Underwater sensor networks are deployed in marine environments, presenting specific challenges compared to sensor networks deployed in terrestrial settings. Among the major issues that underwater sensor networks face is communication medium limitations that result in low bandwidth and long latency. This creates problems when these networks need to transmit large amounts of data over long distances. A possible solution to address this issue is to use mobile sinks such as autonomous underwater vehicles (AUVs) to offload these large quantities of data. Such mobile sinks are called data mules. Often it is the case that a sensor network is deployed to report events that require immediate attention. Delays in reporting such events can have catastrophic consequences. In this dissertation, we present path planning algorithms that help in prioritizing data retrieval from sensor nodes in such a manner that nodes that require more immediate attention would be dealt with at the earliest. In other words, the goal is to improve the Quality of Information (QoI) retrieved. The path planning algorithms proposed in this dissertation are based on heuristics meant to improve the Value of Information (Vol) retrieved from a system. Value of information is a construct that helps in encoding the valuation of an information segment i.e. it is the price an optimal player would pay to obtain a segment of information in a game theoretic setting. Quality of information and value of information are complementary concepts. In this thesis, we formulate a value of information model for sensor networks and then consider the constraints that arise in underwater settings. On the basis of this, we develop a Vol-based path planning problem statement and propose heuristics that solve the path planning problem. We show through simulation studies that the proposed strategies improve the value, and hence, quality of the information retrieved. It is important to note that these path planning strategies can be applied equally well in terrestrial settings that deploy mobile sinks for data collection.

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The public is welcome to attend.