Enhancing Network Lifetime in WSN Using Collision Free Secure Clustering

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ABSTRACT - Wireless sensor network is an emerging technology and an intelligent self constructing network that consist of several sensor nodes that are deployed in the monitoring region. The major issue in designing a network is to balance the energy consumption of nodes and to increase the lifetime of the network, by knowing that the nodes can be powered only by batteries in most of the conditions. Clustering is one of the most efficient methods to reduce energy consumption of nodes thereby to increase network lifetime. Here, Collision free secure clustering (CFSC) approach has been implemented. High connectivity cluster routing protocol has been implemented for data transaction where the cluster head is selected based on maximum remaining energy level of nodes. To overcome the traffic issues in delivering packets through CH, multi sink concept has been implemented. For secure data transaction in each cluster head IDS has been placed for trusted transaction of data and loss of data issues are also eradicated.

KEYWORDS: Clustering, HCCR-IDS, data compression, minimum energy consumption and enhance network lifetime.

I. INTRODUCTION

Wireless sensor nodes are constructed by a large number of sensor nodes. In general, sensor nodes are considered to be reliable, exact, comfortable, less cost and flexible to implement [1]. In such scenarios like where human interactions are not possible due to environmental constraints would rely on WSNs for collecting information and managing it. Now a day's its application has been enhancing widely in many fields such as, emergency response, military, agriculture, health monitoring, environmental monitoring and smart power grid.

However its applications because of its advantages due to its characteristics WSNs are prone to unexpected accidents failures and affects from adversaries of malicious nodes. Once any one node in a network got compromised, the availability and integrity of the network can be destroyed. The identification of malicious behavior and attackers are difficult. Hence, network security is a major issue in WSN which need additional care to ensure complete data transaction.

Most commonly and widely used method to provide security for data transaction is cryptography, authentication and hash functions to improve security of network. However, the above methods attain great result in improving security in terms of confidential, integrity, authentication, availability, and no redundancy of data in the network [2]. For current situation the above mentioned methods such as cryptography and authentication are not mostly suitable because of constraints in processing capability and limited energy due to complexity and huge computing storage. In addition, our traditional security mechanisms are utilized to deal with external attacks but not suitable for inside attack or node misbehavior attacks in efficient way.

Therefore transferring a data from source to destination without data loss due to misbehaving activities and with minimum energy consumption is a challenging issue. To reduce energy consumption and to increase network lifetime, one of the efficient methods is clustering. Initially clustering will group number of nodes according to particular criteria and elect a cluster head for managing entire node. Most of the algorithms will group data based on distance from base station and distance between each other nodes. In some algorithms cluster will form based on residual energy level of nodes. The issue is during selection of cluster head energy consumption will takes place therefore a clustering algorithm that should consume minimum energy for transaction and for CH selection has been selected. For every clustering methodology an issue will arise in delivering the received sensed data from cluster head. Traffic will occur in base station during this process and this leads to collision and loss of information. Therefore retransmission will takes place and it will consume energy again for same process which decreases the network lifetime. Hence a multi sink mechanism has been developed to analyze network traffic and act according to it. Similarly misbehaving activities has been identified by placing IDS in CH hence loss of packets

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could be identified easily and necessary steps will taken to rectify it.

Key ideas for the proposed system:

1. The major issues (energy consumption and security) in WSN should be avoided thereby to increase the performance of the system.
2. To increase the life time of a network.
3. Collision free data transaction between source and destination.

II. LITERATURE SURVEY

Samaleswari Pr. Nayak et.al (2017), presents WSNs are for the most part a blend of expansive number of low cost what's more, little homogeneous sensors associated by a remote system that gather information to be dealt with locally or exchanged to the sink hub through multi-bounce remote transmission [3]. Because of imperatives of the assets, for example, constrained vitality, limited transceiving range, and bring down computational capacities; it is a testing undertaking for the analysts. A few arrangements were existing to conquer the issues. Bunching calculations have been generally acknowledged to limit vitality utilization. In this situation, one of the fundamental intentions is to choose bunches on the other hand for the whole system to diminish activity by simple adjustment of system way. Through this paper we have proposed an Optimal Clustering Algorithm (OCA) which centers around expanding system life expectancy and hub portability through half and half bounce administration system.

B. K. Nayak et.al (2012) presents gathering of data from basic circumstances where people discover hard to exist is a testing assignment. In such situations small miniaturized scale sensors are thickly conveyed for checking the objective questions or watching certain occasions to happen [4]. The sensor hubs gather data from the objective hubs, speak with their neighbors and afterward forward the data to the base station for additionally activity. Nonetheless, the sensor hubs have restricted battery control, insignificant preparing capacity, and short transmission extend. Presence of the system for a more drawn out period can bolster for data gathering. In this paper we propose the high-availability group directing (HCCR) a novel static bunch based powerful bunch head steering calculation for proficient vitality administration in sensor organize. HCCR utilizes confined coordination to help versatility and joins information combination into the directing to maintain a strategic distance from repetitive data that must be transmitted to the base station found close-by the system. We isolate the entire system into various bunches. A bunch head (CH) is chosen from a group considering greatest remaining vitality and Euclidean separation to every single other hub present in the bunch.

Dr. S.Vijayarani1 and Ms. Maria Sylviaa.S (2015), describes Intrusion Detection System (IDS) is intended to be a product application which screens the system or framework exercises and finds if any malignant activities happen [5]. Huge development and use of web raises worries about how to secure and convey the advanced data in a protected way. These days, programmers utilize diverse kinds of assaults for getting the significant data. Numerous interruption discovery systems, techniques and calculations help to identify these assaults. This fundamental goal of this paper is to give a total report about the meaning of interruption discovery, history, life cycle, sorts of interruption recognition strategies, sorts of assaults, distinctive apparatuses and procedures, examine necessities, challenges and applications.

Gustavo Nascimento and Miguel Correia (2012) states that peculiarity based interruption discovery frameworks (IDS) have the capacity of identifying beforehand obscure assaults, which is vital since new vulnerabilities and assaults are always showing up. Programming as an administration web applications are right now much focused by assaults, so they are an undeniable application for such IDSs [6]. The paper exhibits an investigation of the utilization of abnormality based IDSs with information from a generation domain facilitating a web use of substantial measurements. It depicts how challenges like handling a substantial number of solicitations and getting preparing information without assaults were settled. It too presents an assessment contrasting the precision acquired and the distinctive kinds of models that were utilized to speak to typical conduct.

Raminder Singh Uppal et.al (2013), discusses that wireless sensor networks (WSN), the single way directing may result in way disappointment amid information transmission and re-foundation of exchange way may take more length. Likewise, utilizing design with single sink hub can cause issues of vitality scattering and poor channel condition [7]. Keeping in mind the end goal to conquer these issues, in this paper, we propose a dependable and vitality sparing multipath directing in multisink remote sensor systems. The proposed design contains numerous sink hubs and neighbors of sink hubs are thought to be agent hubs which are in one bounce remove. At first, every hub develops neighbor and agent hub table in light of the parameters, for example, lingering vitality, transmission achievement rate and bounce tally of the hubs. At the point when the hub needs to transmit the information from source to goal, it builds up the different ideal ways for information transmission in light of connection weight gauge in view of the parameters, for example, vitality level

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and transmission achievement rate put away in neighbor table.

B.Sudhakar and K.Sangeetha (2014), describes Sink hubs are utilized to gather information from a gathering of sensor gadgets. The movement design based system stack issue is alluded as hotspot issue. Vitality productive correspondence conventions and multi-sink frameworks are utilized to deal with hotspot issues [8]. Static and portability based sink situation plans are utilized to deal with information accumulation process. Portable sinks are used to expand the system lifetime with defer limitations. Irregular versatility and controlled portability models are utilized in the versatile sinks. The sinks are deterministically moved over the system is alluded as controlled versatility. The Delay limited Sink Mobility (DeSM) issue is started under sensor hub designation to sinks. A polynomial-time ideal calculation is utilized for the beginning issue. Broadened Sink Scheduling Data Routing (E-SSDR) calculation is utilized to plan sink hubs. The versatile sink booking plan is improved to help huge size systems.

III. PROPOSED SYSTEM

The major work of this paper is to increase lifetime of network of the deployed sensors. The entire network will die continuously once the first node starts die due to less residual energy. Therefore efficient approach is needs to attain better performance by attaining the parameters like network lifetime, secure data transaction and reliability of data. Therefore our proposed approach CFSC is designed to overcome the issues and to attain objective of this paper. Initially for data transaction, High coclustering has been applied. Here cluster head are selected according to residual energy among the group of nodes and data transaction is processed. However clustering minimizes energy consumption the issue faced is delivering of sensed data by cluster head will create collision in base station hence it leads to loss of information. Therefore retransmission will takes place and it again needs data transaction and this increases network lifetime.

Therefore to overcome this issue, mobile sink mechanism is implemented which allocate which cluster head should transfer data to base station based on cluster head information. Therefore at a time data are not transferred to base station and it does not create collision. Similarly, in cluster heads IDS is applied therefore continuous monitoring will be takes place which identifies loss of packets, and where it takes place. Hence necessary y steps will take to eradicate misbehaving activities.

3.1Cluster formation:

One of hierarchical fixed cluster based protocol is HCCR, which selects CH based on maximum residual energy compared to other nodes and a highly concentrated nodes within the cluster. To reduce the data transmission between sensor nodes and base station this algorithm uses data gathering mechanism. This algorithm supports both direct and multi hop transmission. The fixed sensors are distributed randomly and always be in active mode. At the time of network creation the sensor nodes in different clusters are distributed and it remain unchanged till the network became non functional. Energy minimization is major key point to increase network lifetime. Hence our routing algorithm minimizes the total energy consumption of all sensor nodes with respect to balancing residual energy of sensors to enhance life time of the network. This routing protocol is silent on sensor mobility and cluster dynamism.

Primarily the selection of a node as a CH depends on the following criteria.

- Number of links with the neighboring nodes
- Residual energy level of the node

The objective of selection of such a CH is to substantially reduce the energy consumption due to intra-cluster communication, to balance the residual energy level and consequently to increase the network life proportionately. To achieve these objectives, the network model considered, the architecture of the protocol used and finally the algorithms to simulate the protocol are presented below.

A. Network Model

The following properties of WSN are considered:

- ❖ All sensor nodes are motionless and identical with restricted stored energy level.
- ❖ The nodes are inbounded with power control capabilities to differ their transmission power.
- ❖ Continuous data flow model is adapted by network.
- ❖ Fixed base station and does not placed among the sensor nodes.
- ❖ In the network all the sensor nodes location information are stored in the base station.

Protocol Architecture

HCCR is defined to be independent and static clustering scheme, here at the beginning stage the distribution of nodes of different cluster is done and left unchanged till the end of the network life time. Further the whole network operations are consist of many cycles where every cycle is again divided into three phases such as setup, CH selection, and finally the steady state phase.

Each of these three phases is described in the following subsections.

Set-up Phase: Formation of different clusters of the sensor nodes that are spread over various regions of non traceable areas is the objective of this set up phase. To reduce

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energy consumption initially the BS sends the message of the first cluster ID node with minimal energy consumption. The nodes which receive this message will confirm receipt of the cluster ID via JOIN-REQ message. Initial transaction is completed the base station will increase the transmission range with respect to pre-transmitted step size and broadcast the second cluster ID.

The nodes that are clustered in initial step were ignoring this message. Apart from these, the nodes beyond the first transmission range and within the second transmission range; will confirm the request. The same process will be repeated for (k-1) times to generate k-1 clusters, where K is the total number of clusters. At last after lapse of a prefixed time span, the nodes that haven't received any message set their cluster-id to k and inform the BS via JOIN-REQ message.

While transmitting the JOIN-REQ messages to BS, all the sensor nodes use CSMA to prevent collision. Once all the nodes set their cluster-id, set-up phase is complete.

CH Selection Phase:

In this step, in each cluster CH is elected for the present round is going to takes place. Once the clusters are formed, the average distance (i.e. AvgDist) from each node to others in every cluster is calculated by Base Station (BS). At the beginning of every round, the remaining energy (i.e. Erem) of each nodes in the cluster are transmitted to the base station. Now, BS plays an important role is selecting CH by performing sorting operation on the nodes remaining energy and elect N.

Where N=α*Total Nodes Alive in Custer-i and 0< α <1

From these nodes, the node having lowest average distance, (AvgDist), is chosen as the cluster head (Chi) for the present round. Therefore a CH is selected for each round based on maximum Erem and minimum of average distance AvgDist calculation. Now the BS broadcast the CH-id for every cluster =1, 2, 3,…, k and the ith cluster-head (CHi) keeps the ID of its preceding cluster heads (i.e. CHs in inner clusters), if available, for multi-hop transmission purpose.

Steady-State Phase:

In this phase, at an allocated fixed time slots nodes send their sensed information to corresponding CH. The time allocated is calculated based on number of nodes in the cluster and time needed for sending a frame according to it. In order to save energy, radios of nodes are kept off until their allocated time slots reaches but the CH will always be in ON mode to receive data from all the nodes. Furthermore, CHs and BS are communicated by mixed mode transmission such as single and multi hop. In order to avoid data loss due to energy loss of node during transmission of data, CH checks whether its energy level is enough for a transmission of data to BS. If energy available in CH is sufficient then packets will be transmitted directly to BS otherwise CH forward the packets to CH in the inner clusters for a multi hop transmission. Until a predefined time period the rounds will be processed.

Once the cluster created, Cluster Head selection and transmission of data are takes place multi sink concept is implemented to avoid loss data during delivering the packets to BS. Because without any schedule of transaction of data from CH creates traffic and it leads to loss of data. To avoid this issue multi sink mechanism has been implemented to avoid unscheduled data delivery of CHs to base station. This sink will receives data from each cluster head and transmit it to BS without any collision occurrence.

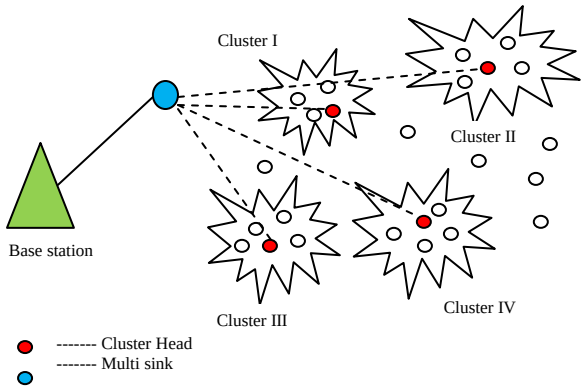

Fig 1: System architecture

The main objective is to achieve longer lifetime, energy efficiency, as well as faster data delivery to each sink this can be done by placing a sink node. So a sink placement strategy is needed for achieving the above-mentioned goals for each sub-network, and all these sub-networks collectively will achieve the goals for the large scale WSN. Now if the sink is placed in a location where number of neighboring nodes is very less then these limited number of nodes will be repeatedly used for relaying packets to the sink. As a result these nodes will run out of battery power very soon and thus the lifetime of the WSN will become shorter. So, for achieving longer lifetime, sinks should be placed in appropriate locations where number of neighboring nodes is high.

Therefore loss of data due to minimum energy level in nodes are eradicated by HCCR routing and traffic occurrence during delivery of data from CH to BS also avoided by multi-sink process. However, major goal of energy consumption has been obtained data loss may occur due to adversaries therefore IDS is placed in every cluster head. IDS will monitor data transaction continuously and if any data loss occurred it would be identified easily. Then reason for data loss is analyzed and respective step will takes place to overcome the issue.

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IV. RESULT AND DISCUSSION

In order to verify the outcome of the proposed adaption scheme, numerous simulations have been performed. We compare the proposed scheme with HEED, LEACH and MESTER. The output is compared with three main parameters such as energy consumption by calculating remaining energy level of nodes after each transaction of data with respect to time. Then data loss is considered this show without collision and energy loss the maximum through put attained. Finally security the data securely transferred from source to destination is concentrated.

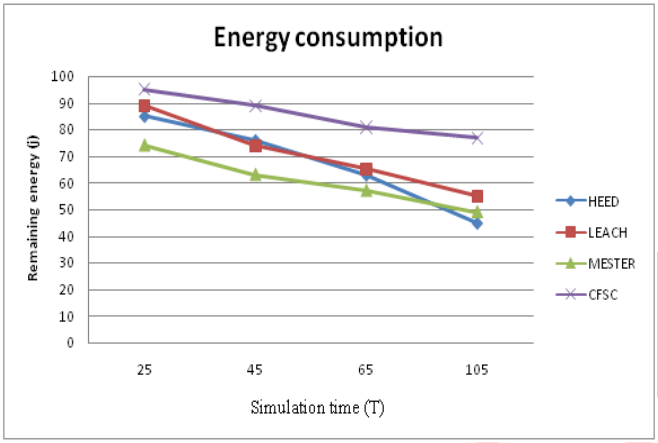

Fig 2: Remaining energy Vs Simulation time

The above graph shows the comparison of various algorithms energy consumption for a particular number of running time. The time is represented as simulation time for a fixed number of time intervals. For each time interval the remaining energy of nodes are calculated after each transaction takes place. Hence our proposed approach attains maximum lifetime compared to existing approaches.

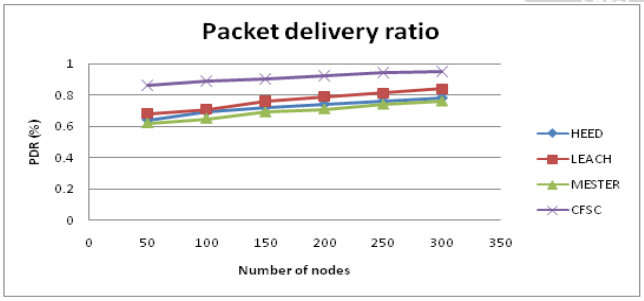

Fig 3: Packet delivery ratio Vs Number of nodes

The packet delivery ratio directly mentions that loss of data when number of nodes increases. When number of nodes increases existing approaches attains minimum delivery ration compared to our proposed approach. If data loss occurs then it leads to retransmission of data from source to destination. This consumes energy and it decreases network lifetime.

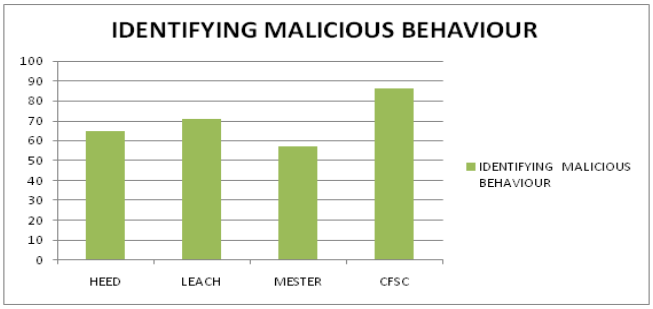

Fig 4: Percentage of secure data transaction

The above graph shows that data transferred from source to destination should be secured from adversaries, malicious behavior and less energy of nodes. By placing IDS on every CH will achieve maximum packet delivery through continuous monitoring. Hence our proposed approach attains better result compared to other existing approaches.

V. CONCLUSION

The objective of our proposed approach is to achieve longer lifetime by reducing energy consumption of nodes and to enable secure data transaction from source to destination. In general clustering consumes minimum energy and increases network lifetime however, during the delivery of data from cluster head to base station creates traffic hence collision occurs and it leads to loss of data. Collision free secure clustering utilizes HCCR routing creates optimal path between source to destination by electing cluster head by considering energy level of nodes and distance from base station. The collected data from CH are delivered to base station without traffic by mobile sink concept. Hence our proposed approach attains better performance according to energy consumption parameter. IDS is used for continuous monitoring of data during transaction and it identifies loss of data due to misbehaving action. Therefore it concludes that our proposed approach attains better performance compared to existing approaches.

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