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UNDERWATER ACOUSTIC COMMUNICATION USING MODEM

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Abstract —*Today wireless communication the biggest part in our life, the idea of wireless under water communications may still seem far-fetched. However, research has been active for over a decade on designing the methods for wireless information transmission underwater. To bring the concept of long lived, dense sensor networks to the underwater environment, there is a need to develop low cost and low-power acoustic modems for short-distance communications. This paper explains about Underwater Acoustic Communication using modem and presents designing and developing such a modem. An underwater communication is a technique of sending and receiving single below water. A modem is typically used to send digital data over a phone line. The sending modem modulates the data into a signal that is compatible with the phone line, and the receiving modem demodulates the signal back into digital data. Wireless modems convert digital data into radio signals and back We therefore explore a complementary path that emphasizes simple but numerous devices that benefit from dense sensing (e.g. Telephone System) and shorter-range communication. In addition to simpler node-to-node channels due to shorter range, higher-level approaches can compensate for channel problems through approaches such as routing, link-layer re-transmission and application-layer coding.*

Keywords-*Acoustic communication, Modulation, Demodulation, Transmitter, Receiver, Sender, Terminology.*

I. INTRODUCTION

In any communication system modem is the most important part of connecting the data source to the communication channel. A modem modulates outgoing digital signals from a computer or other digital device to analog signals for a conventional copper twisted pair telephone line and demodulates the incoming analog signal and converts it to a digital signal for the digital device. A detailed treatment of core subjects is provided, including baseband and pass band modulation and demodulation, equalization, and sequence estimation. The modulation waveforms for communication channels and digital recording channels are treated in a common setting and with unified terminology. A variety of more advanced topics is also covered, such as trellis codes, turbo codes, the Viterbi algorithm, block codes, maximum likelihood and maximum posterior probability, iterative demodulation, and jamming. Numerous end-of-chapter exercises are also included to test the reader's understanding throughout. This insightful book is ideal for senior undergraduate students studying digital communications and is also a useful reference for practicing engineers. Technique of sending and receiving message below water. Most commonly employed using hydrophones. At the beginning of the 20th century, some ships communicated by underwater bells, the system being competitive with the primitive Maritime_radio navigation_service of the time. Underwater communication is very difficult due to factors such as multiple distance propagation, time variations of the channel, availablability of small bandwidth and strong signal_attenuation, especially over long ranges. Compared to terrestrial communication, underwater communication has low data rates because it uses acoustic waves instead of electromagnetic waves. Sensor networks are beginning to revolutionize data collection in the physical world, relatively little work has been done to explore how sensor networks apply underwater.

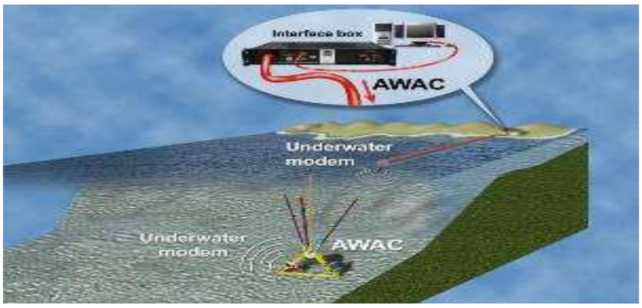

Fig 1: Aqua Communication

1.1 ACOUSTIC MODEMS:

• It employs advanced modulation scheme and channel equalization for improved signal to noise ratio

• Employs high performance error detection and correction coding scheme which reduces the bit error to less than 10^-7.

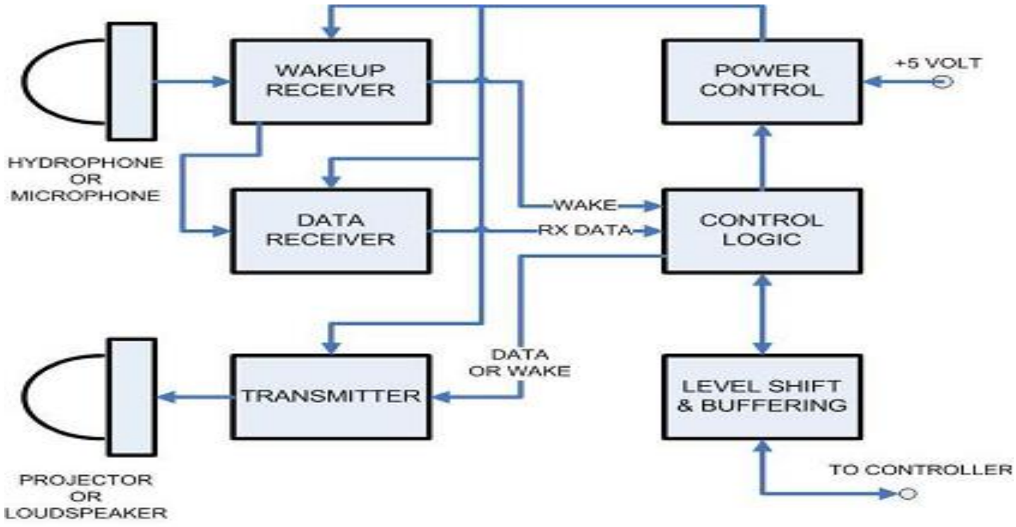

Fig 2: Acoustic Modem

In general the modulation methods developed for radio communications can be adapted for underwater acoustic communications (UAC). However some of the modulation schemes are more suited to the unique underwater acoustic communication channel than others. Some of the modulation methods used for UAC are as follows:

- Frequency Shift Keying (FSK)
- Phase Shift Keying (PSK)
- Frequency Hopped Spread Spectrum (FHSS)
- Direct Sequence Spread Spectrum (DSSS)
- Frequency and Pulse-position modulation (FPPM and PPM)
- Multiple Frequency Shift Keying (MFSK)
- Orthogonal Frequency-Division Multiplexing (OFDM)

1.1.1 PARTS OF AN ACOUSTIC MODEM:

1. DSP board

2. AFE(analog front end)board

3. DC/DC converter

4. Transmiter

5.Modem Chip

6.Capacitors

7.Microphone Socket

8.Telephone Socket

9.Power Input

II. SPECIFICATIONS

Operating Depth 18/34	**200 m, Delran housing** **1000 m, Aluminum Alloy housing** **2000 m Stainless Steel housing** **2000 m Titanium housing**
Operating Depth 18/34D	6000 m Titanium housing
Operating Range	3500 m
Frequency Band	18 - 34 kHz
Transducer Beam Pattern	horizontally unidirectional
Connection	
Acoustic Connection	up to 13.9 Kbit/s
Bit Error Rate	less than 10^{-10}
Internal Data Buffer	1 MB, configurable
Host Interface	Ethernet, RS-232 (RS-485/422 optional)
Interface Connector	up to 2 Sub Conn® Metal Shell1500 Series
Power	
Power Consumption	Stand-by Mode 2.5 mW Listen Mode 5 - 285 mW Receive Mode 0.8 W Transmit Mode: 2.8 W, 1000 m range 8 W, 2000 m range 35 W, 3500 m range 65 W, max. available
Power Supply	External 24 VDC (12 VDC optional) or Internal rechargeable battery (optional)
Physical	
Dimensions	Housing ø110 mm x170 mm Total length 265 mm
Weight, dry/wet	Delran: 2445/400 g Aluminum Alloy: 2170/1470 g Stainless Steel 9400/6900 g Titanium 6500/4500 g

Table 1: Specification of modem

III. ADVANTAGES

- It avoids data spoofing.
- It avoids privacy leakage.
- Pollution monitoring

IV. DISADVANTAGES

- Battery power is limited and battery cannot recharge easily.
- The available bandwidth is severely limited.
- Underwater sensors are prone to failure due to fouling, corrosion, etc.
- Future ocean environment would be increasingly complicated.

V. APPLICATIONS

- Can be used to provide early warnings of tsunami due to the undersea earth quakes
- Underwater data links can be combined with satellite data links to provide real time data(data in real time
- Pressure sensors that are deployed on the seafloor can detect tsunamis.

VI. CONCLUSION

In this paper, we present NAMS, a networked acoustic modem system, which integrates the OFDM modem and the underwater network protocol stack framework, Aqua-Net. The former represents the state-of-art in acoustic modem technology and delivers high speed communication even in environments with strong multipath effects. The latter provides an open, flexible and powerful protocol stack for underwater networks. Our integration efforts have the great potential to significantly improve the performance of underwater networks, which may open the doors for various new applications that previously considered not feasible for underwater operations Wireless information transmission through the ocean is one of the enabling technologies for the development of future ocean observation systems and sensor networks.

VII. REFERENCES

[1] E. Demirors, G. Sklivanitis, T. Melodia, S. N. Batalama, and D. A. Pados, "Software-defined Underwater Acoustic Networks: Toward a High-rate Real-time Reconfigurable Modem," IEEE Communications Magazine, vol. 53, no. 11, pp. 64 - 71, November 2015.

[2] Proc. AIP Conf. Acoustic Particle Velocity Sensors: Design, Performance, and Applications, Mystic, CT, 1995. LinkQuest, “SoundLink High Speed Acoustic Modems,” 1998. [Online].Available: http://www.link-quest.com/

[7] DSPCOMM, “Underwater Wireless Modem,” 2000. [Online]. Available:http://www.dspcomm.com

[8] L. Freitag, M. Grund, S. Singh, J. Partan, P. Koski, and K. Ball, “The WHOI Micro-Modem: An Acoustic Communications and Navigation System for Multiple Platforms,” in Proc. of MTS/IEEE OCEANS Conference, Washington DC, 2005, pp. 1086 – 1092.

[9] J. Wills, W. Ye, and J. Heidemann, “Low-Power Acoustic Modem for Dense Underwater Sensor Networks,” in Proc. of the 1st ACM Intl. Workshop on Underwater Networks, Sept. 2006, pp. 79–85.

[10] E. M. Sozer and M. Stojanovic, “Reconfigurable Acoustic Modem for Underwater Sensor Networks,” in Proc. of the 1st ACM International Workshop on Underwater Networks, Sept. 2006.

[11] T. Fu, D. Doonan, C. Utley, R. Iltis, R. Kastner, , and H. Lee, “Design and Development of a Software-defined Underwater Acoustic Modem for Sensor Networks for Environmental and Ecological Research,” in Proc. of MTS/IEEE OCEANS Conference, Boston, MA, 2006.