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# ABCIP: Artificial Bee Colony Inspired Protocol for Routing in Flying Ad-Hoc Network

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***Abstract**: Flying Ad-hoc Network (FANET) is described as a special kind of ad-hoc network coming under the family of Mobile Ad-hoc Network (MANET). FANETs is characterized to have high range of mobility when comparing with MANET. Setting up the route and maintaining its lifetime is a tedious job in FANET, because the MANET routing protocols that already exist will never fit for FANET because of its increased level of mobility, environmental circumstances and topography structure. There arises a need for bio-inspired based routing protocol to overcome the obstacles. This paper proposes Artificial Bee Colony Inspired Protocol inspired from the bio-inspired concepts. The proposed protocol gradually reduces the level of congestion occurring at different routing path, where it considers the successful route setup and its life time to increase the data delivery. In ABCIP, bee colony is enhanced to analyze and choose the routing path instead of picking up in random. Simulation is carried out using NS2and the results indicates the proposed protocol considerably performs better than the existing protocols in maximizing the successful route setup and its life time, which minimizes the service disruption.*

***Index Terms**: Routing, Optimization, ad-hoc, artificial bee colony, UAV.*

## I. INTRODUCTION

A special kind of ad-hoc network that is emerging is Flying Ad-Hoc Network (FANET), where there exists no infrastructure for making communication. FANET is made up of multiple flying vehicles which have some facilities like camera, sensor, GPS etc. FANETs are mostly used to handle Unmanned Aerial Vehicles (UAV), where UAV flies independently and works in a remote manner without having to convey to the user. The usage of FANET provides assurance for an opportunity in the applications of military and non-military. The main use of UAV is, the country doesn't need to lose the valuable human life. One of the main reasons for introducing the FANET to the networking world is to remove the barriers in communication between flying vehicles. FANET have high mobility rate when compared with other ad-hoc networks like MANET, VANET, CRAHN, and UANET. FANETs have higher mobility rate when compared to networks. FANETs are used in the monitoring of (a) traffic (b) identifying the target (c) disaster (d) wildfire control (e) search and rescue (f) surveillance of the country border.

UAV started evolving and covered as a major interest among the researchers due to numerous advantages, where some of them are:

- ✓ **Expense:** The Cost of purchasing and maintaining mini UAV is too low, when comparing with large UAV [7].
- ✓ **Scalability:** Using of large UAV covers only the specific amount of area, but mini UAV can expand the scalability of the operation in an effortless manner [3].
- ✓ **Survivability:** Due to some conditions, if UAV gets failed when it is operated by another UAV, the mission can't continue. But, if the same condition goes in the multi-UAV framework, then it's not necessary to worry about it because the action can continue with the help of other UAVs.
- ✓ **Accelerate:** It is demonstrated that the assigned work can be finished quicker with the increased count of UAVs [4].
- ✓ **Mini Radar Cross Section:** Multi-UAV frameworks can deliver multiple cross sections of the radar, which is necessary for the applications of the military [12].

### A. VANET Vs MANET Vs FANET

FANETs include distinctive kinds of sensors, where every sensor may require diverse information conveyance methodologies. FANET emerges from the family of MANET and VANET. The FANET has some unique character which differentiates it from other ad-hoc networks [8]:

**Table 1: Different Between Ad-hoc Networks**

| Character | VANET | MANET | FANET |
|---|---|---|---|
| Mobility Level | Medium | Low | High |
| Topology Change | Average Speed | Slow and Steady | Rapid and Speedy |
| Node Distance | Longer | Low | Much Longer |
| Power Consumption | Average | Low | Very High |
| Propagation of Radio Wave | Near to Ground Level | Very Near to Ground Level | Very high to Ground Level |

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| | | | |
|---|---|---|---|
| Node Density | Medium Thickness | Low Thickness | Low Thickness |

### B. *Application Scenarios of FANET*

FANETs are employed in multiple applications where it get increased continuously.

This section discusses about application scenarios of FANET [2]:

- ✓ **Searching and Rescuing Operation:** UAVs plays an important role of looking and sensing the target (mostly in the ground).
- ✓ **Forest Fire Detection**: The applications of forest fire detection will cover the forest area by monitoring the temperature and fire risk, which is necessary for the prevention of forest fire disaster.
- ✓ **Traffic Monitoring:** Monitoring of traffic in the roadway is a hidden application, where UAV in FANET can take over the job of labor and dependency of infrastructure. In a very easy manner UAV can detect and report the crashes about the traffic in road networks and train networks.
- ✓ **Urban Monitoring:** Military assets perform the monitoring of urban areas, moving in the circumstance of army operations in the terrain of urban.
- ✓ **Surveillance Tasks:** UAVs are used in patrolling purpose in a known area for the intention of observing, inspecting, or securing.
- ✓ **Agricultural Management**: Production Management of Agriculture needs monitoring of crops by getting inside the circumstance of precision based agriculture, where it holds the methods and strategies of using new technology to perform the study of agriculture.
- ✓ **Sensing of Environment:** UAVs are by default sensor enabled, which can be used in the monitoring of heat, moisture, wind pressure, strength of light, and level of pollution can be analyzed.
- ✓ **Relaying Network:** For efficient and secure transmit information collected from other nodes, UAVs are used as an airborne communicator. UAVs are used to increase the communication range.

### C. *Routing Protocols*

Routing is a step by step procedure of making data packet to get move from source to destination with the use of neighbor or intermediate nodes. One of the important challenges faced in FANET is routing, which is more significant and challenging. Multiple proposals were done to answer the issues, but still it is not solved. Many researches still focus to design a better mechanism for routing. The three kinds of protocols available for routing are: (i) proactive routing protocol, (ii) reactive routing protocol, and (iii) hybrid routing protocol.

- ✓ **Proactive Routing:** Establish route path from source to destination before starting the communication. In addition, the information regarding the routes are updated periodically in the table of routing. This method will help in preserving the identified path. When there exist a increase in the need for communication, then the node will immediately start to informing immediately like path found as earlier.
- ✓ **Reactive Routing Protocol:** It establishes the routing when there exist a demand for communication between source and destination. Nodes are not necessary to establish the route till the need gets demand. The details regarding the dynamic routes are just kept up.
- ✓ **Hybrid Routing Protocol:** The concepts utilized in proactive and reactive protocols are inherited to satisfy the need based on the situation that arise. Hybrid routing protocols can intended to perform like proactive and reactive at various situations in large scale network.

The main intention of this research paper is: (i) to develop a reactive routing protocol by inheriting the bio-inspired concepts for FANET in order to decrease the delay, (ii) to decrease the level of congestion level to increase the throughput and ratio of packet delivery, (iii) to perform the simulation with NS2 using the benchmark performance metrics. Organization of paper will be as follows: Section 1 has discussed about FANET introduction, comparison of FANET with other ad-hoc networks, Application Scenarios of FANET and Routing Protocols, statement of problem, and the objectives. Section 2 discusses the related works as the literature review. Section 3 proposes the protocol ABCIP. Section 4 demonstrates the performance metrics that are chosen to evaluation and the settings used in NS2 simulator. Section 5 shows the outcome of the proposed work. Conclusion with future dimension is discussed with Section 6.

## II. LITERATURE REVIEW

Multi-Clustering [21] concept was proposed for FANET environment that have efficient management for network, where it minimizes the cost involved for communication and performance of the protocol are optimized for inter-cluster and intra-cluster communication. Mutual Coordinating system [20] routing protocol in FANET was proposed to handle transmission where it resolved the issues that are related to the formation of topology as routing between nodes of 2 different networks. Link Stability Protocol [23] was proposed by targeting FANET on the basis of AODV by taking the advantages of location based information. [17] discussed the different routing methods FANET and reviewed the intelligent based routing methodology in MANET which was based on ant colony algorithm. Analysis [10] was made on AODV cum DSDV and OLSR routing protocols for FANET environment using network simulator version 2.

Bee algorithm [18] described for the routing process based on the algorithms in ad-hoc networks, where FANET routing methods and overview of bee colony algorithms was provided. [5] combined Omni-directional and scheme for directional transmission which has dynamic adjustment in nature. [9]

discussed the routing protocols of unmanned vehicle for the further development. [13] Provided an overview of FANET with its issues compared with common ad-hoc networks and routing protocols available for FANETs were segregated into different categories. [22] Collected the review about existing protocol of FANET, and provided the main challenges of FANET routing protocol design. Reputation Energy Monitoring Method [1] was proposed to establish trust among different peers, where it distributes the monitoring of network with the trustiness between the neighbors. [19] gave an overview about the algorithms that already exist in FANET, and the algorithms that were based swarm intelligence. [15] proposed Media Access Control Protocol namely that includes the use of directional antennas and estimation of location of neighboring nodes. [16] proposed a decentralized cloud computing approach, where the cloud receive more data form sensor and its base station. [14] surveyed the routing protocols of FANET based on UAV positions. [6] proposed a directional scheme by utilizing the concept of unicast and geocast routing, further it uses the information of node position.

## III. ARTIFICIAL BEE COLONY INSPIRED PROTOCOL (ABCIP)

Practices that are inspired by the biological system can easily perform tedious job assignments by relying on efforts of mutual's in the team. The thing that is noted in the biological system is the law. Laws that are maintained in the biological system will be (i) simple, (ii) limited, and (iii) unspecific with no outer controlling elements. There exist multiple bio-inspired protocols to handle issues in different networks, where the Artificial Bee Colony Inspired Protocol (ABCIP) is one of them. The objective of ABCIP is to find the best routing path for UAV to reduce the utilization of energy and increase the packet delivery ratio. The ABC [11] algorithm is pertaining to be a developmental algorithm was introduced. ABC algorithm comprises of three kinds of bees which would commit and accomplish the various tasks by willingly as well as agreeably with cooperation, which are,

- ✓ **Employed bees:** It develops a fresh food source by interchanging the information with its acquaintance (i.e., the neighbors). If the fresh food source found is excel than the existing one, and then it is replaced by a fresh food source.
- ✓ **Onlooker bees:** It selects a single food source from the available food sources based on quality shared by the bees that employed. Finally, these onlooker bees will attempt to enhance the quality of that selected food source.
- ✓ **Scout bees:** It seeks for the indigent food source with the condition of (i) zero level optimization done in a specified number of cycles, (ii) resetting it to optimization.

### A. *Initialization*

The problem that exists in the decision space is multi-dimensional. To overcome the multi-dimensional problem it's necessary to develop the food sources based on the equivalent search space in initialization phase. Every fresh food source is developed (or initialized) though the following equation

$$\sum x_{id}^{n} = lb_d + rand(0,1,food\ source\ count).(ub_d - lb_d) \quad (1)$$

where i denotes the ratio of food source with the bounding values 1,2,…developed-food-source-count, d denotes the dimension ratio of developed very food source with the range of d=1,2,…T, rand(0,1,food source count) denotes the distributed random number uniformly over the interval (0,1,food source count), $ub_d$ indicates the max bound value of d, $lb_d$ indicates the min bound value of d. Final task of the initialization phase is to authorize the food source according to the bounding values. The food sources that are not optimized after a specified number of cycles are terminated, as a next step the employed bee allocate the task to scout bee to search and find the new food source.

### B. *Employed Bee*

Employed bee analyzes every food source based on Eq.(1) and develops a new food source temporarily in its nearby location. ABCIP utilizes a neighbor employed bee to calculate a new position for identifying a next food source; it can be equated as,

$$\sum v_{id}^{n} = x_{id}^{n} + \min_{id} \eta_{id} \sum_{i=0}^{n} (x_{id}^{n} - x_{kd}^{n}) \quad (2)$$

Where k denotes the dimension selected in a random manner, $\eta_{id}$ denotes the neighbor's value selected randomly between [-1,1]. ABCIP gets developed quietly with the utilization of neighbor employed bee. Once the fresh food source is enhanced, it is scrutinized for the value of its fitness. Suppose the fitness value is good, the existing source of provision is substituted with new source of provision, besides the existing food source is maintained and it incremented. Pareto analysis is carried out to estimate the fitness value.

### C. *Onlooker Bee*

Optimizing the food source is carried out by employed bees and it will share with onlooker bees after visiting the hive. Currently, onlooker bee visit the food sources based on the value of fitness recommended by the bee that is employed. In short, onlooker bee visits the food source with the maximum value of fitness which denotes the best source for food.

In traditional ABC algorithm, the bee of onlooker phase will look the fitness value in sorting manner, that is either in ascending manner or descending manner, and it will visit the food source accordingly.

$$Fitness = \sum_{a>0}\left(\frac{Z^{-a}}{1^{-a}+2^{-a}+\ \dots+Z^{-a}+\ \dots+t^{-a}}\right) \quad (3)$$

Where $a$ denotes the parameter which can be adjusted with the value greater than 1, Z denotes the best fitness value, t denotes the worst fitness value.

### D. *Scout Bee*

The food sources that are not optimized in a specified number of cycles are terminated, i.e., scout bee will allocated a job of searching for the indigent food sources based on (i) zero level optimization done in a specified number of cycles, (ii) resetting it to optimization.

### E. *Archive Maintenance*

In ABCIP, information regarding to the preference are never used, because ABCIP considers the undetermined new value will be best when comparing with existing value which are given the preference. So the archive is maintained and increased only by utilizing the undetermined new value. There may be ups and downs in that, but ABCIP hopes to get the best value to maintain and increase archive size.

### F. *Termination*

If the condition for the termination is met, the ABCIP process stops, else the ABCIP gets back to initialization phase and gets continue. Here the termination condition denotes the best routing path to send the data from source to destination in FANET.

Pseudo code of the proposed ABCIP is as follows

**Step 1. Initialize all the phases**
**Step 2. REPEAT**

- **Phase 1 (i.e., Employed-Bees)**
- **Phase 2 (i.e., Onlooker Bees)**
- **Phase 3 (i.e., Scout Bees)**
- **Save the solution achieved by the comparison**
- **Select the solution that has best value**

**Step 3. CONTINUE till the iteration cycle reaches maximum value**

## IV. PERFORMANCE METRICS

The success rate of route setup, average lifetime of the path, ratio of data delivery, time taken for service disruption, count of hops are the performance metrics selected to measure the performance of ABCIP against RARP [5].

- ✓ **Route Setup Success Rate:** It denotes the success rate of route established from source to destination.
- ✓ **Average Path Lifetime:** It denotes the average lifetime of the path that is valid to send the data packet from source node to destination node.
- ✓ **Count of Hop:** It denotes the number of intermediate devices through which data passed to destination from source.
- ✓ **Ratio of data delivery:** It denotes the proportion of data packet received successfully by destination node and the total data packets sent by source node.
- ✓ **Service Disruption Time:** It denotes the service break leading to error resulting to de-synchronization.

## V. SIMULATION MODEL

### A. *Figures and Tables*

In this section, investigation is made on the performance modeling of ABCIP gets processed with success rate of route setup, average lifetime of the path, Ratio of data delivery, time taken for service disruption, and count of hops. This research work use C++ for the simulation in NS2. The parameters utilized for the simulation environment are shown in Table 2. In the simulation space, this research work assumes different flying nodes at various geographic locations. To obtain the probability of failure at single node, values of risks are calculated in the range which lies between 0 and 1. The mobility model utilized is random way point. It is used to receive the movement of nodes that mimic the flying UAV movements. The term keep time is used to denote the time period which is taken by the node to reach a destination at a certain speed.

**Table 2: Simulation Settings and Parameters**

| Parameters | Value |
|---|---|
| Simulation Time | 100 sec |
| Simulation Space | 5 x 5 x 2 $km^2$ |
| Transmission Power | 1000mW |
| Minimum decodable power | -70dBm |
| Pathloss exponent | 2 |
| Frequency | 2.4GHz |
| Unit Time | 10 msec |
| Data Transmission Rate | 10-200 |
| Keep Time | 5-50ec |

## VI. RESULTS AND DISCUSSION

### A. *Route Setup Success Rate*

In Figure 3, Numbers of nodes ranging from 0 to 200 are plotted in x-axis, and the y-axis is plotted with success rate of route setup. Figure 3 shows the success rate of route setup against the parameter number of nodes.

It is easily seen that success rate increases with an increase in the number of nodes for ABCIP and RARP, because more nodes usually increases the probability of the existence of several intermediate nodes between source and destination.

However, the route setup success rate is always higher for the ABCIP compared to the RARP irrespective of the number of nodes. It is clearly evident that the proposed routing protocol ABCIP attains better performance than RARP. The graph clearly says that the protocols ABCIP and RARP are having the higher success rate in route setup when the number of nodes gets increased.

The corresponding value of Figure 3 is shown in Table 3.

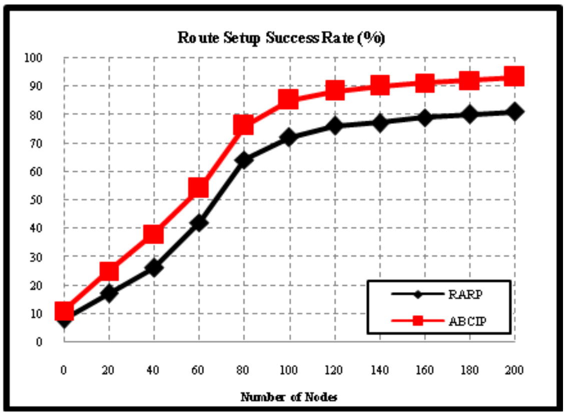



**Figure 3: Number of Nodes Vs Route Setup Success Rate**

**Table 3: Number of Nodes Vs Route Setup Success Rate**

| Number of Nodes | RARP | ABCIP |
|---|---|---|
| **0** | **08** | **11** |
| **20** | **17** | **25** |
| **40** | **26** | **38** |
| **60** | **42** | **54** |
| **80** | **64** | **76** |
| **100** | **72** | **85** |
| **120** | **76** | **88** |
| **140** | **77** | **90** |
| **160** | **79** | **91** |
| **180** | **80** | **92** |
| **200** | **81** | **93** |

In Figure 4, Speed 0 to 350 km/h is plotted in x-axis, and y-axis is plotted with success rate of route setup. Figure 4 indicates the success rate of route setup against the parameter, speed. It is observed that ABCIP's success rate remains unaffected even the speed is increased whereas the RARP value gets minimized a lot with linear increase in the speed. The corresponding value of Figure 4 is shown in Table 4.

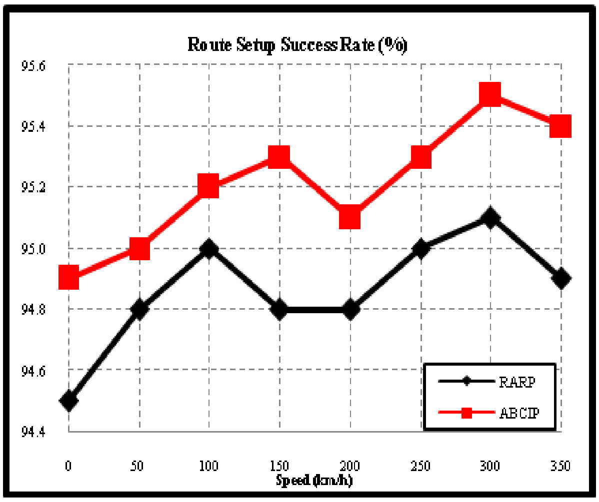



**Figure 4: Speed Vs Route Setup Success Rate**

**Table 4: Speed Vs Route Setup Success Rate**

| Speed (km/h) | RARP | ABCIP |
|---|---|---|
| 0 | 94.5 | 94.9 |
| 50 | 94.8 | 95 |
| 100 | 95 | 95.2 |
| 150 | 94.8 | 95.3 |
| 200 | 94.8 | 95.1 |
| 250 | 95 | 95.3 |
| 300 | 95.1 | 95.5 |
| 350 | 94.9 | 95.4 |

### B. *Average path lifetime*

In Figure 5, Numbers of Nodes ranging from 0 to 200 are plotted in x-axis, and the y-axis is plotted with average path life time. Figure 5, examines the lifetime of average path found by ABCIP and RARP. Thing to be noted is, low number of nodes ends with minimum life time, but the lifetime of the path is independent of node count. When the number of nodes is few, path lifetime is quite high. Average path lifetime decreases with increase in speed, but ABCIP is quite high when compared to RARP. Moreover, the parameters set in the mobility model may differ based on the size and nature of the flying UAV. The corresponding value of Figure 5 is shown in Table 5.

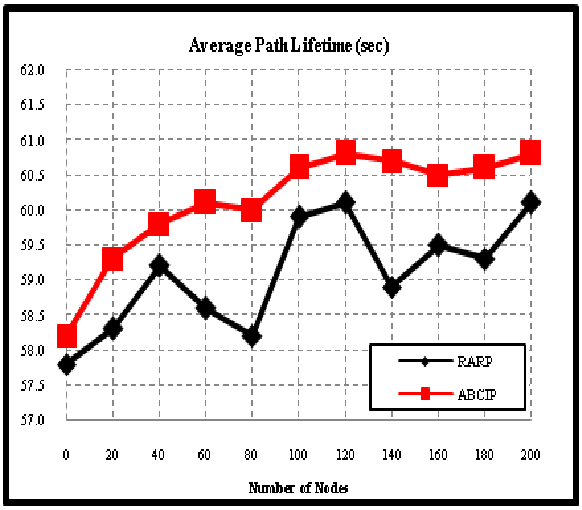
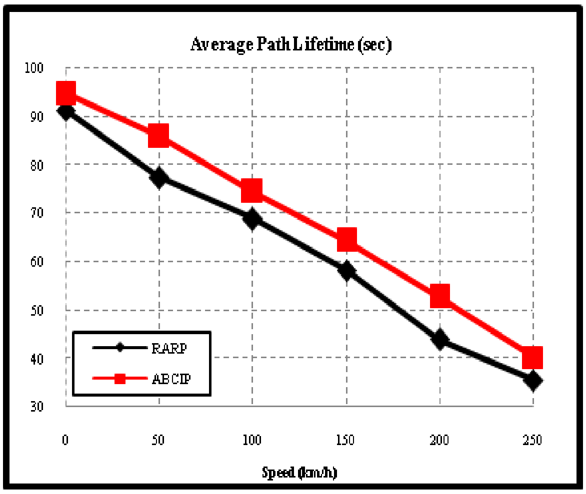



**Figure 5: Number of Nodes Vs Average Path Lifetime**

**Table 5: Number of Nodes Vs Average Path Lifetime**

| Number of Nodes | RARP | ABCIP |
|---|---|---|
| 0 | 57.8 | 58.2 |
| 20 | 58.3 | 59.3 |
| 40 | 59.2 | 59.8 |
| 60 | 58.6 | 60.1 |
| 80 | 58.2 | 60 |
| 100 | 59.9 | 60.6 |
| 120 | 60.1 | 60.8 |
| 140 | 58.9 | 60.7 |
| 160 | 59.5 | 60.5 |
| 180 | 59.3 | 60.6 |
| 200 | 60.1 | 60.8 |

**Figure 6: Speed Vs Average Path Lifetime**




In Figure 6, Speed 0 to 250 km/h is plotted in the x-axis, where the y-axis is plotted with average path life time. Figure 6 shows the average path life time against the parameter, speed. It is observed that the path life time of ABCIP is not affected like RARP when speed gets increased, but RARP gets degrade a lot with an increase in speed. The performance gap between the ABCIP and RARP remains quite high. Moreover, the parameters that are set for the mobility model may gets differed based on the size of FANET. The corresponding value of Figure 6 is shown in Table 6.

**Table 6: Speed Vs Average Path Lifetime**

| Speed (km/h) | RARP | ABCIP |
|---|---|---|
| 0 | 91.2 | 94.6 |
| 50 | 77.3 | 85.8 |
| 100 | 68.8 | 74.3 |
| 150 | 58.2 | 64.3 |
| 200 | 43.9 | 52.6 |
| 250 | 35.5 | 40.3 |

### C. *Hop Count*

In Figure 7, Numbers of Nodes varying from 0 to 200 are plotted in the x-axis, where the y-axis is plotted with hop count. Figure 7 shows the hop count against the parameter, number of nodes. Figure. 7 illustrate a comparison of hop counts between the ABCIP and RARP. It is seen that hop count increases until the number of node reaches 60 and remains identical for both schemes. When the number of node goes beyond 60, hop count decreases for RARP, whereas it tends to approximately saturate under ABCIP. It was found that under the given simulation parameters, not all nodes can be fully connected until the number of nodes reach around 60. Therefore, hop count increase in a similar fashion for both schemes until the number of node reached 60. But, in the ABCIP, risk and connection time are also considered, besides the number of hops, so it is found an insignificant increment in hop count. Moreover, the parameters set in the mobility model may differ based on the size and nature of the flying UAV. The corresponding value of Figure 7 is shown in Table 7.

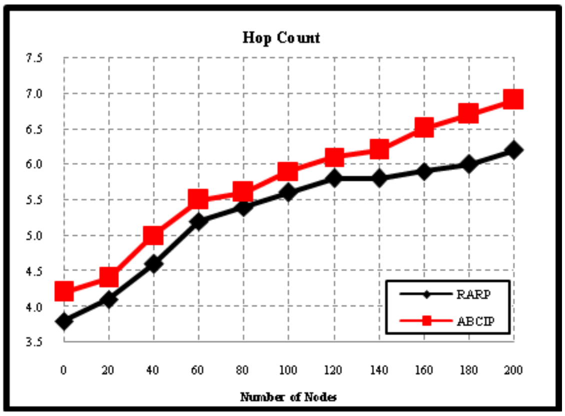



**Figure 7: Number of Nodes Vs Hop Count**

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**Table 7: Number of Nodes Vs Hop Count**

| Number of Nodes | RARP | ABCIP |
|---|---|---|
| 0 | 3.8 | 4.2 |
| 20 | 4.1 | 4.4 |
| 40 | 4.6 | 5.0 |
| 60 | 5.2 | 5.5 |
| 80 | 5.4 | 5.6 |
| 100 | 5.6 | 5.9 |
| 120 | 5.8 | 6.1 |
| 140 | 5.8 | 6.2 |
| 160 | 5.9 | 6.5 |
| 180 | 6.0 | 6.7 |
| 200 | 6.2 | 6.9 |

### D. *Successful Data Transmission Rate*

In Figure 8, Intervals of data transmission varying from 0 to 200 are plotted in the x-axis, where the y-axis is plotted with success rate of data transmission. Figure 8 shows the successful data transmission rate against the parameter, data transmission interval. The interval taken for transmission of data indicates the regular time interval by which the source sends data. It is clear to note that the success rate of data transmission gets decreased when the transmission interval gets increased. The success rate of data transmission rate gets decreased in ABCIP, but the rate of degradation is minimum. At data transmission interval of 200msec, the rate of success transmission of ABCIP is 90.6% while it is merely 86.2% for RARP. The corresponding value of Figure 8 is shown in Table 8.

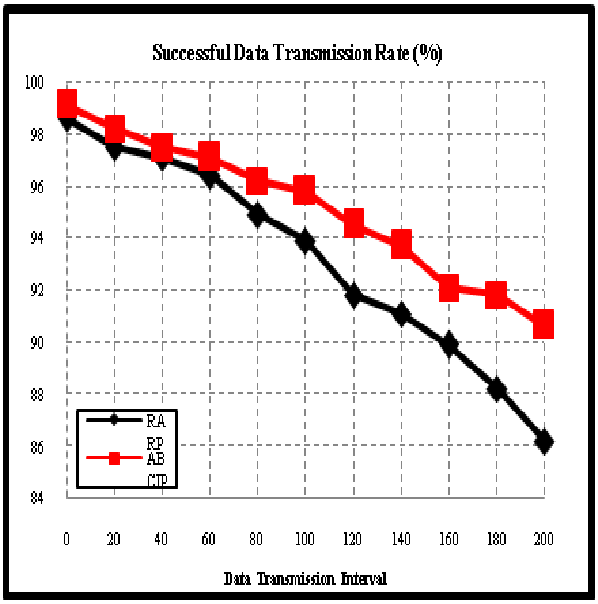


**Figure 8: Data Transmission Vs Transmission Rate**

**Table 8: Data Transmission Vs Transmission Rate**

| Data Transmission Interval | RARP | ABCIP |
|---|---|---|
| 0 | 98.6 | 99.1 |
| 20 | 97.5 | 98.2 |
| 40 | 97.1 | 97.5 |
| 60 | 96.4 | 97.1 |
| 80 | 94.9 | 96.2 |
| 100 | 93.9 | 95.8 |
| 120 | 91.8 | 94.5 |
| 140 | 91.1 | 93.7 |
| 160 | 89.9 | 92.1 |
| 180 | 88.2 | 91.8 |
| 200 | 86.2 | 90.6 |

### E. *Service Disruption Time*

In Figure 9, keep time varying from 5 to 50 seconds are plotted in the x-axis, where the y-axis is plotted with service disruption time. Figure 9 shows the service disruption time against the parameter, keep time. Keep time denotes the time period of flying node in one direction. In figure. 9, service disruption time versus keep time is shown for the ABCIP and RARP having and not having the alternative path setup feature. It is seen clearly that service disruption time for the ABCIP is lower than RARP, when considering alternate path setup. Thus, it is ensuring that the setup feature tends to enhance the reliability of ABCIP. However, the metrics set by the mobility model gets changed based on network size of FANET. The corresponding value of Figure 9 is shown in Table 9.

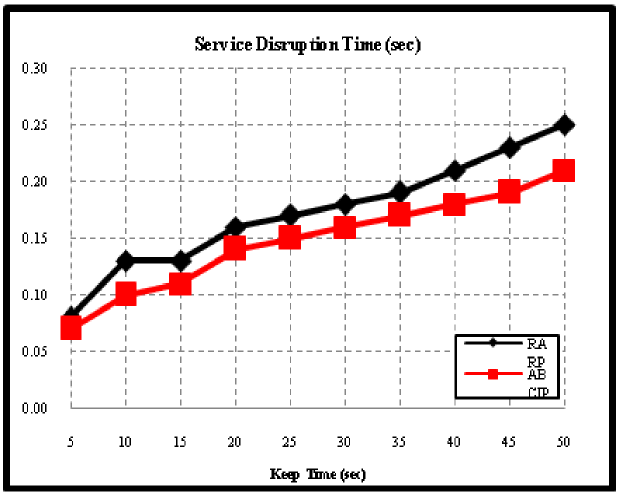


**Figure 9: Keep Time Vs Service Disruption Rate**

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**Table 9: Keep Time Vs Service Disruption Rate**

| Keep Time (secs) | RARP | ABCIP |
|---|---|---|
| 5 | 0.08 | 0.07 |
| 10 | 0.13 | 0.1 |
| 15 | 0.13 | 0.11 |
| 20 | 0.16 | 0.14 |
| 25 | 0.17 | 0.15 |
| 30 | 0.18 | 0.16 |
| 35 | 0.19 | 0.17 |
| 40 | 0.21 | 0.18 |
| 45 | 0.23 | 0.19 |
| 50 | 0.25 | 0.21 |

## VII. CONCLUSION

Maximizing the successful route setup and its life time is the primary objective of research in FANET. In this paper a new reactive multicast routing protocol namely ABCIP is proposed, which progressively reduces the congestion level on various routing path by considering the successful route setup and its life time to increase the data delivery. ABCIP is designed to analyze and choose the routing path instead of picking up in random. This research has used benchmark performance metrics to measure the performance of ABC. The outcome of Monte Carlo simulation visualize that the ABCIP outperforms better than other baseline scheme. Future dimensions of this research work can be aimed with the target of proposing new bio-inspired routing protocols with effect of reducing the Service Disruption Time even more.

## REFERENCES


1. A. Kerrache, E. Barka, N. Lagraa, A. Lakas, "Reputation-Aware Energy-Efficient Solution for FANET monitoring", 2017 10th IFIP Wireless and Mobile Networking Conf (WMNC), Valencia, 2017, pp. 1-6.
2. A. Bujari, C. T. Calafate, J. C. Cano, P. Manzoni, C. E. Palazzi, D. Ronzani, "Flying Ad-hoc Network Application Scenarios and Mobility Models", Int Journal of Distributed Sensor Networks Vol. 13(10), 2017, pp. 1-17.
3. B. S. Morse, C. H. Engh, M. A. Goodrich, "UAV Video Coverage Quality Maps and Prioritized Indexing for Wilderness Search and Rescue", ACM/IEEE Int Conf on Human–Robot Interaction, HRI '10, Piscataway, NJ, USA, 2010, pp. 227–234.
4. E. Yanmaz, C. Costanzo, C. Bettstetter, W. Elmenreich, "A Discrete Stochastic Process for Coverage Analysis of Autonomous UAV Networks", 2010 IEEE Globecom Workshops, Miami, FL, 2010, pp. 1777-1782.
5. G. Gankhuyag, A. P. Shrestha, S. J. Yoo, "Robust and Reliable Predictive Routing Strategy for Flying Ad-Hoc Networks", IEEE Access, Vol. 5, 2017, pp. 643-654.
6. G. Gankhuyag, A. P. Shrestha, S. Yoo, "A novel directional routing scheme for flying ad-hoc networks," 2016 Int Conf on Information and Communication Technology Convergence (ICTC), Jeju, 2016, pp. 593-597.
7. H. Chao, Y. Cao, Y. Chen, "Autopilots for Small Fixed-Wing Unmanned Air Vehicles: A Survey", Int Conf on Mechatronics and Automation, 2007, pp. 3144–3149.
8. I. Bekmezci, O. K. Sahingoz, S. Temel, "Flying Ad-Hoc Networks (FANETs): A Survey", Ad Hoc Networks, Vol. 11, Issue 3, 2013, pp 1254-1270.
9. J. Clapper, J. Young, J. Cartwright, J. Grimes, "Unmanned Systems Roadmap 2007–2032", Tech. rep., Dept. of Defense, 2007, pp. 43-54.
10. K. Singh, A. K. Verma, "Experimental Analysis of AODV, DSDV and OLSR Routing Protocol For Flying Ad-hoc Networks (FANETs)", 2015 IEEE Int Conf on Electrical, Computer and Communication Technologies (ICECCT), Coimbatore, 2015, pp. 1-4.
11. D. Karaboga, "An Idea based on Honey Bee Swarm for Numerical Optimization", Technical Report - TR06, Erciyes University, Engineering Faculty, Computer Engineering Department, Vol. 200, 2005, pp. 1-10.
12. L. To, A. Bati, D. Hilliard, "Radar Cross-Section Measurements of Small Unmanned Air Vehicle Systems in Non-Cooperative Field Environments", 3rd European Conf on Antennas and Propagation, 2009, pp. 3637–3641.
13. M. H. Tareque, M. S. Hossain, M. Atiquzzaman, "On the Routing in Flying Ad Hoc Networks", 2015 Federated Conf on Computer Science and Information Systems, Lodz, 2015, 2015, pp. 1-9.
14. O. S. Oubbati, A. Lakas, F. Zhou, M. Gunes, M. B. Yagoubi, "A survey on Position-Based Routing Protocols for Flying Ad hoc Networks (FANETs)", Vehicular Communications, Vol. 10, 2017, pp. 29-56.
15. S. Temel, I. Bekmezci, "LODMAC: Location Oriented Directional MAC protocol for FANETs", Computer Networks, Vol. 83, 2015, pp. 76-84.
16. Savita, P. Sharma , S.K.Tiwari, "Cloud based Decentralized Approach for FANET", 2016 Int Conf on Signal Processing, Communication, Power and Embedded System, Paralakhemundi, 2016, pp. 2017-2020.
17. V. A. Maistrenko, L. V. Alexey, V.A. Danil, "Experimental Estimate of Using the Ant Colony Optimization Algorithm to Solve The Routing Problem In FANET", 2016 Int Siberian Conf on Control and Communications, Moscow, 2016, pp. 1-10.
18. V. Leonov, "Application of Bee Colony Algorithm for FANET Routing", 2016 17th Int Conf of Young Specialists on Micro/Nanotechnologies and Electron Devices, Erlagol, 2016, pp. 124-132.
19. V. Leonov, "Modeling Of Bio-Inspired Algorithms AntHocNet and BeeAdHoc for Flying Ad Hoc Networks (FANETs)", 2016 13th Int Scientific-Technical Conf on Actual Problems of Electronics Instrument Engineering, Novosibirsk, 2016, pp. 90-99.
20. V. Sharma, R. Kumar, N. Kumar, "DPTR: Distributed Priority Tree-Based Routing Protocol for FANETs", Computer Communications, Vol. 122, 2018, pp 129-151.
21. W. Zafar, B. M. Khan, "A Reliable, Delay Bounded and Less Complex Communication Protocol For Multicluster FANETs", Digital Communications and Networks, Vol. 3, Issue 1, 2017, pp. 30-38.
22. X.Fan, W.Cai, J.Lin, "A Survey of Routing Protocols for Highly Dynamic Mobile Ad-hoc Networks", 2017 IEEE 17th Int Conf on Communication Technology, Chengdu, 2017, pp. 1412-1417.
23. X. Li, J. Yan, "LEPR: Link Stability Estimation-based Preemptive Routing protocol for Flying Ad Hoc Networks", 2017 IEEE Symposium on Computers and Communications (ISCC), Heraklion, 2017, pp. 1079-1084


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