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RESEARCH ARTICLE

A QOS Based Prioritized Routing Protocol for Wireless Sensor Network

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Abstract— Due to vast researches in the field of wireless sensor network (WSN) many routing protocols and scheduling mechanisms have been developed. But the protocols that have a strict constraint on quality of service (QOS) metric are very rare. Scheduling mechanisms must be such that they must cope with the QOS metrics. In many applications of WSNs, different sensor types require different QOSs. This paper proposes a QOS based prioritized forwarding routing mechanism where the sensed data is prioritized based on the requirements, scheduled according to the priority and performance evaluation of the scheme using QOS metrics.

Keywords— wireless sensor network, quality of service

I. INTRODUCTION

In many application of WSN, the sensors in the network differ based on the QOS requirements. The sensors nodes are heterogeneous i.e., nodes with different sampling rate, computing power, range, etc. The QOS requirements and the surrounding environment of the sensor node can change over time according to the application scenario. We present an application scenario of a hospital environment where patients with various diseases are monitored continuously by deploying sensors on the human body. The sensed data is continuously forwarded to the medical server. One of the challenges is assuring the timely and reliable delivery of life critical medical data in a resource constrained environment. Therefore, it has become important to provide a service differentiated real-time and reliable transmission scheme for WSNs to provide a QOS guarantee from end to end.

The objectives of this proposed work is

- To simulate hospital environment where many patients with various diseases are monitored employing wireless sensor network.
- Emergency based Priority assignment to the sensed data.
- Routing Data based on priority.
- Evaluation of QOS metrics.

II. RELATED WORK

Data prioritization has been used for data routing in several protocols for WSNs. This section reviews the existing approaches in using priorities in WSNs and states the goals and the contribution of this paper. In [1], a practical traffic scheduling scheme for differentiated services of healthcare system on wireless sensor networks is proposed where differentiation, classification and scheduling of traffic over multiple routes in WSN is presented. In [2], a priority-based routing path selection mechanism is exploited for a proposed multi-path routing protocol which is based on the directed diffusion [3]. Actually, sampled data items are not prioritized in this protocol. Instead, each gradient is given a priority tag based on its accumulated hop count to the sink or the remaining energy source of nodes in that particular routing path. The source node then uses the priority tags of all received gradients to select the best. The Priority-based Dynamic Adaptive Routing (PDAR) protocol is proposed in [4] aiming to balance the energy consumption while providing better service for significant information. The protocol is based on a former routing protocol for multi-hop wireless ad hoc networks called Dynamic Source Routing (DSR) [5] with the emphasis on congestion prediction and priority scheduling for data routing. Data packets are categorized into two classes of vital and common packets. Accordingly, every node in the routing path maintains two separate data queues, each dedicated to a certain class of packets. The packets in the higher-priority queue (vital packets) are always sent before packets in the lower-priority queue (common packets). Data priorities are supposed to be determined by the application.

In a recent work, presented in [6], the Priority-based Hybrid Routing (PHR) mechanism is proposed in which the characteristics of the sensed data determine its priority. An abrupt change in the data stream reveals the importance of the new data. Consequently, a multi-path diffusion-based mechanism is used for forwarding the packets of high importance to provide a more reliable and faster data delivery. A single-path routing mechanism based on the known Ad-hoc On-demand Distance Vector (AODV) [7] approach, that is prone to data loss, is exploited for normal packets. Each work has a specific criterion for assigning the priorities and a particular means for providing proper services according to the priorities. In this paper, we propose a mechanism to dynamically assign priorities to data items waiting to be forwarded at any node regardless of the type of routing structure with a focus on considering dynamic heterogeneity in the network. The mechanism aims to provide differentiated services for data items according to their QOS requirements.

III. APPLICATION SCENARIO

The basic idea of the proposed scheme is to classify and prioritize patient vital signs dynamically. A queue scheduling and path choose scheme is used to ensure timely delivery in real time traffic. An application scenario is given that will be used throughout this work. A hospital environment where patients with various diseases are controlled by employing a ubiquitous sensor network to handle vital sign delivery, including ECG tracings, heart rate, blood pressure, blood sugar, SPO2, and temperature are considered. This application scenario focus on three diseases: sepsis, sleep apnea and intradialytic hypertension (IDH).

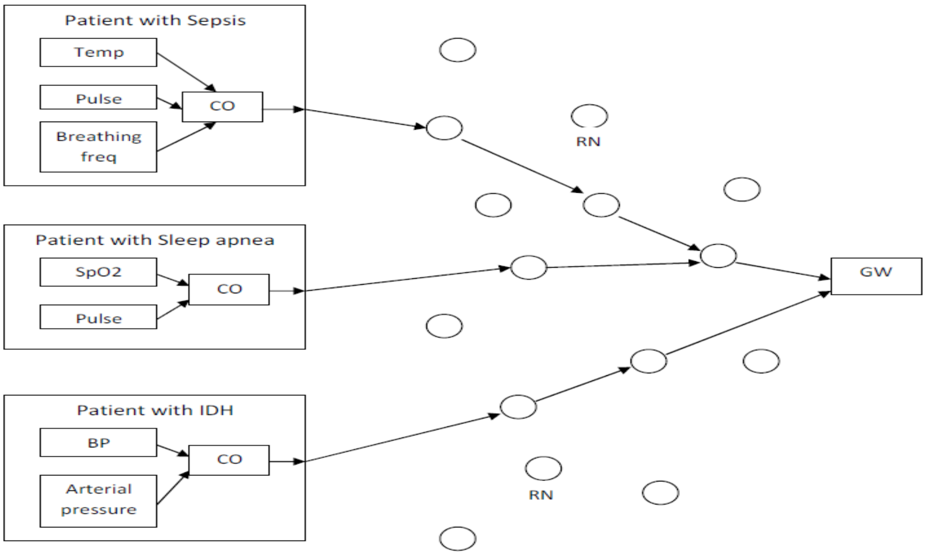

Fig.1 - System architecture

The system architecture consists of groups of sensors attached to a patient's body: a coordinator (CO), relay node (RN), and gateway (GW) as illustrated in Fig.1. Body sensors collect and send data to the CO, which in turn follows data to a GW (base station) through RNs if necessary. The GW save patients' data into the hospital database where they can be accessed by hospital staff in real-time. The overall procedure consists of 4 steps and is outlined briefly as

1) After each sensor node (Source Node) senses data from patients, it classifies data into two phrases: Event or Normal. And it sends data to the CO.
2) Coordinator decides patient status as "Normal/Moderate/Urgent" data. Traffic Scheduling, path selection and data transmission processes are handled considering patient status.
3) Relay node relays the data to Gateway.
4) Gateway transfers the data to Medical Server using wired network, Internet.

The threshold levels of the three diseases and conditions to decide the status of these disease are taken from [1].

A. Data classification

When the sensor node senses the data it immediately compares them to the respective threshold and compares whether it is a data or event. The event occurs when the sensed data crosses the threshold level. Sensors will then forward the data to the coordinator. The coordinator has the table for comparing the vital signs of the patient's data. At the coordinator, the patient's status is set as urgent, moderate or normal based on the disease criteria.

We categorize patients as normal, moderate, or urgent based on the sensed data and their criticality level

1) Normal: A patient status is set as normal when the coordinator node does not find any disease criteria/events.
2) Moderate: A patient status is set as moderate if the coordinator node perceives any one of the disease criteria, which designates the criticality level as medium.
3) Urgent: A patient status is set as urgent if the coordinator node identifies two of the disease criteria or all disease criteria simultaneously, meaning the criticality level is high.

B. Traffic scheduling

Once the status of the three patients is computed at the coordinator, the status and the data is transmitted to the gateway through the relay nodes. The priority of transmission for the urgent data should be given the highest priority, then followed by remaining priorities for moderate and normal data. Urgent data must be transmitted through the shortest path, moderate data is transmitted through next shortest path and normal data through remaining paths.

C. Performance evaluation

The simulation is carried out by assuming that there is no interference between adjacent patient's body sensors and the patients are assumed to be immobile. The patients are situated at the distance apart such that there is zero interference between them. We implemented the scheme described in the NS2 simulator. We have used the IEEE 802.15.4 MAC layer specification for the sensors on the body that are operating in the frequency band of 2.4 GHz. The relay node and the gateway have the 802.11 MAC layer specification. The QOS metric considered for the performance evaluation is delay between CO and gateway and end-to-end delay between body sensors and gateway.

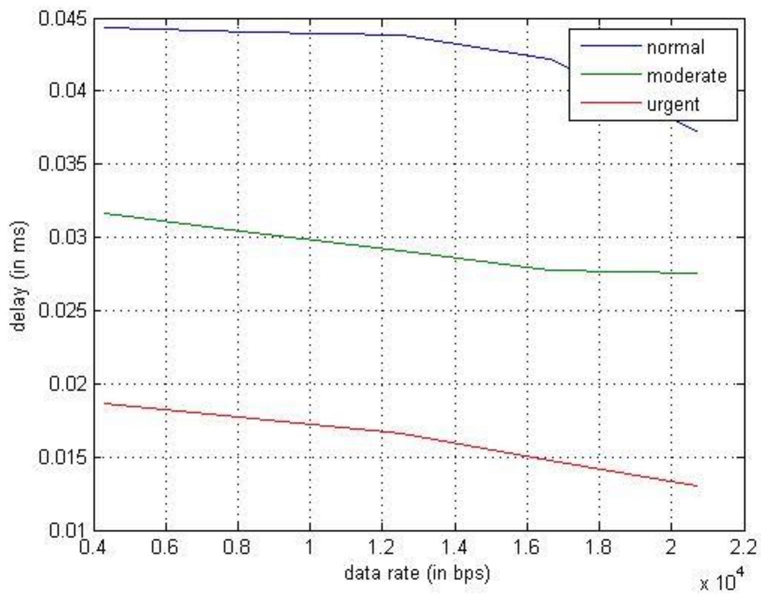

Fig. 2 – Delay versus data rate

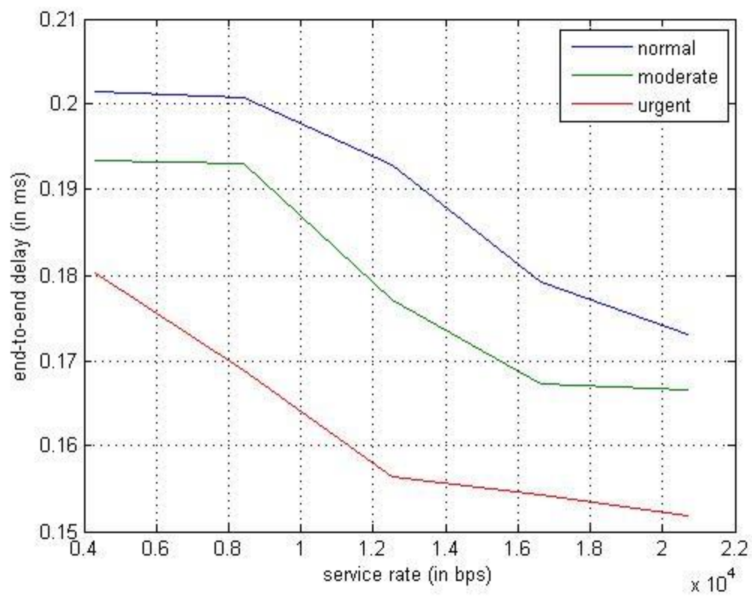

Fig. 3 – end-to-end delay versus service rate

Fig. 2 shows the delay occurred for transmitting the status of the various patients from the CO to the gateway versus data rate. The delay for the urgent data is less compared to moderate and normal. Fig. 3 shows the end-to-end delay for the data transmission from the body sensor to the gateway versus service rate. The end-to-end delay is more compared to the delay because due to the time utilized in classifying patients' data at the CO.

IV. CONCLUSIONS

Since the delay is the important QOS metric in designing the routing mechanism in health care application, we have minimized the delay using the proposed system. We have presented the traffic classification and traffic scheduling schemes over multiple routes. The criticality level of the patients' data is prioritized and the delay for the urgent data is minimized. The future work of the proposed scheme should consider other QOS metrics, interference between the patients' sensors and the mobility of patient.

REFERENCES

[1] Cecile Kateretse, Ga-Won Lee, Eui-Nam Huh, "A practical traffic scheduling scheme for differentiated services of healthcare system on wireless sensor networks," Springer, Sep 2012.

[2] Y. Liu and W. W. Seah, "A scalable priority-based multi-path routing protocol for wireless sensor networks," International Journal of Wireless Information Networks, vol. 12, no. 1, pp. 23–33, 2005.

[3] C. Intanagonwiwat et al., "Directed diffusion for wireless sensor net- working," IEEE/ACM Trans. Netw., vol. 11, no. 1, pp. 2–16, 2003.

[4] J. Chen, M. Zhou, D. Li, and T. Sun., "A priority based dynamic adaptive routing protocol for wireless sensor networks." in Proc. of int'l Conf. on Intelligent Networks and Intelligent Systems (ICINIS). IEEE, November 2008, pp. 160–164.

[5] D. B. Johnson, D. A. Maltz, and J. Broch., "DSR: The dynamic source routing protocol for multi-hop wireless ad hoc networks." in In Ad Hoc Networking, Chapter 5. Addison-Wesley, 2001, pp. 139–172.

[6] S. Kim, S. Lee, H. Ju, D. Ko, and S. An., "Priority-based hybrid routing in wireless sensor networks." in Proc. of IEEE Wireless Communications and Networking Conference (WCNC). IEEE, April 2010, pp. 1–6.

[7] C. E. Perkins and E. M. Royer, "Ad hoc on-demand distance vector routing." in Proc. of 2nd IEEE Workshop on Mobile Computing Systems and Applications. IEEE, February 1999, pp. 90–100.

