Fig. 1. A surveillance sensor network with line topology.

We observe that any approach to find sensor locations needs to be driven by a model of events that ultimately create the network traffic. Since events collectively contribute to network traffic over the lifetime of a network, a problem formulation must consider a statistical model of future possible events. In this paper we consider a Poisson model of events and determine sensor locations and idle-listening times to improve network lifetime under this Poisson model.

Our main result is that the network lifetime can be significantly increased when these parameters are deterpoints placed over the target area in [11]. However their approach is not feasible for dense grids and has the typical loss of efficiency drawback due to discrete problem domain.

Virtual communication backbone algorithms in Mobile Ad-hoc Networks (MANETs), MAC protocols [12], [13] and packet distribution protocols use scheduling for data transmission. SPAN [14] is a topology based model in which each node knows its 2-hop neighbors. GAF [15] is a location-based model which requires each node to be aware of its own position and the grid it resides. In both of these approaches, only a subset of nodes keep their radio active while preserving data dissemination capability of the network to solve the idle listening problem. However, both SPAN and GAF are developed in the context of MANETs, where traffic-flow may originate from any node to any other node in contrast to dominant network to base station data flow in sensor networks. In [16], the authors deal with the problem of scheduling packet transmissions in a wireless sensor network in order to find the optimum schedule of data distribution with directional and omnidirectional antennas. However, only packet delivery latency is optimized and relay burden problem, which is critical for network lifetime, is overlooked since nodes are placed

- DE_j: the total energy consumption of node j in Joules up through to the moment when the first node in the network dies, j

within its sensing range can originate anytime. The idle listening duration is found by subtracting the time spent in receiving and transmitting packets from the total listening duration of the sensor node. The sensing region for the first node is identified based on Constraint P.3 and the assumption that a target is detected by closest sensor.

2 (O.4) $DE_j =$

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P

replacing the decision variable with a term subtracting the decision variable from 1.

if (À = 1) *then* (*A* · *B*) ¡ ! (Đ ɨf *66*