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Research Article

COCO: Coherent Consensus Schema For Dynamic Spectrum Allocation For 5G

C. Rajesh Babu[1], **Kadiyala Ramana**[2], **R. Jeya**[3] **and Asadi Srinivasulu**[4]

[1] *Department of Network and Communications, SRM Institute of Science and Technology, Chennai, India*
[2] *Department of Information Technology, Chaitanya Bharathi Institute of Technology, Hyderabad, India*
[3] *Department of Computing Technologies, SRM Institute of Science and Technology, Chennai, India*
[4] *Data Science Research Lab, BlueCrest University, Monrovia, Liberia*

Correspondence should be addressed to Asadi Srinivasulu; head.research@bluecrestcollege.com

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Numerous wireless technologies have been integrated to provide 5th generation (5G) communication networks capable of delivering mission-critical applications and services. Despite considerable developments in a variety of supporting technologies, next-generation cellular deployments may still face severe bandwidth constraints as a result of inefficient radio spectrum use. To this end, a variety of appropriate frameworks have recently emerged that all aid mobile network operators (MNOs) in making effective use of the abundant frequency bands that other incumbents reserve for their own use. The proposed COCO model for Dynamic Spectrum Allocation (DSA) has 2 functionalities such as 1. Coherent PU-SU packet acceptance algorithm for Secondary User (SU) in DSA. 2. Consensus Algorithm for PU-SU Channel Reservation in DSA. To enable a 5G service with one-millisecond latency, interconnection ports between operators are expected to be required at every base station, which would have a significant influence on the topological structure of the core network. Additionally, just one radio network infrastructure would need to be created, which all operators would then be able to use. We allow change of PU SU characteristics to satisfy the needs of new services. These modifications are accomplished via the use of Coherent and Consensus Algorithms that regulate PU and SU through negotiation and allocation procedures. Our primary objective was to decrease interference, handoff latency, and the chance of blocking. In this paper, we describe our idea for employing COCO Model to address the issues of spectrum mobility, sharing, and handoff for Cognitive Radio Networks in 5G.

1. Introduction

In order to meet the technical requirements for 5G, the sub 1 ms latency rate must be achieved. Content must be supplied from a location near to the user's device if a delay time of less than 1 millisecond is required. In order to provide a service with such low latency, content must be placed extremely near to the client, potentially at the base of every cell, including the numerous tiny cells that are expected to be important in achieving densification needs [1].To enable a 5G service with one millisecond latency, interconnection ports between operators are expected to be required at every base station, which would have a significant influence on the topological structure of the core network [2]. Additionally, just one radio network infrastructure would need to be created, which all operators would then be able to use.

Figure 1 illustrates the "overlay distribution" strategy by radio regulating bodies, which allows wide access to the majority of the frequency band, even if the frequency band is authorized for a certain application. Uncoordinated use of spectrum in both the time and frequency domains can be achieved by using the overlay information exchange. Techniques are used to disperse the generated signal across a wide range of frequencies so that existing licensed radio equipment does not detect an unacceptable level of power [3]. Examples of these approaches include frequency hopping, Multiplexing, and Ultra-Wide Band. This kind of

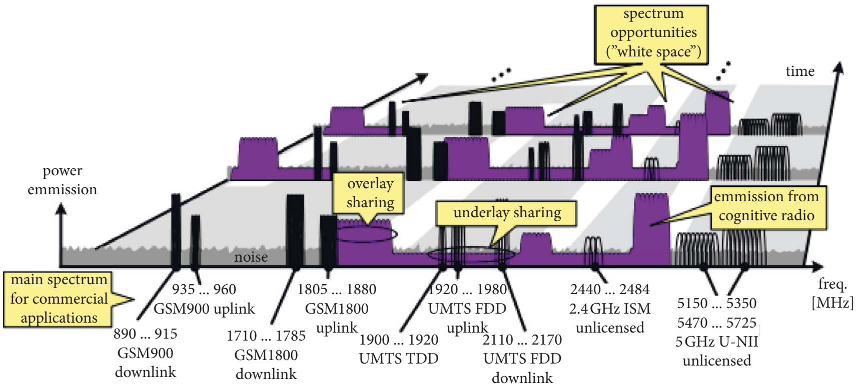

Figure 1: Cognitive radio and spectrum management in 5G.

interference is minimized by placing rigorous limits on the transmission power in the underlying dynamic spectrum.

1.1. Motivation for the Work. The Primary and Secondary users' activation and addition are dynamic with the fluctuating modalities of their interest and their requirements. The resource availability changes according to the usability, and the spectrum wastage occurs due to unused spectrum utilization. A dynamic spectrum sensing and sharing framework based on user needs is the need of the hour topic in Cognitive Radio [4]. There are disruptions possible while providing effective and efficient services meeting the QoS aspects. There is a precondition required to understand the users' requirements with a satisfactory resource provisioning mechanism along with validation with artificial intelligence in place, which remain a community hole to be filled through research.

2. Related Work

Liu et al. (2020) [5] presented a blockchain-based safe FL architecture for creating smart contracts and preventing hostile or untrustworthy parties from participating in FL. To fight against poisoning assaults, the central aggregator identified harmful and untrustworthy individuals by automatically executing smart contracts. Furthermore, membership inference attacks are prevented using local differential privacy approaches. The proposed approach, according to numerical findings, may effectively prevent poisoning and membership inference attacks, thereby boosting the security of FL in 5G networks. According to Rubayet Shafi et al. (2020) [6], Resilience, performance, and complexity were major technological hurdles to overcome while using AI in 5G and beyond 5G. Beyond-5G and sixth generation (6G) networks with AI-enabled cell networks were presented as a possible roadmap for future research to identify top challenges such as training issues, lack of bounding performance, and uncertainty in generalization, as well as a possible roadmap to realize the vision. In order to safeguard the user's identity and location, Hui Li et al. (2019) [7] implemented UGG, IPP, and LPP algorithms in the SBMs upload of a blockchain-based VANET. Two factors were used to assess the availability of k-anonymity unity: connection and average distance. Extensive simulations have shown the effectiveness of a blockchain-based VANET. The simulation took into account a number of elements, such as system time, average distance, connection quality, and privacy breaches. In terms of processing time, the suggested design outperforms the current designs, according to the simulation results. They also demonstrate that their proposed architecture provides a higher degree of privacy for their users' identities and locations. Huijuan Jiang et al. (2019) [8] proposed a distributed user association strategy based on multi-agent reinforcement learning to offer load balancing for cognitive radio networks with several independent APs. APs used reinforcement learning to find the optimum user association rules in the technique they proposed. It is portrayed as a dynamic match game between the APs and SUs. Every iteration, the APs picked which SUs they wanted to be associated with, and the SUs then choose which AP they wanted to be affiliated with based on all the APs' offers. Comparing the suggested multi-agent reinforcement learning technique to the classic max-SINR method, simulation results demonstrate that system performance is greatly improved while excellent resilience is maintained by the latter. According to Semba Yawada et al., (2019) [9] the spectrum mobility in cognitive radio networks has many key aspects. Despite the difficulty of upkeep and upgrading, the novel methods to mobility and connection management attempt to decrease latency and information loss during spectrum handoff. The reasons for spectrum handoff and the methods that lead to it were examined. Protocols have been developed to show how the handoff process works. The different spectrum handoff methods were compared. The suggested technique outperformed the pure reactive handoff method in simulations. There are still many unanswered questions about software-defined networks in 5G and 6G networks that have yet to be addressed by Long et al. (2019) [10]. (SDN). SDN technologies are utilized to introduce 5G and 6G mobile network system designs. It was thus necessary to draw attention to the main issues and common SDN-5G/6G application scenarios. There are also comparisons and descriptions of three kinds of software-defined 5G/6G mobility management frameworks. We took a look at how wireless cellular networks handle interference right now. An overview of interference control techniques was provided in SDN-5G/6G. For software-defined 5G and 6G networks, the mm-Wave spectrum, the absence of standard channel models, huge MIMO, low latency and Quality of Experience (QoE), energy efficiency, and scalability are all investigated. According to Daniel Minoli et al. (2019) [11] in IEEE Spectrum, IoT applications in Smart City environments face a number of challenges, including the requirement for small cells and millimeter-wave transmission issues, building penetration issues, the requirement for Distributed Antenna Systems, and the near-term introduction of pre-5G IoT technologies such as NB-IoT and LTE-M, which could serve as proxies for commercial deployment and acceptance of 5G. An improved target channel selection method was developed by Atif Shakeel et al., (2019) [12] in order to facilitate spectrum handoffs among the SUs in a CRAHN. It was recommended that SUs be organized during channel access according to the shortest job first idea using an improved frame structure that facilitates in cooperation among them in an ad hoc setting. By enabling SUs affected by inaccurate channel state predictions to compete for channel access within a single transmission cycle, the proposed system improves throughput over previous prediction-based spectrum handoff techniques. Since there are less collisions in the proposed method, it outperformed conventional spectrum handoff techniques in terms of throughput and data delivery time. Priority was given to Base Stations, PUs, and SUs in addressing the issue of spectrum resource distribution, according to Wang Bin Song et al. In the research, a multi-layer network model and a multi-agent system model were introduced. The RF Plan's BS structure and the number of Base Stations were both reduced thanks to the use of MAS for resource distribution. Designing a stratified multi-layer Multi Agent System that works in a dispersed environment and provides higher network performance while using less power is the research gap highlighted. A network environment for algorithm simulation is set up by Xiaomo Yu et al (2022) [13], after which they analyse the overall performance of the improved genetic algorithm and investigate the influence of genetic algorithm-related parameters and network environment-related parameters on the overall performance of the algorithm. The findings demonstrate the effectiveness of the enhanced genetic algorithm. It is possible to enhance network efficiency by approximately 2% while simultaneously reducing the frequency of spectrum switching by approximately 69%.

The summary of related work is shown in Table 1.

2.1. Research Gap.

2.1. Research Gap. The basic purpose of cognitive radio is to detect interference on the channel that will be shared, as well as to protect the mobile user (PU) from interference. Due to the passive nature of cognitive radio, there is currently no practical means for identifying its impact on a given channel. According to popular belief, recognising PU signals is the same as finding spectrum possibilities, which is not the case [14].

3. Dynamic Spectrum Management Framework

As shown in figure 2, the DSMF incorporates the important components of a Licensed Spectrum Access domain. The Spectrum Manager is composed of 2 sub system blocks namely, Request Manager, which does the management of prioritizing based on DSA domain spectrum application rules, and Radio Spectrum Resource component, computes accessible resources for allocating the PU, on the basis of spectrum application rules and details saved in a Repository [15]. Regarding the PU block, a multi-PU channel is applied where a licensed system has User Equipment or UE associated to PU's Base Station (BS) provides optimal power which is received. Primary users, the DSA Repository, the DSA Spectrum Manager, and a number of Secondary Users are all implemented in the DSMF. Spectrum sharing policies may be implemented in both macro and small-cell scenarios using the framework's techniques for centralized and distributed allocation of resources. There are two separate modules in the Spectrum Manager, one for managing priority based on DSA spectrum use rules, and one for calculating available resources for Primary Users based on spectrum consumption rules and data stored in the Repository. It is now possible to have each UE (User Equipment) in the licensed network associate with the Base Station (BS) that offers the strongest received power for the PU frame, which is currently the case. The Secondary User's behavior is recorded in the DSA Repository as an array of "pixels." Each SU relates to a specific DSA channel since there is only one array for each DSA channel. It is necessary for DSA licensees to comply to an Interference-to-Noise Ratio (INR) of -6dB inside the SU's zone of protection. By sharing resources that might otherwise go unused, DSA aims to increase the framework's utility [16]. It is possible that greedy operators may pursue their own interests at the expense of other Research on node misbehavior was conducted utilizing the cognitive radio analogy. An analysis of a fictional cognitive radio system revealed that hostile or selfish nodes may engage in acts to disrupt or enhance their own value in the community of cognitive radio nodes. For enforcing shared access agreements both before and after the fact, the authors provide a variety of options. It is hoped that the preventative measures and punitive measures would inhibit tampering with the devices' software and hardware layers, while the latter is designed to identify and punish disobedient users. Instead, we advocate for the creation of a grading system to keep tabs on the DSA's behavior.

4. Network Model

The model analyzes a single channel Cognitive Radio Network. As in practice, with the consensus policy with mobile network operators, the arrival of PU in a channel is arbitrary and has the right to access the channel. SU packets come in two forms: SU1 packets and SU2 packets, and they're both utilized by the system. Priority is given to SU1 packets over SU2 packets. When it comes to taking up a single channel, the PU packets of the system take precedence. Additionally, this research makes the assumption that the spectrum sensing for the SUs is optimal. This suggests that the system model does not take into account the interactions between distinct SUs.

There is, in fact, to limit the contention of SU flooding over the channel, a Secondary User buffer prepared for packets from Secondary User2. If the channel is already full at the time of an incoming Secondary User2 packet, the newly arriving Messages from Secondary User2 will be held

Table 1: Related work Summary.

Reference	Proposed Technique	Allocation/ Sharing/ Sensing	Centralized/ Distributed	Simulation/Frequency Band	Efficiency	Parameters Improved
[5]	Blockchain-based safe FL framework has been presented by the authors in order to build smart contracts and prohibit malevolent or unreliable FL players.	Sharing	Centralized	MATLAB	Improved	PU Arrival Service time Number of Hand-offs
[6]	AI-enabled cellular networks for Beyond-5G and 6th generation (6G) networks are on the horizon.	Sharing	Centralized	Google Tensorflow on MNIST dataset and CIFAR-10 dataset, respectively.	Improved	Data Accuracy
[7]	SBMs are uploaded to the blockchain-based VANET in a revolutionary decentralized architecture employing blockchain technology that integrates UGG, IPP, and LPP algorithms with the method of dynamic threshold encryption and k-anonymity unity.	Sharing and Allocation	Centralized	-	-	AI-enabled fault identification Self-Recovery Mechanism
[8]	User association rules are learned via a reinforcement learning process by access points on their own in order to pick secondary user protocols for handoff and mobility management.	Sharing/ Privacy Protection	Distributed	MATLAB	Improved	system time, average distance, connectivity,
[9]	Protocols for Handoff and Mobility Management	Sharing and Allocation	Distributed	Simulated OFDM based CR	Improved	System Throughput SU Transmission Rate
[10]	Examined new 5G and 6G software defined networks (SDN) technology, which encompasses system design, resource management, mobility management, and interference control. SDN is a cutting-edge technology.	Sharing	Distributed	MATLAB	Improved	Bandwidth Collision Probability Delay
[11]	The millimeter wave spectrum must be addressed in order to accommodate high data rates in 5G cellular technology.	Sharing	Distributed	MAC Protocol from IEEE 802.11a	Improved	Collision with SU Extended Data Delivery Throughput
[12]	The spectrum handoff between SUs in a CRAHN is improved using an upgraded frame structure that promotes coordination among SUs based on an imperfect channel state prediction.	Sharing and Allocation	Distributed	Deployed a Hierarchical Multi Agent System Model for 5G	Improved	Channel Resource Allocation
[13]	A new paradigm for 5G cellular communication networks has been proposed, which balances resource distribution between main users, secondary users, and base stations.	sharing	Distributed	MATLAB	Improved	Switching probability

in the Secondary User2 buffer until they are ready to be sent out. To configure the buffers for Primary User and Secondary User1 packets, there are no alternatives Because Primary User packets have the greatest priority, if a Primary User packet arrives while a Secondary User packet is being sent, the transmission of the Secondary User packet will be immediately halted. For the sake of efficiency, the transmission of a freshly received Secondary User1 packet may only be temporarily halted by another Secondary User1. In both Secondary User1 and Secondary User2 packets, the interrupted packet's heightened need for transmission continuation causes both to become impatient. If a Secondary User packet is stopped during transmission, it will not be saved in the system and will not be able to be sent

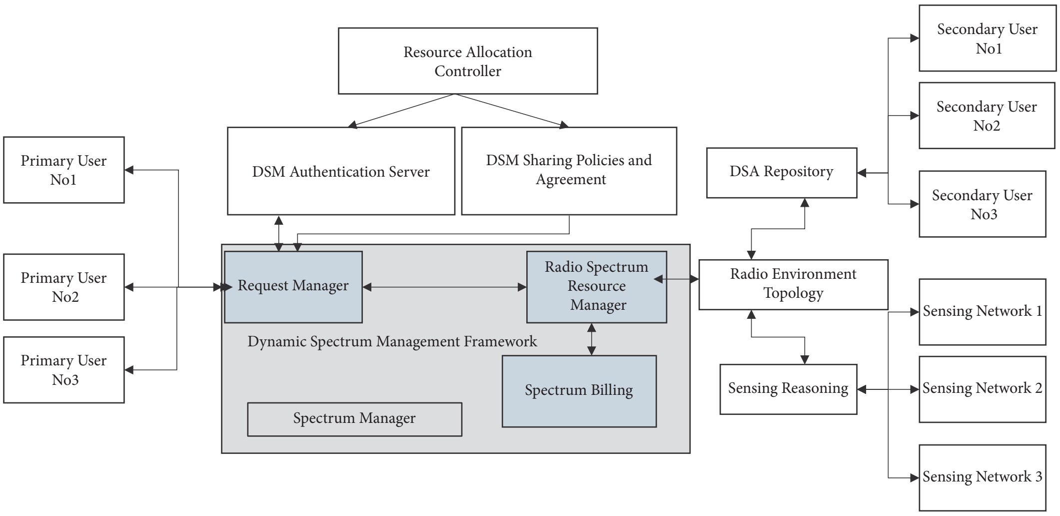

Figure 2: Dynamic Spectrum Management Framework.

again. It is possible for Secondary User packets to exit the system and broadcast on another open channel if they are interrupted. In light of the digital nature of current networks, the discrete-time Markov chain model shown below may be constructed by using the spectrum allocation approach described above. R = 1, 2,... is a convenient way to represent the division of time into equal-sized slots on an axis. Estimated arrival rates of Primary User, Secondary User 1, and Secondary User 2 packet transmission rates are predicted to follow geometric distributions at intervals determined by their respective rates of service μ_1, μ_{21}, and μ_{22}. If PU arrives back in channel, it is the responsibility of the algorithm to release the channel from SU to PU.

A system with a large number of Secondary User2 packets, a large number of Secondary User1 packets, and an even larger number of Primary User packets may be described by the following equation: A three-dimensional process comprised of the number $S(2)$ of Secondary User packets, the number $S(1)$ of Secondary User1 packets, and the number Pn of Primary User packets may be used to abstract the changes in the number of distinct packet types in the system. A discrete-time three-dimensional Markov chain is thus formed by $S(2)$, $S(1)$, and Pn. The state-space of $S(2)$, $S(1)$, and Pn may be expressed using the model assumption mentioned before.

$$\theta = \{(K,0,1) \cup (K,0,0) \cup (K,1,0)\colon\ 0 \le K \le \infty\}. \qquad (1)$$

5. EVALUATION OF MODEL

Assume that P is the probability matrix of state transitions in the Markov chain S(2), S(1), and Pn. The system model implies that the buffer capacity of Secondary User2 packets is limitless in order to accommodate additional Secondary User2 packets in the system. A consequence of this is that P is unlimited in its size by the number of packets experiencing state change for Secondary User2. Here's an example of how you can represent P and it is shown in (1).

$$p = \begin{pmatrix} a & b & & & \\ d & a & b & & \\ & d & a & b & \\ & & \ddots & \ddots & \end{pmatrix}. \qquad (2)$$

Secondary User1 packet transmissions are unaffected by Secondary User2 packets in the analyzed cognitive radio network with categorized Secondary Users and impatient packets. The primary and secondary user1 packet transmission operations may be seen as a single-server pure losing priority queueing architecture.

The transmissions of the Secondary User2 packets, on the other hand, are impacted not only by the transmissions of the Primary User packets, but also by the transmissions of the Secondary User1 packets. As a consequence, the performance of Secondary User2 packets will be the exclusive emphasis of this section. The γ rate of interruptions, throughput, and average latency of Secondary User2 packets are among the key performance measures that we create algorithms for. The number of Secondary User2 packets that are interrupted and leave the system per slot is what is meant by the interruption rate for Secondary User2 packets. The rate at which Secondary User2 packets are being interrupted may be described as in (3):

$$\gamma = \sum_{a=0}^{\infty} \pi_{a,0,0}\mu_{22}\left(1 - \lambda_{21}\lambda_{22}\right). \qquad (3)$$

The throughput ϕ of total number of the Secondary User2 packets successfully sent per slot is defined as Secondary User2 packets. A Secondary User2 packet may be successfully broadcast if and only if it is not interrupted during transmission. Equation (4) may be used to describe the throughput of packets transmitted by Secondary User2:

$$\phi = \lambda_{22} - \gamma. \qquad (4)$$

The average delay β in arrival of a Secondary User2 packets and their exit from system is defined as the Secondary User2 packets. Little's calculation for the mean delay of Secondary User2 traffic is expressed in (5)

$$\beta = \frac{E[SU2]}{\lambda_{22}}, \tag{5}$$

where the system's mean SU2 traffic in steady-state is denoted in (6)

$$E[SU2] = \sum_{a=0}^{\infty} \pi_{a,0,0} + \pi_{a,0,1} + \pi_{a,1,0}. \tag{6}$$

The Secondary User2 packet cannot ascertain the total traffic in the CRN prior to making a decision. If a Secondary User2 successfully sent a packet, it may receive the reward indicated by R, but if it decides to join the system, it incurs the penalty indicated by C per slot. If a single Secondary User2 packet elects to join the system, the Secondary User2 packet's individual net benefit function We(λ_{22}) may be expressed in (7)

$$We(\lambda_{22}) = \left(1 - \frac{\gamma}{\lambda_{22}}\right)R - \beta C. \tag{7}$$

6. Coherent Pu-Su Packet Acceptance Algorithm for DSA

In contrast to standard cognitive radios, adaptive transceivers transmit data using "dynamic" resources, which are always changing. In order to make use of this special quality of cognitive radio systems, the proposed adaptive algorithm distributes bandwidth for individual traffic regarding the knowledge of congestion queues' Quality of Service standards and the related data of the currently available spectrum. As an added bonus, the suggested method, which is applicable to multimedia applications that generate both genuine and quasi traffic, dynamically adapts the distribution probabilities between actual and potential real-time traffic based on the fluctuation of accessible spectrums.

To minimize the latency of SU packets, they are allocated a limited buffer with a capacity of N (N > 0). On the other hand, no buffer is supplied for the PUs, ensuring that the PUs' latency requirements are satisfied to the maximum degree feasible [16].

1. In an adaptive admission control strategy, the central controller counts the number of packets in the system on a regular basis. A fresh SU packet will be accepted or rejected by the system's central controller based on its likelihood with acceptance probability as $\beta = 1/(\lambda + 1)$ or reject it with probability β to the packet count of the system multiplied by the Coherent Factor. The system access probability is inversely proportional to the system packet count.
2. When an SU packet is permitted into the system, it is queued in the buffer if the channel is currently in use by another packet. If the buffer is full, this SU packet will be terminated.
3. To prevent conflict, the newly coming PU packet will be stopped if the channel is already in use by another packet of the same type [17]. If a packet of the same type is already in use by another PU, the newly arriving PU packet will interrupt this SU packet's transmission and take over the channel.

A packet from an SU that was in transit is returned to the SUs' buffer and placed at the front of the queue if the transmission was interrupted. If the buffers of the SUs become full, the system will force the last SU packet queued to exit. Since there is only one gap in the buffer when a fresh admission of an SU packet happens concurrently with an interruption of an SU packet, the newly admitted SU packet will be rejected by the system. Since the interrupted packet has a greater priority than the newly accepted one, it takes precedence. The greater the number of packets in a system, the greater the likelihood that it will be accessed. When the system is overloaded with packets, it's less probable that one of the freshly arrived SU packets will be accepted. Coherent PU-SU Packet Acceptance Procedure is represented inj figure 3.

7. Algorithm Analysis

7.1. Spectrum Analyzer Setup. Each cellular band was measured throughout the day where table 1 detail the spectrum analyzer and antenna specifications, respectively. The spectrum analyzer's frequency range is set at 100KHz to 3GHz. The spectrum occupancy measurement is recorded and plotted using the Rohde & Schwarz FSH Remote and MATLAB software. Spectrum occupancy was determined using a spectrum analyzer operating at frequencies ranging from 100 kHz to 3GHz.

7.2. Parameters and Values. Typical Wi-Fi network parameters, such as RTS = 44 bytes, CTS = 38 bytes, payload = 250 bytes, SIFS and DIFS = respectively 15, 34 microseconds and a slot size of 1 ms are used in the numerical results. We also employ a transmission rate of 10 Mbps while operating in the 2.4 GHz frequency range. The packet transmission rate is determined as $\mu 1$, $\mu 2 = 0.5$.

Additionally, the Malleable or Coherent Factor β data set is set to = {0.0 through 0.1 to, 1.0} with $\beta = 0$ being the standard access to system method without using admission control. This demonstrates the Coherent Factor's effect on the system's performance and the suggested adaptive admission control scheme's efficiency.

Simultaneously, we adjust the arrival rates of the PU and SU packets to $\lambda\ 1 = 0.2$ and 0.3 and $\lambda\ 2 = 0.4$ and 0.6 and investigate the impacts of the arrivals of the Primary User and Secondary User packets on measuring performance in a novel approach. For the sake of illustration, we assume that the SU's buffer capacity is set at $N = 10$. We derive that increasing the Secondary User buffer capacity increases the throughput and mean delay of the Secondary User packets.

From Figure 4, we infer that as the Factor of Coherent Function grows, SU packets' throughput decreases in the same way with the λ 1, the arrival rate of the packets from PU

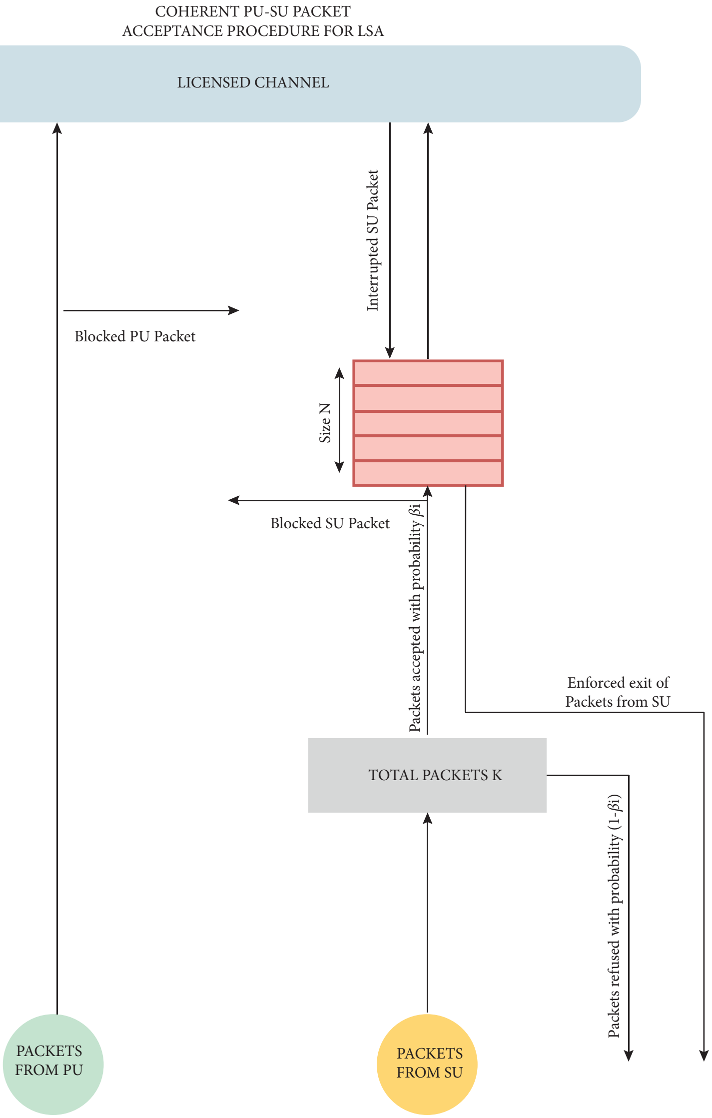

Figure 3: Coherent PU-SU Packet Acceptance Procedure.

and $\lambda 2$ of the SU packets. The reason for this is that when the Coherent Factor β increases, the likelihood of a fresh incoming Secondary User packet being acknowledged for the system decreases, resulting in a throughput decrease of the Secondary User packets.

7.3. Performance Optimization Assumptions. Certain assumptions are made that will be used in further optimizations.

(1) In this scenario, it is assumed that an arriving SU packet does not know the current number of packets in the system and is unsure whether the system would allow it. This is a distinct assumption. A SU packet will either enter the system permanently or not at all, depending on its state when received.

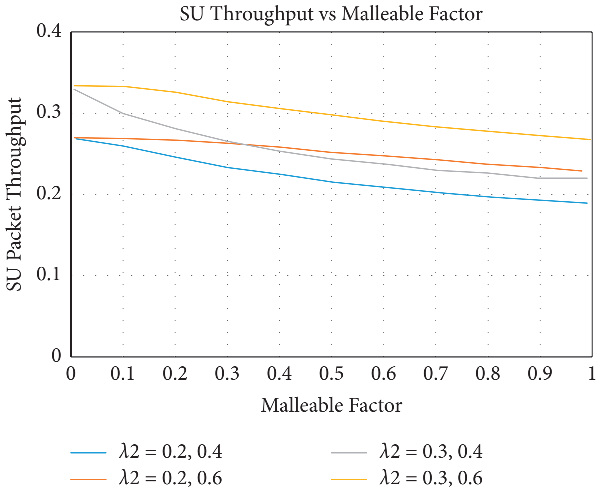

Figure 4: SU throughput versus Malleable factor.

Table 2: SU packet arrival scenarios for analysis.

Scenario 1	Scenario 2	Scenario 3
$\beta(0^+)$	$\beta(T)$	$\beta(0^+) > 0$ and $\beta(0^+) < 0$
Even if no additional SU packets enter the system, the SU packet that attempts to join will get no advantage. Thus, the trial strategy with probability $\eta_e = 0$ is the ideal approach, and there is no alternative optimal strategy [18].	Even if all prospective incoming SU packets attempt to enter the system, they will all get non-negative advantages in this situation. Thus, the trial strategy with probability $\eta_e = 1$ is the ideal approach, and there is no alternative optimal strategy.	If all SU packets enter the system with probability q=1, the Secondary User traffic packet that attempts to join will get a negative net benefit. As a result, q=1 is not the best option. On the other hand, if all SU packets enter the process with probability q=0, the packet from SU that attempts to combine will get a net positive benefit. Thus, q=0 is also not an ideal option. As a result, the best trial probability is ηe = e, where e is determined by solving the equation $\beta(\Gamma) = 0$

(2) Assume *R* is the reward for successfully transmitting an SU packet. Because the admission of SU packets into the system is not assured, the introduction of a new SU packet is known as a trial. Each trial is charged of fee T. (T R). That is, whenever a SU packet is received in the system, regardless of whether it is effectively delivered, it incurs a cost T for attempting to enter the system.

(3) Γ represents the expected pace of arrival of the SU packages

We would get the following equation for the likelihood of sending an SU packet successfully:

$$\omega(\lambda^2) = \frac{S}{\lambda_2}. \tag{8}$$

S denotes the throughput of Secondary User traffic, and λ_2 denotes the arrival rate of Secondary user traffic. The individualized net positive $\beta(\lambda_2)$ for an SU packet seeking to enter the service is calculated as in eqation (9):

$$\beta(\lambda_2) = \omega(\lambda_2)(R - T) - (1 - \omega(\lambda^2))T = \omega(\lambda^2)R - T. \tag{9}$$

The unique net gain of an SU packet decreases asymptotically as the rate of SU packet arrival rises. We analyze three scenarios to determine the ideal trial technique for a single SU packet as given in the Table 2:

The term "Collective Net Gain" refers to the following in equation (10):

$$\beta c(\lambda_2) = (\lambda^2)\omega(\lambda^2)R - T. \tag{10}$$

Additionally, we investigate the consistent characteristic of BS(2) in ith numerical findings. We demonstrate through the following figure 5, how the Collective Net Gain varies with the arrival rate 2 of SU packets for various Coherent Factors.

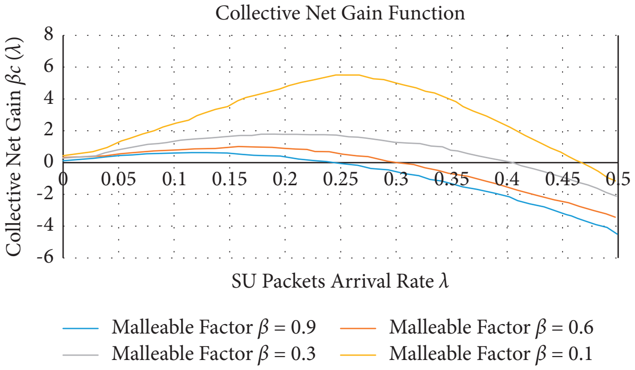

Figure 5: Collective net gain variation.

8. Inference From Numberical Results

From Table 3, as PU packets' arrival rate of λ^1 or SU1 packets' arrival rate of λ^{21} rises, both the optimum indivual and collective access rate of effectiveness drop. Since when the arrival rate of Primary User packets or Secondary User1 packets rises, the probability of successfully transmitting Secondary User2 packets always decreases. As a consequence, a greater number of Secondary User2 packets will decline in reaching the system. Additionally, when incentive R grows, both the individually optimum and collectively ideal access rates increase. The explanation for this trend is self-evident: if the incentive is bigger, the additional Secondary User2 packets will prefer to contact the system since their interests are higher. The numerical findings for establishing the appropriate additional price are shown in the table. However if the rate of arrival of Primary User or Secondary User1 packets improves, decline in the ideal extra price f is observed. Secondary User2 packets are more likely to drop out of the system if Primary User or Secondary User1 packet rates rise.

8.1. Discussions. We concentrated on the limits imposed by channel dynamics and the varying attitudes of PU and SU during times when research must be enforced. We proposed a new algorithm called Coherent PU-SU Packet Acceptance Algorithm For DSA that deals with Channel Reservation using white space terminology, Spectrum Selection and Allocation to the CR-SU by taking into account the functional outputs of the PU-SU dynamics, which involves the contention of SUs for a defined frequency and the constraints imposed by the PUs on the same frequency. The proposed algorithm offers additional services for 5G CORE such as User behaviour based spectrum resource allocation and Policy based dynamic spectrum management framework.

Table 3: Numerical results of individual and Collective Net Gain of cognitive radio users.

Reward R	PU Arrival Rate λ^1	SU Arrival Rate λ^{21}	Individual Gain λ^g		Collective Net Gain $\beta(\Gamma)$		λ^*	β^*	Additional Price A^P
			MIN	MAX	MIN	MAX			
8	0.09	0.14	0.13	0.14	0.6	0.59	0.07	0.3	1.3
8	0.09	0.19	0.09	0.10	0.4	0.34	0.05	0.2	0.8
11	0.09	0.19	0.12	0.13	0.5	0.45	0.07	0.3	1.4
11	0.14	0.19	0.09	0.10	0.4	0.34	0.05	0.2	1.12

9. Conclusion and Future Work

As a result of the discussion above, we can affirm that the Dynamic Spectrum Management framework used to control spectrum in Cognitive Radio networks is capable of providing very efficient solutions to a variety of cognitive radio difficulties. The use of DSMF in cognitive radio networks is intriguing and represents an unexplored research topic. The Dynamic Spectrum Allocation Framework for the 5G environment did not consider the applications which operate on 5G radio environmental dynamics. To address the Application Specific QoS parameters in a 5G scenario, we need to focus on collaborating our proposed Dynamic Spectrum Management framework with the 5G CORE [19]. A fundamental promise of 5G is to offer stakeholders with significantly faster speeds. 5G networks are projected to operate at higher frequencies, including 3-6GHz, which intersects with satellite C-band, and 26-30GHz, which intersects with satellite Ka-band. To allow CR-enabled spectrum management at these frequencies, CORE functionality must be separated from wireless networks [20,21]. Our proposed algorithm in conjunction with 5G CORE is intended to give the ideal solutions for such a high-capacity 5G network situation. As a future direction customized Access Modification Function (AMF) with our proposed algorithm in 5G-CORE is suggested for better performance.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request (head.research@bluecrestcollege.com).

Conflicts of Interest

"The authors declare that they have no conflicts of interest to report regarding the present study."

Authors' Contributions

C.Rajesh Babu: Conceptualization, Data curation, Formal Analysis, Methodology, Software, Writing - original draft; Kadiyala Ramana: Supervision, Writing – review & editing, Project administration, Visualization; R.Jeya: Visualization, Investigation, Formal Analysis, Software; Asadi Srinivasulu: Data Curation, Investigation, Resources, Software, Writing - original draft, Methodology

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