Under Water Communication using Acoustic Modem

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Abstract- *This paper presents the design consideration, implementation details and initial experimental results of our modem. This paper also discusses the various modulation techniques like ASK; this design uses commercial ultrasonic transducer of 200 kHz bandwidth. Massage from transmitter can be displayed in visual format as well as it can be analyzed using different simulation tools at base station. Under water modem consists of three component i) An underwater transducer ii) an analog transceiver (matching pre-amplifier and amplifier), iii) A digital platform for control and signal processing. In this paper comparison of results of communication with ASK, modulation technique microcontroller.*

Keywords- Acoustic modem, ASK or FSK Modulated sound signal, underwater wireless Communication, ultrasonic transceiver, underwater transducer.

I. INTRODUCTION

The knowledge about the ecosystem is increasing due to physical, chemical and biological time series data from long term sensor. Despite the substantial effort for monitoring ecological aspects of aquatic systems, the infrastructure needed for sensor networks in marine and freshwater systems without question lag far behind that available for terrestrial counterparts. Main differences between underwater acoustic network and terrestrial radio network

Sr.No.	Underwater acoustic	Terrestrial radio
1	Low bandwidth (KHz)	High bandwidth (MHz)
2	Long delay	Short delay
3	Distance dependent on bandwidth	Distance independent on bandwidth
4	Few simulation tools available	Several simulation tools available
5	Hard to experiment	Easy to experiment

Now a day's interest in the design and deployment of underwater acoustic communication network. Application of underwater sensor node will be in oceanographic data collection, pollution monitoring offshore exploration, disaster prevention, assisted navigation & tactical surveillance application. (UUV, AUVs) unmanned or autonomous underwater vehicles equipped with sensor will enable to gathering of scientific data. It consists of variable number of sensor & vehicles that are deployed to perform collaborative monitoring task over give area.

II. LITERATURE SURVEY

Literature study into Underwater Sensor Networking: The past 30 years have seen a growing interest in underwater acoustic communications because of its applications in marine research, oceanography, marine commercial operations, the offshore oil industry and defense. Continued research over the years has resulted in improved performance and robustness as compared to the initial communication systems. In this paper, we aim to provide an overview of the key developments in point-to-point communication techniques as well as underwater networking protocols since the beginning of this decade. We also provide an insight into some of the open problems and challenges facing researchers in this field in the near future.

Underwater Sensor Networking (Reference 1, Year: 2006): The paper explores applications and challenges for underwater sensor networks. We highlight potential applications to off-shore oilfields for seismic monitoring, equipment monitoring, And underwater robotics. We identify research directions in short range acoustic communications, MAC, time synchronization, and localization protocols for high-latency acoustic networks, long duration network sleeping, and application-level data scheduling. We describe our preliminary design on short-range acoustic communication hardware, and summarize results of high-latency time synchronization.
Underwater Wireless Sensor Network (Reference 2, year 2008): In this paper, several fundamental key aspects of underwater acoustic communications are investigated. Different architectures for two-dimensional and three-dimensional underwater sensor networks are discussed, and the characteristics of the underwater channel are detailed. The main challenges for the development of efficient networking

solutions posed by the underwater environment are detailed and a cross-layer approach to the integration of all communication functionalities is suggested. Furthermore, open research issues are discussed and possible solution approaches are outlined.

Issues and Solutions (Reference 3, Year: 2008): The paper explores we discuss the issues facing UAN researchers in the following aspects: network topology, physical layer, MAC layer, Network layer, and Application layer. Due to the uniqueness of underwater channels and characteristics of acoustic signal, UAN network topology is different from that of its ground-based counterparts. However, the fundamental design goals are the same, i.e., providing reliable connectivity among nodes in the network; increasing network capacity; and minimize the energy consumption. Basically, two types of network topologies can be used: ad hoc mode and hierarchy mode. In the former one, nodes are self-organized as a peer-to-peer network.

III. BLOCK DIAGRAM OF THE SYSTEM

[A] Underwater acoustic modems consist of three main components:
(1) An underwater transducer,
(2) An analog transceiver (matching pre-amp and amplifier), and
(3) A digital platform for control and signal processing.

[B] A substantial portion of the cost of the modem is the underwater transducer; commercially available underwater omni directional transducers.

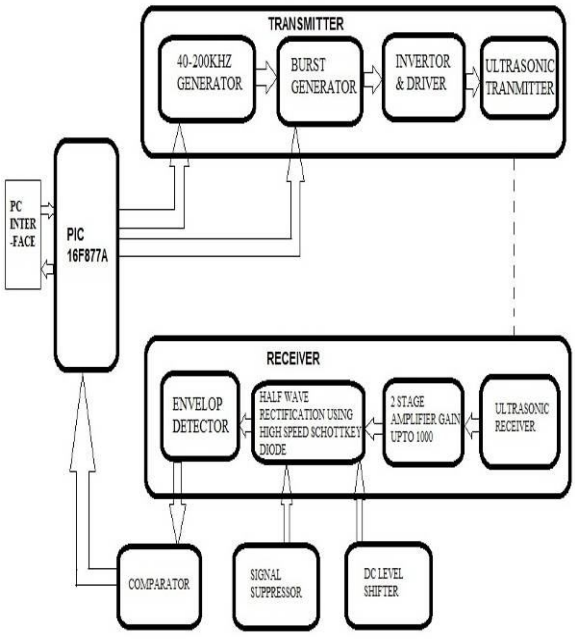


Figure 1: Block Diagram of Underwater communication

[C] the analog transceiver consists of a high power transmitter and a highly sensitive receiver both of which are optimized to operate in the transducer's resonance frequency range.[D]. the transmitter is responsible for amplifying the modulated signal from the digital hardware platform and sending it to the transducer so that it may be transmitted through the water.[E]. the receiver amplifies the signal that is detected by the transducer so that the digital hardware platform can effectively demodulate the signal and analyze the transmitted data.[F] Due to its high linearity, the transmitter may be used with any modulation technique that can be programmed into the digital hardware platform.[G] The digital transceiver is responsible for physical layer communication, i.e., implementing a suitable baseband processing scheme (including modulation, filtering, synchronization, etc.) for the application and environment of interest.[H] .There are many design choices that must be considered when designing a digital transceiver for the underwater acoustic modem including, but not limited to, the choice of modulation scheme and hardware platform for its implementation.[I] we selected to implement frequency shift keying, ( ) & ASK on a field programmable gate array (FPGA) and microcontroller for our modem prototype.

IV. SOFTWARE DEVELOPMENT

Terminal software is a application with many service modules offering different functionality (temperature sensor, conductivity, moisture, etc.). The picture that enables all of the various tools to communicate with each other consists of two main parts from TX & RX.

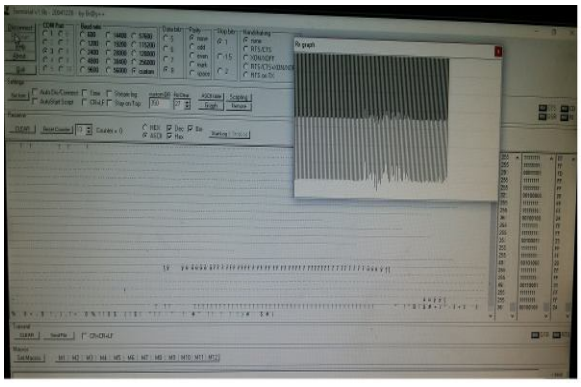
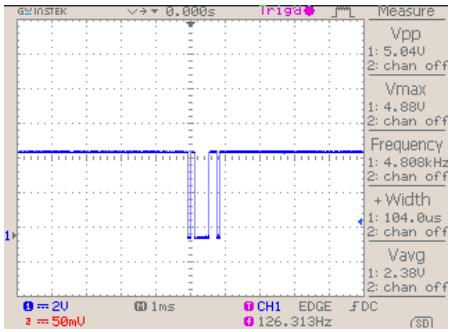


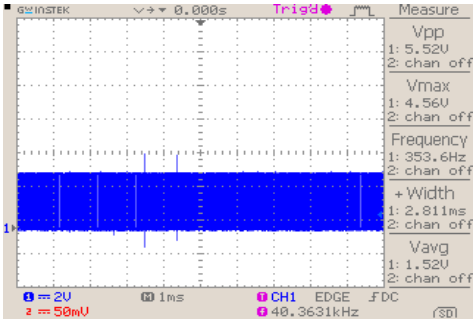
Figure 2: Simulation Result

V. RESULTS

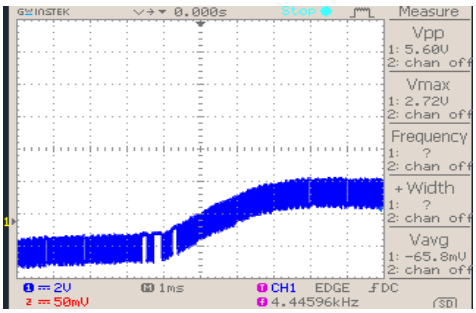
1. Serial data fort transmitting pc:-



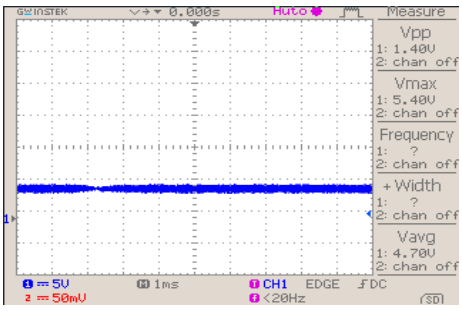
2. carrier generated for pic:-



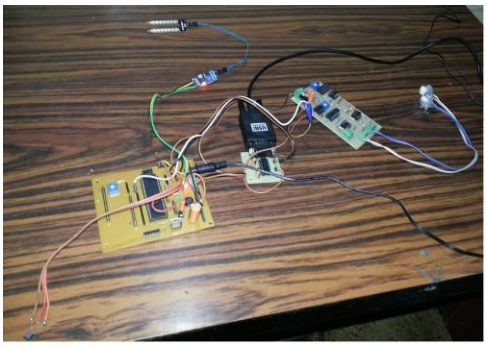
3. transmiiter waveform:-



4. receiver waveform:-



VI. DEVELOPED SYSTEM



VII. ACKNOWLEDGEMENT

It is a great pleasure for us to present a project “Under water communication using acoustic modem” where guidance plays an invaluable key and provides concrete platform for completion of the project.

The hard work and perseverance of our mentor will always be embedded in our memory. Project execution would not have been possible for us without the continued assistance of certain people. We take this opportunity to express our deepest gratitude for all the heartfelt assistance rendered.

We thank Prof.M.Maindarkar our project guide who was responsible for coordinating all efforts and sincerely grateful to him for helping to achieve high standards of performance.

We are very grateful to Prof. P.R Badadapure HOD of ICOER, Wagholi for making available all the facilities required for the successful completion of the project.

VIII. CONCLUSION

In this paper, we presented an overview of the state of the art in underwater acoustic sensor network. We described the challenges posed by the peculiarities of the underwater channel with particular reference to monitoring applications for the ocean environment. We discussed characteristics of the underwater channel and outlined future research directions for the development of efficient and reliable underwater acoustic sensor networks. The ultimate objective of this paper is to encourage research efforts to lay down fundamental basis for the development of new advanced communication techniques for efficient underwater communication and networking for enhanced ocean monitoring and exploration applications.

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