

## ENHANCED CYCLOSTATIONARY TECHNIQUES FOR COGNITIVE RADIO

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### ABSTRACT

Information communication has been reached its top level today. From grass root level to top level of society, all are connected with information communication. With increase in knowledge based data/ Entertainment Based data / Economical Based data / Social Based data, Information technology & Communication becomes integrated part of common man's life. Not only commons life but we can say life of each and every individuals in society is reliable over Information communication & technology. Increase in Information data is proportional to Increased Users. Though Users are increased although the resources like Channel bandwidth required for communication has its limit. The proposed system is handling the same issue of Communication channel utilization against increasing number of users. To utilize and maximize number of users with same number of channels, the proposed system has introduced the Enhanced Cyclostationary technique for Cognitive Radio.

**Keywords**— Cognitive Radio, Cyclostationary Technique, Matlab, Primary User, Secondary User

### INTRODUCTION

Wireless communication used for information access system. For information transmission and reception it requires media. This media is nothing but frequencies provided by Spectrums. There are multiple types of spectrum defined by specific frequency range. These spectrums e.g. UHF, VHF, HF, etc. are utilized for particular reasons. Due to fragmentation of spectrums according to applications, increased users are facing unavailability of channels for communication. Those users who are authorized for accessing the channels are called as primary users. While Non-authorized users are called as secondary users. Conventionally static spectrum approach was in practice. Where specific spectrum was allocated to only primary users. With increased number of users, Static approach in spectrum allocation was also the reason behind scarcity of spectrum. To overcome problems in the Static spectrum allocation, the dynamic spectrum allocation is introduced. Dynamic spectrum allocation is based on the concept that if primary user (Licensed user) is not utilizing or occupying the spectrum for some specific period, at that time secondary user can utilize the spectrum till primary user comes back. Hence the concept of utilizing ideal spectrum by secondary user when primary user is not available called as dynamic spectrum approach. This approach has increased utilization factor of Available signals. To automatically occupy spectrum by primary user and secondary user, the new techniques were introduced. These techniques are Spectrum sensing algorithm and spectrum allocation Algorithm. In this paper these techniques are explored in further topics. In proposed system Enhanced Cyclostationary Spectrum Sensing algorithm is introduced. In proposed method correlation as well as principle component analysis is utilized for better results and effectiveness. In principle component analysis major cyclic properties of signal is used to sense and allocate primary and secondary users. In conventional cyclostationary technique only cyclic properties are utilized to sense and allocate primary and secondary users But in proposed system cyclostationary technique with cyclic properties is enhanced by addition of principle component analysis. Along with this enhanced technique, primary users, Secondary users, the new approach to detect intruders in spectrum is also demonstrated. To implement this overall system MATLAB software is used. According to accuracy. Response time this system is proven to be a really good system. For quality parameter analysis different probabilities such as probabilities of false alarm, Probabilities of miss detection is also plotted on graphical platform to understand effectiveness of proposed system.

## LITERATURE REVIEW

### A. Spectrum Sensing Techniques

There are mainly three spectrum sensing techniques. They are shown in figure.1

As compared to Co-operative and Interference based technique, Noncooperative technique found to be effective and more accurate. Hence in proposed system the focus is given on Non cooperative system. In Non-cooperative system there are three main techniques for spectrum sensing. They are explained as below.

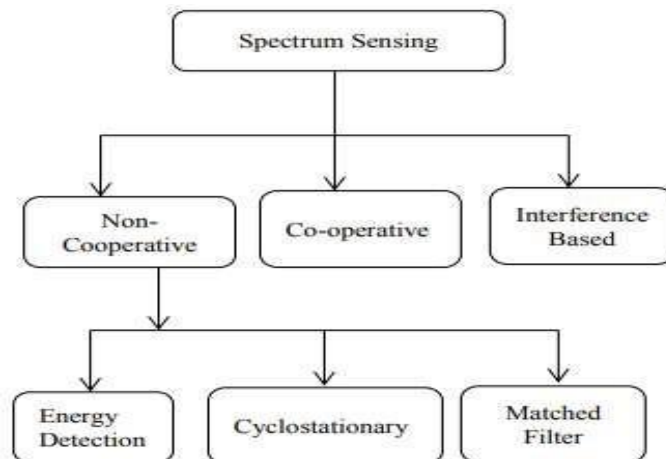


Figure 1

#### I. Energy Detection Technique

In Energy detection technique as its name suggest the predefined energy range of a signal through particular spectrum is utilized to identify the spectrum. Correlation is used to match predefined energy of a signal with Current energy of an ongoing signal. If energy matches primary user gets identified or in other words spectrum sensing is done. Though the said technique is easy although there may be a possibility of missing spectrum sensing due to Noise or signal of a same energy level. This drawback of an energy detection technique leads to have different spectrum sensing technique.

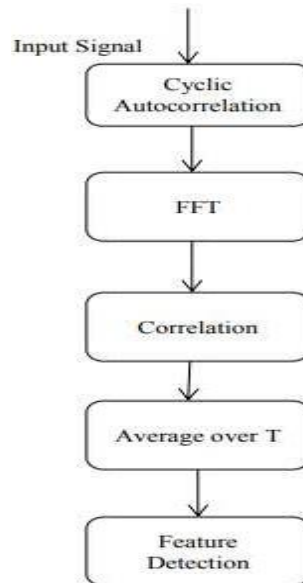
#### II. Matched Filter Technique

Matched filter technique has been implemented by different ways by different researchers and developers according to hardware and application. Still matched filter is oriented on filter concept where filter is used to pass the signal if resonance effect happens, it does mean that signal is matched and identified. If not then signal is not authorized or it may be a noise. this is simple and easy method to implement but still has scope for missed accuracy in spectrum sensing algorithm.

#### III. Cyclostationary Techniques

Cyclostationary is most effective technique as compared to energy detection technique and Matched filter technique. In this paper also cyclostationary method is focused and enhanced for better results and accuracy.

Figure. 2



As shown in figure. 2 cyclostationary technique is dependent on cyclic auto correlation. Each mathematical signal in communication has its own cyclic properties. By correlating these cyclic properties with pre-defined features of authorized signal, the spectrum sensing can be done accurately.

### SYSTEM DEVELOPMENT

To improve conventional cyclostationary technique further, in proposed system major cyclic properties are identified their energy values are correlated with current signal. The identification of major cyclic properties is a part of principle component analysis. The proposed system is shown below in figure. 3

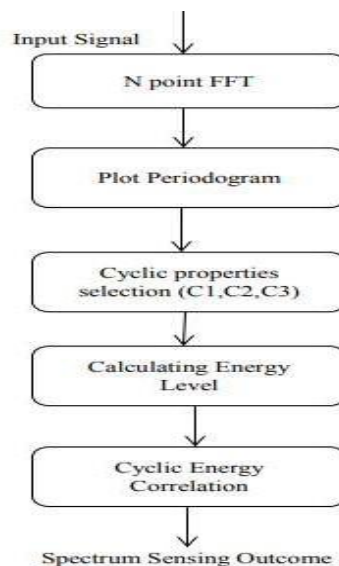
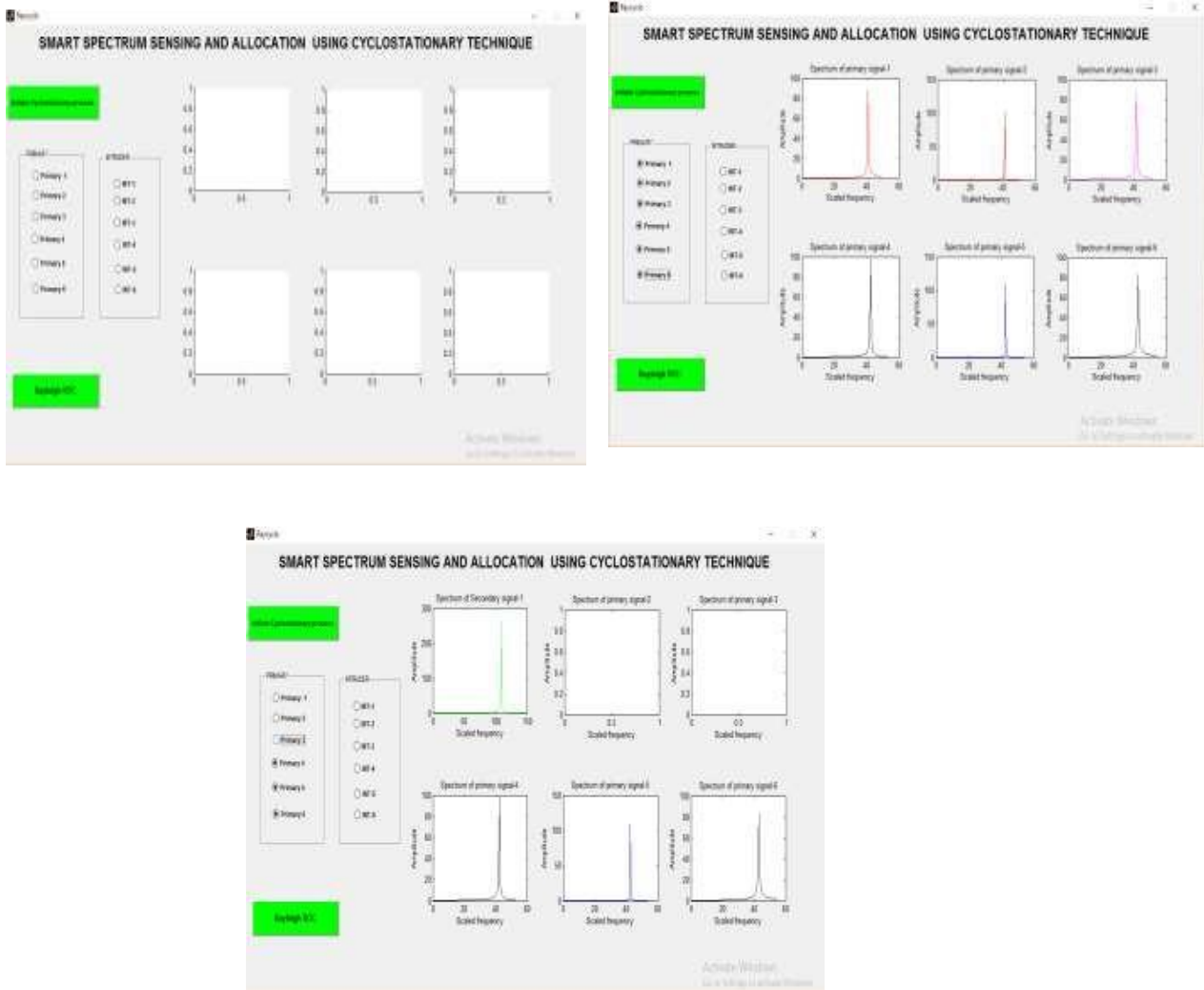


Figure.3

As shown in figure. 3 with addition to conventional cyclo- stationary technique major cyclic component C1, C2, C3 are selected for cyclo-stationary feature correlation based on principle component analysis. Ultimately it becomes more efficient and effective enhanced technique.

### RESULT USING MATLAB

We have used MATLAB to verify the working of cognitive cyclostationary detector



### CONCLUSION

Enhanced cyclostationary technique with principle component analysis used for selection cyclic properties as well as energy calculation over selected cyclic properties found to be more effective in accurate spectrum sensing. This technique almost minimizes chance of miss detection at spectrum sensing. Enhanced cyclostationary technique is actually hybrid technique of cyclostationary and energy level detection technique. It carries all the advantages of both conventional techniques. At the same time it eliminates drawbacks of respective techniques. After spectrum sensing algorithm, spectrum allocation algorithm is also proposed based on AND rule.

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