Underwater Wireless Communication

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Abstract— underwater wireless communication is the wireless communication in which acoustic signal(waves) carry information through an underwater wireless channel.Over the past decades,heavy cables were used to establish a high speed communication between remote end and surface,to overcome such difficulties we can use underwater wireless communication.It includes sensors and autonomous underwater vehicles that interact to perform underwater monitoring.

Keywords—AUV (autonomous underwater vehicles), UWCN (underwater wireless communication), modulation, demodulation, acoustic modem.

I. INTRODUCTION & OVERVIEW

Underwater wireless communication network consists of sensors and AUV that share information to perform sensing and monitoring functions.

II. NEED FOR UWCN

Wired communication is not always feasible because of the following:
1. There may be breaking of wires because of aquatic animals
2. Need of wires cost compared to wireless
3. Implementation of wired communication is difficult.

III. CHALLENGES OF UNDERWATER CHANNEL

1. Channel noise
2. Loss of path due to attenuation
3. Multipath propagation
4. High propagation delay.

Hence achieving reliable AUV communication is difficult due to movement of sensors with water currents.

IV. TECHNOLOGY USED IN UWCN

When the signal is propagated through the acoustic channel it must be either reach the receiver through a direct path or surface reflection due to ray bending of acoustic waves. And the acoustic modem consists of two types of modulation:

1. FSK with coherent detection: FSK usually employs two distinct frequencies to modulate data; for example, Frequency F1 to indicate bit 0 and frequency F2 to indicate bit 1. Hence a binary string can be transmitted by alternating these two frequencies depending on whether it is a 0 or 1. The receiver can be as simple as having analogue matched filters to the two frequencies and a level detector to decide if a 1 or 0 was received. This is a relatively easy form of modulation and therefore used in the earliest acoustic modems. However more sophisticated Demodulator using Digital Signal Processors (DSP) can be used in the present day.

   The biggest challenge FSK faces in the UAC is multipath reflections.

2. PSK with non-coherent detection: This conveys the data by changing the phase of the carrier signal. It uses finite number of phases assigned with unique pattern of binary digits. Each pattern of bits forms the symbol that is represented by the particular phase. The demodulator, which is designed specifically for the symbol-set used by the modulator, determines the phase of the received signal and maps it back to the symbol it represents, thus recovering the original signal (coherent detection). Alternatively, the demodulator determines the changes in the phase of the received signal rather than the phase itself. And as it depends on the difference between successive phases, it is termed as differential phase-shift keying (DPSK).
DPSK can be significantly simpler to implement than ordinary PSK since there is no need for the demodulator to have a copy of the reference signal to determine the exact phase of the received signal (it is a non-coherent scheme).

V. APPLICATIONS OF UNDERWATER WIRELESS COMMUNICATION
1. It is mainly used for pollution control (pollution monitoring).
2. It is also used in seismic monitoring, pollution monitoring, and ocean currents monitoring.
3. It is used in solar-powered autonomous underwater vehicles.
4. It is also used in remotely operated vehicles (ROV).

VI. ADVANTAGES OF UNDERWATER COMMUNICATION
- It avoids the privacy leakage.
- It has the parameter of monitoring the pollution.

VII. LIMITATIONS OF UNDERWATER WIRELESS COMMUNICATION
1. High bit error rate.
2. Available bandwidth is limited.
3. Limited battery power and the batteries are not charged easily.
4. Sensors are damaged due to corrosion.

VIII. CONCLUSION
The main aim is to overcome the present limitations and to implement a technology that is capable of removing noise and have a efficient transmission and reception of audio and video signals.

REFERENCES