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DEVELOPMENT UNDERWATER ACOUSTIC COMMINICATION SYSTEM

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ABSTRACT

In the latest years, the need of dependable, underwater short range non wired verbal communication has been proliferated because of increase in underwater exploration. Because of the excessive density and pollution, confined bandwidth, excessive dealy in the propagation and electricity constraints under water conversation is very challenging work. Researchers evolved different studiesmethodologies to conquer this issue. In this paper we have briefly discussed about the underwater acoustic communication system. In recent years many techniques were used for the underwater communication but most of them are expensive to implement practically. In this paper we have used low-cost piezo electric transducer to communicate underwater. Piezo electric transducer creates an acoustic wave which can easily penetrate through water to reach the receiver. The complete underwater acoustic communication system is built using microcontrollers, audio amplifiers and boost amplifier circuits which are easy to implement as well as low in cost. study provides an overview of the development of underwater acoustic communication systems. Underwater acoustic communications are essential for a variety of applications including underwater exploration, ocean monitoring, offshore oil and gas operations, and defense This operations This article discusses challenges associated with underwater communications, such as high attenuation, multipath propagation, Doppler shift, and environmental noise. The review then describes various modulation techniques, coding schemes, and signal processing techniques developed to overcome these challenges. The document also covers different types of underwater acoustic communication systems, including point-to-point systems, underwater sensor networks, and autonomous underwater vehicles. Finally, the article concludes with a discussion of current research and future directions in the field of underwater acoustic communication.

Keywords: Underwater Communication, Acoustic Communication, Data Transmission, Transceiver, Communication System.

I. INTRODUCTION

Underwater acoustic communication systems have become an essential technology for a variety of applications in oceanography, marine biology, underwater robotics and offshore industry. These systems use acoustic signals to transmit information underwater, which is an effective method due to the strong absorption and scattering of electromagnetic waves in water.

In this research report, we provide an overview of the development of underwater acoustic communication systems, including their history, key components, challenges, and future directions. The history of underwater acoustic communication dates back to the early 20th century, when scientists began to study the use of sound waves for underwater communication. During World War II, acoustic communication systems were developed for military purposes such as underwater detection and communication.

Over the following decades, advances in technology led to the development of more advanced acoustic communication systems, enabling high quality voice and data transmission. The Underwater Acoustic Communication System consists ofseveral key components including a transmitter, receiver, signal processing algorithm, and underwater acoustic channel. The transmitter andthe receiver are respectively responsible for generating and detecting sound signals. Signal processing algorithms are used to improve the quality and reliability of the transmitted signal, while the underwater acoustic channel refers to the medium through which the signal propagates.

Sound waves are electricity that travels through a medium through adiabatic charge and discharge. Important elements in describing sound waves are acoustic stress, particle velocity, particle motion, and sound intensity. Sound waves travel at the functional speed of sound, which depends on the medium through which they can travel. Some examples of sound waves are sound from loudspeakers (waves that travel through air at the speed

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of sound), seismic waves (ground vibrations that travel through the earth) or ultrasonic waves (waves that travel spread throughout the body) for clinical imaging. Electromagnetic waves are also called EM waves. Electromagnetic radiation consists of electromagnetic waves produced when a charged object touches a magnetic region. The systems used technology that was expensive to build and implement, but functional to use. Some electronic components cannot implement the proposed system, so we design and implement an inexpensive but effective underwater acoustic communication system.

II. RELATED WORKS

Survey of the Existing Models/Work:

There are some of the system for Underwater Communication including Li-Fi, IR trans receiver, electromagnetic communication. Some of the examples aregiven below:

In 2019 M. R. Shaharear, H. A. S. Hossen Prayash, M.

F. Islam and T. Dey, "Low-Cost Underwater Wireless Communication System Development Using Piezo Ceramic Transducer" The electromagnetic wave of radio signal, a commonly used electromagnetic wave signal, has high attenuation and reduced strength, so it cannot pass through water smoothly and is noticeable in water. Optical signals are attenuated by reflection, scattering, and so on. However, sound waves propagate very well through water, so acoustic systems can be used to overcome this problem. The acoustic underwater communication system can bebuild using piezo electric transducer which is low cost. Thecustom build piezo ceramic transducer was used with coating on it. At the transmitter section voltage booster, power and voltage amplifier, piezo ceramic transducer SMC20D17H5 was used along with microcontroller to send the signal to the receiver. At the receiver sectionanother piezo ceramic transducer, amplifier, clipper, microcontroller, signal processing system was used to get the message from the received signal. The main problem inthis system is availability of piezo ceramic transducer SMC20D17H5, it is not available in the market currently and without the transducer this system cannot be implemented.

In October 1984, J. Catipovic, A. Baggeroer, K. Von Der Heydt, D. Koelsch, "Design and Performance Analysis ofa Digital Acoustic Telemetry System for the Short Range Underwater Channel" This paper presents the design and performance of a microprocessor based Digital Acoustic Telemetry System (DATS). The system was used to measure the fading characteristics of a group of CW tones and to transmit data over short range underwater paths.This work reports on the test result from Woods HoleHarbor. The system has also been used for under-ice propagation experiments.

In October 2015,Joseph DelPreto, RobertKatzschmann, Robert MacCurdy, Daniela Rus, "A Compact Acoustic Communication Module for Remote Control Underwater" This paper describes an end-to-end compact acoustic communication system designed for easy integration into remotely controlled underwater operations. The systemsupports up to 2048 commands that are encoded as

16 bit words. This paper present the design, supporting algorithms and hardware for this system. A pulse-based FSK modulation scheme is presented, along with a method of demodulation requiring minimal processing power that leverages the Goertzel algorithm and dynamic peak detection.

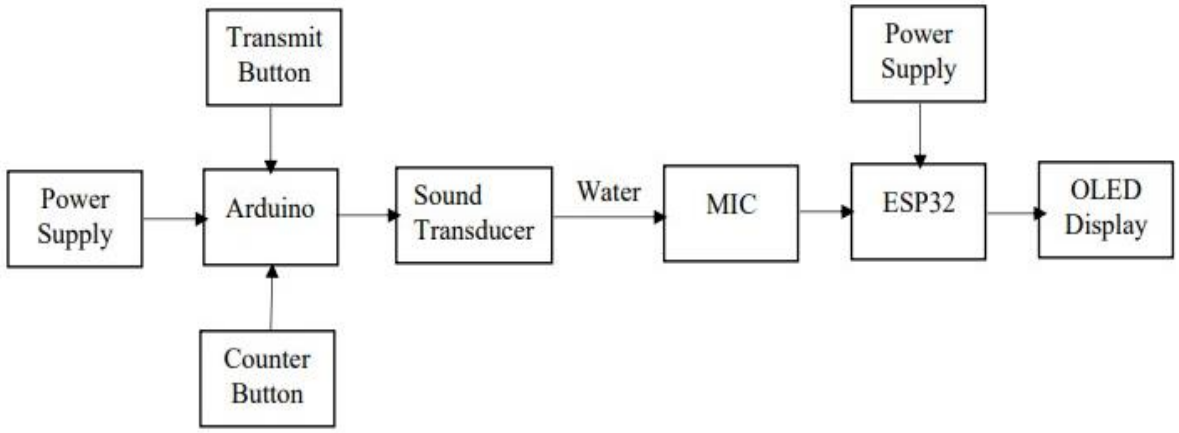

Fig. 1: Block diagram of underwater communication system

In March 2018, Roee Diamant, Lutz Lampe, "Low Probability of Detection for Underwater Acoustic Communication: A Review" LPD i.e Low probability of detection is an extremely important characteristic of an underwater acoustic communication system (UWACS) when used for military-related applications, since the detection of a communication signal in the channel may reveal the presence of the transmitter or receiver. The recent advances in the understanding of the environmental effects of sound transmission in the ocean have led to a growing interest in Low Probability of Detection for UWAC.In this paper, they identify the main challenges for the design of UWAC LPD systems. They described and classify common approaches for transmission, reception, and interception of LPD signals, and discuss their advantages and weaknesses.

III. CONCLUSION

The underwater communication is never be so easy to implement and this much cost effective till now. We have used the best possible way to make the thing affordable and easy to build it. In this work, the main goal was to create a smooth communication for an underwater acoustic channel. We are exploring Amplitude Shift Keying (ASK) , Phase Shift Keying (PSK) and Frequency Shift Keying (FSK) and after that which modulation is better then we will use that modulation for underwater acoustic communication. A four-bit communication system is developed studied here. The result of data transfer is very smooth, which it has can be seen on the oscilloscope graph. Plan for the future this project is to increase the range of communication distance by implementing a powerful voltage amplifier and creating error correction algorithm more efficient and also work with it higher frequency to increase the data transfer rate.

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