

Analysis Report on Body Node Coordinator Placement Algorithms for Wireless Body Area Networks

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Abstract—In a WBAN, network longevity is a major challenge due to the limitation of the availability of energy supply in body nodes. Therefore, routing protocols can play a key role towards making such networks energy efficient. In this work, we exhibit that a routing protocol together with an effective body node coordinator (BNC) deployment strategy can influence the network lifetime eminently. Due to advancement in the telecommunication, wireless communication, wireless sensors, and other technologies a new field of research has been evolved and this area of research is termed as Wireless Body Area Networks. In WBAN miniaturized sensor nodes are implanted in the blood stream or on the human body. These sensor nodes are battery dependent, once the battery dies, node also dies. That's why minimum energy consumption with reliable data transmission is primary requirement in WBAN.

Keywords—Body area network (BAN), body node coordinator (BNC) deployment, energy efficiency, human body,

I. INTRODUCTION (*Heading 1*)

Wireless body area networks (WBAN) give an incredible chance for remote health observance. However, engineering WBAN health observance systems encounters variety of challenges as well as efficient WBAN observance information extraction, dynamically fine tuning the monitoring method to suit the quality of information, and to permit the translation of high-level necessities of medical officers to low-level sensor reconfiguration.[4].

A Body area Network is formally outlined by IEEE 802.15 as “a communication standard optimized for low power devices and operation on, in or round the physical body (but not restricted to humans) to serve a range of applications as well as medical, consumer electronics/personal entertainment and others” [6]. A WBAN connects freelance sensor nodes, known as body node (BN), by using a central controller, known as Body Node coordinator (BNC). the basic conception of WBAN is to continuously monitor a patient's different bio-signals like EEG, ECG, blood pressure, sugar level, heart beat rate, body temperature by using sensors, placed at totally different elements of the human body, and provides an efficient mean of communication among body nodes (BNs) with the outside world. [6]

In the 90's , different groups at MIT (Massachusetts Institute of Technology) start working on wireless personal area network (WPAN) with the aim to communicate between various information devices which are attached to human body

either on the body or implanted [3].These groups were intended to use electrostatic field communication technology for data communication and processing. In 2001, Zimmerman [4] presented how electronic devices implanted or on the body can communicate with each other using capacitive coupling picoamp currents. PAN standards do not satisfy the medical requirements for BAN. So, to overcome the short comings of IEEE 802.15.1 and 802.15.4, a committee was established in January 2006 named as Wireless Next Generation (WNG) which focuses on new topics on wireless technologies. Later on, IG-WBAN (interest group) was established in May 2006, which was approved as SG-WBAN, a study group. This study group was further certified as TG6 (Task group) in January 2008 under 802.15.In May 2008, all submitted applications to TG6 was compiled into a single document and a draft for BAN was approved in December 2011.

Due too many recent technological advances and new ideas, like wireless body area networks (WBANs) and low-power wireless communications, pervasive health monitoring and management services have become increasingly popular. However, efficient management of the big range of monitored information collected from numerous WBANs is a vital issue for their large-scale adoption in pervasive health care services. Since WBANs have limited memory, energy, computation, and communication capabilities, they need a powerful and scalable high-performance computing and large storage infrastructure for real-time processing and information storage, further as for online and offline information analysis.[3]

II. ROUTING PROTOCOLS IN BODY AREA NETWORKS

Communication in the wireless body area networks depends upon routing protocol. Each node after sensing data routes the packet according to the routing protocol implemented. But developing routing protocol for the wireless body area networks is a challenging task due to following challenges.

A. *Body Mobility & Network Topology Partition*

Different postural movements like sitting, standing, walking, running or other posture causes dynamism in the human body and in response to it network topology connections changes or May disconnects. Sometimes body clothing even become the reason for signal blockage and fading. That's why proposed routing protocol should deal with these signal attenuation issues.

B. Body Temperature

Overheating of nodes may result in rising body temperature which can harm body tissues. So the proposed routing protocol must be temperature sensitive and it should keep the node temperature below the danger level in order to minimize signal interference and avoid tissue damage.

C. Energy Consumption & Network lifetime

In the medical WBANs, there are number of sensor nodes implanted on or in the blood stream of the patient. Frequent replacement of nodes must be avoided especially when nodes are implanted within the human body because they are not easily accessible. And this is only possible if nodes are equipped with long battery life and network depletion time is as low as possible. That's why routing protocols require reliability, increased network lifetime and reduced energy-consumption for prolong use [12].

D. Limited Hop Count

Increased number of hops will surely leads to increased energy consumption. So, hop count threshold must be considered during proposing any routing protocol.

III. PROPOSED METHOD

A. Min Hop Algorithm

MIN Congestion aware algorithm takes into thought even the traffic stuck up at the router ports unlike the previous 2 approaches. MIN adaptive routing proposes that each router be aware of network's traffic situation and adapt its routing accordingly. It is also prologs a history window which keeps track of the queues of the nodes. The maintenance should be taken care by a device which has the capability to recharge itself or to be replaced easily and should have highest life. In fact the maintenance has to be done by router.

The Min Hop algorithm can be described as follows

1. Source Node, Destination Node & Transmission Range acts as an input.
2. The neighbor nodes are computed w.r.t Source Node.
3. If the neighbor nodes has the destination node then stop the process.
4. If the Destination node is not present then jump to Step5
5. Compute the distance of each of the neighbor w.r.t destination
6. Find the node which corresponds to minimum distance.
7. Repeat the process until destination is reached.

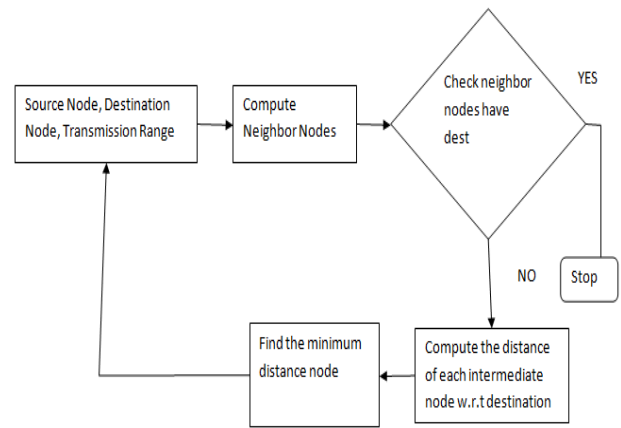


Fig.1 Min hope algorithm

B. Proposed algorithm

Algorithm (N, Src, Dst)

/* Define a Network with N Nodes with Source and Destination*/

1. For i=1 to N

[Define N nodes with the Position and Energy Specification]

{

2. Nodes (i). Position=AreaPos(x, y)

Nodes(i). Type = (Info)

Nodes(i). Energy=1J

Nodes(i). CommCount=0;

}

3. Set CurNode=Src

[Set Source Node as Current Node]

4. While CurNode! =Dst

[Repeat Process Till Destination Node does not Occur]

{

5. Generate the Neighbor List for CurNode called NeighList

6. Set nexthop = NeighList (1)

7. For i=1 to NeighList. Length

{

8. If (Nodes (i).Energy>EThreshold And Distance(i, Dest)<Distance(CurNode, Dest))

9. {

{

10. Set nexthop=i;

}

11. Else If (NeighList (i). Energy>Nodes (nexthop). Energy and NeighList (i). Type=Data and NeighList (i). Distance<Sensing Range)

{

```

12. Set nexthop =i;
}
13. Else If (NeighList (i). CommCount<Threshold and
NeighList (i).Type=Data and NeighList (i). Distance<Sensing
Range)
{
14. Set nexthop =i;
}
}
15.}
16. Nodes (nexthop). Energy= Nodes (nexthop). Energy-
Forwarding Energy;
17. Path. Add (next hop)
18. Nodes (nexthop). CommCount= Nodes (nexthop).
CommCount+1
19. Set CurNode= nexthop
20. Set BNC
}
    
```

IV. RESULT

After In energy aware routing, one of the most used performance assessor metrics is the Depletion Time, which is defined as the time until the first node (or a fixed percentage of nodes) of a network depletes its available energy. Commonly, the routing protocols, used in WBANs, can be classified (based on their data transmission manner) as multi-hop routing protocol and cluster-based routing protocol.

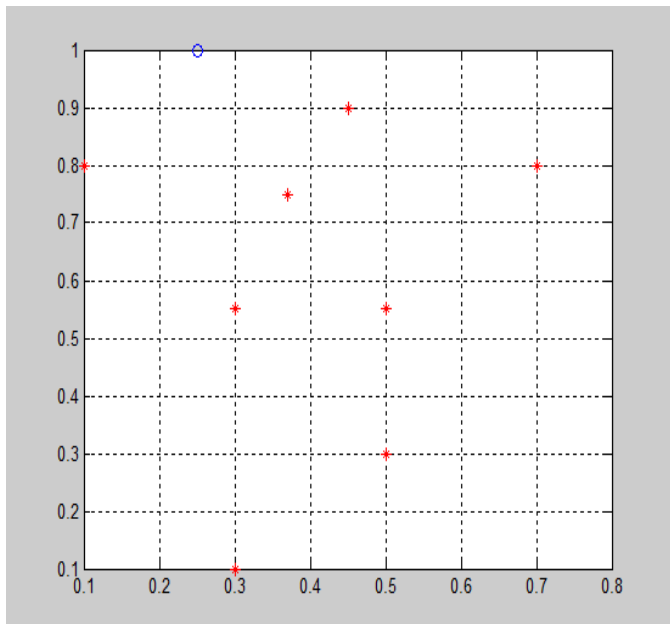


Fig.2 Node deployment of body area network

Fig.2 shows the node deployment of body area networks the dead and alive node of the network.

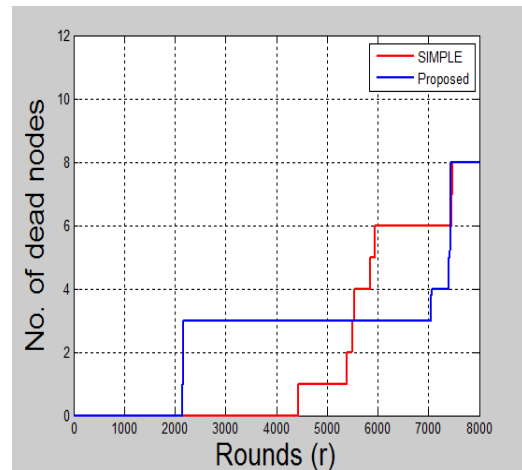


Fig.3 graph of no. of nodes v/s rounds

Fig.3 represents the graph of dead node of the network with the no. of round taken by node, it shows comparison between simple and proposed technique.

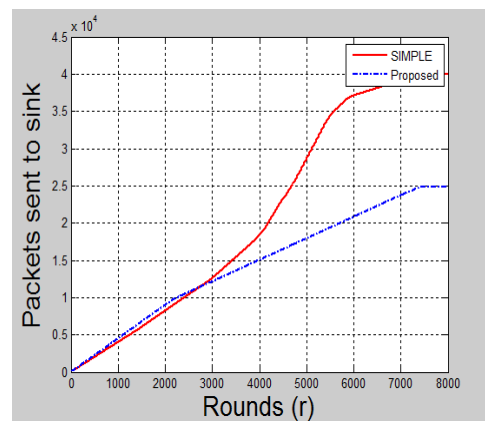


Fig.4 graph of packets sent to sink v/s rounds

Fig.4 represents the graph of packet sent to sink of the network with the no. of round taken by node, it shows comparison between simple and proposed technique.

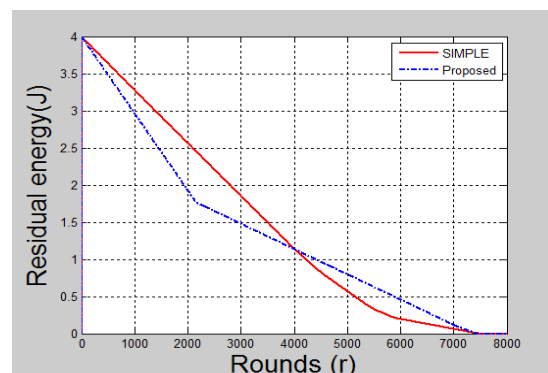


Fig.5 graph of residual energy v/s rounds

Fig.5 represents the graph of residual energy of the network with the no. of round taken by node, it shows comparison between simple and proposed technique.

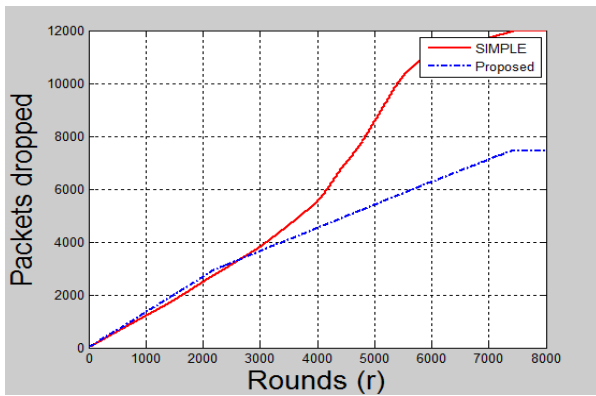


Fig.6 Packet dropped at sink in Round

Fig.6 represents the graph of packet dropped at sink of the network with the no. of round taken by node, it shows comparison between simple and proposed technique.

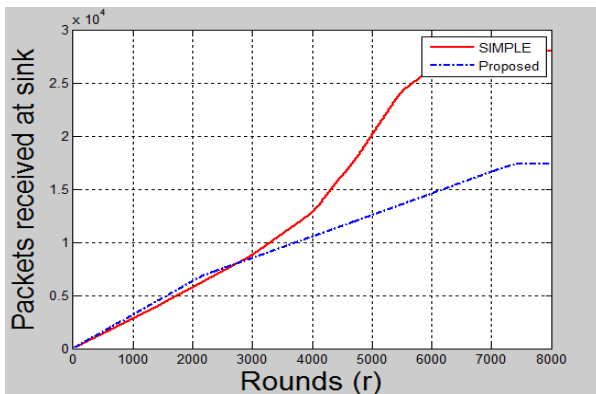


Fig.7 Packet received to sink in Round

Fig.7 represents the graph of packet received at sink of the network with the no. of round taken by node, it shows comparison between simple and proposed technique.

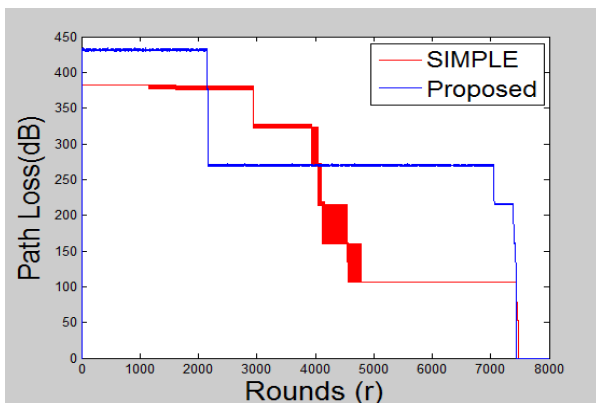


Fig.8 Path losses versus Round taken by body area network

Fig.8 represents the graph of Path loss to the rounds taken by body area network for sink with the no. of round taken by node, it shows comparison between simple and proposed technique.

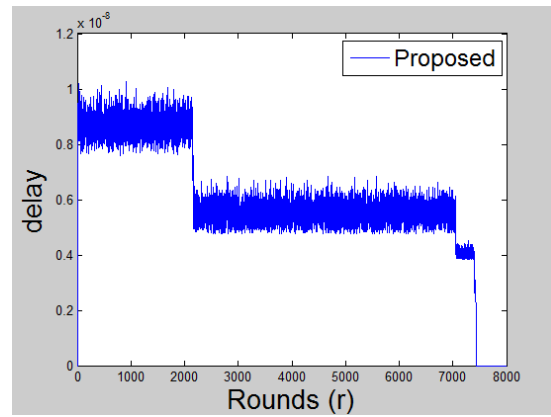


Fig.9 Graphical representation of delay of body area network

Fig.9 represents the delay occurred in the proposed work to optimize the body area network.

V. CONCLUSION

In this work, to provide an efficient energy to the node and also to improve the network lifetime, various techniques have been discussed. The various techniques such as HEED, BNC Placement algorithms includes Distance Aware BNC Placement Algorithm-Iterative, Distance Aware BNC Placement Algorithm-Fixed and Position Aware BNC Placement Algorithm has improved the network lifetime efficiently with less computational processing rather than the node placement algorithms of Wireless sensor network.

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