SIMULATION OF COOPERATIVE SPECTRUM SENSING TECHNIQUES IN COGNITIVE RADIO USING MATLAB

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ABSTRACT

A software defined radio which exploits unused spectrum spaces without causing much interference to licensed spectrum users and thus optimising the use of available radio sequence by its virtue of its intelligence, called cognitive radio. Today cognitive radio is rapidly becoming an area of intense research and study. With advent of new wireless services over the past few years leading to an increased demand for spectral resources has been identified as a possible reason for this. Cognitive radio use any three of techniques- Spectrum Sensing, Spectrum Database and cognitive pilot channel to acquire information about Spectrum usage. Spectrum Sensing is an inherent ability of cognitive radio to autonomously perform required calculations and detects unused spectrum. This paper provide an insight into various Spectrum Sensing technologies and also analyse the advantages and drawbacks of each.

***Keywords:** Cognitive radio, Cooperative spectrum sensing technique*

I. INTRODUCTION

Some "smart radio" proposals combine wireless mesh network dynamically changing the path messages take between two given nodes using cooperative diversity- cognitive radio dynamically changing the frequency band used by messages between two consecutive nodes on the path; and software-defined radio -- dynamically changing the protocol used by message between two consecutive nodes. A CR "monitor its own performance continuously", in addition to "reading the radio's outputs"; it then uses this information to "determine the RF environment, channel conditions, link performance, etc.", and adjusts the "radio's settings to deliver the required quality of service subject to an appropriate combination of user requirements, operational limitations, and regulatory constraints.

II.COOPERATIVE SPECTRUM SENSING TECHNIQUE

The performance of a local detector degrades in the presence of propagation effects such as shadowing and fading caused by multipath. These channel conditions may also result in the problem of hidden node, where a secondary transceiver is outside the listening range of a primary transmitter but close enough to the primary receiver to create interference. These issues can be overcome using cooperative sensing (CS), where neighbouring yet geographically distributed SUs cooperate in sensing a common PU transmission by exchanging sensing information among them before making a final decision. Most of the CS schemes stem from the field of distributed detection.

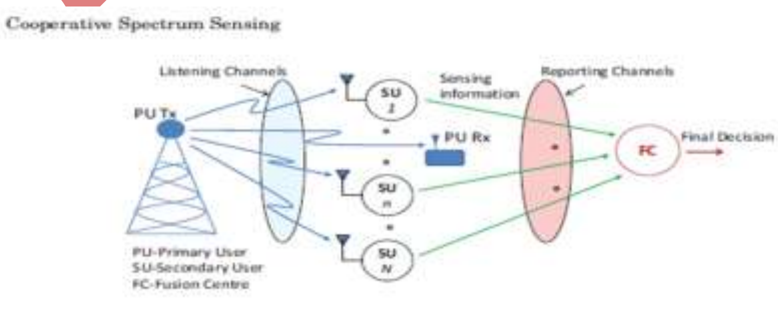

Fig 1: COOPERATIVE DETECTION TECHNIQUE

III. FALSE ALARM DETECTION

If we want to keep the probability of missed detections very low, the probability of false alarms increases and this would result in low spectrum utilization. On the other hand, a low probability of false alarms would result in high missed detection probability which increases the interference to the primary users. This trade-off has to be carefully considered. In most radar detectors, the threshold is set in order to achieve a constant level of false alarm. Threshold level is raised and lowered during detection to maintain a constant probability of false alarm. This approach is known as constant false alarm rate (CFAR) detection.

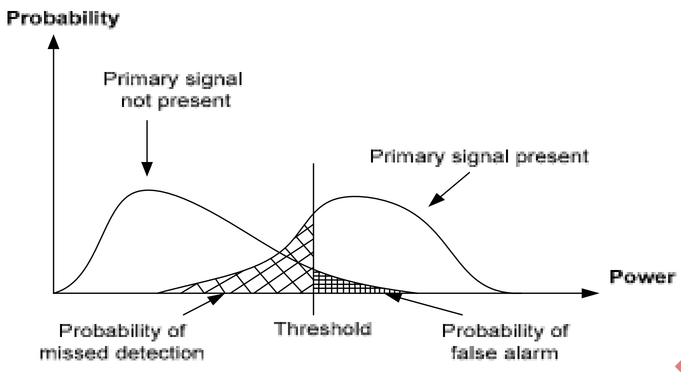

Fig2: FALSE ALARM DETECTION TECHNIQUE

Controlling the false alarm rates and the decision threshold in mobile applications is difficult because signal-to-noise ratios may be time-varying.

IV. RESULT

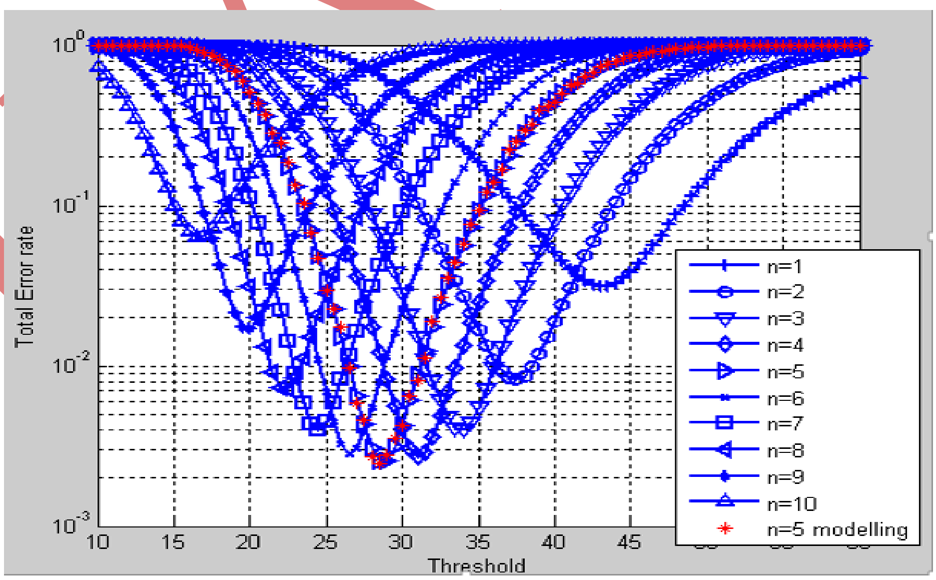

Fig 3: SIMULATION RESULT FOR BIT ERROR RATE BY MANAGING THRESHOLD (N=20)

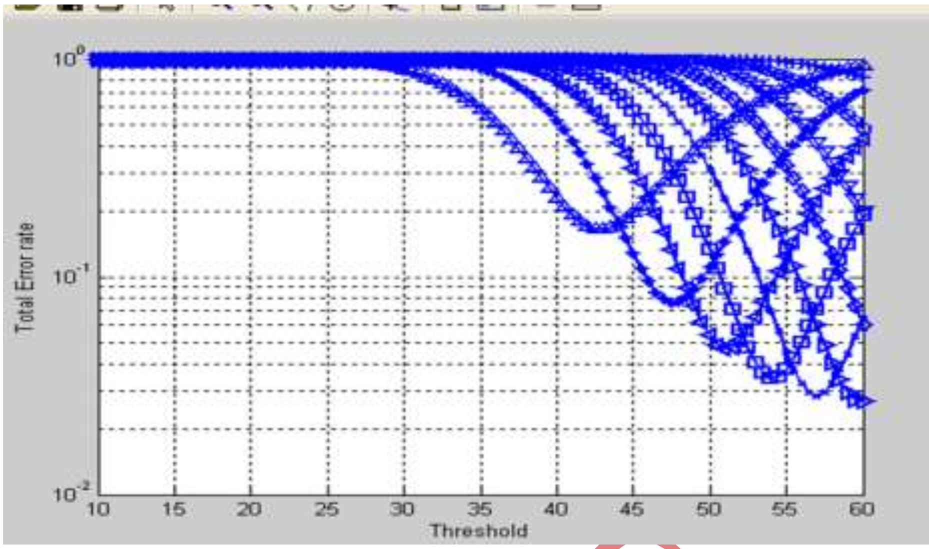

Fig 4: SIMULATION RESULT FOR BIT ERROR RATE BY MANAGING THRESHOLD (N=50)

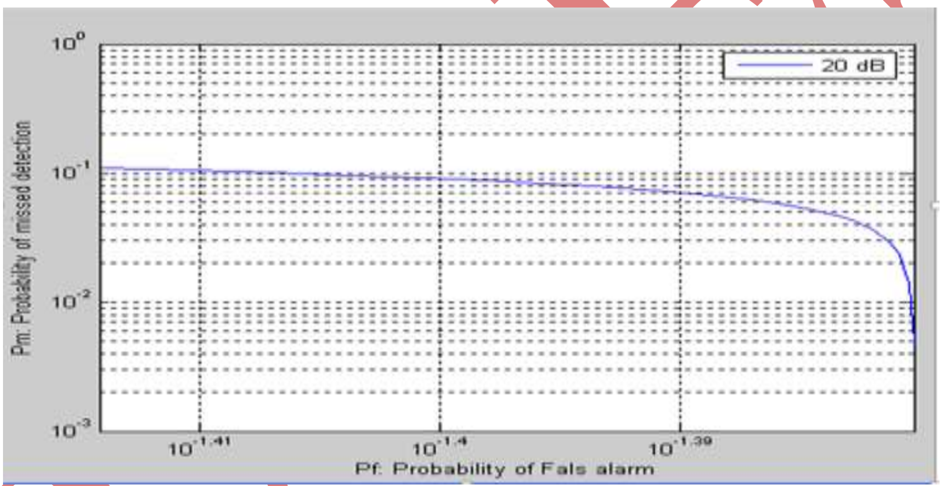

Fig 5: SIMULATIONRESULT FOR FALSE ALARM DETECTION

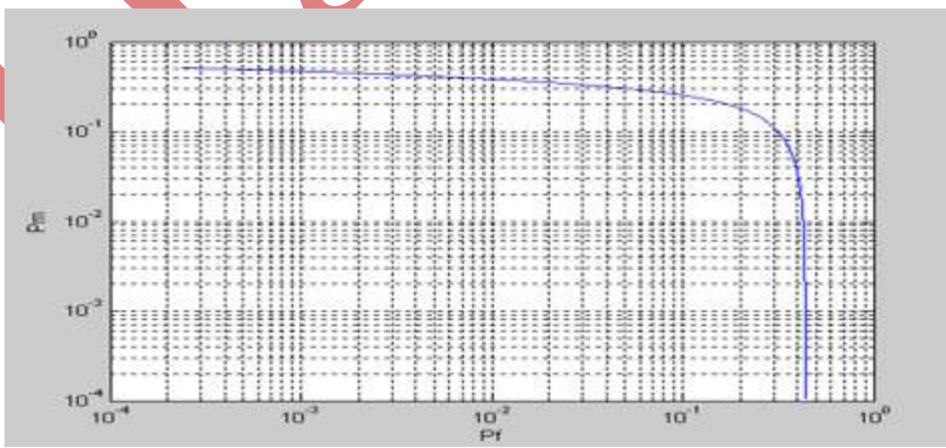

Fig 6: SIMULATION RESULT FOR FALSE ALARM DETECTION (LAMBDA=1:0.001:18)

V. ADVANTAGES

1. Improve overall probability of detection.
2. Interference to Primary User decrease.
3. Increased Bandwidth.
4. Reduce the time of Data Transmission.
5. Increase coverage.
6. Simplify local detector performance.
7. Increase robustness to non-idealities.

VI. CHALLENGES

1. Increased complexity
2. Due to the increment in bandwidth, traffic between the two nodes increase.
3. Shadowing correlation occur when distance between two user is less.

VII. CONCLUSION

Spectrum sensing is a crucial task in the cognitive radio system to identify vacant frequency bands to enable opportunistic spectrum access. In particular, reliable detection of the presence of primary users is of uttermost importance since the cognitive radio operating as a secondary system is not allowed to cause harmful interference to the primary user.In this paper, Bit error rate will be reduced by decreasing the no. of user. If no. of users increased then bit error rate is constant for some time, then it will be decrease. In false alarm detection method, when we change the value of lambda then the no. of missed detection decrease with the increasing no. of false detection.

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