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SPECTRUM SENSING SCHEME USING SOFT COMPUTING TECHNALOGY

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Abstract— In communication system spectrum has a crucial role and wireless technologies are increasing rapidly it is required to make efficient use of spectrum to satisfy the spectrum scarcity problem. Using spectrum efficiently can be done by cognitive radio because of its ability to sense surrounding environment. Cognitive radio sense unoccupied spectrum by detecting the primary users' presence or absence in the spectrum. Using machine learning techniques for the implementation of intelligent cognitive radio increase efficiency and detection performance and detect signal at low SNR condition .Simulation results show that the proposed system gives much better results compared to the conventional energy detection system and improves the performance of the system

Keywords— Cognitive Radio, Energy Detection, Cooperative Spectrum Sensing, Fuzzy Logic, Membership Functions

I. INTRODUCTION

Nowadays with the technology and the science developing the spectrum was nearly fully occupied. In the communications industry, the number of users increasing rapidly with the use of mobile phones, internet access, data transfer which mainly require high-speed data transmission. So, in that case, Cognitive radios especially aimed at improving the utilization of the electromagnetic spectrum. Cognitive Radio is a wireless device which can act as the transceiver and identify the spectrum availability status and adapt to the surrounding environment. It is hybrid technology which adapts to the frequency of communication, encrypts and decrypts the signal sense nearby functioning wireless devices.

The main function of Cognitive radio is a spectrum sensing in which it helps to detect the unused spectrum by the primary user so that the unused spectrum can utilize by other unlicensed users to make efficient utilization of spectrum. So, it is important to detect the transmission of primary user in the spectrum the processing of searching unused spectrum is one of the primary processes of cognitive radio So sensing environment by discovering vacant holes in the spectrum and utilizing that band without damaging primary user and when the primary user starts their transmission immediately vacant the frequency spectrum.

Only on one cognitive radio spectrum sensing cannot depends because if any barrier occurs between the primary user and the secondary user then cognitive radio gives incorrect decision and interference will happen between primary user and secondary user so to improve sensing and output accuracy also problems like interference, shadowing fading and hidden node problem group of cognitive radios used so depend on each cognitive radio decision the presence or absence of primary user transmission in spectrum is detected that group of cognitive radio will cooperatively involve in final decision of Primary user presence so-called cooperative Spectrum sensing techniques .

II. SYSTEM DESCRIPTION

The proposed system has two main parts hardware and software. The hardware part consists of four main hardware System: Pentium IV 2.4 GHz. Hard Disk: 40 GB Monitor: 15 VGA Colour. Mouse: Logitech. Ram: 512 Mb Software part consists of OS – XP or windows 7 Software tools – MATLAB 2017@.

III SPECTUM SENSING MODEL

Spectrum sensing is a most important process performed by cognitive radio. It allows the secondary user to sense the environment by detecting the transmission of the primary user so that it occupied frequency band.

Sensing process depends on two hypotheses

$$H0 \text{ exist if } p(t) = c(t)\ H1 \text{ exist if } p(t) = g(t) + c(t)$$

$p(t)$ is the received signal at a cognitive radio,

$g(t)$ is the transmitted signal from the primary user,

$c(t)$ is the noise signal at AWGN,

$H0$ is the absence of primary user and

$H1$ is the presence of primary user

Detector output or energy (E) is compared to a threshold (□) to make sensing about the presence or absence of primary user. If $E >$□, the $H1$ hypothesis exist and if $E <$ □, H0 hypothesis exist.

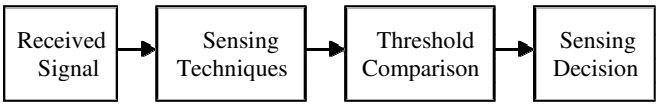


Fig.1. Spectrum sensing model

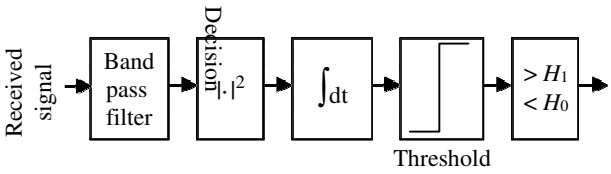


Fig.1. Energy detection technique

Mainly the energy detection method is used for spectrum sensing because it has long computation and execution complexity depending on information like frequency and bandwidth of the signal. For the energy detection, we can take an input signal which selects the bandwidth and it is sampled. Then it uses the implementation for FFT (Fast Fourier Transform), and then the absolute value sampled is squared. At last, we compared with between the output of the integrator and threshold. It is the presence or absence primary user can be detected [10]. Spectrum sensing does not require high processing time but error occur due to interference, shadowing, fading and hidden node problem so to overcome that we switch to cooperative spectrum sensing.

3.1. ARCHITECTURE OF COGNITIVE RADIO NETWORK

In addition to spectrum sensing to effective improve spectrum utilization, a cognitive radio in CRN can sense available networks and communication systems around it. A Cognitive Radio Network(CRN)is thus not just another network to interconnect cognitive radios. The CRNs are composed of various kinds' communication systems and networks ,and can be viewed as sort of heterogeneous networks.

The heterogeneity exists in wireless access technologies, networks, user terminals, applications, and service providers The design of cognitive radio network architecture is toward the objective of improving the entire network utilization, rather than just link spectral efficiency. From the users perspective, the network utilization means that they can always fulfil their demands anytime and anywhere through accessing CRNs. From the operators' perspective ,they can provide better services to mobile users ,and allocate radio and network resources to deliver more packets per unit bandwidth in a more efficient way.

3.2. NETWORK ARCHITECTURE

The CRN scan be deployed in network-centric, distributed, ad hoc, and mesh architecture, and serve the needs of both licensed and unlicensed applications. The basic components of CRNs are mobile station (MS), base station/access point (BSs/APs) and backbone/core networks. These three basic components compose three kinds of network architectures in the CRNs Infrastructure, Ad-hoc and Mesh architectures, which are introduced as follows.

IV.SOFTWARE ARCHITECTURE

In this research work two software Fuzzy logic description and machine learning techniques are used.

4.1. FUZZY LOGIC DESCRIPTION

Fuzzy logic is an extension of Boolean logic by LotfiZadehin 1965 based on the mathematical theory of fuzzy sets, which a generalization of the classical is set theory. By introducing the notion of degree in the verification of a condition, thus enabling a condition to be in a state other than true or false, fuzzy logic provides a very valuable flexibility for reasoning, which makes it possible to take into account in accuracies and uncertainties. One advantage of fuzzy logic in order to formalize human reasoning is that the rules are set in natural language.

V.ADVANTAGES

- All the control would be in your voice commands by using this home automation system.
- This project can provide the facility of monitoring all the appliances with in the communication range through Bluetooth.
- It is robust and easy to use system.
- It is a hybrid system

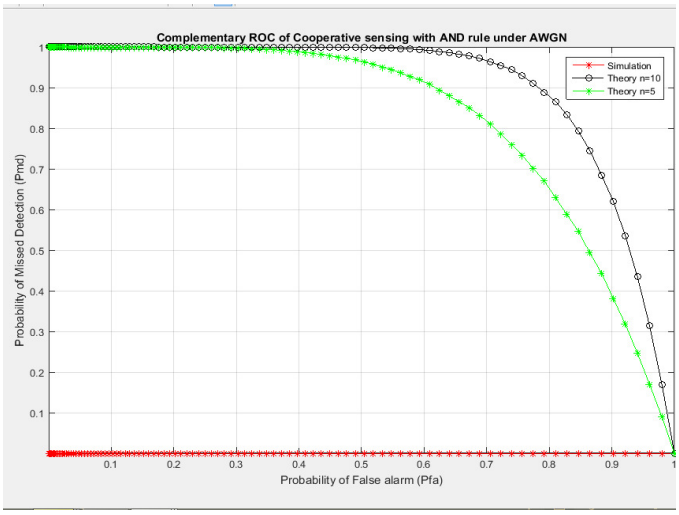
VI.OUTPUT

6.1. SIMULATION RESULTS

Simulation Parameters	Value
Number of Samples	200
Number of primary users	1
Number of secondary users	10
SNR values	- 10dB

Table. 1. Parameters used for simulation

6.2. SIMULATION OUTPUT



Using proposed fuzzy logic technique, presented simulation results for Pdvs. Pfa, Pmvs. Pfa graphs comparing all the fuzzy fusion rules of hard combinations such as union rule, intersection rule, algebraic sum rule, and algebraic product rule at -10 db SNR SNR values using 200 numbers of samples

VII.CONCLUSION

In this paper spectrum, sensing scheme using soft computing technology is proposed. From results, it is inferred that the probability of false rate, the probability of detection and SNR plays a crucial role in deciding the performance of spectrum sensing. It can be enhanced by increasing the value of SNR or by decreasing the Value of the probability of falserate.The Proposed Fuzzy Logic Technique achieves the highest performance in terms of Pe,Pd and Pfa compared to the other algorithms also it detects PU signal at low SNR condition compares to other algorithms.

At-10dB,the probability of error obtained is 0.1101. The energy detection method is very easy to implement but it has poor performance at low SNR and its computational time is approximately 10s. Using new Fuzzy Logic algorithm method is to implement .It gives much better performance at low SNR condition and gives 98% of detection performance.

VIII. REFERENCE

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