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Optimal Performance of Algorithm Handoff in Wireless Mobile Networks

Nahla NurElmadina[1], R. Abdalrahman[2], M. Abudia[3] and Nuha Bihary[4]
[1,2,3,4]College of Computer Science and Engineering, Taibah University, KSA
[1]nahlla.awadnoor@gmail.com, [2]rsabdulrahman@taibahu.edu.sa, [3]abudia@hotmail.com, [4]nuhabeh@gmail.com

***Abstract*– Cellular communications is a growing demand on the mobile wireless operators to give Quality of Service (QoS). Handoff method allows a cellular system to improve call continuation of an active cell once user moves from one cell to another. The optimal algorithm for automatic controlling and adapting Global System for Mobile Communication (GSM) power system for handoff is using measurements of received signal strength and received signal quality. The improved handoff scheme for minimizing handoff failure in mobile networks algorithms based on Matlab languages computing techniques are used in this paper.**

***Index Terms*– Handoff, Access Point (AP), Received Signal Strength (RSS) and QoS**

I. INTRODUCTION

WIRELESS cellular communication system commonly, continuous service is achieved by supporting handoff (or handover) from one cell to cell. Handoff is the method of changing the channel (frequency, time slot, spreading code, or a combination of them) related to present connection while the call is in progress. It is typically initiated either by crossing a cell boundary or by deterioration in Quality of Service (QoS) within the current channel. Handoff is split into two categories hard handoff and soft handoff. The types of handoff are "break before make" and "make before break" in hard handoff. Current resources area unit is released before new area unit resources which is used in soft handoff, every existing area and new area unit resources are used throughout the handoff process in wireless mobile.

The handoff schemes supervise the returned very heavy signaling traffic and low QoS. The explanation why handoffs are deciding in cellular communication systems is that neighbor cells.

Design and defined terminology used in cellular communications is explained as follows [1]:

Mobile Station (MS): The mobile station can be a laptop or a mobile in motion in Cellular system deployed location of user.

Base Station (BS): The base station or Access point (AP) is a fixed station used for radio frequency communication with Mobile Stations (MS).

Base Station Controller (BSC): It handles radio channel setup, frequency hopping, and handovers. The BSC is the connection between the MS and the Mobile Switching Center (MSC). It assigns and releases frequencies and time slots for the MS.

Mobile Switching Center (MSC): The mobile switching center coordinates the routing of calls when it switches between different base stations connected to different Base station controllers.

PSTN: It is known as the Public Switched Telephone Network. The switch communicates, with distant databases over the PSTN too.

HLR (Home Location Register): HLR is a central master database within the GSM network, which maintains a permanent store of subscriber information, and some location information for the mobile network. The HLR provides information on the services subscribed to by the network user, and it is also an important source of data to support the roaming process.

VLR (Visitor Location Register): The VLR is a database that contains temporary information about subscribers that is needed by the MSC in order to service visiting subscribers. The VLR is always integrated with the MSC. When a mobile station roams into a new MSC area, the VLR connected to that MSC will request data about the mobile station from the HLR. Later, if the mobile station makes a call, the VLR will have the information needed for call setup without having to interrogate the HLR each time.

II. DECISION OF HANDOFF

When a MS moves out of the location of reach of its current Base station or Access Point (AP) it must be reconnected to a new base station to continue its operation. The search for a new AP and subsequent registration under it; constitutes the handoff process which takes enough time (called handoff latency). Many strategies proposed to detect the need for handoff:

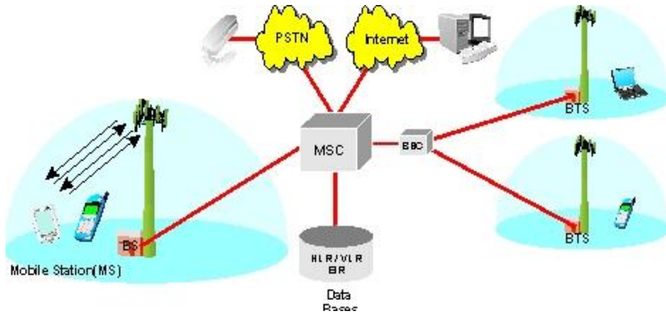

Fig. 1: Mobile cellular communication system

Mobile-Assisted-Handoff (MAHO): The network asks the MS to measure the signal power from the surrounding BSs. The networks make the handoff decision based on reports from the MS [7].

Mobile-Controlled-Handoff (MCHO): The mobile station (MS) continuously monitors the signals power of the surrounding base stations (BS) and initiates the handoff process when some handoff criteria is met [9].

Network-Controlled-Handoff (NCHO): The surrounding BSs measure the power signal from the MS and the network initiates the handoff process.

Traditional handoff algorithms are as follows:

- Handoff based on adjacent Signal SS in which the strongest BS is selected at all time [3].
- Handoff based on adjacent SS with threshold (SS-Th) in which a user handover is executed only if the current signal is sufficiently poor and the other is the stronger signal of the next base station.
- Handoff based on adjacent Signal Strength with effect causing it SS-H in which a user handover is done if the new BS or AP is sufficiently stronger by effect causing margin of signal than the current one.
- Handoff based on adjacent SS with effect causing it and threshold of serving base station (SS-Th) in which the user handover to a new BS or AP only if the current signal level drops below a threshold and the target BS is stronger than the current one by a given hysteresis margin.
- Handoff based on prediction techniques: in which the handoff decision is made on the expected future value of the received signal.

In cellular system wrong handoff may occur, this can be reduced my delaying the occurrence of handoff until the new BS signal strength gets sufficiently stronger. To achieve this, an additional criterion of absolute SS considered as threshold) of a new BS has been involved in the signal strength based RSS-H algorithm. The resultant algorithm is termed as RSS-th-new. This algorithm improves the performance as follows:

-With the proper setting of the new BS threshold it reduces the number of unnecessary handoffs to a new base station when the signal strength of the new BS is not sufficient to serve the call.

-With appropriate higher threshold setting, the number of handoff occurring to the neighboring cell not intended for handoff (wrong handoff) can be minimized.

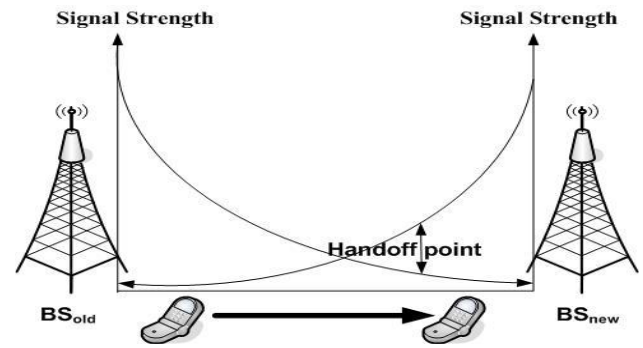

Fig. 2: Movement of MS in the handoff zone

Handoff Types

Hard handoff and Soft handoff [2]: Hard handoff term is used when the communication channel is released at first and the new channel is acquired later from the neighboring cell. Thus, there is a service interruption when the handoff occurs reducing the quality of service. Hard handoff is used by the systems which use time division multiple access (TDMA) [3] and frequency division multiple access (FDMA) such as GSM. Soft handoff is used by the code division multiple access (CDMA) systems where the cells use the same frequency band using different code words. Each MS maintains an active set where BSs or AP are added when the RSS exceeds a given threshold and removes when RSS drops below another threshold value for a given amount of time specified by a timer.

When the presence or absence of a BS to the active set is encountered soft handoff occurs. The sample systems using soft handoff are 3Generation

Horizontal vs. Vertical Handoff: Handoff between homogenous networks where one type of network is considered is called horizontal handoff. On the other hand, handoff between different types of wireless networks is also possible. A handoff in such a heterogeneous environment is named vertical handoff.

III. RELATED WORK

In study [1] proposed an intelligent handoff algorithm based on fuzzy logic. In this paper, a handoff algorithm termed as Fuzzy Controller for Handoff Optimization (FCHO) is introduced based upon fuzzy logic. Traditional algorithms for handoff using fixed values of parameters can perform well only in specific environment but FCHO exploits attractive features of several existing algorithms, and adds more capabilities to improve adaptation [4] to the dynamic environment.

Have reduced handoff latency by reducing the number of base stations or Access Points to be scanned which is accomplished by cell sectoring and distance measurement with help of GPS but still cannot remove ping pong effect which can be minimized by using received signal strength [5].

The various applications of the core soft computing methodologies in mobile and wireless communications reviewed. The advantages of using soft computing include robustness, cost effectiveness and simplicity. Though the application areas can be broadly classified into optimization, uncertainty management and prediction, combining soft computing techniques had shown to effectively solve problems that cut across these boundaries [6].

In [8] another study provided an enhanced version of self optimizing algorithm, have been used to reduce the negative effects which result from the handover process such as handover failure and the ping Pong handover, and compared this algorithm with traditional algorithms indicate that compared to give improved results.

IV. SIMULATION SCENARIOS

Movement in X position only and Direction it either left or right. Assume that the movement direction is not changed during simulation.

Base station position in the center of cell and we can determine the location by the coordination of simulation area was adjusted to (xmin=0, xmax=1000, ymin=0, ymax=1000) two BS coverage area simulations below the list of parameters simulations:

Table I: The Simulation parameter

	Parameter	Value
1	Simulation area(2Base station)	1000m
2	No mobile	1000
3	Distance _minim	200m
4	SIR_max	30dB
5	SIR_ threshold	9dB
6	coverage area BS	500 m

Optimal Algorithm Handoff Description

The flow chart describes the process of controlling the transmitted power between BTS and mobile terminal. The BSC will handle the issue of the controlling power by monitoring the power reports that being transmitted periodically and continuously from BTS and mobile.

During monitoring, BSC will measure and evaluate the differences in power levels between the BTS and mobile depends on the SIR measurements, and therefore it will compare these values with the optimum value of Signal to Interference Ratio (SIR) in GSM system. If the measurement values from the mobile and BS is minimum from the ideal, the BSC will adjust by increasing the BS transmitted power, to overcome the problem of noise which is reducing the power to interference ratio.

At the other side, when the measurement values from the mobile and BS is maximum from the ideal, the BSC will adjust by decreasing the BS transmitted power, to avoid wasting the power transmitted from the BS antennas while the signal to interference ratio is at the desired level.

Finally, and after applying the adaptive power control algorithm above and if the mobile still has a low SIR or low power level the BSC calculates the distance of the mobile using the power level and depends on the power level and the MS distance the BSC told the MS that its transmitting the full power then the mobile asks for a handover request and start measuring the neighbor cell power to perform the handover.

The proposed algorithm will determine the necessary power level needed to be provided for the mobile by BS which will avoid the great number of handover request and helps to get the right decision, when and where to request the handover.

The ideal values for SIR which been considered in GSM is 9dB as optimum and 30 dB as maximum. Then the measurement value from both BS and Mobile terminal will be compared within this value which introduces the two cases above, and the BSC then adjust the BS power. If the measurement values from the mobile and BS is equal to the optimum value, the Bs will keep the power in the current level.

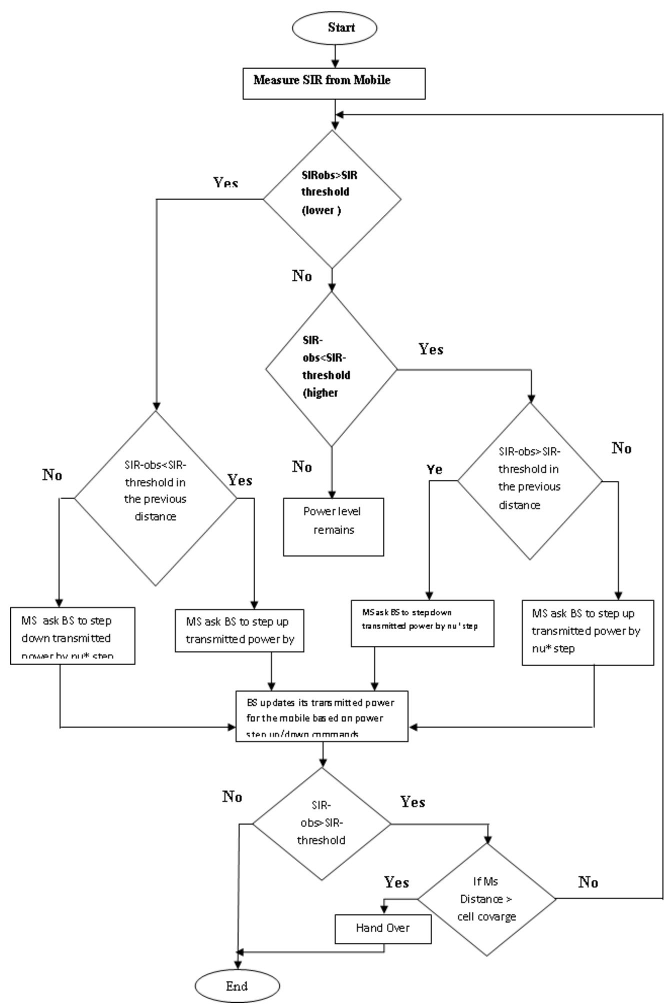

Fig. 3: Simulation flow chart of scenario for optimal algorithm

V. SIMULATION RESULTS

The section presents the results based on the simulation. Fig. 4 illustrates the mobile user position in the cellular mobile system network with random distribution, X axis represent length of simulation area (distance in meter), Y axis represent width of simulation area (distance in meter).

The Fig. 5 shows the power distribution of the MS in the two cells.

Fig. 6 describes the power levels before using the proposed algorithm which shows that the power was distributed in a large range including high and low levels which affect the network performance.

Fig. 7 presents the power levels after using the optimal algorithm which shows that the power levels was distributed in a good way which considering the optimal levels.

Fig. 8 shows a reasonable number of handover requests because in our new algorithm we make sure that the MS power is controlled and the distance and SIR is measured the asks the MS to perform a handover request which means that the MS is really need handover to continue the processed call.

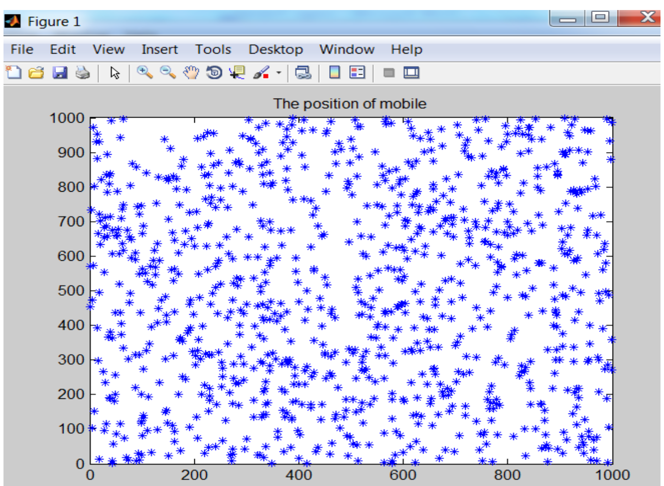

Fig. 4: Shows the distribution of 1000 mobiles inside the simulation area

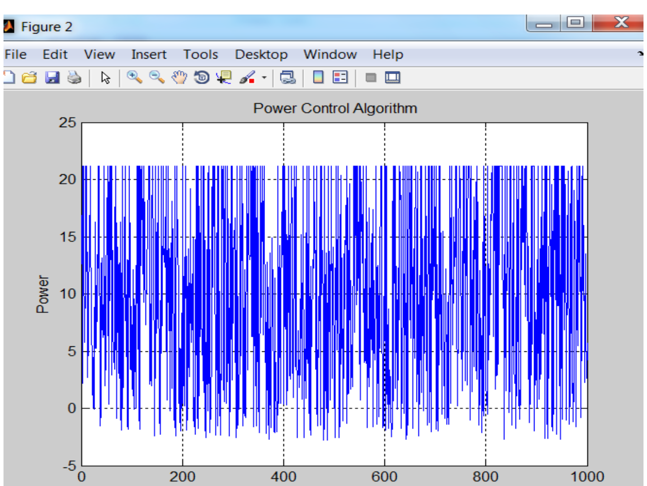

Fig. 5: The traditional power control

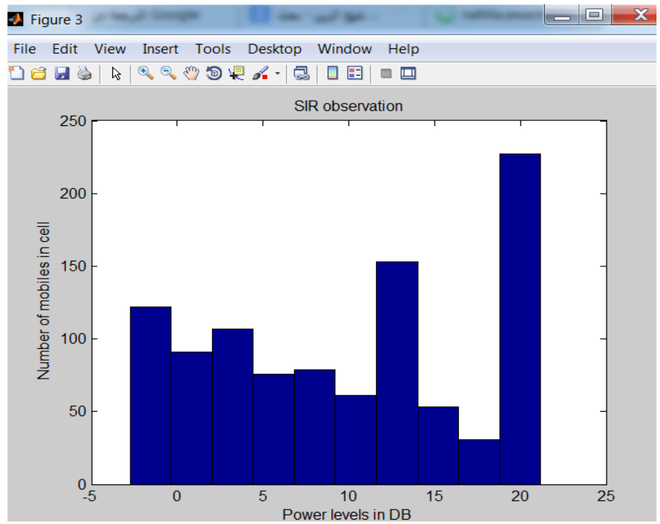

Fig. 6: SIR Signal to Interference ratio before using power algorithm

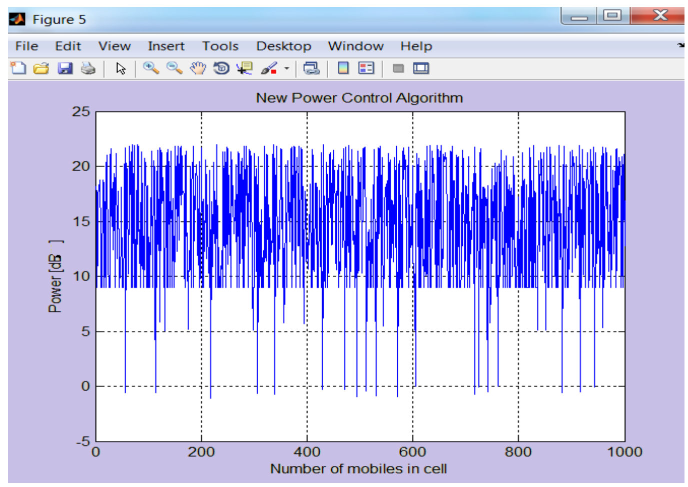

Fig. 7: Optimal algorithm power control

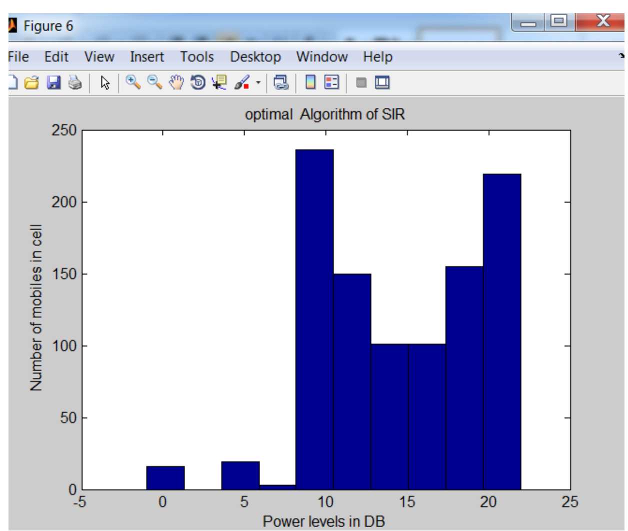

Fig. 8: The optimal Power Algorithm

Table 2: Simulation result for handoff

	Call dropping	Handoff request
Traditional power	165	519
Optimal algorithm	19	63

Table 2 represents the number of the call dropped resulting a bad power control and handover algorithm equals to 165 and the number of Handover request depends on the power levels and the distance between the MS and the BS. It shows a very large number of handover request which is incorrect and increases the call drop percentage which we mentioned before, because most of the request decision is taken on the wrong way and it decreases the network performance

The number of dropped calls in the optimum adaptive handoff algorithm changed to 19, its decreased from the tradition algorithm which will enhance the network performance with a large percentage.

The number of handover requests also changed to 63 which depends on the power levels and the distance between the MS and the BS and the SIR measurements which will make the handover request decision in the right way as shown in Fig. 8.

These blocking values of call and request of handoff also represented in the pie chart in Fig. 9.

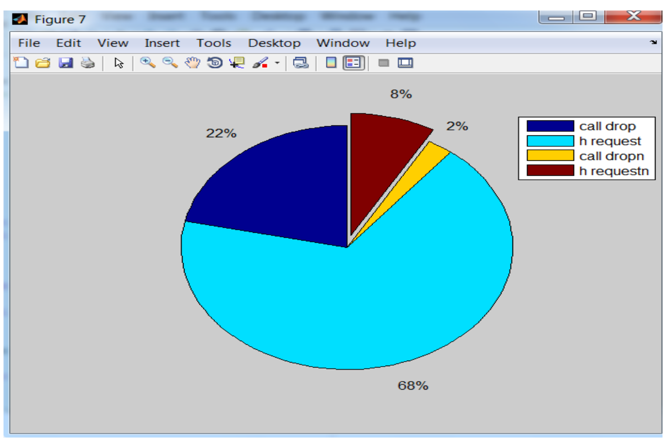

Fig. 9: Pie chart of handoff request and call drop

VI. CONCLUSION

In this paper, the optimal algorithm power control which reduces the number of handoff requests in the wireless mobile network, depending on knowledge of the location of the mobile station at each time update the mobile station location in the mobile wireless network.

From the results of the simulation algorithm MATLAB program through which we obtain higher result of performance in the traditional power control, the number of handover requests less clearly at different power, and number of handover failure is reduced too. In addition to, when system traffic increase it followed by an increase in the number of handover requests.

The comparison of these results with the results of optimal of power control Handoff Initialization Region scenario. According to the previous results we found that, based on knowhow of the mobile station location, the number of handover request and handover failure will be reduced and the wireless mobile network performance will be improved.

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Nahla Awad Elkarim Nur Elmadina: Received her MSC degree in electronic engineering Telecommunication from Sudan University of Science and Technology in 2013 and BSC. (Honor) degree in electronic engineering Telecommunication from Sudan University of Science and Technology in 2007. She was a lecturer in Future University , Department of Telecommunication and Space Technology in the Sudan 2013.Now she is lecturer in Taibah University, Department of Computer Science and Engineering in KSA .The Research is interested in field of wireless mobile networks.

Rugya Abdalrahman haji: Director of Faculty of Computer Science and Engineering at the University of Taibah, Received her PhD from School of Computing, Informatics and Media, University of Bradford, UK in 2012. MSc with Distinction in Software Engineering from School of Computing, Informatics and Media, University of Bradford, UK in 2007. BSC (excellent with honor) in Computer Science from the faculty of science, king AbdulAziz University, Saudi Arabia in 2002. She had published more papers .

Mohammed Ibrahim abudia: Engineering Telecommunication from Sudan University of Science and Technology in 2003.He was Dynamic transmission planning senior engineer with more than 10 years of significant and progressive experience in telecommunications transmission networks (Microwave, PDH, SDH and DWDM). He started my career as a transmission technical support for BSS at ZTE (Sudan). Then he was joined Huawei Sudan as transmission Engineer (fiber, Microwave, SDH, DWDM). Currently, he is working at Sudan Telecom (Sudatel) as a Microwave planning Senior Engineer.

Nuha Muddathir Mustafa Behiery: Assistant Professor, in Department of Computer Science, Faculty of Mathematical Science. Khartoum University, she got PhD. She got her Ph.D. in Computer Science and M.Sc. Master Degree in Computer & Statistics, University of AlNeelain. She got her B.Sc (Hons) in Computer Science & Statistics, University of Khartoum, Sudan 1988. She has published many papers. Now, she is working as Assistant Professor in Taibah University, Department of Computer Science and Engineering, KSA.