iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2017 **Issue:** onference **Month of publication:** September 15, 2017

DOI:

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

A Survey on Routing Protocols in Wireless Sensor Network

Swati Balaram Wadkar[1], Mrs.Naveeta Kant [2]
[1] *Department of Electronics and Telecommunication Engineering*
[2]*Department of Electronics Engineering, VESIT, University of Mumbai, India*

Abstract: Advances in wireless sensor network (WSN) technology has provided the availability of small and low-cost sensor nodes with capability of sensing various types of physical and environmental conditions, data processing, and wireless communication. Variety of sensing capabilities results in profusion of application areas. However, the characteristics of wireless sensor networks require more effective methods for data forwarding and processing. WSN are generally used to monitor activities and report events, such as fire, overheating etc. in a specific area or environment. Itrouts data back to the Base Station (BS). Data transmission is usually a multi-hop from node to node towards the BS. Sensor nodes are limited in power, computational and communication bandwidth. Primary goal is to find the energy efficient routing protocol. Sensor nodes are limited in power, computational and communication bandwidth.
Keywords: Wireless Sensor Network, Routing protocol, Energy efficient, cluster head

I. INTRODUCTION

Wireless sensor network (WSN) is widely considered as one of the most important technologies for the twenty-first century [1]. In the past decades, it has received tremendous attention from both academia and industry all over the world. A WSN typically consists of a large number of low-cost, low-power, and multifunctional wireless sensor nodes, with sensing, wireless communications and computation capabilities [2,3]. Due to the low-cost of these nodes, the deployment can be in order of magnitude of thousands to million nodes. The nodes can be deployed either in random fashion or a pre-engineered way. The sensor nodes perform desired measurements, process the measured data and transmit it to a base station, commonly referred to as the sink node, over a wireless channel. The base station collects data from all the nodes, and analyzes this data to draw conclusions about the activity in the area of interest. Link utilization differs greatly between different routing algorithms [20].

A. Location-Based Protocol

Some real time application needs to know about location of node before communication.In location-based protocols, sensor nodes are addressed by means of their locationsLocation information for sensor nodes is required for sensor networks by most of the routing protocols to calculate the distance between two particular nodes so that energy consumption can be estimated. In this section, we present a sample location-aware routing protocols proposed for WSNs.

B. Geographic Random Forwarding (GeRaF)

In GeRaF [4] when a source sensor has sensed data to send to the sink, it first checks whether the channel is free in order to avoid collisions. If the channel remains idle for some period of time, the source sensor broadcasts a request-to-send (RTS) message to all of its active (or listening) neighbours. This message includes the location of the source and that of the sink. Note that the coverage area facing the sink, called *forwarding area,* is split into a set of *Np* regions of different priorities such that all points in a region with a higher priority are closer to the sink than any point in a region with a lower priority. When active neighbouring sensors receive the RTS message, they assess their priorities based on their locations and that of the sink. The source sensor waits for a clear-to-send (CTS) message from one of the sensors located in the highest priority region. For GeRaF, the best relay sensor the one closest to the sink, thus making the largest advancement of the data packet toward the sink. In case that the source does not receive the CTS message, implies that the highest priority region is empty. Hence, it sends out another RTS polling sensors in the second highest priority region. This process continues till the source receives the CTS message, which means that a relay sensor has been found. Then, the source sends its data packet to the selected relay sensor, which in turn replies back with an ACK message. The relay sensor will act in the same way as the source sensor in order to find the second relay sensor. The same procedure repeats until the sink receives the sensed data packet originated from the source sensor. It may happen that the sending sensor does not receive any CTS message after sending *Np* RTS messages. This means that the neighbors of the sending sensor are not active. In this case,

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor:6.887
Volume 5 Issue IX, September 2017- Available at www.ijraset.com

the sending sensor backs off for some time and retries later. After a certain number of attempts, the sending sensor either finds a relay sensor or discards the data packet if the maximum allowed number of attempts is reached.The procedure is explained in Fig 1.

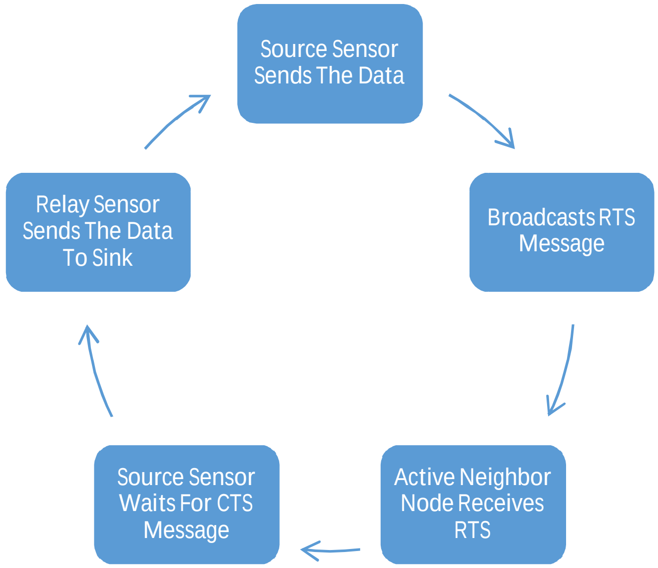


Fig 1: Procedure of GeRaf

II. DATA CENTRIC PROTOCOL

In data-centricprotocols, when the source sensors send their data to the sink, intermediate sensors can perform some form of aggregation on the data originating from multiple source sensors and send the aggregated data toward the sink. This process can result in energy savings because of less transmission required to send the data from the sources to the sink. In this section, we review some of the data-centric routing protocols for WSNs.

A. Directed Diffusion

Directed diffusion [5, 6] is a data-centric routing protocol for sensor query dissemination and processing. It meets the main requirements of WSNs such as energy efficiency, scalability, and robustness. Directed diffusion has several key elements namely data naming,interests and gradients, data propagation, and reinforcement. A sensing task can be described by a list of attribute-value pairs. At the beginning of the directed diffusion process, the sink specifies a low data rate for incoming events. After that, the sink can reinforce one particular sensor to send events with a higher data rate by resending the original interest message with a smaller interval. Likewise, if a neighboring sensor receives this interest message and finds that the sender's interest has a higher data rate than before, and this data rate is higher than that of any existing gradient, it will reinforce one or more of its neighbours.

III. HIERARCICAL PROTOCOL

In this routing, cluster is created and a head node is assigned to each cluster. The head nodes are the leaders of their groups having responsibilities to collect and aggregate data from their respective clusters and forward the aggregated data to the base station. This aggregation of data will greatly reduce the energy consumption in the network that will lead to increase the life time of sensor network. The main idea of developing cluster-based routing protocols is to reduce the network traffic towards the sink [7, 8]. It has been demonstrated that cluster-based protocols exhibit better energy consumption and performance when compared to flat network topologies.

A. Low-Energy Adaptive Clustering Hierarchical (LEACH)

LEACH [9,10] uses clusters to prolong the life of the wireless sensor network and it is based on an aggregation (or fusion) technique that combines or aggregates the original data into a smaller size of data that carry only meaningful information to all individual sensors. This protocol divides the a network as shown in Fig 2. into several cluster of sensors, which are constructed by using localized coordination and control not only to reduce the amount of data that are transmitted to the sink, but also to make routing and data dissemination more scalable and robust. LEACH uses a randomize rotation of high-energy CH position rather than selecting in static manner, to give a chance to all sensors to act as CHs and avoid the battery depletion of an individual sensor and dying quickly. The operation of LEACH is divided into rounds having two phases each namely (i) a setup phase to organize the network into clusters, CH advertisement, and transmission schedule creation and (ii) a steady-state phase for data aggregation, compression, and transmission to the sink. It reduces energy consumption by (a) minimizing the communication cost between sensors and their cluster heads and (b) turning off non-head nodes as much as possible [11]

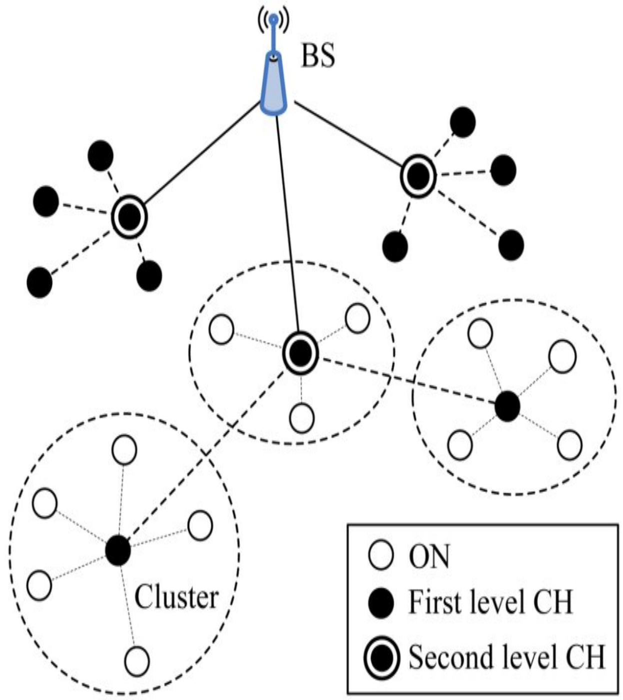


Fig 2: Clustering in LEACH

IV. QOS-BASED PROTOCOL

In addition to minimizing energy consumption, it is also important to consider quality of service (QoS) requirements in terms of delay, reliability, and fault tolerance in routing in WSNs.

A. Sequential Assignment Routing (SAR)

SAR [12] is a table-driven multi-path approachstriving to achieve energy efficiency and fault tolerance. Routing decision in SAR is dependenton three factors: energy resources, QoS on each path, and the priority level of each packet [13, 14, 15]. The SAR protocol creates trees rooted at one-hop neighboursof the sink by taking QoS metric, energy resource on each path and priority level of each packet into consideration. By using created trees, multiple paths from sink to sensors are formed. One of these paths is selected according to the energy resources and QoS on the path. Failure recovery is done by enforcing routing table consistency between upstream and downstream nodes on each path. Any local failure causes an automatic path restoration procedure locally. The objective of SAR algorithm is to minimize the average weighted QoS metric throughout the lifetime of the network. If topology changes due to node failures, a path re-computation is needed. As a preventive measure, a periodic re-computation of paths is triggered by the base-station to account for any changes in the topology. A handshake procedure based on a local path restoration scheme between neighbouringnodes is used to recover from a failure.

V. HETROGENIETY-BASED PROTOCOL

In this section we discuss heterogeneity in WSNs to extend network lifetime and present a routing protocol.

A. Information-Driven Sensor Query (IDSQ)

IDSQ [16, 17] addresses the problem ofheterogeneous WSNs of maximizing information gain and minimizing detection latency andenergy consumption for target localization and tracking through dynamic sensor querying and data routing. In IDSQ protocol, first step is to select a sensor as leader from the cluster of sensors. This leader will be responsible for selecting optimal sensors based on some information utility measure.

VI. MULTIPATH-BASED PROTOCOL

Transmission of data from source to destination can be done in two ways that is single path routing and multipath routing. In single path routing each sensor sends its data towards sink through shortest path whereas multipath routing each sensor having any data firstly finds the shortest path towards sink and then divides its load among these paths.

A. Sensor-Disjoint Multipath Routing

It helps in finding a smaller number of alternate paths that have no sensors in common with primary path. Alternate paths have longer latency and due to this are less desirable. The primary path is best available path for the Sensor-Disjoint Multipath routing [18, 16]. So if it fails it stays local and does not affect any of these alternate path. The sink can distinguish that which of its nearby sensor can provide the finest quality data by the shortest delay and lowest loss once the network is flooded with some low-rate sample. Although disjoint paths are more resilient to sensor failures, they can be potentially longer than the primary path and thus less energy efficient.

B. Network Characteristics

1) *Dense sensor node deployment:*Sensor nodes are usually densely deployed and can be several orders of magnitude higher than that in a MANET.
2) *Battery-powered sensor nodes:*Sensor nodes are usually powered by battery and are deployed in a harsh environment where it is very difficult to change or recharge the batteries.
3) *Severe energy and storage constraints:*Sensors nodes are having highly limited energy, computation, and storage capabilities.
4) *Self-configurable:*Sensor nodes are usually randomly deployed and autonomously configure themselves into a communication network.

C. Design Objectives

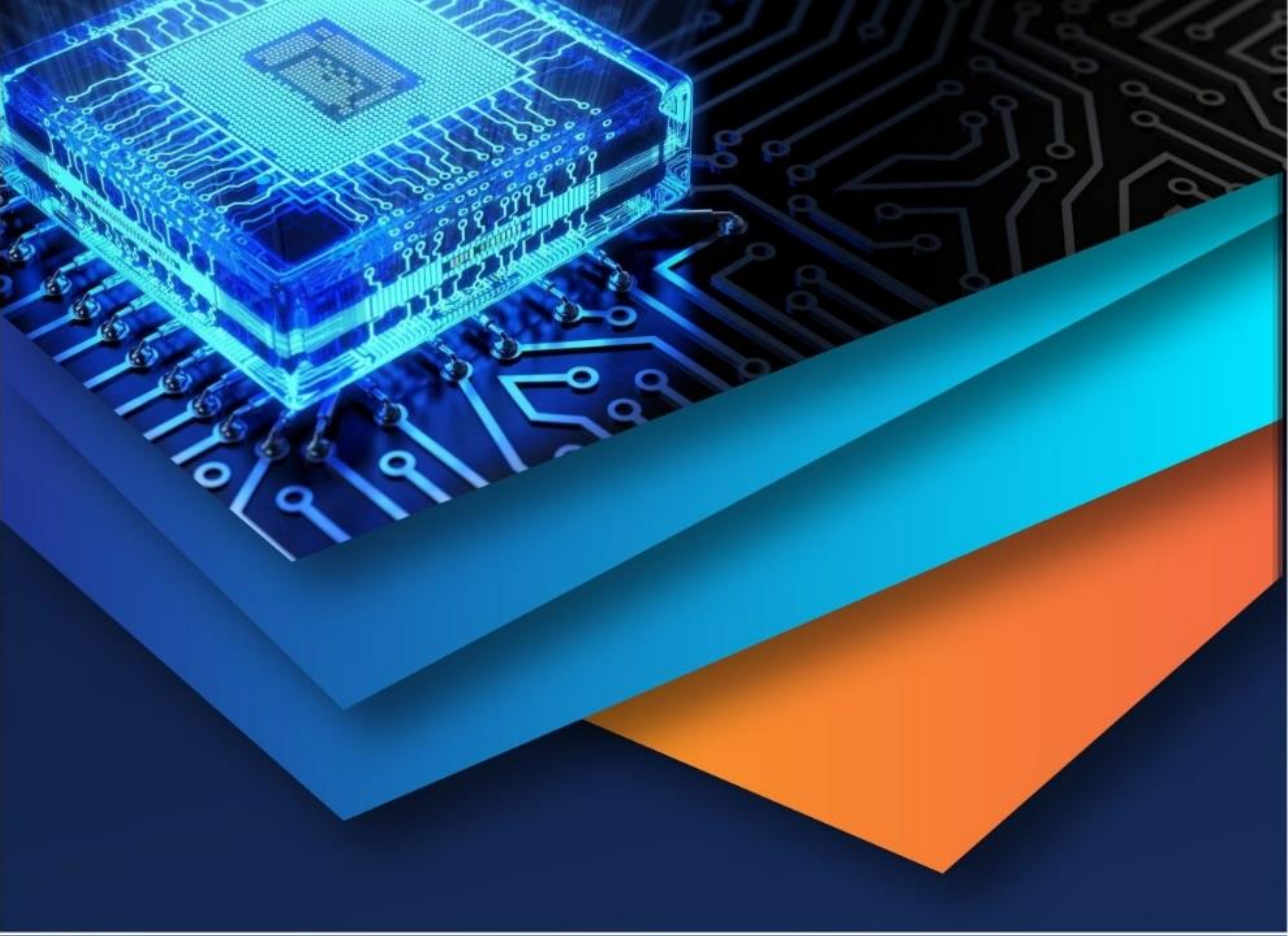
1) *Small node size:*Since sensor nodes are usually deployed in a harsh or hostile environment in large numbers, reducing node size can facilitate node deployment. It will also reduce the power consumption and cost of sensor nodes.
2) *Low node cost:*Since sensor nodes are usually deployed in a harsh or hostile environment in large numbers and cannot be reused, reducing cost of sensor nodes is important and will result into the cost reduction of whole network.
3) *Low power consumption:*Since sensor nodes are powered by battery and it is often very difficult or even impossible to charge or recharge their batteries, it is crucial to reduce the power consumption of sensor nodes so that the lifetime of the sensor nodes, as well as the whole network is prolonged.
4) *Reliability:*Network protocols designed for sensor networks must provide error control andcorrection mechanisms to ensure reliable data delivery over noisy, error-prone, and time-varying wireless channels.
5) *Security:*A sensor network should introduce effective security mechanisms to prevent the data information in the network or a sensor node from unauthorized access or malicious attacks.

VII. CONCLUSION AND FUTURE RESEARCH

WSN is most emerging ubiquitous computing technology which can be employed in wide spectrum ofapplication in both civiliann and military scenarios [18]. Wireless Sensor Network technology extends numerousapplication domains and it is crucial that WSNs perform in reliable and robust manner.One of the main challenges in the design of routing protocols for WSNs is energy efficiency due to the scarce energy resources of sensors. The ultimate objective behind the routing protocol design is to keep the sensors operating for as long as possible, thus extending the network lifetime. Therefore, routing protocols designed for WSNs should be as energy efficient as possible toprolong the lifetime of individual sensors, and hence the network lifetime. For each of these categories, we have discussed a few example protocols.One of the major issuesin the design of routing protocol for WSN is energy efficiency due to limited energy resources of sensors [19]. Thispaper survey several different routing strategies for wireless sensor network. Therefore routing protocolsdesigned for WSN should be energy efficient as possible to prolong the life time of individual sensors..

REFERENCES

[1] “21 ideas for the 21st century”, Business Week, Aug. 30 1999, pp. 78-167.
[2] S.K. Singh, M.P. Singh, and D.K. Singh, “A survey of Energy-Efficient Hierarchical Cluster-basedRouting in Wireless Sensor Networks”, International Journal of Advanced Networking andApplication (IJANA), Sept.–Oct. 2010, vol. 02, issue 02, pp. 570–580.
[3] S.K. Singh, M.P. Singh, and D.K. Singh, "Energy-efficient Homogeneous Clustering Algorithm forWireless Sensor Network", International Journal of Wireless & Mobile Networks (IJWMN), Aug.2010, vol. 2, no. 3, pp. 49-61.
[4] M. Zorzi and R. R. Rao, "Geographic random forwarding (GeRaF) for ad hoc and sensor networks:Mutlihop performance", IEEE Transactions on mobile Computing, vol. 2, no. 4, Oct.-Dec. 2003, pp.337-348
[5] C. Intanagonwiwat, R. Govindan, and D. Estrin, "Directed diffusion: A scalable and robustcommunication paradigm for sensor networks", Proceedings ACM MobiCom'00, Boston, MA, Aug.2000, pp. 56-67.
[6] C. Intanagonwiwat, R. Govindan, D. Estrin, J. Heidemann, and F. Silva, "Directed diffusion forwireless sensor networking", IEEE/ACM Transactions on Networking, vol. 11., no. 1, Feb. 2003, pp. 2-16.
[7] W.Heinzelman, A.Chandrakasan, H. Balakrishnan, application-specific protocol architecture
[8] Hoda Taheri , Peyman Neamatollahi,, Ossama Mohamed Younis , Shahrzad Naghibzadeh,Mohammad Hossein Yaghmaee,”Anenergy-aware distributed clustering protocol in wirelessSensor networks using fuzzy logic “September 2012, Pages 1469–1481
[9] W.R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, “Energy-efficient Communication Protocolfor Wireless Micro sensor Networks”, in IEEE Computer Society Proceedings of the Thirty ThirdHawaii International Conference on System Sciences (HICSS '00), Washington, DC, USA, Jan. 2000,Vol. 8, pp. 8020.
[10] W.R. Heinzelman, A. Chandrakasan, and H. Balakrishnan, “An Application-Specific ProtocolArchitecture for Wireless Micro sensor Networks” in IEEE Transactions on Wireless Communications(October 2002), vol. 1(4), pp. 660-670.
[11] Lan Wang and Yang Xiao, “A Survey of Energy-Efficient Scheduling Mechanisms in SensorNetwork”.
[12] F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, “Wireless sensor networks: a survey”,Computer Networks (Elsevier) Journal, Vol. 38, no. 4, Mar. 2002, pp. 393-422.
[13] T. He et al., “SPEED: A stateless protocol for real-time communication in sensor networks,” in themProceedings of International Conference on Distributed Computing Systems, Providence, RI, May2003.
[14] Kemal Akkaya and Mohamed Younis, “A Survey on Routing Protocols for Wireless SensorNetworks”, Ad hoc Networks, vol. 3, no. 3, May 2005, pp. 325-349.
[15] Jamal Al-Karaki, and Ahmed E. Kamal, “Routing Techniques in Wireless Sensor Networks: AnSurvey“, IEEE Communications Magazine, vol 11, no. 6, Dec. 2004, pp. 6-28.
[16] S. Lindsey, C. S. Raghavendra, and K. M. Sivalingam, "Data gathering algorithms innetworksusing energy metrics", IEEE Transactions on Parallel and Distributed Systems,Vol .13, no. 9, Sept.2002, pp. 924-935.
[17] M. Chu, H. Haussecker, and F. Zhao, "Scalable information-driven sensor querying androuting for adhoc heterogeneous sensor networks", International Journal of HighPerformance ComputingApplications, vol. 16, no. 3, Feb. 2002, pp. 293-313
[18] Akyildiz I, Su W Sankarasubramaniam Y et at. “A Survey on Sensor Network. IEEE Communication Magazine”, 2002, 40(8):102-11
[19] Rajashree.V.Biradar, V.C.Patil , Dr. R. R. Mudholkar , Dr. S. R. Sawant , “ClassificationAnd Comparison Of Routing Protocols In Wireless Sensor Networks,” Ubiquitous Computing And Communication Journal volume 4, pp.704-711, 2009.”.
[20] Singh S., Woo M., Raghavendra C.S. Power-aware routing in mobile ad-hoc networks. Proceedings of the 4th IEEE/ ACM International Conference on Mobile Computing and Networking; Dallas,, USA. 1998. pp. 181–190



10.22214/IJRASET

INDEX COPERNICUS

45.98

IMPACT FACTOR: 7.129

TOGETHER WE REACH THE GOAL

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY