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Abstract : In this thesis, we investigate the performance of wireless sensors in cascaded multi-hop relay network in Underwater Acoustic Communication (UAC). We focus on optimizing the mutual information between transmitted data and received data for a specific network model in underwater channel. Specifically, we use multiple sensor nodes in a relay network to transfer the data signal into long distance for maximum mutual information. In addition, we study the relationship of channel capacity to transmission power, bandwidth and carrier frequency. In comparison with the free space wireless communication, the underwater acoustic communication suffers from the limits of the less available bandwidth and complex noise caused by the underwater channel. Therefore, we derive an algorithm for the placement of sensor nodes at an optimal distance in a multi-hop relay network which we find a more influential than power allocation in UAC. We use information theoretic analysis tools to demonstrate the effect of delay, carrier frequency, noise, and link distance on the maximizing the mutual information. Consequently, we analyze that acoustic signal was characterized by low carrier frequency and distance dependent bandwidth, which significantly limit the system capacity, especially at long transmission distances. In the second part of the research, we work on experimental data received from a

pair of SAM-1 acoustic sensors provided by Desert Star Systems. We use information theoretic tools of entropy, conditional entropy, probability mass function etc. of input and output data signal to analyze the mutual information, information loss, bit error rate, and channel capacity. The significant research of this thesis is observing the multi-hop relay network model and to analyze the optimal distance, frequency, and capacity for available bandwidth in Underwater Wireless Sensor Network (UWSN). Various algorithms are discussed emphasizing on non-coherent approaches.

Descriptors : *ACOUSTIC COMMUNICATIONS , *UNDERWATER ACOUSTICS , *UNDERWATER COMMUNICATIONS , ALGORITHMS , BANDWIDTH , CARRIER FREQUENCIES , CODE DIVISION MULTIPLE ACCESS , DATA PROCESSING , ENTROPY , GAUSSIAN NOISE , INFORMATION EXCHANGE , INFORMATION THEORY , LONG RANGE(DISTANCE) , LOW FREQUENCY , MULTICHANNEL COMMUNICATIONS , MULTISENSORS , NETWORK ARCHITECTURE , OPTIMIZATION , PROBABILITY DISTRIBUTION FUNCTIONS , RELAYS , SIGNAL PROCESSING , SIGNAL TO NOISE RATIO , THESES , TRANSMITTANCE , WAVE PROPAGATION , WIRELESS COMMUNICATIONS

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