

# Wireless Body Area Network in Health Care Applications

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**Abstract:** *Wireless devices have attacked the medical area with an extensive variety of capacity. To screen the patient points of interest in intermittent interim is on overhead utilizing existing innovations. To conquer this we have changed late wireless sensor technologies. When all is said in done six distinctive sensors are utilized to assemble quiet therapeutic data without being infusing inside the body by this we are accomplishing remote checking and information social event of patients. This includes the benefits of versatility. There is no requirement for a specialist to visit the persistent occasionally. In this research paper we proposed a technique to monitor the health using wireless sensor networks. We have compared the performance of the proposed system with exiting system on the various parameters. It is evaluated that the proposed system shows better results as that of the existing system.*

**Keywords:** wireless medical applications; Wireless sensor networks; Health monitoring.

## 1. Introduction

Wireless Sensor Networks (WSNs) are used to monitor certain parameters in numerous applications like environment observing, habitant checking, combat zone, farming field observing and shrewd homes. These remote sensors are scattered in detecting region to screen field. WBAN is new developing sub-field of WSN. A key utilization of WBAN is wellbeing checking. Remote sensors are put on the human body or embedded in the body to screen key signs like circulatory strain, body temperature, heart rate, glucose level and so on. Utilization of WBAN innovation to screen wellbeing parameters significantly decreases the consumptions of patient in healing facility. With the assistance of WBAN innovation, patients are observed at home for more period. Sensors ceaselessly sense information and forward to therapeutic server. In WBANs, sensor hubs are worked with constrained vitality source. It is required to utilize least power for transmitting information from sensor hubs to sink. One of the real obstructions in WBAN is to revive the batteries. A productive steering convention is required to beat this issue of energizing batteries. Numerous vitality effective directing conventions are proposed in WSN innovation. Nonetheless, WSNs and WBANs have distinctive models, applications and work in various conditions. It is difficult to port WSN steering conventions to WBAN. Hence, vitality effective directing convention for WBAN is required to screen patients for more period. We propose a high throughput, dependable and stable steering convention for WBAN. Sensors for ECG and Glucose level are set close to the sink. Both these sensors have basic information of patient and required least weakening, high unwavering quality and long life in this way; these sensors dependably transmit their information specifically to sink. Different sensors take after their guardian hub and transmit their information to sink through forwarder hub. It spares vitality of hubs and system works for more period.

Atypical wireless radio operates in four modes: transmit, receive, idle and sleep, where maximum power is consumed in transmission, and least is consumed during sleeping. For energy efficiency, circuits can be partially turned off during

idle mode to maintain only essential functions such as keep an internal clock, or receiving beacon signals for network synchronization. However, the process of waking up from hibernation (idle or sleep) states, turning off to enter the hibernation state, and switching between transmit and receive modes can also consume a non-trivial amount of power.

In addition to low-power hardware design, energy-efficient wireless system requires low power strategies throughout the entire network protocol stack. In the physical and data link layers, error control schemes such as forward error correction (FEC) coding and Automatic repeat requests (ARQ) can be used to conserve power. Wireless terminals should also be given data transmission starting and stopping time to facilitate switching between different operating modes: a transceiver should fall back into idle or sleep mode whenever it determines that it will not be transmitting or receiving for a period of time. Also, wireless terminals should be allocated contiguous slot for transmission or reception to reduce energy consumption for turn around. Moreover, computation of the transmission schedule should be relegated to a central energy abundant base station. For one, individual sensor node may not hear reservation requests from all other nodes; for two, distributed computation usually consumes more power collectively. Depending on network lifetime, connectivity, and coverage, prioritized transmission from energy scarce node may also be arranged. On the network layer, routing scheme can be established under energy constraint, such that nodes are uniformly depleted of battery power, maximizing the connectivity of network. Depending on the networking protocol under consideration, transport and application layer techniques may also be employed to further reduce the energy consumed per successfully delivered packet. Body Area Networks (BANs) present numerous application opportunities in healthcare, sports, and other areas where personal information is to be stored and shared with another individual or a central database.

## 2. Literature Survey

Reza Khalilian et al.[2016] “An Efficient Method To Improve WBAN Security” This paper presents a new method which helps to improve the security issues of WBANs. The goal of this paper is to decrease the required memory control packets complexity, controlling buffer over flow and controlling the existing damage by using high transferring speed of data between nodes. In this paper the security is improved by using AES-256 scheme.

Uttara Gogate et al.[2016], Healthcare advancements have effectively entered the Wireless age through utilization of Wireless systems. Crucial medicinal services administrations, for example, restorative information examination, therapeutic checking and ready administrations are today plausible to ordinary citizens through this use of Wireless systems. These systems will fundamentally change Healthcare by giving elements of portability, adaptability and consistent observing. A cost proficient, vitality effective and reduced outline is displayed to encourage further advancement of this worldview.

Prof. Prashant S Bibave et al.[2016], A wireless Sensor Network system is having the capacity to screen the Human Health, Structural wellbeing observing for building, spans. In this paper a review on Human wellbeing checking and Structural wellbeing observing is appeared by utilizing remote sensors system. Distinctive applications by remote sensors for social insurance framework are examined. Specialized difficulties with respect to social insurance framework are clarified. Use of omnipresent for basic checking likewise clarified. The focal points and utilizations of remote Sensor Network framework additionally examined. This paper is absolutely an overview of prior work of various Authors.

Nitya et al[2013], In this paper authors propose a system architecture for smart healthcare based on an advanced Wireless Sensor Network (WSN). It particularly targets helped living occupants and other people who may profit by consistent, remote wellbeing observing .It displays best practices in remote sensor system outline for human services applications. Taking into account the most vital angles like force productivity and security which control the advancement of a remote sensor system based applications.

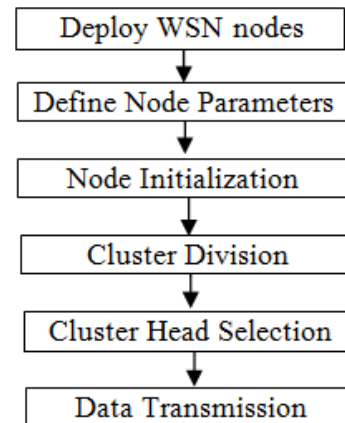
Anurag Tiwari et al.[2016] “Security and Privacy in E-Healthcare checking with WBAN” WBAN are to a great degree vital for those individuals which are experiencing sicknesses like heart related ailments ,rationally agitated patients ,pregnant lady, and so on, they require constant perception .Since because of web related every one of these exercises ,they require more security. So this paper exhibits a security and protection related issues.

## 3. Proposed Methodology

Wireless body area network is an extension of wireless sensor network. In the process of WBAN sensor nodes has been placed on the human body parts to sense various types of information. Sensed information has been transmitted over the network using sink node. Sink node available in the

network use different information for data collection from the sensor nodes. Sensor node transmits information based on routing protocol for data transmission over the network. In the purposed work different nodes have been used for data forwarding and data aggregation over the network.

In the purposed work various sensor nodes have been deployed over the network that used for sensing information. These nodes have to be route selection on the basis of energy consumption over the network. Energy is the main constraint for network lifetime. Energy awareness has to be achieved on selection of path defined by the system.



**Figure 4.1:** Flow of Purposed Work

This figure represents flow of the purposed work that has to be carried out for data transmission over the network. In the purposed work various steps must be carried out for achievement of desired objectives. In the purposed work energy aware cluster based routing strategy has been used for network deployment.

In this deployment various phases has been used for development various phases has been initialized for sensing and transmitting information over the network.

### A. Parameter Setup Phase

In this phase of networking various parameters have been initialized for network deployment and configuration. These parameters are essential for nodes configuration and nodes data transmission over the network.

**Table 4.1:** Simulation Parameters Setup

Parameters	Value
Number of Nodes (n)	12
Total Energy (E)	0.5
Energy transmission (ETX)	50 nJ
Energy Receiving (ERX)	50 nJ
Data Aggregation Energy (EDA)	50 nJ
Message Size (S)	4000 bits
Frequency (f)	2.54 GHz

The above table represent various simulation parameters that have been defined in the purposed work for simulation process. In the purposed work these different parameters

have been used for network initialization and data transmission.

### B. Deployment of Nodes

After initialization of different parameters of simulation nodes deployment has been done for sensing information. After deployment of the sensor nodes sink node has been deployed on human body so that it at equidistance from the entire deployed sensor nodes. After deployment of the nodes at different locations on body parts distance between different nodes has been measured by using distance computation formula. The nodes are deployed having x & y co-ordinates at a particular location.

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \quad (4.1)$$

Equation (4.1) represents distance computation for two different nodes that are placed at different locations (x1,y1) and (x2, y2). On the basis of distance nodes have been divided into different clusters. Distance between different nodes is also used for energy calculation in data transmission.

### C. Cluster Head Selection

After deployment of sensor nodes in the body environment cluster division has been done. On the basis of nodes density clusters have been divided in the network. After cluster division distance between different cluster members has been measured and energy available at a particular node has been measured. On the basis of maximum energy containing node cluster head has been evaluated.

Transmission energy has been computed by using equation (4.2)

$$ETX = (ETX + EDA) * S * d^4 \quad (4.2)$$

Receiving energy has been computed by using equation (4.3)

$$ERX = (ERX + EDA) * S \quad (4.3)$$

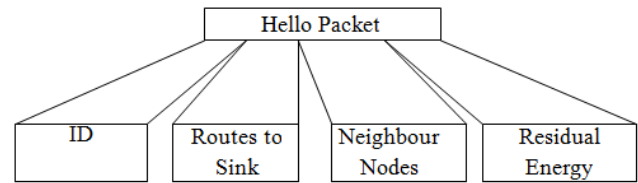
Residual energy is the energy that has been available to particular node is amount of energy available to a node after transmission of data from nodes to base station. This energy has been computed by using this equation (4.4).

$$\text{Residual Energy} = E - (ETX + EDA) * S * d^4 \quad (4.4)$$

On the basis of residual energy and mean distance from the cluster member nodes selection of cluster head has been done. The node containing maximum energy and at minimum mean distance from all the nodes within a cluster has been elected as cluster head node. After election of cluster head hello message has been broadcast by the cluster node about its location, id and neighbor nodes.

### D. Start-up Phase

In this phase, the sink broadcasts a HELLO packet to all the nodes. Each node receives this packet and stores the location of the sink. Then each node broadcasts a packet which contains the ID of a node, its location and the value of the residual energy. In this way, all nodes are updated with the location of neighboring nodes, position of the sink and possible routes to the sink. Fig. 4.2 depicts the format of the HELLO packet.



**Figure 4.2: Hello Message Format**

### E. Routing Phase

After selection of cluster head in a cluster data transmission from the routes has been started. In this process nodes that have to transmit data these nodes sense information from the human body. After sensing information route has been selected for sensed information. In the purposed work distance between cluster head and sink has been measured. Nodes between the clusters transmit sensed information to elected cluster head node and cluster head measure distance from sink node. On the basis of distance cluster head can transmit information directly to base station and with help of other cluster heads available in the network. In transmission of data TDMA approach has been used. This approach that has been used for transmission of data provides time slot for all the nodes available in the network so that easily information can be transmit to base station without any collision.

### F. Parameter Analysis

After routing phase data transmission has been done. In the purposed work network lifetime, packet transmit has been measured for performance evaluation. Network lifetime is the process that provides information about network performance on the basis of different energy levels. As network lifetime increases cost management for WBAN is decreased.

## 4. Results and Discussion

Wireless Body Area Sensors are used to monitor human health with restricted vitality assets. Diverse vitality effective steering plans are utilized to forward information from body sensors to medicinal server. It is critical that detected information of patient dependably got to restorative pro for further examination. At whatever point sink hub leaves from transmission scope of hubs, it utilizes a hand-off hub which gather information from sensor hubs. In pioneering convention, at whatever point quiet moves his hands, the remote connection of sink with sensor hubs detaches. Vitality Consumption is fundamental issue in the Wireless Sensor Network. To minimize energy consumption and to increase the throughput, we propose a new scheme. In our results we are elimination all these problems by analytical study of various routing protocols in the Wireless Body Area Networks (WBANs) which mainly focus link efficiency of networks that had high impact on network performance & Proposed design of a reliable and power efficient routing protocol for Wireless Body Area Networks (WBANs). We are Implementing WBAN routing protocol based on proposed cost function. Wireless Body Sensor networks with any nodes will be implemented to carry out extensive simulations. The sensor field's dimension will be 0.01 Kilometre Square. Then the transmission power, receiving power and electronics power of each node will be calculated. If the txc, trx and elx power is low then the node

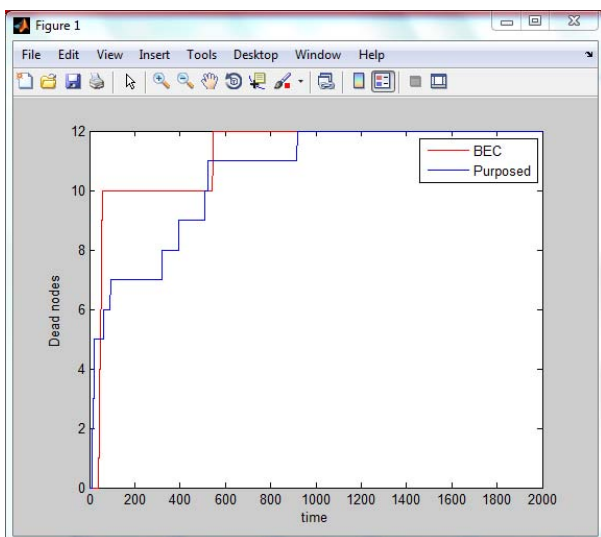
will be simulated to die. The alive nodes will be found out and which node has high energy will become a cluster head.

**a) Performance Parameters**

Given below are some key parameters considered for performance of WBAN. Dentition of performance metrics is given in following subsections.

- 1) Network lifetime: It represents the total network operation time till the last node die.
- 2) Stability period: Stability period is the time span of network operation till the rest node die. The time period after the death of rest node is termed as unstable period.
- 3) Throughput: Throughput is the total number of packets successfully received at sink.
- 4) Residual Energy: In order to investigate the energy consumption of nodes per round, we consider residual energy parameter to analyze energy consumption of network.
- 5) Path Loss: Path loss is the difference between the transmitted power of transmitting node and received power at receiving node. It is measured in decibels (dB).

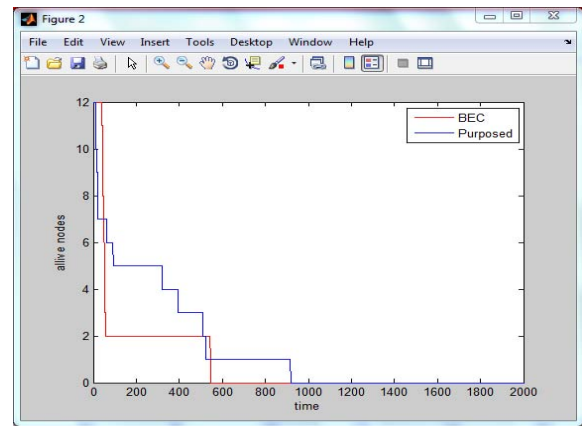
The following graph represents the comparison between the existing and proposed system on the basis of total number of dead nodes.



**Figure 5.5:** Represent Dead nodes

This graph is use to represent the Dead nodes in the graph. Dead nodes mean these nodes whose energy is zero. The Red line is used to represent the BEC protocol and blue line is used to represent the dynamic clustering.

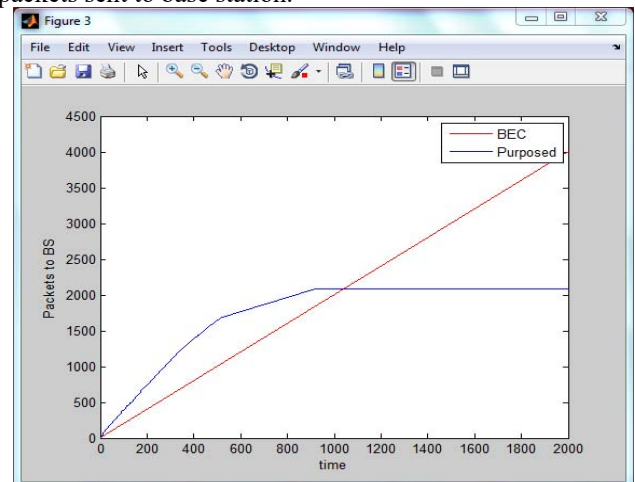
The following graph represents the comparison between the existing and proposed system on the basis of total number of alive nodes.



**Figure 5.5:** Represent alive nodes

This graph is used to represent the Alive nodes in the graph. Alive nodes are those nodes whose send and receive data successfully during transmission & whose energy level is not zero. The Red line is used to represent the BEC protocol and blue line is used to represent the dynamic clustering.

The following graph represents the comparison between the existing and proposed system on the basis of total number of packets sent to base station.



**Figure 5.7:** Represent Packet to BS

This Figure is use to represent to Packet to base station. It means how much packets received by base station successfully. The Red line is used to represent the BEC protocol and blue line is used to represent the dynamic clustering.

**5. Conclusion and Future Scope**

**a) Conclusion**

Wireless Sensor Networks (WSNs) are used to monitor certain parameters in many applications like environment monitoring, habitant monitoring, battle field, agriculture field monitoring and smart homes. These wireless sensors are dispersed in sensing area to monitor field. WBAN is new emerging sub-field of WSN. Wireless Body Area Sensors are used to monitor human health with limited energy resources. Different energy efficient routing schemes are used to forward data from body sensors to medical server. It is important that sensed data of patient reliably received to medical specialist for further analysis.

In this purposed WBAN energy aware clustering based routing protocol has been purposed that has been used for sensing information from human body and transmits this to base station for processing. In this whole network has been divided into different cluster and cluster members have been used for election of best cluster head on the basis of maximum energy and minimum distance from cluster head. In this cluster head selection is dynamically that changes after every round. On the basis of dynamic cluster head selection every node has opportunity to act as a cluster head in single round. Cluster head transmit hello packet to all the nodes that contain information about available bandwidth, id, route and energy available. All the nodes receive packet and start transmission of data to a particular cluster head. Cluster head is responsible for data transmission to base station either directly or via other cluster head available in the network. At last we got various types of parameters i.e. network lifetime, throughput, residual energy and network path loss etc. On the basis of these parameters we conclude that our system gives us better results.

#### **b) Future Scope**

Overall an improved technique has been implemented for wireless body area network .For future work, this wok can be further extended using different performance metrics.

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