*International Journal of Engineering Applied Sciences and Technology, 2016*
**Vol. 1, Issue 8, ISSN No. 2455-2143, Pages 310-313**
Published Online June - July 2016 in IJEAST (http://www.ijeast.com)

# A SEAMLESS VERTICAL HANDOVER IN HETEROGENOUS WIRELESS NETWORKS: REVIEW

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***Abstract*— Future wireless systems will be characterized by their heterogenity because of advancement in the technology. It integrates different networks to provide seamless internet access for mobile users with multimode access ability. Handover in heterogenous wireless network is an important feature for the mobile terminal. It is a strategy that required to maintain the network connectivity which aims to achieve the efficient communication that requires systematic and individual attention in order to provide an efficient service to the user. They provide a cost effective, simple, operable and personalized global communication according to users need. This paper gives the comprehensive study of vertical handover decision based algorithm in order to choose the best available network and increases handover performance so that an efficient service is provided to the users.**

*Keywords*— **WSNs, Handover, Vertical handover parameters, vertical handover decision algorithms**

## I. INTRODUCTION

Wireless sensor networks are consists of a large number of sensor nodes that are distributed in the sensing area and are connected either randomly or hierarchically[1]. To create a wireless sensor network these nodes are combining with routers and gateway. A sensor node have three main capabilities i.e. sensing ,processing and communication[2].These nodes sense the environmental information and then transmit to the end user .WSNs contains a set of diverse applications like area monitoring, detection, health care, traffic control etc.[3].These sensor nodes are organized in the form of clusters in an hierarchical WSNs. As explosive growth in mobile broadband services has stimulated great demands on wireless networks in which heterogenous networks is considered as a prime way to meet the demands for mobile broadband service coverage and capacity[5].The use of wireless sensor networks is becoming popular day by day but at the same time it faces the problem of energy constraints in terms of limited lifetime .As every node for its activities depend on its energy which becomes a major issue in wireless sensor networks[4]

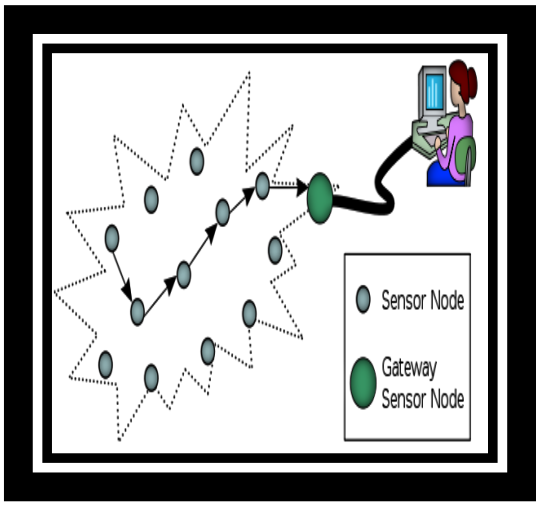


Fig. 1: Multi-hop wireless sensor network architecture [4]

## II. HANDOVER

In the terms of mobility, the network ensures a seamless connection for example in case of fourth generation wireless networks. Handover is a term which is most popular in cellular communication which means when a user continues with its call when he/she switches from one coverage zone to another

**Classification of Handover**

1. **Horizontal handover** – To switch from one coverage zone to another the user uses same access technology.
2. **Vertical handover** – To switch from one coverage zone to another the user uses different access technologies.

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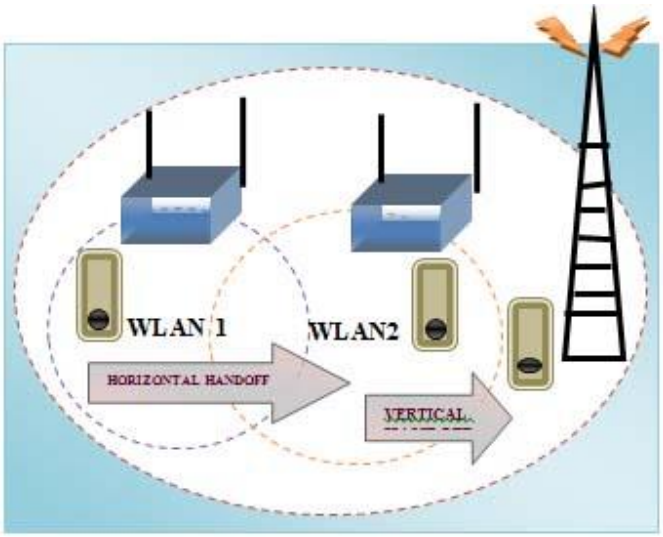


Fig 2 vertical handover vs horizontal handover

**Three phases of handover process** –

1. **Handover information gathering** – All the information is collected which is required for the handover process to take place
2. **Handover decision** – In the decision part we are using the algorithm.
3. **Handover execution** – It is used to change the channels with respect to the details required during decision phase.

To have seamless communication between the heterogenous wireless networks vertical handover is used as it supports multiple features:

- Access technology changed in case of vertical handover.
- It supports number of parameters.
- Network interface is changed
- Different IP are used

The paper is organized as follows. In section 3, it represents the related work in wireless sensor networks. Section 4 defines various parameters in vertical handover and section 5 represents various VHO decision algorithms .Finally conclusion is explained in section 6.

## III. LITERATURE SURVEY

**Nupur gupta ,et.al** A novel study on network reconfiguration system to enhance security in wireless sensor network[4] In this paper a partition detection and route recovery scheme for node failures happened as a result of large scale damage When the partition is detected a local leader will initiates the recovery process.

**Shelej khera et.al** A review on research aspects of vertical handover decision based intelligent algorithm. In this paper vertical handover decision based intelligent algorithm is done. ARM,AI based approach is required to implement the vertical handoff intelligent mechanism in 4G networks to produce an effective service for the user.[5]

**S.Nandakumar, et.al** Traffic driven and RSS adaptive handoff scheme In this paper a handoff mechanism is analysed based on RSS from two different base stations and adaptive RSS is better than fixed RSS as this helps in removing various problems i.e. call failures, interruptions in data transfer

**Hong –chi shih et.al** Fault node recovery algorithm for a wireless sensor network. This paper proposed a fault node recovery algorithm to enhance the lifetime of a wireless sensor network when some of the sensor nodes shut down. It reduces the rate of data loss by 98%.

**Steven-Navarro and W.S wong** Comparison between vertical handoff decision algorithms for heterogeneous wireless networks In this paper there is comparison is made between the vertical handover decision algorithm which includes different attributes i.e. bandwidth, cost, delay, packet loss rate.[6]

**Yamini saini et.al.** Vertical Handover in wireless heterogenous network:A Review This paper gives the comprehensive study of VHO algorithms e.g RSS combined with estimated lifetime.[7]

**Sayan kumar Ray et.al** Handover in mobile WiMax networks: The state of Art and Research issues A survey of MAC, network, cross layer scenarios is presented with different solutions.

**Gurpartap singh,Garima saini** Development of VHO protocol based on MIH in UMTS-WIMAX heterogenous network The vertical handover protocol based on MIH. IEEE standard with MIIS server is proposed. It aims to improve the throughput, reduce overhead and time consumption.[8]

**Gavali V.S et.al.** A study of RSS based vertical handover decision algorithm RSS is one of the major parameter in case of vertical handover decision algorithm. A comparison is made between various VHD algorithms based upon RSS[9]

**Shiwen Nie,Di Wu ,et.al.** An enhanced mobility state estimation based handover optimization algorithm in LTE a self-organizing network considering user equipment and handover types, the optimization algorithm improves the performance of the handover

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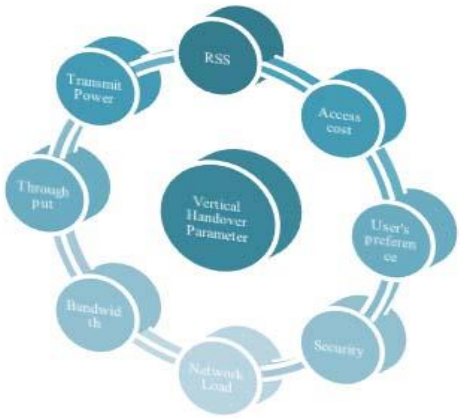
## IV. VERTICAL HANDOVER PARAMETERS

The decision of vertical handover may depend upon various parameters discuss below:

a. **RSS** (Received signal strength) – A Handover initiation decision by a wireless terminal is dependent on RSS. It is one of the most important parameter in vertical handover decision as it is easily measured and directly related with quality of service. It is defined as the distance between the mobile station to the base station[8]
b. **Access Cost** – Every candidate network is associated with cost function, the decision is to select the network with lowest cost value[9]. Therefore we can say that minimal cost is necessary in order to make a vertical Handover decision
c. **User's preference** – It is very important to associate the mobile terminal with preferred network to satisfy user application as it improves resource utilization and quality of service.
d. **Security** – Networks with high security, integrity, confidently is selected instead of network which provides low security[6]
e. **Network load** – It is very necessary to balance the network load. It should be as minimum as possible.
f. **Bandwidth** – The difference in the upper range frequencies and lower range frequencies defines the term bandwidth.
g. **Throughput** – Throughput may be termed as the number of packets received by the receiver in data transmission time. It is expressed in bps(bit per second).
h. **Transmit Power** – Various methods are to be find out to raise the energy efficiency in wireless networks[8]




## V. VHO DECISION ALGORITHM

Both QoS parameters and handover metrics are required for VHD[10].The vertical handover operation provides authentication to the mobile users to maintain the connection in such a manner that packet loss and transfer delay is minimum. The VHD may depends upon various parameters that have mentioned above to enhance the handover performance.

### a. MADM(Multiple Attribute Decision Making)

In [6], the vertical handover decision is constructed as a fuzzy MADM(multiple attribute decision making)problem. The fuzzy MADM includes two concepts .In the first concept a fuzzy data is to be converted into a real number while the second concept is used to find out the ranking order of the candidate networks.
It involves two classical methods i.e. SAW and TOPSI:

1. In SAW (Simple Additive Weighting) the score of each candidate network a is obtained by multiplying each metrics $r_{ax}$ with weight $w_x$ of metrics $_x$ and is represented as

$$A\square\ SAW = \arg\max \sum_{x=1}^{N} w_x r_{ax}\ [1]$$

where a€M, N is no. of parameters and M is no. of candidate networks. If wants to calculate the overall score of a candidate network then, it is find out by the weighted sum of all the attributes values.

2. In TOPSIS (Technique For Order Preference By Similarity to Ideal Solution) the ideal solution is determine by using the best values for each metric where $c_a^*$ represents the similarity of candidate network a to ideal solution and the selected candidate network is that which is close to ideal solution and represented as

$$A\square\ TOP = \arg\max c_a^*\text{ , where a€M[2]}$$

### b. AHP and GRA

In[12], the network selection is depend on AHP(Analytic Hierarchy Process) and GRA(Grey Relational Analysis). AHP divides the network selection problem into many sub-problems and after that assigns a weight value for every sub – problem. AHP can be used to determine the weights[10]. While GRA is used to provide ranking to the candidate network and selects the one whose ranking is highest. GRA ranking is performed by making grey relationship with ideal network. Furthermore the GRC (Grey Relational Coefficient) is calculated for every network which defines the similarity between every candidate network and ideal network. Highest similarity to the ideal network is the selected network and represented as

$$A\square\ GRA = \arg\max T_{o,a}(3)$$

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where a€M and $T_{o,a}$ is the GRC of network a

**c. MEW(Multiplicative Exponent Weighting)**

MEW is MADM scoring method as we know the vertical handover decision problem is expressed in the form of matrix where row a represents the candidate network a and column x represents the attributes. The score of the network is calculated by the weighed product of attributes and represented as

$$S_{a=\prod_{x=1}^{N} p_{ax}^{wx}} \quad (4)$$

Where $p_{ax}$ means attribute x of candidate network a, $w_x$denotes weight of attribute x and $\sum_{x=1}^{N} w_x = 1$.It is necessary to compare each network with the score of ideal network which is the network with best values in each metric. The ratio $R_a$ between network a and the ideal network is determined by:

$$R_a = \frac{\prod_{x=1}^{N} p_{ax}^{wx}}{\prod_{x=1}^{N} (p_{ax}^{*})^{wx}} \quad \text{where } 0 \le R_a \le 1 \quad [11]$$

$$A\square\ MEW = \arg\max R_a \text{ , where a€M} \quad [11]$$

The weights required for VHD algorithms is calculated by using eigen vector method.

## VI. CONCLUSIONS

To have seamless communication between the Heterogeneous wireless networks in fourth generation vertical Handover is very important. This paper gives a brief review on vertical Handover, parameters and vertical handover decision algorithms to raise the QoS parameter and Handover metrics in order to select the best network. This avoids unnecessary Handover and also minimizes the failure probability. In future design by comparing VHD algorithms based on their performance in various aspects optimal solutions are to be provided that enhances the best suited network. [10]

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