

Security Enhanced Multi-Routing Adaptive Cluster protocol (SEMRAC) using Sub Clusters in Wireless Sensor Network

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ABSTRACT: Wireless Sensor Network (WSNs) is a collection of light-weight sensors which are highly battery equipped and also one of the most important types of Wireless Ad hoc Networks. These networks are made up of lots of energy sensor nodes which are located as virtual with in a separate coverage area. It has already acquired the enormous attention of the research persons and the imagination of the people as well as media also. Energy efficiency, Limited storage capacity, achieving scalability with a large number of sensor nodes are some of the issues of Wireless Sensor Networks. Many researchers have been developed different enhanced routing protocols for Wireless Sensor Networks to overcome above said issues. To achieve some improved level of performance enhancement, Security Enhanced Multi-Routing Adaptive Cluster Routing Protocol (SEMRAC) is proposed in this paper and the working capability of this method is compared with the existing methods EBRMFAF and IPEBRM using NS-2 Simulator in terms of performance metrics such as Throughput, Packet Delivery Ratio, Packet Loss Rate and End-to-End Delay.

KEYWORDS: Wireless Sensor Networks (WSNs), Clustering, Energy *Balancing*, EBRM-FAF, NS-2 Simulator.

I. INTRODUCTION

Among variety of types of Wireless Networks, Wireless Sensor Network is the one of the promising and important research area in the field of Wireless Networks for the past decade [1]. It also acts as a bridge between physical world and Industries. The sensor nodes which are connected with wireless network work with each other for sensing purposes. Information are processed through them are analyzed for achieving best results [2].

Routing is referred as a process of finding an optimal shortest path from a source node to every destination node in a particular network. Routing deals with some types of issues like router type, existence of shorter route, link along the route in mobile wireless link. A particular routing protocol sets up a routing route enabled table in routers and switch controllers. A good routing protocol should know something about global state of the node and also should intelligently summarize relevant information about the node in the Wireless Sensor Network. The Global state is inherently large and dynamic and also hard to collect the information. A routing protocol clearly projects how routers communicate with each other which distributing the data packets to select routes between any two nodes on a computer network [3] [4].

Based on the several dynamic criteria regarding the nodes connectivity of the Wireless Sensor Network, the emergence of novel routing protocols is increasing day by day. Different Routing protocols were introduced by various research persons in different disciplines. Label-based Multipath Routing (LMR) proposed by Xiaobing Hou et al using only localized information for Wireless Sensor Networks. It is presented to overcome the issues of finding the valid paths between source and destination and also to present the detailed study on multipath routing techniques for Wireless Ad hoc Networks [5].

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Antonio Caruso et al proposed Virtual Coordinate assignment protocol in Wireless Sensor Networks for assigning GPS free coordination and also for providing efficient routing performance. VCap is simple and have very little requirements in terms of communication and memory overheads [6]. Adam Chalak et al [7] studied the performance of the some routing protocols in Wireless Sensor Networks. Increasing the life time of networks is mainly considered in this paper and its related protocols are investigated effectively. Victor Govindaswamy et al surveyed and briefly discussed the recent routing protocols such as Flat based routing, Hierarchical routing, Joint Sink Mobility Routing, Beacon Vector Routing and Location based routing protocols in Wireless Sensor Networks [8]. Mohammad Masdari and Maryam Tanabi surveyed and analyzed Multipath Routing Protocols in Wireless Sensor Networks. Multipath routing protocols improve the load balancing and quality of service in WSN and also provide reliable communication. This paper [9] investigates various multi-path routing protocols of the WSN in the literature and illustrates its benefits.

In this research paper, the Improved Precipitate Energy Balanced Routing Protocol is evaluated and its issues like less concentration in Security and less network monitoring view are overcome. The Security Enhanced Multi-Routing Adaptive Cluster Routing Protocol (SEMRAC) is proposed in this paper.

II. IMPROVED PRECIPITATE ENERGY BALANCED ROUTING PROTOCOL

The main goal of the Improved Precipitate Energy Balanced Routing Protocol is to decrease the data loss in Wireless Sensor Network, and reducing unwanted data disseminations for avoiding the data redundancy. After implementing this (IPEBR) protocol, WSNs frequently updates its neighbors (sensor nodes which are in direct transmission range). If WSN finds a sensor node within its transmission range, it would check the node ID to identify the group of the nodes. After identifying the particular group or cluster, the sink node transmits the message to the respective group of sensor nodes that are distributed in a uniform manner.

By using the IPEBRM protocol, number of sensor nodes are accessing the same content of Wireless Sensor Network is decreased exponentially in some complex scenarios of WSNs such as low distance between two neighbor sensor nodes and more sensor nodes density. This functionality of IPEBRM protocol significantly reduces redundant broadcasts within the WSNs coverage area. The IPEBRM protocol in sensor nodes decides whether or not to accept the content from the sink node in broadcast communication. The advantage of Improved Precipitate Energy Balanced Routing Method (IPEBRM) protocol is the size of the data packet which is not increased while adding the list of forwarding neighbors. The main challenge in the design of IPEBRM protocol for sensor nodes is to find out whether the received message from Sink node is to be the broadcast or not.

Even though this protocol looks even better with existing protocols, it should not able to competent with the present challenges of the WSN like high level security, throughput improvement and effective monitoring. It leads to the searching of the effective routing protocol. The Security Enhanced Multi Routing Adaptive Cluster Routing Protocol (SEMRAC) is implemented in this work and analyzed with IPEBRM protocol.

III. SECURITY ENHANCED MULTI ROUTING ADAPTIVE CLUSTER (SEMRAC) ROUTING PROTOCOL

Network Monitoring is an important concept to improve the WSN performance and so functions of Genetic Algorithm is introduced for optimization because it has infinite applications through the optimization techniques and network optimization. SNMP (Simple Network Management Protocol) is utilized in this protocol as a basic network protocol for monitoring the network activities.

Selection, Crossover and Mutation are the three operators which dominate the functionalities of the genetic algorithms. Selection grabs an individual from the present generation's population for inclusion in the next generation's population. Crossover works on Crossover Probability to create an offspring by exchanging and combing partial solutions from two or more individuals. Crossover operator can be subdivided into one-point and uniform crossovers. Mutation works by slightly disturbing the recombination solutions with the alteration of small percentage of genes in the given list of individuals. Thus, to maximize the node throughput, each node may increase the carrier sense threshold as long as the

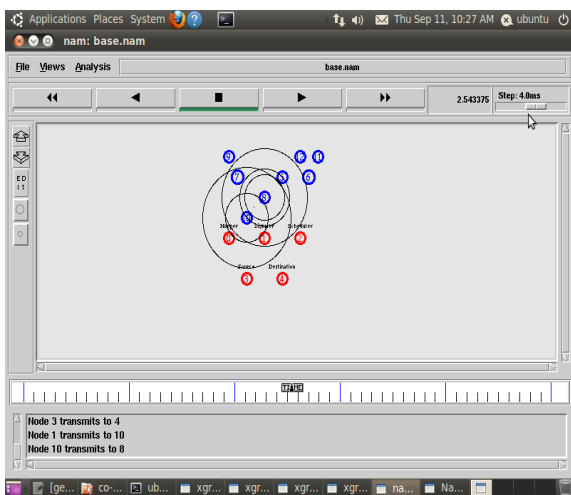
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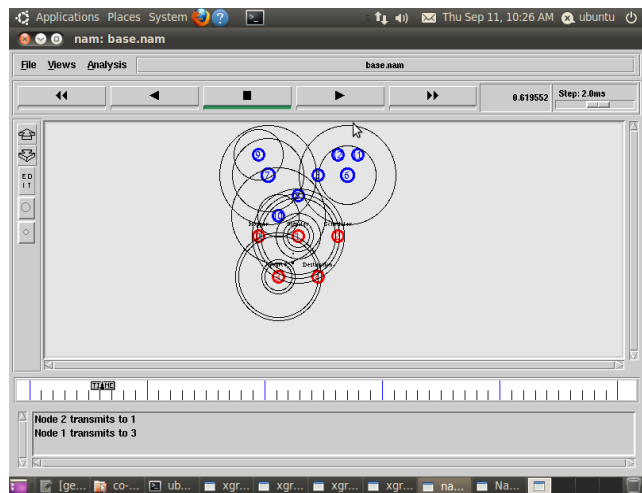
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collision probability is below a reasonable threshold. So, to introduce a new method called Interference and node throughput model. In order to provide security hybrid hiding encryption algorithm is proposed. This encryption algorithm is based on hiding a number of bits from plain text message into a random vector of bits. The locations of the hidden bits are determined by a key known to the sender and receiver. These operations include inserting part of the plaintext bits into a cover to hide it from recognition. The screenshots of the performance of SEMRAC protocol are projected below in Fig 1.

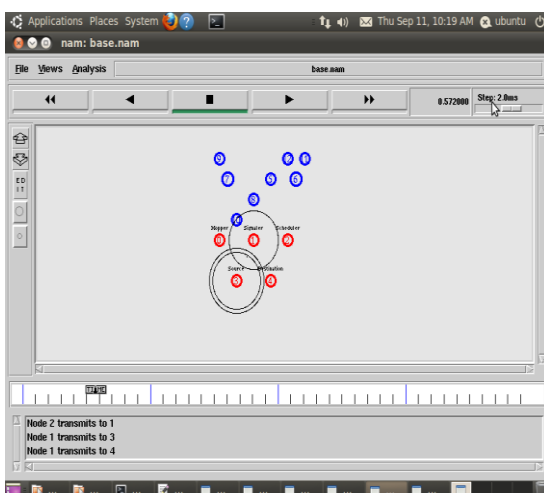
1 (a) Initialization process



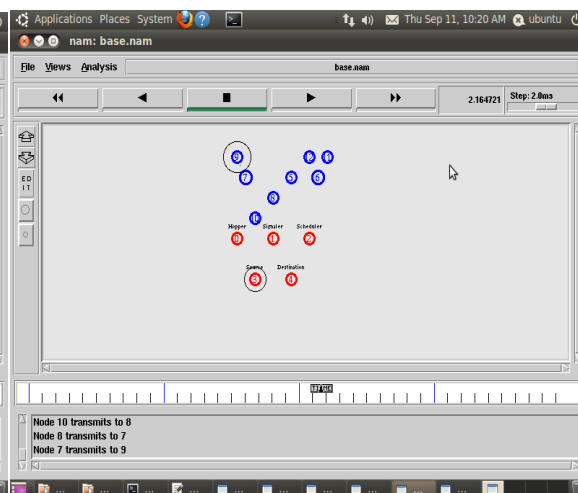
1 (b) Transmitting process



1 (c) Best network selection process



1 (d) Monitoring network process



IV. EXPERIMENTAL RESULTS

The performances of IPEBRM and SEMRAC methods are analyzed in non real time environment by using NS2 simulator. The NS-2 is an acronym for Network Simulator version 2. It is a discrete event simulator and is a standard experiment environment for the research community in networking the simulation area or open area topology

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of NS-2 execution is 1000 meters x 1000 meters by means of 4m/s node velocity. Simulation path is used to indicate the source to destination connections. Different performance metrics have been chosen to evaluate different techniques or different protocols. AODV is used for basic route discovery and maintenance operations. The parameters such as Throughput, Packet Delivery Ratio and End-to-End Delay are used to evaluate the performance of the proposed method for data transmission in routing and compared to others. The performance metrics are shown with their formulae in Table 1.

Table 1: Parameters with its Formulae

PERFORMANCE METRICS	FORMULAE
Throughput	$\frac{\text{No of received packets} \times \text{packet size}}{\text{Transmission Time}}$
Packet Delivery Ratio (PDR)	$\frac{\sum \text{No of packets received}}{\sum \text{No of packets sent}} \times 100$
End-to-End Delay	$\frac{\text{Simulation processing time}}{\text{Overall transmission time}}$

The throughput, Packet Delivery Ratio and End to End Delay values governed by these methods for various nodes in different transmission times 60s, 120s, 180s, 240s, and 300s are tabulated in Table 2, 3 & 4 respectively and their graphical representations are given in Fig.2,3&4.

Table 2: Average Throughput (bps) of routing methods

Transmission time (sec)	Routing methods	
	IPEBRM	SEMRAC
60	8055	9830
120	4505	5324
180	3367	4050
240	2867	3208
300	2457	2676

Table 3: Average P.D.R (%) of routing methods

Transmission time (sec)	Routing methods	
	IPEBRM	SEMRAC
60	59	72
120	66	78
180	74	89
240	84	94
300	90	98

Table 4: Average End to End Delay (ms) of Routing methods

Transmission time (sec)	Routing methods	
	IPEBRM	SEMRAC
60	0.8	0.5
120	1.3	1.0
180	2.2	1.7
240	3.1	2.6
300	4.8	3.2

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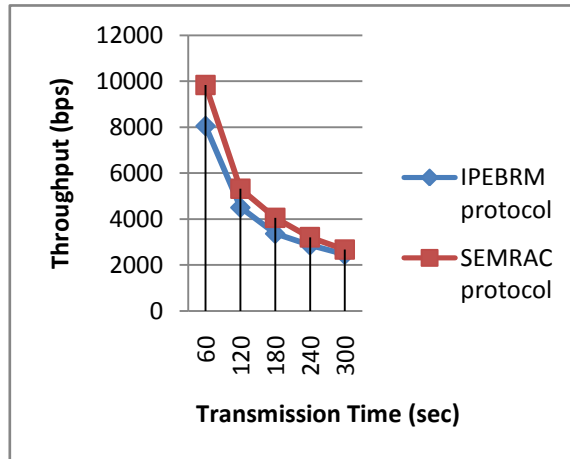


Fig 2: Average Throughput for 100 nodes

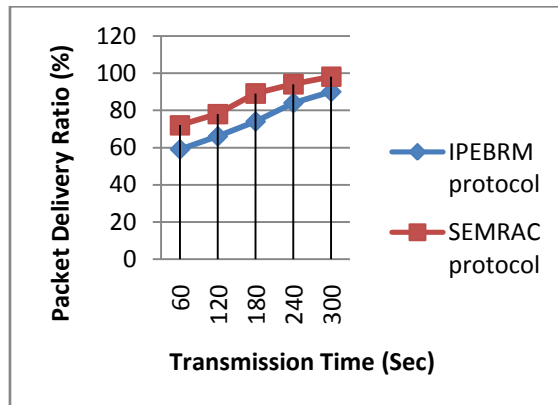


Fig 3: Average P.D.R for 100 nodes

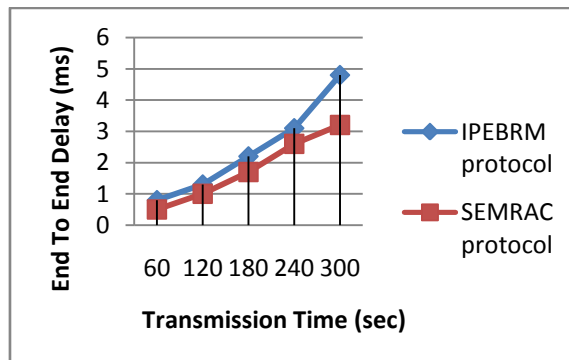


Fig 4: Average delay for 100 nodes

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From the results which are taken and analysed from the tabulations and their respective graphs, it is noted that finally that throughput values of proposed method are higher than the existing method. While the transmission time increases throughput values will be getting reduced. While analysing the Packet Delivery Ratio values, proposed method achieved higher than existing. PDR increases while time increases. According to delay values, proposed method achieved low delay. While time increases delay will be increased.

From the simulation results, it is evaluated that proposed SEMRAC Routing Protocol is effective compared with existing IPEBRM protocol in terms of Throughput, Packet Delivery Ratio and End to End Delay.

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