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Joint Beamforming and Optimization of Energy Saving in Cognitive Radio Network

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Abstract:

Mobile phone has become an important concern for all classes of people. For proper communication via mobile network, signal plays a vital role. One of the largest complaints about mobile users has poor signal in rural areas. Not having the ability to make call, missing calls and having slow net speeds is commonly terribly frustrating. For businesses not having the ability to receive calls will mean revenue loss and upset customers. This paper has a solution for the above problem. Idea implemented here is to share the signal through the network will make a good communication between the mobile users. Sampling Annealing algorithm is being used to share the signals among the mobile users. This algorithm helps the users to receive the signal from the base station, who the stores large amount of signals using mobicrowd. Mobicrowd is used to store the signals. It is also used to send and receive the signals between the base station and server. Interconnecting base station with server and server with client is done by joint beam forming process. HPCM (Heuristic Power Consumption Mechanism) technique is used for solving the problem of energy-efficient network management. TRE (Traffic Redundancy Elimination) technique is used to avoid client's enormous request to base station and to control the traffic in network. Implementing the above methodology will help to save the power (Energy) and share mobile network to multiple users.

Keywords — **Cognitive Network, Beamforming, Sampling Annealing, Mobicrowd, HPCM Technique, TRE technique.**

1. INTRODUCTION

In modern society, wireless access has become an essential and very important component, with many of our day to day routine always involving some types of wireless connectivity. As a result, there is a need for new wireless services, particularly multimedia system applications, jointly with the number of wireless users. Due to increasing application of wireless devices causes a demand for spectrum. To make better use of spectrum, more and more attempts are taken on cognitive radio. Cognitive radio has been identified as an effective technology to improve this concept by utilizing the spectrum unused by the primary users. Under a spectrum sharing state of affairs, the contestant of the cognitive radio network is to ensure the preservation of primary users from enormous interference from secondary users, and to expand its own sum rate.

In this paper, cognitive radio has emerged as an important technology for future wireless communications. Cognitive radio plays as a promising technology to improve the utility of the licensed spectrum, which dynamically provide services to primary users and secondary users. Since secondary users can only utilize the temporally idle spectrum to avoid collisions, resource allocation becomes a key issue. To deal with this problem of resource allocation in cognitive radio networks, many efforts have been made on game theory based approaches.A signal handling technology called beamforming has been established to Cognitive Radio for directional signal transmission. Over the last few years, the widespread use of mobile communication systems has motivated a continuous search for an effective use of the frequency spectrum. As a consequence, extended analysis efforts are dedicated to the event of techniques for rising the spectral efficiency. One of these techniques consists of using beamforming algorithms to dynamically shape the radiation pattern of an antenna array aiming to strengthen the signal of interest and decrease the interfering signals. A beamformer is also a processor utilized in conjunction

with an array of sensors to supply various form of spatial filtering. The sensing elements array gathers spatial samples of propagating wave fields, which are managed by the beamformer. The target is to estimate the signal coming from a desired direction in the presence of noise and interrupting signals.

Beamforming is an well organized solution in cellular systems, where a huge number of single antenna mobile terminals exist. In beamforming, each data stream for each user is separately coded and adequate by its own beamforming vector prior to the transmission from the antenna array. Not only major computational burden can be sufficiently reduced, but also the major part of DPC capacity can be accomplished due to multiuser diversity gain from the massive number of users below the coverage of BS.

Signal failure is one of the most frustrating occurrences in rural areas. This signal failure causes many troubles to connect users with the network. This paper has a solution for the above problem. Stimulated Annealing algorithm is used to share the signal among mobile users. Base station provides signal to server request and sever share the signal to the client. Primary users and secondary users refer to the same service and different service of mobile users. Traffic Redundancy elimination technique is used to avoid server's enormous request to base station.

2. RELATED WORKS

[1] Suren Dadallage, Changyan Yi, Jun Cai has discussed the difficulties of joint beamforming, power and channel allocation for multi-user. The issues are composed as a non-convex MINLP problem, also called NP-hard. In order to minimize the computational complexity, iterative algorithm is suggested to solve possible beamforming vectors and power allocation. GA and SA are proposed to find the suboptimal channel allocations. The procedure cannot tell whether it's found an optimal solution or not.

[2] Omar O. Abdulghfoor, M. Ismail, and R. Nordin presented non-cooperative game theory to find the power allocation difficulties in adhoc cognitive radio network. Cognitive Radio is projected as a unique technology to enhance the spectrum utilization in wireless transmissions through the conflict compensations in order to contribute good quality of service to cognitive radio nodes, on one hand, and to protect the transmission of primary user, on the other hand. The drawback is both primary user and secondary users receivers can permit less quality of interference.

[3] Meng-Lin Ku, Li-Chun Wang, and Yu T. Su studied and analysis a hierarchical cognitive radio network provides an hidden microcellular system concurrently shares identical spectrum resource with a macro cellular system. Spectrum utilization contributed by antenna beamforming is moderately saturated and even becomes worse once huge variety of SU at the same time transmit information. However, the belief of a primary user channel reduces the degree of freedom offered at the secondary base station on channel allocation for secondary user.

[4] Chun-Che Chien, Hsuan-Jung Su, and Hsueh-Jyh Li, proposed joint power allocation and beamforming designs at the BS and the RS via GP optimization and downlink–uplink duality for AP- and SVD-based MIMO BRC. Iterative algorithms have been proposed to solve three sets of design parameters, including downlink power allocation, virtual uplink power allocation, and virtual uplink beam former. Finally, a generalization to the multihop state of affairs is provided to improve the lot of power efficiency. The uplink multiple-access relay channel is not considered

[5] Changyan Yi and Jun Cai analysis the spectrum sharing among multiple heterogeneous POs and SUs in recall-based cognitive radio networks has been discussed. TAGS, which deals with the power allocation issues for initial spectrum allocation and a stackelberg game for deciding best strategies towards potential spectrum recall. Whatever, this framework is also too primal for sensible applications because it assumes just one merchandiser and a homogeneous spectrum demand for all consumers.The amount of actually recalled spectrum does not satisfied.

[6] Peng Cheng, Lei Deng, Hui Yu, Youyun Xu, and Hailong Wang has considered how effectively involve device to device communications for secondary users in a cognitive cellular network. During this network, primary users convey via base station usually, while secondary user can involve multiple transmission nodes. Secondary users who have the possible to communicate to one another using device to device mode form a group. Among this group, they can transmit to every different via BS mode or using device to device mode. Device to device is usually short range communication with limited power.

[7] Karama Hamdi, Wei Zhang, and Khaled Ben Letaief investigates the case of a huge number of primary and secondary users, is needed by user selection. The author proposed a low complexity algorithm for choosing the group of users to improve the system performance.

[8] Bassem Zayen, Aawatif Hayar and Geir E has discussed a joint beamforming and single primary user channel assignment problem to widen the uplink throughput of the cognitive radio network while assuring a SINR constraint for secondary user receiver and interference elimination at the primary user receiver.

[9] Ciro André Pitz, Eduardo Luiz Ortiz Batista, and Rui

Seara has discussed the unique approach for joint beamforming and power management in cellular systems. The suggested beamforming algorithm, referred as a adaptive-projection provides an increase in SINR performance and reduced computational burden.

[10] Simon Yiu, Mai Vu, and Vahid Tarokh has discussed the impact of beamforming in cognitive radio networks, where the primary and secondary users are shared uniformly in a rounded disc. The secondary transmitters which allows to transmit concurrently with the primary transmitters. To reduce the interference created by the primary receivers, the secondary transmitters are provided with several antennas and engage with beamforming for transmission.

3. PROPOSED SYSTEM

The proposed system is based on stimulated annealing algorithm which shares the signal among the mobile users. Normally, base station will receive signals from the spectrum. In our proposal, users will send request to BS (Base Station) and BS process the request by generating id for request nodes. BS responds for the node which acts as server in receiving the signals from the BS and share signal among different client. Client can be of same service or with different service. Using this approach power consumption is reduced to great extent.

3.1 Efficient bandwidth cooperative networks Communications

Spectrum manager is used for managing the use of radio frequencies to support effective use and gain internet social benefit. Here, Spectrum manager is used to provide signal to the base station within the specified frequency range 0 - 49 Hz. The frequency spectrum is a demanding natural resource due to large and growing number of services such as fixed, mobile, broadcasting, etc. Frequency Spectrum should be allocated properly in order to have an improved and effective communication. Spectrum is the key resource which is used for an effective allocation process of the mobile industry. Process of assigning frequencies to other applications is done by bandwidth allocation technique. Base station signal access range should be defined properly and is determined by total bandwidth Allocation. Node creation, assemble and establish can be done in spectrum aware routing.

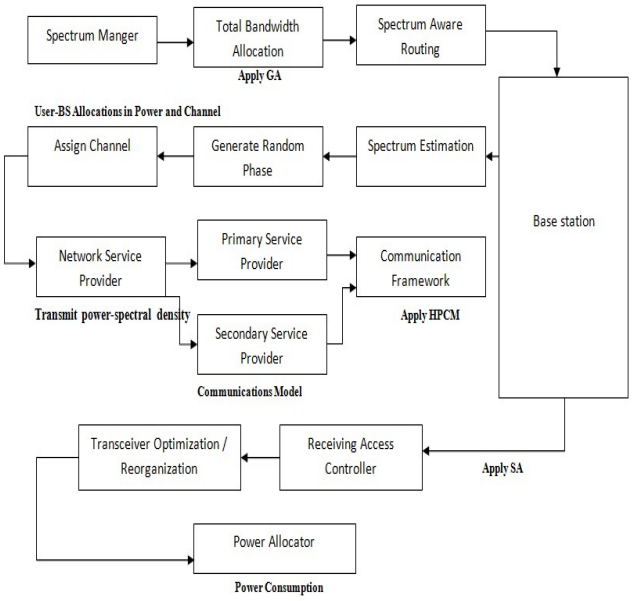

Fig-1: System Architecture

3.2 User-BS Allocations in Power and Channel

The Primary Base Station is able to dynamically access the spectrum by using the cognitive radio techniques. The PBS has the extensive access to the licensed band. Spectrum estimation is used to check the total number of client and the corresponding receiver needed for processing. Generate random phase processing the incoming request at the base station might lead to heavy traffic at BS. Therefore in order to overcome the heavy traffic, methodology of Random IDs generation is being used. Base station will be fed with Heavy traffic request from different Client. Assign Channel is to assign the base station with the exact Client to be responded.

3.3 Transmit power-spectral density

In this module receiver mobile will receive the data either from the PU or SU through the mobile core network (PBS or SBS). Compare with PBS the data received through SBS is high then we are achieving/saving at least 50% power consumption. Receiver Module will also register the corresponding amount of data received as well. Network service supplier is a corporation that sells information measure or network access by providing direct access to a web service supplier. There are 2 types of service provided that is possible with this module

3.4 Communications Model

Primary Service Provider and Secondary Service Provided are in this module. Network Service provided is used to get acknowledgement to base station for the

service that was provided to the receiver mobile. Primary service providers are the one who traditionally correlate with service and will have direct connection with Mobile User. Eg. Airtel to Airtel. Secondary service providers are the one who is not directly connect the client, but gave support to the primary providers. Eg. BSNL to Airtel. Communication Framework is also known as Client storage area, will help us to check and confirm if the Spectrum usage was directed to the correct client by using the stimulated annealing Algorithm.

3.5 Power Conservation

Energy transmitter is used in receiver access controller to save the energy. Heuristic power consumption mechanism is to reduce the power consumption. To receive the unused energy from the client is done by using time set. Once energy is increased power is also increased.

4. DESCRIPTION OF ALGORITHM

4.1 Genetic Algorithm

Genetic algorithms are frequently used to produce high-quality resolution to development and search issues, which can be implement to locate near optimal resolution to an optimization issues without the understanding the impartial function's derivatives or any slope related information. The key plan of GA is to first choose collection of possible values for the decision variables and so design new resolutions based on the previous set to make better objective function. This algorithm is used to identify the signals and maintain the average range of signals while receive the signals from spectrum to base station.

4.2 Stimulated Annealing Algorithm

SA algorithm used to find the possible solutions and converge to an suboptimal resolution. Specifically, the SA algorithm starts with an impact parameter granting an initial channel allocation which is to produce a new nearest channel allocation. Then, the new channel allocation is shown to improve the performance. Otherwise, it's going to still be accepted with a definite probability that permits SA algorithm to get away from local optimal configurations. The cooling schedule handles the control parameter through the optimization method. This algorithm used to share the signals among mobile users. It is used to check whether the client get the signals from the server correctly. Using algorithm, frequency does not cause any misfortune in the transmission of signal between base station and server.

4.3 Heuristic Algorithm

Another approach for resolution the issues of energy effective network management relies on development of heuristic mechanism. Heuristics are necessary in observe because efficiency is commonly a high priority. An effective heuristic algorithm is the one which determines an answer at intervals cheap time victimization cheap resources. Some types of issues is considered as a typical cheap timeframe may be a few hours and a typical cheap resource may be a high-end personal computer (server). This technique is used to save the energy via energy transmitter. The energy transmitter lies in base station that is used to receive the unused signals from the client.

4.4 Traffic Redundancy Elimination Algorithm

This algorithm is used to eliminate the redundancy between the users and network. In existing concept, there is a heavy traffic at the base station because of many clients' request of signals. Due to this problem, the data cannot be stored in offloading section. To solve this problem, TRE is used to avoid traffic in base station by generating id for each node in network to avoid uncertainty in the network. This technique is used to minimize the node collision in all transceivers of the network.

4.5 Beamforming

Beamforming or spatial filtering could be signal process techniques employed in sensor arrays for directionalize the signal transmission or reception. Beamforming are often used at each the transmitting and receiving ends so as to attain spatial property. The development compared with Omni directional reception or transmission is called as the directivity of components. Associating the base station with server and server with client is done by joint beam forming process. Primary user act as same service mobile users and secondary user act as different service mobile users. Joint beamforming is used to send the signal by serial sequence. Also, by using joint beamforming technique, Secondary users will receive the signal via default gateway.

5. PERFORMANCE ANALYSIS

The performance analysis shows the following section in the form of line graph. The performance of energy throughput, Comparison for delay, Comparison for time rating is based on the number of nodes in signal transmission. Fig 2. shows mobile users of the network send the signal request to base station. Fig 3. shows sharing the signals among the mobile users from the server.

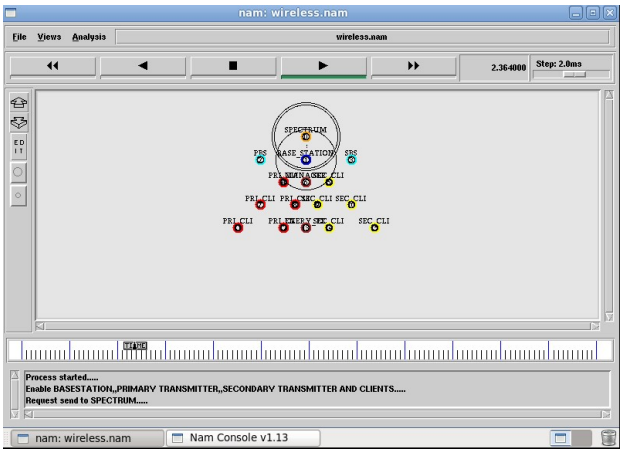

Fig-2: Signal transmission

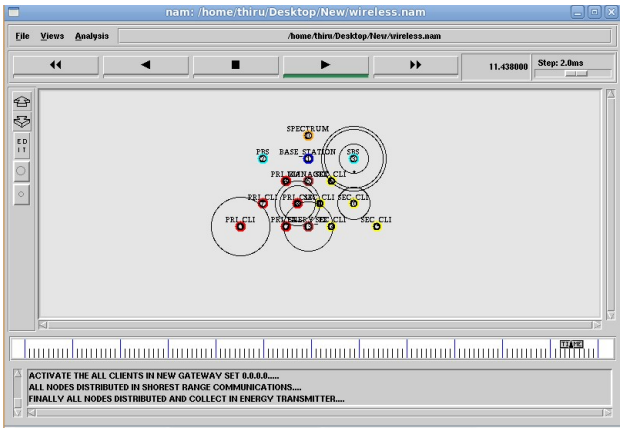

Fig-3: Signal sharing

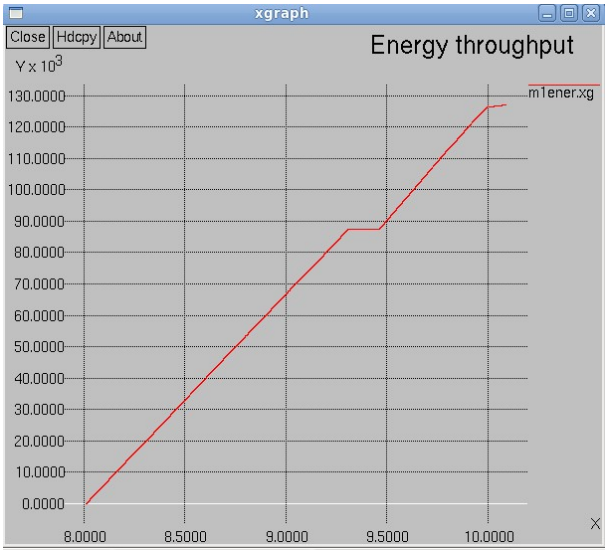

Fig-4: Energy throughput

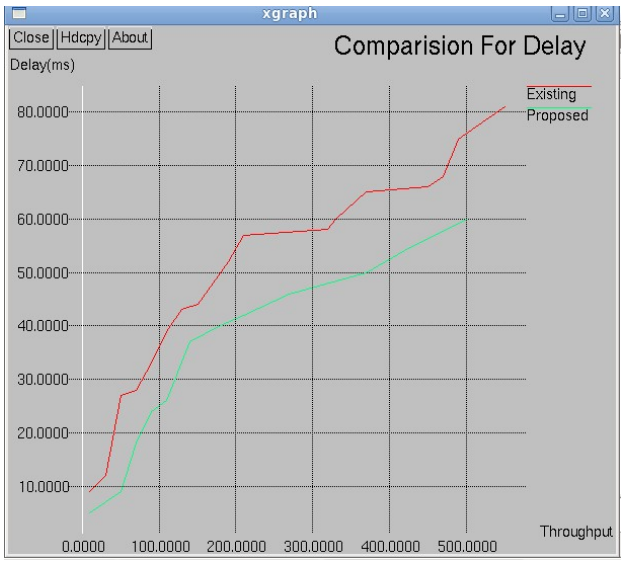

Fig-5: Comparison for Delay

Fig-6: Comparison For Time Rating

Fig-4: specifies the energy saving process by using energy transmitter. This energy transmitter consumes the remaining energy, which is not used by the client to save energy. Fig-5: specifies the transmission time between each node and there by the time delay. Here, the delay is reduced from 80.0000 ms to 60.0000 ms. Fig-6: specifies the signal strength where primary and secondary users

get the signals from the base station. In proposed work the delivery ratio is comparatively low than the existing.

6. CONCLUSION AND FUTURE WORK

The main objective of this system is to have equal signal for all different users who is requesting for Signals. Transmission of signals can be done by using both primary and secondary connections. Reliable transmission of signals among mobile users can be done by using stimulated annealing algorithm. TRE technique is used to control the traffic in network. Usage of Heuristic power consumption mechanism also reduces the power consumption thereby energy. In future, the Signal Sharing mechanism is used to get the signal from neighboring user with excellent Signal strength.

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