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ADAPTIVE BINARY SEARCH TREE STRUCTURE FOR ENERGY EFFICIENT DATA COLLECTION IN WSN

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Abstract *— Wireless Sensor Network (WSN) plays a vital role in today's real world applications. The effectiveness of WSN's depends on the data collection scheme. In this proposed work, an adaptive binary search tree method is applied and they are used to adapt themselves between the nodes and routing protocol during the data transmission. In the existing method, the LEACH protocol is used in the binary search tree method in a data aggregation process to calculate the reduction of energy spent and data collection in WSN. Clustering approach is used to separate a sensor networks into an minor administrable units is called an clustering. Here, we proposed a new AODV protocol is used to overcome the energy consumption problems in WSN. In this proposed method, the adaptive binary search tree method used in a data aggregation process to calculate the reduction of energy spent and data collection in WSN and it is applied to the Ad-hoc On Demand Distance Vector Routing protocol (AODV). The main advantages of this protocol are high Security protocol, More Energy Efficient protocol, and low cost and the AODV gives the better performance for the longer duration of traffics compared to other protocols.*

Keywords **Wireless Sensor Networks(WSN), Data Aggregation, Adaptive Binary Search Tree Method, Energy Efficient, Ad-hoc On Demand distance vector (AODV).**

I INTRODUCTION

Wireless Sensor Network is a network device that will communicate through the information gathered from a monitored field through the wireless link and it is a self - organizing multi hop ad-hoc networks. WSN comprises of each sensor nodes over a environmental region for monitoring physical phenomenon like vibrations, seismic events, and temperature. Wireless sensor network has some most important factors like power efficiency, reliability, mobility and scalability process, which results in heavy communication overhead across the network and gives growth so it is called as bottle neck effect. In this sequence to maximize the life time of the network and to reduce an energy consumption process. The main objective of data aggression algorithm is to aggregate the data and save energy in an efficient way. Data aggression is a procedure of aggregating the sensor data through aggregation manner. The Adaptive binary search tree method is used to adapt themselves between the nodes and routing protocols to reduce the energy consumption during the data transmission between the nodes in a wireless sensor network. The main idea is to adapt the nodes during the search process to the particular tree that is being searched and it has a higher number of dimensions.

A key Solution to enhance the energy saving by correlation structures by using an clustered routing algorithm is presented (Cheng Zhao et al, 2017). Here they used an CS based techniques discrete cosine transform (DCT), mostly adopted sparsification basis, cannot sufficiently sparsify real world signals. They proposed an energy efficient cs based scheme, called Treelet -based clustered compressive data aggregation and numerous data collection schemes such as multipath,chain,tree, cluster and hybrid topologies are available for collecting the data in wsn (R.Velmani and B. Kaarthick, 2015). They proposed a velocity energy efficient and link aware cluster tree (VELCT) scheme's for data collection, mightly some problems are coverage distance, mobility, tree intensity and end to end connection. The strength of the VELCT algorithm is to construct a simple tree structure, thereby reducing the energy consumption of the cluster head and avoids the frequent cluster formation times. The main aim of the method is to reduce energy consumption of wireless sensor hierarchal clustering is the efficient type of clustering technique (Dr. O.S. Lamba, Abdulmalik Danmallam Bello, 2020).In this scheme whole network will be divided into fixed size clusters and cluster heads are selected in each cluster. In this research work, WEMER protocol is implemented and improved to increase lifetime of wireless sensor networks.Gateway nodes are deployed in network to increase lifetime of WSN. In the proposed improvement gateway nodes are deployed near to base station which takes data from the leader nodes. The leader nodes take data from the cluster head. The proposed WEMER protocol is implemented in Matlab. The simulation results show that this WEMER protocol has less number of dead nodes, high number of alive nodes, send more number of packets and more remaining energy consumption.

Energy efficient data aggregation is a key solution to enhance the lifetime of wireless sensor networks (S.Gopi Krishnan, 2018). The article explores a two-hop data aggregation tree construction algorithm using binary search tree to reduce the total energy consumption of sensor nodes in wsn. Here, the binary tree based data aggregation can reduce the total energy consumption and resolves the maximum data aggregation issues in wireless sensor network. The main aim is to reduce energy consumption in wsn , duty cycle, energy optimized schedule, energy-aware routing and data aggregation are widely used (Mohan Raj. C.R,2019). In this paper addresses the data aggregation during routing process and to transmit the data required single 32-bit computation. The RSA cryptography algorithm is proposed for data aggregation and data security in wsn The performance can be analysed in terms of End to End Delay, Packet Delivery Ratio (PDR) and Throughput. The RSA algorithm is used for encryption and decryption for data security. The data security issue is also solved by the compromised sensor or aggregates nodes by changing the final aggregation values. One of the main primary challenges in Wireless Sensor Networks (WSNs) is energy efficiency(Pravin Chandra,et al 2019). Energy efficiency of a clustered WSNs can be improved and to reduce the size of data being transmitted in the network process.In this paper is presented an energy efficient data aggregation scheme for clustered wireless sensor network (EEDAC-WSN) and it reduces intra-cluster communications by allowing cluster member nodes to send small sized control frames followed by relatively detailed frames from nodes selected by the cluster head node. This work can dovetailed with any clustering scheme, so they have used it with LEACH for the purpose of simulation. The results obtained are substantial in terms of network stability period and lifetime.

The aim is to reduce the energy consumption in mobile nodes (Silki Baghla et al, 2019). In this work, the mobile sinks are deployed in the network for data aggregation from the wireless sensor nodes. This algorithm is implemented in MATLAB and results are analyzed in terms of dead nodes, alive nodes and number of packets transmitted. It is analyzed that in this algorithm EDEDV (Enhanced Dynamic Estimation of Data Value), number of dead nodes are less, alive nodes are more and number of packets transmitted to base station are also high as compared to existing DEDV (Dynamic Estimation of Data Value) algorithm. Data aggregation is a fundamental and efficient algorithm to reduce the communication overhead and energy consumption in wireless sensor networks (Simin hu et al, 2020). In this paper, they proposed an energy-efficient and privacy-preserving data aggregation algorithm CBDA (the chain-based data aggregation). The CBDA can achieve less energy consumption and higher aggregation accuracy during data aggregation. They performed a comprehensive simulation to make a comparison among the CBDA with existing algorithms. The experimental results demonstrate that the CBDA outperforms the existing algorithms.

The energy consumption is an important concern for WSN (Mohamed Elshrkawey et al, 2018). Authors propose an enhancement approach to reduce the energy consumption and extend the network lifetime. The improved method is based on a cluster head selection method. In addition, an enhanced schedule of the TDMA has been implemented. Finally, the development approach indicates the progress in terms of network lifetime, Number of cluster head, energy consumption and number of packets transferred to BS compared to LEACH and other related protocols. Mathematical analysis and MATLAB 2015a simulation results show the effectiveness of the proposed approach. The energy consumption of WSN has been reduced up to about 60% and prolong the network life cycle by 73% than LEACH.

II. PROPOSED METHOD:

In this proposed system, the adaptive binary search tree is used in the data aggregation process to calculate the reduction of energy spent and data collection in Wsn. The AODV protocol is used, Ad-hoc On Demand distance vector is a self-starting environment of the nodes such as node mobility, link failures and packet losses. Route Requests (RREQs), Route Replies (RREPs), and Route Errors (RERRs) are the message types defined by AODV. At each node, AODV maintains routing table. The Routing table is used to store the routing information for the entries routing, destinations and IP address. The Next hop send the packets to destination hops to the sequence numbers by New route to measure the hop counts to measure the distance. The nodes discover the routes in request response cycle. A node request route to a destination by broadcasting a RREQ message to all its neighbors. This process repeats until the RREQ reaches a node that has a valid route to the destination. The nodes respond with a route reply (RREP) message. When a node loses connectivity to its next hop, the node invalidates the route between the source and destination. The combinations of DSR and DSD mechanisms are used in the protocols. The main aim is to reduce the energy consumption using an AODV protocol that can be a zero cost and high security protocol.

III. PROPOSED ALGORITHM:

- Begin
- Generate the Network and the number of nodes.
- AODV protocol is used.
- Describe the source and destination.
- Discover the neighbors node of the source node.

- From source to destination, send route request to neighbour nodes for finding the destination,
- If the next node is destination, then the direct path is established.
- Else, Transmit the RREQ to next neighbours.
- After, the wait for RREP from destination to source.
- Choose the path along with average hop counts.
- Nodes to be created, send the data packets to the nodes.
- After that transmitting the data packets from one node to another node.
- After that the retransmission process will occur until the simulation process end.
- Id represents the identification of the data packets.
- X represents the sensor node that receives the packets.
- G the minimum rectangle covers the query window
- R the minimum rectangle that totally covers the sink node and query window G

```
ReceiveQueryRequestPackage (G, R, id){
Begin
if (X is within the zone R)
if (X is a CH)
if (package ID==id)
then
Step1. X directly discards the packet;
Step2. X sends the packet to its next routing hop CH;
Step3. X sends the packet to its CH;
Else
if (X is within the query window G)
if (X is a CH)
if (package ID==id)
Step1. X directly discards the packet;
Step2. X sends the packet to its CMs;
Step3. X sends the packet to its CH
End
}
```

IV. DATA AGGREGATION:

Data aggregation process is used for collecting and aggregating the information as shown in figure 1. It is one of the best method for conserving the energy. The integrity and data privacy becomes necessary when the sensor network is delivered in hostile surroundings. Data aggregation is a procedure of aggregating the sensor data through aggregation manner. The main objectives of the data algorithm is to aggregate data and to save energy in an efficient manner. The Effectiveness of data aggregation depends on the communication among the nodes in the networks.

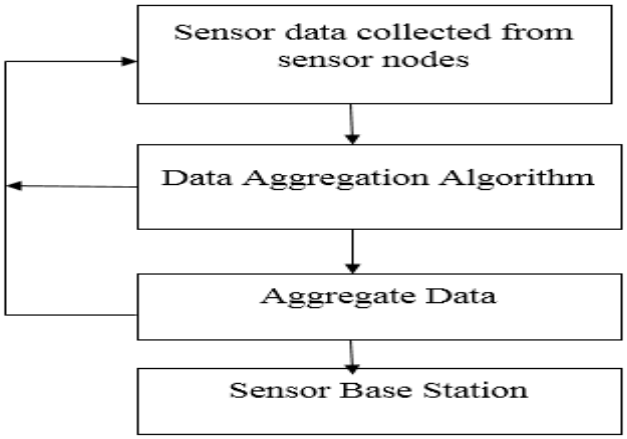

Figure 1. Process of Data Aggregation

V. RESULTS AND DISCUSSION:

We have implemented the AODV protocol using Network Simulator 2 (NS2). Network Simulator (Version 2), it is known as NS2, it is an event driven simulation tool. It provides a good platform for wsn simulation. Simulation of wired as well as wireless network functions and protocols (e.g., routing algorithms, TCP,UDP) can be used in the NS2. NS2 provides users with executable command ns which takes an input argument, the name of a Tcl simulation scripting file Here the Nam animation tool is used to develop the concept of Tcl/Otcl script file, to visualize the simulation process to view the node creation ,packet traces, data transmission and similar graphs.

The performance of our proposed AODV protocol is performed by using the network simulation (NS2) tool. The AODV is used for the simulation at the network layer. Nodes send constant bit rate(CBR) traffic at varying rates. The performance of the Energy Efficient based Cluster protocol in Wireless Sensor Network(WSN) is being estimated with the help of simulation on network simulator-2. Following results will be calculated by using the. awk script. Using the output we plotted the energy consumption graphs of the parameters. The result will be carried out by NS-2 Simulator using the Energy Consumption parameter. Energy Consumption is expressed in joules. The main part of this proposed method is to implement the AODV protocol in the data aggregation process in an adaptive binary search tree to adapt themselves during the data transmission between the nodes. Here, the main objective of this process is to reduce the energy consumption process. Table 1 shows the simulation parameters.

Table 1: Simulation Parameters

PARAMETERS	VALUE
Software used	Network Stimulator2 (NS2)
Ns2 Version	ns-allinone-2.35
Operating System (OS)	Ubuntu 13.10
Protocol	Ad-hoc on demand distance vector (AODV) routing protocol
Number of Nodes	49 nodes
Initial Energy	100 joules
Maximum packets	10000 bytes
Packet size	512 bytes
Total Simulation time	10000 ms
Energy Consumption	Reduces the 81% of energy Consumption

In the initialization stage, the nodes are created as shown in figure 2 and the data transmission between the source nodes and destination nodes happen.

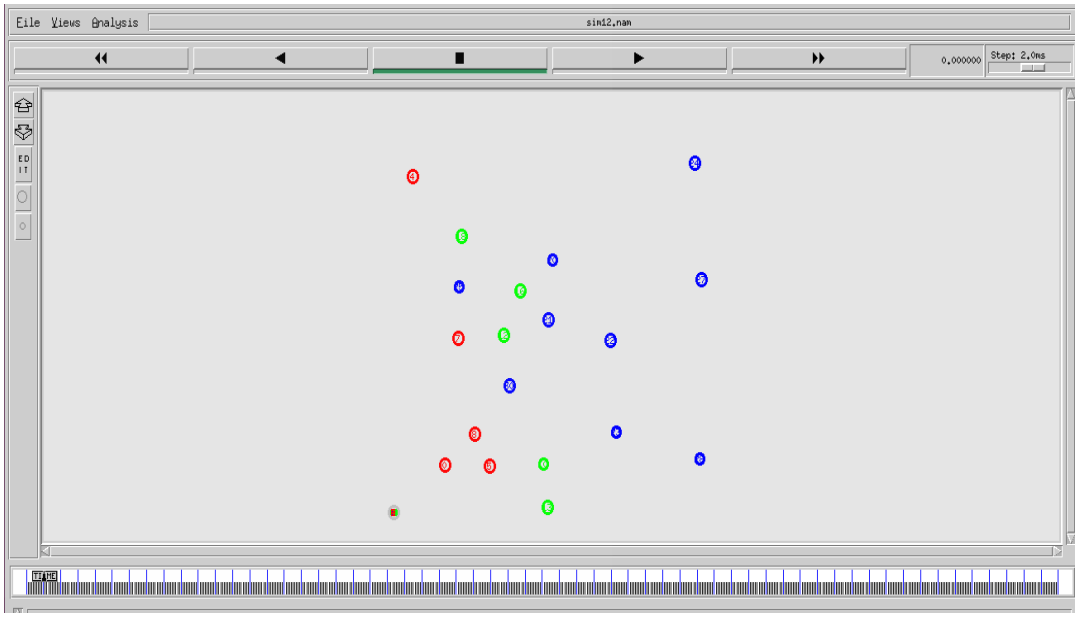

Figure 2. Creation of nodes

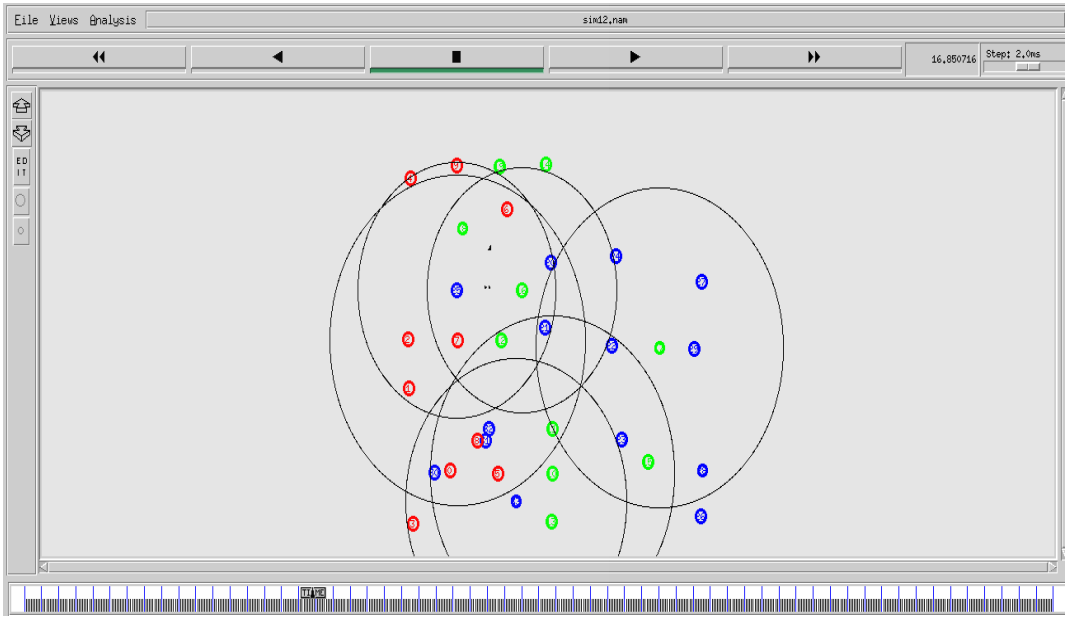

Figure 3. Creation of AODV protocol

For the purpose of sending the data packets from the source nodes to destination nodes, here the source nodes send the RREQ messages and the destination nodes reply with the RREP messages to the source nodes as shown in figure 3. After, that if any error occurs, route error messages RERR will be sent which is undetermined.

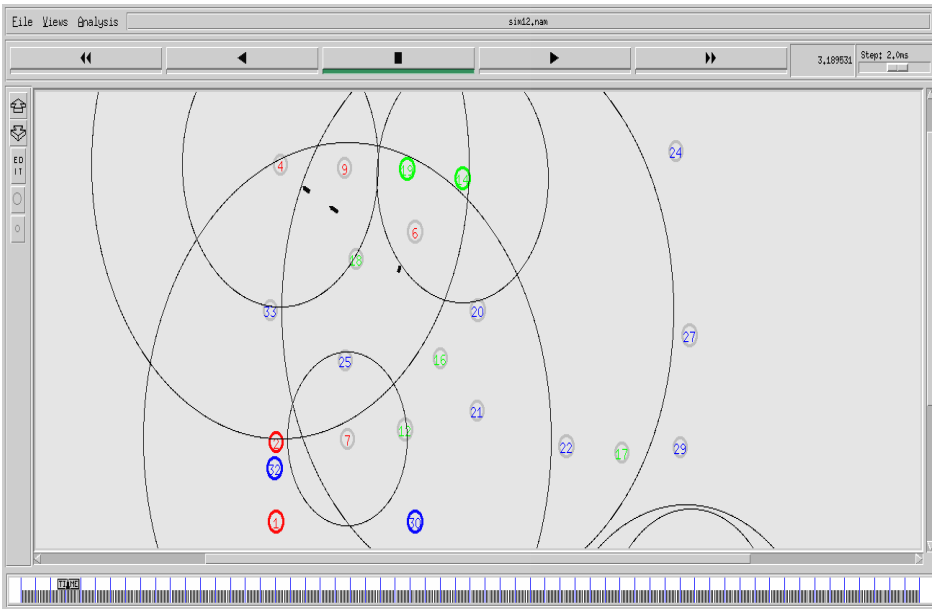

Figure 4. Data Transmission

The energy is the product of power consumed by the mobile nodes in wsn and it is expressed as "y" represents the remaining energy value that is joules and "X" represents the Average energy consumption that is time in Seconds. The proposed AODV routing protocol shows better energy consumption performance when compared with the leach protocol.

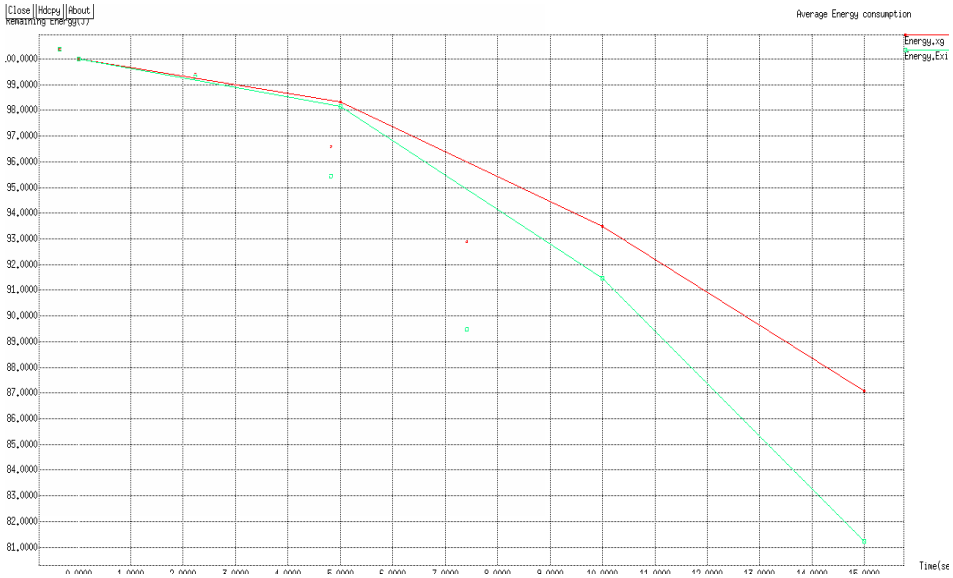

Figure 5. Energy consumption

For a good Communication Network, the energy consumption level should be less. With less security Level in a Leach protocol, the energy consumption is above 92% with loss of energy.In the proposed AODV protocol, the energy consumption level is reduced to 81% with high security as shown in figure 5.

VI. CONCLUSION:

Wireless sensor network is an emerging field in the present era, sensor networks can be used in variety of applications such as weather forecasting, disaster management etc. The proposed AODV protocol for data aggregation algorithm is to reduce the energy consumption and to improve the data collection in a wireless sensor network by using an adaptive binary search tree. Here, the adaptive binary search tree structure is an efficient data aggregation algorithm that resolves many data aggregation issues in an energy-efficient way. There are some major issues such as energy efficiency, coverage and connectivity

and latency in the wireless sensor networks. There are many research studies focusing on different network topologies, data processing and data collection methods to reduce energy consumption for prolonging the network lifetime. This research has proposed a collision free data aggregation construction algorithm based on an adaptive binary search tree protocol.

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