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An Energy optimization Technique for Longer Lifetime Wireless Sensor Networks

Mohamed Ahmed S. Moursi[1] *El-SayedSoliman* A. Said[2],
[1]MSc. Student, Al-Azhar University, Egypt Electrical Eng Dept., Al-Azhar University, Egypt
[2]Associate Professor, Electrical Eng Dept., Al-Azhar University, Cairo, Egypt

1. Abstract:
Optimizing wireless sensor network life time by mobility of the sinknode is one of the most efficient technique for energy saving and optimization.Path is created by routing algorithm the Ad hoc On-DemandDistance Vector (AODV). Information gathering by the mobile sink node can reduce the energy consumption of sensor nodes. This is duo to the reduction of the multiple hops. An adequatelifetime is improvement can therefore, satisfactory achieved based on this aggregated hops networks.

Key words: *WirelessSensor Networks (WSNs), mobility, AODV, Routing, Energy, Optimization, Dimension, Protocol.*

1. Introduction

A wireless sensor nodeis configuring of sensing, computing, communication, actuation, and power components. These components are integrated on a single or multiple boards, and packaged in a few cubic inches.Moreover, one of the WSNscontains of several to thousands of these nodes that communicate through wireless channels for information sharing and cooperative processing. The basic philosophy behind WSNs is that, while the capability of each individual sensor node is limited [1].As the sink nodes are usually supplied with larger energy support and computational power, the energy conservation researches goalsare mostly to minimize the power consumption among the sensor and/or relay nodes [12]. According to the functions of sensor nodes, power consumption can be divided into three domains: sensing, communication, and data processing. Of these domains, a sensor node expends maximum energy in data communication. This leads to the research preference in the networking area to mainly focus on minimizing communication costs in data transmission to achieve the optimal power efficiency.[13]

2. Problem definition

The protocols aim at balancing the energy consumption instead of minimizing the absolute consumed power [2]. The mobile sink approach, by further involving mobility, increases the dimension of such optimization problems.

1. Principles of Sink Node Mobility

Sensor data (mote) will be sent from the place of event occurrence through intermediate sensor nodes to the sink. According to the multi-hop data transmission model [], data packages are sent to the sink node through different sensors. The closer sensors to the sink then needs to receive and forward data from other sensors that are far away from the sink. The closer mote to the sink is of course capable to forward higher data, a lot of computational and communication resources are expected. This results in much more process the data relaying of these sensors.Furthermore, the sensors that are only one hop away from the sink; they can transmit data directly to the sink node. This leads to a situation where these sensors consume much more energy and consequently deplete their energy much faster than the others. These sensors ultimately become the bottleneck that negatively affect the network lifetime. This happens because a large portion of sensors are depending on those “closer-to-the-sink” sensors and when they die, a large amount of data cannot reach the sink, resulting in a severe downgrade of the network performance. This work proposes an optimized alternative by which an extra life time of the network can be fulfilled. To overcome to the wider coverage areas; wireless sensor network should select the sink to a definite number of locations. If any node is having energy less than minimum, that node is not considered in communication path then alternate path is created by the routing algorithm ODV[3]. Information gathered by mobile sink can reduce the energy consumption of sensor nodes by reducing multi hop communication; automatically network lifetime is then improved.

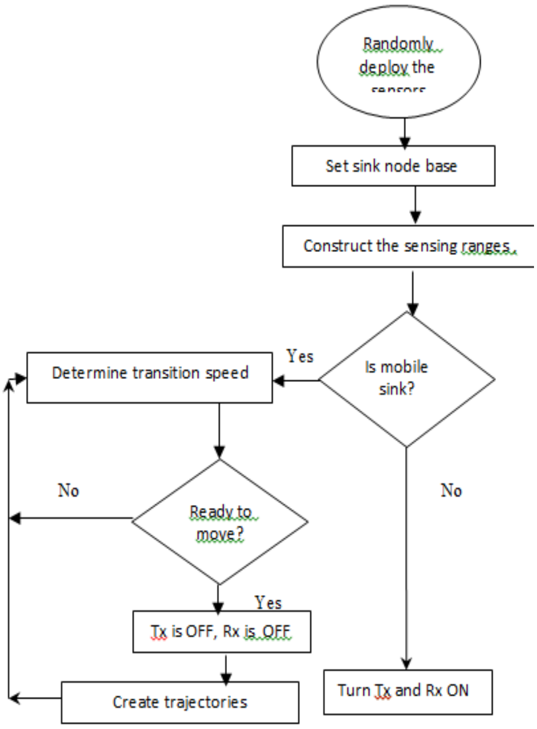
2.1.Energy Optimization through Mobility

The condition for mobility is that a sink move in such a point randomly in the network where at least one sensor is present and no other sink is present. A pause time is the time period for which a node waits in its current position before moving again [10].

2.2.Modeling the sink node

Using NS-2 network simulator package,the sensor node wants to send data packet to sink node by moving sinks to the finite set of location as following steps, see the flow chart of Fig.3xxx:

- Selecting the sensor nodes type such as Mica2 or Telosb and make them active, and then localizing the sink node location as well as the coverage range.
- Finding the Route between source to sink nodes using AODV routing, protocol, a Hello packets are then ready to be exchanged
- A mote RREQ to the Sink is used to check the target availability, free path is detected, then sink node sends RREQ inthe same path (the condition of routing table creation).
- Acquiring the environmental data is achieved by using the sensor nodes..
- The sink nodes gather the information from neighboring sensor nodes.
- Sink node will stay in the current position and gather the information even during pause time.
- By end of the pause time, sink node moves to the new location in the network[5].
- At this time and location, the mote energy reaches the minimum value (threshold), drop (by passing)this mote.



2.3.Sink node implementation by using NS-2

In the actual implementation of network process, multiple events may take place simultaneously [6xx]. The optimal position of sink node should be closer to those events that cover larger area, as they trigger more sensors to report events and hence generate more data to be transmitted to the sink node. Based on the above reasoning, the optimal position of the sink, $P_{optimal}$ = (Xs, Ys) is given by the following equations:

$$X_s = \frac{\sum_{v \in E} x_v}{|E|}, Y_s = \frac{\sum_{v \in E} y_v}{|E|},$$

where: E is the set of all active sensor nodes in the network, and (X_v, Y_v) [7]are the coordinates of sensor node v ∈ E.

During the process of network operation all the nodes, including sensors and sink can access this table (table.1) to acquire status information of sensors.

Table3: Sensorspacket :

Sensor ID	X coordinate	Y coordinate	Living?	Sensing?	Residual Energy
xx	5	6	Yes	Yes	80%

2.1.1. Methodology

Functioning of the proposed system will bedescribed and explaining in following subsections:.

2.1.1.1.Application Layer.

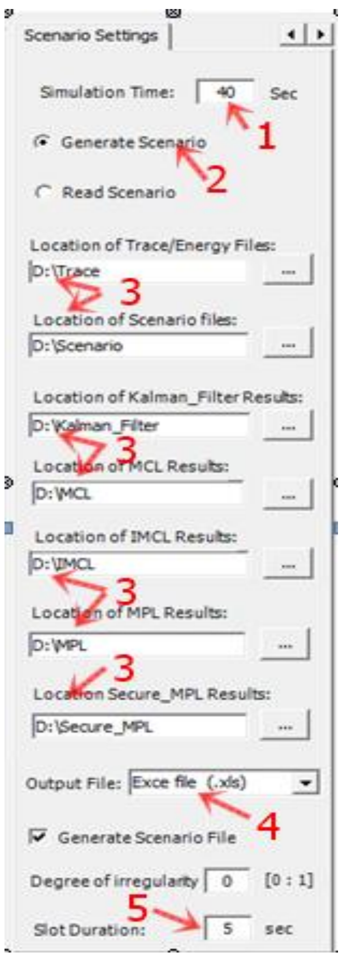


Figure 1. NS-2 interface

All the sensor nodes which are active are start sending or generating data, Sink node is equated to 0, to send data from current source node to destination node[8]. The sensor will check if route exist to the destination or not , if route exists it will start sending a data if not there it will generate route request message .

2.1.1.2.Physical Layer Energy Model

Energy is a phenomenon of physical layer and energy loss due to transmission and reception is much higher than that of idle time energy loss. Therefore in this project we assume that one unit energy is lost for every packet reception and three units of energy at the transmission time i.e., when packet arrives from MAC layer node energy is given by[9].

A snapshot of the simulation scenario is shown in Figures. Every sensor in the network is assigned a defined transmission power. We assume that one unit energy is lost for every packet reception and three units of energy at the transmission time i.e., when packet arrives from MAC layer energy is given by.

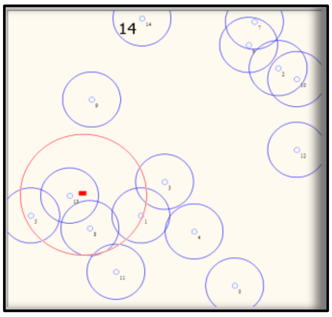
2.4.System simulation

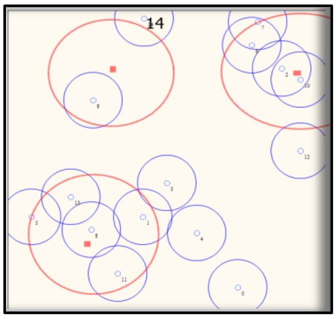
NS-2 software package is used to implement the proposed algorithm in this work. The implementation depicts wireless sensor network includes:

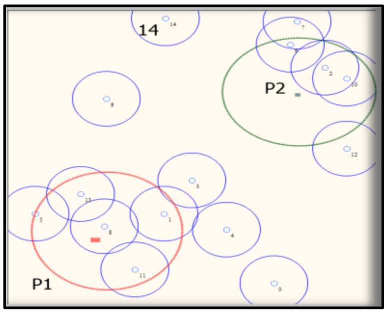
- -Sink without mobility.
- -Sink with mobility.
- -Multiple sinks with mobility.

2.4.1. Simulation Procedure:

1. Set the time of simulation.
2. Determine whether generate scenario or read from a file.
3. Set the location of the output files.
4. Select the type of output file mote
5. Set the sink location duration.



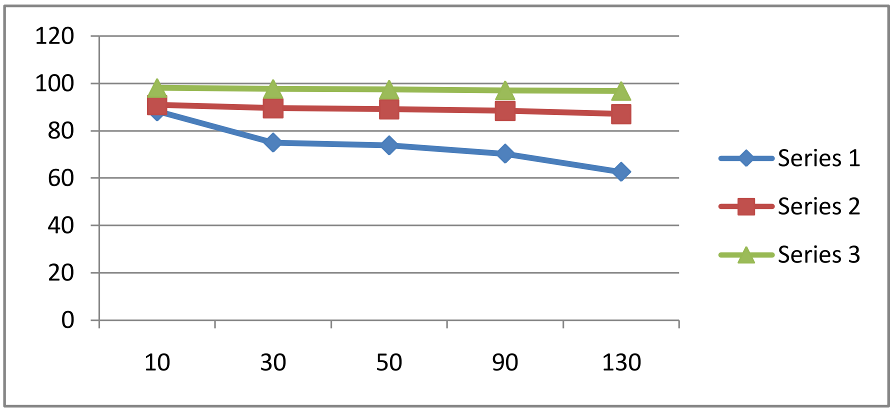




2. Result and discussion :

Table2 .result file

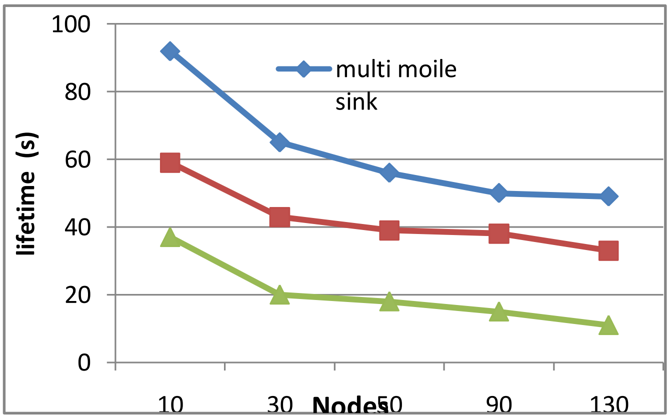
State	Residual energy
STATIC SINK	96.3
SINGLE MOBILE SINK	98.2
MULTIPLE MOBILE SINK	99.6



- Area monitoring
- Environmental monitoring -Forest fires detection

  - Greenhouse monitoring
  -Landslide detection

- Industrial monitoring
- Agriculture.



3. Conclusion And Future Enhancements

This paper has explained that how the energy conservation can be reduced by moving the sinks in a planned way therefore subsequently distributing the power consumption across the networks. Initially problem is solved by involving a single sink, then generalized this to approximate the original problem involving multiple sinks. Finally, the results demonstrate that network lifetime can be significantly improved using this technique and also results in better packet delivery ratio and low bit error rate.Further it can be used for node maintenance protocol (battery replacing or recharging for sensor nodes).The protocol can be extensible to any sensor architecture. This design work considered static sensor nodes but same can be extended for dynamic (moving) nodes as well.

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