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Threshold DV-HOP based Localization Technique for WSN

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Abstract
Localization in Wireless Sensor Networks has become a crucial research challenge. In many applications, the exact location of the sensor nodes is unknown after deployment. Localization is a process used to locate sensor nodes' positional coordinates. WSN type of network where various nodes consists of moving and static topology. There are sink nodes where whole data is collected once it will be sensed by stationary and mobile wireless sensor node. This process of collecting the data is undertaken after each interval of time. For data transmission of data from sensor node to the base station through the cluster head requires energy that is battery power. Current research objective is to make system such that minimum energy should be wasted. Threshold based DV-Hop localization algorithm. Rather than calculate the all beacon node average weighted distance. Technique will be used will set the threshold over to the hop count. So that only those beacon nodes will be considered for average weighted hop distance, whose hop distance is less than or equal to the threshold hop distance. In result it will reduces the computational and storage overhead. Because doing so requires less energy because base sink remains nearer and shorter path is identified. But the technique are being experimented using various parameters like Energy, Time, error rate etc. so that each parameter can be tested for having better system analysis. The parameters like Energy, Time, and error rate has shown the improvement in current research compared to the previous research.

Keywords: Hop Count, DV hop, Residual Energy

Introduction

Wireless sensor networks (WSNs) are most important technology in this century. WSN composed of various nodes called as sensors. By the advancement in area of microelectronic mechanical systems (MEMS) [Jennifer Yick, Biswanath Mukherjee, Dipak Ghosal, 2008] as well as wireless communication technology small, cheap and smart sensors are positioned in physical area and connected through wireless links and the internet provides remarkable opportunities for various applications. WSN is a network in which nodes are deployed at physical area of interest or very close to that area for monitoring that particular area [Majidreza Shams Zahraie, Alireza Zareh Farkhady, Abolfazl Toroghi Haghighat, 2009]. The locations of sensors need not to be pre-planned. Embedded microprocessors and radio transceivers are combined with sensors nodes. Sensor nodes are used for sensing the data, processing the data and for communication purpose [Rajdeep Kaur, Ravneet Kaur, Gursharan Kaur, 2014].

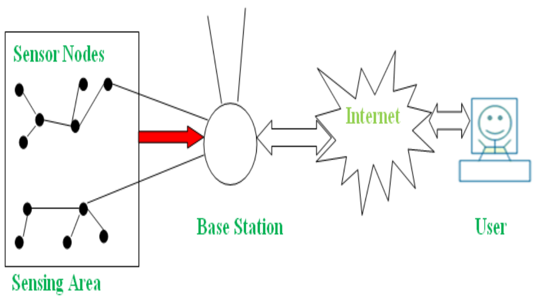


Fig.1.1: A general layout of a wireless sensor network

As shown in figure 1.1, a WSN is usually deployed within a geographical area (called sensing area shown in rectangle), where there is some event to be measured

[Gaddafi Abdul-Salaam, Abdul Hanan Abdullah, Mohammad Hossein Anisi, 2015]. Sensor nodes (black dots) are scattered inside the sensing area in order to attain the sensing task effectively and accurately. When sensor nodes obtain data from their locality they send this data continuously or periodically to the base station [Archana Pandita, Dr. P.K Upadhay, 2015] (shown by circle with antenna) directly as well as by following proper routing path (shown as solid lines). On the other hand, a base station is responsible for processing, analyzing and extracting meaningful information from collected data to provide an overall view of the sensing area being detected. Sink node and sensor nodes are two components in the infrastructure of wireless sensor network. Sink nodes are considered as base station in the network that wirelessly receive and collect data package generated from all the sensor nodes in the network and provide them to the user. Nowadays, WSN become very useful infrastructure to extract the data from environment and also to monitor environmental parameters [Bahmanyar Esfandiari Far et al., 2014]. WSN is a platform which is provided to sensor nodes for sensing and monitoring a particular region. There are many applications of WSN like hospitality, environmental monitoring, and homeland security [Abdul Wahid Ali, Parmanand, 2015]. The localization in WSN is a substantial key enabling technology, attracting relatively large research interest. With the limited resources of network sensors, as well as their high failure rate, many challenges prevail in the automatic determination of the sensor's location. Various application requirements such as scalability, energy efficiency, cost, consistency, responsiveness and privacy affect the research and development of sensor localization systems.

Single-hop vs. Multi-hop algorithms.

A direct link between two neighbor nodes is called a hop. Localization algorithms that make use of single hop radio information are called the one-hop or 'single hop'.

Single-hop localization is possible when a maximum number of beacon nodes is comprised of one hop neighbors of a blind-node. A GPS system is a good example. It uses satellites as beacons and performs multi lateration to detect position a mobile target on the earth's surface [6]. When the distance between two nodes is greater than the radio range but there are other nodes that create a continuous path between them, the path is called a multi-hop path. In WSNs that cover a very large area, such as a forest, there are many node pairs that can only communicate over a multi-hop path. The structure of such a WSN is called a multi-hop topology.

The single-hop algorithms are lighter and simpler than multi-hop solutions but they have severe scalability problems. Whereas multi-hop localization schemes are much more scalable because of their distributed nature.

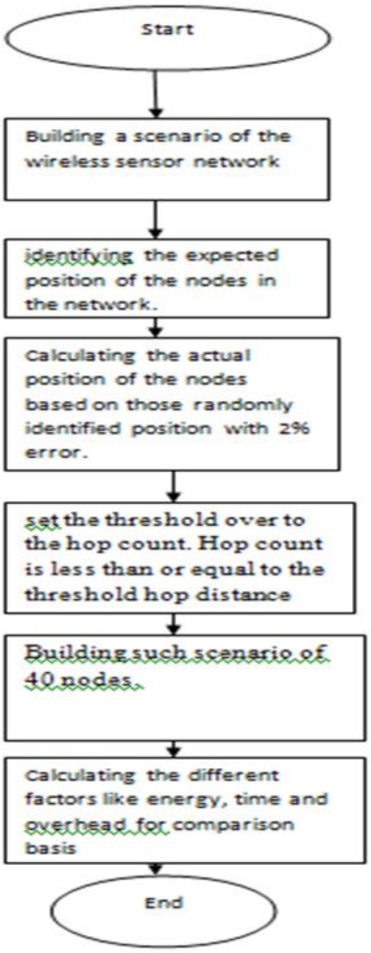
Related Work

Harsimran Kaur(2015) The wireless sensor networks are prone to various connectivity, coverage and localization issues. All of these three terms are related to the neighbor formation, connectivity and convergence of the sensor networks. The techniques surveyed under this survey are novel three-dimensional localization DV-Hop algorithm (NTLDV-HOP), distance vector hop (DV-HOP).[26] Qihong Tao(2016) Positioning scheme is one of the fundamental issue in wireless sensor network (WSN), especially for the situation needing the accurate position of sensed information. Many approaches have been performed to identify the inaccurate node localization. DV-Hop (Distance Vector-hop) is a well-known localization algorithm [1,2]. In wireless sensor network with conventional algorithm for DV-Hop localization, ordinary nodes use average hop distance value estimated by the nearest beacon node to locate themselves. However, hop distance value estimated by only one beacon node may not reflect the true situation accurately. For the purpose of further improving the position accuracy, in view of the analysis of DV-HOP algorithm, Ordinary nodes reference estimated average hop distance node and operate on weighted numbers of hop from multiple beacon nodes to make network average hop distance estimate more accurate and improve positioning accuracy[2]. Yunzhou Zhang(2014) collinearity theory is widely used in large-scale sensor network. When the anchor nodes are located at almost a straight line, the collinearity phenomenon will happen and usually cause negative influence on positioning accuracy. From detailed analysis of the relation between DV-Hop localization error and the collinearity, To select the anchor nodes which can meet the condition of hop count threshold and collinearity to participate in the localization procedure[15].

Xiao Chen(2012) Average one-hop distance between anchor nodes is modified, and the average one-hop distance used by each unknown node for estimating its location is modified through weighting the received average one-hop distances from anchor nodes. Finally, we use the particle swarm optimization to correct the position estimated by the 2D hyperbolic localization algorithm, which makes the result closer to the actual position. The simulation results show that the proposed algorithm has better localization performance in the localization precision and stability than the basic DV-Hop algorithm and some existing improved algorithms[18]. Abdullah Alomari(2016) Localization is essential to consider in relation to wireless sensor networks issues. Establishing mobility in the localization process creates improvements in various regards. Static path planning is one of a number of mobility models that are used in localization in wireless sensor networks. Most static path planning models depend on trilateration or triangulation concepts in direct connection fashion between unknown nodes and anchors for successful node localization; however, such methods are insufficient in cases of mobility discontinuity[1]. Hongyang Chen(2008) Aiming at the positioning problem of wireless sensor network node location, an improved DV-Hop positioning algorithm is proposed in this paper, together with its basic principle and realization issues. The proposed method can improve location accuracy without increasing hardware cost for sensor node. Simulation results show that it has good positioning accuracy and coverage[27]. Abdelali Hadir(2014) Several localization algorithms have been proposed to accurately locate nodes. These algorithms can be categorized into two main families: range-based and range-free. Algorithms using the range-based technique are mainly based on exact computation of the distance or the angle between two nodes (i.e., transmitter and receiver) in the network. Thus, the position can be obtained using trilateration or triangulation.

Algorithm
Step1: Build a scenario of the wireless sensor network having specific area of working and no. of nodes and energy at each node.
Step2: Consider four sink nodes also called as becon nodes. Where whole data will be collected.
Step3: Identify the expected random positions of each wireless sensor nodes. Where there can be the position of the real wireless sensor node can be occurred.
Step4: Dynamically identify the intermediate nodes using which source node send the data to the destination node. The number of hop should be less than the threshold count.
Step5: Evaluate the energy and time for whole communication for sending the packets from source to the destination.

Flowchart



Results

Snap shot of DV-Hop Localization without Setting Threshold

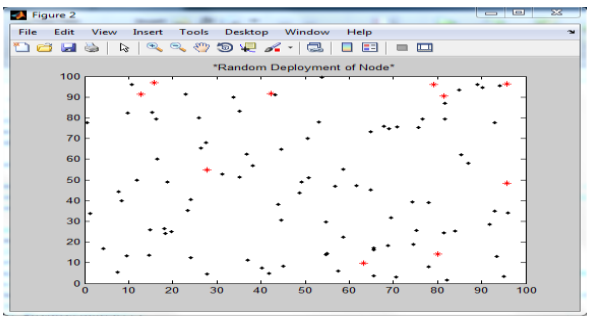


Fig. 5.1: (without threshold)

Snap shot of DV-Hop Localization with Setting Threshold

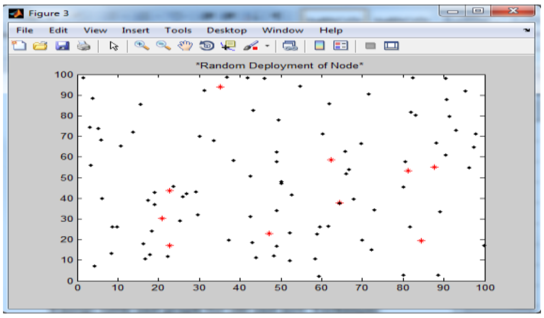
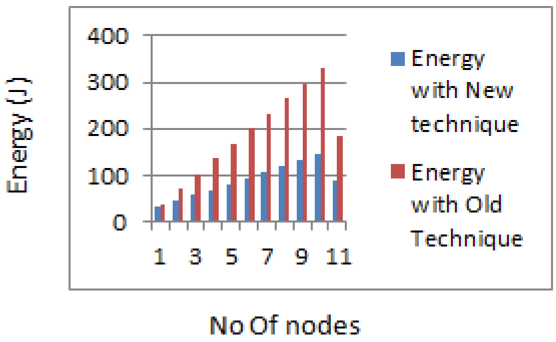


Fig. 5.2: (with threshold)

Energy table and graph for old and new Technique
As from above graph it is clear that the energy dissipation in old as well as new technique there is large difference. Energy in case of new technique is very less compared to the old technique. The results in case of energy has shown the improvement of 43%.

Table 5.1

Energy with New technique	Energy with Old Technique
32	37
44.4	69.4
56.8	101.8
69.2	134.2
81.6	166.6
94	199
106.4	231.4
118.8	263.8
131.2	296.2
143.6	328.6
87.8	182.8



Result Improved is

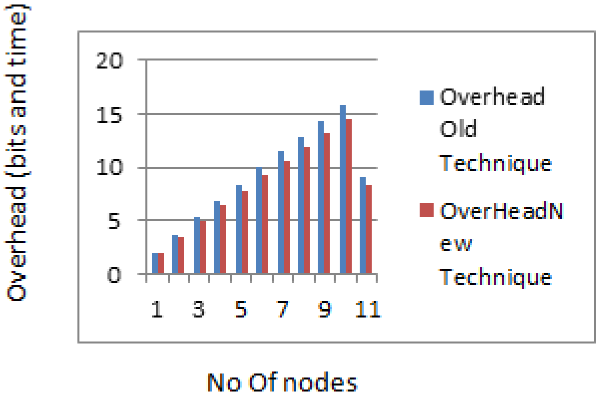
Average Result	**43.18844054**

Overhead table and graph for old and new Technique
Overhead in case of new technique has improved. That is there are less overhead in case of new technique in comparison to the old technique. Overall the results has shown the improvement of 91%.

Table 5.2

Overhead of Old Technique	Overhead of New Technique
2	2
3.714213562	3.564214
5.332050808	5.032051
6.9	6.45

8.436067977	7.836068
9.949489743	9.19949
11.44575131	10.54575
12.92842712	11.87843
14.4	13.2
15.86227766	14.51228
9.096827819	8.421828



Average Results improved

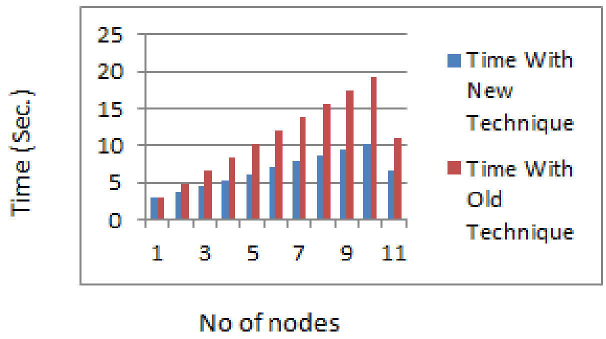
Average Results	21.24362

Time table and graph for old and new Technique

As in case of time the results again has shown the improvement. There requires less time in case of new technique. That is total time taken for communication in case of new technique is 91% less. It is Because of threshold on hop count.

Table 5.3

Time With New Technique	Time With Old Technique
3	3
3.8	4.8
4.6	6.6
5.4	8.4
6.2	10.2
7	12
7.8	13.8
8.6	15.6
9.4	17.4
10.2	19.2
6.6	11.1



Average Results Improved

Average Results	41.24362

Conclusion

Localization is the most important issue as far as nodes positioning is concerned. Because in initial nodes are positioned randomly in specific area. While sending the data from source to the destination DV-Hop will identify the distance vector hop based path. this path includes various intermediate nodes so that data can be travelled through these intermediate nodes. In current research work while identifying the intermediate nodes to arrive at beacon nodes. Whichever will be having minimum number of hops will be considered the path. but the hop count should be limited to the threshold limit. Beyond this threshold limit the path to the beacon node will be rejected. The new technique based on threshold limit imparts better result in all the parameters like energy shows the 43% improvement, overhead shows that there is 21% improvement and time factor shows the improvement of 41%. So the threshold limit will stop the node to go on comparing the average weight. Which will in result reduces the time and energy requirements and also shows the improvement in overhead.

Future Work

Current research is based on DV-Hop with threshold. In future we can fix the z trajectory. So that path that will be checked only on those nodes which lies on the z-trajectory.

References

1. Abdullah Alomari, Nauman Aslam, William Phillips, Frank Comeau," Using the DV-Hop Technique to Increase the Localization Ratio in Static Path Planning Models in Wireless Sensor Networks", 2016 10th International Symposium on Communication Systems, Networks and Digital Signal Processing vol. 3 issue 4. pg 12-21,2016.
2. Qihong Tao1,a,Linghua Zhang2," Enhancement of DV-Hop by Weighted Hop Distance", IEEE,vol 4, issue 4, pg 9613-24,2016
3. M.S. Aruna, Ridha Bouallegue, and E. Cayirci, "Comparative study of learning-based localization algorithms for Wireless Sensor Networks," Computer Networks J., 38(4), Vol. 3, issue 4,pg. no. 393–422, 2015.
4. Gabriele Oliva, D. Evans, "Localization for Wireless Sensor Networks:protocols and Perspect," Proc. 10th Annual Int. Conf. on Mobile Computing and Networking, Philadelphia, PA, USA, 2015.
5. Xin Tan and S.S. Iyengar, "Localization in Cooperative Wireless Sensor Networks: A Review,", issue 4, vol. 5 pg 456-62,2015
6. M. R. Ghafouri Fard," Angle of Arrival Localization for Wireless Sensor Networks," vol. 3 issue 4. pg 21-29,2015
7. Ravi chander Janapati, H.C. So, W.K. Ma, Y.T. Chan, ''Received Signal Strength Based Mobile Positioning via Constrained Weighted Least Squares,'' Proc. of Int. Conf. on Acoustics, Speech, and Signal Processing (ICASSP 2003), issue 3,vol. 5,pg 567-72, 2015.
8. Sunil Kumar, Nabanita Das, "Multiple Sink Deployment in Multi-Hop Wireless Sensor Networks to Enhance Lifetime", Application and Innovations in Mobile Computing, issue 3 vol. 3 pg 34-42,2015.
9. Kai Yik Tey, H. Lichtenegger, and J. Collins, Global Positioning System: Theory and Practice, 3 rd ed. New York, NY: Springer-Verlag, vol. 4 issue 6. pg 32-37, 2014.

10. Amitangshu Pal, Jau-Der Shih, Bo-Han, and Tin-Yu Wu "A Network Lifetime Enhancement Method For Sink Relocation and Its Analysis in Wireless Sensor Network", IEEE Sensor Journals, VOL. 14, NO.6, pg 1932-1943,2014.
11. Griffith S. Klogo, N.M. Abdul Latiff, and N.N. Nik Abdul Malik, "Energy Efficient Protocol in Wireless Sensor Networks using Mobile Base Station", IEEE 2nd International Symposium on Telecommunication Technologies, issue 6 vol. 3,pg 56-60,2014.
12. Azzedine Boukerche, S.Alirezaee, S.Makki, "Wireless Sensor Network Energy Minimization Using the Mobile Sink", 7th International Symposium on Telecommunications, IEEE, issue 3 vol. 5,pg 1184-1188,2013.
13. Hanen Ahmadi, C. Lanzl, "Designing a positioning system for finding things and people indoors," Spectrum, IEEE, 35(9),issue 3 vol. 5, pg 71-78, 2013.
14. Yao-Hung Wu, "A distributed location system for the active office," IEEE Network, 8(1), 62-70, 2013.
15. Yu Hu • Xuemei Li," An improvement of DV-Hop localization algorithm for wireless sensor networks", Telecommun Syst 53:vol. 5 issue 6,pg.13–18,2013
16. Neal Patwari and V. Padmanabhan, "RADAR: An in-building RF-based user location and tracking system" Proc. Of INFOCOM, issue 4 vol. 3, pg. 775–784, March 2013.
17. S. Alireza Motevallian, A. Chakraborthy, and H. Balakrishnan,"The cricket location support system," Proc. of ACM/IEEEInt. Conf. on Mobile Computing and Networking (MOBICOM), vol 3, issue 4 pg 234-42, 2013.
18. Xiangli Zhang, Hanrong Bao, Kun Yan, and Hongmei Zhang, Jin Ye, "A Data Gathering Scheme for WSN/WSAN Based on Partitioning Algorithm and Mobile Sinks", IEEE International Conference on High Performance Computing and Communications & IEEE International Conference on Embedded and Ubiquitous Computing issue 3 vol. 4, pg1968-1973,2013.
19. Farzad Tashtarian, M.H. Yaghmaee Moghaddam, Khosrow Sohraby, and Sohrab Effati "On Maximizing the Lifetime of Wireless Sensor Networks in Event-driven Applications with Mobile Sinks", IEEE,issue 3 vol. 2, pg1-13,2013.
20. Mostafa Mofarreh-Bonab, J. Heidemann, and D. Estrin. "GPS-less Low Cost Outdoor Localization for Very Small Devices," IEEE Personal Communications Magazine, 7(5), vol. 1,issue 3,pg. 28-34, Oct. 2013.
21. Liang Yuan, H. Shrobe and J. Bachrach, "Organizing a Global Coordinate System from Local Information on an Ad Hoc Sensor Network," vol. 3 issue 4. pg 12-21,2013.
22. Bin Li, H. Park and M.B. Srivastava, "The n-Hop Multilateration Primitive for Node Localization Problems," Mobile Networks and Applications, issue 8, vol. 4,pg. 443-451, 2013.
23. Giuseppe Anastasi and Sajal K. Das, "Lifetime Optimization with QOS of Sensor Networks with Uncontrollable Mobile Sinks", issue 6 vol. 4,pg:12-20, 2013.
24. Enrique V. Carrera, Esra Kadioglu-Urtis, and Bulent Tavli, "Optimal Base Station Mobility Patterns for Wireless Sensor Network Lifetime Maximization", IEEE Sensors Journal, issue 9 vol. 4, pg. 1-12,2013.
25. Gabriele Oliva, Stefano Panzieri†, Federica Pascucci† and Roberto Setola, "Sensor Networks Localization: Extending Trilateration via Shadow Edges" Proc. 10th Annual Int. Conf. on Mobile Computing and Networking, Philadelphia, PA, USA, 2004.
26. Harsimran Kaur, Rohit Bajaj," Review on Localization Techniques in Wireless Sensor Networks", International Journal of Computer Applications issue 4 vol. 5,pg.8875 – 8887,2013.
27. Hongyang Chen1, Kaoru Sezaki2, Ping Deng3, Hing Cheung So4," An Improved DV-Hop Localization Algorithm for Wireless Sensor Networks", issue 9, vol. 4, pg.1718-1728,2003.
28. A. Savides, H. Park and M.B. Srivastava, "The n-Hop Multilateration Primitive for Node Localization Problems," Mobile Networks and Applications, issue 8, vol. 7 pg. 443-451, 2003.
29. A. Harter, "A distributed location system for the active office," IEEE Network, issue 8vol. 1, pg. 62-70, 1994.
30. Abdelali Hadirl, Khalid Zine-Dine1, Mohamed Bakhouya2, Jamal El Kafi1," An Optimized DV-Hop Localization Algorithm Using Average Hop Weighted Mean in WSN s", issue 9vol. 4, pg 705-14,1994