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IMPROVING QUALITY OF SIGNAL IN LONG PATH SCALE FREE DYNAMIC NETWORK CONNECTIVITY OF WIRELESS BODY AREA NETWORK

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ABSTRACT

In a hospital environment, the total number of Wireless Body Area Network (WBAN) equipped patients requesting ubiquitous healthcare services in an area increases significantly. Therefore, increased traffic load and group-based mobility of WBANs degrades the performance of each WBAN significantly, concerning service delay and network throughput. In addition, the mobility of WBANs affects connectivity between a WBAN and an Access Point (AP) dynamically, which affects the variation in link quality significantly. To address the connectivity problem and provide Quality of Signal (QoS) in the network, a dynamic connectivity establishment and cooperative scheduling scheme, which minimizes the packet delivery delay and maximizes the network throughput. First secure the reliable connectivity among WBANs and APs dynamically, a selection parameter using a price-based approach. Thereafter, a utility function is formulated for the WBANs to offer QoS using a coalition game-theoretic approach. The performance of the proposed approach holistically, based on different network parameters. The performance of the proposed scheme with the existing state-of-the-art is also compared.

KEYWORDS —WBAN, Controlled Traffic, Energy Efficient

1. INTRODUTION

The increasing population and the need for offering improved medical care has evolved the concept of E-health care services. To cope with the problem, Wireless Body Area Networks (WBAN) have become one of the key technologies of E-health care services. In WB ANs, several heterogeneous body sensors collect the physiological medical data and the collected physiological data are aggregated by the data aggregator. After that, data aggregator sends the checkup data to the right to use point which finally sends the data to the medical server. The body sensors are lightweight, small-size, ultra-low-power, and intelligent in natural world. WBANs are not only second-hand in health monitoring it also used in unusual fields like Military and sports training, and Interactive gaming.

2. RELATED WORK

Mobile WBANs face interference in a dense population based area as a result of which energy and throughput of the system degrades, which causes a serious problem for remote patients. To minimize this effect Zhijun Xie *et al*. proposed a Clique-Based WBAN Scheduling (CBWS) algorithm [2], in which

WBANs are partitioned into different groups, each of which is activated in different times. The IEEE 802.15.6 standard for WBANs focused on the physical layer, media access control (MAC) layer and network layer [3]. As per the IEEE 802.15.4 standard, a WBAN is a one hop network topology, and multi-hop topology is not considered in a WBAN. Hiep *et al.* proposed [4] a cluster-based two-hop topology. In this paper a cluster head (CH) forwards the received data packet from a sensor to the coordinator in the cluster-based WBAN as a result of which over-crowding can be avoided and the performance of the system can be improved. Depending on the augment in the number of clusters, the throughput of the system also increases in a two hop network topology. In medical emergency situations, the density of WBANs increases with the time elapse in time. Due to this fact, the social interaction between WBANs also increases. For epidemic diseases as the social contact increases, the affected patients also increase. In such a situation, it is difficult to control the disease. Traditional treatments are not appropriate due to the inability to gather medical data and social control information. It is also challenging to isolate a patient in a high inhabitants. To cope up with this situation, Zhang *et al.* proposed a cluster-based epidemic control scheme for smart phone based WBANs. The works based on the physical locations and the social contact information of WBANs, in which multiple clusters are formed. The proposed scheme is applied to the both intra-cluster and inter-cluster to control the epidemic disease. In this paper, we consider the traffic load of the WBANs in a particular area. We formed the relational patient grouping (RPG) based on the different disease types. Motivated by the Zhang *et al.* [5], we have assumed that within a RPG, three types of WBANs are present-Suspected, Infected, and Recovered. Within a RPG, the recovered WBANs also use the resources (bandwidth, spectrum,and time) of the system, which may decrease the resource available for the Suspected and the Infected WBANs. To provide the efficient resources to the Suspected and the Infected WANs, we use a decision making process to choose only the Suspected and the Infected WBANs based on the section parameters (importantly critical index).

3. PROPOSED METHODOLOGY

The performance of each WBAN degrades in terms of packet delivery delay and throughput. Not only the network performance degrades, but also the energy of each WBAN decreases. As WBANs are energy constrained in nature, all the WBANs may not be able to process their data immediately due to increased traffic.

Therefore provide Quality of signal (QoS) to each WBAN in an energy efficient manner. Due to the increase in traffic load computational complexity of the algorithms also increases, which leads to the degradation of total energy of the system.

- The performance of the proposed approach holistically, based on different network parameters.
- Finally, critical WBANs in the proximity of an AP form coalitions to ensure QoS between them. In each coalition, the WBANs participate in cooperative packet scheduling to provide services to the critical WBANs.
- For handling cooperation between WBANs, we proposed another algorithm Optimal Cooperative Packet Scheduling.

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ADVANTAGE

1) This work considers the relational patient groups based on some similar disease types and syndromes.

2) The proposed solution of group formation is energy efficient with less computational complexity.

3) The work focuses on the decision making process of a selection of critical WBANs for the formation of virtual patient groups.

4) This proposed solution focuses on the balancing of traffic load in the presence of heterogeneous WBANs in a particular location.

4. SYSTEM MODEL

1) HOP NETWORK TOPOLOGY

WBAN is a one hop network topology, and multi-hop topology is not considered in a WBAN a cluster-based two-hop topology. In this paper a cluster head forwards the received data packet from a sensor to the coordinator in the cluster-based WBAN, as a result of which over-crowding can be avoided and the performance of the system can be improved.

Depending on the increase in the number of clusters, the throughput of the system also increases in a two hop network topology.

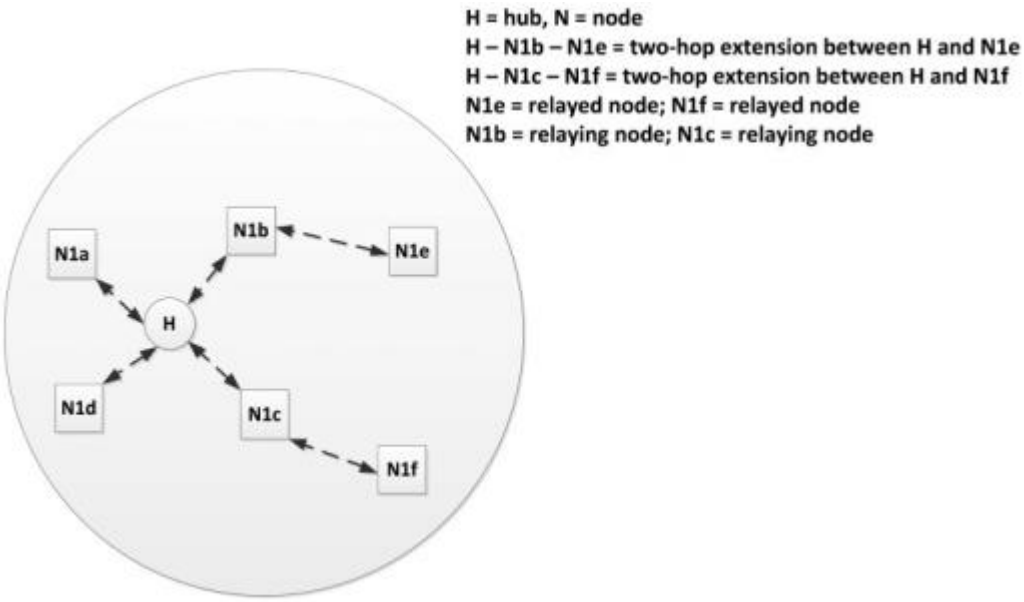

Fig 4.1: Hop Network Topology

2) PACKET DELIVERY DELAY CALCULATION

Let Di denote the total packet delivery delay, which represents the duration from when a packet originates from a WBAN, Bi, to when it is received by its destination AP. The total packet delivery delay not only depends on the transmission delay. The packet transmission rate of sensor nodes is assumed to be homogeneous in nature, but in case of WBANs, the same of body sensor nodes is heterogeneous. Also,

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according to the IEEE 802.15.6 standard, each body sensor node has different user priority to transmit its data packets. Therefore, the proposed model is better suited for use in WBAN-based communications.

- The homogeneous traffic flows for the data communication process, but the proposed model is suitable to heterogeneous traffic flows in the network.
- Beside the group-based mobility, whereas the proposed model considers group-based mobility in order to incorporate the effects of dynamic postural partitioning and variation of link-qualities in the network.

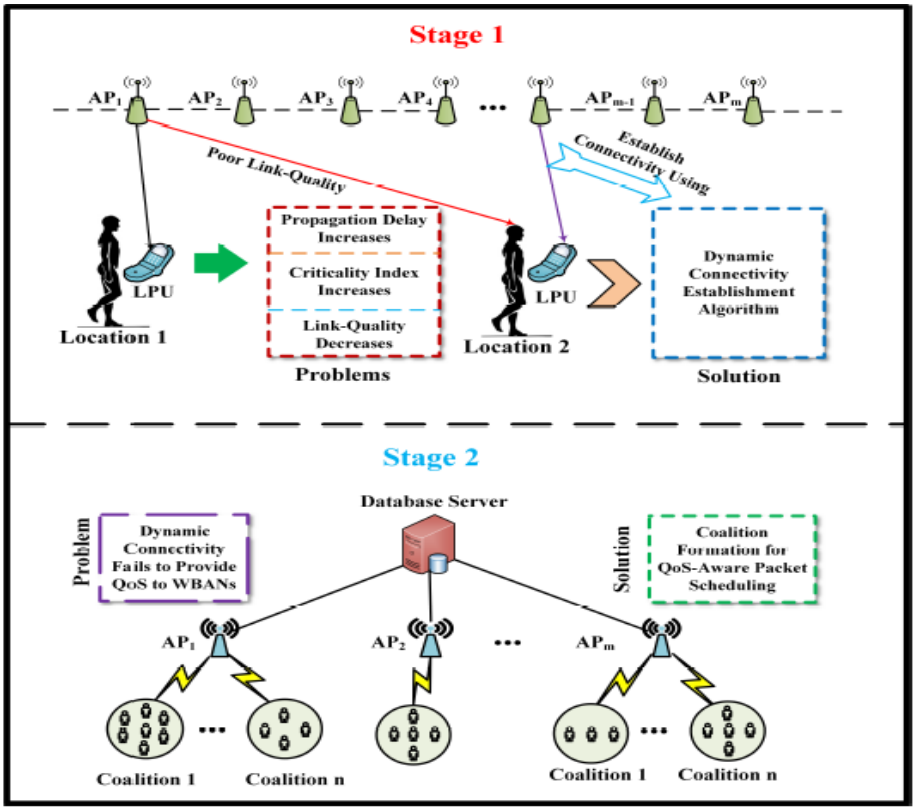

Fig 1: Overall proposed architecture of WBANs

CONCLUSION

Dynamically choose a dynamic AP for the critical WBANs, so as to deal with the transient connectivity problem between WBANs and APs. To manage connectivity, we proposed the Dynamic Connectivity Establishment algorithm, which is based on a price-based approach. Finally, critical WBANs in the proximity of an AP form coalitions to ensure QoS between them. In each coalition, the WBANs participate in cooperative packet scheduling to provide services to the critical WBANs. For handling cooperation between WBANs, we proposed another algorithm Optimal Cooperative Packet Scheduling. Our proposed schemes with the existing schemes, based on which we show that the former our approach outperform the later. Future extension of this work includes studying and characterizing the dynamic behavior of link quality between WBANs and APs for the connectivity problem. Another

extension of the work is to observe the performance of the proposed solutions in real-life setting for mobile edge computing applications. Consequently, in the presence of transient connectivity, the data rate adaption technique can be implemented to increase the overall performance of WBANs. On the other hand the security and privacy issues of cooperative packet scheduling among WBANs in a critical emergency situations.

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