EFFICIENTLY UTILIZE THE SPECTRUM AND LOAD BALANCING IN COGNITIVE RADIO NETWORK USING GENETIC ALGORITHM WITH COVERSET PREDICTION

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ABSTRACT

Wireless communication is one of the most in-demand fields of communication nowadays. Due to people's desire to transfer data as fast and broadly as possible, most communication processes are impacted by overloading and spectrum shortage when there is significant network usage. Make use of a cognitive radio network to keep an eye on things automatically, and use the spectrum dynamically to avoid overloading. Instead of evaluating the node's fitness, the CRN will alert the secondary user (SU) of the unused spectrum. To choose the fittest node in an environment with a coverage zone, a cognitive radio network in the proposed work uses a genetic algorithm plus coverset prediction. To address these issues, this paper offers a CRN calculation strategy.

INDEX TERMS: *Spectrum Sensing, Dynamic Spectrum Utilization(DSU), Genetic Algorithm, Coverset.*

1. INTRODUCTION

Wireless communication is extensively used in a variety of claims, including medical, civilian, and commercial applications. From all this area, the user wants to transmit data fast and immediately without interference.
In this situation, the main problem is spectrum scarcity, and the network is limited in its ability to sense the availability of unused fit nodes in the environment. For this, we need to automatically sense the environment and find the available node for transactions to use the Cognitive Radio Network (CRN). [1] The main aim of the CRN is to opportunistically select the availability of channels and dynamically utilise the spectrum. Particularly at the time when the R-user (reserved user) does not use the spectrum, the NR-user (non-reserved user) uses the spectrum with the idea of DSU, but at the same time needs to find a fitness node for the transaction to avoid delay. Finally, the coverset prediction is used to shape recognising the fit node in the coverage zone. By using these techniques, we can easily transfer the data without interference and increase the throughput.
The remainder of this paper is organised as follows: The linked tasks of detecting channel availability and locating the fit node with the coverage zone are covered in Section 2. Section 3 presents the suggested method, while Section 4 introduces the results. In Section 5, the paper is finally closed.

2. RELATED WORK

The author of [2] suggested that service providers share spectrum by using cognitive radio, which has been looked into. The spectrum sharing technique that enables providers of services to dynamically distribute their licenced spectrum is taken into consideration.
In heterogeneous networks, Kavitha and Kaniezhil [3] explain how to identify nodes for spectrum sharing and how to use them over time. We employ DSU without interference in this paper.
In order to identify the issue of mutual exclusion and perform read and write operations, Ramanuja Vedantham et al. [4] proposed a sensor with an actor network. They also proposed a localised and fully distributed approach, known as the approach, that effectively addresses the issue and its associated challenges.
[5] Rangaiah L. and J. Divyalakshmi presented A cognitive radio monitors the available spectrum in a cognitive radio cycle, gathers data about the available spectrum bands, and determines which ones are available. To estimate spectrum sensing, the identified properties of spectrum spaces are employed. Next, based on its attributes and the requirements of the user, the appropriate spectrum band is selected. After deciding on the operating spectrum band, communication can occur over this frequency range.
The Federal Communications Commission (FCC) reports that the authorised spectrum is still underutilised, as the writers of [6] claim [3]. Cognitive radio networks have been created to address this problem by opportunistically utilising the spectrum of countless user networks.
Using GA, the authors of [7] suggested a routing strategy that improves network quality. Numerous eventualities, such as node failure and mobility speed, have been taken into account in this work. The network's performance was enhanced in comparison to alternative protocols. It was not, however, regarded as a problem with energy usage.
The obstacles and issues that are explored include spectrum unpredictability (channel diminishing or shadowing), limits on signal interference, and noise certainty, as proposed by the author, Samriti Kalia [8]. Prior to allocation, the CR node senses the spectrum.
The author of [9, 10] explains how a GA works in networking to choose the most efficient routes with the greatest fitness values. The notion of choosing the most efficient route with the least amount of energy consumption and the least amount of travel was introduced in [9] with the proposal of FF-AOMDV.
The association among the network penetration rate and the sensor utilisation rate was examined by the author [11]. Proposed is ECSS, an effective algorithm for selecting cover sets that is based on enhanced NSGA-II. Two limitations are applied in this: the number of working nodes selected from the entire network and the intended coverage rate of the network. It provides several significant benefits, such as minimal computation time and a single reset of all sensor node statuses.
In [12], the author provides a genetic algorithm-based target coverage scheduling strategy that can choose the best cover sets to increase network lifetime while employing the evolutionary global search method to monitor every target. It's employed to sense or locate the fit.
Seema Dev Aksatha et al. [13] suggested a calculated strategy for CR-based WSNs, enhancing the energy efficiency by employing the EECSP algorithm's coverset prediction. They also suggested various strategies to get around the challenges. When an EECSP method is used on a level network, the suggested coverset prediction can enhance network performance, and energy-based grouping, as it has been seen, can enhance the packet delivery ratio.
[14] This article examines the target handling problem in a directional sensor network, where targets are attached with varying coverage quality criteria and directional sensors are free to move around their centres. Maximising the sensor network's lifespan while meeting each target's requirements for coverage quality is the primary objective.
[15] The author represents the Three distinct groups—region coverage, targeting coverage, and boundary coverage are used to group the coverage problem. One of the biggest issues facing wireless sensor networks is the coverage issue. In this particular context, two essential features of a WSN are coverage and connectivity, which are connected. A distributed linked coverage algorithm was proposed. This algorithm aimed to decrease the number of active nodes in order to save energy and lengthen the network's lifespan. To establish a dominant set of networks is the fundamental objective of this method. The technique can successfully increase the network's lifetime by regularly recreating the dominating set.
[16] In order to monitor a group of discrete targets and increase the network lifetime, the author suggested one solution. In order to ensure that only a certain amount of functioning sensors can maintain temperature, it entails scheduling sensors

to switch between active and inactive states. An effective scheduling technique that can group sensor nodes into many cover sets so that each cover set can keep an eye on every targetTo attain a fair balance between targeted coverage and energy usage, a novel wireless sensor network that provides energy-efficient coverage technique based on a genetic algorithm is described in [17]. All targets could be k-covered using the fewest locations that could be found by applying this strategy.

An innovative algorithm that generates both non-disjoint and disjoint cover sets is proposed by Anvesha Katti [18]. Our suggested method provides the energy-optimized minimal route from the sink to the sensor node as well as from the cover set to the sink in addition to creating cover sets to track targets.

3. SYSTEM MODEL

A. COGNITIVE RADIO PROCESS

A cognitive radio that may be dynamically constructed and programmed is known as an intellectual radio. It automatically finds available channels in the wireless spectrum and adjusts their broadcast or reception qualities to enhance the number of wireless broadcasts active at once in that band. Dynamic Spectrum Utilisation is the process of opportunistically choosing the available channel (DSU). Cognitive wireless protocols fall into two categories: spectrum sharing and spectrum sensing. The SU is liable for locating and broadcasting spectrum opportunities in the absence of the PU. In the former case, SUs exchange spectrum in order to avoid causing significant interference to primary receivers. In such systems, a Medium Access Control Layer Protocol (MACLP) which can divide the spectrum among unlicensed users appropriately is required.

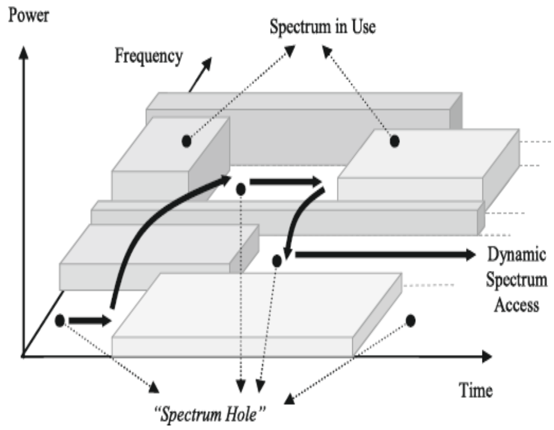

Figure 1. CRN- Dynamic Spectrum Access

B. GENETIC ALGORITHM WITH COVERSET MODEL

A search-based programme known as the Genetic programme (GA) establishes principles from genetics and congenital selection. This is an ingenious way to concentrate the search on regions in the solution space that perform better by combining random search with historical data. It is commonly used to generate logical recommendations for efficiency and search-related problems.

Algorithm for CSCRGACP (CHANNEL SELECTION COGNITIVE RADIO GENETIC ALGORITHM WITH COVER SET PRETICTION)

The proposed method **CSCRGACP** can be described in the following steps,

Step 1: Primary user position=OFF (currently not use spectrum for transaction)

Step 2: Secondary user position = ON →(Now start to use the PU's spectrum)

Step 3: CR node → spotted the availability node and set-up the route for data transmission then send to the BS

Step 4 : If CR route > 1

{

Result=BS send shortest distance to the SU

}

Else

{

Result= BS send available route to the SU

}

Step 5: After getting the channel availability find the fit node based on GA process.

Step 6: All the fit nodes are shaped into the coverage zone

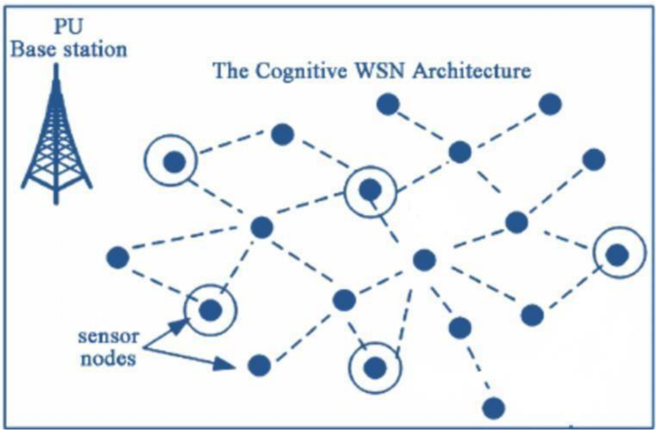

Figure 2. **CSCRGA**

Requesting a service from the BS will reveal which channels are open. The BS will forward the channel entry to the CR node upon receiving a service call from the mobile nodes. The CR node sends the information to the nearby CR node after receiving the channel entry. A neighbouring CR node receives the broadcast message and relays the list of available channels to the base station. The CR node and its neighbours update the channel obtainability list, after which the BS receives a response. In the event that the CR node replies, the BS selects an available channel and uses it to transmit a service response to the mobile nodes. This illustrates how to make the most of a channel.

4. SIMULATION AND RESULT

In this segment, the performance of the total system efficiency has been assessed using NS2 simulator.

Constraints for Simulations Process	**Values**
Simulation Period	60 second
Number of Nodes to Use	300
Amount of CRI (Cognitive Radio Interfaces)	3
Quantity of Primary User	10
Sum of Secondary User	30
Speed in Use	20 m/s
Packet Size	1024 bytes

Table 1. Simulation Constraints

The data broadcast chart's interval vs. delay is displayed in Figure 3. The transmission delay is indicated by the Y-axis, while the interval time is represented by the X-axis.

It is the typical time for a data packet to be transmitted over a network from its source to its destination. It also takes into account the time lag resulting from the queue in the information package broadcast and the route detection procedure. The only packets that were computed were those that were successfully delivered to their destinations.

End to End Delay = ∑i (Arrive time – Send time) / ∑i Number of Connections

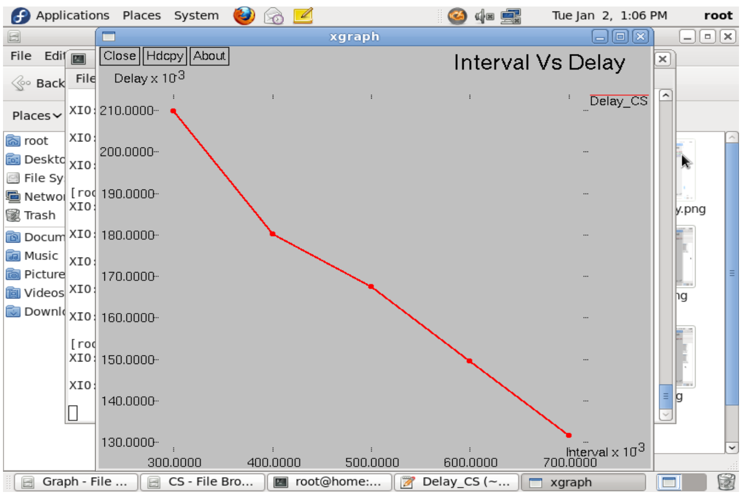

Figure 3. Data Transmission Delay Chart.

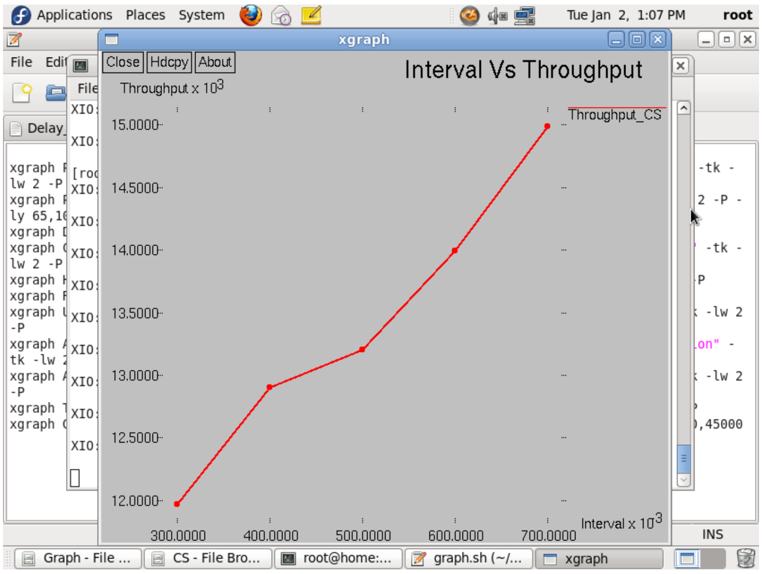

Figure 4. Throughput Chart.

Throughput, the primary quality-of-service stricture in wireless networks, is shown in Figure 4. It is the typical data transfer rate over the course of a data connection. It can be defined as the mean quantity of bits transferred or received for each request for data during the average length of the data transfer. The throughput to be calculation between average duration of data transfer per data request into average data send or received.

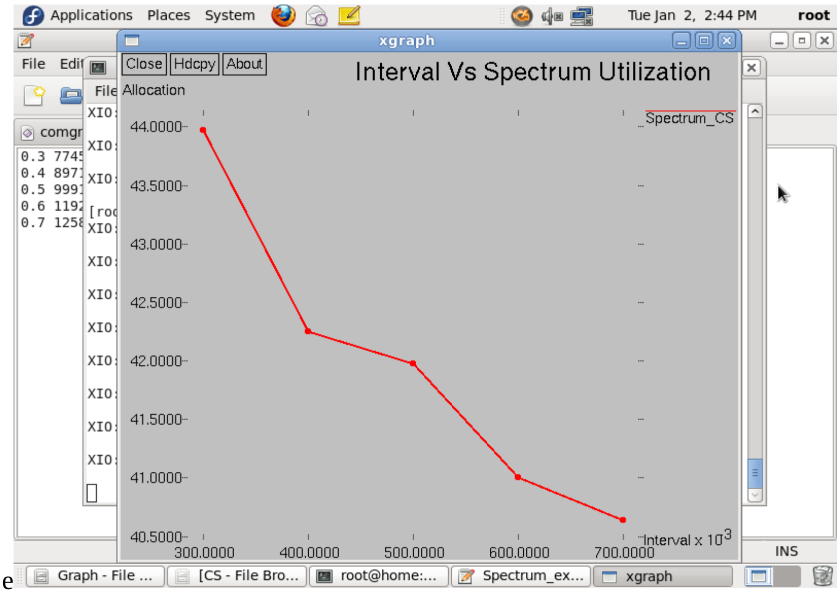

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Figure 5. Spectrum Utilization

Figure 5 demonstrates the ingesting of the spectrum in the proposed work, which is progressed from underutilization of the spectrum using CR. so that act and usage of network processes will increase. It also shows the goodput of transaction.(i.e., total transfer time into size of transmitted data to be calculated).

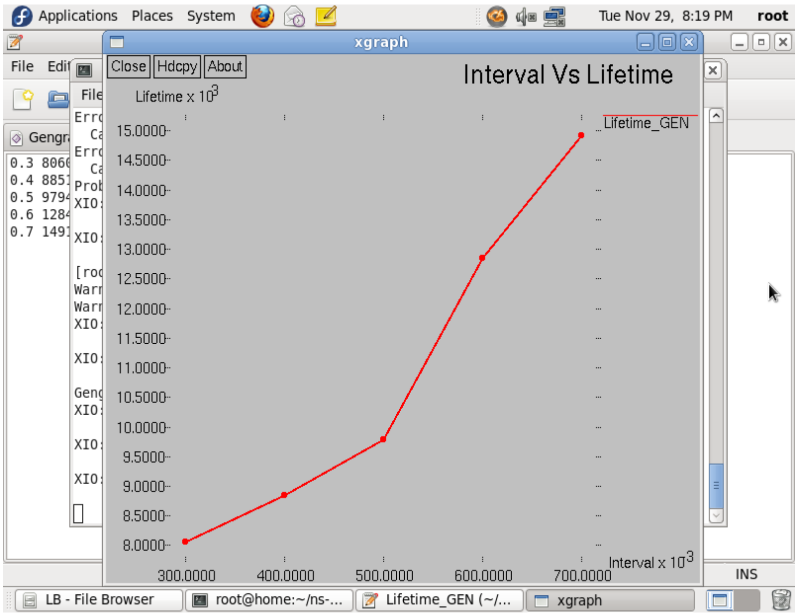

Figure 6. Channel lifetime

The lifetime of a node, or the quantity of packets transmitted to or from a node, is displayed in Figure 6. This metric's most easily quantifiable predictor is this one. The longest possible network lifespan would be ensured by a network set up that minimises the total node load.

5. CONCLUSION

The lifespan for the spectrum in activities will be extended by the use of CRNGACP. Reenactment results show that whenever an algorithm is used to a particular level system and energy-based grouping, using the suggested coverset prediction can enhance network performance. Transmission power regulation appears to be helpful in increasing throughput and reducing latency. Improved network performance from beginning to end is accomplished by taking into consideration distinct spread models for further dissection in more plausible conditions, in order to improve the evolutionary algorithm fit nodes control technique.

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