Improve The Life Of A Network In UWSN

Abstract— Wireless sensor network is a class of wireless ad-hoc networks in which sensor nodes collect process and communicate data acquired from the physical environment. There is some of the basic component in a sensor network: sensing unit which sense and get information, processing unit which process information, transmission unit which transmit information between sensors and to BS, power unit which supply power to all units, position finding system and mobilizer. An underwater sensor network is one of the emerging technologies that require the data transmission at high rate with higher reliability ratio. . These kind of network needs the equal concern for the architectural definitions as well as the algorithmic enhancements. While defining these kind of network, the concern is required while selecting the sensors based on the type of surface, the type of link, control center, control parameters etc. These networks needs the regular monitoring of network because of continuous change is possible as the sensors are having floating movement and relatively need to analyze the energy definitions, requirement, consumption etc. It also needs to analyze based on type of communication, type of channel etc.

Key words: BS, UWSN, LEACH, PEGASIS, WSN

I. INTRODUCTION

About two-third surface area of our earth is covered with the water. To establish an underwater sensor network is quite difficult as there is no GPS system can be established. These sensor networks are very different to the traditional sensor networks in terms of software as well as the hardware specifications. The sensors used in such network are configured with some memory and the smart sensing capabilities. These smart sensors are defined with following capabilities: In Underwater Sensor network, the nodes are having the random mobility; each node holds the information about the neighboring nodes defined within the sensing range; each node is defined with some energy specific parameters; the load on each node is defined.Underwater Sensor Networks are used in a wide range of applications to capture, gather and analyze live environmental data. An Underwater Sensor Network typically consists of a base station and a group of sensor nodes. The sensor nodes are responsible for continuously sampling physical phenomena such as temperature and humidity. They are also capable of communicating with each other and the base station through radios. The base station, on the other hand, serves as a gateway for the sensor network to exchange data with applications to accomplish their missions. While the base station can have continuous power supply, the sensor nodes are usually battery-powered. The batteries are inconvenient and sometimes even impossible to replace. When a sensor node runs out of energy, its coverage is lost. The mission of a sensor application would not be able to continue if the coverage loss is remarkable. Therefore, the practical value of a sensor network is determined by the time duration before it fails to carry out the mission due to insufficient number of "alive" sensor nodes. This duration is referred to as the network lifetime. It is both mission-critical and economically desirable to manage sensor data in an energy-efficient way to extend the lifetime of sensor networks.

There are some of the issues in underwater sensor network. The main issue in underwater sensor network is the localization and the clustering.

In this research paper section 2 describe the problem of localization, section 3 defines the problem of clustering, section 4 is data aggregation within the clustering, section 5 is about the routing protocols related to the network, section 6 describes the LEACH protocol, section 7 shows the simulation results, section is the conclusion and section 8 is the references.

II. LOCALIZATION

The important concepts associated with any sensor network are localization and the clustering. The localization basically defines the physical location of the nodes in a network. In case of underwater sensor network the localization concept is crucial because of the moving nature of the nodes. Because of this movement, no topological decision can be taken about the network. It also gives the difficulty to generate the static path over the network. To cover this problem, each node maintains the information of neighboring nodes and as the communication is performed the decision is taken regarding the next neighbor selection under the defined parameters.

III. CLUSTERING

The sensors defined in a network are defined with low sensing range. Because of this, these nodes cannot travel data to the larger distance nodes. The issue is the energy consumption with each associated communication. As the communication is performed, Because of these reasons, the complete network is divided in smaller sub networks called clusters. Each cluster is defined with a controller node called cluster head. Each sensor node within cluster communicates to its relative cluster head and the cluster head communicate with base station.

IV. DATA AGGREGATION WITHIN THE CLUSTERING

Data aggregation is the new concept associated with the underwater sensor networks. Data aggregation makes the network energy efficient in the UWSN. Data aggregation can be used within the any particular cluster. This makes the network energy-efficient and enhances the power of the network.

In-network aggregation is a well-known technique to achieve energy efficiency when propagating data from information sources (sensor nodes) to multiple sinks. The main idea behind in-network aggregation is that, rather than sending individual data items from sensors to sinks, multiple data items are aggregated as they are forwarded by the sensor network. Data aggregation is application dependent, i.e., depending on the target application, the appropriate data aggregation operator (or *aggregator*) will be employed. [Jan Steffan ,LudgerFiege, Mariano Cilia and Alejandro Buchmann (2004)] However since various sensor nodes often detect common phenomena, there is likely to be some redundancy in the data the various sources communicate to a

particular sink. In-network filtering and processing techniques can help to conserve the scarce energy resources.[Zhao Yulan and Jiang Chunfeng (2005]. Figure 1.1 shows the basic principle of the in-network data aggregation technique

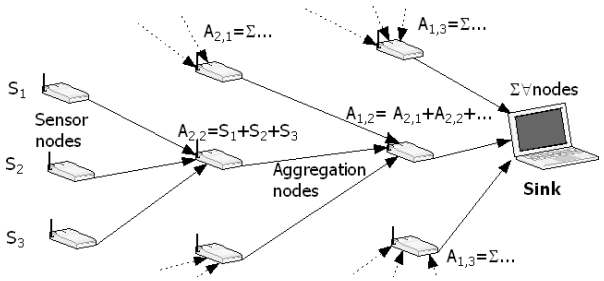

Fig. 1: in-network data aggregation

V. ROUTING PROTOCOLS

Different routing protocols are used in network data aggregation. Routing protocols are design to utilize limited resource and power of the sensor network. These protocols are responsible for the secure and energy efficient data transmission among the nodes, nodes and the cluster-heads and cluster-heads to the base station. Figure 1.2 represents the classification of routing protocol in WSN

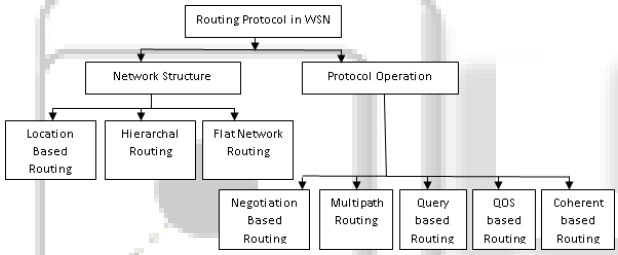

Fig. 2: Classification of routing protocols in wireless sensor networks

Hierarchical based routing protocols or cluster based routing protocols:

In this every cluster has a cluster head which aggregate sensed data from non-CH nodes and then send to base station. The goal of hierarchical routing is to manage the energy consumption of WSN efficiently by establishing multi hop communication within a particular cluster. The following are the protocols which uses hierarchical network model [Salvador Climent (2011)]

- Low Energy-adaptive clustering hierarchy (LEACH)[Curt Schurgers and Mani B. Srivastava (2000)]
- Power-efficient gathering in sensor information systems (PEGASIS)[V. Rajaravivarma, Yi Yang, and Teng Yang (2001)]
- Threshold-sensitive energy-efficient sensor network protocol (TEEN)[IoanRaicu (2002)]
- Adaptive threshold-sensitive energy-efficient sensor network protocol (APTEEN) [Y. Thomas Hou and Hanif D. Sherali (2002)]

VI. LEACH (LOW ENERGY ADAPTIVE CLUSTERING HIERARCHY)

The LEACH routing protocol is developed by Dr. Wendi RabnirHeinzelman in 2002. LEACH [Hiren Kumar Deva Sarma and AvijitKar(2002)] uses a periodic distributed clustering function to balance energy costs throughout the network. Time is divided into rounds, and every sensor has a certain chance of self-electing itself as a cluster head.

LEACH is a clustering-based protocol that includes the following features:

- Randomized, adaptive, self-configuring cluster formation,
- Localized control for data transfers,
- Low-energy media access, and
- Application-specific data processing, such as data aggregation.

Low Energy Adaptive Clustering Hierarchy (LEACH) is the first hierarchical cluster-based routing protocol for wireless sensor network which partitions the nodes into clusters, in each cluster a dedicated node with extra privileges called Cluster Head (CH) is responsible for creating and manipulating a TDMA (Time division multiple access) schedule and sending aggregated data from nodes to the BS where these data is needed using CDMA (Code division multiple access). Remaining nodes are cluster members.[Kay Romer and FriedemannMattern, Eth Zurich (2000)][Hiren Kumar Deva Sarma and AvijitKar (2002)][M. Ibrahim Channa and IrumMemon (2001)][Michael O'Rourke (2012)].

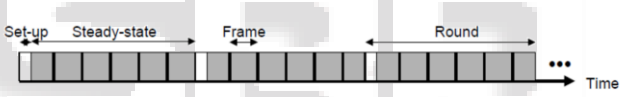

Fig. 3: LEACH protocol Phases

This protocol is divided into rounds and each round consists of two phases. Figure 1.5 represent the LEACH protocol phase.

- Clustered Architecture
- The basic objective on any routing protocol is to make the network useful and efficient. A cluster based routing protocol group's sensor nodes where each group of nodes has a CH or a gateway. Sensed data is sent to the CH rather than send it to the BS; CH performs some aggregation function on data it receives then sends it to the BS where these data is needed.

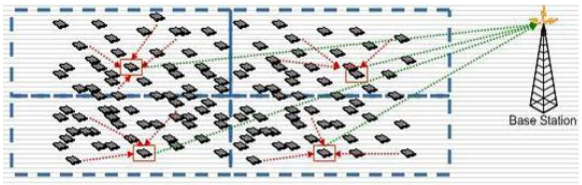

Fig.4: clustering architecture

- The experimental result shows that the improved clustering approach in underwater sensor network decreases the amount of dead nodes and increase alive nodes. This experimental result will shows that the life time of network is enhanced because of dynamic clustering and increased packet transmission rate

MATLAB is a high-performance language for technical computing. It is designed for convenient numerical computations, esp. matrix manipulation. It was being developed by Cleve Moler in 1970s as a teaching tool. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation.

The name MATLAB stands for matrix laboratory. MATLAB was originally written to provide easy access to matrix software. MATLAB has evolved over a period of years with input from many users. In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high-productivity research, development, and analysis.

VII. SIMULATION RESULTS

Results of existing work vs. proposed work:

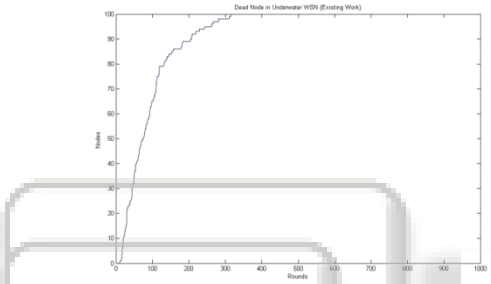

Fig.5: Dead Node Analysis (Existing Approach)

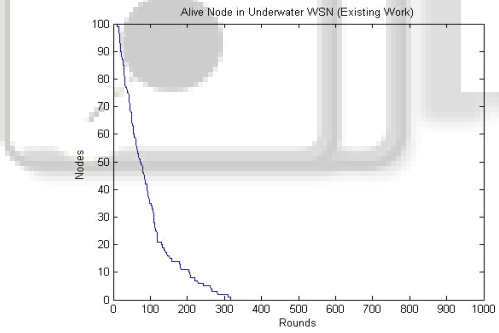

Fig.6: Alive Node Analysis (Existing Approach)

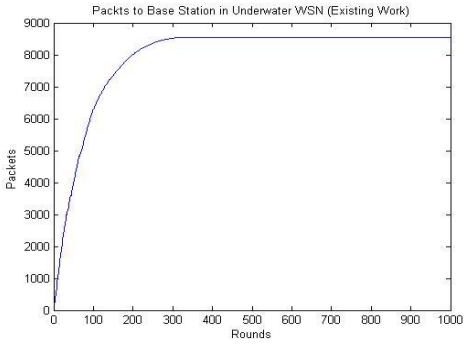

Fig. 7: Packet Transmitted to base Station(Existing Approach)

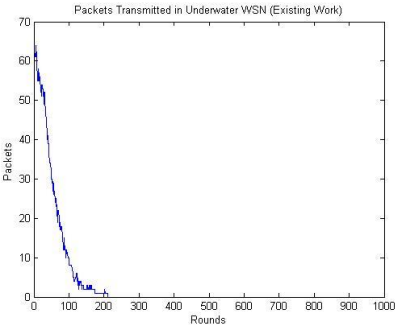

Fig.8: Intercluster Transmission(Existing Approach)

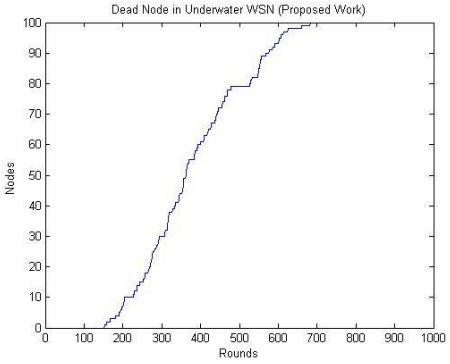

Fig.9: Dead Node Analysis (Proposed Approach)

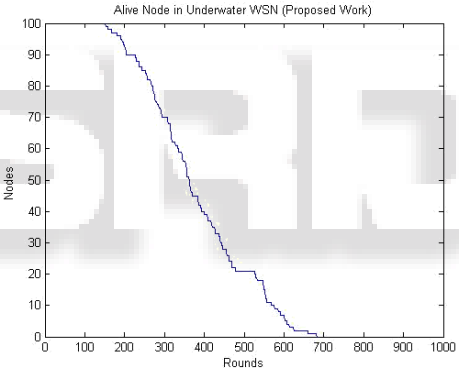

Fig. 10: Alive Node Analysis (Proposed Approach)

Base Station (Proposed Approach)

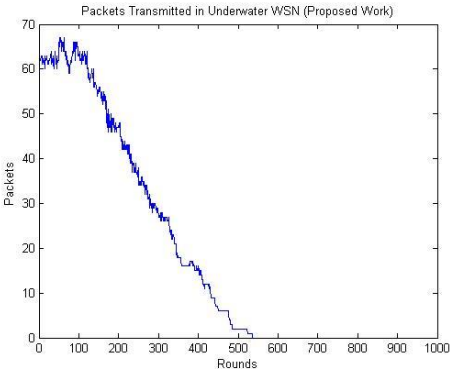

Fig.11: Dead Node Analysis (Proposed Vs. Existing)

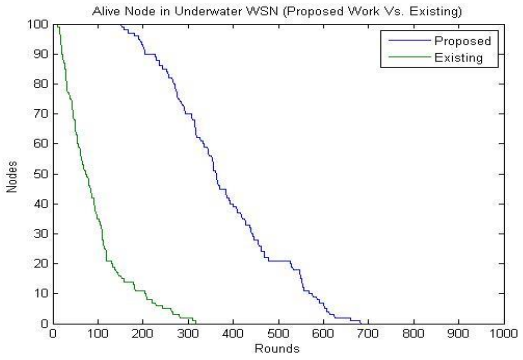

Fig. 12: Alive Node Analysis (Existing Vs. Proposed)

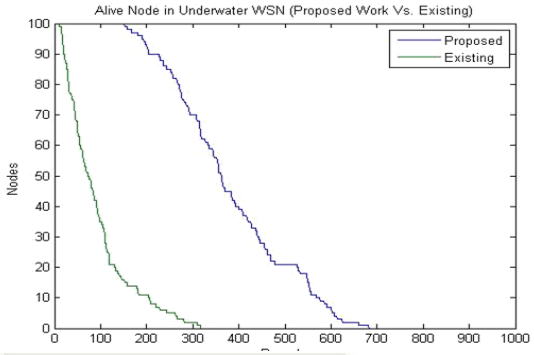

Fig.13: Alive Node Analysis (Existing Vs. Proposed)

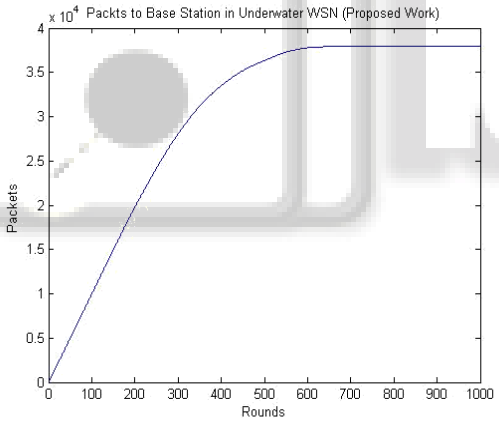

Fig.14: Packet Transmission to Base Station(Existing Vs. Proposed)

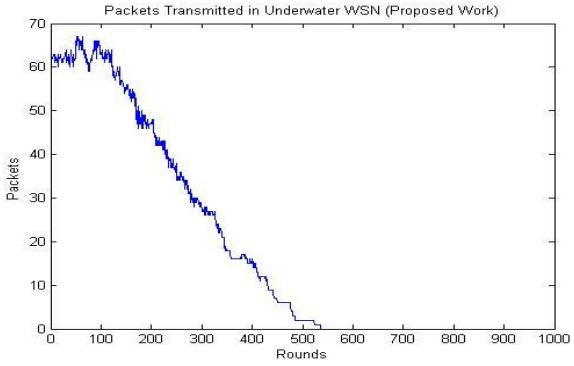

Fig. 15: Intercluster Communication (Existing Vs. Proposed)

VIII. CONCLUSION

The paper is focused on the formation of a reliable and effective clustered network in underwater sensor network. A clustered network is the basic clustering architecture used by any sensor network in which the whole network is divided in small sub networks called clusters. The core operation of a cluster head is to gather the data from nodes and convey the collected data to a BS for further processing and analysis. In this work, the clustering architecture is been defined under the limits of underwater network. In such networks, the nodes are having the random mobility over the network as well as the absence of the GPS increases the complexity of the work. We have defined an improved clustering architecture with two cluster heads in each cluster. These cluster heads are called Main Cluster Head and the Vice Cluster Head. The Main Cluster head is responsible to manage the cluster and to perform the communication between the cluster head and base station as well as between the sensor nodes and the cluster head. The work is here performed in the cluster head selection procedure. In this work, some restrictions are defined in cluster head selection such as the maximum number of cluster head in the network cannot exceed to the 10%. The minimum number of nodes are required to connected in the sensing range of a cluster head represents its eligibility. The cluster head selection is also defined parametric; the parameters considered here are the maximum connectivity, maximum energy and the probability vector. In same criteria, the secondary cluster head is also defined within same cluster at minimum distance from the main cluster head. As the main cluster head is dead, it will be replaced by vice cluster head as the immediate effect and new secondary cluster head will be identified in same cluster head. The obtained results show that the presented work has improved the network life and the overall communication over the network.

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