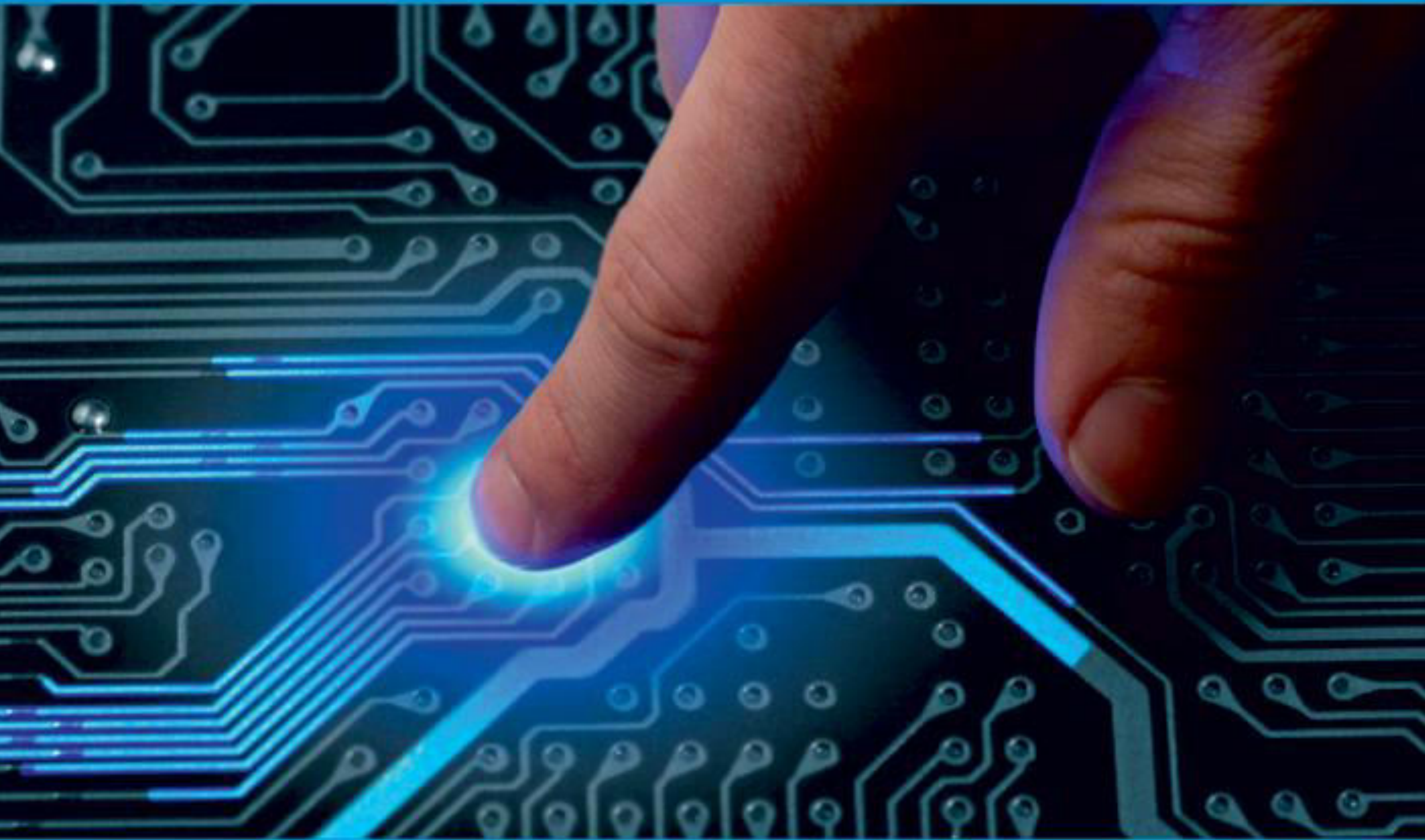
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 10, Issue 6, June 2022

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.165

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006153|

Analysis and Comparison of Algorithm for Energy Efficiency in WSN

Harsh Kumar[1], Kanishk Gupta[2], Nikhil Kumar[3], Saikat Chattoraj[4], Dr. T.C.Manjunath[5], Trupti S Tagare[6]

UG Student, Dept.of ECE, Dayananda Sagar College of Engineering, Bengaluru, Karnataka, India[1,2,3,4]

Head of Department, Dept.of ECE, Dayananda Sagar College of Engineering, Bengaluru, Karnataka, India[5]

Assistant Professor, Dept.of ECE, Dayananda Sagar College of Engineering, Bengaluru, Karnataka, India[6]

ABSTRACT: Among the main limitations of wireless sensor networks (WSNs) are limited energy sources, low processing power, and limited storage capacity. Due to the increasing popularity of WSN, the greatest obstacle is the low energy reserve of each node. To solve this issue, we can improve the existing Routing algorithm because it can be implemented in existing WSN networks. Many studies have recently focused on these topics. Researchers have proposed a variety of protocols such as LEACH, E-MODLEACH, EEAHP, etc. By analyzing algorithms and comparing their effectiveness for energy efficiency in WSN nodes, an explanation and a visualization of the data are presented in brief, using a simulator, to understand how the nodes work and how their energy is affected by an increase in several nodes, the Cluster Head and initial energy of each node.

KEYWORDS: WSN; Energy Efficiency; Throughput; Energy dissipation.

I. INTRODUCTION

Sensor networks generally consist of hundreds, if not thousands, of low-cost, low-power, and tiny nodes that have sensing, processing, and wireless communication capabilities. Using these sensor nodes, data can be gathered in physical environments and transmitted to the Base Station (BS), where data can be analyzed and observed. This isn't always straightforward as the sensor nodes are usually battery-powered, and if the network is deployed in remote regions, the sensor nodes have limited means for recharging their batteries. Sensor node consumes energy for different tasks including sensing, processing, transmitting, and receiving data. Communication takes the most amount of power so it needs to be done as efficiently as possible. Energy consumption in the sensor's data transferring phase can be reduced with the help of energy-efficient routing protocols.

In most cases, routing protocols are beneficial for saving large amounts of energy and extending the sensor lifespan by reducing the number of transmissions in the network and eliminating redundant data collection. Several protocols address the energy management issues in WSNs, these protocols are classified as Location-based, Flat, and Hierarchical routing protocols. Hierarchical clustering-based routing protocols are particularly useful for utilizing energy effectively and efficiently.

II. RELATED WORK

In the calculation of hierarchical groups Calculation using Low Energy Adaptive Grouping Hierarchy (LEACH), where group leaders and the rest of the bunch are responsible for information sharing. For LEACH each hub sends a message right away to the group leader and base station steering with a single hop. Drain has two remarkable phases in every round of activity. Additionally, the second area is used to send data to the base station. The LEACH's primary advantage is that it avoids overt repetition of records at the station base. It presents perspectives on data security, extended network lifespan, and flexibility. Use filters random pivot of nearby bunch heads to allocate resources fairly to the local energy load on the sensors. Previously, the option for bunch heads (CHs) was expected. There is a risk associated with hubs having a lot less traffic as a result. Energy can also be selected as a CH. Each time the emphasis is correspondence cycle LEACH incurs additional costs because of the bunch head approach. The calculations bring to light the power limitation for dynamic grouping when used in non-static large-scope organizations. A Modified Low Energy Adaptive Clustering, is described above. Previously, it was suggested to work on the Order (MOD-LEACH) LEACH.

Dual transmission power levels and effective CH replacement methods are added to LEACH in MOD-LEACH to reduce the overall energy consumption of nodes. It employs a new cluster head election algorithm in which nodes

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006153|

having residual energy above a threshold continue to operate as CHs for subsequent rounds. However, there is no restriction on the number of cluster heads in this algorithm. Even though the improved CH assignment mechanism only works during the first few rounds if the cluster head has so little energy left than the required threshold, it still works similarly to the LEACH algorithm.

A clustering method like LEACH is used in the Threshold sensitive Energy Efficient sensor Network algorithm (TEEN) to design a routing algorithm for reactive wireless sensor networks. To minimize data transmission TEEN establishes two significant thresholds—one for hard data and the other for soft data—and the Cluster Head (CH) broadcasts these to its greater level until the data reaches the sink. The detected attribute's hard to limit is a threshold value. It is the attribute's absolute value over which the matching sensed node identifies this value as CH. The soft threshold is a slight variation in the value of the capabilities that enable the node to turn on its transmitter and then transmit. The node turns on and communicates the sensed data the first time one of the parameters in the attribute set meets the hard threshold value. The sensed value will be kept in an internal node variable. TEEN performs admirably in circumstances involving abrupt changes in perceived characteristics, such as temperature, weather reports, etc. TEEN is not appropriate for applications that require regular data reporting or networks with many levels but a big surface area.

The DEEC algorithm makes use of a cluster-based system for two- and multi-level heterogeneous WSN. The basis for cluster head generation is the average energy of the network and the residual energy of the nodes. Here, the cluster head is chosen based on the probability ratio between residual energy and network average energy. In DEEC, the cluster head is more likely to be a high-energy node than a low-energy node.

By employing a different method for cluster head election from Hybrid Energy-Efficient Distributed (HEED) clustering, the Enhanced Modified Low Energy Adaptive Clustering Hierarchy (E-MODLEACH) algorithm chooses a node as the cluster head based on the node's remaining energy. In this model, an energy hole-filling mechanism has been employed, which keeps a node in sleep mode if its energy level is below a threshold. Additionally, if there are more than 11 sleep nodes, they are kept in the active state while being brought back one at a time.

III. PROPOSED METHODOLOGY AND DISCUSSION

This study compares and analyses several state-of-the-art wireless sensor network protocols. The application of a wireless system aids enterprises to avoid the expensive means of making use of cables for buildings or connecting different equipment settings. The basis of any wireless system is radio waves/microwaves, and their application that ensues at the physically advanced level of network construction both for radio waves/microwaves, radio communications systems (RCSs), and other relevant EMWs.

Nodes can communicate routing information and make routing decisions using routing protocols. The routing protocol has been created with the consideration that energy consumption should be maintained to a minimum to maintain the network active for lengthy data transmission rounds. The computational aspect of the sensor connection is optimized to do this.

Routing protocols enable connectivity between the base station and the sensor. They describe how data generated at the sensor is delivered there (sink). While collecting sensitive data via a sensor network, it is essential to keep the network operational. The key challenge to sustaining the node's life is battery-supplied energy. Because energy is a finite resource, saving energy will enable sensors to send data more frequently as opposed to only when an information trigger happens.

A high-performance numerical calculation and visualization tool has been used to develop the proposed routing algorithm MATLAB simulation software. It provides a dependable and adaptable environment for interaction. It is easy to comprehend and use software that enables users to design new capabilities. Additionally, this provides access to FORTRAN and C programming via external interfaces. Numerous research papers have therefore examined how well this program serves the aims of implementation and analysis, including those by Cao and Zhang (2018), Chowdhury et al. (2018), and Shangyang et al. (2018), the researchers have selected this program to test their suggested methodologies in real-world settings. Due to its effective and user-friendly modeling and Muhammad Zafar Iqbal Khan, Kamarularifin Abd Jalil, and Mohd Faisal Ibrahim's PREPRINT analytical capabilities, this study has also chosen this program to assess the efficacy of the suggested technique. In a variety of applications, including long-term monitoring, wireless sensor networks require a longer network lifetime and more network capacity. As a result, it is believed that the challenges of energy and network capacity utilization are at the heart of the sensor research model. The routing protocol functioned as the mechanism by which the energy required for various activities to complete the data transmission to the sink was reduced using hierarchical clustering.

To replicate these protocols' algorithmic structures in Matlab, research has been done on a wide range of original wireless sensor network protocols. This specific objective was the driving force behind the study's design. To understand whether changing the parameters of the algorithm leads to a better result, the parameters of the algorithm

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006153|

were studied and simulated. The version that we started with has been studied with a graphical representation to make comparisons easier. We've provided a created and constructed GUI to demonstrate how the system operates. Using user inputs like the number of results, the GUI would display the rounds, number of nodes, probability, and initial energy.

The paperwork undertaken by us is organized in the following sequence as follows. The Introduction in section I gave a succinct overview of the study. Section II contains a presentation of the literature review. Discussion and Proposed Methodology In Section III. Experimental results are presented in section IV, which includes graphs and tables that show data obtained from simulations in which several parameters are varied at each simulation, such as the number of rounds, the number of sensor nodes, the initial energy, and the probability of failure. The number of nodes that are still alive after the simulation, throughput, aggregate latency, traffic load, packets received at cluster heads, packets received at the base station, and total energy dissipation is all represented. The paper's end is concluded with a conclusion and suggestions for further research in section V. with references at section bottom.

IV. EXPERIMENTAL RESULTS

In evaluating each Protocol's performance and determining how they compared to one another in terms of energy usage and the proportion of successful base station reception throughout the length of the network lifetime, we conducted a comprehensive simulation in our research. To accomplish that goal, the MATLAB R2015a tool has been used to conduct the simulations.

We conducted these simulations using the same scenario outlined in each procedure to show the value of our contribution. In light of this, we considered a network topology that included 100 stationary sensor nodes. The distant base station is located at positions x = 200, and y = 200, and sensor nodes are randomly scattered inside a 400 m 400 m square using a uniform distribution function. At the beginning of the experiment, each sensor node contained exactly one joule of energy or energy.

To evaluate how well therapies function in a real-world situation, initial parameters summarized in Table 1 are employed. The final sensor in the sensor network expires at that point, which is how we presumptively define system lifetime. Average findings were obtained following each round, the length of which varies based on each regimen. The simulations continued until the energy of all the network's sensors was exhausted. This period is a measure of the cluster timeout. It is used to extend the network's life and maintain an even distribution of energy across all of its sensors. The election system for the cluster-head is yet again started after this period expires.

Table 1: Initial parameters

Parameter	Value
Network Grid	(0,0) x (400,400) m^2
Base Station	(200,200)
Initial Energy per Node	1 joule
Number of Nodes	100 nodes
Cluster head Probability	0.5
Number of rounds	4500
Transmitter energy per node	5.0000e-08 j/bit
Receiver energy per mode	5.0000e-08 j/bit
Data Aggregation Energy	5.0000e-09 j/bit
Threshold Dist.	87.7058

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006153|

A. Nodes lifetime

The definition of network life states that the period between the first and last dead node is the maximum amount of time that a node can be active. In contrast to previous protocols, which show that the first and last nodes die sooner, Fig. 1 shows the number of alive nodes for each round in the EEAHP protocol. Because there are fewer CHs and a different method of plugging energy holes, this occurs.

B. Throughput

A communication channel's throughput represents the average rate at which packets are successfully delivered over a given period. Figure 2 shows how throughput decreases and fluctuates as the number of nodes increases for each protocol. As the number of nodes between the source and the destination increases, the packet error probability increases, resulting in a decrease in network traffic throughput.

C. Aggregate delay

The aggregate delay is the total time it takes for a packet to reach its destination. Fig. 3 illustrates how to aggregate delay increases with the number of nodes for every protocol and is different for each protocol. SEP, TEEN, and EAHP possess the least aggregate delay among the others under the provided conditions.

D. Data transmission

Comparing EEAHP to other algorithms, EEAHP receives the most packets at the base station, as shown in Figure 4, and EMODLEACH receives the least. Data transmission also increases as the number of rounds increases, since with each round packets are sent to the base station.

E. Total Energy Dissipation

Figure 5 illustrates how Total Energy Dissipation decreases for every protocol as the number of rounds increases. At the initial number of rounds, the energy dissipation is highest. Here MOD-LEACH shows the least energy dissipation.

F. Traffic Load

The traffic loads represent the data sent to the base station. In Figure 6, the average traffic load per node is plotted against the number of nodes. Traffic load decreases as the number of nodes increases.

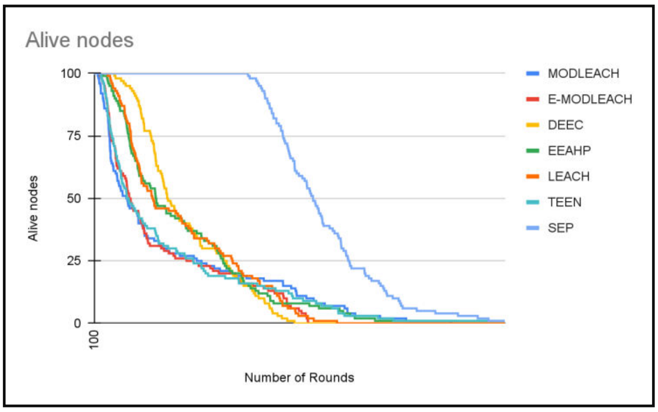


Fig.1 Alive Nodes vs Number of rounds

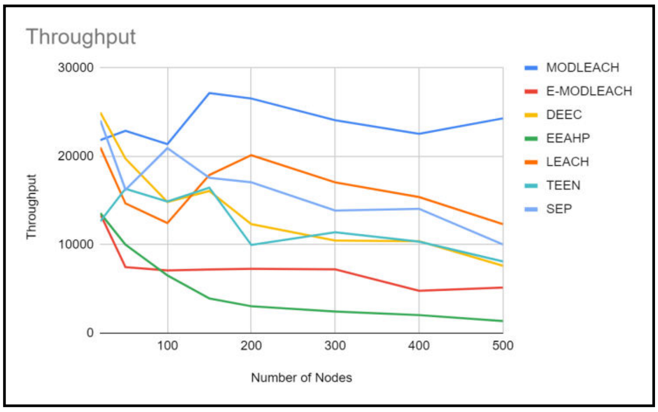


Fig. 2. Throughput vs Number of nodes

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006153|

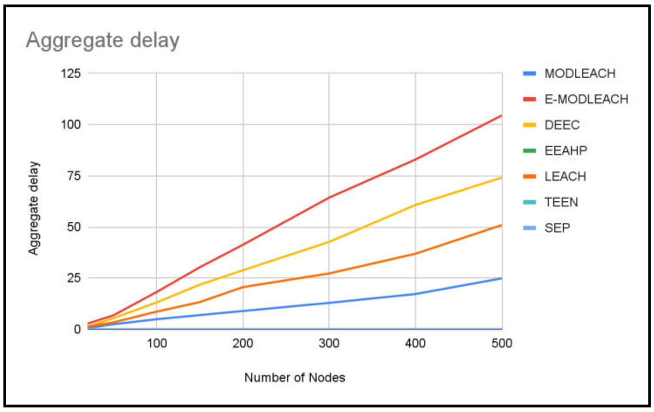


Fig.3. Aggregate delay vs Number of nodes

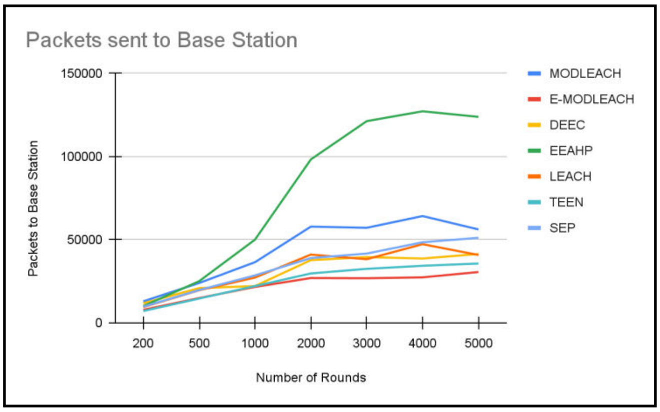


Fig. 4. Packets transmission to BS vs Number of rounds

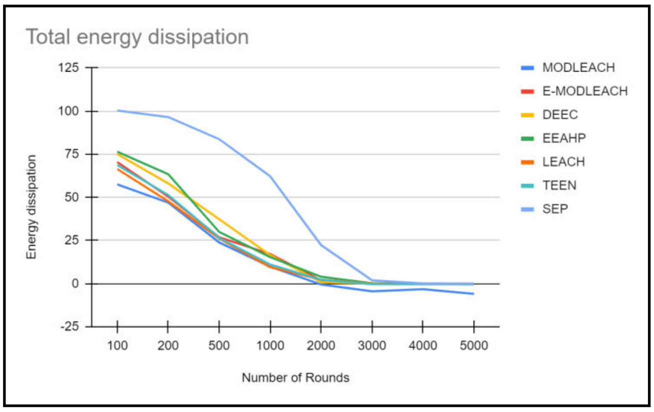


Fig.5. Total energy dissipation vs Number of rounds

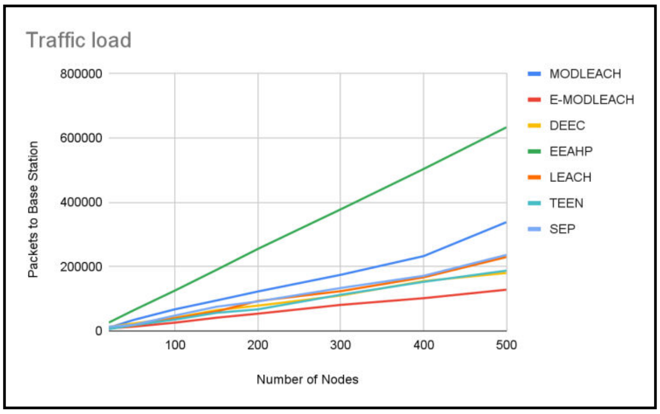


Fig.6.Traffic load vs Number of nodes

V. CONCLUSION

Due to the increase in data coming from wireless sensor nodes, it is necessary to reduce energy consumption in these nodes. We briefly discuss such energy-efficient protocols here. Optimizing network lifetime and reducing energy consumption are important parameters when designing wireless sensor networks. Among the existing routing algorithms in WSN, EEAHP has proven to be the most optimized algorithm based on simulation and analysis.

REFERENCES

1. Comparative Study of Energy Efficient Routing Techniques in Wireless Sensor Networks, Zagrouba & Kardi - Information - 2021
2. A Survey of Network Lifetime Maximization Techniques in Wireless Sensor Networks, Yetgin, et al. - IEEE Communications Surveys & Tutorials – 2017.
3. A Survey on Reliability Protocols in Wireless Sensor Networks, Kafi, et al. - ACM Computing Surveys – 2018.
4. Survey on WSN Routing Protocols, Kaur, et al. - International Journal of Computer Applications – 2015.
5. M.Shanthi Dr. E.RamaDevi "A Cluster-Based Routing Protocol in Wireless Sensor Network for Energy Consumption" Int. J. Advanced Networking and Applications Volume: 05, Issue: 04, 2014.
6. Energy-Efficient and Fault-Tolerant Routing Protocol for Mobile Sensor Network, Karim & Nasser - 2011 IEEE International Conference on Communications (ICC) - 2011.
7. An energy-efficient and QoS-aware multipath routing protocol for wireless sensor networks, Yahya & Ben-Othman - 2009 IEEE 34th Conference on Local Computer Networks - 2009.
8. Enhanced energy-aware multi-hop hierarchical routing algorithm for wireless sensor networks, Shemim et al. - 2017 International Conference on Electrical and Computing Technologies and Applications (ICECTA) - 2017.

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 8.165 |

|| Volume 10, Issue 6, June 2022 ||

| DOI: 10.15680/IJIRCCE.2022.1006153|

9. Performance Evaluation of the WSN Routing Protocols Scalability, Alazzawi&Elkateeb - Journal of Computer Systems, Networks, and Communications - 2008.

BIOGRAPHY

Harsh Kumar is Under Graduate Student pursuing his B.E. inthe Electronics and Communication Department, at Dayananda Sagar College of Engineering, Bangalore, Karnataka, India. His current interests are MATLAB-based projects, Internet of Things, and Operating systems.

Kanishk Gupta is Under Graduate Student pursuing his B.E. inthe Electronics and Communication Department, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India.His current interests are Computer Networks, the Internet of Things, and Data structures.

Nikhil Kumar is Under Graduate Student pursuing his B.E. inthe Electronics and Communication Department, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India.His current interests are Computer Networks, Operating Systems, and microprocessors.

Saikat Chattoraj is Under Graduate Student pursuing his B.E. inthe Electronics and Communication Department, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India.His current interests are Wireless sensor networks and MATLAB-based projects.

Dr. T.C Manjunath is a Head of Department in the Electronics and Communication Engineering Department, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India. He received a B.E. Degree in Electrical Engineering from the University of Bangalore in 1989 and an M.E. in Automation and Control Engineering from the University of Gujarat in 1994, respectively. He is a Ph.D. Research Scholar in the Interdisciplinary Programme in Systems and Control Engineering, Indian Institute of Technology Bombay, Mumbai-76, India in the field of modeling, control, and implementation of smart structures and their applications. His current research interests are in the area of robotics, control systems, signal processing, periodic output feedback control, fast output feedback control, sliding mode control of SISO, and multivariable systems.

Trupti S Tagare is an Assistant Professor in the Electronics and Communication Engineering Department, Dayananda Sagar College of Engineering, Bangalore, Karnataka, India. She received a B.E. degree in Electronics and Communication Engineering from the K.L.E College of Engineering, Belgaum VTU in 2009 and an M.Tech. in Digital Electronics from the Gogte Institute of Technology, Belgaum, VTU in 2013 in First Class with Distinction, respectively. Currently, she is pursuing her Ph.D. in Wireless Sensor Networks, DSU, Bengaluru since 2020. Her current interests are in the area of Wireless Sensor Networks, Analog, and Digital Communication, Power Electronics, Digital Electronics, Wireless Communications, Basic Electronics, and Computer Communication Networks.

INNO SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.165

doi cross ref

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

निस्केयर
NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING