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Research paper

Secured Energy Aware Projected 5G Network Architecture for Cumulative Performance in Advance Wireless Technologies

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Abstract

Wireless Networks are known to be susceptible from different energy consumption issues and enormous algorithms are devised so far to improve the lifetime of sensor networks. Low-energy adaptive clustering hierarchy (LEACH) is one of the classical approaches that is adopted in many wireless implementations along with the variants of LEACH to escalate the overall life of nodes as well as network. Underwater Sensor Network or Acoustic Network (UWSN / UWAN) is a type of wireless network that is deployed under the ocean to monitor the movements of enemy or specific corporate purposes. The UWSN are having their base stations at the ships to keep and log the signals from underwater sensor nodes (USN). Such nodes are difficult to track physically and once their lifetime is over because of energy depletion, there is need to redeploy these nodes. To improve the lifetime of such underwater network, a novel and energy efficient approach of population based optimization is used in this research work with integration of soft computing. In this approach, the behavior of the bees in selecting their heads is adopted to form the dynamic cluster head in underwater wireless networks. It is found from the results that the bee colony based energy optimization approach is better as compared to the traditional approach in terms of multiple parameters.

Keyword: *Energy Optimization, Soft Computing, LEACH, Underwater Sensor Networks, UWSN*

1. Introduction

5th Generation Wireless Network also known as 5G is the powerful technology for wireless communication in assorted network based devices [1]. The key features and focus with 5G includes the higher degree of accuracy, throughput, mobility, minimum packets loss and higher density
in connections. This technology makes use of additional spectrum for the communication with support of 20 GBPS speed[2,3].
Countries using 5G Network [4,5]

- USA
- South Korea
- Sweden
- Estonia
- Turkey
- Japan
- China

3G VS 4G VS 5G

	3G	4G	5G
DEPLOYMENT	2004-05	2006-10	BY 2020
BANDWIDTH	2mbps	200mbps	>1gbps
TECHNOLOGY	Broadband with/CDMA/IP technology	Unified IP and seamless combination of LAN/WAN/WLAN/PAN	4G + WWWW
SERVICE	Integrated high-quality audio, video and data	Dynamic information access, variable devices	Dynamic information access, variable devices with all capabilities

2. Underwater Networks and 5G Integration

Underwater Sensor Networks are the specialized class of wireless networks which are deployed in the ocean so that the underwater monitoring can be done for different applications including defense, oil exploration, terrorists' movements, minerals exploration and many others [6,7]. To work on these perspectives, there is need to deploy the sensor nodes with higher lifetime so that there is minimum decay or loss of signals strength. UWSN can be equipped with the 5G network based communication for higher security and better transmission rate [8,9]. Following is the traditional scenario of underwater network having assorted constituents deployed in the ocean region with the monitoring cells.

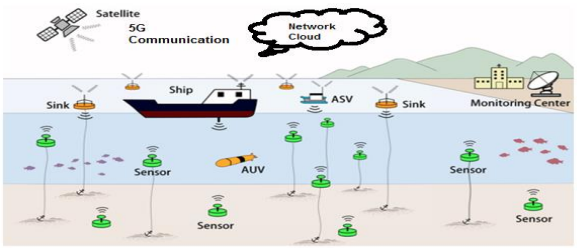

Figure 1: Underwater Sensor (Acoustic) Network with 5G Communication

In Figure, the different elements of UWSN are presented including Satellite, Sensor Nodes, Autonomous Surface Vehicle (ASV), Monitoring Center, Sink, Autonomous Underwater Vehicle (AUV) with the signals transmission.
All of these elements work and communicate together to share and transmit the signals for specific goals to the base station and controlling monitoring center[10,11].

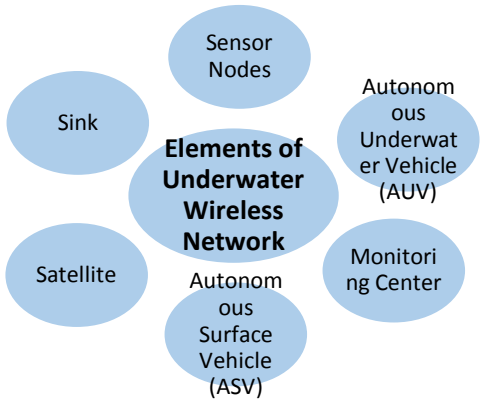

Figure 2: Elements of Underwater Sensor Network

3. Energy Optimization and Routing in Wireless Environment

The energy and power in the wireless nodes are very limited which makes the network scientists aware with the development of new protocols so that the high performance algorithm for energy optimization can be devised. There are number of algorithms and approaches for energy optimization and harvesting in wireless sensor networks which are having key focus on the cluster head formation so that the minimum energy loss can be implemented in overall network scenario [12,13].

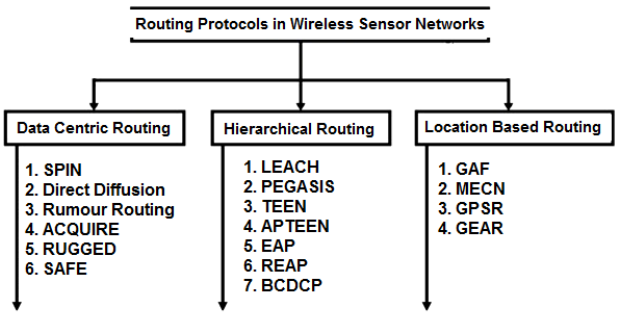

Figure 3: Taxonomy of Protocols in Wireless Networks

Low-energy adaptive clustering hierarchy or LEACH is one of the prominent protocols for energy optimization in the wireless sensor networks. LEACH encapsulates the properties including threshold value, TDMA based communication, cluster based aggregation, direct communication by the cluster head to the node or sink. Following are the excerpts from the key routing protocols in wireless sensor networks. Low-energy adaptive clustering hierarchy or LEACH is one of the prominent protocols for energy optimization in the wireless sensor networks. LEACH encapsulates the properties including threshold value, TDMA based communication, cluster based aggregation, direct communication by the cluster head to the node or sink.
SPIN – Sensor Protocols for Information via Negotiation (SPIN) is a d Data-Centric routing approach that is based on the negotiation family with the elimination of redundant data. This family avoids the limitations of
Implosion, Overlap and Resource Blindness as key obstacles in the traditional flooding.
Direct Diffusion – The implementation of data aggregation is done at each node. The advertising of data is done after confirmation from base station (BS).
Rumour Routing – The routing of queries is done to the events with the acknowledgement from the event to which the query is transmitted.
ACQUIRE – Active Query forwarding InsensoRnEtworks or ACQUIRE follows the approach of active query routing that is transmitted to the network to fetch the solution. The query is transmitted to each node and multiple hops to resolve the query.
RUGGED – It is RoUting on 54ingerprint Gradient in sEnsor networks. It is gradient based routing that relies on the utilization of fingerprint associated with the event for logging and tracking.
PEGASIS – It refers to Power Efficient Gathering in Sensor Information System with the key focus on energy efficient approach in the wireless environment. The approach grants the local communication and coordination in the nodes so that minimum bandwidth and energy can be consumed.
TEEN – Threshold sensitive energy efficient protocol or TEEN focuses on the grouping of sensor nodes so that the cluster formation can be done with the generation of cluster head to lead the cluster communication.
EAP – Energy Aware Routing Protocol (EAP) is another class of hierarchical protocols in wireless sensor networks for the lifetime improvement and optimization of the energy in wireless environment. EAP presume that the locations are not known to the sensors and these sensors communicate using different paradigms of information including Global Positioning System (GPS), Positional Algorithm and Antenna.

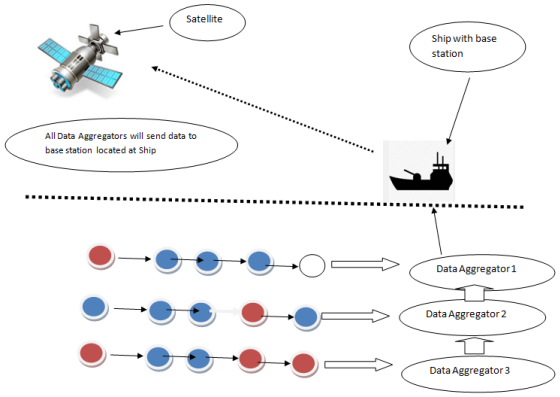

Figure 4: Flow of the Work

Figure 5 depicts the flow of work with the multiple phases of data aggregation with 5G Technology and the transmission to base station by which the overall energy optimization is achieved. The work is having enormous advantages as compared to the traditional approaches including there is higher degree of optimization with the threshold analysis of multiple nodes so that the cluster head formation can be dynamic. The shuffling or changing of the cluster head to avoid any type of attack to disguise the cracker of intrusion attempts. The nature inspired approaches are always effectual in terms of minimum delay and higher performance in the multiple scenarios. The repeated flow in the path makes sure the genuine or authentic river formation or simply network path for traversing of the data packet in secured channel

4. Implementation Results and Outcome

To implement the energy efficient approach using soft computing based optimization, the simulation of wireless environment is done in MATLAB using Biograph toolbox to depict different sensor nodes. Following are the screenshots and output obtained from the simulation scenarios in different time spans.

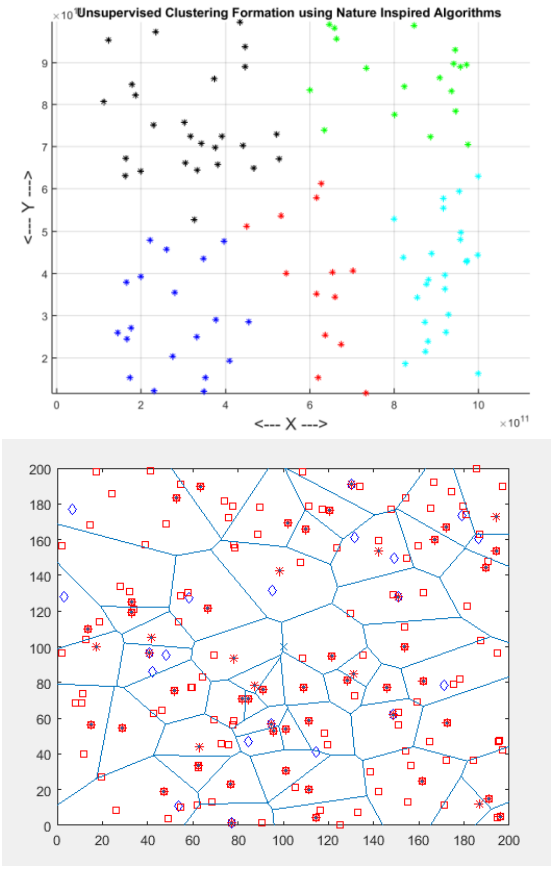

Figure 5: Cluster Formation in Wireless Environment

Figure 5 depicts the scenario of cluster Formation in wireless environment and it is visible in the results that multiple nodes are in the grouping phase for the data transmission and overall energy optimization.

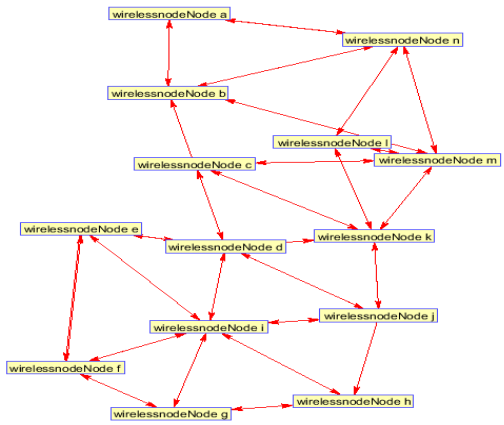

Figure 6: Biograph toolbox view with mobile 5G Nodes

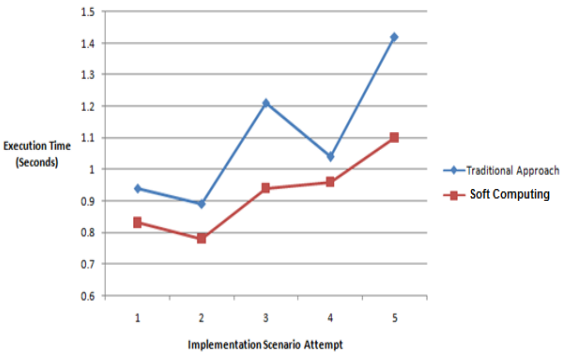

Figure 7: Evaluation of Execution Time

Figure 8 presents the evaluation and comparison of execution Time in the traditional and proposed Soft Computing approach. It is evident from the results that the execution time of Soft Computing is comparatively effective and less than the traditional approach.

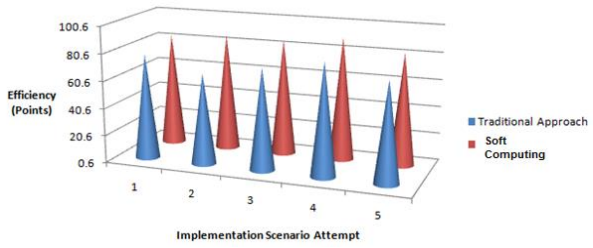

Figure 8: Evaluation of Efficiency

Figure 8 presents the evaluation and comparison of efficiency in the traditional and proposed Soft Computing approach. It is evident from the results that the efficiency of Soft Computing is comparatively effective and more than the traditional approach.

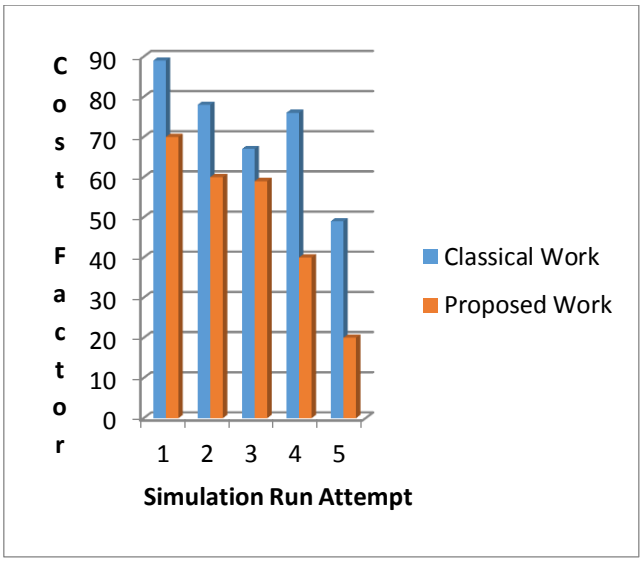

Figure 9: Contrast of the simulation results in traditional and projected approach in terms of cost

Figure 9 presents the evaluation and comparison of cost factor in the traditional and proposed Soft Computing approach. Classical / Existing Approach based on greedy architecture is not having effectiveness and efficiency as compared to Soft Computing based approach. The classical work is taken as the implementation without integration of metaheuristic based simulation. It is evident from the results that the factor of Soft Computing is comparatively effective and less than the traditional approach.

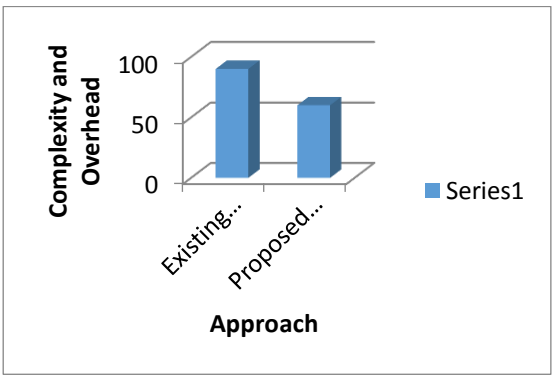

Figure 10: Contrast of the simulation results in traditional and projected approach in terms of complexity

Figure 10 presents the evaluation and comparison of complexity and overhead in the traditional and proposed Soft Computing approach. Classical / Existing Approach is not having less complexity and overhead as compared to Soft Computing based approach. The classical work is taken as the implementation without integration of metaheuristic based simulation. It is evident from the results that the complexity and overhead factor of Soft Computing is comparatively effective and less than the traditional approach.

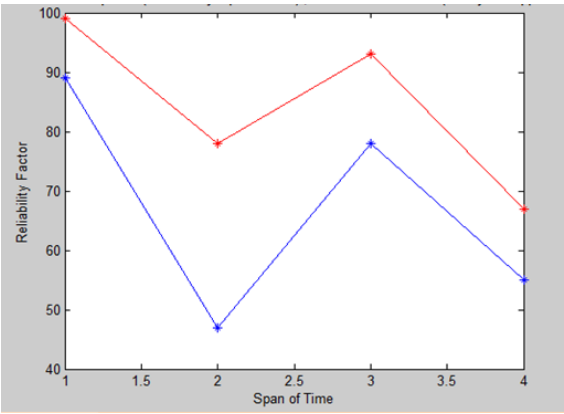

Figure 11: Evaluation of Reliability

Figure 11 presents the evaluation and comparison of reliability in the traditional and proposed Soft Computing approach. Classical or Existing Approach of energy optimization is not having more reliability as compared to Soft Computing based approach. The classical work is taken as the implementation without integration of metaheuristic based simulation. It is evident from the results that this factor of Soft Computing is comparatively effective and less than the traditional approach.

5. Conclusion and Future Scope

Population based optimization approaches are quite prominent and widely used to solve the assorted combinatorial optimization problems or in the engineering optimization domain. This work is having the implementation perspectives of soft computing with the analogous aspects to cluster head formation in the underwater sensor networks so that the overall lifetime of network can be improved. The work is based on the dynamic clustering with selection of dynamic cluster head as similar to the population based approach of soft computing. To improve this work, the integration of deep Learning can be done that is highly optimized approach with the advancements of artificial intelligence. In addition, the approaches of Soft Computing and nature inspired paradigms can be associated for global optimization or simply effective results can be fetched from a huge search space of solutions. The prominent Soft Computing approaches which can be used for further optimization include, Fuzzy Logic, Support Vector Machines, Swarm Intelligence, Metaheuristics, Ant Colony Optimization, Cuckoo Search, Bees Algorithm, Particle Swarm Optimization, Firefly Algorithm, Bat Algorithm, Simulated Annealing, Flower Pollination Algorithm, Bayesian Network, Evolutionary Approaches, Nature Inspired Algorithms**,** River Formation Dynamics and many others.

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