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Spectrum Sensing by Using Energy Detector

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ABSTRACT

Radio frequency applications and services are increasing viable now a day. The range sensing problem has gained new look with cognitive radio and opportunistic band access concepts. After the critical analysis of the licensed band it is clear that it is not utilizing properly. The spectrum indicates that we have a lot of opportunity with respect to time; so that we can accommodate new users (secondary users) or unlicensed users with respect to time assuring that due to our modification the current users (primary users) will not be in trouble. We have verity of diversity techniques to sense a range properly and efficiently, but it is difficult to recognize whether the band is in use or not for this purpose we use "energy detector".

Keyword: *Spectrum, Energy Detection (ED), Licensed User, Unlicensed User, Primary User, Secondary User*

1. Introduction

There is an intense need for an efficient and reliable sensing technique which should cater characteristics of propagation and other important parameters. The proposed methods are temporary and need to be improvised. The choice of research based on spectrum sensing is due to the limitation of available bands. Fast and fine spectrum sensing is the primary demand of a cognitive radio system.

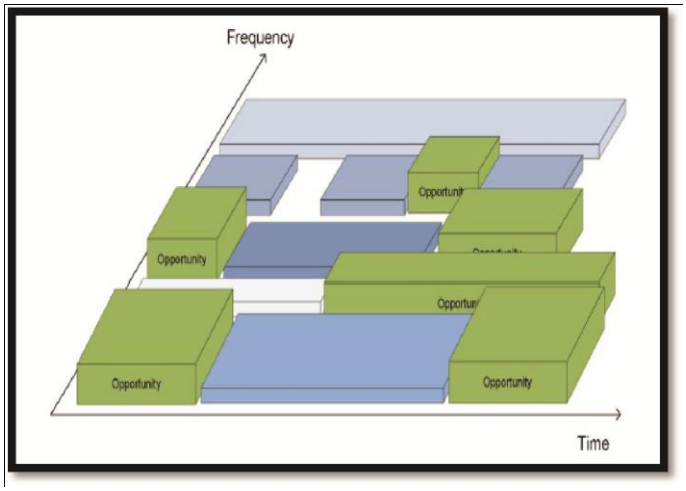

Figure 1: Frequency Allocation with respect to time [1]

The experiment which we had done provide appropriate solution for utilizing the spectrum efficiently. If the non-cognitive user is not using the same radio frequency band then the particular radio frequency will be utilize by cognitive user.
In order to utilize the spectrum efficiently , if the energy level will be below the threshold level than through switching the frequency will be transmitted through the antenna to some other users. In this way we can utilize our spectrum efficiently & can also accommodate new users.
As discussed in A Survey of Spectrum Sensing Algorithms for Cognitive Radio Applications [1], the availability of a specific part of the spectrum in time varies.

In other words, the band is not continuously used. There will be times where it will be available for opportunistic usage after the critical analysis of the licensed band it is clear that it is not utilizing properly. The spectrum indicates that we have a lot of opportunity with respect to time; so that we can accommodate new

users (secondary users) or unlicensed users with respect to time assuring that due to our modification the current users (primary users) will not be in trouble.
We have verity of diversity techniques to sense a range properly and efficiently, but it is difficult to recognize whether the band is in use or not for this purpose we use "energy detector". To explain this idea let's have a concept, suppose there are two threshold levels for a specific user, for example: if the threshold level is high user is present and if the threshold level is low the user is absent generate alarm. The probability of using band depends on the generation of alarm [2].

By choosing the optimum power operation according to different system settings, new energy detectors with better detection performances can be derived. These results give useful guidance on how to improve the performances of current wireless systems using the energy detector. It also confirms that the conventional energy detector based on the generalized likelihood ratio test using the generalized likelihood function is not optimum in terms of the detection performance.

2. Aims & Objectives

As the technology is enhancing day by day the misuse of the facilities is also increasing & due to this the companies are also suffering with a heavy loss. The disaster increase in users & completely packed licensed frequency spectrum is also the main reason of our motivation to provide the solution of both the major issues so that the companies could not bear any loss & can increase their revenue in the shape of new users.

3. Methodology

This research paper had been written after practical implementation. In this paper we had discussed the problems which we are facing badly. It also includes the results of those problems which we obtained virtually. We had tried to provide the solution for adjusting the new users in the same frequency spectrum & in such a way that the primary users (licensed users) do not have any interference, disturbance & their quality of service does not degrade.

We had also made a circuit that will stop the misuse of the facility by sensing the energy level, if the energy level of the user will be increase the allowable energy level (energy level of the particular user) than the alarm will be generated & any one of the user will be deactivated either the 1^{st} user or the 2^{nd}. For this we are using the Energy Detector algorithm [3].

Spectrum Sensing by Using Energy Detector

Energy detector for spectrum sensing had been developed by considering Urkowitz model [3]. Initially transmitter is transmitting the signal which will be receive at receiver, than the signal is passing for filtering to achieve a certain band of 1khz-3khz. After filtering the signal is squared to convert power into energy. Now for energy sample we had integrate the received signal for certain period of time. Finally we had developed a Threshold circuit which will decide the presence of licensed users by comparing a certain level of reference input [4].

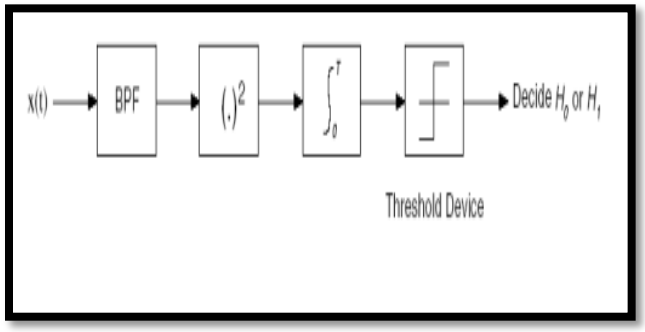

Figure2: Block diagram of Energy Detector [3]

We had also developed a Fusion Centre circuit which is also acting as a switching circuit. If licensed user is not present (H_o) then it will transmit the signal to unlicensed user (secondary user). When licensed users come again (H_1) it will automatically deactivate unlicensed user & not accommodate secondary user till primary user is present. The status of the user is also displayed via serial interfacing & LCD [5].

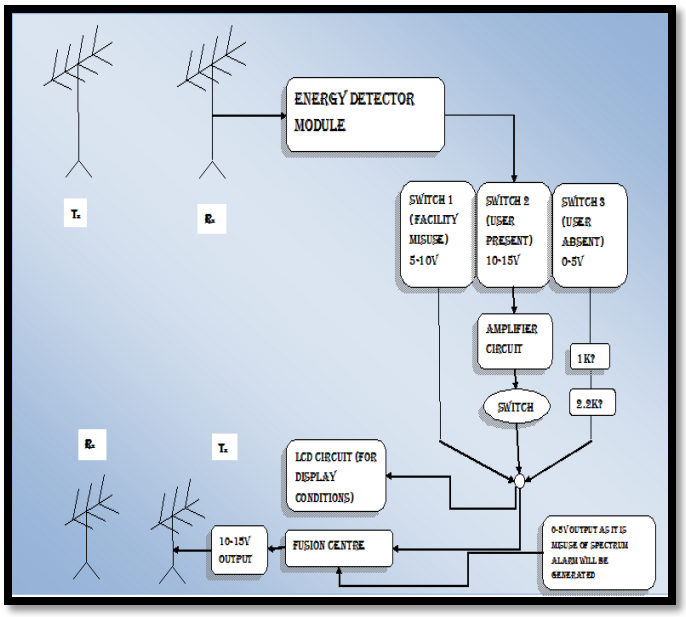

Figure3: Block Diagram of an overall system which had been implemented practically

In this experiment We had assumed that below 5V (output <5V) facility is misuse, voltage greater than 5V but less than 10V user is present (i.e. primary user), voltage greater than 10V user is absent & that particular frequency may be grasp by the secondary user (unlicensed user) till primary user does not returns at that particular frequency [6-7].

The benefits of this experiment & research paper are that in near future the problem of spectrum limitation would likely to be more severe. This research work is aimed to focus on future limitations of available free bands for wide variety of wireless services and applications. Cognitive radio has the potential to exploit efficiently the licensed bands through shared utilization, hence opens up a new paradigm for future wireless networks.

Cognitive radio is the proposed solution to the spectrum limitation problem. In cognitive systems, spectrum sensing will be performed first to find out whether any portion of the spectrum is in use or not. Hence provide the advantage of exploitation of idle bands by opportunistic way [8].

4. Conclusion

Wireless technology is enhancing day by day and the services and applications related to it are also increasing. This rapid increase in user's results completely packed licensed radio frequency spectrum. This is the main motive of our experiment, research paper to design & achieve almost possible solution for an efficient scheme which provides a solution by means of cognitive radio.
To work on the problem of frequency limitation in radio band cognitive radio is proposed by Mitola [4]. Spectrum sensing is the first and most important task in cognitive radio. We had designed energy detector for spectrum sensing in cognitive radio network. Our model is based on URKOWITZ, 1967 [9].
In this scheme a cognitive user [unlicensed user] will first sense the availability of free spectrum by assuring that any non-cognitive user [licensed user] is not operating in the same band.

This opportunistic exploitation of radio frequency band will bring an efficient utilization of inefficient radio frequency allotment scheme. This can also be implemented on FPGA (Field Programmable Graphic Array) [10].

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