node. Apply First come first serve (FCFS) and Time-division multiple access (TDMA) scheduling method.[7]
5. As soon as urgent data transmission completes, sink node will be free to accept normal data.

B.Improved PAT protocol algorithm

Algorithm: Enhanced Path Assured Transfer
Input: Data from Sensor network.
Output: Data received by sink node based on priority (urgent or normal data). The priority of urgent data is more than normal data.

{
1. If data is urgent data then
   Send block broadcast message to all neighboring nodes.
   Else
   Continue sending normal data
2. Create selected path tree for urgent data transmission.
3. If normal data detected then
a. Check priority of packet P1, P2, P3.
b. Calculate count of packet per process.
c. In each slot calculate packet size.
d. Apply FCFS and TDMA scheduling method.
e. Finally average wasting time decide normal or urgent data.
   Else
   Stop
4. If urgent data transmission complete than
   Transmit normal data
   Else go to step 2
}

Results

IV. RESULTS AND ANALYSIS

A. *Interval*

1) Packet Delivery Ratio

Fig. 2 gives the interval vs packet delivery ratio in PAT, and improved PAT system and table 1 shows the comparison of PAT and Improved PAT in terms of interval and packet delivery ratio. Packet delivery ratio of improved PAT is more than the existing PAT system. Hence improved PAT works better then PAT system in terms of packet delivery ratio.

Comparison of PAT and Improved PAT (Interval vs Packet Delivery Ratio)

Interval	PAT	Improved PAT
0.3	60.7914	86.4621
0.4	78.9855	84.9515
0.5	78.6378	82.8221
0.6	79.7101	84.7273
0.7	71.6102	84.2324

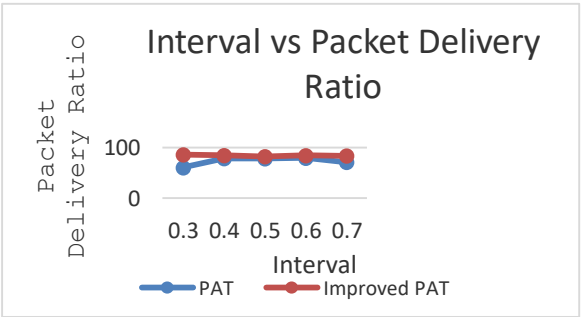

Fig. 2. Comparative study of PAT and improved PAT (Interval Vs Packet delivery ratio).

2) Delay

Fig. 3 gives the comparison of PAT and improved PAT system based on interval vs delay. In improved PAT delay is slightly more compared to delay in existing PAT system. This has to be reduced in improved PAT.

Comparison of PAT and Improved PAT (Interval vs Delay)

Interval	PAT	New MAC
0.3	0.196141	0.22781
0.4	0.190187	0.253802
0.5	0.188938	0.28478
0.6	0.189483	0.260207
0.7	0.187862	0.260932

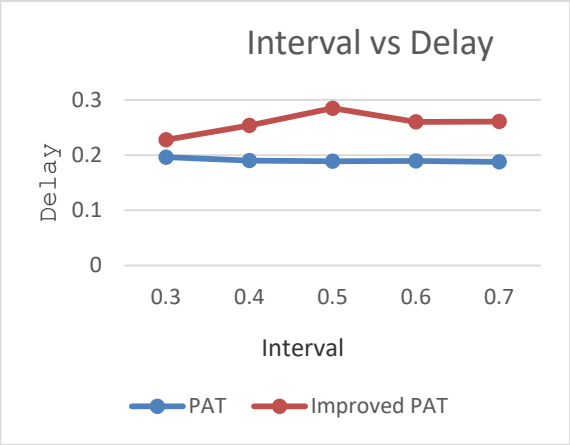

Fig 3: Comparative study of PAT and improved PAT (Interval vs Delay)

B. *Node*

1) Packet Delivery Ratio

Fig. 4 gives the node vs packet delivery ratio in PAT, and improved PAT system and table 4 shows the comparison of PAT and Improved PAT in terms of node and packet delivery ratio. Packet delivery ratio of improved PAT is more than the existing PAT system. Hence improved PAT works better then PAT system in terms of packet delivery ratio.

Comparison of PAT and Improved PAT (Node vs Packet Delivery Ratio)

Node	PAT	Improved PAT
60	79.702	83.814
70	70.9378	85.7275
80	74.0019	84.9483
90	67.3469	83.6906
100	64.4921	86.2037

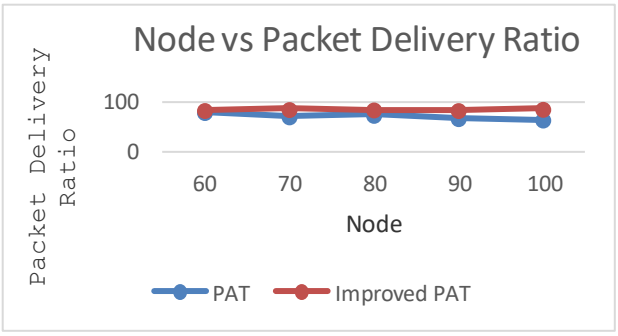

Fig. 4 Comparative study of PAT and improved PAT (Node Vs Packet Delivery Ratio)

2) Delay

Fig. 5 gives the node vs delay in PAT, and improved PAT system and table 5 shows the comparison of PAT and Improved PAT in terms of node and delay. Delay of improved PAT is less than the existing PAT system. Hence improved PAT works better then PAT system in terms of delay.

Comparison of PAT and Improved PAT (Node vs Delay)

Node	PAT	Improved PAT
60	0.41639	0.30407
70	0.524536	0.303031
80	0.536672	0.310564
90	0.528574	0.208085
100	0.588868	0.405236

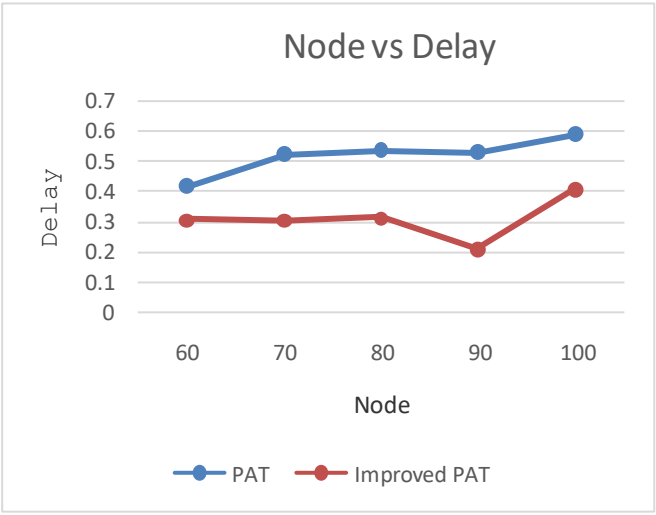

Fig. 5. Comparative study of PAT and improved PAT (Node Vs Delay)

C. *Packet Size*

1) Packet Delivery Ratio

Fig. 6. gives the packet size vs packet delivery ratio in PAT, and improved PAT system and table 6 shows the comparison of PAT and Improved PAT in terms of packet size and packet delivery ratio. Packet delivery ratio of improved PAT is more than the existing PAT system. Generally it is same for all packet size. Hence improved PAT works better then PAT system in terms of packet delivery ratio.

Comparison of PAT and Improved PAT (Packet size vs Packet delivery ratio)

Packet Size	PAT	Improved PAT
30	70.5566	86.4621
35	62.7737	86.4621
40	67.156	86.4621
45	57.1949	86.4621
50	60.7914	86.4621

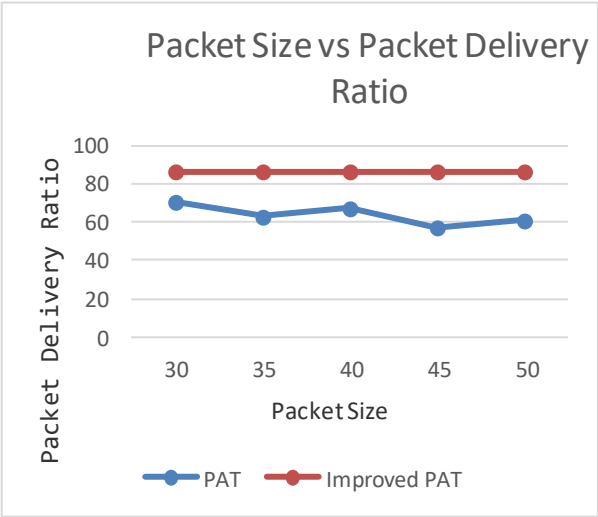

Fig. 6. Comparative study of PAT and improved PAT (Packet Size Vs Packet Delivery Ratio)

2) Delay

Fig. 7 gives the packet size vs delay in PAT, and improved PAT system and table 7 shows the comparison of PAT and Improved PAT in terms of packet size and delay. Delay in improved PAT is very less than the existing PAT system. Generally it is same for all packet sizes. Hence improved PAT works better then PAT system in terms of delay.

Comparison of PAT and Improved PAT (Packet size vs Delay)

Packet Size	PAT	Improved PAT
30	0.996049	0.490747
35	0.964344	0.490747
40	1.09008	0.490747
45	0.998045	0.490747
50	1.22291	0.490747

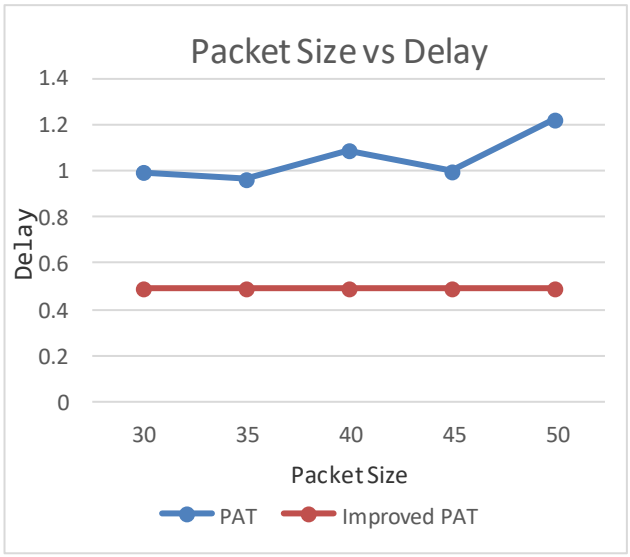

Fig. 7. Comparative study of PAT and improved PAT (Packet Size Vs Delay)

D. *Simulation Time*

1) Packet Delivery Ratio

Fig. 8 gives the simulation time vs packet delivery ratio in PAT, and improved PAT system and table 8 shows the comparison of PAT and Improved PAT in terms of simulation time and packet delivery ratio.

Comparison of PAT and Improved PAT (Simulation time vs Packet delivery time)

Simulation Time	PAT	Improved PAT
100	81.3665	90.6061
125	83.8137	89.5787
150	83.2168	87.6522
175	84.5714	86.5714
200	82.7879	86.8039
225	79.6663	86.1229
250	78.4658	86.1137

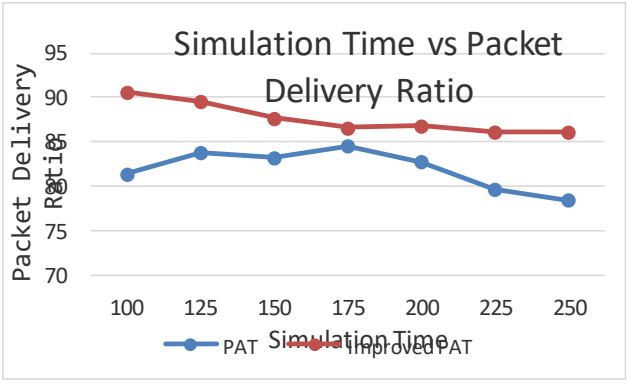

Fig. 8. Comparative study of PAT and improved PAT (Simulation Time Vs Packet Delivery Ratio)

2) Delay

Fig. 9 gives the simulation time vs delay in PAT, and improved PAT system and table 9 shows the comparison of PAT and Improved PAT in terms of simulation time and delay. Delay in improved PAT is very less than the existing PAT system. Delay less than 50%. Hence improved PAT works better then PAT system in terms of delay.

Comparison of PAT and Improved PAT (Simulation time vs Delay)

Simulation time	PAT	Improved PAT
100	1.00038	0.462513
125	0.8073	0.582439
150	0.74341	0.497002
175	0.98934	0.457822
200	0.67369	0.55065
225	1.0102	0.53716
250	0.74156	0.507567

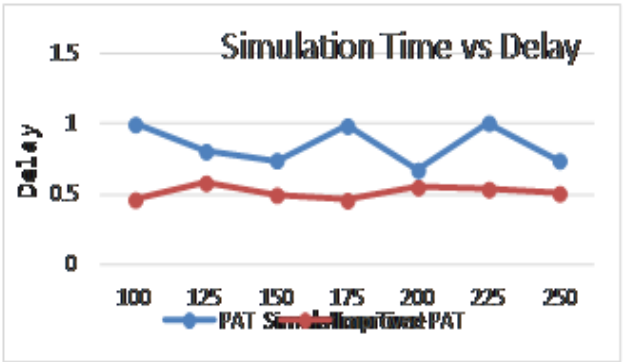

Fig. 9. Comparative study of PAT and improved PAT (Packet Size Vs Delay)

V. CONCLUSION

Wireless Sensor Network is sensor network that communicates with different devices. Data gets transmitted from different sensor nodes to master node. Data can be urgent data and normal data. Urgent data has to be given more priority and data has to be transferred priority wise. The proposed improved PAT protocol works for both urgent data and normal data. It checks whether data is urgent data and if it urgent data then it will be transmitted first to master node. The improved PAT works more efficiently and is better than existing PAT protocol. Results of this system shows the improved PAT is better than PAT protocol

REFERENCES

1. R. BeulaJayakumari and S.Vinoth Lakshmi, “Routing Imperative Data Packets in WirelessSensor Networks using Congestion Free Path”, Indian Journal of Science and Technology, Vol 8(32),November 2015 DOI: 10.17485/ijst/2015/v8i32/87508.
2. AshwiniD.Karanjawane, Atul W. Rohankar, S. D. Mali1, A. A. Agarkar, “Designing Path Assured Data Transfer Protocol for Wireless Sensor Network”, International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 2 Issue 11, November – 2013.
3. W. Rohankar, Mrinal K. Naskar, Amitava Mukherjee, "DistributedSystem Architecture for WSN: WiFiNet," IJAISProceedings on International Conference andworkshop on Advanced Computing 2013 ICWAC,vol. 2, pp. 49-54, June 2013.
4. Avinash Devare, G.K.Mohan, “Analysis of QoS for PAT and EnOPATr System in WSN” International Journal of Engineering & Technology, 7 (2.7) (2018) 99-103.
5. AvinashDevare, G.K.Mohan, “Adaptive Data Transmission in WSN Using Enhanced Path Assured Transmission Protocol” Proceedings of the International Conference on Data Engineering and Communication Technology, Advances in Intelligent Systems and Computing 468, DOI 10.1007/978-981-10-1675-2_28, 2017.
6. A.S. Devare , G.K. Mohan and MayuriGade “Transmitting Urgent Data Using ANKM Method ” International Journal of Control Theory and Applications, Volume 9 , Number 43 , 2016.
7. H. Ju and R. Zhang, “Throughput maximization in wireless powered communication networks,” IEEE Trans. Wireless Commun., Volume: 13, no. 1, pp. 418-428, Jan. 2014.

a. Boyer and S. Roy, “Backscatter communication and RFID: Coding, energy, and MIMO analysis," IEEE Trans. Commun., Volume: 62, no. 3, pp. 770-785, Mar. 2014.

AUTHORS PROFILE

Mr A S Devare currently pursuing PhD and worked as research scholar in in the Department of CSE, KL University, Guntur.his research interest in Wireless Sensor networkHe obtained his BE Degree from RSCOE college SPPU,ME from SCOE college SPPU university.

Dr. G. Krishna Mohan, working as Assoc.Professor in the Department of CSE, KL University, Guntur. He obtained his M.C.A degree from AcharyaNagarjuna University, M.Tech from JNTU, Kakinada, M.Phil from Madurai Kamaraj University and Ph.D from AcharyaNagarjuna University. He qualified, AP State Level Eligibility Test. His research interests lies in Data Mining and Software Engineering. He published 28 research papers in various National and International journals

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