

Centenary Celebrated Sharnbasveshwar Vidya Vardhaka Sangha's



A State Private University approved by Govt. of Karnataka vide Notification No. ED 144 URC 2016 dated 29-07-2017
Recognised by UGC under Section 2f vide No. F.8-29/2017 (CPP-I/PU), dated 20-12-2017 & AICTE, CoA, PCI New Delhi

AN EFFICIENT GENETIC ALGORITHM FOR MAXIMIZING AREA COVERAGE IN WIRELESS SENSOR NETWORK (font size. 16 - bold)

*(A Thesis submitted in partial fulfilment of the requirements for the award of the
degree of Doctor of Philosophy in Mechanical Engineering) (font. Size 12)*

Submitted by (font. Size 14)

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July – 2026 (font size. 14 - bold)

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**FACULTY OF ENGINEERING AND TECHNOLOGY
COMPUTER SCIENCE & ENGINEERING**

CERTIFICATE

This is to certify that **XXXX bearing USN: XXXXXXXX** is a research scholar of Sharnbasva University Kalaburagi, in the Faculty of Engineering & Technology-Computer Science and Engineering. She has satisfactorily completed his/ her research work entitled "**XXXX XXXXXXX XXXXXXX**" and submitted to Sharnbasva University, Kalaburagi for the award of the degree **Doctor of Philosophy** in the Faculty of Engineering & Technology-Computer Science and Engineering. This thesis does not contain any work which has been previously submitted for the award of any degree anywhere.

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DECLARATION

I ABCD declare that the thesis entitled “XXXX XXXX XXXXX XXXX” submitted by me in partial fulfillment of the requirements for the award of the degree of Doctor of Philosophy in Computer Science and Engineering, Sharnbasva University is based on the results of the research work carried out and reported by me under the guidance of Dr. XXXX, Professor, Computer Science and Engineering, Faculty of Engineering and Technology, SHARNBASVA University and Dr. PQR, Professor, Electronics and Communication Engineering, Faculty of Engineering and Technology, SHARNBASVA University.

I also declare that this thesis or any part of it has not been submitted for award of any other degree / diploma of this or any other University / Institute.

I further declare that this thesis has undergone plagiarism verification and it is found to be within the permissible limit.

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It is certified that, XXXX has carried out the research and has prepared the thesis submitted in partial fulfillment of the requirements for the award of the degree on the above-mentioned topic under my guidance and supervision. This thesis has undergone plagiarism check and it is found to be within the permissible limit. Further, this thesis or any part thereof has not been submitted for any purpose to any other University or Institute.

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ACKNOWLEDGEMENT (font size. 16 - bold)

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ABSTRACT (font size. 16 - bold)

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TABLE OF CONTENTS (font size. 16 - bold)

Contents (12)	Page No.
Acknowledgement	i
Abstract	ii
Table of Content	iii – iv
List of Figures	v
List of Tables	vi
List of Abbreviations	vii
List of Notations	viii
 CHAPTER I: INTRODUCTION	 1-18
1.1 Introduction	1
1.2 Review on Genetic Algorithms in WSN Coverage	2
1.3 Importance and Challenges in Area Coverage of WSN	3
1.3.1 Importance of Area Coverage	3
1.3.2 Coverage Issues and Challenges	3
1.3.3 Traditional Coverage Optimization Techniques	4
1.3.4 Hybrid Genetic Algorithms for Maximizing Coverage	4
1.4 Review on Area Coverage Maximization in WSN	4
1.4.1 Review on Adopted Techniques	9
1.4.2 Analysis on Performance Measures	9
1.4.3 Analysis on Maximum Performance	10
1.4.4 Analysis on Performance Measures	10
1.4.5 Research Gaps and Challenges	11
1.4.6 Research Gaps Addressed in This Work	12
1.5 Problem Identification and Motivation (Mandatory)	13
1.6 Objectives (Mandatory)	15
1.7 Original Contributions (Mandatory)	16
1.8 Organization of the Thesis (Mandatory)	
 CHAPTER II: LITERATURE SURVEY	 12-42

- 2.1. Maximizing Area Coverage approaches in WSN
 - 2.2.1 Genetic Algorithms in WSN
 - 2.2.2 Efficient Routing Algorithms for WSN
- 2.4. Research Gaps **(Mandatory)**
- 2.5. Research Objectives **(Mandatory)**
- 2.6. Problem Statement **(Mandatory)**
- 2.7. Research Methodologies **(Mandatory)**
- 2.8. Summary of the Chapter **(Mandatory)**

CHAPTER III: SELF-IMPROVED JELLYFISH OPTIMIZATION FOR EXTENDING COVERAGE IN WSNS

- 3.1 Introduction
 - 3.1.1 Design Issues
 - 3.1.2 Contributions
- 3.2 Overview of Self-Improved Jellyfish Optimization
- 3.3 Design of Proposed Model
- 3.4 Simulation Environment and Result Analysis
 - 3.4.1 Simulation Environment
 - 3.4.2 Simulation Results
 - 3.4.3 Result Analysis
- 3.5 Summary

CHAPTER IV:

CHAPTER V:

CHAPTER VI: CONCLUSIONS AND FUTURE ENHANCEMENT

- 6.1 Conclusion
- 6.2 Future Scope

LIST OF PUBLICATIONS

REFERENCES

LIST OF FIGURES (font size 16)

Figure no.	Description (font size. 12)	Page no.
1.1	Flow Diagram for proposed Methodologies	14
2.1	Architecture of a Wireless Sensor Network	22
2.2	Cluster-Based Deployment	26
2.3	Multi-Hop Communication Model	29
2.4	Coverage Models in WSNs	31
3.1	Framework of proposed SIJSO approach for nodal coverage expansion	38

LIST OF TABLES (font size 16)

Figure no.	Description (font size. 12)	Page no.
3.1	Simulation Parameters for designing SIJSO	47
3.2	Statistical study on SIJSO and traditional approaches in terms of distance for sensing radius 10m	51
3.3	Statistical study on SIJSO and traditional approaches in terms of distance for sensing radius 20m	52
3.4	Analysis on coverage area for SIJSO and conventional methods for 10m	54
3.5	Analysis on coverage area for SIJSO and conventional methods for 20m	31

LIST OF ABBREVIATIONS (16)

ABC	Artificial Bee Colony algorithm
ACBOA	Adaptive Cauchy variant Butterfly Optimization Algorithm
BMO	Blue Monkey Optimization
BOA	Butterfly Optimization Algorithm
BPA	Basic Probability Assignment
BWO	Beluga Whale Optimization algorithm

LIST OF NOTATIONS (16)

α	Clock skew of a node
β	Clock offset of a node
γ	Intracuster synchronization factor

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CHAPTER I (16)

INTRODUCTION (14)

1.1 Overview of the Wireless Sensor Networks (12)

Wireless Sensor Network (WSN), is an infrastructure-less wireless network that is deployed in a large number of wireless sensors in an ad-hoc manner that is used to monitor the system, physical, or environmental conditions. ----- (12) (line spacing 1.5)

Sensor nodes are used in WSN with the onboard processor that manages and monitors the environment in a particular area. They are connected to the Base Station which acts as a processing unit in the WSN System. The base Station in a WSN System is connected through the Internet to share data. WSN can be used for processing, analysis, storage, and mining of the data [1].

1.2. Wireless Sensor Network Architecture

A Wireless Sensor Network (WSN) architecture is structured into three main layers:

- **Physical Layer:** This layer connects sensor nodes to the base station using technologies like radio waves, infrared, or Bluetooth. It ensures the physical communication between nodes and the base station.
- **Data Link Layer:** Responsible for establishing a reliable connection between sensor nodes and the base station. It uses protocols such as IEEE 802.15.4 to manage data transmission and ensure efficient communication within the network.
- **Application Layer:** Enables sensor nodes to communicate specific data to the base station. It uses protocols like ZigBee to define how data is formatted, transmitted, and received, supporting various applications such as environmental monitoring or industrial control [3 - 4].

These layers work together to facilitate the seamless operation and data flow within a Wireless Sensor Network, enabling efficient monitoring and data collection across diverse applications.

1.3. WSN Network Topologies

Wireless Sensor Networks (WSNs) can be organized into different network topologies based on their application and network type. Here are the most common types:

- **Bus Topology:** In a Bus Topology, multiple nodes are connected to a single line or bus. Data travels along this bus from one node to the next. It's a simple layout often used in smaller networks.
- **Star Topology:** Star Topology have a central node, called the master node, which connects directly to multiple other nodes. Data flows from the master node to the connected nodes. This topology is efficient for centralized control.
- **Tree Topology:** Tree Topology arrange nodes in a hierarchical structure resembling a tree. Data is transmitted from one node to another along the branches of the tree structure. It's useful for expanding coverage in hierarchical deployments.
- **Mesh Topology:** Mesh Topology feature nodes interconnected with one another, forming a mesh-like structure. Data can travel through multiple paths from one node to another until it reaches its destination. This topology offers robust coverage and redundancy.

Each topology has its advantages and is chosen based on factors such as coverage area, scalability, and reliability requirements for the specific WSN application.

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