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Integrated sensing, modeling and control in undersea sensor networks

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The way forward in adaptively sampling the vast ocean environment is by deploying a network of sensors with different capabilities. Due to the complex nature of the environment, covering such an area cannot be achieved by simply deploying underwater sensor nodes at pre-defined locations. The undersea network topology should dynamically adapt to the events and changes in the environment. However, the main challenge for undersea network autonomy is due to the limitations in underwater acoustic communication. In order to overcome such limitations, Nested Autonomy architecture is being developed and demonstrated in programs such as PLUSNet and Ocean Observatories. This paper looks into the implementation of such autonomy architecture in different sensor nodes with different capabilities. This is achieved by separating the "low-level" tasks of a sensor node with its "high-level" tasks. Low-level tasks will be sensor specific while the high-level tasks looks into the autonomy required for the adaptive sampling applications, which here refers to as the "Backseat-driver paradigm". The "backseat" carries the on-board intelligence required for the mission at hand. Behavior-based autonomy architecture which is used in the back-seat significantly improves the sensor performance by selecting the best behavior for the given state of the vehicle, mission at hand and the observations being made.