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RESEARCH ARTICLE

A Compression Adaptive Communication Mechanism to life of Sensor Network

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Abstract: A sensor network is energy adaptive communication network. To improve the network life, there are number of existing routing and clustering approaches. But in this work, a data size reduction approach is defined to improve the network communication and network life. The presented approach is defined for clustered sensor network to provide the compressed data communication. As the communicating data size is reduced, the network load will also get reduced and the network life improved. The obtained results show the effective improvement in network communication and network life.

Keywords: Clustered Communication, Network Life, LEACH, Adaptive Encoding

I. INTRODUCTION

Sensor network is one of the most congested and critical communication network defined under lot of restrictions. These restriction are defined in terms of energy specification and the memory limits. It means, each sensor node is a small sensing device having a limited memory, sensing range and the energy. The criticality parameters to a sensor network are shown in figure 1. The energy criticality is actually responsible for the network life time. A node having the effective energy is considered as the alive node. As the communication performed, each participating node loses some amount of energy. If the node energy set at 0, the node is considered as dead node. Another critical parameter considered here is sensing range. Each sensor node generally has a limited sensing range because of this, the light of site or the communication is restricted. Because of this, to perform long distance communication, multihop communication will be performed. Clustered network architecture also resolves the problem occur because of small sensing range. According to

this architectural form, complete network is divided in smaller segments called clusters. Each cluster is controlled by a particular cluster head. As the communication performed, the cluster node performs communication with cluster head and cluster head perform communication with base station. Another criticality parameter in sensor network is memory constraint. Memory of each sensor network node is limited or some time the memory is absent. A node with memory and decision power constraint is called smart sensor node. But these kinds of sensor nodes are expensive and because of this used in few intelligent applications.

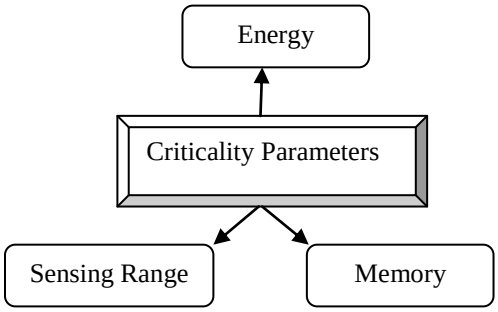

Figure 1: Sensor Node Criticality Parameters

The main challenge in sensor network is to perform the power saving communication. To perform this communication, there are number of constraints and the limitations are defined in sensor network. These sensor networks are defined under different frequency bands to control the communication and to obtained the actual circuit design. The outcome of these communication network depends on different factors such as the frequency range, kind of device, spectrum type etc.

Another improvement to the sensor network is in terms of intelligent sensing devices. These devices are called smart sensor devices. The network composed from these sensing devices is called smart dust network. In critical application areas such as medical network, these kind of communication architectures are been used.

In this paper, the communication architecture and the communication dependencies are discussed in sensor network. These architectures and protocols are discussed under different constraints and requirements. In section I, the basic requirement of communication sensor network is defined along with requirement specification. In section II, the work done by the earlier researchers is discussed. In section III, the available protocols in sensor network are discussed as well divided them in different classes. These protocols are divided in application area specific classes.

II. EXISTING WORK

In this section, the work done by the earlier researchers in the area of Data classification is discussed and presented. In year 2000, a work on energy effective sensor network was defined by W. Heinzelman. Author defined the clustering algorithm along with protocol specification. Author introduced the LEACH protocol. LEACH protocol includes the cluster formation based architecture so that the hierarchical communication will be carried on over the network. This proposed protocol divided the complete network in smaller segments called clusters and each cluster communication is control by the cluster head. The algorithmic approach is defined on the selection of this cluster head. This cluster head selection is performed under the energy and load based analysis. LEACH protocol is able to provide the effective communication in effective time frame. It also defined the communication under the assumptions and the constraints. The drawback of the protocol is the random selection of cluster head. It gives the equal probability of a node to set as cluster head. But this gives the unequal distribution of clusters over the network. There are the chances that a particular protocol is congested and some cluster is not having the enough nodes. It also gives the problem of orphan nodes i.e. the nodes that not covered by any cluster. Another drawback of this protocol is the election of cluster heads with each communicating round that gives the communication delay. Because of these reasons there was the requirement of certain

improvement over the clustering architecture so that reliable and balanced communication will be performed over the network[1][2][3][4].
Different authors provided the improvement over the LEACH protocol and clustering architecture. One of these improvements includes the format energy LEACH and the multi hop LEACH. These improved protocols improve the process of cluster head selection. The cluster head is formed on each communication rounds based on the residual energy comparison on nodes. Another improvement to the protocol is done in terms of multi hop communication. It improves the network communication. Authors discussed the comparative analysis between the energy LEACH and multi-hop LEACH[5][6].
Some authors also provided the communication over the network under different routing protocols. A lot of work is done to identify the effective routes in network. Authors discussed different constraints while performing the route identification in sensor network. These parameters includes the layered based communication, data centricity, path redundancy, location information analysis, QoS parameters evaluation etc. The type of network i.e. homogeneous or heterogeneous networks also affects the network architecture and the communication. The main objective behind the formation of this clustering architecture is to improve the network life time and to provide the energy effective communication. The work also controls the energy consumption and provides the dominated transmission and reception. The routing protocol designed here is energy effective as well as provide the network architecture so that the network life time is improved[7][8].

The energy criticality in case of LEACH protocol is discussed and resolved by many researchers under the energy restricted resources available in the sensor network. These sensor networks are defined under the energy source specification so that the effective design will be performed along with communication control. The author discussed the operative time span so that the restricted power supply over the network will be obtained. These protocols are dependent on the network layers. The communication in such network is based on the probabilistic estimation on the cluster head selection and to perform the communication based on network coordination. The network is defined with initial energy specification and to discuss the certainty in LEACH. Author discussed different aspects of these protocols so that the life time of the network will be improved. The communication is performed for N number of rounds and based on the energy effectiveness of network as well as the communication is measured. Simulated results shows the improvement to the network life upto 20% with the modification on the cluster head selection process[8][9].
An improvement to the clustering routing protocol is defined reduce and control the network deficiencies. Different authors discussed different ideas to provide the improvement to the network communication and the clustering process. These improvements are defined in the form of cluster selection process. One of such improvement is presented in the form of N-LEACH protocol. This improvement protocol has restricted the number of clusters over the network so that the equalize distribution of network nodes will be obtained. The root node collects data from the base station and improves the network energy effectiveness and the life time. N-LEACH algorithm is discussed to provide the energy balanced communication. This communication protocol is also effective to provide the long distance communication[9]
Another improvement to LEACH protocol was presented by Khamayesh in year 2009. This improvement is presented in the form of a new protocol called V-LEACH protocol. This protocol reduces the energy consumption over the network and provide the effectiveness of clustering architecture. According to this new protocol, each cluster have two cluster heads called, Main Cluster head and Vice Cluster head. As the main cluster head dies, the vice-cluster head takes its position so that the process of cluster selection is reduced. Author defined this protocol to reduce the communication between the cluster head and the base station. The obtained results from the system shows that the defined protocol reduced the network communication and improved the network life. In VLEACH protocol, the number of messages generated by the cluster head is lesser than the traditional LEACH protocol[10].

Some author modification to the existing protocols is done by different authors. These protocols provided the energy adaptive communication in sensor network as well as provided a balanced communication over the network. The balanced network communication is controlled under the residual energy based communication so that the network communication and performance will be improved. The comparative analysis over the network is performed to provide the reliable communication[11][12].

These available protocols in sensor network are effective under different parameters as well as the architecture. Based on the application areas these network architectures are applied as well as according to the type of application area, the respective protocols are applied. In next section, the classification of these protocols is defined.

III. RESEARCH METHODOLOGY

In the research work, an efficient and secure authentication scheme is proposed to achieve the reliable network communication. The work is based on the public key cryptographic approach. A secure aggregative communication is defined over the network. The base station is defined as the controller node; the public key generated by the base station is distributed over each node of aggregative path. The base station holds the private key of the network. As the communication is performed, each node will secure the data by using the partial key. The concept of partial key give the energy efficient authenticated communication. As the communication is moved to the next node, the data encryption is performed. On each node data aggregation as well as the aggregative key composition will be performed. As the data will reach to the base station, all the data will be collected and composed key will be matched to analyze the authenticated and secure communication. The base station will decrypt the data by using its private key. The work will increase the network the network security without much consumption of energy.

A) Clustering

Sensor data in an energy-efficient way to extend the lifetime of sensor networks.
The data captured by the sensor nodes are often converted into an aggregate form requested by the applications (e.g., average temperature reading). Primarily designed for monitory purposes, many sensor applications require continuous aggregation energy consumption because each sensor node has to report every reading to the base station. In wireless sensor networks, communication is a dominant source of energy consumption to save energy; data semantics can be relaxed to allow approximate data aggregation with precision guarantees.

The precision can, for example, be specified in the form of quantitative error bounds: "average temperature reading of all sensor nodes within an error bound of 1 C." In this way, the sensor nodes do not have to report all readings to the base station. Only the update is necessary to guarantee the desired level of precision need to be sent. It is, however, a challenging task to optimize network lifetime under approximate data aggregation because the sensor nodes are inherently heterogeneous in energy consumption. First, when the data captured by different sensor nodes change at different magnitudes and frequencies, the sensor nodes may report data at different rates. Second, the wireless communication cost depends on the transmission distance. Due to the geographically distributed nature of sensor networks, the sensor nodes are likely to differ significantly in the energy cost of sending a message to the base station. Even if all sensor nodes report data at the same rate, their energy consumption can be highly unbalanced, thereby reducing network lifetime.
In addition to reporting local sensor readings, the intermediate nodes in a multi-hop network are also responsible for relaying the data originated from other nodes to the base station. The clustering architecture is shown here in figure 2

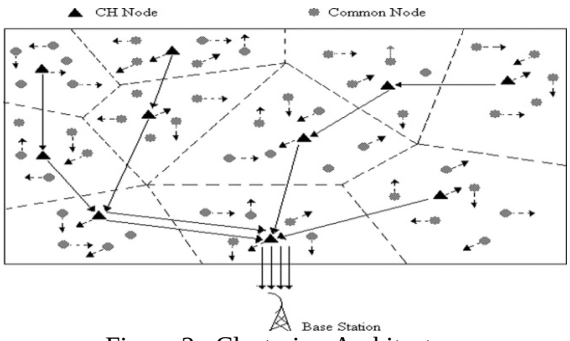

Figure 2 : Clustering Architecture

IV. RESULTS

The presented work is implemented in matlab environment under the defined communication scenario. The parameters considered for communication are given here in table 1

Table 1 : Communication Scenario

Property	Values
Network Area	200x200
Initial Energy	Random
Transmission Energy	50 nJ
Receiving Energy	50 nJ
Forwarding Energy	10 nJ

The analysis of work is done in terms of number of packet communicated over the network and in terms of network life. The parameters considered in this work are defined here under.

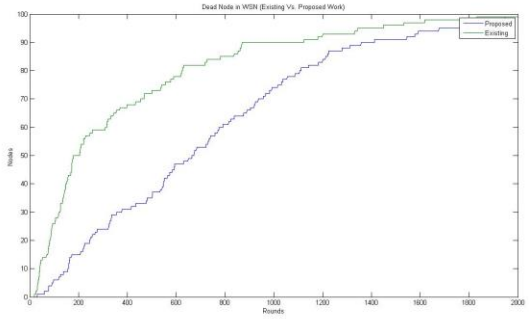

Figure 3 : Dead Node Analysis (Existing Vs. Proposed Approach)

Here fig. 3 is showing the comparative analysis of Dead Node process in case of existing and proposed approach. Here blue line is showing the results for proposed approach and green line is showing the results for existing approach. As we can see, in case of existing approach, node start losing energy earlier so that the energy loss ratio in existing approach is higher. Whereas, in proposed approach, the nodes will keep the energy for maximum time and network is alive for more number of rounds. In existing work about 97 nodes are dead after completion of 2000 rounds whereas in case of proposed approach about 67 nodes are dead.

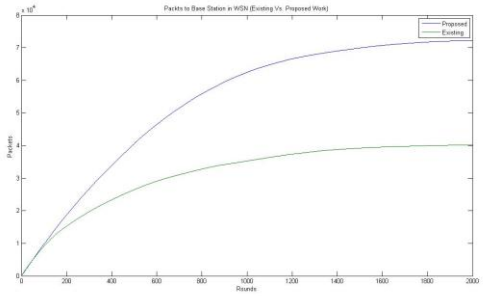

Figure 4 : Network Communication Analysis (Existing Vs. Proposed Approach)

Here fig. 4 is showing the comparative analysis of total communicating packets over the network. The figure is showing the aggregative communication analysis for all nodes over the network. Here blue line is showing the results for proposed approach and green line is showing the results for existing approach. As we can see, in case of existing approach, the packet communication is much lesser than proposed approach because, the nodes are losing energy very fast and it reduced the network life.

V. CONCLUSION

In this paper, a compression effective approach is defined to improve the network communication. The work is defined in two stages. In first stage, the clustered communication architecture is formed. In second stage the data is transmitted after compression. The work has improved the network communication and network life.

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