An Madm Algorithm for Vertical Handover Decision in Heterogeneous Wireless Networks

J. Santhi, K. Prabha

Abstract*: *One of the utmost stimulating themes for next generation wireless networks is vertical handoff model since several wireless technology are presumed to collaborate. In despite, of this heterogeneous, seamless inter system mobility is the manufacture of vertical handover system, which is for user that transfer between dissimilar kinds of network. Trendy this object a seamless mobility handover scheme is accessible. The innovation of the future system is that handover is totally measured by the terminal. The recover presentation handover decision algorithm by Multiple Attribute Decision Making (MADM) such as Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Grey Relational Analysis (GRA) and Multiplicative Exponent Weighting (MEW). Allowing to the result access, the proposed wireless network based vertical handoff decision system is clever to define whether a handoff is mandatory or not appropriately, and chooses the best selected access system considering the above declared parameters. Sufficiently of parameters correlated to user preferences and network environments like as data rate, Bandwidth, Delay and cost etc.

Index Terms*: *vertical handoff, heterogeneous wireless network, MADM, parameters, handoff decision.

I. INTRODUCTION

Sprouting user request for access to connection amenities everywhere and anytime is hurrying the knowledge expansion near the combination of several wireless access machineries, currently so-called as portion multiplying wireless system [1]. 4G wireless system spirit provide expressively advanced data rates after a verity of services and presentations earlier not passible due to rapidity limitation and allow global roaming amongst a various collection of mobile access network [4]. Therefore the eventual mind be talented to choice the best effective access system in relationships of handler gratification and achieve the handover in an extremely accessible and bendable. [5, 6, 7].The proposed vertical handover scheme comprise three stage: *Handover initiation*:

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Determine all the accessible wireless network, in advance and intercommunication with these network for etching the additional information.*Handover decision*: select the suitable network established on the network information effort requests, single quality, and user preference.

Handover execution: handover the gathering effortlessly to the selected system. Several workings take specified that the handover initiation phase meaningfully moves handover presentation [2]. For example when a user transfers in a varied wireless system atmosphere. Outdated handover decision are correlated one with the relation excellence, while in subsequent generation heterogeneous wireless systems, handover between dissimilar technologies and organizational dominions in probable, and handover decision will be founded on further criteria.

A Wireless Atmosphere it's dynamic characterized by a nature integral insecurity and constrictions, defective parameters. Network parameters like throughput RSS and network delay etc., are inherently indefinite [3]. The measurement of accurate these system parameters happening a wireless atmosphere is a different task. The numerous MADM algorithms are used to secure amongst accessible ranking and candidate network. In this paper, an article target is present in the situation of heterogeneous wireless network selection scheme. This scheme analysis a GRA, MEW and TOPSIS ranking algorithm [5] to choice be a target network and collective with a weighted elicitation performance that are implement. A weighted system is also established built on provide performance and network parameters by giving them. There are three criteria are expected for this article such as wifi WiMax and umts. The parameters selected since every network include Qos related parameters like band width, datarete, delay, jitter and cost, activity of the MS its stirring track expanse amongst the (BS) traffic-loading conditions, security parameters and cost of the provide services. Here consume been a variety of network collection algorithms for mobile node (MN) built on the handover decision phase are reported in the literature [12–13].

In direction to estimate the whole structure of our performance. VHO procedure by integrating the ranking process is used to select a handoff initiation model. The reminder this article is equipped as follows. In this section II discuss MADM algorithm, section III result and discussion, and finally finishing observations are drawn in section IV.

II. MULTIPLE ATTRIBUTE HANDOVER SELECTION ALGORITHM

MADM methods present to making preferred decisions concerning choice, valuation or ranking of decision alternatives in relation to selected decision criteria.

Computation (values) of every alternative in relations to criteria are most often presented in the form of decision estimation of matrix in table1.In [3] the authors have appraised the presentation of three MADM methods namely TOPSIS, GRA and MEW. This comparison review allows to identify a suited MADM algorithm which can be used in the situation of vertical handover decision.

Table 1: Decision matrix for network selection

	Band Width (A1)	Data Rate (A2)	Delay (A3)	Jitter (A4)	Cost (A5)
WIFI (X1)	20	30	60	50	10
WIMAX (X2)	30	65	62	15	20
UMTS (X3)	15	10	50	60	8

A. Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) Method

TOPSIS was planned by Hwang and Yoon (1981) [9] to define the best alternate based on the concepts of the concession resolution. The compromise solution can be observed as selecting the clarification with the straight Euclidean distance from the ideal resolution and the furthest Euclidean distance after the undesirable ideal resolution. The processes of TOPSIS canister be labeled as follows.In this system binary synthetic alternate are hypothesized: positive ideal alternative, negative ideal alternative. TOPSIS selects the alternate that is the neighboring to the ideal resolution and farthest from negative ideal resolution [10].

1. Constitute the methodized decision matrix: each element rij is obtained by the Euclidean formalizations.

$$x_{ij} = \frac{d_{ij}}{\sum_{i=1}^{n} d_{ij}^{2}}$$

2. Constitute the weighted methodized decision matrix: The weighted methodized decision matrix vij is computed as

$$v_{ij} = w_{ij} * x_{ij}$$

3. Define the positive model and negative model solutions.
Positive model solution

$$A^{*} = \{v_1^{*}, \dots v_n^{*}\} = \{(max_i v_{ij} | j \in J), (min_i v_{ij} | j \in J')\}$$

Negative model solution

$$A^{*} = \{v_1', \dots v_n'\} = \{(min_i v_{ij} | j \in J), (max_i v_{ij} | j \in J')\}$$

4. Calculation of the similarity distance:

$$S_i^{*} = \sqrt{\sum_{i=1}^{m} (v_i^{*} - v_{ij})^2} \; --- \; j = 1 \dots\dots m$$

And

$$S_i^{*} = \sqrt{\sum_{i=1}^{m} (v_{ij} - v_i')^2} \; ------ \; j = 1 \dots\dots m$$

5. Estimate the virtual nearness to the ideal resolution C_i^{*}

$$C_i^{*} = \frac{S_j'}{S_j^{*} + S_j'}$$

A set of alternatives can be ranked conferring to the lessening order of C_i^{*}.

B. Grey Relational Analysis (GRA) Method

The gray system model presented in Deng (1982) is an influential methodology for the systematic analysis of relations and for model building of a system with doubt and incomplete data [8]. It also services approaches of expectation and decision making to study the relationships among attributes and to help gain a purer illustration of the relations among features of a scheme. The gray relation model, which is an estimation method, has some primary functions: determining the relationships between separate attributes of the target system, screening out important attributes that would heavily affect the operative purposes of a system, and enhancing the effective growth of a system. GRA is usually implemented following three stages:

Step 1: The standardization of the classification data is achieved according to the three conditions (highest-the-better, lowest-the-better, and nominal-the-best) as follows:

$$x_{ij} = \frac{y_{ij} - min\{y_{ij}, i = 1 \dots m\}}{max\{y_{ij}, i = 1 \dots m\} - min\{y_{ij}, i = 1 \dots m\}}$$

$$x_{ij} = \frac{max\{y_{ij}, i = 1 \dots m\} - y_{ij}}{max\{y_{ij}, i = 1 \dots m\} - min\{y_{ij}, i = 1 \dots m\}}$$

Step 2: Grey relational co-efficient be used for defining how close $x_{ij}$is tox_{0j}. The greater the grey relational coefficient, the close x_{ij} andx_{0j}. Theory relational co-efficient container be designed by Eq.

$$\gamma(x_{0j}, x_{ij}) = \frac{\Delta_{min} + \Delta_{\xi max}}{\Delta_{ij} + \Delta_{\xi max}}$$

In Eq. $\gamma(x_{0j}, x_{ij})$ is the grey relational coefficient between $x0j$ and xij.

$$\Delta_{ij} = |x_{0j} - x_{ij}|$$

Step 3: The Grey Relational Grade can be here considered by

$$\beta(x_0, x_i) = \sum_{j=1}^{n} w_j \gamma(x_{0j}, x_{ij})$$

In Eq. $\beta(x_0, x_i)$ Is the grey relational grade amongst X_0 andX_i. The weight carry hold given by w_j.

C. Multiplicative Exponent Weighting (MEW) method

This process is also termed as weighted product method (WP) in MADM scoring technique. The following equivalence was used in demand to define the measurements. The main alteration is that in its place of adding usually mathematical procedure now there is expansion [8].

Standardization of values can be supported out by,

$$r_{ij} = \frac{d_{ij}}{d_{ij}^{maqx}}$$

Where r_{ij} reresents the standardized presentation rate and d_{ij} denotes characteristic j of candidate's networks.

$$r_{ij} = \frac{d_{ij}^{min}}{d_{ij}}$$

Wherever rij represents character j of candidate network i, we designates the weight of character j.

$$A_{MEW}^{*} = max_i \prod_j rij^{wj}$$

III. RESULTS AND DISCUSSION

In directive to value the presentation of every MADM algorithm, we reflect a network selection situation in an atmosphere integrate by three network as WIFI, WIMAX and UMTS, and five resolution criteria take to be estimate and paralleled in directive to detect and prompt a vertical handoff. Include available bandwidth (AB), data rate, jitter and packet delay (D) and cost per byte (CB).

A. Simulation 1 TOPSIS Methods

The choice of values of the parameters or decision criteria are selected at a time of best network. Table 2 provide a normalization decision matrix in Topsis method.

Table: 2 Normalized Topsis method

	Band Width (A1)	Data Rate (A2)	Delay (A3)	Jitter (A)	Cost (A5)
WIFI (X1)	0.205	0.083	0.181	0.062	0.126
WIMAX (X2)	0.307	0.179	0.187	0.018	0.253
UMTS (X3)	0.154	0.027	0.151	0.075	0.101

In Fig: 1 show the TOPSIS WiMax displays greater values for handoff decision making. So, WIMAX can be selected as a better choice for roaming after successful handoff. Then WIFI band-width as well as Date rate has decreased heavily. And cost has improved, so it will not be a decent option to select. UMTS has decreased bandwidth, data rate, increased delay, jitter and cost. So at this point derives WIMAX as the best option for handoff selection when compared to other networks.

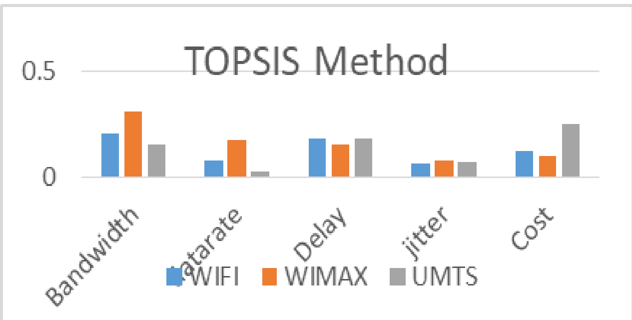

Figure: 1 Topsis method

B. Simulation 2 GRA Methods

The collection of attitude of the parameters or result criteria are designated at a phase of best network. Table 3 provide a normalization decision matrix in Gra method.

Table 3: Normalized GRA method

	Band Width (A1)	Data Rate (A2)	Delay (A3)	Jitter (A4)	Cost (A5)
WIFI (X1)	0.333	0.363	0.166	0.222	0.833
WIMAX (X2)	1	1	0	1	0
UMTS (X3)	0	0	1	0	1

The Fig: 2 the grey relational grade values are characterized by swelling the criterion co-efficient values with their equivalent weights. Uniform though the delay, jitter and cost of the WIMAX is reduced, it shows good presentation for bandwidth and data rate while paralleled with further alternatives.

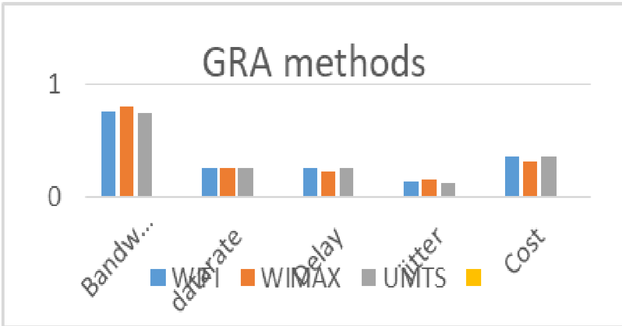

Figure 2: Grey relational grade

C. Simulation 3 MEW Methods

The variety of values of the considerations or choice criteria are selected at a period of best network. Table 4 provide a normalization decision matrix in Mew method.

Table 4: Normalized Mew method

	Band Width (A1)	Data Rate (A2)	Delay (A3)	Jitter (A4)	Cost (A5)
WIFI (X1)	0.666	0.461	0.833	0.3	2
WIMAX (X2)	1	1	0.806	0.1	1
UMTS (X3)	0.5	0.15	1	0.25	2.5

In fig 3: show available network to select the best vertical handoff decision. The algorithm in [15] takes into interpretation the user performance, Qos and network condition requirements when selecting the best network.

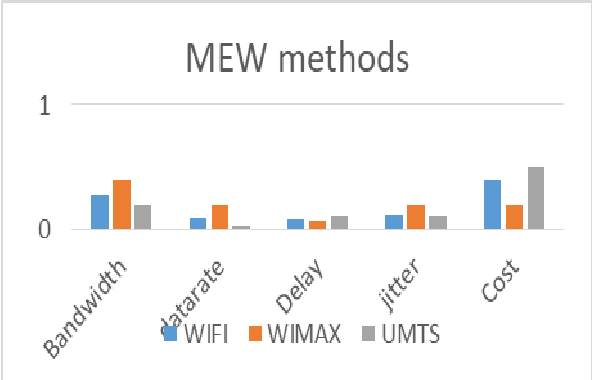

Figure 3: Mew method

The Fig: 1, 2 and 3, showed TOPSIS, GRA and MEW for all the alternatives by broadcasting with their equivalent weights. WIMAX reference sequence is closer to the comparability order in band-width and Date rate criteria. Hence it is the best alternative for handoff decision. But it ensures not have higher reporting, thus it requests too several handoffs which is not a good option. WIFI and UMTS results are not significant here since it displays reduced processes still its delay, jitter and cost is average. These events are based on Concordance value. For TOPSIS, GRA and MEW methods displays greater values for handoff decision making. The three methods are analysis the WIMAX network is maximum value. So, WIMAX can be selected as an improved choice for travelling after successful handoff. From the Table: 5 below the simulation parameters for execution of handoff decision can be obtained. Node movements are random and the simulation period is approximately 60 seconds.

Table: 5 simulation parameters

Topology Outline	500 Meter * 500 Meter
Radio range of every node	150-200 Meters
Transmission Quantity	1 Mbps
Base Station	MultiHop / Hierarchical
Node Tally	15-21
Average transmission of Packets	2 packets
Maximum speed of a node	5 meters / second
Node minutes	Random
Simulation Period	60 minutes

We have evaluated the Throughput of all five networks from the Wimax shows highest score when compared to other networks. Fig: 4, Next to Wifi shows the highest Bandwidth and Data rate. As we concerned about the benefit, the negative side should also be considered here. From the fig: 5, Wimax has large amount of packet drop even though its Bandwidth and Data rate is high. Delay and Jitter gets low packet loss. Latency seems to be more or less equal for the networks such as Wifi, Wimax and UMTS. It is clear from the Wifi gets very high latency, since its coverage area is very small. By these analysis we can select Wimax for handoff.

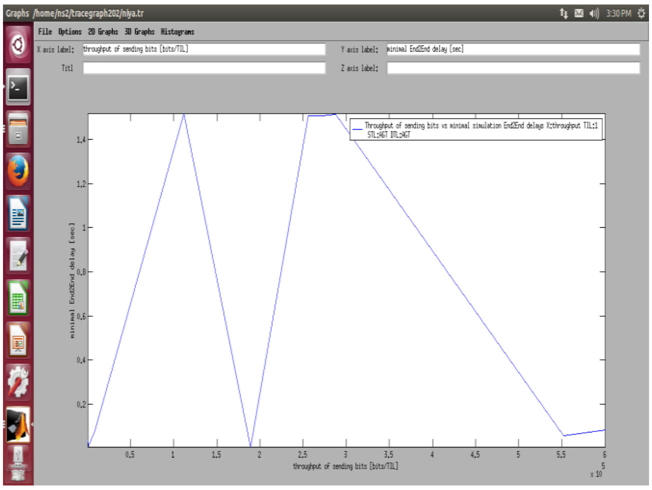

Figure: 4 Packet Throughput

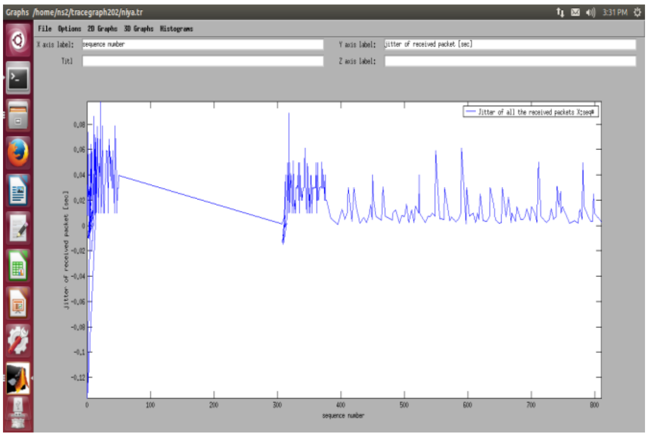

Figure 5: Packet Jitter

IV. CONCLUSION

Upcoming wireless communication scheme will comprise several categories of mobile access networks and seamless vertical handoff amongst dissimilar networks is a thought-provoking problematic in HWNs. Though several vertical handover decision algorithms have been projected, utmost of them do not deliberate the effect of MNs velocity throughout the vertical handover decision development. Trendy adding, most of present multi-attribute vertical handover systems deceit expect MNs environments dynamically. This substance presented an efficient and innovative Multiple Attribute Decision Making (MADM) system such as GRA, TOPSIS and MEW methods. The future approach could be used in the instance of a general MADM problem, where the description of importance and the grade are desired for a settled of alternatives WIFI, WIMAX and UMTS concluded a set of criteria parameters standing procedures.

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