ENERGY EFFICIENT RESOURCE ALLOCATION FOR COGNITIVE RADIOS: A GENERALIZED SENSING ANALYSIS

Abstract

In this paper, two resource allocation schemes for energy efficient cognitive radio systems are proposed. Our design considers resource allocation approaches that adopt spectrum sharing combined with soft-sensing information, adaptive sensing thresholds, and adaptive power to achieve an energy efficient system. An energy per good-bit metric is considered as an energy efficient objective function. A multi-carrier system, such as, orthogonal frequency division multiplexing, is considered in the framework. The proposed resource allocation schemes, using different approaches, are designated as sub-optimal and optimal. The sub-optimal approach is attained by optimizing over a channel inversion power policy. The optimal approach utilizes the calculus of variation theory to optimize a problem of instantaneous objective function subject to average and instantaneous constraints with respect to functional optimization variables. In addition to the analytical results, selected numerical results are provided to quantify the impact of soft-
sensing information and the optimal adaptive sensing threshold on the system performance.

**Existing System**

The transmission power subject to primary interference constraint is minimized as a quadratic constraint quadratic problem under imperfect channel state information (CSI). Since the problem is not a convex one, two randomization schemes have been proposed. It is argued that minimizing the energy per good bit (EPG) outperforms both categories in-terms of system energy efficiency. The EPG function describes the energy consumption per successfully received bit. The authors of considered an average EPG as their energy efficiency metric. They proposed a joint design of the optimal sensing duration and optimal power allocation, to maximize their system efficiency. They enforced a detection probability threshold and an average interference constraint to protect the PU. In this paper, an energy efficient spectrum
sharing system is analyzed and designed by utilizing the sensing information about PU. Two resource allocation schemes have been proposed to show the impact of adaptive optimal power, adaptive sensing threshold, and soft-sensing information on the system performances.

**Drawbacks**

- High Energy Consumption
- To overcome the inefficient use of frequency spectrum and its resulting scarcity

**Proposed System**

We proposed two energy efficient resource allocation schemes that utilize the sensing information. The sub-optimal scheme is proposed based on the channel inversion power policy, whereas the optimal scheme is based on the calculus of variation principle. We analyzed both schemes, and derived their performances. Also, we analyzed the benchmark systems where no sensing is used, for both
Advantages

- Less Energy Consumption.
- Efficient use of frequency spectrum.

Modules

- Node Creation & Routing
- Problem Formulation And Systems Analysis
- Sub-Optimal Approach: Channel Inversion
- Performance Analysis And Result Comparison
Module Description

Node Creation & Routing

In this module, a wireless network is created. All the nodes are randomly deployed in the network area. Our network is a mobile network, nodes are assigned with mobility (movement). Source and destination nodes are defined. Data transferred from source node to destination node. Since we are working in mobile network, nodes mobility is set i.e., node move from one position to another.

Problem Formulation And Systems Analysis

The EPG metric is a common objective function among all schemes. Furthermore, there are three common constraints, namely, peak power constraint, minimum rate constraint, and average PU interference constraint (CR constraint). The formulation of the common problem, called P0, is expressed as The EPG objective function is
defined as the power to rate ratio. The power profile $\Psi_i$ and $P_p$ are the transmission powers of SU and PU, respectively, at sub-carrier $i$, $N$ is the total number of sub-carriers. The power profile $\Psi_i$ is defined individually for the benchmark and proposed systems in each of the following sub-sections. The corresponding vector of the power profile is expressed as $\Psi() = f\Psi_1() ; \Psi_2() ; \ldots ; \Psi_N()g$. The parameters $P_{max}$ and $R_{min}$ are assigned constants for the SU’s instantaneous power budget per sub-carrier and minimum fixed rate of the SU, respectively. The constants $k_t$ and $k_c$ refers to the power amplifier and circuit operation constant powers, respectively.

Performance Analysis And Result Comparison

- For performance evaluation we use the following graph
  
  – Packet delivery ratio
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- Throughput
- Delay

System Requirements

HARDWARE REQUIREMENTS:-

Processor - Pentium –III

Speed - 1.1 Ghz

RAM - 256 MB(min)

Hard Disk - 20 GB

Key Board - Standard Windows Keyboard
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Mouse - Two or Three Button Mouse

Monitor - SVGA

SOFTWARE REQUIREMENTS:-

Operating System : LINUX

Tool : Network Simulator-2

Front End : O TCL (Object Oriented Tool Command Language)
References
