

Contents

1	Introduction to Area Coverage in Sensor Networks	1
1.1	Background	1
1.2	Basic Concepts	2
1.2.1	Sensor Deployment	3
1.2.2	Sensing Models	3
1.2.3	Coverage Classification	4
1.3	The State-of-the-Art Work on Area Coverage	5
1.3.1	Deterministic Deployment	5
1.3.2	Random Deployment	7
	References	8
2	Energy-Efficient Capture of Stochastic Events in Sensor Networks	11
2.1	Introduction	11
2.2	Problem Setup and Performance Metrics	13
2.3	Event Capture by Periodic Sensor	15
2.4	Energy-Aware Optimization of Synchronous Periodic Schedule	16
2.5	Optimization of Asynchronous Periodic Schedule	18
2.6	General Regionally Synchronous Networks	20
2.7	Coordinated Sleep Under Periodic Scheduling	24
2.8	Numerical Results	27
2.8.1	Illustration of Analytical Results	27
2.8.2	Network Simulations	29
2.8.3	Summary of Experiments	32
2.9	Conclusions	33
	References	34
3	Energy-Efficient Trap Coverage in Sensor Networks	35
3.1	Introduction	35
3.2	Preliminary and Problem Formulation	37
3.2.1	Network Model	37
3.2.2	Trap Coverage Model	38
3.2.3	Minimum Weight Trap Cover Problem	39

3.3	Algorithm Design	40
3.3.1	Finding the Diameter of a Coverage Hole	40
3.3.2	Algorithm Overview	41
3.3.3	Removal Strategy Design	42
3.3.4	Algorithm Illustration	46
3.4	Performance Analysis	47
3.4.1	Theoretical Analysis	47
3.4.2	Network Lifetime Analysis	50
3.4.3	Simulation Performance	51
3.5	Localized Protocol	52
3.5.1	Protocol	52
3.5.2	Analysis	56
3.5.3	How to Find the Largest Diameter	58
3.6	Simulation Results	60
3.6.1	Experiment Setup	60
3.6.2	Energy Balance and Consumption	60
3.6.3	Lifetime Performance Evaluation	64
3.6.4	Communication Cost	64
3.7	Conclusions	65
	References	65
4	Trapping Mobile Intruders in Sensor Networks	69
4.1	Introduction	69
4.2	Preliminary and Problem Statement	72
4.2.1	Network Model	72
4.2.2	Probabilistic Trap Coverage Model	72
4.2.3	Problem Statement	73
4.3	Probabilistic Trap Coverage	74
4.3.1	Detection Gain	74
4.3.2	Impact of Maximum Speed	76
4.3.3	Circular Graph	77
4.3.4	(D, ϵ) -Trap Coverage	82
4.3.5	Solving an Open Problem in Barrier Coverage	83
4.4	Localized Protocol	84
4.4.1	Probabilistic Trap Coverage Protocol	84
4.4.2	Protocol Analysis	87
4.5	Performance Evaluation	90
4.5.1	Environment Setup	90
4.5.2	Simulation Results	91
4.6	Conclusion	94
	References	94
5	Conclusions	97

Energy-Efficient Area Coverage for Intruder Detection in
Sensor Networks

He, S.; Chen, J.; Li, J.; Sun, Y.

2014, VIII, 97 p. 32 illus., Softcover

ISBN: 978-3-319-04647-1