A Survey on Network Lifetime in WBAN

E.Janani[1] and S. Karuppusamy[2]

[1]PG Scholar, Department of CSE, Nandha Engineering College (Autonomous), Erode, Tamil Nadu, India

[2]Professor, Department of CSE, Nandha Engineering College (Autonomous), Erode, Tamil Nadu, India

Email: jananicse1992@gmail.com[1], karuppusamy.s@nandhaengg.org[2]

Abstract - Wireless Body Area Network (WBAN) is emerging very quick innovation and it has so many new methods and algorithms for finding the optimal path for propagating emergency messages. One of the main cultural algorithms is ACO (Ant Colony Optimization), which helps to solve many hard problems such as Travelling Salesman Problem (TSP). In the TSP a set of locality (e.g. cities) and the distances between them are given. The problem consists of finding a closed tour of minimal length that visits each city. We consider the graph characterized by associating the set of cities with the set of vertices of the graph. This graph is called construction graph. We set the lengths of the edges between the vertices to be proportional to the separations between the cities represented by these vertices and we associate pheromone values and heuristic values with the edges of the graph. In addition to that, it could consider the hospital environment as one of the main applications. In this work, the ACO approach which helps to Travelling Salesman problem for finding shortest path to send the emergency messages to the doctor via sensor nodes and also it has used static Bayesian Game Formulation with mixed strategy which enhance the network life time. Whenever the patients need emergency treatment or medical care, the emergency messages will be created by the WBAN and sends to the destinations of doctor. These communications can be done using ACO and Bayesian Game Formulation.

I. INTRODUCTION

Network security consists of the policies and practices adopted to prevent and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Network security involves the authorization of access to data in a network, which is controlled by the network administrator. Users choose or are assigned an ID and password or other authenticating information that allows them access to information and programs within their authority. It is likely that these workstations may not be centrally managed, nor would they have perimeter protection. They may have a variety of operating systems, hardware, software and protocols, with different level of cyber awareness among users. Now imagine, these thousands of workstations on company network are directly connected to the Internet.

A. Network Security in Body Area Network
A Body Area Network (BAN), also referred to as a Wireless Body Area Network (WBAN) or a Body Sensor Network (BSN), is a wireless network of wearable computing devices. BAN devices may be embedded inside the body, implants, may be surface-mounted on the body in a fixed position Wearable technology or may be accompanied devices which humans can carry in different positions, in clothes pockets, by hand or in various bags. The development of WBAN technology started around 1995 around the idea of using Wireless Personal Area Network (WPAN) technologies to implement communications on, near, and around the human body. A WBAN system can use WPAN wireless technologies as gateways to reach longer ranges. Through gateway devices, it is possible to connect the wearable devices on the human body to the internet. We are currently witnessing a growing interest in the area of Wireless Body Area Networking (WBAN) accompanied by the strong demand of the medical and healthcare society as well as by the advances in low-power micro and nano-electronics and wireless networking.

B. WBAN with Ant Colony Optimization and Travelling salesman Problem
Wireless Body Area Network (WBAN) is emerging very fast technology and it has so many new methods and algorithms for finding the optimal path for propagating emergency messages. One of the main cultural algorithms is ACO (Ant Colony Optimization), which helps to solve many hard problems such as Travelling Salesman Problem (TSP). In the TSP a set of locality (e.g. cities) and the distances between them are given. The problem consists of finding a closed tour of minimal length that visits each city. To apply ACO to the TSP, we consider the graph characterized by associating the set of cities with the set of vertices of the graph. This graph is called construction graph. We set the lengths of the edges between the vertices to be proportional to the separations between the cities represented by these vertices and we associate pheromone values and heuristic values with the edges of the graph.

In addition to that, it could consider the hospital environment as one of the main applications. In this work, the ACO approach which helps to Travelling Salesman problem for finding shortest path to send the emergency messages to the doctor via sensor nodes and also it has used static Bayesian Game Formulation with mixed strategy which enhance the network life time. Whenever the patients need emergency treatment or medical care, the emergency messages will be created by the WBAN and sends to the destinations of doctor. These communications can be done using ACO and Bayesian Game Formulation.

II. MATERIALS AND METHODS

The following literature survey shows the various techniques and algorithms which have been proposed to network security in wireless body area network.

A. Enhanced Secure Sensor Association and Key Management in Wireless Body Area Networks [1]
A novel enhanced secure sensor association and key management protocol based on ECC and hash chains in order to provide secure and correct association of a group of sensors with a patient and satisfy the requirements of data confidentiality and integrity in BANs. The authentication procedure and group key generation are very simple and efficient. Therefore, our protocol can be easily implemented in the power and resource constrained sensor nodes in BANs.

B. Self-Adaptive Data Collection and Fusion for Health Monitoring Based on Body Sensor Networks[2]
A series of simulations on real medical data recordings were carried out to show the effectiveness of our algorithms and approaches. The results show that our approach reduces considerably the sensed and the transmitted data and the energy consumption while maintaining data integrity and decision accuracy. This solution alerts the employees when their vital signs become abnormal. We intend to test our proposed scheme in a real life WBSN application and to propose a method for the fusion and the aggregation of heterogeneous data in a context-aware WBSN.

C. Point-to-Point Wireless Information and Power Transfer in WBAN With Energy Harvesting [3]
A point-to-point communication system in a wireless body area network capable of harvesting radio-energy is studied. We investigate two scenarios for transmission, which are in normal circumstance and in abnormal circumstance. We consider power splitting protocol in normal circumstance and time switching protocol in abnormal circumstance at the sensor, respectively. Based on two protocols the optimal power splitting and time switching ratios are derived in each scenario. The goal of this paper is to maximize the information throughput from the sensor to the access point in uplink by balancing the time duration among the command transfer phase, the energy harvesting phase, and the information transfer phase while satisfying energy harvesting and consumption balance constraint at the sensor. Numerical results demonstrate the effectiveness of the optimal solution.

D. Wireless Body Area Networks for Healthcare Applications: Protocol Stack Review [4]
Wireless Body Area Networks (WBANs) supporting healthcare applications are in early development stage but offer valuable contributions at monitoring, diagnostic, or therapeutic levels. They cover real-time medical information gathering obtained from different sensors with secure data communication and low power consumption. we compile and compare technologies and protocols published in the most recent researches, seeking WBAN issues for medical monitoring purposes to select the most useful solutions for this area of networking. The most important features under consideration in our analysis include wireless communication protocols, frequency bands, data bandwidth, transmission distance, encryption, authentication methods, power consumption, and mobility.

E. A Review of Wireless Body Area Networks for Medical Applications [5]
WBANs promise unobtrusive ambulatory health monitoring for a long period of time, and provide real-time updates of the patient's status to the physician. They are widely used for ubiquitous healthcare, entertainment, and military applications. This paper reviews the key aspects of WBANs for numerous applications. We present a WBAN infrastructure that provides solutions to on-demand, emergency, and normal traffic. We further discuss in-body antenna design and low-power MAC protocol for a WBAN. In addition, we briefly outline some of the WBAN applications with examples. Our discussion realizes a need for new power-efficient solutions towards in-body and on-body sensor networks.

F. Applications, Challenges, And Prospective In Emerging Body Area Networking Technologies [6]
BAN technology is in the early stage of development and several research challenges have to be overcome for it to be widely accepted. In this article we study the core set of application, functional and technical requirements of the BAN. We also discuss fundamental research challenges such as scalability (in terms of data rate, power consumption and duty cycle), antenna design, interference mitigation, coexistence, QoS, reliability, security, privacy, and energy efficiency. Several candidate technologies poised to address the emerging BAN market are evaluated, and their merits and demerits are highlighted.

G. Efficient Certificate less Access Control for Wireless Body Area Networks [7]

An efficient certificate less signcryption scheme and then design an across control scheme for the WBANs using the given signcryption. Our scheme achieves confidentiality, integrity, authentication, non-repudiation, public verifiability, and cipher text authenticity. Compared with existing three access control schemes using signcryption, our scheme has the least computational cost and energy consumption for the controller. In addition, our scheme has neither key escrow nor public key certificates, since it is based on certificate less cryptography.

H. Double Threshold Authentication Using Body Area Radio Channel Characteristics [8]

The demand of portable and body-worn devices for remote health monitoring is ever increasing. One of the major challenges caused by this influx of Wireless Body Area Network (WBAN) devices is security of user's extremely vital and personal information. The algorithm is based on the user's behavioral fingerprint extracted from the radio channel characteristics. Effectiveness of this technique is established through experimental measurements considering a variety of common usage scenarios. The results show that this method provides high level of security against false authentication attacks and has great potential in WBANs.

I. Congestion Control in WBAN in the Field of Heterogeneous Network [9]

The present day applications considering energy, security, routing, load balancing, optimization etc. The application of Wireless Body Area Network (WBAN) in recent times has significantly increased the potential of remote healthcare monitoring systems. The control parameters such as distance and the traffic load were also computed which resulted in a more robust analysis on congestion control. Graphs of Cumulative Distribution Function (CDF) vs. traffic load and Probability Density function (PDF) vs. traffic load were given which shows an improved rate in the flow of traffic with respect to congestion control. Evaluation with respect to energy consumption with respect to WBAN nodes is also performed.

J. Low-Power Wireless ECG Acquisition and Classification System for Body Sensor Network [10]

Most of the main functions of the proposed system have been tested and verified. However, this system still needs further improvement, particularly in the synthesizer design of the transceiver for multichannel bio signal acquisition, the feedback control for the body-end chip, the integration of the receiver and the DSP circuit in a single receiving-end chip, and the combination of the receiving-end chip and the smart phone. The new functions and further integration will be studied in the future to complete the personal care device for BSNs.

III. RESULTS AND DISCUSSION

The following table summarizes different techniques to obtain the better network, parameters, and other factors. The different algorithms are working on same parameters at some cases. Each algorithm focuses on improving various kinds of requirements in the network. The differences are shown in Table 1.

TABLE I: DIFFERENT TECHNIQUES & IMPACTS

S.No	Techniques and algorithms	Parameters and analysis	Conclusions
1	Short range Wireless communication techniques. key management protocol based on elliptic curve cryptography and hash chains.	Time in terms of seconds and 1024 bits modular exponentiation.	provide secure and correct association group of sensors with a patient and satisfy requirements of data confidentiality, integrity BANs.
2	Data collection, Basic decision tree algorithm, decision matrix and fuzzy set theory.	Energy consumption on the node	Fusion and the aggregation of heterogeneous data in a context-aware WBSN.
3	Dynamic programming and convex optimization.	Transfer phase and energy harvesting.	Maximize the information throughput with energy constraint. Numerical results in different system parameters are provided.
4	The use of redundant transmissions and coding Techniques. CSMA and Time TDMA are the most popular medium access techniques.	CDMA and EDMA, Multipath and multi hop.	WBANs for medical purposes such as patient mobility, secured and reliable data, economy of power consumption, and the need for a large number of sensor nodes to coexist in a relatively small space.
5	WBAN traffic requires sophisticated low-power techniques to ensure safe and reliable operations.	Antenna design and MCA protocol	A Further provided a technical discussion on the in–body antenna design and supported patch antenna for in-body communication.
6	Scalability (in terms of data rate, power consumption and duty cycle), antenna design, interference mitigation, coexistence, Qos, reliability ,security,	Minimize power conception, novel lightweight and resource efficient.	Developing a unifying BAN standard that addresses the core set of technical requirements is the quintessential step to unleash the full potential of BAN.

7	Signcryption, neither key escrow nor public key certificates.	Time and energy.	Reduce the computational time and Energy consumption in BSN.
8	Conventional authentication techniques a double threshold algorithm as a Physical Layer Security (PLS).	Mean offset, filtering accuracy, False positive rate, False negative rate	A method provides high level of security against false authentication Attacks Filters.
9	A significant role in the present day applications considering energy, security, routing, load balancing, optimization.	Reliability and efficiency.	We have successfully built the WBAN network model in a heterogeneous condition. An improved rate in the flow of traffic with respect to congestion control.
10	High-pass sigma delta modulator super-regenerative on–off keying transceiver.	Power conception and frequency.	It diagnose heart disease based on the MIT-BIH arrhythmia database studied in the future to complete the personal care device for BSNs.

IV. CONCLUSION

In this paper, optimal shortest path for WBAN has been determined using Ant Colony Optimization algorithm. To check whether the network life time is increased or decreased, we have used Bayesian game formulation with their Nash equilibrium In our proposed method, the ACO approach is used in Travelling Salesman problem which finds the shortest path to send the emergency messages to the doctor by the Way of sensor nodes and also it has used static Bayesian Game Formulation with mixed strategy which enhance the network life time. Whenever the patients need the emergency treatment or medical care, the emergency messages will be created by the WBAN and sends to the doctor's destinations. These communications can be effectively enhanced the emergency messages in real time environment such as hospital environment.

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