SOFT COMPUTING BASED CLUSTER HEAD SELECTION FOR SECURED ENERGY AWARE ROUTING IN FLYING AD HOC NETWORKS (FANET)

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ABSTRACT: *Flying Adhoc Networks (FANET) refers to the Unmanned Air Vehicle (UAV) that is used for defense applications so that the multiple flying objects or military air vehicles can communicate with each other. Network Communications generally encounter assorted assaults from different sources and channels which creates huge vulnerabilities and susceptibilities in the overall environment. By this integration of assaults, the overall communication gets under halt and the cumulative trust factor is affected. In this paper, the different perspectives of wireless communication on flying objects are underlined with the different types of energy based attacks. FANET is a type of ad hoc network in which the temporary communication channel is created on demand so that the communication and transmission of signals can be done for specific applications with the higher degree of accuracy and performance. In this manuscript, the implementation of Simulated Fermentation Optimization (SFO) is implemented so that the higher degree of performance and optimization can be done.*

Keywords - FANET, Flying Adhoc Network, Wireless Network, Simulated Fermentation Optimization (SFO)

INTRODUCTION

Wireless communication involves the transmission and sharing of information in multiple nodes without using the electrical conductor. The wireless communication depends on the radio technology and related assorted aspects for effective and secured data transmission. There are assorted perspectives of wireless communication including wireless sensor networks, mobile ad hoc networks, wi-max and many others. Now days, the inclusion of flying objects are prominent in military applications so that the flying aircrafts can communicate with each other during war time or other similar instances. The wireless communication when takes place in the flying objects or flying aircrafts are commonly known as Flying Adhoc Network (FANET) [1, 2].

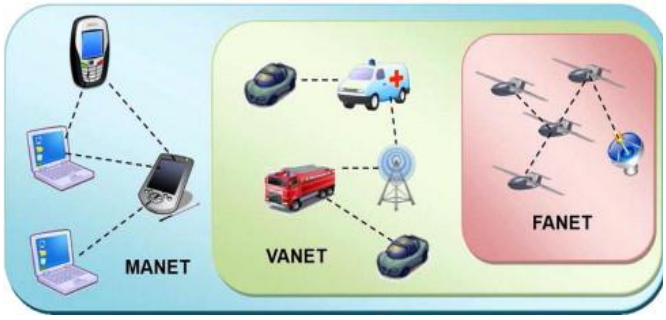

Figure 1.1. Depiction of MANET, VANET and FANET

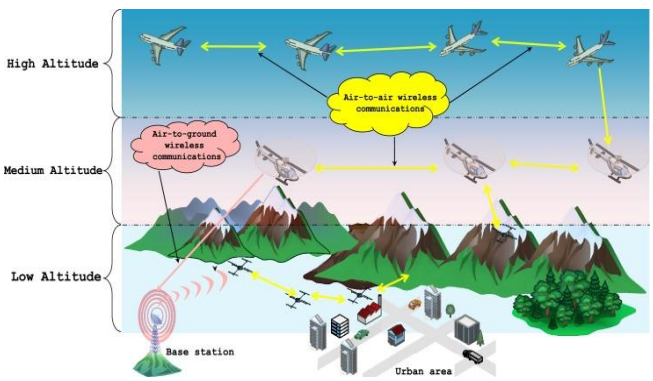

Figure 1.2. Flying Ad-hoc Networks (FANET)

Energy and Power in Wireless Sensor Networks

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.

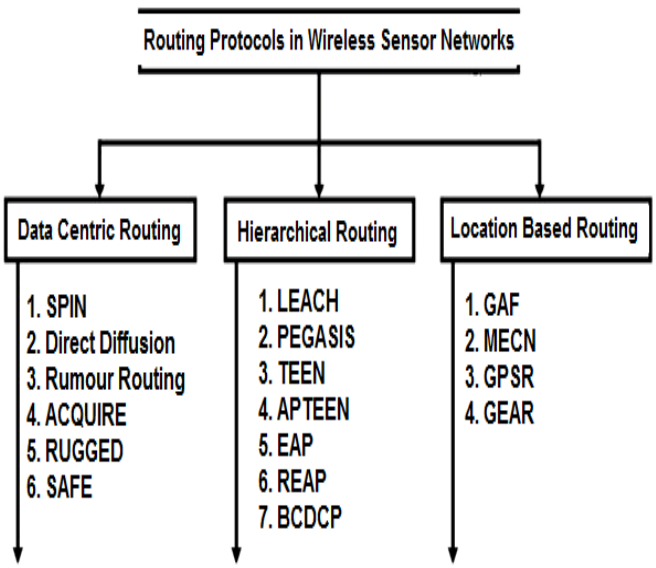

Figure 1.3. Taxonomy of Routing Protocols in Wireless Networks

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.

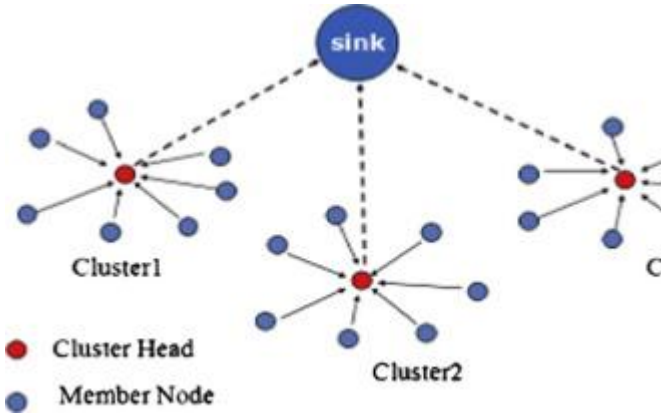

Figure 1.4. Low-energy adaptive clustering hierarchy (LEACH) Protocol

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).

Rumor 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 in sensor networks 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 fingerprint 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. APTEEN is the escalated or improved version of TEEN that refers to Adaptive Threshold sensitive energy efficient protocol.

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.

Review of Literature

A number of researchers and practitioners have worked on the analysis of similar domain with the suggestive remarks but there is huge scope for the improvement in cases where the deep evaluation of the tools, technologies and paradigms are required to be done. Enormous multi-sources based manuscripts, research papers and articles are analyzed from the time span up to year 2017 so that the latest trends in wireless communication can be evaluated. Enormous multi-sources based manuscripts, research papers and articles are analyzed from the time span up to year 2017 so that the latest trends in energy optimization and lifetime of flying adhoc networks can be evaluated.

Bekmezci *et al.* [5] worked on the assorted aspects of energy and security in Unmanned Air Vehicles (UAV) commonly referred to as Flying Objects communicating in the wireless environment. The work presents the key differences in FANET, MANET, VANET and related technologies of wireless communication with the advantages of using FANET.

Sahingoz *et al*. [6] underlines the network models and paradigms of flying ad-hoc networks with the challenges and key concepts. The architectures and security models associated to enable the integrity aware FANET.

Singh K *et al*. [7] presents the experimental evaluation of flying ad-hoc networks on different protocols including AODV, DSDV, OLSR with the effectual comparative analysis. The work presents the use of FANET for military applications and performance aware environment in minimum delay.

Temel S *et al*. [8] depicts the promising technologies of High Altitude Platforms (HAP) with the integration of Flying Adhoc Networks (FANET) for different domains including military as well as civilians. The work Research's the unique and effective protocol titled Location Oriented Directional MAC (LODMAC) based on MAC for the network discovery and effectual data transmission.

Rosati S *et al*. [9] evaluates the dynamic routing in the unmanned air vehicles or flying adhoc networks with the experimental evaluation and results on small flying robots for testing. The work presents the comparison of two routing approaches in ad hoc networks including OLSR and Predictive OLSR (P-OLSR). The approach of P-OLSR is developed for FANET and tested as the effectual algorithm.

Koucheryavy A *et al*. [10] presents the research challenges and assorted aspects of public flying ad hoc networks in multiple applications. The work evaluates the assorted aspects of Public Flying Ubiquitous Sensor Networks (FUSN-P) with the presentation of a network model and the effectual solution for different application in military.

Research Objectives and Methodology

The multilayered approach for energy harvesting and energy optimization shall be done in the proposed approach at the multiple layers of sea with the deployment of FANET. The work includes the research goals including subterranean evaluation of energy and optimization approaches in Flying Ad-hoc Network (FANET). The work presents the pragmatic Exploration of the Energy Harvesting and Associated Packets Loss in the Flying Ad-hoc Network (FANET). The work proposes and devises an effectual and novel algorithm for energy optimization in Flying Ad-hoc Network (FANET) using Simulated Fermentation Optimization (SFO). The implementation of proposed approach using open source research based simulation tool is done with the evaluation of the Researched Proposed Results with the Traditional Approach. The work includes sensors deployed to form the dynamic clustered head and reconfiguration of the network. The fuzzy formula based dynamic selection of the cluster head shall be implemented with the shuffling of cluster heads. The proposed work is providing the feature and

dynamic nature to the cluster head. The work is fault and failure tolerant due to shuffling of the cluster head.

In this novel and effectual research work, we hereby present and depict the Soft Computing Approach titled "Simulated Fermentation Optimization (SFO)". This approach can be used for optimization of Engineering as well as Social Problems.

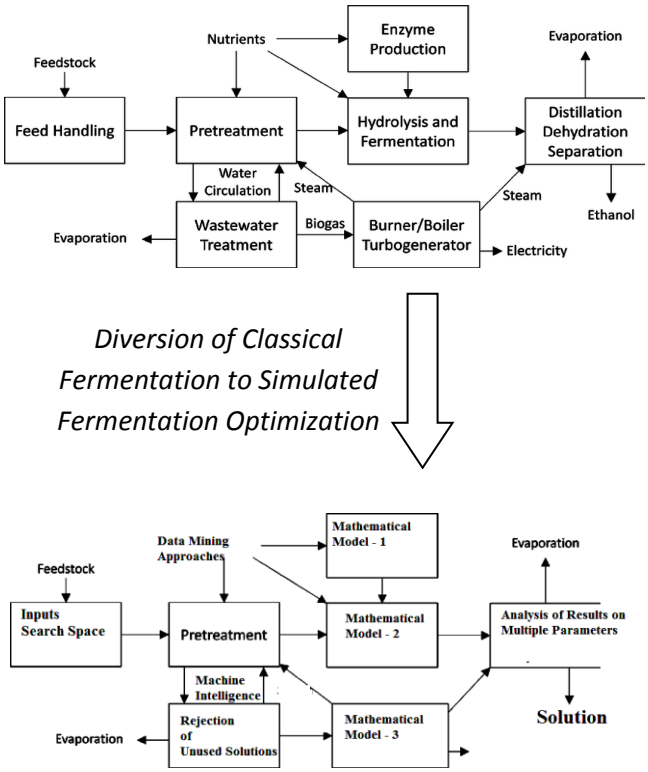

Figure 1.5. Simulated Fermentation Optimization (SFO)

In Figure 1.5, the proposed Nature Inspired Algorithm (SFO) is depicted. The components and process of classical fermentation is related to the proposed approach. Using SFO, we can fetch the integrity and performance based results. The wireless nodes with degree of energy and lifetime shall be given occasion to be cluster head so that overall performance and lifetime of the clustered environment can be escalated.

There are many procedures to select the cluster head based on the criteria including fermentation quantity and timelines, Battery power, Communication range, Position of the node, Total number of nodes in range and Mobility of the node

RESEARCH RESULTS AND OUTCOME

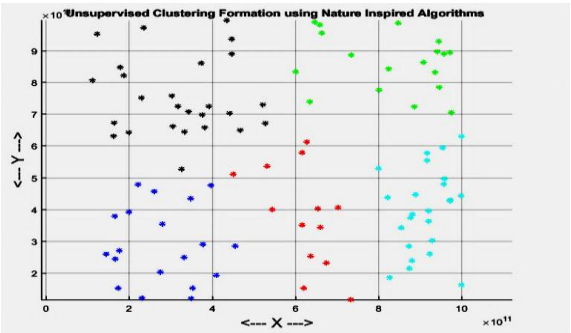

Figure 1.6. Implementation of Clustering in Wireless Environment

Figure 1.6 depicts the implementation scenario of clustering in the flying adhoc networks in the aerial region. The different points in plot presents the flying objects or aircrafts in communication with each other to share and signals and the data transmission.

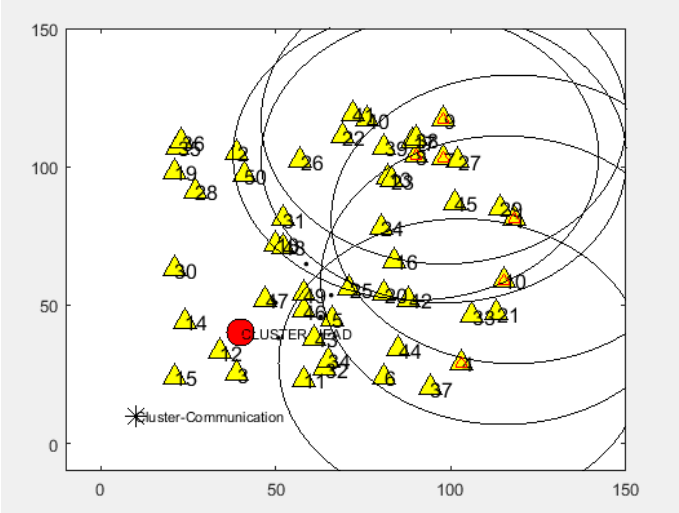

Figure 1.7. Communication in Wireless Flying Objects

Figure 1.7 presents the communication scenario between the flying aircrafts and communication with the base station and controller along with the inter-aircraft transmission of signals.

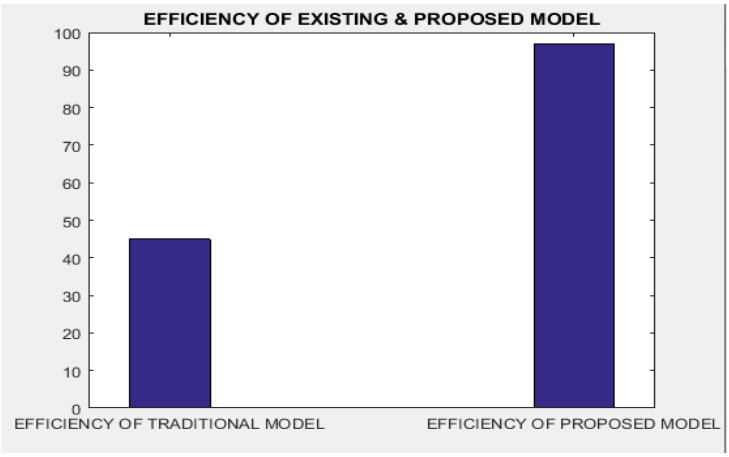

Figure 1.8. Comparison of Efficiency in Existing and Proposed Approach

From the results, it is evident that the Researched approach of SFO is presenting the superior results in terms of efficiency or performance as compared to the traditional approach of energy optimization in FANET. The implementation is done in the performance aware simulation tool to have the overall outcome. By this, it is palpable that the soft computing approaches are quite effectual and integrity aware for multiple scenarios and applications.

CONCLUSION

Soft computing approaches are widely used for the optimization of engineering problems including wireless energy optimization, security, malware detection, log file analysis, image processing, video forensic and many others. In this research work, the proposal of a new approach Simulated Fermentation Optimization (SFO) is presented with the pragmatic evaluation on performance and found

the approach better to improve the lifetime and energy optimization in the flying ad hoc networks.

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