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# WSN Localization in 3-D Environments to Minimize the Localization Errors

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**Abstract:** ***The development of wireless sensor network have brought dominant transition in the current extent of research and development because it isextensively used in the various applications around the world. Localization of sensor nodes is one of the major obstacle in WSN.The localization is the process of hierarchical connectivity between the sensor nodes. The localization process is prone to various types of localization errors, which affects the connectivity of individual nodes or the group of nodes. The priority of the nodes is defined in many data forwarding techniques. A falsified priority mechanism may lead the data of several sensor nodes towards the dead ends, which causes the data unavailability on the sink nodes and leads towards the partial or false analysis. In this paper, we are proposing a new techniques for localization and edge node (dead end) marking.The accuracy of presented approach will be high.The performance of the proposed system will be measured using the number of connected nodes with sink node, hop count, delay, drop ratio of packet, etc.***

**Keywords:** WSN, localization, dead ends, edge node marking, localization errors

## 1. Introduction

The existing era of Research and Development has been blessed up with unique emerging trend acknowledged as Wireless Sensor Network over few years.WSN field is highly significant as it serves a major backbone for incredible variety of applications.The development Of WSN has provided motivation for deployment of these networks in various applications including Security and Surveillance, Industrial applications, Environmental Monitoring, Medical Diagnostics, Animal Tracking, Detection of Landslide and Forest Fires, Natural Disaster Prevention.WSN commence to become a reality, and a number of unmarked limitations has become a crucial space of analysis.

The term Wireless Sensor Network can be described as Adhoc Network which comprises cluster of sensors of identical or numerous types that are connected to each other by a communication network.WSN is formed with number of nodes that are termed as Sensors which are small,smart,low priced and throwaway devices that are capable of sensing and performing computation.A sensor node is a primary component that accomplishes some operation, assembles all the auditory knowledge and interacts with all the linked nodes that are deployed arbitrary in a network.The nodes that are deployed over some geographical area sense the information from the area and forward the sensed information to an intermediate location known as Base Station.These sensor nodes function collaboratively.Therefore to estimate the location information of sensor nodes is a technical challenge in WSN.

Localization is part and parcel of Wireless Sensor Network.The field of localization has drawn interest of Researchers and Scholars from many years.Localization is the fundamental techniques in WSN. Localization is a vital research area as it assists various functions of WSN such as Deployment Of Nodes, Management of Network, Routing, Topology Design, Coverage, Tracking of Targets, Record and Detection of Events.

The location information of Sensor Nodes is one of the foremost critical issue of WSN. The accurate position information of sensor nodes facilitates proper functioning of WSN. In most applications of WSN, localization is used to detect the node that interrupts normal operation of WSN and report to base station that which node was responsible for the disruption of WSN activities. The task of determining which node caused abnormal event in WSN activities or where the sensor nodes are placed in a Network and how we will obtain the location information about these sensor nodes is referred as Localization Problem .Thus how to attain the location of sensor nodes placed in a network that are not aware of their coordinates cost effectively and compactly has become a substantial matter of concern.

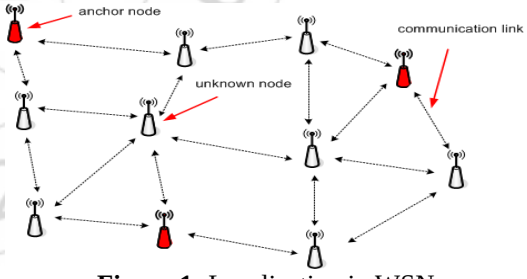


**Figure 1:** Localization in WSN

The localization techniques are applied in WSN to determine the coordinates of unknown node with help of anchor nodes. These anchor nodes are specific kind of sensor nodes who have knowledge about their coordinates in the network with the help of GPS.But equipping nodes with GPS involves high energy consumption,extra support of hardware,immense amount of memory making it an extravagant approach.

A wide variation of node localizationalgorithm have been designed for localization in WSN. The current localization technique can be grouped into two types:

- Range-Based Localization
- Range -Free Localization

Range- Based localization techniques will achieve the position of unknown node with the calculation of angle or distance information between sensor nodes and persuade the location of node with the employment of trilateration or triangulation .The most prominent methods are Time Difference Of Arrival(TDOA), Time Of Arrival(TOA),Received Signal Strength(RSS) and Angle Of Arrival(AOA).However range based technique attains precise information about sensor nodes but is an overpriced way to get angle ,range or distance calculations. On the other hand,Range-Free localization techniques determine the location of unknown node with the help of node connectivity in WSN. They do not require any information about range, angle or distance of nodes and are economical to use. Hence how to enhance the accurate positioning of sensor nodes in range-free algorithms have fascinated Research Workers.

## 2. Literature Survey

Chen, et.al. [1] have developed a novel 3D localization algorithm based on DV-Hop which is based upon Conventional DV-Hop Algorithm that suffers from high localization errors for finding out unknown nodes and covers small area.These demerits lead to the development of novel 3D DV-Hop that improves per hop distance for the calculation of distance between unknown nodes and anchor nodes and Total Least Square Method for changing the anchor node location deviation.

Gayan, et.al. [2] have improved DV-Hop algorithm through anchor point re-estimation. With the help of DV-hop algorithm evaluation of known anchor locations is done. Then the optimization technique is applied for under estimating the location errors .Method of Least Square is used with altered hop size for obtaining location of unknown nodes.

Wu, et.al. [3] presented RCDV hop localization algorithm for WSN which is composed of two parts:-RDV -Hop and CDV-Hop. RCDV minimizes the position errors between unknown and anchor node and provides better location information about the sensor nodes.

Bal, et.al. [4] prepared a Testbed for localization and tracking in WSN that focus on importance of employment of WSN and WSN localization in automation environment.

Shekofteh, et.al. [5]developed a localization algorithm using Tabu Search and Simulated Annealing for WSN in which localization takes two steps for completion.In the primary step,accurate estimation of nodes location is done by using Tabu Search.The second step involves Simulated Annealing Algorithm(SAA) which process the location estimates of node that possess flip ambiguity drawback.

Pei, et.al. [6]workedon anchor free localization technique for mobile targets in coal mine WSN that is based on Nonmetric Multidimensional Scaling (MDS) and RankSequence.At first construction of coal mine WSN in underground mines is done on the basis of Zigbee technology. Later a Nonmetric MDS algorithm measures the location of reference node. Lastly an improved sequence based location algorithm is conferred for completing the exact localization for mobile targets.

Kumar,et.al. [7] worked on meta heuristic range–based node localization algorithm for WSN in which representation of error model is done for the evaluation of best node location by reducing the location error with the help of HPSO and BBO algorithms. The proposed HPSO and BBO algorithms are considered for improving the location of sensors and accomplish high with respect to current optimization algorithms such as Genetic Algorithms(GA),Simulated Annealing Algorithm.

Tang, et.al. [8]conducted research on node localization algorithm based on moving beacon node that serves as basis upon traditional DV-hop algorithm.

## 3. Problem Formulation

Considering the given scenario of base paper,A novel three-dimensional localization algorithm based on DV-HOP is proposed and implemented. The existing algorithm is capable of WSN localization on the basis of 3-D coordinates of the nodes. The existing algorithm uses various methods to find out the actual distance and actual position of the unknown node. The unknown node is the entity which is not yet a part of the WSN cluster. The existing technique is not able to handle and mark the dead ends and notdesigned to handle the localization errors. The localization errors are the errors where the nodes choose the path or the route other than the best available path. Sometimes some nodes remains unknown even after localization due to localization errors.The localization errors have to be handled effectively in order to collect the maximum possible data from WSN. It may also improve the cluster lifetime. The dead ends are the WSN nodes on the edge, which has to be detected and marked as dead end, so that no node sends any data toward these nodes. If some WSN node will send data towards the dead ends, the data will reach nowhere. This may cause the calculation errors due to inappropriate data collection, which may be caused due to unmarked dead ends.

## 4. Proposed Research Model

In the proposed model,we will work on the robust 3-D localization by enhancing the existing algorithm. The algorithm enhancement will include the edge node marking and minimizing the localization errors. The edge node marking technique would be implemented as a part of the proposed localization algorithm based on localization algorithm in 3-D space. The major objective of the proposed model is to maximize the WSN node connectivity and to minimize the localization errors in the WSN nodes.

## 5. Methodology

At first, the literature on the WSN localization protocols and WSN processes would be studied in detail. Then the algorithm flow would be reviewed and refined in case any changes are required. Afterwards, the algorithm would be programmed in NS-2. The experimental resultswould be thoroughly analyzed and compared with the existing

algorithm results. This is also very important to get the information aboutthe parameters used for wireless sensor network localization protocol simulations. This project would be implemented in the NS-2 simulator. A thorough performance and feature testing model would be formed and utilized to analyze the performance of the simulated clustering protocol, to detect the flaws and to recover them. Afterwards, the experimental results would be thoroughly analyzed and compared with the existing localization algorithms to examine the performance of the new WSN localization algorithm.

## 6. Conclusion

Due to the weak points of existing algorithm which outcomes in localization errors and is inadequate for handling the dead ends, we have come up with a newly designed 3-dimensional localization approach in order to minimize the localization inaccuracy and adverse effects on data delivery processes to localization errors to mark the edge nodes (called dead end nodes or connectivity holes). The proposed model will also excel the location precision of the nodes while performing the process of localization. The performance of the proposed model will be measured using the various performance parameters like positioning error, localization coverage rate, positioning coverage, positioning rate, etc. In the future the proposed algorithm will be implemented using the most adaptable simulator. The NS-2 simulator has been selected for the purpose of development of the proposed model.

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