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Reduction of BER in Underwater Wireless Communication Using Matlab

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ABSTRACT: Because an ocean has various water columns in each of its sections, cellular communication under water is very different from that over land. Because the water column gap between the transmitter and receiver will be completely different from that between the transmitter and receiver, a transmitter-receiver brace designed to operate in deep ocean positions won't operate in shallow littoral zones. The variety of aquatic bodies is what makes communication link more difficult to carry out. Currently, the most promising system being used to establish UWC link is acoustics. However, multipath miraculous, which introduces a significant detention spread, hinders this system. This will therefore have an impact on Inter Symbol Hindrance (ISI), which will lower the system's efficiency. Using OFDM technology will cut down on the delay spread. A better method to lessen error bursts in multi-access underwater applications is provided by OFDM combined with IDMA. This study presents an IDMA-OFDM Simulink model. On the BER graph, which showed a BER v/s SNR plot, its performance was evaluated.

KEYWORDS - Underwater Communication, Wireless, Orthogonal Frequency Division Multiplexing (OFDM), Interleave Division Multiple Access (IDMA).

I. INTRODUCTION

Essentially, Earth is made up of twenty nine percent land and seventy one percent water. Human birth rates have risen in recent years relative to human death rates. Additionally, the death rates have dramatically dropped as a result of different medical developments. The stress on the planet will rise dramatically in the near future, and there will eventually be no more land mass accessible for any use. With this in mind, it only seems sense that we should utilise our most plentiful resource, the enormous water bodies, to the fullest extent possible. The main prerequisite for doing so is to establish a communication link between the undersea and terrestrial zones. There are two categories of underwater communication: wired and wireless. Fibre optic cables are placed on seabeds to provide wired communication. The following are the main problems of using the wired medium: • External interventions brought about by ships and aquatic animals • Short-term experiments • the price of installing cables • Wires breaking; • Long-distance experimentation Consequently, using a wireless medium is an alternative. Communication across wireless networks is comparatively under-explored since it presents greater difficulties than communication over the air. There are various water columns in seawater and ocean bodies. The water quality along shallow coastal zones differs greatly from that of the deep bottom. As a result, a technique created for one type may not be effective in other areas of the same body of water.

The following performance criteria must be taken into account when designing an underwater communication link: - Absorption Salinity of the water, dispersion, physical obstructions, multipath propagation, and background noise.

The term "underwater wireless communication" describes methods for sending and receiving data underwater via wireless technology. The oil sector, the military, and environmental operations are among the fields in which underwater wireless communication is used. To implement wireless communication underwater, various methods can be applied. These consist of wireless acoustic, radio frequency, and electromagnetic waves as well as wireless optical. The most widely used, effective, and tested method for establishing wireless communications underwater is using acoustic waves. The longest range is provided by acoustics among the three. It has a maximum range of 20 kilometres.



Due to attenuation and electromagnetic interference, the range of RF electromagnetic waves is constrained through water. The underwater application of optical communications is severely constrained by the necessity of line of sight.

Over the past several decades, there has been active study into underwater wireless information transfer from a variety of underwater networks (which may include autonomous underwater vehicles (AUV), unmanned underwater vehicles (UUV), or sensor networks). This section will outline the evolution of several physical waves (including acoustic, RF, and optical) and weigh their advantages and disadvantages in the context of effective underwater wireless communication.

Due to their comparatively low absorption and extensive coverage, acoustic waves—one of the three types of waves previously mentioned—are utilised as the main carrier for underwater wireless communication. Using single sideband (SSB) suppressed carrier amplitude modulation at carrier frequencies between 8 and 15 kHz along with straightforward voice band and pulse shaping filters, the first underwater audio transmission was created in the United States. The distorted speech must be detected and processed by the human ear and brain due to the poor quality of the incoming signal. A relative gain in data throughput and operational range has been shown since the development of digital communication in 1960. Using multipath compensating approaches, a better throughput has been seen.. In order to provide more effective underwater audio communication, numerous researchers have devised advanced methods for channel estimation and created different algorithms. Underwater audio communication has also made considerable use of orthogonal frequency division multiplexing (OFDM) to obtain large data speeds without the usage of complicated equalisers. Although technology has made amazing strides, underwater audio communication still faces a number of challenges to efficient communication. This is due to the fact that the underwater environment is far more diverse and difficult because no standard form of underwater acoustic channel exists; hence, a system created for one environment, such as shallow water, may not function properly in another environment, such as the deep ocean. Furthermore, these waves exhibit three key characteristics: high delay, time-varying multipath propagation, and frequency-dependent attenuation.

II. RELATED WORK

Sandra Sendra; Jaime Lloret; Jose Miguel Jimenez; Lorena Parra, “Underwater Acoustic Modems”, IEEE Sensors Journal, Volume: 16, Issue: 11, Pages: 4063 – 4071, Year: 2016. Studied about we analyzed the investigations made in regard to software and simulators of underwater acoustic networks. As we have seen, researchers have mainly based their improvements on the ns2 Network simulator.

Anna Lakshmi and Sakthivel Murugan1Research Scholar, SSN College of Engineering, India “Fish & Ocean Opj Underwater Acoustic Modem-Challenges, Technology and Applications-A Review Survey”, Volume 2 Issue 4 - May 2017, Published: May 02, 2017:Studied about underwater modems and underwater acoustic modem.

Henry S. Dol; Paolo Casari; Timo van der Zwan; Roald Otnes “Software-Defined Underwater Acoustic Modems: Historical Review and the NILUS Approach”, IEEE Journal of Oceanic Engineering, Volume: 42, Issue: 3, Pages: 722 – 737, Year: 2017. Learned that general-purpose (GP) computing architectures running open-source operating system and tools. The first field tests of the NILUS MK 2 node in multihop underwater acoustic networks.

Sangram More, K. Krishna Naik, “Modelling and Simulation of IDMA-OFDM for Underwater Acoustic Communication”, Defence Science Journal, Vol. 6, pp.307-311, July 2015. Studied about Simulation of IDMA-OFDM for underwater application was done satisfactorily with the help of Matlab Simulator-based BER tool.

HemaniKaushal; Georges Kaddoum, "Underwater optical wireless communication", IEEE Access Volume: 4, Pages: 1518 – 1547, Year: 2016. We conclude that though acoustic waves are the robust and feasible carrier in today's scenario but with rapid technological development and active ongoing research in UOWC, this technology will be more promising with game-changing potentials in the near future.

III. OBJECTIVES

- To look for various wave types utilised for wireless communication underwater.



- To verify and lower the bit error rate in wireless communication underwater.

III. PROPOSED METHOD

Utilising OFDM technology will lessen the propagation of the delay. Multi-access underwater applications can more effectively limit error bursts by combining OFDM and IDMA. OFDM-based digital data encoding makes advantage of multiple carrier frequencies. A bit stream is split up into numerous parallel, low-bit-rate streams in this case, and each sub-carrier signal is then modulated using the appropriate modulation method, known as 128 QAM at low data rates. By eliminating signal overlap, inter carrier interference is avoided. On its transmitter and receiver sides, OFDM uses IFFT and FFT, respectively. OFDM is a formidable rival for UWC due to its exceptional capacity to endure challenging channel conditions.. The signals in OFDM are less susceptible to interference from reflection because of the modest data rates used. As a superior substitute for CDMA, IDMA is employed. IDMA does not use a spreading sequence that is user-specific, in contrast to CDMA. Instead, forward error correction makes full use of bandwidth expansion. Iterative receiver selection is easier than Rake receiver thanks to IDMA's iterative chip-by-chip multi-user detection method.

IV. BLOCK DIAGRAM FOR PROPOSED METHOD

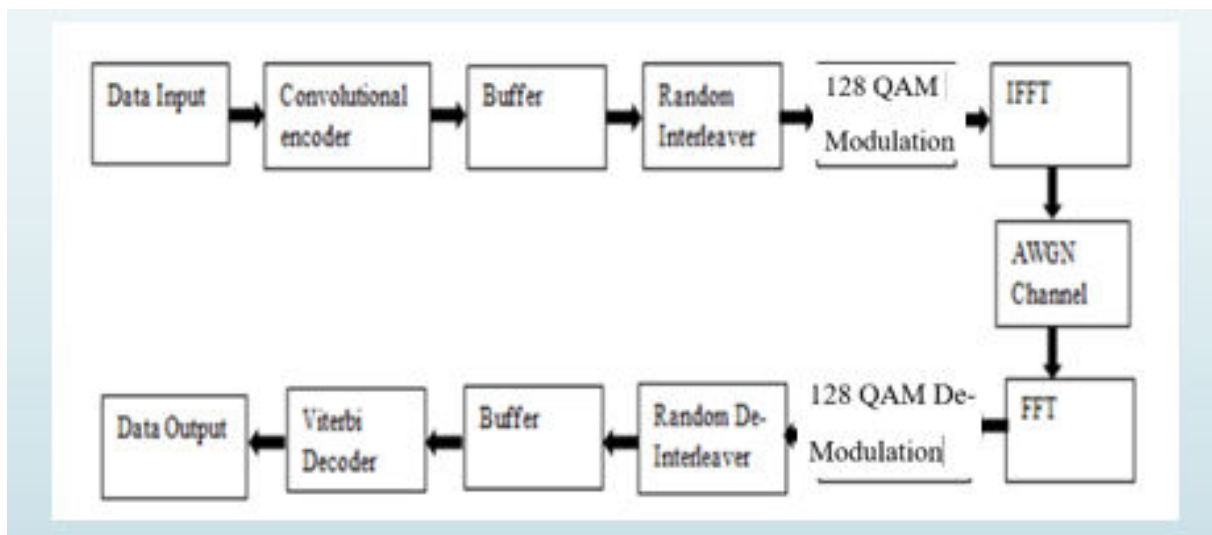


FIG – 1 BLOCK DIAGRAM FOR PROPOSED

BLOCK DIAGRAM OF IDMA-OFDM UWC LINK

V. BASIC THEORY

- Since RF waves necessitate a sizable antenna and considerable transmission power, underwater wireless acoustic communication primarily relies on acoustic wave transmission.
- Because optical waves require line-of-sight between the transmitter and receiver and have a short range, mobile nodes find it challenging to communicate.
- In recent years, underwater acoustic communication has attracted a lot of attention for uses such as sensor nodes, underwater robotics and vehicles, and unmanned submarines.
- It is thought that the shallow-water route has the greatest acoustic challenges for data transmission. The development of a trustworthy underwater acoustic communication system is extremely complex, and the main



challenges are multipath interference and bandwidth of operation. By splitting a bit stream into parallel ones that have a low bit rate and then modulating each one of these parallel ones over a number of modulation subcarriers, a method known as orthogonal frequency division multiplexing (OFDM) is used to transmit data over an additive white Gaussian noise channel.

VI. IMPLEMENTATION

Both hardware and software elements are needed to lower the bit error rate in underwater wireless communication utilising MATLAB and a modem. The typical hardware and software elements needed for such a system are listed below in brief:

Hardware Requirements:

Operating Systems:

- Windows 10
- Windows Server 2019

Processors:

Minimum: Any Intel or AMD x86-64 processor

Recommended: Any Intel or AMD x86-64 processor with four logical cores and AVX2 instruction set support

Disk:

Minimum: 2.9 GB of HDD space for MATLAB only, 5-8 GB for a typical installation

Recommended: An SSD is recommended a full installation of all Math Works products may take up to 29 GB of disk space

RAM:

Minimum: 4 GB

Recommended: 8 GB

Software Requirements:

- MATLAB R2018a.



VII. EXPERIMENTAL RESULTS

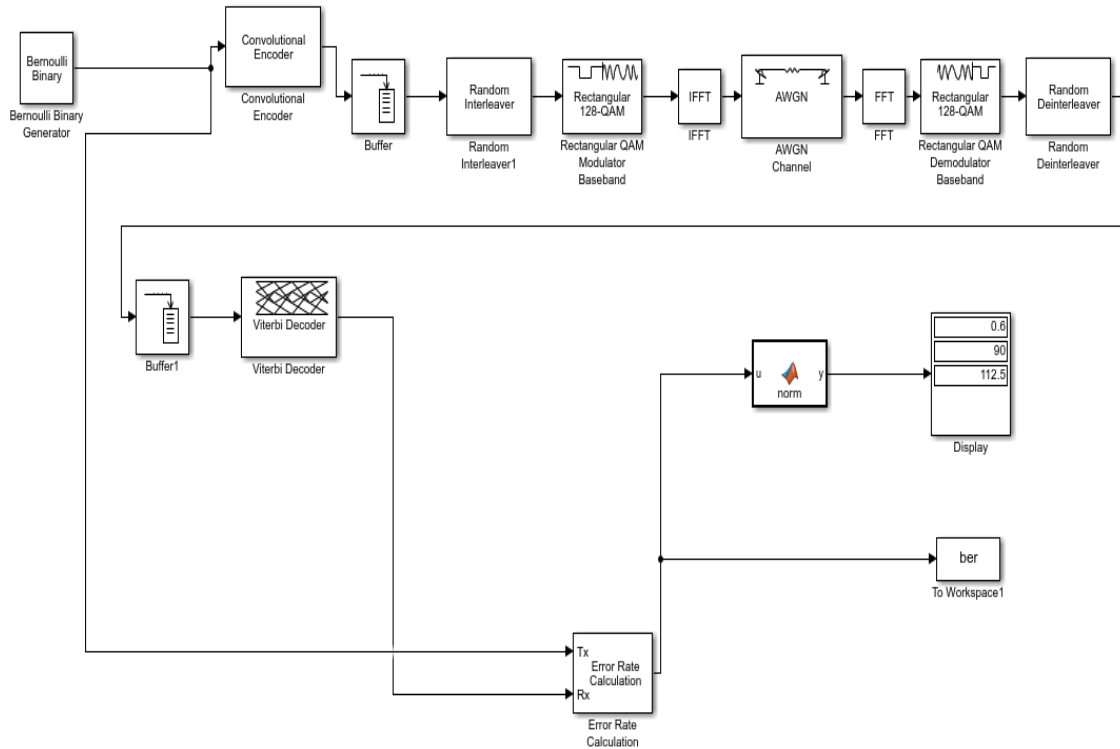


FIG -2 CODING IN SIMULINK

N	Buffer Size	Random interleaver size	BER
10 ⁷	50	50	0.6
	70	70	0.62
10 ⁸	10	10	0.62
	70	70	0.48
10 ⁹	10	10	0.65
	50	50	0.66

TABLE – 1 RESULTS OF BER

Table -1 provides conclusive findings from the BER plot. As can be observed in table we see that as the value of N is increased the error rate decreases. Ideally when the error is less than 0.5 it can be neglected but error greater than 0.5 is significant and has to be taken into consideration.

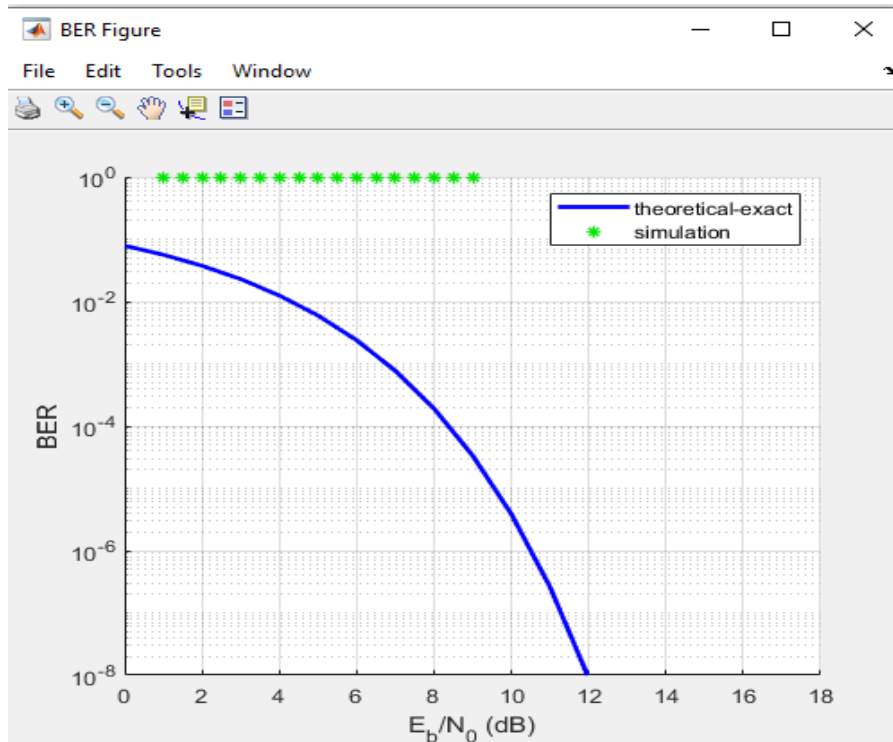


FIG 3 – BER FIGURE

VIII. CONCLUSION

When utilising a convolutional encoder and Viterbi decoder in combination, we can encode and decode signals with comparatively little error. As N is increased, BER's performance improves. Further advancement will be achieved by using higher order advanced modulation techniques, such as 128 QAM. An IDMA-OFDM paradigm for establishing an underwater communication link was put out in this paper.

REFERENCES

[I.] HemaniKaushal; Georges Kaddoum, "Underwater optical wireless communication", IEEE Access Volume: 4, Pages: 1518 – 1547, Year: 2016.

[II.] Henry S. Dol; Paolo Casari; Timo van der Zwan; Roald Otnes "Software-Defined Underwater Acoustic Modems: Historical Review and the NILUS Approach", IEEE Journal of Oceanic Engineering, Volume: 42, Issue: 3, Pages: 722 – 737, Year: 2017.

[III.] Raja Jurak; Cristina Vieira Lopes; "Software Acoustic Modems for Short Range Mote based Underwater Sensor Networks", Pierre BaldiOCEANS 2006 - Asia Pacific, Pages: 1 – 7, Year: 2006.

[IV.] Nam H., An S., "An Ultrasonic Sensor Based Low-Power Acoustic Modem for Underwater Communication in Underwater wireless sensor networks", In: Denko M.K. et al. (eds) Emerging Directions in Embedded and Ubiquitous Computing. EUC 2007. Lecture Notes in Computer Science, vol 4809, Springer, Berlin, Heidelberg, 2007.

[V.] Anna Lakshmi and Sakthivel Murugan Research Scholar, SSN College of Engineering, India "Fish & Ocean Opj Underwater Acoustic Modem-Challenges, Technology and Applications-A Review Survey", Volume 2 Issue 4 - May 2017, Published: May 02, 2017.

[VI.] Sandra Sendra; Jaime Lloret; Jose Miguel Jimenez; Lorena Parra, "Underwater Acoustic Modems", IEEE Sensors Journal, Volume: 16, Issue: 11, Pages: 4063 – 4071, Year: 2016.



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