Energy Aware Clustering and Aggregate Node Rotation with Sink Relocation in WSN

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Abstract— As the WSN used in industrial and Environmental monitoring the most critical issues in the WSN is to reduce the energy consumption to extend the lifetime of the wireless sensor network. The intermediate hop nodes are working throughout the data transmission so those nodes drain out their energy which automatically reduces the life time of the wireless sensor network. To overcome these drawbacks the EAC-ASR protocol (Energy Aware Clustering Aggregate Node Rotation) with sink relocation method four important processes which are present in this protocol was Clustering, data aggregation, mobile node rotation by swapping algorithm and sink relocation are applied. In this paper theoretical analysis and the simulation analysis are done and the result shows that the EAC-ASR protocol reduces the energy consumption and increase the energy efficiency.

Keywords-*WSN, EAC-ASR, Sensor nodes, Clustering*.

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I. INTRODUCTION

Wireless communication technologies enabled large scale wireless sensor networks (WSNs) deployment of sensor nodes was very easy, wireless sensor networks (WSNs) have a vast range of applications such as monitoring of environment and rescue missions. WSN 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 are used for data collection and processing in real time from environment. Sensors measure the ambient conditions in the environment and then processed measurements in order to assess the situation accurately in area around the sensors. Over a large geographical area large numbers of sensor nodes are deployed for accurate monitoring. Due to the limited radio range of the sensor nodes the increase in network size increases coverage of area but data transmission i.e. communication to the base station (BS) is made possible with the help of intermediate nodes. Wireless sensor networks are either deployed manually or randomly. After being deployed either in a manual or random fashion, the sensor nodes self-organize themselves and start communication by sending the sensed data. There are two main applications of wireless sensor networks which can be categorized as: monitoring and tracking. Ad Hoc Network (MANET) that is connected by wireless links is a self-configuring network of mobile nodes. The devices freely move in any direction and links among these devices are changed frequently. A cooperative network organized by collection of sensor nodes is a wireless sensor network. Both of these networks fall into the category of infrastructure less wireless networks as they do have any requirement regarding infrastructure during the deployment. Wireless Local Area Networks (WLANs) and cellular networks fall into the other category of wireless networks that require infrastructure during their deployment. Routing of information differentiate these networks from other ad-hoc networks.

II. LITERATURE SURVEY

Energy-Efficient Cloud Computing was proposed by Andreas Berl et al [1] where they proposed the usage of methods and technologies currently used for energy-efficient operation of computer hardware and network infrastructure. They reviewed the potential impact of energy saving strategies for the management of integrated systems that include computer systems, networks and proposed that cloud computing with virtualization as a way forward to (i) identify the main sources of energy consumption, and the significant trade-offs between performance, QoS and energy efficiency and (ii) offer insight into the manner in which energy savings can be achieved in large-scale computer services that integrate communication needs.

Document clustering based on keyword frequency and concept matching technique in Hadoop was proposed by R.Priyadarshini, Latha Tamilselvan [2] where they used a novel semantic and similarity measure based technique that concurrently considers both structural and semantic information of document. Semantic analysis based clustering was applied to the text documents and then similarity measure was devised among the documents based on machine learning algorithms using Apache hadoop. The documents were stored in hadoop distributed file system and they were clustered using K-means algorithm.

Energy-aware management for cluster-based sensor networks was proposed by M. Younis et al [3] where they present a novel approach for energy-aware management of sensor networks that maximizes the lifetime of the sensors while achieving acceptable performance for sensed data delivery. They dynamically set routes and arbitrate medium access in order to minimize energy consumption and maximize sensor life. Based on energy usage at every sensor node and changes in the mission and the environment, the gateway sets routes for sensor data, monitors latency throughout the cluster, and arbitrates medium access among sensors. Simulation results have shown an order of magnitude enhancement in the time to network partitioning, 11% enhancement in network lifetime

predictability, and 14% enhancement in average energy consumed per packet.

Power-Aware Localized Routing in Wireless Networks was proposed by Ivan Stojmenovic and Xu Lin [4] where they presented a new power-cost metric based on the combination of node's lifetime and distance based power metric. The power-aware routing algorithm was attempted to minimize the total power needed to route a message between a source and a destination. The cost-aware routing algorithm extended the battery's worst-case lifetime at each node. They combined power-cost localized routing algorithm to minimize the total power needed and to avoid nodes with a short battery's remaining lifetime.

ROUTING TECHNIQUES IN WIRELESS SENSOR NETWORKS: A SURVEY was proposed by Jamal et al [5], where they presented a survey of state-of-the-art routing techniques in WSNs. The routing techniques are classified into three categories based on the underlying network structure: flit, hierarchical, and location-based routing. Furthermore, these protocols can be classified into multipath-based, query-based, negotiation-based, QoS-based, and coherent based depending on the protocol operation.

Energy aware efficient geographic routing in lossy wireless sensor networks with environmental energy supply was proposed by Kai Zend et al [6], where they proposed Geographic Routing with Environmental Energy Supply (GREES) and proposed two protocols, GREES-L and GREES-M, which combined geographic routing and energy efficient routing techniques and took into account the realistic lossy wireless channel condition and the renewal capability of environmental energy supply when making routing decisions. GREES-L and GREES-M exhibit graceful degradation on end-to-end delay, but do not compromise the end-to-end throughput performance.

A survey on routing protocols for wireless sensor networks was proposed by Kemal Akkaya and Mohamed Younis [7] where they presented a survey o recent routing protocols for sensor networks and classification. They mainly explored on data-centric, hierarchical and location-based.

Energy Balanced Routing Method for In-Network Data Aggregation in Wireless Sensor Networks was proposed by Juby K Baby P K Poonguzhali [8], where they presented an Enhanced Forward Aware Factor-Energy Balanced Routing Method (EFAF-EBRM) based on Data aggregation technique that had some key aspects such as a reduced number of messages for setting up a routing tree, maximized number of overlapping routes, high aggregation rate, and reliable data aggregation and transmission. Proposed method is compared with FAF-EBRM and LEACH. Experimental resulted that proposed method outperforms FAF-EBRM and LEACH, which balances the energy consumption, prolongs the network function lifetime and provides the best aggregation quality.

An Efficient Routing Method for Lifetime Enhancement in Wireless Sensor Network using Fuzzy Approach and A-Star Algorithm was proposed by Yadav et al [9], where they presented a method to determine an optimal routing path from the source to the destination by favoring the highest remaining battery power, minimum number of hops, and minimum traffic loads. This proposed approach was compared with A-star search algorithm and fuzzy approach using the same routing criteria in terms of energy consumption, residual energy etc. The effectiveness of proposed method was measured in terms of throughput, packet delivery ratio and average energy consumption.

III. METHODOLOGY

We proposed the EAC-ASR protocol (Energy Aware Clustering Aggregate Node Rotation) with sink relocation method. The following Fig. 1 represents the System Architecture of EAC-ASR protocol.

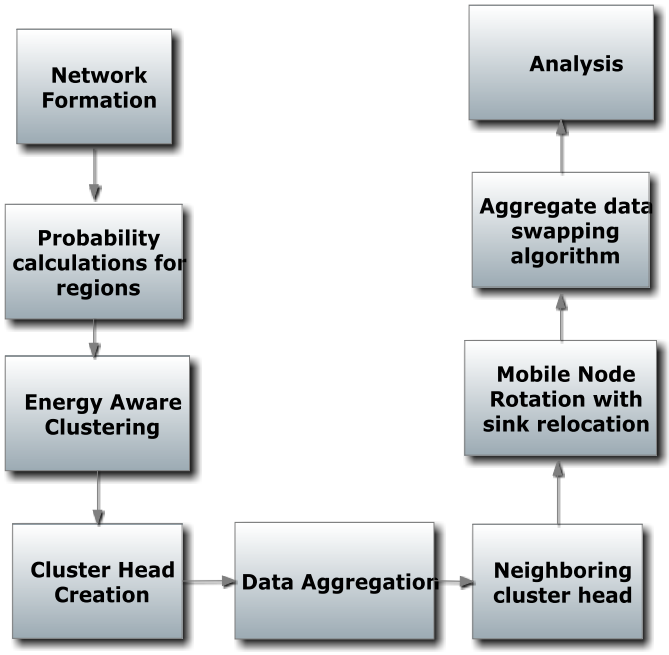

Fig. 1 System Architecture of EAC-ASR protocol.

The four important processes which are present in this protocol are Clustering, data aggregation, mobile node rotation by swapping algorithm and sink relocation. Here the sensor deployment is carried out by the Network formation, Region Division, Number of node calculation, Coverage area calculation, Probability calculations for regions. Clustering is used to reduces the energy consumption and it is also used to increase the access control mechanism of the network. Then the data aggregation is processed by the data collection algorithm which leads to effective multi-hopping process. Rotation of intermediate hop nodes during the process of data transmission, continuous the working of the particular hop nodes reduction. Swapping is done based on the maximum energy level of the nodes. Each cluster heads are created are created so that clustering of nodes are possible with high similarity between cluster center head and nodes. Data swapping algorithm is applied for further analysis of sensor nodes. We are using NS2 tool in our research work.

Energy saving is an important design issue while developing a new routing protocol for wireless sensor network. Clustering is a key technique which helps in maximizing the network

lifetime and scalability. Following Fig 2 shows output of our research work.

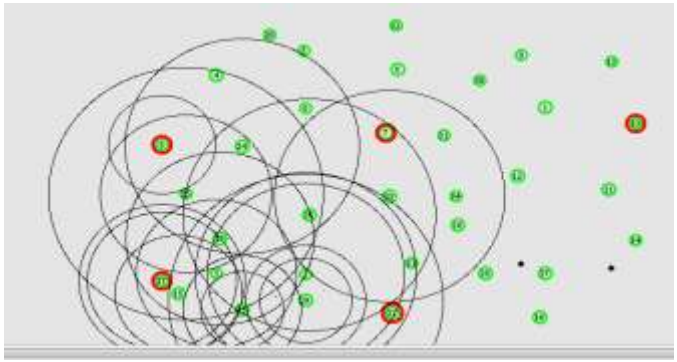

Fig 2. Energy Balanced Routing.

IV. CONCLUSION

In the WSN, while data transmission the intermediate hop nodes drain out their energy due to the continuous multi hopping method. By the use of the Energy Aware Cluster – Aggregate Rotation with sink relocation (EAC-ASR) protocol. The energy loss which is happened by the multi-hopping concept is reduced and the energy consumption due to cluster communication is also comparatively reduced. By using this protocol the energy efficiency and the network life time is increased. We presented the design, analysis, and implementation of Spot: a system for accurate and efficient multi-entity device free WSN localization. Spot leverages probabilistic techniques to provide a smooth environment image. It uses a cross calibration technique and an energy minimization framework to reduce the calibration overheard to linear in the number of locations, which turns the DF multi-entity tracking to a tractable problem. We showed an efficient solution to the proposed energy minimization framework by mapping the energy function to a binary graph-cut problem. Implementation on standard WiFi hardware shows that Spot can achieve 1.44m median distance multi-entity tracking error, which is better than the stat-of-art techniques by 108.33%. In addition, it can estimate the number of entities correctly to within one entity difference 92% of the time. These highlight the promise of Spot for a wide range of multi-entity DF tracking applications.

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