

Optimized Routing Protocols for Data Monitoring in Wireless Sensor Network



Nabeena Ameen, D. Najumnissa Jamal, L. Arun Raj

Abstract: In recent, the wireless networking technologies have witnessed monumental growth. The discovery of IEC (Integrated Electronic Circuits) which provide minute, intelligent sensory nodes that are being embedded within the human body has resulted in the formation of WBANs - Wireless Body Area Networks. The technology of WSN (wireless sensor networks) aids in uninterrupted monitoring of an individual's health and the patient's diabetes practice period with no involvement in patient's mundane activities on local servers. There is a central sink node present within the sensor network, which supervises wireless transmission, optimizes the lifetime of the network and picks out the optimal path. The present research work proposes the framework of DCDH-SRP (dynamic channel direction and hop count based secure routing protocol) also termed as a secure communication monitoring system for transmitting and receiving the sensitive data in a secured way from the server to the network users. In the enhanced EAODV protocols, each node possesses the transmission rate as TX and receiving rate being RX. TX and RX rely upon the chosen optimal path. ACO - Ant Colony Optimization which is founded on the ODMRP-ACO (optimized dynamic, secure multipath routing protocol) is adapted for transmission of data in the wireless sensor networks. ACO determines the shortest path amidst the source and the destination node. The protocol recommended is DCDH-SRP which aids in data transmission and determining of shortest path relies upon the direction of dynamic channel node and minimum hop count in wireless sensor networks. For analyzing the performance related to the path duration and hop count metric, a network (n) model for DCDH-SRP is being formulated. A comparison is made between the proposed system and the improvised (Enhanced -Ad Hoc On-Demand Distance Vector) EAODV and (Optimized Dynamic Multi-path Routing Protocol- Ant Colony Optimization) ODMRP-ACO (of an earlier work). According to the output generated, the performance is enhanced using the proposed protocol than the other existing systems. In order to verify the mathematical models and perform extensive testing of the proposed protocol, the NS2 simulator is adopted. Remarkable and improvised performance is revealed by the DCDH-SR Protocols.

Keywords : Channel Assignment, Channel Policy, Hop Count, Communication Protocol, Patient Monitoring, and Local Servers.

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* Correspondence Author

Nabeena Ameen *, B.S.Abdur Rahman Crescent Institute of Science & Technology GST Road, Vandalur, Chennai 600 048, Tamilnadu, India

D. Najumnissa Jamal, B.S.Abdur Rahman Crescent Institute of Science & Technology GST Road, Vandalur, Chennai 600 048, Tamilnadu, India

L. Arun Raj, B.S.Abdur Rahman Crescent Institute of Science & Technology GST Road, Vandalur, Chennai 600 048, Tamilnadu, India

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I. INTRODUCTION

WSN - Wireless Sensor Networks comprise of confined resource devices which is responsible for collecting information from the environment. With the help of these devices better sensing, processing and communication can be achieved thereby enhancing the outlook and retrieval of information concerning the world. Using an effective wireless sensor network tool built for real-world scenarios, the process of information retrieval and collection related to health monitoring and diabetics' system support can be improvised [1] [2] [3]. In numerous WSN application security services like integrity, data-confidentiality and authentication of data source holds extremely crucial [4]. Though here, there is constrained utilization of resources or hardware, but the security services offered by traditional networks usually result in unwanted consequences like for instance: remarkable rise in energy consumption and/or delay in communication from processing overhead or from increase in data transmitted. Therefore, concerning the adoption of security services in WSN, the primary target being rectified the clash among a limited consumption of resources, at the same time increasing security.

The presents research secure communication monitoring system for transmitting and receiving the sensitive data in a secured way from the server to the network users. E-AODV and ODMRP-ACO is the two protocols utilized for secured forwarding. In the improvised EAODV protocols is each node has a transmission rate as TX and receiving rate being RX. Selection of optimal path is on the basis of cumulative transmission rate – TXX and cumulative receiving rate – RRX is utilized for forwarding the packets from source to the destination node. ACO - Ant Colony Optimization which is founded on the ODMRP-ACO (optimized dynamic secure multipath routing protocol) is adapted for transmission of data in the wireless sensor networks. ACO determines the shortest path amidst the source and the destination node. The present research work proposes the framework of DCDH-SRP (dynamic channel direction and hop count based secure routing protocol) also termed as a secure communication monitoring system for transmitting and receiving the sensitive data in a secured way from the server to the network users. The protocol recommended is DCDH-SRP which aids in data transmission and determining of shortest path relies upon the direction of dynamic channel node and minimum hop count in wireless sensor networks. For the model of DDE (decision-directed channel estimation), a complexity algorithm is being proposed employing and discovering channel ranges and capacities.

The algorithm adopts the latest channel estimate for priority information in order to minimize the issue of error propagation while the data is being communicated in the local server. For analyzing the performance related to the path duration and hop count metric, a mathematical model for DCDH-SRP is being formulated. A comparison is made between the proposed system and the improvised EAODV and ODMRP-ACO (of an earlier work). According to the output generated, the performance is enhanced using the proposed protocol than the other existing systems.

Following is the research work classification: Section 2 presents related work along with available WNS and communication protocols. Section 3 describes the proposed technique for Data transmitted in routing by merging wireless networks with servers. Section 4 presents results and discussion. Lastly, section 5 presents the conclusion of the research work.

II. LITERATURE SURVEY

To finding problems of this works analysis of security and network life time and static channel selection. In this paper to design a secure communication monitoring system for securely forwarding and retrieve the sensitive data from servers into users in the network area.

Xiaoyang Liu et al, proposes that there has been a magnificent growth in the WSN technology and also its localization method which is one among the basic services for collecting data in WSN. The localization low accuracy relies upon the accuracy related to distance estimation. Examining effective local algorithms that can fulfill the accuracy parameter for wireless sensor networks confronts various issues due to the restriction in size, power, and cost of sensor nodes. Initially, establishment of a WSN node localization model takes place as per the WSN environment. Thereafter conventional methods of WSN node localization namely: GA, DV-HOP and PSO are learnt. By adopting dynamic mathematics modeling, Localization algorithm concerning WSN is recommended [5].

Hao Zhang, Wei Liu, et al [6–8] proposed and ascertained that for three-dimensional node localization the flip ambiguity detection is same to the intersecting plane, which intersects with complete range error spheres of the reference nodes of unknown node in the ideal radio model, known as the problem of EIP (existence of intersecting plane). The algorithms of CTP (common tangent plane) and OP (orthogonal projection) are being proposed. Here lots error accruing and medium security. Hua-Dong Mo and Rodolfo Feick [9, 10] recommends a Bluetooth, interior location algorithm that relies upon Bayesian theory for RSSI probability distribution. This algorithm is a complex one and utilizes the maximum posterior probability for identifying the position of the moving target. Though, huge error is reported.

Renan C. A. Alves et al, proposes multiple communication patterns prevailing within WSN (Wireless Sensor Networks). Though implementation of this model across networks that are resource-constrained networks is complicated specifically if there is a need of security mechanisms. Prevailing SDN techniques for Wireless Sensor Networks has gradually progressed, taking into account the resource-constrained necessities. Though the security services are not being incorporated in their design and

implementation. The primary services which the system must offer includes the secure node admission and end-to-end key distribution which aids in secure communication. Specification, design, implementation, and experiments are being illustrated taking into account the protocol and device limitations/constraints and which one not suitable [11]. Wireless Sensor Networks are incorporated to combine, supervise and examine real-time data in numerous applications, befitting as a quintessential segment of smart cities. Collecting sensitive information and adopting wireless communication has led to various security challenges. The present research not only focuses on such challenges, but also aids in providing a resolution for the same and minimum security [12].

Review work on wireless sensor network is illustrated in the existing research. It depicts that the capability of network nodes is restricted in terms of energy supply, limited computational capacity and communication bandwidth. Usually, to manage all the network routes, the Routing protocols for WSN are accountable, which ascertains trustworthy multi-hop communication. Multiple protocols are being presented which includes: DSR - Dynamic Source Routing, DYMO - (Dynamic MANET On-demand), the ZRP - (Zone Routing Protocol) and OLSR - (Optimized Link-State Routing) as well as the comparative attributes such as Throughput, Residual Battery Capacity, Packet-Delay and Average End-to-End Delay all are minimum output and also taken into consideration [13].

Dapeng Wu et al. [14] makes use of a data forwarding technique that's quiet, energy-efficient and aids in balancing the sensor node energy consumption, thereby improvising the lifetime of the network. It works by compressing the original physiological data in order to minimize the data size, thus enhancing the energy effectiveness of the body sensor nodes and transmitting the data using a multi hop tree based routing protocols. B. Chen et al. [15] offers a cognitive radio capability to the sensor node for avoiding EMI- (Electro Magnetic Interference) that usually lowers the consumption of sensor power. The cognitive process in the cognitive radio system generally begins with spectrum sensing, thereafter comes the channel identification based on the one way path a selection and spectrum management. The channel having best quality and undergoing least interference or fading, is selected for packet forwarding.

Many systems in the WBAN (Wireless Body Area Network) tend to be ineffective in confronting the problems related to security deployment. The research work proposes the mechanism of GTSSE (Game Theory with Stackelberg Security Equilibrium) for securely accessing the patient information on WBAN. In this technique all the players take into consideration. Patients are supervised by placing the power position, authority at the beginning. Experiments are being carried out using the proposed approach on features like the security ratio considering health information about the patient, level of system flexibility, energy consumption rate and information loss rate. SSE (Stackelberg Security Equilibrium) is reported to enhance the power of the solution by yielding decreased security [16].

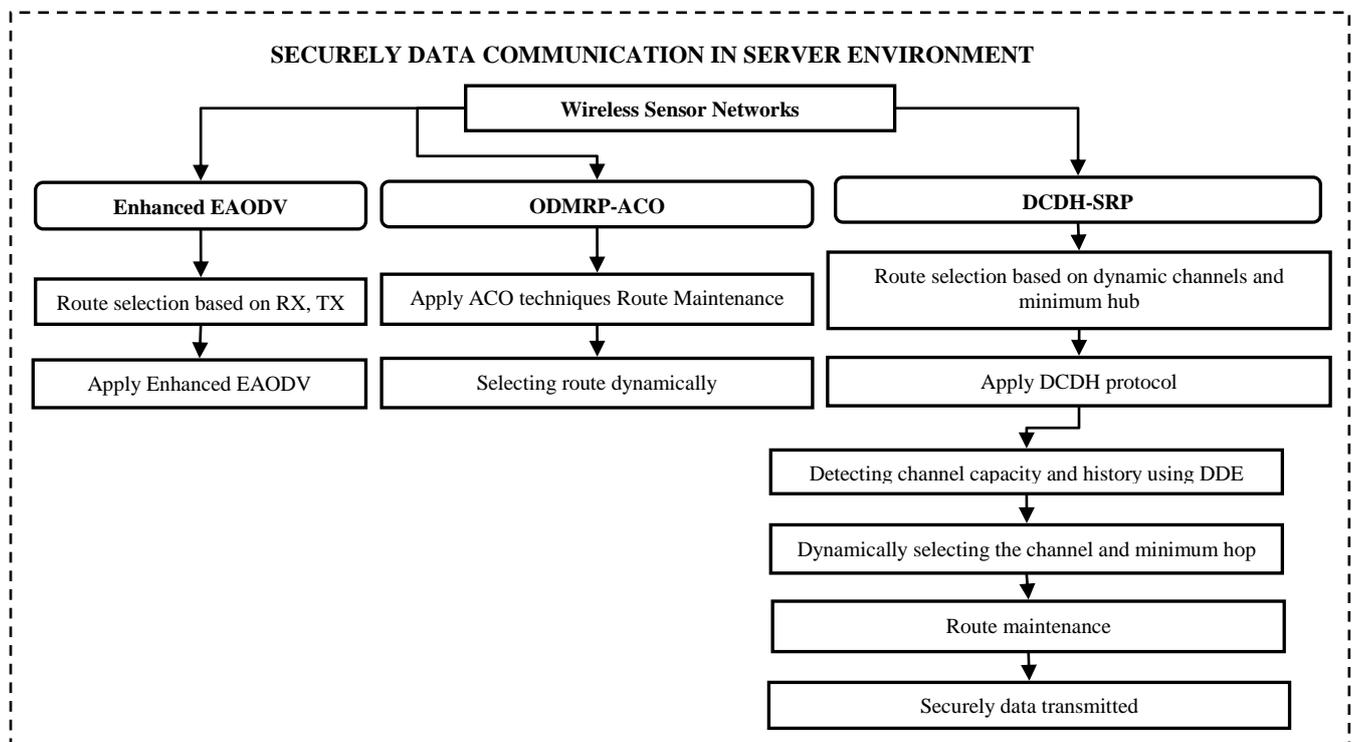
Game Theory Based Congestion Control Protocol in [17] is adopted to attend the congestion issue amidst parent and child nodes within networks that bring RPL-enabled and to help enlarge the throughput. Though, the time consumption involved in packet transmission is greater. Here [18], a new MAC protocol is proposed by the author in order to monitor or supervise health via WBAN. The proposed protocol acquires multiple Wireless Body Area Network beacon frames in gradual time span for an efficient and enhanced WHMS (Wearable Health Monitoring Systems), though compromising with accurate time synchronization. WBAN is capable in handling and monitoring numerable patients' health by reducing energy consumption via utility function. A game-based analysis concerning security policies built in [19] obtains an optimal blend of security policies for accessing the content in MSNs. Though, the flexibility, security and credibility of game based analyses are undesirable. Sheikholeslami et, al [20] put forwards that the multimedia applications are in need of specific QoS (Quality of Service). The research presents an optimized routing taking into account the ACO (Ant Colony Optimization). By adopting an optimized routing, an average throughput of 164.65 kbps can be achieved for multimedia data transmission, also an improvised QoS (quality of service) is acquired in comparison with DSDV and AODV routing protocols [21]. The WSN routing protocol involves four methods which being: Network Structure, Communication Model, Topology, and Reliable Routing.

multiple applications executing across numerable computer systems and servers to access the services via internet simultaneously. Also, there is working flexibility from any place at any given time. Wireless sensor network comprises of number of channel policy low cost, low power and multifunctional sensor nodes that being employed in the interested or required area. They possess communication, data processing and sensing abilities. Usually, the doctors monitor the aged or senior patients. There are hospitals who provide service by sharing patient's data on the server. The research work presents a novel mechanism of Quality of Service – aware patient monitoring system (based on local server) in case of emergency for the monitoring of important health information. The present research work proposes the framework of DCDH-SRP (dynamic channel direction and hop count based secure routing protocol) also termed as a secure communication monitoring system for transmitting and receiving the sensitive data in a secured way form the server to the network users. For analyzing the performance related to the path duration and hop count metric, a mathematical model for DCDH-SRP is being formulated. For the model of DDE (decision-directed channel estimation), a complexity algorithm is being proposed employing and discovering channel ranges and capacities. The algorithm adopts the latest channel estimate for priority information in order to minimize the issue of error propagation while the data is being communicated in the local server.

III. PROPOSED METHODOLOGY

A. Research Outline

The Server is the centralized figure which facilitates



1

B. Enhanced EAODV

The Enhanced EAODV protocol is utilized for transmitting and retrieving sensitive data in a secured manner from cloud environment to the cloud users present in the network region. In the enhanced EAODV protocols, each node possesses the transmission rate as TX and receiving rate being RX. Selection of optimal path is on the basis of maximum TX, and forwarding the packets from source to destination node is on the basis of maximum RX. TXX represents the cumulative transmission-rate, RXX represents the cumulated receiving-rate at each available path. Route having the highest value of TXX and RXX is being chosen as the best optimal route amidst the source and the destination node. Subsequently, prioritizing of data packets takes place.

C. ODMRP-ACO

ODMRP (Optimized dynamic multipath routing) protocol by utilizing the techniques of ACO (Ant colony optimization) has enhanced wireless sensor networks with respect to efficiency, energy, performance, scalability and robustness. This model being motivated from the behaviors of the actual ant colony that locates the shortest possible path amidst its nest and the food source. Ants generally live in colonies and are basically social insects. They work for the benefit of the colony, they are residing in. ACO makes use of cooperation and behavior of ant colony who work by identifying shortest path from their nest till the food source. The process of routing optimization adopts ACO for determining the shortest path from the source to the destination node. The routing mechanism involves extracting various paths depending on distance and energy so as to transmit data from source node to the destination node. Therefore to carry out optimized routing, ODMRP-ACO (Optimized dynamic multipath routing - Ant colony optimization) protocol is being proposed. As a result, there is load reduction on wireless nodes as the route with maximum energy is being chosen having minimum hop count in a multipath group.

D. Security and Privacy

The major elements in transmitting and processing data in WBAN are the security, privacy and integrity of the data collected from a monitored person. Transmitting or forwarding of any health based information from on-body sensors to monitoring devices in WBAN systems and thereafter across the internet to the core controllers in hospitals are extremely confidential and personal. The authorities in healthcare, having access to patient's personal information must ascertain that this information remains unaltered and is exact with the original information of the patient being monitored. Besides, a system that is tightly and extensively secure may prohibit the healthcare experts to access patient's essential health-related details in case of emergency, putting the patient's life in danger. Also, elevating such systems with security and privacy measures can lead to hike in energy cost involved in communication, resulting in increased power consumption from small batteries [22]. DCDH-SRP, which is a hop count based secure routing protocol also referred to as secure communication monitoring system is adopted for transmitting and retrieving sensitive data from the server in a secured manner.

E. Node deployment

The sensor nodes are being incorporated for monitoring the area within and across the network, thereby gather the perceived information from the sensor nodes and forward it to the destination. The distribution of sensor nodes is carried in a normal manner. The data packets are being sent using the source node and are received by one of the neighbor node. Each node must register on the server with details such as Id, Name and rest of the values. Sources identifies the optimized path and accumulate key of entire intermediate nodes. Moreover, the entire node communication is monitored by the network for security reason.

F. DCDH-SR Protocol

The mechanism of dynamic channel selection which relies upon the distance and hop-count, transmits every single data packet, which carries the entire sequence of nodes the packets must forward in order to reach the destination. This is called source routing, which ascertains that the sender is aware of the complete route till the target/destination. The protocol relies upon two methods: (1) the channel discovery process and (2) the dynamic channel maintenance process. The data transmitted dynamically creates channels where the channel receives data from the neighboring node. Thereafter the time span is hidden by the channels so that there is no data loss. In this work a DDE model is built to identify channel history, estimation and capacities. Before transmitting the information using healthcare monitoring and communication systems, some particular attributes concerning the radio waves are altered with respect to the information. The DCDH-SRP (dynamic channel direction and hop count based secure routing) protocol also termed as a secure communication monitoring system for transmitting and receiving the sensitive data in a secured way from the server to the network users.

Algorithm of DCDH-SR Protocols

```

Set Node = N;           // number of Node's
Set Sender = S;        // S ∈ N;
Set Receiver = R;      // R ∈ N;
Set Channels = Ch      // Ch ∈ Networks;
Channel configurations → Id, thresholds Values, states, dynamic, static;
Channel selecting for securely forwarding data;
if (highest ← channel rate selection) then
for χ ← 1, χ max do
if (chCONj => thresholds(x) && chCONj => ConFig(Weight)) then
Select Ch_Max mode x
else
Omit Ch_Min mode x
end if
end for
if (nodes = range (thresholds(x) ) THEN {
Node → forward(Transmitted);
Node → identifier to Ch_Max mode x (node);
Transmit 1 training packet
Configure mode → dynamic, static
Dynamically configured some channels → Id, Dummy id, thresholds_Values,
states, dynamic static, Locations;
for χ ← 1, χ max do
if ( chCONj == thresholds(x) && chCONj == Mode_MinCop ) &&
(SE_level >= Max) then
if(configuration : Dynamic //
chCONj =< ConFig(Weight))
identify → Dynamic channels;
Transmit 1 training packet
Packets → crash ;
    
```

```

Dismantle → particular Channel;
end if End for
if chCONj == thresholds(x) && chCONj == Mode_MinCop && SE_level
>= Max then
if(configuration : static || chCONj => ConFig(Weight))
Again Transmit 1 training packet
Packets → transmitted successfully;
Packet received → destination node
Secured communication in sender and receivers; end if end for
Save the index of the selected static chCONj mode.
This will be fed back to the transmitter for adaptation.
    
```

Explanation of this algorithm to extend into first off all node deploying and then nodes selection and channel selection based on the node condition and channel condition and the transmitted the data's. Once if any, during path failed to stop transmitting of the data. Finally to selection multi way based channels and node selection after that sending the data properly. Remarkable and improvised performance is revealed by the DCDH-SR Protocols. Hence, it's concluded that DDE has the potential and ability of Channel and optimizing the routing algorithms, assisting the multimedia applications over Wireless sensor networks. In this proposed works to be benefits overall security and optimized to path selection and channel selection minimizes to delay and increased network life times.

G. Decision-Directed Channel Estimation (DDE)

Before transmitting the information using healthcare monitoring and communication systems, some particular attributes concerning the radio waves are altered with respect to the information bits. If the channel attributes are recognized, the information bits are received precisely at the receiving end. Due to the propagating medium, there may be rapid variation in channel, resulting in signal degradation. The CSI - Channel State information, offers the known channel characteristics for a wireless link. It offers fading and scattering effects on a signal spreading via the medium. Usually, the CSI (Channel State information) assessed at the receiver end, is input back to the transmitter. If not been accurately assessed at the receiver, it can result in system degradation. The estimation can be carried out by utilizing various channel estimation algorithms. The DDE (Decision Directed Channel Estimation) model helps in detecting channel range and capacities. The algorithm adopts the latest

channel estimate for priority information in order to minimize the issue of error propagation while the data is being communicated in the local server. With the help of an already known sequence of unique bits, the estimation is carried out for a specific transmitter which can be carried out further in each transmission burst. Hence the channel impulse response for every burst can be estimated separately by a channel from the transmitted bits that are already known and from the respective received samples. There is a remarkable hike in the data throughput and coverage with no surplus bandwidth or transmit power. Moreover, increased spectral efficiency and link reliability is also achieved.

Algorithm of DDE

```

Input:  $CN_t$  : Current channel numbers;
 $CR_t^{max}$  : Current maximum bandwidth, maximum capability and positions;
 $\bar{w}_t$  : Available bandwidth estimation of current state  $s_t$ ;
 $\$i, \mu_i$  : Current information from MAC layer and physical layer
Output:  $\bar{w}_{t+1}$  : Estimation of available bandwidth in next state  $s_{t+1}$ ;
 $CN_{t+1}$  : Estimation of channel numbers in next state  $s_{t+1}$ 
update  $w^{low} w^{high}$ 
Estimate available bandwidth  $w_t$ 
 $\bar{w}_{t+1} \leftarrow a w_t + (1 - a) \bar{w}_t$ 
If  $(\bar{w}_{t+1} \leq w^{low} CR_t^{max})$  then
If  $CN_t < CN_{max}$  then
 $CN_{t+1} \leftarrow CN_t + 1$  else  $CN_{t+1} \leftarrow CN_{max}$ 
End end
If  $(\bar{w}_{t+1} \geq w^{high} CR_t^{max})$  then
If  $CN_t < CN_{min}$  then
 $CN_{t+1} \leftarrow CN_t - 1$  else  $CN_{t+1} \leftarrow CN_{min}$ 
End end
If  $(\bar{w}_{t+1} > w^{low} CR_t^{max}) \&\& (\bar{w}_{t+1} < w^{high} CR_t^{max})$  then
 $CN_{t+1} \leftarrow CN_t$ 
End
Return  $\bar{w}_{t+1}, CN_{t+1}$ 
Update  $CN_{min}, CN_{max}, S_{t+1}$ 
    
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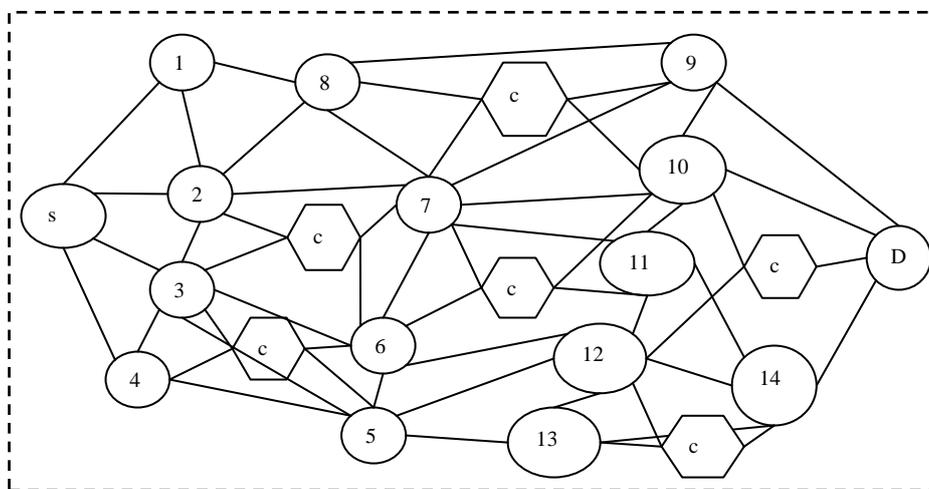


Figure 2: Connectivity of nodes and channels

Table 1: Hop-count list of nodes.

Pathway	Node	Hop List Count
1	S,1,8,c,9,D	5
2	S,2,c,7,c,10,c,D	7
3	S,3,c,6,12,11,c,D	7
4	S,4,c,5,12,14,D	6
5	S,4,c,5,13,c,14,D	7

Step 1: S Nodes → RREQ to all nodes

The neighboring nodes are numbered as 1,2,3,4,5,6,7,8,9,10,11,12,13,14 of the node S and the node neighbor represented as corresponding neighbor node of the following: 1,2,3,4,1,2,3,4,5,6,7,8,9,10,11,12,13,14. The source node - S initiates a route request by distributing RREQ and receiving from a single hop neighbor 1,2,3,4,5,6,7,8,9,10,11,12,13 and 14. Once RREQ is obtained, every single hop neighbor node verifies if the node resembles the destination or not. In case it's not the destination node, the current information of every node is being updated (fig 3 & 4 depict RREQ – RREP).

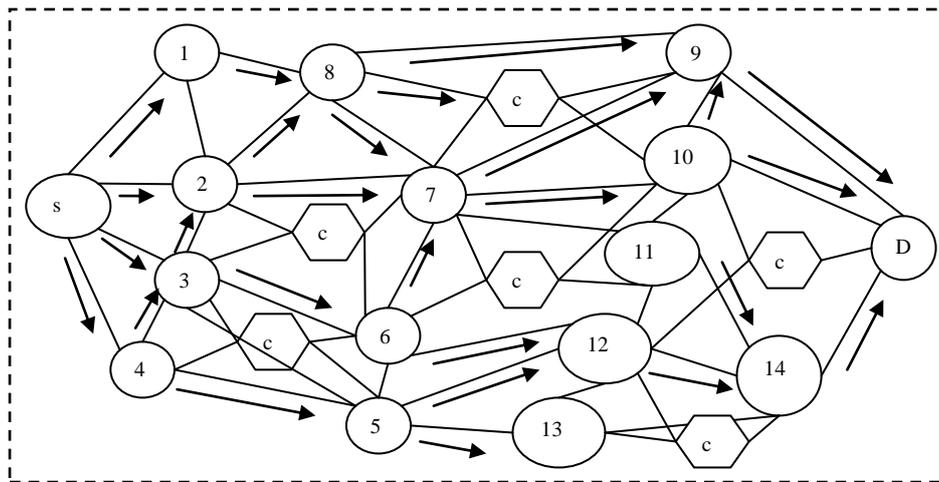


Figure 3: S Nodes to all nodes RREQ

Step 2: S nodes ← response and capacity (Range)

Current information concerning one hop, two hop neighbor list and capacity are updated and ranges nodes numbered: 1,2,3,4,5,6,7,8,9,10,11,12,13,14 dispatch a route reply to the source node, including capacity and ranges.

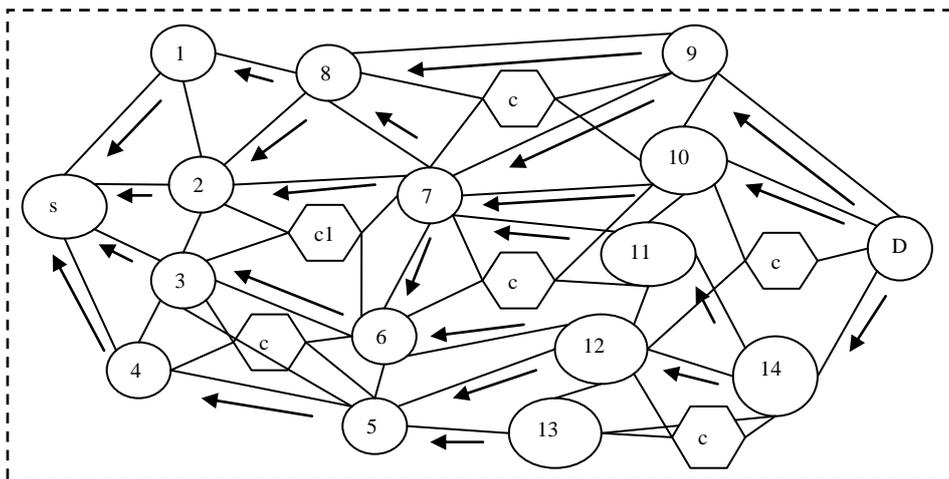


Figure 4: Replay all nodes

Step 3: S nodes ← capacity (Range)

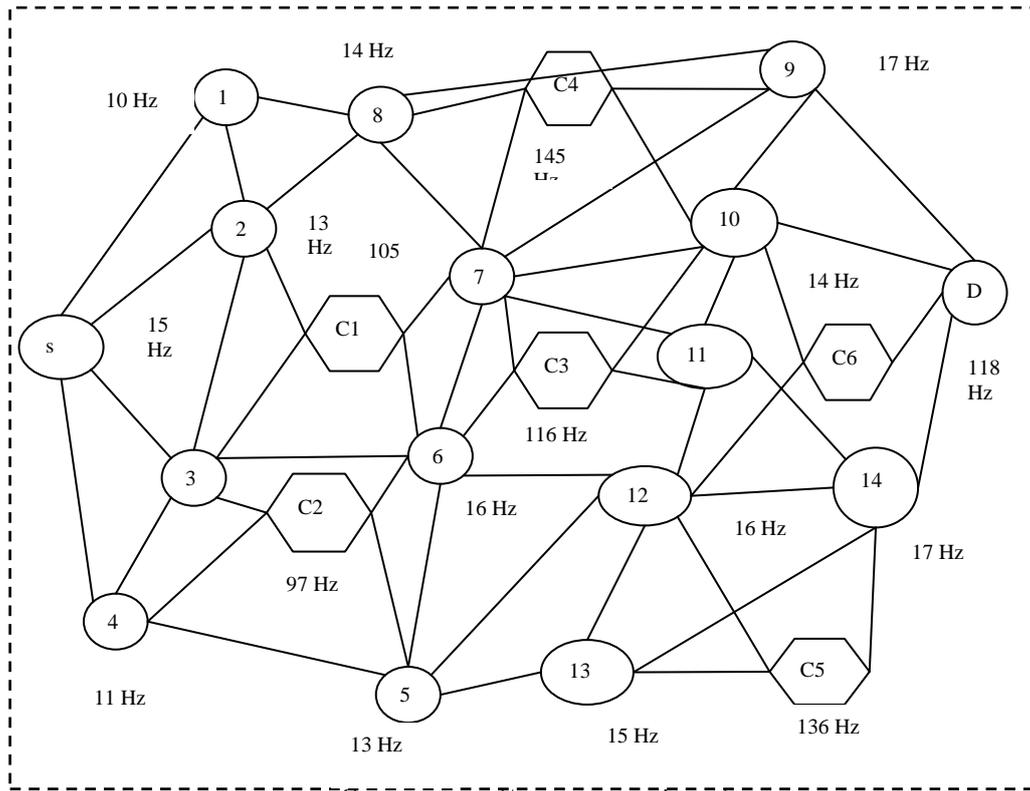


Table 2 : Frequency of nodes.

Nodes and channels	Frequency
Node1	10 Hz
Node2	13 Hz
Node3	15 Hz
Node4	11 Hz
Node5	13 Hz
Node6	16 Hz
Node7	15 Hz
Node8	14 Hz
Node9	17 Hz
Node10	14 Hz
Node11	15 Hz
Node12	16 Hz
Node13	15 Hz
Node14	17 Hz
Channel1	105 Hz
Channel2	97 Hz
Channel3	116 Hz
Channel4	145 Hz
Channel5	136 Hz
Channel6	118 Hz

Step 4: S → dynamic channel selecting and optimized path

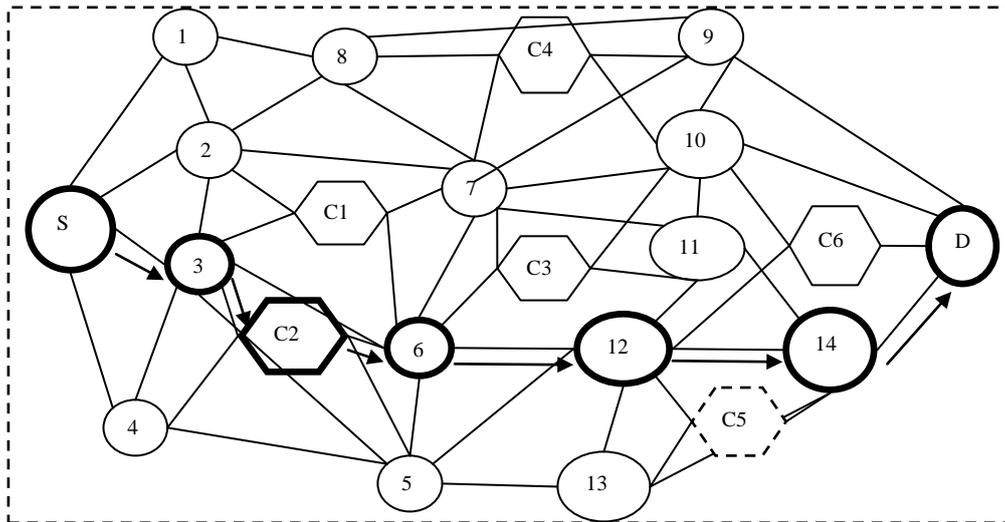


Fig 6 illustrates the selecting process of optimized and dynamic, secure channel, that being utilized for data sharing and forwarding. The selection is made relying upon the location, distance and minimum hub count.

H. Dynamic channel selecting & minimum hop

In the network initialization process the nodes identify their neighbors along with the channels. Neighbors’ selection relies upon location, transmission range, capacity, direction, depth and channel estimation ranges. For selecting a node as the neighbor node, it’s been verified if it possesses enough residual energy and lies in relatively equivalent or lower depth. To prevent flooding, Depth threshold is adopted and the selection depends upon the number of neighbors a node has. In this process every node is suggested to detect their alive neighbors at consistent time intervals for adapting to the depth threshold appropriately. Thereafter, channels are being created dynamically to obtain the data once the channel leaves the route in order to determine channel estimation range. Data forwarding is conducted by the nodes by adopting the depth channel threshold (capacity) value, location and the neighboring nodes’ direction ranges info.

I. Route maintenance

It’s elaborated as how every node is linked or associated with its neighboring node for gaining self-stability, maximum channel capacity and minimum hop count. In case the nodes are in transmission range, messages can be exchanged with one another. Every single node includes: information related to connectivity, the signal stability of one-hop neighbors, and also keeps track of a neighbor list. The degree of a node n is resembled as the number of nodes that are linked to it. Channels are being created dynamically to obtain the data once the channel leaves the route in order to determine channel estimation range and capacity that the router maintains.

J. Securely data transmitted

In wireless communication links, nodes, DDE give the known channel characteristics of the link and channels that are being dynamically created.

Usually, the CSI (Channel State information) assessed at the receiving end, is fed back to the transmitter. As a result, both the receiver and the transmitter may possess separate CSI. CSI can be either instantaneous or statistically. In case of Instantaneous CSI, the prevailing channel conditions are

already known that can be accessed by acquiring the impulse response of the transmitted sequence. On verifying if the data has arrived at the destination, an acknowledgement is sent from the destination to the source node.

The healthcare monitoring system accurately retrieves the CSI and synchronization amidst the receiver and the transmitter.

IV. RESULT AND DISCUSSION

The research work aims to assess the performance of dynamic multi-channel Selection and allocation mechanism via simulation. And in order to verify the mechanisms’ performance, the NS2 simulator is adopted. Results reveal in improvised efficiency and performance on considering multiple metrics in comparison to rest of the available approaches in the work. Table 3 depicts the simulation parameters which are being employed in the protocol design.

Table 3: Simulation Parameters

Parameter	Value
Simulator	NS-2(v2.34)
Simulation Landscape	2500*1000
No. of. nodes	50
Node Type	Heterogeneous
Transmission Range	250m
Node Energy	100J
Packet size	1000bits
Transmission Range	100 KBytes
Antenna Type	Omni directional
Mobility Models	Random-way point (0-30 m/s)
Radio Frequency	850-950 MHz
Routing Protocol	DCDH-SRP
MAC Protocol	IEEE 802.11
Background Data Traffic	CBR
Packet Interval	0.01 Sec

The simulation output is assessed with respect to following performance metrics.

Total Number of Packets Received: To compute the total no: of data packets received by sink node, the count value of (total no: of data packets transmitted by cluster head node and received by sink/base node) is considered.

Packet Delivery Ratio: This ratio is determined by the no: of packets received successfully in regard to the total no: of packets transmitted.

End-to-End Delay: the delay in seconds is computed as: the average time consumed to route a data packet from source to destination node.

Throughput: It's denoted as the no: of packets transmitted per second.

Packet Dropping Ratio: is determined as the ration between no: of packets dropped against no: of packets transmitted.

Network Lifetime: This metric computes the time during which the first node failure took place because of the battery power discharge. The no: of active nodes in every round is shown in UWSN.

Total Energy Consumption: it computes the overall energy consumed by the nodes in transferring the packets via simulation.

Average Energy Consumption: It depicts the overall energy consumed in receiving total packets and overall energy consumed by the nodes in transmitting the packets.

Distance of Length Ratio (DLR): DLR is the ratio in Distance of the length of the optimized path.

$$DLR = \frac{DL}{\text{optimized Path}} \quad (1)$$

Speedup (SP) - SP ratio is computed as the time consumed in solving a problem in a single processing element. That is sequential execution in comparison to the time consumed to resolve the similar problem in a parallel execution.

$$SP = \frac{\text{Sequential execution time}}{\text{Parallel execution time}} \quad (2)$$

Energy Efficiency (EEFF) – it is denoted as the ratio of speedup to the no: of processing elements. It is the amount of time-fraction for which the processing element is significantly engaged, that is, how efficiently the resources are utilized during the program execution.

$$EEFF = \frac{SP}{\text{Number of Processing elements}} \quad (3)$$

Distance

Source node = $(ch(x)_2 - ch(x)_1)^2$ And Destination node = $(sn(y)_2 - sn(y)_1)^2$

$$Distance = \sqrt{(SN(x)_2 - SN(x)_1)^2 + (DN(y)_2 - DN(y)_1)^2} \quad (4)$$

Packet delivery ratio

$$\frac{\sum \text{Number of packets received}}{\sum \text{Number of packets send}} \quad (5)$$

Delay

$$\frac{\sum (\text{Arrive time} - \text{sent time})}{\text{Number of connections}} \quad (6)$$

Table 4: End to end delay

Techniques	50n	100n	150n	200n	250n
Enhanced EAODV	0.38	0.41	0.46	0.48	0.56
ODMRP-ACO	0.26	0.3	0.31	0.39	0.48

PEGASIS	0.35	0.39	0.4	0.58	0.59
DCDH-SRP	0.22	0.2	0.28	0.35	0.44

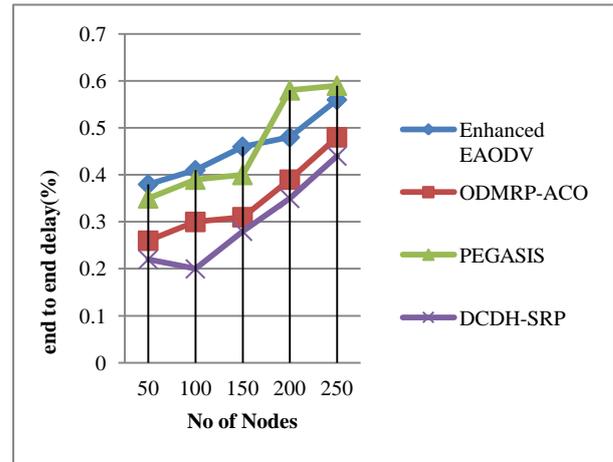


Figure 7: End-to-end delay

Fig 7 and Table 4, depicts that the End-to-end delay detection and examination compared to various other techniques such as DCDH-SRP (dynamic channel direction and hop count based secure routing protocol), Enhanced EAODV and PEGASIS (Power-Efficient-Gathering-in-Sensor-Information-Systems). The proposed technique of DCDH-SRP yields in effective and improvised results compared to rest others.

Table 5: Packets delivery ratio

Techniques	50n	100n	150n	200n	250n
Enhanced EAODV	71	73	78	80	83
ODMRP-ACO	84	87	87	85	89
PEGASIS	70	73	76	79	83
DCDH-SRP	87	90	91	92	93

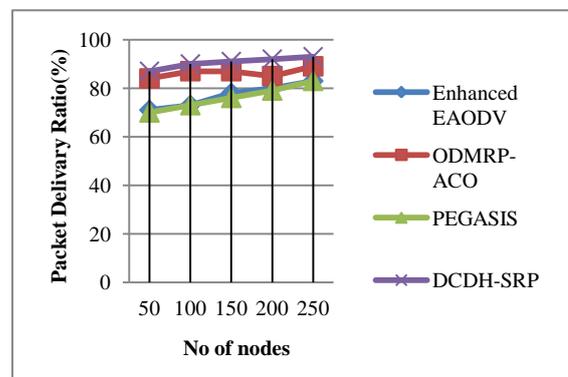


Figure 8: Packet delivery ratio(%)

Fig 8 and Table 5, represents the Packet delivery ratio detecting and counting compared with DCDH-SRP (dynamic channel direction and hop count based secure routing protocol),

Enhanced EAODV and PEGASIS (Power-Efficient-Gathering-in-Sensor-Information-Systems). The proposed technique of DCDH-SRP yields in effective and improvised results compared to rest others.

Table 6: Throughput

Techniques	50n	100n	150n	200n	250n
Enhanced EAODV	100	95	90	85	84
ODMRP-ACO	100	100	99	98	84
PEGASIS	100	93	90	89	85
DCDH-SRP	100	100	99	98	93

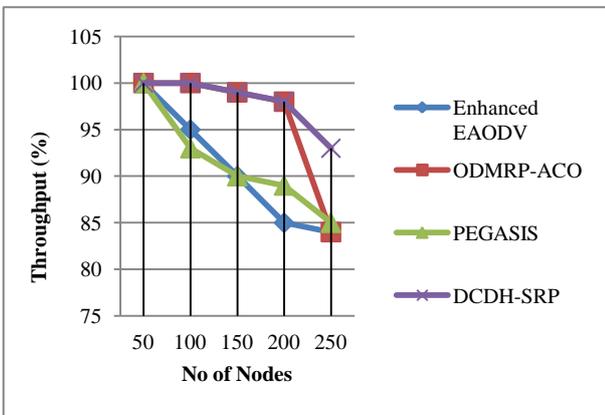


Figure 9: Throughput

Fig 9 and Table 6, illustrates the Throughput counting and analysis compared with DCDH-SRP (dynamic channel direction and hop count based secure routing protocol), Enhanced EAODV and PEGASIS (Power-Efficient-Gathering-in-Sensor-Information-Systems). The proposed technique of DCDH-SRP yields in improvised results compared to rest others.

Table 7: Network lifetime

Techniques	50n	100n	150n	200n	250n
Enhanced EAODV	72	68	65	50	51
ODMRP-ACO	70	62	56	53	52
PEGASIS	78	70	60	55	50
DCDH-SRP	84	74	69	60	58

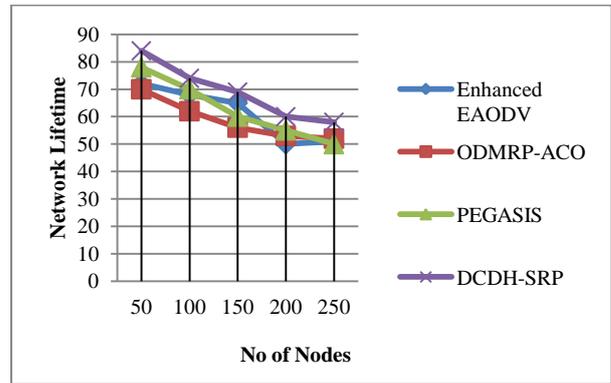


Figure 10: Network Lifetime

Fig 10 and Table 7, illustrates the Network lifetime analysis compared with DCDH-SRP (dynamic channel direction and hop count based secure routing protocol), Enhanced EAODV and PEGASIS (Power-Efficient-Gathering-in-Sensor-Information-Systems). The proposed technique of DCDH-SRP yields in effective and improvised results compared to rest others.

Table 8: Energy Consumption

Techniques	50n	100n	150n	200n	250n
Initial energy	100	100	100	100	100
Enhanced EAODV	18	17.9	14.3	12	12
ODMRP-ACO	14	12.3	12	11.6	10
PEGASIS	16	16	12.9	13.3	12.9
DCDH-SRP	14	12.3	12	11.6	10

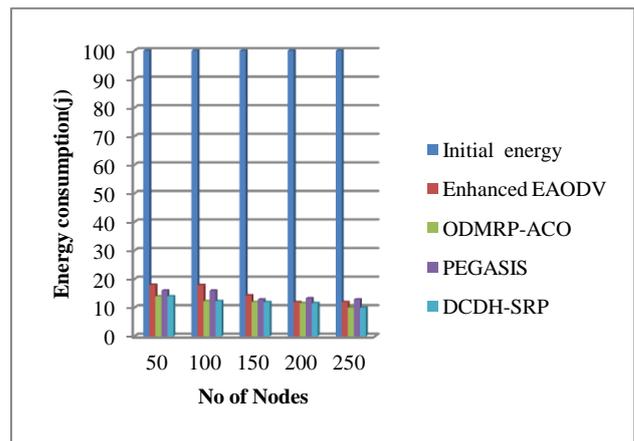


Figure 11: Energy Consumption

Fig 11 and Table 8, depicts the Energy Consumption evaluation compared with DCDH-SRP (dynamic channel direction and hop count based secure routing protocol), Enhanced EAODV and PEGASIS (Power-Efficient-Gathering-in-Sensor-Information-Systems). The proposed technique of DCDH-SRP yields in effective and improvised results compared to rest others.

V. CONCLUSION

The present research work to propose a DCDH-SR Protocols that calculates the anticipated hop count and the path duration taking into account the maximum distance and minimum angle from the line drawn amidst the source and target/destination in the Local server. Here mathematical models are recommended for the above protocol for obtaining desired, expressions for the hop count and the path duration relying upon the Poisson randomly distributed network. Using the proposed protocol, the hop counts are being minimized and expected path duration is increased by determining the positions of next-hop nodes in an already defined region close to the border of the channel estimation and transmission range. Concerning the secure communication protocol, DDE (decision-directed channel estimation) model is built by incorporating the channel ranges and capacities. And in order to verify the mathematical models and perform extensive testing of the proposed protocol, the NS2 simulator is adopted. Remarkable and improvised performance is revealed by the DCDH-SR Protocols. Hence, it's concluded that DDE has the potential and ability of Channel and optimizing the routing algorithms, assisting the multimedia applications over Wireless sensor networks. In this proposed works to be benefits overall security and optimized to path selection and channel selection minimizes to delay and increased network life times.

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AUTHORS PROFILE



Nabeena Ameen received the B.E., (Madras University) , M.E., in computer science engineering (Anna University) in 1989, 2002. Working at B.s. Abdur Rahman crescent Institute of science and technology as Assistant Professor (Sr)(Gr) since 2000. Her current research interests include wireless networks, cloud computing, mobile computing.



Dr. D. Najumissa Jamal Professor working at B. s. abdur rahman crescent Institute of science and technology . She received the B.E. in electrical and electronics engineering in Madras University , M.S., in control and instrumentation engineering In Anna University and Ph.D. degree in medical electronics Anna University in 1989, 1992, and 2012. Her current

research interests include modeling of biosignals , biosignal engineering, wireless networks.



Dr. Arun Raj received the B.S., M.S., in computer science engineering and Ph.D. degree in information and communication from Anna University in 2006, 2010, and 2017. Working at B.s. Abdur Rahman crescent Institute of science and technology as Associate Professor . His current research interests include 5G wireless networks, web security, Image

processing