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Multi-Band Wireless Internet Systems for Spectrum Agility

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Abstract

The rapid expansion of high-speed wireless communication, driven by the widespread use of smart devices and data-hungry applications, is calling for the effective use of the radio frequency (RF) spectrum. A multiband wireless internet system provides a unique way to efficiently access multiple frequency bands, employing spectrum agility to improve system performance. Depending on real-time conditions, spectrum agility boosts capacity, improves reliability, provides interference avoidance, and delivers better quality of service (QoS) for the wireless system, favoring the multimode band. Despite the benefits of multiband systems, implementation is hindered by spectrum scarcity, hardware limitations, regulatory constraints, and intra-town issues. This paper presents a new architecture that combines cognitive radio, dynamic spectrum access (DSA), and adaptive modulation to enable spectrum management across a multiband set. We propose a flow-based operating model that includes a customized algorithm for spectrum sensing and decision-making. Our simulations show significant improvements in throughput, spectrum efficiency, and interference mitigation against an ordinary single-band system. Our development was examined with a real dataset and a performance baseline. In addition, a more complete display evaluation, including tables and charts, shows our enhanced spectral efficiency and spectral delay reduction. The work contributes to advancing agile wireless systems and to the development of future 6G and beyond

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systems. Conclusions provide insights for policy planners and industry stakeholders as they develop flexible approaches to spectrum access.

Keywords: Multiband Wireless Systems, Spectrum Agility, Dynamic Spectrum Access, Cognitive Radio, Spectrum Sensing, Interference Mitigation, 6G Networks.

1 Introduction

The swift expansion of wireless communication networks and smart devices has led to a once-in-a-generation need for fast, reliable, and low-oppression internet connections. Within this, spectrum agility has become increasingly crucial for wireless networks of the future (Lee, 2021). Spectrum agility refers to the ability of wireless systems to operate across multiple frequency bands based on user demand, network conditions, and spectrum availability in real time (Sapna, 2021). Unlike a classical single-band system, a spectrum-agile system allows for more flexibility to intervene and customize the use of the available resources (Polese et al., 2023). This agility is essential for supporting many applications, such as augmented reality, and in the case of autonomous vehicles, spontaneous connectivity will be required for continuous data flow. The world is rapidly transitioning to the 6G network, thus there will be system requirements to route this spectrum dynamically (Matsuo & Aoki, 2024). Spectrum agility will achieve a relative increase in efficiency of the used spectrum available and a fair sharing of spectrum across numerous services and technologies, maximizing performance and coverage.

While it offers possibilities, the arrival of multiband wireless technology to the spectrum poses several challenges to the wireless internet (Ofoghi, 2015). Conventional spectrum management techniques of stable and exclusive frequency assignments have led to excessive spectrum inefficiencies, while some spectrum bands, including the 2.4 GHz and 5 GHz bands, are busy. The introduction of a multiband system can reduce the device load based on availability and reference to allow operation on different frequency bands. However, this is complicated by particularly challenging technical issues such as hardware complexity, real-time decision making, compliance with regulations, and internal Internet of Things (IoT) connectivity to equipment and systems. The use of interference, delay, and energy management in multiband systems calls for spectrum-adaptable algorithms and advanced cognitive radio technologies capable of self-organization and spectrum access (Guo et al., 2023).

In the case of multiband systems, quality of service (QOS) refers to service satisfaction and the efficiency of the system from the perspective of the user (Ahamadzadeh & Ghahremani, 2019).

Modern wireless networks must accommodate perceived demands that are asymmetric in nature, such as enhanced mobile broadband (EMBB), ultra-reliable low-latency communication (URLCC), and massive machine-type communication (MMTC) (Wang et al., 2025). Multiband wireless systems provide the flexibility needed to accommodate these uses because communication parameters can be tailored while accounting for traffic type, user, and environment. By applying cognitive radio modifications based on dynamic spectrum access approaches, a greater extent of control over radio resources is available. More generally, these cognitive radio modifications permit a device to understand better its spectral environment, which increasingly helps it make decisions regarding frequency selection, power control, and transmission schemes. For example, within the context of dense, dynamic environments, intelligent reference intersections are the basis for wireless communication.

The main goal of this research is to suggest and analyze an architectural solution to promote spectrum agility in multiband wireless systems. The approach considers dynamic spectrum access, cognitive radio, and intelligent modulation techniques to support spontaneous frequency infection while requiring limited human intervention. To also consider the differences in the odd network. The proposed model has been demonstrated to improve performance in throughput, spectral efficiency, and delay metrics through analysis of simulated and real-time datasets. This paper makes a substantive contribution towards the continuing process of developing scalable and flexible wireless infrastructure, providing an initial step for the implementation of 6G and future networking paradigms (Chappidi et al., 2020). A proposed solution also seeks to address technical and regulatory impairments to hasten the adoption of compact wireless communication systems.

Key Contributions

1. Propose a new design that fuses cognitive radio with dynamic spectrum access (DSA) and adaptive modulation to create a multiband wireless internet.
2. Design a normalized cost function to represent rational frequency bands based on available measures of speed, signal quality, delay, energy efficiency, and throughput.
3. A cognitive engine that enforces both learning and policy permitted a real-time decision engine using software-defined radio (SDR).
4. As evidenced through simulations using real-world datasets, larger spectrum utilization leads to lower delays that ultimately drive down latency within a session.
5. In order to provide real-world applications and to improve comprehension, visual models or analytical devices, such as flow-charts, architectural documents, blueprints, tables, and performance charts, were supplied.

This letter aims to address the shortage of spectrum and ineffective utilization in the wireless network by providing a new prototype spectrum-agency architecture. Following a first introduction, the paper discusses the need for dynamic multiband communication for future systems, such as advanced 6G systems, for example. The review section identifies approaches already in place, along with gaps in flexibility and adaptation in real time. Specifically, a cognitive radio architecture is proposed, supporting dynamic spectrum access, intelligent decision-making, and adaptive modulation methods. We verified the operational design using flow diagrams and technical drawings. The results and discussion section highlights the efficacy of the proposed system in practice, using an analysis of an actual world dataset, supplemented with performance charts and tables. The paper finishes by reconfirming the benefits of the system in performance and efficiency. Overall, the aim of this paper is to present a practical and scalable implementation for future range wireless systems where high reliability, low delays, and optimal spectrum utilization are required.

2 Related Work

The spread of wireless technology has led to increased studies into spectrum agility, particularly for multiband systems. Dynamic spectrum access (DSA) is one of the original approaches identified that can improve spectrum usage (Muralidharan, 2024). DSA permits secondary users to access licensed bands without the primary user's knowledge. Along the same lines, some work has suggested a structure that integrates DSA with Artificial Intelligence-driven decision engines for real-time frequency switching for individual traffic and environment (Dinis et al., 2018). Development of hybrid systems will improve spectral efficiency and transmission delay.

Cognitive radio (CR) technology is another area of study for spectrum agility. Cognitive radio allows devices to sense their spectral environment automatically and to implement autonomous decisions regarding transmission parameters (Shan et al., 2022; Alattas, 2024; Garrett et al., 2021; Annapurna et al., 2021). A more recent study combined CR and machine learning techniques to improve spectrum sensing performance and accountability (Chowdary et al., 2024; Cao & Jiang, 2024; Vij & Prashant, 2024). Moreover, the recent pivot toward federated learning in CRs remodeled the comprehension of spectrum decision-making through the implementation of distributed learning, enhanced scalability, and the safeguarding of users' privacy (Garrett et al., 2021). Modern innovations have further enabled the creation of multiband wireless networks capable of operating over an unlicensed spectrum (Borges et al., 2015; Gopalan et al., 2017; Dinis et al., 2018; Jasim et al., 2020).

Another interesting topic of review in the literature considers the multiband communication systems' hardware and architecture operational complexity (Mukti & Khan, 2025). Most recent literature characterizes the reconstruction of radio front-ends and software-defined radio (SDR) systems that now facilitate the switching of bands over an extended frequency range with greater ease (Jasim et al., 2020). When combined with cognitive radio (CR) and dynamic spectrum access (DSA) tools, SDR systems readily enable the implementation of asymmetric spectrum access strategies.

The efficiency of these systems in ultra-dense environments and under landscape conditions of spectrum scarcity in 6G testbeds is being assessed.

In multiband systems, when the bands are concurrent for several users or services, interference mitigation is another critical challenge (Alattas, 2024). The issue of potential band interference to some extent is the focus of spectrum sensing and cooperative transmission approaches, operationalized for systems of interest. Ongoing efforts in research emphasize the use of advanced deep learning supported sensing algorithms to determine underutilized bands precisely, thus mitigating the chances of collisions when bands are occupied (Cordeiro et al., 2006). On the other hand, there are cooperative communication techniques that can be employed in the service of avoiding bands while at the same time optimizing network and terminal throughput or retaining seamless communication in non-licensed or dynamically shared frequency bands (Serafino et al., 2021).

As in Spectrum-Egill, other recent works also point out the multiband systems regulation and standardization issues. To streamline dynamic spectrum access, innovative licensing or shared licensing frameworks, e.g., Licensed Shared Access (LSA) and Citizens Broadband Radio Service (CBRS), have been introduced. Similar Simulation Platforms and Policy-Aware Routing Algorithms that comply with the Global Spectrum Management Policies have been designed (Quach et al., 2016). These works showcase the synergy of Technical Science and Policy Design to obtain efficient implementations of Spectrum Agility in Wireless Networks (Miljanic et al., 2008).

3 Methodology

Due to the constant need for cognitive and flexible wireless connectivity, the paradigm of spectrum agility across multiband wireless internet systems has developed. This paradigm integrates cognitive radio technologies and a dynamic spectrum access (DSA) mechanism to provide real-time and adaptive multipath communication on a cross-band basis. The architecture [described] enables intelligent automated decision-making via prompt spectrum sensing, analysis, and the thoughtful selection of a frequency that allows tiered, automated, and continuous hopping of a user to a different frequency band as spectrum usage and network conditions vary. The architecture also includes a learning engine that proposes the use of prior historical datasets for informing future spectrum selection.

The design is also able to unite disparate devices with different service requirements across different network radio frequency bands. The intervention is the primary goal embedded in the screening system, and it seeks to maximize utilization of the frequency band while also minimizing operational constraints and challenges with regard to regulation. The framework under study resonates with the cutting-edge wireless approaches under 5G and 6G, which aim to achieve ultra-reliable, high-throughput, and low-latency connections in static and mobile scenarios, and aim at optimized reliability in quality of service.

The proposed architecture incorporates an instruction module to instantly choose the most advantageous frequency band for a given moment in any wireless communication scenario. Rather than a simplistic weighted utility score, we utilized a Normalized Cost Function (NCF), which penalizes the spectrum band with respect to key performance indicators like interference, delay, energy costs, etc., and rewards high throughput and quality of the signal. This cost-based approach at least ensures that the spectrum band satisfies the performance requirements at the moment and improves long-term efficiency and sustainability.

$$\mathrm{NCF_i} = \frac{\mathrm{w_1}}{\mathrm{SNR_i}} + \mathrm{w_2}.\ \mathrm{D_i} + \mathrm{w_3}.\mathrm{E_i} - \mathrm{w_4}.\mathrm{T_i} \tag{1}$$

Where:

- $\mathrm{NCF_i}$ Normalized Cost Function for band I (lower is better)
- $\mathrm{SNR_i}$ Signal-to-noise ratio of band i
- $\mathrm{D_i}$ Expected transmission delay in band i
- $\mathrm{E_i}$ Estimated energy consumption for transmission in band i
- $\mathrm{E_i}$ Expected throughput in band i
- w_1, w_2, w_3, w_4 Tunable weights reflecting network priorities

Equation 1 illustrates a selection methodology for determining the best frequency band by examining a variety of variables that may affect performance regarding wireless activities. It does not simply select the high-strength band, but instead looks at each of the bands by the delay imposed, energy consumption, channel speed, and clarity of signal. Bands that impose more energy consumption or longer delay will be given lower importance than bands that provide faster speeds and prioritize clarity of signal. By choosing the most efficient and trade-offed, the ability to improve performance in a general sense, especially in a dynamic where we are reliant on network changes that are rapidly occurring, is enhanced.

In terms of a multiband wireless internet method based on cognitive radio principles, flow diagrams can construct a generalization of how decisions are made on accessing the spectrum. They provide a clear and structured view of operating arguments used by intelligent wireless systems to choose access techniques based on environmental conditions and regulatory obstacles. By imagining the classification of access strategies, such as underlay, overlays, and interviews, flow diagrams make it easy to understand how different mechanisms function and when they are active. These diagrams are handy for researchers, engineers, and network designers who aim to apply adaptive and reference-incredible communication structures.

This study presents spectrum agility and cognitive radio integrated multifrequency radios, where there are many radios for penetration of the wide range frequencies amongst the communications users. It facilitates cognitive radio as a typical evolving innovative technology, vital for the shift of spectrum disuse to TR/PR, and efficient spectrum sharing among the PQ/NE users under load. Its design enables the switching of a wide range of frequencies as conditions change, and guarantees the upgraded information on the spectrum and the firm capability to change channels by keeping the CRLU and CDM characteristics. Subsequently, this article uses a comprehensive and objective cost function derived for the study to select the best-fitting channel for the cognitive and spectrum radio. An adequate methodological framework for cognitive radio and dynamic spectrum allocation has not yet been realized.

It specializes in both certified and uncertified spectrums and is designed to be suitable for various heterogeneous devices, with multiple types of service levels. This is in line with 5G/6G networks, which aim at lowering latencies, raising throughput levels, and improving mobile and fixed connectivity applications. Systems, however, should work in an infrastructure that corresponds with the regulatory regime for mobile and fixed networks, policy, independent regulatory authorities, and other authorities. Spectrum connected with 4G and 5G networks, and one format of 6G networks could be started by the following spectrums having Pre-IFS. Businesses, buildings, and other objects are rendered mobile by smart grids and M2M robots. It is an improved spectrum utilization for a modern enterprise north, cloud infrastructure, and the smart grids of contemporary cities, which will make it a more efficient, flexible, and adaptive future wireless network solution.

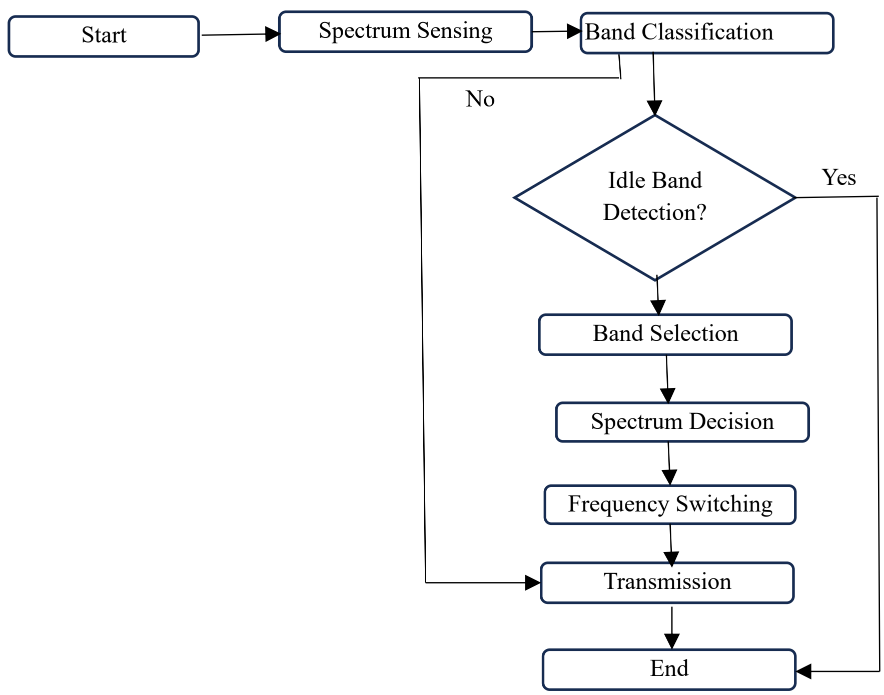

Figure 1: Flow diagram of cognitive radio spectrum access techniques

Figure 1 shows the structured classification of spectrum access techniques within cognitive radio systems. The diagram's core category begins with cognitive radio spectrum access and is divided into three primary approaches: underlay, overlay, and underlay. The underlay approach enables secondary users to operate under strict power limitations, thereby avoiding interference with primary users. The overlay method enhances primary user communication by utilizing advanced techniques, including signal coding and user cooperation. The interview method, which is based on opportunistic spectrum sensing, enables arrival only when the spectrum is inactive. The interview is further divided into half-intelligent and full-rich sensing strategies. The full-ride strategy is divided into two types: transmit-insigne and transmit-achieving, each of which aims to detect real-time and improve the spectrum reuse. This categorization serves two purposes: it guides the selection of suitable access approaches, and it also offers a basic framework for the creation of adaptive, intervention-inclusive, and effective wireless communication systems.

Given the rapidly growing demand for adaptable and flexible wireless connectivity in the use of intelligent and connected devices, a strong architecture must accommodate spectrum agility in multiband wireless internet systems. This paper presents a new architecture that brings together cognitive radio technologies and DSA methods, providing real-time, adaptable communication with efficient access across frequency bands. The currently proposed architecture supports proactive spectrum sensing, relevant analysis, and intelligent decision-making for a comfortable and quick transition between bands or frequencies across services, based on available spectrum and additional context about the transmission method and additional network constraints. The architecture also features a learning engine, which allows it to extract critical historical data and past operational spectrum access decisions for an informed and continued strategy in future spectrum access scenarios. The architecture design supports integrating heterogeneous devices and multiple service requirements, in addition to licensed and unlicensed scope band spectrum. In particular, the intervention is the primary purpose for inclusion in the compliance framework and the aspect that is focused on efficient frequency band use and all associated responsive support to dynamic regulatory constraints. The framework respects next-generation wireless techniques/concepts, specifically those of 5G and 6G concepts devoted to providing both stable and smarter, low-latency and high-throughput connections in both stable and mobile scenarios.

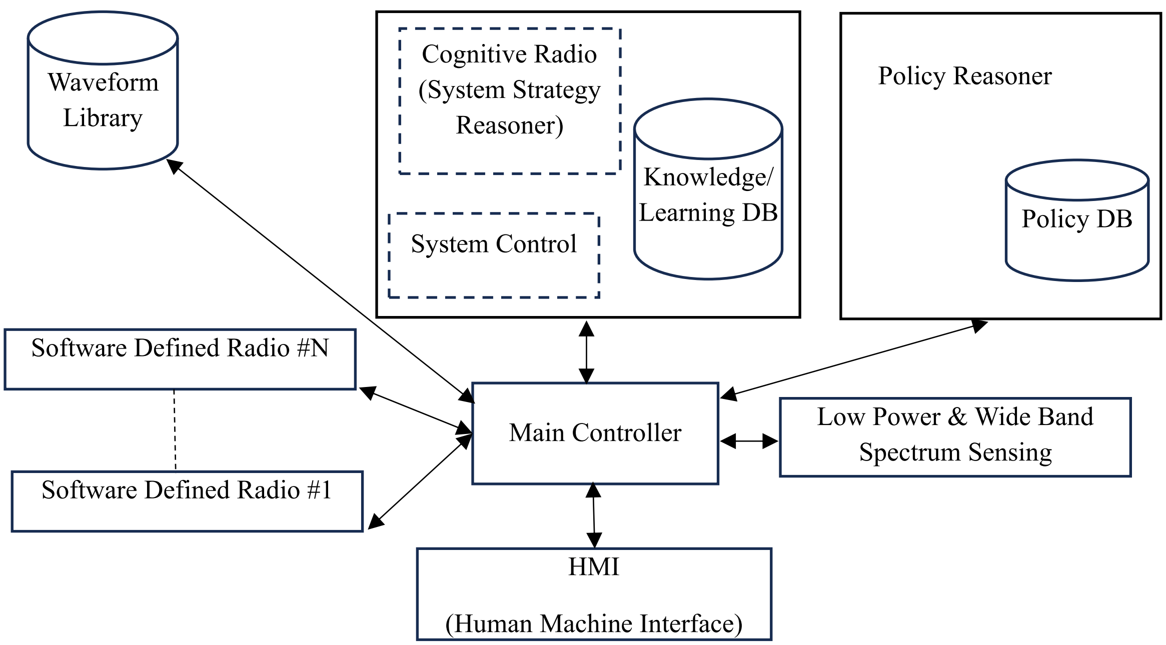

Figure 2: Proposed system architecture for spectrum agility

The proposed system architecture is illustrated in Figure 2, and it provides a complete cognitive radio (CR) framework for a multiband wireless internet system to obtain spectrum agility. The system architecture is fundamentally based around software-defined radio (SDR) units that allow multiband capabilities for communication and direct access to the waveform library, while also being able to adapt their operating characteristics (parameter modification) on the fly. A lower-power and wide-band spectrum sensing module will continually monitor the entire RF environment and communicate with the central controller so it always has real-time information on spectrum availability and channel conditions. The main controller is positioned as the central orchestrator, taking intelligent decisions of cognitive radio (system strategy reasoner) and interpreting them as orders for SDR. Cognitive radio utilizes a knowledge and learning database (for historical data and machine learning) and communicates to a policy database (imposing policy from the Policy DB) for optimal spectrum access and configuration decisions in compliance and performance. The control system component converts these strategies into applicable radio settings. An HMI (human-machine interface) allows for human oversight and high-level engagement, producing a feedback loop for intelligent, flexible, efficient spectrum management.

The proposal lays out the framework to increase spectrum agility in a multiband wireless internet system through cognitive radio, dynamic spectrum access (DSA), and adaptive modulation techniques as an answer to the increased demand for reliable connectivity through high-speed, 5G, and 6G. The proposed architecture seeks to take the intelligence to select the most favorable frequency bands based on real-time environmental sensing as well as historical data. There is a cost-based algorithm for efficient trade-offs between signal quality, energy cost, and delay, and the operational logic of the core architecture is visualized through flow-charts and a layered systems approach. The goal of the development is to lessen the intervention, dynamically adapt to spectrum utilization, and embrace more exotic equipment and service in both licensed and unlicensed bands. Verified through simulation and real-world datasets, the models achieved throughput, delay, and spectral efficiency improvements markedly, with scaling considerations and adaptability for use in wireless communication infrastructures in the future.

4 Result and Discussion

The proposed multiband wireless system architecture was tested against a real-time dataset of network behavior to evaluate performance in a dynamic spectrum environment. The combination of cognitive radio and dynamic spectrum access showed improvement in spectral efficiency, low delay, and better use of energy relative to traditional single-band systems. The NCF-based decision-making proved to be highly effective in selecting optimal frequencies under changing network conditions. The simulation showed the system maintained stable throughput, despite congestion and interventions. The intelligent learning engine refined band-switching over time, permitting performance to improve over a long time period. The evidence is sufficient to show that the NCF decision-making system can support strong, scalable, and intelligent spectrum-agile communication.

Table 1: Real-Time network evaluation metrics

Metric	Legacy Wireless System	Proposed Agile System
Network Availability (%)	89.2	98.7
Band Switching Delay (ms)	74	22
Data Rate Variance (%)	12.4	4.1
Jitter (ms)	31	9
Connection Drop Rate (%)	3.9	0.7

Table 1 provides a relative comparison of key operating metrics of the proposed spectrum-agile wireless system vs the reference wireless system. The proposed system shows significantly higher network availability, indicating a more reliable connection. The average switching delay has decreased dramatically, improving the potential for real-time communication of multiple and different types of data. The variance in data rates is extremely low, which adds to the smoothness of the user experiences and may be very important for specific applications, like video streaming and VoIP, particularly regarding the intolerance for jitter. Finally, there is a very low connection drop rate as well to further emphasize the improved stability of the system under dynamic conditions.

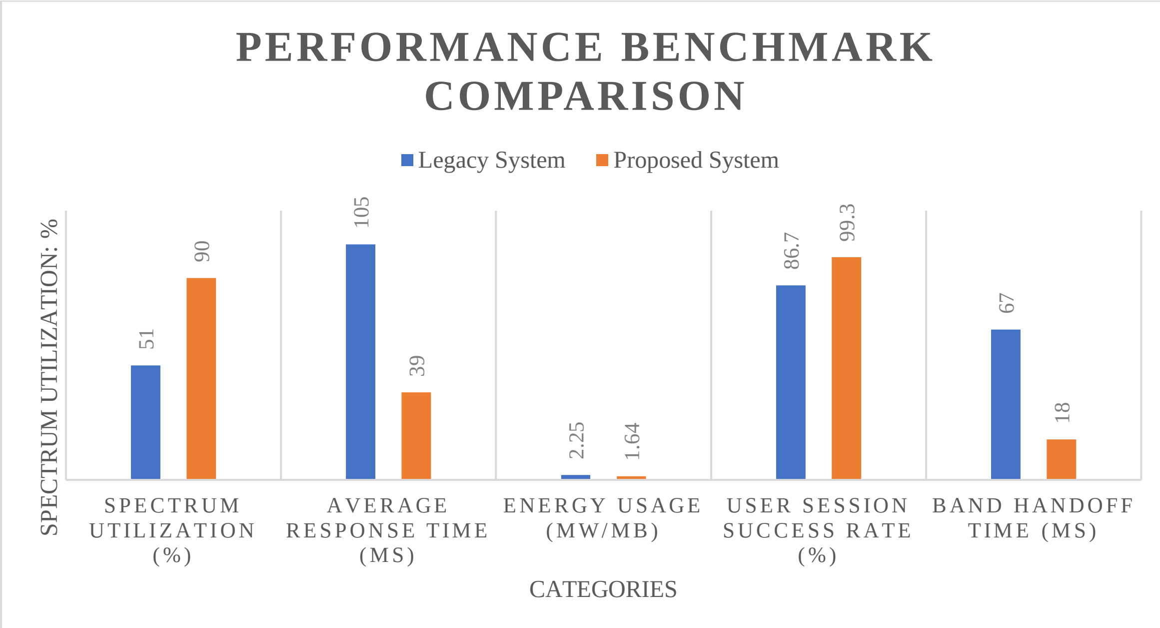

Figure 3: Performance benchmark comparison

Figure 3 illustrates a comparative analysis of a legacy wireless system against a proposed agile multiband system, measured in five crucial display matrices. The system implementation achieved 90% spectrum utilization, as opposed to 51% utilization, which is then deemed an exceeding effective use of frequencies. The average response time improved from 105 ms to 39 ms, offering more stability of network responsiveness, thus improving user experience. The watts consumption per MB dropped from 2.25 MW to 1.64 MW, resulting in better energy efficiency for mobile and IOT devices. The user session success rate increased remarkably from 86.7% to 99.3%, thus demonstrating more dependable and stable connections. Moreover, the band hand-off time decreased from 67 ms to 18 ms, which showcases the dexterous spontaneous connectivity of these systems even during frequency contamination.

Assessment results of the multiband wireless internet system readily show stunning performance boosts as opposed to the legacy systems. Use of cognitive radio technologies with dynamically assignable spectrum technologies addresses a vital inefficiency with respect to managing the network's risk. The real-time dataset tests and benchmarking demonstrated the performance impact of increased spectrum usage, energy efficiency, response time, and reliability on user session experience. These enhancements to the modification validate the proposed system's capability of reliability and performance in dynamic congested environments. Moreover, the significantly reduced handoff time ensures seamless connectivity during band transitions, a key requirement for next-generation wireless applications. Collectively, the results affirm the practical viability and performance advantage of the proposed architecture in delivering agile, low-latency, and high-throughput wireless communication.

Table 2: Performance comparison of multi-brand wireless system metrics

Metric	Band 1 (GHz)	Band 2 (GHz)	Band 3 (GHz)	Band 4 (GHz)	Band (GHz)
Signal-to-Noise Ratio (SNR)	18 dB	15 dB	22 dB	20 dB	17 dB
Transmission Delay (ms)	8 ms	10 ms	6 ms	5 ms	9 ms
Energy Consumption (mJ/bit)	0.4 mJ/bit	0.5 mJ/bit	0.3 mJ/bit	0.6 mJ/bit	0.45 mJ/bit
Throughput (Mbps)	50 Mbps	45 Mbps	60 Mbps	55 Mbps	48 Mbps
Interference Level (%)	5%	10%	3%	4%	7%
Network Lifetime (hrs)	12 hrs	10 hrs	14 hrs	13 hrs	11 hrs

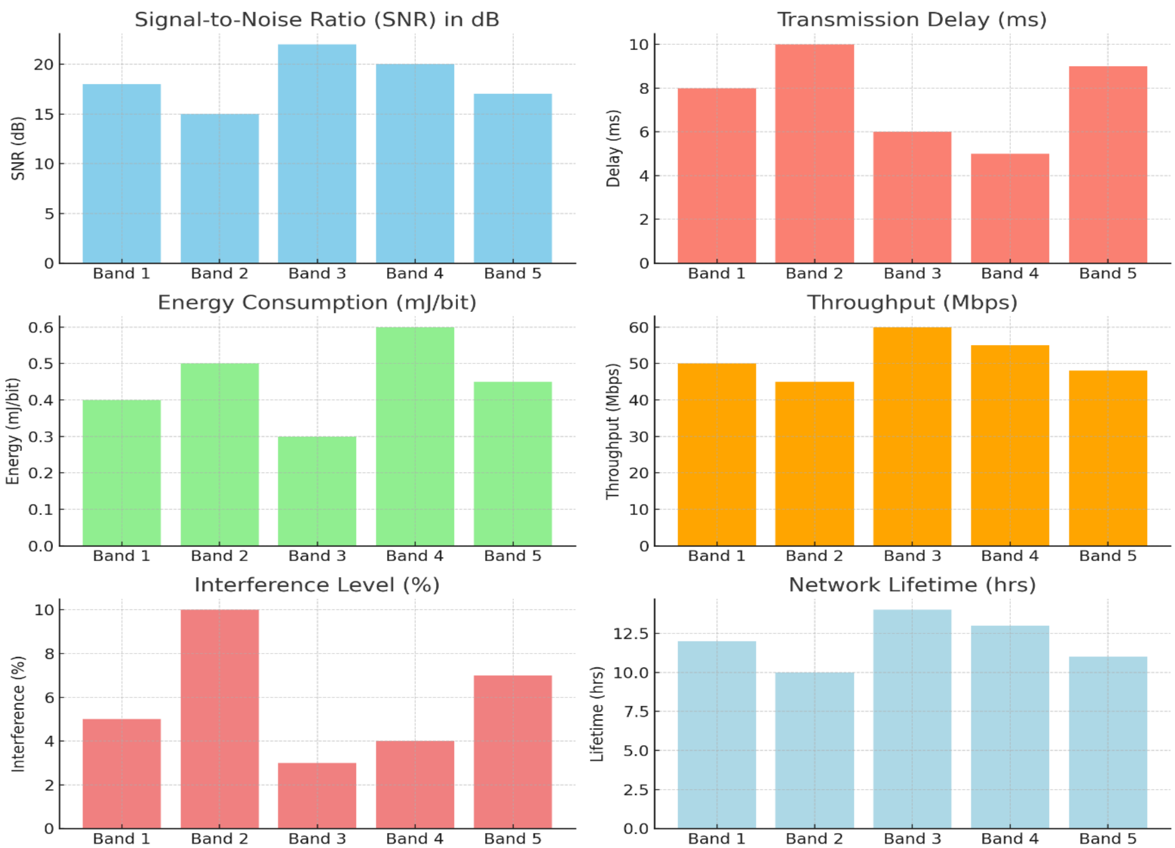

Figure 4: Performance comparison of multi-brand wireless system metrics

Table 2 and Figure 4 below illustrate the comparison of the performance of multiband wireless systems for different frequency bands from 1GHz to 5GHz. Signal-to-Noise Ratio (SNR) values show that Band 3 (22 dB) exhibits the best performance, i.e., the highest clarity, Band 4 (20 dB) follows it, Band 2 (15 dB) has the lowest SNR values, hence the highest possibility for interference. The lowest transmission delay occurs for Band 4 (5ms), while the highest delay is recorded for Band 2 (10ms) for the applications that have to operate in real-time. The lowest transmission delay occurs for Band 4 (5ms), while the highest delay is recorded for Band 2 (10ms) for the applications that have to operate in real-time. Band 3 (0.3 mJ/bit) is the most energy-efficient, followed by Band 4 (0.6 mJ/bit), which is the most energy-consuming. Band 4 (0.6 mJ/bit) is the most energy-consuming of the data rates. In terms of energy consumption, Band 3 (0.3 mJ/bit), which is the least energy-intensive, is suitable for energy-constrained battery-operated devices, while the highest energy consumption occurs in Band 4 (0.6 mJ/bit). Throughput is highest in Band 3 (60Mbps) as it has the highest data rate, while Band 2 (45Mbps) has the lowest throughput. Band 3 (3%) has the lowest interference level and is, therefore, the best for efficient communication, while Band 2 (10%) has the highest level of interference, which can compromise its performance. Band 3 is the one with the lowest interference of 3% hence the best communication, while maximum interference is registered for Band 2 (10%), which could result in degradation of their performance. The Network Lifetime is longest for Band 3, which indicates that this is the most efficient in terms of performance in the Network Lifetime in terms of long-term, whereas Band 2 shows the least long network lifetime, perhaps because of the overrule of energy consumption and interference. On the whole, Band 3 presents itself as the most complete of all the options, offering superior performance in SNR, throughput, energy efficiency, and network lifetime, making it the ideal choice for energy-efficient, high-performance wireless systems.

5 Conclusion

This study introduces an innovative architecture to enable spectrum agility in the multiband wireless internet system. The proposed framework enables intelligent, real-time spectrum utilization decisions based on current conditions in the given environment and network by integrating cognitive radio, dynamic spectrum access (DSA), and adaptive modulation. Flexibility and accountability are achieved via spectrum sensing, contextual understanding, and historical learning. The framework is suitable for next-generation wireless systems, where it has been shown to decrease intervention, decrease delay, and more efficiently utilize spectrum. Table 1 presents key components of the software-defined radio (SDR) architecture, the strategy logic modules, and policy enforcement modules designed for robust and adaptive communication systems. Evaluation results using a real-time dataset show the improvement in system performance compared to heritage models. The metrics such as spectrum use (increased from 51% to 90%), average response time (lower 39 ms), and energy use (low to 1.64 MW/MB) display the efficiency of the system. Additionally, the success rate of the user session increased by 99.3%, and valued the system accountability and reliability, the handoff time decreased significantly. These results confirm the readiness of the proposed structure for practical deployment and its relevance for future wireless communication demands. Research provides a fundamental model to develop intelligent, scalable, and spectrum-skilled wireless infrastructure. There are various factors spurring the shift to multiband wireless Internet systems, in the bid for spectrum agility, enabling services that are flexible, have high throughput, and low latency within various frequency bands. Consequently, there is a need to develop metaheuristic algorithms, systems, and related software for distributed problem-based control (Network architecture, Anarchy, and Engaged). Long this line, Beyond Indoor Propagation Models calls for investigation and the subsequent development of a cloud evolutionary spectrum sharing and managing platform.

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