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OPTIMIZATION IN 5G NETWORKS FOR DEVICE TO DEVICE COMMUNICATIONS

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***Abstract*—**5g is known as the fifth generation technology in the cellular communication networking, cellular companies started to introduce 5g networks in 2019, this network is a upcoming successor for the 4g communication networking. This provides connectivity to most cellular users. Similar to its predecessors, 5G networks are the cellular networks in which the coverage area is divided into small areas called cells. D2D communication generally plays vital role in the future 5g networking as it has very low-latency for the data transmission between the users. This can be operated in a new mode named licensed or unlicensed spectrum. Social network in mobile and D2D communications have are better and future techniques which can support local services in 5G networking. The process of integrating between mobile social networking and D2D communications in 5G networks faces major roles like exploiting the relationship between the cellular users and managing interference, energy and spectrum to get better results of D2D communication.

***Keywords*—**5G networks, D2D communication, EEO, Spectrum efficiency

I. INTRODUCTION

5G is the latest technology which is the upcoming cellular mobile communication networking. Mobile network companies started offering this network communication in 2019. This type of cellular communication is upcoming technology which has lower latency rate for the data transmission between the mobile users. Its operated in two types of modes. There are lot of advantages of using 5g networking.

D2D communication is the latest technology with the use of 5G network communication. In this communication the devices can communicate each other in short ranges and transmit data at higher speeds. The process of mobile social networking, device to device communication in 5g networking faces major challenge in exploitation of relationship between the mobile users.

II. **Proposed System**

A. Energy Efficiency optimization technique

Nowadays, there are studies which are trying to solve EE problem in wireless communication.

We are proposing EE problem technique for device-to-device communication in 5G networking. We are analyzing and evaluating the dependence of social relationship on the working of device-to-device communication, which helps us to create a solution for the EEO problem while taking the relationship of social networking between the mobile users. Energy efficiency problem which we are facing can be a solution for optimal channel mode selection as well as transmission power which are being allocated to every mobile user to get higher efficiency using the optimization technique.

B. Block diagram model and notations

Block diagram model and notations are shown below:

Table 1: Important Notations

Symbol	Explanation
N_C	Number of cellular users
N_D	Number of D2D pairs
$\mathcal{S}_C$	Set of cellular users
$\mathcal{S}_D$	Set of D2D pairs
C_i	i-th cellular user ($i = 1, 2, \ldots, N_C$)
D_j	j-th D2D pair ($j = 1, 2, \ldots, N_D$)
U	Vertex set, which denotes the set of all users in social domain
S	Edge set, which is also matrix of social relationship strength
$S_{i,j}$	Strength of social relationship between users C_i and D_j
$J_z^{i,j}$	Jaccard coefficient of z-th social factor ($i = 1, 2, \ldots, N_C$; $j = 1, 2, \ldots, N_D$)
$P_{Tx}^{C_i}$	Transmission power of cellular user C_i
$P_{Tx}^{D_j}$	Transmission power of D2D pair D_j
$P_{max}^{C_i}$	Maximum transmission power of cellular user C_i
$P_{max}^{D_j}$	Maximum transmission power of D2D pair D_j
I_{C_i}	Interference power at the BS for cellular user C_i
I_{D_j}	Interference power at the D2D receiver D_{jr}
λ_{C_i,D_j}	Spectrum resources reusing indicator
R_{C_i}	Achievable link rate at the BS from the cellular user C_i

B. Model of System

D2D communication in 5G networking are mixture of physical as well as social domain shown in first figure. Model of system is shown in the sequential order.

C. Physical Domain

Users are able to line up device to device communication link to use cellular sources counting on physical as well as communication restrictions. Therefore, take device to device wireless 5g networking in one base station to another is at the middle and many mobile pairs are distributed randomly.

In this system model, we use communication phase as well as assumptions that every cellular user are going to be used as an orthogonal sub channel and Device to device pairs are able to use spectrum of mobile user to reinforce the efficiency of spectrum.

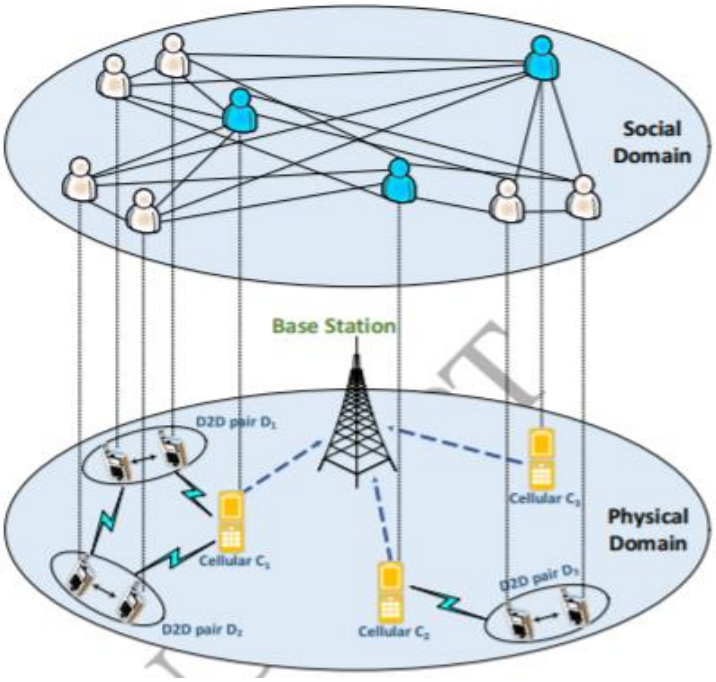
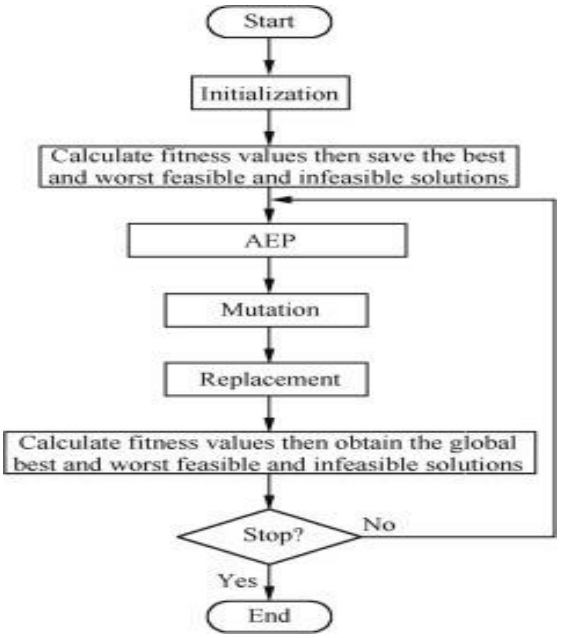


Figure 1: System model

D. Adaptive Genetic Algorithm Flow chart

The parameter settings in a network area of 500m x 500m. The D2D transmitters and D2D receivers and base station are represented in the below figure 3. figure 4 indicates the convergence rate of adaptive genetic algorithm when it is generated from 1 to 100 mobile users. The best and mean values are given in the graph using the formulation method.



Adaptive Genetic Algorithm

Algorithm 1 The implementation of Adaptive GA for our social-aware energy efficiency optimization problem

Require: Initial parameters of the Adaptive GA
$NI = 200$: Number of individuals in a population
$NB = 32$: Number of bits to denote an individual of solution set $\{S^z\} = \{\lambda^z_{C_i,D_j}, P^{C_i,z}_{Tx}, P^{D_j,z}_{Tx}\}, z = 1, 2, \ldots, NI$
$NG = 100$: Maximum number of generations
$PG = 0.9$: Generation gap
Ensure: $S^* = \lambda^*_{C_i,D_j}, P^{C_i,*}_{Tx}, P^{D_j,*}_{Tx}$
1: Generate random NI individuals of solution $\{S^z\}$
2: Calculate fitness values $EE_{penalty}(\{S^z\})$ in (22) of all individuals of $\{S^z\}$ in current generation
3: **repeat**
4: Put $\{S^z\}$ and $EE_{penalty}(\{S^z\})$ in the mating pool
5: Select $NI \times PG$ best individuals with better fitness values, i.e., higher values of $EE_{penalty}(\{S^z\})$, for breeding the next generation by using stochastic universal sampling operator [44]
6: Define the diversity level of population (DL) as: $DL = \frac{best\_population\_fitness\_value}{average\_population\_fitness\_value}$

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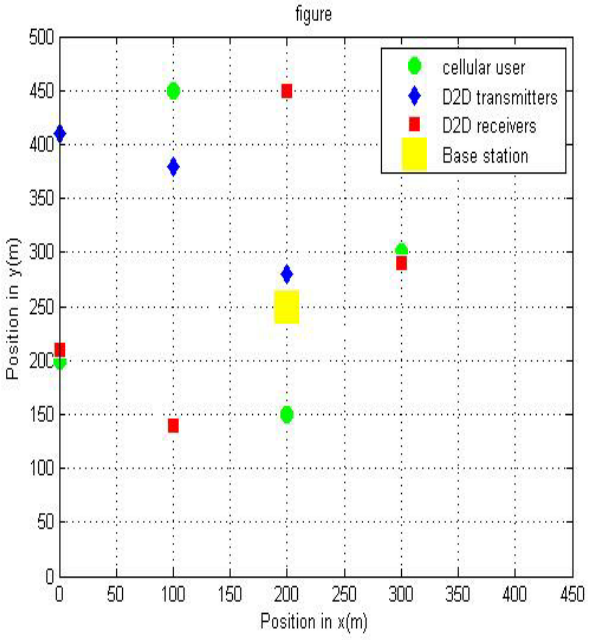

Figure 3 .Network Layout

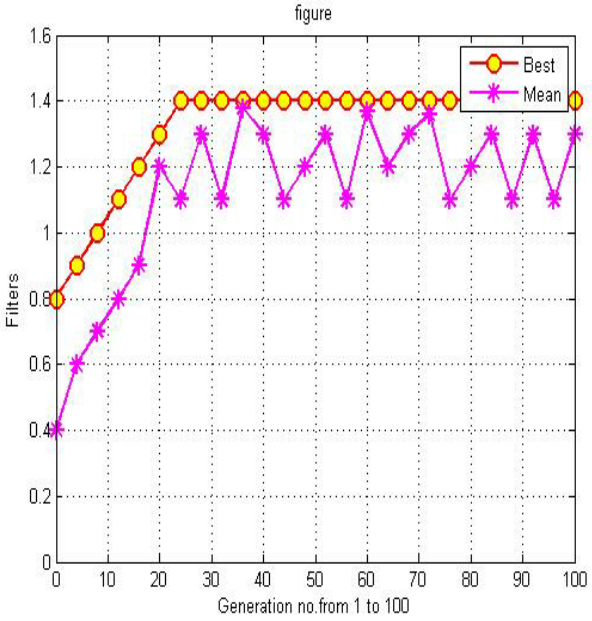

Figure 4: Mean and best values of Energy Efficiency

Figure 5 shows EE from EEO is high with high in coefficient of strength o social relationship α. Coefficient of strength in social relationship is higher the communication in Device to device communication are less complex which can increase in energy efficiency. EEO increases energy efficiency which is 40% and 55% better than in the Energy Channel Propagation and Radical Channel Propagation. From figure 6 system through put in EE outperforms that within the Energy Channel Propagation and Radical Channel Propagation schemes.

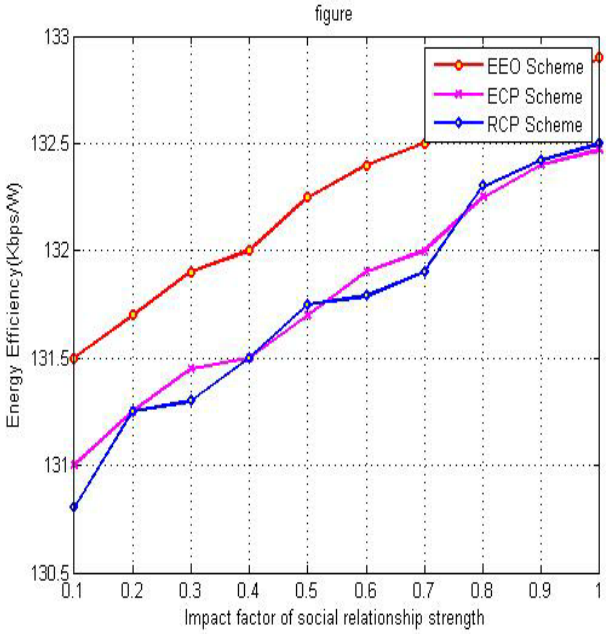

Figure 5: Energy Efficiency vs. α

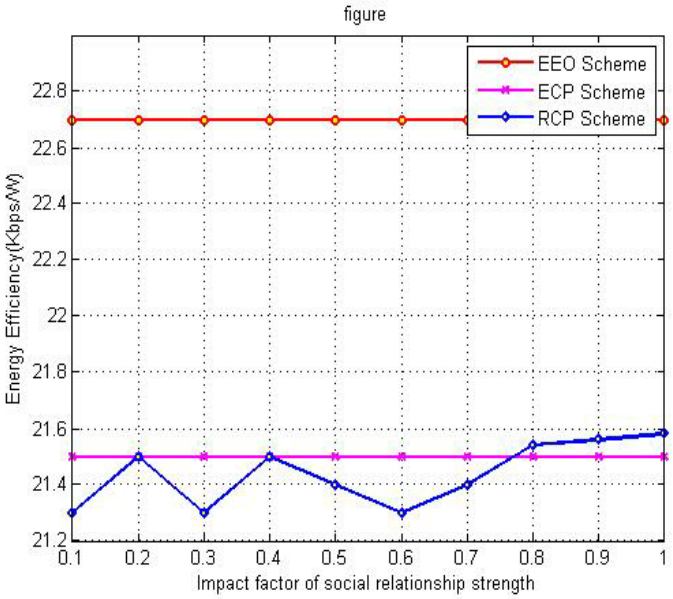

Figure 6: System Throughput vs. A

E. The amount of cellular users NC

We can prove efficiency for the three optimisation techniquies under use of the amount of mobile users NC by using α equal to 1 and ND = 5 when changing N C from two to twenty. Results in Figure 7 and 8 by higher amount of mobile users NC leads to better performance in the efficiency of energy and throughput of system as sharing is easier in D2D communications are often easier. By comparing EEO has best energy efficiency and throughput of system when compared to ECP and RCP as it improves performance of system.

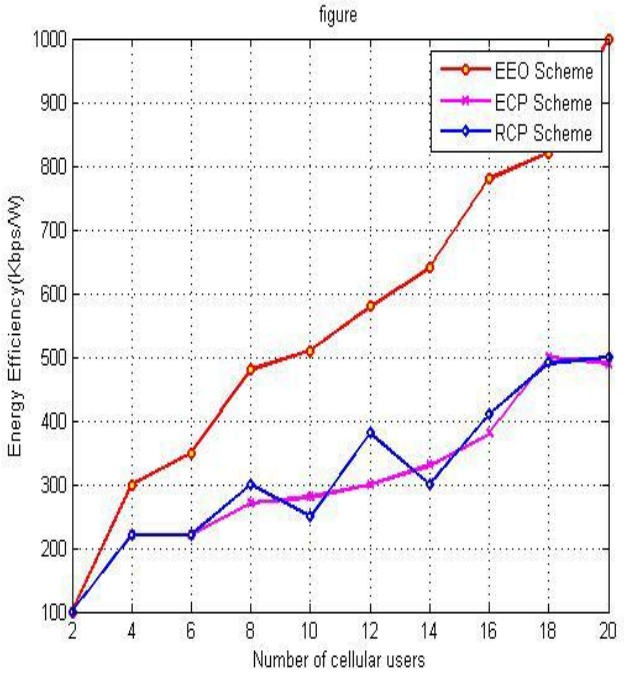

Fig7: Energy Efficiency vs. NC

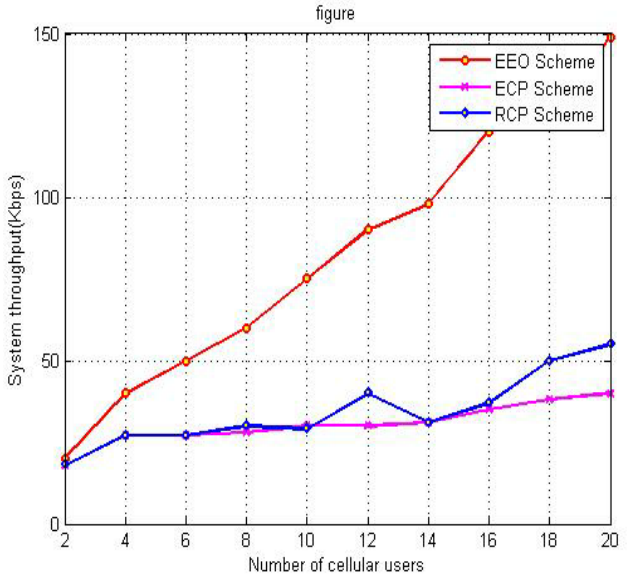

Fig8: System Throughput vs. Nc

F. The amount of Device to device to device pairs ND

We take α is equal to 1 , NC is equal to 5 varying ND 4 to 12, for calculating performance of Energy Efficiency Optimization, Energy Channel Propagation , Radical Channel Propagation under use of the amount of Device to Device pairs N D. These are shown from Fig. 9 and Fig. 10, while changing higher amount of Device to device pairs ND, energy efficiency and throughput of system in "ECP" also "RCP" techniques drops 92% while the proposed system EEO is high (about 30%).

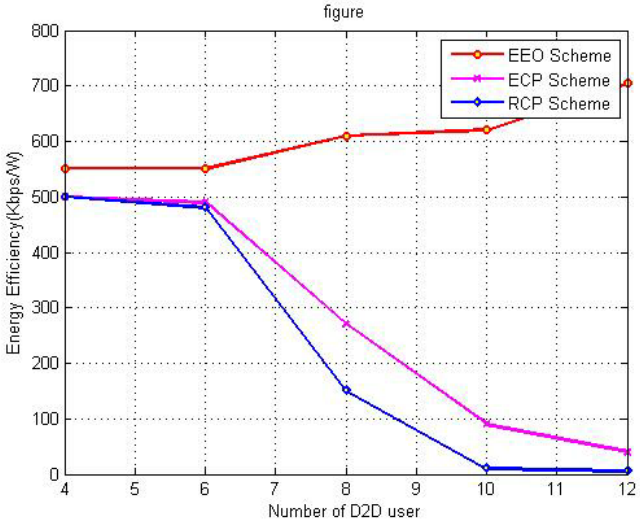

Figure 9. Energy Efficiency vs. ND

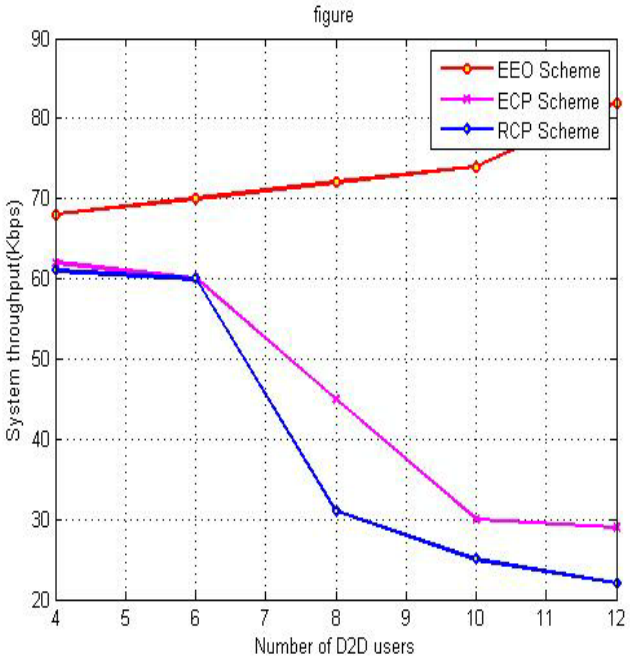

Figure 10: Frameowork Throughput vs. ND

EEO solution is the good solution with higher efficiency of energy and throughput of system than other two techniques because of optimal mode selection and transmission power allocation. The result which we got from our proposed energy efficiency optimization solution also increases the performance of Device to device communications under many number of Device to Device pairs in 5g networking.

References:

[1] J. Qiao, X. S. Shen, J. W. Mark, Q. Shen, Y. He, L. Lei, Enabling device-to-device communications in millimeter-wave 5G cellular networks, IEEE Communications Magazine 53 (1) (2015) 209–215. doi: 10.1109/MCOM.2015.7010536.

[2] M. Chen, Y. Hao, L. Hu, K. Huang, V. K. N. Lau, Green and mobilityaware caching in 5G networks, IEEE Transactions on Wireless Communications 16 (12) (2017) 8347–8361. doi:10.1109/TWC.2017.2760830.

[3] L. Jiang, H. Tian, Z. Xing, K. Wang, K. Zhang, S. Maharjan, S. Gjessing, Y. Zhang, Social-aware energy harvesting device-to-device communications in 5G networks, IEEE Wireless Communications 23 (4) (2016) 20–27. doi:10.1109/MWC.2016.7553022.

[4] Y. Hao, M. Chen, L. Hu, J. Song, M. Volk, I. Humar, Wireless fractal ultra-dense cellular networks, Sensors 17 (4) (2017) 841–848. doi:10. 3390/s17040841. URL http://www.mdpi.com/1424-8220/17/4/841

[5] M. N. Tehrani, M. Uysal, H. Yanikomeroglu, Device-to-device communication in 5G cellular networks: challenges, solutions, and future directions, IEEE Communications Magazine 52 (5) (2014) 86–92. doi: 10.1109/MCOM.2014.6815897.

[6] M. Noura, R. Nordin, A survey on interference management for deviceto-device (d2d) communication and its challenges in 5g networks, Journal of Network and Computer Applications 71 (2016) 130 – 150. doi:http://dx.doi.org/10.1016/j.jnca.2016.04.021. URL http://www.sciencedirect.com/science/article/pii/ S1084804516300753

[7] N. Panwar, S. Sharma, A. K. Singh, A survey on 5G: subsequent generation of mobile communication, Physical Communication 18, Part 2 (2016) 64 – 84, special Issue on Radio Access Network Architectures and Resource Management for 5G. doi:https://doi.org/10.1016/j.phycom.2015.10.006. URL http://www.sciencedirect.com/science/article/pii/ S1874490715000531

[8] B. Yu, K. Yang, C.-Y. Sim, and G. Yang, "A novel 28 GHz beam steering array for 5G mobile device with metallic casing application," *IEEE Transactions on Antennas and Propagation*, vol. 66, no. 1, pp. 462–466, 2018.

[9] M. Richart, J. Baliosian, J. Serrat, and J.-L. Gorricho, "Resource slicing in virtual wireless networks: a survey," *IEEE Transactions on Network and Service Management*, vol. 13, no. 3, pp. 462–476, 2016.

[10] K. Wang, H. Li, F. R. Yu, and W. Wei, "Virtual resource allocation in software-defined information-centric cellular networks with device-to-device communications and imperfect CSI," *IEEE Transactions on Vehicular Technology*, vol. 65, no. 12, pp. 10011–10021, 2016.