PERFORMANCE ANALYSIS OF CO-OPERATIVE MULTI AGENT ROUTING IN MOBILE COGNITIVE NETWORKS

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Abstract
Cognitive radio significantly mitigates the spectrum scarcity for automation application built on wireless communication. Current technique in multi-channel multi-flow MCADNs is becomes even worse because multiple links potentially interfere with each others. To solve this problem, we propose Co-operative Multiagent Routing Protocol in Mobile Cognitive Networks. The main aim of this paper is to avoid the collision and packet loss, minimizing energy consumption on dynamic of spectrum availability in Mobile Cognitive Networks using Multiagent routing protocol. NS2 based simulation results demonstrate that our Co-operative Multiagent routing protocol significantly outperforms related proposals in average e2e delay, throughput, packetloss rate and energy consumption.
Keywords: Mobile cognitive radio networks, collision avoidance, routing protocol

1.INTRODUCTION

Wireless communication is steadily increasing in automation applications because it can offer several advantages over traditional wired communication systems. Unfortunately, with the rapid growth of various automation applications, channel competition is becoming more and more serious due to the severe scarcity in unlicensed spectrum. Cognitive radio is a promising technique to improve the efficiency of licensed spectrum by dynamic spectrum access. In a cognitive radio network, users opportunistically access the existing wireless spectrum without interfering with existing users. A key challenge in the design of cognitive radio networks is dynamic spectrum allocation, which enables wireless devices to opportunistically access portions of the spectrum as they become available. In mobile cognitive networks, secondary users frequently sense activities of primary users and opportunistically access idle licensed channels of PUs[1]. The Uncertainty of PUs activities, co-channel interference among SUs and node mobility in MCADNs significantly affects delay and reliability of automation applications. In cognitive radio network with multihop communication requirements (i.e., cognitive radio adhoc networks), the dynamic nature of the radio spectrum calls for the development of novel spectrum routing algorithm[2]. Cognitive Radio technology enables secondary users to sense, identify and intelligently access the unoccupied spectrum. The fundamental difference of Cognitive Radio network from traditional wireless networks is that there is no statically allocated spectrum[3].

[5]The Routing in multi-hop CR networks faces several new challenges. The collaboration between spectrum decision and route selection by establishing a "spectrum-tree" in each spectrum band[4]. For a multihop route in CRN, the channel availability on each hop may be different as a result of the real-time channel occupation of PUs. Efficient routing should accommodate to the dynamic heterogeneous channel availability and be tightly coupled with channel selection.

For the reasons above, in this paper, we propose a distributed algorithm that jointly addresses routing, dynamic spectrum-assignment and power allocation functionalities for cognitive radio networks. The objective of the proposed algorithm is to avoid the interference and minimize the energy consumption.

We show how Co-operative Multiagent routing solves routing and spectrum allocation at each hop outperforms approaches where routes are selected independently of the spectrum assignment. Our main contributions can be outlined as follows. We derive a distributed and localized algorithm for joint dynamic routing and spectrum allocation for multihop cognitive radio networks. The proposed algorithm jointly addresses a routing and spectrum assignment with power control under the physical interference model, which computes the interference among secondary users using signal-to-interference-plus-noise ratio(SINR) based model.

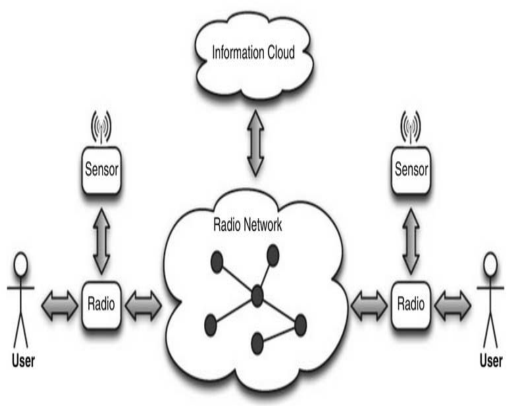

Fig.1.External interface of CR

Architecture of shows a radio network interact with a number of external system, including the radio user, the network, sensors and other resources accessible through the network. Most of these interfaces were recognized as features of cognitive radio.

In the proposed algorithm, each cognitive radio makes real-time decision on spectrum and power allocation based on locally collected information. Nodes can adjust their transmission power to maximize the link capacity on the selected spectrum portion. We show how the proposed algorithm can be interpreted as a distributed and practical solution to the interference problem.

The remainder of this paper is organized as follows. In Section II, we review related work. In Section III, we propose the Co-operative Multiagent routing protocol, which is our distributed algorithm for joint routing and dynamic spectrum routing. In Section IV, the performance of the algorithm is evaluates. Finally, Section V concludes this paper.

2.LITERATURE SURVEY

Cognitive radio is a radio that can be programmed and configured dynamically to use the best wireless channels to avoid user interference and congestion. The main functions of cognitive radios are spectrum sensing and spectrum sharing. Detecting unused spectrum and sharing it, without harmful interferences to other users; an important requirement of the cognitive radio network is to sense empty spectrum. Detecting primary users is the most efficient way to detect empty spectrum.

Many protocols have been developed to find the satisfactory solutions. [1] the author have proposed Delay Minimized Routing Protocol to minimize the end to end delay by using joint routing and channel assignment algorithm. It is used

to predict e2e delay in the collision probability. The Heuristic routing algorithm that jointly explores routes with the minimal e2e delay and assign channels in MCADNs for automation applications. Cross layer design typically requires a tight coupling between the routing and the spectrum management. Some works aimed to maximize network throughput[2][3]. In[2] the cross layer design algorithm was proposed and discussed, in which the distributed algorithm for joint opportunistic routing and dynamic spectrum access in multihop cognitive radio network. It is a platform based on an open source platform built on GNU Radio and USRP2. In [3], the on-demand protocol for routing and spectrum assignment in Cognitive radio networks. The all possible delays during a multihop transmission through Cognitive Radio network were developed the metrics and mechanism of spectrum assignment. STODRP [4] uses a routing metric that combines transmission delay, channel switching delay and protocol delay. In all these delay oriented related proposals, channel collision probability plays an important role to estimate delay exactly. In cognitive networks, however, channel collision probability prediction is still a big challenge. It combines tree-based proactive routing and on-demand route discovery. It is used to establish a spectrum tee in each spectrum band . It also proposed fast and efficient spectrum adaptive route recovery method.

Minimizing the interference between different sessions while providing throughput and reliability guarantee investigated in [5] which jointly considered route selection and channel assignment. In this paper, the robust route and channel selection problem is addressed. It is proposed to find reliable candidate paths and a joint route and channel allocation algorithm is proposed to construct the throughput satisfied route from these paths. [6]The Effective Transmission Time (ETT) metric captures the transmission delay of links. The distributed resource management solution using AFP significantly improves the performance of delay sensitive applications transmitted over a multihop cognitive radio network. The proposed approach can also be used to support QoS for general multi radio wireless networks, when there is no PU. [7]the potential benefits and current limitations of using cognitive radio techniques in industrial wireless sensor networks were discussed. Cognitive radio approaches can be added to the lower layers of existing industrial network to improve resistance to interference. It include the standardisation, latency and efficiency of spectrum sensing on restricted sensor nodes, the speed of channel selection and dynamic reconfiguration once a channel encounters interference and compliance with timeliness constraints in industrial applications.

[9]Delay constrained routing protocol is proposed to minimize the total cost subject to some delay constraint. Extensive simulation demonstrated the outperform of existing caching approaches in terms of total cost and delay constraints and the hybrid approach performs the delay constraints. In [10], the channel assignment problem in cognitive radio networks is studied. Three algorithm were proposed such as node-based, link based, node-link based. [11]present a cross-layer framework that employs cognitive radio communications to circumvent the propagation conditions in power systems and supports QoS for smart grid applications. Thus from the survey the problems in cognitive radio have been discovered and identified.

3.PROPOSED WORK

In our proposed system, we propose Co-operative Multiagent routing protocol to increase the throughput ratio and to reduce the packet loss and energy consumption. We assume that our protocol will be deployed in a cognitive radio network that employs an overlay transmission. In such network, PUs and SUs cannot transmit signals simultaneously. Thus we propose Co-operative Multiagent routing protocol to overcome the problem. When some node has a data packet to send, it broadcasts a route request packet to all of its neighbours and wait for replies. Each neighbour is checked for its ability to host the data packet to the target destination. A neighbour is able to be a part of the route if its distance to the final destination is less than the distance from the source to the destination. In this case, such neighbour is considered as a potential relay node for this transmission. Each potential relay considers all of its neighbours as possible next hops. For each possible next hop, the relay tries to construct different groups of different size with its neighbours. For each potential constructed group, its routing metric is calculated. By using our proposed protocol, the multihop communication is possible during the data transmission. The PUs and SUs can send the data to their destination simultaneously.

3.1 CO-OPERATIVE MULTIAGENT ROUTING PROTOCOL

Multi-agent routing is the routing technique of using multiple alternative paths through a network, which can yield a variety of benefits such as fault tolerance, increased bandwidth, or improved security. In multi-hop networks, Co-operative Multiagent routing protocol have become increasingly popular and have numerous applications. One application in which it may be useful is in mobile cognitive networking.

The complete routing mechanism includes two parts:(1) a modified dynamic source routing algorithm that handles route discovery;(2) a local statistical computation and link monitoring function located in each nodes. This routing method provides better transmission performance by providing: Simultaneous, parallel transport over multiple carriers. Load balancing over available assets. Avoidance of path discovery when reassigning an interrupted stream. Shortcoming of this methods are: Some applications may be slower in offering traffic to the transport layer, thus starving paths assigned to them, causing under-utilization. Moving to the alternative path will incur a potentially disruptive period during which the connection is re-established. This method provides significant performance benefits over the former: By continuously offering packets to all paths, the paths are more fully utilized. No matter how many nodes fail, so long as at least one path constituting the virtual path is still available all sessions remain connected. This means that no streams need to be restarted from the beginning and no re-connection penalty is incurred.

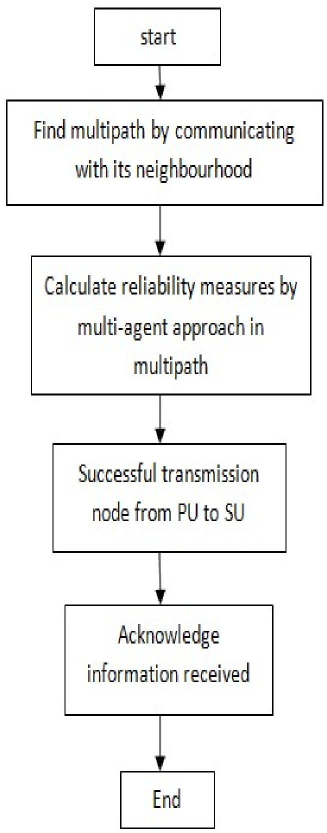

Fig.2Flowchart for mutiagent communication

3.2VIRTUAL IMPLEMENTATION

In wireless network, the mobile nodes are spread in random manner. The sensing process is takes place in every node to identify the utility and capacity of the node. Then, the utility based best relay selection process is performed. The relay process is used to select the relay nodes. The source node select the shortest path for the data transmission. After selecting the optimizing path to send data from source to destination, the routing path is formed to send the data. Random nodes are grouped together for Co-operative scheduling. Each node have a head node which is known as cluster head. The cluster head is select based on the capacity of node and the energy efficiency of the node. All nodes send the data information to the cluster head and it will transfer the data into the base station. Here, the energy consumption for transferring data from source to destination will reduce. The life time of the nodes will increase.

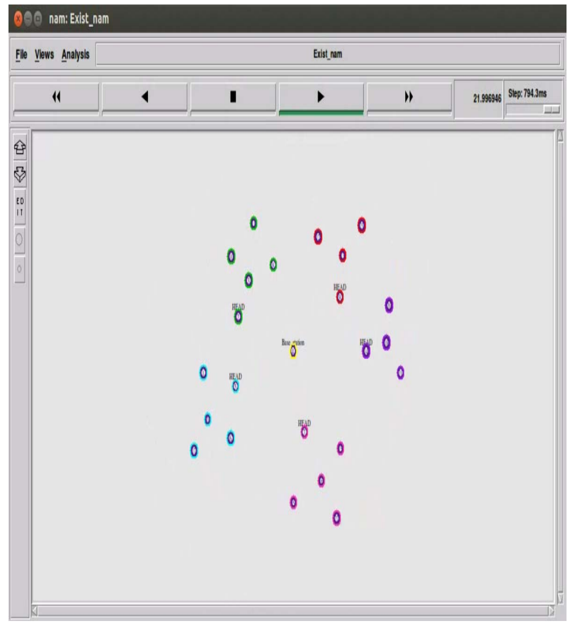

Fig.3.Virtual Implementation

The randomly spreaded nodes are grouped

together to perform cooperative scheduling and the cluster head is select for each grouped node and it is shown in fig.3.

3.3PROTOCOL IMPLEMENTATION

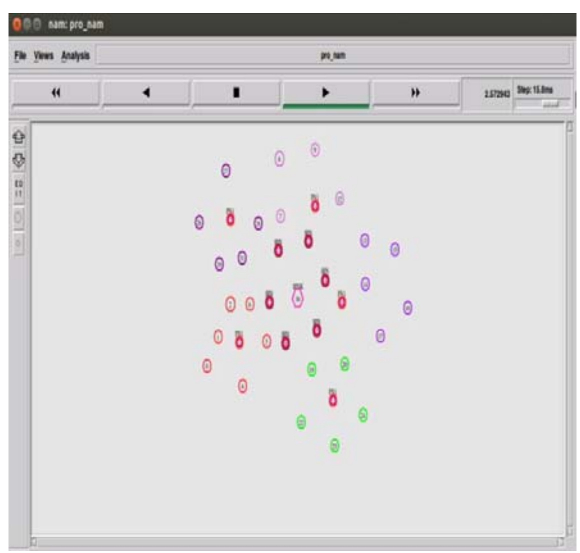

Fig.4.Execution of CMAS protocol

The PUs and SUs are identified in fig.4. The nodes are group together and select the cluster head. Then it will send the data to base station. The Base station send the data to the destination node. Here, the Co-operative Multiagent protocol used to avoid the collision between the PUs and SUs. The fig.4. shown the secondary users and primary users where in the same network. The secondary users send the data to sink node, whether it transfer the data simultaneously by many user, there will be no packet loss and collision. For every secondary user, the time slot where fixed, though it can also send the data at the same time by multi-user in the name of multihop communication.

4.SIMULATION RESULT AND DISCUSSION

In this section, we evaluate the performance of proposed routing protocol Co-operative Multiagent Routing based on NS2 simulator. The performance of CMAS protocol in Delay ratio, node drop measurement, packet loss ratio, channel frequency, protocol frequency are compared with DMR protocol. The following shows the simulation parameters of proposed CMAS protocol,

4.1 SIMULATION RESULT

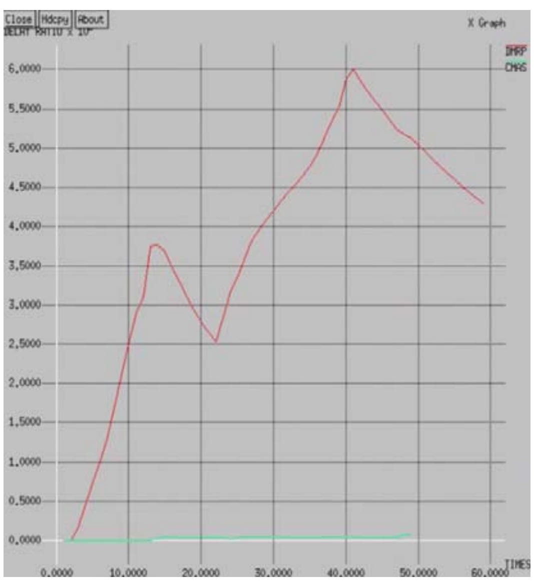

Fig.5.Delay Ratio

The performance of Delay ratio is shown in the fig.5. Delay Ratio is refers to the time taken for a packet to be transmitted across a network from source to destination. The time taken to send a data from source to destination in CMAS is low compare to DMR protocol. The minimization of delay ratio is due to available of multipath in the network. Comparing to the protocol DMR, the protocol CMAS has delay ratio about 0.05 at the time of 12,000-25,000 whereas the delay ratio of DMR is about 3.5500. This shows an improvement of 90% in the delay ratio.

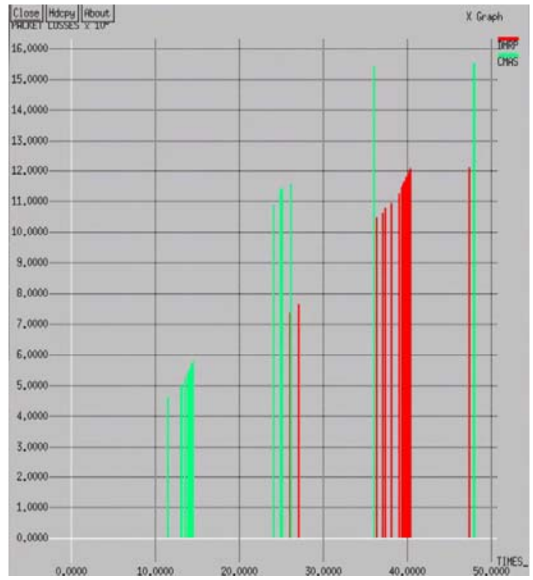

Fig.6.Packet loss

The performance of packet loss ratio is shown in fig.6. Packet loss ratio indicates the amount of packet drops after the transmission of all the packets. The simulation result shows that the packet loss ratio is more in DMR at the time of 30,000 to 40,000, whereas the CMAS have less packet loss compare to the DMR.

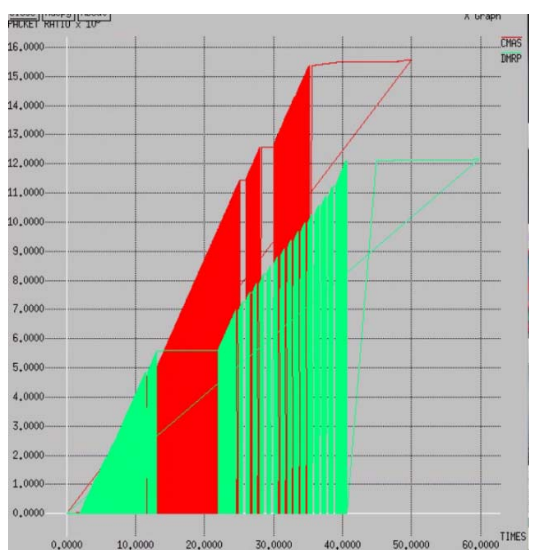

Fig.7.Throughput

Throughput performance is shown in the fig.7. Throughput is defined as the number of packet successfully transmitted from sender to receiver. The performance of throughput is higher in CMAS compare to DMR. This improvement is due to minimization of e2e delay. At the time of 22,000-40,000, the packet delivery ratio of CMAS is about 15,5000 whereas at the same time, the packet delivery ratio of DMR is about 12,0000. This shows 25% of improvement in the throughput.

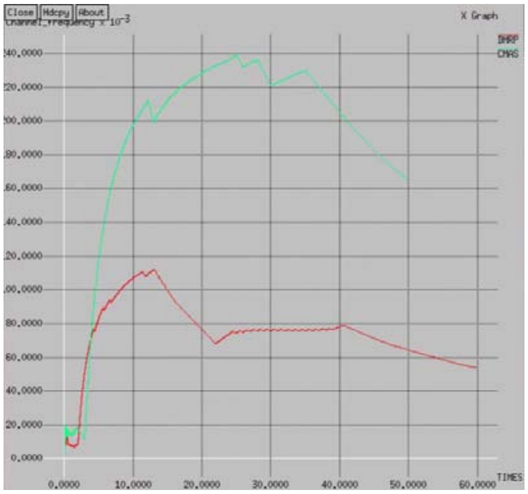

Fig.8.Channel Frequency

Fig.8. shows the comparison of channel frequency of CMAS and DMR protocols. At the time of 20,000-30,000, the frequency range of CMAS is about 23.0-24.0*10^-3, whereas the DMR range is about 70.0-79.0*10^-3. This shows the improvement of CMAS protocol in channel frequency about 60%.

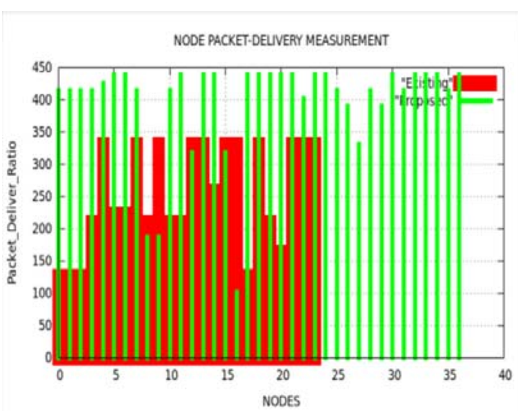

Fig.9.Node drop measurement

The comparison of the node measurement between CMAS and DMR protocol is shown in fig.9. At the nodes 15-25, the no. of packet delivered in DMR is about 340, in CMAS about 440. This shows 22% of improvement in packet delivery ratio.

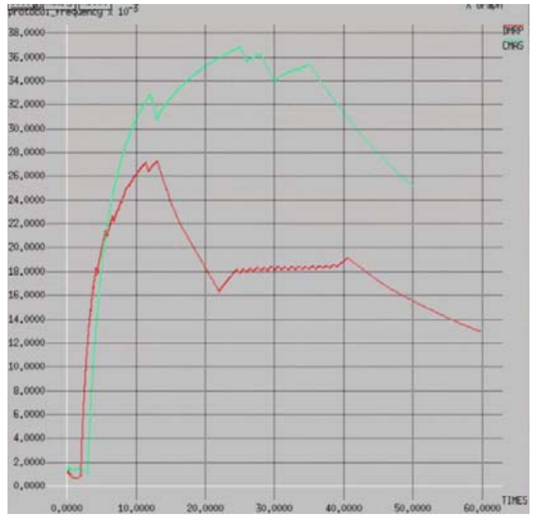

Fig.10.Protocol frequency

Fig.10 shows the comparison of efficiency of CMAS and DMR protocol. Our proposed protocol has higher efficiency about 47% than the existing DMR protocol.

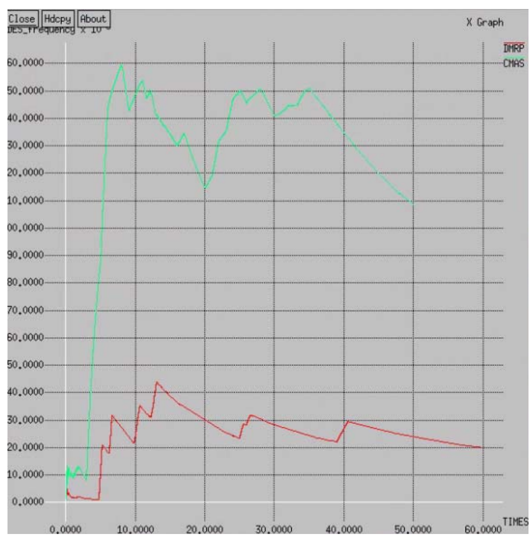

Fig.11.Destination frequency

Fig.11. shows the comparison of CMAS and DMR in destination frequency. This shows the capability of destination node to receive the packet. The capability of our proposed protocol is 70% higher than the DMR protocol.

5. CONCLUSION

In this paper, we presented the CMAS protocol for multihop CR network. The key concept of our protocol is to avoid the interference in the cognitive network. The comparison of CMAS and DMR shown in the above graphs. From the result obtained our protocol shows an improvement about 50-60% when compared to the DMR protocol in throughput, packet loss ratio, packet delivery ratio, channel frequency, efficiency of protocol and destination frequency.

REFERENCE

1. "Delay-Minimized Routing in Mobile Cognitive Networks for Time-Critical Applications" Feilong Tang, Can Tang, Yanqin Yang, Laurence T. Yang, Tong Zhou, Jie Li, and Minyi Guo

[2] L. Ding, T. Melodia, S. Batalama, J. Matyjas, and M. Medley, “Crosslayer routing and dynamic spectrum allocation in cognitive radio ad hoc networks,” IEEE Transactions on Vehicular Technology, vol. 59, no. 4, pp. 1969–1979, May 2010.

[3] I. Pefkianakis, S. Wong, and S. Lu, “Samer: Spectrum aware mesh routing in cognitive radio networks,” in DySPAN 2008, 2008, pp. 1–5.

[4] G.-M. Zhu, I. Akyildiz, and G.-S. Kuo, “Stod-rp: A spectrum-tree based on-demand routing protocol for multi-hop cognitive radio networks,” in IEEE GLOBECOM 2008, Nov 2008, pp. 1–5.

[5] J. Zhang, F. Yao, Y. Liu, and L. Cao, “Robust route and channel selection in cognitive radio networks,” in IEEE 14th International Conference on Communication Technology (ICCT), 2012, pp. 202– 208.

[6] H.-P. Shiang and M. van der Schaar, “Distributed resource management in multihop cognitive radio networks for delay sensitive transmission,” IEEE Transactions on Vehicular Technology, vol. 58, no. 2, pp. 941–953, Feb 2009.

[7] T. Chiwewe, C. Mbuya, and G. Hancke, “Using cognitive radio for interference-resistant industrial wireless networks: An overview,” IEEE Transactions on Industrial Informatics, vol.11, no.6, pp.1466–1481, 2015.

[8] A. S. Cacciapuoti, M. Caleffi, F. Marino and L. Paura, “On the Route Priority for Cognitive Radio Networks,” IEEE Transactions on Communications, vol. 63, no. 9, pp. 3103–3117, 2015.

[9] J. Zhao, W. Gao, and Y. Wang, “Delay-constrained caching in cognitive radio networks,” in IEEE INFOCOM 2014, 2014, pp. 2094–2102.

[10] J.Wu, Y. Dai, and Y. Zhao, “Effective channel assignments in cognitive radio networks,” Computer Communications, vol. 36, no. 4, pp. 411– 420, 2013.

[11] G. Shah, V. C. Gungor, O. B. Akan et al., “A cross-layer qos-aware communication framework in cognitive radio sensor networks for smart grid applications,” IEEE Transactions on Industrial Informatics, vol. 9, no. 3, pp. 1477–1485, 2013.