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IMPLEMENTATION OF MITIGATING INTERFERENCE BETWEEN MACROCELL AND FEMTOCELL IN USE OF WIRELESS NETWORKS

[1] Dr.Rahul Ashok Patil,[2] Dr.Shinde S.N
[1]Research Scholar, [2]Principal.
[1-2]Deparment of Computer science and engineering.
[1]Research Scholar, K.T.H.M College Nashik, Pune,[2]Principal, CMCS College Nashik, SPPU, Pune.
Email: [1]patilra@rediffmail.com, [2]sns110@gmail.com.

Abstract: The future of cellular networks is inclining towards the growth of the "Information and Communication Technologies" (ICT). In order to satisfy the demand of subscribers, the higher and higher data rate is being expected in the present period of time. The deployment of small cells such as femtocells and picocells has helped to align the traffic and workloads in macrocells. Cellular networks' spectral efficiency and network coverage are both targeted for improvement as well. It is necessary to overcome interference between macrocells and small cells in order for numerous practical uses of small cell deployment. This paper explores the mitigation model to alleviate the interference between macrocell and femtocell of the cellular systems. The searching intelligence is facilitated by the femtocell networks. Mostly the secondary users communicating with the "cross-tier interferences to the authorized network is known as macrocell network". By keeping this in mind, the Fractional Frequency Reuse (FFR) model is designed to mitigate the interferences between the macrocells and femtocells. With the use of Femtocell Access Points (FAPs), the best locations of the node placement are done. Furthermore, it is analyzed in both indoor and outdoor environments for better resource utilization. The spectral efficiency of the nodes is improved by increasing the count of FAPs. The network throughput rate is improved by lowering the interferences happening during cross-tier systems. The random placement of cellular nodes experiences a lowered SNR that drains the node's energy rapidly. Pertaining to this goal, the proposed interference management follows three actions, namely, planning that assists the femtocell devices with better transmission power; gaming action that ensures the selection of best FAPs and performance assists for the best location. The Femtocell User Equipment (FUEs) combines with the FAPs during the connection process. The simulation analysis is carried out in the wireless cellular environment with some assumption on network constraints. It is inferred from the results that the proper alignment of the femtocells node can eliminate the interference happening in the co-tier systems.

Keywords: Cellular Networks; Small Cells, Femtocells Access Points, Frequency Reuse; Spectral efficiency and Interferences.

1. INTRODUCTION:

Many real-time applications, including "medical, military, monitoring, tracking, and so on", have taken use of wireless sensor network advancements. For real-time applications, the need for low-cost wireless devices led to their research and construction. An important part of the decision-making process is examining a wide range of network indicators. When many devices work together, new types of information are revealed, making decision-making more difficult [1]. According to Therein and co-authors, 2010). As a result, WSN-collected data has the potential to be associated with a wide range of devices, which might delay the transmission of information. WSNs, despite their unique features, have a limited application support. The most common method of connecting various gadgets is through radio frequency range. Sensor nodes are placed and talked with according on the needs of the application. By organizing themselves in relation to one another, nodes create networks that are able to capture and store valuable data from the physical world [2]. (J. S. Lee and colleagues, 2012). The clustering strategy is in charge of managing the nodes. Various approaches are used, including centralised and distributed [3] execution. (B. A. Attea and colleagues, 2012). From the perspective of the centralised clustering strategy, the sink node is in charge of gathering information from wireless networks and storing it locally. In order to overcome the limitations of the sink node's energy and storage, each sensor node is given with global information. Finally, the sink node calculates the CHs as well as the members of the network. In the large-scale setting, however, it is not ideal [4] for the optimally based environment. (2014); (P. Kuila, 2014). Local knowledge is used in the distributed clustering strategy, and each sensor node is capable of choosing the CHs on the basis of network needs, which is achieved via the use of distributed clustering. Clustering approaches in heterogeneous sensor networks have led to issues such as high traffic rates, network congestion, under and over sampling of cluster centers as well as over and under sampling of sensor nodes. Using a mixed clustering strategy is recommended in this research[5] (M. Shokouhifar, 2015) in order to eliminate (or) reduce the impacts of energy and storage restrictions.

In general, some emitted radio spectra are being underutilized and thus, the demand for Cognitive Radio (CR) based applications is introduced. It is explored to capitalize the resources of the spectrum using opportunistic networks rather than the primary networks. It is otherwise called 'spectrum holes'. With the help of sensor networks, the cognitive femtocells make use of frequencies. It enhances the power system's performance by covering macrocell networks' peripheries[6]. So far, the research on Cognitive Radio (CR) portrays to be mold-breaking and prospective technologies like opportunistic spectrum access and spectrum sensing. The set of users that utilize the cognitive networks is known as the femtocell network (or) secondary network. By means of WSNs, it supervises the usage of the spectrum by easily exploiting the holes of the spectrum.

The femto-cell networks make it easier for the seeking intellect to find its way. Macrocell networks are often used to refer to secondary users who communicate with the authorized network while experiencing cross-tier interferences. The architecture of the communication system is composed of the core components of CR technology, which include the sensing module and the fusion module, which links the communication and sensing modules [7]. In order to receive the detected data from the WSNs, the fusion model must first collect the detected data. It also assesses the circumstances in which the spectrum is being used. It also interacts with the communication network in order to increase the searching capabilities. - On the other hand, it is also necessary to perform cognitive applications in the most efficient manner possible. It is distributed across the sensor nodes, which are exploited in a dense manner throughout the network, as well as over the sink. The sink nodes that have been installed "may be placed inside or outside of the network". Because the sensor nodes are endowed with intelligence, the monitoring tactics must be updated to reflect this. Uncontrolled mechanisms of deployment and exploitation make it very easy to use. As a result, the researchers are investigating an effective energy management method [8] in order to extend the network's lifespan.

The frequency allocation employed entirely separate frequency bands for femtocells within a macrocell sector and overlaid macrocell sector for alleviating the femtocell-macrocell interference. The inter-femtocell interference is mitigated intelligently by tuning up the power and frequency among the adjacent femtocells. Therefore, the need for self-organizing network-dependent femtocell architecture performed self-healing, self-configuration and self-optimization [9]. However, the effects of multiple macrocells are not considered in most cases of the study. Thus, the need for further research by considering the capacity analysis and multiple macrocells is to be recommended. Additionally, the study of static frequency reuse methods [10] for discrete femtocells is suggested.

The remainder of "the work is split into the following categories: Section 2 describes the associated work; Section 3 describes the scope of clustering technologies in WSNs; Section 4 describes the research technique; Section 5 describes the experimental results and analysis; and Section 6 summarizes the study".

2. RELATED WORK:

This section contains an overview of the approaches that are currently in use. The author of [11] suggested a multichip backhaul concept that made use of cloud radio access networks to achieve its objectives. For the purpose of increasing the sum-rate of the backhaul network capacity, compression algorithms were used. It has resulted in a reduction in the computing effort required for the compression process. In the end, the implementation of multiple route and multi-gateway systems resulted in a 40 percent increase in aggregated throughput as well as a 99 percent decrease in latency. In order to enable hierarchical networks by boosting the efficiency of the spectrum areas enabling fibre connections with decreasing capacity, a durable and efficient millimetre wave [12] was developed. This traffic is handled by a super-base station, which is a group of base stations that handle the backhaul traffic. In the aftermath of this step, the diversity in routing in the vicinity of the traffic has been reduced. Access prices have increased as a result of a lack of attention being given to load balancing across various networks. "Radio Resource Management (RRM) has addressed the tough problem of guaranteeing connectivity over backhaul in macro and micro base stations in heterogeneous networks [13] by using cross-layer approaches. A hidden convexity-based link scheduling technique was developed in order to address the poor signaling challenges. The results of the simulation have guaranteed a 40 percent rise in performance gain over older designs, which are a substantial improvement over the previous designs".

It was decided to use spatial and energy sensitive routing algorithms [14] in order to increase the lifespan of wireless sensor networks. In addition, a hierarchical trust mechanism was developed, which was very effective in detecting assaults by matching the data behavior patterns. The average packet transmission rate of this system has increased while the computing time has decreased. The radio frequency between distinct cluster heads has been enhanced by the system. Network coverage is a universal hurdle that may be overcome by using a hub-and-spoke structure [15]. In order to achieve optimum solutions, three models were developed: "an Integer Nonlinear Program (INLP), an Integer Linear Program (ILP), and an Optimization-via-Simulation (OvS) model. A variety of sensor and target kinds, a probabilistic detection function, sensor dependability, communication range, communication interference, network architecture, and budget limitations have all been taken into consideration". Despite the fact that the system has minimized the discontinuity between distinct communication pathways, certain complicated locations are still unable to recognize intelligent targets.

The notion of network virtualization was established in order to investigate the feasibility of a more efficient wireless communication method [16]. Because of the variety across wireless networks, it is impossible to establish a globally optimum solution. Consequently, an Integer Linear Programming model was created to assist virtual network service providers in their operations. Virtual algorithms have succeeded in lowering the cost of communication to some degree, but at the expense of the security afforded by virtual networks on the opposite end of the spectrum. According to the authors of [17], they conducted a comparative examination of access mechanisms in 5G millimeter wave cellular networks. The use of several iterative and exhaustive search models was investigated in order to overcome the latency caused by the network. It is widely believed that, as a result of the misdetection probability levels, the trade-off between network delays will be reduced to the bare minimum. [18] Then investigated the scheduling of on-link traffic in dual hop mm Wave networks under dual hop conditions. Pico-Net Coordinator was used to reduce the issue of Maximum Expected Delivery Time (MEDT) to the bare minimum. It was possible to decrease the MEDT issue to a manageable size by using joint relay optimization in conjunction with a sufficient number of relay nodes

The interference issues in heterogeneous networks are managed by enhancing the performance of the cell-edge users. Frequency Reuse is the well-known techniques employed to satisfy the network requirements. Presently, "in order to mitigate the interference in wireless communications, a technique named, Interference Alignment (IA) is employed to arrange the received interference from the abnormal transmitters under different transmissions" [19] and it's also been explored by several researchers under different network scenarios [20]. In the angle of heterogeneous networks, several researches have also been done to administer the interference by the use of above techniques. In [21], a hierarchical IA method was introduced to overcome the interference issue under both cross-tier and co-tier systems. It was explored to administer the three users. Pertaining to it, "Multi-User Inter-Cell Interference Alignment (MUICIA) was introduced to resolve the inter-cell interferences". Here, the macrocell base station has two users wherein the IA constraint needs to be satisfied. In [22], the authors have explored a partial connectivity module that fits-in the macrocells with different picocells. It has weakened the interference by adding random noise. Regardless of it, there are many pico users that enrage a strong pico avoiding interference using accurate IAs. In [23], the authors have presented an IA method for two-tier networks under different multiple access multiple channel modules. It was sorted out using the least square model that explored an asymmetric power between users of macrocell and femtocell. It has handled much interference by means of IA that reduced the breakage. Despite single macrocell modules, the interference in inter-cell is non-negligible in the case of heterogeneous networks. With the help of Semi-Definite Programming (SDP) an unlimited number of participants with different leakage was scrutinized. Moreover, the data is being transmitted with precise channel information among deployed macrocells [24,25]. It has limited the capacity of the backhaul problems. "IA algorithm with user selection has been an effective approach to both ensure the IA feasibility condition and reduce the required amount" of precise CSI [26]–[29]. In [30], the authors have introduced the concept of Multi-User Equipments (MUEs) with the lowered SINR performance. This has significantly reduced the interferences in both inter and intra-cellular networks.

3. PROBLEM STATEMENT

The frequency allocation employed entirely separate frequency bands for femtocells within a macrocell sector and overlaid macrocell sector for alleviating the femtocell-macrocell interference. The inter-femtocell interference is mitigated intelligently by tuning up the power and frequency among the adjacent femtocells. Therefore, the need of self organizing network dependent femtocell architecture performed self-healing, self configuration and self optimization. However, the effects of multiple macrocells are not considered in most cases of the study. Thus, the need for further research by considering the capacity analysis and multiple macrocells is to be recommended. Additionally, study of static frequency re-use methods for discrete femtocells is suggested. Interference is the research gaps found from the study's background. It happens by developing an overlapping process among the wireless network users. The performance of the low-power assisted WSNs is determined by tuning up the transmission rate and the size of the data payloads according to the interferences influenced by the channelling of the wireless networks. The probability of the transmission failure and the data bandwidth will be determined to maximize the performance of the throughput. The performance of the radio communication indulging in the wireless networks is greatly affected by the interferences. It affects the performance of the packet delivery; invalid re-transmissions of the data packets; instability occurring between the wireless links and the improper behaviour of the routing protocols. Henceforth, Interference Management is considered to be a very challenging task in dense cellular deployments. Interferences occur due to most of the macrocells and femtocells utilize the same part of the spectrum. Various studies have been performed for Interference Mitigation (IM) in cellular networks. The conventional study focuses on improvising the frequency bands combining with the users from primary networks on a similar frequency. It is mostly applied in the AM/ FM radio, broadcasting and cellular communications models. Each wireless carrier is auctioned with the frequency bands. The generated interference issue is resolved by proper utilization of the assigned frequency spectrum. While in the case of static frequency allocations, the licensed (or) unlicensed frequency bands might affect the performance of the multiple networks in a given window time frame. This has inspired to mitigate "the interference between macrocell and femtocell" in the use of wireless networks.

4. RESEARCH METHODOLOGY

In this section, firstly, the network system model will be discussed. Secondly, the design of "Femtocell Access Points (FAPs)" is discussed for indoor and outdoor deployment. The proposed phases are explained as follows:

4.1 Constructing the topology of the cellular system:

The node deployment plays a vital role in the cellular system. The proper spacing of node deployment eradicates the interference issue. To begin this study, "the deployment of Femtocell Access Points (FAPs)" is done to find out the best locations of the node placement. Furthermore, it is analyzed in both indoor and outdoor environments for better resource utilization. The spectral efficiency of the nodes is improved by increasing the count of FAPs. The network throughput rate is improved by lowering the interferences happening during cross-tier systems. The random placement of cellular nodes experiences a lowered SNR that drains the node's energy rapidly. By keeping this in mind, the proposed interference management follows three actions, namely, planning that assists the femtocell devices with better transmission power; gaming action that ensures the selection of best FAPs and performance assists for the best location. The Femtocell User Equipment (FUEs) combines with the FAPs during the connection process. The proposed FAPs topology is constructed for indoor as well as outdoor environment. These are presented as follows:

4.1.1 Formation of FAPs:

Initially, the femtocell device is installed interior to an anechoic chamber which tunes the transmission power. Next to it, the installed femtocell device determines the indoor and outdoor back environment. It also aims for reducing penetration loss and path loss. It connects with their referred networks by covering the maximum transmission power to 50m. With the 16 FEUs of the closed access mode, the number of required FAPs, so as to yield the optimum coverage is likely to be estimated as,

$$\text{No. ofFAPs} = \frac{(\text{Len} * \text{Wid})}{\text{Thresh}'^{2}}$$

Where,

Len and Wid are the "length and width of the target area".

Thresh is the threshold radius.

4.1.2 FAPs topology for the indoor environment:

Received Signal Code Power (RSCP) value is used to locate/install the FAPs. Along with the RSCP value, it also makes use of Threshold thresh, Multi-Path value (PI) and Transmission Power T_p. In this study, the T_p has "the ability to control the interference and outage administration". Consider an instance, the weakest signal is being received from 45 * directions is measured as,

$$\text{Transmission}^{\text{Center}} \dashrightarrow [\text{Leng}/2, \text{Widt}/2]$$

For all T1...Tn where n>=1

$$\text{Tn} \rightarrow \theta + (\theta \times (\text{N} - 1))\text{Transmission}^{\text{Center}}@5\text{m}$$

Where,

$\text{Transmission}^{\text{Center}}$is the analysis processed in the centre of the specified area.

→ represents the 2D directions

L denotes the building length

W denotes the building width

Tn denotes the resultant of the carried tests

θ denotes the angle of testing.

Based on the RSCP signal value obtained by the macrocell, the first_ FAPs is deployed. Likewise, the testing process is done for each locations with the following constraints,

For all, $t^1 \ldots . t^n$wheren ≥ 1

$$t^n \dashrightarrow \theta + (\theta \times (\text{N} - 1))\text{FAP}^{n-1}@5\text{m}$$

Where,

FAP^{n-1} denotes the deployment of final FAPs with the interval of 5m

During the deployment stage, outage range and their coverage are incessantly monitored and determined for each FAPs. Concurrently, FAP is being outraged and updated for all the weakest ratios. Furthermore, the interferences in the deployment of FAPs is sorted out as,

$$\text{FAP}^1 = \min\{\text{RSCP}^{\text{macro}}\} \ldots . . \max\{\text{coverage}\}$$

The deployment of continues FAPs is given as,

$$\text{FAP}^n = \min\{\text{RSCP}^{n-1}\} \ldots . . \max\{\text{coverage}\} \ldots \ldots . \theta = 45\,\circ$$

4.1.3 FAPs topology for the outdoor environment:

At the angle of 45*, the topology of the outdoor environment can't be explored properly. Henceforth, it is analyzed at the specified area in 2D direction. The specified area is covered and tested. Here, the interferences can be avoided by estimating the distance between lines of two directions that do not exceed the threshold value. The actions taken for outdoor environment are:

$$\sum_{p}^{q} T^{pq} = HL^{p} \cap VL^{q} @ D$$

Where,

p=1 …. P & q= 1...q

D denotes the estimated distance between HL and VLs

While performing the tests, the performance of the intersections lines in vertical and horizontal directions are also evaluated.

4.2 Designing Fractional Frequency Reuse (FFR) scheme:

Fractional Frequency Reuse (FFR) scheme is applied here to discover and connect the best nodes in order to eliminate the co-tier interference systems. The modelling of the static region of cell edge and center rely on the positions of users which is not optimum under dynamic cellular systems. With the best knowledge derivation of the user positions, an adaptive FFR scheme helps to correlate the geographical position of users with the available resources. It is achieved by two phases, namely,

4.2.1 Best Nodes Discovery (BND)

The working of the BND algorithm between FUEs and FAPs is analyzed from the parameters estimated RSCP, PL and Threshold. The best nodes are discovered from FAP and FUE near the interference causing area. The inter-nodes are not entered into the FAPs. The threshold Thresh value is determined from the parameters RSCP and PL. There are two constraints which help to associate between the FAPs and FUEs, such as,

a) The connection value should lie within the radio threshold of FAPs.
b) It obtains RSCP value which is higher than obtained RSCP values of macrocells.

The path loss model which is obtained from the specified locations is given as,

$$PL = PL^{radius} + J \times 10\log_{10}\left(\frac{distance}{radius}\right) + \sum_{w}^{n}(Lw * n + Hw * n)$$

where ,

The path loss at the referral point r is given as PL^{radius}.

The exponent part of the path loss is given as J.

The distance between a referral point of a FAP is given as r

The walls with light and heavy are denoted as L and H.

The count of walls is given as n.

With the above equation as the base, the RSCP value is determined as:

$$\mathrm{RSCP} = \mathrm{Transmission}_{\mathrm{power}} - \mathrm{PL}$$

Since it follows the hybrid gaming approaches, the best nodes are discovered by means of auction game theory. The highest payoff is given as,

$$d_i = \max\{d^i\}$$

Where,

The highest bid is given as, d_i

The bid given by the bidder is, d^i.

The performance of the two bidders and its payoffs is given as,

$$u^j(d^1) = \{d_i \ \mathrm{if} d^i > d^j\}; \{\frac{d_i}{2} \mathrm{if} d^i = d^j\}; \{0 \mathrm{if} d^i < d^j\}$$

Where,

The payoff for the 1st bidder is given as ,$u^j(d^1)$

The bid of the 2nd bidder is given as, d^i

The bid of the 1st bidder is given as, d^1

Therefore, the best node is discovered as,

$$\mathrm{if} \mathrm{FAP}^{i\mathrm{RSCP}} > \mathrm{RSCP}' \wedge \mathrm{FAP}^{id} < D \text{ then } \mathrm{FAP}^i \approx \mathrm{BN}$$

In some cases, a similar FAPs are captured which are evaluated using FAPs and the payoff function such as,

$$\mathrm{BN}_{\mathrm{FUE}}^{\mathrm{RSCP}} = \{\max(\mathrm{RSCP}); \mathrm{PL}; D\}$$

While in the case of two optimum RSCPs is determined as,

$BN_{FUE}^{D} = \{\min(RSCP); sta *; D\}$

where ,sta* denotes the stackelberg value.

The main role of the stackelberg competition is to eliminate the arbitrary choice of the candidate FAPs.

4.2.2 Associating the best nodes:

On the installed FUEs, the RSCP value of the best nodes should be higher than the threshold is localized from the installed 1st FAPs. It obtains signals which are lower than the RSCPs. It covers the targeted area of the macrocell which receives the strongest RSCP from the 1st FAPs. It is given as,

$$20 - PL = RSCPs$$

$$PL = 50 + 2.17 \times 10\log_{10}(32) + \sum_{w}^{n}(4 * 1 + 8 * 0)$$

From the above equation, the highest PL value is located far away from the received power of a macrocell. It indicates the association between the predecessors installed FAPs and FUEs. Henceforth, the probability of outage with the RSCPs residing in the anechoic chamber. In some scenarios, FAP1 and FAP2 yield lower power from the macrocells by lowering the curve demand on the stackelberg than the estimated RSCPs.

5. RESULTS AND DISCUSSION

This section goes into further detail about the simulation setup as well as the performance measurements that were utilized to verify the suggested framework. The present strategies for consolidating the planned framework will also be described in conjunction with this. The proposed Fractional Frequency Reuse (FFR) is executed and implemented using the Matlab programming system. The wireless cellular networks are designed in this study. Each communication channel is associated with a "Global Positioning System (GPS)" that contains different parameters, interference, signal to noise ratio and the attenuation. The parameters studied are:

a) Lifespan of the network: The lifespan of the network is defined as the operational time taken by the sensor nodes (or) a group of sensor nodes without losing their energy.
b) Packet loss estimation: Packet loss estimation is defined as the dropping of packets during the communication process. It is estimated as,

$$\text{Packet loss } \% = \text{Packet loss} * 100.$$

c) Delay estimation: Delay estimation is defined as the process of time consumed by the "cluster heads" to acquire the data from their cluster members. It is usually measured in seconds.

d) Energy usage: Energy usage is defined as the process of "energy consumed" by a sensor node at each network cycle.

e) Travelled distance to find best nodes: The distance taken by the sensor nodes during the data acquisition process from cluster heads to its node members.

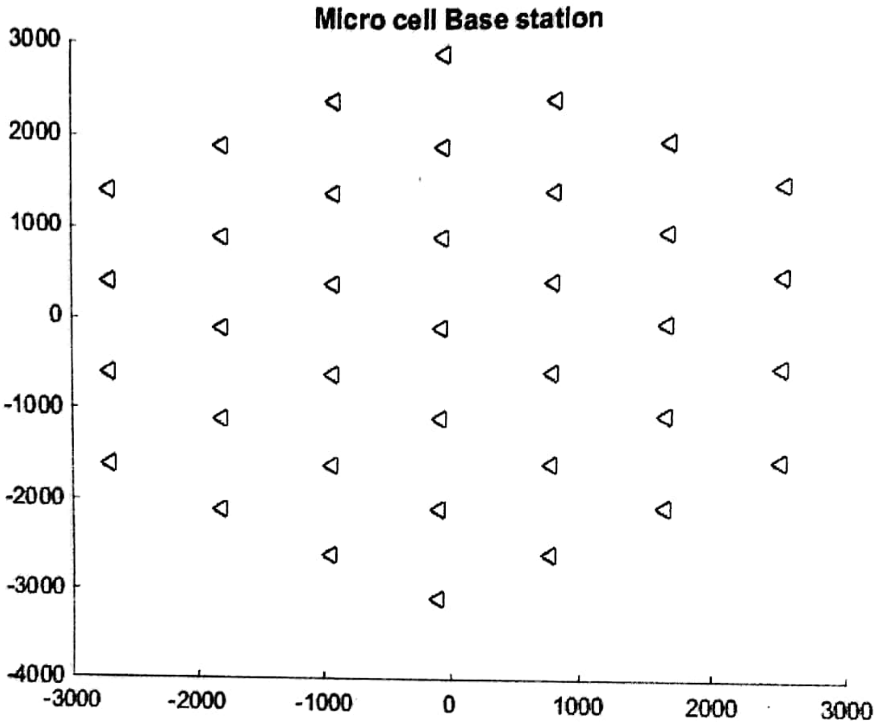

Fig.1: Simulation of microcell base station

The above fig.1 represents the simulation view of the macrocell base station. Each femtocell is explored with the help of a micro-base station. The number of sender nodes and the receiver nodes are intialized at this stage. Let us assume a single LTE based macro base station that covers the cellular network area under hexagonal shape form. The cell size determines the transmission power of the receiver. Pertaining to this, the PL is set to 3GPP TR with 2.6GHz of carrier frequency with antenna height of 25m and 1.5m of user height.

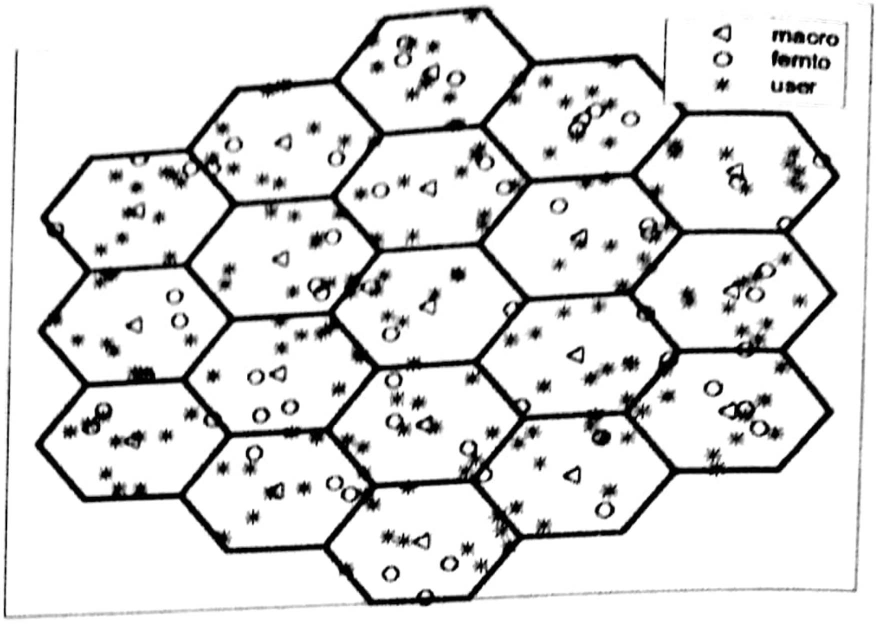

Fig 2: Creating the cells

The fig.2 presents the creation of cells in "micro base- stations". In order to study the challenges given by interference issues, the heterogeneous networks are studied. The deployment of "micro base stations", femtocells and the number of cells are employed for this study.

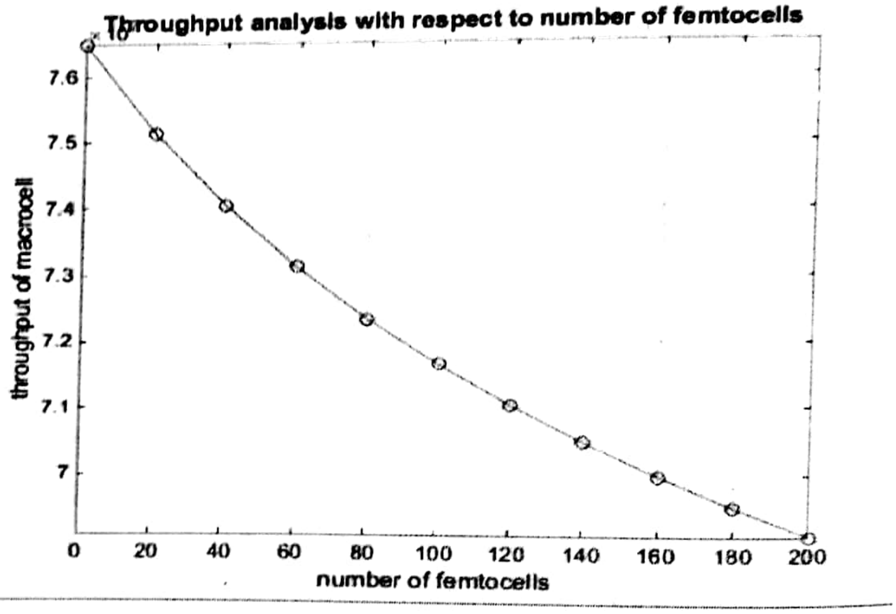

Fig 3: Throughput analysis

From fig.3, it infers that depending on the count of femtocells coverage, the throughput level is estimated between the femtocells and macro base station. Irrespective of the count of femtocells, a high peak performance is achieved that ensures the flexibility among the cellular nodes.

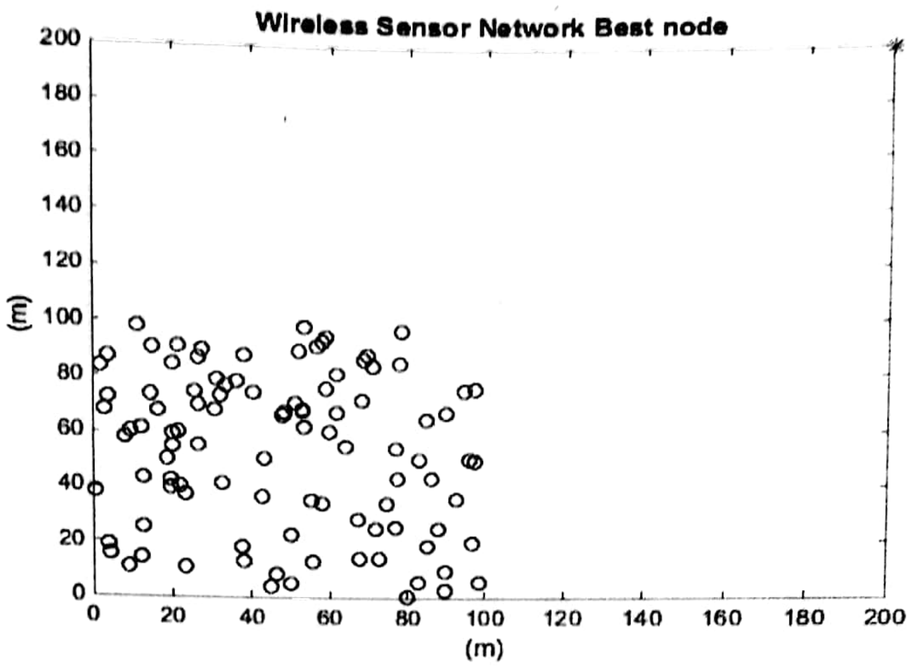

Fig 4: Discovery of best nodes

The formation of best nodes by exploring the network constraints of indoor and outdoor environments. With the help of random distribution models, the best nodes are selected from the region of interest.

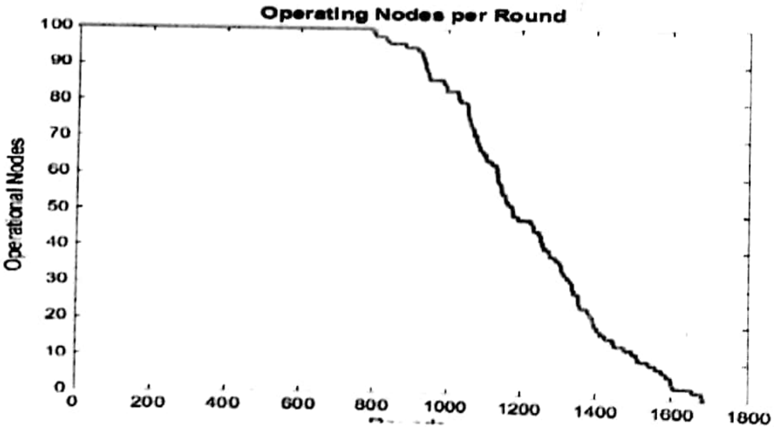

Fig 5: Performance of the nodes at each round

The above fig.5 presents the simulation view of nodes operating at a round. UE demand may create location fluctuations and poor energy preservation methods in certain circumstances since UEs have a high demand for electricity.

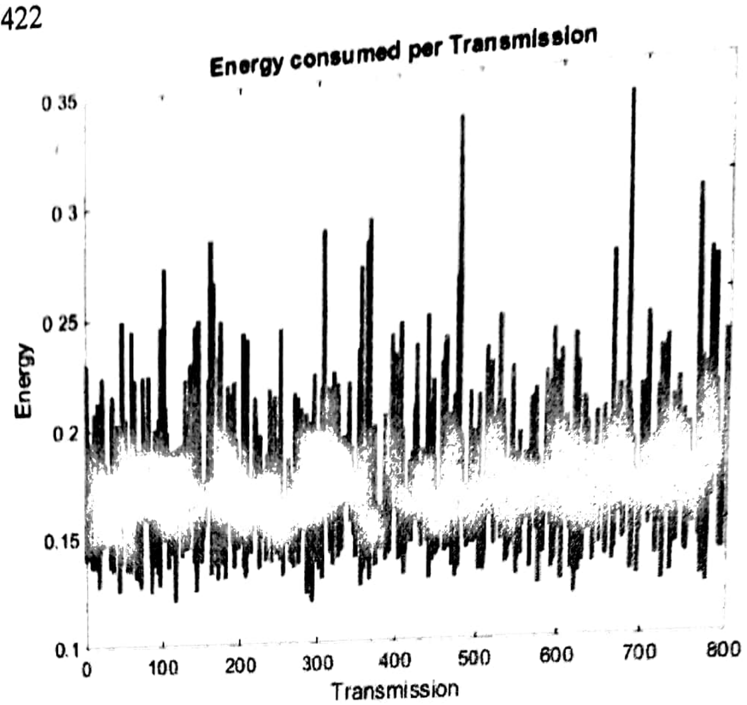

Fig 6: Energy consumption analysis

The fig.6 gives an examination of the pace at which energy is used. If the connection is not up to par, the possibility for data transfer is significantly diminished. Whenever the minimum time spent by living nodes goes below a certain threshold, the size of the biggest linked nodes falls below a predetermined threshold.

6. CONCLUSION

In this paper, we make an attempt to explore the mitigation model to alleviate the interference between macrocell and femtocell of the cellular systems. The deployment of femtocells facilitates the searching capabilities whereas the secondary users associated with the authorized networks are known as macrocell networks. Here, the Fractional Frequency Reuse (FFR) model is designed to mitigate the interferences between the macrocells and femtocells. The best nodes are localized and placed with the use of Femtocell Access Points (FAPs). Moreover, it is analyzed in both indoor and outdoor environments for better resource utilization. The spectral efficiency of the nodes is improved by increasing the count of FAPs. The network throughput rate is improved by lowering the interferences happening during cross-tier systems. The random placement of cellular nodes experiences a lowered SNR that drains the node's energy rapidly. The proposed interference management follows three actions, namely, planning that assists the femtocell devices with better transmission power; gaming action that ensures the selection of best FAPs and performance assists for the best location. The Femtocell User Equipment (FUEs) combines with the FAPs during the connection process. The simulation analysis is carried out in the wireless cellular environment with some assumption on network constraints. It is inferred from the results that the proper alignment of the femtocells node can eliminate the interference happening in the co-tier systems.

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