Enhance Security in Wireless Sensor Network Using Trust Awareness Routing Protocol (TARP)

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Abstract:As the Trust issue in wireless sensor network is emerging as an important factor in security of node. Sensor networks are implementing on large scale in real time environments due to its incredible uses in real life. Wireless sensor network don't need human interference for its working so they can place where human cannot reach easily. It is necessary to analyze how to resist attack with a trust scheme. In this paper we categorize various types of attacks and counter measures related to trust schemes in WSNs. Furthermore we provide the development of trust mechanism which give a short stigmatization of classic trust methodologies and emphasize the challenge of soft trust scheme in WSNs. Based on the analysis of attack and the existing research an open field and future direction with trust mechanisms in WSNs is provided. Wireless sensor networks are mainly deployed to monitor events and report data, both continuous and discrete the development of new trust models addressing the continuous data issue and also to combine the data trust and the communication trust to infer the total trust.

Keywords:Wireless sensors network, Security, Energy efficient, Trust, Communication trust, Data trust, Recommendation trust, optimal route, Particle swarm optimizationAlgorithm, Trust management.

1. INTRODUCTION

Wireless Sensor Networks (WSN's) are emerging technologies that have been widely used in many applications such as emergency response, healthcare monitoring, battlefield surveillance, habitat monitoring, traffic management, smart power grid, etc. However, the wireless and resource-constraintnature of a sensor network makes it an ideal medium for malicious attackers to intrude the system. Thus, providing security is extremely important for the safe application of WSNs.[1]

WSN is a wireless network consisting of spatially distributed autonomous devices using sensors to monitor physical and environmental condition. Critical vulnerabilities such as node capture and denial-of-service (DoS) attacks. Various security mechanisms, e.g., cryptography, authentication, confidentiality, and message integrity, have been proposed to reduce the security threats such as eavesdropping, message reply, and fabrications of messages.[3]

Sensor nodes are small in size and able to sense events, process data, and communicate with each other to transfer information to the interested users. Typically, a sensor node consists of four sub-systems:-

- Computing sub-system (processor and memory).[1]
- Communication sub-system (transceiver).
- Sensing sub-system (sensor).
- Power supply sub-system (battery).

WSNs are a collection of self-organized sensor nodes that form a temporary network. In wireless sensor network, trust specifies the reliability or trust worthiness of sensor node. In this, trust model specifies & plays an important role in identifying misbehavior nodes and providing collaboration among trustworthy nodes. The reputation –based framework for high integrity sensor network was first trust based model designed and developed for sensor networks. [1]

Trust is defined as a belief level that one sensor node puts on another node for a specific action according to previous observation of behaviors. Trust value ranges from 0 to 1 where 1 is completely trustworthy. Trust is of mainly three types, they are as:-

- Direct Trust: based on direct communication behaviors.
- Recommendation Trust: filtered recommendations for 1-hop nodes.
- Indirect trust: trust for multi-hop nodes based on recommendations.

Trust is having numbers of features in WSN: -[1]

- Asymmetry: If node A trusts B, it does not imply nodes B trusts Node A.
- Transitivity: Trust value can be passed along a path of trusted nodes. If node A trust node B and node B trust node C, then A trust C at certain levels. It is important in trust calculation between two non–neighbor nodes.
- Composability: Trust values received from multiple available paths can be composed to obtain an integrated value

2. RELATED WORK

Now a day'slots of research are going on WSN as it is a new system of technology which is used in lots of field. This technology helps us in numbers of different field it also makes our work very easy. Main factor is of keeping the data's more secure it can be done by using different mechanism, one of the mechanisms is Trust Mechanism. We have Analysis and summary of the different papers. All papers points are mentioned and show the things which is included and to what more importance is given, and what more should be done in future.

Li Ma, Guangjie Liu [2] uses a Hierarchical Trust Model in a paper a hierarchical trust model for cluster-based wireless sensor network. According to the differences between cluster heads and general nodes, the distributed and centralized trust management mechanisms are combined in this paper.In this model, the computation of node trust is based on communication, data and energy aspects. The defined trust

value can denote the trust level of WSN nodes objectively and respond to a variety of security threats which wireless sensor network might encounter.

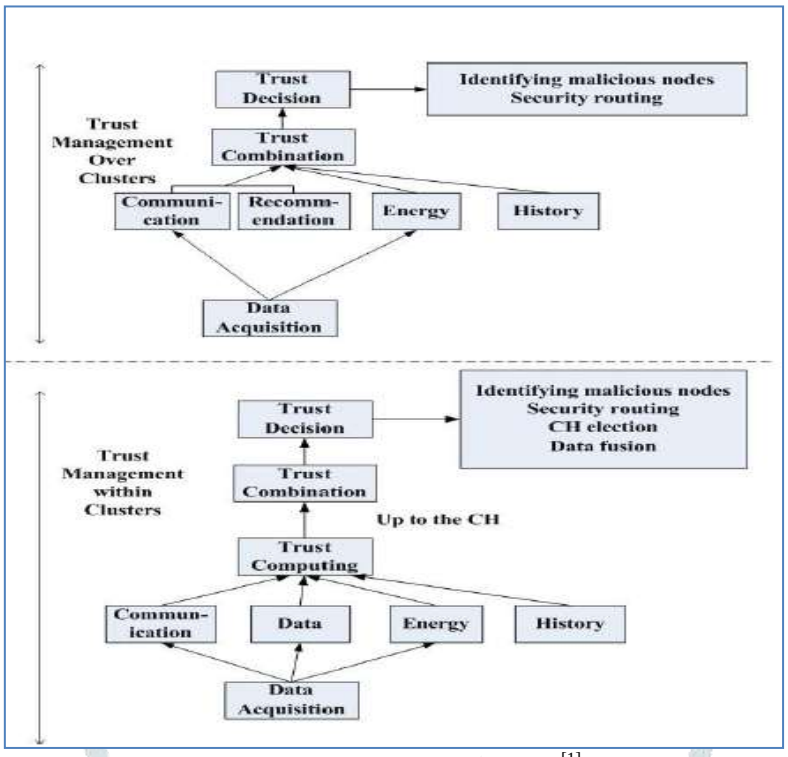


Fig-1 Framework for trust model[1]

A hierarchical dynamic trust management model is proposed for cluster-based wireless sensor network, which is based on three trustworthiness aspects such as communication, data and energy.
The trust model is featured with distributed and centralized trust management framework, the structure difference within one cluster and over clusters, and the different missions. The model has a good performance in dynamic adaptability, fault tolerance and superiority.
S. Anbuchelian, S. Lokesh and Madhusudhanan Baskaran[3] tried to improve the security in Improving Security in Wireless Sensor Network Using Trust and Metaheuristic Algorithms.Trust is important in wireless networks as collaboration /cooperation among nodes is critical to achieving system goals like routing reliability which is NP Hard. In this work a trust based Cluster Head selection mechanism using Firefly based Metaheuristic is proposed to improve the security and network lifetime of the WSN.
In this work the proposed algorithm was:-[3]

- Implemented in a mote test bed consisting of 23 motes and one laptop acting as the base station.
- Simulations were carried out extensively using MATLAB and varying the number of nodes from 100 to 900.

Each node will calculate trust for all its surrounding nodes and store these values locally for later usage. [4]

$$A = \mp \sum_{i=1}^{n} T_{y_i}(x) \quad (1)$$

$$B = \frac{\sum_{y=1}^{m} T_y(x)}{m} \quad (2)$$

The proposed Trust Firefly Algorithm decreased the end to end delay when compared to Weighted Clustering Algorithm. The packet delivery ratio is significantly improved for the proposed Trust Firefly Algorithm compared to Weighted Clustering Algorithm. The average PDR improvement of the proposed system was 33.12%.

Jinfang Jiang, Guangjie Han, Feng Wang, Lei Shu, and Mohsen Guizani [5] proposed an efficient distributed method in the paper named An Efficient Distributed Trust Model for Wireless Sensor Networks. In this paper, Authors proposed an Efficient Distributed Trust Model (EDTM) for WSNs. First, according to the number of packets received by sensor nodes, direct trust and recommendation trust are selectively calculated. Then, communication trust, energy trust and data trust are considered during the calculation of direct trust.
TRUST CALCULATION IN EDTM [5]

1. The calculation of Direct Trust
2. Calculation of the Communication Trust

Tcom = 2b + u/2

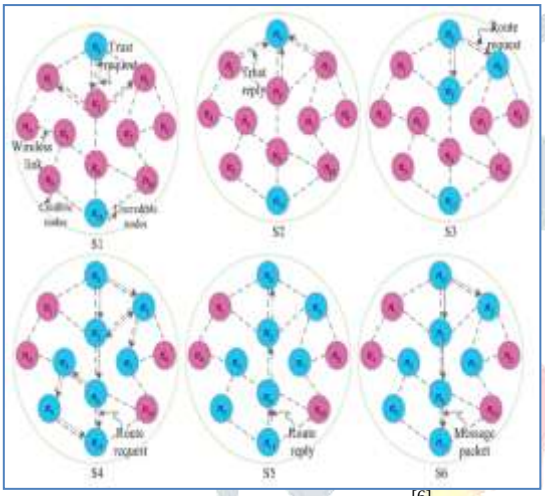
3.Calculation of the Energy Trust [5]

$$T_{ene} = \begin{cases} 1 - p_{ene}, if E_{res} \geq \theta \\ 0, else \end{cases} \quad (3)$$

A distributed and efficient trust model named EDTM is proposed. During the EDTM, the calculation of direct trust, recommendation trust and indirect trust are discussed. Furthermore, the trust propagation and update are studied. Simulation results show that EDTM is an efficient and attack-resistant trust model.

DanyangQIin, Songxlang Yang, ShuangJia, Yan Zhang, Jingya Ma, And Qun Ding [6] did research on Secure Routing in Research on Trust Sensing Based Secure Routing Mechanism for Wireless Sensor Network. The typical network attacks caused by the limited energy and the poor deployment environment of wireless sensor network on data transmission, a trust sensing-based secure routing mechanism (TSSRM) with the lightweight characteristics and the ability to resist many common attacks simultaneously is proposed in this paper.
Here the process is divided into main 3 parts: - [6]

- NetworkInitialization Process
- Route Construction Process
- Route Maintenance Methods



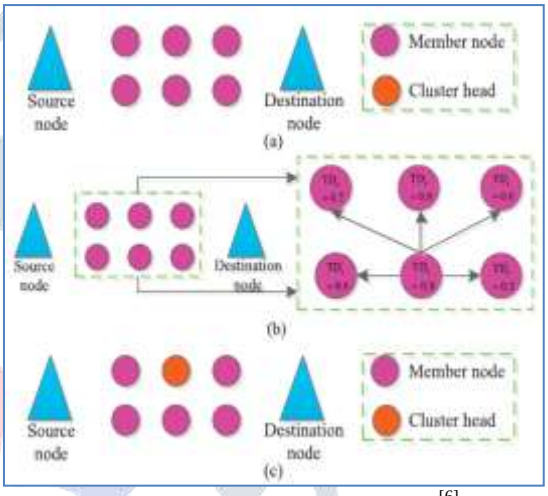


FIG-2 ROUTING PROCESS [6] **FIG-3** CHOICE PROCESS OF CLUSTER HEAD [6]

This paper presents a trust sensing based secure routing mechanism to handle common network attacks. An optimized routing algorithm is proposed by using semiring theory, which considers the trust degree and other QoS metrics.

VijenderBusi Reddy, S Venkataraman and AtulNegi [7] proposed a communication and data trust in the paper Communication and Data Trust for Wireless Sensor Networks using D-S Theory. In this paper, a trust mechanism which evaluates Communication trust and Data trust for WSNs. Communication trust is computed from direct and indirect observations of the neighbour's forwarding behaviour. Direct trust is derived from the consistency of forwarding behaviour.We use Weighted Dempster-Shaffer (D-S) theory to compute indirect trust. Data trust is computed by using median of sensor data.

- Direct Trust (DT^B_A (t)): [7]

$$DT_A^B(t) = DT_A^B(t-1) \times cos(\frac{\pi}{2} \times \delta_t) \quad (4)$$

- Indirect Trust (IT^B_A (t)): [8]

$$IT_A^B = m_x^B(H) \bigoplus m_y^B(H) ... \bigoplus m_y^B(H) \quad (5)$$

The proposed model TWSN uses weighted Dempster-Shaffer theory to aggregate the recommendations. Direct trust is computed using forwarding ratio with cos(x) function to mitigate on-off attacks.TWSN mitigates packet modification/dropping attack, bad mouthing attack, collusion attack and on-off attack. We also derive data trust to identify malicious sensor data.

3. PROPOSED WORK

The proposed Trust model flow chart consists of numbers of step. In this mainly there is three steps in which consist creation of network ID and object ID and next to it the calculation of neighbor and Trust value come into picture which will show the most trustworthiness using the Particle swarm optimization Algorithm. This Algo. Will help in getting optimized Route and after getting optimize route the data is transmitted with more security and through proper node using the shortest or best applicable path. We will discuss the details in the following paragraph.

3.1 Create Network Topology: -

This is the first step of the proposed method. In this step the Network topology is created which is used in connecting the numbers of nodes together or making a bridge among the different nodes.

3.2 Create Network ID & Object ID: -

This is the second step which includes the creation of network ID and object ID. In this step ID is created for network and object. This is done for the Identification purpose. This further helps during the node connection and in getting the proper path.

3.3 Calculation of neighbor and Trust Value: -

This is the step which consists of calculation of neighbor and trust value. Both can be calculated using different methods like calculation of communication trust, Energy trust, Data trust, Recommendation trust, Recommendation reliability, Indirect trust etc.

3.4 PSO Algo: -

This is the step in which PSO Algo is used for getting optimized Route. This is the Algo used in this proposed methodology which gives us a short and best applicable path.

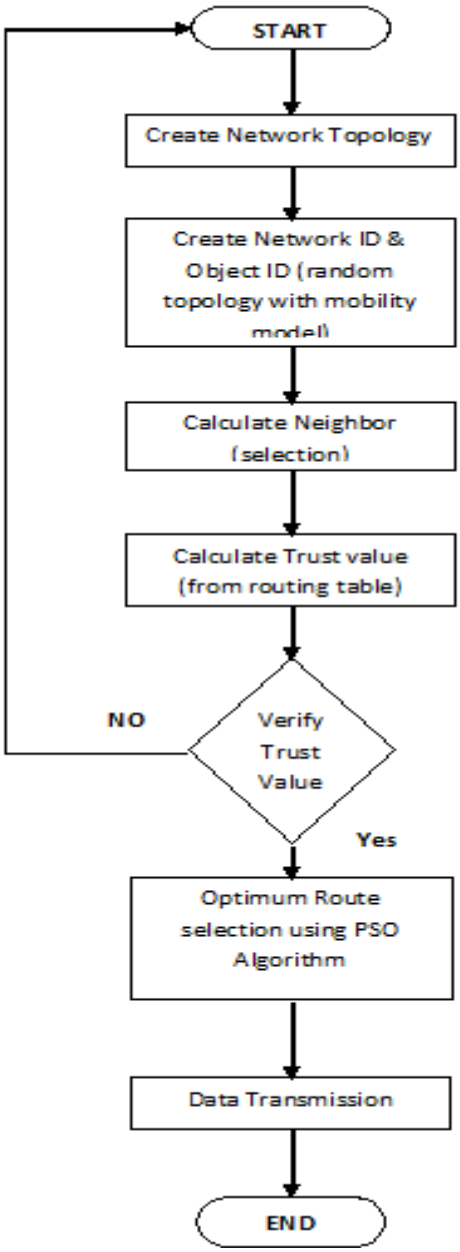


Fig. 4 Flow Diagram of Proposed System

4. EXPERIMENTAL EVALUATION

Here we have used matlab 2017R for the simulation of the system. We have taken 200 nodes for the simulation and have derived simulation results for the same. We have derived the energy consumption for every node taking into consideration the trust value.

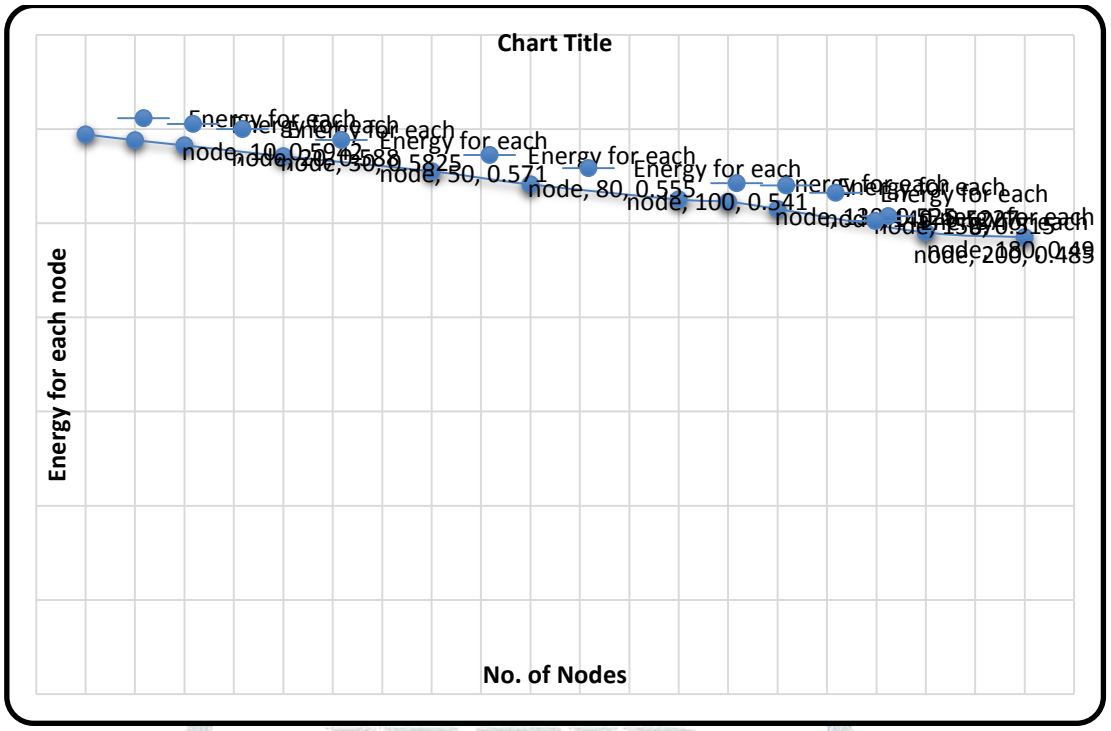


Fig. 5 Energy Consumption of nodes

Table 1 Energy of nodes

Nos. of nodes	Energy for each node
10	0.5942
20	0.588
30	0.5825
50	0.571
80	0.555
100	0.541
130	0.525
140	0.5227
150	0.515
180	0.49
200	0.485

Here the below chart shows the comparison between probability of false alarm with the energy consumption of nodes.

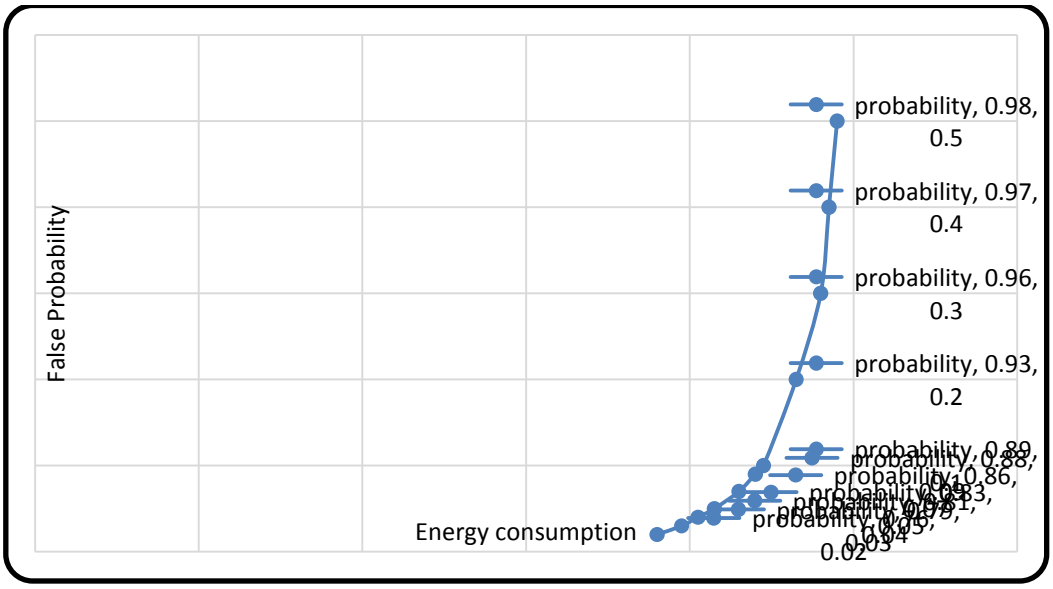


Figure 6 Comparision of False probability with Energy

Below figure gives the comparision of the probability of false alarm with the elapsed time of the communication nodes.

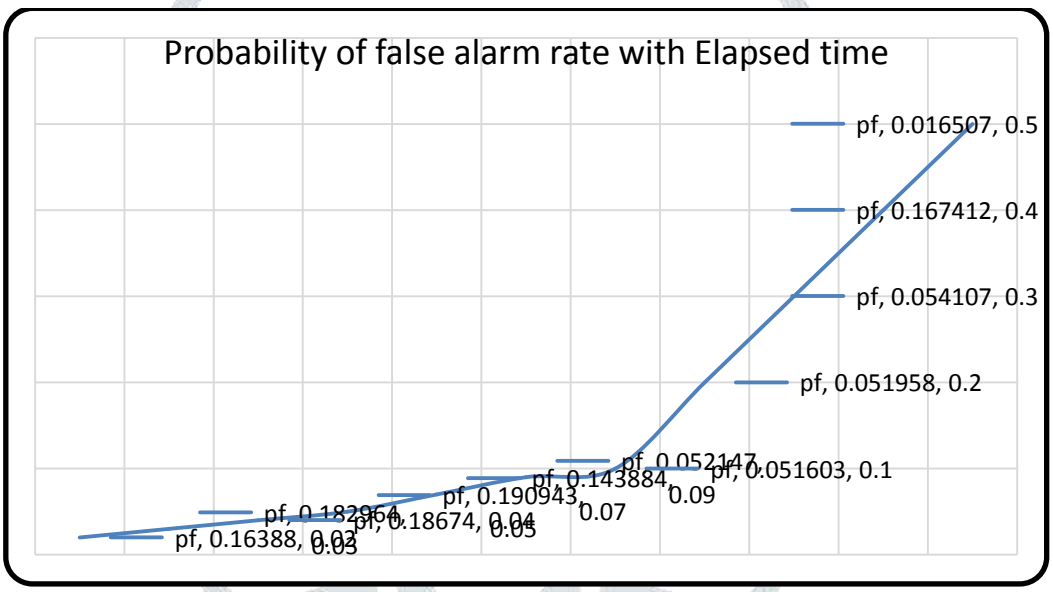


Figure 7 Comparison of False probability with Elapsed time

5. CONCLUSION

In all papers we have seen that any one theory is taken and one process is followed for e.g. distributed and centralized trust management framework, Trust Firefly Algo. , semiring theory etc. is used. We here use a proposed method which will give more security and less use of energy, as well as trustable node selection and optimum node selection process is made easy and more accuracy is obtained using the calculation of neighbor and trust value and also using PSO Algo. Trust in wireless sensor networks is an important issue and it solvesthe problem of access control, privacy, secure routing scheme andreliable communication. in these paper we introduces a new approach tocalculate the trust in WSN. The proposed algorithm and the evaluationof the trust value of the node in the network depend on the trustattributes, metrics and trust parameters.According to literature analysis we use PSO with trust mechanism for improving existing systemso using our proposed system we achieve significantimprovement in results.

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