

Contents

List of Figures	x
List of Tables	xiv
List of Abbreviations	xv
List of Symbols	xviii
Abstract	xx
1 Introduction	1
1.1 Background	1
1.2 Challenges	5
1.3 Applications	7
1.4 Motivation	9
1.5 Objectives	12
1.6 Thesis Contribution	13
1.7 Thesis Organization	15
2 Prior Related Works	17
2.1 Literature review	18
2.1.1 Data collection in homogeneous networks	18
2.1.2 Data collection in heterogeneous networks	24
2.1.3 Obstacle-aware data gathering	28
2.1.4 Network cut detection and recovery	30
2.1.5 Emergency evacuation system	34
2.2 Research Gaps	38
2.2.1 Issues in data collection in homogeneous networks	38
2.2.2 Issues in data collection in heterogeneous networks	38

2.2.3	Issues in obstacle-aware data gathering	39
2.2.4	Issues in network cut detection and recovery	39
2.2.5	Issues in emergency evacuation system	39
2.3	Summary	40
3	MS based data collection in homogeneous networks	41
3.1	Introduction	41
3.2	Network Model and Energy Model	44
3.2.1	Network model	44
3.2.2	Energy model	45
3.3	Multi-Objective Optimization and Pareto Optimality	46
3.4	Proposed Methodology	47
3.4.1	Set-up phase	47
3.4.2	Proposed MOGWO based algorithm	53
3.4.3	Intelligent routing phase	54
3.5	Performance Analysis	55
3.5.1	Stability period and network lifetime	55
3.5.2	Energy consumption and residual energy	56
3.5.3	Alive nodes	58
3.6	Summary	58
4	MS-based data collection in heterogeneous networks	60
4.1	Introduction	60
4.2	Network Model	63
4.3	Proposed Scheme	64
4.3.1	Optimal number of cluster head and rendezvous point selection	65
4.3.2	A deep learning-based optimal path design mechanism for MS .	70
4.3.3	MS-based data collection mechanism	73
4.4	Performance Evaluation	74
4.4.1	Stability period and network lifetime	75
4.4.2	Residual energy	77
4.4.3	Data collection delay	78
4.4.4	Data lost due to buffer overflow	78
4.4.5	Testbed experiment	82
4.5	Summary	85

5	Obstacle-avoiding data routing scheme for IoT-enabled WSNs	86
5.1	Introduction	86
5.2	System Model and Application Scenario	89
5.2.1	Energy model	91
5.3	Problem Statement	92
5.4	Proposed Work	93
5.4.1	MRFO based optimal number of RP selection and cluster formation phase	93
5.4.2	Obstacle aware optimal path planning mechanism	99
5.4.3	MS Safety Assessment	103
5.4.4	MS-based optimal data routing mechanism	104
5.5	Performance Analysis	105
5.5.1	Testbed experiment	110
5.6	Summary	112
6	MS-based network cut detection and recovery scheme for IoT-enabled WSNs	114
6.1	Introduction	114
6.2	Energy and Network Model	117
6.3	Problem Statement	118
6.4	Proposed Work	119
6.4.1	RLBSO based optimal number of RP selection and path designing mechanism	120
6.4.2	Data forwarder node selection	125
6.4.3	Network cut detection and recovery algorithm	126
6.4.4	MDC-based data gathering approach	130
6.5	Performance Analysis	131
6.5.1	Testbed	135
6.6	Summary	138
7	Indoor emergency evacuation system using IoT-enabled WSNs	140
7.1	Introduction	140
7.2	System Model	143
7.2.1	Network model	144
7.2.2	Assumptions	146
7.3	Proposed Scheme	146
7.3.1	Software unit	147

7.3.2	Hardware unit	147
7.3.3	Shortest safe path planning algorithm	149
7.3.4	Space and time complexity	152
7.4	Simulation Results and Analysis	153
7.5	Summary	161
8	Conclusion and Future Scope	162
8.1	Conclusion	162
8.2	Scope for future work	166
	List of Publications	167
	Bibliography	169