H-Leach Based Cluster Head Selcetion Algorithm For Effective Data Transmission In Underwater Acoustic Sensor Networks

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ABSTRACT

Water Pipeline Monitoring Systems have emerged as a reliable solution to maintain the integrity of the water distribution infrastructure. Various emerging technologies such as the Internet of Things, Physical Cyber Systems, and machine to-machine networks are efficiently deployed to build a Structural Health Monitoring of pipeline and invoke the deployment of the Industrial Wireless Sensor Networks (IWSN) technology. Efficient energy consumption is imperatively required to maintain the continuity of the network and to allow an adequate interconnection between sensor nodes deployed in the harsh environment. In this context, to maximize the Lifetime of the WSN underwater Distribution system domain is a primordial objective to ensure its permanently working and to enable a promising solution for hydraulic damage detection according to diverse performance metrics In this context, the data aggregation techniques are well-designed and various smart algorithms are developed to reduce the quantity of transmitted data and to minimize the energy consumption. In this project, we propose a Hybrid Low Energy Adaptive Clustering Hierarchy in order to improve the WSN Lifetime. Clustering applied in order to eliminate redundant data either from different sensor nodes at the same time or from the same sensor node at various time steps .NS2 simulator tool has been used to evaluate existing and proposed system performance. Then, efficient dataaggregation allowing the redundancy elimination at the cluster and sensor node level improves more the results and reduces the energy consumption

I. INTRODUCTION

At present, most pipeline sensors are connected using wired networks. Wired networks are either copper or fiber optic cables. The wired networks are usually connected to regular sensor devices that measure specific attributes such as flow rate, pressure, temperature, sound, vibration, motion, and other important attributes, see Fig.1. The wires are not used for communication only but also to transfer electrical power to different parts of the pipeline system to enable the sensors, actors, and communication devices to function. Power for the pipeline resources and networks can be provided by different sources like Solar Energy, Pipeline Flow Energy and other External Energies.

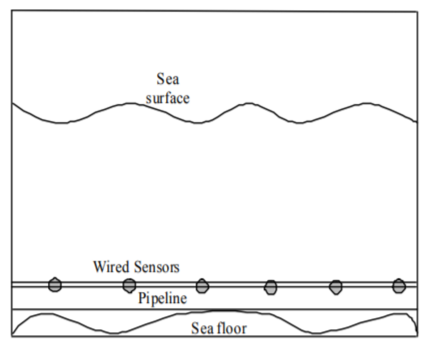

Fig.1 underwater wired sensor network

Currently, there are about 1000 Remotely Operated Vehicles (ROVs) and up to 700 AUVs in the world, according to Douglas-Westwood. In the coming 4 to 5 years it is expected that this fleet can be increased by 50-60% and may be even more than doubled.

The vast majority of AUVs currently belongs to the defense industry, where they are called Unmanned Underwater Vehicles (UUV). There is no difference in meaning between UUV and AUV, but the abbreviation UUV is used in the defense industry and in military circles, and therefore correspond to military applications; AUV is used in civil applications. In the military applications, approximately 35% are 'heavy' vehicles, 25% are 'middle' vehicles and 40% are 'light' vehicles.

The majority of heavy ROV vehicles are used in drilling and construction support of the subsea infrastructure in the oil & gas industry. Light ROV vehicles are often used in Inspection Repair and Maintenance (IRM). Of these approximately 70-80 percent of all ROVs are ‘heavy’ to ‘medium’ and 20-30% are ’light’ vehicles.

There have been attempts to shift UUV applications from the defence to civil market, assuming that AUVs will take over some IRM tasks from ROVs. Much attention has been paid to deep water ROV & AUV operations in depths up to 3,000 metres of water. Although from a market point of view, such ‘frontier types’ of vehicles will not be decisive because about 80% of the total pipelines length are located in depths shallower than 500 metres.

The Oil & Gas industry has been under pressure over the past 2 years, which has resulted in a challenge to reduce prices and therefore also a critical review of approaches to development in the industry. For example, with regard to IRM of underwater pipelines. Currently the total length of pipelines in the world is approximately 150 thousand km, and will increase by 20% towards 2019. As a majority of these pipelines is older than 20-25 years, the approaching end of their life cycle will mean that the requirements with respect to conducting regular inspections will be tightened and the inspection frequency increased.

Wired networks are considered the traditional way for communication in pipeline systems. They are easy to install and provide power supply for through the network wires. However, there are a number of reliability problems related to using wired networks with regular sensors for monitoring pipelines. These problems are:

If there is any damage in any part of the wires of the network, the pipeline communication system will be completely or partially damaged. This depends on how the wired network is organized and used. If the communication is done in one direction on the wire, then a single cut on the wire will disconnect all the nodes after the cut from the NCC. If the communication is two-directional then the negative impact on the communication is less as some nodes will use one direction for communication while the nodes after the cut can use the other direction. In this case the NCC needs to be connected to both ends of the network. However, if there are two or more cuts in the network, then all nodes between the cuts will not be able to communicate with either of the NCC. In addition, if there is a power outage, some of the nodes may not be able to operate.

In our approach, we Proposes an efficient localization AUV-based LSN (ALSN) algorithm, which provides the framework for monitoring and protection of underwater pipelines. We also consider the Range free localization method for node placement and RRT based path planning schemes for UAV paths. This approach provides a efficient results for SN, SINK and UAV communication for underwater pipeline network in terms of delay and power.

II RELATED WORKS

Maroua Abdel hafidh et al [1] proposed an hybrid clustering algorithm based on K-means and Ant Colony Optimization (ACO); called K-ACO to improve the WSN Lifetime. Efficient energy consumption is imperatively required to maintain the continuity of the network and to allow an adequate interconnection between sensor nodes deployed in the harsh environment.

MutebAlsaqhan et al [2] presented the work of developing a low- complexity, power-efficient, scalable node for linear wireless sensor networks. The developed system is intended primarily water pipeline leakage detection applications. This work mainly tackles the communication part of the system.

Adnan Nasir et al [3] presented a human centric cyber physical framework architecture of our in-pipe water monitoring and feedback system. This system comprises of the physical water distribution infrastructure, together with the hardware and software supported intelligent agents for water allotment, leak detection and contamination spread control.

Ahmed M. Alotaibi et al [4] Proposed an energy-efficient cooperative scheme for a group of mobile wireless sensor nodes deployed inside the pipeline. The nodes are supposed to run cooperatively in order to save their resources. It is assumed that only one node shall remain active for a specific period of time while all other nodes are in sleep mode. As soon as the active node completes its cycle, it goes to sleep while another node is triggered by its timer to wake up and continue the process.

Meenakshi et al [5] designed to reduce the propagating delay and to allocate channel in optimal relay node selection by using a heterogeneous network. In underground pipeline communications, sensor nodes detect the signal and forward it to the relay node, which is placed in above ground.

Ayadi et al [6] investigates various leakage detection formulations based on WSN in order to identify, locate and estimate the leak size. In addition, a computerized techniques based on the analysis of pressure measurement in water distribution system is presented to find the defective pipe.

III PROPOSED SYSTEM

H-LEACH uses residual and maximum energy of the nodes to elect a channel head for each round. The proposed algorithm is used to find the life time of the nodes in terms of rounds when the proposed threshold and energy conditions are considered. The nodes with energy less than to that of the (Etr) minimum energy required for transmitting and receiving signals is made to die as it lacks energy to do it. Etr issubtracted from the energy of the node s(i).e in every round as that much of energy is consumed. Total number of alive nodes are calculated for every round so as to have a track on the life time of the network.

A. Design and Function

The following flow chart briefly describes the working of HLEACH protocol. When the network enters the setup phase, Ep, the probability of using energy considerations is calculated by using Emax, Cp and Ep.then the average energy of all the nodes are calculated. Then the threshold value is calculated. A number is randomly picked in the range 0 to 1. If the number picked is less than the threshold value and the corresponding node is assigned to be cluster head if its energy is more than that of the average energy. The energy required for data transmission is deduced from the energy of the node in every round. When the energy falls below the minimum value, it is declared to be dead. A graph is plotted for sum of alive nodesin each round

Hybrid-Low Energy Adaptive Clustering Hierarchy
1.Initialization:N=(n1, n2, n3…,nn), E=(e1,e2,e3….,en), r= number of rounds, Ech= Energy of channel head,e0 = initial energy of each node, Eavg= Average energy of all nodes in particular cluster., Ep= Probability using energy considerations, Er= reaming energy, Etr= energy required for transmitting and receiving data Emax= Maximum energy of a node, TDMA= Time division multiple access
2.Inputs: Er, Emax, n, r, e0,
3.Outputs: CH, graph plotting alive nodes.
4. $E_{avg} = \frac{\sum_j^n en}{n}$
5. i = 1 to r
6. if (ni∈N) then
7. e0(i)=P*((Emax-Eused)/Emax)
8. t(n)= (e0(i)/(1-e0(i)*mod(r,round(1/e0(i))
9. t=random number (0-1)
10. if((t<t(n)) && (ei > Eavg)) then
11. CH ← ni
12. s(i).e = s(i).e- Etr :used to send information through TDMA
13. end if
14. i= i+1
15. goto step 6
16.plot total alive nodes for each round
17.end if

B. Cluster head Data transfer

Here Cluster head is used for communication to base station and a radio model analysis is carried out in order to send the data. Transmitter sends the information to amplifier and then it is sent to receiver. Distance between transmitter and receiver isused to evaluate the performance of hopping distance among the nodes.

Scheduling packets

TDMA is used to schedule packets from Channel head to base station. The process is carried out once it receives all the nodes from normal nodes and every specific packets has a separate slot in order to avoid congestion in the network. Here Energy using transmission and receiving is considered with energy of a photon, bit rate and transmission range.

IV RESULTS AND DISCUSSION

Our proposed work have been developed and simulatedby the networksimulator(NS-2) software. The results for an each process have been figured out in the following below.

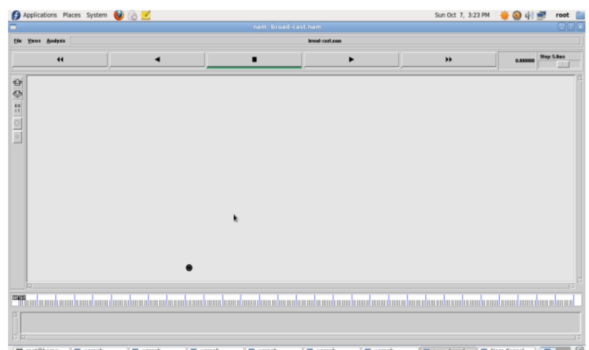

Fig. node creation

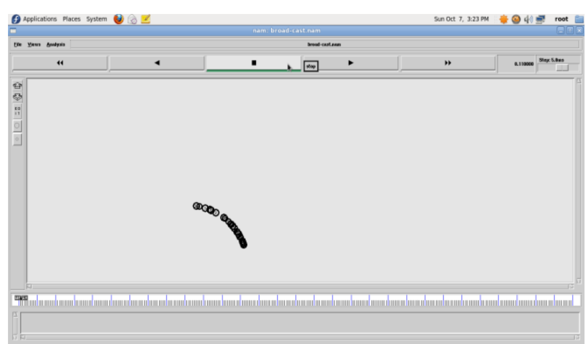

Fig.Node Deployment

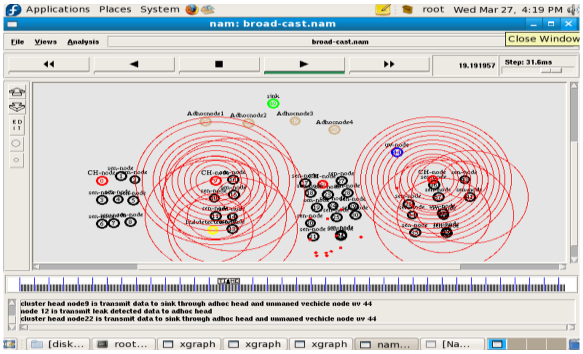

Fig. Surface Sink to Network Controller Communication for cluster head changing

V PERFORMANCE ANALYSIS

The Performance graph of results between no. of nodes, speed, delivery ratio, delay and energy is shown in following figures.

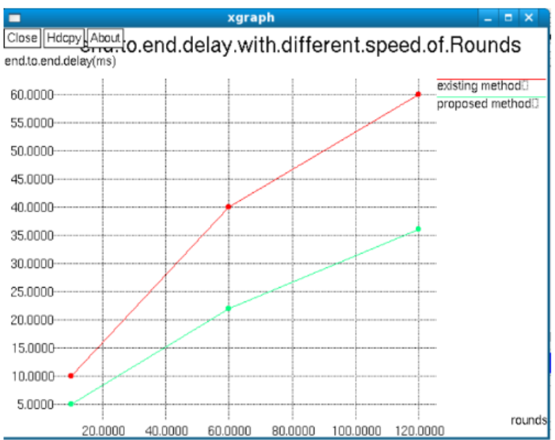

Fig. performance analysis

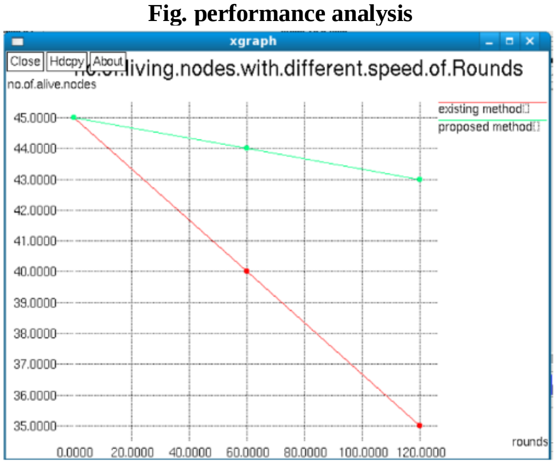

Fig. performance analysis

VI CONCLUSION

In this project, results indicate that proposed H-LEACH is more efficient than existing one underwater communication. In the HLEACH, the average energy and residual energy of the nodes play a vital role in the selection of cluster heads. H-LEACH, being the combination of HEED and LEACH over comes the node energy issues, which is the major disadvantage of the existing one. A new formula is proposed in this project to find the threshold value by using the average energy of the node. The energy consumed by the node for transmitting and receiving data is reduced in every round to keep track of the alive nodes in every round. Node is declared dead when its energy falls below the minimum energy required to transmitenergy. LEACH being homogenous protocol achieves maximum lifetime in the proposed approach.

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