



e-ISSN: 2319-8753 | p-ISSN: 2320-6710

IJRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 1, January 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.512

9940 572 462

6381 907 438

ijirset@gmail.com

www.ijirset.com

Formidably Improved Protocol for Significantly Increasing Battery Life for MANET Application

Rahul Mukherjee¹

Assistant Professor, Dept. of E&TC, Rungta College of Engineering and Technology, Bhilai, India¹

ABSTRACT : A Mobile Ad-hoc network (MANET) is a network formed and functioning without any established infrastructure or centralized administration and consists of mobile nodes that use a wireless interface to communicate with each other. These mobile nodes serve as both hosts and routers so they can forward packets on behalf of each other. Hence the mobile nodes are able to communicate beyond their transmission range by supporting multihop communication. Mobile nodes can move freely, and organize themselves randomly i.e. each host can dynamically enter and leave the network. Thus, the network topology may change frequently and rapidly. This means that the network has to adapt itself to the current topology. A MANET may either work as self-configured stand-alone network or may be connected to the Internet through gateway nodes.

I. INTRODUCTION

A Mobile Ad-hoc network (MANET) is a network formed and functioning without any established infrastructure or centralized administration and consists of mobile nodes that use a wireless interface to communicate with each other. These mobile nodes serve as both hosts and routers so they can forward packets on behalf of each other. Hence the mobile nodes are able to communicate beyond their transmission range by supporting multihop communication. Mobile nodes can move freely, and organize themselves randomly i.e. each host can dynamically enter and leave the network. Thus, the network topology may change frequently and rapidly. This means that the network has to adapt itself to the current topology. A MANET may either work as self-configured stand-alone network or may be connected to the Internet through gateway nodes.

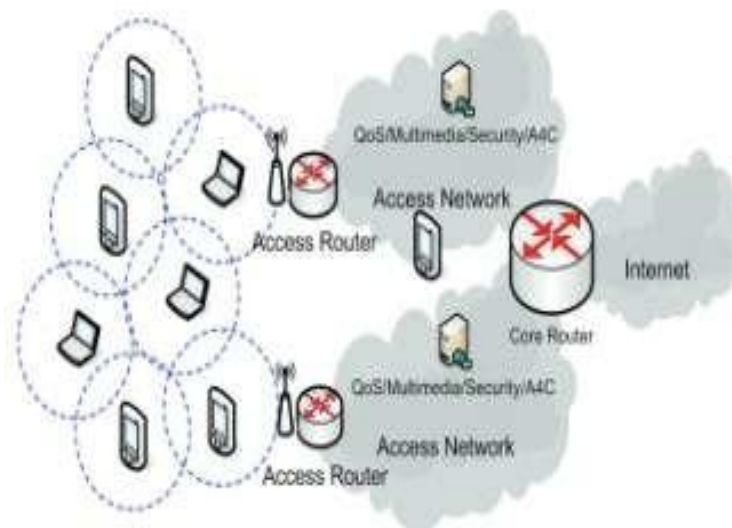


Figure .1. Ad-hoc Wireless Network



➤ **Hidden and Exposed Node Issue**

The transmission range of stations in wireless network is limited by the transmission power; therefore, all the station in a LAN cannot listen to each other. This means that normal carrier sense mechanism which assumes that all stations can listen to each other, fails. In particular, this gives rise to hidden node and exposed node problem. Consider stations A, B, C and D as shown in figure.

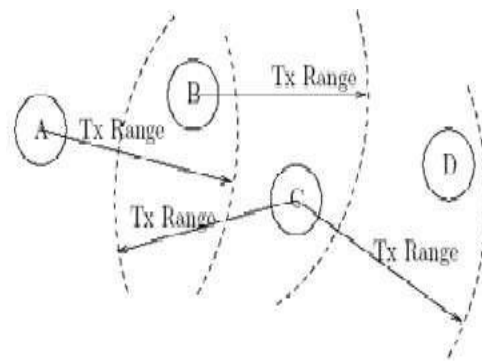


Figure .2. Hidden & Exposed node problem

II. IEEE 802.11 SCHEME SPECIFICATION

IEEE 802.11 specifies two medium access control protocols, PCF (Point Coordination Function) and DCF (Distributed Coordination Function). PCF is a centralized scheme, whereas DCF is a fully distributed scheme. We consider DCF in this paper.

- **Transmission range :** When a node is within transmission range of a sender node, it can receive and correctly decode packets from the sender node. In our simulations, the transmission range is 250 m when using the highest transmit power level.
- **Carrier sensing range :** Nodes in the carrier sensing range can sense the sender’s transmission. Carrier sensing range is typically larger than the transmission range, for instance, two times larger than the transmission range. In our simulations, the carrier sensing range is 550 m when using the highest power level. Note that the carrier sensing range and transmission range depend on the transmit power level.
- **Carrier sensing zone :** When a node is within the carrier sensing zone, it can sense the signal but cannot decode it correctly. Note that, as per our definition here, the carrier sensing zone does not include transmission range. Nodes in the transmission range can indeed sense the transmission, but they can also decode it correctly. Therefore, these nodes will not be in the carrier sensing zone as per our definition. The carrier sensing zone is between 250 m and 550 m with the highest power level in our simulation.

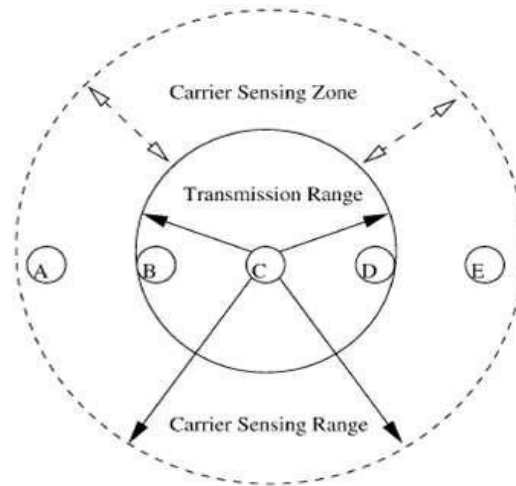


Figure .3. Carrier Sensing

III. BASIC POWER CONTROL PROTOCOL

Here nodes A and B send RTS and CTS, respectively, with the highest power level so that node C receives the CTS and defers its transmission. By using a lower power for DATA and ACK packets, nodes can conserve energy.

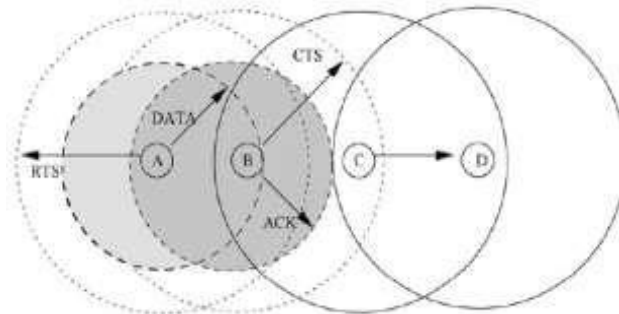


Figure .4. Basic Scheme

In the Basic scheme, the RTS–CTS handshake is used to decide the transmission power for subsequent DATA and ACK packets. This can be done in two different ways as described below. Let p_{max} denote the maximum possible transmit power level.

- Suppose that node A wants to send a packet to node B. Node A transmits the RTS at power level p_{max} . When B receives the RTS from A with signal level p_r , B can calculate the minimum necessary transmission power level, $p_{desired}$, for the DATA packet based on received power level p_r , the transmitted power level, p_{max} , and noise level at the receiver B.

We can borrow the procedure for estimating $p_{desired}$ from. This procedure determines $p_{desired}$ taking into account the current noise level at node B. Node B then specifies $p_{desired}$ in its CTS to node A. After receiving CTS, node A sends DATA using power level $p_{desired}$. Since the signal-to-noise ratio at the receiver B is taken into consideration, this method can be accurate in estimating the appropriate transmit power level for DATA.

- In the second alternative, when a destination node receives an RTS, it responds by sending a CTS as usual (at power level p_{max}). When the source node receives the CTS, it calculates $p_{desired}$ based on received power level, p_r , and transmitted power level (p_{max}), as

$$P_{\text{desired}} = p_{\text{max}}/pr \cdot R_{\text{xthresh}} \cdot c,$$

where R_{xthresh} is the minimum necessary received signal strength and c is a constant. We set c equal to 1 in our simulations. Then, the source transmits DATA using a power level equal to p_{desired} . Similarly, the transmit power for the ACK transmission is determined when the destination receives the RTS.

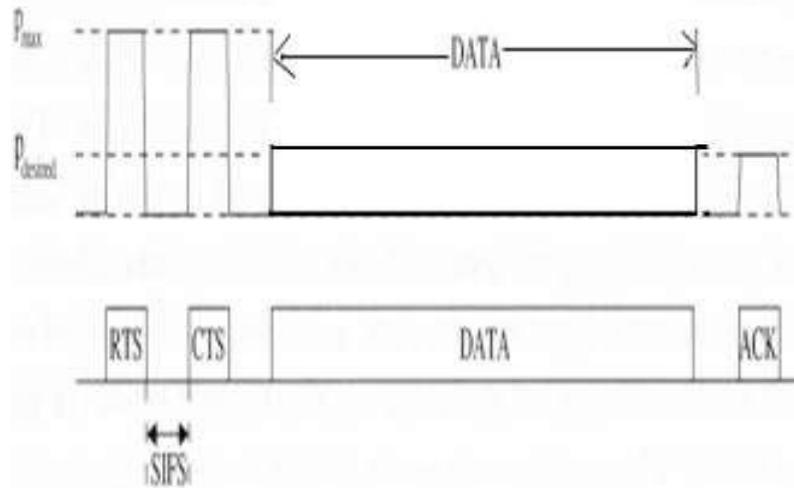


Figure .5. Basic Power Control Protocol

IV. DEFICIENCY OF THE BASIC PROTOCOL

In the Basic scheme, RTS and CTS are sent using p_{max} , and DATA and ACK packets are sent using the minimum necessary power to reach the destination. When the neighbour nodes receive an RTS or CTS, they set their NAVs for the duration of the DATA-ACK transmission. When D and E transmit the RTS and CTS, respectively, B and C receive the RTS, and F and G receive the CTS, so these nodes will defer their transmissions for the duration of the D-E transmission. Node A is in the carrier sensing zone of D (when D transmits at p_{max}) so it will only sense the signals and cannot decode the packets correctly. Node A will set its NAV for EIFS duration when it senses the RTS transmission from D. Similarly, node H will set its NAV for EIFS duration following CTS transmission from E.

When transmit power control is not used, the carrier sensing zone is the same for RTS-CTS and DATA-ACK since all packets are sent using the same power level. However, in Basic, when a source and destination pair decides to reduce the transmit power for DATA-ACK, the transmission range for DATA-ACK is smaller than that of RTS-CTS; similarly, the carrier sensing zone for DATA-ACK is also smaller than that of RTS-CTS.

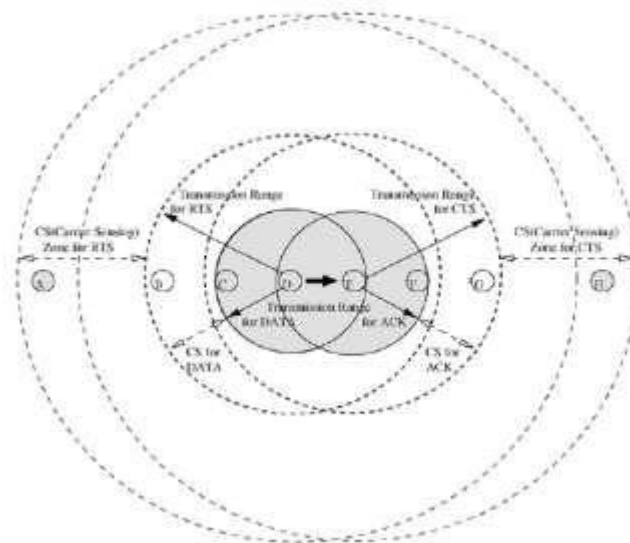


Figure .6. Basic Scheme

V. PROPOSED POWER CONTROL MAC PROTOCOL

Proposed power control MAC (PCM) is similar to the Basic scheme in that it uses power level p_{max} for RTS–CTS and the minimum necessary transmit power for DATA–ACK transmissions. We now describe the procedure used in PCM.

1. Source and destination nodes transmit the RTS and CTS using p_{max} . Nodes in the carrier sensing zone set their NAVs for EIFS duration when they sense the signal and cannot decode it correctly.
2. The source node may transmit DATA using a lower power level, similar to the BASIC scheme.
3. To avoid a potential collision with the ACK (as discussed earlier), the source node transmits DATA at the power level p_{max} , periodically, for just enough time so that nodes in the carrier sensing zone can sense it.
4. The destination node transmits an ACK using the minimum required power to reach the source node, similar to the BASIC scheme.

Figure shows how the transmit power level changes during the sequence of an RTS–CTS–DATA–ACK transmission. After the RTS–CTS handshake using p_{max} , suppose the source and destination nodes decide to use power level p_1 for DATA and ACK. Then, the source will transmit DATA using p_1 and periodically use p_{max} . The destination uses p_1 for ACK transmission.

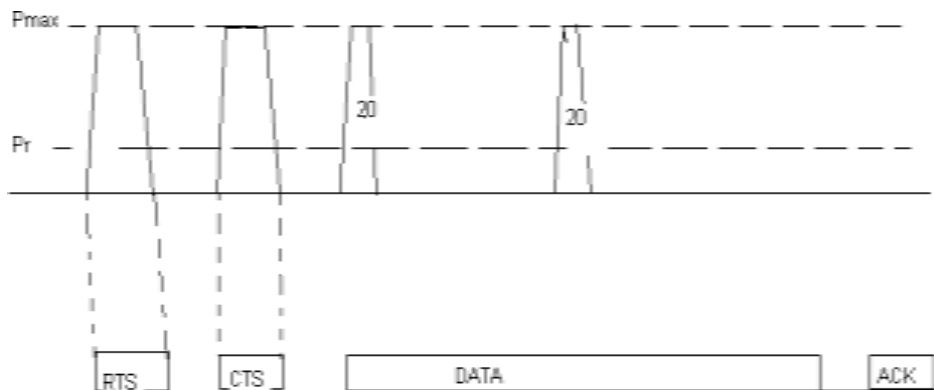


Figure .7. PCM periodically increases



The main difference between PCM and the Basic scheme is that PCM periodically increases the transmit power to p_{max} during the DATA packet transmission. With this change, nodes that can potentially interfere with the reception of ACK at the sender will periodically sense the channel as busy, and defer their own transmission.

Accordingly, $15 \mu s$ should be adequate for carrier sensing, and time required to increase output power (power on) from 10% to 90% of maximum power (or power-down from 90% to 10% of maximum power) should be less than $2 \mu s$. Thus, we believe $20 \mu s$ should be enough to power up ($2 \mu s$), sense the signal ($15 \mu s$), and power down ($2 \mu s$). In our simulation, EIFS duration is set to $212 \mu s$ using a 2 Mbps bit rate. In PCM, a node transmits DATA at p_{max} every 190 μs for a $20 \mu s$ duration. Thus, the interval between the transmissions at p_{max} is $210 \mu s$, which is shorter than EIFS duration. A source node starts transmitting DATA at p_{max} for $20 \mu s$ and reduces the transmit power to a power level adequate for the given transmission for 190 μs . Then, it repeats this process during DATA transmission. The node also transmits DATA at p_{max} for the last $20 \mu s$ of the transmission.

With the above simple modification, PCM overcomes the problem of the BASIC scheme and can achieve efficiency comparable to 802.11, but uses less energy.

The proposed power control protocol is modified such that in this the Data and ACK is transmitted at lower power level but after a certain duration it is transmitted at higher power level for a very fraction of time, in order to make the neighboring nodes understand that transmission is going on and they should restrict their transmission during that period so that collision does not take place hence saving power consumption.

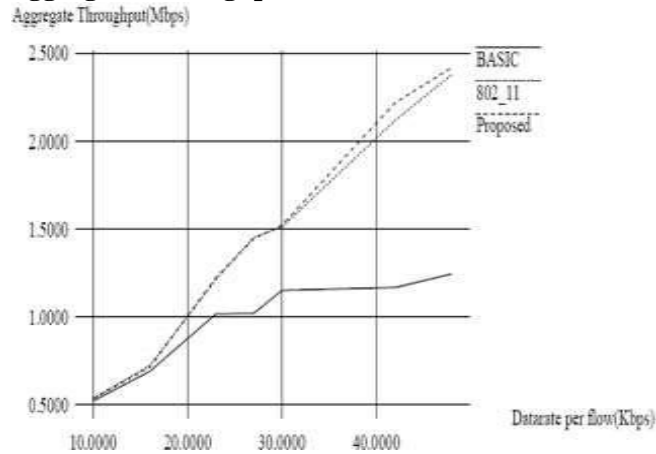
VI. SIMULATION RESULTS

The given table shows all the different parameters taken into account for conducting the simulation in NS-2 atmosphere. In this table the values of all the different parameters are shown, using which the simulation for aggregate throughput and total data delivered per joule in accordance with Data rate per flow and Packet size is calculated for all three schemes namely, BASIC, 802.11 and Proposed protocol's.

Parameters	Values
Number of nodes	50
Simulation Area(m)	800x800
Topology	Random
Transmission range	50,100,150,200,250
Radio Propagation model	Shadowing
Traffic model	CBR, TCP
Packet Size	256,512,1024 bytes
Simulation times	150 seconds,300 seconds
Bandwidth	2 Mbps
Routing	DSR

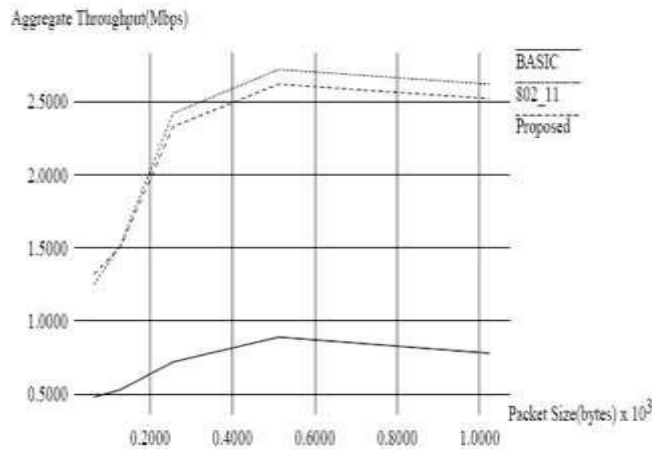


A. Simulation Result for Aggregate Throughput vs Data Rate Per Flow



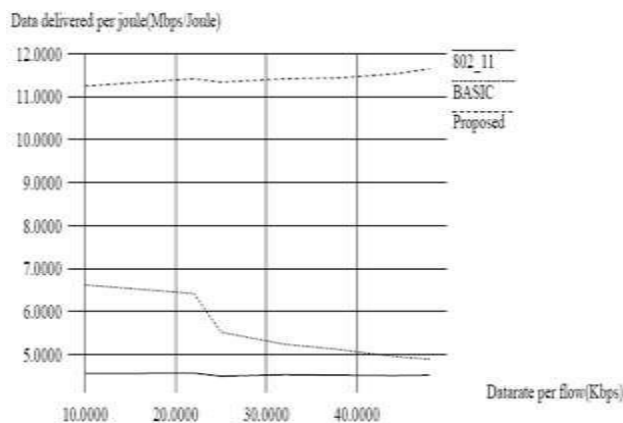
The graph clearly depicts an increase in aggregate throughput vs data rate flow in proposed

B. Simulation Result for Aggregate Throughput vs Packet Size



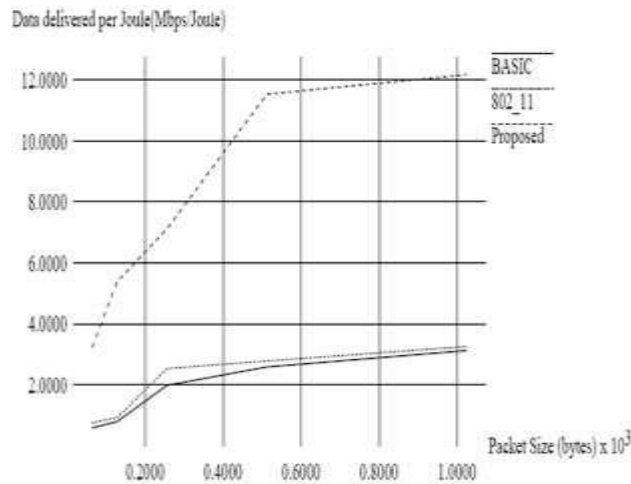
The graph clearly depicts an increase in aggregate throughput vs packet size in proposed

C. Simulation Result for Data Delivered per Joule vs Data rate per flow



The graph clearly depicts an increase in data delivered per joule vs data rate flow in proposed

D. Simulation Result for Data Delivered per joule vs Packet Size



The result shows sustainably increase in data delivered in proposed protocol compared to others

VII. CONCLUSION

It is shown that the Basic scheme increases collisions and retransmissions, which can result in more energy consumption and throughput degradation. Hence, the proposed protocol is more efficient than Basic scheme and 802.11 yielding better throughput with much less power consumption, hence yielding better performance compared to the rest protocols.

VIII. SUGGESTION FOR FUTURE WORK

- We have shown the throughput of proposed protocol comparable to 802.11 with less power consumption for random topology ad hoc network.
- In future the same power consumption scheme will be conducted for grid topology.

One possible approach to the mobile ad hoc network power control scheme is that, it is only applied to the Random topology ad hoc scenario but it can also be made applicable for Grid Topology power control scheme without degrading the network throughput. Where the nodes will be placed sequentially in a proper manner i.e, in an arranged fashion.

REFERENCES

- [1] B. Awerbunch, D. Holmer, and H. Rubens .The medium time metric: High throughput route selection in multi-rate adhoc wireless network.
- [2] Ruay-Shiung Chang and Shing-Jiuan Leu, January 2006, "Long-lived Path Routing With Received Signal Strength for Ad Hoc Networks", IEEE International Symposium on Wireless Pervasive Computing.
- [3] R. Wattenhofer, L. Li, P. Bahl and Y.-M. Wang, Distributed topology control for power efficient operation in multihop wireless ad hoc networks, Vol. 3 pp. 1388–1397 (April 2001).
- [4] N. Poojary, S.V. Krishnamurthy and S. Dao, Medium access control in a network of ad hoc mobile nodes with heterogeneous power capabilities, in: Proc. IEEE International Conference on Communications (ICC 2001), Vol. 3 pp. 872–877 (2001).
- [5] M.K.Marina and S.R.Das, 2001, "On-Demand Multipath distance vector routing in ad hoc Networks" in: Proceedings of 9th IEEE International Conference on Network Protocols (ICNP).
- [6] Performance analysis of AODV, DSDV AND DSR in MANETS, International Journal of Distributed and



Parallel Systems (IJDPS) Vol.2, No.6, November 2011

- [7] Geetha jayakumar and G Gopinath – —Performance comparison of Two On- demand routing protocols for Ad-hoc Networks based on random way point mobility model. | – Department of Computer Science, Bharathidasan University, Triuchirapalli- 620 023, India
- [8] Sridhar Subramanian and Baskaran Ramachandran, “Trust Based Scheme for QoS Assurance in Mobile Ad-Hoc Networks” ,International Journal of Network Security & Its Applications (IJNSA), Vol.4, No.1, January 2012 , DOI : 10.5121/ijnsa.2012.4108 77.
- [9] D. Arivudainambi n, D.Rekha , ”Memetic algorithm for minimum energy broadcast problem in wireless adhoc networks “ , Science Direct journal , 22106502/2013ElsevierB.V..<http://dx.doi.org/10.1016/j.swevo.2013.04.001>.
- [10] Jeong-Hun Lee , Ilkyeong Moon , “Modeling and optimization of energy efficient routing in wireless sensor networks” , Science Direct , Applied Mathematical Modelling journal ,0307-904X/\$ - see front matter _ 2013 Elsevier Inc. <http://dx.doi.org/10.1016/j.apm.2013.10.044>.
- [11] Ruo Jun Cai, Peter Han Joo Chong, Cherry Ye Aung , “Poster: Trust-based Routing with Neighborhood Connectivity to Prevent Single and Colluded Active Black Hole” ,2014 9th International Conference on Communications and Networking in China (CHINACOM).

BIOGRAPHY



Rahul Mukherjee : Asst Prof. (ET&T-Dept), Rungta College of Engineering & Technology, Bilhailai, India. Pursuing P.hd in the field of Adhoc Networking, published research papers in Eighteen International Journals. Published a book with an European Publishing House. Pursued M.Tech in Communication Systems Engineering from KIIT University, Bhubaneswar. His field of interest comprises of Adhoc Networks, Wireless Networks & Mobile Communication.



INNO  **SPACE**
SJIF Scientific Journal Impact Factor

**Impact Factor:
7.512**

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 **9940 572 462**  **6381 907 438**  **ijirset@gmail.com**



www.ijirset.com

Scan to save the contact details