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Multimedia Transmission in Cognitive Radio Networks with Efficient QoS

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Abstract:

The recent development in the wireless communication systems is mainly focusing on the cognitive radio (CR). These cognitive radios are targeted on the implementation of the spectrum that is appropriately utilized for the wireless communication systems. The progression of the radio spectrum is dependent on the allocation of the effects of the spectrum. Without disturbing the licensed primary users, the unlicensed cognitive radio user is all capable of utilizing the freshly licensed spectrum. In CR handoff data via CR is critical task because of primary user interruption. By interruption of primary user achieve QOS for forwarding data is a major problem. In this paper it focus on multimedia application data handoff in CR. The main aim in implementing the parameters in the handoff strategy is to overcome the problem arising in the spectrum mobility. This paper mainly focuses on QOS based routing algorithm which will not disturb the channel even the intrusion of the primary user. For the selection of the perfect route for the data transmission QOS parameter is analyzed using a QOS algorithm. This algorithm concentrates on both route selection and avoiding the primary user interruption.

Keywords: *Cognitive Radio Network, Primary user, Cognitive Radio User, Spectrum Sensing, SNR,Quality Of Service Parameters.*

1. INTRODUCTION

Cognitive Radio is a developing system that uses the limited data for the transition of the voice communication to the multimedia based application from the appropriate spectrum. The usage of the appropriate spectrum is very difficult in the recently operating systems to solve this problem Cognitive Radio is used [1]. CR network has the capacity to determine the environmental condition and improve parameters at network level [2]. This network will identify the condition and rectify the network properly. For the rectification of the network problem, there are three core tasks are available. The three core tasks that are prevailing with CR network are: measuring the temperature of the radio environment and the spectrum holes, termed as radio scene analysis; assessment of channel state information and channel capacity which is termed as channel identification; and finally the transmit power control which has the capacity for identifying and taking action in the radio transmission.

The shortage of the spectrum utilization is handled with the effective utilization of the dynamic spectrum which is accessed along the CR networks [3]. The effective spectrum sharing depended on the proper sharing of spectrum between both users. The secondary users have thecapability to identify the effective parameters for the existing spectrum using the radio devices.This radio device has the ability to determine the spectrum holes transmission information and assessing the radio signals using software configuration. The CR networks assure the more appropriate usage of the spectrum which is targeted on the high Quality of Service (QoS). The main function of the CR network is to establish an algorithm and scheme for the efficient functioning. For attaining the maximum Quality of Service in the spectrum a complete analysis in the channel activity is done by the secondary users.

The parameter that plays a main role in the CR network is the Medium Access Control which includes the spectrum distribution, portability of the spectrum, identification, and analysis of the channel [4]. The medium access control is done with the successful transmission of the higher spectral application. Spectrum mobility will create a link in the communication between the secondary user and primary user, where the primary user access the vacate band of the secondary user [5]. Channel sensing will keep all the information about the spectrum users and utilized in the

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available channels. Resource allocation is designed to maintain the QoS of the available channels to cognitive users [6]. Due to the extensive growth of the wireless multimedia application over the wireless internet created a rise in the requirement of the radio spectral resources. To avoid the delay in the multimedia data and lesser the bandwidth various sensing procedure are followed in the classification and derivation of the channels. These sensing techniques are subjected to various examination and investigation to defeat the issues in the CRN spectrum sensing and to neglect the interference. The sensing of the spectrum ensures the portion that is licensed by the primary users.

Spectrum decision: It finds out the effective availed vacant spectrum hole from the identified spectrum holes. The spectrum decision is mainly done to identify the available spectrum for the secondary users. Spectrum sharing: It contributes the spectrum-related information among the neighbor nodes.

It differs from user to user. It is an access given by the primary user to share the unlicensed spectrum to the secondary user or the CR user. Spectrum mobility: Spectrum mobility is the method that allows the easily available spectrum bands from primary user to the CR user for the betterment of the spectrum data. This will avoid the seamless connectivity between the users in case if the primary user needs the spectrum used by the CR user [7]. A regular algorithm is used to avoid the lag of accepting the delivery ration. This paper mainly focused on the requirement of multimedia data that is best suited for the quality assured spectrum band. The algorithm was designed in such a way to find the path where the secondary user disturbs the primary user's path that belongs to him.

The major drawback of the CR is handoff the multimedia data without affecting the QOS. These QOS parameters are helpful in minimizing the values for the user's needs. The advantages of our proposed algorithm are assuring the lower delay and higher packet delivery ration than the regular CR ad hoc networks. CR system is developed with various objectives due to lots of restrictions. A technique is required to control the QOS parameters to get local maxima or local minima[8].

2. RELATED WORK

A mutated ant colony optimization cognitive radio engine was determined by Nan Zhao et al in 2011 [9]. This paper introduced the ACO algorithm that is applied to the cognitive radio engine design. A genetic algorithm is used to solve the cognitive engine problem which is slow and needs an improvement. MACO algorithm is used for acognitive engine for betterment.

Cognitive radio is designed using simulated annealing (SA) technique which is developed by the Kiranjot Kaur et al, in 2013 [10] showed a theoretical global optimization that is independent of local optima. The quality of the SA is assured by the minimum transmission power with maximum spectral effects that is required for the QOS. This paper showed that the SA algorithm operates more efficiently than the genetic algorithm. SA is compared with the GA with the number of interaction and period for attaining an optimization solution.

A study on the genetic algorithm with a crossover method was determined by the Abdelfatah Elarfaoui et al in 2013 [11]. The compliance of the genetic algorithm showed an increased quality with minimum time by using withmetaheuristic algorithm. The various parameters are examined to ensure the desired results and outputs.

A scheme which works on the adaptive genetic algorithm with its parameters was studied by the Ismail AlQerm et al in 2014[12] the study is more complex because of the various operations.

Seshadri Binaya Behera et al in 2015analyzed an algorithm on the optimization of particle swarm to control the resource allocation problem [13]. To control these kinds of problems the cognitive radio users needs some components for the determination of the spectral abundance and capability of the signal that will relate to the SINR. These Signal to interference noise ratio (SINR) can be modified according to the user's requirement. For the improvement of the spectrum utilization parameters are controlled using PSO. The author compared PSO and GA by the comparison of the outputs with minimum complications.

5-G wireless technology which is a Cognitive radio network (CRN) is IEEE 802.22 standards studied by the Jyotshana Kanti and Geetam Singh Tomar in 2016 contains all the details of the users. This paper is strictly focusing on the CRN functions with various sensing techniques with their advantages and disadvantages [14].

The novelty of the present study is to find a spectrum and effectively use the spectrum in the CR networks. There are two types of users, one is the licensed users, who have the authorization to utilizeand one, unlicensed users has defined anapproachto the spectrum. The unlicensed users are also known as acognitive user.

The main aim of the CR network is to restrict the secondary user's transmissionpackets over the primary user.To attain a QoS the secondary users can transmit the packets along with the primary users but with fewer threshold values [15].

The dramatic development in the communication technology results in an increasein the radio spectral resources. For the improvement of the spectral quality and band width, various techniques are applied for the channel identification and arrangements to improve drawback arising during the signal transmission. The aim of the study is to find out appropriate spectrum for the secondary userthe cognitive radios. The Poisson process is used to finds the traffic of the primary user and to select the technique for the reliability, spectral efficiency and coding overhead with amodel for the accessing the secondary spectrum [16].

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3. PROPOSED WORK

The requirement of the data rate for the application of the multimedia creates an interest over the spectrum for developing a frequency allocation scheme. For this Cognitive Radio (CR) a device which can control the parameters at the network level is used. In CR networks, the network communication is very efficient and parameters are controlled by the wireless nodes for minimizing the confusion with the licensed and unlicensed users. The capacities of the cognitive radio are the communication with the environmental parameters and making them fit with the dynamic radio environment. A routing algorithm is developed with a QOS for the improved for multimedia data.

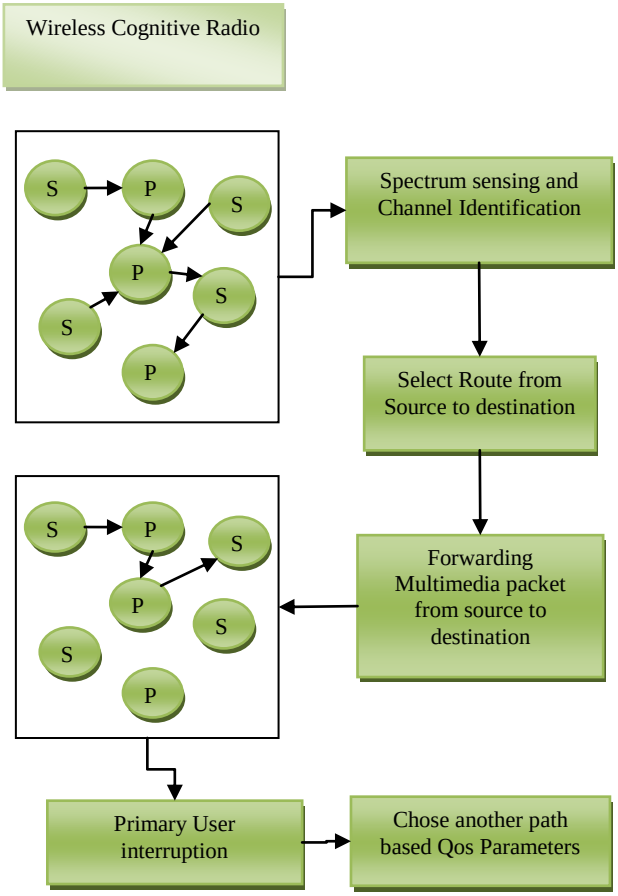

Figure 1: Construction of the effective data in CRN focusing the Multi-Media Data Hand Off.

3.1 Collection and updating of the spectrum Sensing information

The process of the CR can be accessed by the repetition of sensing period. This process is divided into regular cycles where it will reach the path which is known as sensing period. The T represents the sensing period, which gathers the information from its environment. After completing the sensing time, CR starts transferring the data onto the same or the vacant channel which is called as spectrum hole. The main target of the spectrum sensing is to find out the spectrum hole, where the data reaches in a minimum time period. The transmission is continued from sensing time till the sensing period which is referred to us has CR communication frame.

A routine algorithm is proposed in order to identify the sensing period in order to find the transmission time. Using this, handoff multimedia data can be efficiently handled where the PU prevent the SU path. This mechanism keeps on updated with the regular information in every sensing period. The transmission time (T-t) calculated with the frame and sensing time.which is depended on the sensing period which is denoted as 1/T representing thesensing frequency. The transmission timecan be created using all frames or changed depending on the requirements.

3.2 Spectrum Handoff in CR networks

The spectrum handoff appears when a licensed user are avail in the spectral channel which makes the secondary user search for another new available channel. The primary users perform ahandoff from the available multiple networks, but the secondary users or the CR users uses the channel that is available for them and implements the handoff in the existing channel. While detecting the handoff the communication must be interrupted and the secondary user has to wait for the new channel till the transmission buffers are opened. The process of changing the spectrum by a secondary user is termed as a Spectrum Handoff in CR networks. The main drawbacks in this are time to identify the new channel avail and the type of the information need to transmit. The main two users depended on events, involved in this are thepresence of the primary user in licensed channel which creates the secondary user to handoff and another is the spectrum handoff which is caused by the secondary user mobility.

To overcome spectrum sensing problem this paper applies a technique called matched filter detection method also known as coherent detection. It is a spectrum detection method, which needs an information about the primary user (PU), and the SNR (signal to noise ratio).The information prevailing in the primary user are given to the cognitive radio, where the optimal detector present in the stationary Gaussian noise are compared as they are suitable for the SNR. These signals are compared with the known signals, or templates to acquire knowledge about the unknown signals as they have formulatedcodes which can be retrieved by the coherent (matched filter) detection. The major advantage of these techniques is the minimum time required to complete the high processing gain. The main disadvantage of this method is the user should have an experience in the up- to-date signals and complex application. The error in the identification of the channel is more common has they are evaluating the quality of the channel.

3.3 Novel QOS Routing algorithm

Discover channels

for channel = 1 : num – channels do sensing channel ( )

Channel – S_{min} – ber = log10 (0.5) / log10 (P_{be})

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Channel – S_{max} – throughout = l – log2 (M) / log2 (M_{max})
M – Modulation index
Channel – S_{min} – Power = P / P_{max}
P – Power
Channel – S_{min} – interference = { (P + B + TDD) – (P_{min} + B_{min} + 1) } / P_{max} + B_{max} + RS_{max})
B → Band Width
Channel – S_{max} – spectral eff = (1 – ($M*B_{min}*RS$)) / ($B*M_{max}*RS_{max}$)
Channel – S_{Delay} DT = N/R
N → No of Bits
R → Transmission Rate
Channel – $F_{Brandwidth}$ = C/λ
C → Speed of Data
Λ → Wavelength in meters
S_{sum} = W1 * (S_{min} – BER) + W2 * (S_{max} – throughput) + W3 * (S_{min} – Power) + W4 * (S_{min} – inference) + W5 * (S_{max} – Spectral efficiency) + W6 * (S_{Delay}) + W7 * ($S_{Brandwidth}$)
S → Sensing function
Store S_{sum}
Calculate = Multimedia [Response – Time, Throughput, BER, Bandwidth, Delay]
Categorize – spectrum = quality [spectrum];
Select route path
SUS constructs RREQ message m
SUS broadcast m through channel to the neighboring SU
for all SU x which receives m
Receiver Send sender
While (SU Forward data ctrum)
if (PU interrupt spectrum)
SU → New Route
SU Hand off Data

4. RESULT AND DISCUSSION

Cognitive Radio is an effective technique for the desired communication parameters in order to control the spectrum radio. The conclusion obtained in QoS based routing method showed as a multi-media optimization handoff problem when the primary user comes closer to the data transmission. The algorithm used in this study is less time taken with a maximum packet delivery ratio.

Sensing Method	Sensing Time	Detection Performance	Complexity
Matched Filter	High	High	Medium
Radio Identification Based	Medium	Medium	High
Correlation	High	Medium	Medium

Table 1: Comparison of sensing methods

Table 1 shows comparison table of sensing methods between Matched Filter, Radio Identification Based and Correlation method. Here Matched Filter detection method is used for sensing available in PU spectrum.

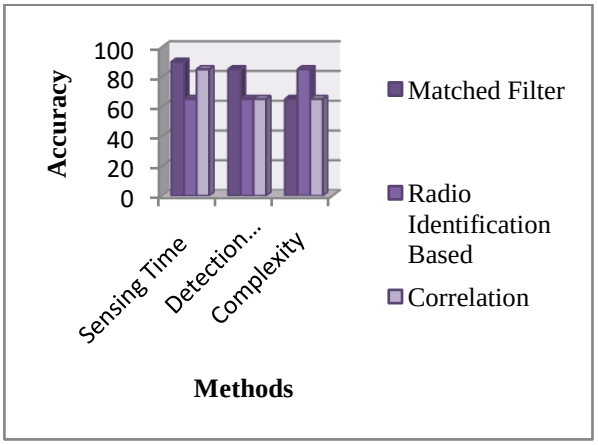

Figure 2: Accuracy comparison of sensing methods

This paper proposes a new QOS based novel routing algorithm for efficient handoff multimedia data during the disruption of the data by the primary user. Figure 2 shows comparison process of three methodswith sensing time, detection performance and complexity. Compare than other two methods Matched filter methods provides better accuracy on sensing time, performance detection and complexity. Matched filter methods shows 90%, 83% and 62%respectively for Sensing time, Performance detection and complexity. At the same way Radio identification methods shows 63%, 63% and 84% respectively for Sensing time, Performance detection and complexity.Correlation method shows 83%, 63% and 63% respectively for Sensing time, Performance detection and complexity.
In that way, the algorithm contributes efficient routing as well as the identification of the routing the secondary user spectrum which is disturbed by the primary users.

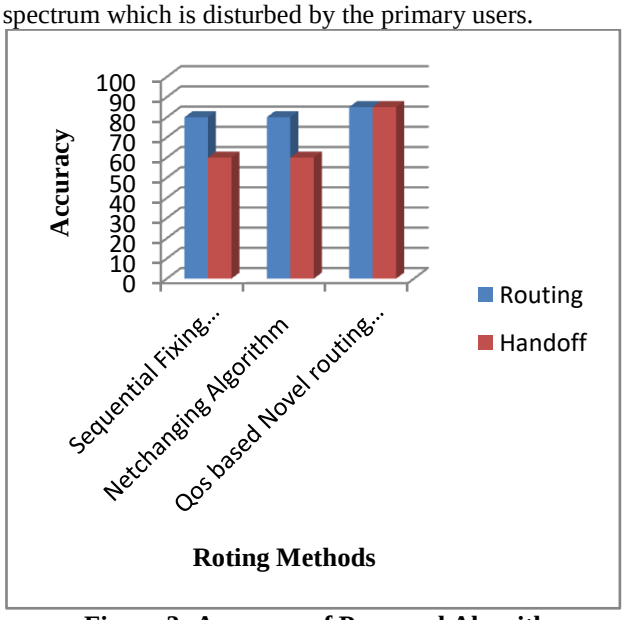

Figure 3: Accuracy of Proposed Algorithm

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Figure 3 gives a correlation of CR using the algorithm routing. The study derived a route for the QOS that is an aspect for handoff network which showed a better accuracy than any other algorithms. Compare than other two methods Novel QOS provides better accuracy for Routing(83%) and Handoff (83%). For Sequential fixing algorithm it shows 78% and 57% for Routing and Handoff. For Net changing algorithm it shows 78% and 56% for Routing and Handoff.

Figure 4: Nodes Plotting

Figure 4 shows sensing of each channel in the network. Once nodes plotted in network area, primary user, secondary user and channels are assigned. After that channel sensing is happened to find free channel in CGN.

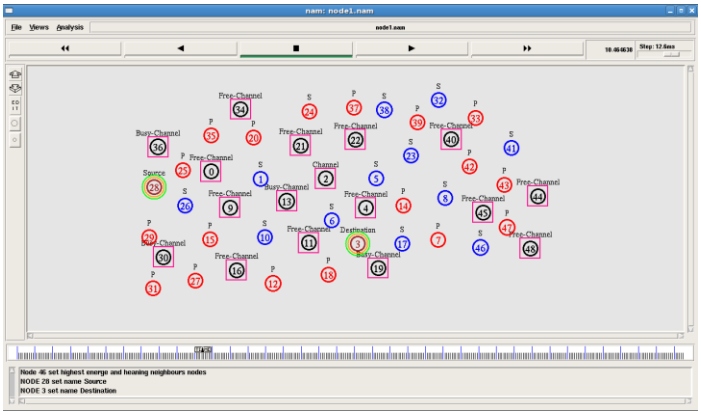

Figure 5: Source and Destination

Figure 5 shows source and destination selection process. After the process of channel sensing source and destination is selected for moving multimedia packet. Source and destination are selected from primary user.

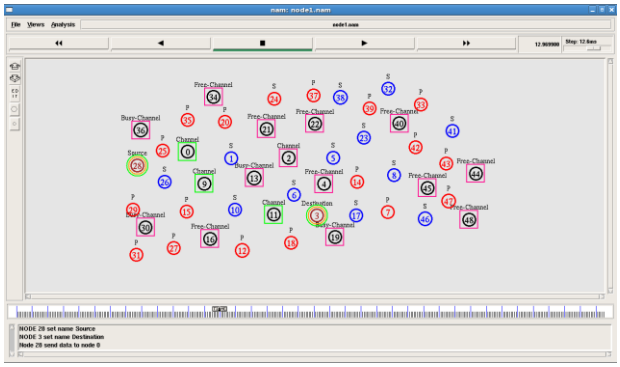

Figure 6: Channel selection for Source and Destination.

Figure 6 demonstrate channel selection process for multimedia packet moving. Each channel is selected based on the capacity of multimedia QOS parameter. If channel is not supported for Multimedia QOS parameter, this proposed method won't select that channel as a moving channel.

Figure 7: Primary user Interrupt

Figure 7 shows Primary user interruption when multimedia packet is moving from source to destination. If primary user interruption is occurred when packet moving time, channel sensing is achieved for identifying matching channel for QOS parameter.

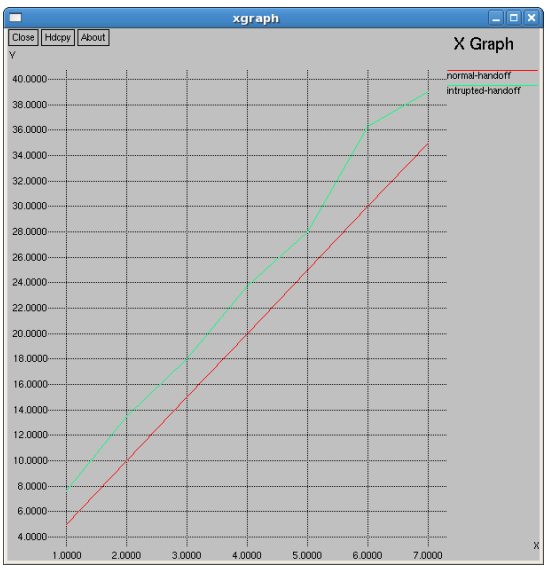

Figure 8: Comparison Graph

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Figure 8 shows comparison graph of normal handoff and interrupted handoff of multimedia packet moving. It shows time delay performance between normal and primary user interrupted handoff.

5. CONCLUSION:

Cognitive radio technology is a solving technique for the recent wireless network problems which uses the inefficiency spectrum with the finite spectrum availability. The spectrum channels are very complex and finding a route in their availability is a major problem in the CNs. Finding route for multimedia data with capable of QOS in CN is one of the main problems. To minimize this problems this work proposed novel QOS algorithm to maintain QOS for multimedia data when forwarding data by CN.This novel QOS routing algorithm find route in order to meet quality of service for multimedia data.In the present study, QOS routing algorithm is proposed for efficient handoff multimedia data which provides us a route for the better quality of the spectrum. Using this algorithm also capable of checking the multimedia QOS when the primary user enters into the secondary user's path which is a major cause of the multimedia data.

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