Reduced Energy Based Wireless Sensor Body Area Network

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ABSTRACT

The creation of (WBANs) wireless sensor body area networks are driven by the rapid advent in wearable computing and wearable sensor tools. The WBANs consists of remotely attached miniaturized sensors mounted in or on the patient body that provide continuous tracking of physiological indications to help medical, lifestyle and entertainment applications. This paper provides a study of the wireless sensor-based body area networks explanation. Moreover, in this concentrate on certain software of a special interest in patient care. The contact in the WBAN and its location between the various technologies would then be addressed. In this research work, suggest a routing protocol that provides highly effective and stable throughput for wireless body area networks. Multi-hop topology is used to obtain low energy usage and longer network life. In this paper suggest a cost feature to select forwarder or parent node. The new proposed cost method selects the parent node that has strong residual energy and the least distance to fall. Residual energy parameter controls the energy usage of the nodes when the distance parameter guarantees the efficient transmission of the packet. The cost function is analyzed and compared on performance measuring metrics Throughput, Path Loss, Network lifetime, Residual Energy, Stability period using MATLAB.

Keywords: Health care Applications, wireless body area sensor networks WSN, patient monitoring.

1. INTRODUCTION

A Wireless Sensor Body Area Network (WBAN) is an emerging invention, a sub-field of the wireless sensor network (WSN), primarily developed to track and collect data from wireless sensors [1]. The system is very exciting and has implementation in a broad variety of areas, such as ecosystem surveillance, agricultural field tracking, smart houses, battlefields, etc. One of the significant uses of WBAN is the healthcare industry, where patient wellbeing is tracked continuously on an ongoing basis and knowledge exchanged by the end consumer or the server. In order to track vital parameters such as heartbeat, blood pressure, glucose content, body temperature, etc., health tracking devices are either mounted or inserted on the human body. There is no question that the effects of tracking human safety environment by the usage of existing WBAN technologies would minimize inpatient expenditure [2] [3]. WBAN is equipped with a specific purpose module that can be individually attached to a number of sensors and devices around the patient or human body. Figure 1 demonstrates a basic WBAN architecture where the design is separated into many parts. In this split the network design into four parts. The first segment is the WBAN component consisting of wide range of sensor nodes. Any wired communication in a control network can be troublesome and uncomfortable for a person and may limit his or her mobility [2]. WBAN may therefore be a very successful solution in this field, especially healthcare applications, where the individual needs to be constantly watched and autonomy is needed. The next segment is the coordination node where all the sensor nodes are explicitly linked to the coordination node identified as the Central Control Unit (CCU). The CCU shall have the authority to gather data from the sensor nodes and forward the segment. To track the movements of the human body [3] [4].

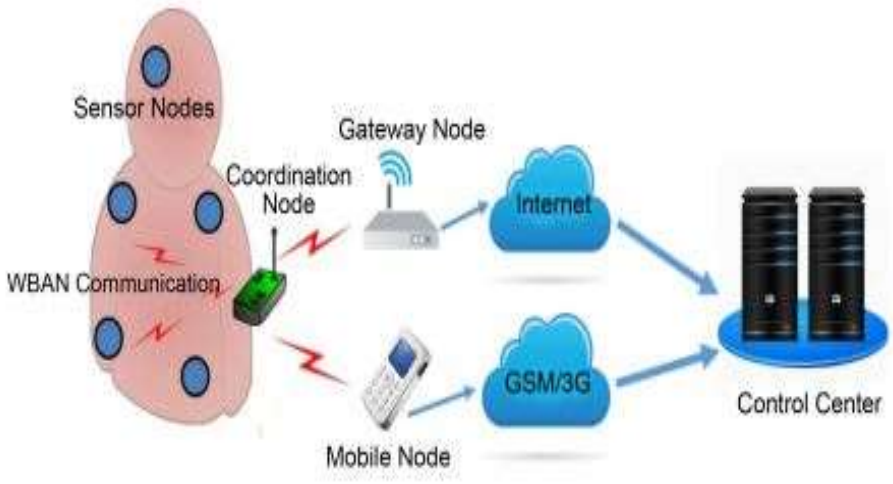

Fig 1. WBAN Architecture [1]

Technologies and Standards for wireless body area network

Wireless body area network is a short-range network, various forms of short-range wireless infrastructure may be used at different times. In this segment, define the most popular technology like, ZigBee, Wi-Fi, IEEE 802.15.6, Bluetooth etc. can be applied to create WBAN [1][3].

Bluetooth: Bluetooth is known as Wireless Personal Area Network. Its standard is an IEEE 802.15.1 Bluetooth technology was established as a short-range wireless networking protocol, and is planned to create a stable network with low power consumption. A precise kind of Bluetooth network may be constructed with more than one Piconet known as Scatter net [4] [5].

ZigBee: ZigBee is an IEEE 802.15.4 combined wireless networking systems improved for sensors and controls and ideal for usage in extreme or isolated conditions. One of the biggest aids of the ZigBee network is its low power usage. ZigBee network topology consists of three groups of computers or nodes, such as coordinators, routers and end users. There is one controller in each ZigBee network. Starts the network and performs the control tasks as well as the application routing structures. End systems are machines that are battery-powered owing to their low power usage. Some of the time, they are in stand-in mode and are involved in data gathering and transmission [1][2][6].

Wi-Fi: Wi-Fi is an IEEE 802.11 interface for a wireless local area network called WLAN network. Commonly, Wi-Fi hardware arrives with four protocols (802.11 a ,802.11 b, 802.11 g, 802.11 n) working in two different bands 5 and 2.4 GHz with a modest 100-meter range. Wi-Fi enables customers to transmit data at high speed while linked ad hoc mode and to an access point or access point. Wi-Fi is best suited for a huge number of high-speed wireless data connections that enable video conferencing, voice and video streaming [7]. An important benefit is that both smartphones, tablets and laptops have Wi-Fi integrated; however, heavy energy usage is the biggest drawback of this system

Applications [1][3][5]

- Remote Healthcare Monitoring
- Medical Applications
- Telemedicine
- Assisted Living

2. RELATED WORK

Negra et al. [1] Author discussed the rise adoption of wireless networks and the stable maturation of electrical forward/non-invasive devices which allows the deployment of WBAN. Due to

showing a wide variety of certain technologies, using the proper technology for a medical function is being a face down. In this paper, the different medical applications are presented.

Ghamari et al. [2] Author gathered data which was forwarded to the sink utilizing current wireless connectivity protocols for additional processing. This material introduces researchers with the intention of contrasting existing low-power communication technologies that could theoretically direct the accelerated production and implementation of WBAN systems, and focuses primarily on remote control of elderly or critically ill patients in urban aura.

Yazdi et al. [5] In this author reviews the literature and discusses the complexities of the WBANs' creation architecture. And also defined the problems of WBANs that required to be handled in order to improve them. In addition, examine the different illnesses and healthcare services and the latest state-of-the-art technologies and concentrate primarily on clinical surveillance of aged and critically ill patients.

Quwaider et al. [6] In this the author describe an area-based store-and-fleading routing algorithm for WBAN with continuous postural separation. The WBAN prototype was prearranged to reflect on-body topology detachment analytically in the context of ultra-short-range radio networks, unpredictable RF depletion, and human postural flexibility. It is shown that by completely leveraging the location node knowledge, the new algorithm can provide better routing delay as compared to established probabilistic routing protocols in the literature.

3. PROPOSED METHOD

Wireless Body Field Devices are used for tracking human safety with minimal energy resources. The noticeably experienced routing methods are handed on to the advancing information from the body sensors to the medical repository. It is important to predict the specifics of the case specifically designated for the medical expert for further examination. Planned process support for reliability at low performance and additional hardware number of relay nodes. They're putting a sink in the hand. If the node of the sink goes further from the connection of nodes, it adopts a relay node that collects information from the nodes of the sensor. In a resourceful procedure, as the patient lifts his head, the wireless link in the sensor and the sink nodes becomes abrupt. Link breakdown absorb also function of sensor nodes and relay node also more packets will drop, which causes important and critical data to loss [3] [4] [8] [9].

Moreover, to overcome power consumption and maximize efficiency, a new program has been implemented. In fact, our suggested scheme manages a longer stable period. Nodes stay active longer and use less resources. The long stable time and the low energy usage of the nodes lead to high throughput [10] [11] [12].

4. EXPERMENTAL

The experiment was implemented in MATLAB R2019a. The system used in this experiment was Intel® i5-5200U CPU at 2.20 GHz with 4 GB of RAM and 1TB HDD. The proposed protocol was evaluated based on following parameters Throughput, Path Loss, Network lifetime, Residual Energy, Stability period. In this paper evaluated primary key feature metrics for proposed protocol. Explanation of performance metrics is given in following subsections.

1. Throughput: Throughput is the total sum of packets reached at destination successfully [4][13] [14].

2. Path Loss: Route failure is the gap between the transmission power of the node and the transmitted power at the receiving node. This is calculated by decibels (dB) [4][13].

3. Network lifetime: This reflects the cumulative duration of the network activity before the last node dies [1][13][15].

4. Residual Energy: In order to examine the energy consumption of nodes per circle, we find the residual energy parameter to evaluate the energy usage of the grid [13].

5. Stability period: The equilibrium duration is the duration of network activity before the first node dies. The time after first node dead is called an unstable time [4][13] [15].

5. RESULTS AND DISCUSSION

1. Throughput

- Network Throughput is the total sum of packets reached at destination successfully.
- More alive nodes contribute towards higher throughput. [4][13].

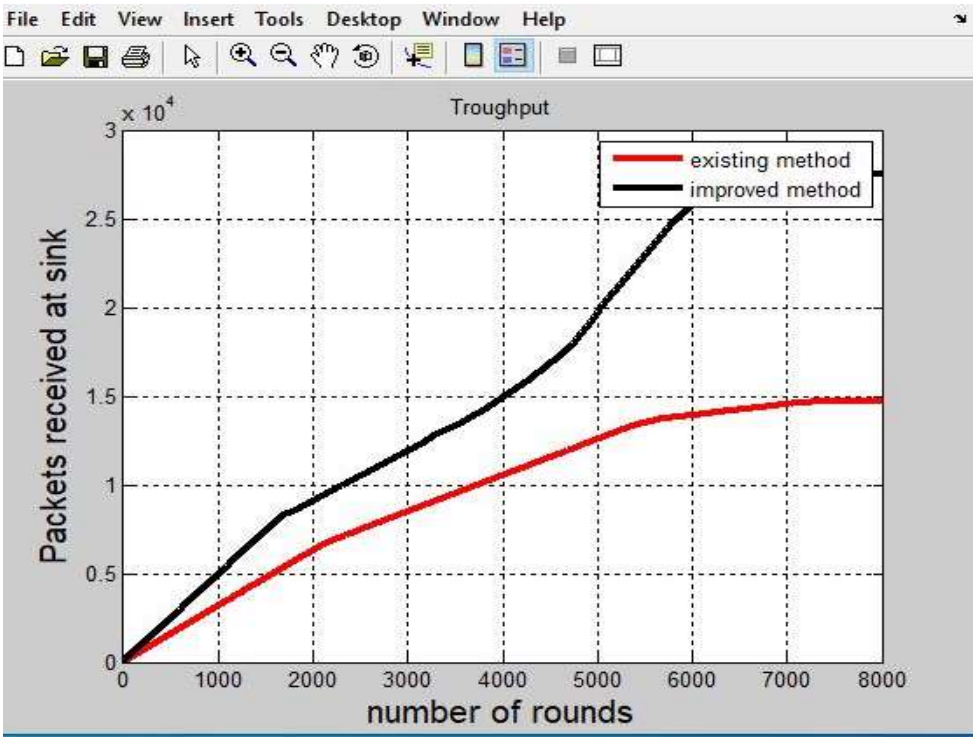

Fig. 2: Analysis of Throughput

In Fig 2 shown Throughput when round increase then packet speed (packet received at sink) also increases. Packet speed show in kbps and rounds define the how much packets send source to sink at a time. In existing method only 15000 packets received at 8000 rounds and but in improved method 27000 packets received at 8000 rounds increase number of packets received. The new method better than existing method.

2. Path Loss

- The Path loss is reduced by using multi-hop technology.
- Maximum path loss due to direct distant communication [1][4][13].

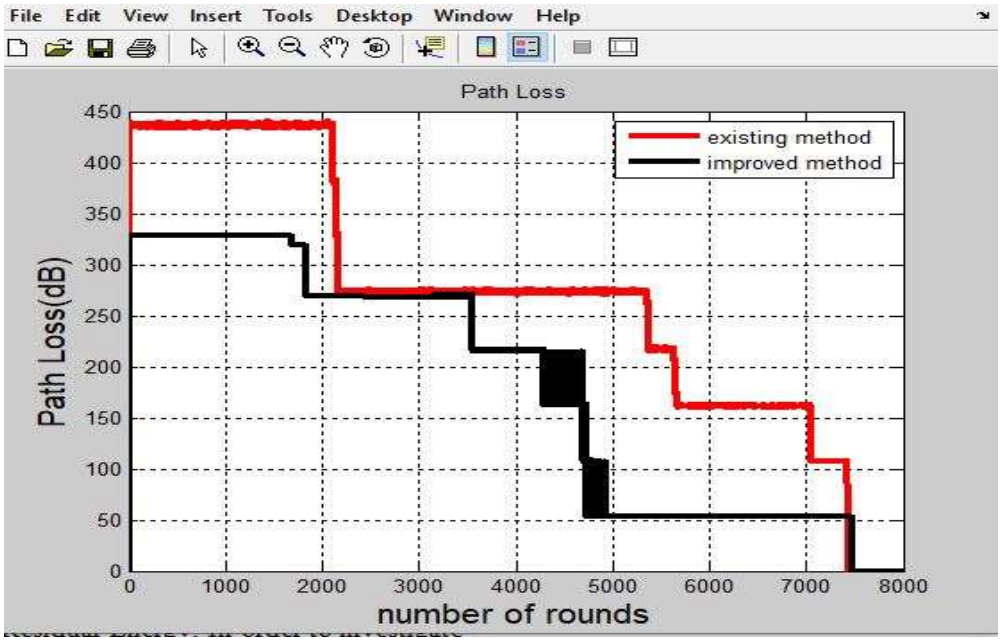

Fig. 3: Analysis of Network path loss

In Fig 3 shown Network path loss when count of rounds increase then path loss decreases. Path loss show in decibels. In this fig when nodes send packet in Fourth round 4000 packets the path loss rate in new method is nearly 225dB but in existing method the path loss rate is 375dB. Graph shows Maximum path loss in existing method is 440 but only 330 in improved method. This graph clearly shows that proposed method reduces path loss.

3. Network lifetime

- Increase in stability period due to appropriate selection of forwarder node in each round.
- Balanced energy consumption among all nodes in stable region [4] [13][15].

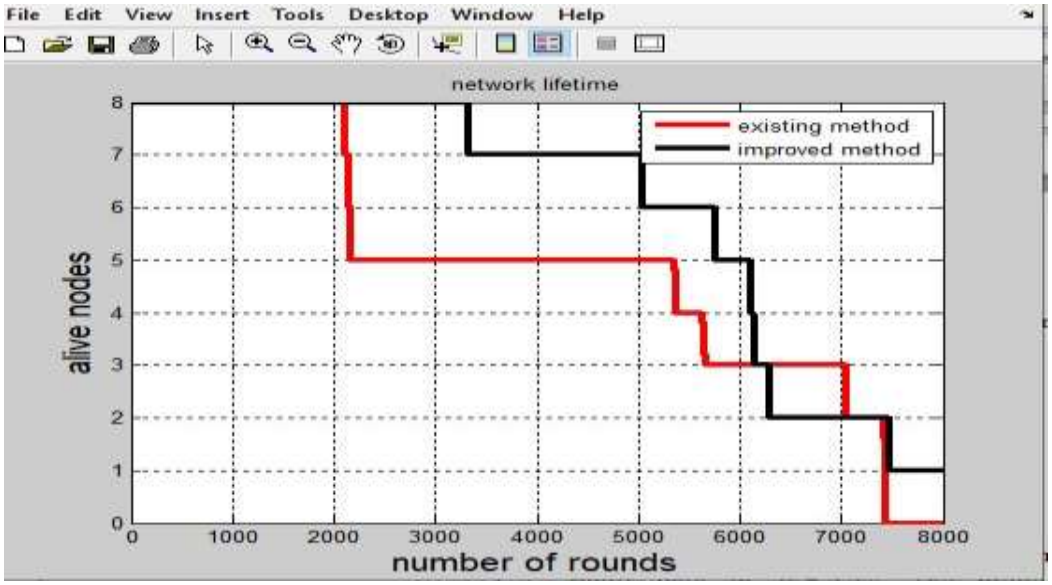

Fig. 4: Analysis of Network Lifetime

In Fig 4 shown Network lifetime when number of rounds increase then the number of alive nodes very less due to energy loss. In this fig when nodes send packet in Fourth round 4000 packets the number of alive nodes in new method is 7 but in existing method the alive node is 5. It is shown new method better than existing method in case of network life time.

4. Residual Energy

- Nodes drain less power during stability phase.
- Nodes drain faster in unstable period [1] [13].

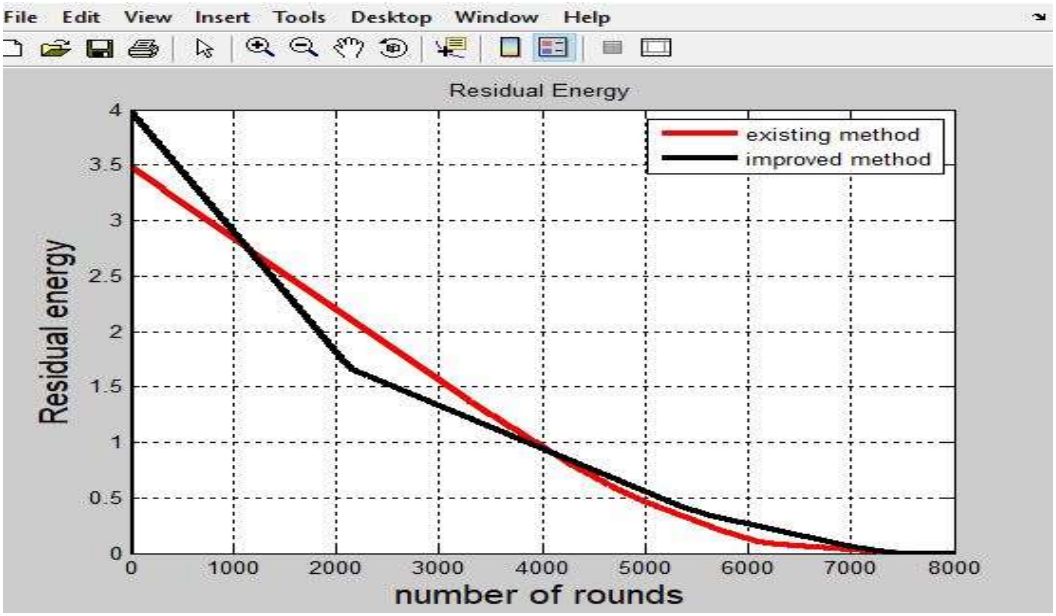

Fig. 5: Analysis of Remaining energy

In Fig 5 shown Remaining energy (Residual energy) when number of rounds increase then the residual energy is decreases. Residual energy or remaining energy shown in joules. In this fig when nodes send packet in Fifth round 5000 packets the residual energy in Improved method is nearly 0.6 joules but in existing method only 0.4 joules are the residual energy. This graph clearly shows that proposed method improves residual energy of network. In existing method residual energy decrease rapidly but in proposed method it decreases slowly.

5. Stability period

- Packet loss occurs in network when one or more packets of data travelling across a computer network fail to get their final destination [4][13] [15].

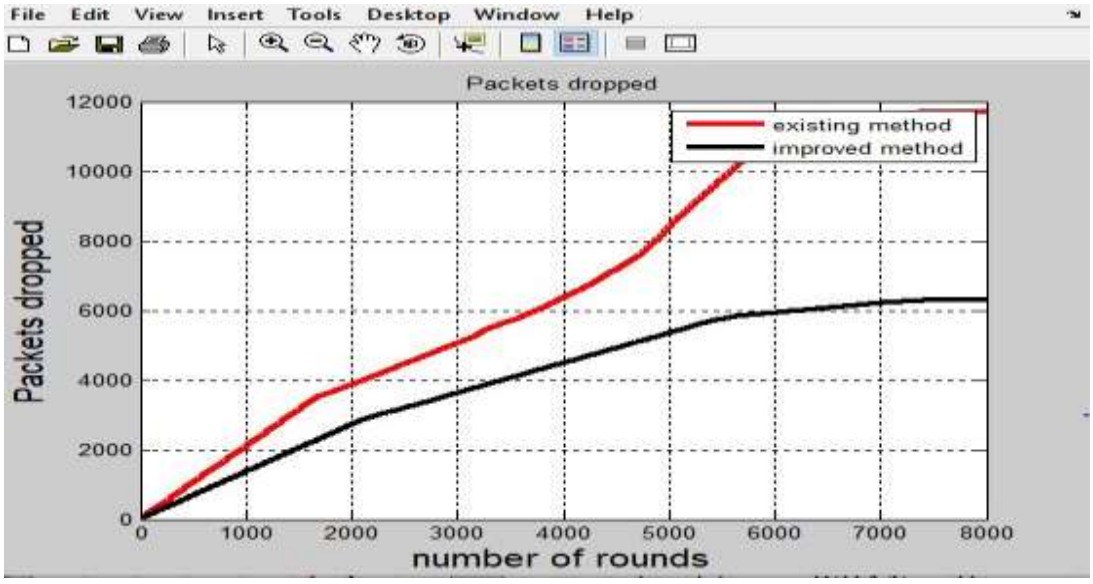

Fig. 6: Analysis of Packets Dropped

In Fig 6 shown Packet Dropped when rounds rise then the Packet dropped ratio is also increases. This graph shows less packet drop in new method as compare to existing method.eg. At 5000 rounds, 8000 packets drop in existing method but only 5500 pack drop in proposed method.

6. CONCLUSION AND FUTURE SCOPE

In this paper a new method to route data to WBANs. The suggested scheme uses the expense feature to choose the correct path to fall.

Nodes with a lower cost function value are selected as the parent node. Certain nodes are the offspring of the parent node and transmit packets to the parent node. Glucose and ECG monitoring nodes transmit their packets directly to their sink node because they are located near the sink, but these two nodes cannot be selected as the parent node since both sensor nodes provide sensitive and relevant medical data. It is not necessary for these two nodes to drain its resources in the transmission of data from other nodes. Our analysis tests demonstrate that the suggested routing scheme increases the network stability period and the packet sent to the sink.

Path loss is also being explored in this protocol and in future research, we will incorporate Expected Transmission Count (ETX) relation metrics as demonstrated**.**

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