Mucl-Multi-Hop Revolutionary Communication With Localization in Underground Wireless Sensor Networks

P.Rama, S.Murugan

***Abstract:** Hop count method is refers the intermediate devices; these devises must pass data between starting place and target, somewhat better than fluid in a straight line over a solo wire. major issues consider in subversive wireless antenna network is approximating the distance among sensor nodes with finding position of sensor nodes. In many cases, the large area coverage is not possible to target all wirelese sensor nodes with localization techniques. In this paper, the performance costing of on hand the hop-count techniques is measuring in a simulated environment. The metrics considered are location accuracy, scalability, area size and computation of shortest route. A Multi-hop Underground Communication with Localization (MUCL) is proposed to restrict and passing of routing data to sensor nodes available in these localities by formating their positions and spaces of repeated nodes hop-by-hop to move Base Station. The simulated and comparative results with other algorithms are proved in expressions of localization error. It is examining that MUCL performs DV-hop in moment in time and measurement of distance by achieving a higher throughput by taking minimum time for data transmission for locating the target sensor node. The replication result shows increase the throughput up to 34 % than the existing work. The simulations are per-forming in the NS2 to confirm the computational method proposed here.*

***Keywords:** MUCL, DV-Hop, Localization, Sensor nodes, Multi-hop, Base Station.*

1. INTRODUCTION

The communication process across the globe mainly done through two-network process;

i. Wired Network
ii. Wireless Network

Considering the wired network that is been widely used in the current scenario has found place in generally for the terrestrial areas ranging from domestic to industrial application.

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P.Rama, Research Scholar, Sathyabama Insttitute of Science and Technology, Chennai. ramaponnuvarman@gmail.com

Dr. S.Murugan,Department of Computer Science and Engineering, Sathyabama Insttitute of Science and Technology, Chennai.

However, this system found vulnerable due in the subterranean areas. This leads to an all-new reign of the wireless networks. The wireless sensor network consists of nodes that ought to be installing to cover up the region of connectivity. At times, the communication is tedious while being implemented in underground areas. The penetration of wireless signals seems to be unsatisfactory levels.

While the WSN is having high impact in the industrial monitoring and control, it is not the same case with subterranean area. The underground explosion in London 2005 is a prevailing example of this. Moreover, there arises an urgent need for the safe implication of WSN in underground regions. Fundamental assumptions of the subversive sensor networks are that:

- The nodes implied should be below the ground level with probably.
- A middle node is receiver / a sink should connect and report to another sink node and it carry to which sink node nearby base station.
- Wireless subversive sensors are at random implies in transmissible range in the underground region.

Now arises the cause of localization of the network various methods have been planned for detection with localize target nodes within literature. Rate of accuracy achieved by the existing methodologies is approximately 50%. The beacon-based communication may localize proficiently and communicate by neighbour nodes in networks.

2. RELATED WORKS

2.1 NLOS (Non-Line-Of-Sight)

Multi-hop localization in unmanageable environments may capitulate major developments of localization accurateness. The localizer to helps, target the sensor node accurately than measure distance among large NLOS errors. Advantage of multi-hop localization in disorder especially distinct when all the reference

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or anchor are dying from the node or android that want to localized [8]. In the Distance vector -Hop localization technique, the affix node show its real positions to the Sensor Node. The sensor node approximates average distance for a single hop for total wireless sensor networks [11].

2.2 Cramer-Rao Bound analysis (CRB)

CRB is used in two localization algorithms, they are distributed and centralized localization algorithm. These algorithms are used to spot the unknown nodes. In the CL-basic algorithm are calculate approximately the space between unfamiliar node and anchor node and report to the sink node. Base on sink node information to target sensor node [10].

2.3 Three-dimensional DV-Hop algorithm

Three-dimensional DV-Hop algorithm improved algorithm revise as per skip distance to compute space between unfamiliar node and anchor node.

Anchor node itself modifies its position error with the help of total least square method. It follows three steps: (i) To be calculated minimal hope count among each anchor node and unknown nodes, (ii) distance will be calculated among the anchor nodes and unknown nodes, (iii) Measure four edges for find the coordinates of unknown nodes.

2.4 Multi-hop Localization Algorithm in UWSNs (MLA)

A multi-hop localization method in Underground WSN estimates the space between the isolated nodes and to a suggestion node. Issue of the method is error rate is high [2]. The DV-Hop localization technique is finding the actual node position in underground networks [3].

2.5 Distributed Multi-Hop Localization in Cluttered Environments

The ADAPTPLACDVDIST algorithm can be used two methods for finding shortest path, finding distance error and locate the target node. They are Cluster topology and, Minimal-length Multi-hop path method. Advantage of these methods improvises the scalability of network path and thereby minimizing the path loss error. Subsequently, the localization correctness is significantly improved[4].

2.6 A New RND-Based Range-Free Localization

Basic idea after RND is to utilize regulated number of common neighbors among two neighboring nodes to calculate the proximity. The property of RND has evaluated and its applications to distance evaluation and localization have examine by models. Simulation results displays that DV-RND help to decrease hop distance ambiguity, and significantly improves multi-hop distance evaluation accuracy [6]. Density-aware Phase is used to share hop-count information from the individual sensor node. This information has used for estimating distance between sensor nodes. Path-aware phase is used for establish the sensor node [12].

3. SIMULATION COMPARISON

Figure 1 shows the simulations results of distance estimation; and localization. MDUE method is compared with DV-Hop and DV-Hop (LS) using [6]. It is observed that normalized distance absolute evaluation errors of the MDUE method are smaller than errors of DV-Hop and DV-Hop (LS) method. The error of MDUE method increases when hop count increase not including for the 10-hop count [12, 13]. RND is based on disk model and may not handle the varied ranges than the DV-RSD algorithm [13]

The association stuck among the localization correctness and the communication range also confirm that the localization accuracy has enhanced by utilizing the selected contact range. Also, it is observed that DV-Hop scheme using selection method of the communication range better other schemes in localization accuracy [5].

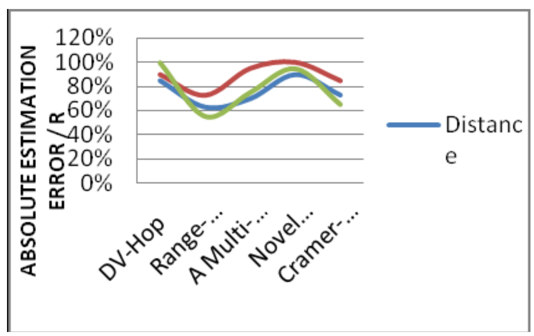

Figure 1. Comparison among MDUE, RND, DV-RSS,DV-Hop and DV-Hop (LS) for different hop count [13]

Finally this survey paper describes many hop-count methods and its advantages, disadvantages, simulation result of hop count methods. The simulation results of Hop Count Methods are provides in Table 1.

Table1. Hop count method simulation Result Merits and Demerits

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Location Techniques	Merits	Demerits
Multi-Hop Scheme	Error distribution range of radio connectivity is improved 100%.Data Transmission rate is 83%.	Shortest path is not calculating accurately.
Range-Free Multi-Hop Schemes.	Improve localization accuracy.Communication range is DOI of 0.1.	Average location error increases
Multi-Hop Localization Algorithm in UWSNS.	Localization accuracy is raise. Percentage of localization error is reducing.	Approximated distance among isolated nodes and reference nodes have high error in large dynamic underground area.
Novel Three-Dimensional Location Dv-Hop Algorithm	Average positioning error decreases continuously. Localization accuracy is more precise.	Position deviation is large scale.
Cramer-RaoBound Analysis	CRB analysis increases the localization accuracy and decrease the communication overhead.	It is not estimation unbiased parameter
Multi-Hop Localization Techniques	Communication range is increase dynamically and error rate decreased.	This method is not suitable for small area communication.

4. PROPOSED WORK

In underground wireless communication using sensor networks, the nodes regularly updates their location information because of information transmission between the sensor nodes. Many algorithms are used to discover node distance as one of the method for multi-skip underground communiqué in the sensor networks. This is essential to recognize the location of the sensor nodes. The protocols are proactive routing protocols and reactive protocols. However, the issue in obtaining the node distance or the location remains. Clearly, the proposed algorithm is key meant for significant spot of nodes towards catalyze communiqué in underground WSNs.

Figure 2 shows the collection of sensor nodes arranges in the secretive networks region. In certain region of the networks, a set of sensor nodes has been selected. Selected node is referred to as sink node; it collects the distance information from its neighbors node and communicate with another neighbor nodes in underground networks. Sink node communicate to the BS (Control Point). GPS be locating the all sensor nodes are around the BS , but this leads to reference a sensor node in the poor communication scenario by the BS.

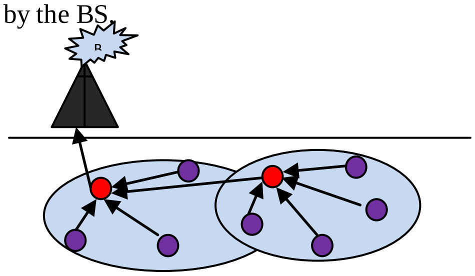

Figure 2. Network Topology in Underground Wireless Sensor Networks

BS = Base Station

= Sink Node

= Neighbors Node

Each sensor node has a processor consist of separate memory contains co-ordinates of the sensor node, which is updated and bright tuned after each movement and communicating the process with its neighboring nodes. In minimum time can transmit maximum date with the help of MUCL method at the same improve the throughput and improvise the location accuracy in underground wireless sensor networks.

Sink node S is proficient of providing the GPS information of each node N∈V (node N and V vertices), essential for the location purpose in nodes that organize randomly. Based on GPS information nodes N form a graph G (V,E) by V vertices and E edges.

Sink node S tries to find its neighbor $(N_1,N_2.....N_n)$ node present in region with broadcasting a pilot signal. This pilot is recognized by its own sink of nodes (1).

$S=N_1,N_2,N_3..........N_n$……..............................……… (1)

Eg $S(V_c, E_c)$

C = circle

The sink node receives RSS (Received Signal Strength) from its neighbor nodes, and the RSS value is calculate from the received signal. The RSS values of the nodes surrounded by $S(V_c,E_c)$ are calculated to gain the distances and the information is shared among the other sink nodes. RSS value is the measure of the power transmission between the sensors devises.

The sink node at this time calculates the distance among the neighbouring nodes and transmits data to the related nodes. The nodes inside region update their routing tables with distances to their neighboring nodes.

A node i from Circle becomes arbitrary sink for the subsequent set of neighbors from the subset $S(V_{ci}, E_{ci})$. The search is performed recursively, until all nodes are updated with distances , angles and the neighbor route tables are

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updated and is obtained by applying the equation (2).

Cartesian co-ordinates of N_1 and $N_{1/2}$ were obtain using GPS value store by undergoing the surface used to discover angle N_1 with the line $SN_{1/2}$ calculated as $<N_{1/2}$ S N_1using equation (5).

$$d=\sqrt{(x-x_1)^2+(y-y_1}$$ ……….............. (2)

d = distance

x and x_1 = co-ordinates of two nodes

Figure 3 shows that Cartesian co-ordinates of S and N_1 are acquired from GPS makes direction with an arbitrary line SO. Likewise, $<OSN_{1/2}$is produced by finding an angle of the line $SN_{1/2}$ produced by an individual co-ordinates of S and $N_{1/2}$. By finding these values, the required angle $<N_{1/2}$ S N1 is obtained as dissimilarity between the two angles as in equation (4).

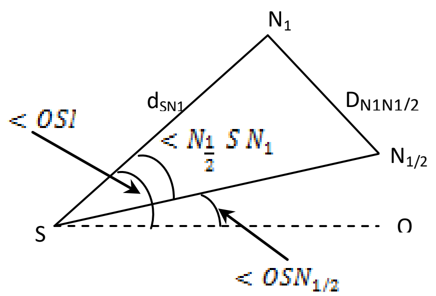

Figure 3. Estimating angle from nodes

Direction among two lines combination is S and N_1 by matching co-ordinates x_s,y_s and x_a,y_a can be agreed with substitute equations (3) in (4),

$$dx = x_s - x_a$$
$$dy = y_s - y_a$$ .... (3)

$$angle = \text{Atan}\,2(dy, dx) \times \frac{180}{\pi}$$ …............................ (4)

Comprising direction $<N_{1/2}SN_1$ and distances d_{SN1} and $d_{SN1/2,}$ is probable to find the third side by the law of cosines, which is an addition of the Pythagoras theorem as in equation (5).

$$< N_{\frac{1}{2}}\, S\, N_1 \;=< OSN_1 - < OS$$ .... (5)

$$c^2 = a^2 + b^2 - 2ab\cos\theta$$ .....……..(6)

Therefore, consistent with this system model, equation (6) can be rewrite like,

$d_{N1N1/2}{}^2{=}d_{SN1}{}^2 \quad d_{sN1/2}{}^2$ - 2 d $_{N1}{}^2$ d $_{N1/2}$ cos $-\angle OSN_{1/2}$ ….......................(7)

Thus, when this method persist for all nodes distances of all nodes in network can approximate and co-ordinate their efficient.

5. RESULT ANALYSIS

Network Simulator 2 was uses in sensor networks. C++ and Tool Command Language (TCL) is applying in NS2, it is open source software. When using NS2 simulation can locate sensor node in minimum cost. In networking NS2 has been used for simulate purpose.

The proposed method here,the NS2 a simulator can taken with 35 sensor nodes deploying and creating network in underground area using wireless senor network. The detailed provision are mention shown in table 2.

The results of the simulation model with above requirements shown in table 3. The distances to the nearby nodes from the target are considered both additionally and directly with distance formula. Table exhibits that it consist of minimal variation in distances attained computational and actual.

Table 2. Simulation Parameters

Parameter	Value
Number of nodes	40
Routing protocol	Extended DSDV
Traffic model	CBR
Simulation Area	1800 x 1000
Transmission range	300m
Antenna Type	Omni antenna
Mobility model	Two ray
Network interface Type	WirelessPhy
Channel Type	Wireless channel

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Table 3. Computational Distance and Actual Distances from the target

Neighbor Node	Computational Distance	Actual Distance
18	140.53861551597208	140.18559127100045
22	135.77894352449104	135.5581056226435
6	127.00281624970899	129.01550294441361
2	136.83777065308337	136.49908424601244
12	255.81050828655049	255.93163149560078
28	101.18751200360981	102.95630140987001
9	199.47185721083744	199.07787421006887
10	240.11529338575417	239.88330496305906
28	178.52435818556606	179.38784797192923
9	143.5017432670229	143.17821063276352
22	224.96288834755998	224.72205054244233
23	217.07560746950384	218.08255317654368
11	232.98355953842196	232.72301132462169
15	197.37982171832442	196.95684806576287
27	156.48525759593733	158.11388300841898

The modification in distances obtained are plotting in given figure 4 , shows node to node communication efficiency of the localization in underground sensor network using the proposed MUCL method.

The proposed method is simulated around 40 nodes with configuration in underground area for sensor networks.

Throughput were used messages and inworked in proposed method is measure to ensure that its is not interrupted in normal sensor working model. Total number of data packets are reached successfully is calculated throughput of the proposed method. Thus, the diagram 4 gives about high throughput across the wireless sensor network. Through the proposed MUCL method, the delay in data transmission becomes extremely low when compared.

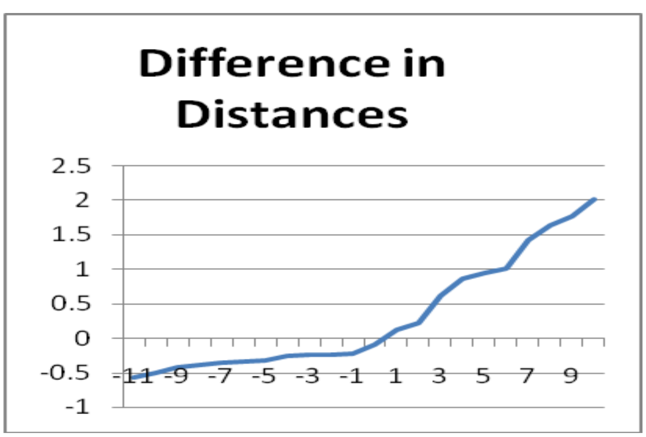

Figure 4.Localization of a Target

Figure 5. Throughput

6. Conclusion

This article discussed about the different hop count techniques for localization and estimating distance between sensor nodes in underground sensor network. Therefore, location information facilities easier, better, better performance, accuracy, finding shortest path, increase throughput and more localization and internationalization of other aspect of the underground sensor node application such as the user interface. In this simulation work, result is proven localization error and compare with other algorithms. The MUCL method can consequently helps for locate target node, communication of sensed information return back to the base station with higher throughput by taking minimum time. It is conclude as, MUCL performs DV-hop in time and distance measurement for establishing the target node.

REFERENCES

1 Manju Chen and Xiangqian Ding, Xiaodong Wang, Xiaowei Xu., ‘ A Novel Three-dimensional Localization Algorithm Based on DV-HOP’, IEEE, 978-1-4799-5274-8/14 ©2014.

2 Zhiwen Zhu, Wenbing Guan, Linfeng Liu, Sheng Li, Shanshan Kong, Yudao Yan., ‘A Multi-hop Localization Algorithm in Underwater Wireless Sensor Net-works ‘,IEEE. sixth international conference on woreless communication and sig-nal processing, 978-4799-7339-2/14@2014.

3 Walid M. Ibrahim and Hossam S. Hassanein, Abd-Elhamid M. Taha., ‘ Does Multi-hop Communication Enhance Localization Accuracy?’, IEEE Globecom 2013 Ad-hoc and sensor networking symposium. Page 121- 126 @ 2013.

4 Muzammil Hussain, Niki Trigoni., ‘ Dynamic node placement for multi-hop loca-lization in cluttered environments’, 2013 8th Annual IEEE communication society conference on sensor , mesh and ad-hoc communications and

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Blue Eyes Intelligence Engineering & Sciences Publication

Retrieval Number: A00370681S519/19©BEIESP

networks, page 167-169.IEEE 2103.
5 Sangho Lee and Kiseon Kim., 'Determination of Communication Range for Range-free Multi-hop Localization in Wireless Sensor Networks', IEEE, 978-1-4577-0638-7 /11©2011.
6 G. Wu S. Wang B. Wang Y. Dong., 'Multi-hop distance estimation method based on regulated neighbor-hood measure', 2084 IET Commun., 2012, Vol. 6, Iss. 13, pp. 2084–2090 & The Institution of Engineering and Technology 2012 doi: 10.1049/iet-com.2012.0108.
7 Q. Li, X.B. Zhang, Q.C. Zhou, LandscaPe-3D: A Robust Localization Scheme for Sensor Networks over Complex 3D Terrains. Local Computer Networks, Nov. 2006: 239-246.
8 Savvides, Garber W. L., Moses R. L., and Srivastava M. B., 2005, An analysis of error inducing parameters in multihop sensor node localization, IEEE Transac-tions on Mobile Computing,4(6), 567 – 577.
9 Drake.S and Dogancay.K.,2004. Geolocation by time difference of arrival using hyperbolic asymptotes, in IEEE International Conference on Acoustics, Speech, and Signal Processing, 2, ii–361–4.
10 Tang, Zuoyin, and Jianhua He., (2013).Cramer-Rao bound analysis of location es-timation in multi-hop wireless sensor networks, IEEE 8th International Confe-rence on ICST Communications and Networking, 389-394.
11 Ibrahim, Walid M., Hossam S. Hassanein, and Abd-Elhamid M. Taha.,(2013), Does multi-hop communication enhance localization accuracy?, IEEE Global Communications Conference (GLOBECOM), 121-126.
12 Wong, Sau Yee, Joo Ghee Lim, S. V. Rao, and Winston KG Seah.,(2005),Multihop localization with density and path length awareness in non-uniform wireless sensor networks, IEEE 61st Conference on Vehicular Technology, 4, 2551-2555.
13 Quanrui Wei, Dexing Zhong*, Jiuqiang Han,'Improved localisation method based on multi-hop distance unbiased estimation', IET Commun., 2014, Vol. 8, Iss. 16, pp. 2797–2804 doi: 10.1049/iet-com.2014.0263,& The Institution of Engineering and Technology 2014.
14 P.Rama and Dr. Meera Gandhi G., 'Multi-hop Communication with Localization in Subterranean Wireless Sensor Networks', Paper ID:372, Third International Conference on Recent Trends in Computing 2015 , Elsevier 1189-1198.

FIRST AUTHOR / MAIN AUTHOR

P.RAMA is a research scholar in COMPUTER SCIENCE AND ENGINEERING department **Sathyabama Institute of Science and Technology** University. She is currently working as ASSISTANT PROFESSOR Faculty of CSE ,.She has a total teaching experience of 13 area of research is WIRELESS SENSOR NETWORKS , MOBILE COMPUTING, NETWORKING, CLOUD COMPUTING .Completed M.S IT. in the year 2003 , PERAMBALUR, Tamilnadu, India. Affiliated to BARATHIDASAN UNIVERSITY ,Completed M.TECH CSE in the year 2011from DR M.G.R UNIVERSITY Chennai. Affiliated to DR. M.G.R UNIVERSITY. Registered Ph.D started in the year 2013.

Mail id: ramaponnuvarman@gmail.com

SECOND AUTHOR

DR. S. MURUGAN is a research supervisor in CSE department **Sathyabama Institute of Science and Technology** University. He is currently working as PROFESSOR Faculty of **CSE**,. He has a total teaching experience of 16 area of research is Web Technology ,Big Data, Cloud Computing Networking, Image Processing Completed B.E in the , Kovilpatti, Tamilnadu.Completed M.E, Completed Ph.D in the year 2015.

Mail id: snmurugan@gmail.com