GLOBAL SENSOR DEPLOYMENT AND LOCAL COVERAGE –AWARE RECOVERY SCHEMES FOR SMART ENVIRONMENTS

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Abstract—One critical issue, for a wireless sensor network (WSN) to operate successfully, is to provide sufficient sensing coverage. Define the smart sensing environment as a sensing system with the capability to sense the environment and respond properly in an automated manner In this paper, we target on smart sensing environments and deal with heterogeneous sensors (here sensor heterogeneity is defined as sensors having different sensing ranges) equipped with actuation facilities to assist in the sensor self-deployment. Coverage-aware sensor automation (CASA) protocol is proposed to realize an automated smart monitoring network. Two centralized algorithms are included in the CASA protocol suite: enhanced virtual forces algorithm with boundary forces (EVFA-B) and sensor self-organizing algorithm (SSOA). Unlike most previous works that tackle the deployment problem only partially, we intend to address the problem from both global deployment (EVFA-B) and local repairing (SSOA) perspectives. The EVFA-B protocol enhance the sensing coverage (after a possibly random placement of sensors). Furthermore, in the presence of unexpected failures, our SSOA algorithm is activated to perform local repair by repositioning sensors around the sensing void (uncovered area).The proposed Deployment Coverage Conscious Connectivity Restoration (DCCR) addresses concern about field coverage. To overcome connectivity problem, DCCR not only strikes a balance between connectivity and coverage but also balances load among neighbors of failed node.

INTRODUCTION

MEMS (micro-electromechanical system) significantly encouraged the development of WSN in the past decade. A WSN is widely used for habitat and environ-mental surlacement of sensors). The efficiency of a wireless sensor network is depended on Sensor deployment and it also reflects the cost and detection capability. A good deployment strategy should be considering both coverage and connectivity of the network. Coverage means that every location in the region of interest is monitored by at least one sensor.

Connectivity means that each node in network should be involved in communication with base station and networks are not separated in terms of node communication. A Wireless Sensor Network is composed many tiny, low-power nodes that integrate sensing units, transceivers, and processing unit and wireless communication capabilities. These devices are deployed in a region of interested area to collect the information from the environment, which will be sent to a remote base station. Wireless Sensor Networks are used for many applications, such as surveillance, biological detection, and traffic, pollution, civil infrastructure monitoring, health care, fire detection and disaster management.

EXISTING SYSTEM

We target on smart sensing environments and deal with heterogeneous sensors (here sensor heterogeneity is defined as sensors having different sensing ranges) equipped with actuation facilities to assist in the sensor self-deployment. Coverage-aware sensor automation (CASA) protocol is proposed to realize an automated smart monitoring network. Two centralized algorithms are included in the CASA protocol suite: enhanced virtual forces algorithm with boundary forces (EVFA-B) and sensor self-organizing algorithm (SSOA). Unlike most previous works that tackle the deployment problem only partially, we intend to address the problem from both global deployment (EVFA-B) and local repairing (SSOA) perspectives. The EVFA-B protocol exerts weighted attractive and repulsive forces on each sensor based on predefined distance thresholds. Resultant forces then guide the sensors to their suitable positions with the objective of enhancing the sensing coverage (after a possibly random placement of sensors). Furthermore, in the presence of sensor energy depletions and/or unexpected failures, our SSOA algorithm is activated to perform local repair by repositioning sensors around the sensing void (uncovered area).

PRIOR WORK

Depending on the target applications, earlier studies in WSNs generally focus on outdoor large-scale environments, where planned sensor deployment is difficult, or indoor small scale monitoring zones, where sensor deployment mechanism is feasible and beneficial. The objective of those proposed working schedules (node-scheduling protocols) is to achieve energy conservation (prolonging system lifetime), while preserving reasonable sensing coverage and network connectivity.

For the monitoring environments where planned sensor deployment is possible, various static deployment strategies have been introduced to enhance the surveillance coverage. However, such static deployment involves manual sensor placement/installation, and is incapable of dynamically repairing sensing voids (uncovered areas) in the presence of unexpected sensor failures. With the motion facilities equipped at the sensing devices, sensors can move around to deploy themselves. Assuming there exists a powerful **cluster head**, capable of communicating with all sensors and obtaining sensor locations, the firstly identify the coverage holes (sensing voids) based on **Voronoi diagram**, and then propose three algorithms (choices) to guide proposed algorithms and then evaluates all attractive and repulsive forces and obtains the resultant force exerted on each sensor. The computed resultant force then directs the sensor to move to a desired position.

Also utilizing mobile sensors, the authors introduce a distributed sensor self-deployment scheme. They suggest to sensor movements toward the detected holes. Therefore some optimization heuristic is needed to prevent sensors from moving too far and keep a reasonable number of total movements, further complicating the deployment computations.

As a result, the authors in develop a **SCAN-BASED MOVEMENT-ASSISTED SENSOR DEPLOYMENT (SMART)** method to address the unbalanced problem. Instead of tackling the deployment problem directly, SMART focuses on sensor load balancing by using 2D scanning and dimension exchanges to achieve a balanced network state. As claimed by the authors, SMART can operate on top of existing sensor deployment schemes, and produces good performance especially for unevenly distributed WSNs.

We observe that most previous works explore the sensor deployment problem only partially, leaving issues such as heterogeneous sensors (with different sensing ranges) and locally recovering sensing holes (caused by sensor failures) unaddressed. However, in practice, those closely-related deployment issues should be resolved as a complete proto-col set to achieve an operative WSN with high detection capability. A **CASA** protocol suite is proposed to address the global sensor deployment scheme (EVFA-B) and sensing coverage recovery in the presence of sensor failures (SSOA).

COVERAGE-AWARE SENSOR AUTOMATION PROTOCOL

Two deployment-related mechanisms are incorporated in our CASA protocol set: EVFA-B and SSOA. The detailed operations of respective mechanism, with the objective of enhancing/preserving/recovering the sensing coverage for a smart sensing environment respectively .Below we summarize the environmental assumptions made in this work.

(A1) There exists a powerful cluster head responsible for performing centralized computations. All sensors are able to communicate with the cluster head via single-hop or multi-hop wireless transmissions.

(A2) Sensors have the isotropic sensing shape and the binary sensing /detection behavior, in which an event is detected (not detected), by a sensor with complete certainty if this event occurs inside (outside) its sensing radius. Both the homogeneous (having identical sensing range) and heterogeneous (having varying sensing ranges) sensors are allowed in our model.

ENHANCED VIRTUAL FORCES ALGORITHM WITH BOUNDARY FORCES (EVFA-B)

The concept of virtual forces is inspired by the combined idea of potential field and disk packing theory. Each sensor behaves as a source giving a force to others. This force can be either positive (attractive) or negative (repulsive). If two sensors are too close, they exert repulsive forces two to separate each other, otherwise they exert attractive forces to draw each other. We quantify the definition of "closeness" by using the distance threshold d_{th}^{ij} for any sensors s_i and s_j with respective sensing radius r_i and r_j .Virtual physics based approach is one of the major solutions for self deployment in mobile sensor networks. To overcome connectivity maintenance then virtual force algorithm is the best approach with ideal deployment. Simulation result shows that self deployment by the EVFA-B can effectively reach the deployment in the mobile sensor networks. Here the problem of global deployment overcome by EVFA-B. The main objective of EVFA-B is to improving the sensing coverage (after a possibly random placement of sensors)

SENSOR SELF –ORGANIZING ALGORITHM

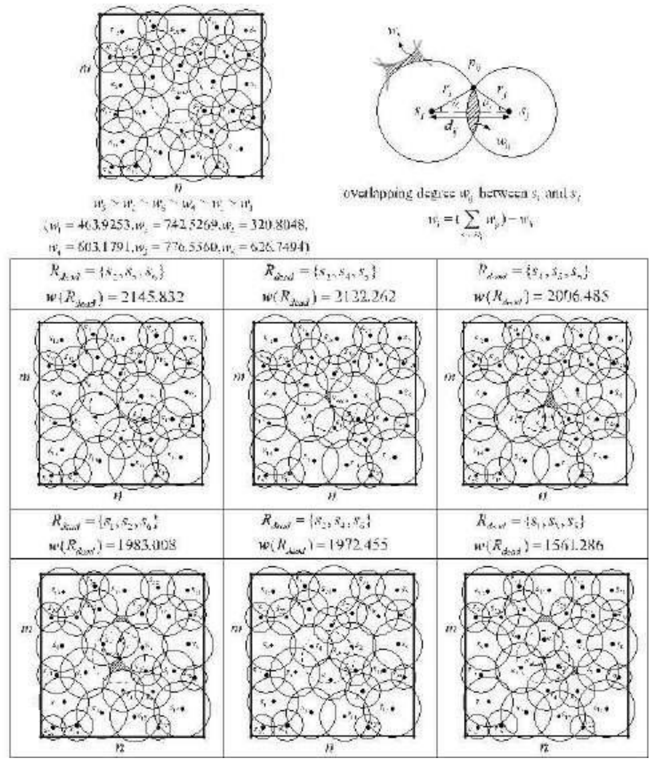
The main objective of SSOA is local repairing the sensors. SSOA algorithm is activated to perform local repair by repositioning sensors around uncovered area. To preserve the required sensing cover-age, one alternative is to perform EVFA-B periodically for global redeployments. However, such constant global redeployment is costly in terms of communication overhead and consumed moving energy, and should be kept infrequent.

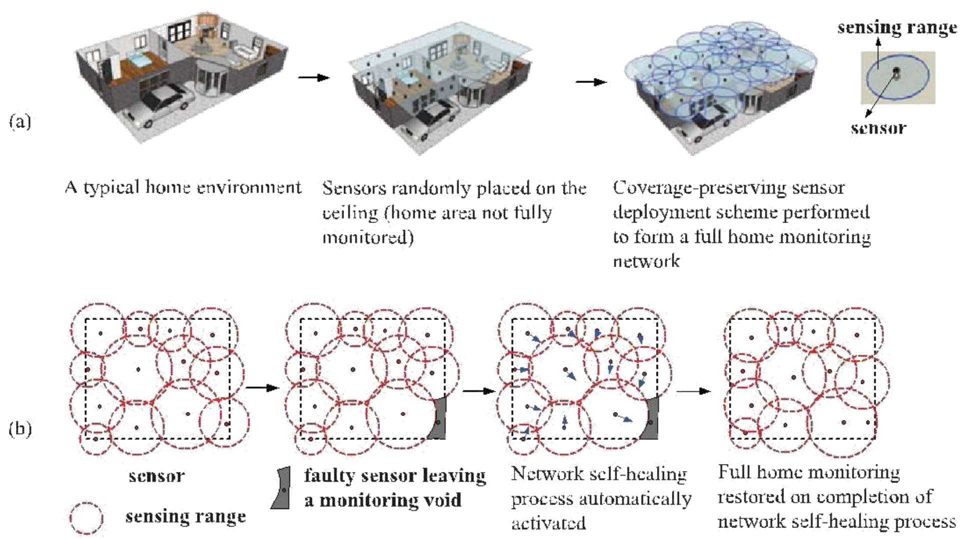
Therefore, we propose the SSOA to firstly repair the sensing void (uncovered area caused by some broken sensor) by locally repositioning sensors around the sensing hole.

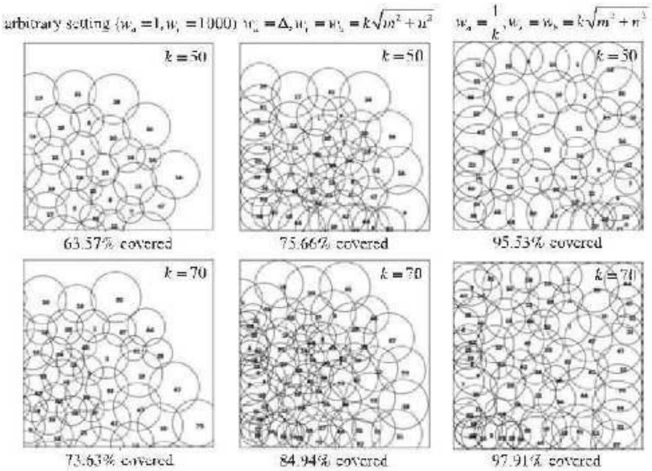
Two issues need be addressed to realize this local recovery: selection of repairing sensors and physical movements performed by the selected sensors. In case the local repairing is unable to recover the required sensing (detection) capability, SSOA then invokes EVFA-B to globally redeploy sensors.

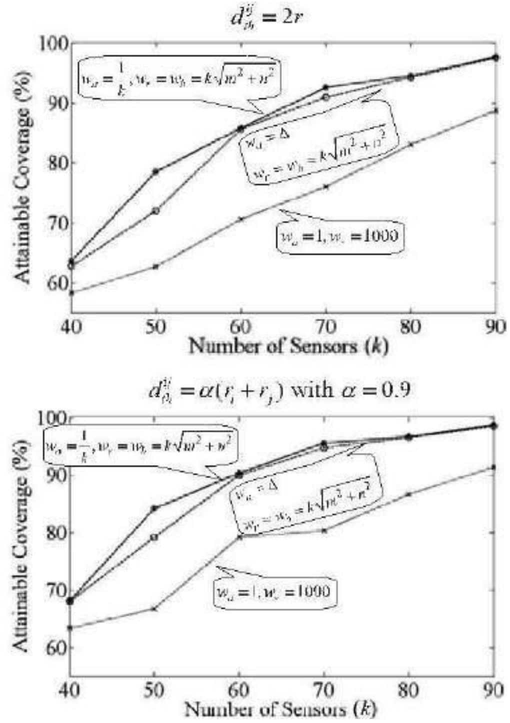
PROPOSED SYSTEM

Since failure of a sensor leads to loss of connectivity it may cause a partitioning of the network. A number of approaches have been recently proposed that pursue node relocation in order to restore connectivity. A failure of a node can cause a mobile sensor network to partition and thus disrupt the application. Unlike most prior work that exploits node relocation to restore connectivity, **Deployment Coverage Conscious Connectivity Restoration (DCCCR)** addresses the concern about field coverage. Basically, a lack of coverage-awareness in the connectivity restoration process may leave some areas unmonitored by any sensors. To overcome this problem, Deployment Coverage Conscious Connectivity Restoration (DCCCR) avoids permanent repositioning of nodes. Basically the neighbors of the failed node F coordinate among themselves and agree on their role in the recovery. Each neighbor will move to the position of F to restore connectivity and coverage in that area and then go back to its original position after serving for some time. The neighbors of the failed node take turns. Deployment Coverage Conscious Connectivity Restoration (DCCCR) not only strikes a balance between connectivity and coverage, but also balances the load among the neighbors of the failed node. Deployment Coverage Conscious Connectivity Restoration (DCCCR) is a distributed and localized algorithm that imposes little messaging overhead and can thus scale for large networks.









we can see from the figure, arbitrary setting (though w_r w_a) without boundary forces performs poorly, while the third alternative by making w_a inversely proportional to k performs the best with the highest cover-age ratio achieved. Interestingly, by setting w_a ¼ $\frac{1}{k}$ (independent of sensing radius), we actually obtain a better sensing coverage than that by setting w_a ¼ D (sensing radius dependent), which implies that good choices for the weight constants depend on the sensor population (parameter k) and monitoring dimensions (m and n), and can be made independent of sensing radius. This implication greatly simplifies the design of weight constants when dealing with heterogeneous sensors

Verification of Parameter Settings

We conduct more EVFA-B experiments (Maxloops ¼ 100, c_{th} ¼ 0:95) in this section to observe the combined impact of d^{ij}_{th}, w_a, w_r settings on the attainable coverage ratio. In Fig. 6, two d^{ij} designs are experimented (where r ¼ $\frac{1}{}$ Pk ¼1 ri, rep-resenting the average sensing radius), both with three different wa, wr settings. As depicted in the figure, by setting w_a ¼ $\frac{1}{k}$ and w_r ¼ k m^2 þ n^2, we obtain the highest coverage under both d^{ij}_{th} values. Moreover, even higher coverage ratio is attainable if we make the distance threshold on per node-pair basis by setting d^{ij}_{th} ¼ aðr$_i$ þ r$_j$Þ. The results indi-cate the importance of proper parameter settings on the dis-tance threshold (d^{ij}_{th}) and weight constants (w_a, w_r, w_b), further validating our parameter designs proposed

CONCLUSION

As technology emerges over the decades WSN has come to the spotlight for unattained potential and significance. Consequently billions of dollar are being committed to research and development of sensor network in order to address the additional the operational challenges that are still associated large scale implementation of sensor network without having proper blueprint no construction manager could put up any building according to the architect intention. Various smart applications and sophisticated system could share the same sensor nodes deployed around the particular area of interest (AOI) for performing job. WSN the emerging technology makes the recognizing present and predicting future in a way not possible in past. A smart environment is to be regarded as indispensible stage of real time system foe sensing and prevention of undesirable occurrence

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