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DESIGN AND PERFORMANCE ANALYSIS OF MIMO-OFDM SYSTEM USING DIFFERENT ANTENNA CONFIGURATIONS

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Abtract: 4G is demonstrating acceptable accelerates to 1Gbps. At that point for what reason do we need much else. The issue is that it can't give constant applications. 5G is the name given to the up and coming age of versatile information availability. It will give extraordinary paces between 10Gbps to 100Gbps This proposition contains higher MIMO plots alongside the OFDM and furthermore it decide the Bit Error Rate contrasted and diverse recieving wire designs. In enormous MIMO, the base stations are outfitted with numerous reception apparatuses. The excess of radio wires offers the jammer opportunity to look out and abuse structure in signs to support its stickings. This plenitude of recieving wires brings a few new, entrancing angles contrasted with single-client MIMO and multi-client MIMO. OFDM might be joined with recieving wire clusters at the transmitter and recipient to expand data transmission proficiency and heartiness utilizing multipath signal spread, bringing about a MIMO-OFDM arrangement. The forward error correction(FEC) alongside amazing interleaving calculations assumes a significant job in the improvement of the presentation of the MIMO-OFDM frameworks was planned. In this task a MIMO-OFDM framework with convolutional coding with code rate ½ and investigated the presentation of the framework utilizing distinctive reception apparatus design in AWGN channel. Complete OFDM modules were created including information age, forward blunder rectification, tweak, IFFT/FFT and Viterbi decoder.

Index Terms – MIMO, OFDM, BER, FEC, RS Code, high data rate.

I. INTRODUCTION

The name which is given to the up and coming age of remote correspondence is fifth era that is 5G. The principle point of the 5G is too increment Data rate, accessibility and to diminish Latency. These days Mobile information traffic is beginning rapidly thus the huge accomplishment of advanced cell, tablets and various information traffic apparatuses. The single direction to diminish the portable information traffic is to present progressively number of recieving wires at the base station (BS) and restricted the cell arrange. Enormous MIMO is one of the trend setting innovations which are utilized in 5G remote correspondence. In Massive MIMO we can utilize more radio wires at both transmitter and beneficiary side that is 10 to 100 recieving wires can be utilized at both transmitter and collector side. The fundamental point of this theory is to lessen bit mistake rate by utilizing Massive MIMO innovation in 5G versatile correspondence and also OFDM system is used as modulation for latest wireless and communication standard. Bit Error Rate implies the apportion of blunder bit to add up to number of transmitted piece. BER is the rate at which blunder happen in got data, BER can be decreased by expanding sign to noise ratio(SNR).

II. LITERATURE REVIEW

- *Gohil et al.[1]* The primary point of this paper is to learn about 5G innovation of portable correspondence This paper additionally incorporates difficulties move from 4G they are multimode utilizer terminal, security, arrange framework, Quality of Service and so forth. It gives data about key terms of 5G innovation, physical/MAC layer, Network layer and furthermore tells about 5G features.5G innovation which is structured as open source on assortment of layer from physical layer to application layer.
- *N. H. M. Adnan et al. [2]*In this paper they state about Massive MIMO innovation which uses progressively number of radio wires at both transmitter and collector side. Gigantic MIMO has bit of leeway of improving limit, phantom effectiveness and vitality productivity and can be built by utilizing minimal effort and low force supplies.
- *H. M. El Misilmani et al. [3]* This papers presents a diagram of the significant perspectives identified with gigantic MIMO configuration including, reception apparatus exhibit general structure, configuration, and difficulties, not with standing progressed beamforming strategies and channel displaying and estimation issues influencing the usage of such frameworks.
- *Azizzadeh et al. [4]* In this paper we can see uplink Massive MIMO model alongside that recognition model and furthermore graps which contrast Bit Error Rate and diverse adjustment techniques. They likewise understand that using more radio wire at base station can offset the exhibition and lower the impact of utilizing low-goals simple to advanced converters on Bit Error Rate.

- *P. Fernandes et al. [5]* In this paper we can get data about how the blend of Massive MIMO-OFDM works and their bit of leeway of that mix. Huge MIMO method alongside the mix of orthogonal frequency division multiplexing modulation is being put forword for fortune wideband remote structure, for example, 5G cell networks. This paper additionally gives data about channel characterstics which are spoken to in grid structure.
- *P. Fernandes et al. [6]*this paper examines the coding collaboration dependent on convolutional LDPC codes. Right off the bat, channel coding the first data by LDPC convolutional codes, at that point isolated the coded words into two sections by puncturing calculation; besides, bringing space-time transmission into the second casing of coded participation, so the decent variety addition can be gotten under various blurring situations.
- *O. Daoud et al. [7]* Orthogonal Frequency Division Multiplexing (OFDM) is a promising procedure in the following advancement of the mobile communication. This paper presents a structure for a Low Density Parity Check (LDPC) code that accomplishes a decent mistake remedy execution and is utilized to bring down the Peak to Average Power Ratio (PAPR) in a Multiple Input Multiple Output Orthogonal Frequency Division Multiplex System.

III. PROPOSED METHODOLOGY

1. **OFDM (TRANSMITTER)**

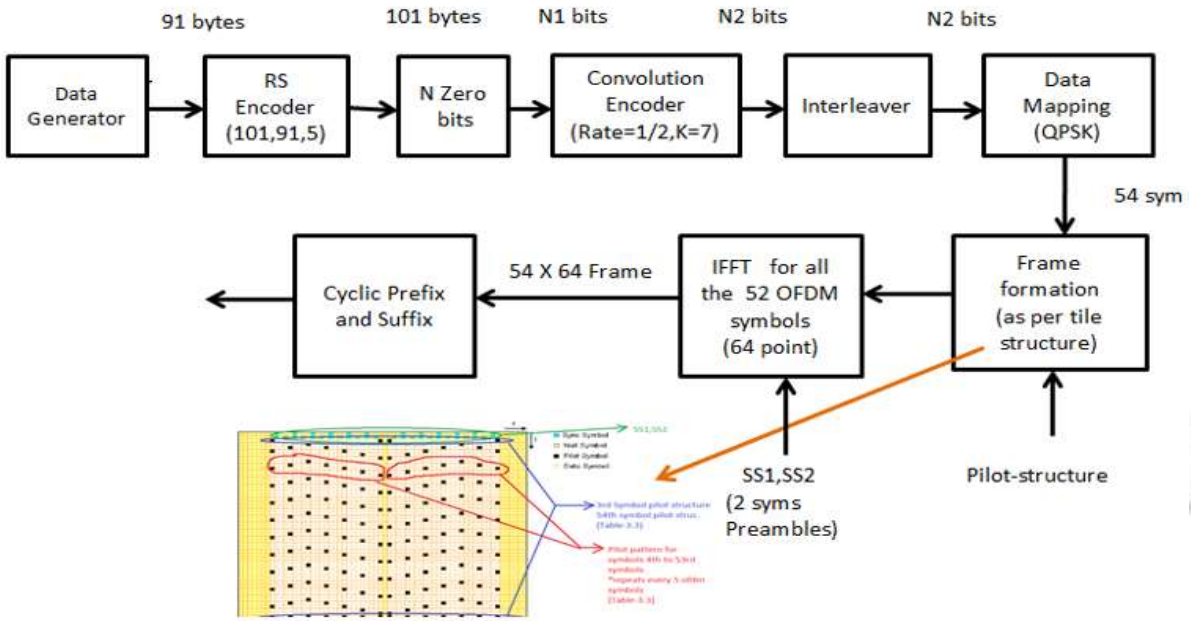

Fig 1: OFDM physical layer(transmitter)

Data Generator

The bit stream which is required for the framework is produced by the information generator and it goes about as a MAC emulator. In genuine situation, since MAC layer isn't executed information generator is utilized and information is sent as MAC headers.

RS Encoder

The task of RS Encoder is to take a square of advanced information and includes additional "excess" bits. Amid transmission or capacity blunder can happen for numerous reasons like commotion or impedance, marks on a CD, etc. Reed-Solomon codes are straight square codes furthermore a subset of BCH codes. The encoder takes k information images of s bits respectively and improves equality images to make a n image code word. (n-k) equality images are there for s bits each. Here, it is determined with RS (n, k) with s-bit images.

N-Zero bits

This square is a cushioning square, which cushions or stuffs zeros to the information with the goal that the yield bytes coordinates the required LDACS standard.

Convolution Encoder

Convolution encoding is a strategy for adding repetition to an information stream which is done in a controlled way to enable the goal to address bit mistakes without requesting that the source retransmit.

Interleaver

Interleaving is finished by spreading the coded pictures in time before transmission.

Data Mapping

Subordinate upon its size, the bit interleaved information are then yielded to the example mapper, where the information was modulated using the subsequent four disparate variety plans: BPSK, Gray-mapped QPSK, 16-QAM and 64-QAM. Balance is achieved by varying the period of the basis0functions relying upon the message images. In Quadrature Phase Shift Keying (QPSK) two sinusoids (sine and cosine) are taken as basic0functions for adjustment. In the event that the image is available in the main quadrant, at that point it is image '0', on the off chance that present in second quadrant, at that point image '1', on the off chance that present in third quadrant, at that point image '3', else it is image '2'. They are spoken to utilizing dark code.

Frame Formation

Frame development is the way toward masterminding images in a specific request to shape a downlink or a forward connection outline. The subtleties of the chart is appeared in the underneath figure 14.

Cyclic Prefix

Particular OFDM cyclic prefix lengths are available in various structures. The cyclic prefix is made with the goal that each OFDM picture is gone before by a copy of the end some portion of that equivalent picture.

Burdens

Reduces information limit: As the cyclic prefix re-transmits information that is as of now being transmitted, it takes up framework limit and decreases the general information rate.

Absolute number of pilots = 4+140+14 = 158 pilots

Absolute bearers = 52 * 50 = 2600,

Information conveys = 2600 – 158 = 2442 images for each FL Data

Sync symbol

Synchronization images are utilized to synchronize both transmitter and beneficiary oscillator tickers for whenever and recurrence balance remedy.

Null symbol

Null symbol is zero which is the DC transporter part.

Pilot symbol

Pilot symbols are utilized for channel estimation.

Data symbol

Data symbols the genuine information which is to be transmitted from transmitter to beneficier.

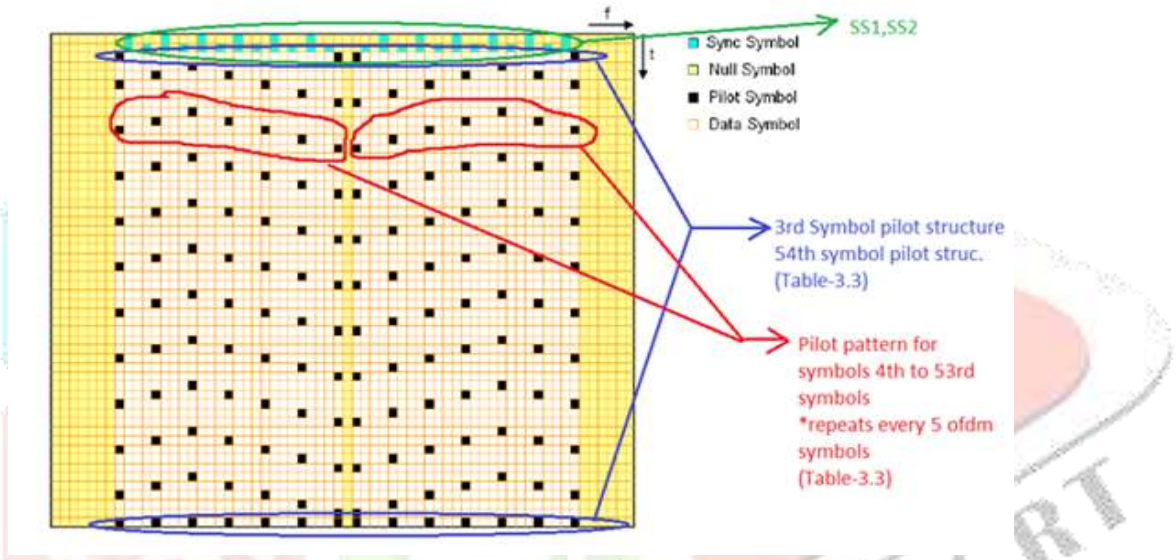

Fig 2: Frame Formation diagram as per tile structure

2. OFDM (Receiver)

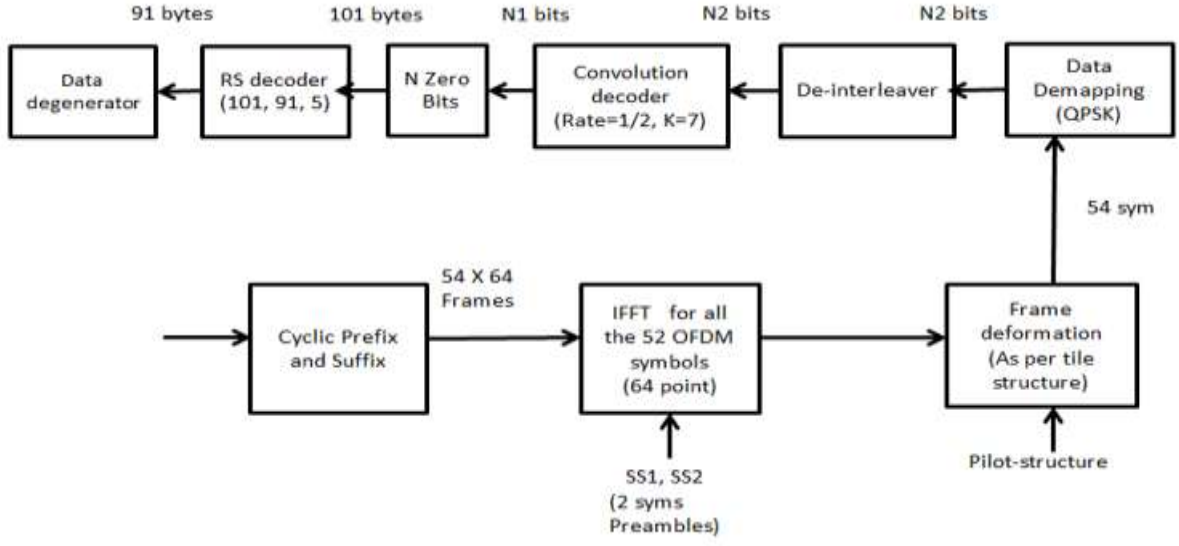

Fig 3: OFDM physical layer (receiver)

The square shows the basic correspondence chart with transmitter, channel and recipient. The transmitter's capacity is to process the message signal into a structure reasonable for transmission over the correspondence channel. This is called regulation. With respect to the correspondence channel, its capacity is to give a pathway between the transmitter's yield and the collector's information. The activity of the recipient is to process the got sign to recoup the fitting message signal. In the event that the various components carry out their responsibilities as needs be, at that point the yield sign should equivalent to the information message signal.

3. MIMO-OFD

Fig 4: MIMO-OFDM System

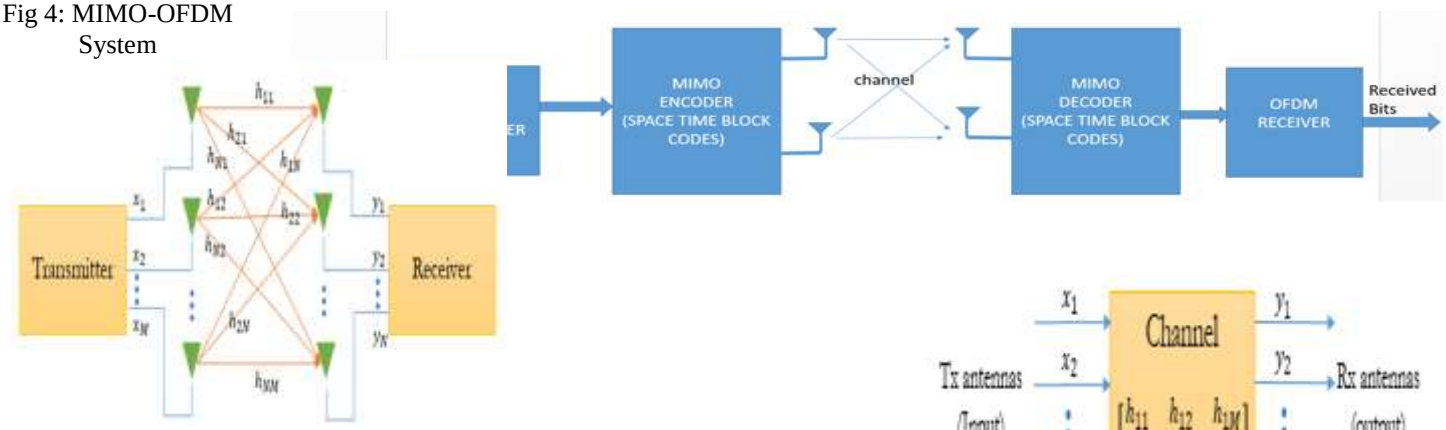

Fig 5: Multiple Input Multiple Output(MIMO) System Fig 6: Channel model for massive MIMO

MIMO Equations are determined dependent on MIMO Book, all the conditions for 2x1 , 2x2, 4x1 and 4x4 are tried, and conditions for 4X4 , 8X4 and 8X8 are inferred dependent on directly expanding on the set up codes, for example, STBC and OSTBC and these are based on crude Space time square codes, for example, 2x2 and 4x4. Here beneath zone not many conditions utilized for MIMO Encoding and disentangling in this manner. The following are a couple of conditions which are utilized in the code.

$$\mathcal{G} = \begin{pmatrix} x_1 & x_2 & x_3 & x_4 & x_5 & x_6 & x_7 & x_8 \\ -x_2 & x_1 & x_4 & -x_3 & x_6 & -x_5 & -x_8 & x_7 \\ -x_3 & -x_4 & x_1 & x_2 & x_7 & x_8 & -x_5 & -x_6 \\ -x_4 & x_3 & -x_2 & x_1 & x_8 & -x_7 & x_6 & -x_5 \\ -x_5 & -x_6 & -x_7 & -x_8 & x_1 & x_2 & x_3 & x_4 \\ -x_6 & x_5 & -x_8 & x_7 & -x_2 & x_1 & -x_4 & x_3 \\ -x_7 & x_8 & x_5 & -x_6 & -x_3 & x_4 & x_1 & -x_2 \\ -x_8 & -x_7 & x_6 & x_5 & -x_4 & -x_3 & x_2 & x_1 \\ x_1^* & x_2^* & x_3^* & x_4^* & x_5^* & x_6^* & x_7^* & x_8^* \\ -x_2^* & x_1^* & x_4^* & -x_3^* & x_6^* & -x_5^* & -x_8^* & x_7^* \\ -x_3^* & -x_4^* & x_1^* & x_2^* & x_7^* & x_8^* & -x_5^* & -x_6^* \\ -x_4^* & x_3^* & -x_2^* & x_1^* & x_8^* & -x_7^* & x_6^* & -x_5^* \\ -x_5^* & -x_6^* & -x_7^* & -x_8^* & x_1^* & x_2^* & x_3^* & x_4^* \\ -x_6^* & x_5^* & -x_8^* & x_7^* & -x_2^* & x_1^* & -x_4^* & x_3^* \\ -x_7^* & x_8^* & x_5^* & -x_6^* & -x_3^* & x_4^* & x_1^* & -x_2^* \\ -x_8^* & -x_7^* & x_6^* & x_5^* & -x_4^* & -x_3^* & x_2^* & x_1^* \end{pmatrix}$$

$$\mathcal{G} = \begin{pmatrix} x_1 & x_2 & x_3 & 0 & x_4 & 0 & 0 & 0 \\ -x_2^* & x_1^* & 0 & x_3 & 0 & x_4 & 0 & 0 \\ x_3^* & 0 & -x_1^* & x_2 & 0 & 0 & x_4 & 0 \\ 0 & x_3^* & -x_2^* & -x_1 & 0 & 0 & 0 & x_4 \\ x_4^* & 0 & 0 & 0 & -x_1^* & x_2 & -x_3 & 0 \\ 0 & x_4^* & 0 & 0 & -x_2^* & -x_1 & 0 & -x_3 \\ 0 & 0 & x_4^* & 0 & -x_3^* & 0 & x_1 & x_2 \\ 0 & 0 & 0 & x_4^* & 0 & -x_3^* & -x_2^* & x_1^* \end{pmatrix}.$$

Fig 7: MIMO STBC Equation for 8X8 Full rate Fig 8: MIMO STBC Equations for 4X4 Half rate

It was seen that the half rate was giving better BER results to 64 image regulation. There are no legitimate conditions accommodated higher Antennas plans, however it has been proposed that Equations fabricate dependent on Fig 4 straight for 4X4 8X4 and 8X8 will yield results and a marginally better BER gain. Consequently conditions for higher transmits conspire was developed utilizing the above equation matrix as shown in Fig 8 Typically half rate ofdm codes are employed for lower power consumptions on the hardware as 50% of the symbol space are zero's as compared to full rate which as a certain non-zero value.

IV.RESULTS

Below are self-explanatory snap shots of the MIMO simulator and results

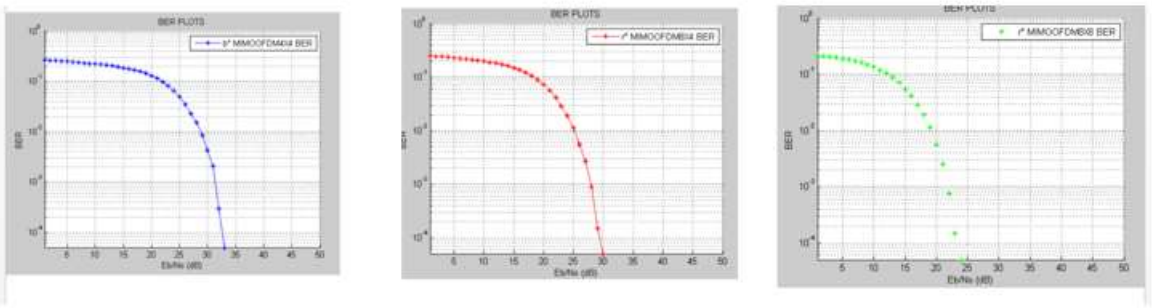

Fig 9 : BER results for individual system 4X4, 8X4,8X8

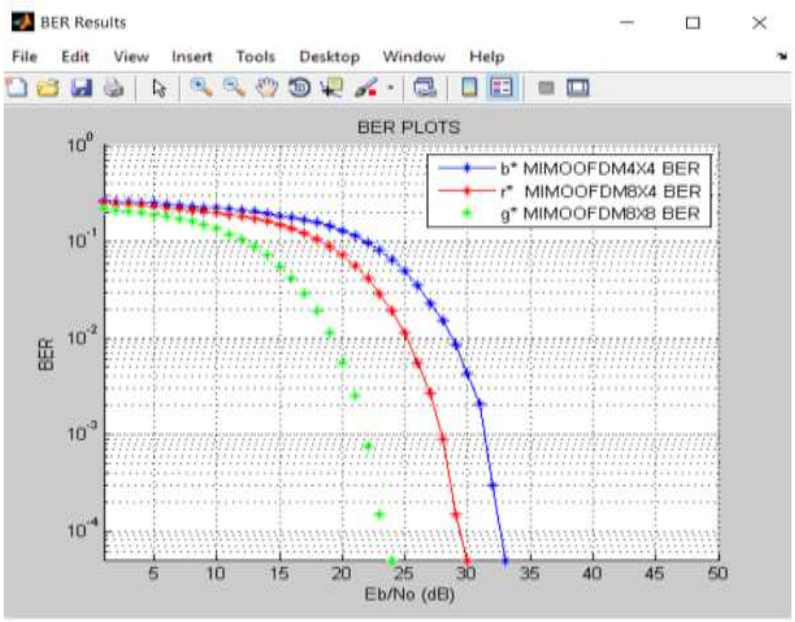

Fig 9 : BER results for Combined 4X4, 8X4,8X8

Figure Above shows the BER vs SNR plots for a given set of MIMO OFDM parameters. OFDM chain consists of Data generation Module, Interleave, Forward error correction block includes RS encoder and Convolutional encoder, Then the Modulation scheme of 64 QAM is used. Various other modulation schemes mainly BPSK and QPSK were also used initially to validate the BER. Even in higher data rate streams which employ higher modulation schemes for data transfers. Above Plots depicts the output for 4, and 8 Transmit and 4 and 8 Receive antenna configurations as t can be observed from the results that better performance is achieved for higher antennas schemes.

V. CONCLUSION AND FUTURE SCOPE

1. Conclusion

5G innovation vows to be progressive which is required to assume a key job in advanced economies, improving monetary development, upgrading residents' educational encounters and making new business openings. Bigger transmission capacity and low inertness times will permit the advancement of new administrations and the improvement of existing ones. Utilizing OFDM/OFDMA in 5G systems will upgrade otherworldly productivity of future portable correspondence arranges as Compared to LTE-Advanced systems utilizing CDMA innovation. Huge MIMO-OFDM Physical layer is actualized in the work, different Space time square codes were broke down and executed to show up at the task objective, there are various kinds of plans in STBC codes, for example, Full rate, ¾ rate, ½ rate coding plans for radio wires. MATLAB code was utilized to show the working of above, BER versus SNR plots were over served to recognize the framework execution, and it is seen that higher request recieving wires plans perform better at that point lower request plans. Additionally OFDM Physical layer alongside direct estimation was consolidated in the structure chain.

2. Future scope

As a feature of future degree, MIMO encoder can be taken up as an equipment execution either on a DSP or FPGA stage, or on any standard proving ground and could be tried. Adjustment plans can likewise be expanded to coordinate the higher information rates. Pillar shaping procedures can likewise utilized for future. Additionally UFMC modules can be structured in blend with MIMO space time square codes which include decent variety regarding mistake rate is added to the chain.

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