A Session Based Probabilistic Method for QoS Optimization in WBAN Communication

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Abstract: WBAN is the topology driven smart sensor network in which each sensing device captures the specific information from the body. The node and communication type increases the transmission challenge in this network. In this work, a session based probabilistic method is provided for effective node selection in WBAN. The parameter based analysis is applied on each node to identify the reliable next hop. The work is implemented in NS2 environment. The results shows that the method has reduced the communication loss and improved the packet communication.

1. Introduction

WBAN is the critical real time network form in which nodes are attached over body or placed in the body skin. The specialized sensor devices for specific organs are placed. These devices are able to record the organ criticalities and the statistical health information. The information captured by the sensor device can be continuous as some signal form or the discrete quantitative information. The network is also defined with specification of controller infrastructure. The controller node is attached to capture the signal and to provide the communication to the outer world. Most commonly, these controllers are the mobile PDA devices having the specialized applications to connect to different physicians directly. The medical suggestions and the medicine information can be taken using these controller devices. The WBAN is having the significance in various application areas including the sports, defense, health, space etc. Each of need different processing characteristics on captured information. In some networks, there is the requirement to generate the comparative analysis between different individuals. Because of this there is the requirement to perform, Inter-BAN and intra-BAN communication. The WBAN framework and infrastructure is capable to provide the communication and to provide the solution against various network issues. The relative layered exploration of network is provided to achieve the effective network communication. The basic architecture of WBAN is shown here in figure 1. The figure shows that the WBAN communication is defined as three tier architecture: 1st tier is the individual tier in which the specialized sensors captured the health information and deliver it to the controller device. In this tier intra-BAN communication is defined.

In second tier, the controller is connected to the internet environment with global information transition. At this tier, the communication is defined between multiple WBAN. The global connectivity also increases the security issues and increases the communication criticalities. Later on, the services access through PDA devices in third tier of this architecture. The hospital information, instant health treatment, ambulance services and emergency services are connected through some app and a relative provides the service access and communication in global web integrated environment. In this research, an improved intra-WBAN communication is defined under session specific analysis.

2. Related Work

Lots of work is already done by researchers for body area network to optimize the capabilities under different aspects. These aspects include the architectural improvement, localization
improvement, routing approaches etc. Some of such work is defined specific to the application area. Most of the work done by the researchers is on health monitoring system for the patients. Some work has also done in application areas such as soldiers monitoring, war area analysis, chemical plant workers analysis, athletes analysis etc. Some of the researchers presented the network models and algorithms to optimize the network strength, communication and effectiveness. Some of such work defined by earlier researchers is given in this chapter. Author[5] provided a work on optimization of communication route based on multiple constraint for WBAN. Author defined an event driven communication model applied in various scenarios. Author also provided the inter network and intra network communication and improved the energy utilization. The node level, communication level observations are applied on multiple parameters to generate effective communication route. Observations show that the work has improved the communication throughput and reduced the communication loss. Author[6] provided a work on reliability improvement in WBAN communication. Author provided a probabilistic method for improving the communication under distributed aspect. Author identify the observations respective to path loss parameter and provided a safe and reliable communication. Author provided the randomized communication along with throughput observations so that the improved communication aspect will be formed. Author provided the reliability driven aspect map to reduce the data loss over the network. Author also provided the medium observations to achieve the communication reliability. Author[7] defined a chip integrated form to improve the communication reliability during routing. Author identified the route optimization model based on the configuration level observations. Author identified the parameter driven hop selection under signal modeling and communication aspect extraction. Author[8] provided a work on improved architectural formulation in WBAN network. Author provided the medical information processing and distance pervasive communication modeling to utilize the capabilities of the network. Author provided the specification under the behavioral analysis and cooperative communication observation to improve communication reliability. Author[9] provided an effective communication model under deployment measures. Author obtained the observations against the coverage perspective and provided the performance driven measures. Network analysis is provided under mobility, fault and scalability vectors to achieve energy effective communication and route formulation. Author provided the energy formed optimized in WBAN. Muhammad Quwaider [6] has defined a work on packet routing algorithm in the body area network. The location specific packet forwarding routing was performed for body area networks under postural partitioning approach. The experimentation under critical situations to the work was done under topological specification and network generation. The author provided the parametric analysis for system evaluation and experimentation. The probabilistic routing on specialized body packet flooding was performed so that routing delay over the network will be reduced. Shrut P. Mahambre [7] has defined a work on decentralized system for adaptive routing to improve the reliability of work under broken network. The quality of service based analysis was defined on event delivery for recognized system. The experimentation was done on routing events and provided the investigation on reliability needs of network and path quality analysis. The work on reliability analysis of decentralized system to perform reliability estimation was carried out. Message complexity analyzed to generate the network aspects and to perform the route generation.

3. Problem Definition

Body area network is an infrastructure and topology specific real time sensor network. The objective of this network is to extract the health information of an individual using on-body or in-body sensors. Each of the sensor devices is intelligent and specific to the organ, extracted data form and application. The application and objective of individual sensor and network also increases the criticality of network. Accurate and effective communication is the primary requirement of this network. In this work, an optimized trust analysis based communication model is presented to optimize the communication in this network. The presented work is here defined in two main stages. In first stage, a session driven probabilistic analysis will be defined to identify the trust weight for each node. The trust factors considered in this work are based on loss rate, communication delay, data form and node criticality. These parameters will identify the effective intermediate node to deliver the data to main controller node. Based on this nodes, a weighted list of feasible next node will be identified for each node. In second stage of this method, the effective neighbors will be identified under the data load and delay parameters to identify the most effective node. These neighbors will be combined in sequence to generate the final communication path. The presented work will be implemented in NS2 environment. The work is about to improve the communication throughput and reduce the communication delay.
4. Results

The work is here implemented in NS2 environment with defined fix scenario of 16 nodes. The controller is defined to capture the communication and connecting to the environment. The results are here taken in terms of packet communication and loss rate analysis.

![Figure 2. Packet Communication Analysis (Existing Vs. Proposed)](image)

Here figure 2 is showing the comparative analysis of packet communication for existing and proposed approach. Here x axis is showing the communication time and y axis is showing the packet communication. The figure shows that the proposed approach applied on body sensor network has optimized the network communication. The comparative results driven here verifies that the communication throughput is improved in this work.

![Figure 3. Packet Loss (Comparative)](image)

Here figure 3 is showing the comparative communication loss analysis under communication loss parameter. Here x axis showing the communication time and y axis showing the number of packet lost. The proposed session adaptive approach shows that the loss occur only once till the decision regarding node selection is not taken. After that the communication loss drop and the effective network communication is achieved from the work. The method has reduced the communication loss.

![Figure 4. Loss Rate Analysis (Existing Vs. Proposed)](image)

Here figure 4 is showing the comparative communication loss analysis under communication loss rate parameter. Here x axis showing the communication time and y axis showing the number of communication loss rate. The proposed session adaptive approach shows that the loss occur only once till the decision regarding node selection is not taken. After that the communication loss drop and the effective network communication is achieved from the work. The method has reduced the communication loss rate and improved the communication throughput.

5. Conclusion

Body Area network is the real time hybrid network defined by specialized sensor devices and with fixed infrastructure. The proposed method has applied a session specific load, delay and loss analysis to identify the weight for each nodes. Based on these weight the eligibility of a node is identified in communication participation. The simulation results shows that the method has reduced the communication loss and communication delay.

6. References


and Applications, 978-0-7695-3330-8/08 © 2008 IEEE.


