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Secure Data Transmission in IoT based on Optimization Based Routing Protocol for Wireless Body Area Networks

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Abstract—The security of Internet of Things (IoT) networks has become highly significant due to the growing number of IoT devices and the rise in data transfer across body area networks. The main purpose is to enhance the security level of data transmission between patients and health service providers by considering the availability of energy at sensor nodes through the Wireless Body Area Network. Energy efficiency is considered a foremost challenge to increase the lifetime of a network. To deal with energy efficiency, one of the important systems is selecting the relay node, which can be modeled as an optimization problem. This research proposes the patient health collected data are needed for transmission in IoT-Patient Care Monitoring (PCM) based on the Optimized Routing Protocol along WBANs. The proposed model focuses on a routing mechanism that makes use of an Optimization Routing-based Algorithm along with the relay node selection based on distances and residual energies. DO NOT USE SPECIAL CHARACTERS, SYMBOLS, OR MATH IN YOUR TITLE OR ABSTRACT.

Keywords-Internet of Things (IoT), Patient Care Monitoring (PCM), Optimization Routing protocol, Wireless Body Area Networks (WBAN).

I. INTRODUCTION*(HEADING 1)*

Currently, the Internet of Things (IoT) faces several challenges in meeting the demands of the future. The development of technology is focused on reducing the amount of data that must be transmitted and the amount of network traffic that must be handled. [14] Wireless Body Area Networks (WBAN) comprise of the nano sensor nodes placed in the human body to gather and monitor patient data. Body nodes collect data and transmit it to the medical server through a wireless channel. [12] In the Wireless Body Area Networks (WBAN), wearable sensors are used to screen and gather patient's medical record information remotely. At all times, WBAN systems are required to measure the security parameters like data delivery ratio, energy consumption of data transmission, loss of data and delay time of a patient's health records. WBAN must consider implementing security features that will guarantee the patient's medical data is protected from security attacks when being transferred, collected, processed, and stored safely. Cryptographic algorithms are classified into private or symmetric key algorithms and public or asymmetric key algorithms. [15].

II. LITERATURE REVIEW

Aditya Sai Srinivas Thuluva, Manivannan Sorakaya Somanathan (2021), IoT-based Patient Health Monitoring is considered for use in IoT sensors deployed in devices. During data transfers from devices connected to the patient's body to the doctor, the data may be susceptible to security threats. To propose the use of the traditional Caesar Cipher Algorithm (CCA) along with the Lightweight Encryption Algorithm (LEA) and the Received Signal Strength Indicator (RSSI) to detect and prevent Sybil attacks in an IoT environment. The proposed algorithm detects the false node in a particular path by announcing the attack to another node. It also prevents the attack by choosing an alternative path by which to forward data packets to the desired users. To ensure authentication, privacy and data integrity, the lightweight encryption algorithm with a 64-bit key is used with AODV as the routing protocol. The Ad Hoc On-Demand Distance Vector (AODV) routing protocol is utilized for creating the optimal route from one node to another. The data, which is encrypted by CCA with LEA, is transmitted via the route of AODV.[1]

Ch. Rajendra Prasad, Polaiah Bojja (2020), one of the major applications of Wireless Body Area Networks (WBAN), and the Internet of Things is the Electronic Health-Care systems. The progress in WBAN and implanted health monitoring technologies has strong potential to alter the future of healthcare services by enabling ubiquitous monitoring of patients. A hybrid energy-efficient routing protocol is proposed in this paper for the distributed Wireless Body Area Network. In which a hybrid communication method and a new synchronization scheme are discussed. Hybrid communication enhances the network lifetime, and the synchronization scheme will consume less energy by avoiding collisions. The performance of the proposed protocol is analyzed, and it is compared with three baseline routing protocols at the 2.4 GHz ISM band with two ultra-low power transceivers.[2]

Neelam Sharma, B. M. Singh (2020) Clustering routing protocols for WSNs have evolved. This study seeks to extend the literature and ensure efficient actions by proposing QoS-based energy-efficient protocols for WSNs, which provide QoS via energy consumption and end-to-end delay. The MATLAB software is used to perform the simulations. Through multiple time simulations, some of the performance metrics that are analyzed include the percentage of dead nodes, the average energy consumption for each node, the throughput, delay, network lifetime, fraction of alive nodes, and the optimum quantity of CHs (Channel Heads) in different rounds. Similarly, the protocol outperforms frameworks such as ATEER(Average Threshold Energy-Efficient Routing), EDDEEC (Enhanced Developed Distributive Energy-Efficient Clustering), and DEEC (Developed Distributive Energy-Efficient Clustering) relative to the parameters of network throughput and delay, energy efficiency, and network lifetime, proving superior.[3]

Mohamed Kas, Youssef El Merabet (2019), the Local Binary Patterns descriptor demonstrated remarkable performance and high robustness in extracting distinguishing features from a given image. The efficiency and usability of the LBP operator and its success in various real-world applications have inspired the development of many new powerful LBP variants. Indeed, after the appearance of the LBP operator, several renowned extensions and modifications of LBP have been proposed in the literature to the point that it can be difficult to recognize their respective LBP-related strategies. This literature reviews the performance of 30 recent state-of-the-art handcrafted descriptors in face recognition through a comprehensive experimental study using widely used benchmarks. Simulated experiments on ORL (Our Database of Faces), Extended Yale B and FERET (Facial Recognition Technology) databases proved that some evaluated descriptors realize good classification results which outperform many recent state-of-the-art face recognition systems. [4]

Seyyed Yasser Hashemi, Fereidoon Shams Aliee (2020) The Routing Protocol for low-power and lossy Networks (RPL) [5] was introduced and improved versions of it are experiencing severe performance gaps under network attacks such as BLACKHOLE, SYBIL and RANK. This review uses the concept of trust as an umbrella to cover countermeasures for addressing the consequences of attacks. Accordingly, a multi-fuzzy, dynamic and hierarchical trust model (FDTM-IoT) is proposed. The main dimensions of this model are Contextual Information (CI), Quality of Service (QoS) and Quality of P2P Communication (QPC). Each dimension also has its own sub-dimensions or criteria. FDTM-RPL provides high performance in detecting attacks. Additionally, it improves network performance in a variety of criteria, including end-to-end delay and packet loss rates.

Guangsong Yang, Xin-Wen Wu (2019), an energy efficient protocol for routing and scheduling in Wireless Body Area Networks is proposed by considering node energy, path loss, traffic type, and other relevant factors. First, a channel competition procedure is proposed to reduce network flooding, making use of the related information that sensor nodes collected in the initialization phase. An energy efficient protocol for Wireless Body Area Networks is proposed in this review. In the initialization stage of the protocol, the number of broadcast flooding is reduced according to the distance between nodes and CN, thus the time of network information collection is reduced. In the slot allocation stage, the time slot is allocated according to node data requirements and priority. The analysis and simulation results show that the proposed protocol can take into account the difficulty of replacing the sensor nodes in human bodies.[6]

Ripty Singla, Navneet Kaur (2019) Wireless Body Area Network (WBAN) has attracted the attention of researchers as various biosensors can be embedded in or worn on the body of human beings for the measurement of health parameters. The patient's health data is then sent wirelessly to the physician for health analysis. This review has identified the numerous security requirements in WBANs and has provided an extensive review of existing secure routing protocols reported in the literature. It has been seen that symmetric key cryptographic routing protocols emphasize more on the resource-constrained nature of WBAN than patient data security. On the other hand, asymmetric and biometric key cryptographic routing protocols emphasize more on the security of patient data than resource resource-constrained nature of WBAN. Hybrid key cryptographic routing protocols attempt to balance both aspects. [7]

Hong Zhang,, Zhanming Li, (2019) Industrial Wireless Sensor Network (IWSN) has changed the information transmission way for existing Industrial control systems. To meet the delay requirements and minimize energy consumption, a data collection strategy based on Ant Colony Optimization with a mobile sink is proposed for Industrial Wireless Sensor Networks. Then, secondly, an Ant Colony Optimization algorithm is proposed to obtain the optimal access path for the mobile sink, which can achieve a trade-off between the energy consumption of the network and transmission delay. To reduce the number of nodes directly accessed by the sink and shorten the traversed path, the selection of RNs based on the entropy weight method is introduced according to the density of nodes, relative residual energy, and the degree of uniformity of distribution.[8]

Niharika Panda and M. Supriya (2022) Internet of Things (IoT) technology acts as a passive observer of the environment that sends data to a remote location. This review shows different smart home architectures in static and mobile environments, taking into account some of the challenges like orchestration, mobility, and range in IoT. For network communication, routing protocol over 6LoWPAN (RPL) is used. The goal of the work is to optimize the communication network in both static and mobile environments. To attain this goal, this paper proposes an algorithm that improves path selection by modifying the existing objective functions of RPL. The proposed smart home architectures are analyzed and compared based on different parameters such as Packet reception ratio, Network overhead, Throughput, Average latency, and Total energy consumption. Even when some of the devices in the smart home are mobile, the Modified Smart Home-Optimized Path (MSHOP) is found to achieve a packet reception ratio of 99.93%, minimum latency of 0.9 s, and the highest total energy usage in the network of 3373 million joules.[9]

Rahat Ali Khan, Qin Xin (2020) Wireless Body Area Sensor Networks are related to the monitoring of human physiological parameters. These small-sized machines called sensors are used to observe the physiological parameters. In this paper, an energy-efficient routing protocol is presented which uses sensors in WBASN to observe parameters in a much more efficient way. The concept of multi-hopping has been utilized with forwarder nodes. The Forwarder node accepts data from sensor nodes that are far from the sink. After accepting data the forwarder node forwards this data to the sink node. This scheme is compared with an existing scheme with which it has been compared in terms of four parameters which are residual energy, network stability and lifetime, throughput and path loss. [10]

Muhammad Aamir Panhwar, Deng Zhong Liang (2020) the energy constraint WBAN has to perform these measurements with minimum energy consumptions of the nodes, maintaining the durable health monitoring process. This paper uses the meta-heuristic Genetic Algorithm (GA) to select the best routing path by calculating distances between the nodes under multiple scenarios, in contrast to the available direct distance optimization method. The evaluation metrics include the number of dead nodes, and packets sent and received at the sink. The proposed optimization also outperforms the previous approach in terms of the number of dead nodes, which results in saving energy to increase the lifetime of the WBAN significantly. [19]

III. PROBLEM STATEMENT

Recent interest in the Internet of Things has grown especially in the medical field. Security, scalability, and Big data analytics are just a few of the pressing concerns in the Internet of Things. The characteristics of IoT networks vary greatly in terms of network size, traffic patterns, and mobility. A variety of factors, including traffic conditions, energy consumption, scalability, portability, bi-directionality, and transmitter range, must be taken into account when determining the need for a routing protocol in a given scenario.

As a result of the unique characteristics of IoT devices, new routing protocols have been developed. It is desirable to have energy-efficient routing protocols that maintain the required reliability value for sending the data from a given node to the sink.[13]

The existing one was minimum consumption of energy and maximum satisfaction with the QoS requirements are essential design aims of the WBAN. To find an efficient path using smart devices for transmitting the data towards the repositories while ensuring efficient energy utilization.

This presents the Robust Cluster Based Routing Protocol (RCBRP) to identify the routing paths where less energy is consumed to enhance the network lifespan. [16] For this purpose, the RCBRP protocol was implemented. The energy-efficient Robust Cluster Based Routing Protocol algorithm following:

A. Algorithm: RCBRP Cluster formation and CH selection

(CH←ClusterHead, SCH←SelectClusterHead)
function cluster formation **begin**
Nodes←BS (location_msg, energy)
separate the simulation region into n small groups
if node (x) = cluster (y) **then**
label node (x) belongs to cluster (y)
end if
confirm for all ‘x’s and all of ‘y’s
end
function CH_SCH_Selection **begin**
Sort (distance) for the initial assortment of CH
select min (distance)
select max (distance)
if min and max energy consumes less energy **then**
select that part for CH
end if
CH: (min_distance, max_energy)
END
function distanceCalc_CH_SCH **BEGIN**
nodes send their location information to CH and SCH

However, the RCBRP does not manage the transmission and reception of data and will consume energy. So to overcome this problem, we need another advanced model. The previous model was developed using the Secured Optimal Path-Routing (SOPR) protocol in WBANs. The SOPR protocol incorporates encryption along with routing. [11] In the SOPR, the transmitter node creates the operation of route discovery by transmitting the request for the route to the destination.

B. Algorithm: SPOR

N←No of sensor nodes;
N←n_1,n_2,n_n;
N←∈ inactive mode;
While *find ≠ 0* **do**
ID ← allocate to data packets;
if *TransmitID found* **then**;
Incoming data packets rejected;
Else if *TransmitID notfound* **then**;
N←Mmodes;
S∈RRange;
Choose n_k nodes ∈ MinR;
(n_k>AvgEnergy)
Data successfully transmitted;
(n_k>AvgEnergy)
Repeat with S modes;
End if
then *DataID found*
Successful Transmission;
Else *DataID not found*
Repeat Discovery;

It explores the potential of SOPR and is planned for the development of a Secure Optimal Path-Routing Protocol (SOPR) along with a balanced, energy-efficient, and reliable algorithm to save energy. But this model leads to a focus more on energy efficiency than security. Henceforth, security, privacy, and energy efficiency issues need to be addressed well with optimal solutions. To optimize the proposed FDT-RPL’s performance, the BAO algorithm is utilized. The BAO algorithm is a search agent whose fitness changes depending on the Butter Ant. During the BAO algorithm simulations, a certain amount of memory is provided to hold the information of all butter ants.

C. BAO Pseudocode
Input: a,b,c and d;

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Output: z*
Initiate the probability switch (a), Power exponent (b)
Mode of perception (e), and population size of BA(d).
Set u = 0
for (p = 1:p <= e) do
Make a tiny BA starter colony.
Find the fitness levels of every BA.
Determine the fragrance of the BA using the eq. (3).
Choose the BA that will provide the best total solution (l*)
stop for
Although not being met, the stop requirements (u < e) do
Set u = u + +.
for (p = 1:p <= u) **do**
Generate a random number n, n ϵ (0,1)
if (i < a) then,
Check to see whether BA is at its best (z*) as in equ. (4).
Otherwise
Move butter-ant randomly, as in eq. (5).
end-if
Every BA is assessed according to its fitness function.
stop for
Desire the finest solution for the each and every situation (z*)
Decide the value of the sensory modality using equ. (6).
stop
Make the best solution (z*)

IV. Proposed Model

Based on the above work, the proposed method can achieve efficient multi-hop routing transmission of data and improve the reliability of network data transmission. The continuous data sensing and transmission of information over long distances result in huge energy consumption at these nodes. So, conservation of energy is the need of the hour. To solve this problem, this research proposes an energy-efficient routing protocol for reliable data transmission in a Wireless Body Area Network. The main focus of the current study is on the routing mechanism that makes use of particle swarm optimization based on algorithms along with relay node selection based on distances and residual energies. The Optimization is based on selecting the relay node to aid energy efficiency for routing the data in WBAN.

The proposed Optimization-Based Routing Protocol Algorithm reduces the total network installation cost and the energy consumed by the whole network and sensors. The proposed algorithm will work as follows:

Input: Sensor nodes, a sink node, distance from each sensor node to the sink node, distance from each sensor node to neighboring nodes, the initial energy of each sensor node, weights v1 and v2.

Output: Maximize the network lifetime and reduce energy consumption through optimal routing.

Step 1: Distance of each sensor node from the sink ($distance_{s,sink}$)

$$distance_{s,sink} = \sqrt{(x_s - x_{sink})^2 + (y_s - y_{sink})^2} \quad (1)$$

Where x_s is the source node and the y_s is the destination node and x_{sink} and y_{sink} are the synchronizes of the sink nodes.

Step 2: Neighbor selection between the sensor and sink node

$$n_i = select(\text{neighbor}) \quad (2)$$

Step 3: Distance from each node to the neighboring node

$$distance_{s,t} = \sqrt{(x_s - x_t)^2 + (y_s - y_t)^2} \quad (3)$$

Where x_t and the y_t neighbour node

Step 4: Evaluate the robustness value for all optimization algorithms.

$$rob_f = v_1 . \sum_{i=0}^{n} \frac{distance(current\ node, \text{neighbour node of j})}{n} + v_2 \sum_{i=0}^{n} \frac{N_n(\text{neighbour of j})}{N(current\ node)} + (1 - v_1 - v_2) \times \frac{1}{number\ of\ nodes\ covered\ by\ current\ node} \quad (4)$$

where N(current node) and N_n (neighbor of i) represent the energy of the source node and neighbor node, respectively; v_1 and v_2 are weight of the sensor node and relay node (forwarder node) for each optimization, respectively.

Step 5: Update all the values after each iteration.
Step 6: Repeat step 4 until the maximum iterations reach.
Step 7: find the best one.
Step 8: End

The main goal of the proposed work is to minimize energy consumption through route selection for transmitting the data from the source to the sink node. In this proposed work, we discovered a route for transmitting the data that is optimal and efficient. It uses an energy model to calculate energy and path loss models to calculate path loss on the selected route. A PSO Optimization-Based Routing Algorithm is used for finding the best route for data transmission in WBAN. [18]

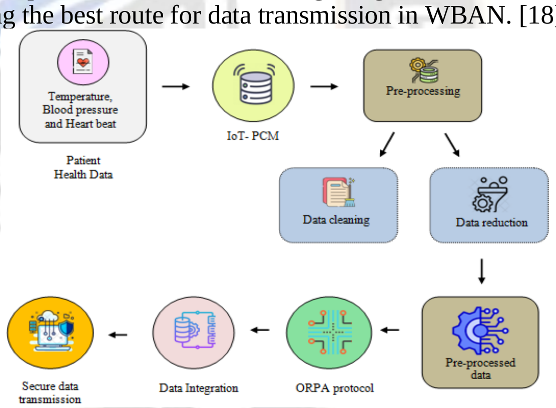

Figure 1: proposed Architecture for ORPA

C. Pseudo code: Optimization based Routing Protocol Algorithm (ORPA)

Start
Initialize the WBAN node(n_i), iteration (i), f_value, Global best(gb), Local best(lb),position(p).
(//deploy WBAN sensor and sink node)
for*(I in n_i)*
$D_{x,y} = x_i y_i$
x_i *=rand( )*
y_i *=rand( )*
end for
for *i in n_i*
calculate f_value of the WBAN particles
$lb[i] \leftarrow p[i]$
end for

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for *i in r /*maximum rounds*/*
    */*Update the position*/*
if*(f_value (i) ≤ gb(i)*
    bg=lb(i)
end if
    best solution = gb[i]
end for
end

After selecting the best particles obtained from equations 1 and 2, we need to choose the best forwarded node. In order to select here to adopt the cost function based on distance, energy, and position, the following equation is given as,

$$cf(n) = \alpha \frac{d_n}{N_n} \quad (5)$$

Where d represents distance, N represents energy, and α is a tuning parameter whose value ranges from 0 to 1, the selection is based on different applications in WBANs.

a) Data Set Collection: The IoT equipment is associated with patient health data. Body sensors like temperature sensors, blood pressure sensors, and heart rate sensors are fixed to the human body. The respective sensors are collecting patient health data. The collected patient health data is stored in the IoT.

A	B	D	E	F	G
Age	Sex	High	Low	Temp	Heart Rate
40	M	140	85	98	55
49	F	160	88	99	60
37	M	130	70	98	65
48	F	138	60	98	70
54	M	150	65	99	65
39	M	120	70	100	65
45	F	130	75	99	65
54	M	110	80	98	60
37	M	140	84	98	55
48	F	120	90	99	62

Figure 2: Dataset

b) IoT Data Center: The Internet of Things allows the user to easily store the patient's health data. The data collection process by the body sensors is stored in the IoT Patient Care Monitoring (IoT-PCM) center. When the user wants to access the data, they can send a request to the data IoT-PCM center. For this purpose, we need a routing protocol to transmit and receive the data.

c) Data Cleaning: Identifying mistakes, missing values and corrupted records is part of this stage. The accuracy of a machine learning (ML) model can be severely impacted by training it on data that contains missing values. The K-Nearest Neighbour approach is a basic yet efficient machine learning algorithm for classifying and recognizing patterns. Cleaning away low-quality training data is also a good idea if KNN algorithms are going to be used on huge training data.

d) Data Reduction: When dealing with high-dimensional data, the employment of Data Reduction methods is necessary since many dimensions are unnecessary and can obscure existing clusters in noisy data, as well as because the increased complexity of processing might jeopardize real-time requirements. The model makes use of Principal Component Analysis (PCA). As a data reduction technique, PCA may be used to construct a subset of new data by projecting existing characteristics onto new data.

e) Data Transformation: The Proposed Technique ORPA protocol optimized function with shortest path and energy as its parameters play an important role in selecting the next optimal hop node for transmitting health data. The proposed work attempts to choose the optimum channel for transmission of data packets with minimum energy consumption and high throughput by using the PSO algorithm.

f) Particle Swarm Optimization Algorithm: In this phase, data is transmitted from the source node to the sink by using the shortest route as selected by particle swarm optimization. This algorithm has been applied to optimization problems and validated with other state-of-the-art, nature-inspired algorithms.

g) Data Integration: The Proposed technique OAPR protocol proposes an optimized function with distance, data length, and energy as its parameters, which play an important role in selecting the next optimal hop node for transmitting the data. The optimized function has allowed uniform energy dissipation in the network as well as choosing the next hop node with minimal distance to prevent packet loss.

V. EXPERIMENTAL EVALUATION

Presented here is a schematic representation of the suggested technique, which involves analyzing the dataset for IoT sensors, pre-processing the data with Data Cleaning and Data Reduction with the ORPA routing protocol, and a PSO algorithm based on secure healthcare data transmission in IoT for Wireless Body Area Networks. At all times, WBAN systems require measuring parameters like Data delivery ratio, Energy consumption of Data transmission, Loss of data, and Delay time of a patient's health records. To evaluate the proposed ORPA protocol and compare its performance with the existing WBAN routing protocols like RCBRP, SOPR, and FDTM-RPA, the NS2 is used with the parameters for simulations as mentioned in the following tables and figures. Key performance metrics for both protocols are defined in the following subsections:

a) Packet Delivery Ratio: In other words, the Packet Delivery Ratio is the ratio of the number of packets received at the destination to the number of packets sent from the source.

$$Packet\ Delivery\ Ratio = \frac{\sum(Total\ packets\ received)}{\sum(Total\ packets\ send)} \quad (6)$$

b) Packet Loss Ratio: The reliability of a communication network path is expressed by the packet loss rate.

$$Packet\ Loss\ Ratio: \frac{Number\ of\ received\ packets}{Number\ of\ Send\ packets} \quad (7)$$

c) Energy Consumption: Energy Consumption is the output of a specific amount of energy taken to the data transmission.

$$Energy\ Consumption = p \times \frac{t}{1000} \quad (8)$$

d) Pocket Loss Ratio: The Packet Loss Ratio represents the ratio of the number of lost packets to the total number of sent packets. Each packet has a deadline before which it must be executed, and if this is not possible, the scheduler tries to minimize the number of lost packets due to deadline expiry.

$$Total\ Pocket\ Loss\ = \frac{Number\ of\ packet\ loss}{Number\ of\ packet\ received} \quad (9)$$

e) End-to-end delay: The End-to-end delay is calculated by obtaining time delay of a packet between the transceiver. [16] Therefore end to end delay ratio is improvised as shown in the following equation, where ATP (Arrival Time of Packet) and STP (Leave Time of Packet), it is measured with the routing protocol.

$$End\ to\ End\ Delay = \sum ATP - \frac{LTP}{No.of\ Connections} \quad (10)$$

TABLE 1: Experimental Evaluation between Existing method and proposed method

Parameters	RCBRP	SOPR	FDTM-RPL	ORPA
Packet delivery ratio (%)	77	81	86	93
Energy consumption (%)	91	87	85	82
packet loss(pkts)	24	19	14	07
End-to-end delay (ms)	21	17	14	10

From the above table clearly described that the experimental evaluation between the Existing method and proposed routing models.

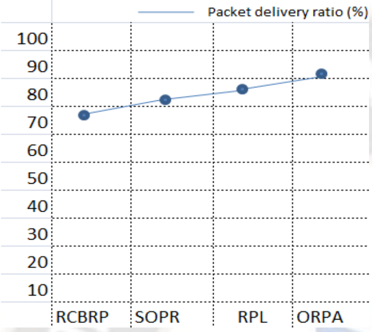

Figure 3: Packet Delivery Ratio (%)

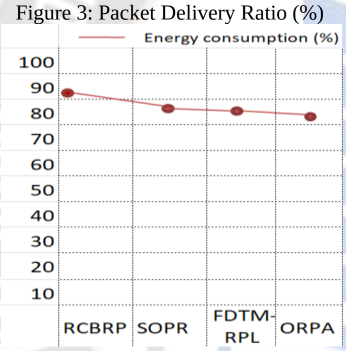

Figure 4: Energy Consumption (%)

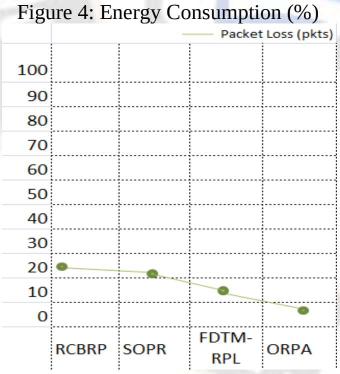

Figure 5: Packet Loss (pkts)

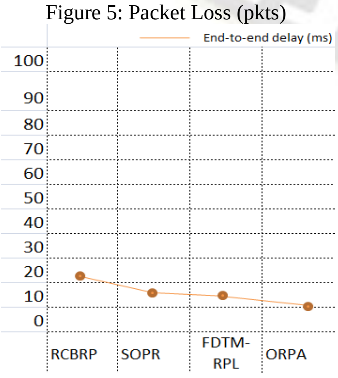

Figure 6: End-to-end delay (ms)

The RCBRP, SOPR, and FDTM-RPL are existing routing models, and the ORPA is a proposed one. These models are measured using the four parameters named Packet Delivery Ratio, Energy consumption, Packet loss, and End-to-end delay. The proposed ORPA model Packet Delivery Ratio (93%) is very high compared to the other models. ORPA reduced the Energy consumption by 82% compared to the other models. Packet Loss Ratio is very low (07) compared to other models, and the End-to-end delay is also low (10) by the proposed model.

VI. CONCLUSION

The research will be of interest to users wishing to learn more about IoT in healthcare. As a platform for the transfer of medical data in Wireless Body Area Networks, it provides a comprehensive IoT-PCM for healthcare. The proposed solution focuses on reducing the level of energy and the data delivery and transmission of WBAN. From this research study, when compared to existing methods, the proposed techniques perform well in terms of various parameters like Packet Delivery Ratio, Energy consumption, Network lifetime, Packet loss, and End-to-end delay. The proposed system, ORPA, will produce more efficient results than the existing ones. In future development, if artificial intelligence-based techniques are used, then we will enhance the performance of this research additionally.

Future Enhancements

In the future, work can be further extended to collect the data from the user end via an IoT device. After the original data is collected, we will decrypt the data and send it to the network to store it in the cloud. The network protocol of the current proposed model is used to handle the data travel. Then we will decrypt the data if the medical user wants to view the original data for medical purposes. The data view request and decryption process are extended for future research.

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