Routing in Accumulative Multi-Hop Networks using EC-AODV Routing Protocol

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***Abstract*— The most essential issues in WSNs (Wireless Sensor Networks) are a powerful utilization of resources, as the sensors in the network hand-off on these limited assets, for instance lifetime of battery, CPU, memory and so forth. Along these lines the basic issue in such kind of systems is energy compelling and reliable. So, to lessen the energy utilization and to improve the network execution and security, we redesign a broadly used reactive routing algorithm known as Adhoc On-demand Distance Vector Routing protocol (AODV) and use AES(Advanced Encryption Standard) for detecting malicious nodes which are responsible for dropping of data packets or modifications in data. The truth of the matter is that the sensor nodes set in the shortest path will drop their energy frequently. So, the essential thought is to think about the sensor lifetime and remaining energy for picking the best ideal path. The updated AODV routing protocol know as Energy Constrained AODV routing protocol(EC-AODV), which enhances the network lifetime by controlling the residual energy of the considerable number of nodes in the network and by picking the energy efficient methodologies for finding the routing path.**

***Index Terms*— AES, AODV, EC-AODV, Node Lifetime, Residual Energy, Wireless Sensor Network.**

I. INTRODUCTION

Wireless Sensor Networks (WSNs) can be defined as a self-designed and structure less wireless network. A sink or base station behaves like an interface amongst clients of the Network. One can recover required data from the Network by infusing questions and assembling out comes from the sink. Regularly a remote sensor arranges contains a huge number of sensor hubs. The sensor hubs can impart among themselves utilizing radio signs. A remote sensor hub is outfitted with detecting and processing gadgets, radio handsets and power segments. The nodes in a Wireless Sensor Network (WSN) individually inherent the resources with constraints: they have constrained handling speed, limited storage capability, and correspondence data transfer capacity means Bandwidth. After the sensor nodes are sent, they are in charge of self-sorting out a proper Network framework frequently with multi-jump interaction with them. At that point the installed sensors begin gathering required data. Wireless sensors likewise react to questions sent from a "control site" to perform particular actions or for sensing. The working method of the sensor nodes might be either nonstop or occasion driven.

Energy assurance in wireless sensor networks has been the basic objective, yet it is not considered as the only idea to enhance the working of wireless sensor networks. There are distinctive objectives like adaptable design, inactivity and directing. It is basic to guarantee that information can be viably gotten to the base station the first run through rather than being retransmitted. In wireless sensor networks arrangement of data and directing are complex assignments due to their dynamic and distinct properties. Numerous directing conventions are made, yet among those conventions cluster based routing protocols are energy capable, versatile and drag out the network lifetime .In the location condition, nodes are movement less and dynamic when the operation happen. Sensor nodes discontinuously send the accumulate information to the base station. Routing is a basic issue in data gathering sensor framework, while on the other hand rest wake synchronization is the key issues for occasion discovery sensor systems.

II. RELATED WORK

Numerous Routing protocols have been proposed for ad-hoc systems. Conventional Routing protocols mean to locate the most limited way from a source node to a goal node. Proactive protocols, for example, DSDV keep up paths between all source-goal combinations paying little respect to the utilization of such paths. Then again, reactive protocols, for example, DSR and AODV, Endeavour to discover paths on request, that is, at the point when a source node demands them. Portable ad-hoc system as a rule comprises of battery-worked nodes. In this way, the energy productivity is imperative in portable ad-hoc systems. Power-aware protocols consider the node remaining energy to decide the routing way for energy proficiency and load adjusting.

A few nodes may transmit and additionally transfer more disturbances than others. This unequal battery control utilization may cause an early battery weariness of a node and system division .EA-AODV [1] which works comparably to AODV yet chooses a path considering the least energy accessibility and the energy utilization per data packet of the paths. A source node starts a path finding by communicating the RREQ (Route Request) parcel. The goal node answers back to the source node utilizing the RREP (Route Reply) parcel. At the point when a transitional node advances the RREP parcel, it records its remaining energy in the parcel. At that point the source node chooses the way with the most elevated least node remaining energy thinking that AODV select the most limited way.

In survey [2], the creators clarified completely the plan issues and strategies for the WSNs. They characterize the "physical requirements of sensor nodes" and the "proposed protocols" catching all layers of the system stack

III. EXISTING SYSTEM

Energy is the essential component in Wireless Sensor systems, nearly sensor nodes will exit because of energy issues. Usually for information sending, all the networks will select the shortest way. Because of the consistent utilization of same way for information sending, the nodes which are put in that way will reduce their energy regularly. With the goal that the nodes may pass on and the information which must be transmitted won't be reached to the destination node, this decreases the general network life time.

Disadvantages

Due to the persistent utilization of same path for information sending, the nodes which are put in that way will deplete their energy in general interims. With the goal that the nodes may die and the information which must be transmitted won't achieve the goal to reach the destination, this diminishes the general system life time. It is somewhat difficult to detect Malicious Nodes which are responsible for data loss and modifications in data.

IV .PROPOSED SYSTEM

In the proposed framework, AODV Algorithm with included Energy Constraint (EC-AODV) is utilized to choose the best ideal way with most extreme remaining energy. The benefits of this framework are Network life time will be expanded and Battery level can be overseen. And also AES (Advanced Encryption Standard) is used here to detect the malicious nodes and to avoid dropping of data packets if a malicious node appears throughout the data transmission from source to destination sensor nodes.

Advantages

- Network Lifetime will be Increased
- Battery Level can be Managed
- Provides Security for entire Network

V.ENERGY EFFICIENT METHODOLOGIES

Energy Efficient techniques are required because the sensor nodes are scattered thickly in a field either close to or inside the multi-jump wireless sensor protocols between the sink node and the sensor nodes .Traditional Adhoc routing strategies don't typically fit the necessities of the sensor networks. As indicated by the below standards the network layer of sensor network is developed:

- Always Power adequacy is a critical idea.
- Sensor systems are generally data driven.
- When communitarian exertion isn't ruin at exactly that point Data total is helpful.
- The best sensor framework has awareness about area and knowledge about addressing.

Energy effective courses can be found in perspective of the available power (PA) in the hubs or the vitality required for transmission in the associations along the courses. By one of the accompanying techniques energy effective course is picked.

I. Maximum available power (PA) route:

The path that has greatest total PA is selected. By adding the PAs of each node along the path the total PA is computed. It is important not to consider paths controlled by expanding paths that can relate the sensor node to the sink at this moment path.

II. Minimum hop (MH) route:

The path that makes the MH to achieve the sink is selected. Minimum Energy (ME) conspire picks a similar course directly as the MH when a similar measure of energy (i.e., all α are the same) is used on each association. In this way, when nodes communicate with same power level with no power control, MH is then similar to ME.

III. Maximum minimum PA node route:

The path along which the minimum PA is higher than the minimum Pas of all other paths is selected. This plan hinders the danger of going through a sensor node with low PA much sooner than the others in light of the way that they are on path with nodes that have high PAs.

VI. EC-AODV ROUTING PROTOCOL

Adhoc on-demand distance vector (AODV) [3] routing protocol utilizes an on request approach for discovering paths, that is, a path is set up just when it is required by a source node for transmitting information. It utilizes goal grouping numbers to recognize the latest route. Be that as it may, in AODV, the source node and the moderate hubs store the following jump data relating to each stream for information bundle transmission. In an on request routing protocol, the source node surges the Route Request parcel in the system when a path isn't accessible for the goal node. It might get numerous paths to various goals from a solitary Route Request. A node refreshes its way data just if the DestSeqNum of the present parcel got is more prominent than the last DestSeqNum put away at the node.

The Route discovery in AODV routing protocol is only based on the link weight so that the data packet could be transmitted through the shortest path. But the problem here is that due to the usage of the shortest path for data transmission again and again the

energy of the nodes which are present in that shortest path will decrease every time. At some point the nodes will be drained which decreases the overall lifetime of the network. So, we have designed the AODV protocol with added Energy constraint called as EC-AODV (Energy Constraint AODV) Routing protocol in which the path is discovered by considering the energy levels of the nodes as shown in Fig.1.

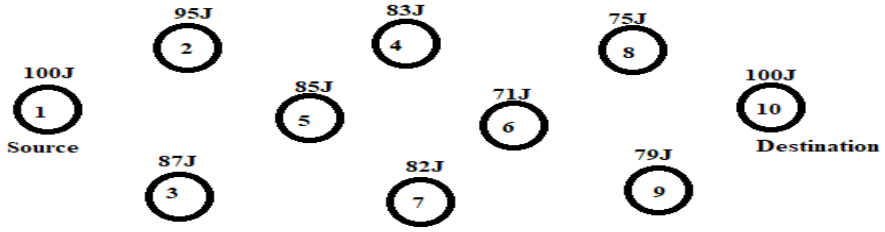

Figure 1: WSN with Node Energy

For the first time the shortest path is selected for data transmission based on link weights as shown in the Fig. 2.

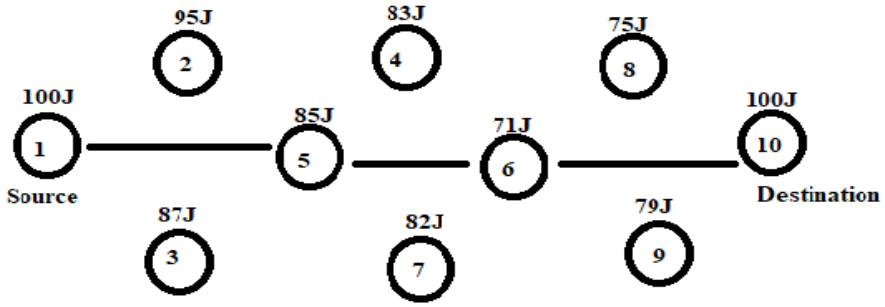

Figure 2: Data Transmission through the Shortest Path

After the first data transmission the path is selected by choosing the nodes with maximum remaining energy which forms an approximate shortest path as in Fig. 3.

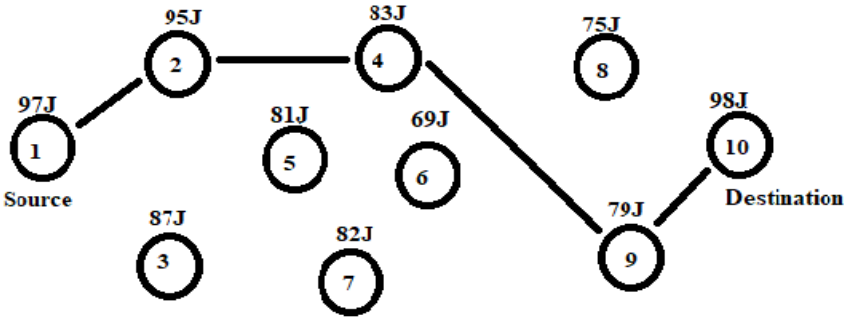

Figure 3: Data Transmission through the path selected based on Energy levels of Nodes

VII. AES ALGORITHM

Design principle used in AES is substitution and permutation system which is the mix of both substitution and permutation. As it is a block cipher having a block size of 128 bits. AES takes into consideration three distinctive key lengths, they are 128, 192, or 256 bits. The majority of our examination will accept that the key length is 128 bits. With respect to utilizing a key length other than 128 bits, the fundamental thing that progressions in AES is the manner by which you create the key schedule from the key. Encryption comprises of 10 rounds of handling or processing for 128-bit keys, 12 rounds of handling for 192-bit keys, and 14 rounds of handling for 256-bit keys.

For every situation except for the last round, every other round is indistinguishable. Each round of handling incorporates only one single-byte based substitution step, a column-wise mixing, a row-wise permutation step, and the expansion of the round key.

Encrypted Key Expansion

Presuming a 128-bit key, the key is additionally orchestrated as a matrix of 4 × 4 bytes. Similarly with the input block, the beginning word from the key occupies the beginning column of the matrix, etc. The four column expressions of the key matrix are ventured into a calendar of 44 words. Each round expends four words from the key schedule. Prior to any round-based handling for encryption can start, the input array is XOR with the initial four expressions of the key schedule. Likewise goes on amid decryption aside from that now we XOR the cipher text state cluster with the last four expressions of the key schedule.

For encryption, every round comprises of the accompanying four phases:

1) Substitute the bytes
2) Shift the bytes

3) Mix sections and
4) Adding round key

The last step comprises of XORing the yield of the past three stages with four words from the key schedule.

For decryption, every round comprises of the accompanying four phases:

1) Inverse the shifted rows
2) Inverse the substituted bytes
3) Add the round key
4) Inverse the mix sections

The third step comprises of XOR the yield of the past two steps with four words from the key schedule. Note the contrasts between the request in which substitution and moving operations are done in a decoding round opposite the request in which comparative operations are conveyed out in an encryption round. The final round for encryption does not include the "Mixing columns" step. The final round for decryption does not include the "Inverse the mix columns" step.

VIII. MODULES

I. Creation of Wireless Sensor Network Nodes

Create a group of nodes which forms a sensor network which are randomly distributed with the following properties:

- In Network nodes are arranged in the random format which consists of one sink node and group of sensor nodes.
- The energy of the sensor network cannot be recharged or replaced.
- Here receiving power is 0.5 J, Transmission power 1 J and Idle power is 0.1J.
- The data forwarded by the sensor nodes is through replay communication to sink node.
- Sensor generally prefer shortest path for forwarding data.
- In WSN all the packets travel through multiple hops.

II. Adding Energy Metrics for WSN Nodes

In this module every sensor node will be appointed with a condition on Energy levels. For each transmission and reception of the information some energy of the nodes which are accessible in the shortest route will be dropped down. The EC-AODV Routing protocol is utilized to locate the ideal most short way in view of the energy levels of sensor nodes implies it chooses the nodes with highest energy.

III. Secure Data Transmission

The information packet which is encrypted by the source using the Advanced Encryption Standard (AES) is transmitted to the destination node utilizing ideal and shortest way which contains the nodes having greatest residual (remaining) energy through various jumps. So at long last, the Network lifetime is expanded. Finally, at the destination the received encrypted data is decrypted by using the same Standard.

IX. RESULTS

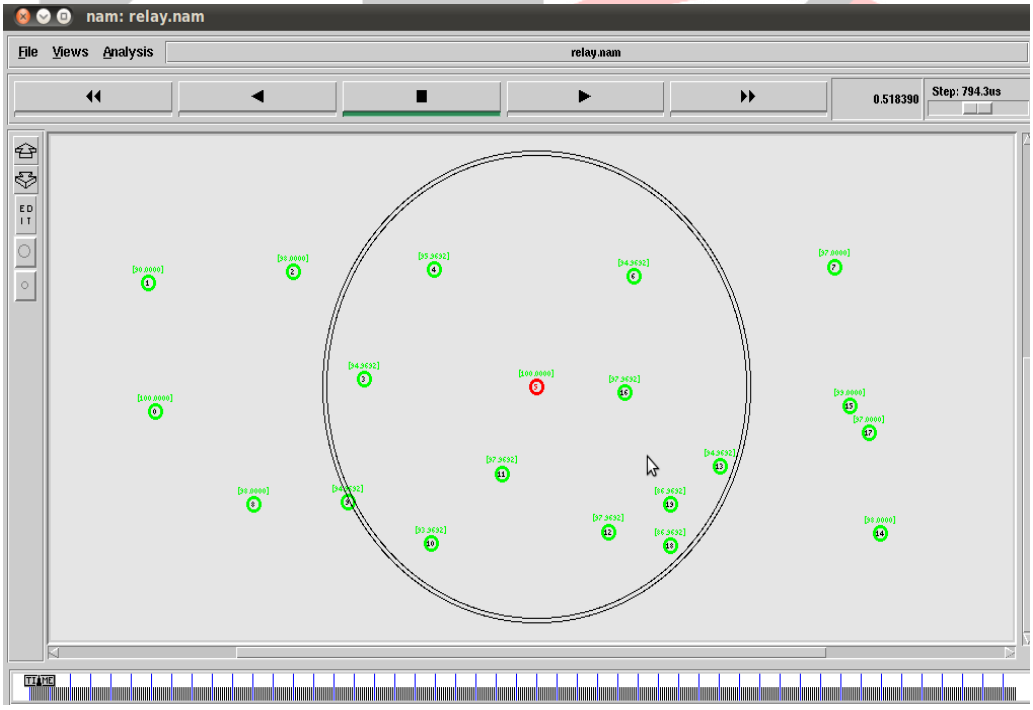

Figure 4: NAM Detecting Malicious Node

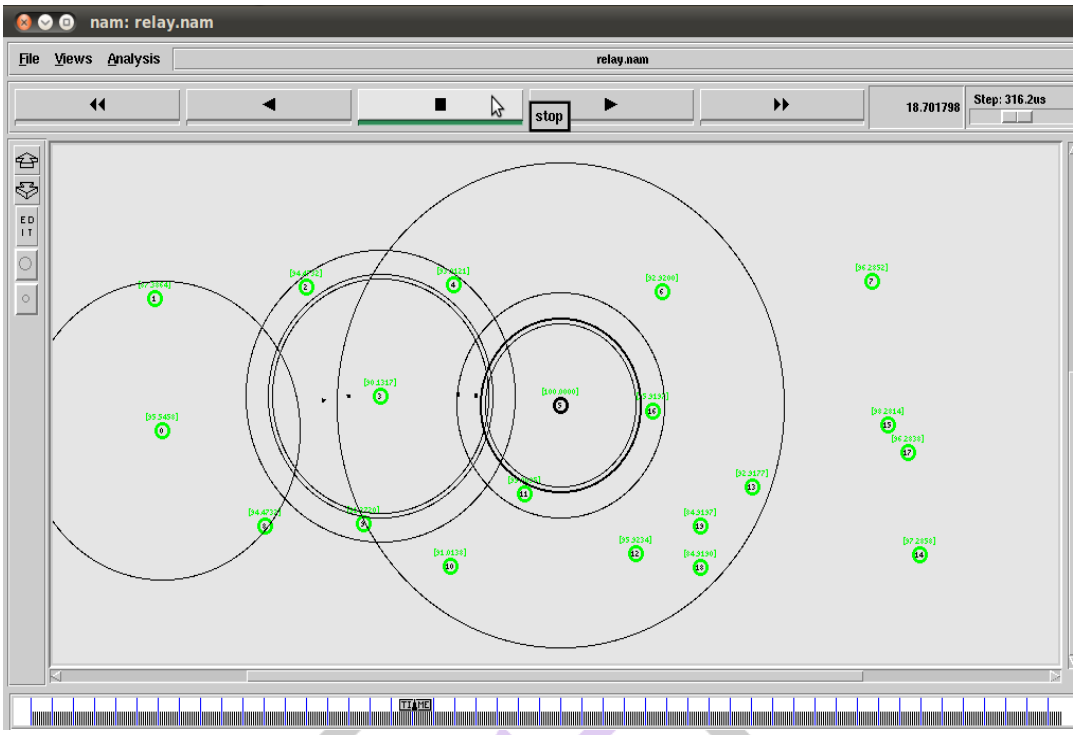

Figure 5: Data Packets Loss due to Malicious Node

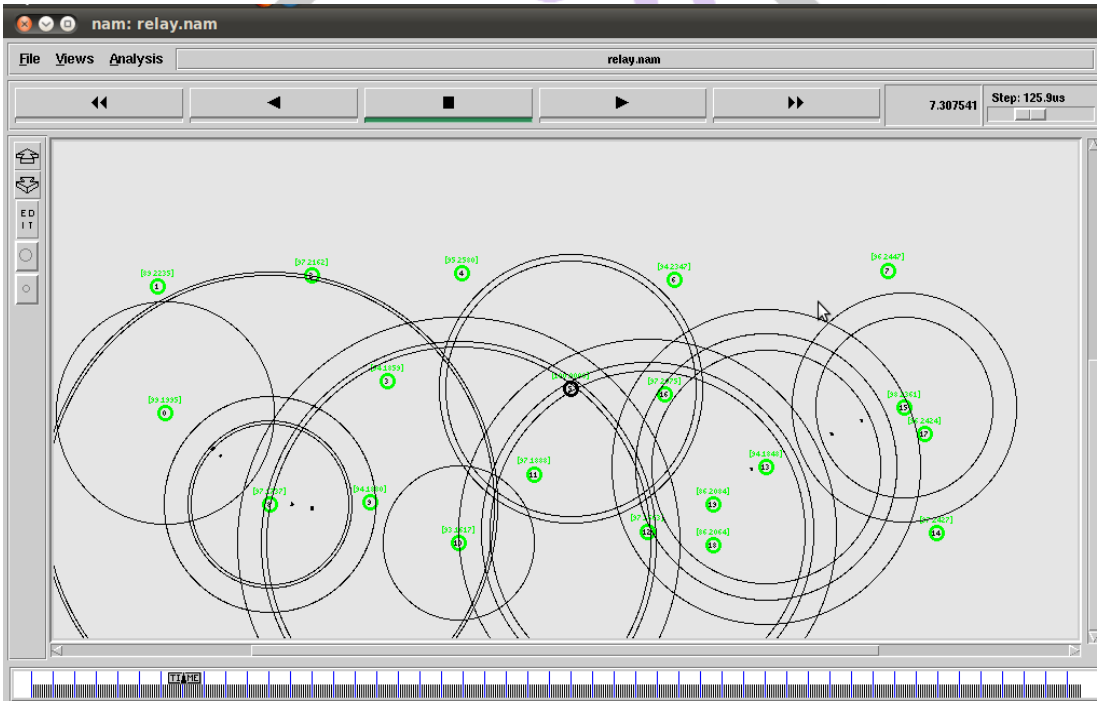

Figure 6: Data Packets Received by Destination

X. CONCLUSION

In Wireless Sensor Networks, once the energy of the nodes is drained then we cannot recharge or replace the battery of nodes which reduces the lifetime of the entire Network. AODV Routing protocol is used generally to find the route for data transmission from source to destination which considers only the link weight but not energy of node. The problem with this approach is that the energy levels of the nodes which are available in the shortest path will decrease gradually and after continuous usage the nodes will be drained.

Hence, in this paper we designed AODV protocol with added energy constraint which is EC-AODV routing protocol which considers the maximum remaining energy of the nodes to select a route. So, the nodes will not be drained which in turn increases the lifetime of Network and also helps in balancing the Energy Levels of Nodes.

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