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# INTER-CLUSTER COMMUNICATION AND INTRUSION DETECTION FOR EFFICIENT DATA TRANSMISSION IN WIRELESS SENSOR NETWORKS

**M.S.Vijayakumar [1], Dr.S.V.Manisekaran [2]**

*[1] PG Scholar, [2] Assistant Professor, Department of IT,*

*Anna University Regional Centre Coimbatore, Tamilnadu (India).*

**ABSTRACT**

*In wireless sensor network, during the process of communication the information is lost due to lack of security in the network. Several authentication methods are present to increase the security in the wireless sensor network. But still many Active and passive attacks are present in the network to reduce the privacy of the network. The current state of art in the authentication protocols will take us to the conclusion that the topic is still open. So in the proposal using the clustering, intrusion detection and fusion methods to overcome the active and the passive attacks in the network. PEGASIS Clustering is used to improve the efficiency of energy. The Algorithm is used for intrusion detection is Rational Operating recall Curve Algorithm. It works to reduce the intrusion rate of the system during the process of communication in the network. The fusion method is also introduced to find the precision rate of the network. By using this method the security of the wireless sensor network increases and the data loss and the delay factors are reduced.*

***Keywords: AODV Routing, RORCA, Recall, Precision, Throughput, Pegasis, Omnet++.***

## I INTRODUCTION

The advancements in wireless communication technologies enabled large scale Wireless Sensor Networks (WSNs) deployment. Due to the feature of ease of deployment of sensor nodes, wireless sensor networks (WSNs) have a vast range of applications such as monitoring of environment and rescue missions. Wireless sensor network is composed of large number of sensor nodes. The event is sensed by the low power sensor node deployed in neighborhood and the sensed information is transmitted to a remote processing unit or base station.

Wireless sensor networks (WSN) are playing-vital role in commercial, military application, critical event monitoring and networks monitoring such as fire detection in forest, gas monitoring in coal mining, large scaled wireless sensor nodes are deployed in wide range of area. The sensor nodes collectively work together and send the detected information to other sensor nodes. To transmit the message it needs twice the energy it takes to receive the message. Major challenge of WSN is reducing the energy consumption. To increase the efficiency of energy using a techniques called inter-cluster communication and Rational Operating Recall Curve Algorithm (RORCA). In inter-cluster communication, each cluster has a coordinator referred to as a cluster head. In rational operating recall curve algorithm, the intrusion detection rate of the system can find effectively.

### 1.1 Clustering in WSN

Clustering mechanism helps in improving the energy efficiency in sensor networks. Clustering in WSN splits the sensor nodes into small groups. A cluster head (CH) would be selected for each group. The nodes in the group reports the information gathered to the CH. All sensor nodes in a cluster are called cluster members; including one cluster head. Cluster heads transmit the aggregated data to a base station, instead of collecting data from cluster members. Thus, clustering reduces the overhead of the sink.

Clustering is introduced in network and is divided into ‘n’ radial level with base station (BS) at the center

**Cluster Head**

**Cluster** **Sink**

**Figure 1: Cluster Model**

The main idea of clustering is optimal selection of cluster head (CH) based on their level. Then the node having more energy is selected as cluster head.

### 1.2 AODV Routing Protocol

Ad-hoc On-demand Distance Vector (AODV) routing protocol uses traditional routing information-base (RIB) for one task creation and to determine an up-to-date path to receiver.

The neighbors are notified in case of route is broken due to temporal packet loss. Messages can be controlled using header field named control and breakages of route are as follows:

- Route Request Message (RREQ)
- Route Reply Message (RREP)
- Route Error Message (RERR)
- HELLO Messages.

## II RELATED WORK

Lettieri and Srivastava [6] have proposed a new adaptive link layer control technique to provide robust and energy efficient operation even in the presence of orders of magnitude variations in bit error rates. An exchange exists between one another to reduce the header and physical layer overhead by making frames large. In addition, the adaptive frame length control can be used to improve the energy efficiency for a desired level of good put, and to extend the usable radio range with graceful throughput degradation, but has battery energy limitations.

Ferriere et al. [4] have proposed the Simple Packet Combining (SPaC) error-correction scheme for wireless sensor networks. When two or more corrupt versions of a packet grabs, a packet merge sequence makes an effort to achieve the original packet from the corrupt copies. Packet combining exploits a multi-hop wireless network and point-to-point forward error correction (FEC), packet combining therefore helps multi-node interactions such as multi-hop routing or broadcasting as well as to hop-by-hop communication. SPaC does not estimate the channel conditions.

Dong et al. [1] have proposed a Dynamic Packet Length Control (DPLC). DPLC is used for packet length optimizations for sensor networks to make more efficient in terms of channel utilization, incorporate a lightweight and accurate link estimation method. It also provides two easy use of services, one is aggregating a small message and another is fragmenting large message to facilitate upper layer application programming. A DPLC overcomes the limitations of prior work, but still can reduce the overheads and increase the energy efficiency by using some other techniques.

Krishnan et al. [5] have proposed a packet length adaptation (PLA) in wireless local area network (LAN). A packet can lost due to many reasons, to reduce some of loss in medium access control (MAC) layer using a local packet adaptation algorithm. In PLA, each node dynamically adjusts its packet length based on estimates of the probabilities of each significant type of packet loss. In PLA, the access point periodically broadcasts channel information in order to estimate current network conditions. The throughput gains up to 20% via NS-2 simulations, but in transmitting hidden nodes unable to sense the transmission which leads to staggered collision.

Jamieson and Balakrishnan [2] have proposed a partial packet recovery (PPR). In before, to correct small number of bit errors, retransmitting the whole packet by using Forward Error Correction (FEC). The FEC wasting network capacity, to overcome this inefficiency, jamieson and balakrishnan implement a partial packet recovery (PPR) system. PPR incorporate two new ideas such as SoftPHY and a post-amble scheme. As a result increases end-to-end capacity by a factor of 2× under moderate load, but still can improve the performance of routing protocol in SoftPHY.

## III DESIGN

It is proposed that the intrusion detection and fusion methods, to overcome the active and the passive attacks in the network. Rational Operating recall Curve Algorithm (RORCA) is introduced in the rational intrusion detection method. This Rational operating recall Curve Algorithm is used to find the intrusion detection rate of the system effectively. And also employs to reduce the intrusion rate of the system during the process of communication in the network. The fusion method is also introduced to find the precision rate of the network. As a result, the proposed method performs well in monitoring the network and reduces the data loss.

Figure 2 shows an overall architecture design of proposal method. The application or data or messages are passed. Network is formed and route is discovered, then sending a request to topology. A topology is selected as random topology. In Inter-cluster communication cluster head is selected and cluster is formed. Then a method called Intrusion detection used for prevent from attackers. In intrusion detection Rational Operating Recall Curve Algorithm is used, then followed by recall, precision and fusion method.

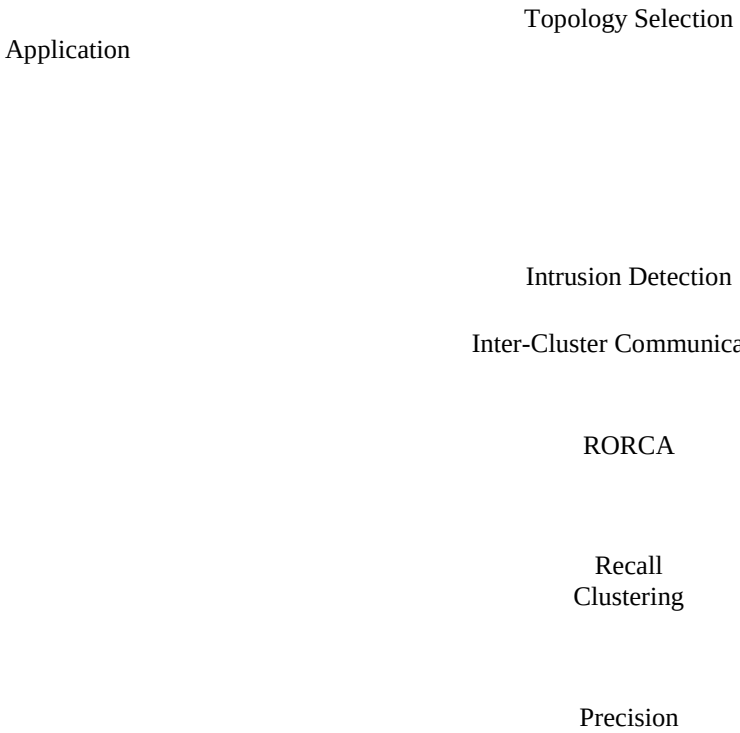



**Figure 2: Architecture.**

- **Network Creation**

The network is created based on topology. Here using random topology i.e., mostly using Mesh topology. The mesh topology combines one or more topologies.

- **MAODV Protocol**

The Multi-casting AODV routing protocol builds on top of the DSDV protocol that was previously described. AODV is an improvement of DSDV as it minimizes the number of required broadcasts since it creates routes in an on-demand basis, in contrast to DSDV which maintains a complete set of routes. It utilizes destination sequence numbers to ensure loop-freedom at all times and to avoid the count-to-infinity problem associated with classical distance-vector protocols.

When a node needs a route to a destination it broadcasts a Route Request (RREQ) message. The RREQ message is spread throughout the network and as soon as the message reaches a node with fresh enough routes to the specific destination or the destination node itself, a Route Reply (RREP) message is unicasted back to the requesting node.

AODV is able to provide unicast, multicast and broadcast communication ability. This capability of having all three communication forms in a single protocol offers numerous advantages. When searching by using the multicast route discovery it increases the unicast routing knowledge and vice versa. By having all three communication forms in a single protocol simplifies the implementation process of the protocol.

- **Energy Aware Clustering**

PEGASIS (Power-Efficient Gathering in Sensor Information Systems) is for each node to receive from and transmit to close neighbors and take turns being the leader for transmission to the BS. This approach will distribute the energy load evenly among the sensor nodes in the network. We initially place the nodes randomly in the play field, and therefore, the *i* –th node is at a random location. The nodes will be organized to form a chain, which can either be accomplished by the sensor nodes themselves using a greedy algorithm starting from some node. Alternatively, the BS can compute this chain and broadcast it to all the sensor nodes. We used random 100-node networks for our simulations.

PEGASIS performs data fusion at every node except the end nodes in the chain. Each node will fuse its neighbor's data with its own to generate a single packet of the same length and then transmit that to its other neighbor**.** With our simulation experiments, found that the greedy chain construction performs well with different size networks and random node placements. In constructing the chain, it is possible that some nodes may have relatively distant neighbors along the chain. Such nodes will dissipate more energy in each round compared to other sensors. The performance of PEGASIS is improved by not allowing such nodes to become leaders. By setting a threshold on neighbor distance to be leaders, able to slightly improve PEGASIS's performance further by applying a threshold adaptive to the remaining energy levels in nodes. Whenever a node dies, the chain will be reconstructed and the threshold can be changed to determine which nodes can be leaders.

### 3.4 Intrusion Detection

Intrusion Detection is used for detecting the intrusion, which are created by the external environment. To detect the intrusion in network proposing the Rational Operating recall Curve Algorithm (RORCA).This Rational operating recall Curve Algorithm is used to find the intrusion detection rate of the system effectively and also reduce the intrusion rate of the system during the process of communication in the network. The data fusion method is used to increase the precision rate of the system.

## IV SIMULATION

This project is simulated in OMNeT++. OMNeT++ is an object-oriented modular discrete event network frameworks simulation. OMNeT++ simulations can be run under various user interfaces. OMNeT++ also supports parallel distributed simulation. The parallel simulation algorithm can easily be extended, or new ones can be plugged in. OMNeT++ simulation tool is chosen, because it provides better performance than NS2 and OPNET. OMNeT++ is much scalable than NS2. OMNeT++ joins with MIXIM and used in numerous domains from queuing network simulations to wireless and ad-hoc network simulations. OMNeT++ cost is also low and it works well and coding of this also easy compared to test-bed like TOSSIM. OMNeT++ provides more accuracy of results, it's a new development tool and it becomes popular in future**.**

### 4.1 Simulation Results

The simulation results are shown in figure 3and 4 respectively.

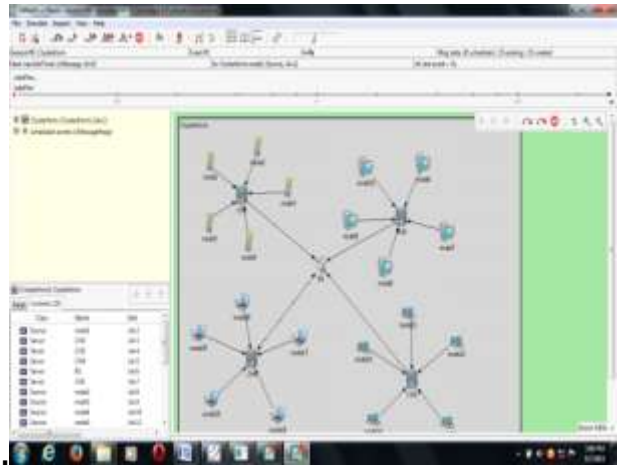


**Figure 3: Network Creation**

In fig. 3, the network is created by random topology selection which contains many numbers of cluster heads and up to 90's to 100's sensor nodes are connected.

In fig. 4, the cluster communication is done by using pegasis clustering. In this simulation result, there is transmission of message between cluster heads and sensor nodes.

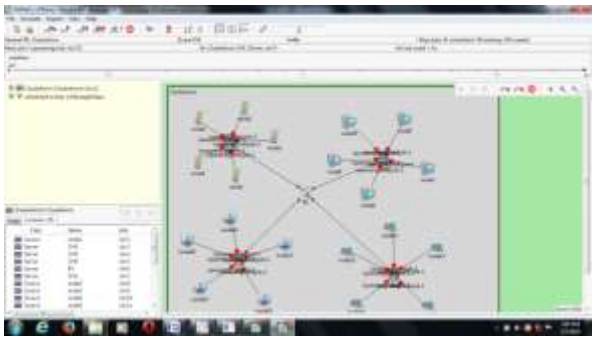
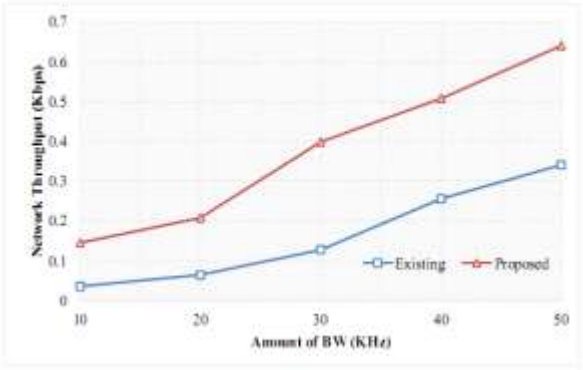


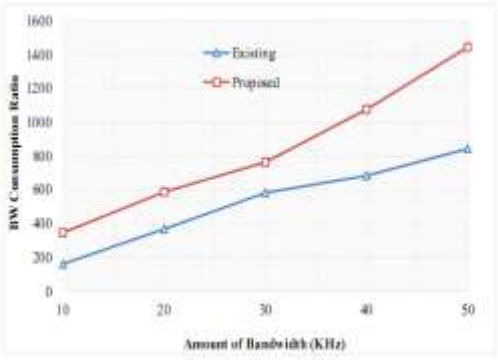
**Figure 4: Clustering**

### 4.2 Expected performance Analysis

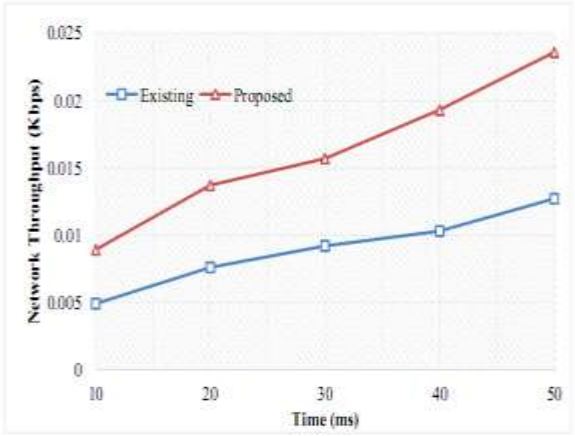
In this section, representing expected performance analysis in comparison with proposal and existing method.




**(a) Network Throughput vs Bandwidth.**




**(b) Amount of Bandwidth vs BW Ratio.**




**(c) Network Throughput vs Time.**

**Figure 5: Performance Comparisons.**

In fig. 5, has three performance simulations in comparison of existing and proposed method. (a) represents network throughput in kbps versus amount of bandwidth (BW) in kHz. (b) represents bandwidth consumption ratio versus amount of bandwidth in kHz. (c) represents network throughput in kbps versus time in milliseconds.

## V CONCLUSION

This paper presents PEGASIS Clustering and Rational Operating recall Curve Algorithm (RORCA). PEGASIS Clustering is used for improving performance and aware energy. RORCA is introduced in the rational intrusion detection method. This Rational operating recall Curve Algorithm is used to find the intrusion detection rate of the system effectively. The fusion method is also introduced to find the precision rate of the network. As the result, it is expected that the proposed method performs well when compared with the existing method. Also the energy efficiency increases by using pegasis clustering and provides safety by preventing from the attackers.

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