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Cognitive Load Distribution and Energy Redeeming In Cooperative Communication

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Abstract: *Cooperative communication is a varied area with various prospects and has been anticipated long as an active technique for redeeming energy consumption of mobile terminal in wireless network. Researches on this very topic have hit the roof. In this paper we try to enhance the existing cooperative communication system to whole new level, where our model will have active mode and inactive mode for each MTs these two modes can easily control the access of voice and data channels of the MTs during the handovers. Competent algorithms based on Fibonacci search and alternative optimization techniques are recommended to crack the delinquent behavior of the independent and dynamic service. This will ensure that every source MT finds every standard relay or helping relay to forward its data to base station (BS) with noble performance. Unlike the current systems in cooperative communication, we intend to consider multiple relay selection to keep the communication overhead low.*

Keywords: *Cooperative Communication, Energy Saving, Load Sharing, Pricing Mechanism, Wireless Network.*

I. INTRODUCTION

The incredible innovation in the smartphones and amazing updates in multimedia applications, wireless cellular network is be subjected to an unwavering escalation in the wireless data traffic and now a day's mobile terminals (MTs) tends to consume higher amount of energy than earlier . MTs are normally run by batteries and the battery has to galvanize all the features of MTs for which renewing and recharging battery frequently is very difficult. With finite energy, we can only hand on a finite amount of information [1]. Therefor a revaluation in minimizing the energy consumption and improve the connectivity of the network is very critical for wireless cellular networking.

Furthermore the exploration on network communication corroborate that enormous amount of energy is consumed by the MTs in 2G, 3G era [2] and also the modern 4G lacks in energy efficiency[3]. This gives a good inspiration to explore the energy redeeming and improve the connectivity for the MTs in communication.
Cooperative communication the solid and one of the most effective design considerations for energy saving in wireless communication, Moreover it can revitalize the energy-constrained networks like wireless cellular network and wireless sensor networks. However the prior researches are planned to improve the quality of service and performance, maximize the coverage, minimize coverage overlap they did not considered about the heterogeneity among MTs, battery level's and elongated existence of MTs at the same time.

Within the wireless cellular network some of the MTs are seems stumpy battery level and some are rich. If the energy level of the MTs is uncared, each MT is assumed to transmit data as well as act as a cooperative agent for another MT in wireless communication. But this is obviously unfeasible if the battery level of the MTs is drained easily. At this situation MTs in low battery can get help from other MTs which has rich in battery such that the baseline transmitting power is reduced and their operation time can extended.

Section II discussed about related work, Section III Proposed model discussed, Section IV will explore the full cooperation network under complete information with proposed technique. Section V will show the general case of partial cooperation with incomplete information. Section VI illustrate the numerical results and finally section VII will conclude this paper and discuss the future work.

II. RELATED WORK

There are already prior works investigating about the energy efficiency in mobile terminals (MTs) [4]-[6]. In specific [4] explored the optimal modulation system to curtail overall energy consumption required to send a given amount of data. Coded and uncoded systems are equally taken as for modulation optimization. Overall energy consumption consists of transmission energy and circuit energy consumption. [5] Explored the optimal power control problem to curtail the average energy consumption of MT in multi-cell TDMA system by decomposition method. In particular, [6] deliberate the energy saving of MTs by strengthening of cellular network at the base station (BS). Current [7], [8] meditated that there is atrade-off's between the BS and MTs for minimizing the energy consumption and maintain the quality of service.

Energy redeeming of MTs for cooperative communication in wireless cellular network has been explored in [9]-[11]. In particular, [9] deliberate the timer based-relay selection in a distributed fashion with minimum signalling overhead for reduce the net energy consumption and capitalize the network lifetime. [10] Suggested a distributed space-time coding scheme for the MTs to hand on the information to the BS under given outage and capacity constraints since the overall transmission energy is reduced. [11] Proposed the optimal time and power allocation technique for minimizing the net energy consumption under quality of service with spectrum sharing in cognitive radio network. [12] measured the handover mechanism, andmainly discuss the utilization of a cost function to perform associate a network selection exploitation information provided by the standards, such as network coverage or network properties and the research is focused on rising each seamlessness and energy efficiency of the devices in handovers also evaluate our approach supported usage scenarios over 2G, 3G and 4G GSM networks.

In handover the process of roaming across heterogeneous networks, is one of the most important features. Network selection is a component of the handover procedures to select a network among others networks. Traditionally, network selection has been based on evaluation of the Received Frequency Signals (RFS), e.g., an access point that gives the strongest RFS to the selected nodes. Moreover transmitting the same data by multiple nodes, optimal relay selection and transmission coverage are investigated in [13], [14]. [13] Suggested distributed energy-efficient selective diversity (EESD) technique for reducing the transmission power of the MTs and increase the network connectivity. [14] Suggested a distributed game-theoretical framework for achieve optimal relay selection and power distribution in multiuser cooperative communication network without familiarity of centralized resource allocation [15] and a two-stage Stackelberg game is modelled to cogitate the interests of the source and helping relay terminals, where the source MT is modelled as a buyer and the helping relay terminals are modelled as sellers for providing relay channel for the source MT.

2.1 MAIN CONTRIBUTION AND ORGANIZATION

The main contribution of this paper is summarized as:

Energy saving and pricing mechanism for cooperative network: In the paper we consider that all the MTs are independent and only ready to cooperate when they have benefits from the cooperation [16]. Apart from the previous works on cooperative network we take multi relay mechanism and Fibonacci algorithmto make the cooperative communication more efficient with transmitting cost and battery.

Full cooperation under complete information: First we consider the case of full cooperation under complete information with split table and non-split table data. The relay selection of MTs for transfer the data to base station and heterogeneities of battery is formulated as problem.

*Partial cooperation under incomplete information:*In partial cooperation under incomplete information each mobile terminal belongs to different entities so it's not ready to share their private information to other MTs in the spectrum.so that the expectation is taken in two aspects successfully and unsuccessful under the depraved condition of MTs we formulate a optimization technique for improve the energy efficiency and pricing of the cooperative network [17],[18]. *Active and Inactive Mode:* In this paper we also proposed a active and inactive mode for the device these two modes can easily control the access of voice and data channels of the MTs during the handovers and it will help to save battery.

III. PROPOSED MODEL

3.1 SYSTEM MODEL

At the beginning of the communication to its end, every mobile terminal (MT) deserves or desire for a comfort traffic. All MTs hope for unified service and connectivity, only thing which holds and accelerate the data communication are optimal relay, since it is one of the most difficult things in present life [19]. To reduce the total energy reaping and data transmission delay, the signal processing block at transmitter and receiver should be consider in the optimization model and the communication channels of all helping and source mobile terminal (SMT) has been explored in priority manner as shows in Fig. 1. The cooperative transaction [20] contains five phases and Fig. 2.will deliberatesthe active and inactive mode in handover mechanism, as in Fig. 1: phase I and phase II illustrate common events ensues in cooperative communication.

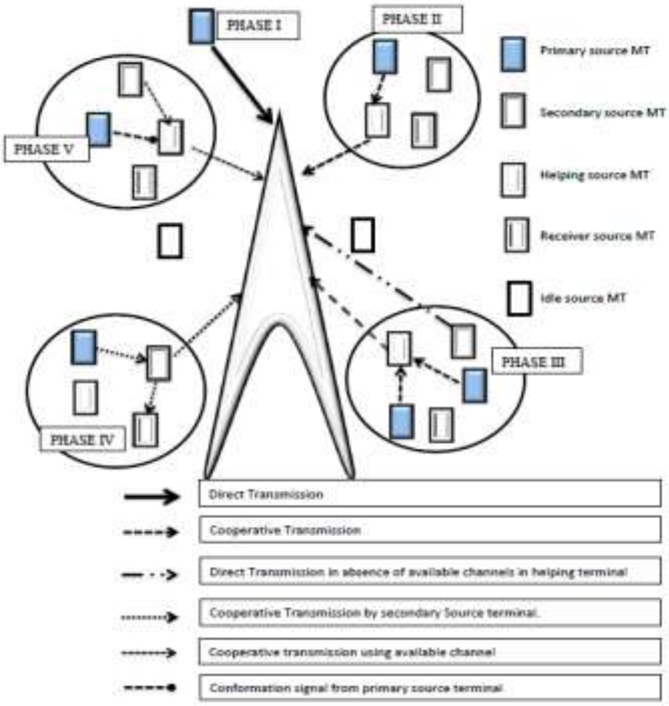

Figure .1. Cooperative communication with four phases

In phase III the multiple source mobile terminals (MSMT) uses the channels of helping mobile terminal (HMT) in cooperative network to send their data to the base station (BS). In phase IV: The SMT uses the licensed spectrum of helping mobile terminal to transact the data to BS and another MT in the cooperative network spectrum, In phase V: Illustrate the process of gaining the access of licensed spectrum from the SMT by HTM and sending their data to BS. In the first half the SMT disseminates its data to the HMT, on the second half the HMT decrypts the received data from the SMT and forwarded to BS and MT in the cooperativespectrum. The MSMT will access the channels in by (TDMA). The device that should move from one place to another so automatic channel controlling and power estimations are important for moving devices, Fig. 1.1. Illustrate the controlling of data channel and voice channel in different area with different signal strength. In phase 1: the device at quality signal area and in active mode. In phase 2 and 4: The device at good signal strength and also in active mode and the phase 3: illustrate the device at bad signal strength and also with inactive mode. In active mode both the data channel and voice channel are ON and when the device go to the area which have bad signal strength the device automatically turns into inactive mode that means only the voice channel will search for the signal and the data channel in OFF condition and its again switch to active mode when the device get a good signal strength this will help to save device from the over depletion of battery power so in presence and absence of signal strength the power redeeming can easily done.

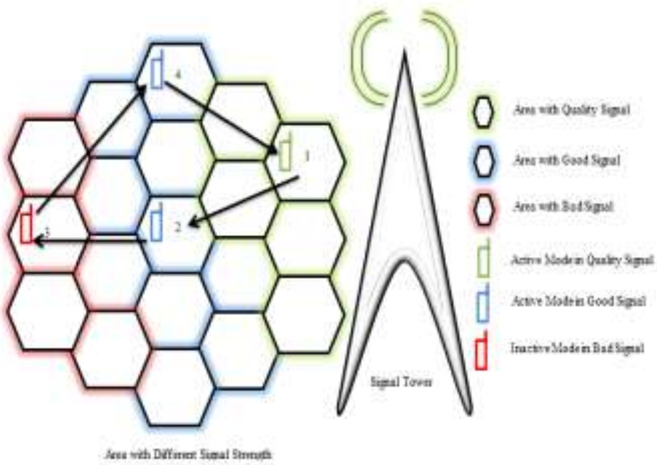

Figure .1.1. Active and Inactive Mode operation in cooperative communication

3.2 IDENTIFYING AND ALLOCATING CHANNEL FOR SOURCE MOBILE TERMINAL

In ideal case, the private information of HMT which consists of number of channel, battery levels and conditions are shared between each SMT and HMT truthfully. But in practical case, the private information does not shared. Each MT does not know about the channel condition of other MT and their battery level. For cooperation under incomplete information between SMT and HMT, the problem of decision making under uncertainties with expected utility theory is formulated. Here, we assume that all the channel gain and battery level of HMT are independent. The conditional expected energy cost of SMT for set of HMT is determined. The reservation utility is measured which denotes the level of minimum benefit for the helping mobile terminal (HMT) in the cooperation. For higher reservation utility for HMT, the expected energy cost of SMT is high. Based on this the channels of HMT is identified.

The channels allocation of HMT for the SMT and the access gain back of channel by SMT when they are in need it is done by considering the set of idle mobile terminal (IMT) are denoted within the short range communication distance d from MT as its set of HMT H_i where $|H_i|=N_i$ is the number of MT in the channel. Then N_i follows Poisson distribution and its PDF is measured. If $N_i \geq 1$, SMT can operate in cooperative transmission mode by choosing HMT to relay the data. For selecting HMT, the channel gain between HMT and SMT is computed. Also, the energy cost function and utility function of its battery level are determined. Based on the difference between utility function and energy cost, the HMT is identified. There must be time slots for SMT to access the channel with a time slotted system. The symbols for data are transmitted in each time slot. The number of symbols is transmitted per time slot are normalized to unity to transmit without data loss.

Figure .2. Direct transmission

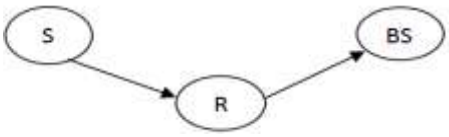

Figure.3. Cooperative transmission

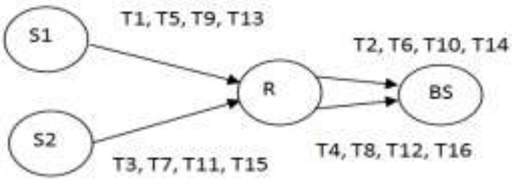

Figure.4. Cooperative transmission at different time slot

The direct transmission of data to the BS from the SMT is represented in Fig.2. . Fig.3. represent the cooperative transmission that the SMT send the data to the BS with the help of a HMT and Fig.4.explore the cooperative transmission at different time slots. We consider two SMTs and one HMT as relay MT and one BS. While the SMT 1 transmits the data at time slots T1, T5, T9 and T13, the relay MT receives and forwards the data to BS at time slots T2, T6, T10 and T14. On the other hand, SMT 2 transmits the data at time slots T3, T7, T11, and T15 and relay MT receives and transmits the data at time slots of T4, T8, T12 and T16 to BS.

3.3 DATA TRANSMISSION AND POWER ATTENUATION

Mostly MTs initiate data traffic or transmission independently and in simplified channel model incorporating the large scale with large scale power attenuation is as follow:

$$G_k = \begin{cases} G_0 \left(\frac{r_k}{r_0}\right)^{-\alpha} & r_k > r_0,\ k \in K \\ G_0 \text{ , otherwise} \end{cases} \quad (1)$$

Where G_0 is the constant path loss between the MT and BS at reference distance r_0,r_k is the distance from MT to BS and α>2.The data rate D_k is normalized by the available bandwidth at the MT for transmission of each symbol with an energy E_k, the achievable data rate for MT is represented in bits/sec/Hz(bps/Hz).

$$D_k = log_2\left(1 + \frac{g_k E_k}{\sigma^2}\right) \quad (2)$$

Where σ^2 is represent the power of noise at the BS receiver and $g_k$is channel power gain between the MT and the BS its will expressed as

$$g_k = |h_k|^2 = n_k G_k, k \in K \quad (3)$$

Where h_k is the channel coefficient expressed as

$$h_k = \begin{cases} \bar{h}_k \sqrt{G_0 \left(\frac{r_k}{r_0}\right)^{-\alpha}} & , r_k > r_0, \quad k \in K \\ \bar{h}_k \sqrt{G_0} & , otherwise \end{cases} \quad (4)$$

3.4 DIRECT TRANSMISSION (DT MODE):

In direct transmission mode the MTs directly transmit their data to the BS with a normalized data rate D_i and its need to calculate the energy per symbol for transmitting the data from MTs to BS with data rate D_i is

$$E_i^{(D,S)} = \frac{\sigma^2}{g_i}(2^{D_i} - 1), i \in K_s \quad (5)$$

3.5 COOPERATIVE TRANSMISSION (CT MODE):

In cooperative transmission mode some SMT associated with the helping mobile terminal with in short range distance d, then the HMT can help to relay the data of SMT to the BS, consider set of ideal mobile terminal (IMT) or normal MTs as the set HMT H_i with in distance from the SMT. where $|H_i|=N_i$ is the number of MT in the channel. Then N_i follows Poisson distribution with mean

$$\mu N_i = (1 - \rho)\lambda \pi d^2 \quad (6)$$

Where λ is the spatial density 1-ρ is the probability of MTs remaining ideal. The probability mass function is of N_i directly proportional to the sort range distance d, and is explored as

$$P_r(N_i = n) = \frac{\mu^n N_i}{n!} e^{-\mu N_i}, n = 0,1.., i \in K_S (7)$$

Where μN_i is the average number of HMT for SMT if N_i=0 or HMT H_i=0 or null the SMT will enter into direct transmission and it will send the data directly to the BS. When the N_i>1 and H_i>1 the SMT terminal try to find a HMT and relay the data through HMT. In cooperative transmission data rate should be split as $D_i = D_I^{(S)} + D_i^{(R)}$ here $D_i^{(s)}$ representing the direct transmission of data if the SMT fail to find a better HMT to relay their data with specific condition, then the energy is explored as like (5) and $D_I^{(R)}$ represent the cooperative transmission data rate of SMT and HMT. In CT mode first SMT find the perfect HMT then SMT disseminates its data to the HMT, on the second half the HMT decrypts the received data and forwarded to BS. The power gain between SMT and HMT is follow as $g_i = n_j G_i$ where n_j is the short term Rayleigh fading of the channel power and its distributed independently with in MTs and the energy consumption for data transmission is

$$E_j^{(C,R)} = \frac{\sigma^2}{g_j}\left(2^{D_i^{(R)}}\right), j \in H_i, i \in K_s \quad (8)$$

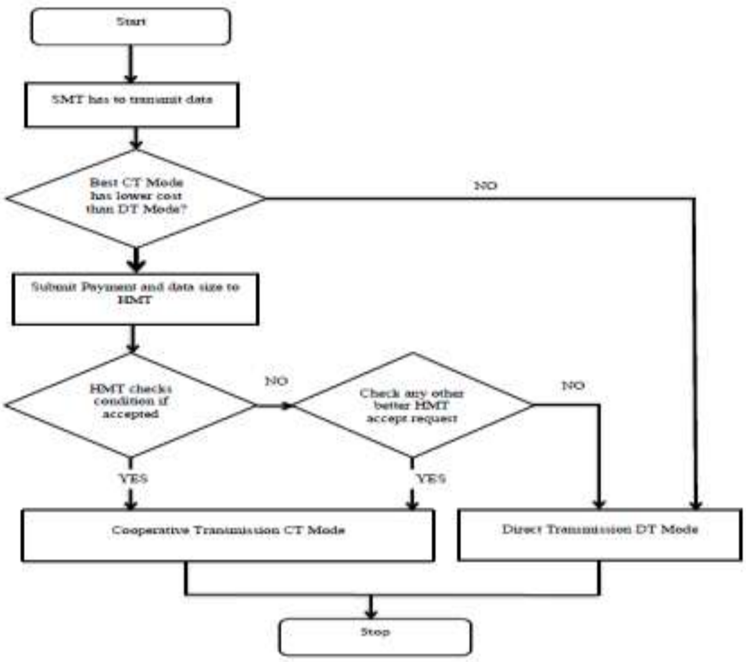

Figure .5. Cooperative communication protocol

3.6 COOPERATIVE TRANSMISSION PROTOCOL

The cooperative communication protocol that should keep in cooperative network for the data transmission with mutual benefits is explained in Fig.5.

- If a SMT has data to transmit to BS then it will select any one of the data mode CT or DT according to the SMT wish and here also consider complete and incomplete information.
- In DT mode SMT directly transmit their data to the BS and if it selected the CT mode then the Source MT should announce the data rate and payment procedure to all of its HMT.
- If any MT accept the request it will send the acknowledgement to the SMT and its will relay the data to the BS
- If multiple MTs accept the request then SMT select the best MT by condition and the selected HMT will help to relay the data to its BS.

In the case of multiple MTs accept the request form the SMT then it will filter and find the best HMT by the tender or any future agreement by the cooperative communication protocol we can reduce the cost and energy of data transmission in this incentivizing HMT in cooperative network is the major designing challenge.

IV. FULL COOPERATION UNDER COMPLETE INFORMATION

In full cooperation under complete information all the MTs willing to help each other without requirement on reserved utility and they will share their private information including number of HMT, channel condition, battery truthfully and so it's known by SMT and as a result of fully cooperation under complete information SMT only need to make the payment to HMT because of the reservation utility of each HMT reduced to zero. Then SMT have to optimize data rate for their helping mobile terminal to minimize the sum of energy cost

$$C_{i,j} = \min_{D_i^{(R)} \geq 0}. \zeta_j E_j^{(C,R)} + \zeta_i E_i^{(C,S)} \qquad (9)$$

Where $\zeta_j E_j^{(C,R)}$ is the energy cost for transmitting the data from HMT to BS and $\zeta_i E_j^{(C,S)}$ is the energy cost for transmitting the data from SMT to BS here we minimizing weighted energy sum of HMT and SMT where the weight is unit energy cost of individual MT. Hence the unit energy cost of SMT and HMT is same then it has to reduce to the sum energy minimization. If the unit energy cost of one MT is larger than other MT then it's very easy for the optimization of batter level as like max-min optimization. After obtaining the minimum energy cost the each HMT, the SMT will select the best HMT by the relay

$$\hat{C}_i = \min_j. C_{i,j} \qquad (10)$$

For selecting the cooperative mode by SMT we have to satisfied with best case that the cost reduction of CT mode has much difference than a threshold γ_i and the condition for satisfying SMT for choose CT is

$$\hat{C}_i \geq \zeta_i E_i^{(D,S)} \qquad (11)$$

4.1 COOPERATIVE TRANSMISSION WITH NON SPLITTABLE DATA

In full cooperative transmission with non splittable data (FCNSD) the SMT will not split their data due to privation of energy, timeor complication in processing functionalities so all the data of SMT transmitted by HMT and data rate of SMT will be $D_i^{(S)}$= 0 and $D_i^{(R)}$=D_i according to $D_i^{(S)} + D_i^{(R)} = D_i$ then the cost of the SMT linking with HMT is reduced as

$$C_{i,j} = \zeta_j \frac{\sigma^2}{g_j}(2^{D_i} - 1) \qquad (12)$$

Where g_j is the channel power gain of HMT, σ denotes the power of noise.

4.2 COOPERATIVE TRANSMISSION WITH SPLITTABLE DATA

In this case full cooperative transmission with splittable data (FCSD)the optimal relay data rate shadows a threshold structure with respect to the log ratio between the operative energy cost SMT and HMT based on that the SMT will decide to either split the data or not, mainly three condition are there, when the effective energy cost of the SMT is too less than HMT then the HMT can't satisfied the SMT and in this case the SMT will not split their data with HMT, it will send all the data itself by SMT. If the operative energy cost of SMT and HMT are comparably equal the then the SMT will split the data package with HMT and finally if the operative energy cost of HMT will much lower than SMT then SMT ask help to HMT transmit the data to the BS and is by

$$\widehat{D_i}^{(R)} = \begin{cases} 0, \ if \log_2 \frac{\theta_i}{\theta_j} < -D_i \\ \frac{1}{2}\left(D_i + \log_2 \frac{\theta_i}{\theta_j}\right), \ if -D_i \le \log_2 \frac{\theta_i}{\theta_j} < D_i \\ D_i, \ if \log_2 \frac{\theta_i}{\theta_j} \ge D_i \end{cases} \quad (13)$$

Where θ_i is the energy cost of SMT and θ_j is the energy cost of HMT it is by $\theta_i = \frac{\zeta_i}{n_i}$ and $\theta_j = \frac{\zeta_j}{n_j}$, $\log_2 \frac{\theta_i}{\theta_j} < -D_i$ denotes the extension of cost rate to satisfy SMT in this case the SMT will send the data itself to BS, $-D_i \le \log_2 \frac{\theta_i}{\theta_j} < D_i$ in this case the operative cost equal so the SMT will split the data with HMT, $\log_2 \frac{\theta_i}{\theta_j} \ge D_i$ here the SMT operative cost is more higher than HMT in this SMT will ask for the data transmission through HMT and HMT will send all the data

V. PARTIAL COOPERATION UNDER INCOMPLETE INFORMATION

In partial cooperation under incomplete information the discussed scenario will not applicable because of here each mobile terminal belongs to different entities so it's not ready to share their private information to other MTs in the spectrum.so that the expectation is taken in two aspects successfully and unsuccessful rely association and the probability of reject the request by HMT is $P_r\left(\pi_i - \zeta_j E_j^{(C,R)} \le \epsilon\right)$.

Where ϵ represent the minimum level of benefit for HMT in cooperative communication, the energy cost $E|C_i|$ is increase with ϵ also the reservation utility of the HMT is high then the expected energy cost SMT is also high. For minimizing the expected cost of SMT over price and data is

$$\min_{\pi_i, D_i^{(R)} \ge 0} E\ [C_i]$$

$$\epsilon \le \pi_i \le \zeta_i E_i^{(D,S)} - \zeta_i E_i^{(C,S)} \quad (14)$$

As we disused in cooperative transmission under complete information here also criterion for selecting DT and CT, for selecting CT its need to reduce the energy cost of SMT from that of direct transmission to be a larger than a threshold γ_i .condition for choosing the CT mode by SMT is

$$\zeta_i E_i^{(D,S)} \ge max\{\gamma_i + E[C_i^*], \epsilon\} \quad (15)$$

Where $E[C_i^*]$ is the minimum expected cost and its mainly depend on whether the is splittable or not splittable data and the probability function for successful cooperation between the SMT and HMT is

$$P_r\left(\pi_i - \zeta_i E_j^{(C,R)} \ge \epsilon\right) = P_r\left(\frac{\zeta_i}{n_j} \le \frac{G_i(\pi_i - \epsilon)}{\sigma^2\left(2^{D_i^{(R)}} - 1\right)}\right)$$

$$= P_r\left(\frac{\zeta_i}{n_j} \le \omega_i\right) \quad (16)$$

In partial cooperation under incomplete information the unit energy cost and its battery level of MTs is

$$\zeta_k = \zeta_{max}\left(1 - \frac{B_k}{B_{max}}\right) \quad (17)$$

And the probability of successful association between the SMT and HMT with expected energy is

$$E[C_i] = \sum_{n=0}^{\infty} P_r(N_i = n)\left\{\left[1\left(1 - \frac{\omega_i}{\zeta_{max}} - \left(1 - e^{-\frac{\zeta_{max}}{\omega_i}}\right)\right)^n\right] \times \left(\pi_i + \zeta_i E_i^{(C,S)} - \zeta_i E_i^{(D,S)}\right) + \zeta_i E_i^{(D,S)}\right\} \quad (18)$$

$$\text{Here } \omega_i = \frac{G_i(\pi_i - \epsilon)}{\sigma^2\left(2^{D_i^{(R)}} - 1\right)}$$

5.1 PARTIAL COOPERATIVE TRANSMISSION WITH NON SPLITTABLE DATA

Partial cooperative transmission with non splittable data (PCNSD) is also similar to cooperative transmission with non splittable dada in this case also the data is not split by the SMT all the data's of SMT is transmitted by HMT $D_i^{(S)} = 0$ and $D_i^{(R)} = D_I$ and the probability successful association with SMT and HMT reduced as

$$\min_{\pi_i} \sum_{n=0}^{\infty} P_r(N_i = n)\left\{\left[1-\left(1-\frac{\omega_i}{\zeta_{max}}-\left(1-e^{-\frac{\zeta_{max}}{\omega_i}}\right)\right)\right]^n \times \left(\pi_i - \zeta_i E_i^{(D,S)}\right) + \zeta_i E_i^{(D,S)}\right\} \quad (19)$$

$\varepsilon \leq \pi_i \leq \zeta_i E_i^{(D,S)}$

5.2 PARTIAL COOPERATIVE TRANSMISSION WITH SPLITTABLE DATA

In this case Partial cooperative transmission withsplittable data (PCSD) the SMT will decided to split their data only if SMT is satisfied and there will be a fixed cost for transmitting the data to the BS by HMT and the payment π for the HMT from the SMT is minimized by the Fibonacci search algorithm and the algorithm follows some values with on the range of $\delta_{c_i}$from at least local optimum solutions because it reduces the value of price π with precision δ_{π_i} and also considering two main condition lower bound and upper bound, the lower bound is denote by$O\left(\log_2 \frac{\zeta_i E_i^{(D,S)}}{\delta_{\pi_i}}\right)$and upper bound with the data rate $D_i^{(R)}$and total payment price $\pi_i$is as explored as $N_{D_i^{(R)}} = \log_2\left(\frac{D_i}{\delta_{D_i^{(R)}}}\right)$ and $N_{\pi_i} = \log_2 \frac{\zeta_i E_i^{(D,S)}}{\delta_{c_i}}$ and the total number of iteration in the alternative optimization of upper bound is $M = \frac{\zeta_i E_i^{(D,S)}}{\delta_{c_i}}$ and the upper bound complexity is explored by $O\left(M\left(N_{\pi_i} + N_{D_i^{(R)}}\right)\right)$.

VI. NUMERICAL RESULT

In this section we explored the comparison of single relay selection and multi relay selection under proposed technique in different transmission mode with existing model at the first step, then multi relay selection under proposed technique simulation is considered and validate the result, simulation is done under$100 \times 100\ m^2$ area with data rate $D_i = 16$ bps/Hz. Also the position of MTs re-generate in iterations.

Table 1: values for simulation setup

Simulation parameters	Values
Total number of MTs	$\lvert K \rvert = 100$
Probability of MTs initiate data transmission	$\rho = 0.2$
Data rate	$D_i = 16bps/HZ$
Average number of HMTs	$\mu N_i = 1.2$

6.1 SINGLE RELAY SELECTION WITH DICHOTOMOUS SEARCH ALGORITHM

The simulation of single relay selection will illustrate the energy efficiency of the battery and the cost for the data transaction in cooperative mode and partial cooperative with split table and non splittable data.

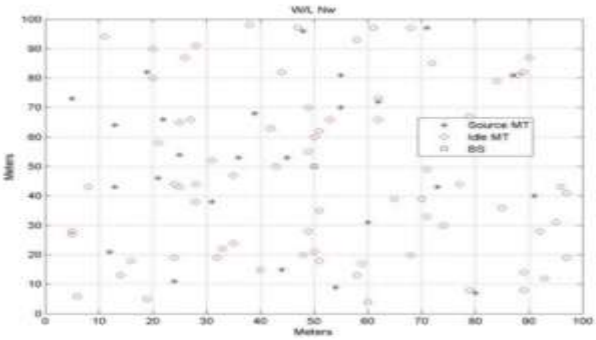

Figure .6.Setup for simulation single relay selection of MT with $\lvert K \rvert$ =100 MTs

Comparison of Estimated coverage cost of data rate vs battery level and Average battery level vs Time slot is:

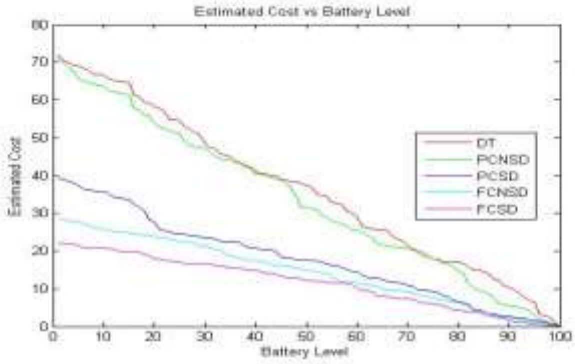

Figure.7. Expected cost of MT versus battery level under different mode of transaction

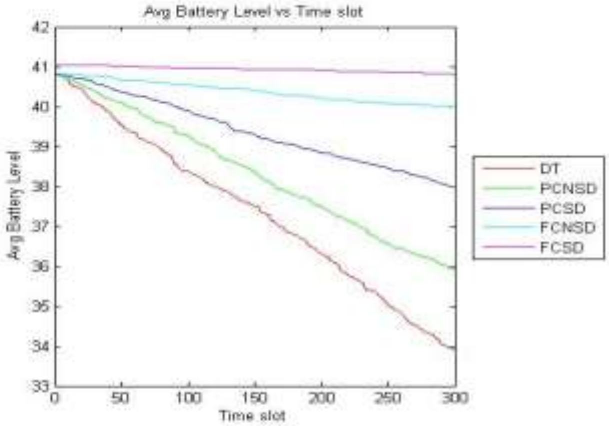

Figure.8. Average battery level $\sum_k B_k$ $|K|$ of the MTs over time slot

6.2 MULTI RELAY SELECTION WITH PROPOSED TECHNIQUE

The simulation for multi relay selection under proposed technique and algorithm shows performance improvement in terms of battery and unit cost. In multi relay selection simulation probability of overlapping HMT for different SMT is more and one HMT can possibly relay with two different SMT to avoid this situation we use the function as follow $\mu N_i = (1-\rho)\lambda\pi d^2$ for regenerating the position of the MTs if there is overlap between the HMT and the average number of HMT is $\mu N_i = 1.2$ and energy maximum for any time slot is 3J. Comparison between the modes with convergence cost of data rate vs battery level in multi relay selection of MTs is:

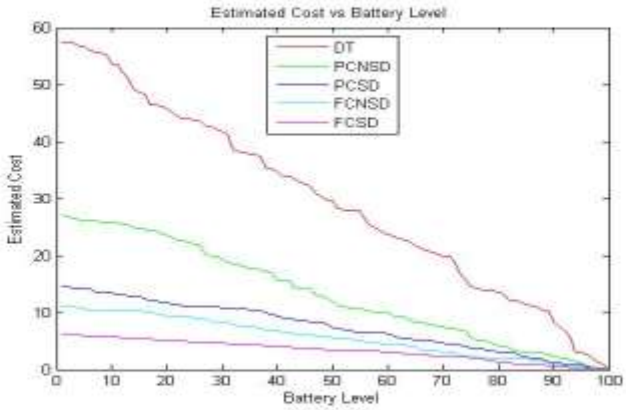

Figure .9. Expected cost MTs versus battery level under different mode of transaction

The proposed technique with cooperative communication reflect better effective in the reduction of battery outage of MTs and energy cost of average battery level $\sum_k B_k/|K|$ for the time slot is:

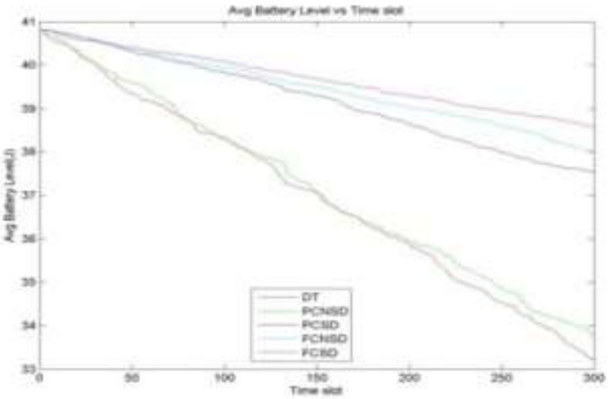

Figure .10. Average battery level $\sum_k B_k |K|$ of the MTs over time slot

VII. PERFORMANCE EVALUATION

Performance evaluation reflect that proposed technique with cooperative communication is very effective and here we exploring the performance evaluation mainly with three case Direct Transmission,

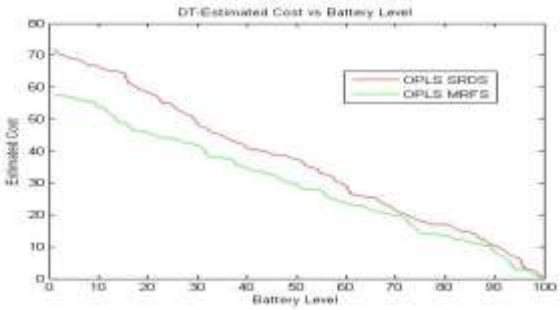

Figure.11. Expected cost of MT versus battery level under single relay dichotomous search and multi relay Fibonacci search

Full cooperation under complete information and Partial cooperation under incomplete informationComparison of Estimated coverage cost of data rate vs battery level and Average battery level vs Time slot in direct transmission (DT) by optimal pricing and load sharing (OPLS) single relay Dichotomous search algorithm (SRDS) and multi relay Fibonacci search algorithm (MRFS) is:

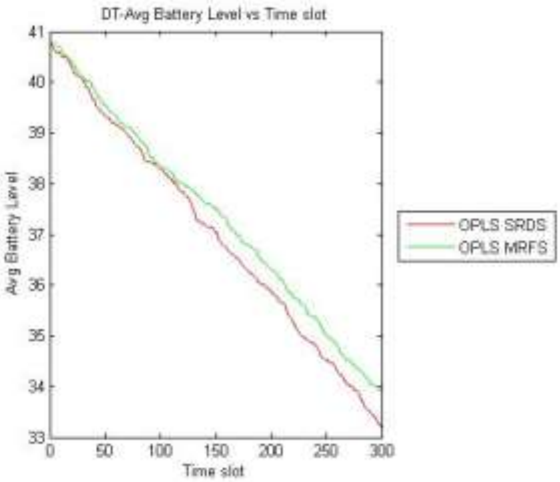

Figure.12. Average battery level $\sum_k B_k |K|$ of the MTs over time slotunder single relay dichotomous search and multi relay Fibonacci search

Comparison of Estimated coverage cost of data rate vs battery level and Average battery level vs Time slot in Full cooperation under complete information with splittabledata (FCSD) and non splittable(FCNSD) data by optimal pricing and load sharing (OPLS) single relay Dichotomous search algorithm (SRDS) and multi relay Fibonacci search algorithm (MRFS) is:

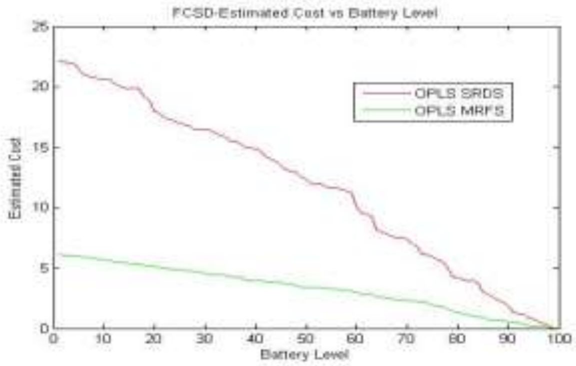

Fig.13. Expected cost of MT versus battery level under single relay dichotomous search and multi relay Fibonacci search in splittable data

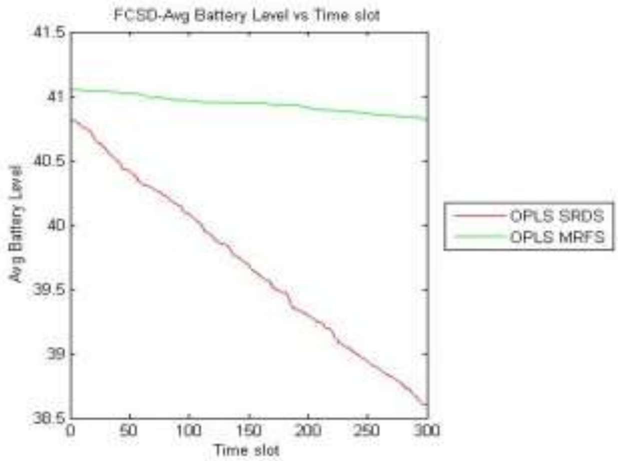

Fig.14. Average battery level $\sum_k B_k |K|$ of the MTs over time slotunder single relay dichotomous search and multi relay fibonacci search in splittable data

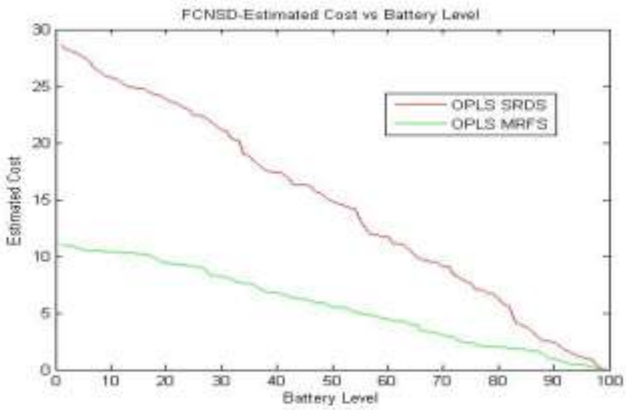

Fig.15. Expected cost of MT versus battery level under single relay dichotomous search and multi relay fibonacci search in non splittable data

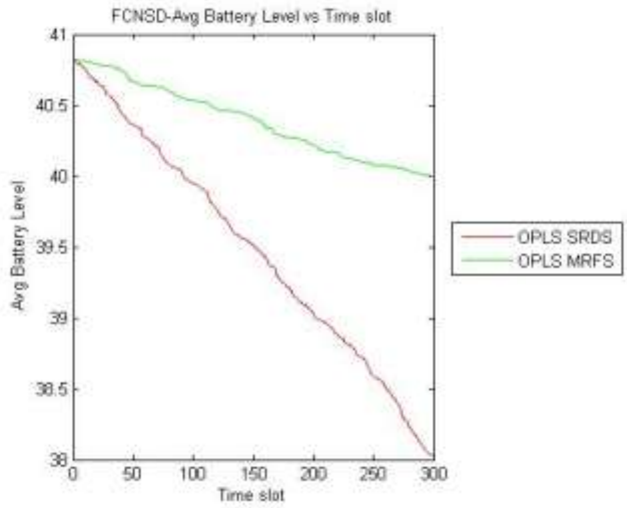

Fig.16. Average battery level $\sum_k B_k |K|$ of the MTs over time slotunder single relay dichotomous search and multi relay fibonacci search in non splittable data

Comparison of Estimated coverage cost of data rate vs battery level and Average battery level vs Time slot in Partial cooperation under incomplete information with splittable (PCSD) and non splittable (PCNSD) data by optimal pricing and load sharing (OPLS) single relay Dichotomous search algorithm (SRDS) and multi relay Fibonacci search algorithm (MRFS) is:

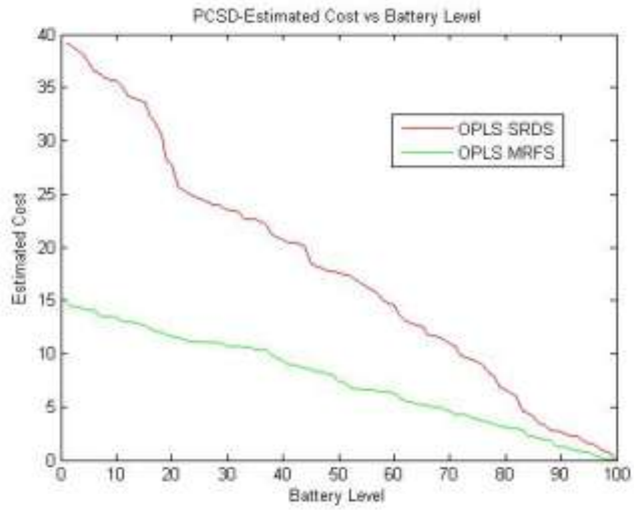

Fig.17. Expected cost of MT versus battery level under single relay dichotomous search and multi relay fibonacci search in splittable data

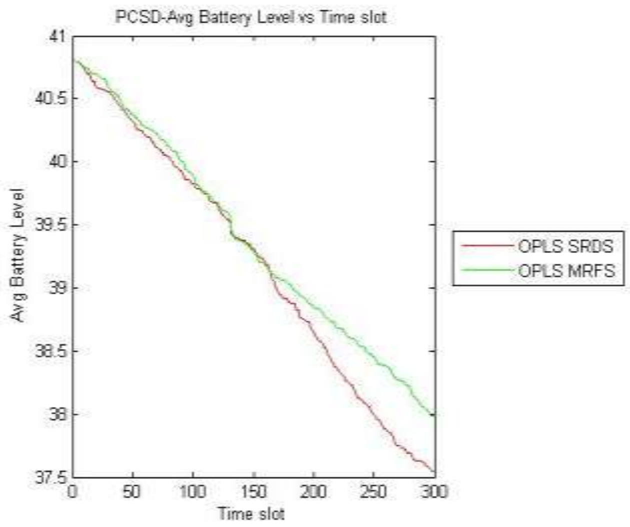

Fig.18. Average battery level $\sum_k B_k |K|$ of the MTs over time slotunder single relay dichotomous search and multi relay fibonacci search in splittable data

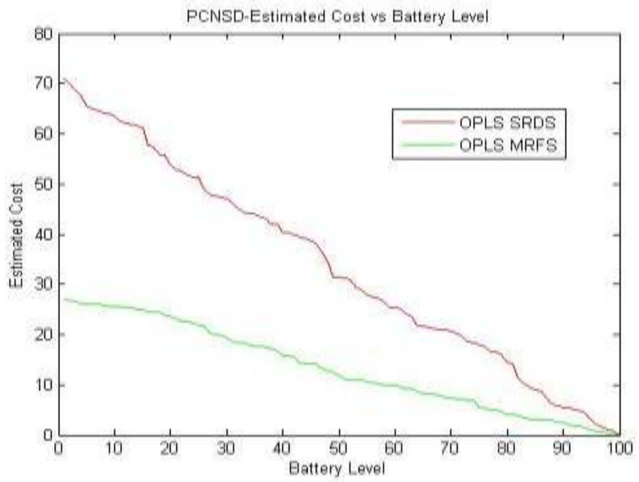

Fig.19. Expected cost of MT versus battery level under single relay dichotomous search and multi relay fibonacci search in non splittable data

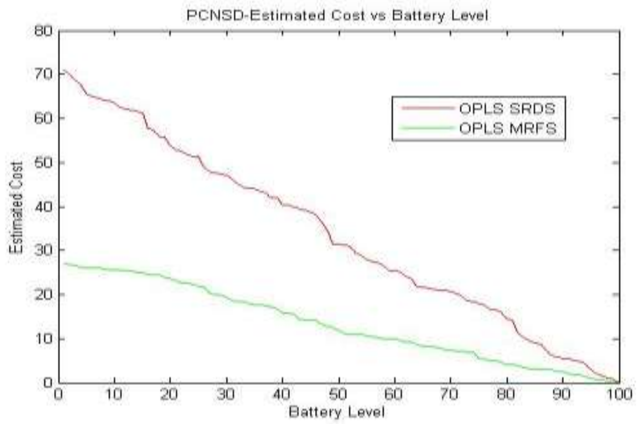

Fig.20. Average battery level $\sum_k B_k |K|$ of the MTs over time slotunder single relay dichotomous search and multi relay fibonacci search in non splittable data

Finally the evaluation of optimal pricing and load sharing (OPLS) of single relay selection with dichotomous search algorithm (SRDS) and multi relay selection combined with fibonacci search algorithm (MRFS) and active inactive node is proved that the proposed technique is more efficient and effective method for reducing the battery outage of MTs and energy cost of average battery level over the time slot is:

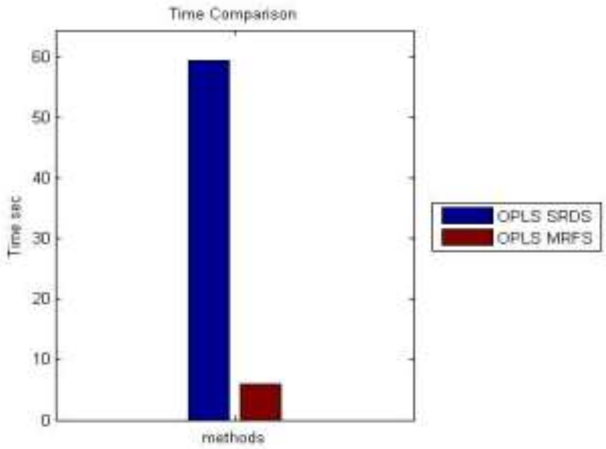

Fig.21. Comparison of prior model with proposed model

VIII. CONCLUSION AND FUTURE WORK

This paper investigated the gains of wireless cooperative communication with different scheme then studied the optimal pricing and load sharing for redeemable battery energy of MTs, full cooperation under complete information with split table and non split able data is deliberated first then partial cooperation under incomplete information with split table and non split table data is evaluated and the optimal solution is achieved by Fibonacci search and alternative optimization algorithm. At last simulation of single relay selection in MT and multi relay selection in MTs is explored and prove that the proposed technique for cooperative communication effectively reduce the battery outage of MTs and the result shows fresh discernment on the energy saving and cost reduction in wireless cooperative communication.In this work multi relay selection is used to keep the traffic overload low. For more efficiency to reduce the energy cost, used the available channel mechanism where the SMTs ask help to HMT to send the data to BS and HMT will help SMT, in return SMT offers the payment for data rate of give the access permission to use the licensed spectrum of SMT under condition and practice active and inactive mode between data and voice channel for moderate the battery usage of MTs in wireless communication.

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