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# New Improved Simple Protocol for Wireless Body Area Network

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**ABSTRACT**

The creation of Wireless Body Area Networks has been enabled by recent advancements in wearable computing and wearable sensor devices (WBANs). The wireless body area network consists of remotely linked miniaturised sensors mounted in, on or around the human body, providing continuous monitoring of physiological signs to support applications for medicine, lifestyle and entertainment. We propose a secure, power-efficient and high-throughput routing protocol for Wireless Body Area Networks in this research work. To achieve minimum energy consumption and longer network lifespan, we use multi-hop topology. In order to pick the parent node or forwarder, we propose a cost function. A parent node with high residual energy and a minimum distance to sink is selected by the pro-posed cost function. The residual energy parameter balances the energy consumption between sensor nodes, while the distance parameter ensures that the packet is transmitted successfully to the sink.

***KEYWORDS:*** *Patient monitoring, Wireless body area networks, Health care Applications, WSN etc*

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## INTRODUCTION

### Wireless sensor body area network

The latest emerging sub-field of WSN is WBAN. Health monitoring is a primary application of WBAN. For monitoring vital signs such as blood pressure, body temperature, heart rate, glucose level, etc., wireless sensors are mounted on the human body or inserted in the body. Using WBAN technology to monitor health parameters dramatically reduces hospital patient spending. Patients are tracked at home for [1] longer periods of time with the aid of WBAN technology. Data is constantly sensed by sensors and forwarded to medical servers.

The Wireless Body Area Network (WBAN) is a telemedicine-integrated wearable health monitoring device, a technology capable of enabling the early identification of abnormal conditions and the avoidance of their severe consequences. A WBAN consists of a variety of tiny sensor nodes used to connect to an external database server, as well as a gateway node. The sensor node could be connected to a variety of telecommunication networks by the Gateway node. A regular [2] telephone network, cell phone network, a dedicated hospital/medical centre network or public WLAN hotspots may be the contact network (WiFi). WBAN will also work with mobile data networks to relay data from patients, such as 3G/4G networks. WBAN may allow their personal data to be stored on any portable device (PDA / iPod, etc and then transferred to suitable computers. The ICT [3] systems are already in use in medical areas but their applications are limited. The main drawback of current systems is the location specific nature of the system due to the use of fixed/wired systems. WBAN are location independent monitoring systems.

WBAN are classified into 2 categories

1. Wearable WBAN
2. Implantable WBAN

In WBANs, sensor nodes are operated with limited energy source. It is required to use minimum power for transmitting data from sensor nodes to sink. One of the major obstacles in WBAN is to recharge the batteries[4]. An efficient routing proto - col is required to overcome this issue of recharging batteries. Many energy efficient routing protocols are proposed in WSN technology. However, WSNs and WBANs have different architectures, applications and operate in different conditions. It is impossible to port WSN routing protocols to WBAN. Therefore, energy efficient routing protocol for WBAN is required to monitor patients for longer period.

We propose a high throughput, reliable and stable routing protocol for WBAN. We deploy sensor nodes on the body at fixed places. We place sink at waist. Sensors for ECG and Glucose level are placed near the sink. Both these sensors have critical data of patient and required minimum attenuation, high reliability and long life therefore; these sensors always transmit their data directly to sink. Other

sensors follow their parent node and transmit their data to sink through forwarder node. It saves energy of nodes and network works for longer period.

WBAN is designed with special purpose sensor which can autonomously connect with various sensors and appliances, located inside and outside of a human body. Figure demonstrates a simple WBAN architecture where the architecture is divided into several sections. Here we have classified the network architecture into four sections. The first section is the WBAN part which consists of several numbers of sensor nodes. These nodes are cheap and low-power nodes with inertial and physiological sensors, strategically placed on the human body. All the sensors[5][6][7] can be used for continuous monitoring of movement, vital parameters like heart rate, ECG, Blood pressure etc. and the surrounding environment. There are vast monitoring systems are being used already based on wired connections. Any wired connection in a monitoring system can be problematic and awkward worn by a person and could restrict his mobility. So, WBAN can be a very effective solution in this area especially in a healthcare system where a patient needs to be monitored continuously and requires mobility. The next section is the coordination node where the entire sensor nodes will directly-connected with a coordination node known as Central Control Unit (CCU). CCU takes the responsibility to collect information from the sensor nodes and to deliver to the next section. For monitoring human body activities :


**Fig1. WBAN Architecture [8]**

There is no such wireless technology is fixed for targeting WBAN. Most popular wireless technologies used for medical monitoring system are WLAN, Wi-Fi, GSM, 3G, 4G, WPAN (Bluetooth, ZigBee) etc.

**PERFORMANCE METRICS:**

We evaluated key performance metrics for proposed protocol. Definition of performance metrics is given in following [9] subsections.

1. Network lifetime: This indicates the cumulative operating time of the network before the last node dies.
2. Stability period: The time span of network operation before the first node dies is the stability period.
3. Time period after the death of first node is termed as unstable period.
4. Throughput: Throughput is the total number of packets successfully received at sink.
5. Residual Energy: We consider residual energy parameters for analysis of network energy usage in order to investigate the energy consumption of nodes per round.
6. Path Loss: The difference between the transmitted power of the transmitting node and the power obtained at the receiving node is path loss. In decibels, it is measured (dB).

**Topology used in WBANs**

The IEEE 802.15.6 working group considered that WBANs would run in either a single-hop or two-hop star topology, with the node located at a position like the waist in the middle of the star. In the single-hop star topology, two feasible forms of data transmission occur: transmission from the system to the coordinator and transmission from the coordinator to the computer. Beacon mode and non-beacon mode are communication mechanisms that exist in the topology of the stars. In beacon mode, the communication is controlled by the network controller, who is the node in the centre of the star topology. To allow network association control and system synchronisation, [10][11] it transmits periodic beacons to define the beginning and end of a super framework. The service cycle of the device, which is the duration of the beacon time, may be determined by the consumer on the basis of the WBAN standard. In non-beacon mode, a node on the network is capable of sending data to the coordinator and can use the CSMA / CA (Carrier Sense Multiple Access Collision Avoidance) mode when required. The nodes need to be powered up and the coordinator needs to be surveyed to collect results. The organizer cannot connect with the nodes at all times, though, because the nodes will wait before they are invited to join in the communication.

**Results & Discussion**

To evaluate proposed protocol, we have conducted an extensive set of experiments using MATLAB.

1. Throughput
   Throughput is the number of packets received successfully at sink. More alive nodes contribute towards higher network throughput.

2. Path Loss
   Multi-hop topology minimizes the Path loss. Direct distant communication causes maximum path loss.

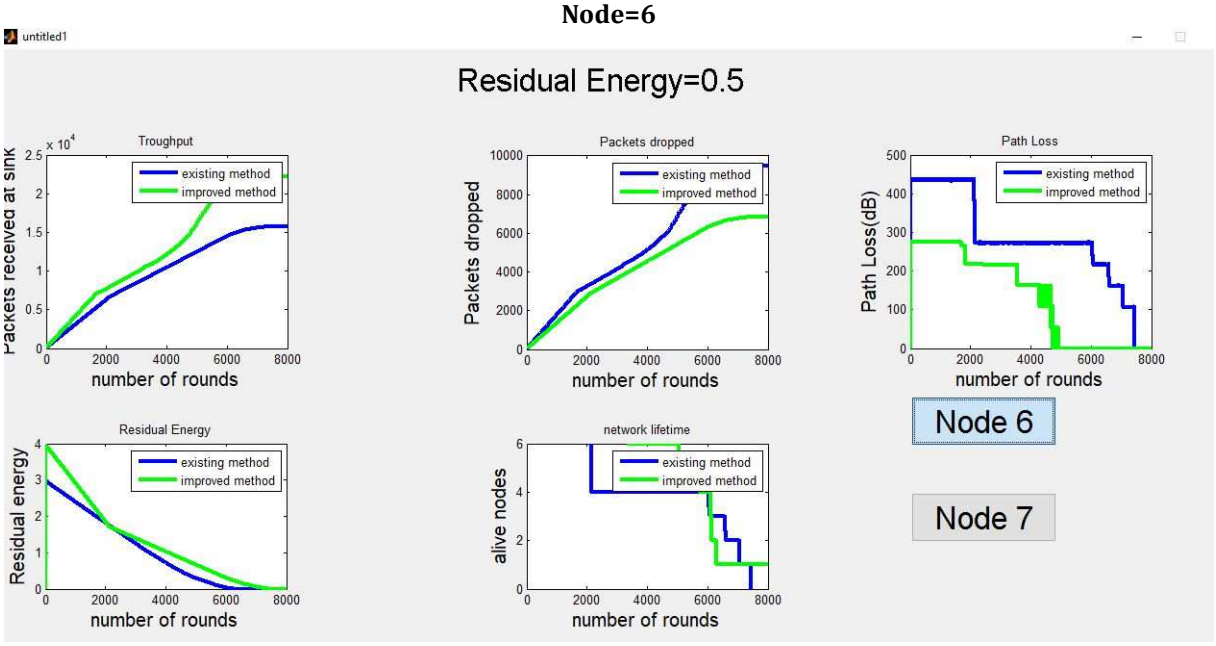
3. Network Lifetime
   Increase in stability period due to appropriate selection of forwarder node in each round. Balanced energy consumption among all nodes in stable region.

4. Energy
   Nodes utilize less energy in stability period. Nodes consume energy faster in unstable region.

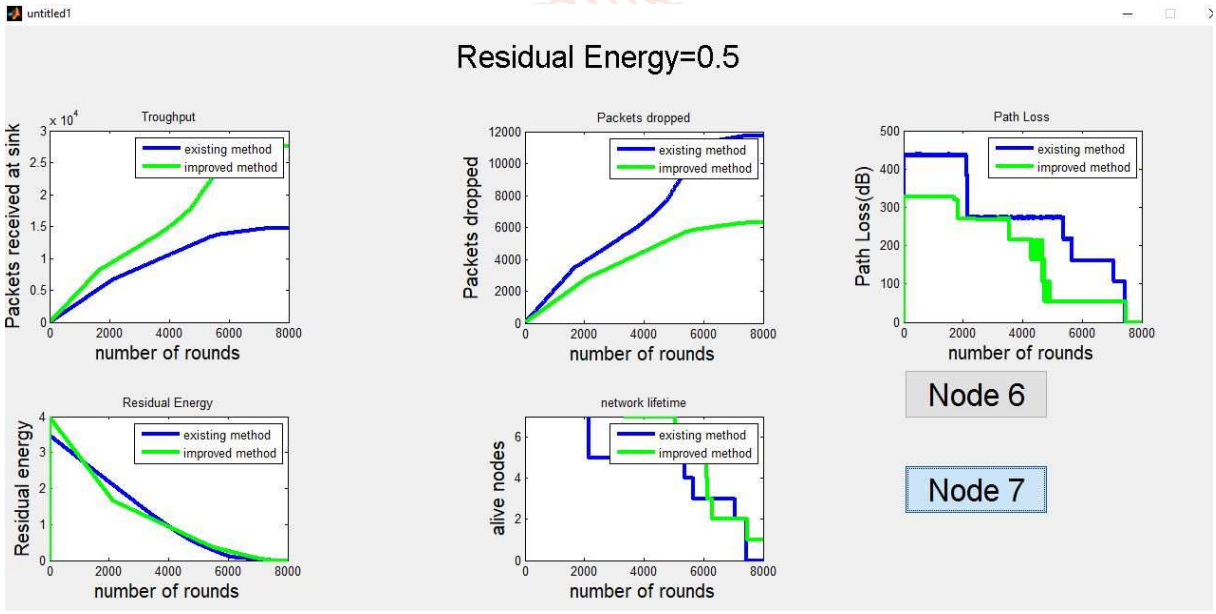
5. Packets Dropped
   Packet loss occurs when one or more packets of data travelling across a computer network fail to reach their destination.

Residual Energy=.5

**Node=6**

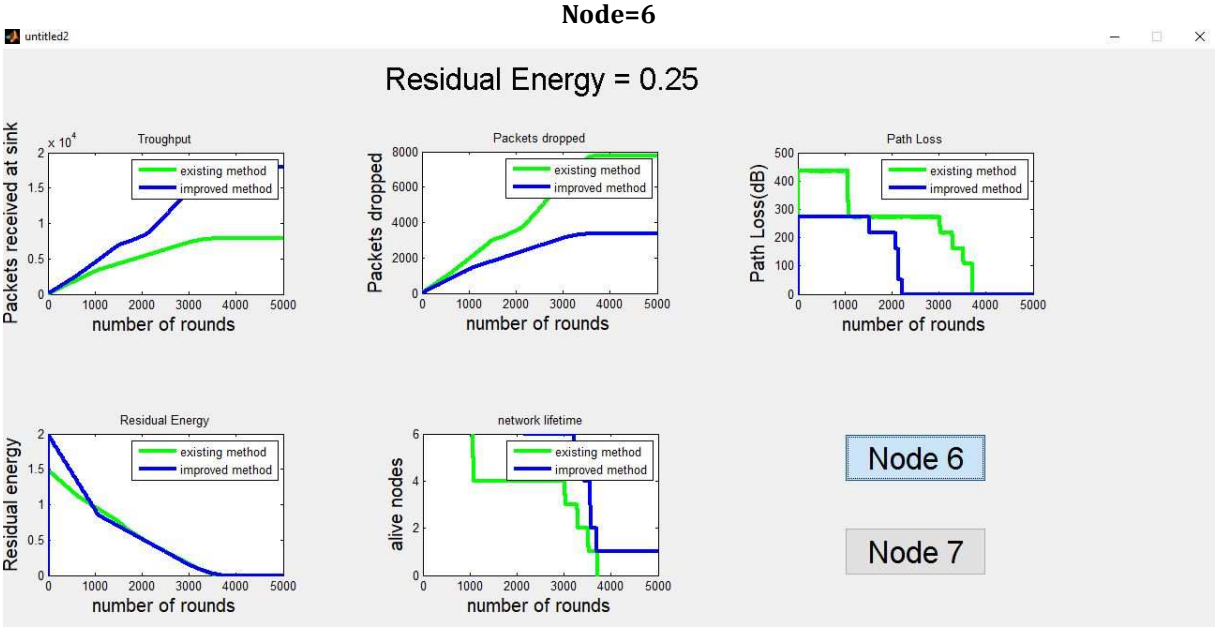



**Node=7**

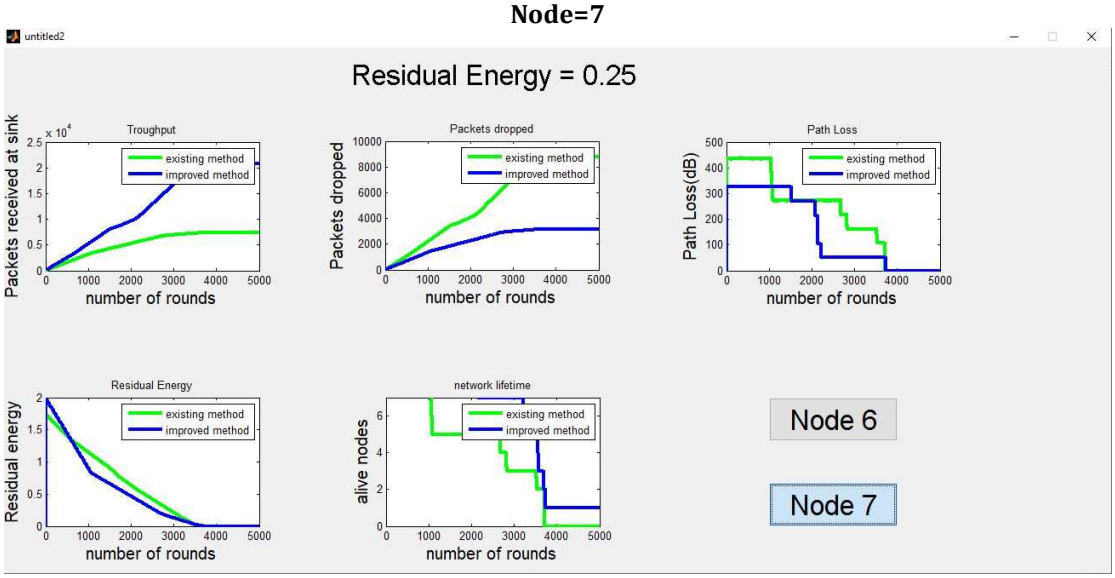



Residual Energy =.25

**Node=6**



**Node=7**




## Conclusion

We suggest a method for routing data to WBANs in this work. A cost function is used in the proposed scheme to choose the best route for sinking.

Nodes with a lower cost function value are chosen as parent nodes. The children of that parent node become the other nodes and forward their data to the parent node. Two ECG and Glucose monitoring nodes forward their data directly to sink as they are located close to sink, since both sensor nodes have important and relevant medical data, these two nodes can also not be chosen as parent node. These two nodes are not needed to deplete their energy in the forwarding of other node data. Our simulation results show that the proposed routing scheme improves the time and packet transmitted to sink network stability.

## FUTURE WORK

In future work, we will implement Expected Transmission Count (ETX) link metrics as demonstrated.

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