Location Identification and Tracking of Nodes using ACO Approach

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Abstract

Tracking mobile targets is an important wireless sensor network application in both military and civilian fields. One interesting application of MSN is target tracking. It comprises of estimating instantly the position of a moving target. This work studies the problem of tracking signal-emitting mobile targets using navigated mobile sensors based on signal reception. The mobile target's maneuver is unknown here. We propose an ant colony optimization approach to estimate the location for tracking .It enlightens the approximation of the position of the nodes and that approximated positions are used to guess the location of the nodesThe simulation results show the performance analysis of the mobile sensor nodes and it also managing sensors mobility, aiming at improving the tracking of targets.

Kewords

ACO, Mobility,,Tracking.

I INTRODUCTION

In recent years, wireless sensor networks have found rapidly growing applications in areas such as automated data accumulation, surveillance, and natural overseeing.One important use of sensor networks is the tracking of a mobile target (point source) by the network. Ant colony optimization is a technique for optimization that was introduced in the early 1990's. The inspiring source of ant colony optimization is the foraging behavior of real ant colonies. This behavior is exploited in artificial ant colonies for the search of approximate solutions to discrete optimization problems, to continuous optimization problems, and to important problems in telecommunications, such as routing and load balancing.Typically,target tracking includes two steps. First, it needs to estimate or aniticipate target positions from noisy sensor data estimations.Second, it should control mobile sensor tracker to follow or capture the moving target. The goal is to estimate the target position and to control the mobile sensor for tracking the moving target. An ant colony optimization(ACO) approach is used to estimate the location for tracking. In Ant Colony Optimization, problems are defined in terms of components and states, which are sequences of components. Ant Colony Optimization incrementally generates solutions in the form of paths in the space of such parts, adding new components to a state.

II WIRELESS SENSOR NETWORK CONSTRUCTION

The WSN is built of "nodes" – from a few to several hundreds or even thousands, where each node is connected to one (or sometimes several) sensors. Every such sensor network node has nomally several parts: a radio transceiver with an internal antenna or connection to an outside reception apparatus, a microcontroller, an electronic circuit for interfacing with the sensors and an energy source, generally a battery or an embedded form of energy harvesting. A sensor node may fluctuate in size from that of a shoebox down to the size of a grain of dust, although functioning "motes" of genuine microscopic dimensions have yet to be created.

We think about a sensor network of N anchored nodes at the positions indicated by a set of m-dimensional vectors x1; . . . ; xN (with m ¼ 2 or 3 for 2D or 3D space, respectively). The moving target is a signal emitter whose signal transmission is measured by the N anchor sensor nodes. A mobile sensor additionally emanates signals to permit sensors to gather information necessary to determine its location. The versatile sensor, at the same time,can additionally measure signal from the target. In the data fusion center, a portable sensor controller regulates the mobile sensor to reach and follow the target dependent upon multiple sensor measurements.

III LOCATION OF TARGET

The first step of tracking is to estimate positions of both target and mobile sensor. On the other hand, the moving target is a signal emitter whose signal transmission is measured by the anchor sensor nodes. A mobile sensor additionally emamates signals to permit sensors to gather information necessary to determine its location. The mobile sensor, at the same time,can additionally measure signal from the target. In the data fusion center, a mobile sensor controller directs the mobile sensor to reach and follow the target dependent upon multiple sensor measurements.

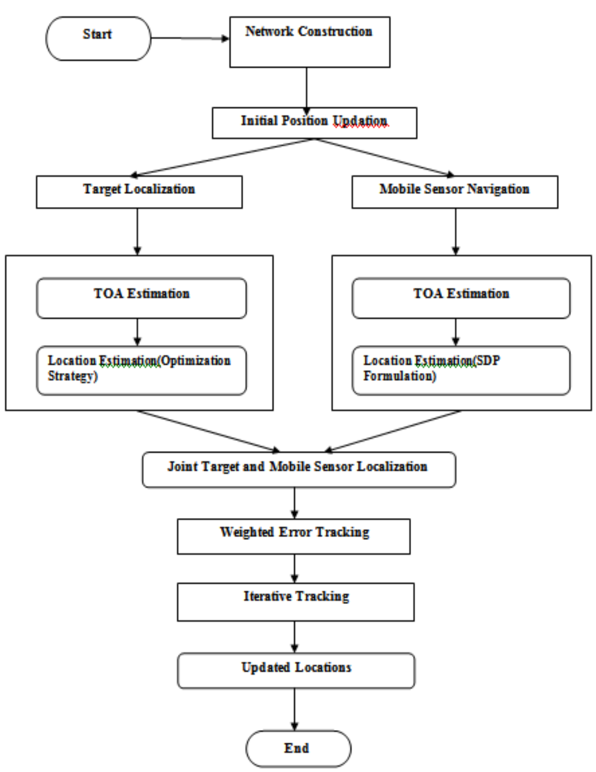

Fig1:Flow Diagram of Target Tracking

To track a moving target with a mobile sensor, the data fusion center must appraise the locations of both the target and the mobile sensor. An ant colony optimization approach is used to estimate the location for tracking which can be efficiently finds the location of the target

IV ANT COLONY OPTIMIZATION

Ant Colony Optimization (ACO) algorithms are constructive stochastic search procedures that make use of a pheromone model and heuristic information on the problem being tackled in order to probabilistically construct solutions.A pheromone model is a set of so-called pheromone trail parameters.The numerical values of these pheromone trail parameters reflect the search experience of the algorithm. They are used to bias the solution constructionover time towards the regions of the search space containing high quality solutions.

Set parameters, initialize pheromone trails
while termination criterion not satisfied **do**
ConstructAntSolution
ApplyLocalSearch
Update pheromones
end while

Alg1:Outline of Ant Colony Optimization Metaheuristic.

1.AntBasedSolutionConstruction

An ant is a simple computational agent in the ant colony optimization algorithm. It iteratively constructs a solution for the problem at hand. The intermediate solutions are referred to as solution states. At each iteration of the algorithm, each ant moves from a state x to state y, corresponding to a more complete intermediate solution. For ant k, the probability p_{xy}^{k} of moving from state $x$to state y depends on the combination of two values, viz., the attractiveness η_{xy} of the move, as computed by some heuristic indicating the *a priori* desirability of that move and the trail level τ_{xy} of the move, indicating how proficient it has been in the past to make that particular move.In general, the kth ant moves from state x to state y with probability

$$p_{xy}^{k} = \frac{(\tau_{xy}^{\alpha})(\eta_{xy}^{\beta})}{\sum_{y \in \mathrm{allowed}_y}(\tau_{xy}^{\alpha})(\eta_{xy}^{\beta})}$$

Where T_{xy} is the amount of pheromone deposited for transition from state x to y, $0 \leq \alpha$ is a parameter to control the influence of τ_{xy}, η_{xy} is the desirability of state transition xy (*a priori* knowledge, typically $1/d_{xy}$, where d is the distance) and $\beta \geq 1$ is a parameter to control the influence of η_{xy}. τ_{xy} and η_{xy} represent the attractiveness and trail level for the other possible state transitions.

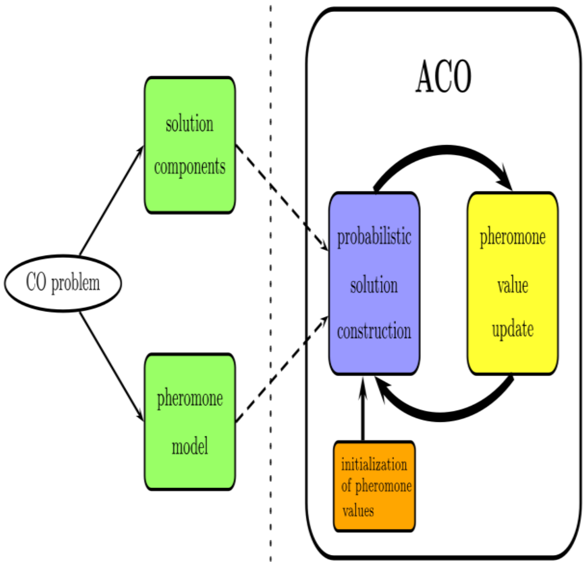

Fig2:Working of the ACO Metaheuristic

2.Pheromone update

When all the ants have completed a solution, the trails are updated by

$$\tau_{xy} \leftarrow (1-\rho)\tau_{xy} + \sum_{k} \Delta\tau_{xy}^{k}$$

where τ_{xy} is the amount of pheromone deposited for a state transition xy, ρ is the pheromone evaporation coefficient and $\Delta\tau_{xy}^{k}$ is the amount of pheromone deposited by kth ant,

$$\Delta\tau_{xy}^{k} = \begin{cases} Q/L_k & \text{if ant } k \text{ uses curve } xy \text{ in its tour} \\ 0 & \text{otherwise} \end{cases}$$

where L_k is the cost of the kth ant's tour (typically length) and Q is a constant.

Begin
Initialize
While stopping criterion not satisfied **do**
Position each ant in a starting node
Repeat
For each ant **do**
Choose next node by applying the state transition rule
Apply local pheromone update
End for
Until every ant has built a solution
Update best solution
Apply global pheromone update
End While
End

Alg2:Outline of ACO

V PERFORMANCE EVALUATION

The following examples are to illustrate the tracking performance of the proposed algorithm.

This is a graph drawn between number of nodes and delay(Fig:3).When number of nodes are increased delay of nodes are also increased because of traffic between nodes.But using ant colony optimization approach it should be decreased.

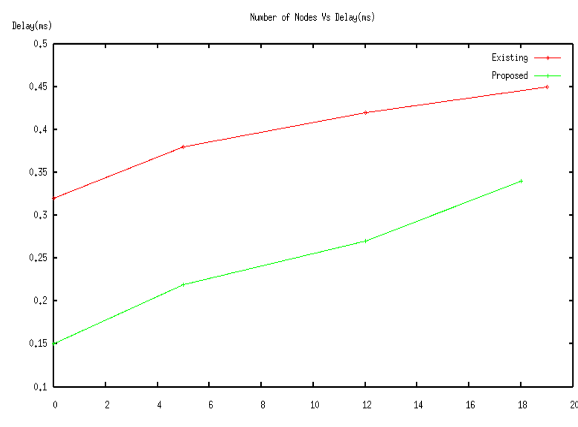

Fig.3: Delay of nodes

This is a graph drawn between number of nodes and energy(Fig:4).When number of nodes are increased energy of nodes are also increased because of delay of nodes. But using ant colony optimization approach it should be decreased.When the energy of nodes should be reduced the lifetime of network is increased .

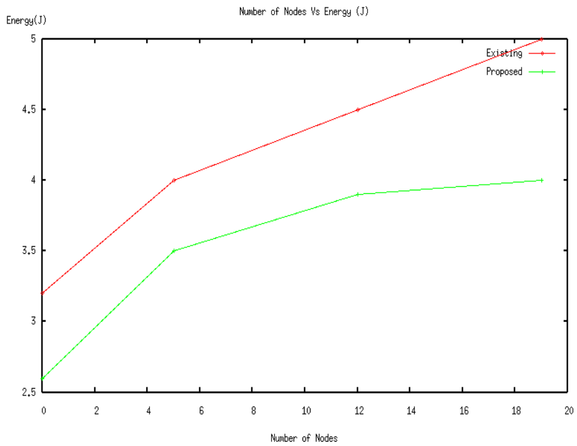

Fig.4: Energy of nodes

VI CONCLUSION AND FUTURE WORK

This paper deals with the problem of tracking a moving target using navigated mobile sensors in wireless sensor networks. With mobile target and sensor locations, the locations of the target and the mobile sensors are estimated first. An ant colony optimization algorithm is used for managing sensors' mobility aiming at improving the tracking of targets.One important factor is to diminish the energy consumption of the sensors in order to increase the lifetime of the network. Simulation results illustrate successful tracking and navigation performance for the proposed algorithms under different trajectories and noises.

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