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Effective way of Target Tracking and Mobile Sensor Identification using ACO in WSN

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Abstract— ***this work is about the difficulties involved to track the target which emits the signal using the mobile sensor based on reception of signal. As the mobile target plan is unknown, time of arrival (TOA) measurements from the mobile sensor network is used by the mobile sensor controller. Mobile sensor controller collect TOA is obtained from both the mobile target and mobile sensor to direct mobile sensor to follow the target and also to estimate location. To estimate the location we used min max approach. We propose Ant colony optimization (ACO) to estimate location efficiently and for managing sensor mobility aiming at improving the tracking of a single target. This enlightens the approximation of the position of the nodes to guess the location of the nodes. Once the entity is managed, mobile sensor nodes concentrate in that entity and the location of the mobile sensor and target jointly to improve the tracking accuracy. We provide a sequential algorithm and a joint weighted localization algorithm before controlling the mobile sensor movement to follow the target. For the navigation of mobile sensors improves efficiency, the cubic law is applied. The simulation results are shown.***

Index Terms—**Min-Max, Ant Colony Optimization, Semi definite Programming, Weighted Tracking, TOA.**

I. INTRODUCTION

In modern years, wireless sensor networks have found rapidly growing applications in areas such as environmental monitoring, automated data collection and surveillance. One of the significant uses of sensor networks is the tracking of a mobile target (point source) by the network. Mobile target tracking has a number of sensible applications, including search-rescue, wildlife monitoring, robotic navigation and autonomous surveillance. To keep check on movement of suspicious people and activities monitored using surveillance, tracking system and video monitoring. Usually, target tracking involves two steps. At first, it needs to estimate or predict target positions from noisy sensor data measurements. Then, it needs to control mobile sensor tracker to follow or capture the moving target. As a result the problem of mobile target positioning in a sensor network consists of stationary sensors and a mobile sensor. The aim is to estimate the target position and to control the mobile sensor for tracking the moving target.

II. LITERATURE SURVEY

The challenge of target tracking and mobile sensor navigation arises when a mobile target does not follow a predictable path. Triumphant solutions require a real-time location estimation algorithm and an effective navigation control method. Target tracking can be seen as a sequential location estimation problem. Characteristically, the target is a signal emitter whose transmissions are received by a number of distributed sensors for estimating the location. Here exist a number target localization approaches-based various measurement models such as time of arrival (TOA), received signal strength (RSS), time difference of arrival (TDOA), signal angle of arrival (AOA), and their combinations [2], [3]. For target tracking, Kalman filter technique was proposed in [4], where a geometric-assisted predictive location tracking algorithm can be effective even without sufficient signal sources. The use of extended Kalman filter in TOA measurement model for target tracking [5]. Particle filtering has also been applied with RSS measurement model under correlated noise to achieve high accuracy [6]. In addition to the use of fixed sensors, several other works focused on mobility management and control of sensors for better target tracking and location estimation. Distributed mobility management scheme for target tracking is studied Zou and Chakrabarty [7], Mobile targets emits signal using navigated mobile sensors based on signal reception, the mobile sensor controller utilizes the mobile target signal which is time of arrival (TOA) the measurement collected by a WSN. Estimation of location distance is done using min max approach [8].It is used to estimating the current position of a single target in the sensor networks. Estimated positions are then used to predict the location of the target. Each node is then assigned to one position this minimize traveled distance by the nodes using Ant Colony optimization.[9] The sensor node movement decisions were made by considering the tradeoff among target tracking quality improvement, loss of connectivity, energy consumption and coverage. Rao and Kesidis [10] further considered the cost of node communications and movement as part of the performance tradeoff. To allow target tracking by a mobile sensor with a former knowledge on target motion, [11], [12] also presented a proportional navigation strategy and several variants. A continuous nonlinear periodically time-varying algorithm was proposed for adaptively estimating target positions and for navigating the mobile sensor in a trajectory that encircles the target [13]. Belkhouchet et al. [14] modeled the robot and the target kinematics equations in polar coordinates and proposed a navigation strategy that attempts to position the robot in between a reference point and the target to successfully follow the target. The similar set of nonlinear kinematics equations are using to proposed a cubic navigation function, which is simple and effective

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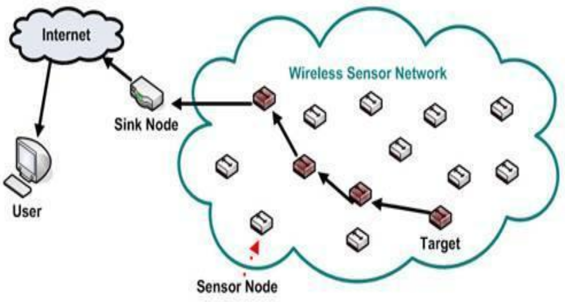
[15]. Here, we adopt this simple navigation function.

III. NEW CONTRIBUTION

We propose Ant colony optimization approach to estimate tracking the location efficiently .This approach is for improves tracking and organizing the sensor mobility. This informs the approximation of the position of the nodes to estimate the location of the nodes. When the entity is managed, mobile sensor nodes concentrate in that entity.



IV. MODULUS DESCRIPTION

A. WSN construction and Acquirement

A wireless sensor network is constructed with n number of nodes and n sensors. Every sensor network has number of internal parts such as a radio receiver, a microcontroller, an electronic circuit interfacing with sensor, energy source. The node emits signals which are received at the Mobile sensor controller center. Sensor Collects the initial location data about the target node and transfers to the Mobile sensor controller. The Controller receives both the signals and records the initial locations of both the target and the sensor. In the data fusion centre, a mobile sensor controller regulates the sensor to reach and follow target dependents upon multiple sensor measurement. We form the time of arrival measurements from the target y_j is the location of the target at the anchor node x_i at time instant T_j for the signal and for the z_j is the location of the mobile sensor respectively as

$$t_{ji} = \frac{1}{c}\|\mathbf{x}_i - \mathbf{y}_j\| + t_{j0} + \frac{1}{c}\|\mathbf{x}_i - \mathbf{y}_j\|\eta_{ji} + \delta_j, \quad \ldots(1)$$

$$\tau_{ji} = \frac{1}{c}\|\mathbf{x}_i - \mathbf{z}_j\| + \tau_{j0} + \frac{1}{c}\|\mathbf{x}_i - \mathbf{z}_j\|\eta_{ji} + \rho_j. \quad \ldots(2)$$

c is the signal traveling speed for tj0,Tj0 are, respectively. Where δj and ρ_j are noise terms. To track a moving target with a mobile sensor, the data fusion center must assess the locations of both at time immediate. The mobile sensor controller receives the TOA measurements frequently from the anchor sensors to estimate the target and mobile sensor locations to direct the movement of the mobile sensor for target tracking.

B. Localization of Target

The foremost step of tracking is to estimate positions of both target and mobile sensor. First in this module, we analyze the location of the target by using the TOA measurement information collected by the controller. Along with this, the velocity of the current location of the target at time is defined as the above equation considers the sensing error which occurs during the signal receiving. In order to avoid the dependency on sending error, the optimization approach is being introduced. The optimization approach we proposed is the ACO (Ant Colony Optimization). This attempts to minimize the Peak error that occurs during the signal transmission.

C.Localization of sensor

As in the Target tracking, the Mobile sensor is also tracked by using the SDP mechanism. SDP-Semi definite Programming, this also uses the TOA measurement and estimates the current location of the mobile sensor. Finally, both the locations are joined together to estimate the positions.

D. Detection Strategy

This is to avoid the sensor getting closer to the target mobile. In other words, this strategy is used to measure the distance between the target and the mobile sensor. This uses the Kinematics theory in order to measure the polar co-ordinates in which the target and the sensor deviates. Our proposed system also measures the speed of motion of target and sensor.

E. Sequential Tracking

The sensor and target keeps on moving. Hence, the sequential Tracking is more important in order to analyze the current locations .This uses a weighted approach for estimating the noise from multipath propagation. Thus we, implement an iterative weighted approach to predict the locations. Every updating predicts the next location of the target before they find the new weighting factor.

V. EXISTING SYSTEM

A. Min –Max Formulation

In the existing system we use min-max formulation for calculating the distance between mobile sensor and target.

$$\hat{\mathbf{y}}_j = \arg\min_{\mathbf{y}_j} \max_{i=1,\ldots,N} \left|(t_{ji} - t_{j0})^2 - \frac{1}{c^2}\|\mathbf{x}_i - \mathbf{y}_j\|^2\right|. \quad \ldots(3)$$

Disadvantage

The min max is only approximation method to locate the target.

VI. PROPOSED SYSTEM

A. Ant Colony Optimization

Ant Colony Optimization is based on real Ants behavior. When ants are searching for food, it secretes the Pheromone on the way. Another member sense those pheromone and path is attracted by them. Because the pheromone is volatile it evaporates over time. Longer paths get erased and shorter path are refreshed quickly. In the proposed system these ACO is used to locate the target accurately.

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i. Edge Selection

An ant is a simple computational agent in the ant colony optimization algorithm. ACO iteratively constructs a solution for this problem. The middle solutions are referred to as solution states. At each iteration of the ACO algorithm, each ant moves to a state y to state x, corresponding to a more complete intermediate solution.

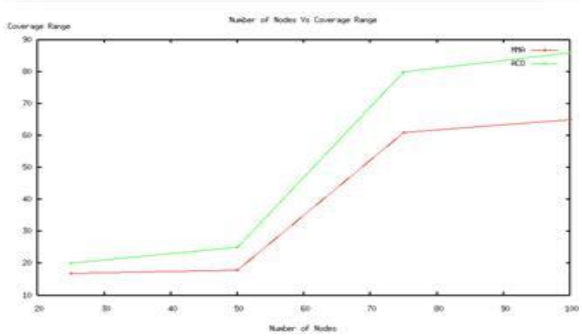
$$p_{xy}^{k} = \frac{(\tau_{xy}^{\alpha})(\eta_{xy}^{\beta})}{\sum_{y \in \mathrm{allowed}_y} (\tau_{xy}^{\alpha})(\eta_{xy}^{\beta})} \quad \ldots(4)$$

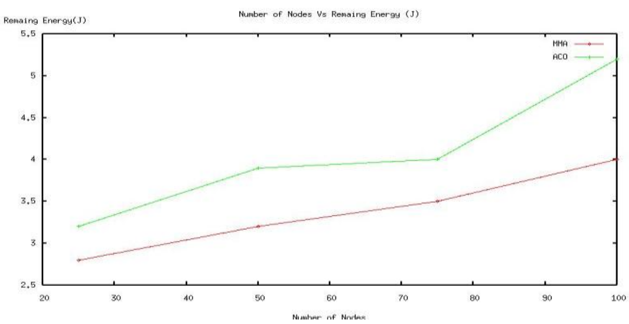
- The probability for each k^{th} ant moves state x to y is,

Where Txy is the amount of pheromone deposited (Fig: 4).When number of nodes are increased remaining for transition from state x to y. energy of nodes are also decreased because of delay of nodes.

VII. 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 coverage range (Fig: 2). When number of nodes are increased coverage range are also increased. Even though the coverage range is increased the delay is increased and energy of nodes are decreased using min-max approximation approach. But the Ant colony optimization is used to improve more coverage range.





VIII. CONCLUSION

The approximation and there foreseeing of the nodes are done by space Theory and the location of the nodes by using Ant Colony Optimization. The Network simulation results show the performance analysis of the mobile sensor nodes compared with coverage range, time delay, remaining energy respectively. Hence a sequential algorithm and a joint weighted localization algorithm are used before controlling the mobile sensor movement to follow the target. In support of the identification of mobile sensors, the cubic law is applied to improve efficiency. Simulation results illustrate successful tracking and navigation performance for the proposed algorithms under different trajectories and noises.

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