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Optimizing the Call Drop Probability in the Wireless Heterogeneous Networks

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***Abstract* – The world today is dependent on the communication system so much that for every small thing, the people need to take help of wireless communication system. Heterogeneous networks are one of the new subjects in wireless networking. A convergence visualization in which a user of mobile / computer will connect concurrently to different wireless access networks (example cellular, WLAN, WMAN) is built for the next generation of wireless networks. The main thing which strikes to our minds nowadays, when we discuss about heterogeneous wireless networks, is the seamless connection to access networks. In this paper suggests a new method in which mobile users constantly evaluate the network and build a repository of the best networks available. Here, in the proposed work, we have proposed an algorithm that uses Particle Swarm Optimization (PSO) for reducing the call drop probability in the wireless heterogeneous networks. Investigational outcomes indicated that the suggested technique works efficiently for reducing the call dropping probability in wireless heterogeneous networks.**

Keywords* – *Call Drop Probability; Particle Swarm Optimization; wireless access networks; heterogeneous networks; next generation

I. INTRODUCTION:

One of the world's recklessly rising markets is mobile communications. The number of smartphone users has risen at a very rapid pace over the past couple of decades. Currently, due to the rapid development of the digital Internet and mobile communications industry, mobile networks, in addition to more varied network configurations, have been developed with more complex infrastructure and a greater variety of related devices [1]. Operators are increasingly making a great deal of effort to satisfy the consumer's needs. Recently, heterogeneous wireless networks (HetNets) have been developed as the system architecture to meet the rising demands for services which needs mobile data. They have a classified structure with added levels of small cells (femtos, picos, and WiFi) involving a macrocell network overlay. It expands the community of current mobile device spectrum assets as they are recycled across several levels in the HetNet, including by integrating hotspots (femto cells) into the network [2], harnessing an additional spectrum in unlicensed bands. In such emerging heterogeneous mobile networks (HetNets), the dynamic system resources focused on the well-organized structure present a huge number of practical challenges. On next-generation networks, multimedia services with unique QoS settings should be supported. Therefore to satisfy these diverse QoS requirements, it is important to establish sophisticated call drop probability reducing schemes. Wireless resources must be managed efficiently from the point of view of service providers for optimal productivity and improved yield on investment [3]. Among the main performance indicators needed by different service providers to calculate service quality is drop-call probability. It usually describes the phenomenon in both data and voice networks of call/packet dropping. Call/packet falling denotes the incidence defined as ending of calls which are ongoing beforehand the call is deliberately terminated by any person involved [4]. Call falling is triggered by the absence of radio channels open, that in turn can happen because of transmission factors like loss of distance, multipath fading, path loss, RF interference and shadowing [5], [6]. Additional variables that differ in channel capability include handover and service prioritization [7], [8].The figure 1 shows the wireless heterogeneous network.

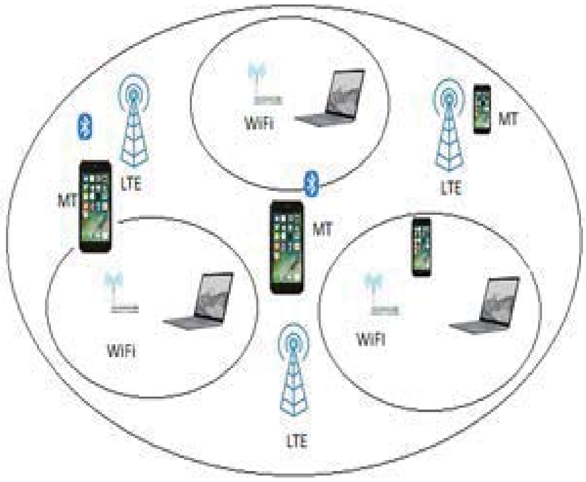

Fig.1. Wireless Heterogeneous Networks

Many authors have contributed in the field of wireless communication. Some of the magnificent works which has helped us to carry on the research is discussed as. Tarkaa et al [4] in their work presented a summary of drop-call likelihood variables in mobile networks in this paper. In addition, to learn the patterns in relation to an active GSM network, some of the variables have been examined and the findings are addressed. In [9], Liu et al, for a phase mobile network with fractional frequency reuse (FFR), applied scientific prototypes to examine the probability of novel call blocking and handover call (HC) fall. They then derived the three forms of hindering chances of new calls and two kinds of falling likelihoods of HCs on the grounds of the static probability of Markovian states. Ultimately, they performed vast computational simulations. They revealed two vital instructions for selecting the optimum range of the SG from the effects of computer modeling, with which the blocked and falling likelihood of the device can be efficiently minimized. Sadi et al [10], in this paper, using the amalgamation of restricted and unrestricted customers, a -dimensional traffic prototype of a movable cellular network is suggested. Based on both smoothing and deteriorating conditions, a novel call admission scheme (CAS) is suggested. In contrast to newly originated calls, the fading state of the mobile communication links to a handoff call is given priority. In [11], the authors studied the influence of handoff prioritization schemes and retrial queues on calls entering the network in this paper. The findings showed that there is a small decline in handoff calls with the call drop minimization techniques. Furthermore it minimizes the heavy terminating of handoff calls .In [12], the authors investigated the call drop rate and the call handover success rate as the main performance metrics, and it investigates the quality of service of GSM networks in Nigeria. They used the Erlang B probability formula in the study, which illustrated the service quality of the multitude of screens available at that time at any given time. With the assistance of data collected from the Nigerian Communications Commission, the parameters of the four major GSM services in Nigeria have been analyzed. The findings indicated that with respect to such indicators, the operators did not function well thus, ways are recommended to improve not only the output of the indicators but also the success of the overall network. The research reveals that GSM services are actually unreliable in Nigeria. Cell segregation, sectoring, and proactive resource management are highlighted as the potential means of improving the quality of operation of the networks as enacted. This execution would result in soft handover in the network thus, creating a more robust telecommunication system. In [13] Ramnath et al took minor cell network into consideration and research the influence of customer flexibility. They answered the description of handoffs at the limits, presumptuous Poisson call deliveries at random locations with haphazard velocities. Explicit expressions derive from us using instruments from spatial queuing theory for call blocking and call drop chances. For the mediocre virtual server keeping up interval, they also extracted expression. Using some numerical examples, these functions are used to determine optimal cell sizes for different velocity profiles in small cell networks. The performance of the optimal system has been further discussed. Xshafa et al in [14], , in their paper they presented an analytical structure for dynamic scheduling queueing in cellular connections for handoff calls. For handoff calls, the method incorporates a queuing up system with two priority classes. For the two categories of handoff calls, two lines are employed, Ist priority and IInd priority. The preference of lined up handoff call is not only dependent on the strength of the signal obtained, but on the residual time also between two cells in the overlay zone. They also had a priority switch among queue handover calls; specifically based on certain requirements, a second priority handoff call in the second important queue can become a first important handoff call and enter the chief priority handoff line. In [15], the authors in their study adopted an empirical approach to model and evaluated the efficiency of the Global Cell Phone System by designing a new Handoff Scheme. The handoff queue is inserted into the M+G scheme via this scheme. This help to reduce handoff failure even more. Using MatLab simulation, this arrangement is calculated in relations of the likelihood of handoff failure. In the study of mobility management and connection efficiency, this methodology is adopted with a focus on the prioritization. Poisson is considered to be the coming tariffs of initiating and handover calls, while time variables are supposed to be exponentially distributed, such as channel holding time, call holding time, cell residence time, registration area (RA), inter-service time and residence time. In [16], Zaffer et al, considered a multi-hop wireless network that can be temporally reused, with a correlation traffic model and multiple transmission channels. The blocking likelihood of a call that allows a channel demand on such a network. It relies on i) the assignment of channel scheme (ii) the node transmission radius that affects outcome of the network connection. Throughout this project, these 2 fundamentals were analyzed for wireless heterogeneous networks. Especially, for a grid network and wireless line, they established blocking probability analysis and explored the adjustment among the blocking probability and transmission radiuses for multi-hop calls. They showed that a bigger transmission radius for a line network will significantly decrease the hindering likelihood of calls, while a smaller transmission radius is better for a grid network with a denser node structure. Asuquo et al [17] et al, in their paper introduced an updated Erlang-B active network assignment (MEB-DCA) scheme. A preferential threshold for handovers request assignment is implemented by the MEB-DCA algorithm to insure that cellular networks do not pointlessly prioritizes handover call to the disadvantage of new call. When designing linear relation between parameters, it is hard to extract information from inaccurate network data, needing advanced simulation tools with cognitive expertise. Assuming its capability to accurately reflect both expert information and data, soft computing methods were revealed to tackle this task. To programme the communication constraints learning for optimised decisions on channel allocation, an adaptive neuro-fuzzy inference system-based dynamic channel allocation (ANFIS-DCA) framework had been suggested. In [18], the authors suggested a method to determine the efficiency of the integrated network model handover or inter-system handover (ISHO) procedures for inter-radio access technology. In the suggested integrated HWN, three separate practical handoff scenarios have been examined. This article aims to test the inter-system handover output for the suggested model. In terms of the average number of handovers and conclusion delays, implementation of the suggested network model was carried out using the suggested ISHO-algorithms. Additional elements like time to cause and hysteresis values were taken into consideration to decrease the excessive handovers, to board off the ping-pong influence and to decrease the conclusion lag.

II. PARTICLE SWARM OPTIMIZATION:

Particle swarm optimization algorithm (PSO) is a swarm-based stochastic optimization technique suggested by Eberhart and Kennedy (1995) and Kennedy and Eberhart (1995) [19]. Particle Swarm Optimization algo follows the communal conduct of animals, that includes birds, herds, insects and fish. The groups create a supportive way of finding nutrition, and every member in the swarm continues to change the form of search based on their own and other members' learning experiences [20]. This model is too modest and too remote. In specific instances, the speed is applied to the random variable Item. Specifically, at any iteration, apart from The PSO algorithm's main design idea is thoroughly linked to 2 research studies: first is an evolutionary procedure, just like an evolutionary algorithm; Particle Swarm Optimization also makes the use of a group mode to concurrently look for huge regions within the resolution area of the optimized objective function. Another is artificial life, that is, it learns the lifestyle artificial systems. Each of the birds is represented by a dot in the Cartesian coordinate scheme, distributed at random with primary velocity and positioning. Then run the program as per "the Matching velocity rule adjacent proximity, "so that single individual has the similar velocity as its closest neighbour by the iteration and all the points will have the same Fast Velocity.reaching the adjacent velocity match "will be applied to each speed. Firstly, we assumed that the cornfield's position coordinate is (x_o,y_0), and individual bird's position coordinate and velocity coordinate is (x, y) and (vx, vy). Distance from current position to cornfield is used to calculate current position and velocity efficiency. The farther the distance to a "cornfield," the improved the performance, on the other part, the performance is poorer. Suppose that every bird has the capability of memorizing and can remember the best position it has ever attained, called pbest. A is speed regulating. Persistent, rand signifies an arbitrary number in [0, 1], the velocity item can be changed agreeing the rules:

If x > pbest x, v x = v x − rand × a, else, v x =v x + rand × a.

If y > pbest y, v y = v y − rand × a, else, v y = v y + rand × a.

Thus suppose that swarm can interact in the certain way, and every employee can see and remember the best position of the total swarm so far (marked as gbest). And b is the persistent speed adjustment; after the speed object has been modified in accordance with the rules above, it must also be revised in accordance with:

if x > gbest x, v x = v x − rand × b, otherwise, v x = v x + rand × b.

if y > gbest y, v y = v y − rand × b, otherwise, v y = v y + rand × b.

Based on the same, the PSO procedure can be summarized as follows: The PSO procedure is a type of swarm-based search method, in which every individual is known as a particle well-defined as a possible solution to the enhanced problem.

D-dimensional search space, and it can remember the swarms and its own optimal location, as well as the speed. In each group, the knowledge about particles is united to change the velocity of every measurement that is used to measure the particle's new location. Particles constantly change their state in multidimensional search Space, before equilibrium or optimum state is reached or beyond the approximation limit. Unique connection is created via objective functions between dissimilar sizes of the delinquent space. Many empirical evidence has shown this procedure is an operative tool for optimization.

III. RESULTS:

A. Call dropping rate fitness calculation:

The entire possibility for dropping call rate in handover or failure in handoff can be shown as [21] as below:

$$cd_{THandoff} = cd_{HHandoff} + cd_{VHandoff}$$

Where cdTHandoff is the total call drop probability during handoff

cdHHandoff is the call drop probability during horizontal handoff

cdVHandoff is the call drop probability during vertical handoff

Call Drop Rate: Call Drop is a major drawback in any Handoff Algorithm.Here from the figure below, we can see that the call drop ratio is lesser in PSO-VHO in comparison to the existing algorithms.

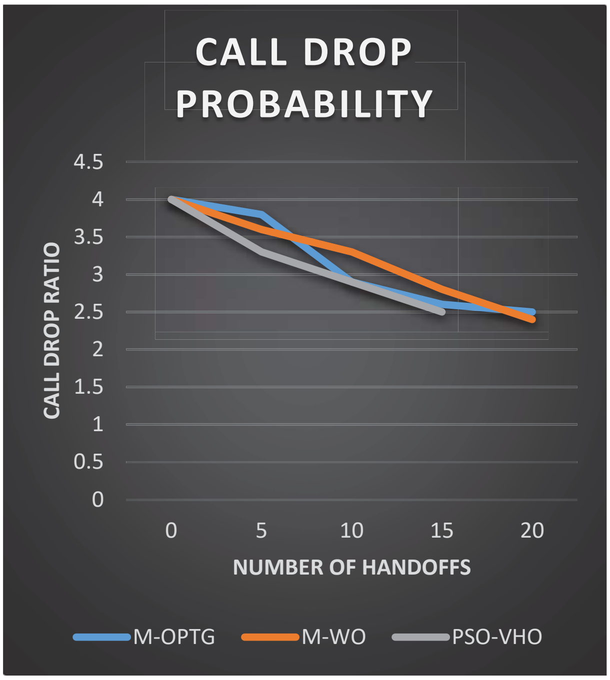

Fig.2. Results showing lesser call drop probability in the proposed algorithm

IV. CONCLUSION:

The call dropmis the major concern when we talk about the seamless connectivity.In the proposed work, we have tried to improve the performance of the wireless communication networks.From above analysis, it can be concluded that the proposed algorithm works well to reduce the call drop probability in the wireless heterogeneous networks.

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