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SMART CHANNEL ALLOCATION IN SPECTRUM SHARING NETWORKS

Mrs.M.Kalaivani[1], M.JANANI[2], K.KAVIYANJALI[3], S.SANGAMITHRA[4]

[1]Project Supervisor, Assistant Professor,

[2,3,4] Final Year Student

[1,2,3,4] Department of Computer Science and Engineering,

[1,2,3,4] E.G.S. PILLAY ENGINEERING COLLEGE, Nagapattinam, India

ABSTRACT

Smart Channel Allocation in Spectrum sharing Networks focuses on improving spectrum utilization and energy efficiency in modern wireless communication systems. Cognitive Radio Networks (CRNs) enable secondary users to opportunistically access unused spectrum allocated to primary users without causing interference. However, improper channel allocation leads to communication delays, reduced throughput, and energy wastage. This project proposes a smart channel allocation mechanism that dynamically assigns available channels to secondary users based on channel conditions and energy availability. The system integrates energy cooperation mode, where secondary users harvest energy from primary user signals, and joint cooperation mode, which allows information sharing for improved performance. A modified multicasting mechanism using a Markov-based prediction model is applied to estimate channel availability and optimize allocation decisions. The proposed approach ensures efficient spectrum reuse, minimizes interference, and enhances network lifetime. Performance analysis shows improvements in throughput, delay reduction, and energy efficiency compared to existing methods. This system is suitable for wireless mesh networks and future communication environments. Overall, the project provides a reliable and adaptive solution for smart spectrum management in Spectrum sharing networks.

1. INTRODUCTION:

Spectrum sharing Networks have emerged as an effective solution to address the problem of spectrum scarcity in wireless communication. In traditional systems, licensed spectrum is often underutilized, leading to inefficient usage of available resources. CRNs allow secondary users to access unused spectrum without interfering with primary users. This dynamic access improves overall communication efficiency. It also supports better utilization of limited bandwidth resources.

Despite the advantages of Spectrum sharing networks, efficient channel allocation remains a major challenge. Improper allocation of channels can lead to increased communication delays and reduced system performance. Secondary users may experience difficulty in accessing free channels due to poor coordination. Additionally, interference between primary and secondary users can degrade network quality. Therefore, an intelligent and adaptive channel allocation mechanism is necessary. Such a mechanism should ensure reliable communication and optimal spectrum usage.

This project proposes a smart channel allocation approach to enhance the performance of Spectrum sharing networks. It incorporates energy cooperation and joint cooperation modes to improve both energy efficiency and data transmission. The system dynamically detects free channels and assigns them to secondary users based on network conditions. A modified multicasting mechanism is used to predict channel availability and optimize allocation decisions. The proposed method aims to reduce delay, increase throughput, and extend network lifetime. Overall, it provides an efficient solution for modern wireless communication systems.

II. EXISTING SYSTEM:

In existing Spectrum sharing networks, channel allocation is not efficiently managed, leading to poor spectrum utilization. Secondary users often face delays in accessing available channels due to lack of proper coordination. Many systems do not consider energy efficiency, resulting in increased power consumption. Interference between primary and secondary users is also a common issue in traditional methods. Additionally, current approaches lack dynamic adaptation to changing network conditions, which reduces overall performance.

Limitations of Existing System

1) Inefficient spectrum utilization due to improper channel allocation.
2) Increased communication delay for secondary users.
3) High interference between primary and secondary users.
4) Lack of energy-efficient mechanisms in the system.
5) Poor adaptability to dynamic network conditions.
6) Reduced overall network performance and throughput.

III.PROPOSED SYSTEM:

The proposed system introduces a smart channel allocation method to efficiently utilize unused spectrum in cognitive radio networks. It uses energy cooperation and joint cooperation modes to improve energy efficiency and communication performance. A dynamic allocation and prediction mechanism reduces delay, minimizes interference, and enhances overall network throughput.

System Features

1) Spectrum Sensing – The system detects available channels by identifying unused spectrum from primary users.
2) Channel Allocation – It dynamically assigns free channels to secondary users without causing interference.
3) Energy Harvesting – Secondary users collect energy from primary user signals to support data transmission.
4) Cooperation Mechanism – The system uses energy and joint cooperation modes to improve communication efficiency.
5) Channel Prediction – A Markov-based model predicts channel availability for better allocation decisions.
6) Performance Evaluation – The system analyzes throughput, delay, and energy efficiency to measure overall performance.

IV.SYSTEM FLOWCHART DESCRIPTION

The system flowchart begins with the initialization of the Spectrum sharing network, where primary users (PU) and secondary users (SU) are defined. The process starts with spectrum sensing to identify whether channels are free or occupied. This step is important to avoid interference with licensed users. Based on the sensing result, the system decides the next action.

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If a channel is free, it is assigned to the secondary user for communication. If the channel is busy, the system waits and continuously rechecks for availability. After assigning a channel, the system performs an energy check to ensure sufficient power for transmission. Then, it selects an appropriate cooperation mode such as energy or joint cooperation.

Once the cooperation mode is selected, data transmission takes place between users. The system then predicts channel availability using a Markov-based model for better future allocation. Finally, performance is evaluated based on throughput, delay, and energy efficiency. The process ends after analyzing the overall system performance.

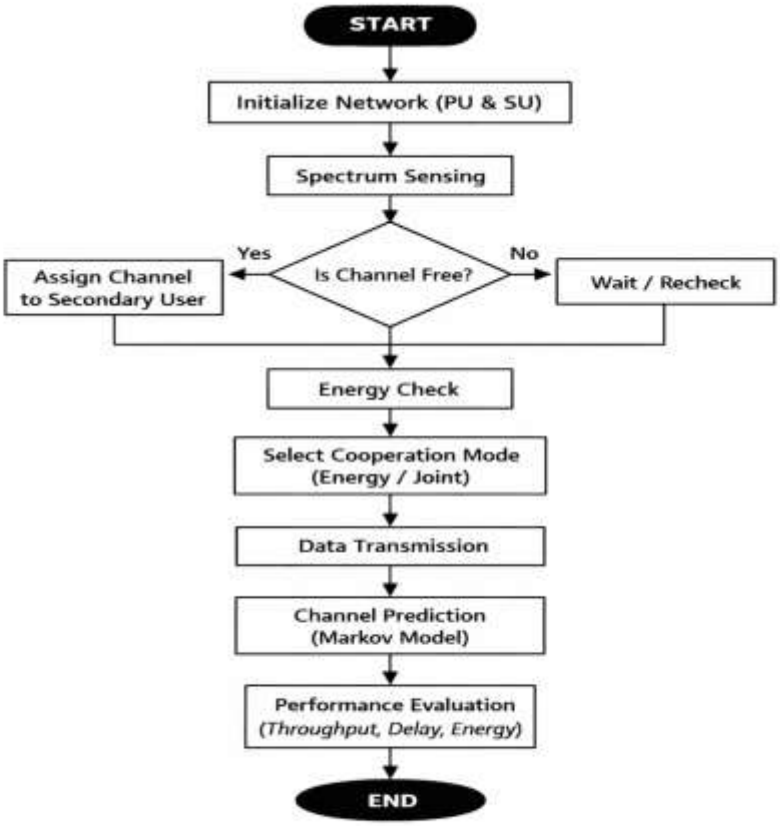

Fig:1

V. SYSTEM ARCHITECTURE AND WORKING MODEL

The system architecture of the Spectrum sharing network consists of primary users (PU), secondary users (SU), and a central channel allocation unit. Primary users have licensed access to the spectrum, while secondary users access it opportunistically. The architecture includes modules such as spectrum sensing, energy harvesting, and

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channel allocation. These components work together to ensure efficient communication. The system is designed to avoid interference and improve spectrum utilization.

The working model starts with spectrum sensing to detect available channels in the network. Once a free channel is identified, it is allocated to the secondary user for communication. The system then performs an energy check using energy harvesting techniques from primary user signals. Based on channel conditions, it selects either energy cooperation or joint cooperation mode. This helps in improving both energy efficiency and data transmission performance.

After selecting the cooperation mode, data transmission is carried out between users. The system also includes a channel prediction mechanism using a Markov model to forecast future channel availability. This improves decision-making for dynamic channel allocation. Finally, performance evaluation is done based on throughput, delay, and energy efficiency. The overall system ensures reliable, efficient, and adaptive communication in cognitive radio networks.

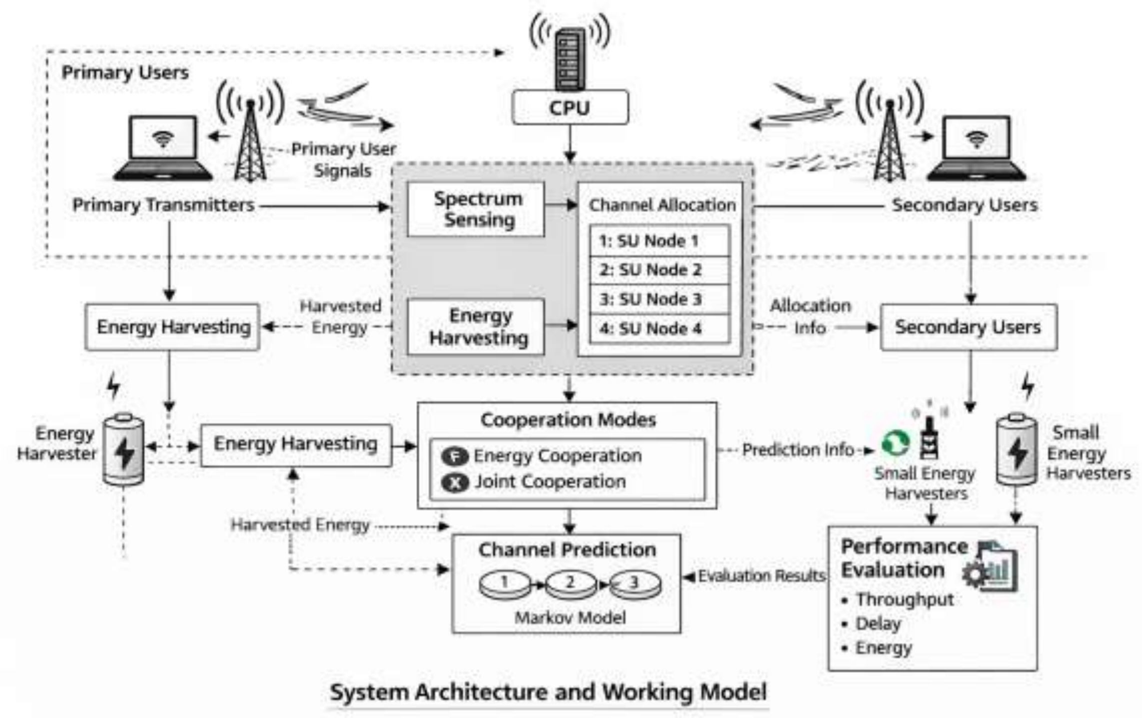

Fig:2

VI. SYSTEM DESIGN AND DATA FLOW MODEL

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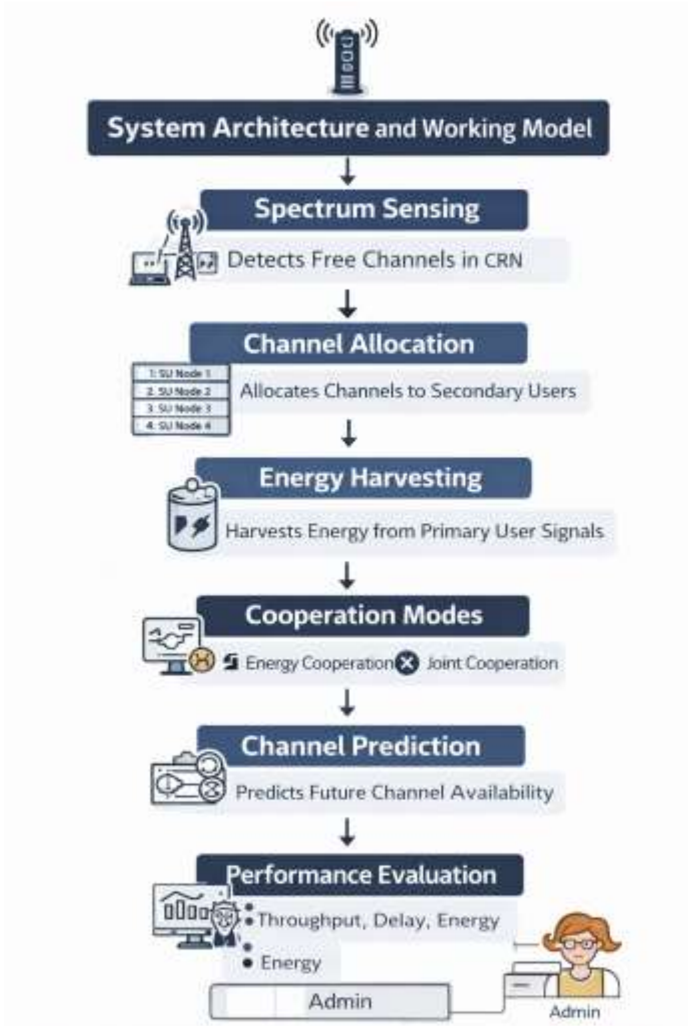
The system design and data flow model explain the working process of the smart channel allocation system in cognitive radio networks. The architecture shows how communication flows between primary users (PU) and secondary users (SU) through different stages such as spectrum sensing, channel allocation, energy harvesting, cooperation modes, and channel prediction. Each stage processes the data efficiently to improve spectrum utilization, reduce delay, and enhance energy efficiency.

The first stage is spectrum sensing, where the system detects available channels that are not being used by primary users. This helps secondary users to access free spectrum without causing interference. The system continuously monitors channel conditions and identifies idle slots. This information forms the basis for dynamic channel allocation and efficient communication in the network.

After spectrum sensing, the system performs channel allocation and energy harvesting. Free channels are assigned to secondary users based on availability and network conditions. At the same time, secondary users harvest energy from primary user signals to support their transmission. This improves energy efficiency and reduces dependency on external power sources.

Finally, the system applies cooperation modes and channel prediction mechanisms. Based on channel conditions, energy cooperation or joint cooperation mode is selected to optimize performance. A Markov-based model predicts future channel availability for better decision-making. The system then evaluates performance based on throughput, delay, and energy efficiency, ensuring reliable and adaptive communication.



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FUTURE ENHANCEMENT:

1) Integration of AI and machine learning models for better channel prediction accuracy.
2) Extension to large-scale networks with more users and dynamic environments.
3) Improvement in energy harvesting techniques using multiple renewable sources.
4) Implementation of real-time adaptive algorithms for faster decision making.
5) Enhancement of security mechanisms to protect against network attacks.
6) Development of more efficient multicasting methods for better data transmission.

CONCLUSION:

The proposed system improves spectrum utilization in Spectrum sharing radio networks through smart channel allocation. It effectively allows secondary users to access unused channels without interfering with primary users. The integration of energy and joint cooperation modes enhances both energy efficiency and communication performance. The use of channel prediction helps in making better allocation decisions and reducing delays. Performance evaluation shows improvements in throughput, delay, and energy usage. Overall, the system provides a reliable and efficient solution for modern wireless communication networks.

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