Quick Review on Channel State Estimation in Cognitive Radio System

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Abstract- After a thorough study we have seen that Now-a-days problem of spectrum scarcity increased due to tremendous growth of new players in wireless base system by the evolution of the radio communication. This problem occurs because there are many areas of the radio spectrum that are occupied by authorized user/primary user (PU), which are not fully utilized. Cognitive Radio is an emerging concept to resolve this problem, which proves as the next generation wireless communication system that proposed as a way to reuse this under-utilized spectrum in a non-interfering and opportunistic basis. A CR is an entity in a wireless communications environment that senses its tracks changes, environment, and reacts upon its findings and frequently exchanges information with the networks for secondary user (SU). However, CR facing collision problem with tracks changes i.e. reallocating of other empty channels for SU while PU arrives*. In this paper we have discussed different approaches followed to perform Channel Estimation.* ***Our main research objective is to utilize spectrum hole efficiently for data transmission and reception, which is an opportunity for unlicensed user (as a Secondary User) under licensed user as a Primary User). In this work channel state estimation is observed by energy detection (as opposed to feature detection—requires prior knowledge of the PU's Signal and transmission or reception is carried out in a multiple spectrum hole for lower probability of communication loss.***

Keywords **– Cognitive Radio, Primary User, Secondary User.**

I. INTRODUCTION

in radio resource management for wireless and cellular network it's highly required to have channel allocation schemes to allocate bandwidth and communication channels to base stations, terminal equipment and access points. The prime concern of this radio resource management is to maximize system spectral efficiency by the proper frequency reuse in terms of bit/s/Hz/site without failing to be on a certain grade of service by avoiding adjacent channel and co-channel interference among nearby cells or networks that share the bandwidth. For which two types of strategies that are followed, in which first one is fixed, where frequency is assigned on manual basis by the network operator and second one is dynamic, where three methodologies are used to assign the band spectrum which are DCA (Dynamic Channel Allocation), DFS (Dynamic frequency Selection) and Spread Spectrum.

Due to immense growth of the wireless access communication technologies, required more and more spectrum resources following the conventional spectrum band, where most of the spectrum bands are exclusively allocated to the licensed services. Our studies shown that the spectrum wastage and creates artificial spectrum scarcity occurs because a lot of licensed bands are under-utilized. This suggests that the solution to the problem is to use dynamic spectrum access methodologies instead of static spectrum allocation policies to. This can be accomplished through the use of Cognitive Radio Technology.

Cognitive Radio is the emerging concept which follows the process of dynamic spectrum management, which is an intelligent radio that can be programmed and configured dynamically. It is capable of altering its reception or transmission parameters in accordance to the radio environment and the network state to use the available spectrum in optimal manner. Its transceiver is designed to use the best wireless channels in its vicinity. Such a radio automatically detects available channels in wireless spectrum,

then accordingly changes its reception or transmission parameters to allow more concurrent wireless communications in a given spectrum band at one location.

1. CR Network: -

In wireless communication to communicate efficiently transmission or reception parameters get changed without interfering with licensed users Parameter changes are based on the active monitoring of several factors in the radio environment (eg. Radio frequency spectrum) this approach is enabled by the software defined radio frequency spectrum. Cognitive radio has been considered as a key factor for future wireless communications and mobile computing. The cognitive radios can form cognitive radio networks (CRN) by extending the radio link features to network layer functions and above. [27] Has categorized CRN architecture into several structures and classify the unidirectional links in such structures, to pave the way for future systematic CRN research.

2. Cognitive Cycle: -

In order to overcome the problem of radio spectrum scarcity, cognitive radio is required to adaptively modify its characteristics and parameters to access radio spectrum without causing excessive interference to the primary licensed users. Cognitive radio's cognitive cycle operation as secondary radio system is shown in the following figure.

Steps of the cognitive cycle are:

- spectrum sensing
- spectrum decision
- spectrum sharing
- spectrum mobility.

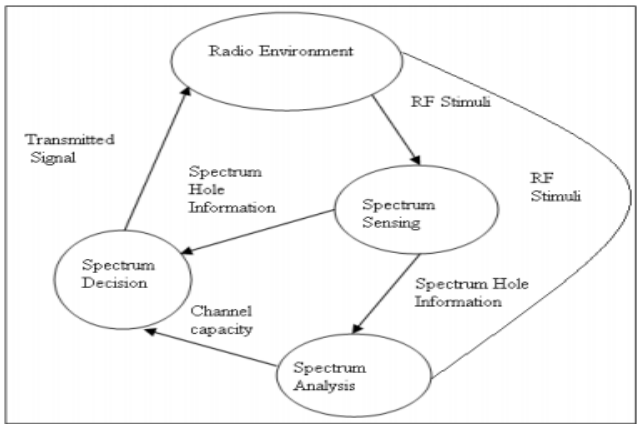

Fig-1 CR Cycle

Spectrum sensing can be considered as an active spectrum awareness process where cognitive radio monitors its radio environment and geographical surroundings, detect usage statistics of other primary and secondary users and determine possible spectrum space holes.

Spectrum sensing can be done by any one of the following:-

- cognitive radio
- by multiple cognitive radio terminals
- by independent sensing network exchanging information in a cooperative way which improves overall accuracy and performance.

Spectrum decision: Based on surrounding spectrum sensing information cognitive radio selects when to start its operation, operating frequency and its corresponding technological/technical parameters. Prime objective of Cognitive radio system is to transfer as much as possible information without causing excessive interference to the primary users with satisfying required quality of service. Moreover, cognitive radio may use data from regulatory database and policy database to improve its operation and outage statistics.

Spectrum Sharing: Since there are number of SU and non-licensed participating in usage of available spectrum holes, it's imperative for cognitive radio to achieve balance between its self goal of transferring information in efficient way and altruistic goal to share the available resources with other cognitive and non-cognitive users. This balance is done with policy rules determining cognitive radio behavior in radio environment.

Spectrum mobility: If PU or licensed user starts to operate, cognitive radio has to stop its operation or to vacate currently used radio spectrum and change radio frequency. This function has to be performed in real time to avoid interference to primary licensed users; therefore it's required to constantly investigate possible alternative spectrum holes. Cognitive radio is developing radio concept founded on software defined radio, digital signal processing and artificial intelligence [16-18]. Ultimate goal of cognitive radio is to use natural resources efficiently including frequency, time, space, and transmitted energy by sensing the environment and adaptive transmission without causing excessive interference to the primary licensed users.

The performance and optimization requirements for cognitive radio system are as follows:

- reliable spectrum hole and primary user detection
- accurate link estimation between nodes
- fast and accurate frequency control and power control method that assures reliable communication between cognitive radio terminals and non-interference to primary users.

3. CRN Architecture :-

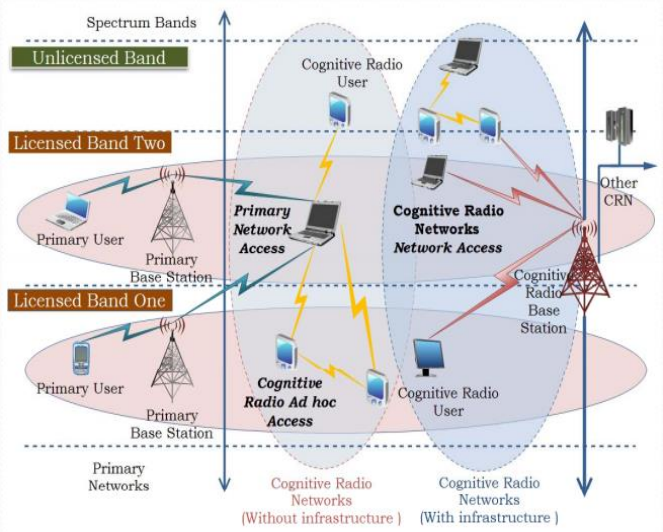

Fig-2 CRN ARCHITECTURE

4. CRN Functions:-

- Spectrum Sensing
- Spectrum Management
- Spectrum Mobility
- Spectrum Sharing

We are focusing on Spectrum Sensing Techniques

5. Problem Statement:-

This work will examine the problem of dynamic spectrum access in the presence of licensed signal, when unlicensed communicating devices have intelligent radios capable of sensing and reacting to their environment using channel state estimation.

6. Proposed work : -

In this work channel state estimation is observed by energy detection (as opposed to feature detection—requires prior knowledge of the PU's Signal) and transmission or reception is carried out in a multiple spectrum hole for lower probability of communication loss

7. Expected result :-

- Better power spectrum density versus frequency response for lower SNR also.
- Low probability of false alarm versus SNR.

8. Application:-

- Leased Network
- Emergency Network
- Military Network
- CR Mesh Network
- Multimedia
- Cellular Network

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