International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463
Vol. 3 Issue 7, July-2014, pp: (34-40), Impact Factor: 1.252, Available online at: www.erpublications.com

An optimization to target coverage using Genetic Approach

Manisha Rana[1], Devender Kumar[2]

[1]M.Tech Student, Dept. of CSE, MERI College of Engineering, Maharishi Dayanand University, Rohtak, Haryana, India
[2]Asst. Professor, Dept. of CSE, MERI College of Engineering, Maharishi Dayanand University, Rohtak, Haryana, India

Abstract: Network lifetime plays an integral role in setting up an efficient wireless sensor network. This paper is about to define an effective target node generation approach that will provide the energy effective over the network and also resolve the problem of location deficiency. In this paper, the network is defined with N number of sensor nodes and M number of target nodes. The work is divided in two main stages. In first stage, the identification of the cover node based on the target node analysis is performed. Once the cover nodes are identified, the next work is perform the activation of the cover node in such way energy consumption in coverage process will be reduced. In this paper, an energy effective approach is defined for Q coverage problem in homogenous sensor network. The energy and distance parameters are used for target generation. Experimental results taken using MATLAB software demonstrate the feasibility of the proposed scheme.

Keywords: genetic approach, Q-coverage, optimization, wireless sensor network, energy efficient.

I. INTRODUCTION

The past few years have seen tremendous increase of interest in the field of wireless sensor network. These wireless sensor network comprise numerous small sensor nodes distributed in an area and collect specific data from that area. The nodes comprising a network are mostly battery driven and hence have a limited amount of energy. The target coverage deals with the surveillance of the area under consideration taking into account the energy constraint associated with nodes. In nutshell, the lifetime of the network is to be maximized while ensuring that all the targets are monitored. The approach of segregating the nodes into various covers is used such that each cover can monitor all the targets while other nodes in remaining covers are in sleep state. The covers are scheduled to operate in turn thereby ensuring that the targets are monitored all the time and the lifetime of the network is also maximized.

II. METHODOLOGY

The genetic algorithm is a method for solving both constrained and unconstrained optimization problems that is based on natural selection, the process that drives biological evolution. The genetic algorithm repeatedly modifies a population of individual solutions. At each step, the genetic algorithm selects individuals at random from the current population to be parents and uses them to produce the children for the next generation. Over successive generations, the population "evolves" toward an optimal solution. Genetic algorithm can be applied to solve a variety of optimization problems that are not well suited for standard optimization algorithms, including problems in which the objective function is discontinuous, non differentiable, stochastic, or highly nonlinear. The genetic algorithm uses three main types of rules at each step to create the next generation from the current population: 1. Selection rules select the individuals, called parents that contribute to the population at the next generation. 2. Crossover rules combine two parents to form children for the next generation. 3. Mutation rules apply random changes to individual parents to form children.

The genetic algorithm differs from a classical, derivative-based, optimization algorithm in two main ways, as summarized in the Table 1. Figure 1 show the Flow Chart of overall research design process.

Table 1: Comparison between classic and genetic algorithm

Classical Algorithm	Genetic Algorithm
Generates a single point per iteration. The sequence of points approaches an optimal solution.	Generates a population of points per iteration. The best point in the population approaches an optimal solution.
Selects the next point in the sequence by a deterministic computation.	Selects the next population by computation which uses random number generators.

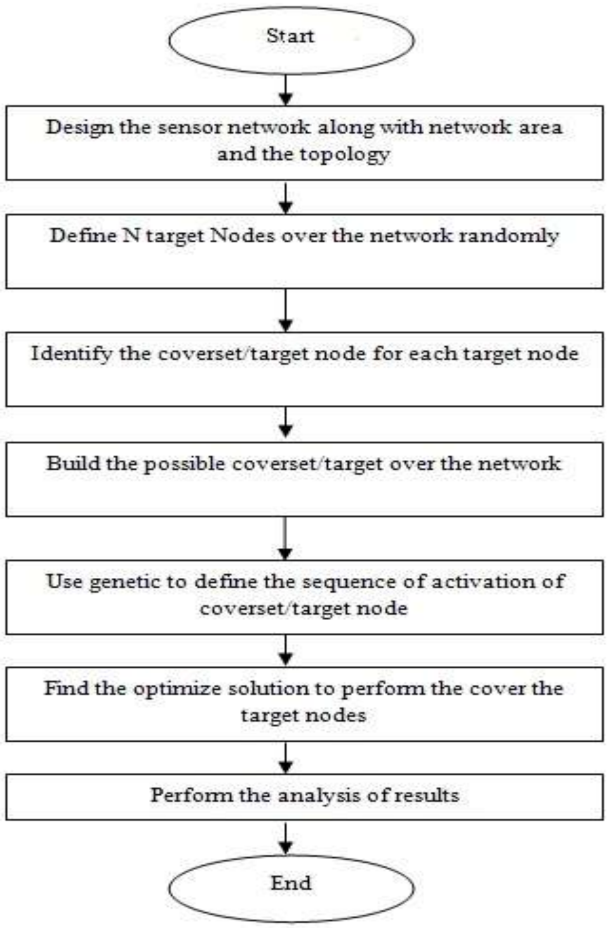


Figure 1: Flow Chart of overall research design process

III. RESULT

For the simulation environment, a static wireless network of sensors and targets which are scattered randomly on 20m × 30 m area is considered. The energy specifications and the sensing range of each sensor node is assumed to be same. Simulations are carried out by varying the number of sensors and the lifetime is measured. The number of targets with various combinations is also varied. The reliability of the system is also analyzed by varying the failure probability of the sensor cover.

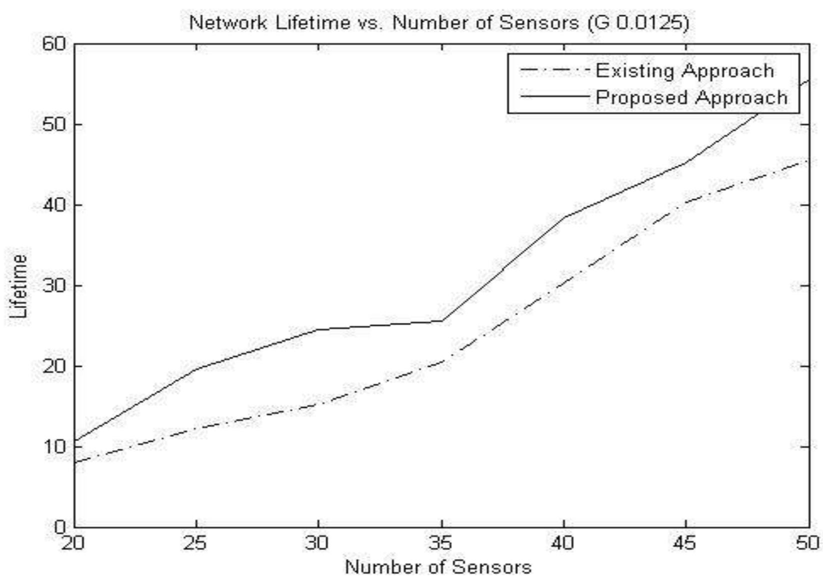
In the first simulation, the network lifetime computed by the existing and the proposed algorithm is compared by varying the number of sensors. In order to make comparison with the existing algorithm we use the same parameters as theirs. The simulation is conducted with 5 randomly deployed targets, 20-50 sensors with an increment of 5. Each sensor has a maximum of 30m sensing range with binary sensing model. The corresponding results are shown in Table 2 and 3.

Table 2: The lifetime of Sensor Networks with 5 Targets and 30m sensing range with G=0.0125

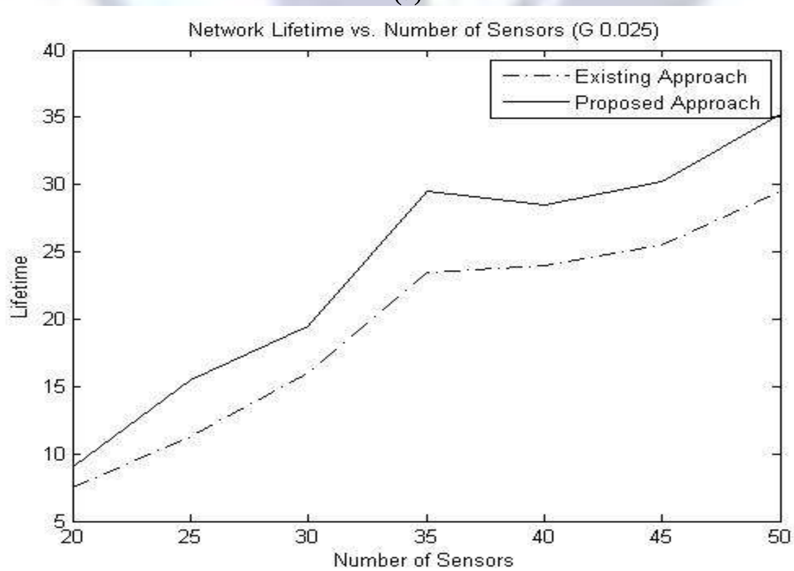
Number of Sensors	20	25	30	35	40	45	50
Proposed Algorithm	10.5	19.5	24.50	25.5	38.25	45.25	55.5
Existing Algorithm	8	12.25	15.25	20.5	30.25	40.25	45.5

Table 3: The lifetime of Sensor Networks with 5 Targets and 30m sensing range with G=0.025

Number of Sensors	20	25	30	35	40	45	50
Proposed Algorithm	9.	15.5	19.5	29.5	28.5	30.25	35.25
Existing Algorithm	7.5	11.25	16	23.5	24	25.5	29.5



(a)



(b)

Figure 2: Network Lifetime vs. Number of Sensors (a) G=0.0125 (b) G=0.025

The results from the simulations in Figure 2 show that the lifetime increases with the increase in the number of sensor density because when more sensors are deployed, each target could be covered by more sensors. The above graphs and tables show that when lifetime granularity of sensors participating in the covers is increased than the network lifetime decreases as the more energy will be utilized by the sensors.

In the second simulation, the number of targets is varied from 3 to 7 as shown in Table 4 and 5. The number of sensors and their sensing range are kept same. The results show variation when the number of targets is increased. As the number of targets is increased more number of sensors is needed to cover these targets. So the number of sensor covers generated decreases as the number of targets increases, because the number of sensors is fixed to 35.So the network lifetime decrease by increasing the number of targets. But proposed parameter based algorithm shows better results than the existing algorithm. As there is less decrease in the network lifetime in the proposed approach.

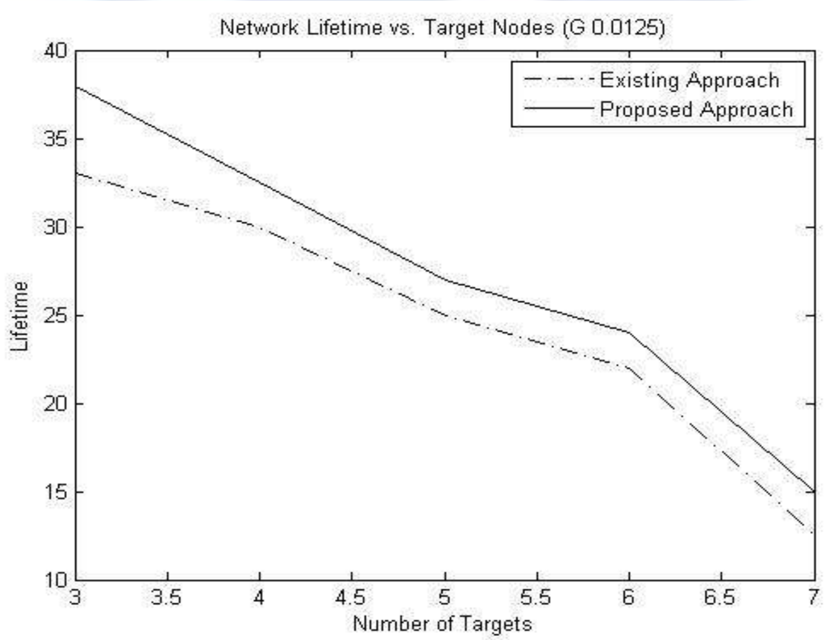
Table 4: The lifetime of the network with 35 Sensors and 30m sensing Range with G=0.0125

Number of Targets	3	4	5	6	7
Proposed Algorithm	38	32.5	27	24	15
Existing Algorithm	33	30	25	22	12.5

Table 5: The lifetime of the network with 35 Sensors and 30m sensing Range with G=0.025

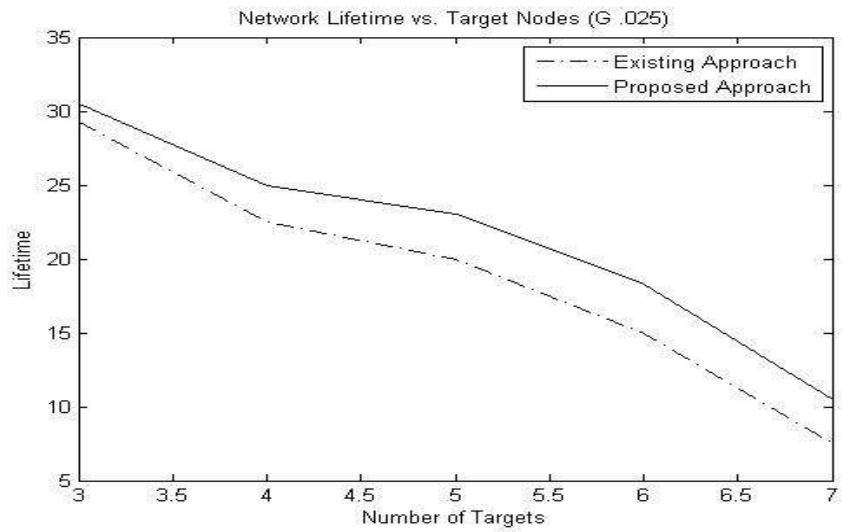
Number of Targets	3	4	5	6	7
Proposed Algorithm	30.5	25	23	18.25	10.5
Existing Algorithm	29.25	22.5	20	15	7.5

The results from the simulations in Figure 3 show that the lifetime decreases with the increase in the number of targets because more sensors are used to cover the targets and thus less covers will be generated. Moreover the proposed parameter based algorithm shows better results than the existing algorithm.



(a)

International Journal of Enhanced Research in Science Technology & Engineering, ISSN: 2319-7463
Vol. 3 Issue 7, July-2014, pp: (34-40), Impact Factor: 1.252, Available online at: www.erpublications.com



(b)

Figure 3: Network Lifetime vs. Number of Targets (a) G=0.0125 (b) G=0.025

In the third and fourth simulation the network lifetime is analyzed by the number of alive and dead sensor nodes in the network with respect to the number of iterations. The number of sensor and target nodes is kept fixed. The sensing range and energy specifications of the each sensor node are also the same as in the previous simulations. In the results the number of alive nodes is found more in the proposed parameter based algorithm than the existing algorithm. The number of nodes dead is also less with the number of iterations in the proposed algorithm than the existing algorithm.

Table 6: The number of alive nodes in the network for numbers of iterations.

Number of iterations	20	40	60	80	100
Proposed Algorithm	30	28	25	21	19
Existing Algorithm	29	26	22	20	17

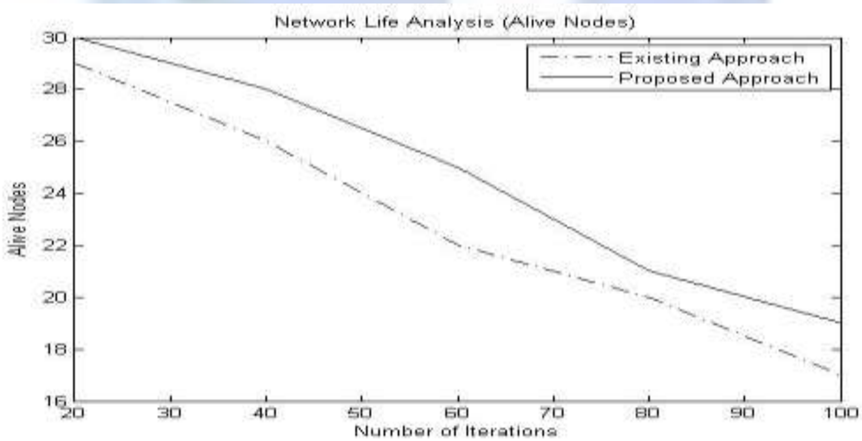


Figure 4: Number of iterations vs. alive nodes

Table 7: The number of Dead nodes in the network for number of iterations.

Number of iterations	20	40	60	80	100
Proposed Algorithm	30	28	25	21	19
Existing Algorithm	29	26	22	20	17

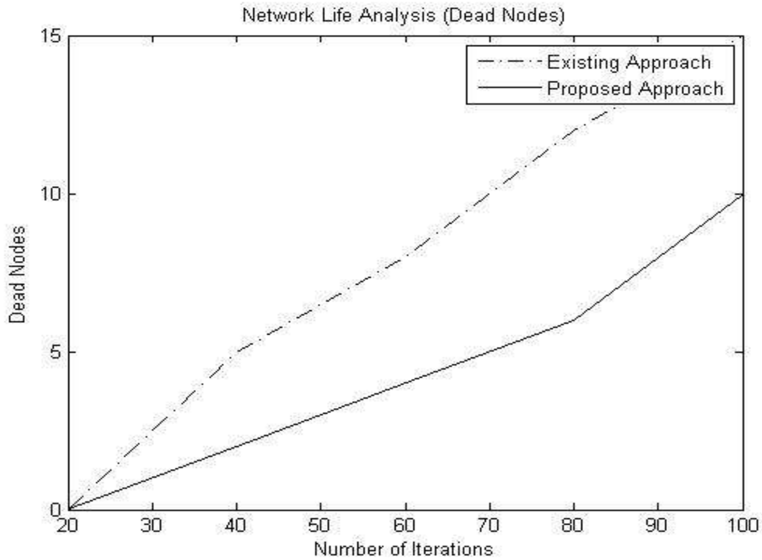


Figure 5: Number of iterations vs. dead nodes

The Figure 4 and 5, and Table 6and 7 shows that the number of alive nodes are more for number of iterations by proposed parameter based algorithm than the existing algorithm .Thus the network performs better as more number of nodes are alive and less number of nodes are dead during each iteration.

IV. CONCLUSION

One of the critical problems in sensor network is the target coverage problem. The criticality of this cover problem increases in case of Q-Coverage problem. In this problem, it is required to monitor or cover these nodes at same time. In this work, an energy and failure analysis approach is defined to cover K Nodes regularly so that the energy effectiveness over the network will be improved. We simulate proposed algorithm by MATLAB software. The obtained results show the improved network life time.

V. FUTURE SCOPE

We will work coverage and connectivity on 3D WSN models by viewpoint energy and distance parameters. In this work, the energy and distance parameters are used for coverset/target generation. In future some sensor node parameters can be used for coverset/target generation.

REFERENCES

[1]. GholamAli Yaghoubi," Connectivity Issue in Wireless Sensor Networks by Using Depth-First Search and Genetic Algorithm", 2010 International Conference on Computational Intelligence and Communication Systems 978-0-7695-4254-6/10 © 2010 IEEE (pp 377-381).
[2]. Nauman Aslam," Distributed Coverage and Connectivity in Three Dimensional Wireless Sensor Networks", "IWCMC'10, June 28– July 2, 2010, Caen, France. Copyright © 2010 ACM 978-1-4503-0062 - 9/10/06 (pp 1141-1145).
[3]. Yinian Mao," Coordinated Sensor Deployment for Improving Secure Communications and Sensing Coverage", SASN'05, November 7, 2005, Alexandria, Virginia, USA. ACM 1595932275/05/0011 (pp 117-128).
[4]. Chi-Fu Huang," The Coverage Problem in a Wireless Sensor Network", WSNA'03, September 19, 2003, San Diego, California, USA. Copyright 2003 ACM 1-58113-764-8/03/0009 (pp 115-121).
[5]. Ashwinkumar Badanidiyuru," Approximating Low-Dimensional Coverage Problems", SCG'12, June 17–20, 2012, Chapel Hill, North Carolina, USA. ACM 978-1-4503-1299-8/12/06 (pp 161-170).
[6]. Vikram P. Munishwar," Coverage Management for Mobile Targets in Visual Sensor Networks", MSWiM'12, October 21–25, 2012, Paphos, Cyprus. ACM 978-1-4503-1628-6/12/10 (pp 107-115).
[7]. Muzammil Hussain," Distributed Localization in Cluttered Underwater environments", WUWNet'10, Sept. 30 - Oct. 1, 2010, Woods Hole, Massachusetts, USA ACM 978-1-4503-0402-3 .

[8]. M Bala Krishna," Computing Methodologies for Localization Techniques in Wireless Sensor Networks", International Conference and Workshop on Emerging Trends in Technology (ICWET 2011) – TCET, Mumbai, India ICWET'11, February 25–26, 2011, Mumbai, Maharashtra, India. ACM 978-1-4503-0449-8/11/02 (pp 1024-1028).

[9]. Diba Mirza," Real-time Collaborative Tracking for Underwater Networked Systems", WUWNet'12, Nov. 5 - 6, 2012 Los Angeles, California, USA. ACM 978-1-4503-1773-3/12/11.

[10]. Liangjie He," Implementation and Emulation of Distributed Clustering Protocols for Wireless Sensor Networks", IWCMC'07, August 12-16, 2007, Honolulu, Hawaii, USA. ACM 978-1-59593-695-0/07/0008 (pp 266-271).