Maximum Energy Optimization in Cognitive Radio Networks

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ABSTRACT: Energy efficiency (EE) is one of the important metric in cognitive radio networks. Cognitive Radio Network (CRN) can use radio spectrum more efficiently because of its ability to search for idle spectrum and access it opportunistically in order to transmit its own data. Exploring how better energy efficiency can be achieved in a spectrum sharing environment. This field shows that energy efficiency in cognitive radio network is better when number of secondary users (SU) is more than available channels.To explore the methods to maximize energy efficiency of the Cognitive Radio network in order to enable green wireless network. Therefore, we can make Cognitive Radio network both spectrum efficient and energy efficient.This paper focuses on optimization algorithms to optimize radio resource usage in heterogeneous cognitive wireless networks. The simulation result shows that the proposed algorithm could not only protect the primary users from interference due to secondary users, but also obtain the optimal utility of the cognitive user.

KEYWORDS: Energy efficiency,Cognitive radio, Secondary user, Spectrum efficient

I. INTRODUCTION

Cognitive radio(CR) is a form of the wireless communication in which a transceiver (transmitter and receiver) can detect intelligently where the communication channels are in use and which are not in use, and move instantly into the vacant channels while avoiding occupied ones. It optimizes the use of available radio-frequency (RF) spectrum. The concept of the Cognitive Radio was first proposed by Joseph Mitola III in 1998.The first cognitive radio wireless regional area network standard, IEEE 802.22, was published in 2011 and developed by LMSC IEEE 802 LAN/MAN Standard Committee. Depending on transmission and reception parameters, there are few types of cognitive radio:

- Full Cognitive Radio: In Full Cognitive Radio, every possible parameter is observable by a wireless node or a network which is considered.
- Spectrum-Sensing Cognitive Radio: In Spectrum-Sensing cognitive radio only the radio-frequency spectrum is considered.

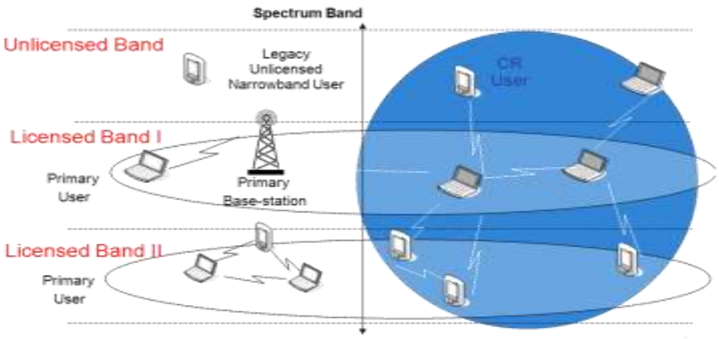

Fig 1

Other types are dependent on parts of the spectrum available for the cognitive radio

- Licensed-Band Cognitive Radio: In Licensed-Band Cognitive Radio,it is capable of using the bands which are only assigned to the licensed users.
- Unlicensed-Band Cognitive Radio: In Unlicensed-Band Cognitive Radio,it can only use the unlicensed parts of the radio frequency (RF) spectrum.
- Spectrum mobility: The process by which a user(cognitive radio) changes the frequency of operation.
- Spectrum sharing: Spectrum sharing cognitive-radio network allows the users to share the spectrum bands of the licensed-band users.

- Sensing-based Spectrum sharing: In sensing-based spectrum sharing the cognitive radio users first listen to the spectrum allocated to the licensed users to detect the state of the users. Based on the results, cognitive radio users decide their transmission strategies

II. RELATED WORK

In Literature survey ,providing the related background and work on each contribution listed as :
In 2011, S.Mishra[11] proposed a system called Efficient power aware routing (EPAR), a new power aware routing protocol that increases the network lifetime. EPAR identifies the capacity of a node not just by its residual battery power, but also by the expected energy spent in reliably forwarding data packets over a specific link. Using a mini-max formulation, EPAR selects the path that has the largest packet capacity at the smallest residual packet transmission capacity. This protocol must be able to handle high mobility of the nodes that often cause changes in the network topology. proposed scheme reduces for more than 20% the total energy consumption and decreases the mean delay, especially for high load networks, while achieving a good packet delivery ratio.
Su, H., &Zhang,X.(n.d.). Energy-Efficient Spectrum Sensing for Cognitive Radio Networks. In this paper he has proposed an energy efficiency sensing scheme by using adaptive spectrum sensing algorithm andsequential sensing policy. On the other hand, sequentialsensing policy is to constrain two error probability, namely false alarm probability and misdetection probability.

III. PROPOSED SYSTEM

WATER FILLING ALGORITHM:
The process of water-filling is similar to pouring the water in the vessel. The unshaded portion of the graph represents the inverse of the power gain of a specific channel.The portion representing the shadow represents η the power allocated or the water shows the maximum water level.
The total amount on water filled (power allocated) is proportional to the Signal to noise ratio of the channel.
The Capacity of a system is the sum of the capacities of all channels and is given by the formula below.

$$Capacity = \sum_{i=1}^{n} \log_2(1 + PowerAllocated * H)$$

Power allocated by the individual channel is given as shown in the following formula

$$Powerallocated = \frac{Pt + \sum_{i=1}^{n} \frac{1}{H_i}}{\sum channels} - \frac{1}{H_i}$$

maximize the total number of bits to be transported.

METHODOLOGY :
As per the scheme following steps are followed to carry out the proposed water filling algorithm.
1. We do not need to Reorder the MIMO (Multiple input multiple output)-OFDM sub channel gain realization in a descending order.
2. Take the inverse of the channel gains.
3. Water filling has non-uniform step structure due to the inverse of the channel gain.
4. Initially take the sum of the Total Power Pt and the Inverse of the channel gain .It gives the complete area in the water filling and inverse power gain.
5. Decide the initial water level by the formula given below by taking the average power allocated (average water Level).
6. The power values of each sub-channel are calculated by subtracting the inverse channel gain of each channel .

IV. EXPERIMENTAL SETUP

Python 3.7.1 version is installed in windows 10 and after installing python the program is executed and the result can be seen in Command prompt. But first we have to install packages which includes the word “pip”. My project contains needed packages like numpy, scipy, matplotlib.

V. RESULT

The result can be seen in Command prompt

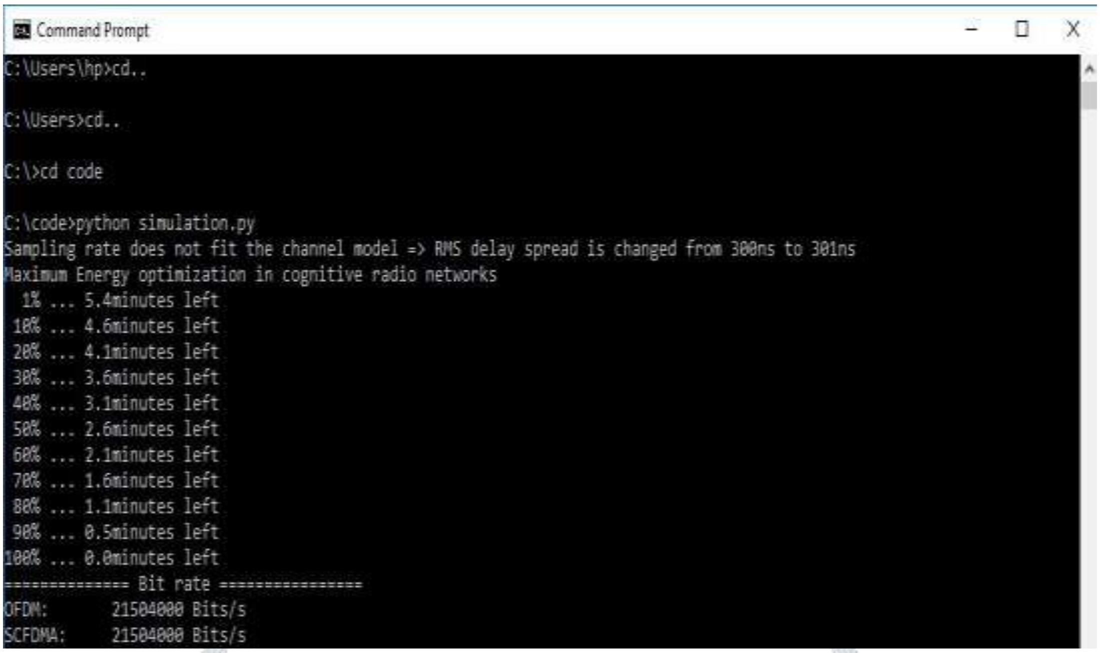

Fig.2

Maximizing the energy optimization in cognitive radio networks is shown in fig.2.For 1% the total time taken for the energy consumption is shown as 5.4minutes.So gradually it has to decrease the time and increase the energy optimization and finally when it is in 100% the total time taken for energy consumption is shown as 0.0minutes left. Finally energy optimization is increased gradually.

The graphs generated after finishing the process is shown below:

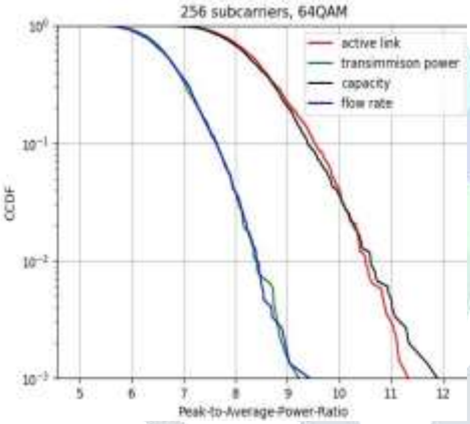

Fig.3 Peak-to-Average-Power-Ratio vs CCDF

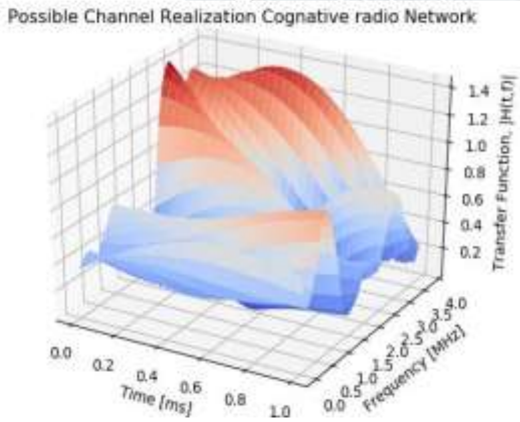

Fig.4 Time vs Frequency vs Transfer function

VI. CONCLUSION:

In this paper the power allocation strategy in a wireless cognitive radio network based on the water filling algorithm to enhance the capacity of a MIMO cognitive radio system with different channel assumptions are described. Here each transmitter decides the distribution of power to the several independent subcarrier channels. We observed maximum power is allocated to the channel having greater capacity. The result indicates that the water-filling scheme has better capacity. The capacity is enhanced significantly by transmitting the different stream of data through different antennas at same frequency. Capacity is increased with increase in number of antennas. The proposed algorithm maximizes the total bit rate under the constraint of a maximum transmit power for each user. The simulation result shows that the proposed algorithm obtains the optimal utility of the cognitive user.

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