

# Chapter 4

## Underwater Localization Techniques

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### **ABSTRACT**

*Underwater acoustic communication uses sound waves to trans-ceive information, diving deep inside water, environment scanning, undersea explorations, disaster prevention, etc. In this chapter, an attempt has been made to cover stationary and mobile localization algorithm. They are further subdivided into distributed and centralized. Each one is further subcategorized into estimation-based and prediction-based schemes. The category therefore extends on the basis of ranging method, communication, and synchronization, some of which are area localization, sensor-based localization, forming a sensor array, motion-aware self-localization, silent localization. Each one will be discussed in detail in this chapter. At last, hybrid technique is also discussed, which combines stationary and mobile techniques. The discussion includes various nodes including anchor node, unknown node, sink node, and reference node. Various methods to follow the techniques are also discussed, which include anchor-based method, ranging method, and message communication.*

### **INTRODUCTION**

The occurrence of UWSNs introduces us with the latest opportunities to study and understand the communication through ocean.

Underwater sensor nodes are the one that are capable to communicate through acoustic signals and are also less expensive.

Broadly, anchor nodes, reference node and unknown nodes are used. The unknown nodes usually sense the surrounding signals, if any, and anchor nodes are used to find the location of the unknown nodes. They pre obtain their location information with the help of GPS systems. Anchor nodes and unknown

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nodes are embedded in the reference node. Acoustic signal produces less attenuation and higher speed. In distributed localization algorithms, localization information is collected and the algorithm is made to run. In centralized localization algorithms, base station or a sink node is used to detect. Further, the previous or present data is used to find the location of next node and therefore the classification is based on estimation and prediction.

Basically, three types of nodes do exist:

Anchor node, unknown node and reference node. Since the environment data is to be sensed, so the unknown node will be used. Therefore we should know the position of the unknown node, for which anchor nodes are responsible. There is third type of node that is, reference node, which contains the localized unknown node, and initial anchor node. Estimation based technique uses current information to predict the next location. Whereas, prediction based, uses the previous data to find next node location.

## **LITERATURE REVIEW OF UNDERWATER WIRELESS SENSOR NETWORK**

Before the advent of Underwater wireless communication, Sound navigation and Ranging, came into effect. SONAR operators then predicted underwater acoustics.

Then the question comes, why underwater communication via acoustics? It is because, the earlier used approach of ocean monitoring, have limitations, including online real time prediction, unable to detect the failure of location, and requirement of large storage capacity of information. The information, contains the location and task performed on the nodes. The applications of underwater thereby includes, ocean networks, undersea security, environmental detection, catastrophic prevention, etc. Since to perform the above applications, what is needed is desired location, with efficient power and energy consumption, the chapter discusses the major techniques of finding the respective node location. Localization applications include tracking of a desired node or underwater vehicle, detecting the targets, and improvement of medium access and network protocols.

The technique could have used adhoc, mobile networks, but the later ones' protocols are not suitable for the wireless sensor network applications. Wireless sensor networks are not only used in underwater, but also used in sensing environment, patient health control, traffic control monitoring.

## **ISSUES OF WIRELESS SENSOR NETWORKS**

1. Hardware and operating system environment, requiring large power consumption.
2. Medium access methods control the node radio functionality.
3. Proper synchronization of clock issues, in case of non stationary nodes.
4. Deployment problems, with varying terrain.

Since the sensors are very small in size, we do need them in large number, in order to increase the processing capabilities.

## **Motivation and Objective**

1. 1. To minimize the node size, in order to reduce the operating area.

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