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Designing E-PAT Method in WSN

A.S. Devare and G.K. Mohan
Department of Computer, K.L University, Guntur, India

Abstract: Wireless sensor network is highly dynamic network environment and it is class of wireless network specially designed for monitoring. Large number of application such as military systems, object tracking, monitoring, disaster reporting are designed on the top of WSN. These are real time applications and generate very sensitive data or urgent data. This sensitive information need to communicate reliably. Accurate delivery of sensitive information has direct impact on the overall performance of the system. Achieving reliability and congestion free communication is important for the WSN. Some urgent data transmission protocol in WSN mainly focus on transmission of sensitive data only at the same time it neglect the normal data traffic. Motivated by these challenges we propose EPAT system which is autonomous and distributed. This system achieve reliable and congestion free urgent data as well as normal data communication at the same time.

Key words: WSN, EPAT, congestion, urgent, data, communication

INTRODUCTION

Wireless sensor network are specially designed networks which comprises autonomous system placed in distributed fashion this autonomous devices like sensor can monitor as well as gather the context. Context may be either location, noise level, traffic condition, vibration, pressure, sound, motion, temperature, weather condition, etc., these autonomous system have limited computation power battery powered less memory limited bandwidth.

Wireless sensor network is wide research area where hardware designs software developer user application domain expert cooperatively design client system autonomous device also called as node which has its own sensing computation and wireless communication capability. Quality of service is the main design issue in wsn to achieve the QOS and efficient network performance, many efficient routing protocols, power management technique, data dissemination protocol are specially designed. Wireless sensor network is self-configuration network where every sensor node communicate with each other using radio signal it is deployed in quality to sense monitored and understand the physical world contextual info is the data sensed by sensor. Data aggregation is the process of collection of useful contextual info in wireless sensor network. It is an efficient and effective way to save limited resources data receiving from number of sensor node is aggregate as is they are about the sane attribute of the phenomenon when they reach the same routing node on the way back to the sink while collecting info by reducing the number of transmission and network. Computation at intermediate node can substantially increase network efficiency on the other end it also increase amount of info contained in single packet and makes the system vulnerable to packet loss (Sankarasubramaniam *et al*., 2003; Sharma and Kumar, 2009) rather than retransmitting dropped packet which cause additional delay wireless broadcasting is an effective strategy to improve delay performance data confidentiality integrity and security issue. In data aggregation process is crucial when the sensor network is deployed in adverse environment because of high packet loss rate in WSN more reliability in data transmission is desirable because of WSN application require various level of communication reliability. We proposed urgent data transmission scheme where sensitive data is transmitted on priority basis or via. dedicated path at the same time normal data packet transmission is also takes place using efficient mechanism.

MATERIALS AND METHODS

"To Transmit Urgent data using E-PAT method" E-PAT method is one mechanism which is used to transmit urgent data, using dedicated path. All other protocols are just used for reliability purpose or congestion avoidance, congestion detection, congestion elimination purpose. But here, we propose one mechanism which is use to send urgent data as well as normal data.

Corresponding Author: A.S. Devare, Department of Computer, K.L University, Guntur, India

Goal: Traditional transport layer protocol is not directly used to send urgent data before transmitting normal data. So here, we try to send urgent data using assured path. Which conserves the property like congestion avoidance, congestion elimination and reliabilit . This mechanism can be used in the area of military, earthquake (Devare *et al*., 2016).

Congestion elimination protocols for urgent data: Majorly buffer occupancy notification and rate adjustment scheme are used for the congestion control. But, it may be possible that in case of emergency situation large amount of traffic is injected into the network in very short amount of time and it is required to get the information of the event quickly. There are number of protocols are designed for communication and avoid the congestion control in wireless sensor network but there are few of them which offers the transmission of urgent data.

ADMQOS: It proposed framework for adaptive management of QOS. It proposes a framework in different situation like management of rescue operation and cooperation during a disaster. The proposed framework also adapts its behavior to minimize delay and ensured reliability (Kawai *et al*., 2006; Sharma and Kumar, 2009).

OD-AODV: AODV stands for Ad hoc On-Demand Distance Vector Routing. It is used in order to discover and maintain shortest path. This protocol presence a framework for adaptive routing protocol. This framework defines two paths to transmit data according to their priority (Ishibashi and Yano, 2005).

FMUMUWSN: FMUMUWSN stands for Forwarding Method for Urgent Messages on the Ubiquitous WSN. it is useful to forward urgent messages, even there is packet loss on the wireless links. The urgent messages are send from monitoring node (Karanjawane *et al*., 2013).

Data aggregation: Data aggregation is one of the most widely used solution to collect data. And it also used to minimize unessential number of packets which are sent to base station (Sasirekha and Swamynathan, 2015; Kawai *et al*., 2006).

Leach-R protocol: Based on hierarchical process this protocol improve region or cluster using conservation. As compared to LEACH-R protocol enhanced LEACH-R gives better result (Kaur *et al*., 2015).

RETP-UI; Reliable Transmission Protocol for Urgent Information: This protocol categorized traffic into 3 different types and for each kind it maintain different queue. Congestion in the network is predicted accurately based upon the queue length and its fluctuation. This protocol provide high throughput, less delay and probability of loss of packet is very less (Liang *et al*., 2010).

Fast and reliable transmission mechanism for urgent information in sensor network: This is reliable transport layer protocol for urgent data transmission. In case of any emergency data transmission, node will establish the alive connection between source node to the sink node. All nodes which are part of live connection keep awake all the time for transmission of the data as well as it refrain from emission of normal packet, i.e., it neglect the transmission of normal packet until all emergency packet are not delivered. This protocol also added retransmission mechanism of lost emergency packet on priority basis. In implementation they showed the alive connection can be established very quickly and emergency data is transferred with accuracy. This protocol achieve efficient Urgent data transfer to the sink node with 92% of packet delivery ratio and <92 m/sec delay. Congestion is eliminated by reducing or neglecting the data transmission of normal packet (Ishibashi and Yano, 2005).

PAT; Path assured data transfer protocol: This protocol operates three steps. In the first step, emergency data node initiate the blocking request to the other node to block their normal data transmission. Due to blocking mechanism path will get cleared. In the second step, urgent data is transferred to the sink or master node and acknowledgement is received for the same. When data transmission of urgent data completed, sink node or master node will send the release message. This dedicated path for a moment will guarantee collision free data transmission and reduce the delays due to re-transmission of data (Karanjawane *et al*., 2013).

Design and implementation of E-PAT method

Design and implementation of EPAT method: Network architecture here the EPAT method is implementing at transport layer. Assured path data transfer EPAT method is used in three phases: Firstly, using the assured path for data transmission. Transmission of urgent data using reliability mechanism. Network is again available for normal operation. In WSN urgent data transfer is very important, so, we studies PAT in which when end nodes detects any urgent data they perform three steps broadcast block message: Its broadcast urgent data

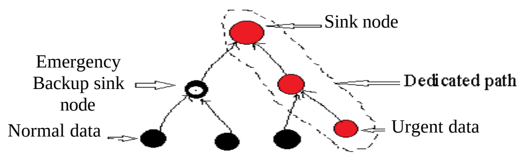

Fig. 1: Urgent data transmission

detection message to neighboring node then this node stop transmitting normal start to send urgent data through dedicated path after data transmission node are free to send normal data but we propose E-PAT in which while transmission urgent data through dedicated path (Devare *et al*., 2017), reaming nodes which are not in dedicated path they start sending normal data side by side to the next hop level node of sink and when urgent data transmission complete sink node or master node become free at that time node present at next hop level of sink transmit normal data to sink it increase the performance of the system as shown in Fig. 1.

RESULTS AND DISCUSSION

Simulation parameter: The E-PAT is implemented in NS-2 simulator environment and conducted extensive simulation experiments. In all of the simulation experiments, different sensor nodes are uniformly and randomly distributed in a 500×500 m two-dimensional region with a master at its lower center. The introduced strategy is checked for its performance on the simulator. For this, we used the Network Simulator 2 tool on red hat operating system. In this study, we validate the analysis through simulations and compare the performance of PAT and EPAT with that of the in-network . Whole simulation study is divided into two part one is create the node, i.e., NS-2 gives output as called NAM (Network Animator) file which shows the nodes movement and communication occurs between various nodes in various condition or to allow the users to visually appreciate the movement as well as the interactions of the mobile node and another one is graphical analysis of trace file (.tr). Trace file contain the traces of event that can be further processed to understand the performance of the network as shown in Fig. 2-3.

Evaluation metrics

End-To-End delay: End-To-End delay is the average time that takes by a data packet to reach its destination. This metric is calculated by subtracting time that first data take to traverse the network from time at which first data packet arrived to destination. This is a time the generate data packet by sender and it received by receiver at destination in application layer and it is measured in seconds. All delays in network is cause by node mobility, packet, retransmission and due to weak signal strength between nodes connection tearing and its making is also be included.

Packet delivery fraction: Packet delivery fraction is defined as the ratio of data packets received by the destinations to those generated by the sources. Mathematically, it can be defined as:

$$PDR = S1/S2$$

Where:

S1 = The sum of data packets received by the each destination

S2 = The sum of data packets generated by the each source

Graphs shows the amount of data packets that are delivered successfully during simulations time versus the number of nodes. Performance of the DSDV is reducing regularly while the PDF is increasing in the case of OLSR and ZRP. OLSR is better among the three protocols.

Packet loss: The difference between the generated and received packets is packet loss. Packet loss is calculated using AWK script in which the trace file is processed and the result is produced.

Throughput: The total throughput is measured as the number of data packets receive data the sink divided by the time interval between when the first data packet is generated and the last packet is received. The achievable total throughput reflects the efficiency of the protocol the higher the achievable total throughput, the faster source nodes can deliver their data packets to the sink.

Residual energy: The energy model represents the energy level of nodes in the network. The energy model defined in a node has an initial value that is the level of energy the node has at the beginning of the simulation. This energy is termed as initial energy. In simulation, the variable "energy" represents the energy level in a node at any specified time. The value of initial energy is passed as an input argument. At each transmission node looses energy, as a result, the value of initial energy in a node gets decreased. The current value of energy in a node after receiving or transmitting routing packets is the residual energy. Data transmission is established between nodes using UDP agent and CBR traffic. In find energy procedure at different times the residual energy of the node i s evaluated by accessing inbuilt variable "energy".

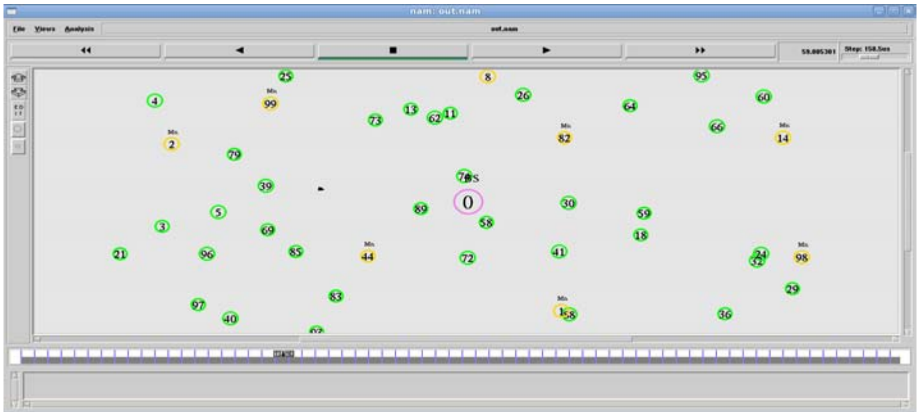

Fig. 2: Simulation of PAT

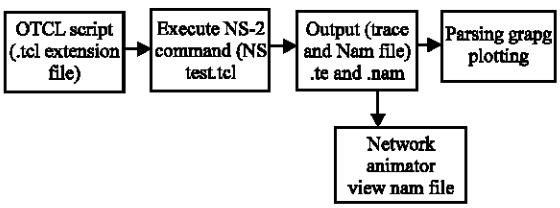

Fig. 3: Execution flow

Jitter: Jitter in IP networks is the variation in the latency on a packet flow between two systems when some packets take longer to travel from one system to the other. Jitter results from network congestion, timing drift and route changes. Jitter is delay that varies over time. To measure jitter we take the difference between samples, then divide by the number of samples (-1).

Energy consumption: The variable "energy" represents the energy level in a node at any specified time in simulation. The value of initial energy is passed as an input argument. At each transmission node looses energy, as a result, the value of initial energy in a node gets decreased. The difference between the current energy value and initial energy value gives the energy consumption. If an energy level of a node reaches zero, it cannot receive or transmit anymore packets.

Simulations and performance analysis: Here, we have some simulation results based on graphs. All parameters are compared over the varying number of total nodes. The parameters like:

- Packet delivery
- Delay
- Dropping ratio
- Average energy consumption
- Residual energy
- Jitter

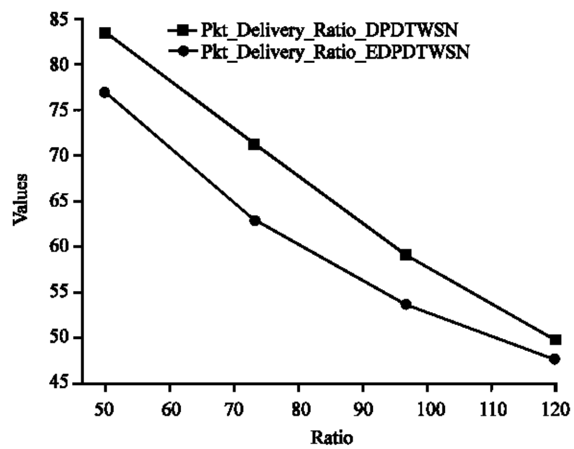

Fig. 4: Normal_Packet Delivery Ratio; Graphs for normal data in PAT and EPAT

Throughput following graphs show the improved behavior using the active cache strategy. As shown below in the graphs (Fig. 4) by using indications viz. the black line... (i.e., EPAT) and the existing reading using the red line... (PAT). Packet delivery has been increased as it can be clearly observed shown by using the black line... Packet delivery is more as compared to previous results.

There are various graph which shows that how EPAT is more advanced then PAT by considering various parameter such as node vs packet delivery ratio etc in this graph x axis represent node and y axis represent packet delivery ratio, graph shows that for same number of nodes PDR of EPAT is higher than PAT This simulation is conducted in three different scenarios. In the first scenario, the comparison of the existing and proposed is done for the varying no of packets, different node intervals and then for variable packet size and all the

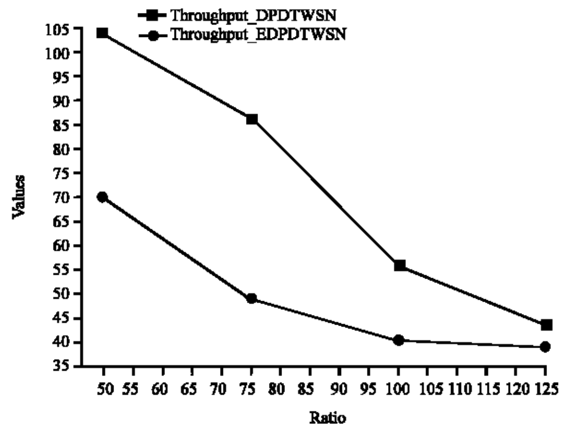

Fig. 5: Normal_Throghput; Graphs for urgent data in PAT and EPAT

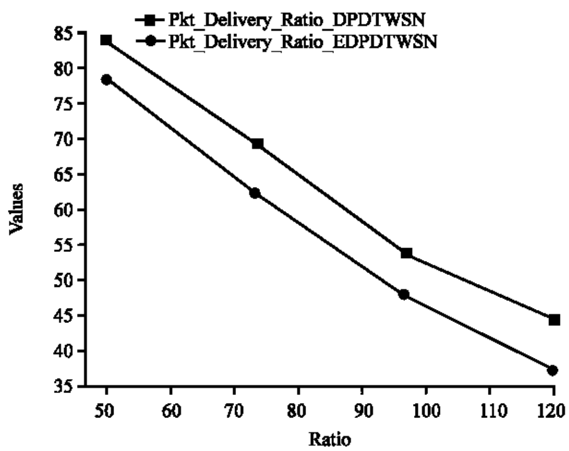

Fig. 6: Urgent-Packet Delivery Ratio

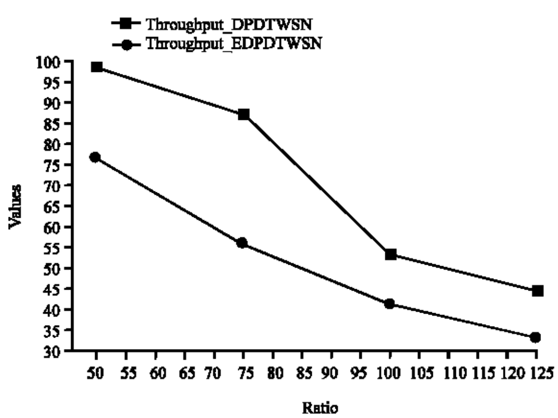

Fig. 7: Urgent-Throughput

graphs show the efficient results. As above graphs show the reading in varying no of packets. We have got following results as output (Fig. 5-8).

```
[root@localhost script]# awk -f wireless.awk out.tr
No of pkts send                   6861
No of pkts recv                   4439
Pkt_delivery_ratio:               64.699
Control_overhead:                 15929
Normalized_routing_overheads:     3.58842
Delay:                            6.47128
Throughput:                       59929.5
Jitter:                           0.0364964
No of Pkts Dropped                2422
Dropping_Ratio:                   35.301
Total_Energy_Consumption:         69.4856
Avg_Energy_Consumption:           0.694856
Overall Residual Energy:          9930.51
Avg_Residual_Energy:              99.3051
```

Fig. 8: Results of simulation

CONCLUSION

In this study, WSN has many applications where time critical and urgent information needs to be transferred to the master sink node apart from regular data reporting activity. There are many protocols presented for this cause. In summary, we concluded the necessity of clear path assurance to transfer urgent information as well as normal. The summary also helped us to finalize some of the core functionalities for E-PAT.

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