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PSO BASED DESIGN PERFORAMNCE IN FANET

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Abstract *Vehicular Ad-hoc Networks (VANETs) which nowadays showed distinct researches around the globe. Advancements in wireless networks globally, which gave a new dimension to researchers. This paper work the concepts of FANET and PSO. The new implementation of the PSO algorithm, Particle Swarm Optimization (PSO), presented improvements with respect to previous implementations. The execution time is reduced because the dimension of the problem is reduced, and different kinds of maneuvers can be selected to solve the detected conflicts: course/heading, speed or altitude changes. The PSO has been validated with simulations in scenarios with multiple FANETs in a common airspace. . Also, a comparison to a genetic algorithm and a PSO algorithm has been performed to highlight the advantages of the PSO. The main advantage was that PSO always ensures solution from the first iteration. This requirement was essential in safe cooperative missions*

Key Words: FANET,UAV,PSO,LOS

1.INTRODUCTION

Technologies, the production of unmanned aerial vehicles (UAVs) has suit possible. However, the task capability and stiffness of one large UAV is limited. With the advancement of embedded systems and decrease of micro-electromechanical systems, instead of a single large UAV, the help of multiple small UAVs is ensured. As a result of this, the creation of the systems beyond the ability of a UAV has become possible and this has proved to be very advantageous. Communication is one of the most important troubles which has been encounter when difficult to ensure the coordination of multi UAVs systems. One of the methods developed to solve the problem of contact among UAVs is Flying Ad Hoc Networks (FANET) . An ad hoc network is a distributed wireless network structure that allow communication among nodes without the want for infrastructure [1]

Before debating the characteristics of FANETs, we furnish a proper meaning of FANET and a brief discussion concerning the meaning to comprehend FANET clearly.

FANET can be described as a new form of MANET in that the nodes are FANETs. According to this meaning, solitary FANET arrangements cannot form a FANET that is valid merely for multi-FANET systems. On the supplementary hand, not all multi FANET arrangements form a FANET. The FANET contact has to be comprehended by the aid of an ad hoc web amid FANETs. Therefore, if the contact amid FANETs fully relies on FANET-to-infrastructure links, it cannot be categorized as a FANET.

In the works, FANET connected researches are learned below disparate names. For example, aerial robot team is a cooperative and self-governing multi-FANET arrangement, and usually, its web design is ad hoc. In this sense, ad hoc established aerial robot teams can additionally be believed as a FANET design. Though, aerial robot team studies generally ponder on the cooperative coordination of multi-FANET arrangements, not on the web constructions, algorithms or protocols. One more FANET connected case is aerial sensor network.

Fig1.1: A FANET scenario to extend the scalability

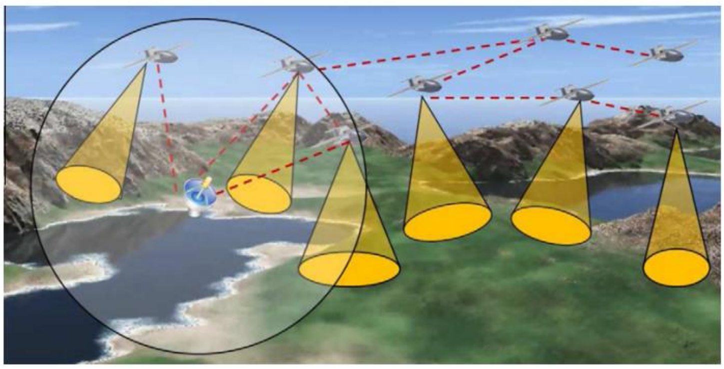
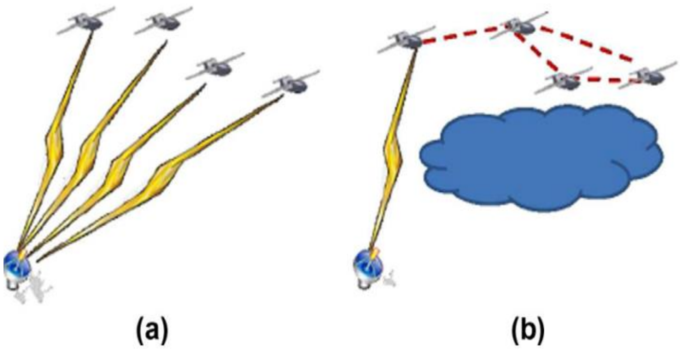


Fig1.2: A FANET application scenario for reliable multi-FANET communication



Aerial sensor web is a extremely enumerated mobile sensor and actor web so that the nodes are FANETs. It moves concerning the nature, senses alongside the sensors on the FANETs and relays the amassed data to the earth base. In supplement, it can deed alongside its actors on the FANETs to comprehend its mission. It is a understanding subject to term the setback as hovering ad hoc web or aerial sensor network. The frank design trials of a established sensor web are power consumption and node density and none of them is connected alongside multi-FANET systems. Generally, FANETs have plenty power to prop its contact hardware, and node density of a multi-FANET arrangement is extremely low after it is contrasted to established sensor networks. Below the light of these discussions, it is larger to categorize the multi-FANET contact arrangement established on FANET-to-FANET links as a enumerated ad hoc web, instead of a enumerated sensor network. FANET ad hoc web is one more case, which is closely connected to FANETs. In fact, there is no momentous difference amid the continuing FANET ad hoc web researches and the above FANET definition. Though, FANET word instantly reminds that it is a enumerated form of MANET and VANET. Therefore, we favor shouting it as Hovering Ad-Hoc Network, FANET.

III.RESEARCH METHODOLGY

Methodology is the set of principles of research that guides the researcher to decide the type of research method which would be most appropriate in solving the questions undertaken in the study, based on its core theoretical and philosophical hypothesis. It is vital for the researcher to have an in depth understanding of the research process and the philosophical aspects and assumptions which will strive towards the possible solutions. A methodology can also be described as an organization of rules and methods which assist the appropriate collection and synthesis of the relevant data. There are various methods to be used in any research. These methods are the tools which are applied within the structure of the methodology to produce the results.

Many research papers will be collected related to research work to be carried out in the dissertation. A literature survey will be carried out covering the period from 2009-2016.

The main purpose of this thesis is to analyze the different trust-based routing protocols and management schemes of FANETs and map the characteristics to UAVs, considering the modifications, to provide efficient UAV based communication in various applications and environments. Along with this a framework will be designed to have the collision free path planning. The results produced with the proposed approach will be compared with other existing approaches.

IV .Related Work

The author has described in (**Bekmezci, I. et al,2015**) one of the most important design problems for the multi unmanned aerial vehicles systems was communication between FANETs. In a multi-FANET system, the communication between FANETs is provided with all FANETs connecting directly to the ground station via satellite or infrastructure. However, infrastructure or satellite-based communication architectures restrict the capabilities of the multi-FANET systems. Infrastructure or satellite-based communication problems of multi-FANET systems can be solved with ad hoc networks among FANETs. This special ad hoc network structure was called as FANET. In this paper, a FANET test bed implementation study was presented.

The authors described in (**Hasan Tareque, M. et al, 2015**) the usage of Unmanned Aerial Vehicles (FANETs) has been increasing day by day. In recent years, FANETs are being used in increasing number of civil applications, such as policing, fire-fighting, etc in addition to military applications. Instead of using one large FANET, multiple FANETs will nowadays used for higher coverage area and accuracy. Therefore, networking models were required to allow two or more FANET nodes to communicate directly or via relay node(s). Flying Ad-Hoc Networks (FANETs) were formed which is basically an ad hoc network for FANETs. This was relatively a new technology in network family where requirements vary largely from traditional networking model, such as Mobile Ad-hoc Networks and Vehicular Ad-hoc Networks. In this paper, Flying Ad-Hoc Networks were surveyed along with its challenges compared to traditional ad hoc networks. The existing routing protocols for FANETs were then classified into six major categories which were critically analyzed and compared based on various performance criteria. Our comparative analysis will help network engineers in choosing appropriate routing protocols based on the specific scenario where the FANET will be deployed.

The authors has described in (**Singh, K. et al, 2015)** recent years the capability and role of Mobile Ad hoc Networks have rapidly evolved. Their use in emergency, natural disaster, military battle fields and FANETs was getting very popular as a result of cutting edge technologies in networking and communication. Using the concept of MANET new networking paradigms like VANET and FANET have evolved. FANET was comparably new concept of MANET and it has capabilities to tackle with situations where traditional MANET cannot do so. Due to high mobility and fast topology change in FANET, this was highly challengeable for researcher to implement routing in FANETs. Routing protocols play a dominating role in enhancing the performance of adhoc networks. In this paper, experimental analysis was carried out on AODV, DSDV and OLSR routing protocol for FANET environment using NS2 simulator.

V. Proposed Algorithm Description

Based on the above description, Firefly can solve formation reconfiguration problem. The algorithm can be divided into two stages, the PSO stage and the GA stage. The solutions can be found by the following steps:

Step 1: Initialize M nodes randomly, the max iteration time Ncmax, and the parameters in firfly. The crossover probability and mutation probability are 0.9 and 0.05 respectively.

Step 2: Calculate the objective function values of all nodes, store the position of the node with the minimum objective function value as the global best node.

Then, we can get the new objective function value of x_i and record it as f_i' . If f_i' is less than F_i , the current personal best node's objective function is f_i' , and the current personal best position is the new position. If$f_i'$is less than G_{pso} , the global best node's objective function value is f_i' and the global best position is the new position.

Step 3: GA stage. GA has three operators, namely selection, crossover, and mutation, described as follows:

1) Selection Operator

Roulette wheel selection strategy is widely used in GA because it can ensure that the selection probability of each node is proportional to its fitness, i.e. the better a node's fitness, the more likely it will be selected.

2) Crossover Operator

Crossover happens between two parents which are independently selected from the population. Children are created by the single-point crossover operation. It can be defined as follows:

$$p_1^{new} = w.Pi + (1-w).P2$$

$$p_2^{new} = w.P2 + (1-w).P1$$

where P_1 and P_2 are parent nodes, P_1^{new} and P_2^{new} are child nodes, ω is a random number such that $\omega \in [0,1]$.

3) Mutation Operator

Mutation operator can maintain node diversity and avoid premature convergence. It is executed on a node which is selected based on its fitness. We adopt the adaptive acceleration mutation operator which can be defined as follows:

$$P_i^j)k+1) = P_i^j(k) + p.sP_i^j(k),$$

Where

$$\Delta P_i^j(k) = \left(P_i^{best}(k)\right).|N(0.1)|sP_i^j(k+1) = \beta.acc^j(k).\Delta P_i^j(k) + p.sP_i^j(k).$$

$P_i^j(k)$ is the ith dimension of the *jth* node in the *kth* generation, $P^{best}(k)$ is the best individual in the kth generation. t and b are the learning speed and inertia constant respectively, and they are set as 0.6 and 0.4 based on trial experiments. N(0,1) is the normal random distribution function, and acc j (k) is defined as follows:

$$acc^j(k) = \begin{cases} 1, if\ new\ fitness\ greater\ than\ before \\ 0, else, \end{cases}$$

The position $Gbest_{ga}$ and objective function value G_{ga} of the best node that the GA can find are stored. The best objective function value is the reciprocal of the maximum fitness.

VI. Simulation and Result Analysis

After the implementation of the proposed model is done by applying various algorithms that are discussed in previous chapter the next step is to describe the results. This chapter describes what results come out and what these results or model are prepare for. Various graphs are shown along with their explanation. These graphs tell firefly based path optimization, search position, search position variance and objective position variance. This chapter further includes different scenarios of random FANET architecture of 30 to 90 nodes.

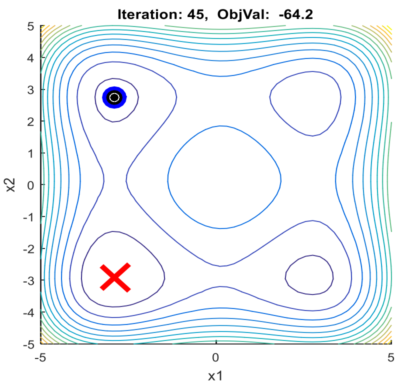


Fig 6.1 Initial position and target position

This graph shows the objective function of flying adhoc networks. Starting point is described in blue and end point s describes in red.

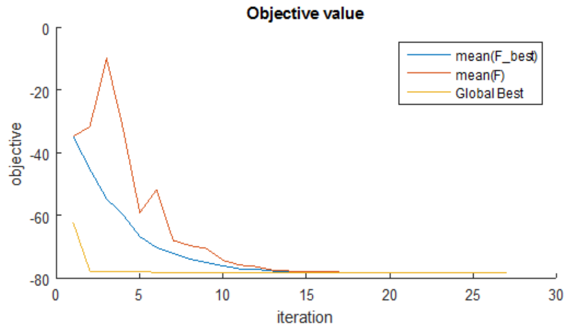


Fig 6.2 Objective value

Because we have to minimize the energy of overall system, the objective function must be decreased as number of iterations started to increase. Both mean, mean best and mean global best values decreases and iteration gets improved.

Fig 6.3 Search position

Search position indicates exact position of start. It can be seen that in less than 10 iterations, target position has been achieved.

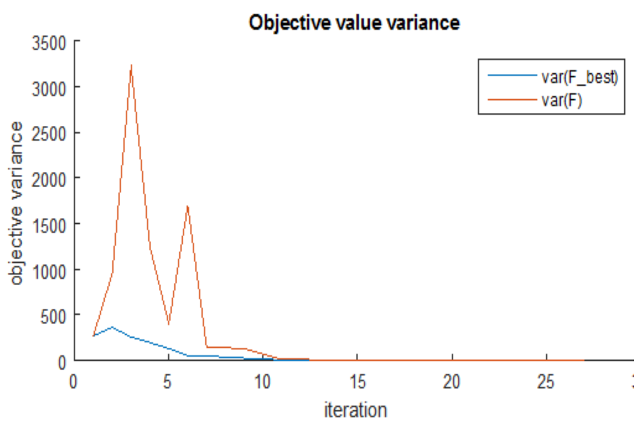


Fig 6.4 Objective Value variance

Objective variance describe change in target position.After only 10 iteration variance mimimzes.As variance increases collision get increases.

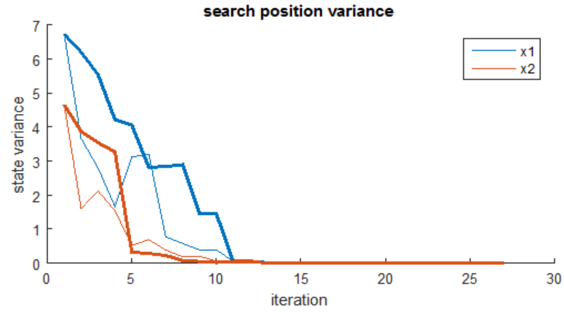


Fig 6.5 Search position variance

This graph shows search position variance which tells accuracy in search position.State variance indicates changes in state.More changes in state will result in bad affect.

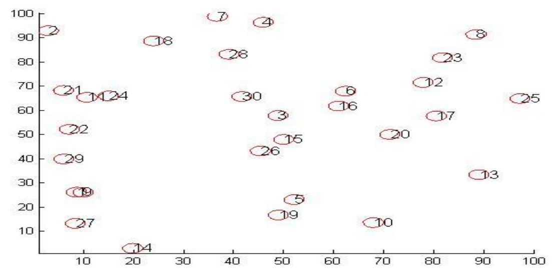


Fig 6.6 : Random FANET Network Architecture of 30 Nodes

In figure 6.6 we can see that the network is defined with 30 numbers of nodes. As we can see the nodes are numbered from 1 to 30. Blue nodes are showing source node and the destination node. All other nodes are the intermediate nodes. On this network we have first implemented the shortest path algorithm, the path obtained from the network is

1=> 29=> 24 =>28=>30

As shown in the figure 6.7

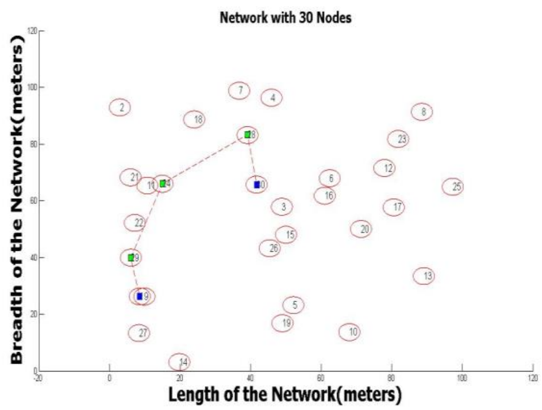


Fig 6.7 Generated Path with 30 Nodes (Existing Approach)

The Parametric Table of Existing Work is:

Table 6.1 Parametric table of existing work with 30 nodes

Parameters	Values
Distance	88.6753 (meters)
Energy Consumed	1.3150e+004 (joules)
Network Delay	3.3799e+005ms
Elapsed time	2.193787 s
Path followed	[1 29 24 28 30]

But as we know such kind of path is always the first choice of intruder. The proposed FIREFLY improved algorithm has defined an intruder safe compromising path that will not cover any node of shortest path and will return a safer path to the user.

The connectivity of the Proposed Graph is shown in figure 6.8

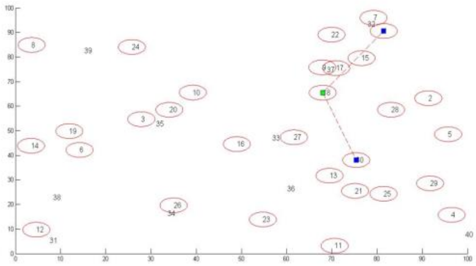


Fig 6.8 : Generated Path with 30 Nodes (Proposed Work)

The Parametric Table of Proposed work is:

Table 6.2 Parametric table of proposed work with 30 nodes

Parameters	Values
Distance	2.2678 (meters)
Energy Consumed	1.8020e+003 (joules)
Network Delay	596.9317ms
Elapsed time	0.000846 s
Path followed	[1 29 27 26 23 19 20 30]

V .Conclusion

To raise the scalability of the arrangement, there is a demand of new networking standards thoughts in multi-FANET systems. Networking of multi-FANETs is not merely desirable but additionally a critical feature to raise the efficiency of the arrangement by safeguarding connectivity of the arrangements in non-LOS, city, hostile, and/or loud environmental association systems. Because of the exceedingly mobile nodes, the networking construction ought to be crafted in ad-hoc manner, and is shouted as Hovering Ad-Hoc Web (FANET), that needs scalable, reliable, real-time and peer-to-peer mobile ad-hoc networking amid FANETs and earth stations. Networking amid FANETs is considerably disparate from established ad-hoc networking assumptions Mobile Ad-Hoc Webs (MANET) and Vehicular Ad-Hoc Webs (VANET) in words of connectivity, data transport, latency, ability and etc

REFERENCES

[1]. Bekmezci, I., Sen, I., Erkalkan, E., "Flying ad hoc networks (FANET) test bed implementation", Comput. Eng. Dept., Turkish Air Force Acad., Istanbul, Turkey, 10.1109/RAST.2015.7208426, 665-668, 2015

[2]. Hasan Tareque, M., Shohrab Hossain, M., Atiquzzaman, M., "On the routing in Flying Ad Hoc Networks", Dept. of Comput. Sci. & Eng., Bangladesh Univ. of Eng. & Technol., Dhaka, Bangladesh, 10.15439/2015F002, 1-9, 2015

[3]. Bekmezci, I., Ermis, M., Kaplan, S., "Connected multi FANET task planning for Flying Ad Hoc Networks", Comput. Eng. Dept., Turkish Air Force Acad., Istanbul, Turkey, 10.1109/BlackSeaCom.2014.6848998, 28-32, 2014

[4]. Oren, A., Temel, C., "Impact of the average network delay on the operator capacity for FANETs", Hava Trafik Kontrol Programi, Hava Astsubay Meslek Yuksek Okulu, Izmir, Turkey, 10.1109/SIU.2014.6830475, 1299-1302, 2014

[5]. Singh, K., Verma, A.K., "Experimental analysis of AODV, DSDV and OLSR routing protocol for flying adhoc networks (FANETs)", Comput. Sci. & Eng. Dept., Thapar Univ., Patiala, India, 10.1109/ICECCT.2015.7226085, 1-4, 2015

[6]. Singh, K., Verma, A.K., "Applying OLSR routing in FANETs", Comput. Sci. & Eng. Dept., Thapar Univ., Patiala, India, 10.1109/ICACCCT.2014.7019290, 1212-1215, 2014

[7]. Temel, S., Bekmezci, I., "Scalability analysis of Flying Ad Hoc Networks (FANETs): A directional antenna approach", Turkish Air Force Acad., Istanbul, Turkey, 10.1109/BlackSeaCom.2014.6849036, 185-187, 2014

[8]. Bekmezci, I., Ulku, E.E., "Location information sharing with multi token circulation in Flying Ad Hoc Networks", Comput. Eng. Dept., Turkish Air Force Acad., Istanbul, Turkey, 10.1109/RAST.2015.7208427, 669-673, 2015

[9]. Eckert, J., Eckhoft, D., German, R., "Flying Ad-Hoc Network communication for detecting thermals: Feasibility and insights", Dept. of Comput. Sci., Univ. of Erlangen (FAU), Erlangen, Germany, 10.1109/INTECH.2013.6653654, 333-338, 2013

[10]. Ulku, E.E., Bekmezci, I., "Multi token circulation for Multi-FANET systems", Bilgisayar Muhendisligi Bolumu, HUTEN, Istanbul, Turkey, 10.1109/SIU.2015.7130011, 1042-1045, 2015