A Review report on Body Node Coordinator Placement Algorithms For Wireless Body Area Networks

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Abstract *– A Wireless body area network (WBAN) consists of communication technology, sensors technology like wearable and implantable biosensors, along with recent developments among the embedded computing area are enabling the design, improvement, and implementation of body area networks. Wireless body area networks (WBANs) are intelligent wireless monitoring systems, consisting of wearable and implantable computing devices on or within the human body. Body sensor networks consisting of low-power on body wireless sensors connected to mobile users are utilized in the long term to watch the health and well being of patients in hospitals or at home. This paper motivated us to work on an efficient node placement strategy for a BNC, within a WBAN; and therefore we propose 3 different BNC placement algorithms considering different options of available energy efficient routing protocols during a WBAN.*

Keywords*: Body area network (BAN), body node coordinator (BNC) deployment, energy efficiency, human body, IEEE 802.15.6, Internet of Things (IoT), node deployment, wireless body area network (WBAN).*

I. Introduction

.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]

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]

The health care industry these days is facing increased pressure largely due to the ever increasing population and reduced funding from governments. Therefore, various research initiatives are setup to develop new solutions to assist enhance and support a lot of efficient and price effective health care systems [4]. One approach toward this is often to enable a lot of efficient monitoring techniques that may give numerous advantages, including:

1) the examination of patients based on their criticality, that successively enhances doctor's time efficiency in examining patients, and lowers queues in emergency rooms, and

2) Correct monitoring of patients conditions and trends over a amount of time.

Wireless body area networks (WBAN) provides a chance to permit monitoring with such capability and high precision.[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]

II. Literature Survey

Md. Tanvir Ishtaique ul Huque et. al [1] illustrated the importance of effective BNC placement inside a WBAN to maximize the network longevity. Besides, to measure the life expectancy of a node, we have shown the lacking in measuring of available metrics and so projected a new metric to satisfy this demand. Supported our projected metric, we have planned 3 totally different algorithms, that are different in their necessities, formations, and lead to totally different level of energy efficient and computationally efficient performances. The simulation results show the consistency of PBP, over DBP-I and DBP-F, in term of energy efficient and computationally efficient performances. In our next step, we'll use specialized software system, Castalia [28], to evaluate the performance of our projected algorithms, in terms of dependability and control message overheads.

Samaneh Movassaghi et. al [2] a reviewed of the on-going analysis in WBANs in terms of system design, address allocation, routing, channel modeling, PHY layer, MAC layer, security and applications is provided. A comparison of WBANs with respect to WSNs and different wireless technologies is given. Additionally, a listing of existing and applicable sensors, radio technologies and current analysis projects, open issues, and future work in WBANs is additionally presented. WBANs can allow for continuous observance of patients in medical applications, capable of early detection of abnormal conditions leading to major enhancements within the quality of life. Significantly, even basic very important signs observance (e.g. heart rate) will enable patients to engage in normal activities as opposed to being home certain or near specialized medical services. In summary, the procedural analysis on this valuable technology has important importance in better usage of available resources that may little doubt really affect our future well being. we really believe this analysis to be a supply of inspiration towards future developments in WBANs.

Jiafu Wan et. al [3] The seamless integration of WBANs and MCC provides tremendous opportunities for pervasive health care systems. During this article, we offer a short review and outlook of this promising field, and discuss a cloud-enabled WBAN design for pervasive health care systems. Particularly, we study the practicality and reliability of MCC services. We additionally recommend some future analysis directions to enhance performance and QoS of cloud-enabled WBANs. We believe cloud-enabled WBANs can attract enormous attention and research effort within the near future.

Stepan Ivanov et. al [4] WBAN provides a new chance for observance health care patients. during this paper, we tend to propose the VGE design for virtual group formation that enables medical personnel to continuously analyze PM, and fine tune changes in sensor behavior through high-level polices. The dynamic policy changes performed by the medical officers will improve the sensor readings of critical patients once performance of the network degrades. we have additionally projected a new metric referred to as QoHM, that enables medical officers to produce feedback on the standard of sensor readings by setting their preference through policies. The hierarchical policy structure will permit doctors to specify their QoHM threshold that in turn can go down and assemble the cooperation and routing behavior of the sensor nodes. The projected resolution is evaluated through simulation using our custom created Java event-based simulator.

Okundu Omeni et. al [5] presents a new energy-efficient mac Protocol targeted at wireless body area sensor networks focused on pervasive health care applications. The protocol exploits the attributes of this sort network to implement a very low power design that continues to be capable of fast reaction to sporadic Alarm events. The novel conception of 'wakeup fallback' time is additionally given as a method of reducing the quality of time-slot management within the presence of link failures resulting from Alarm events or different interference. The mac has been implemented as a part of a larger SoC (Sensium™), and measured results have valid the effective operation of the new mac protocol.

III. Method

III.1 Body node coordinator (BNC) deployment

The nodes ought to be placed effectively in WBANs should possess the subsequent characteristics:

- Message exchange and computational complexity should be least as possible.
- The entire operation should be centralized one.
- Sensor nodes should involve less in- order to form the network energy efficient.

Most of the techniques usually need large amount of procedure support at the BNC. Heavy computation implies that the massive processing is processed in BNC. This information is gotten by existing node of the network. This expands the radio communication between a BNC and nodes that in turn depletes the energy of nodes. Therefore, network life decreases because of additional energy consumption and complexity in computation.

Modified Position-aware BNC coordinator placement algorithmic rule is possible only if the routing protocols knows the spatial data of the nodes. Since spatial data of the nodes is taken for the issues there's no got to determine the relative distance. Modified Position aware BNC Placement algorithmic rule (MPBP) involves low complexion compared to different node placement algorithms. The sole drawback is that it holds linear computational complexity. And additionally it takes into the account of the spatial coordinate location rather than considering their respective relative transmission distance with respect to BNC. Following are the issues made for the algorithm:

- All the nodes during a WBAN ought to be within the transmission vary of the BNC. The BNC should have the details about the spatial data of all the neighbor nodes within the network.
- In MPBP, the BNC should be placed within the network. Step by step details relating to the algorithmic rule.
- BNC computes the relative communication distances of nodes within the network that mainly considers their spatial coordinates.
- Relative communication distances (dr) and Utility factor (U) of all the nodes within the WBAN is computed by considering their respective available energy (E).
- BNC computes the maximum utility issue from the available UFs (1) that is calculated within the previous step.
- Body Node coordinator determines the most value of the Utility factor "u" from the offered ones so it normalizes the Utility factor "u" of every node with respect to the most value, that obtains χ. Therefore, each node has its own χ.
- At last, every and each node within the WBAN and multiply their own χ with their several coordinates and divides the resultant value with the entire number of nodes within the WBAN.

III.2 IEEE 802.15.6 Description

The following sections describe the main features of IEEE 802.15.6 standard including PHY and MAC layers specifications.

A. *PHY Layer Specification*

The IEEE 802.15.6 supports three different PHYs, i.e., NB, UWB, and HBC.

1) Narrowband PHY (NB): The NB PHY is responsible for activation/deactivation of the radio transceiver, Clear Channel Assessment (CCA) within the present channel and information transmission/reception. The Physical Protocol data Unit (PPDU) frame of NB PHY contains a Physical Layer Convergence Procedure (PLCP) preamble, a PLCP header, and a PHY Service data Unit (PSDU).

2) Ultra Wideband PHY (UWB): UWB PHY operates in 2 frequency bands: low band and high band. every band is split into channels, all of them characterized by a bandwidth of 499.2 MHz. The low band consists of three channels (1-3) only. The channel two includes a central frequency of 3993.6 MHz and is considered a compulsory channel. The high band consists of eight channels (4-11) wherever channel 7 with a central frequency 7987.2 MHz is considered a compulsory channel, whereas all different channels are optional . A typical UWB device ought to support a minimum of one in all the necessary channels. The UWB PHY transceivers permit low implementation complexity and generate signal power levels within the order of these used in the MICS band.

3) Human Body Communications PHY (HBC): HBC PHY operates in 2 frequency bands focused at 16 MHz and 27 MHz with the bandwidth of 4 MHz. each operational band are valid for the united states, Japan, and Korea, and therefore the operational band at 27MHz is valid for Europe. HBC is that the electrostatic field Communication (EFC) specification of PHY that covers the whole protocol for WBAN like packet structure, modulation, and preamble/SFD.

B. MAC Layer Specification

1) In IEEE 802.15.6, the whole channel is split into super frame structures. Every super frame is bounded by a beacon amount of equal length. The hub selects the boundaries of the beacon amount and thereby selects the allocation slots. The hub can also shift the offsets of the beacon period. Generally, the beacons are transmitted in every beacon period except in inactive super frames or unless prohibited by regulations like in MICS band. The IEEE 802.15.6 network operates in one amongst the following modes.

2) 1) Beacon mode with beacon period super frame boundaries: during this mode, the beacons are transmitted by the hub in every beacon period except in inactive super frames or unless prohibited by laws.

3) 2) Non-beacon mode with super frame boundaries: during this mode, the whole super frame duration is covered either by a kind I or a kind II access section however not by each phase.

4) 3) Non-beacon mode while not super frame boundaries: during this mode, the coordinator provides unscheduled sort II polled allocation only.

C. Security Paradigm

The standard defines the subsequent 3 levels of security. Every security level has different security properties, protection levels and frame formats.

1) Level 0 - unsecured communication: this can be the lowest security level wherever information is transmitted in unsecured frames. There's no mechanism for information authentication and integrity, confidentiality

and privacy protection, and replay defense.

2) Level 1 - authentication only: this can be the medium security level wherever data is transmitted in secured authentication however isn't encrypted. The confidentially and privacy isn't supported by this mode.

3) Level 3 - authentication and encryption: this can be the highest security level wherever information is transmitted in secured authentication and encryption frames. It provides solutions to all of the issues not covered by the level zero and level one.

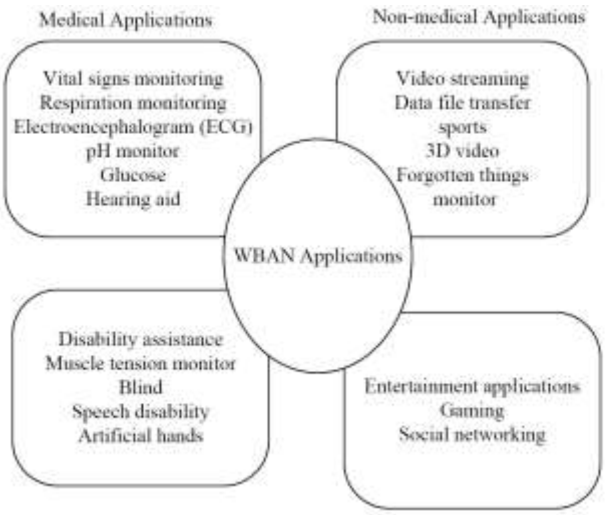

Fig.1 WBAN Applications targeted by IEEE 802.15.6

IV. Conclusion

This paper has reviewed the mainly latest analysis trends and projected the Energy efficient data broadcasting throughout a Body Node Coordinator Placement Algorithms for Wireless Body Area Networks. The main focus of the importance of effective BNC placement within a WBAN to maximize the network longevity. In this paper review of different level of energy efficient and computationally efficient performances

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