DESIGN OF ENERGY EFFICIENT MASSIVE MIMO SYSTEM USING HYBRID PRECODING

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Abstract - *Massive multiple-input multiple-output (MIMO) is one of the central technologies in the emerging 5G (Fifth-generation wireless) systems, but also a concept applicable to other wireless systems. Utilization of the large number of degrees of freedom in massive MIMO essential for achieving high spectral efficiency, high data rates and extreme spatial multiplexing of densely distributed users. The benefits of applying massive MIMO for communication are well known and there has been a large body of research on designing communication schemes to support high rates. On the other hand, using massive MIMO for Internet-of-Things (IoT) is still a developing topic, as IoT connectivity has requirements and constraints that are significantly different from the broadband connections. Hybrid precoding is a promising technology for MIMO systems. It can reduce the number of radio frequency (RF)chains.However,the power consumption is still very high owing to large scale antenna array. In this paper we investigate the applicability of massive MIMO to IoT connectivity with high energy efficiency. The numerical results indicate that the proposed SEEHP algorithm achieves higher secure energy efficiency compared with three existing physical layer security algorithms – SHP,SCM,SEEPA algorithms , especially when the number of transmit antennas is large. Thus the energy efficiency is achieved even upon increasing the number of antennas.*

Key Words: ***Massive MIMO system, Secure Energy Efficient Hybrid Precoding algorithm, Secure Hash Algorithm ,Secrecy Capacity Maximization algorithm , Secure Energy Efficient power Allocation algorithm***

1.INTRODUCTION

IoT (Internet of Things) is an advanced automation and analytics system which exploits networking, sensing, big data, and artificial intelligence technology to deliver complete systems for a product or service. These systems allow greater transparency, control, and performance when applied to any industry or system. IoT systems have applications across industries through their unique flexibility and ability to be suitable in any environment. They enhance data collection, automation, operations, and much more through smart devices and powerful enabling technology. IoT systems allow users to achieve deeper automation, analysis, and integration within a system. Massive multiple-input multiple-output (MIMO) requires a large number (tens or hundreds) of base station antennas serving for much smaller number of terminals, with large gains in energy efficiency and spectral efficiency compared with traditional MIMO technology. Large scale antennas mean large scale radio frequency (RF) chains. Considering the plenty of power consumption and high cost of RF chains, antenna selection is necessary for Massive MIMO wireless communication systems in both transmitting end and receiving end. Thus a hybrid algorithm is being produced to achieve energy efficiency in MIMO systems. The proposed algorithm is verified by analysis and numerical simulations. Good performance gain of energy efficiency is obtained comparing with existing physical layer algorithms.

2. LITERATURE REVIEW

In paper 1, they have investigated the low latency massive SIMO using non-coherent ML detection for industrial IoT communications. Low latency helps in data reception in a safe and timely manner. However the drawbacks resides like data speed reduction and number of errors keep increasing with increase in the amount of data.

In paper 2, the concept of full duplex is adopted which in turns results in data transmission and reception without proper utilization of channel bandwidth.

In paper 3, the authors investigated about achieving high energy efficiency and physical layer security in AF relaying. "Amplify and forward protocol" is used for proper data transmission but it leads to ambiguous data transfer.

In paper 4, energy efficient precoder is designed for multiple input and multiple output systems (MIMO). Wiretape channels are used for the data transfer. These channels,however,energy efficient, results in eavesdropping

In paper 5, reliable IOT which is efficient in energy is designed but the storage capabilities are low and the processing speed is comparably decreasing with increase inthe amount of data being transmitted.

3. SOFTWARE USED

Matrix Laboratory (MATLAB) software.

MATLAB is a high-performancelanguage for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. MATLAB is an interactive system whose basic data elementis an array that does not require dimensioning. This allows you to solve many technical computing problems, especially those with matrix and vector formulations, in a fraction of the time it would take to write a program in a scalar no interactive language such as C or Fortran. MATLAB was originally written to provide easy access to matrix software developed by the LINPACK and EISPACK projects, which together represent the state-of- the-art in software for matrix computation. MATLAB has evolved over a period of years with input from many users.

In university environments, it is the standard instructional tool for introductory and advanced courses in mathematics, engineering, and science. In industry, MATLAB is the tool of choice for high- productivity research, development, and analysis. MATLAB features a family of application-specific solutions called toolboxes. Very important to most users of MATLAB, toolboxes allow you to learn and apply specialized technology. Toolboxes are comprehensive collections of MATLAB functions (M-files) that extend the MATLAB environment to solve particular classes of problems. Areas in whichtoolboxes are available include signal processing, control systems, neural networks, fuzzy logic, wavelets, simulation, and many others.

4. PROPOSED ALGORITHM

Secure Energy Efficient Hybrid Precoding (SEEHP).

A secure energy efficiency hybrid precoding algorithm is proposed to solve the transformed optimization problem. Numerical results indicate algorithm achieves the highest secure energy efficiency and close secrecy capacity compared with other three physical layer security algorithms when the maximum trans-mit power is small. In addition, when the number of antennas keeps increasing, the secure energy efficiency performance advantage of the proposed SEEHP algorithm strengthens. The secure energy efficiency optimization problem is formulated. It detailed describes how the secure energy efficiency optimization problem is transformed and solved with the proposed SEEHP algorithm. It gives the numerical resultsoftheSEEHP algorithm compared with other three physical layer securityalgorithms.

5.WORKING PRINCIPLE

The system is proposed to achieve and establish high energy efficiency in Multiple- input Multiple-output (MIMO) system. Secure energy efficiency optimization is done by Hybrid Precoding. Power consumed by the gateway controller hardware is maintained constant, even upon increasing the number of antennas at transmission and reception. It is achieved by Secure Energy Efficient Hybrid Precoding (SEEHP) algorithm. Thus the data stream transfer from transmitter to the receiver in MIMO system can be performed with high accuracy and less power consumption.

The MIMO system being setup when deployed with SEEHP algorithm can achieve energy efficiency in three constraints.

1. High energy efficiency when compared with physical layer algorithms.
2. Multiuser configuration.
3. Increasing the number of transmitting and reception antennas.

5.1.ADVANTAGES OF THE HYBRID PRECODING

1. Hybrid precoding can reap the benefits of large antennas.
2. When the number of RF chains is equal to that of antennas,the system energy efficiency achieved.
3. Even upon increasing the number of antennas the energy efficiency is retained.
4. The data received at the destination is accurate.
5. It removes the data ambiguity

5.2.FLOW DIAGRAM

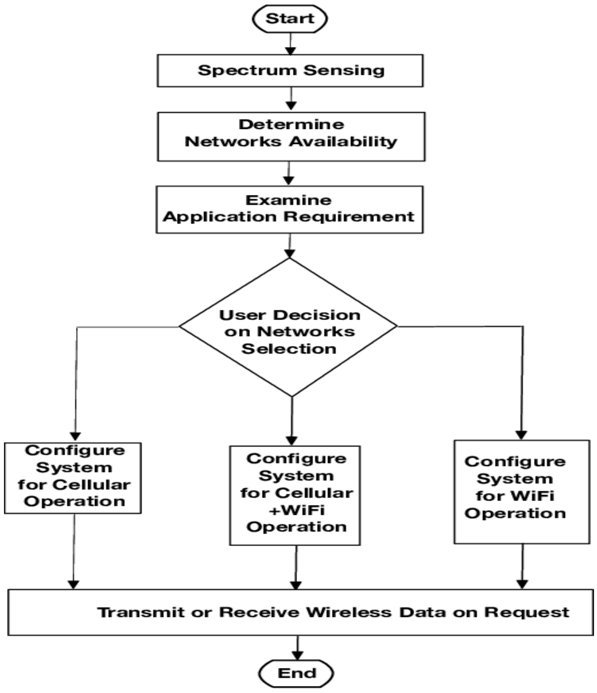

Fig.1.Working of hybrid precoding in MIMO system

6.APPLICATIONS

1. Telecommunication.
2. Healthcare.
3. Datacenters.
4. Industrial manufacturing plants.

7.OUTPUT

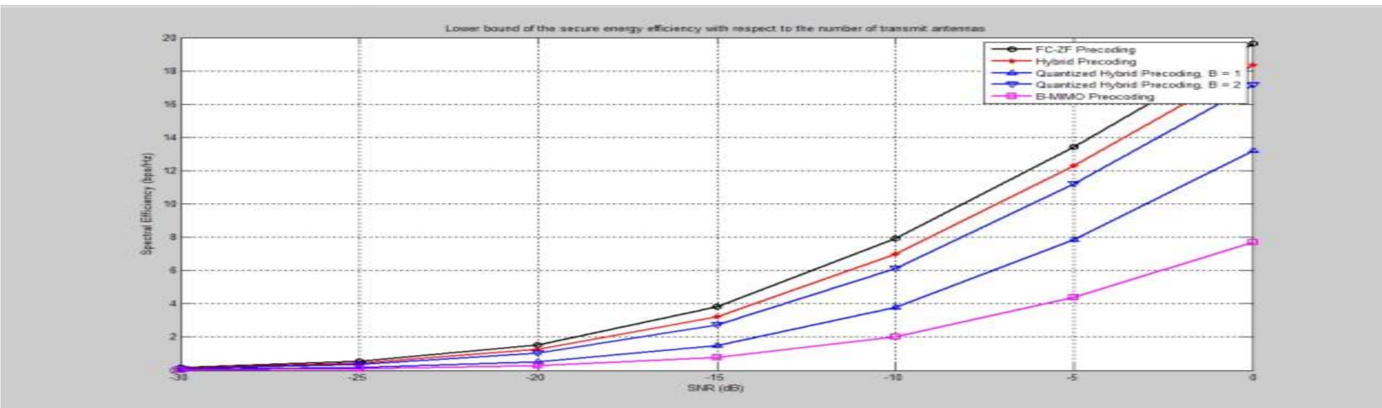

Fig.2. Lower Bound of the secure energy efficiency with respect to number of transmitting antennas.

Even upon increasing the number of transmitting antennas the energy efficiency is maintained and data is transmitted securely throughout the transmission phase**.**

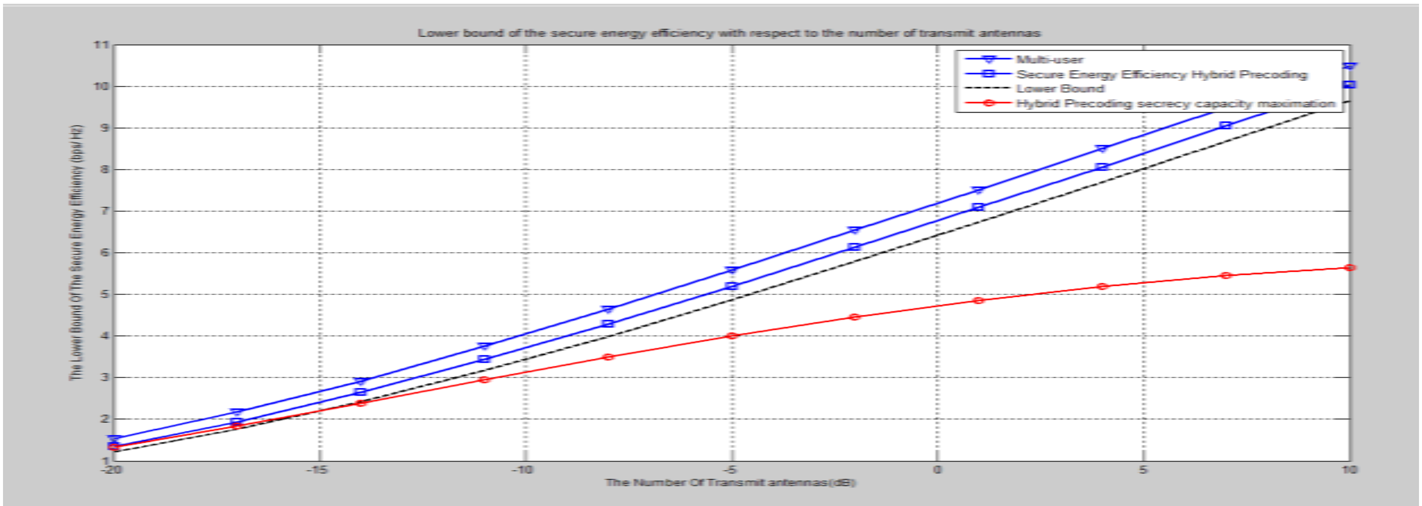

Fig.3.Energy Efficiency of Hybrid Precoding with Multiple users.

Energy efficiency is achieved even when the number of users accessthe channel for data transmission. Thus, hybrid precoding forms a vital role in allowing multiple users to use a channel with high energy efficiency.

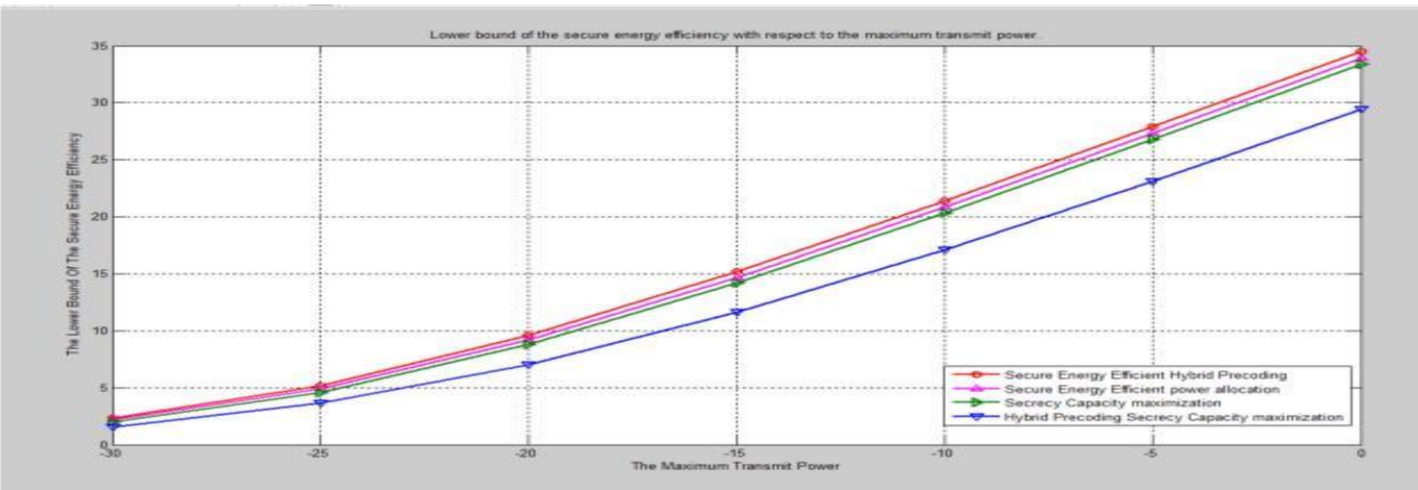

Fig.4.Energy Efficiency of Hybrid Precoding in comparison with physical layer algorithms.

The output shows the graphical representation of energy efficiency of hybrid precoding when it is compared with the physical layer algorithms.Hence,with the technique of hybrid precoding accurate transmission of data can be performed achieving high energy efficiency.

8.CONCLUSION

The project presented on Design of energy efficiency of IOT using Hybrid Precoding achieves high energy efficiency in MIMO systems.When the maximum transmit power is small, the SEEHP algorithm achieves close secrecy capacity compared with the other three algorithms. In addition, when the number of antennas keeps increasing, the SEEHP algorithm achieves much higher secure energy efficiency than the compared algorithms.

FUTURE WORK: In the near future, we will try to investigate and optimize the secure energy and spectral efficiency of the IoT network with multiple eavesdroppers and imperfect Channel State Information (CSI) in MIMO systems.

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