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Secure and Energy Efficient Routing using PSO Technique in WSN

Pooja Sengar
M.Tech Student
Computer Science and Engineering
Madhav Institute of Technology and Science
Gwalior, India

Neha Bhardwaj
Assistant Professor
Computer Science and Engineering
Madhav Institute of Technology and Science
Gwalior, India

Abstract: Wireless communication technology are enabling the assigning of networks of miniature sensors. These sensor network(SN) used in armed forces monitoring, industrial control, climate monitoring, product tracking, home control etc. A Sensor System is a remote, specially appointed system, made of a substantial number (hundreds or thousands) of nodes, whose locations happen randomly .Ant Colony Optimization(ACO) mainly used for optimal path selection but it is considered as low optimization with high computational cost and produce low throughput of the network(N/W).it is not very efficient technique because there is no guaranty of convergence in that point . So in proposed work, PSO utilized for the optimal route and RSA which change over the information into secure way. The simulation is done in NS2 which performed the packet transmission from the nodes to base station(BS). In that outcomes showed that we improved the arrangement of network by increase the packet delivery ratio(PDR).

Keywords: Wireless Sensor Network, Base Station, K-means Clustering, PSO algorithm, RSA cryptography.

I. INTRODUCTION

WSN commonly consists of sensor node that are arbitrarily arranged in the area that is called as sensor fields or field of observation. Sensor nodes have restricted distributed power supply and may have difficulty of charging when battery runs out. Therefore, the mechanism of control managing for efficient energy in utilization is necessary. Wireless sensor execute three sorts of operations: event sensing, event processing and communicating with adjacent nodes. Among these, energy in utilization must significant assets for communication. We need to remember that routing protocols must be energy efficient keep in mind the end goal to expand the life of sensor node and the sensor network.. Routing protocols (RP) are classify into three hierarchical data-centric protocols, protocols and geo-social-based protocols. RP and agreement on the categorization of the recent paper survey 15 RP their comparison as discussed [1].

II. ROUTING PROTOCOLS IN WSNS

Routing in WSNs differ from conservative routing in set networks in different ways. There is infrastructure less, wireless links are variable sensor nodes might be unsuccessful, and routing protocols have to assemble strict energy saving requirements [2]. Numerous routing algorithms were generated for WSNs in general. In WSNs proposed routing protocols might be separated into number of classes as displayed in Table 1. In this study sample RP of these classes defined into sub-sections.

Table 1: Routing Protocols for WSNs

Category	**Representative Protocols**
Location-based Protocols	MECN, SMECN, Geographic Adaptive Fidelity (GAF), Geographic and Energy Aware Routing(GEAR),Span,TBF, BVGF, GeRaF
QOS-based protocols	SAR, SPEED, Energy-aware routing
Heterogeneity-based Protocols	IDSQ, CADR, CHR
Multipath-based Protocols	Sensor-Disjoint Multipath, Braided Multipath, N-to-1 Multipath Discovery
Data-centric Protocols	SPIN, ACQUIRE, Information-Directed Routing, Directed Diffusion, Gradient Based Routing, Rumor Routing ,Energy-Aware Routing(EAP), COUGAR, Information-Directed Routing, EAD, Home Agent- Based Information Dissemination, Quorum-Based Information Dissemination
Mobility-based Protocols	SEAD, Data MULES, Data MULES , TTDD, Tree-Base Data Dissemination, Dynamic Proxy, Joint Mobility and Routing
Hierarchical Protocols	LEACH, PEGASIS, HEED, TEEN, APTEEN

III. K-MEANS CLUSTERING

K-MEANS is the simplest algorithm used for clustering which is unsupervised clustering algorithm. This algorithm segments the data set into k groups utilizing the cluster mean value therefore subsequent clusters intra cluster similarty is high and inter cluster similarity is low. K-Means is repetitive in nature. It follows following steps:

1. Arbitrarily create k point (cluster centers), k being the quantity of clusters wanted.
2. Calculate the interval between each of the data points to each of the centers, and allocate each indicate the nearest center.
3. Calculate the new cluster center by figuring the signify rate of all data center in the individual group.
4. With the new center, repeat step 2. In the event that the task of cluster for the data point changes, repeat step 3 else stop the procedure.

RSA Algorithm

A strategy to execute a public key cryptosystem whose security depends on the trouble of factoring prime numbers

was proposed in RSA remains for Ron Rivest, Adi Shamir and Leonard Adleman, who first freely depicted the calculation in 1977. Through this process it is probable to encrypt data and generate digital signatures(DS). It was so successful that today RSA public key algorithm is the mainly broadly used in the world.

Key generation:

1. Choose two different prime numbers, p and q.
2. 2.Calculate $n = p * q$
3. 3.Calculate $\varphi(n)$, $f = (p - 1)(q - 1)$ where *f* is Euler's Totient Function.
4. Select public exponent (small no.) e that is co-prime to *f* such that 1 < e < *f* and gcd(e, *f*) = 1
5. Compute private exponent $de \bmod f = 1$
6. Public key is {n, e}, secret key is {d, *f* }
7. Encryption: $c = m^e (mod\ n)$.
8. Decryption: $m = c^d (mod\ n)$.
9. Digital signature: $s = H(m) * d \bmod n$,
10. Verification: $m' = s * e \bmod n$,
11. If $m' = H(m)$ signature is correct. H is a publicly known as hash function.

IV. PSO ALGORITHM

In the fundamental particle swarm optimization(PSO) algorithm, particle swarm contain of "n" particles, and the place of all particle stands for the possible solution in D-dimensional space. The particles vary its situation according to the following three principles: (1) to keep its inertia (2) to fluctuate the situation on the basis its main optimist location (3) to fluctuate the situation according to the swarm's for its main optimist location. The position of each particle in the swarm is effected by its most optimist location during its motion (individual experience) and the location of its most idealist particle in its enclosing (near experience). When the all particle swarm is enclosing the particle, its most optimist location of the enclosing is equal to the individual of all most optimist particle; this algorithm is termed the whole PSO. If the narrow surrounding is used in the algorithm, this algorithm is termed the partial PSO. Every particle can be shown by its recent speed and location, its most optimist location of each individual and its most optimist location of the enclosing [3].

V. LITERATURE SURVEY

Umadevi M et al. [2016] in this report, this approach help in increasing the packet delivery ratio(PDR) and reduce delay with control packet overheads which in change minimize the energy usage in a sensor network. Imitation outcomes of this proposed work were examined and compared with the existing works. The SFDA has an average difference of 1.22% higher in (PDR) when correlate to the existing approach and 2.92 % against the grid approach. The major dissimilarity in the results proved that SFDA was more reliable at higher mobility scenarios with its performance metrics [5].

Walaa Abdellatief, et al. [2016] In this report, our propose a globally distributed c1ustering technique. This technique depends on some global information about the network to permit each node to decide its task in the produced clusters locally. This information is assumed to be known by default by the BS for any communication or topological control activities. . Imitation results showed that proposed technique achieve less power consumption and therefore longer network Lifetime when compared with other c1ustering techniques [6].

Iness Ahriz, et al. [2015] in this report propose a easy and novel formulation and infer an algorithm to resolve this problem, more suitable to the time and complexity constraints of IOT context. Moreover, we proposed Denoising - Greedy Recovery Algorithm (D-GRA) to contract with noise measurement affecting the established signal strength used to the sensor localization. This proposed algorithm were compare to the classical trilateration method by performing different imitation. The gained results demonstrated by the proposed algorithms outperform the trilateration method in a noisy environment [7].

Kuei-Ying Lin et al. [2015] In this report, we represent cross-layer protocol that integrates multipath routing protocol and data Interleaving method based on Reed-Solomon code. We create the problem of selecting the sensor transmission paths as a greedy algorithm knapsack problem and solve it. Our multipath routing protocol, it allows every sensor to choose multiple transmission paths, using optimization algorithms. Based on the number of channels, data interleaving technique that works by using Reed Solomon code to provide reliable data transmission. Imitation outcomes display that our scheme of multipath routing protocols over their existing network of life, because the balancing power consumption and facilitates communication reliability [8].

Najma Ismat et al. [2014] In this report,we represented a virtual grid-based distributed clustering (VGDC) solution for mobile wireless sensor network(MWSN) that deliver information reliability equal to 30% more than existing solutions at the cluster-heads. Our work VGDC scheme also minimize energy utilization resulting in improved lifetime of the network [9].

VI. PROPOSED WORK

In the existing work, they performed clustering on the foundation of energy and thickness of the network. It also used ACO for the efficient path selection from cluster head(CH) to BS. But they didn't mention any clustering technique which they used to configuration clusters of the nodes. Efficient path selection has done by ACO but it is not very effective technique.

In this proposed work, we spread the sensor nodes in the network and placed base station at middle. Then we form the clusters by applying K-means clustering by calculating the distance from the BS and select appropriate cluster head. Now we generate the efficient path by using PSO with the best fitted path. Lastly we transmit our encrypt data by using RSA algorithm which makes them more secure. By this technique, we get more secure network and better performance of the network.

Proposed algorithm:

Step:1 Place N number of sensor nodes in network

Step:2 Put base station at the middle

Step:3 division the network into different clusters
Step:4 Select cluster head for each cluster
Step:5 Now find suitable path for data forwarding
Step:6 Apply PSO between cluster heads to base station(BS)
Step:7 Encrypt the data using RSA algorithm
Step:8 Send data towards Base station

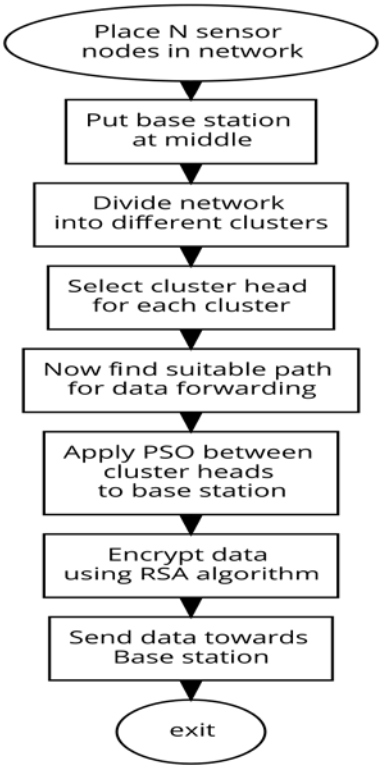

Fig. Proposed Flowchart

VII. RESULT ANALYSIS

1. Packet Delivery Ratio (PDR):
It outlines the proportion of packets deliver from supply toward destination. The graph show a PDR graph among base approach as well as proposed approach. This PDR rate is best in proposed than existing approach.
PDR= received packets/generated packets*100

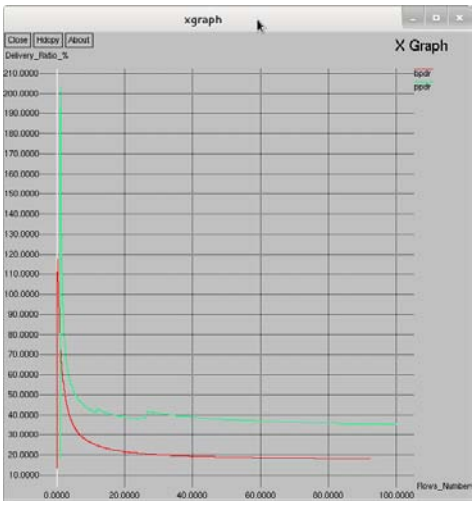

Fig. Packet delivery ratio(PDR)

2. Throughput:
The transfer of information lying on information measure is decision as output. The graph represents a output graph among base approach moreover as projected approach. The output of the projected approach is okay than the present approach.
Throughput = File Size / Transmission Time (bps)

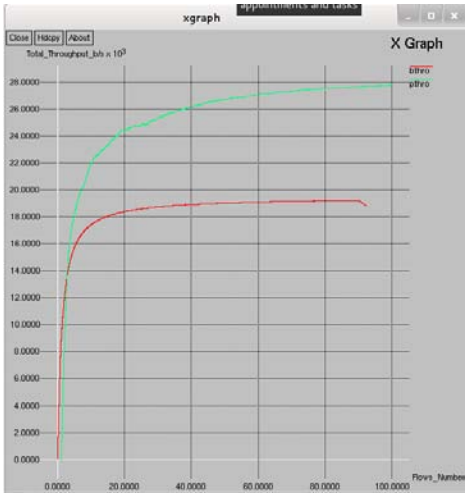

Fig. Throughput

3. Routing overhead:
It is determind as the flooding of information to the network transmitted by application, which utilize a bit of easy to get to transfer rate of communication protocols. The graph represents a routing overhead graph among base approach with proposed approach. The proposed approach has an extra overhead than the base approach. Since the overhead be supposed to be minimum except as the routing increases this proposed work the overhead also increases.
Routing overhead = Number of packets control in particular time

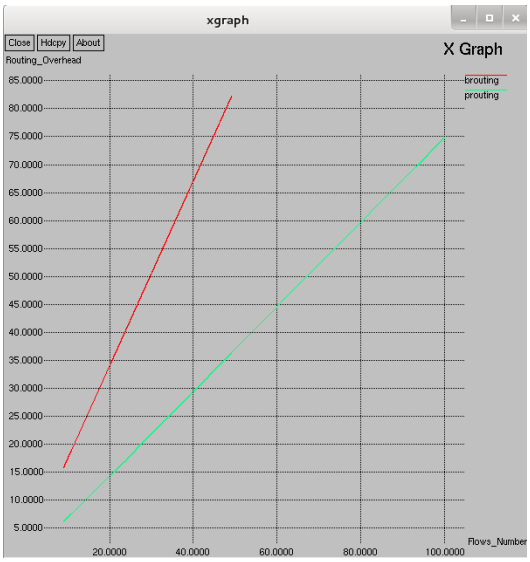

Fig. Routing Overhead

VIII. CONCLUSION

WSN contains many nodes which communicate to each other throughout sensing them. Sensor nodes gather the information from the environment and forward the data from one node to a new node. We proposed the method which is energy proficient protocol by enhance the network existence and including earlier system used RP and cluster. A network is generally target for amount of a assortment of kinds of attacks. This paper, the technique enhance the security and the authentication of a network and ignores of attacks. After experimentation, we get the outcomes that express the obstacle of attacker effect on system. Our method is enhanced in developing the PDR and in addition enhances the network existence as compare with prior system.

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