A compact MIMO antenna for high speed WLAN gadgets in small sizes – A Review

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Abstract-The short range antenna applications used for transmit high-data-rate transmissions are WiFi etc. Since the frequency band 2.4-5.0 GHZ spectrum is authorized for the WLAN applications for wireless networks, these UWB systems have attracted much attention towards antenna. The WLAN adapters are being launched in compact sizes every year to make them adjustable everywhere. The WLAN antennas are being embedded in Internet dongles, Wi-Fi adapters, Smart Phones, etc. Multiple-Input-Multiple-Output (MIMO) technology can be used to provide multiplexing gain and diversity gain to improve the capacity and link quality, respectively, of wireless systems. The compact sized MIMO antennas can be used for various real life WLAN gadgets like portable WLAN applications like internet dongles or smart phone hotspots. In this research, we are proposing a multiple-input multiple-output (MIMO) multipath fading channels based antenna for indoor compact MIMO applications. This IEEE 802.11abgn i.e. WLAN based MIMO multipath fading channel system antenna will be equipped with two or more transmit and receive antennas for each process. This antenna will be simulated using Matlab and will perform a detailed analysis on the transmission parameters and channel models for indoor wireless local area networks (WLAN). The proposed MIMO antenna will have an impedance bandwidth of 2.4–5.0 GHz, low mutual coupling of less than 15 dB, and a low envelope correlation coefficient of less than 0.2 across the frequency band to make it a good candidate for portable WLAN applications.

Index Terms – MIMO, multi input multi output, WLAN antenna, Compact Antenna

1. INTRODUCTION

All wireless technologies face the problems of signal fading, multipath fading, increases interference and limited spectrum .To remove these kind of problems we use the MIMO system. MIMO stands for multiple input multiple output. In MIMO system we use the multiple antennas at both transmitter and receiver to improve the communication process. MIMO offers significant increase in data throughput and link range without using an additional bandwidth or transmit power. By using MIMO system we can achieve an array gain that improves spectral efficiency and diversity gain which reduced the fading.

There are four major types of the MIMO system: SISO – single input single output, SIMO-single input multiple outputs, MISO-multiple input single output, MIMO-multiple input multiple outputs.
MIMO takes advantage of multi path. MIMO uses multiple antennas at transmitter to send parallel signals from transmitter. In an urban environment, these signals will bounce off trees, buildings and continue their way to destination but in different directions. Different signals arrive at the receiver at various times so multi path occurs. In MIMO system, the receiver uses an algorithm or special signal processing to sort out the multiple signals to produce one signal that has originally transmitted data.
The main benefit of MIMO is increased transmission range and robustness. MIMO uses multipath technique that helps improve the SNR ratio and reliability significantly.

WLANS links two or more devices using some wireless distributed method like spread spectrum or OFDM .and providing a connection from an access point to the wider internet .with this the users have the ability to move around with in the local area coverage and still be connected to the network. Most LANS are based on IEEE 802.11 standards. WLANS have become very popular in home due to the ease of installation and in commercial complexes offering wireless access to their customers often for free.

WLANS have a great deal of applications. WLANS are used in home, office, campus or other networks. Users can access the internet from wireless LAN in hotels, restaurants and now with portable devices that connect to 3G and 4G networks.

2. LITERATURE REVIEW

Li Liu, S. W. Cheung *et. al.* A compact multiple-input-multiple-output (MIMO) antenna with a small size of mm is proposed for portable ultra wide band (UWB) applications. Tzu-Chun Tang *et. al. proposed* Design of Antenna on Glass Integrated Passive Device for WLAN Applications. Jian-Feng Li et. al. proposed Compact MIMO Antenna with Simple Decoupling Method. A Compact multiple-input multiple-output (MIMO) antenna with a simple decoupling method is presented. P. Subbulakshmi etl. Al. proposed Design and Characterization of Corporate feed rectangular Microstrip patch array antenna. This paper proposes the design of 4-Element microstrip patch antenna array which uses the corporate feed technique for excitation. M. H. Mokhtar et. al. proposed A Compact Slotted Microstrip Patch Antenna for RFID applications

3. PROBLEM FORMULATION

As the popularity of WLAN applications is rising, the WLAN access points are getting smaller and smaller in size

every year. They are being embedded into various gadgets like, WLAN-APs, Smart Phones, Internet dongles, etc. A compact MIMO antenna in smaller size can be used in the smaller sized WLAN applications to provide a healthy wireless communication with minimum performance lags. In this research, a compact multiple-input multiple-output (MIMO) multipath fading channels based antenna with two transmit and two receive channels for indoor WLAN applications. The simulation of proposed model will be prepared using MATLAB. A series of simulation experiments for detailed analysis will be conducted for the performance of the proposed antenna with impedance bandwidth of 2.4–5.0 GHz, with low mutual coupling of less than 15 dB.

4. METHODOLOGY

At first, the literature on the antennas and their working processes would be studied in detail. Then the algorithm flow would be reviewed and refined in case any changes are required. Afterwards, the antenna would be simulated in MATLAB. This is also very important to get the information about the parameters and protocols used in antenna simulations. This project would be implemented in the MATLAB Simulator. A thorough performance and feature testing model would be formed and utilized to analyze the performance of the new antenna model, to detect the flaws and to recover them. Afterwards, the experiment results would be thoroughly analyzed and compared with the existing antenna models to examine the performance of the new antenna.

5. CONCLUSION

In this research, the proposed multiple-input multiple-output (MIMO) multipath fading channels based antenna for WLANs applications will be developed. The performance of IEEE 802.11abgn based MIMO multipath fading channel antenna will be thoroughly inspected for its performance. In this research, we will simulate our proposed model using MATLAB and will perform various simulation experiments with different sizes. The perfect size of compact MIMO antenna will be found after conducting a number of experiments on various sizes with various parameters. The proposed MIMO antenna will work in 2.4–5.0 GHz bandwidth with low mutual coupling and a low envelope correlation coefficient to make it a good candidate for portable WLAN applications.

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