

## ENERGY EFFICIENT ROUTING IN WSN

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### ABSTARCT

*In today's world wireless technology become more and more important as it play vital role in many of the crucial transactions. The two major parameters such as security and energy are difficult to handle. Because of limited resources and security issues it restricts the implementation of security. The routing protocols used for other media cannot be applied on WSN. Instead the routing should be in energy efficient manner. The proposed routing scheme improves the network lifetime by selecting the most trusted optimal shortest path. The optimal path can be drawn by link state routing and selecting the shortest path by dijkstra's algorithm.*

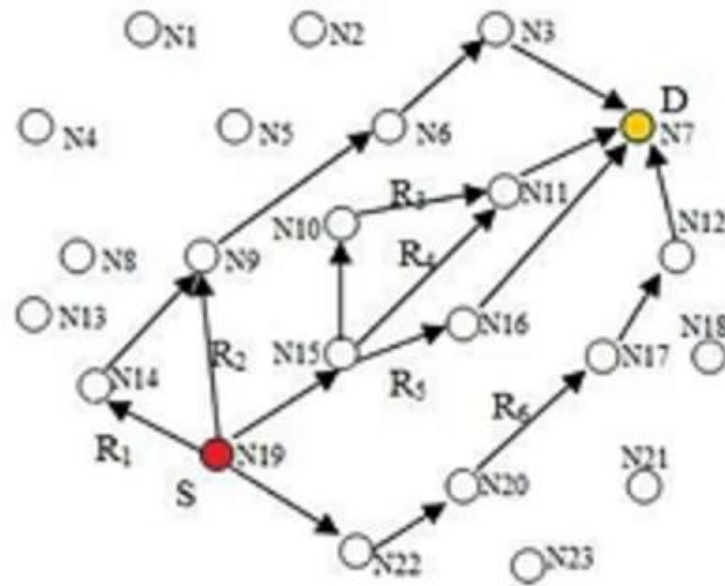
**Keywords:** *Dijkstra Algorithm, Link State Routing, Optimal Path, Shortest Path, Wsn.*

### I. INTRODUCTION

Wireless sensor network is network of small tiny component of electronic devices with limited energy and processors with it. The most important task of nodes is to route packet so reliably from one sensor node to its base station. Routing is more complex while considering sensor network as compare to other wired or wireless networks. Because of battery power of nodes other routing protocols applied for other networks cannot be used here.

In such case as much as the energy of node is limited, networks lifetime is considered to be a critical issue. As the energy sources are scarce also, the batteries are low powered; an energy efficient routing is supposed to be a crucial challenge in WSN. In WSN most of the energy is consumed while transmission and reception/communication of data packets. As a result the energy- aware routing protocol must be design in such a way that controls and manages energy efficiently.

This research specially focuses on the already created network where sender and receiver are decided, and data packet to be sent is already selected. The proposed work is to find best all possible paths from source to destination, select best among them and secure it. Assure the guaranteed delivery, and take minimum hop-to-hop delay. Taking routing as main objective, proposed routing mechanism is dedicated for wireless sensor networks. In our proposed method, the new algorithm SRPT (Secure Routing Path using Trust values) has better performance as compared to existing systems. Here, in this approach, during transmission of packets, if any node in the routing path get fails to transmit the packets. At such situation it automatically chooses the routing path to transmit the packets to the required destination.



**Figure1: Routes from Source to Destination with Node Numbers as Selected by LSRP**

The paper is organized as chapter 2 describe literature survey, chapter 3 gives the general idea for energy waste, chapter 4 describes proposed approach for energy efficient routing, chapter 5 describes WSN’s affected features and lastly chapter 6 describes conclusion from the above studies.

**II. LITERATURE SURVEY**

B.Baranidharan and B.Shanthi [1] proposed an efficient technique for energy saving called clustering and tree based approach. Clustering divides network into manageable units to improve scalability of network also, add the advantage of conserving communication bandwidth, avoids redundant message, localize efficient rout setup within clusters. Some of clustering protocols are LEACH, HEED, DECA, etc... On the other hand, tree based approach manages the hierarchical aggregation points which form the tree structure. Leaves act as source and root act as sink node. The data from different source get aggregated when travelling from source to sink and stores in intermediates itself. The most successful protocol for this approach is PEGASIS.

Ali Ghaffari [2] proposed energy efficient routing using A\* algorithm which finds optimal path from source node to destination node (base station) against some crucial parameter of sensor network such as packet reception rate (PRR), residual energy and node buffer state. The sink node is only responsible for scheduling nodes and broadcasting the routing path by considering the nodes parameter and state. Residual energy is compared with threshold (T) value, if less then T then that node isn’t involve in communication. A\* algorithm open list- that keep record of nodes that are to be examined whereas closed list keep records of already examined nodes. It uses Best-First-search for optimal path and Distance-Plus-Cost- heuristic  $f(n)$  function to determine order of visiting nodes. The function is:

$$f(n) = g(n) + h(n) \dots\dots\dots(2.1)$$

Where  $g(n)$  is cost from source to current node and  $h(n)$  is admissible heuristic estimate of distance from n to destination.

Zahra Rezaei and Shima Mobininejad [3] Proposed general approaches for energy saving such as duty-cycling, energy efficient MAC protocols, data driven approaches. Duty cycling can be defined as fraction of times when nodes are active during their lifetime and it focuses on networking subsystems, whereas to improve energy efficiency data driven approaches are used. There are some MAC protocol viz. S-MAC, T-MAC, U-MAC, DEE-MAC, SPARE-MAC, Z-MAC, A-MAC. Data driven approaches involve viz. Data Prediction approaches and in-network processing, it build a model that describe sense phenomenon, queries can be answered by a model instead of sensed data.

Rathna. R and Sivasubramanian [4] Proposes improving energy efficiency through scheduling and routing. Sleep/wake-up scheduling uses strategy of asynchronous periodically activating certain nodes which are going to wake-up and send receive data, other nodes are in sleep state. Energy checking will be done before hanging state of node from wake to sleep. Clustering based routing uses idea of aggregate data when number of nodes is large. Based on weight of nodes cluster are formed with some rules such as no two or more nodes are in same interference range etc...

Sourabh Jain, Praveen Kaushik et. Al. [5] Proposes set K-cover algorithm for energy efficient monitoring it include randomized, distributed greedy, and centralized greedy. Randomized algorithm allows each sensor to assign a cover to itself chosen randomly from all set of cover. A distributed greedy algorithm allows each sensor to assign itself to a cover with minimum intersection between sensor monitored area and area monitored by cover. Centralize algorithm is equivalent to distributed except it uses weighted intersection area based on criteria how much is it to be covered by other sensor whenever assignment will be done later.

Monika Raghatate, Prof. Dipak W. Wajgi [6] has created the network where the complete work is divided into two phase, viz. selection phase and data transfer phase. In selection phase the high energy node is selected as cluster head and other nodes send to sleep mode. The cluster head send normal message to sensor node and receives the acknowledgement. The normal sensor decides that to which cluster they wants to belong. As the energy of cluster head become zero other members with high energy become cluster head. In transmission phase the depth first search which goes to next higher level cluster.

Sunita, O.S Khanna et. Al. [7] has implemented the work for Improvement in End-to-End delay and Energy Consumption using Routing Algorithms in Wireless Sensor Network. They proposed a network where the wireless channel is used as the sender nodes deployed that communicate wirelessly. There are two protocols, one for energy consumption and other is for end to end delay. First calculate mean and variance based on payload, free buffer, SNR and residual energy. The second algorithm finds start and end time. The delay is acknowledged from source to sink node.

ShyamNandan Kuma [8] has presented a Secure Path-Based Hybrid Routing Protocol for Wireless Sensor Network where he proposed two protocols namely Cluster-based and Tree-based protocols. In his work he used fuzzy logic inference system for secure routing so that to protect from attack. This protocol adopts three fuzzy inference systems (FIS) to handle efficient power supply and secure shortest path.

### III. SOURCES OF ENERGY WASTE

The major sources of energy waste can be categorized as “useful” and “wasteful”. The useful sources may be due to sending or receiving data, processing queries, neighbor sensing etc. whereas wasteful energy waste can

be due to continuously sensing the network, idle listening, and collision etc. There are number of techniques are proposed to reduce the useful energy waste sources.

#### **IV. SECURE ROUTING PATH APPROACH**

The proposed energy efficient approach involves combination of three important concepts, viz. routing protocol, dijkstras' algorithm, and genetic algorithm. The energy efficient mechanism requires that the following things must be design in reliable and efficient way-

- Node scheduling
- All possible path drawing from source to destination
- Selecting best and closest path

By using these concepts sequentially one can organize the efficient rout. The scheduling and path drawing will be done by using link state routing protocol whereas selecting best among them is the work of dijkstras' algorithm.

##### **4.1 Scheduling**

Node scheduling results in good routing mechanism as it minimizes the routing time to create the new path. Here, we are using a link state routing protocol for 2 reasons. First it arrange the nodes in such a manner that node with less distance and maximum energy placed first in a list, next with less energy and at last the node with maximum load, less energy and maximum distance from source. Now the last nodes are removed from communication and are send to sink, so that recovery can be done. Second since the behavior of node is continuously in watchdog monitoring, affected or misbehaving nodes are directly send to sink for recovery purpose. Finally the scheduling list contains only good and enough energy seeking nodes which are active for current communication, makes the decision easy for watchdog to involve which nodes in communication.

##### **4.2 Possible Path Creation**

A scheduled list provides all active and good nodes in descending order. The entire possible path form source to destination are created and entered in path dictionary. The reason behind selecting more than 1 path is in WSN if node attack occurred during the communication, the system must be able to select another best rout, and it should not waste time in searching ad then deciding next rout. The packet can be sent from another best rout without fail and minimize delay. The next selected rout is also making secure before packet travel through it. The security is given by genetic algorithm.

##### **4.3 Selecting Best Path**

Now selection of best path is a crucial decision. Each time whenever a node fail occurs another path with sequence of node must be ready. The second path selection decision is taken by the last successful node as it also contains information about next good node from scheduling and path dictionary. Dijkstra's algorithm is used to make decision about choosing reliable path. It makes decision based on distance from source to destination. The path may contain number of hops or may not contain a single node except source and destination.

#### 4.4 Link State Routing Protocol: A Rout Discovery Mechanism

A link state routing protocol which is used as rout discovery, allows dynamically discover a rout from any host in network to any other host in the same network. Whether the rout is direct from source to destination or it may contain number of intermediate network hops through other hops, which collectively form a single rout. A hop broadcasts a rout requesting packet that initiate the rout discovery. A host initiating a route discovery broadcasts a *route request* packet which may be received by those hosts within wireless transmission range of it. The route request packet identifies the host, referred to as the *target* of the route discovery, for which the route is requested. If the route discovery is successful the initiating host receives a *route reply* packet listing a sequence of network hops through which it may reach the target.

#### V. AFFECTED FEATURES OF WSN

Routing design is related to network system architecture, following are the factors that affect the design of routing protocol.

- 1) **Sensor Location:** Managing the sensor location is a big challenge in WSN, since nodes location can be track by global positioning system (GPS) or by routing protocol to sensing the sink to learn about their location.
- 2) **End-to-End Delay:** It is a time taken to send packet from one node to another. The affected node is away from path selection hence data packet will only reach to successful node which saves the time.
- 3) **Fault Tolerance:** In case of node failure, routing protocol generates new routes to data collection point.
- 4) **Data Security:** As selected data packet is secured with 3DES encryption technique. The sender is sure about right packet delivery.

#### VI. ANALYSIS OF ENERGY EFFICIENCY

The comparison is done on the basis of increase in number of packets. As the number of packets increases the energy consumption rate remain same. There is no random utilization for increasing nodes. Figure given below shows the comparison of proposed algorithm with other available techniques.

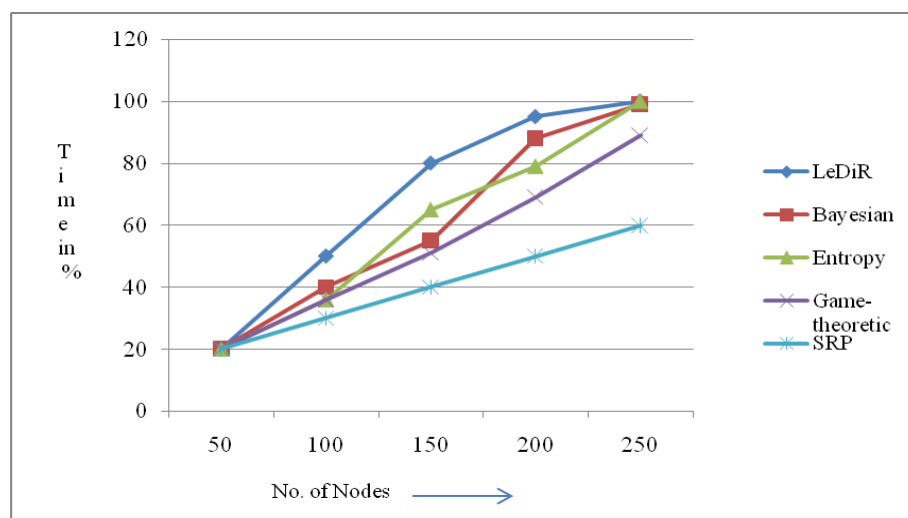


Figure 2: Comparative Graph Showing Energy Consumption Rate

## **VII. CONCLUSION**

The combination of link state routing protocol and dijkstra algorithm proved to be a good solution especially for wireless sensor network. Since the most trusted rout can be achieves by using this strategy. In addition the scheduling mechanism ignores the affected or low energy node from the routing table hence no network jam occurs. The advantage of this system is it removes end to end delay in transmission also next path selection is fast. This feature is useful in internet banking, military applications etc.

Still there are certain limitations of using wireless sensor network such as it is impossible to recharge the deployed node. The future work includes finding the type of attack on nodes so that security can be applied to get the best recovery and fast transaction of data.

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