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**Robot Control Strategies for Task Allocation with Connectivity Constraints in Wireless Sensor and Robot Networks**

**Abstract:**

Mobility within Wireless Sensor Networks (WSNs) has been widely considered for data collection tasks, where mobile robots physically collect the data from the sensors and return to the base station. Although this approach has proven to be useful in prolonging the lifetime of these networks, it cannot meet the requirements of real-time data collection tasks. For such tasks, we need to utilize mobile robots to create a connected path from the base station to the event, as well as use innetwork forwarding through that path. This will provide a longer lifetime while addressing efficiency and scalability issues because mobile robots have a larger and renewable energy reserve, a longer transmission range, and capacity. One of the fundamental problems is how to coordinate robots to establish a connected path from the event location to the base station. We consider this fundamental problem with two objectives, namely minimizing distance traveled by the robots and minimizing hop count (the number of robots used on paths) under the constraints of satisfying the path and/or network connectivity. After mathematically formulating the underlying problems and discussing their NP-hardness, we propose various heuristic solutions. We then demonstrate the efficacy of our proposed solutions through extensive simulations.

**Existing System:**

Through these interacting networks, WSRN applications can start monitoring a given environment for basic events. When there is an event requiring more attention, the sensor(s) at that event location can trigger a request for the WSRN system to send a mobile robot to that location in order to conduct a more advance monitoring (e.g., using audio and video sensors), or perform some other task in real-time. The collected data needs to be sent to an operator (or decision maker) at a base station for better analysis and/or tracking. Based on the received multi-sensory data, the decision maker can determine appropriate strategies/actions and carry them out by using autonomous robots, or to inform a human operator to deal with the situation by teleoperating some of the robots in real-time.

**Proposed System:**

We focus on *how to move robots to appropriate positions while keeping them connected*. In a small scale setting, the base station can directly communicate with robots, assign new tasks/positions to them, and even teleoperate them to perform some actions. However, as the size of the monitored area increases, the number of robots will not be enough to cover the entire area. So, we need to dynamically manage the robots and move one to the area where there is a request for extra monitoring or action. Upon moving to a new location, the robot may not be able to communicate with the base station as the distance between the base station and the event is often more than the communication range.

In cases such as the first option, the base station can try to communicate with the robots through the underlying WSN, which we assume is a connected network and deployed uniformly in order to have good coverage of the monitored area. However, transmitting too much data through the WSN would be a problem, as that would deplete the energy in the WSN dramatically. In order to alleviate this problem, we need to identify other robots and move them to appropriate positions such that they create a connected path from the base station to the event. This will allow us to better utilize energy resources and prolong the network lifetime as the robots will have a larger and renewable energy reserve, as well as a longer transmission range than the static sensors in the WSN. In summary, we should maintain connectivity of the MRN and use it to transmit most of the data, while limiting the usage of the WSN to exchanging basic sensory and control information.