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# Simulation of Vertical Handover Algorithm for Seamless Connectivity using Advanced Cuckoo Search Algorithm

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**Abstract**

In mobile communication network, handover may be used as the method of sending data or it can be session of ongoing call from the source to target BS. It may also be referred as process of decision-making for handover that activates handover only when some specific situation is satisfied. The situation for handover might differ over time because of the mobility of UE. The main objective of the work is to trigger well-known cuckoo's algorithm with advanced modification so that accurate prediction and handover to the Target eNB is achieved. Consequently, optimization of the parameters is of huge importance to confirm that how efficient and reliable the handoff algorithm is. This algorithm is simulated on Matlab platform. Based on the different parameters like Channel Capacity, Signal to Noise Ratio, available Bandwidth, the decision of handover is considered. Since the user's mobility is inevitable, the reduction of the handover failure rate is reduced using the proposed method and also it improves quality of service.

**Keywords*:*** VHO, channel capacity, power consumption, SNR, BER.

## INTRODUCTION

In recent years, the demand for communication services has been growing rapidly, connectivity with a high rate of data and adequate bandwidth has thus become mandatory. For the improved cellular network with low latency, channel capacity, area of coverage and data rate should be considered. Thus, most network researchers tend to concentrate on the enhancement of spectral efficiency for the next-generation wireless technology to keep QoS high. Long-term evolution (LTE) is a high-performance air interface that comes under the third Generation Partnership Project (3GPP). 3GPP LTE is a packet-switched telecommunication technology which provides the outstanding service close to 4G networks. LTE provides higher data rate with minimum latency. Major objective of 3 GPP is to fulfill the prerequisite of rapid information transportation medium as well as high capability of voice. The requirement of the next generation networks is 100 Mbps of high throughput for downlink and for uplink it is 50 Mbps.

## HANDOVER

A handover can mainly be classified into two categories:

hard and soft handover.

### Hard Handover

In this case, the break before make method is used. Hence, the connectivity with the target cell is made and the connectivity between source cells will break before. In hard handover, limited channels of base stations are not wasted which proves an added advantage for the system. One of the important benefits is that, it is a kind of handover process in which the previous connection will break first and then it will make connectivity with the another target base station, so that there is less wastage of the resources(Base Stations/cell) and also leads to cost reduction of the network[4].

The main problem with this type of handover process is that, if the device is fails to make connectivity with the target cell the call can be interrupted or sometimes it can be ended so that the device will not able to perform re-connectivity with the previous source base station as it already release the source base station.

### Soft Handover

In this case, the make before break method is used. Here, source cell channel is preserved and utilized until a new connection is made with the target base station. After getting

service from the target base station the device can release the previous channel or disconnect from the source base station. In

soft handover the mobile device is able to maintain connectivity with more than 3 base stations at same time. The main advantage of soft handover is, it provides minimum data loss and reduced call drop with increased efficiency. Moreover, soft handovers plays a major role in the very critical hardware were *a* single or multiple connection is needed all the time.

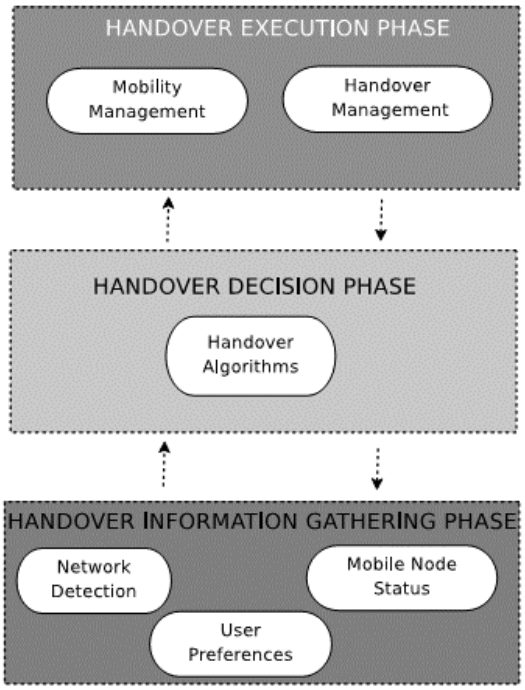


**Figure 1:** Handover Process

## RELATED WORK

A typical handover process is explain with the help of figure 1, where the throughput of a vertical handover (VHO) is calculated as : ( number of successful handover / total number of handover initiated ). The Hasswa algorithm[1] is a model which is developed to design a smart 4G system in the wireless heterogeneous networks which has the ability to provide context-awareness as well as mobility management by maintaining the high levels of QoS (Quality of Service). Also the system meets user preferences and support seamless handover among heterogeneous wireless networks.

Hasswa A., Nasser N., and Hassanein H[1] proposed a typical "Tramcar" where the smart vertical handover method is

discussed. Developed algorithm utilizes the application and transport layers avoiding any changes in the network layer of the Communication layered model. The architecture has two parts one is Connection Manager and second is Handover Manager. Connection Manager mainly responsible for managing the Mobile Host's and it operates in transport layer whereas Handoff Manager is responsible for providing mobility and location management [1].

Hu and Perrig [5] has focused on the development of an algorithm in which both source node and destination node authenticates the message. For better connectivity, the intermediate nodes are also expected to insert their own signature in the route request.

Buchegger and Boudec [6] proposed a protocol, called CONFIDANT. This algorithm detect and isolate the misbehaving nodes which results in making these nodes unattractive.

Michiardi and Molva [7] have proposed CORE mechanism. Here, based on different information, indirect and functional reputation, a watchdog monitoring protocol is suggested for isolating selfish nodes.

As per the authors, Bansal and Baker [8] Ad hoc networks mainly rely on the hand-to-hand functioning of nodes. Here every node in the network is participates in forwarding packets towards each other. Based on the traffic, a node may accept or deny received packets. But the major drawback of suggested method is that if maximum of available nodes exhibit this behavior, degradation in network performance is observed due to which cooperating nodes becomes loaded.

Zapata and Asokan [9] proposed the Secure Ad-hoc On-Demand Distance Vector routing protocol. It provides various security features like integrity, authentication and non repudiation along with protection of route discovery mechanism.

## OVERVIEW OF THE PROPOSED ALGORITHM

In our contribution to the existing cuckoo's algorithm, we need to develop our novel decision making algorithm through learning connection properties before changing the connection

In this section, a directed network G (N, E) comprising of a set of nodes N and a set of directed arcs E is considered. The set of nodes N is composed of three categories: a set of Servers S , a set of Mobile Terminals M , a set of Internet Service Providers I where

$$N = S \cup M \cup I$$

Conventionally, the selection of the best eNB is based on the instantaneous channel condition between the relay and the user, such that the user will have a high throughput. In case of conventional method, end to end delay is observed which results in reduced throughput. The aim is to develop a simple distributed solution for relay selection during the handoff process. The proposed relay selection algorithms controlled by a type of mobile assisted controlled hand over process.

This paper proposes to a novel approach using cuckoo's algorithm[10] for efficient handover procedure. Here, a typical four cell structure is taken into consideration with different users carrying different bandwidth and power. Each user in the channel is allocated with a separate bandwidth. Furthermore, available channels are allocated to these users as per the status and requirement of the user. In this method, whenever the handoff algorithm is triggered, best possible connection is established based on different parameters like ; Channel capacity, BER, SNR and Bandwidth. To achieve required goal, viterbi decoding operation is performed for decoding a bit stream so as to calculate bit error rate.

Whenever any mobile user moves from one BS to another, cuckoo's algorithm is triggered to calculate and analyze channel capacity of each and every nearby BS. Based on the "best" solution available, resource allocation is carried out and Handover is initiated [3]. Here the terminology "best" solution is used to represent that there are more than one solution available to initiate the Handover process with different values of suggested parameters. Out of which the "one" which has maximum optimization is used for the Handover. Here, optimization (figure 2) is the process which adjusts all the inputs to device and does an experiment to find the maxima and minima results with the help of ;

$$H = \prod_{i=1}^{N_H} P_i$$

where

H = Number of different Hanover Combinations available

$N_H$ = Total Number of Handover Combination Possible and

$P_i$ = Number of different values of variable *i*

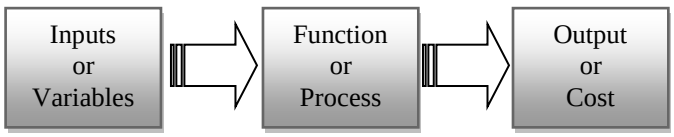


**Figure 2:** Block Diagram of a process which is to be optimized

## IV. Performance Evaluation

Figure 3 shows a simple structure of proposed work.

The proposed system is executed in three major phases :

1) Network Discovery Initiation

2) Handover Decision Making and

3) Hand Off Execution

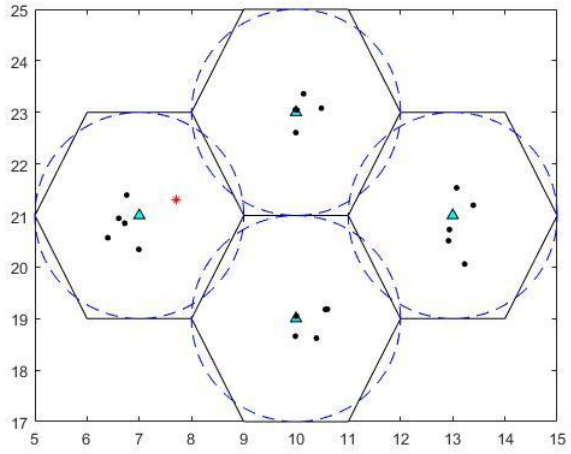


**Figure 3:** Proposed Work Structure

1) *Network discovery initiation*:
In this phase (also called information gathering),as shown in figure 5, the UE periodically receives the values of signal strength from home serving cell and neighbor cells which helps to initiate handover in the required network. Alongwith that, the channel capacity is also verified by the system as shown in figure 4. Some of these following factors are related to network parameters such as Reference Signal Received Quality (RSRQ), Signal Interference to Noise Ratio (SINR), Received Signal Strength Indicator (RSSI), Signal to Noise Ratio (SNR), and Carrier Interference Ratio (CIR). On the other hand, other factors are related to UE, such as velocity and battery life.

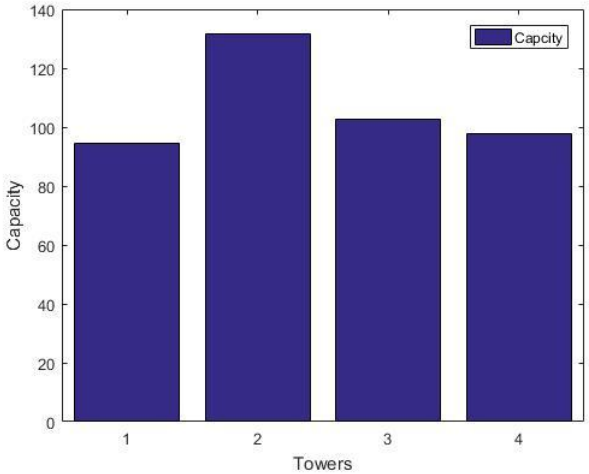


**Figure 4:** Calculation of Channel Capacity

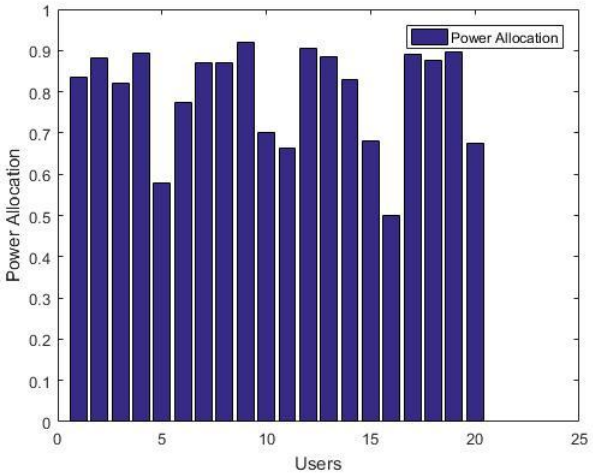


**Figure 5:** Calculation of RSS

2) *Hand over decision making*: Once the more reliable link is elected based on the channel capacity received by neighboring cells as shown in figure 4. Then a new link between the mobile terminal and a base station (or an access point) located in the new network is setup. They will exchange their connectivity and protocols on Layer 2 (medium access) or Layer 3 (IP) are information vice versa. It also includes the Authorization / Administration procedures.

3) *Hand over execution:* Once the MT controller decides the data mode and control mode all the communications with the old link are transferred to the new link. The control signals and data packets are allocated to the connection associated with the new base station or access point (figure 6).

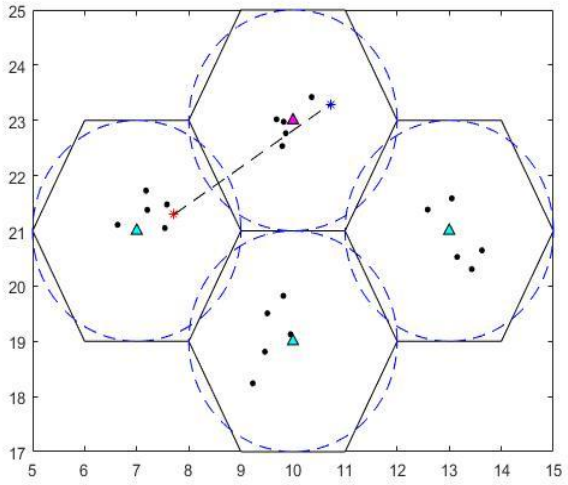

**Figure 6:** Handover Execution

## RESULTS

Table 1 Shows the Comparative study between Hasswa, Omar and Advanced Cuckoo's algorithm . In case of Omar Algorithm, it is observed that the Success rate is more than the Hasswa algorithm due to the selection of the optimum RAT. On considering execution time, the time required for Omar algorithm is comparatively more than Hasswa algorithm. On the other hand, proposed Advanced Cuckoo's algorithm provides required solution to the mobile user with maximum success rate (figure 8) and reduced SNR (figure 7).

**Table 1:** Success Rate of Hasswa , Omar and Advanced Cuckoo's algorithm

| Algorithm | No. of Users | Hand Over to UEs | % Success Rate |
|---|---|---|---|
| **Hasswa** | 150 | 120 | 70.00 |
| **Omar** | 150 | 128 | 85.33 |
| **Advanced Cuckoo** | 150 | 137 | 91.33 |

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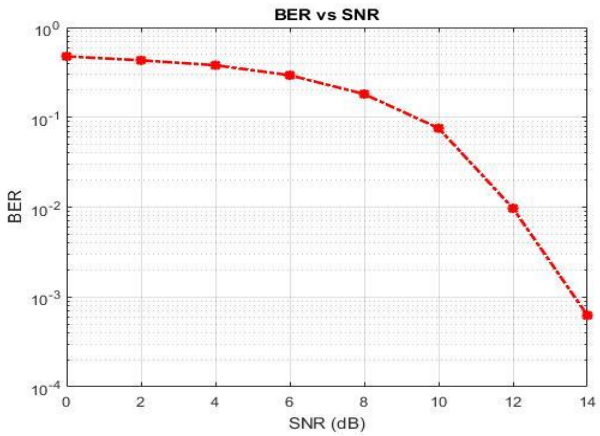


**Figure 7:** BER Vs SNR for proposed algorithm

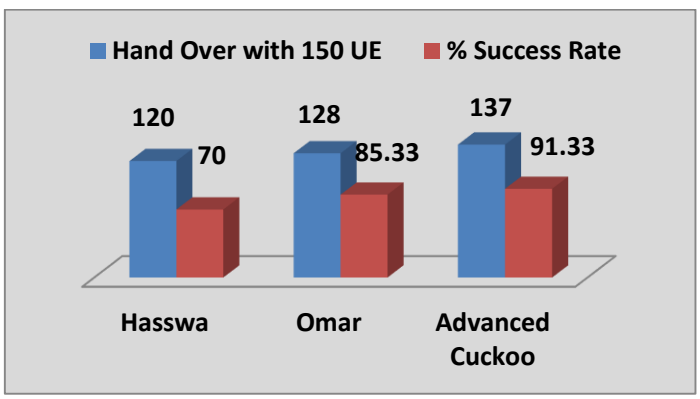


**Figure 8:** Result Comparision

## CONCLUSION

In this research work, a mobility oriented handover algorithm is developed which takes care of mobile users to establish seamless connectivity. In the first phase of the system, detection of mobile user who is in need of handover is identified. Based on user's movement, best possible solution is given with the help of Advanced Cuckoo's Algorithm. The discussed VHO approach provides solution for mobile user with its better performance, less complexity. In this paper, results of Advanced Cuckoo's Algorithm is compared with Hasswa et al. [1] algorithm and Omar et al. algorithm [2] methods.

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