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Design Data Fusion Model for Distributed Detection of Wireless Sensor Network using Improved Genetic Algorithm

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ABSTRACT
The detection of the target node is a big issue in the wireless sensor network environment. the detection of the target node applies the process of distance estimation from the local sensor node to the target sensor node. Therefore, the data fusion methods play a vital role in detecting the target node in a wireless sensor network. The data fusion methods collect the local sensor data and make decisions for the target node. This paper design methods for the detection of the target node. The design model is based on an improved genetic algorithm and data fusion process. The design model reduces the possibility of false detection of the target node and improves energy utilization. However, the utilization of energy is compromised with the maximum distance of the target node with local sensor nodes. The applied model estimates the optimal distance of the target node. The design model simulates in MATLAB environments with standard simulation parameters. The design model compares with two algorithms is called DS and CWN. the analysis suggests that the design model is very efficient in compression with the existing algorithm.
Keywords : WSN, Distributed Detection, IGA, Data Fusion, MATLAB, Energy.

I. INTRODUCTION

A large mass of sensor nodes is supposed to scatter in a geometric region, with nearby nodes communicating with each other directly. Without the help of a large amount of uniformly deployed seed nodes, this scheme fails in WSNs with possible holes. The global geometry and topology of a WSN has a great influence on the design of basic networking functionalities, for example, point-to-point routing and data collecting mechanisms, or if they are desirous to spread some mobile sensors in an unknown region formed by static sensor nodes, knowing the border of the region permits us to guarantee that newly added sensors are deployed only in the expected region [1, 2]. In most applications, the sensor nodes are randomly deployed in a high-density target area. To keep the cost low, those sensor nodes that are responsible for collecting data are usually made from inexpensive parts[3]. Therefore, when deployed in a variety of complex environments, such as mining fields and fish farms, these sensor nodes might become highly unreliable for data acquisition. To this end, it is unfeasible to only rely on a single sensor node to collect the data of a monitoring object[4]. The state-of-the-art is to deploy multiple sensor nodes to monitor the same object to improve the reliability of the monitoring information. Monitoring the same object using multiple sensor nodes leads to the situation of receiving multiple relevant, possibly redundant, data of the same object[5]. How to obtain accurate and reliable information from these redundant data is a key research question. Recent literature shows that energy consumption in WSN comes from two sources: computing and communication [1]. Since the ratio between computing- and communication-incurred energy consumption is about 1:3000, sensor nodes should focus on local simple data processing and reduce long-distance data transmission. In order to achieve this goal, sensor nodes must work in a coordinated manner. One possible approach is to organize WSN nodes in clusters, which forms a tighter interaction and collaboration between nodes while facilitating the reliability of the entire WSNs and saving network bandwidth. Moreover, data fusion within the cluster can effectively optimize redundancy, reduce the amount of data transmission and energy consumption in the network, extend the network life cycle, and improve bandwidth utilization. Decision's fusion represents a formal framework that deals with data collected from different resources to obtain a greater quality of global decision about a certain phenomenon. Decisions fusion with uncertainty has been investigated and a Bayesian sampling approach has been proposed to address this issue [10]. In [11,12], the optimum fusion rule has been obtained under the conditional independence assumption. A fusion of decisions that are correlated to each other has been studied in [13]. Distributed detection in a constrained system has been considered in [14]. Decision's fusion in WSN operated with a multiple input multiple output (MIMO) channel has been investigated in [15,16]. Universal decentralized detection in a bandwidth-constrained sensor network with binary decisions made by sensor nodes has been constructed in [17]. Universal detectors for the decision fusion problem have also been considered in [18]. The distributed detection problem in WSNs has been studied using two kinds of communication channels: the traditional parallel access channel (PAC) in which each sensor has a dedicated independent channel to fusion center (FC) and the multiple access channel (MAC) in which the FC receives a coherent superposition of the sensor transmissions [19,20]. On the one hand, for networks with a large number of sensors, PAC implies a large bandwidth requirement and a large detection delay. On the other hand, the bandwidth requirement of MAC does not depend on the number of sensors, but due to the additive nature of the channel, the received signal at the FC is usually not sufficient for reliable detection. The optimality of distance estimated with various algorithm such as markov chain model, neural network and swarm intelligence. The applied optimization algorithm estimates the optimal path for the target node selection. In this paper proposed model based on data fusion and improved genetic algorithm for the detection of target node in dense wireless sensor network. The improved genetic algorithm[21] applied the weight fitness function for the selection of optimal path. They have found many attentions in the area of surveillance systems, which are used for security applications such as barrier monitoring. These types of networks have many resource constraints, such as computing, transmission and power capabilities. The main reason is that the nodes in the network will lose their power and cannot be used further. Therefore, WSNs need to exploit efficient techniques to decrease these limitations. There are many issues in WSNs which have to be considered, such as coverage, life-time, energy efficiency and security. Among these concerns, lifetime and energy efficiency are the most crucial issues and they are related to the nodes' battery usage [2]. The rest of paper organized as in section II related work in section III proposed model. In section IV experimental analysis and finally conclude in section V.

II. LITERATURE SURVEY

Collaborative Mobile Sink Sojourn Time Optimization Scheme for Cluster-Based Wireless Sensor Networks Et al. [1] This paper presents Collaborative Mobile Sink Sojourn Time Optimization (CMS2TO) scheme, which aims to optimize the sojourn time of MS in each cluster in order to balance the lifetime of CHs located at different layers of the network. Most of existing mobility-based schemes are evaluated under unpredictable mobility pattern, which leads to increase the energy consumption of the network. To evaluate the performance of CMS2TO, extensive simulation experiments are performed against existing relevant algorithms. Simulation results shows that proposed CMS2TO enhances the network performance in terms of different performance evaluation metrics.

Robustness of the Counting Rule for Distributed Detection in Wireless Sensor Networks Et al. [7] They consider the problem of energy-efficient distributed detection to infer the presence of a target in a wireless sensor network and analyze its robustness to modeling uncertainties. The sensors make noisy observations of the target's signal power, which follows the isotropic power-attenuation model. Beyond studying the impact of modeling uncertainties on the performance of distributed detection in WSNs, their results show the broader applicability of the notion of performance limits in detection problems originally studied, where SNR walls for energy detectors were considered. Note that, the received-signal strength is a function of the distance of the sensor from the source.

Discrete R-Contiguous Bit Matching Mechanism Appropriateness for Anomaly Detection in Wireless Sensor Networks Et al. [8] The discussed model has been tested against some of the attacks. The high detection rate has proved the appropriateness of R-Contiguous bit matching mechanism for anomaly detection in WSNs. The result shows that the discussed IDS have shown satisfactory results with high detection rates and low false positives for the routing loop, sinkhole, wormhole, blackhole and sybil attacks. They are planning to extend the concept of anomaly detection system using the discussed technique for Internet of Things. The Internet of thing is secured with authentication and encryption but it cannot be protected against cyber-attacks.

Adaptive routing in wireless sensor networks: QoS optimization for enhanced application performance Et al. [9] This work, distinguishes itself from current state of the art solutions in three respects. First, it uses a combination of optimizable routing metrics to build energy efficient clusters at low cost. These parameters can be configured and managed to allow user applications to perform better and coexist with each other's. Second, it defines a new cluster balancing method. Third, unlike existing work that focuses on one design goal, ROL/NDC can achieve comparable results in all of the above design aims.

Physical-Layer Security in the Internet of Things: Sensing and Communication Confidentiality Under Resource Constraints Et al. [10] They pinpoint the most energy-efficient and low-complexity security techniques that are best suited for IoT sensing applications. The paper concludes by discussing open research issues and avenues for further work, especially the need for a theoretically well-founded and holistic approach for incorporating complexity constraints in physical-layer security designs. They offer their views on how to progress toward a more general understanding of physical-layer security aspects, followed by a discussion of potential new research topics: Need for a New Framework and New Applications.

Wormhole Attack Detection Algorithms in Wireless Network Coding Systems Et al. [11] they have proven the correctness of the Centralized Algorithm by deriving a lower bound of the deviation in the algorithm. they have also discussed a Distributed detection Algorithm against Wormhole in wireless Network coding systems, DAWN. DAWN is totally distributed for the nodes in the network, eliminating the limitation of tightly synchronized clock. DAWN is efficient and thus it fits for wireless sensor network. The simulations have shown that the discussed algorithms can detect the malicious nodes participating in wormhole attack with high successful rate and the algorithm is efficient in terms of computation and communication overhead.

An adaptive clustering approach to dynamic load balancing and energy efficiency in wireless sensor networks Et al. [12] In Wireless Sensor Networks, where nodes have at their disposal non-rechargeable batteries with limited initial energy budget, it is of paramount importance to get rid from node energy exhaustion. Nodes energy is a vital factor greatly influencing the WSN mission outcome. So, energy issue increasingly attracts researcher's attention in order to make sensor nodes saving their energy consumption for lasting as long as possible. This is what their proposal HEBM is aiming to. Thus, new useful metrics and multi-hop intra inter clusters routing have been used guaran-teeing an efficient node clustering repartition leading to improved node energy saving which involve network lifetime duration enhancement.

Bee-Sensor-C: An Energy-Efficient and Scalable Multipath Routing Protocol for Wireless Sensor Networks Et al. [13] They discussed Bee-Sensor-C, an energy-aware and scalable multipath routing protocol based on dynamic cluster and foraging behavior of a bee swarm. Bee-Sensor-C is an evolution from Bee Sensor which is a bee-inspired routing protocol for WSNs. Through simulations, the network performance is evaluated and the results demonstrate that Bee-Sensor-C outperforms the existing protocols in terms of energy efficiency, energy consumption balance, packet delivery rate, and scalability.

Saliency-directed prioritization of visual data in wireless surveillance networks Et al. [14] they have discussed a cost-effective image prioritization framework for wireless sensor networks. Novel integral-image-based temporal gradients were introduced to efficiently calculate the salient motion in videos. The performance of monitoring applications depends on salient activity coverage, requiring several camera sensors with overlapping FoVs. However, numerous cameras with overlapping FoVs results in unnecessary and redundant visual data transmission to the SN.

Energy efficient fuzzy adaptive selection of verification nodes in wireless sensor networks Et al. [15] they have discussed a fuzzy rule-based inference method that helps select intermediate verification nodes adaptively on the basis of three network parameters: the residual energy of the intermediate nodes, the proximity of the intermediate nodes to the original cluster, and the attack ratio in the deployment area. The discussed method improves energy conservation and guarantees sufficient protection against FRIA and FVIA. The simulation results validate the effectiveness and efficacy of the discussed method.

Channel assignment schemes for cooperative spectrum sensing in multi-channel cognitive radio networks Et al. [16] New centralized and distributed channel assignment schemes have been discussed. The centralized schemes consist of two implementation options with different signaling overhead, while the discussed distributed scheme solves the multiple channel assignment problem based on coalitional game theory. The simulation results demonstrate that the discussed schemes increase the number of available channels significantly compared with the counterparts and reach near optimal performance.

Decentralized Learning for Wireless Communications and Networking Et al. [17] This paper puts forth an optimization framework for learning over networks, that entails decentralized processing of training data acquired by interconnected nodes. Impact of the decentralized learning framework to contemporary wireless communications and networking tasks is illustrated through case studies including target tracking using wireless sensor net-works, unveiling Internet traffic anomalies, power system state estimation, as well as spectrum cartography for wireless cognitive radio networks.

Cross-layer optimized routing in wireless sensor networks with duty cycle and energy harvesting Et al. [18] They discussed a cross-layer optimized geographic node-disjoint multipath routing algorithm, that is, two-phase geographic greedy forwarding plus. To optimize the system as a whole, their algorithm is designed on the basis of multiple layers' interactions, considering the following. First is the physical layer, second is the sleep scheduling layer, third is the routing layer. Performance of two-phase geographic greedy forwarding plus algorithm is evaluated under three different forwarding policies, to meet different application requirements.

Nilanjan Biswas, Priyadip Ray and Pramod K. Varshney "Distributed Detection over Channels with Memory", IEEE, 2015, Pp 1-10. Et al. [19] They have derived the optimal fusion rule for distributed detection over channels with memory and have shown the improvement in detection performance over the Chair-Varshney fusion rule and channel aware fusion rule for a memoryless BSC channel. They have also shown that when the number of sensor decisions is large, as well as when the channel is memoryless, the derived fusion rule reduces to the well-known counting rule.

A Fuzzy Rule-based Key Re-Distribution Decision Scheme of Dynamic Filtering for Energy Saving in Wireless Sensor Networks Et al. [20] The discussed scheme saves energy by detecting false reports at an earlier hop than the existing scheme by using fuzzy logic and the feature of a loaded secret key of each node in the key pre-distribution phase. The flag of the fuzzy logic execution results considers the network situation, so more energy is saved. Security improvement: The BS counts false reports sent to the BS that are not detected at the intermediate nodes. When the count value exceeds the threshold, the BS decides to execute the key re-distribution through fuzzy logic. Because the distributed key detects false reports that are not detected in the existing scheme, the detection performance is improved.

III. CONCLUSION

The Lung dicom images are given as an input to as various ensemble classifier like Bagging, Adaboost and Random Sub Space. It classifies of pulmonary nodule patterns as malignant and benign. In this research, classification effort is an important work in the medical diagnosis. In our work, we include a new category called "undetermined" containing that the nodule might be further examined, as well as malignant and benign classes.

IV. PROPOSED MODEL

The proposed algorithm based on the methods of data function and improved genetic algorithm. The process of data fusion gathered the local unit sensor data and make decision for target node detection. The applied improved genetic algorithm estimates the optimal distance of fused sensor node to target node. The encoding of genetic algorithm by binary encoding and the selection of fitness constraint's function based on the concept of threshold.

Methods of data fusion

1. The process of event occurs, sensor node collects information
2. Set the value of threshold T≥0
3. Process of fusion and remove redundant collected data.
4. The sink node collect data after certain time interval.
5. If Final are change do
6. The sink node transmit data to base station
7. Else
8. Final not transmitted
9. End if

Algorithm for target detection.

1. The sensor unit collect data within define interval of time T
2. The collected data of sensor unit Ci= {s1, s2, s3, ……, sn}
3. The fitness function of improved genetic algorithm for optimal selection of path to find target node

$$Fwi = \frac{1-Ei}{S-\sum_{i=1}^{m} Ei} \dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where $Ei = \frac{1}{n}\sum_{j=1}^{n} Si$

4. Estimate the optimal distance of target node as

$$Doptimal = \frac{1}{n}\sum_{i=1}^{n} FwiDi \dots\dots\dots\dots\dots\dots\dots\dots (2)$$

5. Now estimate the target node as sensor events as

$$PD = \sum_{j=1}^{n} Doptial(Si) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

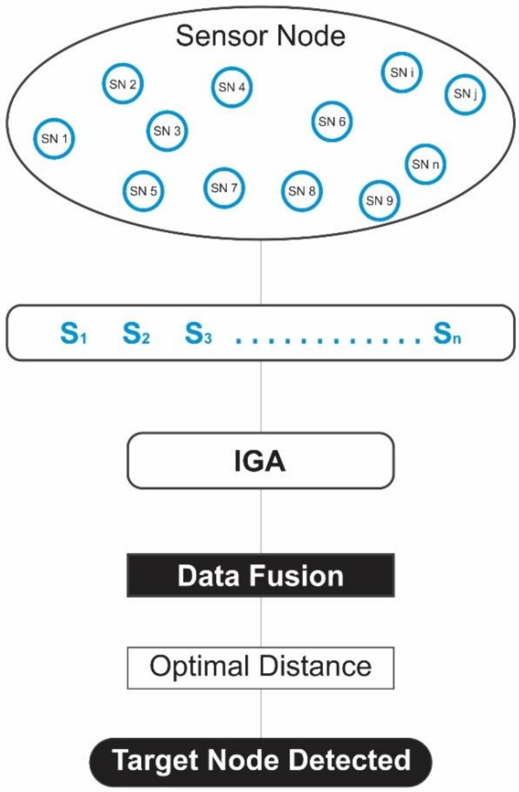

Figure 1 : proposed model of data fusion and IGA for target node detection.

V. EXPERIMENTAL ANALYSIS

To evaluate the performance of proposed algorithm simulates in MATLAB environments with different scenario of wireless sensors. The design simulation process performs in windows operating system 10. With 8GB RAM and 1TB HDD. The process of simulation performs different time interval such as 10,20,30, 40 and 100 MS. The analysis of parameter consists of energy factor and life time of network.

Input	Parameters	DS [2]	CWM [3]	PROPOSED
Number of nodes 25	TEC	0.0100	0.015	0.0021
	NLT	200	200	202

Network size 10 Round 20	RE	2	1.8	1.5
	ANNOS	17	17	18
	ET	4.461	2.354	0.344

Table 1 : show that the comparative analysis between DS, CWM and PROPOSED method for Total Energy Consumption (TEC), Network Life Time (NLT), Residual Energy (RE), Number of Alive Node (ANNOS) and Elapsed Time (ET) using number of nodes is 25, network size is 10 and round is 20.

Input	Parameters	DS [2]	CWM [3]	PROPOSED
Number of nodes 50 Network size 20 Round 30	TEC	0.0761	0.072	0.0374
	NLT	200	203	205
	RE	2.1	2.0	1.6
	ANNOS	14	15	15
	ET	4.488	4.289	0.394

Table 2 : show that the comparative analysis between DS, CWM and PROPOSED method for Total Energy Consumption (TEC), Network Life Time (NLT), Residual Energy (RE), Number of Alive Node (ANNOS) and Elapsed Time (ET) using number of nodes is 50, network size is 20 and round is 30.

Input	Parameters	DS [2]	CWM [3]	PROPOSED
Number of nodes 75 Network size 30 Round 40	TEC	0.0252	0.241	0.0124
	NLT	210	205	210
	RE	2.2	1.9	1.4
	ANNOS	19	18	20
	ET	8.268	3.541	0.345

Table 3: show that the comparative analysis between DS, CWM and PROPOSED method for Total Energy Consumption (TEC), Network Life Time (NLT), Residual Energy (RE), Number of Alive Node (ANNOS) and Elapsed Time (ET) using number of nodes is 75, network size is 30 and round is 40.

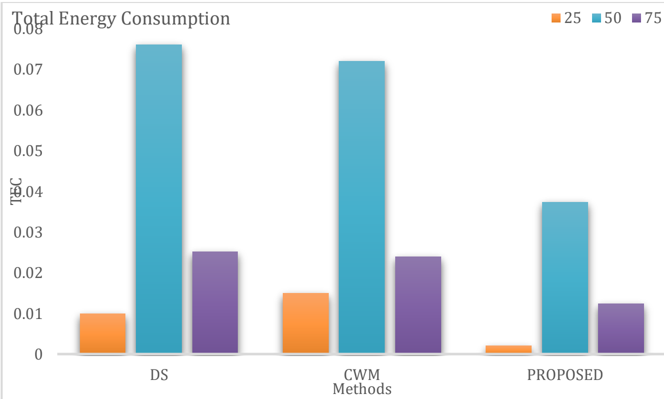

Figure 2: Show that the comparative analysis between DS, CWM and proposed method for Total Energy Consumption using number of nodes are 25, 50 and 75.

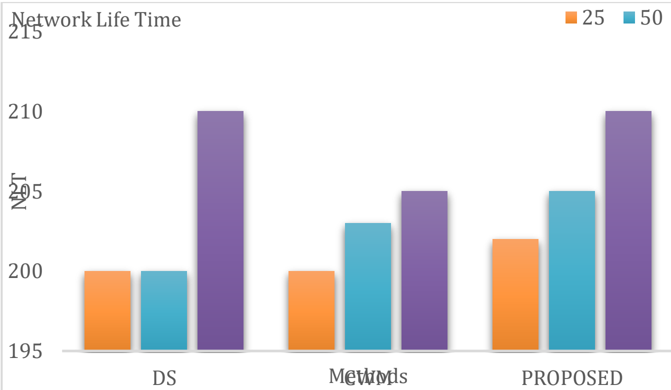

Figure 3: show that the comparative analysis between CMS2TO and proposed method for Network Life Time using number of nodes are 25, 50 and 75.

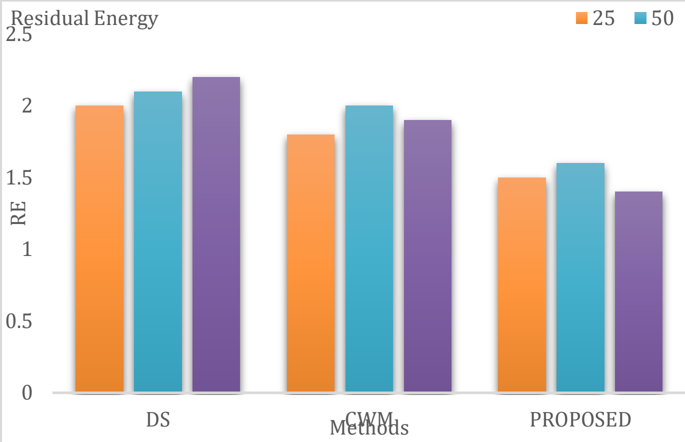

Figure 4: show that the comparative analysis between DS, CWM and proposed method for Residual Energy using number of nodes are 25, 50 and 75.

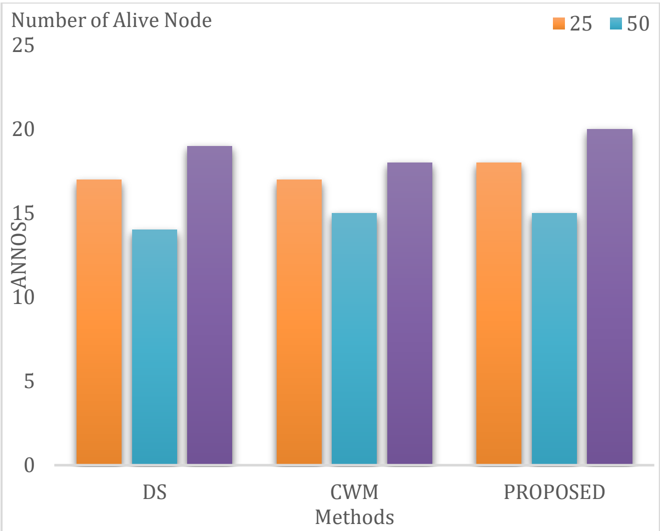

Figure 5: show that the comparative analysis between DS, CWM and proposed method for Number of Alive Node using number of nodes are 25, 50 and 75.

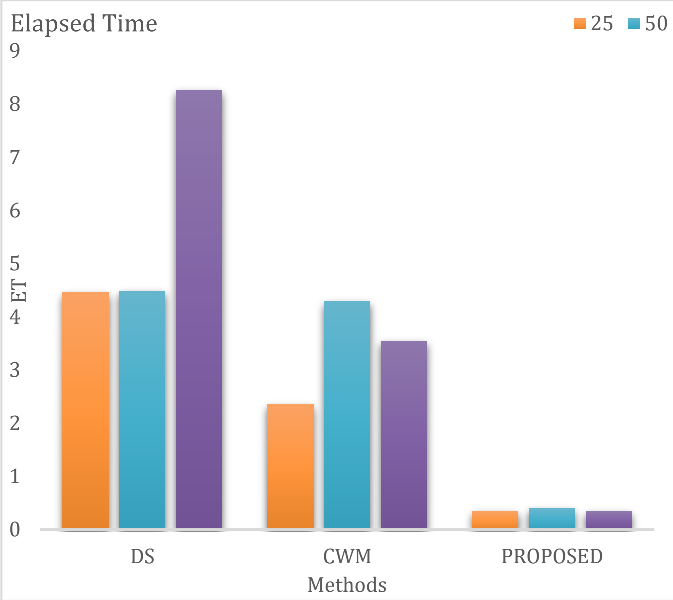

Figure 6: show that the comparative analysis between DS, CWM and proposed method for Elapsed Time using number of nodes are 25, 50 and 75.

VI. CONCLUSION

The efficient energy and optimal distance of target node play vital role in distributed detection of wireless sensor network. The design model is very efficient in terms of optimality and utilization of energy. The applied genetic algorithm defines the weight factor corresponding to distance and estimate the fitness function of local sensor unit data. the process of data fusion defines in time interval T. the process of data fusion also minimizes the issue of data redundancy in fusion methods of wireless sensor network. The process of performance evaluation in different scenario of sensor network with different value of distance measure the value of energy and target node. The existing two algorithm such as CWN (constraint wireless sensor network) and DS (data assisted) fusion methods in wireless sensor network. The detection accuracy of sensor node are increases in compression of CWN and DS methods. the proposed model also increases life of network and reliability of network. Although we considered the energy savings estimations as realistic, consumption may vary for other office settings that include other installations. While we validated our algorithm with MATLAB environment our concept of exchanging fusion ratio, with or without trace-back, lends itself well to other sensing modalities to fuse data in multimodal systems and to allow sensors to even exchange soft-decisions and reliability information.

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