ISSN No. 2395-0900

International Journal of Engineering Studies and Technical Approach

Smart Channel Assignment in Mobile Communication Systems

Mohamed Abdelghader Morsi*, Dr. Amin Babkir A.Alnabi, Dr. Ashraf Gasim Alsid*** & Khalid Qasem Mohamed Alborahy******

**P.G. Student, Department of Communication Engineering, Engineering College, El. Neelain University and Spectrum Engineer at National Telecommunication Corporation (NTC), Planning & Research &studies Department, Head of Future Trends, Khartoum, Sudan.*

***Assocaite Professor, Alneelain University, Faculty of Engineering, Khartoum, Sudan.*

****School of Electronic Engineering, College of Engineering, Sudan University of Science & Technology, Khartoum, Sudan.*

*****Department of electrical and electronic engineering, University of Khartoum, Khartoum, Sudan.*

ABSTRACT

This Paper deals with the handover & blocking probability minimization in mobile communication system. In this paper a new algorithm was proposed for channel Assignment. This proposed algorithm is a Smart one, which use Smart Channel Assignment (SCA) and it utilize the information from the MCS regarding the traffic load. If the load is very high the algorithm increase the common channels and if the traffic load decrease the algorithm reduce the common channels within the cluster. The algorithm was tested using MATLAB program. The simulation model was build based on a geographical and call generation model. The simulation result shows a good performance of the Smart Channel Assignment (SCA) algorithm.

1. INTRODUCTION

In recent years, the number of cellular users and the popularity of mobile computing have grown tremendously. This is due to the many technological advances supporting mobile communications such as providing high-quality voice communications and high-speed data services. Channel assignment is a vital process in the mobile communication systems; there are three types of channel assignment algorithms, Fixed Channel Assignment (FCA), Dynamic Channel Assignment (DCA), and Hybrid Channel Assignment (HCA). In Fixed channel assignment algorithm each Base transceiver Station (BTS) is allocated a predetermined number of channels, Fixed channel assignment algorithm advantages are avoiding co-channel interference, less expensive, less complex than Dynamic Channel assignment, and suitable for symmetric load, but in FCA the available frequencies are not utilized efficiently and this is it's disadvantage. In Dynamic channel assignment algorithm there is pool of frequency. The advantages of DCA algorithm are it's efficient utilization of available frequencies and thus decreasing blocking probability, but it's disadvantages is that it creates a high computational load in switches. The third type of channel assignment is Hybrid channel assignment; this method is a mixture of FCA and DCA, where the disadvantages of each method are avoided. In HCA part of the available frequencies are distributed among the

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available cells on the cluster and the remaining part are left on the pool, through this type of assignment we can achieve better spectrum utilization with lower computational load.

2. APPROACH

In this paper the existing channel assignment algorithms will be reviewed. The main aim of this revision is to examine the advantages of that algorithm. The analysis of mobility and traffic parameters variation on the network performance is examined by a simulation program written using MATLAB Editor. The simulation process using MATLAB will start with modeling this include Physical model (Geographical area is part of Khartoum city to simulate traffic), Mathematical model, Simulation scenario. The simulation results used to develop the HCA Smart algorithm, which can be developed farther to run in the MSC switch and improve the handover process. The smart algorithm is proposed also to enhance the performance of the network and utilize the advantages of existing algorithms in one adaptive algorithm.

3. SIMULATION SCENARIO

Figure (1) & (2) shows the block diagram for the simulation program. This program is written using MATLAB instruction:

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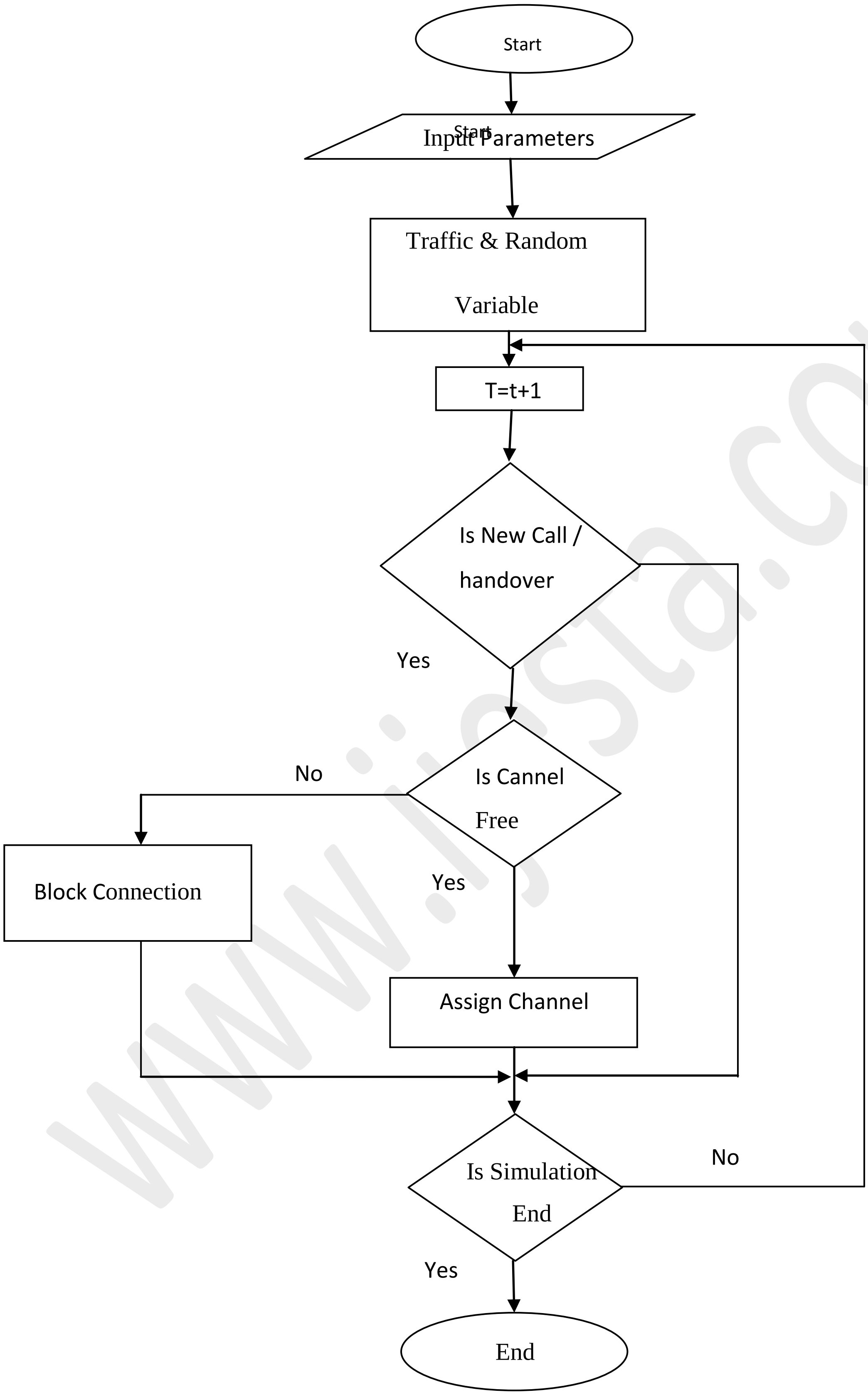

Figure (4.1): Flow chart of the first simulation

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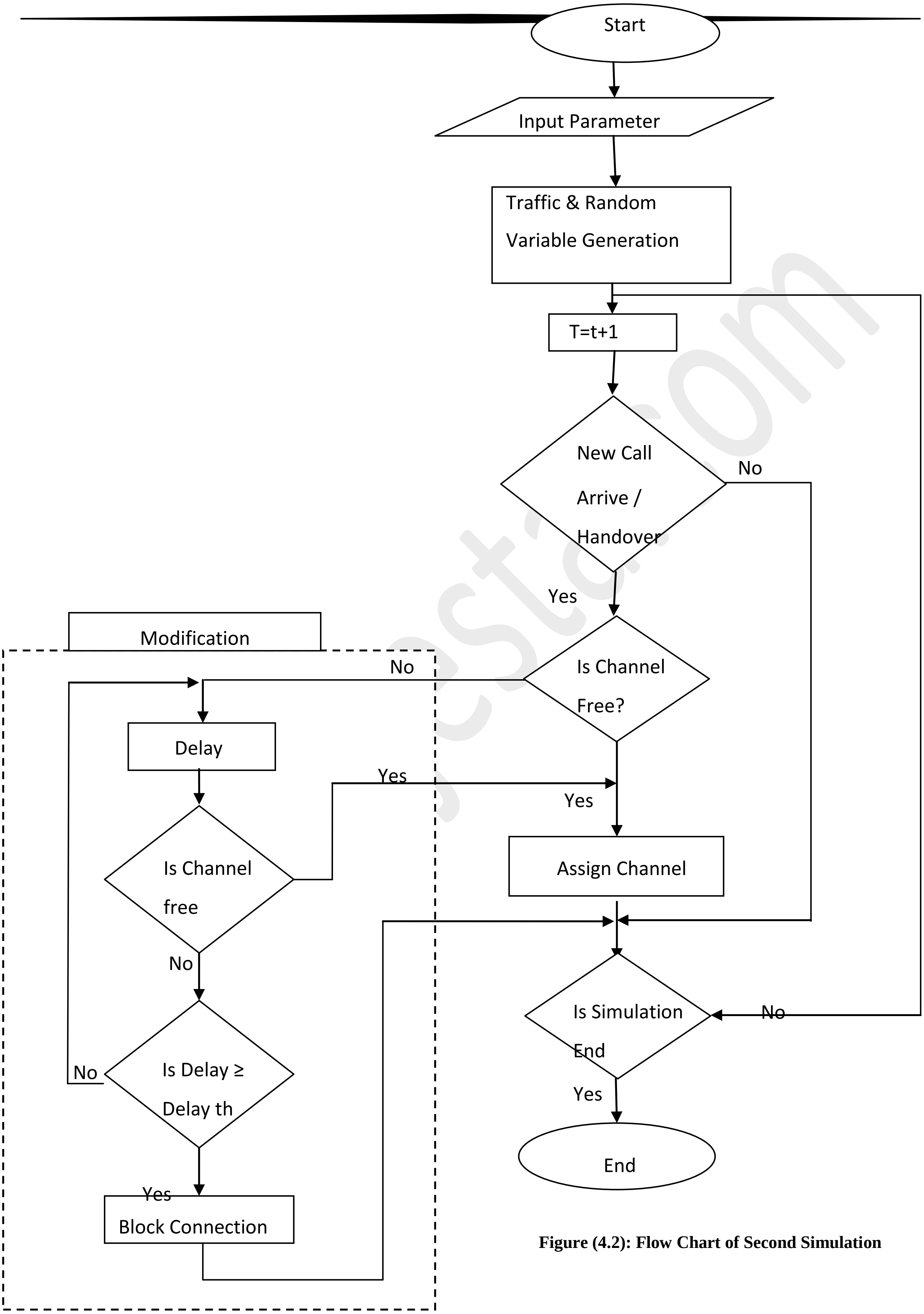

Figure (4.2): Flow Chart of Second Simulation

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4. SIMULATOR RESULTS VALIDATION

The random generators have been tested and the graphical results indicated its performance. The mobile position generated according to non uniform distribution in which the cell in middle has a very large number of mobiles as in figure (3) from the simulation output. This done to create asymmetric traffic load.

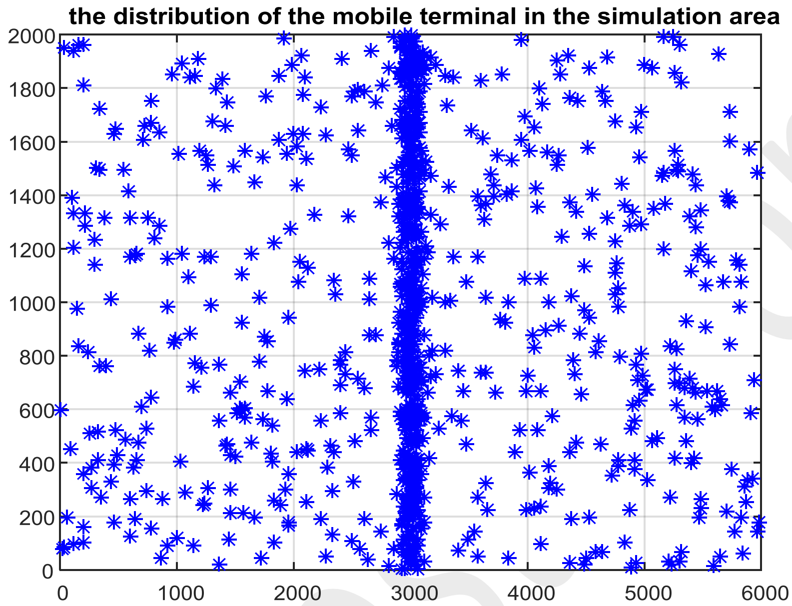

Figure (3): non uniform distribution of the mobile position

The traffic generator is tested and the result indicates its efficiency. That generator includes the call interarrival and call duration as in figure (4) and (5). The call interarrival is Poisson random distribution. The call duration has a uniform distribution

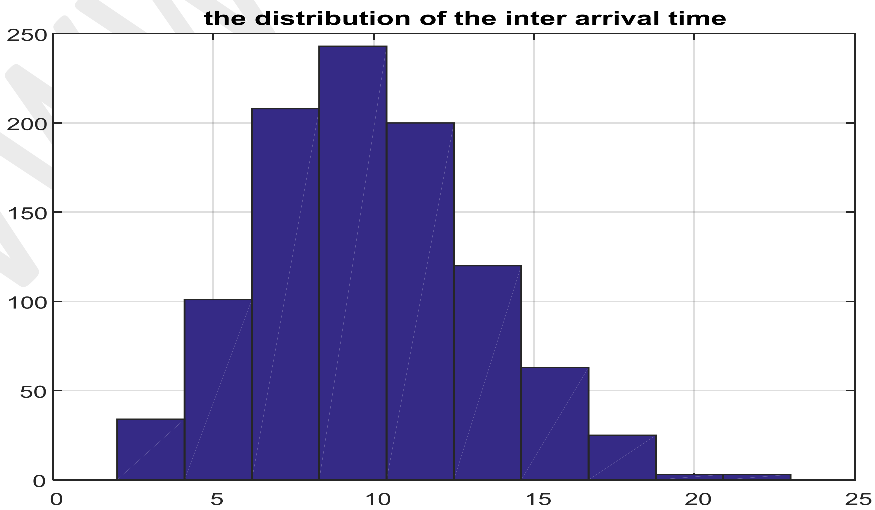

Figure (4): call Interarrival

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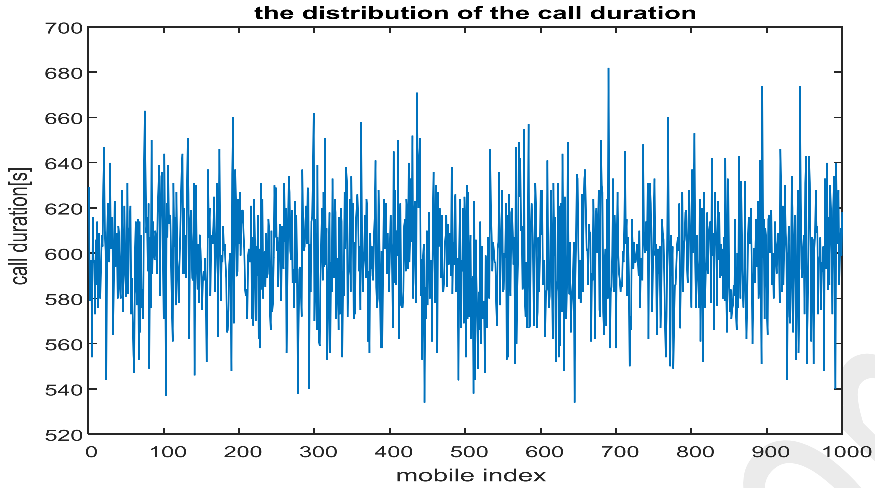

Figure (5): call duration

5. THE EFFECT OF THE MOBILITY AND TRAFFIC VARIATION

The handover counter or handover request for 1000 users with very long and short connection is proportional to mobility. In long connection the average mobility has a higher handover request. The results also show that the handover increase due to high mobility, as in figure (6). In the average the handover request increase with the mobility. The handover request was identical in the results of the two simulation scenario. Figure (7) shows the new call block and it's identical in the two simulation scenario. The handover counter or handover request for 500 users is also has a similar pattern to the 1000 users.

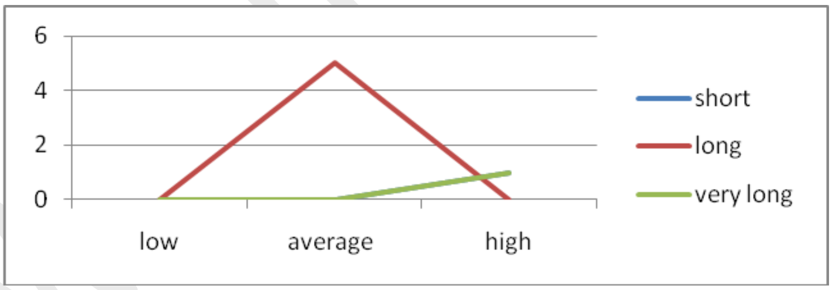

Figure (6): handover counter between mobility and connection

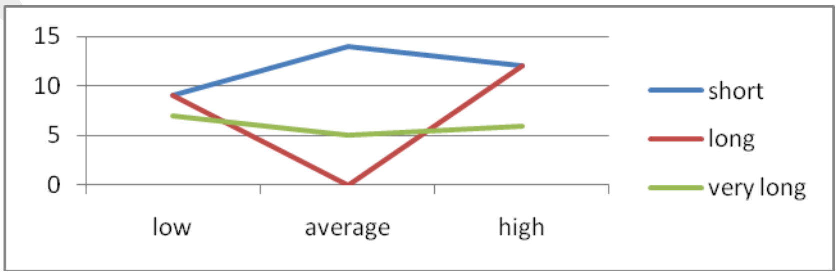

Figure (7): new call failure between mobility and connection

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6. PERFORMANCE ENHANCEMENT IN THE PROPOSED HANDOVER ALGORITHM

Table 1 and 2 shows the enhancement percentage for the proposed handover algorithm. Figure 8 shows the general performance and enhancement in the handover failure. The proposed algorithm has better performance in high mobility. The performance for low and average mobility is better for large number of user 1000 user however there is no enhancement for low number of users 500 user.

Table 1 Connection block improvement percentage for 1000 users

User /connection types	Overlapping area [m]	Low mobility	Average mobility	High mobility
1000 / Short connection	150	0.51%	0.52%	0.29%
1000/long connection	150	0.20%	0.93%	0.71%
1000/Very long connection	150	0.64%	0.35%	1.12%

Table 2 Connection block improvement percentage for 500 users

User /connection types	Overlapping area [m]	Low mobility	Average mobility	High mobility
500 / Short connection	150	0%	0%	0%
500/long connection	150	0%	0%	0.39%
500/Very long connection	150	0%	0%	0.99%

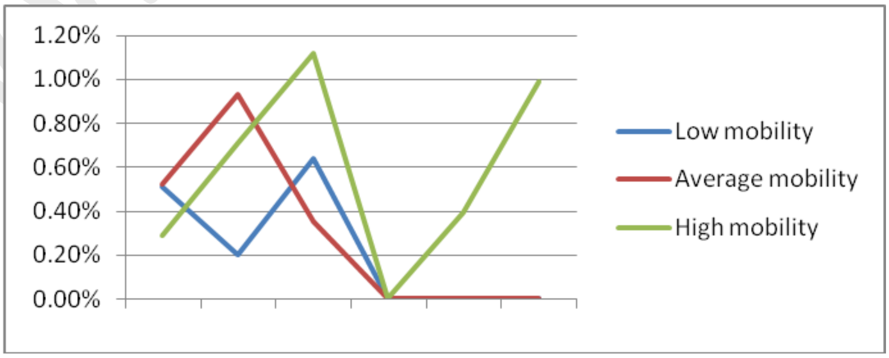

Figure (8) enhancement of proposed handover algorithm

ISSN No. 2395-0900
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7. CONCLUSION

There are problems of a new call blocking in the mobile network. These problems occur due to the demand of the channel and lack of channel resources. The fixed and dynamic assignment has its disadvantages. The HCA was proposed to over comes those disadvantages because it contains fixed channel for each cell and other shared channels for the entire cell in the cluster. However the HCA algorithm in the mobile switching center is not adaptive because the percentage of shared and fixed channels is not varying according to the traffic. This might cause a handover blocking problem especially if the traffic load is asymmetric.

Another important factor in channel allocation is the new calls vs. handoff calls. From a customer point of view it is much less desire able to drop a call in the middle of the connection because of lack of channels in the cell the customer is moving into rather than to be denied admission of his service request at all Virtually all channel assignment protocols give priority to handoff calls over new calls.

In this studies identify the effect of the mobility on the new call blocking and handover failure, determine the effect of the cell overlapping and traffic load variation on the new call blocking and handover failure and Develop a smart adaptive channel assignment algorithm, with the possibility of varying the percentages of shared and fixed channels according to the traffic load distribution with a consideration of the handover.

The proposed algorithm shows unique solution to enhance the mobile network performance. This work estimates the full network capacity with the available channels, and with various mobility patterns.

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