Development of Improved Wireless Technology using MIMO-OFDM with Linear and Non-Linear Detection Methods

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Abstract - Modern communication technology is the subset of wireless communication and the day by day innovations are somewhere, somehow connected to the wireless technology. The innovations are mostly belongs to this area of technological research which is all time favorite with researchers. The most excellent thing about wireless technology is that it facilitates every device able to connect to the world in seconds and share information or retrieve information as quick as possible of any kind (images, video, data, and voice etc.). this paper discuss about the technology is being worked and possible enhancements can be done without losing its performance, and to achieve such improvement a non-linear detection technique V-Blast, integrated with the basic wireless system with the linear detection technique because these techniques are very efficient. To maintain the quality of service additional technology MIMO-OFDM is also integrated in the infrastructure of proposed communication system. Outcomes of the system are analysed under BER vs SNR graphs for different data lengths, different number of transmitter and receiver antennas by adopting QPSK modulation scheme. From the simulation Results to reduce the error probability Zero Forcing(ZF) and Minimum mean square error(MMSE) with V-Blast and Gaussian Filter made an extremely good combination.

Keywords: Non-Linear, Linear Detection Techniques, MIMO-OFDM and Gaussian Filter.

I. INTRODUCTION

Wireless technology merges particular existing and future wireless network advances to guarantee flexibility of development and consistent wander starting with one innovation then onto the next. It gives sight and sound applications to the end client by various advances through nonstop and constantly most ideal association.

Wireless systems are incorporated with center system and a few radios get to systems. The center interface is utilized for communication with the center system and radio get to systems, the accumulation of radio interfaces are utilized for communication with the radio get to systems and mobile users. The fundamental recognizing component somewhere around 3G and Wireless is data rate. Wireless can bolster no less than 100Mbps pinnacle rate in full-portability wide zone scope and 1Gbps in low-versatility neighborhood where as the speed of 3G can be dependent upon 2Mbps, which is much lower than the paces of Wireless. Notwithstanding, Wireless standard will base on broadband IP-based completely applying bundle exchanging technique for transmission with consistently get to union. It implies that Wireless coordinates all get to innovations, administrations and applications boundlessly through remote spine and wire-line spine by utilizing IP address

OFDM stands for orthogonal frequency division multiplexing, which transmits extensive measure of advanced data over the radio wave. OFDM works by part the radio signal into various littler sub signals and after that transmit at the same time at various frequencies to the collector. Huge Area Synchronized Code Division Multiple Access (LAS-CDMA) empowers rapid data and builds voice limit. Multi-Carrier Code Division Multiple Access (MC-CDMA), which is intended for running on wide range, called large scale cell. The Local Multipoint Distribution System, (LMDS), intended for smaller scale cell is utilized to convey voice, data, web and video benefits in 25GHzand higher spectrum.

The necessities are many scrambles accessibility and non accessibility of viewable pathway between the transmitter and receiver i.e. (numerous structures and different objects lessen, reflect, refract, and diffract the signal).The way between the base station and mobile station of earthbound versatile communication is described by different obstacle and reflections.

The radio waves transmitted from the base station emanates every which way including reflected waves , diffracted wave, dispersing wave and the immediate wave from the base station to the versatile station. Since the way length of the immediate, reflected, diffracted, and diffusing waves are distinctive, the time taken to achieve the versatile station is diverse for scattered waves.

The reception environment described by superposition of postponed waves is known as a multipath propagation environment. In a multipath propagation environment, the

aggregate got signal is the vector entirety of independently postponed signals.

II. SYSTEM MODEL

OFDM is created by firstly picking the range required, based on the information data, and modulation technique utilized. Every carrier to be created is doled out a few data to transmit. The desired amplitude and phase of the carrier is then figured based on the tweak plot (ordinarily differential BPSK, QPSK, or QAM). At that point, the IFFT changes over this range into a period space signal.

The FFT changes a cyclic time space signal into its identical recurrence range. Finding the equal waveform, created by an aggregate of orthogonal sinusoidal segments, does this. The amplitude and phase of the sinusoidal segments represent to the frequency range of the time space signal.

The primary elements of a useful OFDM system are as per the following:

- Some handling is done on the source data, for example, coding for adjusting errors, interleaving and mapping of bits onto symbols. A case of mapping utilized is QAM.
- The signals are modulated onto orthogonal sub-carriers. This is finished by utilizing IFFT.
- Orthogonality is kept up amid channel transmission. This is accomplished by adding a cyclic prefix to the OFDM edge to be sent. The cyclic prefix comprises of the L last specimens of the edge, which are duplicated and put in the start of the casing. It must be longer than the channel motivation reaction.
- Synchronization: the presented cyclic prefix can be utilized to identify start of each of frame. This is finished by utilizing the way that the L first and last specimens are the same and along these lines associated. This works under the suspicion that one OFDM casing can be thought to be stationary.
- Demodulation of the received signal by using FFT
- Channel equalization: the channel can be evaluated either by utilizing a preparation grouping or sending known alleged pilot symbols at predefined sub-carriers.
- Decoding and de-interleaving.

III. PROPOSED METHODOLOGY

The working block diagram of the Proposed MIMO-OFDM system with QPSK modulation using Gaussian Filtering Methodology is shown in Fig. 3.1. Here the proposed methodology utilizes QPSK modulation with Gaussian Filter and Different MIMO Antenna Configurations has been used to reduce the Bit Error Rate which is analysed with different levels of SNR.

The Block Diagram in the transmitter section very firstly the data is modulated by QPSK modulator and then OFDM Modulation i.e. Inverse Fast Fourier Transform (IFFT) is applied for multiplexing then after addition of cyclic prefix is data signal transfer through the channel the noise is mixed in the receiver section then cyclic prefix is removed Fast Fourier Transform (FFT) is applied for de-multiplexing then QPSK Demodulation has been done then after V-BLAST with MMSE and ZF linear detection methods have been adopted and in final stage the Gaussian Filter is adopted to reduce the BER.

As the flow graph shows the whole simulation flow of Proposed Methodology in this firstly, the environmental variables initialized then the data is generated, QPSK Modulates then IFFT Technique is used after that addition of cyclic prefix then noise mixed with data signal during transmission. Then Cyclic Prefix is removed FFT is adopted and PSK demodulator is implemented then V-BLAST ZF & MMSE with Gaussian Filter for minimizing the BER.

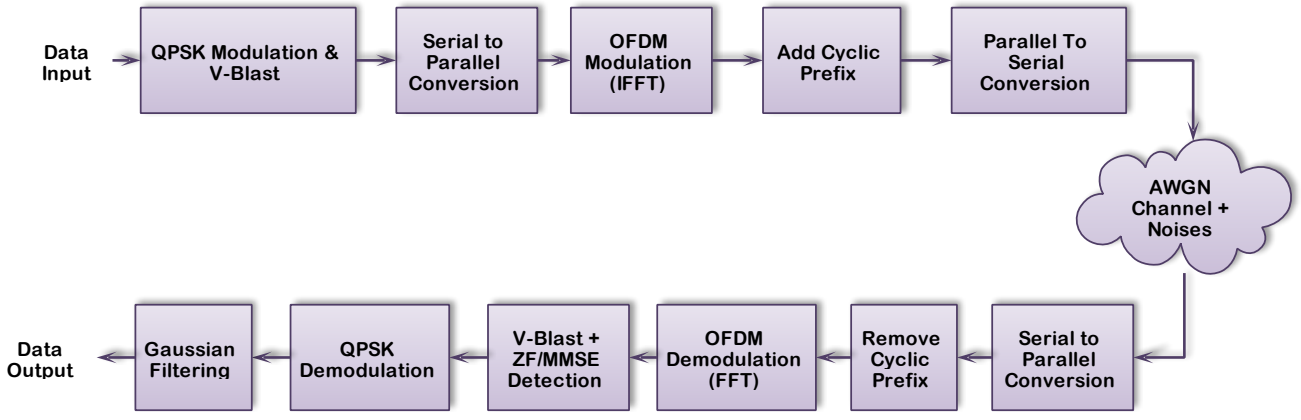

Fig. 3.1 Block Diagram of Proposed Methodology

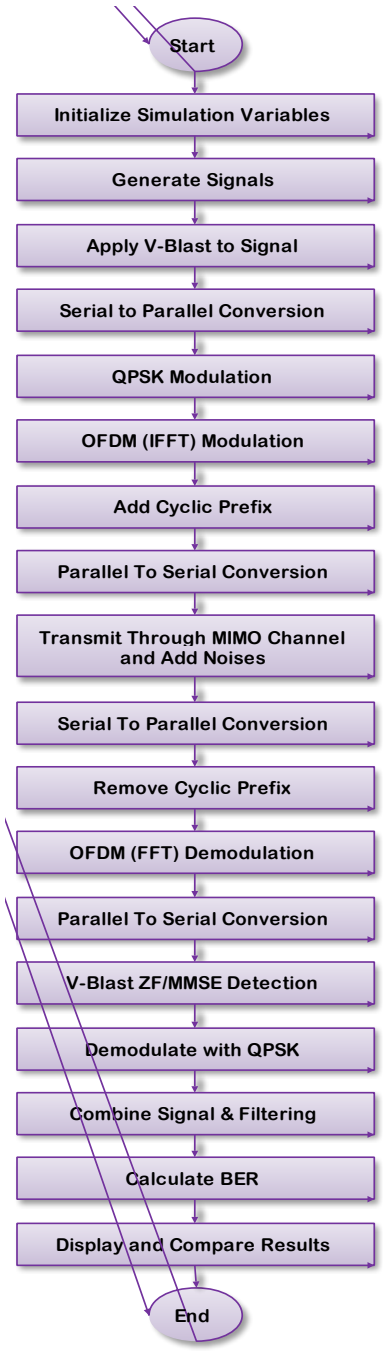

Fig. 3.2 Flow Chart of Proposed Methodology

IV. SIMULATION RESULTS

The proposed system is explained in the previous section. In this section the results of simulations performed on the proposed system is discussed. The system in evaluated under different data lengths and with PSK modulation. The results is compared for V-Blast with ZF, V-Blast with MMSE and both with and without filter. The results are shown in below figures.

In Fig. 4.1 the simulation results with 4x4 antenna system is displayed, and the performance of the V-Blast with Zero Forcing using filter perform better than other techniques. So here V-blast MMSE with Filtering is optimum for system.

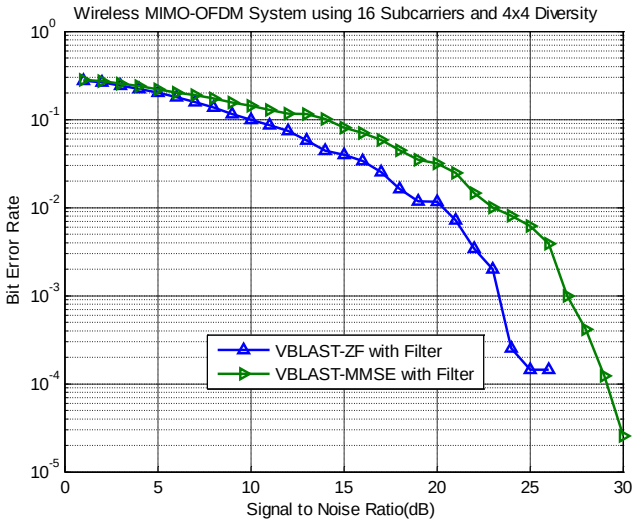

Fig. 4.1 Performance of V-Blast MIMO-OFDM System using ZF and MMSE detection with Gaussian Filter and 4x4 Antennas and 16 Subcarriers

In Fig. 4.2 the simulation results with 4x4 antenna system with 32 Subcarriers is displayed, and the performance of the V-Blast with Zero Forcing using filter enhanced a little bit than previous configuration. So here Filtered V-blast ZF is optimum for system.

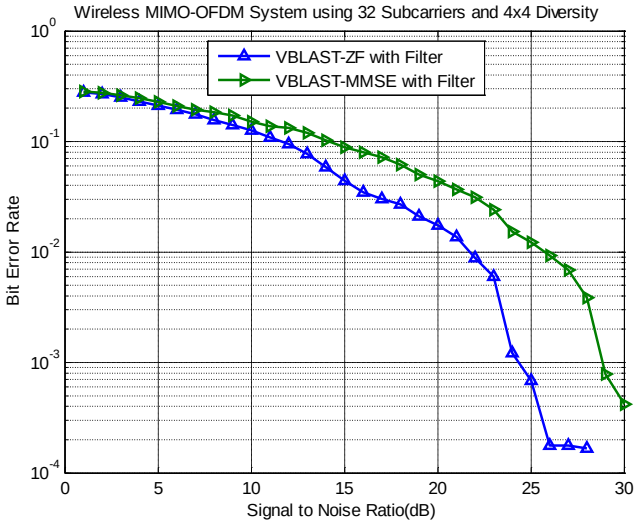

Fig. 4.2 Performance of V-Blast MIMO-OFDM System using ZF and MMSE detection with Gaussian Filter and 4x4 Antennas with 32 Subcarriers

In Fig. 4.3 the simulation results with 4x4 antenna system with 64 subcarriers is displayed, and the performance of the V-Blast with Zero Forcing using filter enhanced again a little bit than previous configuration. So here Filtered V-blast ZF is again optimum for system.

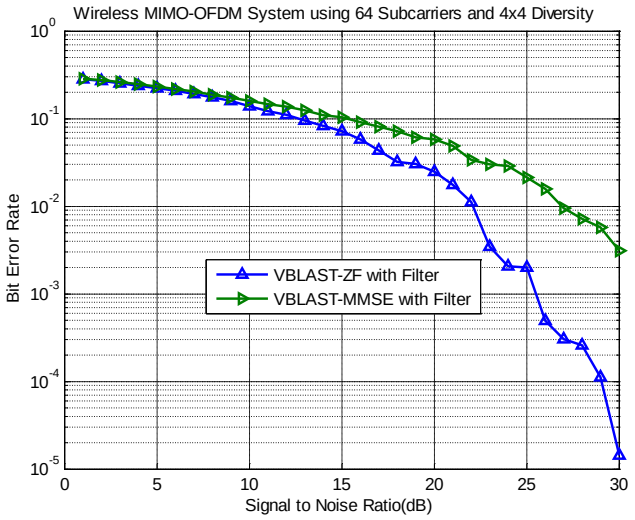

Fig. 4.3 Performance of V-Blast MIMO-OFDM System using ZF and MMSE detection with Gaussian Filter and 4x4 Antennas with 64 Subcarriers

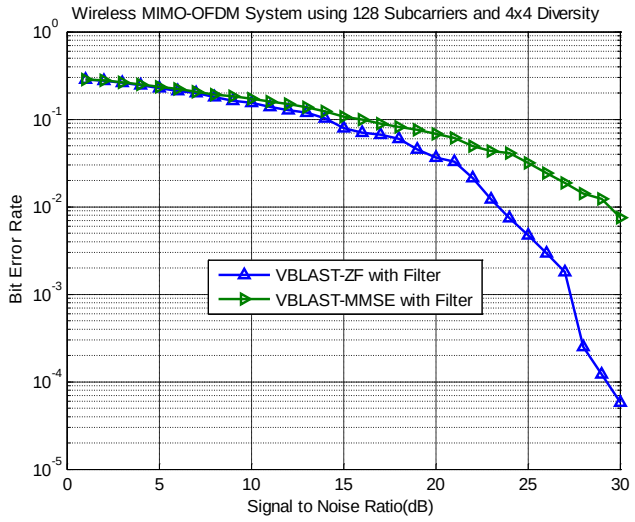

Fig. 4.4 Performance of V-Blast MIMO-OFDM System using ZF and MMSE detection with Gaussian Filter and 4x4 Antennas with 128 Subcarriers

In Fig. 4.4 the simulation results with 4x4 antenna system with 128 subcarriers is displayed, and the performance of the V-Blast with Zero Forcing using filter enhanced again a little bit than previous configuration. So here Filtered V-blast ZF is again optimum for system.

V. CONCLUSION AND FUTURE SCOPE

The outcomes of the simulation of proposed system are shown in the last section. In the outcomes it is clearly shown that the minimum mean square(MMSE) and zero forcing (ZF) with V-blast performs better with MIMO-OFDM system and it will be enhanced when Gaussian filter is used with this technique. The OFDM technology is widely used technique to transfer large data over narrow bandwidth wireless media, as a result proposed work has added better BER performance to the system. In future improvements the OFDM base wireless systems more sophisticated modulation techniques with definitely perform better and gives as low as possible error than existing systems, in addition with the system efficient detection techniques will help to reduce the noises presents in the signal at the receiver.

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