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Exploring the Effect of Various Cluster Structures and Improvement of Energy Consumption in Cognitive Radio Wireless Sensor Networks

Subhashree Mohan¹, Dr. K. Gunasekaran²

P.G. Student, Department of Electronics and Communication Engineering, GRT IET College, Tiruttani, Tamilnadu, India¹

Professor, Department of Electronics and Communication Engineering, GRT IET College, Tiruttani, Tamilnadu, India²

ABSTRACT: The growing demand and wide deployment of cost effective wireless communication networks, and the challenges related to its technical design and operations have necessitate the work on the more resourceful use of the very limited radio frequency spectrum, limited energy resources and reduction of the end-to-end delay as an integral part of the next making smart wireless networks. In this work we look at three different Cognitive Radio Wireless Sensor Networks (CRWSNs) cluster structures; modified single-hop structure, multi-hop cluster structure and hybrid cluster structure. We revise the effect of the three structures in multiple setups in regards to varying the selected area. The evaluation results of the suggested three structures are comparing to the single-hop cluster.

KEYWORDS: Cognitive Radio, Cognitive Radio Wireless Sensor Network, Cluster Structures.

I. INTRODUCTION

The rising require and extensive deployment of cost valuable wireless communication networks, and the challenges related to its technical design and operations have necessitated the work on the more efficient make use of the very partial radio frequency spectrum, limited energy resources and decrease of the end-to-end delay as an integral part of the next generation smart wireless networks. Three various Cognitive Radio Wireless Sensor Networks (CRWSNs) cluster structures are explored; modified single-hop structure, multi-hop cluster structure and hybrid cluster structure. The effects of the three structures in multiple setups are studied in regards to varying the selected area. The estimation outcome of the recommended three structures is compared to the single-hop cluster.

In this paper, we propose three different CRWSN cluster structures; modified single-hop cluster structure, multi-hop cluster structure, and Hybrid cluster structure to address the communication between CR mobile users in CRWSN. The proposed scenarios are discussed with regards to the communication coverage standards for WiFi and Mobile Applications. The proposed single-hop cluster structure is a modified version to the one where the number of registered nodes are conditionally controlled and restricted to be no more than three. On the other hand, we propose a multi-hop and a hybrid cluster structure, to enhance the energy efficiency and the end-to-end, with a wider coverage area which overcomes the short coming of a high concentration of a large number of nodes. This leads to an increase in the intensity of electromagnetic waves within the coverage area, which negatively affects human health.

In the multi-hop cluster structure, the system model is collected of multi-hop communications sensor nodes formed in sets of overlapping clusters to make sure full coverage. Within multi-hop communication range, the CR mobile user is surrounded by one or more clusters of sensor nodes. In order to save energy, inactive clusters are kept in sleeping mode. In the hybrid structure, the CR mobile user establishes a connection using either the shared CRWSN or direct ad-hoc setup, based on the CR mobile sender and receiver location and Signal to Noise Ratio (SNR). The overall end-

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to-end delay and energy consumption are measured when sensor nodes are in single-hop cluster, in a modified single-hop cluster and in a multi-hop cluster model. Also, the probability of detection and false detection are evaluated. The remainder of this paper is organized as follows; in section II we give a detailed system description, along with an explanation of how to form a cluster and subset division. In section III we explain the system model. In section IV the simulation results and detailed discussion and a through comparison with the other algorithms are introduced. Finally the paper is concluded in section V.

II. RELATED WORK

Cognitive radio (CR) networks can be combined with sensor networks, it can not only share traffic of sensor networks but also reduce the transmission delay because of the spectrum advantage, thus can perform monitoring tasks better. To improve the reliability of the mixed network and energy efficiency of sensors, this article achieves sensor networks clustering based on the mobility and distribution of CR nodes. The CR nodes act as cluster head and undertake the task of relay between clusters. In every cluster, the sensor nodes are divided into several coverage subsets, and their working duration are scheduled by the distribution of energy. Simulation results showed that the strategy proposed can reduce the network energy consumption and delay, guarantee the quality of monitoring, and extend the network lifetime effectively.

General relativistic effects have long been predicted to subtly influence the observed large-scale structure of the universe. The current generation of galaxy red shift surveys has reached a size where detection of such effects is becoming feasible. In this paper, we report the first detection of the red shift asymmetry from the cross-correlation function of two galaxy populations that is consistent with relativistic effects. The data set is taken from the Sloan Digital Sky Survey Data Release 12 CMASS galaxy sample, and we detect the asymmetry at the 2.7σ level by applying a shell-averaged estimator to the cross-correlation function. The proposed DMP consists of three sub-units: 1) Bayesian approach based tunable Thompson sampling algorithm for sub band statistics estimation, 2) Thompson sampling algorithm based subband access scheme exploiting the past collision events to minimize collisions among CRs, and 3) Mode selection scheme. Simulation results show that the proposed DMP offers 10–35% improvement in the throughput of the decentralized network and 40–90% reduction in the number of subband switchings compared to existing DMPs

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This paper presents a novel cognitively inspired artificial bee colony clustering (ABCC) algorithm with a clustering evaluation model to manage the energy consumption in cognitive wireless sensor networks (CWSNs). The ABCC algorithm can optimally align with the dynamics of the sensor nodes and cluster heads in CWSNs. These sensor nodes and cluster heads adapt to topological changes in the network graph over time. One of the major challenges with employing CWSNs is to maximize the lifetime of the networks. The ABCC algorithm is able to reduce and balance the energy consumption of nodes across the networks. Due to the under-utilization problem of the allocated radio spectrum, cognitive radio (CR) communications have recently emerged as a reliable and effective solution. Among various network models, this survey paper focuses on the enabling techniques for interweave CR networks which have received great attention from standards perspective due to its reliability to achieve the required quality-of-service. Spectrum sensing provides the essential information to enable this interweave communications in which primary and secondary users are not allowed to access the medium concurrently.

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III.METHODOLOGY

Breadth – first search (BFS) is an algorithm for traversing or searching tree or graph data structures. It begins at the tree root (or some arbitrary node of a graph, sometimes referred to as a 'search key'), and discovers all of the neighbour nodes at hand depth prior to moving on to the nodes at the next depth level. It utilizes the contrary approach as depth-first search, which instead searches the highest-depth nodes first before being required to back off and make bigger shallower nodes.

The advantages of BFS (Breadth-First Search) this algorithm computes shortest path (fewest number of edges) from S to all other vertices in a graph in time proportion to $E+V$. This will decrease your time when your search target is relatively close evaluate to the full depth of the search space of Graph. Cognitive radio is extensively predictable to be the next Big hit in wireless communications. This article summary definition of Cognitive radio systems and describes the state of art in the regulatory and standardization activities on cognitive radio all over the world, which are deemed to have fundamental influence on the future of wireless communications. Cognitive radio concepts can be applied to a variety of wireless communications scenarios, a few of which are described in this document. Cognitive radio concepts can be applied to a variety of wireless communications scenarios, a few of which are described in this document additionally, the major functions and applications of cognitive radio and components of cognitive radio and implementation issues are reviewed.

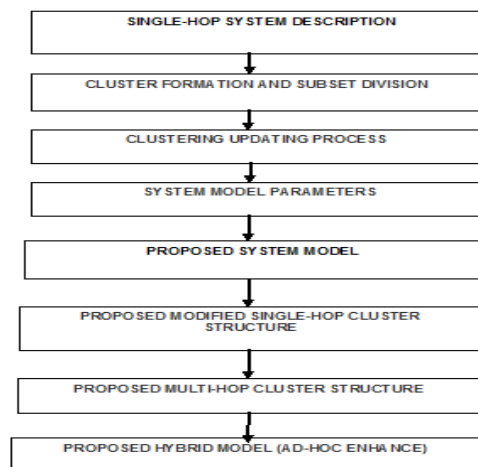


Fig.1. Block diagram of Proposed System

MODIFIED SINGLE HOP CLUSTER STRUCTURE

The sensor nodes within communication range r of each CR are grouped into clusters, and each cluster is divided into disjoint subsets with overlapped sensing coverage.

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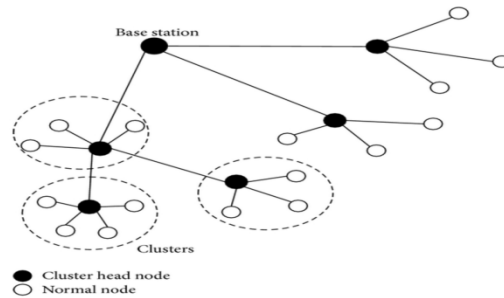


Fig.2 Single hop clustering

MODIFIED MULTI HOP CLUSTER STRUCTURE

In this form the same number of clusters as in the modified single-hop design is used to form a multi-hop cluster architecture with 120 % increase in the coverage area. The updates between the clusters are controlled via the central cluster to limit the update flooding messages. The update messages are sent when any new registration process starts. Moving between more than one shorter hop distance may be more efficient than moving between those fewer but longer hop distances.

MODIFIED HYBRID CLUSTER STRUCTURE

In the hybrid model, in order to provide the optimum energy efficient path, the source CR receives the infrastructure path metrics information via the control channel of the joined CRWSN. It compares to the calculated path metric information to reach the destination CR mobile user directly. The CR mobile user determines the optimal transmission technique (ad-hoc scenario or Infrastructure based scenario). In order to enhance the CR mobile user performance, the CR mobile user is configured with dual transmission technique as in algorithm

IMPROVE ENERGY CONSUMPTION BY REDUCING THE NUMBER OF SENSED SAMPLES

Energy expenditure in sensing stage of CR can be enhanced by dropping the number of sensed samples while it decrease the quantity of calculation done by energy detector before making a conclusion. This approach also guide to reduce time necessary in sensing and it is value if the sensing reliability of the cognitive radio network is kept to a acceptable level. The sensing dependability is defined by maximum likelihood of detection (specifies that a detector makes a correct result that a channel is engaged H1(Hypothesis 1) and minimum probability of false alarm (a false alarm event occurs when the detector assumes H1).

IV. RESULT

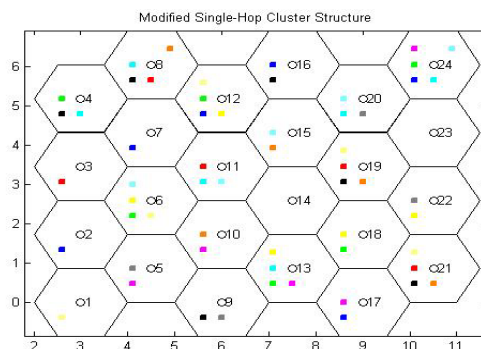


Fig. 4 Single Hop cluster structure

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In this cluster structure design, the wireless sensor nodes are in fully overlapped coverage to form single-hop cluster coverage. The sensor nodes within communication range r of each CR are grouped into clusters, and each cluster is divided into disjoint subsets with overlapped sensing coverage.

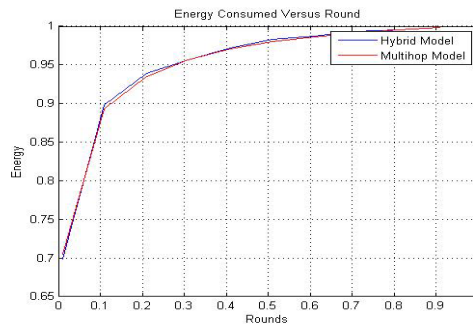


Fig 3. Energy consumption

The overall energy consumed over different communication coverage ranges r , in which the energy consumed is about 0.07J with r between 0 to 30m.

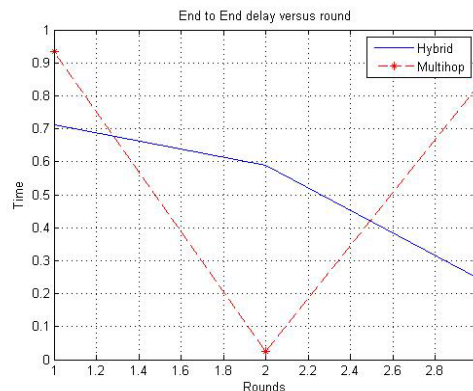


Fig.5 End to End delay versus round

The overall end-to-end delay varies in different formations as presented in Fig.5 setting up the sensor nodes in multi-hop architecture decreases the delay to around 6m.

V. CONCLUSION

The energy consumption and overall end-to end delay of several cluster structure for CRWSN has been analysed. First, an improvement to the single-hop structure is initiated by controlling the number of registered nodes per cluster in each round. This change results in slightly decreasing the energy consumption contrast to the unmodified single-hop structure. In order to improve energy efficiency, the multi-hop cluster structure is suggested. Simulation results show that the multi-hop cluster structure decreases energy consumption while simultaneously expanding the coverage area. The extension in the coverage area is a result of reducing the overlap between clusters. In the final configuration, a hybrid selection criterion is added to the mobile devices, which permits the mobile device to offer a connection using either the shared CRWSN or direct ad-hoc setup.

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BIOGRAPHY



Subhashree Mohan is the PG student of Communication and Networking Engineering in GRT Institute of Engineering and Technology, Tiruttani. She graduated UG in Electronics and Communication Engineering in GRT Institute of Engineering and Technology, Tiruttani. She completed SSLC in the year of 2011 and HSC in the year of 2013 in Bharathidhasanar matriculation Higher Sec School.



Dr. K. Gunasekaran, is a Professor of Electronics and Communication Engineering at GRT Institute of Engineering and Technology, Tiruttani, Tamilnadu, India. He received B. E degree in Electronics and Communication Engineering from Thanthai Periyar Government Institute of Technology (TPGIT), Madras University, Tamilnadu, India and M. Tech degree in Applied Electronics from M.G.R. University, Tamilnadu, India in 2000 and 2006 respectively. He received Ph.D., Degree from St. Peter's University, Tamilnadu, India in 2016. He is having 18 Years of Teaching Experience. His research interest in VLSI Design.