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CO-OPERATIVE AND ACTIVE SENSING FOR SCALAR FIELD MAPPING USING WIRELESS SENSOR NETWORK

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ABSTRACT

Scalar field mapping has many sensing application related to monitoring, rescue, disaster etc. In our work we proposed cooperative and active sensing mechanism of sensor deployed in field. The cooperative and active sensor is designed via the real-time feedback of the sensing performance to steer the mobile sensors to new locations in order to improve the sensing quality. The sensor sensing functions here defined is according to the active sensing framework that employed in sensor nodes. While sensing happened in near field area the movement of sensor taken place. During the movement of the mobile sensors, the measured value of each sensor node and its neighbors are fused with the corresponding confidences using distributed consensus filters. As a result Localization information about the presence of sensor in the sensing field can be determined and various path of sensor can be traced.

KEYWORDS: Scalar field mapping, active sensing, sensor fusion, mobile sensor networks.

INTRODUCTION

The development of technologies in sensing, signal processing, communication, networking, and advanced computing enables mobile sensors and mobile sensor network to accomplish complicated tasks, especially in hazardous environments where human access or assistance is not available. Mobile sensors, including unmanned aerial vehicles, underwater vehicles, and ground vehicles, are capable of various sensing applications of exploration, searching, mapping, target detection and tracking, etc. The common features of mobile sensors in these applications fall into flexible mobility, self navigation, and large coverage. All of these features enable mobile sensors to actively respond to the environment according to sensing demands. In this dissertation, an adaptive sampling method based on mobile sensors is proposed, which can adaptively collect sensing elements of interest and real-time recover the original scene.

Cooperative sensing using MSNs has gained increasing interest in environmental modeling and coverage. Cooperative sensing based on the gradient descent algorithms to obtain the optimal coverage is developed in and optimal sensor placement for environment monitoring can be found in. For dynamic environment coverage, a control strategy based on the discrete Kalman filter is developed. An approach relies on the Kalman filter to estimate the field and on the filter's prediction step to plan the vehicles' next move to maximize the estimation quality. In an optimal filtering approach to fusing local sensor data into a global model of the environment is developed. The approach is basedon the use of average consensus filters to distributed fuse the sensory data through the communication network. Along with the consensus filters, control laws are developed for mobile sensors to maximize their sensory information relative to current uncertainties in the model. Additionally, cooperative sensing algorithms have been developed for applications in environmental estimation, sampling and exploring. More details of the existing works in this area can be seen in. In an MSN is deployed in an environment of interest, and takes measurements of a spatio-temporal random field. A distributed Kriged–Kalman filter is enveloped to estimate the random field and its gradient. In underwater vehicles are deployed to measure temperature and currents.

Relatedwork: Sensing performance along with cooperative sensing, the active sensing algorithms for source seeking and radiation mapping have been developed. The problem of source seeking is first addressed in and then it is thoroughly studied in [for the case when direct gradient information of the measured quantity is unavailable. Specifically, Pang and Farrell address chemical plume source localization by constructing a source likelihood map based on Bayesian inference methods. Mesquite *et al*. introduce a source seeking behavior without direct gradient information by mimicking *E. coli* bacteria. Mayhew *et al*. propose a hybrid control strategy to locate a radiation source utilizing only radiation intensity measurements. Additionally, active sensing for radiation mapping is developed in. The control algorithm takes into account sensing performance as well as dynamics of the observed process. Captured, it can steer mobile sensors to locations where they maximize the information content of the measurement data.The rest of this paper is organized as follows. Section 3 first gives the details of our proposed work, the scalar field and measurement modeling and the problem formulation, and then presents an overview of the approach to cooperative and active sensing for scalar field mapping using mobile sensor networks. Section 4 presents a distributed sensor fusion algorithm, creating sensor nodes that functioning for mapping the unknown scalar field. Section 5 proposes a design of the active sensing that to be controlled the sensed data from sensor targets.

Proposed work

Our goal is to develop a cooperative and active sensing algorithm for MSNs sensor only interacts with its neighbors and uses the local observations to adjust the configuration of the MSNs so that the sensing performance is improved. A distributed sensor fusion algorithm is developed for cooperative sensing and this algorithm integrates both spatial and temporal estimation based on consensus filters. An active sensing algorithm is developed to incorporate the real time feedback of sensing performance into the sensor motion control. Such a feedback control enables the mobile sensor network to achieve a quasi uniformity on the confidence of the estimates. Our problem focuses on how to control the movement of the mobile sensors in a cooperative fashion to increase the confidence level of the estimates and to ensure quasi uniform confidence on the estimates.

Problem Formulation

We first model a mobile sensor network as a dynamic graph G consisting of a vertex set ϑ = {1, 2..., n} and an edge set$\zeta \subseteq \{(i, j):i, j \in \vartheta, j _= i\}$. In this graph, each vertex denotes a mobile sensor node, and each edge denotes the communication link between sensor nodes.We then define a neighborhood set of sensor node i at time step t as follows:

$Ni(t) = \_j \in \vartheta : \_qj - qi\_ \leq r, \quad \vartheta = \{1, 2, . . . , n\}\ j \_= i\_$ (1)

Here $qi \in R2$ is the position of sensor node i; and r is the Communication (active) range of the sensor node.

We model the scalar field of interest in a 2-D space of (x, y) as [17] $F(x, y) = \_\_T\ (x, y)$ $=K\_j$=1

$\theta j\varphi j(x, y)$ (2) here $\_ = [\theta 1, \theta 2, . . . , \theta K]$, and $\_(x, y) = [\varphi 1, \varphi 2, . . . , \varphi K]$,

Where $\varphi j(x, y)$ is a function representing the density distribution,And θj is the weight of the density distribution of the Function $\varphi j(x, y)$. j is the index, and K is the total number of density distribution functions. We partition the scalar field F into a grid of C sensors cell. Each sensor i makes an observation (measurement) of the scalar field at cell k ($k \in \{1, 2, . . . ,C\}$) at time step t mki

(t) = Oki

(t)[*Fk(t) + nki*

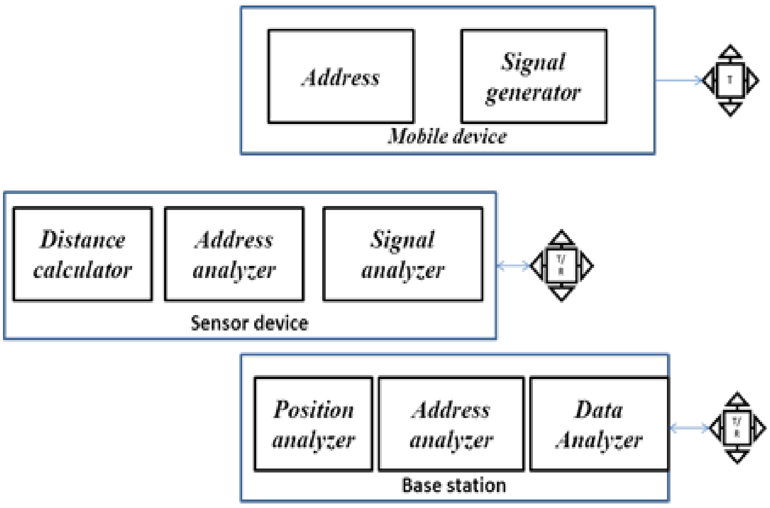
(t)]

Algorithamic Representation:

Input: Set of randomly deployed repeater/sensor nodes
Output: Localization/Mapping of nodes-to-nodes
foreach *Task m* **do**
  foreach *sensor i* **do**
    Calculate Range using SRQ(i,j);
    if $LoS(i,j) \neq LoS(j,i)$ **then**
      $i = \theta j$;
      $j = \theta i$;
while *non-localized sensor remaining* **do**
  foreach *sensor m* **do**
    Calculate through planar trigonometry, PT(i,m);
    if $PT(i,j) \leq PT(i,m)$ **then**
      $m = \theta j$;
  Mapping(sensor i on sensor j) ;
for *sensor field* **do**
  Levelling in the sensor field;
  if *Packet from parent node* **then**
    Set level, L_1 ;
    Continue until Level, L_m
for *sensors inside the levels* **do**
  mesh grids.

Module Description

The sensing can be base on Potential Controller with attractive force and repulsive forces.We are planned to divide our project into four modules are Deploying the sensor nodes,Creating the mobile target,Creating the sensor nodes and Creating the base station node And we Calculate details of mobile target,

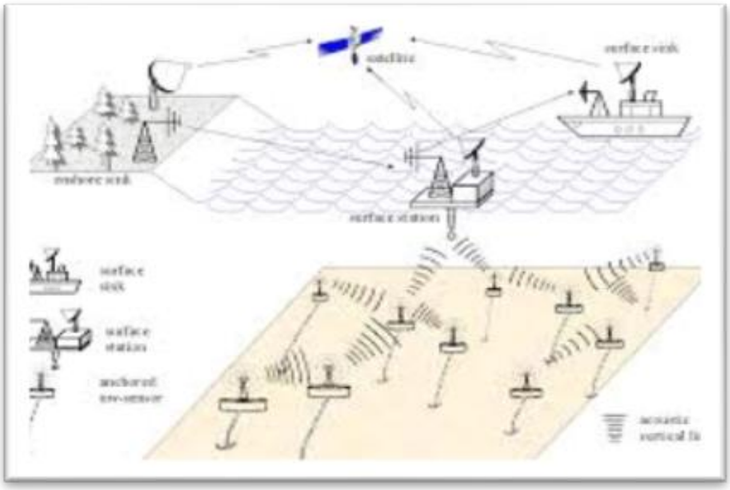


In the above Fig(1): Architecture for Target detection in scalar field

Deploying The Sensor Nodes

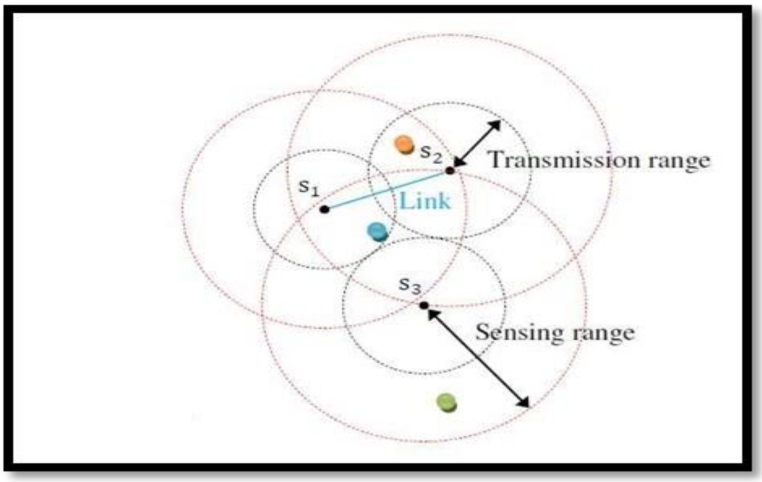
We focus on fully scalar field environments where sensors positions can be actually optimized.

The design of a WSN for scalar field sensing detection requires a completely different deployment approach..We are implementing two methods. One, Sensors must be positioned in order to maximize the exposure of the least-exposed path, subject to a budget on the installation cost (number of sensors). Another one is Sensors have to be positioned so as to minimize the installation cost, provided that the exposure of the least-exposed path is above a given threshold.



Creating The Mobile Target

We need to create mobile device, it's should be satisfy following contains. Our purpose is to use the feedback of the estimation confidence to adjust the movement of the sensors so that they can improve the sensing performance in a distributed fashion. Specifically, the potential controller is designed to steer the mobile sensors to the new locations in order to achieve the quasi uniformity of the confidence and able to move from one place to another place.It has to generate beacon message in short interval with following metrics.Then the metrices arer Time Stamp,Mobile Device Address,Broascast ID and Sequence number.At each time *t*, the mobile sensor *i* may have several cells which have confidence lower than the desired one. In order to steer the mobile sensor to go to these low confidence cells, the virtual attractive forces are generated at these cells. If the cell has lower confidence a bigger attractive force is generated.



Creating Sensor Nodes

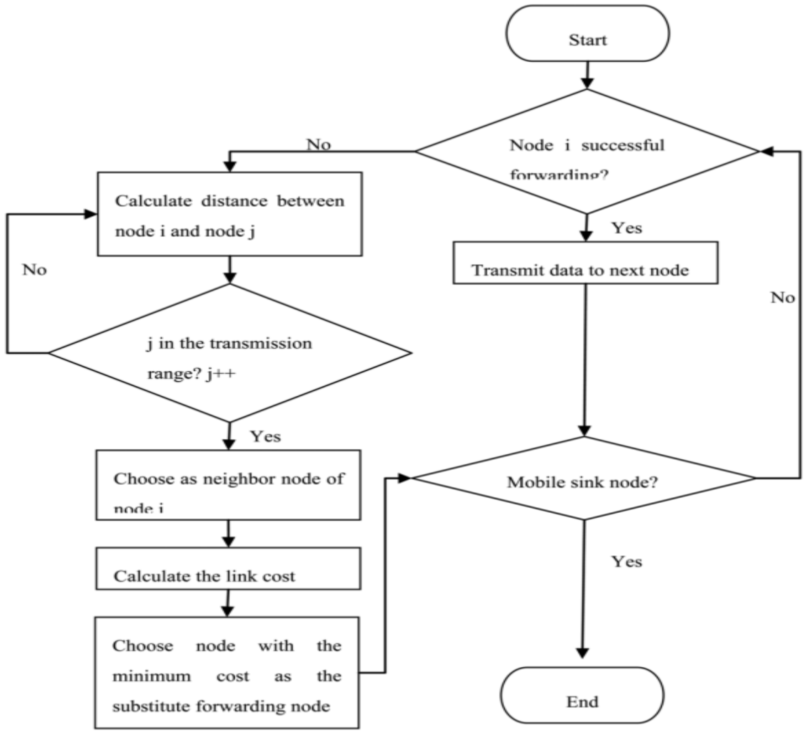
We need to create sensor device, it's should be satisfy following contains.It able to transfer analyzed data to control station.And able to receive beacon message from mobile node and also can analyze the following metrics are Time Stamp ,Mobile Broadcast ID and Sequence number are to be calculated the distance between mobile target and sensor.

Creating Base Station Node

We need to create base station device, it's should be satisfy following contains Based on the attractive force design in the previous subsection; the confidence level can be increased. However, some cells may have very high confidence, which will cause unnecessarily measurements and energy consumption. Therefore, it is desirable if we can maintain both lower and upper bounds of the confidence performance, or we call a quasi-uniform confidence.Is to receive analyzed data from sensor device and able to find the position by using following conations the Time comparison,Find sensor address and Position,Distance Comparison and Calculate the mobile node position.

Flowchart:

In the below fig(2) on,



Then the sensor is to be start searching for the node .And is to be calculated each shortest path from the neighbour node.They have to be chech and verify the shortest path from it is neighbour node.By the way, we are using Shooter Localization algorithm get easily find a path very qucikly .Finally,we reach the node.Suppose we cannot find a node means then the process is to be proceed repeatately.

CONCLUSION

In this paper, We have described an algorithm Shooter Localization Algorithm.It developed a cooperative localization algorithm that combines measurements from a small number of mobile sensor platforms to cooperatively explore astatic planner scalar field.we combined estimate on dynamic node depend on the motion model with the gurantee convergence of the algorithm.We take a geometric approach in formation control where reduction is performed on the total configuration space.

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