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Analysis of Efficient Opportunistic Routing Protocol for Wireless Body Sensor Area Network

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Abstract - Due to open nature of wireless communications and infrastructure less network topology, the opportunistic Wireless Body Area Networks (WBANs) suffered from the challenges such as network the board expense reducing furthermore potential usage decrease to carry the generative and quick administrations to clinical patients in medical care demand. In literature many solutions proposed to overcome such challenges but neglected to cover whole the parts of WBANs correspondence such as energy efficiency, cost efficiency and reliability. We come up with novel OPS for WBANs with mean to illuminate the examination challenges related to reduction in energy utilization and network cost for data communications and enhancing the QoS through reliable links establishment. In the first place, we proposed the novel vitality beneficial and circled network the board amount minimization structure for dynamic accessibility and data disseminating in deft WBANs. At that point think of the weight based algorithm for dependable node information scattering. We exploit weights (energy and mobility) of nodes to establish the reliable communication links to disseminate in co-operative sensing framework, while limiting drive cost for keeping up adequate number of clinical member.

Key Words: data dissemination, energy efficiency, cost efficiency, WBAN, opportunistic protocol.

1. INTRODUCTION

One of the emerging and highly demanded wireless communication medium since from last decade is WBAN which deliver the ongoing electronic medicinal services administrations to therapeutically rising patients in a cost compelling way. Because of body developments and portability of WBANs, the association attributes of intra-Boycott and between Boycott correspondence units spoil inside and out, which assembles the parcel adversity rate and upset the life-time of the body sensor hubs. Further, the above moreover exasperate information scattering. In this way the QoS the executives cost in the network is increments so as to keep up reasonable QoS among WBANs. As the network affiliation foundation and QoS the chairmen cost increment in the network, we requirement a network the board cost minimization system to give reliable and cost persuading the organization to WBANs. To address the current research problems, we come up with the opportunistic communication protocol for WBANs to achieve not just the energy efficiency and network the executives cost decrease yet additionally take care of the issue non-solid hubs information dispersal. In the first place, we proposed the novel vitality capable and scattered network the administrator's cost minimization system for dynamic availability and information spread in artful WBANs. At that point we come up with the weight based algorithm for reliable node data dissemination. We exploit weights of nodes in trust based method to disperse solid data in participatory detecting framework, while limiting motivation cost for keeping up adequate number of clinical members.

1.1 Methodology

Initially, we proposed the novel vitality productive and circulated network the executives cost minimization system for dynamic availability and information scattering in artful WBANs. At that point proposed the weight-based methodology for solid hub information spread. The proposed protocol is called as Weight based Network Communications and Distributed Management (WNCDM) which is based on recent work NCDM.

A. Programme Structure and Description of Subroutines

WNCDM is based on three algorithms such as energy efficiency, cost efficiency and reliable communication described below.

Algorithm 1: Energy Optimization Distributed Network Management
Information sources: • B: Quantity of WBANs. • AP: Quantity of APs • b: Description of sensor nodes. • T: Total-time limit

Result: Energy consumption rate ($F_{ec}^{t^*}$)

1. Measure x_{ij}^{intra} and X_{ij}^{inter} at time t.
2. Calculate f_{ij}(t) and R_{ij}^{q}(t) at time t.
3. **if** ($\xi_{decision}^{t} \geq \xi_{decision}^{t}$) **then**
4. Connectivity establishment
5. Calculate F_{ec}^{t} at time t.
6. **if** ($F_{ec}^{t} \geq F_{ec}^{th}$) **then**
7. Formulate pioneering vitality constraint parameter.
8. Formulate optimization question.
9. **end if**
10. **if** ($\mathcal{P}_i \geq \mathcal{P}^{th}$) **then**
11. Update waiting time $\mathrm{T}_{wait} = \mathrm{T}_{low}$.
12. Optimal energy consumption rate ($F_{ec}^{t^*}$).
13. **end if**
14. **end if**
15. Update $\mathrm{T}_{wait}^{*} = (\mathrm{T}_{low} + 1)$.
16. Return when $\mathrm{T}^{*}=T_{tot}$.

Algorithm 1 demonstrates the procedure for energy utilization minimization. The variables x_{ij}^{intra} and X_{ij}^{inter} are denotes the intra- BAN and between BAN connects between ith sensor link also jth LPU link. The determination metrics $\xi_{decision}^{t}$ is computed to identify the entrepreneurial network for intra-BAN and between BAN correspondence units, subordinate upon the affiliation quality and duplication delay at time t.

Further, to reduce the system the official's costs, other algorithms for perfect cost minimization algorithm. This algorithm includes, interference system charge, energy system charge, information propagation charge, and and QoS-guaranteeing cost. 'Algorithm 2 speaks to the procedure to limit the network the board cost.

Algorithm 2: Cost Optimization Distributed Network Management

Information sources:

- B: Quantity of WBANs.
- AP: Quantity of APs
- B: Description of sensor nodes.
- T: Total-time limit

Result: Cost Management Matrix ($CM_{i,j}^{*}$).

1. Measure x_{ij}^{intra} and X_{ij}^{inter} at time t.
2. Calculate $C_{x_{ij}}^{intra}$ and $C_{X_{ij}}^{inter}$ at time t.
3. **if** $\xi_{decision}^{t} \geq \xi_{decision}^{t}$ **then**
4. Opportunistic connectivity extraction
5. Update waiting time $\mathrm{T}_{wait} = \mathrm{T}_{low}$
6. **if** $C_{OC_{tot}}^{t} \geq C_{OC}^{th}$ **then**
7. Calculate $C_{DC_{tot}}^{t}$, $C_{inff_{tot}}^{t}$.
8. Calculate $C_{qos_{tot}}^{t}$, $C_{E_{tot}}^{t}$
9. **end if**
10. **if** $C_{tot}^{t} \geq C_{tot}^{th}$ **then**
11. Develop the network management cost
12. Optimal Network Management Cost Management Matrix ($CM_{i,j}^{*}$.
13. **end if**
14. **end if**
15. Update $\mathrm{T}_{wait}^{*} = (\mathrm{T}_{low} + 1)$.
16. Return when $\mathrm{T}^{*} = T_{tot}$.

Where, $C_{x_{ij}}^{intra}$ and $C_{X_{ij}}^{inter}$ are intra-BAN connection cost and between BAN connection cost individually. $C_{DC_{tot}}^{t}$ and $C_{inff_{tot}}^{t}$ are Data dissemination and interference management costs respectively. The $C_{qos_{tot}}^{t}$ and $C_{E_{tot}}^{t}$ are

QoS ensuring cost and energy management costs respectively.

Algorithm 3: Reliable Data Dissemination

Inputs

S: Source Vehicle

D: Destination Vehicle

1. *S* initiates the route discovery
2. *S* finds one-hop neighbouring nodes *n*
3. *S* broadcast RREQ's to *n*
4. Upon receiving RREQ at each $I \epsilon n$

   w1 = mobility (I)

   w2 = residual energy (I)
5. Compute the trust:

   $T^I = (w1 + w2)/2$
6. Select *intermediate node I* with maximum value T^I among all *n*
7. Update routing table
8. If (I == D)
9. *I* sends RREP to *S*
10. *S* starts data transmission
11. Else
12. Repeat *S* = *I*
13. End If

The weight based on mobility is computed as:

$$w_j = 2 - S^j \quad \ldots (1)$$

Where S^j is the current moving speed of node *j*. In this paper, we assume max speed of WBANs is 2 m/s. Maximum the value of w_j, better the trust value of node *j*.

1.2 Results and Discussion

The results of throughput shows the OPS protocol is performing worst compared to NCDM and proposed WNCDM protocols as there is no functionality for the network cost and energy management. The NCDM protocol delivers the second best performance as it includes the algorithms for energy and cost optimization for network management. The proposed WNCDM further improves the NCDM performance.

2. Abbreviatios

WBAN : Wireless Body Area Networks

OPS : Opportunistic Routing Protocol

NCDM:Network communication and Distributed Management

WNCDM: Weighted NCDM.

Chart -1

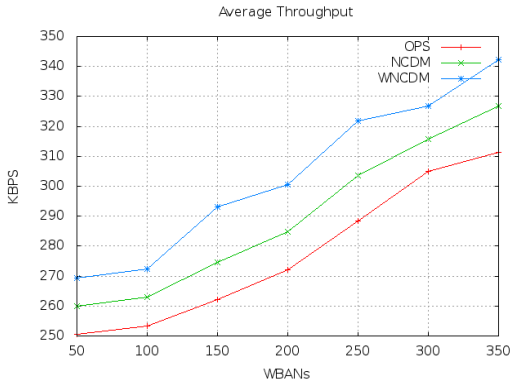

Table2: Throughput results

WBANs	OPS	NCDM	WNCDM
50	250.48	259.87	269.27
100	253.38	262.88	272.38
150	262.14	274.48	292.98
200	272.19	284.85	300.67
250	288.52	303.71	321.93
300	304.91	315.67	326.8
350	311.25	326.81	342.37

Chart -2

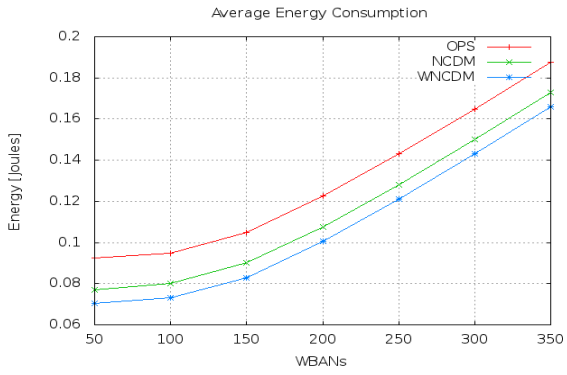

Table 2: Average energy consumption results

WBANs	OPS	NCDM	WNCDM
50	0.0924	0.076	0.0704
100	0.093	0.07	0.072
150	0.104	0.08	0.082
200	0.1224	0.1074	0.1003
250	0.142	0.127	0.122
300	0.164	0.14	0.142
350	0.1877	0.1727	0.1658

Chart -3

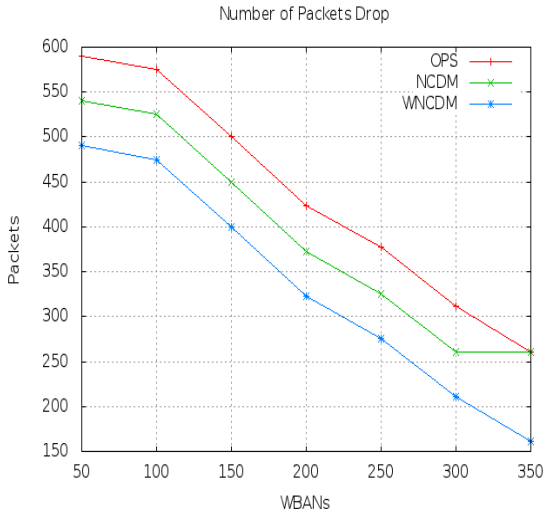

Table 3: Number of packets dropped results

WBANs	OPS	NCDM	WNCDM
50	590	540	490
100	575	525	475
150	500	450	400
200	423	373	323
250	377	325	275
300	311	261	211
350	261	261	161

3. CONCLUSION

This paper presented the design and evaluation of new opportunistic routing protocol for WBANs. The intent was to minimize the energy consumption and cost while performing the WBANs network management with acceptable QoS performance. The mobility and energy constraints lead the unreliable communications in network. To address such problems, we designed weight based link establishment algorithm. The simulation results show that WNCDM.

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