Research on the Underwater Acoustic Localization based on Time Difference of Arrival (TDOA)

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Recently, Underwater Wireless Sensor Network (UWSN) has engaged much consideration and provided satisfactory technical support to many application fields. Thus, Localization technology is a massive key technology of UWSNs. Due to the complex underwater environment, the ground node location method cannot be applied directly to UWSNs. It is needed to make efficient and accurate localization data to generate information on underwater-based applications among acoustic channels. According to the literature review, diverse localization techniques have been proposed for UWSNs, and the range-based localization technique has taken priority for that. The range-based method employs to perform the position computation after distance estimation. These types of methods are involved two stages called distance measurement and position calculation. Hence, the Time Different of Arrival (TDOA) localization technique is the most suitable technique for underwater localization than the Angle of Arrival (AOA), Received Signal Strength Indicator (RSSI), and Time of Arrival (TOA). It has evaluated the Iterative (Taylor) and Closed-form method (Chan method/TSWLS) for the Time Difference of Arrival, and the CRLB has been used to take the best result of the unbiased estimator. The calculation time of the Two-Stage Weight Least Squares (Chan algorithm) is shorter than the Taylor algorithm. On the other hand, the accuracy of the Taylor algorithm is higher than the Chan algorithm. However, the complexity (iterative time) of the Taylor algorithm is too long than the Chan algorithm. Thus, few types of research have improved the Taylor algorithm, while many kinds of research are improving the Chan algorithm. This study realizes and simulates the performance of the Taylor algorithm and the Chan algorithm while considering the Improved Two-Stage Weight Least Squares (ITSWLS) method using Virtual Instrumentation (VI).

Keywords: *Taylor algorithm, Time Difference of Arrival (TDOA), Two-Stage Weight Least Squares (TSWLS), Underwater Wireless Sensor Networks (UWSNs), Virtual Instrumentation*