INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact factor: 4.295

(Volume3, Issue2)

Available online at: www.ijariit.com

A Review on Performance Analysis of Energy Detection Technique for Cognitive Radio over Different Windowing Techniques

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Abstract: The Spectrum is based on the tremendous growth in the wireless communication network which raises the demand of the frequency user.The most efficient way of allocating spectrum and reliable spectrum sensing is Dynamic spectrum allocation. Cognitive radio is one of the emerging technologies in wireless communications in which a network can flexible changes its transceiver parameter. The Primary user can take the priority decision to detect the presence of the primary user; this can be done by a technology so-called cognitive radio. This can happen if we prefer the appropriate window technique to evaluate system parameter for sensing the availability of vacant band. We show that by comparing the different windows techniques, cognitive radios not only provide better spectrum opportunity but also provide the chance to a huge number of wireless users. In this paper Energy detection based Spectrum Sensing with different windowing methods i.e. rectangular and hamming are developed, that uses to detect the energy of the received signal. We detect the spectral correlation between the two peaks of the signal to sense the presence of the primary user.Therefore windowing strategies are used for improves system performance by reducing spectrum leak. The comparative analysis using different windowing methods shows in Energy detection method.

Keywords: Primary User, Secondary User, Spectrum Sensing and Window Technique etc.

I. INTRODUCTION

The present scenario is huge demand of the spectrum is turns to provide the scarcity of the available spectrum. In order the resolve these problems a new methodology [1] has been implemented i.e. cognitive radio .that can be programmed and configured dynamically to use wireless channels. Such a radio automatically detects the available channels in wireless spectrum and automatically updated the transmission as well as receiver parameter which allow the more devices to access the spectrum, dynamically.For the better respond the spectrum sensing technique is proposed by FCC to provide the flexibility to primary user communication through the possible interference occurred due to secondary users. Here we proposed a model for the better efficiency of spectrum sensing technique by using different windows techniques for the detection of fee spectrum band [2] [3].

II. SPECTRUM SENSING

The main function of spectrum sensing is to sense the available free spectrum [5]. At these time the Primary user is not accessing the defined band for the specified period of the time which are not effectively utilized by the primary user. These introduced the secondary user to access the free available spectrum. Cognitive radio has our major functions. They are spectrum sensing, spectrum management, and spectrum sharing and spectrum mobility. Firstly

we take about spectrum sensing is a method of identified the presence of the primary user as well as the secondary user. Secondly, deals with spectrum management is used to identify that how long the secondary user can use white space. Thirdly Spectrum sharing is to share the spectrum hole between the secondary users & fourthly Spectrum Mobility is used to maintain that if there is breakage in the communication during the transition [6].

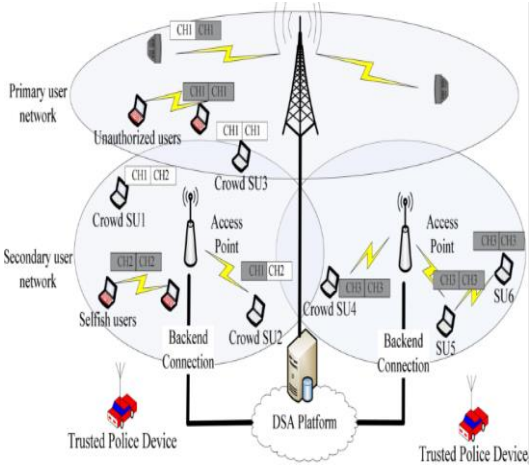

Fig: 1.1 Dynamic Spectrum sensing

There are 3 types of the Sub band in the radio spectrum are occupied in the categorized as follows:
1) White space 2) Gray space 3) Black space
1) White space: - These are RF interference introduced in the spectrum apart from the noise and the natural and artificial sources.
2) Gray spaces: - These are practically occupied by interferes as well as noise.
3) Black spaces: -These contain the interfering signal plus noise.

III. SPECTRUM SENSING TECHNIQUES

A Variety of the different methods has been developed foe the spectrum sensing techniques [7] are of the three types they have matched filter detection, energy detection, and feature detection. Matched filter is one of the optimal methods for detection of the primary users when the transmitted signal is known it is equivalent SNR for the given input signal.It is obtained by correlation the known signal in the unknown signal.The Matched filter requires the cognitive radio to demodulate received signals The basis function of the matched filter is that it has the perfect knowledge of the primary user signal such as bandwidth, operating frequency, modulation type, pulse shaping and frame format.

The another detection techniques are Cyclo stationary Feature detection, these techniques are consist of the detecting the information of the primary uses for instance transmission characteristics, modulation rate, carrier frequency, hopping sequence, cyclic prefixes etc. It consists of the periodicity property which is not occurring in the stationary noise and interference. Similarly Energy detection in which is also known as the radiometer which is based on the principle of the signal detection phenomena in which is non-coherent in nature. Energy detection it is radiometer is based on the signal detection. It does not require the prior information of the primary user or not which is compared with the predetermined the threshold is exceeded.Here be are estimating the signal strength as well as the power level to maintain the threshold level.

DIGITAL FIR FILTER: - Digital filter is an important techniques [8] [9] in the digital signal processing application. A digital filter is a mathematical algorithm implemented to remove the unwanted component of the Signal. Basically it process the digital input signal to the desired output signal .It is classified into two categories i.e. FIR and IIR .The difference between the FIR and IIR filter is that FIR is consist the response of finite duration were As the IIR consist of the infinite duration .we can design the FIR filter by using the windowing techniques, Frequency sampling method and Miniamax FIR design. There are basically 5 types of the filter which depends on The present and past input samples [10]. In this paper attention is given to different windowing method [11] [12]. Here in this we discuss the review paper on the different windowing techniques such as Hanning , Hamming , Blackman, Barttlet and Kaiser window [13].

IV. **DIFFERENT WINDOW TECHNIQUES**.

Window technique involves a function so-called window function which states that if any interval is taken then it returns the finite non-zero value within the interval and outside the interval, it returns the zero value. Here if we use the IIR system it will obviously return the finite none zero value inside that interval producing a FIR system and all other value outside the interval will be zero [14].

The basic principle of the window function is to calculate the value of the h(n) by the anti-Fourier transform based on the ideal filter for the frequency response.

The h (n) is given as

$$h_d(n) = \frac{1}{2\pi}\int_{-\pi}^{\pi} H_d(e^{j\omega})$$

Here the h (n) is a unit impulse response and the w(n) is the window function

$$h(n) = w(n).\, h_d(n)$$

There are many windowing techniques available for the FIR filter and they are 19 20 21 22

1. Hamming
2. Rectangular

We are using impulse response in the filter to reduce the oscillation inside the Fourier series method. The w (n) are the windowing function which consists of two side lobe and main lobe with their ripple factors. Here the ripple factor should be as low as possible [15].

i) HAMMING WINDOW

In signal processing, a window function (also known as an apodization function or tapering function) is a mathematical function that is zero-valued outside of some chosen interval. The window with these particular coefficients was proposed by Richard W. Hamming. The window is optimized to minimize the maximum (nearest) side lobe, giving it a height of about one-fifth that of the Hann window [16].

$$w(n) = \alpha - \beta\, \cos\left(\frac{2\pi n}{N-1}\right),$$

with

$$\alpha = 0.54,\ \beta = 1 - \alpha = 0.46,$$

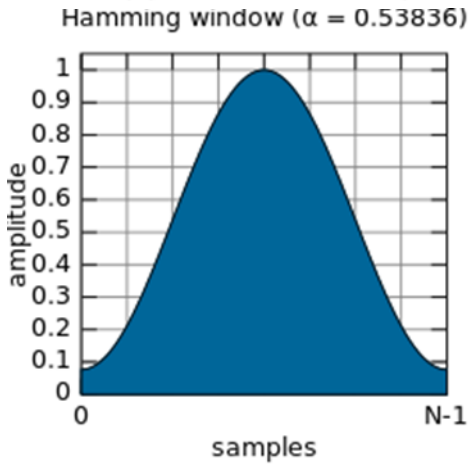

Figure: 1.2 Hamming Window

ii)RECTANGULAR WINDOW

The rectangular window (sometimes known as the boxcar or Dirichlet window) is the simplest window, equivalent to replacing all but N values of a data sequence by zeros, making it appear as though the waveform suddenly turns on and off: Other windows are designed to moderate these sudden changes, which reduces scalloping loss and improves dynamic range.

$$w[n] = \begin{cases} 1, 0 \le n \le M \\ 0, \text{ otherwise} \end{cases}$$

We have studied this function extensively in class, and know its DTFT to be

$$W(e^{j\omega}) = \frac{\sin\left(\frac{M\omega}{2}\right)}{\sin\left(\frac{\omega}{2}\right)} e^{-j\omega M/2}$$

The plots of the original sinc function above and its magnitude plotted in dB, which is shown in fig.

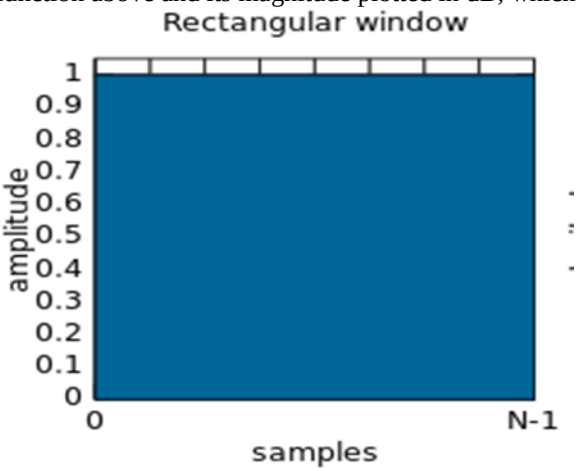

Figure 1.4 Rectangular window

CONCLUSION

In this paper, we have discussed a new type of strategy for utilization of free spectrum by using a different type of the windowing techniques to obtained the high performance in the cognitive radio. The proposed methodology is basically used to fill the hole between the demanding of the user and shortage to the supply in wireless user here in order to solve these in the radio spectrum environment. Our proposed model is used the enhance the spectrum availability using the different windowing techniques

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