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Research Article

Selection of Access Point Based on Handover Decision Using Fuzzy Logic in LTE Network

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Abstract

Handover decision-based establishment of access point plays a vital role in LTE networks. For making a proper handover decision it is essential to implement various techniques. This gives a break less network connection for a fast-moving node. Billions of mobile nodes need connectivity with a major access point with a balanced cell load and signal strength. This is possible with a successful handover. However, making handover results in ping-pong effect, channel fading and an increase in call drop rate. This can be effectively avoided by choosing proper neighbouring access point within a time slot frequently. The node when varied rapidly from one location to another it needs a proper network connection. The previously used techniques in LTE network are not so effective. Hence, we propose a novel Dynamic magnetic Force Optimization (DMFO) technique for choosing access point appropriately and fuzzy logic for a successful handover. The implemented system model terminates the negative impacts of the previously existing algorithms and the results of comparison are represented. Hence, it proves that the proposed model is a better solution for making handover decision.

Keywords: LTE network, Handover, Access point, Break less network, MFO, Fuzzy logic, Ping-pong effect, Channel fading, Call drop rate

1. Introduction

In recent days mobile communication has raised tremendously all over the globe. Connectivity of a call at all locations is the primary need for the satisfied customer in mobile network. There is various mobile network namely 4G/ LTE/ 3G and 2G [1]. In this study LTE network is taken into account for this research [2]. This study is based on the handover strategy takes place at LTE network [3]. Handoff or Handover takes place when a signal gets dropdown the access point of the mobile switches automatically from one cell to another without any delay. Handover is need for the mobility and user preference of the mobile network. The difference between Handoff and Handover is that there is break in handoff during cell transfer and handover eliminates the break during transfer. There are two types of handover in general namely hard handover and soft handover. In hard handover the network decides a handover is required dependent upon the signal strengths of the existing link, and the strengths of broadcast channels of adjacent cells [4]. In soft handover the selection is made by the outer loop power control algorithm measurement [5]. However, the handover undergoes certain resistive parameters namely ping-pong effect, channel fading and increase call drop rate. The handover when takes place between clusters to clusters the selection happens from small cells to macro cells, macro cells to small cells. This results in an edge-node traffic of signal selection [6] [7]. In order to overcome the above scenario instead of macro cells small cells are implemented for a continuous networking. In LTE network three types of handover happens namely Intra-LTE handover, Inter-LTE handover and Intra-RAT (Radio Access Technology) handover [8]. In media communications there might be various causes for taking handover decision:

1. At the point when the node is moving from one location to another, it enters into a new coverage area. The access point coverage where the node entered must take over the network connection from the primary access point.
2. When the node enters the coverage area of a new access point the network connection gets terminated when the load balancing of new access point is low.
3. At LTE networks the availability of the channel is given to the node which uses same access point of the other node. This is done to avoid the corruption in network connection. Hence the network connection is moved from one access point to another.
4. When a node is moving fast it is connected to a Macro cell. When it stops the connection may transfer to a micro cell in order to reduce the cell load of the macro cell. Hence it may be helpful for a fast-moving node to utilize the macro cell access point. Similarly, when the node is detected to move continuously fast the network can be transferred from micro cell access point to macro cell access point hence to serve a break less connection.

Many logics were used previously to overcome these issues. The traditional method used is GSM handover method for mobile network. LTE network (Long Term Evolution) [9] is the most familiar radio technology used in mobile communication. It has an increase speed and capacity compared to other networks. However, 5G network is in undergoing process. The selected LTE network primarily use GSM handover technology for handover process. Sometimes selection of wrong cell may accomplish failure of the handover strategy. The signal strength and quality of the signal must be comparatively high for selection of cell at the time of handover. Appropriate selection of cell leads to a successful

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handover. For the above-mentioned scenario certain logics were used. One of the traditional logics discussed above is the GSM handover logic. This logic has its own limitations during handover. The previously used optimization techniques are Data-Driven Handover optimization (DHO), Dynamic Edge backup node optimization, optimization based on AHP-TOPSIS, Dynamic Handover Optimization and Swarm Optimization al., [10]. This paper proposes fuzzy logic [11] [12] in handover optimization. Fuzzy logic has a flexibility of selecting values comparatively among the initial signal strength to the current one. After that it selects the desired cell access point. This leads to a continuous break less handover of network [13] [14]. The proper or accurate neighbouring cell is selected by examining the cell load, signal strength, distance from the base station to the access point also the speed and direction of the device [15]. However, the previously used optimization techniques have some undesirable limitations like inaccuracy of KP value, environmental changes and requirement of various parameters. In this paper we propose a MFO algorithm to overcome the above issues.

This work is aligned as follows Section 2 presents the Literature Review, Section 3 briefs on proposed model, Section 4 shows the upshot of the simulation in the system model and the next section 5 exhibits Conclusion.

2. Literature Review

The term Handover is termed for the process of transferring a network connection from one cell access point to another access point depends on certain parameters. For taking the decision of transfer spectral efficiency, throughput and outage probability must be valuated using certain logics. The traditional logics like GSM handover was sticky to fixed values, it causes limitations of the system. In this section we analyse previous algorithms and research done in Handover of LTE mobile networks.

[16] have reported that the next generation mobile networks have problems in mobility. Hence, this approach identified and optimized the different mobility issues using DHO (Data Driven Handover approach). This algorithm used HOM (Handover Margin) and TTT (Time to Trigger) for the optimization KPI (Key Performance). KPI was calculated using different weightage mean of the mobility parameters. However, the DHO algorithm discussed in the study was unable to optimize or minimize KPI under complex effects. Also, it was challenging to find the accurate value of KPI.

[17] have proposed that the wireless transmission method based on fuzzy rule. This method was implemented at urban environment during blind zone where the vehicle set up delivery paths was required. The key technology used in this method for selection of an optimal solution from all the feasible ways that considers various factors subsequently. The vehicle speed prediction approach was done using fuzzy rule approach. However, at some instance the proposed algorithm of this study was confined into a local coverage and various initial conditions gave different outcomes. It was sensitive to initial centroids. Moreover, this approach was not possible to give appropriate result at low speed vehicle detection environment.

[18] have proposed the utilization of AI (Artificial Intelligence) and information mining procedures to permit the base stations to self-learn and recognize trademark designs in the received signal quality qualities (revealed by clients during the handover process), and this application was implemented in cell boundaries. This study mutually considered the radio recurrence conditions at the cell-edge and the heap levels of the base stations, to decide handover at cell edge. However, this approach was excessively forceful sometimes or excessively moderate in others. Moreover, the streamlining of handover boundaries turns out to be more confounded on the off chance that similar to the subsequent load factor.

[19] this paper examined the handoff challenges in bunch-based handoff utilization for the improvement of dynamic edge-reinforcement hub. The outcomes showed that rationality in correspondence during the handoff strategy was updated, upgraded, and improved using the proposed procedure. Yet there was a requirement for an indicator to act proactively to envision the conceivable handoff when taking new cell. Still the requirement in the handover strategy was required. This paper also requires different parameters for the valuation of the outcome. Hence, the handover was delayed.

[20] have put forth a SO (Swarm optimization) calculation that performed some improvements of the base station. Here the base station was based on the nature of the sign. This paper proposed displaying the choice of the best base station utilizing for PSO (Particle Swarm optimization) calculation the choice cycle utilized PSO created by utilizing a mix of different calculations. Reenactment was demonstrated and still all the way it was open to be formed into a 3D shape with the irregular arrangement models. However, the improvement was needed in every pivot to get the new hub.

[21] have reported a method for media transmission that enhance handover methodology and accordingly its limited handover disappointment and handover ping-pong impact. The determination of eNB (evolve Node) by utilizing AHP-TOPSIS [Analytic Hierarchy Process (AHP) - Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS)] strategy and setting off point by utilization of Q-learning approach. The result dissected mathematically and with recreation. Moreover, improvement to make vitality proficient system with ensured QoS (Quality of service) and prerequisite was needed.

[22] have proposed an algorithm for an average handover decision making factor called fuzzy logic approach-based handover algorithm. The variation between proposed two algorithms was whether to use the hysteresis margin of the handoff factor. The outcome produced showed that the proposed two algorithms might take handover decisions efficiently at a high speed between access points, when GSM-R was decreased it gives a probability of unnecessary handoff. However, when the speed of MT was below 270 km/h, two proposed algorithms unable to perform efficiently.

Some of the problems identified from the existing techniques are followed:

- In the previous techniques there is changes in signal strength which in turn causes ping-pong effect and channel fading.
- For an improved handover performance with a break less network connection, various methods and metrics is presented. Even though if appropriate handover technique is not implemented it may cause large ping pong effect and channel fading at the access point.

Poor handover decision happens when the defined metrics are not balanced properly and repeated attempt of handover results in system load to increase which is a negative impact. This may lead to an unsuccessful QoS also causes an increase in call drop rate.

3. Proposed Work

In this paper a method of a fuzzy logic-based LTE network for break less handover depending on Path loss, Cell load, MS mobility and BS location. The handover decision is taken when the signal strength becomes low. The model selects any one of the appropriate nearby access points among 6 nearby base stations by using MFO optimization techniques. When the selected access point or base station has more power for balancing load and many networks it is said to be best BS (Base station). Unless if the selected access point has more cell load then the process is handover to next nearby access point which is chosen by using fuzzy logic method. Initially when the signal strength decreases the proposed model analyses the signal strength of nearest BS location its cell load and the mobility speed during travel and path loss and it finds the best access point using MFO algorithm. The model then takes handover decision in LTE network. The fitness function takes parameters like spectral efficiency, outage probability and throughput measure as input and must give outcome with satisfied cell load value. The first neighboring access point or else the next nearby access point is chosen by taking load balancing or channel fading effect into account. The next nearby BS is selected by using MFO algorithm in LTE network. If even after the selection the signal strength is low the connection is terminated. The overall architecture (Fig 1) of the proposed methodology is depicted above.

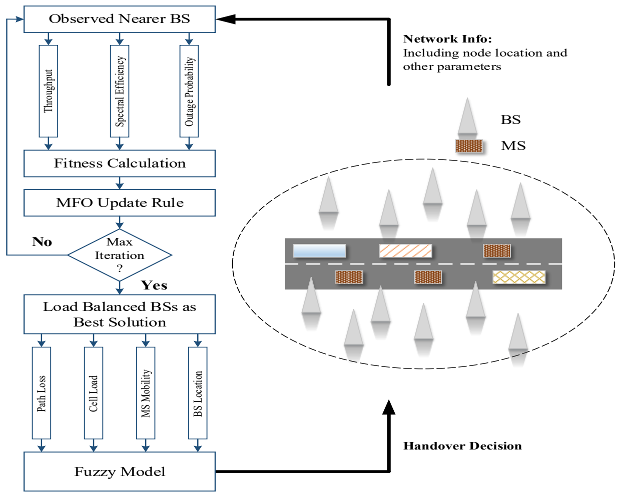

Fig. 1 Overall proposed block diagram

3.1. Handover metrics

In this study three metrics are proposed for valuation of handover logic from various cells. Subsequently the appropriate nearby cell must be selected and shared to the mobile network only when the threshold is exceeded. The parameters are:

- ✓ Throughput
- ✓ Spectral Efficiency
- ✓ Outage probability

3.1.1. An Optimized channel selection depend on DMFO algorithm

For best mobility of network, a break less signal strength from base station is required. The finest access point should be selected using various approaches. In this proposed model DMFO (Dynamic Magnetic Force Algorithm) is used for the selection of access point based on the parameters like signal strength, coverage between user and access point and the bandwidth range. DMFO algorithm is mere and can be applied safely. The fitness function of this DMFO algorithm is very much user- defined. Therefore, in this proposed model DMFO algorithm is used for the selection of access point.

3.1.1.1 Initialization

Initially the network is allocated for each node by taking signal strength and allocation will be done based on the priority of the user i.e. first call first priority. The network when undergoes a circumstance of low signal the DMFO parameters are initiated. The initiation gives a result of parameters when the obtained result is satisfied the next stage of probe distribution is computed.

Initiation of MFO parameters like $y$where $y = \{y_1, y_2, y_3\}$, here

$y_1 \rightarrow throughput$
$y_2 \rightarrow spectral\ efficiency$
$y_3 \rightarrow Outage\ probability$
$M_n \rightarrow number\ of\ nodes$
$Rv \rightarrow number\ of\ users\ and\ T_v \rightarrow D2D$

3.1.1.2 Initial Probe Distribution

The next stage is IPD (Initial Probe Distribution) computed. The IPD validates the signal and the respective probe is established. If the validation of IPD is not successful or not up to the exact value then handover process takes place. The access point selection will be made using the output value of the fitness function.

The validation of IPD is examined using the below equation:

$$S_{(q,j)} = lim_{q\rightarrow 1\ to\ O_q} lim_{j\rightarrow 1\ to\ O_e} Q_{v_j} + \frac{(o-1)\left(T_{v_j} - Q_{v_j}\right)[O_e(q-1)+j-1]}{O_q O_e - 1} \quad (1)$$

3.1.1.3 Evaluation of fitness function

The fitness function analyses the signal strength by taking three parameters namely throughput, spectral efficiency and outage probability as input. The outcome of the fitness function must reach the desired QoS (Quality of service) unless the function is repeated until the appropriate QoS value is equated. Based on the position of the probe evaluated from IPD, the fitness function gets upgraded. The calculation of fitness function is briefly explained below.

A. Throughput

The throughput is defined as the extreme number of data which can be transmitted from one access point to another. It can be given as

$$y_1 = AP_{loc} \times b \times log_2(1 + AP_{loc} \times S_n) \quad (2)$$

Where

$AP_{loc} \rightarrow location\ of\ the\ access\ point$

$b \rightarrow bandwidth\ and\ S_n \rightarrow SNR$

$$SNR = \{\frac{uplink}{packet\ loss} \times m_j \times initial\ noise\ average\} \quad (3)$$

B. Spectral efficiency

The Spectral efficiency is defined as data rate of a individual channel in a given bandwidth. This is denoting as y2 and calculated using the below equation.

$$y_2 = log_2(1 + sum(S_n)) \quad (4)$$

C. Outage probability

Outage probability is the term mentioned when the data probability rate is less than the desired threshold data. This probability value must give an outcome within a specified time slot. It can be validated using the below equation

$$y_3 = 1 - \left[\left(\frac{1}{sum/S_n}\right) + 1)\right] \quad (5)$$

D. Objective function

The fitness function is used to find whether the desired QoS has reached to maximum or not. In the proposed model fitness function must be maximum or else the function goes on repeatedly calculating until the goal is reached. The fitness function should be done rapidly at high rate for computing the values. The output of the fitness function undergoes 81 rules. It is given as

$$y_{max} = Max\{y_1, y_2, y_3\} \quad (6)$$

3.1.1.4 Updating Probe function

The fitness function is updated based on the probe chosen in the initial stage and then depending on the result of fitness value the handover decision is made. Only when the fitness value equates the desired value of the QoS then the handover to the neighbouring access point takes place based on fuzzy logic. The updated fitness metric is calculated as

$$S_{(q,j,k)} = lim_{k\to 1\ to\ O_u} lim_{q\to 1\ to\ O_q} lim_{j\to 1\ to\ O_e} S_{(q,j,k-1)} + \frac{1}{2} B_{(q,j,k-1)} \Delta u^2;\ \Delta u^2 = 1 \quad (7)$$

Where $B_{(q,j,0)=0;\ Where\ 1\le q\le O_q\ and\ 1\le j\le O_e}$

3.1.1.5 Termination criteria of fitness function

When the resultant fitness value does not satisfy the desired QoS then the process gets terminated and a new probe is established. The new probe can be established as

For $q = 1\ to\ O_q$

For $j = 1\ to\ O_e$

$$B_{(q,j,k)} = lim_{q\to 1\ to\ O_q} lim_{j\to 1\ to\ O_e} \left(H \sum_{\substack{l=1 \\ l\ne q}}^{O_q} V \left(N_{(l,k)} - N_{(q,k)}\right)\left(N_{(l,k)} - N_{(q,k)}\right)^b Y \frac{S_{(l,j,k)} - S_{(q,j,k)}}{|S_k^l - S_k^q|^3} \right) \quad (8)$$

$$S_k^l - S_k^q = lim_{q\to 1\ to\ O_q} lim_{j\to 1\ to\ O_e} \sqrt{\sum_{n=1}^{O_e} \left(S_{(l,n,k)}\right) - \left(S_{(l,n,k)}\right)^2}$$

3.1.2. Access point selection using Fuzzy logic

In this proposed model fuzzy logic method is used to overcome pin-pong effect, channel fading and call drop rate increases. Handover decision is made based on the rules generated by the output value of fuzzy logic. This approach makes a way for taking handover decision by taking mid-way possible values between fixed values of the desired system. This approach takes handover decision when it is necessary. After analyzing the speed of the node and the cell load of an access point. To avoid ping pong effect, the utilization of the handover is done based on fuzzy logic parameters. This is the method proposed in this model. For selecting the appropriate access point among 6 neighboring points a fuzzy logic based proposed model is used which allocates high signal incentive to the most merited member. In this fuzzy logic have taken four measurements which will be utilized to ascertain the handover likelihood.

Fuzzy logic takes input from the parameters namely cell load, path loss, cell mobility and access point location. In this proposed model Z-shaped, S-Shaped and Gaussian shaped membership functions are used. The membership functions of the input parameters are listed below.

a. Path loss F_{pl} = {Weak (WK), Normal (NO), Strong (ST)}
b. Cell Load F_{cl}= {Near (NR), Not so far (NSF), Far (FR)}
c. MS mobility F_{mb}= {Low (LO), Medium (ME), High (HI)}
d. Access point location F_{lap}= {Coming Fast (CF), Slow (SL), Going Fast (GF)}

A fuzzy logic system uses membership function which depends on realistic experience. The parameter range was defined for each function type. The path loss at -0.95dbm is medium and acceptable. Cell load more than 50% will be acceptable and mobility is medium at a speed of 50km/hr. The access point location around 20 km is medium solution. The parameter functions are represented in the below table. The table I shows the Linguistic variables of fuzzy logic member functions

The Z-shaped function is calculated as,

$$\eta\ (z) = \begin{cases} 1, & z \le a \\ 1 - 2\left(\frac{z-a}{b-a}\right)^2, & a \le z \le \frac{a+b}{2} \\ 2\left(\frac{z-a}{b-a}\right)^2, & \frac{a+b}{2} \le z \le b \\ 0, & z \ge b \end{cases} \quad (9)$$

The S-shaped function is validated as,

$$\eta(S) = e^{-\frac{(z-c)^2}{z*c}}{}_2 \quad (10)$$

The Gaussian function can be given as,

$$\eta\ (G) = \begin{cases} 0, & z \le a \\ 2\left(\frac{z-a}{b-a}\right)^2, & a \le z \le \frac{a+b}{2} \\ 1 - 2\left(\frac{z-a}{b-a}\right)^2, & \frac{a+b}{2} \le z \le b \\ 1, & z \ge b \end{cases} \quad (11)$$

Table 1 Linguistic variables of fuzzy logic member functions

Metric Name	Function Name	Function type	Parameter range
Path loss	Weak (WK)	Z shaped	[-110 to -95]
	Normal (NO)	Gaussian	[-95 to 5]
	Strong (ST)	S shaped	[-95 to -80]
Cell Load	Near (NR)	Z shaped	[0.1 to 0.5]
	Not so far (NSF)	Gaussian	[0.125 to 0.5]
	Far (FR)	S shaped	[0.5 to 0.9]
MS mobility	Low (LO)	Z shaped	[15 to 40]
	Medium (ME)	Gaussian	[10 to 50]
	High (HI)	S shaped	[60 to 85]

Access point location	Coming Fast (CF)	Z shaped	[-60 to 0]
	Slow (SL)	Gaussian	[-20 to 0]
	Going Fast (GF)	S shaped	[0 to 60]
Handover Decision	Low (LO)	Z shaped	[0.2 to 0.45]
	Medium (ME)	Gaussian	[0.1 to 0.5]
	High (HI)	S shaped	[0.55 to 0.8]

If the Z- shaped function is in the parameter range of -110 to -95, the function type shows a WEAK path loss, when the cell load is at Z- shaped the function type is COMING SLOW state, when the mobility is LOW value and AP location is coming COMING FAST around 0 TO 60 km, the decision of handover is LOW.

If the S- function is in the parameter range of -95 to 80, the function type shows a STRONG path loss, when the cell load is at S-function type is FAR state, when the mobility is HIGH value and AP location is coming COMING FAST around 60 km, the decision of handover is HIGH.

The fuzzy logic system takes these four parameters as input and yield one output. The handover decision is made based on this output and the 81 rules. Table 2 represents the 81 rules for the output of the Fuzzy logic system.

- From Tab 2, for instance if PATHLOSS [PL] is STRONG [ST] whenever CELL LOAD [CL] is NEAR [NR] and MS mobility becomes LOW [LO] whereas Access Point Location [AP LOCATION] is assumed COMING FAST [CF] then the case predicts that the handover decision is LOW.
- From Rule 4 if PATHLOSS [PL] is STRONG [ST] whenever CELL LOAD [CL] is NEAR [NR] and MS mobility becomes HIGH [HI] whereas Access Point Location [AP LOCATION] is assumed SLOW [SL] then the case predicts that the handover decision is MEDIUM.

Table 2. Fuzzy logic based 81 rules

Rule no	Input 1	Input 2	Input 3	Input 4	Output
	Path loss	Cell Load	MS mobility	AP location	Handover decision
1	ST	NR	LO	CF	Low
2	ST	NR	LO	GF	Low
3	ST	NR	ME	SL	Low
4	ST	NR	HI	CF	Medium
5	ST	NR	HI	GF	Medium
6	ST	NSF	LO	SL	Low
7	ST	NR	LO	SL	Low
8	ST	NR	ME	CF	Low
9	ST	NR	ME	GF	Low
10	ST	NR	HI	SL	Medium
11	ST	NSF	LO	CF	Low
12	ST	NSF	LO	GF	Low
13	ST	NSF	ME	SL	Low
14	ST	NSF	HI	CF	Medium
16	ST	NSF	HI	SL	Medium
17	ST	NSF	ME	GF	Low
18	NO	NSF	LO	GF	Low
19	NO	NSF	ME	CF	Low
20	NO	NSF	ME	SL	Medium
21	NO	NSF	ME	GF	High
22	NO	NSF	HI	CF	Medium
23	NO	NSF	HI	SL	High
24	NO	NSF	HI	GF	High
25	NO	FR	LO	CF	Low
26	NO	FR	LO	SL	Low
27	NO	FR	LO	GF	Medium
28	NO	FR	ME	CF	Medium
29	NO	FR	ME	SL	Medium
30	NO	FR	ME	GF	High
31	NO	FR	HI	CF	Medium
32	NO	FR	HI	SL	High
33	NO	FR	HI	GF	High
34	WK	NR	LO	CF	Medium
35	WK	NR	LO	SL	Medium
36	WK	NR	LO	GF	Medium
37	WK	NR	ME	CF	Medium
38	ST	NSF	HI	GF	Medium
39	ST	FR	LO	CF	Low
40	ST	FR	LO	SL	Low
41	ST	FR	LO	GF	Medium
42	ST	FR	ME	CF	Low
43	ST	FR	ME	SL	Medium
44	ST	FR	ME	GF	High
45	ST	FR	HI	CF	Medium
46	ST	FR	HI	SL	High
47	ST	FR	HI	GF	High
48	NO	NR	LO	CF	Low
49	NO	NR	LO	SL	Low
50	NO	NR	LO	GF	Low
51	NO	NR	ME	CF	Low
51	NO	NR	ME	SL	Low
52	NO	NR	ME	GF	Low
53	NO	NR	HI	CF	Medium
54	NO	NR	HI	SL	Medium
55	NO	NR	HI	GF	Medium
56	NO	NSF	LO	CF	Low
57	NO	NSF	LO	SL	Low
58	WK	FR	HI	CF	High
59	WK	FR	HI	SL	High
60	WK	FR	HI	GF	High
61	WK	NSF	HI	CF	Medium
62	WK	NSF	HI	SL	High
63	WK	NSF	HI	GF	High
64	WK	FR	LO	CF	High
65	WK	FR	LO	SL	High
66	WK	FR	LO	GF	High
67	WK	FR	ME	CF	High
68	WK	FR	ME	SL	High
69	WK	FR	ME	GF	High
70	WK	NSF	LO	CF	Medium
71	WK	NSF	LO	SL	Medium
72	WK	NSF	LO	GF	High
73	WK	NSF	ME	CF	Medium
74	WK	NSF	ME	SL	Medium
75	WK	NSF	ME	GF	High
76	WK	NR	ME	SL	Medium
77	WK	NR	ME	GF	Medium
78	WK	NR	HI	CF	Medium
79	WK	NR	HI	SL	High
80	WK	NR	HI	GF	High
81	WK	NSF	LO	GF	High

- From Rule 10 if PATHLOSS [PL] is STRONG [ST] whenever CELL LOAD [CL] is NEAR [NR] and MS mobility becomes HIGH [HI] whereas Access Point Location [AP LOCATION] is assumed SLOW [SL] then the case predicts that the handover decision is MEDIUM.
- From Rule 14 if PATHLOSS [PL] is STRONG [ST] whenever CELL LOAD [CL] is NOT SO FAR [NSF] and MS mobility becomes HIGH [HI] whereas Access Point Location [AP LOCATION] is assumed COMING FAST [CF] then the case predicts that the handover decision is MEDIUM.
- From Rule 28 if PATHLOSS [PL] is STRONG [ST] whenever CELL LOAD [CL] is FAR [FR] and MS mobility becomes HIGH [HI] whereas Access Point Location [AP

LOCATION] is assumed GOING FAST [GF] then the case predicts that the handover decision is HIGH.

- From Rule 37 if PATHLOSS [PL] is WEAK[WK] whenever CELL LOAD [CL] is NEAR[NR] and MS mobility becomes LOW[LO] whereas Access Point Location [AP LOCATION] is assumed GOING FAST [GF] then the case predicts that the handover decision is MEDIUM.
- From Rule 81 if PATHLOSS [PL] is WEAK[WK] whenever CELL LOAD [CL] is NOT SO FAR[NSF] and MS mobility becomes LOW[LO] whereas Access Point Location [AP LOCATION] is assumed GOING FAST [GF] then the case predicts that the handover decision is HIGH.

This paper presents a self-streamlining calculation that tunes the handover (HO) boundaries of a LTE (Long-Term Evolution) network access point location so as to improve the general system execution and reduce negative impacts. The proposed calculation picks the best hysteresis and time-to-trigger handover for the current system status. It also inspected the impacts of this self-calculation in a reasonable situation setting and the outcomes show an improvement from the static worth settings.

Pseudo code 1 Handover logic

Create LTE network
*//*Perform MFO algorithm technique for choosing access point*//*
Declare an integer variable y *and* y_{max}, y_1, y_2, y_3
Initialize y to zero
Initialize $ymax$ *to hundred*
Initialize $y1, y2$ *and* $y3$ *to zero*
// Initialize probe function*//*
Initialize $S_{(q,j)}$
Refer equation (1)
*//*Objective function*//*
If
Refer equation (3)
{
Access point is chosen
Else
{

Update new probe connection

}
}
End if
// Updating probe function*//*
Initialize $\Delta u^2 = 1$
for
Refer equation (6)
End for
// Termination of fitness function*//*
Repeat objective function n times
Set limit for n times
Terminate if limit exceeded
Refer equation (8)
End loop

Pseudo code 2

// Fuzzy logic for handover*//*
Declare $F_{pl}F_{lap}$
Declare $F_{cl}F_{mb}$
For
The membership functions calculate
Refer (9)
Refer (10)
Refer (11)
Fuzzy algorithm start

81 Basic Rules generated

Rule1	*ST*	*NR*	*LO*	*SL*	*Low*
Rule2	*ST*	*NR*	*LO*	*CF*	*Low*
Rule3	*ST*	*NR*	*ME*	*CF*	*Low*
Rule4	*ST*	*NR*	*LO*	*GF*	*Low*
Rule5	*ST*	*NR*	*ME*	*SL*	*Low*
		.			
		.			
		.			
		.			
Rule80	*WK*	*FR*	*HI*	*GF*	*High*
Rule 81	*WK*	*FR*	*HI*	*SL*	*High*

End fuzzy algorithm

4. Simulation Results

The experimental results convey the discussed model outcome. In this model a practical condition is taken into account i.e. when the user travels from one location to other the performance of signal service is analysed for making handover decisions using MFO algorithm and fuzzy logic method. The model is based on LTE data set. The algorithm is applied to the platform of MATLAB having Intel (R) Core (TM) i5-3570S CPU processor with speed 3.10GHz to analyse the product of the proposed model. The evolution metrics used in the proposed research are Outage probability, Spectral Efficiency, SNR and Throughput. Comparisons are made in the realistic environment and the algorithm proposed shows a great performance than the previously proposed ones. The variables chosen for correlation is Time (in seconds). The previously used techniques for comparison are GA (Genetic Algorithm), PSO (Particle Swarm Optimization), ABC (Artificial Bee Colony Algorithm) and CS (Cuckoo Search algorithm). The model proposed in this study tends to find the negative impacts of handover and hopefully attempt to resolve them.

4.1 Performance Analysis

Throughput correlated with the time variable is shown in the graph below. Throughput is the maximum message data conveyed through an individual channel. The value must be maximum for successfully avoiding pin pong effect.

Fig 2 shows the comparison of throughput to the time. When the time is at 10 seconds the throughput is achieved with a maximum value. Similarly, when the time value increases the system model shows an improved throughput value continuously. In the other hand other algorithms shows low value in contrast.

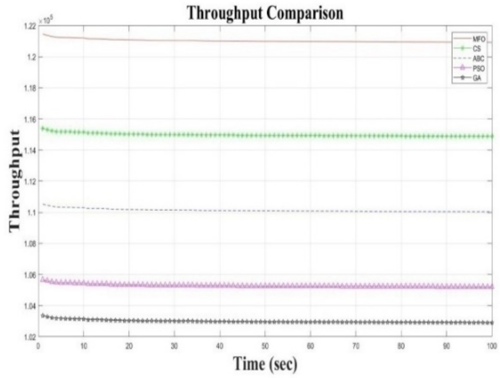

Fig. 2. Comparison of Throughput measure

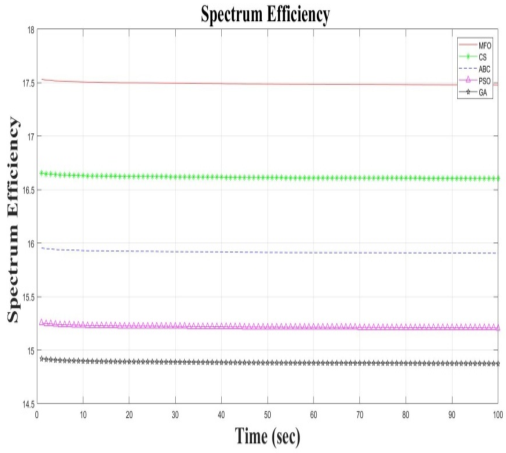

Fig. 3. Spectrum Efficiency compared with time measure in seconds

Spectral efficiency is correlated to time variable and the results are shown in graph below. It is defined as maximum amount of information data transferred per bit through individual channel in a particular bandwidth. Fig 3 shows the comparison results that the spectral efficiency is maximum in the proposed model. Relevantly the other models show comparatively low values.

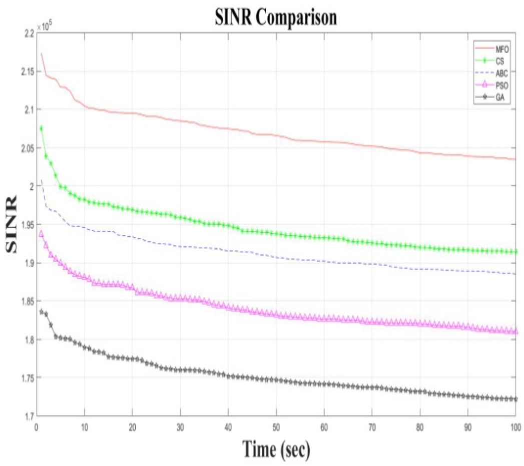

Fig. 4. SINR comparison for proposed and existing technique

SNR (Signal to Noise Ratio) is defined as a portion of source signal based on noise. SNR is compared to the time variable. SNR value is high at zero seconds and decreases gradually up to 10 seconds. Then the SNR shows a linear change with time variable. Similarly, other models show comparatively low performance.

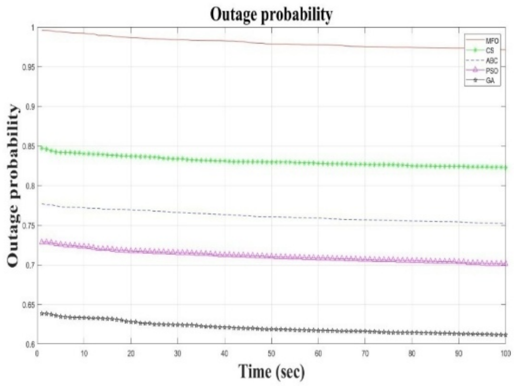

Fig. 5 Outcome of outage probability for proposed and existing methods

Outage probability directly means out of range probability in network communication. This value is the probability of the channel to any desired threshold value. Fig 5 exhibits a graph which compares outage probability to the time variable. This shows that the proposed model decreases from unit value at zero second. The graph states that, it linearly decreases with time change. It results in a maximum outage probability. Consequently, the other algorithm performs less.

5. Conclusion

In this paper, a system has been proposed for taking Handover decision in LTE networks. An appropriate access point must be selected for a break less continuous network. The access point must retrieve with a high signal strength and cell load among six neighbouring cells. In this system the optimization technique using MFO algorithm was implemented for finding the first neighbouring access point. A fitness function in this algorithm repeatedly validated the signal using three parameters namely throughput, Spectral efficiency and outage probability. This function repeats within a particular time slot. The function provided a maximum value as output and hence fuzzy logic was called off for taking handover decision. The fuzzy logic takes cell load, path loss, mobility and access point coverage from the node as input and gave a variable output. The output variable generated 81 rules based on which Handover decision was made. The negative impacts namely pin pong effect, channel fading and increase of call drop rate was hopefully avoided when the proposed model was implemented.

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