IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

COGNITIVE RADIO NETWORK FOR MINIMIZING NETWORK TRAFFIC

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Abstract: The rapidly increasing number of wireless systems is exacerbating the already significant challenge of limited frequency spectrum bandwidth in modern wireless systems. To address this scarcity of spectrum, secondary systems can adopt an opportunistic approach by accessing temporarily unused licensed bands of primary systems. This approach, known as cognitive radio technology, allows secondary systems to modify their transmitting parameters. so to minimize interference with primary users. The problem of spectral crowding can be addressed by utilizing cognitive radio technology, which involves opportunistically utilizing frequency bands that are not heavily occupied by licensed users. This approach provides a promising solution to the challenge of limited frequency spectrum bandwidth in modern wireless systems. With the development of prototypes and the implementation of these approaches on testbeds, researcher scan the effectiveness of cognitive radio approaches and ensure their successful deployment in the real world. The application of cognitive radio technology has attracted significant research interest and has the potential to introduce new approaches to the usage of available spectrum, thereby improving the efficiency of wireless systems.

***Keywords* – Cognitive Radio Technology, Testbeds , Licensed bands.**

I. INTRODUCTION

Wireless technology has revolutionized the way we communicate, connect and interact with the world around us. However, the ever-increasing number of wireless systems, coupled with the limited frequency spectrum bandwidth used in modern wireless systems, has resulted in a scarcity of available spectrum. This has led to a major challenge known as spectral crowding, which limits the efficiency of wireless systems. Cognitive radio technology offers a promising solution to this problem. Cognitive radio enables secondary systems to opportunistically access temporarily unused licensed bands of primary systems, known as spectrum holes or white spaces, while minimizing interference with primary users. By altering their transmitting parameters, cognitive radio enables the opportunistic usage of frequency bands that are not heavily occupied by their licensed users, thereby reducing the problem of spectral crowding.

1.1 COGNITIVE RADIO NETWORK

Cognitive radio has attracted significant research interest, and several works have been reported in the literature. However, the assumptions and simplifications introduced during the modeling of the communication system often yield misleading conclusions each time relevant aspects of their implementation on a testbed are omitted. To study the behavior of cognitive radio prototypes under real-world conditions, researchers often build physical models. Software-defined radio (SDR) has emerged as an ideal tool for this purpose, enabling researchers to experiment with prototypes of cognitive radio approaches. In conclusion, cognitive radio technology introduces new approaches to the usage of available spectrum and has the potential to overcome the problem of spectral crowding. The development of prototypes and the implementation of these approaches on testbeds using SDR technology are essential for evaluating the effectiveness of cognitive radio approaches and ensuring their successful deployment in the real world.

II. STUDY ON RELATED WORKS

Detecting abnormal events often involves first learning normal patterns and then identifying deviations from those patterns as anomalies due to the limited availability of abnormal training data. Local features of videos are typically extracted and used to train a normality model. Trajectory analysis is a common approach, but it may not be practical in crowded environments. Other methods involve using spatiotemporal video volumes with dense sampling or interest point selection to identify spatial anomalies in low-level visual features like histograms of oriented gradients, oriented flows, and optical flow. The effectiveness of these methods depends on the quality and completeness of the training data. Deep learning techniques, such as using a 3D ConvNet for classification or an end-to-end convolutional autoencoder for anomaly detection, have also been used. However, while multiple frames can be used as input, 2D convolutions only operate spatially, compressing temporal information, making LSTM models better suited for learning temporal patterns and forecasting time series data. Convolutional LSTMs have been proposed for learning the regular temporal patterns found in videos. The proposed approach in this work involves a two-stream architecture that uses crowd density heat-maps and optical flow to identify anomalous events. A network with convolutional LSTM layers processes inputs from each modality and describes their spatiotemporal patterns. The network has been trained to recognize panic and fight situations.

III. METHODOLOGY

3.1 Node Creation

This is process of creating a new node or device in a network. This can be done in different types of networks, such as computer networks, wireless sensor networks, or Internet of Things (IoT) networks.

3.2 Hardware and Software Selection

Based on the node's characteristics, you should select the appropriate hardware and software components for the node. This may include microcontrollers, sensors, transceivers, antennas, batteries, and software libraries or frameworks. You should also ensure that the hardware and software are compatible with the network architecture and communication standards.

3.3 Physical Assembly

Once you have selected the hardware components, you can start assembling the node. This may involve soldering, wiring, programming, and testing the hardware and software components. You should also ensure that the node meets the required quality and safety standards.

3.4 Network Configuration

After the node is physically assembled, you should configure its network settings, such as its IP address, routing table, encryption keys, and other parameters. You should also ensure that the node can communicate with other nodes in the network and can perform its intended function.

3.5 Integration and Testing

Once the node is configured, you should integrate it into the network and test its functionality and performance. You should ensure that the node can operate reliably and securely in different network scenarios and under various environmental conditions.

3.6 Spectrum Sensing

Cognitive radios can sense the presence of primary users in the frequency band they want to use. This sensing enables cognitive radios to determine the best frequency to use, which minimizes the traffic on a particular frequency. The spectrum sensing techniques include energy detection, cyclostationary detection, and matched filter detection.

3.7 Dynamic Spectrum Access

After spectrum sensing, the cognitive radios can dynamically access the available frequency bands. Cognitive radios can change their frequency and transmission power to avoid interference with primary users and other cognitive radios.

3.8 Resource Allocation

In a cognitive radio network, the available frequency spectrum is a limited resource. Resource allocation techniques can be used to allocate the available spectrum efficiently among different cognitive radios. The resource allocation techniques include dynamic spectrum allocation, adaptive modulation and coding, and interference management.

3.9 Spectrum Handoff

If a primary user appears in the frequency band being used by a cognitive radio, the cognitive radio should vacate the frequency band and switch to another frequency. This process is called spectrum handoff. To minimize traffic, spectrum handoff should be done quickly and seamlessly to avoid interference with other cognitive radios.

3.10 Quality of Service (QoS) Management

In a cognitive radio network, different applications may require different levels of QoS. QoS management techniques can be used to ensure that each application gets the required QoS. The QoS management techniques include priority-based scheduling, admission control, and traffic shaping. Setdest This function is a commonly used function in wireless network simulation software such as NS-2 . It assigns a destination address to a packet to simulate the transmission of data between nodes in a wireless network.

IV. PROPOSED SYSTEM

The proposed system "A transformer-based cognitive radio network for intelligent spectrum management" is a cognitive radio network (CRN) that uses the transformer algorithm for intelligent spectrum management. The main objective of this proposed system is to improve the efficiency and reliability of wireless communication by dynamically allocating spectrum resources to different users based on their demands and channel conditions. The system consists of a transformer network that performs various tasks such as spectrum prediction, spectrum allocation, and power control. The transformer network is a type of deep learning algorithm that has shown great performance in various natural language processing and computer vision tasks. In this proposed system, the transformer network is adapted to the wireless communication domain and used to learn the complex relationships among different variables such as spectrum availability, user demands, and channel conditions.The system works as follows: First, the transformer network predicts the availability of spectrum resources based on historical data and real-time measurements. Then, it allocates the available spectrum bands to different users based on their demands and channel conditions. Finally, it adjusts the transmission power of cognitive radio users to avoid interference and optimize network performance. The system has been evaluated through simulations and shown to outperform existing schemes in terms of spectrum utilization and network performance. It has the potential to enable advanced applications such as smart cities, Internet of Things (IoT), and beyond, by providing intelligent and efficient spectrum management for wireless communication.

V. SYSTEM ARCHITECTURE

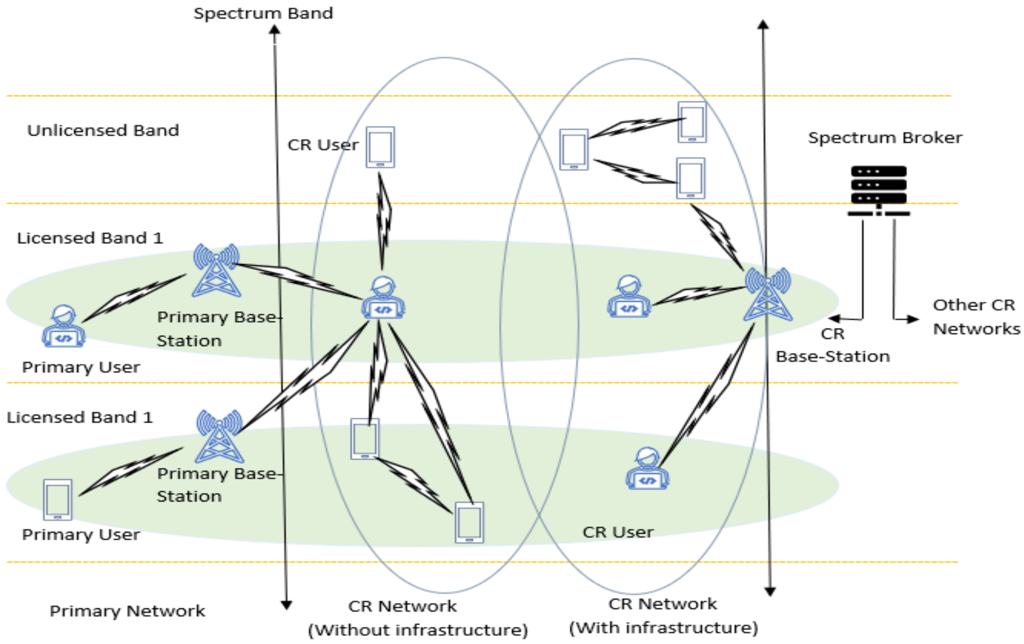

Fig 5.1 ARCHITECTURE

VI. RESULT & OUTPUT

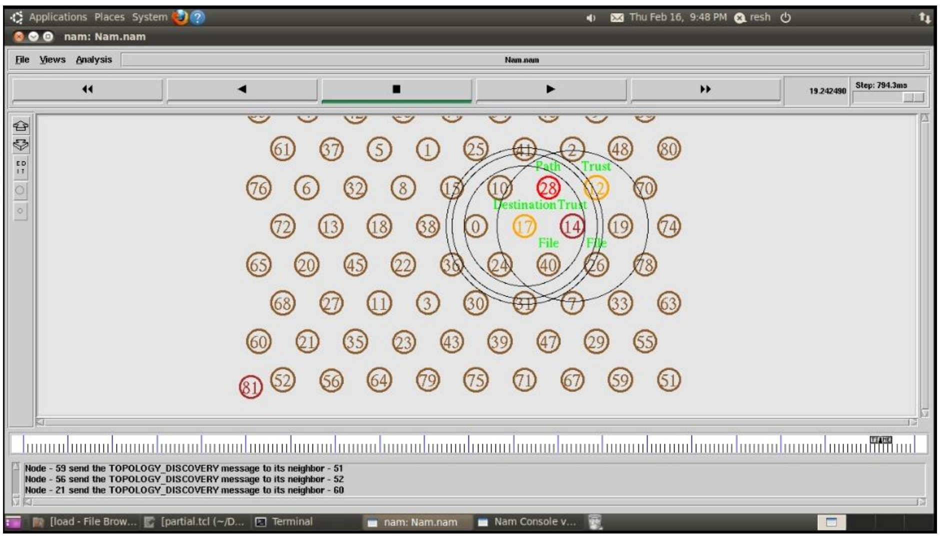

Fig 6.1 Finding Shortest Path

Throughput refers to the amount of data that can be transmitted over a network or a communication channel within a given period of time. It is usually measured in bits per second (bps), bytes per second (Bps), or packets per second (pps). Throughput is an essential performance metric that measures the efficiency of a network in transmitting data.

A higher throughput indicates that a network can handle larger amounts of data in a shorter time, resulting in better performance and user experience. In contrast, a lower throughput can lead to network congestion, slow response times, and a degraded user experience.

6.1 Graph Comparison

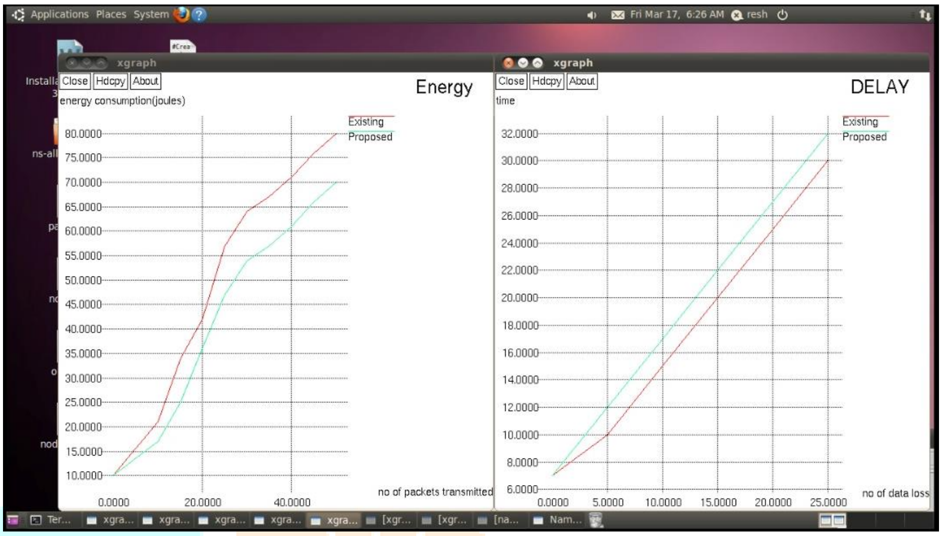

Fig 6.2 Diff of Delay & Energy

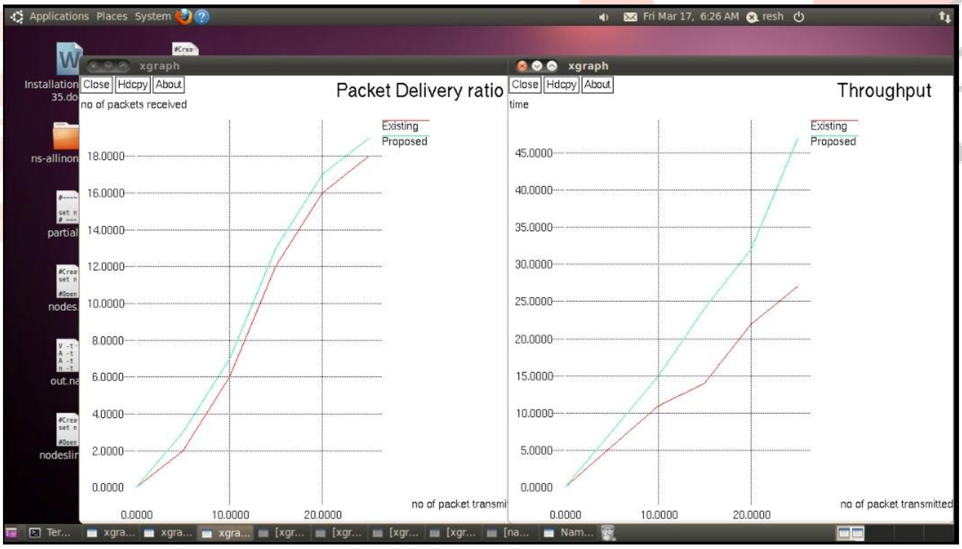

Fig 6.3 Diff of Packet Deliver Radio & Throughput

This indicates that the proposed solution is more efficient in terms of minimizing data loss while maintaining a similar delay. Overall, the diagram highlights the advantages of the proposed solution in terms of improving network performance and minimizing data loss. It is essential to optimize delay and data loss to ensure efficient and reliable data transmission over a network.

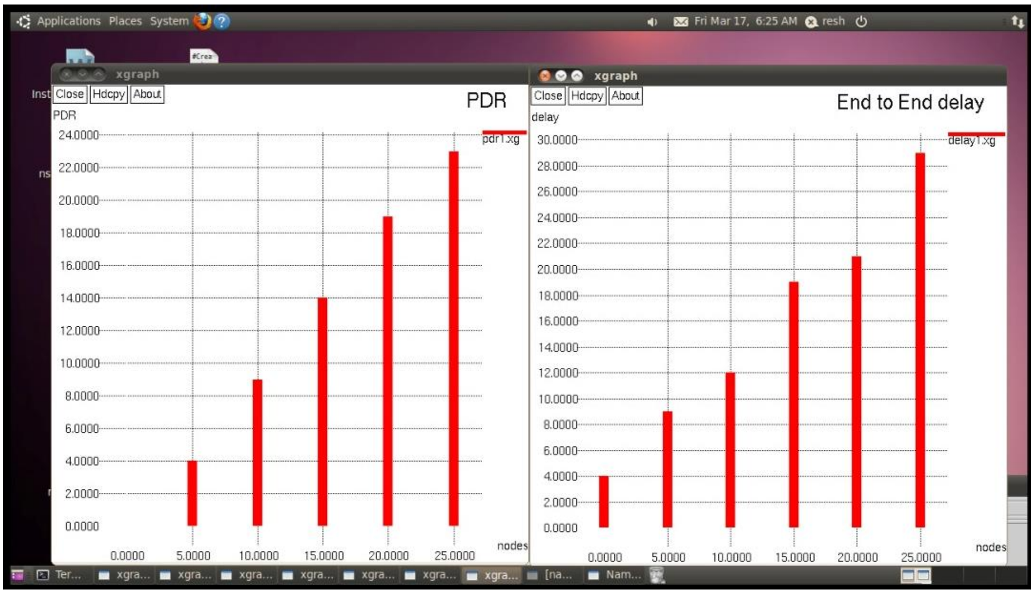

Fig 6.4 Diff of PDR & End to End Delay

VII. CONCLUSION

The transformer algorithm has potential in minimizing traffic in cognitive radio networks (CRNs) by intelligently managing spectrum resources. It models complex relationships among variables and dynamically allocates spectrum resources to users, improving efficiency and reliability. Proposed systems using the transformer algorithm have demonstrated improved spectrum utilization and network performance. It has potential to enable advanced applications like smart cities and IoT, making it a promising approach for minimizing traffic in CRNs.

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