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Performances Enhancement in Wireless Body Area Network (WBAN)

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Abstract*— Wireless body area network (WBANs) is a recent and emerging technology for medical health monitoring wireless communication system. Its provides short range communication between the body surface and the wireless access point. Channel characteristics of WBAN is very peculiar one compare to others wireless channels, particularly when human body rotates and interferences of others human body shadowing and their own shadows. In this papers analysis the characteristics of recently proposed off-body WBAN channels can be achieved by modeling of channels and improved bit error performances when human body rotates as well as shadowing. In order to avoid the above demerits it is important to obtain the improved bit error performances, additionally another receive antenna is attached to the back side of human body. And also various diversity schemes where used to analyze the each performances of WBAN.

***Index Terms*—wireless body areas networks (WBANs), off body channels, Rician K-factor, Diversity schemes.**

I. INTRODUCTION

The increasing use of wireless networks and the constant miniaturization of electrical devices has empowered the development of Wireless Body Area Networks (WBANs). In these networks various sensors are attached on clothing or on the body or even implanted under the skin. The wireless nature of the network and the wide variety of sensors over numerous new, practical and innovative applications to improve health care and the Quality of Life. The sensors of a WBAN measure for example the heartbeat, the body temperature or record a prolonged electrocardiogram. Using a WBAN, the patient experiences a greater physical mobility and is no longer compelled to stay in the hospital. This paper is divided into following sub sections. Section-II explains the WBAN system. Section-III explains the system modelling, diversity and MIMO schemes. Section-IV explains about system model V explains about simulation results. Section VI explains about the result comparison and section VII explains about conclusions and future scope.

II. WBAN

The increasing use of wireless networks and the constant miniaturization of electrical devices has empowered the development of Wireless Body Area Networks (WBANs). In these networks various sensors are attached on clothing of human body or even implanted under the skin. The wireless nature of the network and the wide variety of sensors offer numerous new, practical and innovative applications to improve health care and the life Quality of personnel working in industries. The sensor of a WBAN includes sensors for heartbeat, the body temperature or record a prolonged electrocardiogram and stress rate. Using a improved WBAN, the patient/personnel experiences a greater physical mobility and is no longer compelled to stay in the hospital or in one location in industries.

III. SYSTEM MODELLING

Channel modelling is important for the development of any communication link. Channel models of WBAN are classified as off-body, on-body, or in-body. However, a corrected model describing the characteristics of a WBAN channel does not exist. For this reason, it is difficult to design a suitable communication system. In this project channel model can be categorized into four types they are Ch-1 which is implant on the human body, Ch-2 which is also implanted one but it will be related to inside the body and surface of the body, Ch-3 which is non implant and surface of the body, Ch-4 which is also non implant and it is related to surface on the body and off the body.[1]

A. System configuration

The model of this WBAN system used in the simulation consists of N number of base station each consist of their own nodes. Nodes have their own biosensors which may be an implanted or non implanted devices and for different channels to communicate each others.

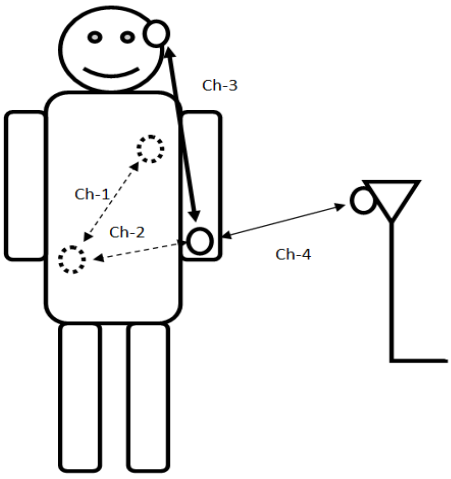

Fig-1 Channel Model Configuration

B. Diversity schemes

Diversity schemes is the very useful techniques in wireless communication system to over the effect of fading occurs in channel due to shadow or other human body. In this paper WBAN is design and simulated for industries employee health monitoring system to safeguard human life while

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employee were met any health emergency. Due to N number of personnel working in an industrial environment there will be fading or multipath reception, path loss, channel fading etc will occur and leads to malfunction of the WBAN system. To overcome these effects the use of diversity schemes has be proposed in this developed model. There are various types of diversity schemes available. In this paper mainly selection combining techniques are used to improve the performances of WBAN and antenna diversity is also another efficient technique to improve the quality and reliability of the communication system. In this system model was simulated by using Network Simulator 2 and the system was analyzed for various parameters. Here selection combining like Selective combining [SC], Equal Gain Combining [EGC], Maximal Ratio Combining [MRC] was targeted for performances enhancement. These algorithm will be adopted automatically depending on the channel model and type of signals being transmitted and the frequency available in the system.

C. MIMO Schemes

MIMO schemes are most useful one for health care monitoring and industrial health care monitoring of personnel's working in different sections and environments.There are several wireless diversity schemes available and two or more antenna were used to improve the system quality and reliability of wireless communication. The received signal vector of the MIMO system is given by

$$y = HS+n$$

Where S is the transmitted signals vector, H is the channel matrix representing the complex Gaussian random variable with zero mean and variance N0/2. [1] When we are using MIMO schemes there is a presence of rician fading due to multiple reception. The elements of H are non-zero mean complex Gaussian. In the presence of the LOS components, the MIMO channel is modelled as[1]

$$H=\alpha H_{LOS}+ ßH_{NLOS}$$

Where H_{LOS} is the LOS component of H, H_{NLOS} is the scattered components of H and $\alpha^{2+} ß^2 =1$[1].

D. Simulation model

Network Simulator NS-2(version 2.35) is a discrete event simulator mostly used for research in networking.NS2 used for wireless network protocol and also with their function. NS-2 provides substantial support for simulation of TCP, routing and multicast protocols in wired and wireless (local and satellite). A comparison and performance evaluation performed by NS2 Simulation experiment is presented here and the results are based on Throughput, Average jitter, End to End Delay, Packet Delivery ratio, Bit error rate etc .

E. PERFORMANCE ANALYSIS

The performance of modelled wireless system is evaluated using different four metrics: throughput, End to End Delay, and Bit error rate performances.

1. THROUGHPUT

Throughput can be defined as how many data packets received by receiver with in data transmission time or successful data transmission performed within a time period. in any network throughput is average rate of successfully data packet delivered from source node to destination node. Throughput is represented in bits/bytes per second. In any network higher throughput is most essential factor. The created environment are tested in network simulator-2 for throughput rate.

2. Delay

End to End delay of data packet is the time taken by the packet from source node to destination node. End to end delay time includes all the delay taken by router to seek the path in network consumption, propagation delay, processing delay and End to end delay for packet p which was sent by the node n, as a source node and received successfully at destination node is given by,

End to end delay np =start time np – end time np

Where start time np is the time when sending of packet p at node n starts, end time np, is the time when packet p is send by node n is received successfully at destination node.

3. Bit error rate

Bit error rate is an important parameter that affects the performances of the system. It is defined as the ratio to total number of error bits and total number of data transmitted.

IV. SYSTEM STRUCTURE

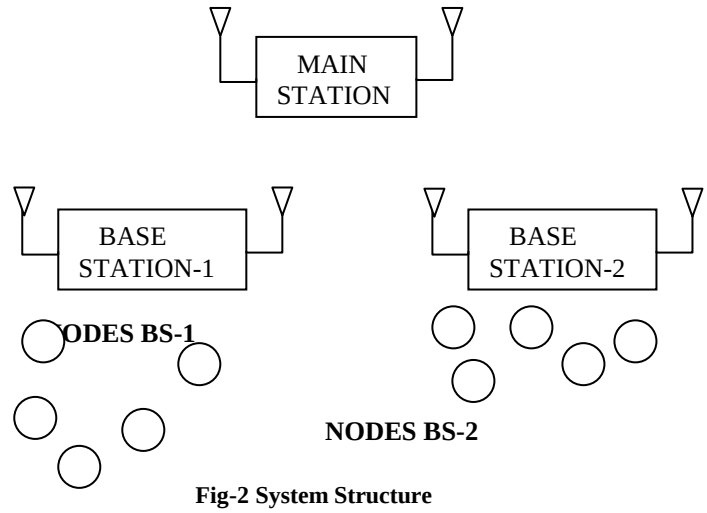

Fig-2 System Structure

An above fig-2 shows the system structure with N number of base station with their own nodes have implanted or non implanted sensors on human body [nodes]. The signals gathered from nodes of base station will be sent to main station. This experimental set up was simulated with the help of Network Simulator-2 and various parameters were obtained. This simulation has been done it for 100 nodes with speed of 200s.

V. SIMULATION RESULTS

1. THROUGHPUT

Throughput of the network is calculated by extracting the data from our modelled protocol by taking the numbers of node on X axis and Number of packets on Y axis s shown in fig.1. Here variation of both mpan and wpan was compared

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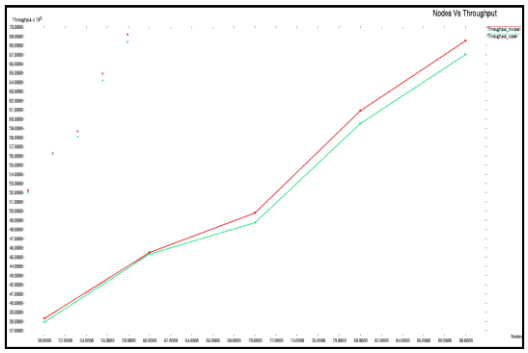
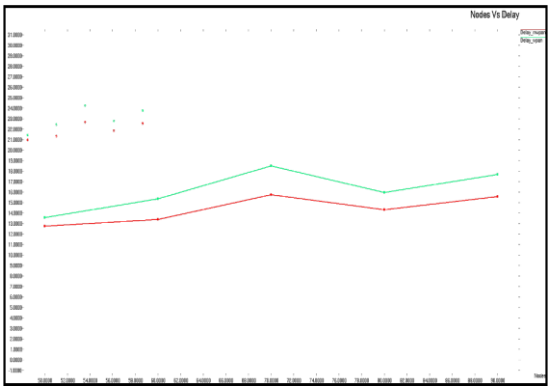


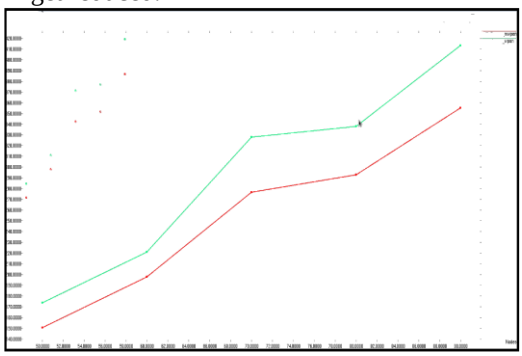
2. Delay

Delay of given simulation output is shown in below fig.2. Since packet is forwarded from source node to destination node by broadcasting so there is no route discovery mechanism is needed



3. Bit error rate performances

Bit error rate for both mwpan and wpan is shown in fig-3. Its is clear that signal to noise is high then the bit error rate will get reduced.



VI. CONCULSION

In these paper performances for various diversity MIMO schemes were evaluated for human body rotation. Selective combining gives worst performances compare to others but maximal ratio combining [MRC] gives best performances but its need exact channel model to evaluates performances parameters like throughput, delay, jitter, PDR, Average energy and bit error performances. Various results were shown above for 100 nodes.

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