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Energy Efficiency and Channel Access Improvement in Cognitive Radio Wireless Sensor Network

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ABSTRACT
Cognitive radio-based wireless sensor network is the next-generation sensor network paradigm. Important to this emerging sensor network is the need to reduce energy consumption, paving way for 'green' communication among sensor nodes. Therefore, in this paper, we have proposed an energy-efficient, dynamic channel decision and access technique for cognitive radio-based wireless sensor networks. Using intelligent learning technique based on the previous experience, the cognitive radio-based wireless sensor network agent decides which available channel to access based on the energy-efficiency achievable by transmitting using the channel.

Keywords: Cognitive radio, Wireless Sensor Network, Cognitive Radio Network, Wireless local Area Network, Spectrum.

INTRODUCTION
Adhoc network is a group collection of mobile node. During the last few years we have all witnessed steadily increasing growth in the deployment of wireless and mobile communication networks [1]. Mobile ad hoc networks consist of nodes that are able to communicate through the use of wireless mediums and form dynamic topologies. The basic characteristic of these networks is the complete lack of any kind of infrastructure, and therefore the absence of dedicated nodes that provide network management operations as do the traditional routers in fixed networks.

In order to maintain connectivity in a mobile ad hoc network all participating nodes have to perform routing of network traffic [5].

Cognitive radio (CR) technology provides a paradigm shift in the way scarce spectrum bands are being utilized. It is a relatively new area of research in wireless communication that provides efficient utilization of communication channels within the spectrum band. Wireless sensor network (WSN), which operates in the license-free industrial scientific and medical (ISM) band is faced with the problem of spectrum scarcity within this band due to over-crowding of different communication systems within this band. To solve this problem, CR is being proposed for WSN.

Cognitive radio-based wireless sensor network (CRWSN) is currently a hot research area. It is believed to be the next generation of sensor networks. There are lots of prospects of deploying CR functionalities in the traditional WSN. Among others, energy efficiency, efficient channel utilization, reliable packet delivery, latency reductions are some of the prospects of deploying CRWSN. Integrating the CR features into the traditional sensor networks in order to achieve these prospects is the main challenge confronting researchers due to event-driven nature of sensor networks.

The rest of this paper is organized as follows in the first section we describe an introduction of about the wireless sensor and cognitive radio network. In

section II we discuss about the cognitive radio wireless sensor network. In section III we discuss about the experimental result analysis and study, finally in section IV we conclude the about our experimental result and future scope.

II CRWSN NETWORK SCENARIO

CRWSN scenario is made up of a licensed PU and unlicensed SU within the same spectrum band made up of different channels. CRWSN is a distributed network of sensor nodes, which sense an event signal and collaboratively communicate their readings dynamically over available channel in a multi-hop manner in order to satisfy the specific application requirements of the network. Most WSN applications use the IEEE 802.15.4 standard and operates in the unlicensed ISM band. This is due to flexibility and low cost of operating within this band. However, in recent time, the unlicensed band has become crowded with other wireless networks such as wireless local area networks (WLANs), wireless body area networks (WBANs) and worldwide interoperability for microwave access (WiMAX) operating within this band. This leads to the building of CRWSN in order to solve the problems associated with coexistence of multiple networks in the unlicensed spectrum band.

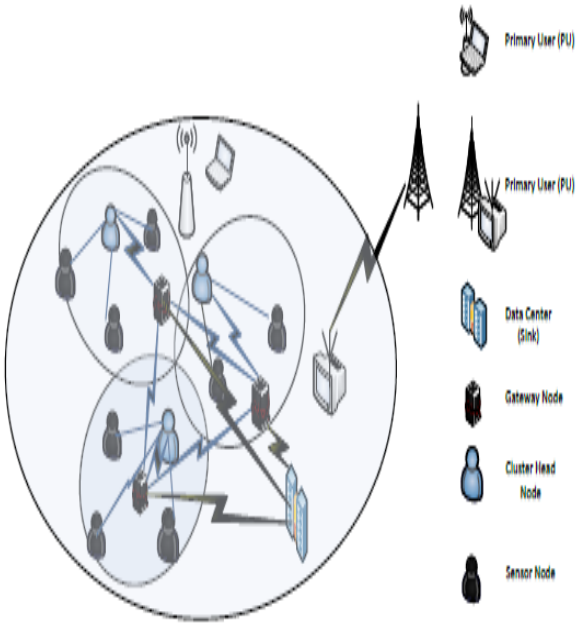

Figure 1. CRWSN Network Scenario.

The low channel utilization among the licensed band users leaves a large amount of resources for WSN to serve traffic with strict quality of service requirements. Without having to access dedicated licensed spectrum, it is possible to build WSN with a low cost. There is little restriction on the air interfaces, coverage area and network topology.

III EXPERIMENTAL RESULT ANALYSIS

The proposed model written in matlab script language command provided by this simulator. Different performance metrics are used to check the performance of proposed model in various network environments. In our experiment we have selected number of licensed channel percentage and packet loss rate against each channel number. The reason for the selection of these performance metrics is to check the performance of proposed model protocols in highly mobile environment of cognitive radio wireless sensor network.

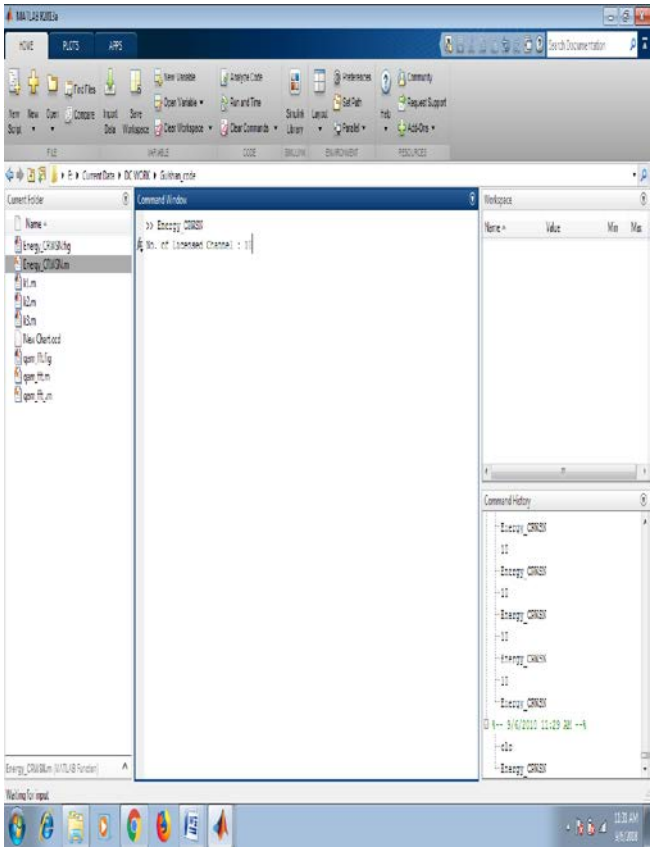

Figure 2: Shows that simulation scenario of 10 number of licensed channel for the performance evaluation of existing method.

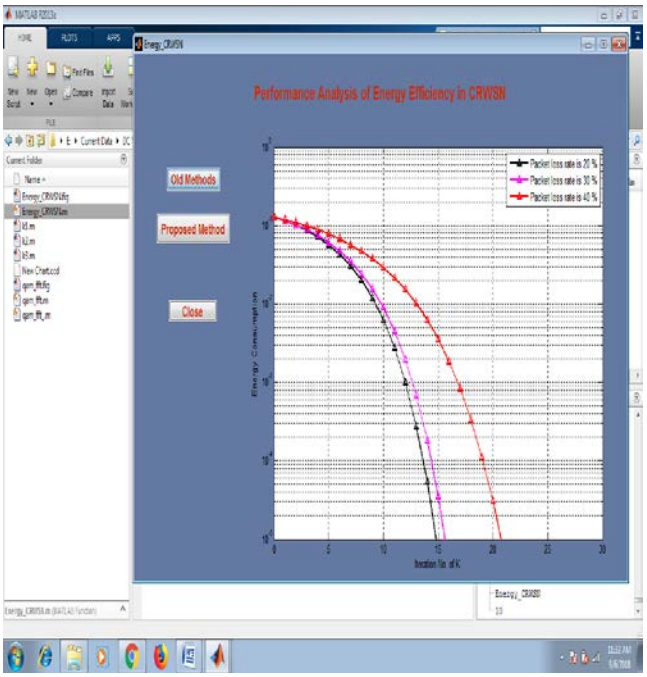

Figure 3: Shows that simulation scenario of 10 number of licensed channel for the performance evaluation of existing methods for the communication.

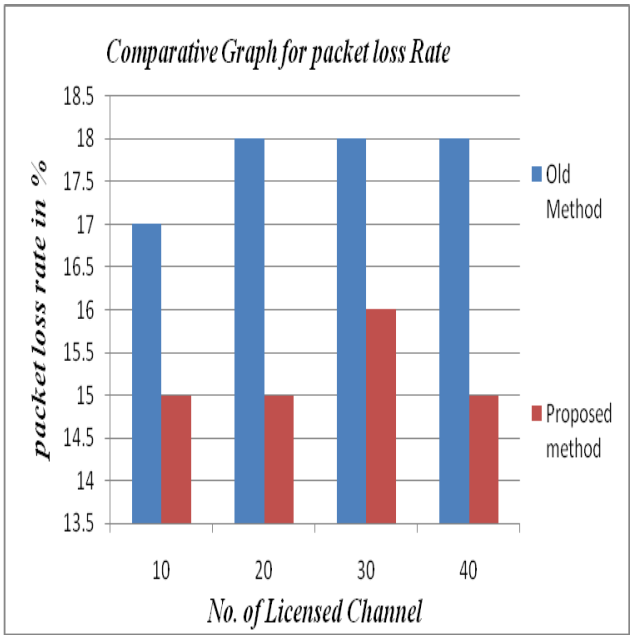

Figure 4: The above figure shows that the comparative performance evlaution graph for the packet loss rate using the old method and proposed method against the number of licensed channel.

IV CONCLUSIONS AND FUTURE WORK

Cognitive radio represents a promising wireless technology to intelligently harness the frequency spectrum that is assigned to licensed users but is not being fully utilized at a specific place or time. Sensor nodes in a CRSN can sense the availability of licensed channels and access the idle channels for data transmission. However, due to channel fading and shadowing, spectrum sensing by individual sensor node has inevitable sensing errors, which adversely impact the performance of both the CRSN and the primary users (PUs) of the licensed channels. For our future work, we will extend our research to a more general network scenario, where the CRSN has no prior knowledge about the compromising probability of the network and the percentage of compromised node may increase time to time.

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