Improvement of Spectral Efficiency in Home Area Network using Cognitive Radio Algorithm

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Abstract—The faster development of wireless communications has made the spectrum ending up with increasingly with more shortage. The idea of CR was proposed to meet the problem of spectrum effectiveness. In the cognitive networks, the SUs are permitted to detect, distinguish and access the frequency bands that are not at present used by the PU's. the SU's must outfit with the spectrum access information to use the primary user's licence in the home region network. We propose a maximum throughput and power based cognitive radio for home region systems (HAN). At the point when there are different SU's and numerous channels, spectrum sharing must be taken into account. In this paper we additionally propose a system of multiple channel sensing. We consider the interference to PU brought about by the dynamic access and the erroneous spectrum sensing technique. We investigate the obstruction brought about by the secondary user's through a reestablishment hypothesis. Under the limitation of interference to primary user, the queuing theory is used to overcome this issue and to obtain the higher data rate of SU's. finally, it is demonstrated that the cyclostationary detection method can be improved when extra channels are accessible.

Index Terms: Spectrum sensing-HAN-Queuing model-Energy efficiency

I. INTRODUCTION

Cognitive radio is a radio that can identify the unused channels in the spectrum and runs more communication through the channel by changing the parameters. The first cognitive radio standard was IEEE 802.22 which was developed by 802 LAN/WAN standard committee. This standard includes geo location and spectrum sensing for identifying the spectrum. Geo-location identifies available channels whereas spectrum sensing identifies occupied channels. The frequencies that are not used in any channel are utilised by this spectrum. Some frequencies cannot be occupied by the cognitive radio such as white space frequency in the television channels.

The spectrum is measured and the results of this measurement indicates that the licensed spectrum was not utilised well while the unlicensed spectrum is facing more issues. To improve the spectrum utilisation efficiency, cognitive radio is used which allows unlicensed users to use licensed spectrum without causing disturbance to the licensed users.To sense the spectrum, various spectrum sensing methods are used. Here we used cyclo-stationary feature detection technique. This technique has some properties and feature that vary according to time. While comparing to other spectrum sensing methods cyclo-stationary method processes more noise immunity. So the cyclo-stationary method is preferred more than any other methods.

To improve the quality of service, Queuing theory is used. Queuing theory is the study of queues, queue lengths, waits times. In this theory, the first input will be served first.

II. RELATED WORKS

REFERENCE [1] focuses on spectrum utilisation efficiency of the Home region Network, Neighbourhood region Network and Wide region Network using grid system. In this advanced metering infrastructure is used. It improves the latency and throughput performance of Advanced Metering Infrastructure.

REFERENCE [2] focuses on cyclo-stationary method and bit error rates are calculated and compared for UMB channel model (CM1/CM2/CM3/CM4).

REFERENCE [3] focuses on various spectrum sensing schemes that are involved in cognitive radio. It differentiates the noise and primary signal.

III. SYSTEM ARCHITECTURE

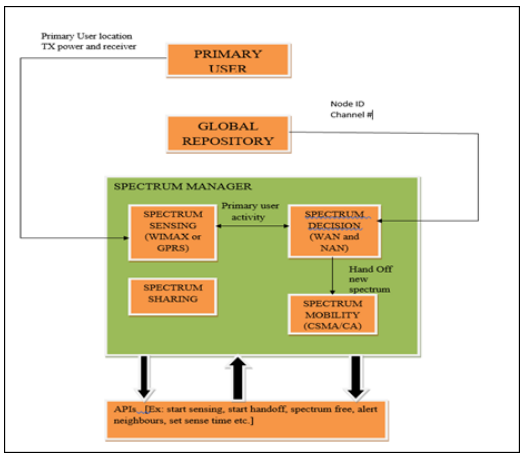

Fig.1. System Architecture

A. GLOBAL REPOSITORY:

It is a world wide repository that act like a centre point of area .it is utilized to store basic items that various engineers will use through easy routes. These items may grasp operational or application source definitions, reusable changes and mappings. where the hub ID and channel are made

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B. CYCLO-STATIONARY SPECTRUM SENSING:

In this type, to identify the presence of primary signal it uses the periodicity in the received primary signal. The cyclic auto correlation function of received signal is necessary. It performs better than any other detection methods in low SNR regions. It also improves the overall cognitive radio throughput.

C. SPECTRUM DECISION:

In the communication there will be huge number of spectrums. In order to satisfy the Qos and secondary users requirement we need to select a spectrum the process ofselecting the spectrum is referred as spectrum decision. Hence comparing the operation of spectrum sharing, we choose short range communication such as home area network (HAN)

D. SPECTRUM SHARING:

In some cases, the spectrum is not fully utilized by the licensed users. Then the secondary users use the unutilized spectrum it is referred as spectrum

sharing. For example, TV white space is an un used frequency spectrum and this can be shared to unlicensed users without any disturbances.

E. SPECTRUM MOBILITY:

When the licensed user does not uses the spectrum then the spectrum user is allowed to use the remaining spectrum without causing any disturbance to primary user and switches to next unused spectrum when ever the primary user appears. This process of switching to another idle spectrum is called spectrum mobility

F. COGNITIVE CLUSTER HEAD:

The cognitive cluster head is cable of using the channel in the cluster. Each CH will use diverse channel and attached to the node to carry the data.

IV. QUEUING MODEL ANALYSIS

The model we used in queuing theory is M/G/1 model. In this model the data is transmitted in the queue. Here we use first input first output algorithm. The data is sent in the form of packets. The packets that are transferred first will be served first and the other packets should wait in the queue until the first packet gets served.

In the M/G/1 model ‘M’ follows Poisson distribution process ,’G’ follows general holding time distribution and ‘1’ follows only one server.

To improve the performance of queue, there are few parameters.

- The number of packets that are waiting in the queue at the time gives the queue length of the system.
- The average time of packets that are waiting in the queue gives average waiting time.

V. RESULT

A. NODE FORMATION AND DATA TRANSMISSION

Data transmission take place between 6 primary nodes and 12 secondary nodes, where CH1 and CH2 nodes transfer data each other. The transmission of data is shown in python output screen.

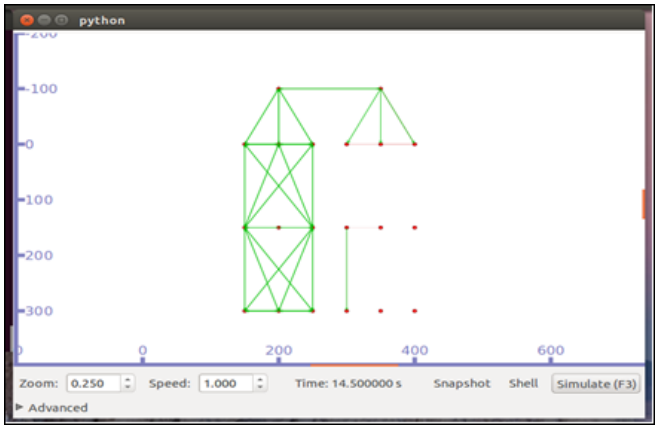

Fig.2 . The data transmission between the nodes and cluster head are linked.

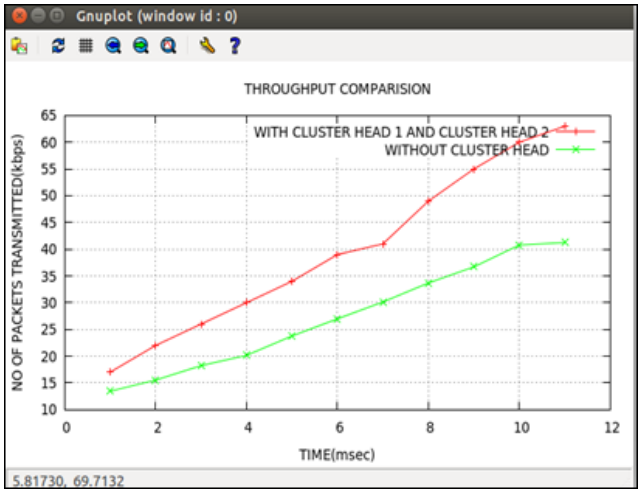

Fig. 3.Throughput comparison of the cluster heads

B. SPECTRUM SENSING BY CYCLO-STATIONATY FEATURE DETECTION

Here in home area network, 41 nodes were created. In that there are 8 primary nodes, 24 secondary nodes, 2 cluster head and 1 receiver. Additionally, we included filtering node. In case of any noise in the data transmission, it can be reduced by using filtering. The cyclo-stationary sensing method is used in data transmission.

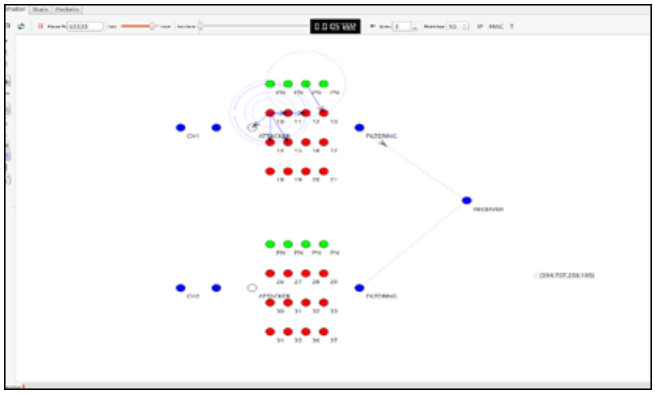

Fig.4. Data transmission in net anim.

C. ENERGY EFFICENCY :

Energy efficiency reduces the amount of energy required to transfer the data.

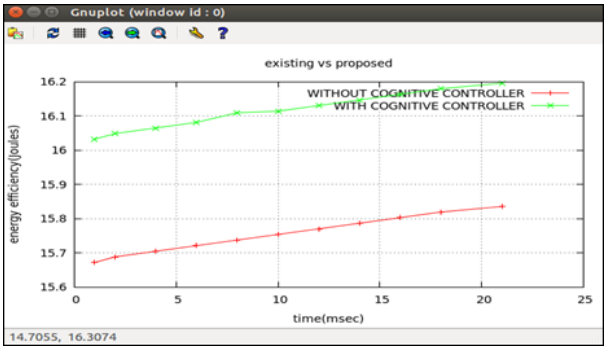

Fig.5. Energy efficiency for existing and proposed method

D. ARRIVAL RATE:

The arrival rate of existing and proposed method are compared and shown in below graph. In the existing method, we use Transfer Control Protocol (TCP) and File Transfer Protocol(FTP) whereas in proposed method , we use User Datagram Protocol(UDP) and Constant Bit Rate(CBR). Proposed method is more efficient method.

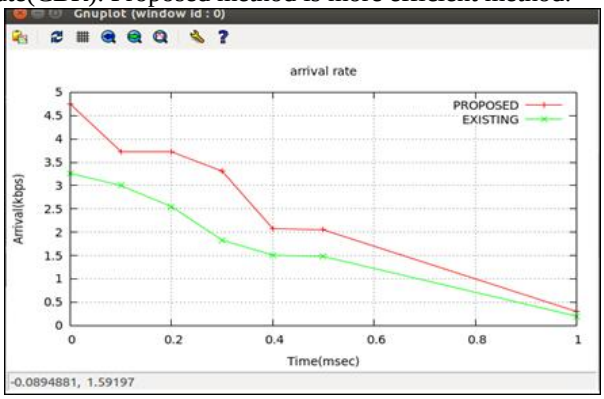

Fig.6.Arrival rate for existing and proposed methods.

VI. CONCLUSION

From the results, we can conclude that we have improved the spectrum utilization efficiency by 20%. We have achieved the quality of service. The arrival rate of the existing and proposed methods is calculated with the help of queuing theory. Based on the arrival rate, the priority of the nodes is decided. It identifies the shortest path among the nodes and the data is transferred through this shortest path. Filtering method is used to reduce the noise that is caused during the transferring of data. Through this projeenergy efficient communication is possible. Causedduring the transferring of data. Through this project, energy efficient communication is possible.

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VIII. AUTHORS PROFILE

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