Marine Information Technology Curriculum Report



<u>Summary on Underwater Wireless</u> <u>Communication Technology</u>

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DECLARATION

I declare that the assignment here submitted is original apart from source material explicitly acknowledged, which an equivalent or related material has not previously submitted for an additional course. I also acknowledge that I'm conscious of University policy and regulations on honesty in academic work, and of the disciplinary guidelines and procedures applicable to breaches of such policy and regulations.

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Abstract

Underwater wireless communication plays a massive role within the survey of marine life, oil and gas rig exploration, naval tactical operations for coastal securities, surveillance of natural disasters, pollution, and the observation of the changes in the underwater environment. In this regard, the widespread adoption of UWC has become an important field of study. It envisions various military and commercial applications that are growing interest in exploring the underwater environment for numerous applications. Acoustic, Optical, and RF wireless carriers have chosen to use for data transmission in an underwater environment. This survey presents an entire overview of current underwater wireless communication techniques, possible plans, and proposals to enable the successive generation of wireless networking systems. The current project schemes, applications, and deployment of the latest amended UWC techniques also discussed. The main initiatives of existing wireless communication schemes in underwater for improving the quality of service and energy of the system over long distances.

Introduction

The investigation of the underwater wireless communication (UWC) technique is to explore the oceanic environment that refers to the method of data transmission within the unexplored water medium. UWC is an innovative approach for underwater communication in modern ages, which has chosen for investigation and observation of data in the underwater environment. Also, UWC is used to relay critical information of earthquakes, seismic, and tectonic plate's movement data early detection warning of a tsunami from an underwater location.

Acoustic waves are the foremost popular method to realize targeting signals in underwater over long distances with low latency and high spreading delay [1].

A high speed underwater acoustic communication (UAC) system proposed in 2005 that recorded 125 kbp/s data rates using a 32-quadrature amplitude modulation technique (QAM) [2].

Electromagnetic (EM) communication was first utilized in the first days when radio waves were established. The electromagnetic waves propagate in underwater with very high speed and frequency for brief distances [3].

Due to limited bandwidth and low data rates of acoustic and EM waves, an alternative approach is an optical communication that provides high-bandwidth data rates with low latency and minimum spreading delay in an aquatic medium [4].

Underwater Communication Technology:-

UWC networks are getting profitable within the direction of technological development and research thanks to demand for ocean exploration in terms of water and environmental pollution monitoring, minerals, and oil. Electromagnetic

communication technology isn't very efficient because of large attenuation and losses within the water channel.

The combined underwater communication emerging wireless techniques and their applications for the specific requirement will trigger up the future in a major evolution of UWC.



Figure 1: Multiple Underwater Communication Technologies

Figure-Ref: Gussen, Camila MG, et al. "A survey of underwater wireless communication technologies."

Merits of Underwater Communication:-

There has been a great advancement in this field, particularly with underwater sensor networks, which have deployed more frequently. An example of this is often the operations of Autonomous Underwater Vehicles (AUV). AUVs are robots that travel underwater without needing an operator. AUVs represent the rapid advancements in underwater communication systems as they increasingly deploy in various capacities for underwater operations.

1. Security:

Underwater Communication systems are instrumental in ensuring the safety of a nation. It is employed by the military to conduct underwater surveillance, also to detect intrusion.

2. Economy:

Underwater communication systems are useful for commercial purposes, particularly in industries like oil and gas.

3. Scientific Exploration and Data Collection:

These systems also are very beneficial to science; because it is employed for exploration and data collection underwater.

4. Monitoring:

The Environment: Underwater communication systems help the govt in monitoring the environment.

5. Search and Survey:

Autonomous underwater vehicles have also deployed in finding crashed aircraft; and investigation into the causes of their crash.

Demerits of Underwater Communication:-

- Battery power is limited, and usually, batteries cannot recharge, because solar energy cannot exploit.
- The available bandwidth is severely limited.

- Channel characteristics, including multi-path, fading problems, long and variable propagation delays.
- High bit error rates.
- Underwater sensors are susceptible to failures due to fouling, corrosion, etc.

How underwater wireless communication is being used in research directions:-

It has been an essential field for researchers and among academicians in recent years. The deployable technologies are advantageous in oceanographic data analysis, observing water pollution, environment monitoring, and early warning of natural disasters such as floods and tsunamis. They are also used to get to know the phenomena of rising water levels in the oceans.

The authors [5, 6–8] discussed the implementation of UWC techniques and their applications. These survey articles provide a corresponding platform to explore existing UWC techniques. A survey article [6] on UWC system, investigated Acoustic, Optical and Electromagnetic waves for underwater communication and related technical issues discussed

Thus, in UWC, we use the three customized existing approaches available for underwater wireless signal transmission.

- The first technology is Electromagnetic waves.
- The second is Optical signal transmission (OPT).
- The third and most generally, employable technology is Acoustic waves.
- One other profitable wireless carrier technique is acoustic waves, which commonly used in underwater wireless communication for long distances with low bandwidth.

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