Delay Aware Optimal Resource allocation in MU MIMO-OFDM using Enhanced Spider Monkey Optimization

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Abstract: In multiple users MIMO- OFDM system allocates the available resources to the optimal users is a difficult task. Hence the scheduling and resource allocation become the major problem in the wireless network mainly in case of multiple input and multiple output method that has to be made efficient. There is various method introduced to give an optimal solution to the problem yet it has many drawbacks. So, we propose this paper to provide an efficient solution for resource allocation in terms of delay and also added some more features such as high throughout, energy efficient and fairness. To make optimal resource allocation we introduce optimization algorithm named spider monkey with an enhancement which provides the efficient solution. In this optimization process includes the scheduling and resource allocation, the SNR values, channel state information (CSI) from the base station. To make more efficient finally we perform enhanced spider - monkey algorithm hence the resource allocation is performed based on QoS requirements. Thus, the simulation results in our paper show high efficiency when compared with other schedulers and techniques.

Keywords: Scheduling, Resource allocation, CSI, optimization algorithm.

1. Introduction

At the present time, on the internet, the wireless network is a significant process in communication through allowing access the data and services. The high-speed communication channel efficiency is essential for an augmentation in multimedia transmission. Therefore, they established numerous type of technologies such as frequency hopping, multiple input and multiple output (MIMO), orthogonal frequency division multiple access (OFDMA), dynamic memory allocation and so on. These are constructing the dependable transmission through the obtainable bandwidth. The MIMO employed extensively in the current wireless network which illustrates the high throughput and bandwidth effectiveness. In the OFDMA and MIMO techniques, the significant function is scheduling and resource allocation among the numerous users. The resource allocation techniques (Pischella, M., & Belfiore, J. C. 2010 “Schober, et al., 2012 “Maciel, & Klein, 2010 “Leinonen, et al., 2013). can exhibit the obtainable noteworthy performance gains, suppose, if frequency hopping and adaptive modulation are utilized in subcarrier allocation, presumptuous facts of the channel gain in the transmitter. The interference cancellation of CDMA can be similar to the frequency hopping approach (Nguyen, Nguyen & Le-Ngoc, 2014 “Nguyen, et al., 2013, December)

In OFDMA-related remote networks, the important function is the efficient resource allocation algorithms. OFDMA (Chen, & Swindle hurst, 2012” Clerckx, et al., 2013) can take place in numerous access atmosphere from a frequency fading channel into a couple flat fading sub-channels which are used to reduce the possessions of inter representation impedance. At the similar time, each user can experience a dissimilar fading in the multiuser OFDMA system. Besides these lines, multiuser prearranged behavior can be mismanaged through organizing the data subcarriers to the users which reliant on the user channel setting. Multiuser deviating behavior can be attached to element resource package which anticipates a fundamental division in modernizing system implementation of OFDMA arrangement. Although, the user is necessitated the condition for hard responsiveness. MIMO networks provide updated implementation alteration based on cluster behavior and data rate devoid of expanding the transmit power or switch over speed. A substantial determine of study work has been dedicated to the combination of MIMO among OFDM systems. Therefore, the wideband replicate precise MIMO channel can be isolated into a phase of unclear MIMO channels.

A greedy heuristic (Choi, et al., 2011) effectiveness related suboptimal throughput augmentation and complication reduction SRA format for downlink multiuser MIMO-OFDMA systems whose method require adequate simplification to deal with propose derived from dissimilar power and sub-band or rate allocation policies. The bargaining explanation (Lin, et al., 2010) accomplish a practical transaction among general system effectiveness and user equality; though they do not regard as the chance of user through heterogeneous QoS necessities nor the combined choice of most favorable multiuser and multimode collection, the equivalent algorithms only encompass logical complication for condition relating a diminutive amount of user among oversimplified methods being obligatory for useful execution (Yen, et al., 2010). In multicarrier systems, the arithmetical postponement necessities of multimedia traffic, the link level representation expressed as effectual capability, which is employed to create resource allocation optimization troubles. A structure for channel and queue conscious development and resource allocation for block diagonalization (BD) related MU-MIMO-OFDMA wireless networks is established (Lima, et al., 2014). Regrettably, many regards as proposing that endeavor for energy efficient and do not regard as the utilization of MU-MIMO-OFDMA techniques. The resource allocation difficulty has been lately measured in numerous investigations. Nearly, the entire difficulties are considered as synchronized resource allocation difficulty in which Quality of Service (QoS) necessities are preset by means of the function.

Currently, there is a variety of optimization algorithms employed in the projected process to offer a competent explanation to the difficulty. A few optimization algorithms incorporate PSO, genetic algorithm, an evolutionary algorithm and so on.
In this paper, the optimal resource allocation mechanism in a wireless communications network are used to acquire an effectual trade-off among the spectral and energy effectiveness and equality, whereas offering approved QoS. This can be accomplished in our proposed process by the use of spider monkey algorithm which is derived from the swarm optimization algorithm. Ns2 is a simulation tool which is utilized in our work and the performance is deliberate by the existed method.
Section 2 illustrates the related work which is based on our proposed method. Section 3 offers the obtainable difficulty and the explanation using our proposed method. Section 4 gives the simulation result with the performance metrics based on the proposed and existing method. Finally, section 5 summarized by the conclusion of our proposed method.

2. Related Works

Chandrasekaran, K. and M.A. Bhagyaveni (Chanthirasekaran, & Bhagyaveni, 2012). initiated a multi-threshold scheduling for the multi-user MIMO systems. MIMO system is extremely utilized in the 4^{th} invention wireless networks for accomplishing the expansion of multiplexing and multiplicity. A variety of scheduling techniques has been established for the MIMO system but the multi-threshold related channel scheduling is projected through illustrating the enhancement of the presentation and the competent allocation of possessions. Furthermore, it also explained the various types of further techniques such as the multiuser Multiple-Input Multiple-Output (MU-MIMO) system beneath Space-Time Block Coding (STBC) transmission. The compensation of scheduler is to augment the package deliverance proportion, low bit fault rate, service fairness and the high standard capability in the middle of the user. In this format, channel eminence is utilized to send the data to the group of users.
Bin Da and Chi Chung Ko (Da, et al.,2009) projected a new scheme for resource allocation in MIMO-OFDMA (Multiple Input Multiple Output - Orthogonal Frequency Division Multiple Access) downlinks among comparative fairness. It contains the collective system boundary to augment the objective for including restrictions on the overall available power and comparative fairness. Devastating Eigen channels can be obtained from MIMO condition network which is exploited to specify this arrangement by means of the low multifaceted environment. It provides a transaction method in the middle of structure boundary, computational many-sided eminence and comparative fairness. Therefore, it shows this new versatile allocation processes which provide a lot preferable boundary amplify in excess of fixed task techniques whereas carry out perfect rationality of rate allocation through a linear complication. Consequently, it might be sensible for fulfilling contrary QoS fundamentals of MIMO-OFDMA system.
Fraimis, Ioannis G. and Stavros A. Kotsopoulos (Fraimis, & Kotsopoulos, 2012) in MIMO-OFDMA Multicast Systems utilize the Low-Complexity Resource Allocation Algorithm among the Spectrum-Guarantee Provisioning. The projected process makes sure a support choice distributes for each user whereas developing the multicast diffusion method. There is a numerous antenna implicated in mutually source and receiver propose spatial conflicting eminence to the structure together with the reappearance dissimilarity integrated through the OFDMA. The computational global environment is pointed from exponential to linear and authorization of the projected process is attained during dissimilar activity position in correlation by way of further multicast and unicast orientation strategy exploited as a division of MIMO-OFDMA system.
Ahmad M. EI-Hajj and Zaher Dawy (El-Hajj, & Dawy, 2013, July) display a novel delay aware combined uplink and downlink resource allocation algorithm that manages the processing system in one manner through exploiting reschedule data from the additional manner. The development of wireless network principles, the management of new management among tight bidirectional environment management fundamentals obligatory the enhancement of original and resource allocation algorithms. These integrate scheduling method founded on postponement aware systems to adjust to the tight surrounding excursion rearrange restrictions required by the actions. The elementary consideration following this arrangement is the alteration of the transmission postponement among the uplink and downlink to preserve a premeditated detachment from resource consumption and service deprivation that can approach regarding as a result of transmission irregular quality. Therefore, it exhibits an improved obliged delay demeanor of the structure. Moreover, exploiting the approval catalog derived from join fairness catalog it carries out exceptional in the resource allocation.
Javad Hajipour, Amr Mohamed and Victor C. M. Leung (Hajipour, Mohamed, & Leung, (2016) regard as the active routing and sub-channel description for furnishing Quality of Service (QoS) in the downlink of OFDMA systems promote by buffering transfer. Especially, they regard as satisfying the QoS necessities of mutually postponement user through the intention of convention package due to data limitation and postponement liberal users who necessitate making sure on their standard throughputs. They propose a system to frequency field scheduling and time field scheduling projected an original Channel, Queue and Delay Aware (CQDA) methods for inventing and elucidation the combined routing and the difficulty origin for the period of resource allocation. Particularly these policies assume various approaches to select regarding the group of users measured in the effectiveness capability, the postponement spending separation in the middle of BS and transfers, the routing course of postponement responsive user package and as well the calculation of slightest rate requirements for providing their queues. The iterative algorithm is employed to make sure of the successive problem.
Saeedeh Parsaeefard *et al* (Danaid, et al., 2016, December) offer a delay aware resource provisioning for the virtualized remote systems to bind the entire standard to transmit power whereas embracing the slightest necessary standard rate of each one cut and the severe usual package transmission delay for each client. The projected cross-layer optimization problem is naturally non-raised and contains high computational multifaceted environment. To increase an expert explanation, we initially modify cross-layer

subordinate restrictions into physical layer subsidiary ones. Afterward, useful distinguishing convexification process in illumination of variable alteration and relaxations and recommend an iterative algorithm to accomplish the supreme explanation.

(Mahtab Ataee and Abbas Mohammadi et al., 2017) have proposed an optimal resource allocation method in multiple-input multiple-output-orthogonal frequency division multiplexing heterogeneous cloud radio access network. They have formulated two non-convex optimization problems for resource block (RB) assignment and power allocation, and then solve both problems using their equivalent convex feasibility problems. By considering Lagrange dual decomposition technique, a closed form expression for joint power and RB allocation in order to improve energy efficiency (EE) is derived. Finally, they have shown the efficiency of the algorithms in enhancing EE through Monte Carlo simulations.

(Emad Hassan 2017 March) have proposed multi-user (MU) MIMO-OFDM structure for BPLC. Unlike to MIMO-BPLC with ideal hardware, the hardware impairments cause a capacity limit at high signal-to-noise ratio (SNR). Another technical challenge in designing MIMO BPLC network was the crosstalk between MIMO PLC ports which has non-negligible effect on network capacity. In order to reduce the effects of crosstalk, they have apporached by applying Pre-coding at the transmitter before applying the singular value decomposition (SVD) on the MIMO channel. Due to the nature of the power-line channel, the different users have different channel conditions.

3. Overview of Proposed Method

During the multi-user process allotting the resources to the specific user become the difficult one. Each user requested with the different type of work such as text messages, audio, video and so on. In these cases, the text messages may take the only limited amount of time and other took a long time than the normal message. So, in such cases the lesser time task to be completed first so that the resources can be free and used for other purposes. So, to maintain this type of progress there is a need for proposing an efficient scheduling method with delay control. Thus, we presented a delay aware optimal resource allocation MU MIMO-OFDM using the optimization algorithm.

3.1 Problem identification and solution

The complicated work of multi-user MIMO system is the scheduling and resource allocation from downlink. Different investigations have been carried out to establish the competent explanation for this difficulty. Guillem Femenias et al (Femenias, & Riera-Palou, 2016) have explained a structure for channel and queue aware scheduling and resource allocation for block diagonalization (BD) related MU-MIMO-OFDMA wireless networks. Although the allocation of resources is utilized as a different scheduler, that is derived from the traffic such as RT, nRT, BE in the network. Although, it contains some disadvantage in postponement and throughput. The majority process only regards as propose that endeavor for energy efficiency and also, do not regard as the employ of MU-MIMO-OFDMA techniques. Lately, the resource allocation difficulty has been regarded as in numerous investigations. Nearly, every one of them describes the difficulty as a synchronized resource allocation difficulty in which Quality of Service (QoS) necessities are preset through the application.

Therefore, we propose the optimal resource allocation techniques intend at acquiring an effectual transaction among the spectral, energy effectiveness and fairness, whereas offering approved QoS in a wireless communications network. We initiate an optimal resource allocation in MU MIMO – OFDMA with the help of spider monkey optimization algorithm. The augmentation of system capability is accomplished through choosing the channel state information (CSI) and Signal noise ratio values (SNR).

3.2 System model

In this model of downlink multiuser, MIMO was obtained as a single base station among a couple of convey antennas converse through the *n* number of mobile users through Raleigh fading channel. The base station distributes a demand to the *n* amount of user to recognize the SNR values and channel condition information. Afterward, it programs the users derived from the SNR values. Subsequently, to distribute the resource was the appropriate exploitation and to develop the presentation of the network through an optimizer. Therefore, the BS scheduler utilizes the projected scheduling algorithm and allows the resources to the numerous users in the course of obvious to propel package. Accordingly, the resource allocation is carried out in the MU MIMO wireless surroundings. The resource is preset in the number of slots per downlink in the subframe. This is indicated by the variable quantity of slots. The proposed system model is given in Figure 1.

For modeling the channel, we use the Raleigh fading channel. The SNR values are calculated by the

$$f(x) = \begin{cases} \frac{1}{\eta}\exp(\frac{-y}{\bar{\eta}}) & if y > 0 \\ 0 & otherwise \end{cases} \quad (1)$$

Where $\bar{\eta}$ is an average SNR value.

The greatest capability of the system is calculated by Shannon‘s rate formula which furnishes the proportion of error correction. The maximum error bit rate is symbolized as

$$R_{\max}(bps) = W\log_2(1+\eta) \quad (2)$$

Where η is the average of received SNR values. W is the bandwidth of the system. And here we assume the bandwidth w=1.

3.3 Working model of proposed method

Initially, the number of users is established in the network. In this, we employ 2 progressions for scheduling and resource allocation. They are as follows

- Initial, scheduling is carried out through the SNR values and channel state information
- After that, the spider monkey algorithm is incorporated to construct the scheduling dependable and the resources are distributed by the scheduling.

3.3.1 First scheduling

- **SNR**

The distinction between the received signal and the noise level is called as SNR, which takes place in the background. For illustration, suppose the radio signal established as -75 dBm and the noise phase is 90dbm, then the SNR value is

15db. Suppose the SNR value is higher than the signal strength, which is stronger than the noise phase or else the noise phase is advanced and the signal force is pathetic. As well, the throughput of the network can be diminished by the minor SNR values.

• **CSI**

In a communication link, the channel state information offers the possessions of the channel. This encompasses the information about the conveying signal from the source to the target. The channel condition information is propelling to the base station in the structure of time slots.

Therefore, the obtainable user information such as SNR and CSI is propelling to the base station. The base station verifies the obtainable resources and the resources distributed for the finest signal strength and the channel quality to the users by the help of channel quality and the SNR condition. Except this value will never assist to construct the dependable transmission because it contains only the signal force and it is not competent. In the MIMO, the users contain a numerous transmission and this will not maintain throughout, energy competent and fairness. Suppose, if resource distributes for the high signal force but the data was big than the signal which turns out to be pathetic for the duration of the transmission, thus the next progression as well postponed this progression may direct to retransmission. Consequently, to evade these troubles, we depart the optimization algorithm through the augmentation described as enhanced spider monkey algorithm (ESM).

3.3.2 Second Scheduling

The SNR value is obtained by the scheduled user. The users are compared in expressions of power allocation, require rate, traffic and time utilization by the use of the ESM algorithm. The carriers are utilized to acquire the message through the channel. The optimizer used in the system known as SM optimizer.

(a) Spider monkey algorithm

It is the iterative process of the trial and error based collaboration.

Algorithm Steps

The steps involved in spider monkey algorithm are as follows

1. Initialize the population, global leader limit, and local leader limit and perturbation rate.
2. Establish fitness value based on the distance from the source.
3. Relate to greedy selection to select the global and local leaders.

While not met the termination condition then performs the following steps

• The new location for population is generated to strike the target with the local leader phase

• The fitness value generated using the greedy selection among the group members.

• Access the probability P_{ri} for all the companions

• Generate the new location for all companion using GLP

• Global and local leader are changed using the greedy selection method.

• If any local leader fails to update position the local leader limit then the group companion gets redirected to the local leader decision phase.

• Any global leader fails to update the status then the global leader decision phase then the group gets divided into subgroups with a minimum threshold of each group size.

End while

(b) Description of SM algorithm

The SM optimization algorithm includes 6 phases. They are Local Leader phase, Global Leader phase, Local Leader Learning phase, Global Leader Learning phase, Local Leader Decision phase and Global Leader Decision phase. The phases are clarified in brief

• **Population initialization**

In this, the SM algorithm generates the initial population with uniformly distributed where i=1, 2….N. D is the dimensional vector. It is the number of variables in the optimization difficulty and SM_i is the spider monkey in i_{th} population. Each one SM_i is measured in below,

$$SM_{ij} = SM_{\min j} + U(0,1) \times (SM_{\max j} - SM_{\min j}) \quad (3)$$

Where $SM_{\max j}$ and $SM_{\min j}$ in j_{th} direction and the random number ranges from (0, 1).

• **Local Leader phase(LLP)**

In the Local Leader phase, each one spider monkey modifies its existing location derived from the information in the local cluster element and local leader. The new location is premeditated by the fitness value. Suppose the new location is bigger than the obtainable one then the location is updated through restoring the obtainable one. It is signified as

$$\text{Fitness value} = f(SM_i) \quad (4)$$

$$SM_{newij} = SM_{\min j} + U(0,1) \times (LL_{kj} - SM_{ij}) + U(-1,1) \times (SM_{rj} - SM_{ij}) \quad (5)$$

Where SM_{ij} is the j_{th} dimension of the i_{th} of the SM. LL_{kj} represent the leader position and r=I, U (0, 1) which randomly distributed.

• **Global Leader Phase (GLP)**

After the conclusion of the Local Leader phase, its progresses to the Global Leader phase (GLP). In GLP, the entire SM’s update their location with the help of Global Leader occurrence and local cluster member’s practice. The equation of location update for this segment is signified as

$$SM_{newij} = SM_{\min j} + U(0,1) \times (GL_j - SM_{ij}) + U(-1,1) \times (SM_{rj} - SM_{ij}) \quad (6)$$

Where GL_j signify the j_{th} dimension of the global leader location and j ∈ {1, 2 … D} pick erratically. In this phase, location is updated through the possibility which is estimated by means of the fitness. Therefore, the finest users are acquired into deliberation.

The probability is calculated using the following equation

$$P_i = 0.9 \times \frac{fit_i}{fit_{\max}} + 0.1 \quad (7)$$

Where fit_i the fitness is the value of i_{th} SM and fit_{max} is the greatest fitness in the cluster component. Therefore, the new one is contrasted by the obtainable one.

- **Global Leader Learning (GLL)**

Here the position of the global leader is updated by applying the greedy selection in the population that is a position of the SM having best fitness in the population is selected as the updated position of the global leader. Then it checks whether global leader position updated or not. If not, it is incremented by 1.

At this point, the location of the global leader is updated through implementing the greedy choice in the population i.e., a location of the SM containing finest fitness in the population which is elected as the updated location of the global leader. Afterward, it verifies whether global leader location updated or not. If not, then it is augmented by 1.

$$GlobalLimitCount = Count + 1 \quad (8)$$

- **Local Leader Learning (LLL)**

In this phase, the location of the local leader is updated through implementing the greedy choice. In that cluster, the location of the SM contains the finest fitness, which is elected as the updated location of the local leader. After that, it verifies whether local leader location updated or not. If not, then it is augmented by 1.

$$LocalLimitCount = Count + 1 \quad (9)$$

- **Local Leader Decision (LLD)**

Suppose, some Local Leader location is not updated for a determined threshold which is identified as $Localleader\lim it$ then the entire element of that cluster updates their location either erratically or from the leaders.

$$SM_{newij} = SM_{\min j} + U(0,1)\times(GL_j - SM_{ij}) + U(-1,1)\times(SM_{rj} - LL_{kj}) \quad (10)$$

The updated values are repelled from the global and local leader.

- **Global Leader Decision (GLD)**

In this phase, the location of a global leader is observed. Suppose, it is not updated for a determined quantity of iterations which is identified as $Globalleader\lim it$ then the global leader separates the population into the minor cluster. Initially, the population is separated into two clusters and after that three clusters and so on till the maximum quantity of groups (MG) are created each one time in GLD phase, LLL progression is instigated to pick the local leader in the recently created cluster. When the greatest quantity of cluster created and as well the leader was not obtaining updated then the cluster was united in one cluster or customized by some other clusters.

3.4 Proposed Enhanced spider monkey algorithm (SME)

In our proposed method, the appropriate scheduling and resource allocation were utilized by the spider monkey algorithm. At the initial, the user was programmed with the help of SNR values and channel state information. After that, the enhanced spider monkey optimization algorithm was utilized to distribute the resource to the user in a competent manner. The progression was carried out by our proposed method, which is given as follows

- Initialize the *n* quantity of users (scheduled user through SNR values).
- Fitness values are premeditated by the resources such as necessary power, channel quality, and demand rate.
- Derived from the fitness value the global leader and the local leaders are elected and the users are created as the group members.
- The finest user is traced out and prearranged by the resources
- Hence it is iteration techniques the techniques are constant through discovery the best value and updated every time through the global leader when the new user incorporated.
- Suppose, the user group is not updated by the global leader then the count value will increase. At last, it is united and clustered by the dissimilar member.
- Therefore, the user is programmed by the best values in expressions of power allocation, demand rate, and channel quality.

3.5 Resource allocation

After the users obtain scheduled, the enhanced spider monkey algorithm is used to verify the available resources in the base station. And the base station carries out the resource allocation function for the scheduled users from the optimization. Therefore, the resources are distributed to the finest user and to reduce the delay of sending a packet and the presentation as well augmented by reason of distributing the resource to the proper user.

4. Simulation and Performance Evaluation

The NS2 is a simulation tool used for analyzing the performance metrics of the proposed method. The test experiment has been simulated using the CBR traffic. The simulation run based on various scenarios such as varying the nodes and rate allocation.

4.1 Performance evaluation

The performance has been evaluated using the following metrics.

Packet delivery ratio

The maximum number of packets that are delivered successfully from the given amount of data packets from the source to destination is termed as packet delivery ratio.

$$Packetdeliveryratio = \frac{Numberofpacketdelivered}{Totalnumberofpackets}$$

Delay

Delay refers the packet that has been delayed to transmit within the given simulated time.

Drop

The node that is fails to transfer from the source to destination within the given simulated time known as the drop.

Overhead

Overhead is the number of packets sent as a fraction of the number of the packet to the destination in the network.

Energy consumption

The energy that has been consumed by each node which sent the packet is termed as energy consumption. In this we use the basic global energy model [20] is represented as

$$E_{avg} = n..t_a.P_a + m.t_{ia}.p_{ia} \quad (11)$$

P_a is the consumed power during active state and a P_s is a power consumption during sleep state with a time t.

Throughput

Throughput or network throughput is the rate of successful message delivery over a communication channel. It usually measured in bits per second.

$$T = \frac{N}{t} \qquad (12)$$

4.2 Result and analysis

Based on the performance it has been plotted with the proposed MIMO OFDM using the monkey spider optimization algorithm while compared with existed BD based MIMO OFDM method in terms of varying the node and rate.

The fig 2 shows the proposed and existing method in terms of delay. While comparing it clearly shows that the proposed method has a less delay such that most of the packets have been successfully transmitted with the simulated time.

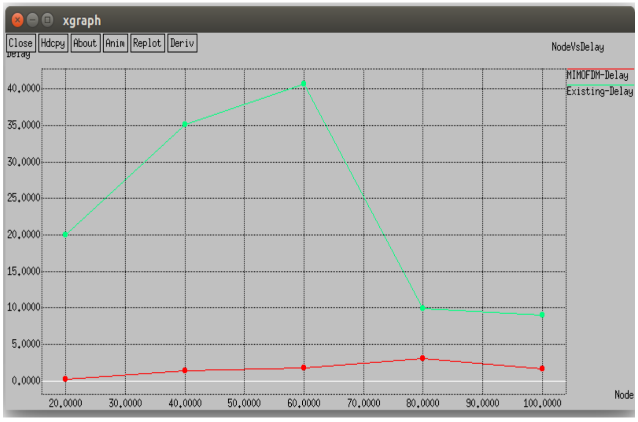

Figure 2. Node Vs Delay

The fig3 shows the delivery ratio which gives the efficient delivery ratio with respect to the existing method. The delivery rate of the proposed method is greater while compared with the other existing method.

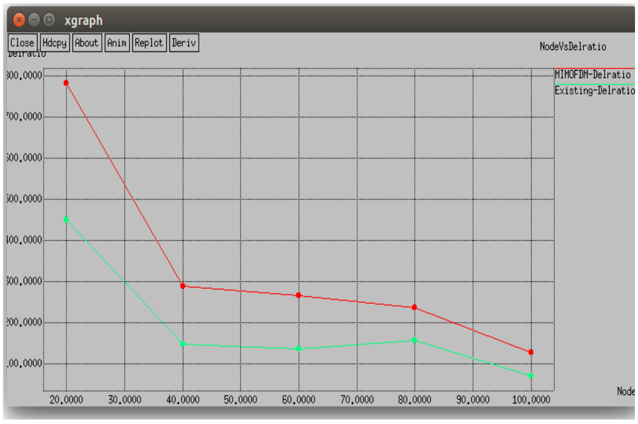

Figure 3. Node Vs Delivery ratio

The fig4 presented the dropping of a node in the network. The graph has been plotted with the proposed and existing method. Thus, it clearly shows that the proposed method has a less dropping rate when compared with the existing one.

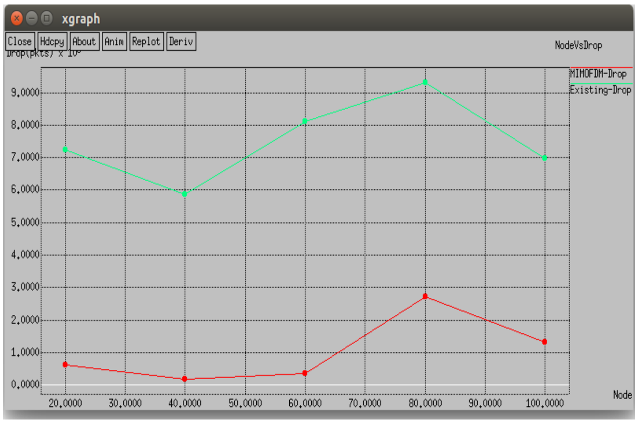

Figure 4. Node Vs drop

Fig 5 explains the energy consumption of each node while transmitting the packet. Thus, by using our optimization technique, the efficient node is selected for transmission. So consequently, the energy is not wasted and the energy consumption less. Thus, the plotted graph gives the energy consumption of proposed and existed method.

Figure 5. Node Vs Energy

Fig 6 explains the overhead of the nodes in the network. Thus, it clearly shows that our proposed method has a less overhead when compared with the existed method.

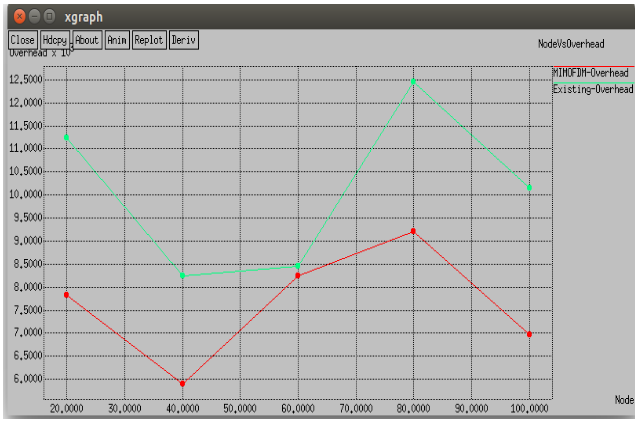

Figure 6. Node Vs Overhead

Fig 7 shows the throughput of the network nodes. Thus, it clearly shows that our proposed method has an efficient throughput ratio when compared with the existing method.

The fig8 shows the proposed and existing method in terms of delay by varying the rate. Thus, it clearly shows that the proposed method has a less delay compared to the existing method. The fig9 shows the delivery ratio which gives the efficient delivery with respect to the existing method. The delivery rate is maximum while comparing with the other existing method.

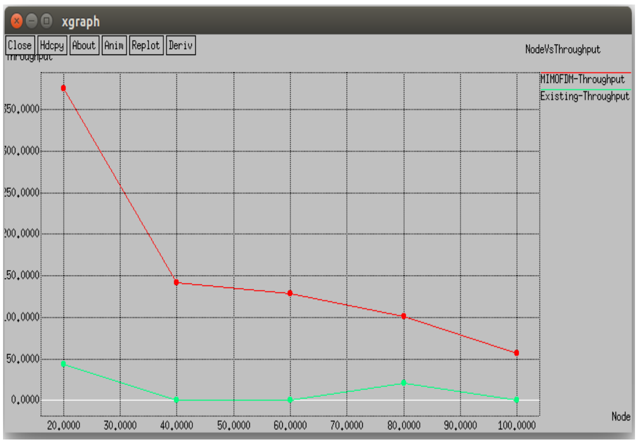

Figure 7. Node Vs throughput

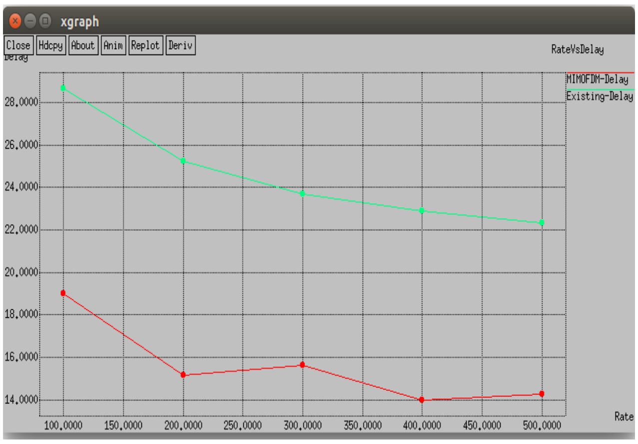

Figure 8. Rate Vs Delay

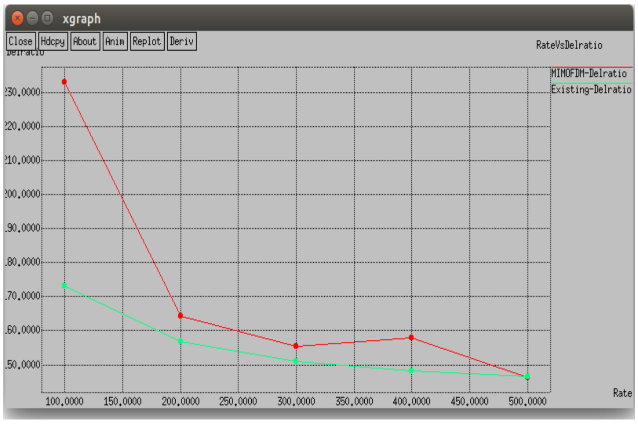

Figure 9. Rate Vs Delivery ratio

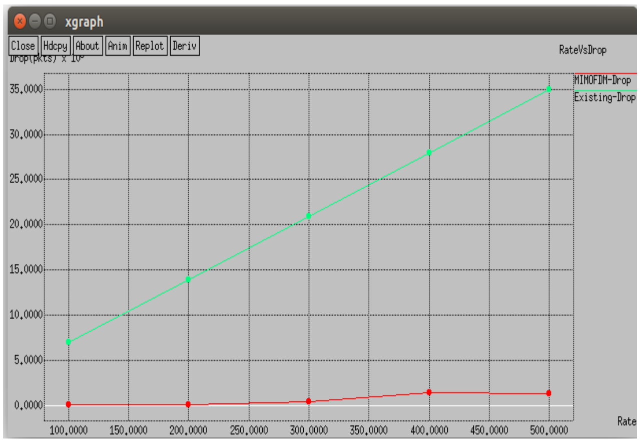

Figure 10. Rate Vs Drop

The fig10 presented the dropping of the packet with the various data rate in the network. The graph has been plotted with the proposed and existing method. Thus, it clearly shows that the proposed method has a less dropping rate when compared with the existing one.

Fig 11 explains the energy consumption of each data rate while transmitting the packet. Thus, by using our optimization technique, the efficient node is selected for transmission. So consequently, the energy is not wasted and the energy consumption less. Thus, the plotted graph gives the energy consumption of proposed and existed method.

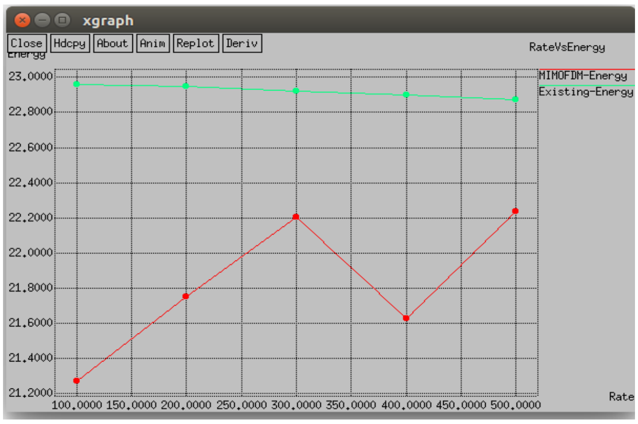

Figure 11. Rate Vs Energy

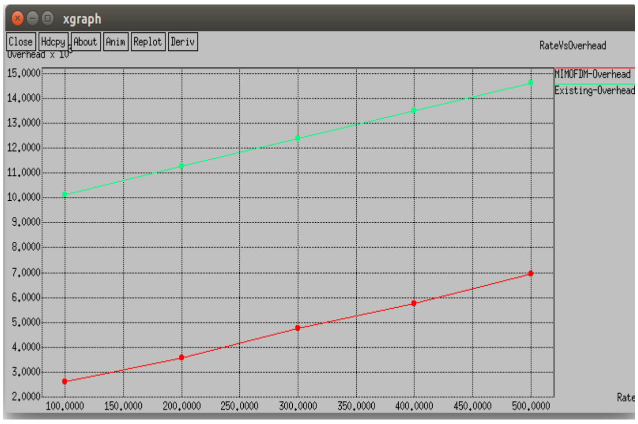

Figure 12. Rate Vs Overhead

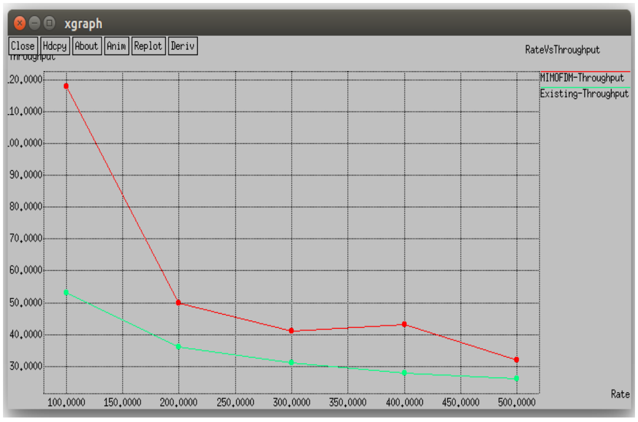

Figure 13. Rate Vs throughput

Fig 12 explains the overhead of the nodes in the network. Thus, it clearly shows that our proposed method has a less overhead when compared with the existed method.

Fig 13 shows the throughput of the network nodes. Thus, it clearly shows that our proposed method has an efficient throughput ratio when compared with the existing method.

Thus, the proposed method gives the maximum efficiency in the scheduling and resource allocation. It has been clearly measured with the performance metrics such as delivery ratio, energy consumption, delay, drop, overhead, and throughput.

5. Conclusion

In this paper, we offered a most optimal resource allocation with the help of spider monkey optimization algorithm. This illustrates the efficient result through the high throughout, high energy effectiveness, delay conscious and fairness. In this process, we utilize the channel state information and SNR values for the entire users. The SNR values are used to schedule the users for to create more satisfactory and also the incorporation of spider monkey which provides the finest consequences. Due to the fitness function, the user is scheduled and distributed by the resources. The fitness is premeditated for the entire users and depends on the algorithm the finest users are scheduled initially and resource allocation is carrying out. The information is transfer from the base station to the user by the aid of Rayleigh fading channel. The NS2 is the simulation tool which takes place in our process that illustrates the consequence of existing method when compared with our proposed method. Thus, it provides an efficient solution for the resource allocation mechanism with the less delay rate.

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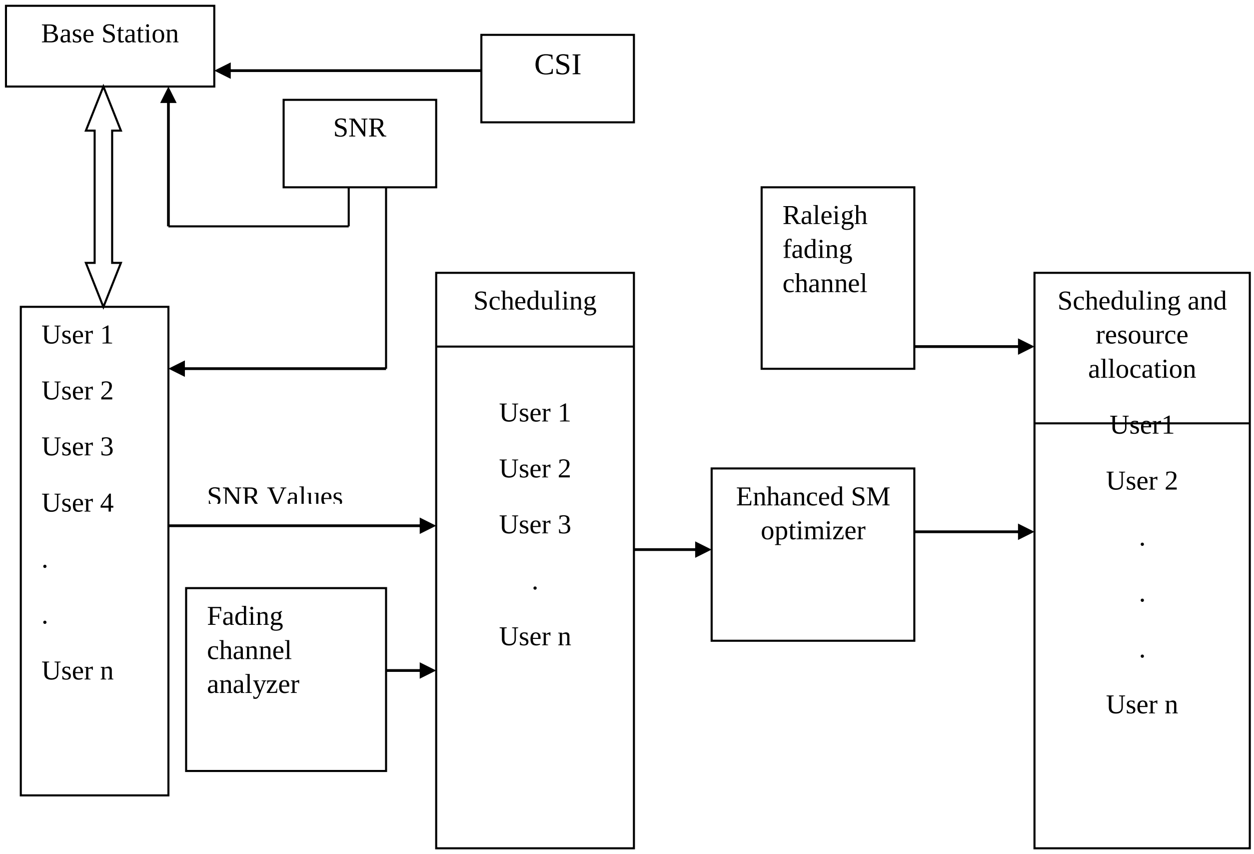

Figure. 1 Proposed system model