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AN MAIMS ALGORITHM FOR HANDOFF TACTIC IN HETEROGENEOUS WIRELESS NETWORK

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ABSTRACT

Wireless communication of users between the heterogeneous networks with multiple access interface services lead to the emergence of most undesirable problem of hand off occurrence. This undesirability in heterogeneous network has its root cause in decision phase, which should be equipped with précised, less latency, congestion free arrangement to mold an eligible network communication. Making this as expectation, Mash-up Analytical Index Multiplicative Sensing (MAIMS) algorithm is framed which makes précised analytical index based parameter selection followed by elimination of uncertainty due to large parameter selection by the actual use of qualitative and consistent unit vector direction, following reduces the latency by the multiplicative process of optimized ranking. The system has then suffered from the congestion, which shatters apt resource utilization making the ranking invaluable due to the off-limit network range. This is thrown away by a threshold-based adjustment in carrier sensing range of this framework. The system had shown improved performance on qualitative network criteria.

Keywords: *MAIMS, F-ANP, VEPSO, Luus-Jaakola, MEW.*

1. INTRODUCTION

In current Scenario mobile stations (MS) are armed with numerous interfaces and can entrée an extensive variety of applications provided by multiple wireless networks in an Always Best Connected(ABC) approach [1]. To contact the communication services whenever, any place with best Quality of Service (QoS) at most reduced cost heterogeneous wireless communication framework is a finest arrangement [2]. Various wireless systems, for example, Bluetooth, Wi-Fi, Wi-Max, GPRS and CDMA have been produced [3]. Each system has been urbanized for specific reason with various highlights like coverage area, mobility support, QOS parameters, price, traffic compose, high information rate, client experience, and so on[4][5]. in any case, Heterogeneous Wireless Systems has distinctive access advancements, covering and coverage, and system engineering, conventions for transport, steering and mobility administration, likewise divergent administrator offers diverse administration demands from mobile clients like voice, video, interactive media, content etc.[6][7]. Handoff process happens when a mobile network from one network getting to other mobile network in another network [8][9]. There are two procedures in handoff event which are HHO and VHO [10]. Both HHO and VHO forms consist of three stages: handover prerequisite estimation, target network selection and handover execution contrasted [11] [12]. The process in vertical handoff are (1) handoff initiation (2) handoff decision (3) handoff execution [13].Channel handover between two distinct systems has been finished by vertical handoff [14]. Amid handover there is a need to choose and pick the best system as specified previously. So the Vertical Handoff Decision Making is an imperative research issue [15].

The best solution for handle the issue concerning selection of access systems is to define set of parameters of intrigue and devise a cost work utilizing Multiple Attribute Decision Making (MADM) Algorithm [16]. MADM techniques are widely utilized for taking care of multi-criteria decision problems including the system selection problem [17]. Handoff Decision is very crucial process because it will be helpful in determining when and where to perform handoff and to select the best network in the Heterogeneous environment without any degradation in the performance which in turn has three brief sections which are given by (a) parameter selection (b) parameter decision (c) parameter aggregation.

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Wireless networks accessing technologies are in vast growth. Owing to this organization of different networks technologies such as 3G (UMTS, IEEE 802.11), 4G (LTE, IEEE 802.16) and 5G, the users gets a great opportunity to be connected to those technologies at anytime and anywhere. The vital accessing of technologies tends to be so quick and easier because of introducing the smart mobile terminal multi accessing modes such as mobile phones, smart-phones, IPAD, etc. The above mentioned modes have enabled users also to handle simultaneously various applications by using different access networks. Although most technologies can be accessed by heterogeneous wireless networks, there exists most vigorous issue. The issue is owing to enabling the users to continuously choose the most appropriate access network during their communication. Similarly, there exist a handoff while a mobile node from one network accessing other mobile node in another network. Also there may arise the mismatch in accessing network which is denoted as Ping-Pong effect. In addition to that during resource allocation there exists shrinkage of network coverage more frequently which readily leads to inaccuracy.

Handoff problem and erroneousness are most undesirable event in a wireless network system. It has to be tackled for better servicing for users and similarly exactitude of the system have to be improved. MADM algorithm is less effective for dealing with data with uncertainty and always not consistent and also lags in time taken for moving to the destination node during weighing process of user criteria. After weighing process ranking is done for correct accessing of the respective networks. Ranking process followed by weighing in turn gives poor weight attributes and leads to congestion which provides poor quality to the user since they utilize additive process. Such that handoff happens which in turn cause the Ping-Pong effect. Additionally, there is a need for resource allocation algorithm which has to adjust the carrier sensing range to expel the drawback of shrinking of network coverage frequently.

Thus, the above drawbacks are been considered and in the way for tackled by utilizing our proposed methodology efficiently. Initially when a user access from one network to another network there occurs a handoff which in turn reduces the accessing desirable networks by user. For that we are using Adaptive MADM (Multi Attribute Decision making) technique to weigh and rank the users and networks based on certain criteria and at the end by matching the respective user to network based on weighed and ranked criteria value. Also the important problem is found in the communication network, which is a main issue is owing to enabling the users to continuously choose the most appropriate access network during their communication. Similarly, there exist a handoff while a mobile node from one network accessing other mobile node in another network. Vertical Handoff occurrence is happening when accessing process of user from one base station of a network to other user belonging to another base station of other network which causes a delay while accessing the networks. Henceforth a proficient algorithm is proposed to tackle that issue as said in the proposed methodology. The rest of the paper is organized as the related researches in the section 2, the section 3 describes the proposed methodology and results followed by the references.

2. RELATED RESEARCHES

Shangguang Wang et.al [18] depicted a novel VHO method in light of a self-selection decision tree for IoVs. A novel handoff method by the self-selection decision tree for IoVs and likewise showed an input decision method as indicated by the criticism of vehicle handoff, to improve next handoff quality when vehicle advancement example and vehicle benefit status change. VHO method in light of a self-selection decision tree, which can support the VHO among WAVE, WiMAX, and 3G cell. The fundamental downside was general Nature of administration improves execution and likewise some obstruction additionally happen amid communication.

Mustafa Ali Hassoun et.al [19] shown an analytical model and a Vertical Handover decision method for Thruways called VHH. which expect to both limit Vertical handover recurrence and keep away from pointless handoffs and ping pong effect between various networks, in the objective of upgrading interactive media gushing services in parkways. The arrangement VHH algorithm a Vertical handover decision method in light of position, speed, jitter, and thickness as pivotal sources of info In any case, this presented approach didn't achieve the correct handoff minimization and likewise it has high time data many-sided quality.

Ji-rui Li et.al [20] portrayed a cross-layer collaboration handoff mechanism based on the improved multi-attribute decision (MAD) to make reasonable, effective and productive handoff decisions by considering the successive development of savvy terminals and the heterogeneity of wireless networks. Because of the limitation of time and vitality, many problems still should be considered further in mobile computation offloading and handoff. But this discussed approach was not properly solved handoff issue due to computation time is high

Shidrokh Goudarzi et.al [21] disclosed the half and half algorithm to limit the cost work and the GA-SA algorithm could diminish the amount of superfluous handovers, and in this way maintain a strategic distance from the 'Ping-Pong' effect. The streamlining of the VHDA-making algorithms with GA and the hybridization of GA-SA in HWN. The results acquired were examined and looked at, and it was found that the GSAVHO had a lower cost work when contrasted with the GAVHO. In this displayed approach for understanding handoff issue which does not achieve the colossal quality of administration amid communication and additionally slacking to decrease the computational cost.

Murad khan et.al [22] clarified the system selection by utilizing Perfect Arrangement (TOPSIS) decision show on various parameters, The PoA of a system figures its rank using TOPSIS and sends it to the client. The client at that point picks the system with the most raised rank. The proposed vertical handover decision plot was contrasted and dark social examination and analytical chain of command process with regards to handover rate, finally talked about approach neglected to achieve handovers, bundle incident proportion, and throughput. This methodology does not accomplish expected computational time amid communication in the system.

In the aforementioned related works lot of challenging problems are identified for solving handoff issue. Shangguang described self-selection decision tree but the overall Quality of service not attain better performance and also some interference also occur during communication [18]. Mustafa Ali presented to tackle the above mentioned problem using an analytical model but this presented approach didn't reach the exact handoff minimization and also it has high time data complexity [19]. To solve the problem time complexity Ji-rui Li labelled a cross layer collaboration handoff mechanism which also failed to solve time complexity to expectation [20].

Then to improve the QoS Goudarzi discussed hybrid algorithm which is failed to attain the good quality of service during communication and also lagging to reduce the computational cost [21]. Finally, Murad presented to solve the computational cost and handover issue during communication in the network. This methodology does not attain expected computational time during communication the network [22]. The overall the process becomes complicated for correct accessing of the respective networks. This leads to congestion which provides poor quality to the user and also consumes the user's time. Above discussed problems are tackled by utilizing our proposed methodology.

3. A TACKLE TO SOLVE VERTICAL HANDOFF ISSUE IN HETEROGENEOUS NETWORK USING MAIMS ALGORITHM

Handoff problem and inaccuracy of QoS are most undesirable event in a wireless network framework, in this research we are focusing an accurate VHO process ought to take into account and care about the service continuity, network discovery, network selection, and QoS issues. To attain that better performance vertical handoff (VHO) methods are required. It has to be tackled for better quality of adjusting for users and similarly precision of the network framework has to be improved. The Vertical Hand Off (VHO) process into three parts: (I) Handoff information gathering, (ii) Handoff decision, and (iii) Handoff execution. The vital cause of this handoff problem is in decision phase.

The decision phase has its initial stage of parameter selection which has a big issue of imprecise nature. The second stage has a major issue of less effectiveness in dealing with data with uncertainty and always not consistent and also lags in time taken for moving to the destination network during measuring procedure of user criteria. By this two problem the third stage of the procedure winds up in complicated correct accessing of the separate networks. This leads to congestion which gives poor quality to the user and also consumes the user's time. To solve this problem MAIMS framework is designed here whose proposed architecture is illustrated in fig: 1. The MAIMS make use of appropriate parameter selection, weighing and ranking followed by best aggregation strategy.

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The architecture as appeared in Figure.1 of heterogeneous wireless networks where an arrangement of 3G networks, Wi-Max network and an arrangement of Wi-Fi Networks are under the coverage of a HSPA+ network depicts the VHO mechanism which would solve the aforementioned problems. The algorithm considers vertical handoff decision as an Adaptive Multiple Criteria decision making problem, which picks one of the available networks based on an arrangement of determined criteria.

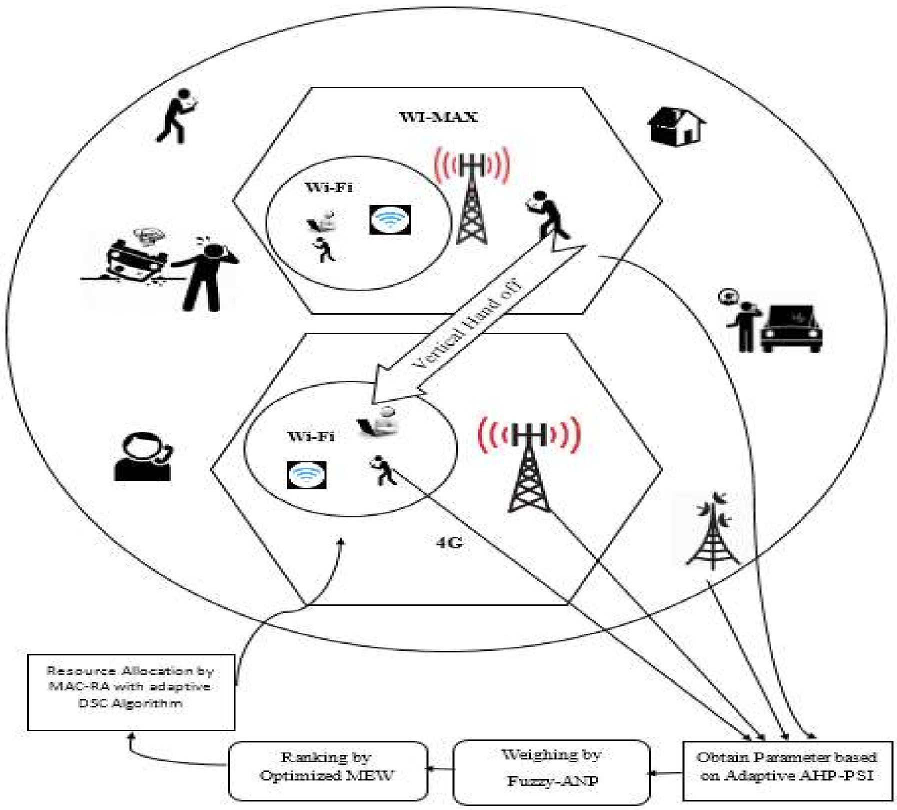

Figure 1: Proposed vertical Handoff Process Architecture

The proposed architecture considers Wi-Fi, Wi-Max and 3G as the available alternatives and an arrangement of QOS parameters as the criteria for access network selection. Considering all the showers of importance proposed work come with precise, faster convergent, congestion free resource utilization scheme which would be an appropriate remedy for vertical hand off issue.

This scheme has taken the base problem of parameter selection which accounts for the improper weighing thereby leading to improper ranking which in turn combines with out of limit problem to cause congestion. This leads to the hand off problem and it is treated by initial precise parameter selection procedure which is carried out by Analytical Hierarchical Process. This is a traditional decision making algorithm for parameter selection, which is lagging to give precise parameter. Accordingly, to attain a precise parameter, Preference Selection Index (PSI) is utilized. The main advantage of this algorithm is selecting a precise parameter using entropy method or standard deviation method with least time. Once the parameters are selected then those parameters has to process in such a way to provide weightage for each node and is carried out by fuzzy ANP. This approach solve the uncertainty in qualitative criteria and always consistent, but it is lagging in moving to the destination node during weighing process of user criteria.

To solve this issue Fuzzy ANP make use of unit vector direction principle of VEPSO (Vector Evaluated Particle Swarm Optimization) in which the destination node is picked up correct by the movement to appropriate position of weight which is close to the destination. Now there arises a need that these weighed nodes should be ranked appropriately to avoid congestion. This is carried

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out by MEW. This can be achieved by its multiplicative feature which has an advantage of taking the values in multiplicative manner, but it has lagging to faster convergence. In order to avoid this problem MEW combines with the Luus Jakoola optimization which provides optimized values to MEW for the faster convergence by considering sequence of data. This give appropriate weighing and ranking for solving the problem of handover to a great extent but in the aggregation phase it is necessary to make proper allocation for the corresponding network. For providing better allocation, Adaptive Temporal MAC-RA is taken which utilizes time domain, makes transmission at same time, and solve the suffering of undesirable sensing range by adjusted carrier sensing range of Dynamic Sensitivity Control algorithm. This provides a threshold based adjustment of carrier sensing range. Finally, it reaches the destination network in least time by proper allocation and adjustment of carrier sensing range and the QoS is improved.

3.1 Information Gathering Of VHO

In order to accomplish an ‘‘always best connected’’ handoff, a complete set of data is gathered and providing to the decision phase. To collect the available information from different sources, the mobile device surveys the surrounding networks in order to discover services, data rates, and power consumption. As a backup to the data accumulated through checking, networks may likewise promote their supported services and QoS parameters, while the gadget data is additionally gathered, i.e., speed, battery status, highlights, and so on. Finally, data concerning client inclinations is likewise an applicable component to the decision-making process, generally because of its effect on the end client's fulfillment. In this phase, the information is gathered to get utilized and prepared for making decisions in the handover decision phase.

Table 1: Information Gathering parameters to process VHO

Symbol	Parameter
P_U	User preferences (e.g. cost, provider)
P_C	Context information (e.g. speed)
P_Q	QoS parameters (e.g. bw offered, delay, jitter)
P_S	Security alerts (e.g. notifications)
P_N	Network load (e.g. bw available)
P_A	Available foreign agents
P_{NP}	Network pre-authentication
P_{NT}	Network topology
P_{RI}	Routing information
P_{LP}	Link parameters
P_{AAM}	Available access media
P_K	K^{th} no of parameter

Let Pji be the set of parameters from the table 1 and it can be given as in eqn (1)

$$P_{ij} = \{P_U, P_C, P_Q, P_S, P_N, P_A, P_{NP}, P_{NC}, P_{NT}, P_{RI}, P_{LP} ......P_K\} \quad (1)$$

Table 1 represents the information that would be taken into justification in order to exploit the benefits of decision-making. It obviously demonstrates that information should be collected at each layer of the network to cover all the probable information sources. Moreover, Table 2 presents various parameters by considering the information in Table 1.

After collecting information, the collected information is sending to decision phase because to take a decision to solve the problem of VHO thereby for suitable network selections, in order to achieve both system and user requests, thus providing the desired seamless communications.

Table 2: Various parameter Information of the system

Domain	Parameter
Network	Latency e2e
	Average Delay
	Network Delay
Coverage	Network
	Availability
	Coverage
Performance	RSS
	CIR
	RTT
	Retransmission
	BER
	SINR
	Security
	Packet Loss
	Throughput ,Data
	Bandwidth
	Available
	Link Capacity
	Network Title
	Network Overhead
Billing	Cost

Miscellaneous	VHO Packet Loss
Network	No.of User

3.2 Top Notch MAIMS Decision Phase

To make an exact decision and to play out the handoff by choosing the most reasonable access arrange this stage exploits algorithms which considering the data accessible play out an assessment procedure with a specific end goal to acquire the best decision for handoff execution. To perform taking into description many parameters obtained from the distinctive information sources as in table 1, which is mathematically, built in equation (1). Vertical Handover Decision Algorithm (VHA) is utilized to weight up and evaluates the parameters required under each particular criterion. This stage has three steps namely parameter selection, processing and aggregation. The overall proposed decision phase architecture is illustrated in figure 2.

3.2.1 Preference Analytical Hierarchical Procedure for precise parameter selection

While vertical handoff decision with multiple attribute is a perplexing problem, AHP is by all accounts the most popular method to decompose it into a hierarchy of easier and more manageable sub problems. In the AHP method, relative importance of each factor is determined as for objective in order to calculate the weight. In addition, the decision maker has to check the consistency in making judgements taken to assign relative importance between attributes and alternatives. This procedure ends up difficult when quantities of attributes and alternatives are larger in selection process. The AHP method is a three-stage process that decomposes the decision problem into various levels of the hierarchy. This compares each factor to all the other factors within the same level through pairwise comparison matrix and then calculates the sum of products of weights obtained from the diverse levels, and selecting the arrangement with the most astounding sum.

Step 1: Construction of level AHP hierarchy

The objective is to select the best available access network and this structures the root hub of the progression. Keeping in mind the end goal to stamp network selection decision, an arrangement of available networks and an arrangement of fitting decision criteria are to be considered. In this progression the complex issue is broken down into a various leveled structure with decision elements.

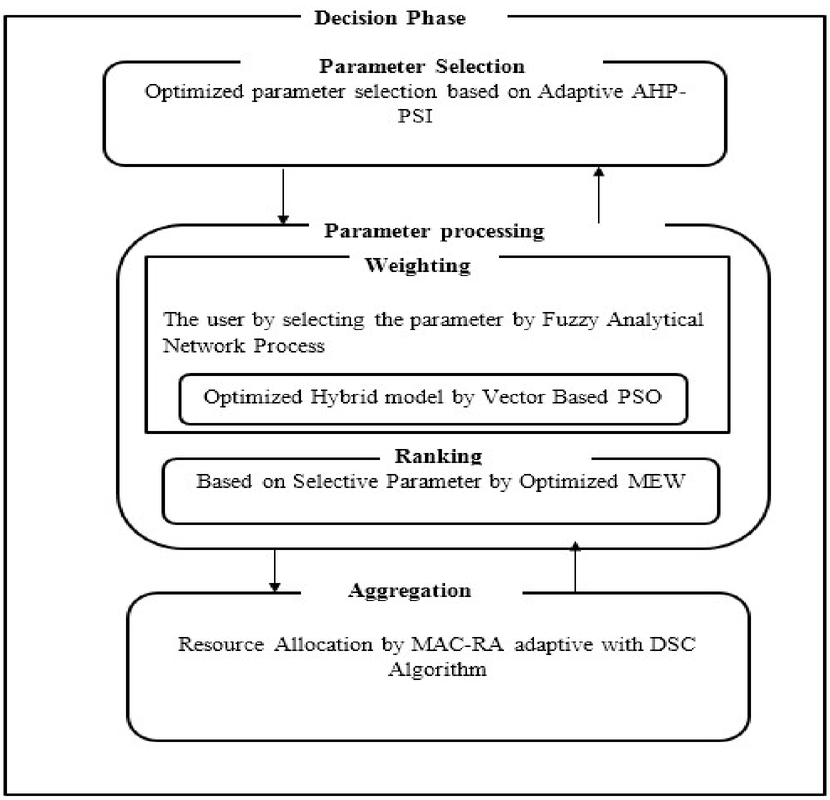

Figure 2: Eminent precise decision making

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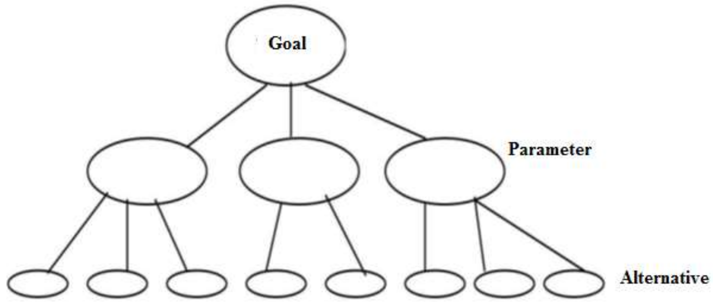


Figure 3: Hierarchy structure of decision problem

Step 2: Construction of pairwise comparison matrix
The set of parameters are taken both row-wise and column-wise. Comparisons are made between each pair of parameters and are given values ranging from 1 to 9. The diagonal elements from top left to bottom-right are assumed to be 1. To start with the upper triangular network is filled in view of how much imperative the line parameter is when contrasted with the section parameter utilizing the correlation scale appeared in Figure 4. After the upper network is occupied lower lattice can be assimilated by utilizing equation (2)

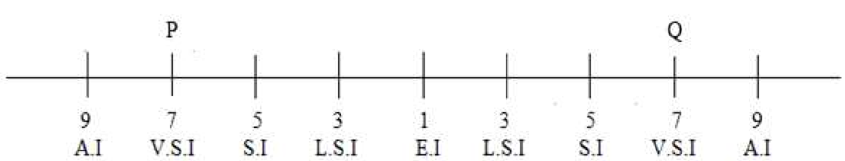
$$P_{ij} = \frac{1}{P_{ji}} \qquad (2)$$

Develop the match insightful correlation network of the decision parameters at level-1 and combine knowledge examination networks of the decision options as for every decision parameter. Therefore, a 6×6 matrix at level-1 and six 3×3 matrix at level-2 are conceivable network from eqn (3).

$$Q = \begin{bmatrix} & P_1 & P_2 & P_3 & \cdots & P_K \\ P_1 & 1 & q_{12} & q_{13} & \cdots & q_{1K} \\ P_2 & q_{21} & 1 & q_{23} & \cdots & q_{2k} \\ P_3 & q_{31} & q_{32} & 1 & \cdots & q_k \\ \vdots & \vdots & \vdots & \vdots & \cdots & \vdots \\ P_K & q_{k1} & q_{k2} & q_{k3} & \cdots & 1 \end{bmatrix} \qquad (3)$$

In order to determine the relative preferences for two elements of the hierarchy in matrix Q, an underlying semantically scale is employs with values from 1 to 9 to rate.

Step 3: Compute the mean value of the normalized data
The whole of each column of the pair-wise comparison framework is found and set in the last row. The resultant grid is normalized by making the elements of the total row as 1 and this lattice is named as Normalized Comparison network. Normalized principal Eigen vector is obtained by discovering average of each row of the normalized comparison network.



A.I	V.S.I	S.I	L.S.I	E.I
Absolutely Important	Very Strongly Important	Strongly Important	Less Strongly Important	Equally Important

Figure 4: Typical comparison scale for matrix

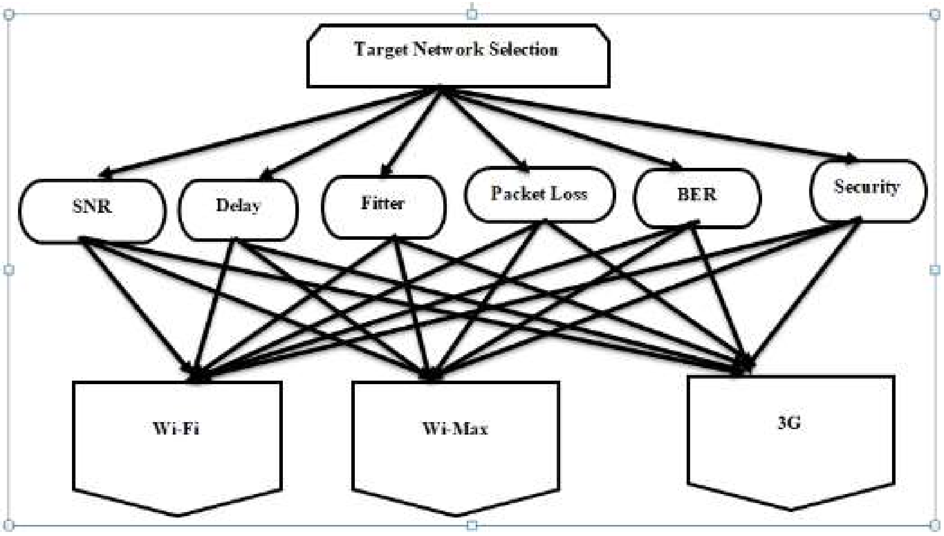


Figure 5: Spam traffic sample

Next the estimation of normalized data is computed in eqn (4).

$$\lambda_{max} = \sum_{i=1}^{k} P_i \times q_i \quad (4)$$

"P_i" is the element in the i^{th} row of the Normalized principal Eigen vector. "q_i" is the element of the sum row in the i^{th} column of the comparison matrix before Normalization.

In the next step, the weights of parameter are normally computed by the AHP method. Moreover, all these methods require complex and weighty calculations. This lead to the introduction of PSI method where results are obtained with minimum and simple calculations as it is based on the concept of statistics without the necessity of weights of parameter. This method can be used for any number of parameter.

Preference selection index method mostly used for resolving the multi-parameter decision making (MCDM) problems. In the proposed method it is not needed to assign a comparative importance between parameter. Moreover, there is no requirement of computing the weights of criteria involved in decision making problems in this technique. This method is useful when there is a conflict in deciding the relative importance among parameter. The exact criteria are selected by given below steps:

Step: 1. Compute the preference variation value:

In this step, a preference variation value between the values of every attribute is computed using the following equation (5)

$$\alpha = \sum_{i=1}^{n} [\lambda_{max} - N] \quad (5)$$

Where λ_{max} is the normalized data, 'N' is the number of attribute.

Step: 2. Determine the standard deviation in preference value:

In this step, deviation in the preference value is computed for every attribute using the following equation (6)

$$\psi = [1 - \alpha] \quad (6)$$

Where ψ is the preference value, α is a preference variation value.

Step: 3. Compute the overall preference value:

In this step of PSI method, overall preference value is determined for every attribute using the following equation (7)

$$w_j = \frac{\psi}{\sum_{j=1}^{m} \psi} \quad (7)$$

Moreover, the total overall preference value of all the attributes should be one i.e. $\sum_{j=1}^{m} \psi = 1$, where ψ is defined as criteria , $\sum_{j=1}^{m} \psi$ is defined as the number of criteria for computing preference value.

Step: 4. Compute the preference selection index:

Now, the Preference Selection Index(PSI) is calculated for each alternative using the following equation (8)

$$\xi = \sum_{j=1}^{m} X_{ij} \times w_j \quad (8)$$

Where ξ is used for less access time for preferring the selective parameter

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Step: 5. Select the appropriate alternative for the given application:
At last, each alternative is ranked in either descending or ascending order to facilitate the managerial interpretation of the results. The alternative having the highest preference selection index will be ranked first and so on.

Once the parameters are selected then those parameters has to process in such a way to provide weightage for each node. ANP (Fuzzy Analytical Network Process) is proposed for doing the job of weighing since improper weighing can lead to unfair user service producing user dis-satisfiability.

3.2.2 Unit Direction Fuzzy-ANP (UDFANP) along with the aid of optimized MEW for parameter processing.

The parameter processing algorithms are in charge of the processing of the chosen parameters and of the provision of the input information to the parameter aggregation algorithms. Fuzzy ANP method is applied for calculating a weight of the selected parameter. Initially by combining the fuzzy set theory. In the ANP Fuzzy, Fuzzy ratio scale used to indicate the relative strength of the factors on relevant criteria. Fuzzy decision matrix can be formed from several alternatives described in the form of fuzzy numbers which are measured as weight of the parameter.

The initial stage of weighting is an assessment of all criteria by the owner and the service based on pairwise comparisons to create a decision matrix. The method used is FANP, this step consists of several steps that are to determine the scale of criteria assessment, determine the membership function, determine the average matrix, and calculate the synthetic extend. The weight of each decision parameter which are based on PSI of eqn (9) is found by

$$W_P\,par = \left[\xi \times \sum_{J=1}^{N} \sum_{J=1}^{M} F_{gi}{}^{j}\right]^{-1} \quad (9)$$

To get this $\sum_{J=1}^{M} F_{gi}^{\ j}$ done adding fuzzy operation of m with particular matrix

$$\sum_{J=1}^{M} F_{gi}{}^{j} = \left[\sum_{j=1}^{m} x_j, \sum_{j=1}^{m} y_j, \sum_{j=1}^{m} z_j,\right] \quad (10)$$

Hence,

$$\left[\sum_{J=1}^{N} \sum_{J=1}^{M} F_{gi}{}^{j}\right]^{-1} = \left(\frac{1}{\sum_{j=1}^{m} x_{j,}}, \frac{1}{\sum_{j=1}^{m} y_j}, \frac{1}{\sum_{j=1}^{m} z_{j,}}\right) \quad (11)$$

Determining the degree of likelihood for convex fuzzy number greater than k to Mi= (i = 1, 2.k) can be defined as:

$$\begin{aligned} S &= (F \geq m1, m2.......mk) \\ &= S[(F \geq m1)]\text{and}[F \geq m2....(F \geq mk)] \\ &= \min S(F \geq Fi) \end{aligned} \quad (12)$$

Table 3: RI values for comparison matrix of Size n

K	1	2	3	4	5	6	7	8	9	10
R.I	0	0	0.08	0.9	1.12	1.14	1.24	1.41	1.45	1.49

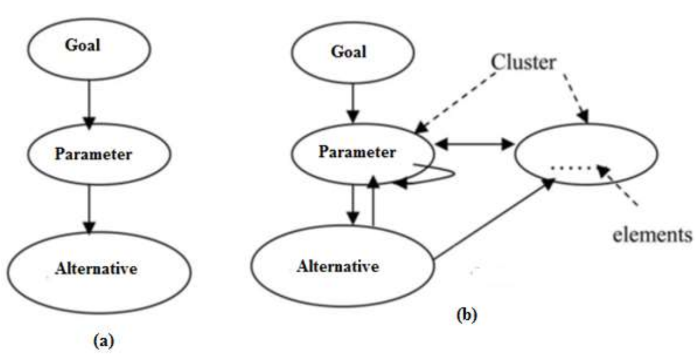

Figure 6: Hierarchy and network (a) Hierarchy (b) network

It is assumed that d = min (S ($T_i \geq T_k$)). So i,k = 1, 2,..., n, k ≠ i then the weight vector equal W

$$W' = (d'(a_1), d'(a_2), d'(a_3) ..., d'(a_n))\,T \quad (13)$$

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Where a_i (i = 1,2,3......, n) an element n, so develop the weight vector normalization shown in equation (11).

$$W' = (d\, a_1), d(a_2), d(a_3) ..., d(a_n)) T \quad (14)$$

It is necessary to overcome the uncertainty in qualitative criteria created by the assumption of and maintain consistency. Perhaps, the F-ANP lags in moving to the destination node during weighing process of user criteria. In order to overcome the existence of drawback in F-ANP we are employing VEPSO (Vector particle swarm optimization) for optimizing the above problem. VEPSO technique involves unit vectors direction which moves to appropriate position of weight which is close to actual location i.e. destination node such that the drawback of F-ANP can be overcome.

The original PSO algorithm was designed for problems with only one objective, it cannot be directly applied to multi-objective optimization problems(MOPs) without modification of the algorithm or objective function. The vector-evaluated PSO (VEPSO) algorithm is a PSO variant for solving MOPs.

$$V_i\ (t+1) = W' + c_1 r_1 (P_{best} + c_2 r_2 (G_{best}) \quad (15)$$

Where velocity 'V' of the particle i in the t^{th} iteration is both the personal best solution (P_{best}) and global best solution (Gbest). Here, c1 and c2 denote acceleration factors. When the weight vectors for all the clusters are computed by using above proposed algorithm, the Cluster Matrix can be formed by setting as Cluster Matrix column the weight vector that corresponds to the columns cluster. If we want to get a Group Decision then on this step before computing the limit priorities we need to combine all group members pairwise comparisons per context cluster, using the geometric mean and then continue with the above process.

The network model developed in order to find out weights of the factors that are to use performance indicators is shown in Figure 7. The criteria to select relevant performance indicators useful for decision making is shown in Figure 8.

C1. Relevance

C2: Reliability

C3: Comparability and Consistency:

C4:Understandability and Representational quality

After weighing using F-ANP, the ranking process is utilizing for accurate accessing of the respective networks in least time. In order to do that we are exploiting Optimized MEW (Multiplicative Exponential Weighting) which provides better weight attributes ranking by solving congestion.

MEW works comparatively to SAW calculations. To score the general option, it utilizes the weighted result of all characteristics, since this item does not have an upper-bound, it is fitting to think about the score against a perfect arrangement and this assessment considers essential network parameters.

```
Psedocode of F-ANP with VEPSO

//Fuzzy ANP
Initialize cluster C
For Check pairwise comparison
Row ();
end
//fuzzy initialization
Initialize fuzzy=F;
Calculate Weighted r matrix;
// Vector Particle Swarm Optimization
Algorithm
particle i;
//Vector Partition by
while ()
        do
        Particle ();
        getbest(i)
        gbest(i)
        For i = 1 to M do
                If (Pbest > 2)
                        for k = 1 to i
                        do
                        partitioned segments
                in particle i */
                        return best particle(i);
                        end
                end
        end
Stop;
//Check if hierarchy
return ();
```

Figure 7: Pseudo code of VEPSO based F-ANP

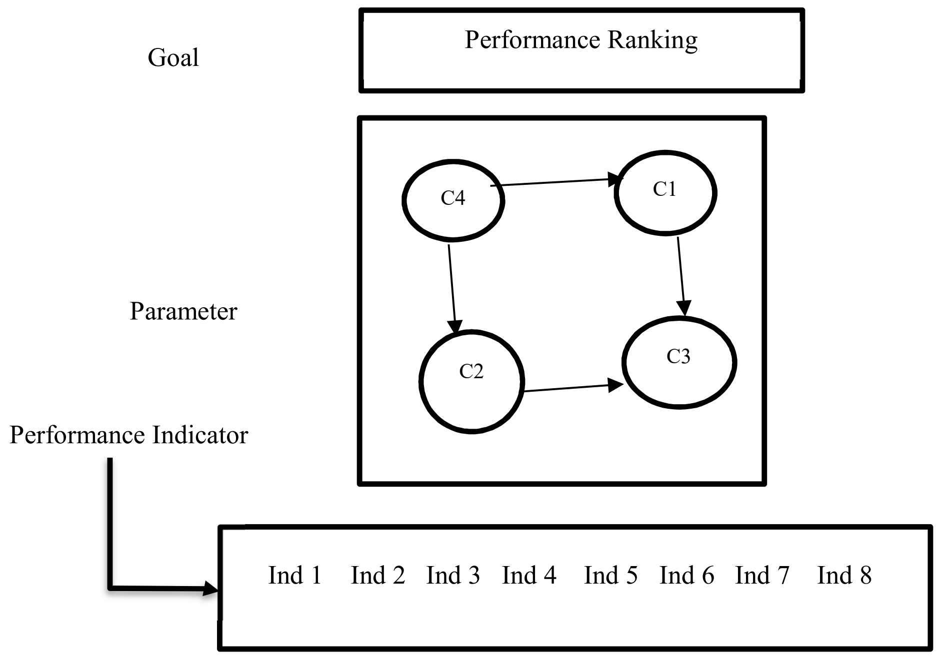

Figure 8: Performance indicator of Selective Criteria

In MEW technique, the vertical handoff decision issue can be communicated as a grid frame, where each row I compares to the applicant network I and each column j relates to a property like data transmission, delay etc. The score (Rank) Si of network I is controlled by the weighted result of the qualities.

$$S_i = \prod_{j=1}^{n} X_{ij} V_i \qquad (16)$$

Where X_{ij} represents attribute j of entrant network i, V_i denotes the optimized weight of parameter from eqn (15). The motive for looking at procedures for both final weights and ranks is since methods may yield different final weights for alternatives, but they can effect in the same or different rank order of alternatives.

Our last four procedures detention this rank disagreement of which events, two are giving more weight to higher rank by the utilization of Luus Jakula optimization algorithm. The set of variables in the optimization method are described by a vector x comprising of a set of real numbers. The idea of the optimization is then very humble, so the standard Luus Jaakula algorithm may be summarized most suitably in the following.

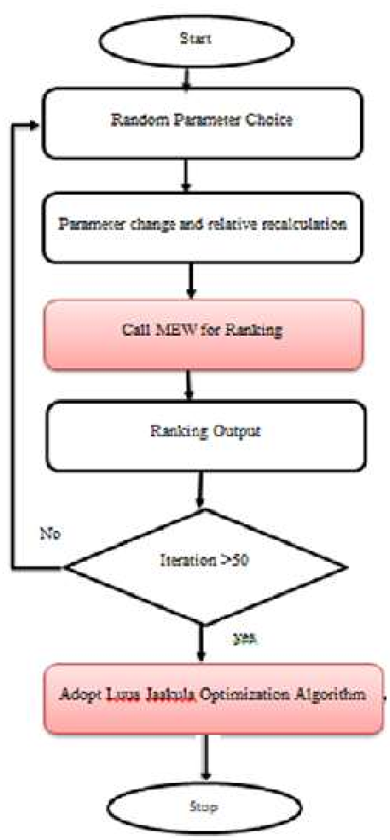

Figure 9: Flow chart of optimized MEW for Accurate Weight Ranking

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Ideally, the LJ optimization procedure is very simple, using randomly chosen test points over a region that is decreased in size as iterations proceed. The steps that are involved are as in the following steps

Thus after weighing and ranking corresponding users has to be allocated with corresponding network. For that here a resource allocation processes have to be included in parameter aggregation.

3.2.3 Coverage forethought Adaptive Temporal MAC-Resource Allocation for aggregation

The principal explanation behind this degradation is that the present random access-based MAC protocol allocates the whole channel to one user as a solitary source because of similarly disseminated time space conflict determination. Regardless of whether senders have a small size of data to send, despite everything they have to fight for the whole channel and get a similarly circulated time open door for transmission. The majority of the difficulties accompany the endeavors to implement MAC-RA in conveyed kinds of wireless network, particularly when there is no centralized station controlling the allotment channel and dispersing the reservation control data.

A random access strategy is a basic capacity for wireless communications, and shows up non-replicable in future WLANs. Initially endeavors have concentrated on expanding the association throughput, rather than on the capable use of the range and the nature of the client encounter. These days, Wireless is sent in more different and thick situations, expanding the two impedances from neighboring gadgets and genuine crashes because of channel conflict. In this manner, a high data rate communication requires an improved MAC layer, where different STAs can fight for and use a divert at the same time or in dispensed periods as per their traffic requests, accordingly expanding overall capability. This is carried out by the threshold of RSS based coverage adjustment principle of Dynamic Sensitive Control.

The LUUS-JAAKOLA (LJ) Algorithm

Step:1.
Choose initial point x* from eqn (16);
size r;
random points R
Step 2.
Choose R equation x=x * + D
Step 3.
IF R == variables.
Return R
Step 4.
Do
Step 5:
Else:
Replace x *< small value.
Step 6.
Repeat steps 2-5 for M iterations.
Step 7.
While (rj+1 = γrj)
Return
Step 8.
continue
For M iterations
end

Figure: 10: The LUUS-JAAKOLA (LJ) Algorithm

DSC calculation alters the transporter detecting range in each station (STA), locally, without requiring any extra data to be traded. DSC tunes Clear Channel Assessment(CCA)edges in view of the Receiver Signal Strength (RSS) esteem from signals got from the related Access Point (AP). In that way, the cell-edge STAs utilize bring down CCA limits than those found nearer to the AP, henceforth expanding their likelihood of fruitful transmission by diminishing the quantity of concealed hubs. So as to decide if the wireless medium is occupied or not, the hub which has a bundle to transmit would perform CCA. The objective of DSC by means of CCA edge tuning is to allow concurrent transmissions that won't disregard collector execution, with a specific end goal to augment spatial reuse. Plans which can enhance the framework execution through changing the transporter detecting limit have been proposed in a few literatures. Be that as it may, a large portion of them utilize the average duration of various states to tune the limit, which isn't anything but difficult to implement since they would set aside a long opportunity to coverage and enhance calculation multifaceted nature.

$$R_{AL} = \sum_{j=1}^{m} S_i \times k^T \quad (17)$$

Where S_i Indicate final rank of the criteria and K^T represents the allocation of the sensing range by the usage of this step correct parameters are considered and movement to destination node happens in minimal time by proper allocation and adjustment of carrier sensing range.

3.3 Handover Execution Phase

This is the final stage in VHO process. Once the decision is made, connections are re-routed from the current network to target network seamlessly. This phase involves radio link transfer along with authorization and authentication. The main use of our proposed algorithms MAIMS act as a major role to solve the handoff issue and finally it transmitted smoothy communication

4. RESULT AND EVALUATION

All the technologies must be compatible to operate together for successful seamless vertical handover. To test the compatibility and to find the attribute values for underlying network we have designed several simulation result with the help of NS3 on the basis of model in given below diagram

User starts using an application under Wi-Max access. After a while, user leaves home for work and moves towards another Wi-Fi covered area.In between the application is supported by a 3rd network like Wi-Fi, WiMAX, MANET, UMTS, UMTS+HSPA, Wired LAN.

NS3 enables users to design new protocol models, Optimize new and existing models, Design Complex wireless networks using user-designed models, analyze the performance of networks and helps in advanced networking planning

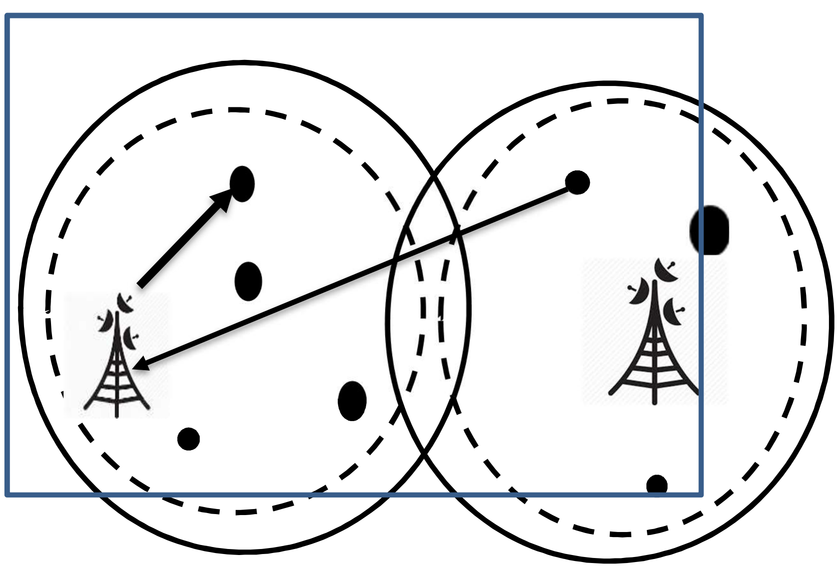

Figure 11: Resource Allocation using MAC RA-DSC

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4.1 Simulation Of Proposed Network

First we create a network using NS3 tool based on the parameters like network, user preference, Terminal related and service related. Figure 11 explains the Initialization of network which consist of many communication network like Wi-Fi, WiMAX, MANET, UMTS, UMTS+HSPA, Wired LAN etc. Figure 12 describes our proposed network for communication using one network to another network. In that particular coverage region, a lot of users access different networks for the communication purpose. Figure 14 describes the Wi-max network region. Figure 15 shows the Wi-Fi coverage region and Figure 16 shows the 3G coverage are network.

After creating network, user can access from one network to another network for communication there occurs a handoff. Figure 17 illustrates the communication between node 1 to node 11 at the time Hand off occurrence. The red line indicates the handoff problem which is a major problem due to communication. In order to avoid this problem, our proposed approach Adaptive MADM (Multi Attribute Decision making) technique is used, based on selected parameter, weight of the criteria. Rank methodology is utilized based on user and network criteria finally to recover from the problem and allocate the network. The initial preferences solve the handoff occurrence based on the proposed method using MAIMS algorithm. Figure 18 illustrates the communication after network recovery.

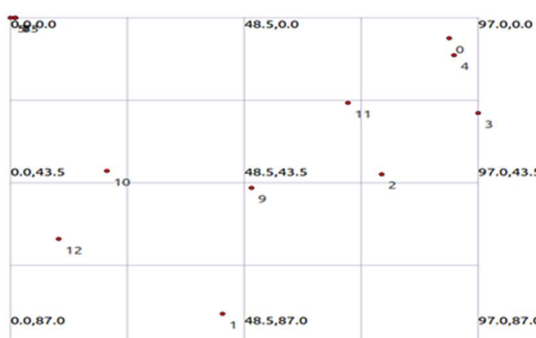

Figure12: Network Initialization

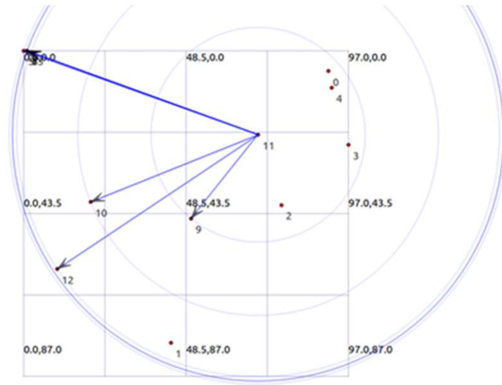

Figure 13: Proposed network Wi-Fi, Wi MAX, and 3G

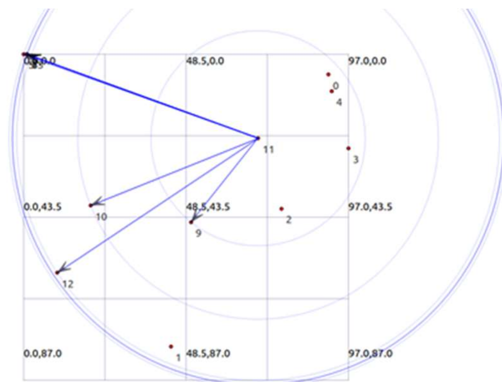

Figure 14: WI-MAX region

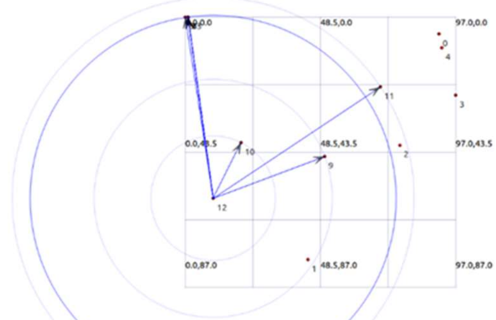

Figure 15: Wi-Fi coverage region in UMTS network

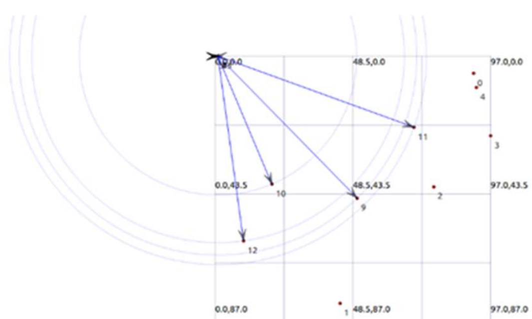

Figure 16: 3G Coverage area network

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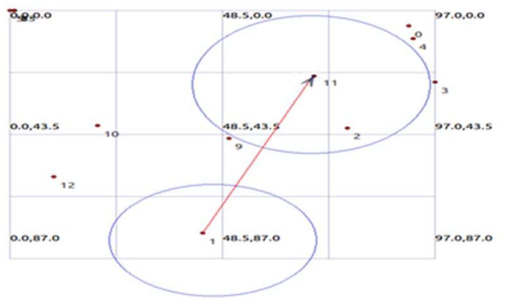

Figure 17: Hand off occurrence during communication WI-MAX to Wi-Fi

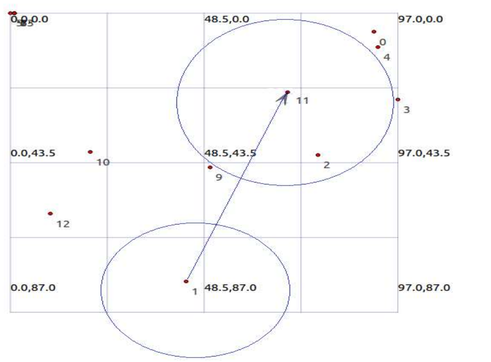

Figure 18: After Recover proposed Network WI-FI-WI-MAX

4.2 Simulation Parameter Analysis

In wireless communication there are a number of parameters on the basis of which we can determine and decide the QoS. Some of them are bit error rate (BER), jitter, latency, error vector measurement (EVM), throughput, delay etc. The paper considers and analyses throughput, end to-end delay, Jitter, BER and SNR.

4.2.1 Throughput:

Throughput or network throughput is the average rate of successful message transport over a correspondence channel. These data might be passed on finished a physical or legitimate association, or go through a specific network hub. Throughput is typically estimated in bits consistently (piece/s or bps), and some of the time in data parcels each second or data bundles per time opening.

$$\text{Throughput} = \frac{[(\text{Total Byte Sent})]}{(\text{Time Last Packet Sent - Time First Packet Sent})} \quad (18)$$

where 'time' is in seconds

4.2.2 End-to-end delay:

End-to-end delay demonstrates the time span taken for a packet to travel from the CBR (Consistent Bit Rate) source to the goal. It addresses the average data postpone an application or a client encounters when transmitting data. The delay is generally estimated in seconds.

$$\text{End - to - End Delay} = \frac{(\text{Total of Transmissi on Delays of All Received Packets})}{(\text{Number of Packets Received})} \quad (19)$$

Where Transmission Delay of a Packet = (Time Pkt. Rxvd. at Server – Time Pkt Txd. at Client) in seconds

4.2.3 Average Jitter:

Jitter is a difference in packet transit delay produced by coating, disputation and series effects on the path through the network. In general, more elevated amounts of jitter are more likely to occur on either slow or deeply congested connections. The typical causes integrate connection timeouts, connection time lags, data traffic congestion, and intrusion. Basically, this jitter is an undesirable *yield* of basis faults and interruptions. In this mode when jitters happen, PC monitors and PC processors may fault, documents may get lost, copied audio documents may acquire noise, Web receiver calls may get intruded, endure time lags or get detached.

$$\text{Average Jitter} = \frac{(\text{Total Packet Jitter for all Received Packets})}{(\text{Number of Packets Received - 1})} \quad (20)$$

Where, Packet Jitter = (Txn. Delay of Current Pkt – Txn. Delay of Previous Pkt) Jitter can be calculated only if at least two packets have been received.

Table 4: Performance values of proposed Wi-Fi and WI-Max

	Wifi	Wimax
Throughput	0.45935	0.45936
End to end delay	3.73191	3.74073
Jitter	0.53313	0.53439
BER	0.38662	0.38571
SNR	1.10223	1.24557
Weight	0.67399	0.72186
Packet loss	0.23193	0.23193

4.2.4 BER -- Bit Error Rate:

Bit error happens once one or more bits of data peripatetic across a system fail to reach them destination. Restricted number of bits on the whole forms a packet. Packet trouble can be caused by a sum of factors, as well as signal degradation over the system medium due to multi-path fading, packet

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drop since of channel congestion, corrupted packets discharged in-transit, defective networking hardware, faulty network drivers or normal directing schedules. In addition to this, Bit Error probability is also affected by Signal-To-Noise Ratio(SNR)and distance between the transmitter and beneficiary.

$$BER = \left(\frac{\text{Packet transmitted} - \text{Packet received}}{\text{Session Time}}\right) * 100 \quad (21)$$

4.2.5 SNR-- Signal to Noise Ratio:

The SNR ratio is considered as the control ratio between a signal and the background noise (unwanted signal): control must be dignified at the same and corresponding focuses in a background, and inside the same framework bandwidth. In the occasion that the signal and the noise are measured transversely the same impedance, then the SNR can be attained by calculating the square of the amplitude ratio:

$$SNR = \frac{P_{signal}}{P_{noise}} = \frac{A_{signal}}{A_{noise}} \quad (22)$$

where A is the root mean square (RMS) amplitude (for example, RMS voltage). Because many signals have a very wide dynamic range, SNRs are often expressed using the logarithmic decibel scale.

4.3 Comparison Result

4.3.1. Comparison strategy of proposed and existing method

Table 5: Handover decision delay versus number of inputs

No of Input	2	3	4	5
SAW	0.003	0.006	0.0125	0.0175
TOPSIS	0.004	0.009	0.014	0.018
FAHP-PCA	0.003	0.006	0.0125	0.0175
Fuzzy-SAW	0.0025	0.0056	0.0123	0.017
Fuzzy-VHO	0.0023	0.005	0.009	0.0165
Proposed	0.00226	0.0045	0.0084	0.016

Table 6: Handover decision delay versus available target networks

Available Target Networks	20	30	40	50
SAW	0.0041	0.0071	0.0136	0.0186
TOPSIS	0.006	0.011	0.016	0.02
FAHP-PCA	0.0044	0.0074	0.0139	0.0189
Fuzzy-SAW	0.0046	0.0077	0.0144	0.0191
Fuzzy-VHO	0.0035	0.0062	0.0102	0.0177
Proposed	0.00566	0.0079	0.0118	0.0194

Table 7: Probability of handover failure versus number of devices

Number of Devices	20	40	60	80	100
SAW	0.125	0.21	0.302	0.405	0.5
TOPSIS	0.1	0.18	0.257	0.38	0.453
FAHP-PCA	0.075	0.125	0.2	0.304	0.384
Fuzzy-SAW	0.071	0.12	0.19	0.273	0.368
Fuzzy-VHO	0.067	0.118	0.185	0.264	0.3
Proposed	0.065	0.115	0.182	0.258	0.297

4.3.2. Comparison Analysis:

From the comparison it is seen that the proposed framework have been compared with prior work such as SAW, TOPSIS, FAHP-PCA, Fuzzy SAW and Fuzzy-VHO.It is observed that the handover failure with number of devices, handover decision delay vs number of inputs and handover decision delay vs available target networks and handover decision delay vs number of devices based on that the throughput and the efficiency of the handoff tackling system with better fuzzy analytic process and ranking with MEW with allocation strategy which in turn ensuring better quality of service.

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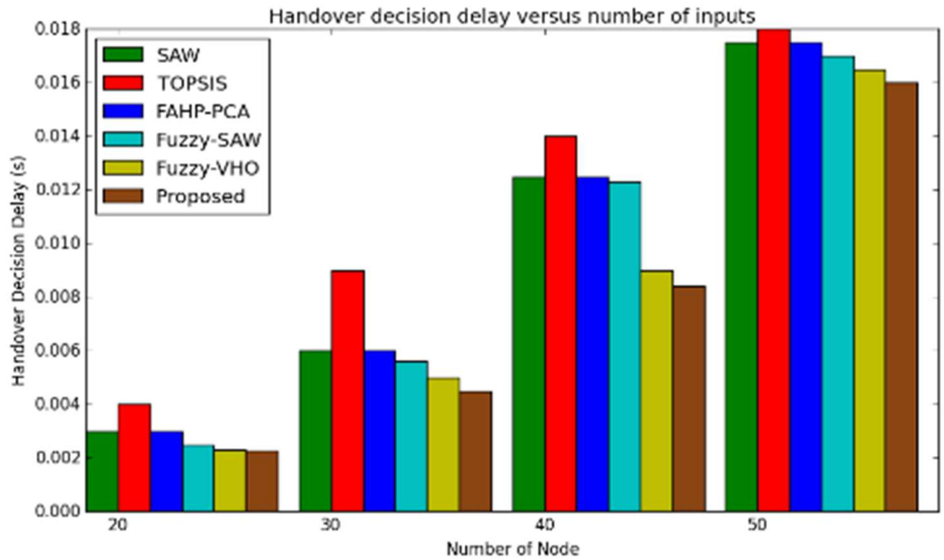

Figure 19: Comparison of Handover decision delay vs number of inputs

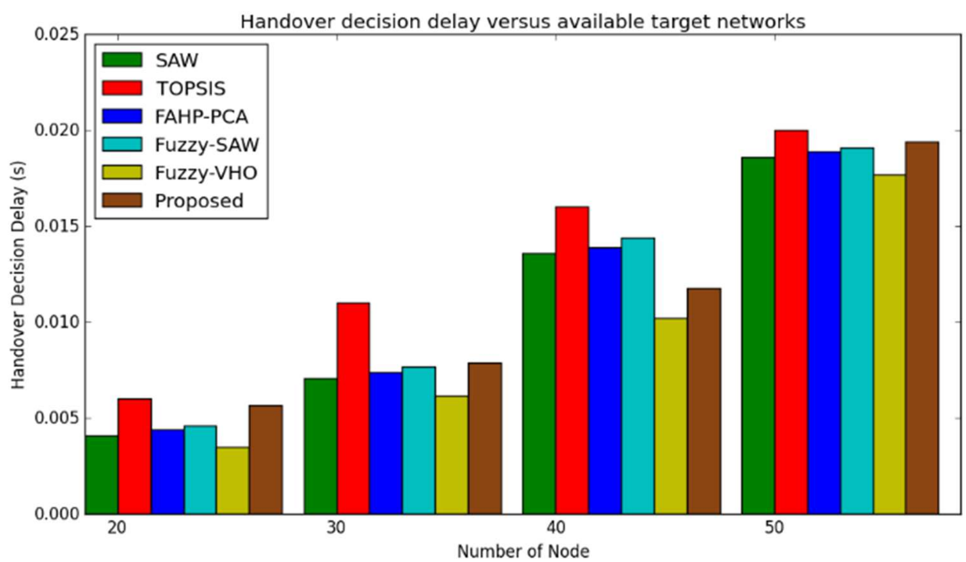

Figure 20: Comparison of Handover decision delay vs target networks

5. CONCLUSION

This article with MAIMS enables the end users to effectively utilize the capacity and advantages of both the networks. It is observed that in this framework, the VHO mechanism which is a new approach based on Fuzzy analytic network process (F-ANP) method and MEW method which efficiently ranks and allocates the corresponding network by based fuzzy based weighing. The simulation shows that, for each traffic classes, our method based on F-ANP and MEW can reduce the ranking abnormality problem better than existing method for all traffic classes. Finally end users to associate with the Wi-Fi network, while using the WiMAX for smooth handover to maintain QoS Simulation results show that the proposed scheme significantly improves the QoS for the end users with less communication cost.

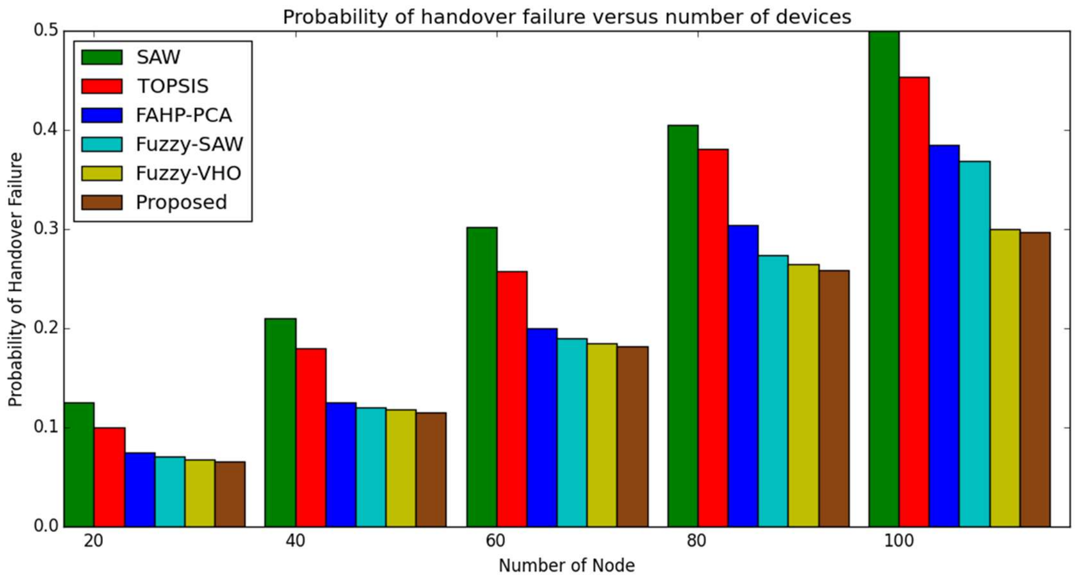

Figure 21: Comparison of Probability of handover failure vs number of devices

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