Load and Zone based Analysis approach for Effective Reconfiguratoin for WSN

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Abstract : The effective utilization of limited capabilities of sensor nodes is very challenging. In this paper, a zone based reconfiguration method is presented to gain the better utilization of network resources and node capabilities. The method has divided the network in smaller zones based on load and connectivity parameters. The energy and connectivity based analysis is performed to identify the zone controller. The communication in the network is performed through these zones and zone controller. The comparative results shows that the method improved the network life and reduced the energy consumption.

Keywords : WSN, Load, Reconfiguration, Communication

I. INTRODUCTION

A group of dedicated and spatially dispersed sensor nodes that monitors and records physical or environmental specifications and organizes the collected data at a central location is known as WSN. WSN measure environmental specifications like pressure, sound, pollution levels, wind speed, temperature, humidity, direction etc. The recorded data is transmitted to the base station through radio frequency channel. Since communication in such networks is carried out via a wireless channel, hence these are known as wireless networks and because of their sensing capanility they are known as wireless senson networks (Dargie and Poellabauer, 2010).

A WSN is a set of few hundreds to thousands number of sensor nodes depending upon the application of WSN with one node as a transmitter and other node as a receiver. A sensor node consists of a radio transceiver with an antenna for communication, a microcontroller for processing the collected data, an interfacing electronic circuit and an energy source, usually a battery. The sensor nodes are small size, light weight and portable and size of sensor nodes may vary from the size of a portable hardisk to as small as the size of a grain. The sensor nodes are manufactured using the prevalent micro electo-mechanical system technologies. Depending upon the functionality specifications of sensors like speed rate, energy consumption, computational, memory, and bandwidth, their prices vary from a few cents to hundreds of dollars (Wang et al., 2006).

Sensors or nodes have limited energy hence they use low power frequencies to conserve energy and prolong battery life. Since they use low frequencies their transmission range is less and they rely on other sensors to route their message to the hub node. Signal propagation problems arise from long distance wireless communication where the signal power level drops before reaching its destination or it might get jammed, blocked, lost due to physical objects. Figure 1 shows the basic architecture of a WSN in which the data from individual sensor nodes is sent to a sink node which is a central base station located far from the network area and the end user can access the data through this sink node.

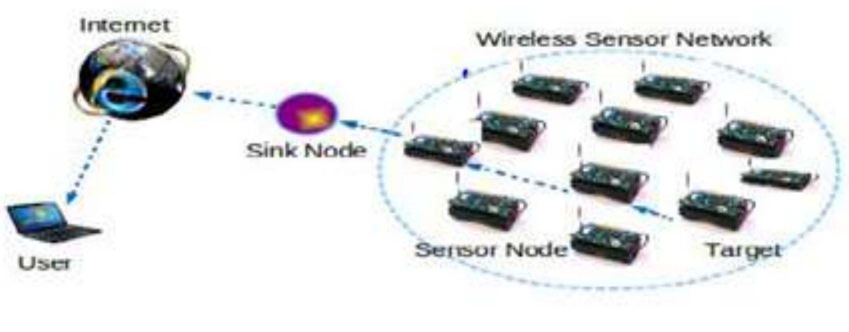

Figure 1 : A Basic Wireless Sensor Network (Alazemi, 2013)

WSNs operation is autonomous with minimal intervention (Alazemi, 2013). They consists of sensor nodes, geographically scattered over an area for monitoring.Since they solely rely on Radio frequency for communication, the wireless channel is more prone to attacks and is inherently insecure. To maintain integrity and confidentiality it is necessary to secure data from attackers. However this task is challenging due to limited energy resources, remote deployment scenarios and nature of wireless communication. Authentication, cryptographic schemes, key management schemes and other secure routing protocols are used to secure the data. But some of these methods require complex mathematical computations and it is not always feasible to use these techniques for basic deployment schemes. Some basic features of WSNs are described below (Wang et al., 2006).

II. RELATED WORK

Author[1] has defined a simulation based optimization method to reconfigure the network for mobile sensor network. The proactive features of traffic signal were defined to reduce the communication delay and to optimize the network architecture. The framework was defined to reduce the delay and to increase the network life time. Author[2] has improved the reconfiguration of sensor network by performing the data collection and many-to-one routing in the network. The scheme was defined to improve the reactive and proactive protocols. The continous data tranmission with remote node specification was defined in this paper. Author[3] has used the leader node recommendation to configure the network and to evaluate the strength of neighbor nodes. The coastal monitoring of sensor nodes was also provided to identify the leader nodes. The maritime environment was monitored in this network based on water characteristics. Author[4] has defined QoI aware unified model to confire the network and classify the nodes in the heterogenous network. The node based capability analysis and constraint based evaluation of network was provided to identify the effective position of nodes. Author[5] has used the mobile agents to track the mobile sensor nodes and to generate the vononoi based analysis in the heterogeneous sensor network. The cluster generation based on the functional and positional analysis on nodes was provided in this work.

Author[6] has defined reversed routing protocol with self configuration of sensor nodes for WBAN network. The collision and structure baed analysis was performed to identify the effective forwarder node to generate the route for the network. Authro[7] has defined an energy cost measuring and modeling method to reconfigure the network network. The generic model based on validation test was defined to improve the utilization of hardware resources. The software encapsulation resources with energy consumpiton analysis was defined to increase the resource utilization. Author[8] has defined a length aware method to configure the toplogy for sensor network. The actor failure and recovery based estimation was defined to estimate the link to the neighbor node. Author has proposed the length aware toplogy reconfiguraiton algorithm (LTRA) to improve the network distribution and self healing the challenging behaviour. Author[9] has provided a work on generic and scalable reconfiguration of network with functional adaptation. The functional behaviour of network reconfiguraiton was requested to improve the communication and to generate the structure of sensor network. The functionality of the heterogenous sensor network was defined to increase the network life and to reduce the energy consumption. Author[10] has defined a study work to identify the issues, features and challenges associated to reconfiguration methods for sensor network. Different approaches wre explored by the author with context information specification. The features were analyzed with fuzzy rulse and with specification of functional attributes. Author[11] has provided the dynamic reconfiguration of network with specification of heterogenous applications. The point to point connectivity baed analysis with delay feature evaluation was provided to improve the reconfiguration of network. The application based reconfiguration and response based event analysis was provided to improve the connectivityto nodes. Author[12] has provided a dynamic reconfiguration based model to process the image sensor network. The partial information processing method was provided to improve the network deployment and to handle the network issues. Author[13] has defined a component and policy based approach to generate the effective network and to improve the reconfiguration of the network. The policy based approach was defined to control the network infrastructure and to regulate the development. Author[14] has defined a work on fault detectiona nd reconfiguration for Zigbee sensor network. The simulation tool was designed by the author to characterize the topology and communication. Author[15] has provided a work to manage and configure the sensor network. The sustainability and management specific difficulties were also identified in this work. The reconfiguration of the network with traffic concerns was provided to improve the policy decisions. The lightweight processing method with node parameter management were desribed to improve the communication.

III. RESEARCH METHODOLOGY

The architectural representation of a network plays an important role to achieve the optimized communication in a network. In adhoc network, this organization is more critical because it suffers from the situational problems like heavy load, orphan nodes, bottle neck etc. While constructing a fixed communication network, it is required to analyze the network at earlier stage and provide the optimum

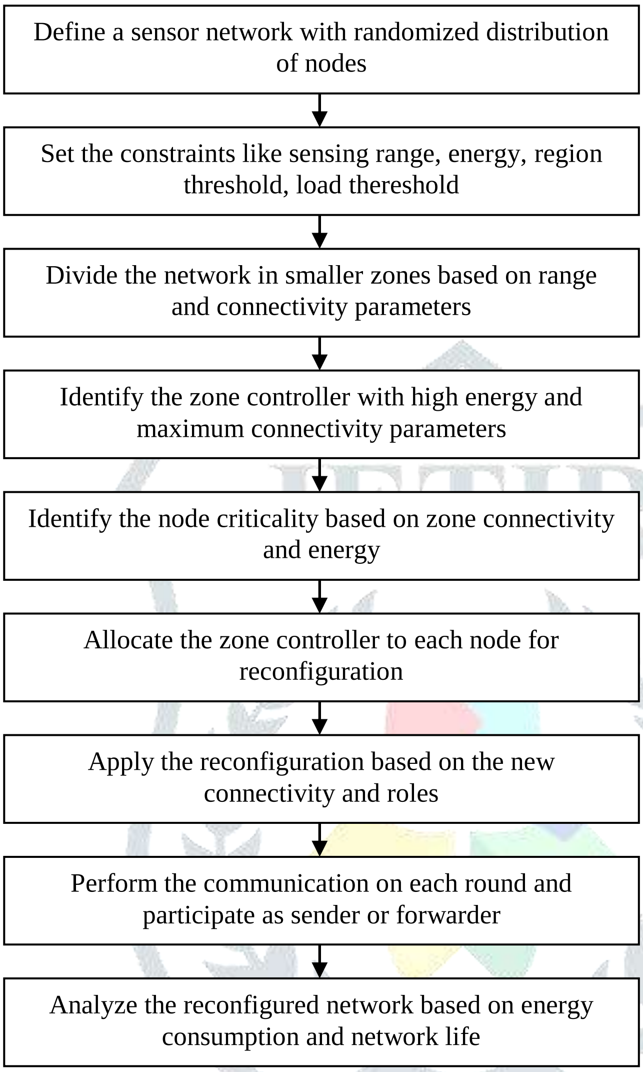

Figure 2 : Proposed Reconfiguration Model

architectural solution so that the optimized communication will be obtained. In energy adaptive network, this architectural representation is more critical to obtain. In this work, a constraint analytical model is presented to achieve the optimized communication based on architectural formation. The work will be divided in three main stages. In first stage, the optimal nodes will be identified to divide the network in smaller zones. In second stage, each zone will be observed under multiple static and dynamic constraints. These constraints includes load, coverage and the energy vector to identify the critical nodes. Once the nodes will be identified, in the final stage, the network reconfiguration will be applied. The work will be applied to achieve the optimized communication and network life improvement over the network. The work will be implemented in matlab environment.

The work is here presented as a three stage model to achieve the architectural improvement to the network so that the network life and communication will be improved. In first stage of this model, the network the observer node will be identified with range specification. In this stage, the network will be divided in smaller zones. In second stage, the zone level analysis will be applied to identify the zone nodes criticality. In the final stage, the optimized node configuration will be identified so that the network life and communication will be improved. The complete architecture considered in this work for network reconfigutaion is described in figure 1.

Figure 2 has presented the complete outline of proposed reconfiguration model. The model is defined with each integrated work stage. The work flow of the presented research is lised in this figure. The figure shows that the input to the system is provided in the form of random network with specification of random position and energy. For reconfiguration, the network is divided in smaller zones based on coverage analysis. The constraints are also defined to control the zone creation in the network. The number of possible zones and load of each zone is control by defining some threshold limits.

IV. RESULTS

In this present work, a dynamic zone adaptive reconfiguration model is provided to improve the network connectivity and to provide effective node tracking. The work is here implemented in MATLAB environment. In this chapter, the tool description, network scenario description and the communication statistics relative to the work are presented. A random placement based sensor network is defined to present the work.

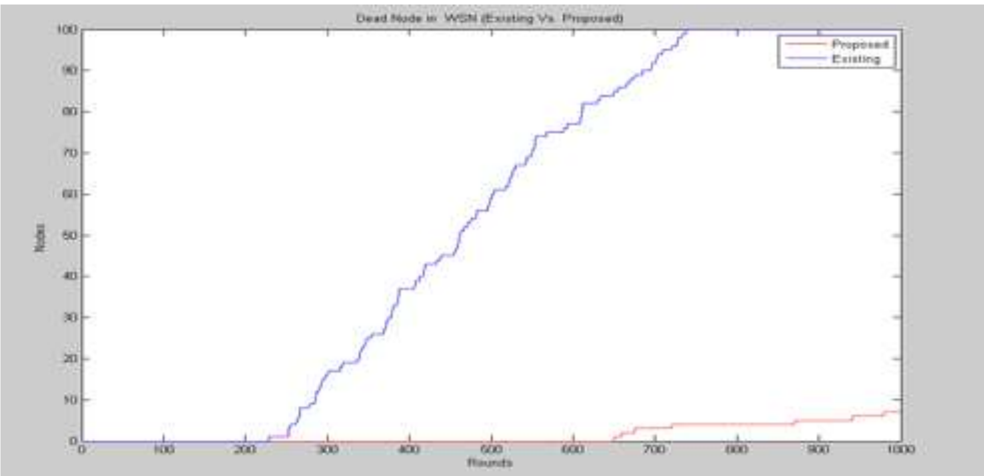

Figure 3 : Dead Node Analysis

Figure 3 provided the comparative analysis of existing and proposed work in terms of dead nodes. Figure 3 indicates significant improvement in the communication as the numbers of dead nodes in existing work higher than proposed approach.

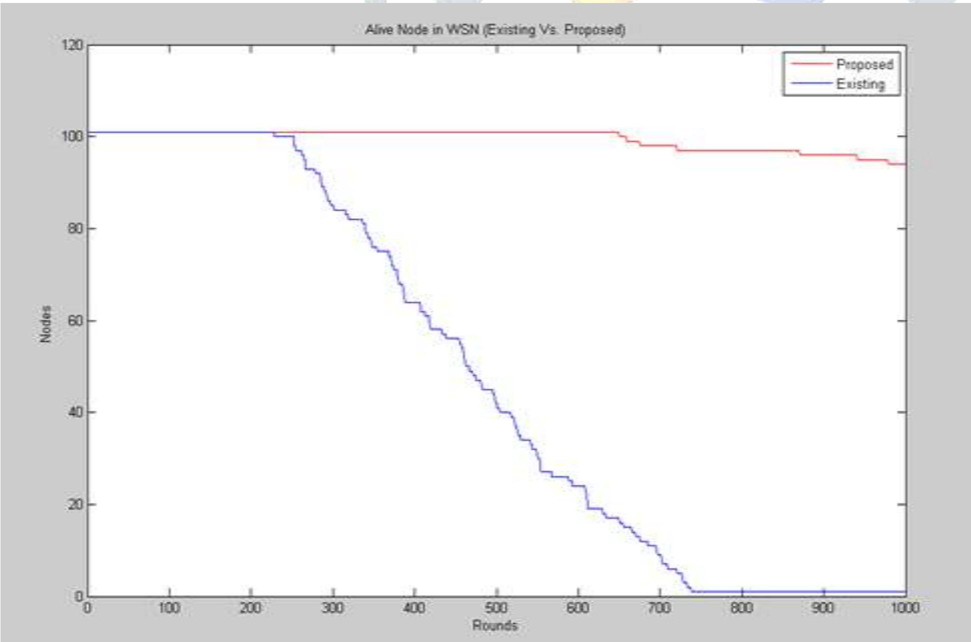

Figure 4 : Alive Node Analysis

Figure 4 indicates the comparative analysis of existing and proposed work in terms of alive nodes. The figure shows that the more number of nodes are alive in this proposed work which signify the network life is improved.

V. **Conclusion**

Each node of sensor network having the responsibility to communicate in the network which increases the network communication and responsibility. In this work, an effective reconfiguration of network is provided to the architectural form to achieve the better utilization of available soures. The proposed work split the network in smaller regions with controller generation. The segment based analysis and communication improved the better utilization of resources and improved the network life and communication.

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