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Research Paper

DYNAMIC ANTENNA FREQUENCY SELECTION IN MIMO SYSTEM USING COHERENT AND NON-COHERENT DETECTION TECHNIQUE

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In this Project, a simple and efficient method for the detection of a Multi operational frequency channel that guarantees satisfactory communication among all network nodes is proposed. Experimental measurements have to carried out in a real environment, reveal the coexistence problem among networks in close proximity that operate in the same frequency band and prove the validity and efficiency of our approach. Dynamic channel selection algorithms have been developed and implement to evaluate the added value of the auxiliary sensing device. As such, we propose a novel energy-aware metric to detect and quantify the harmfulness of dynamic interference. We also to investigate the impact of interference dynamism on algorithms performance and validated the efficiency of the implemented mechanisms by three sets of nodes.

Keywords: MIMO system, Coherent, Non-coherent, Multi operational frequency.

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INTRODUCTION

To analyze the coherent and non-coherent behavior using virtual MIMO technique aided reconfigurable antenna. Coherent signals detectors are those which need carrier phase information and use other methods like square law to recover the transmitted data at receiver end. Receiver use matched filters (or correlation receiver) to detect and decide the transmitted data. In coherent detection the transmitted information is received only when the receiver frequency matches with the transmitter. Coherent detection is complex than non-coherent detection but it gives much better performance too. More will the coherency; the better will be the spectral component of the signal. Moreover coherent detection is less prone to errors. In case of non-coherent detection frequency matching is not a major constraint. Whether the frequency matches or not the transmitted information is received by the receiver. Non-coherent systems do not need carrier phase information and use methods like square law (push detection or energy detection) to recover the transmitted data at receiver end. Time delay may also occur in coherent systems, due to some adjustments required in matching the frequency and phase, which is not the case with non-coherent system.

To Implement the Following Techniques

- Coherent, Non-Coherent Technique
- VMIMO System
- Reconfigurable Antenna

REQUIREMENTS FOR WIRELESS SENSOR NETWORKS

By considering the aforementioned categories of WSN applications, the wide range of applications used by WSN led to the definition of these networks as a large-scale, wireless, ad-hoc, multi hop, mostly immobile, tiny, randomly deployed and remotely deployed (need for long life). Handling such a wide range of application types will hardly be possible with any single realization of a WSN. Realizing the characteristics of WSNs with new mechanisms is the major challenge of the vision of wireless sensor networks [7].

The basic constraints for wireless sensor networks can be summarized as follows:

LOW POWER CONSUMPTION

Maintainability: The System has to monitor its health and situation against some failures in the network. The system has to adapt to the network, for example the system could change some parameters to provide lower quality due to lack of energy resources.

- **Lifetime:** failure of a node in the network due to limited supply of energy could lead to the failure of the whole network.
- **Scalability:** Employed architectures

and Protocols must be able to scale a huge number of nodes in the network

- **Programmability:** Nodes must exhibits a flexibility toward changes in the operation tasks, so they should be programmable
- Small physical size
- Low cost nodes
- Single design for international market

REVIEW OF EARLIER WORK

In this section, a detailed summary of Literature review of spectrum efficiency of various diversity schemes under different adaptation policies, and interference cancellation techniques, is discussed.

CAPACITY ANALYSIS OF MIMO

The increasing demand for transmitting information over a wireless channel has led to the emergence of Multiple Input Multiple Output (MIMO) technology. The use of multiple antennas at both ends of a wireless link enables the opening of multiple spatial data pipes between the transmitter and the receiver within the frequency band of operation for no additional power expenditure. This leads to a dramatic increase in spectral efficiency, known as spatial multiplexing gain. MIMO technology has materialised its promise of providing high information rates without additional spectral requirements, which has been well explained in the pioneering works of Foschini and Gans [1] and Telatar [3].

There is a considerably large amount of literature on 13 Rayleigh fading which considers only Non-Line-Of-Sight (NLOS) components. However, in reality, there are Line-Of-Sight (LOS) components between the transmitter and receiver which are best described by the Rician fading distribution. In [5], the author investigates the capacity limits of MIMO communication system following Rician distribution. In [16], the authors arrived at an exact expression for average Mutual Information (MI) rate of MIMO Rician fading channels when the fading coefficients are independent, but not necessarily identically distributed. Research work in [7] has established that the presence of strong LOS components correlates with the channel sparsity, thereby reducing the number of Degrees of Freedom (DoF).

The presence of NLOS components reduces the correlation between the signals thereby increasing the rank of the channel matrix. Capacity of spatially correlated MIMO channels has been obtained in [8]. Both single-sided and double-sided correlation has been considered in [8]. In [9], the author analyses ergodic capacity for MIMO channels with rank-1 mean matrices. Upper and lower bounds on the ergodic capacity have been presented in [9]. Upper bound on ergodic capacity for a system undergoing Rician fading for arbitrary Signal-to-Noise Ratio (SNR) and rank of matrix is derived in [10]. Researchers have analysed ergodic capacity for MIMO channels with rank-1 mean matrices, upper and lower bounds on the ergodic capacity. Moreover, upper bound on ergodic capacity for a system undergoing Rician fading for arbitrary SNR, and rank of a matrix was also derived.

EXISTING SYSTEM

Single-RF VMIMO transmitter has to repetitively send multiple pilot symbols, each corresponding to the specific antenna pattern, while classic multiple-RF MIMO systems are capable of simultaneous transmissions. There results some loss of data during transmission due to interference that occurs in wireless environment. Thus data recovery is not possible. In order to overcome this single RF VMIMO is proposed. It is capable of forming multiple antenna patterns. It supports repeated multiple symbol transmissions. It can be implemented easily by using STSK encoding concept. The STSK scheme is capable of striking a flexible balance between the rate and the diversity gains, although the STSK transmitter typically assumes the employment of multiple-RF branches. For fast moving destination receiver, it is hard to measure the accuracy of channel coefficients

DISADVANTAGES

- Loss of data
- Data recovery is not possible
- Causes interference due to simultaneous transmissions
- Poor accuracy for measuring channel coefficients
- Additional relaying is required.
- High Cost

PROPOSED SYSTEM

To realize and implement the virtual MIMO system using reconfigurable antenna with coherent and non-coherent detection technique. In coherent detection the frequency matching is required, so we are implementing this technique using LabVIEW. In other platforms like MATLAB, the tuning of frequency is not possible. Therefore, we have to enter the value for particular frequency for tuning process. In case of LabVIEW, we can easily tune the range of frequency and the corresponding output waveforms are obtained. In other platforms, the coding technique is complex and it cannot be easily understandable. But in LabVIEW, the coding is in the form of graphical language. So it is user-friendly. In case of non-coherent detection, whether the frequency matches or not the transmitted information is received by the receiver due to its reconfigurable nature. For hardware implementation we go for embedded system. Embedded System is a combination of hardware and software used to achieve a single specific task.

ADVANTAGES

- Frequency tuning is possible
- User-friendly
- Low complexity.
- Program coding is flexible.
- Dynamic reconfigurability
- Highly efficient
- Good noise immunity

TECHNICAL DIAGRAM FLOW

The following Figures 1, 2, 3 are describes the proposed system architecture where the coherent and non-coherent communication are achieved as per the proposed research objective for MIMO system.

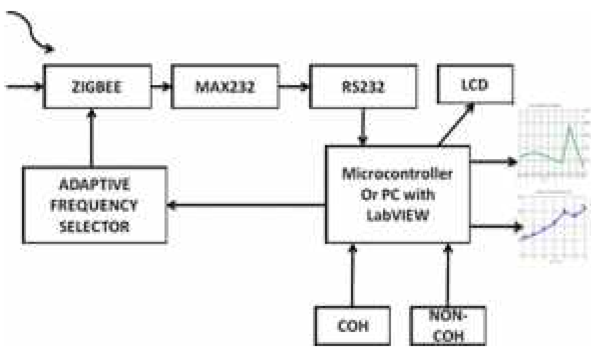


Figure 1: Receiver 1 of the Proposed System

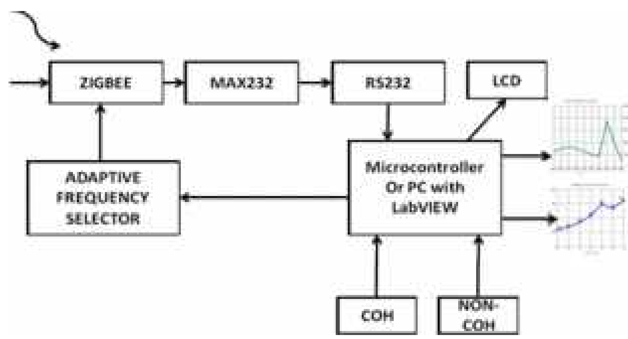


Figure 2: Receiver 2 of the Proposed System

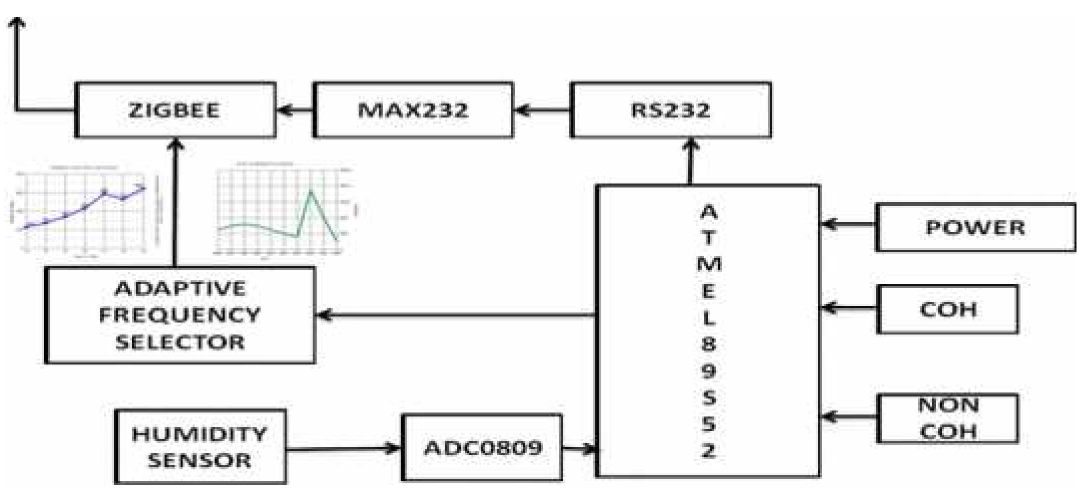


Figure 3: Transmitter of the Proposed System

ADAPTIVE ANTENNA BENEFITS

Multipath propagation, defined as the creation of multipath signal paths between the transmitter and the receiver due to the reflection of the transmitted signal by physical obstacles, is one of the major problems of mobile communications. It is well known that the delay spread and resulting inter symbol interference (ISI) due to multiple signal paths arriving at the receiver at different times have a critical impact on communication link quality. On the other hand, co-channel interference is the major limiting factor on the capacity of wireless communication systems, resulting from the reuse of the available network resources (e.g., frequency and time) by a number of users. Adaptive antenna systems can improve link quality by combining the effects of multipath propagation or constructively exploiting the different data streams from different antennas. More specifically, the benefits of adaptive antennas can be summarized as follows:

• Increased range/coverage: the array or beam forming gain is the average increase in signal power at the receiver due to a coherent combination of the signal received at all antenna elements. The adaptive antenna gain compared to a single element antenna can be increased by an amount equal to the number of array elements, e.g., an eight element array can provide a gain of eight (9 dB).

• Increased Capacity: One of the main reasons of the growing interest of adaptive antennas is the capacity increase. In densely populated areas, mobile systems are normally interference-limited; meaning that interference from other users is the main source of noise in the system. This means that the signal to interference ratio (SIR) is much larger than the signal to thermal noise ratio (SNR). Adaptive antennas will on average, increase the SIR. Experimental results report up to 10 dB increase in average SIR in urban areas. For UMTS networks, a fivefold capacity gain has been reported for CDMA.

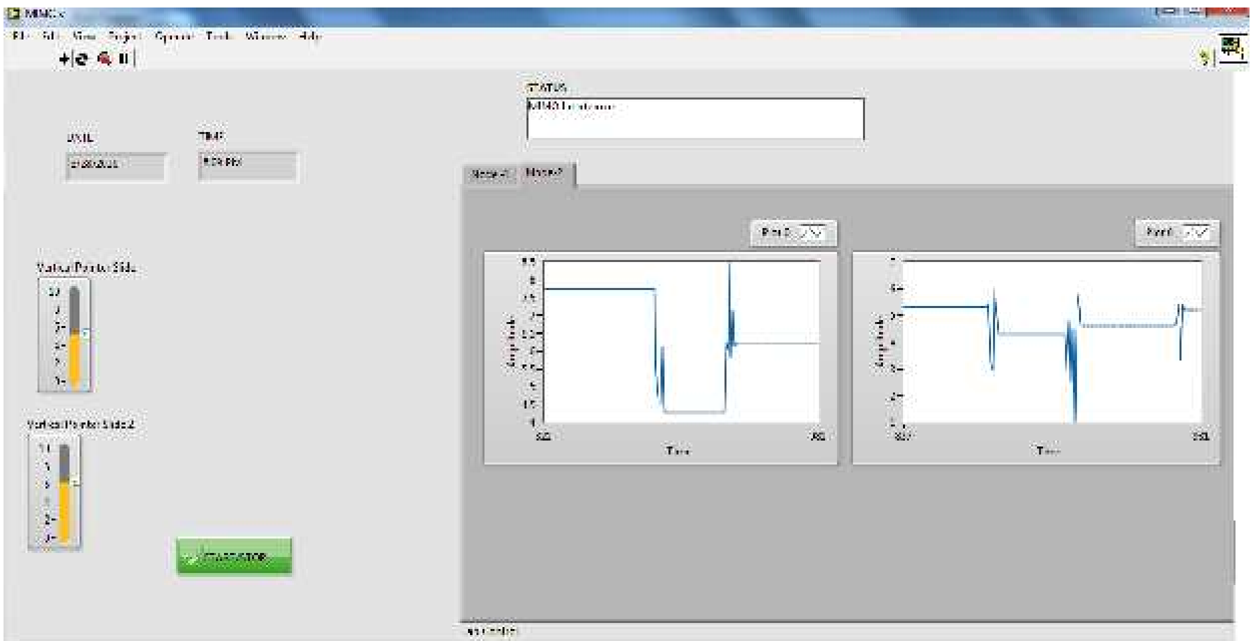
• Lower power requirements and/or cost reduction: Optimizing transmission toward the wanted user achieves lower power consumption and amplifier costs.

• Improved link quality/reliability: Diversity gain is obtained by receiving independent replicas of the signal through independently fading signal components. Based on the fact that one or more of these signal components will not be in a deep fade, the availability of multiple independent dimensions reduces the effective fluctuations of the signal.

• Increased spectral efficiency: Spectral efficiency is a measure of the amount of information –billable services- that carried by the wireless system per unit of spectrum.

It is measured in bits/second/Hertz/cell, thus it includes the effect of multiple access methods, modulation methods, channel organization and resource reuse (e.g., code, timeslot, carrier). Spectral efficiency plays an important role since it directly affects the operator cost structure. Moreover, for a given service and QoS, it determines the required amount of spectrum, the required number of base stations, the required number of sites –and associated site maintenance-, and ultimately, consumer pricing and affordability. Equation (1) shows a simplified formula to estimate the required number of cells per square kilometer. (The offered load is in bits/seconds/km2).

Simulation Results Obtained



CONCLUSION

The project deals with the re-configurability, VMIMO scheme, coherent and non-coherent methods using LabVIEW and Embedded. A single antenna is enough to receive various data which enables low-complexity frequency - based detection. The complexity has been decreased up to 90%. Coherent detection requires frequency matching, so we are implementing this technique using LabVIEW. In other platforms like MATLAB, the tuning of frequency is not possible. Therefore, we have to enter the value for particular frequency for tuning process. LabVIEW can easily tune the range of frequency and the corresponding output waveforms are obtained. In other platforms, the coding technique is complex and it cannot be easily understandable. But in LabVIEW, the coding is in the form of graphical language.

So it is user-friendly. In case of non-coherent detection, whether the frequency matches or not the transmitted information is received by the receiver due to its reconfigurable nature. Reconfigurable antenna which changes its frequency simultaneously which is capable of accepting the data which is receiving from various antennas having different frequency. For hardware implementation we go for embedded system. Embedded System is a combination of hardware and software used to achieve a single specific task.

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