ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

3-D Localization Performance with standard deviations

Sangeeta Majhi[1], Hemant Kumar Soni[2]

PG Student ,Department of EC, Patel Instituteof /Engineering & Science,RGPV University, Bhopal, India[1]

Assistant Professor, Department of EC, Patel Institute of Eng., & Science,RGPV University, Bhopal, India[2]

Abstract: The major characteristic of wireless sensor network is its dynamic formation over the varying topologies. Applications of wireless sensor network vary from defense operations to rescue operations and also extend to various environment monitoring and security surveillance applications. The use of wireless sensor networks in time critical applications has led to various research works which are independent of RF based algorithms. Similarly the RB based algorithms generate high error in distance measurements and hence are in-accurate when used alone.
An algorithm that uses features of both RF and RB algorithms can efficiently solve the issue of location accuracy of sensor nodes in 3-D space. The proposed algorithm makes use of RF and RB based algorithms to successfully overcome the issue of location accuracy in noisy environment. Scalability of the network is considered for testing the accuracy of the proposed method. Results prove that that the performance of the algorithm increases with increase in the number of beacon nodes. The proposed algorithm has better results as compared to the other methods of distance measurement in noisy environment. The ease of changing the granularity of the areas estimated makes the proposed algorithm far more flexible and better.

Keywords: Wireless Sensor Network(WSN),Localization,Rf(Range free) & Rb(Range base).

I. INTRODUCTION

Wireless sensor networks are dynamically formed over the different types of topologies. Wireless sensor networks can helps in performing the rescue operations and can provide search in timely manner. In general, disasters leave the situation worse without power and disruption of communication capabilities destroying the infrastructures [13]. A sensor network mainly consists of anchor nodes as well as the other nodes sensing the content of data. The anchor nodes are aware the location of sensor nodes which obtain its location information through some external methods (GPS, TOA [14, 15]). The un-localized nodes hear the beacons which are broadcasted by the anchor nodes. Determining the location of these un-localized sensor nodes with respect to the anchor nodes is called localization [12]. The localization algorithms generally possess wave-spreading like characteristics in which the intermediate sensor nodes become location aware and act as a new reference anchor node for the un-localized neighboring nodes. All the strategies that are employed for the localization in 2-D spaces are violated in 3-D spaces [1, 2].2-D spaces cannot be directly extended to 3-D just by increasing one parameter. For example, the 2-D localization completely fails in determining the depth of the river bed and other similar sensor network scenarios where the height recommended. There are many known modeling the sensor network as 2-D but are very complex (sometimes NP-Hard) when modeled as 3-D [28-35]. Moreover, the main triangulation approach that is employed for the 2-D space doesn't fit for the 3-D The information received from the remote sensors that are several hops far is meaningless until and unless the location from where the data is received is known [13]. For large scale application scenarios where the geographical data is be known for coarse parameters such as the temperature of an area, the data is aggregated for all the sensor nodes that locates nearby. then, the location information is considered for many location aware sensor.

network protocols. The positional information is used to partition the network into many clusters for routing. For smooth routing the protocols needs the information of the location of the sensor nodes.

The sensors employed near the disaster affected sites might contain the vital parameters of the living being trapped beneath several layers of collapsed surfaces. Based on the size of the area affected by catastrophe the data can be directed to the rescue team in a multi-hop way. The data so received by the rescue team can be processed and a map can be generated displaying the optimized path to send the help service in minimum possible time. Sensors can be deployed for continuous monitoring of some events that occur in physical atmosphere, but we requires a system that can act when sometime disaster happens.[16-20]. some disaster situations like earthquake, avalanche, when the person is in trapped condition beneath the different surfaces like collapsed buildings, snow masses, landslides, etc. for rescue operation of the survivors, the information of location is important within short span situations that can be easily solved
of time. The contributions of the work presented in this paper can be shortly listed as follows.

In Calculation of the 3-dimentional location of sensors attached to the trapped persons lying beneath the several layers of overlapped surfaces relative to the beacon nodes deployed at the surfaces by the rescue team.

- Algorithm needs to be distributed for each sensor node to run.

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

- Propagates the information of location from beacon nodes to the bottom surface passing through several layers of sensors as the radio range of beacon nodes extend only up to the sensors of the neighboring layers.

The rest of the paper is organized as follows: Section II gives a survey of the related works. Section III presents the derivation of the proposed algorithm and work approach towards the solution of the problem. Section IV shows all the comparative simulations results along with the output figure .

I. II. RELATED WORK

In this section ,we review research most relevant to our work . The wireless sensor network is an open research field. All the components of this network are still in developing phase. Many different localization algorithms have been discovered until now. As the sensor networks are application base it is quite hard to generalize the algorithm approaches for localizations that suits to all the different scenarios [21-27].

All the localization algorithms have been broadly classified into two major categories: Rb(range based) and Rf(range free). Both the strategies employ totally different way of approaches.

The Rb method relies on the distance measurements through different received signal strength strategies. Whereas, the Rf method base on the connectivity communication. here the nodes can listen to the beacon from the sensor nodes. As we know the wireless sensor network contains localized anchor nodes and un-localized sensor nodes. The Rf(range free) method uses the connectivity information and bound the nodes location to the common overlapped (intersected) area. Many algorithms describes the different types of methods to calculate the nodes location information within the bounded region with respect to the anchor nodes. The range-based method uses the sophisticated hardware, radio signals to estimate the distance between the receiver and the transmitter antennas. Whereas , the range-free approach reuses the wireless communication radio signals to determine the connectivity between neighbouring sensors and without extra external support. The range-free methods are used where the precise location of the sensor nodes is not required and the coarse position estimation up to some level is tolerable.

A. Range-Based Localization Schemes

1) Received Signal Strength (RSS):

RSS is defined as the power measured by a received signal strength indicator (RSSI) by the receiver. Here, RSS recieved measured power describes as the squared magnitude of the radio signal strength.RSS can be low frequency, RF or other signals .In Wireless communication sensors nodes communicate with neighbouring sensors, so the signal strength of the radio can be calculated by each receiver during normal data communication without requiring additional bandwidth or energy aspects. Localization in RSS measurements can be easily embedded in the motes, because of their costs so that they are most generally used method for distance calculation [6]. Time Based Methods (TOA &TDoA): These methods record the time-of-arrival (ToA) or time-difference-of-arrival (TDoA).

The propagation time can be converted into distance with respect to the known signal propagation speed. Then this methods can be applied to many other signals like RF, acoustic, infrared and ultrasound [9]. TDoA [3]these methods are efficiently [2] accurate under line-of-sight conditions .other than this the line-of-sight condition is difficult to meet in some environmental situations. And the speed of sound in air varies with air temperature and humidity, which introduce inaccuracy into distance estimation. On the other hand Acoustic signals also show multi-path propagation effects that may impact the accuracy of signal detection. Here the signal rely on complex hardware that is very costly and energy consuming; making it less useful for sensor networks where the scalability is high of the lifetime of the network is expected to be more [1].

2) Angle Of Arrival (AOA):

AoA estimates the angle at which signals are received and use simple geometric relationships to calculate node positions. Mostly , AoA techniques provide more accurate localization result than RSSI based techniques but the cost of hardware of more in AoA. Through providing information about the direction to neighboring sensors nodes rather than the distance to adjacent sensors nodes and localization information complementary to the TOA and RSS [4] measurement provided by AOA measurments. Sophisticated direction aware antennas with high synchronization clocks are need in this method. Similar to AOA, TOA and TDOA estimates require additional hardware too expensive to be used in high [5] scalable sensor networks.

B. Range-Free Localization Schemes:

3) Centroid Algorithm:

Anchors send their location information to neighbours that keep an account of all received beacons , simple centroid model is applied for estimation the listening nodes location by using the average information, This protocol is referred as the Centroid algorithm. Here is the steps of the localization:

- Beacon node broadcasts their position.
- Sensor node listens for beacons from anchors nodes and if they are able to hear the beacons can say that they are belong to the ranging area covered by these anchor nodes.
- Sensor node finds its position by averaging of all the beacon node locations.

this shows that the ranging area of these anchor nodes.

Sensor node computes its position by averaging out all the beacon node locations. For proximity-based, In a range-free, a localization algorithm is proposed containing location information (x_i, y_i) that uses anchor beacons, for obtaining the sensor node position. Then these beacons received from anchor nodes , its location is established by a sensor node using the following formula for 2-Dspace :

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

$$(x_{est}, y_{est}) = \left(\frac{x_1 + \ldots + x_N}{N}, \frac{y_1 + \ldots + y_N}{N} \right)$$

Then for 3-D space it can be describe as:

$$(x_{est}, y_{est}, z_{est}) = \left(\frac{x_1 + \ldots + x_N}{N}, \frac{y_1 + \ldots + y_N}{N}, \frac{z_1 + \ldots + z_N}{N} \right) \text{T}$$

he main characteristics of this Centroid localization scheme is its simplicity of calculation and simplicity in implementing it

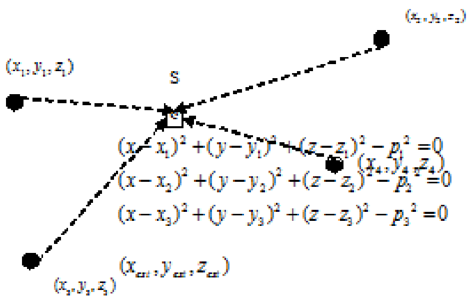


Figure 1: Centroid estimation

4) DV-HOP:

DV-HOP assumes that a network consisting of identical sensing nodes and beacon nodes [7].Anchors flood their locations all over the sensor network Instead of going for the single hop broadcast.As the information propagates over each hop an increment counter each time increments the hop count value [8].Senor nodes calculate their position based on the received beacon locations and with respect to the average distance per hop,t from the corresponding anchor of the hop count ; the working of this strategy is quite similar to existing distance vector routing. A beacon is broadcasted by one anchor node to all over the network containing the beacon location with a hop count value initially set to one.

5) Multi-Dimensional Scaling (Mds):

The multi-dimensional scaling is another type of range-free method. In a large scale sensor networks, Multi-Dimensional Scaling (MDS) only uses the connectivity information. This process has three steps: the distance between all the sensor node pairs can be estimated rougly. Then by Appling the MDS to derive locations fitted [10] roughly to the estimated distances. by taking the known sensor node locations optimization possible.

6) SeRLoc :

SeRLoc [11] is range-free area based localization. The sensor network is formed of two types of nodes: sensor nodes and locators acting as anchor nodes. Un-localized sensor nodes are mounted with omni directional antennas and the anchor nodes i.e. locators are equipped with directional sectored antennas. previously localized nodes aware of its location called as the locators.. In SeRLoc, a sensor node calculates it location by listening the information transmitted by the locators.

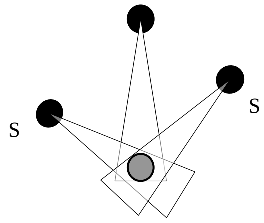
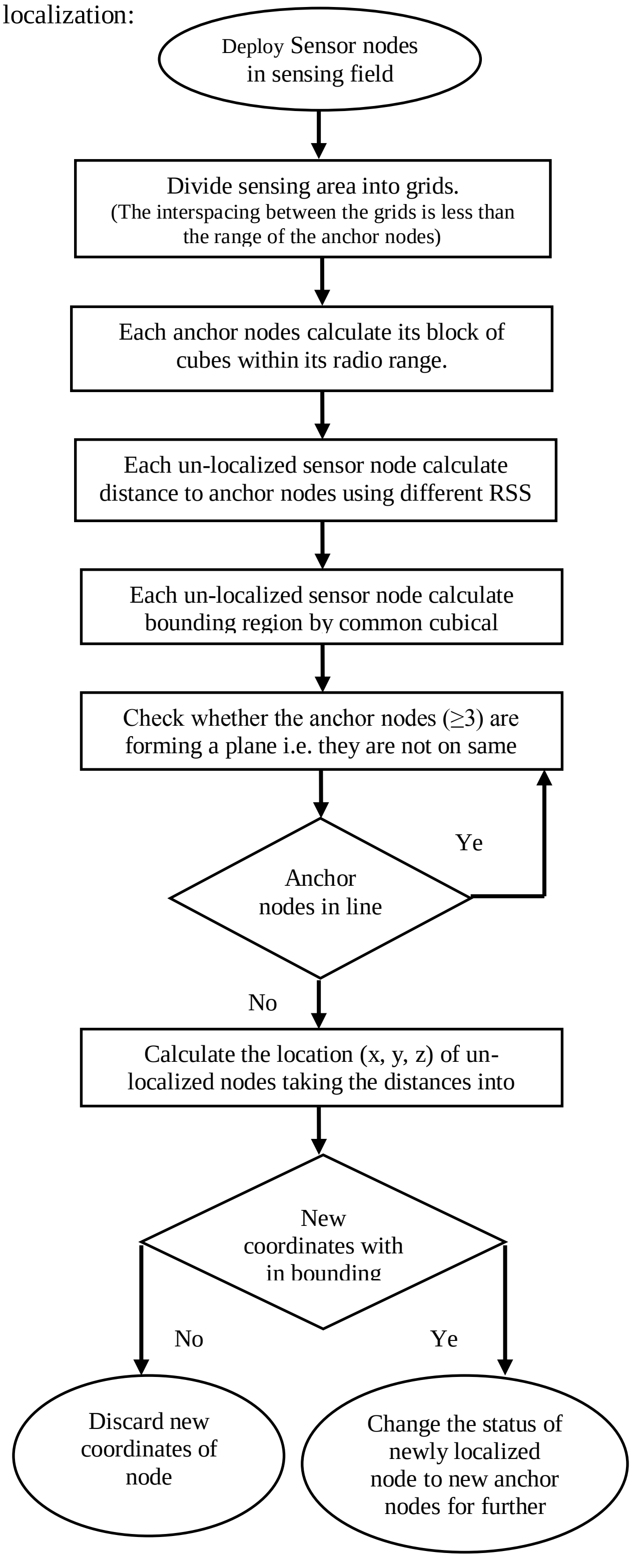


Figure 2: SeRloc, directional antenna, intersection

II. PROPOSED 3D LOCALIZATION ALGORITHM

The following flow chart shows the process of 3-D localization:



ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

C. The bounded area is explained below (Range-Free Approach):

Instead of considering a spherical area around a sensor node we consider cubical area covered by the sensor nodes.. so that all the nodes within the cubical area can listen to anchor node other outside it are not considered to be covered by this anchor node [12]

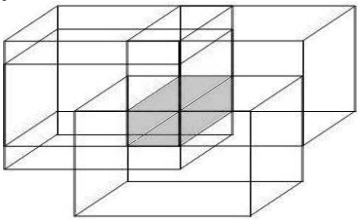


Figure 3 common Intersection of bounding boxes, common bounded region(shaded region)

Each cube representing the [13] bounding area can be represented by the min & max values coordinates of each area. the beacon node P(x, y, z) covers the radio range. varies between [xmin ,ymin , zmin] and [xmax , ymax , zmax] represents the bounded range β of a node.

where, $$\begin{cases} x_{\min} = x - r + \partial \\ y_{\min} = y - r + \partial \\ z_{\min} = z - r + \partial \end{cases}$$

$$\begin{cases} x_{\max} = x + r - \partial \\ y_{\max} = y + r - \partial \\ z_{\max} = z + r - \partial \end{cases}$$

∂ is considered as the error occurs by irregular radio pattern.

r average radio range of the beacon

$$[x_{\min}, y_{\min}, z_{\min}] \leq \beta \leq [x_{\max}, y_{\max}, z_{\max}]$$

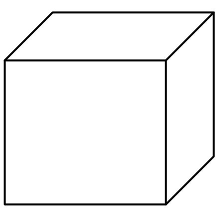


Figure 4 : Bounded values of sensor

The intersection of the two cubical areas [14] is done to reduce the area where the un-localized node is likely to be. As, more number of cubical areas [15] start to merge the common area of intersection starts to reduce. The new rectangular (sometimes square) area that emerges after multiple intersections of beacon nodes represents the bounded area.

Can say common intersection of two bounding cubes;

$$\beta_{new} = \beta_1 \cap \beta_2$$

$$[x_{new_{\min}}, y_{new_{\min}}, z_{new_{\min}}] \leq \beta_{new} \leq [x_{new_{\max}}, y_{new_{\max}}, z_{new_{\max}}]$$

Where $$\begin{cases} x_{new_{\min}} = |x_{2_{\min}} - x_{1_{\min}}| \\ y_{new_{\min}} = |y_{2_{\min}} - y_{1_{\min}}| \\ z_{new_{\min}} = |z_{2_{\min}} - z_{1_{\min}}| \end{cases}$$

$$\begin{cases} x_{new_{\max}} = |x_{2_{\max}} - x_{1_{\max}}| \\ y_{new_{\max}} = |y_{2_{\max}} - y_{1_{\max}}| \\ z_{new_{\max}} = |z_{2_{\max}} - z_{1_{\max}}| \end{cases}$$

Accordingly here also intersection of multiple boundaries can be done to lower the number of positions where a sensor node can be present.

$$\beta_{new} = \beta_1 \cap \beta_2 \cap \ldots\ldots\ldots\ldots \cap \beta_n$$

where, n is the number of beacon nodes covering a un-localized node

The method falls under the category of range-free as it only uses the connectivity information i.e. whether it is able to send & receive the beacon nodes from the respective beacon nodes.

D. Calculating from known distances (Range-Based):

The method uses the distance information [16] between the un-localized node and the beacon nodes. All the beacon nodes are considered to lie on same plane [17], w.r.t of these beacon nodes the nodes localization can be obtained. At a time a set of three anchor nodes are selected . Then this three anchor nodes form a equation of a plane.

For 3 dimensional spaces the standard equation will be :
Qx + Ry + Sz +D = 0

Here in equation (19), Q, R, S correspond to the anchor nodes & D corresponds to the sensor node with unknown location information

The normal to the plane is the vector (Q, R, S).

Given three points in space Q(x1, y1, z1), S(x2, y2, z2), S(x3, y3, z3) the equation of the plane through these points is given by the following determinants.

$$Q = \begin{pmatrix} 1 & y_1 & z_1 \\ 1 & y_2 & z_2 \\ 1 & y_3 & z_3 \end{pmatrix}$$

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

R = $\begin{pmatrix} x_1 & 1 & z_1 \\ x_2 & 1 & z_2 \\ x_3 & 1 & z_3 \end{pmatrix}$

S = $\begin{pmatrix} x_1 & y_1 & 1 \\ x_2 & y_2 & 1 \\ x_3 & y_3 & 1 \end{pmatrix}$

D = $-\begin{pmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{pmatrix}$

Expanding the above gives :

$$Q = y_1(z_2 - z_3) + y_2(z_3 - z_1) + y_3(z_1 - z_2)$$

$$R = z_1\ (x_2\ -x_3) + z_2\ (x_3\ -x_1) + z_3\ (x_1\ -x_2)$$

$$S = x_1\ (y_2\ -y_3) + x_2\ (y_3\ -y_1) + x_3\ (y_1\ -y_2)$$

$$D = -[x_1\ (y_2\ z_3\ -y_3\ z_2) + x_2\ (y_3\ z_1\ -y_1\ z_3) + x_3\ (y_1\ z_2\ -y_2\ z_1)]$$

The sign of, **s = Qx + Ry + Sz + D** determines which side the point (x, y, z) lies with respect to the plane. If s > 0 then the point lies on the same side as the normal (Q, R, S). If s < 0 then it lies on the opposite side, if s = 0 then the point (x, y, z) lies on the plane.

For a plane $Qx + Ry + Sz + D = 0$ and a point $P(x_1, y_1, z_1)$ not necessarily lying on the plane,

the shortest distance from P to the plane is :

$$\text{Distance} = \frac{|Qx_1 + Ry_1 + Sz_1 + d|}{\sqrt{Q^2 + P^2 + S^2}}$$

It follows that if Distance = 0 in equation 24 then P lies in the same plane.

However, in real life environmental conditions where there is interference noise [18] the measuring and calculating errors might change [19] the distance with small value. So that P is considered lying within the same plane if it satisfies the constraint:

if $-\xi <$ Distance $< \xi$ then Distance ≈ 0

Where ξ is minute deviation caused due to errors.

p_i is the distance between the point P and the beacon nodes $B_i(|B_i| > 3)$. The distances are measured by using different received signal strength (RSS) methods. Minimum three beacon nodes are required to calculate the location of unknown sensor node. At first it is determined whether the nodes are forming a plane (Fig. 5).

$$(x - x_i)^2 + (y - y_i)^2 + (z - z_i)^2 = p_i^2$$

$i = 1, 2, 3\ldots$

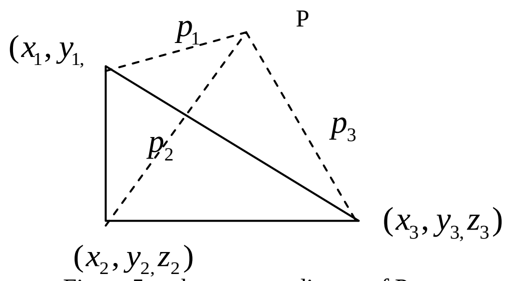


Figure 5: unknown coordinates of P;
p_1, p_2, p_3
are calculated distances using RSS

$$(x - x_1)^2 + (y - y_1)^2 + (z - z_1)^2 - p_1^2 = 0$$
$$(x - x_2)^2 + (y - y_2)^2 + (z - z_2)^2 - p_2^2 = 0$$
$$(x - x_3)^2 + (y - y_3)^2 + (z - z_3)^2 - p_3^2 = 0$$

Solving, the above equations mathematically. For the variable z we get multiple values (as the root of the quadratic equations).By using the bounded cube (explained above) and accordingly values of x, y, z can be taken, then it should be :

$$\beta = \beta_1 \cap \beta_2 \cap \beta_3$$

The β cube is calculated using the intersected cubical rectangle of beacon nodes.

$P \in \beta$

$$[x_{new_{\min}}, y_{new_{\min}}, z_{new_{\min}}] \le P[x, y, z] \le [x_{new_{\max}}, y_{new_{\max}}, z_{new_{\max}}]$$

Now substituting the values of z in other given equations we can derive values of (x, y, z). If an unknown node P receives signals from multiple anchor beacon sensor nodes. Then it will be decided first whether the beacon nodes are also belong to the same plane or not..then If not lying on the same plane then multiple beacon values giving rise to multiple equations are used for finding the values of p(x, y, z) & minimize the error:

$$(x - x_n)^2 + (y - y_n)^2 + (z - z_n)^2 - d_n^2 = 0$$

Where, (x_n, y_n, z_n) correspond to the location of the beacon nodes

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

$$p = \begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

$$\alpha = \begin{bmatrix} 2(x_1 - x_n) & 2(y_1 - y_n) & 2(z_1 - z_n) \\ 2(x_2 - x_n) & 2(y_2 - y_n) & 2(z_2 - z_n) \\ \vdots & \vdots & \vdots \\ 2(x_{n-1} - x_n) & 2(y_{n-1} - y_n) & 2(z_{n-1} - z_n) \end{bmatrix}$$

$$k = \begin{bmatrix} (x_1^2 + y_1^2 + z_1^2) - (x_n^2 + y_n^2 + z_n^2) - (d_1^2 - d_n^2) \\ (x_2^2 + y_2^2 + z_2^2) - (x_n^2 + y_n^2 + z_n^2) - (d_2^2 - d_n^2) \\ \vdots \\ (x_{n-1}^2 + y_{n-1}^2 + z_{n-1}^2) - (x_n^2 + y_n^2 + z_n^2) - (d_{n-1}^2 - d_n^2) \end{bmatrix}$$

Solving the above equations the approximated location can be calculated.

$$p = (\alpha^T \alpha)^{-1} \alpha^T k$$

Further, we bound the many no. of values of x, y, z by selecting only those values which are within the bounding region and rejecting the outside values. where we have the constrained area of x, y, z. considers as the bounded region.

$$\beta_{new} = \beta_1 \cap \beta_2 \cap .... \cap \beta_n$$

III. SIMULATION RESULTS

The algorithm proposed here, as all the geometric approaches of the localization issues, requires a large number of sensor nodes and location aware beacons. MATLAB simulator is selected as it easily handles the matrix calculations very effectively & all the stress of the work can be given to the actual work rather than going on programming details.

We randomly generate the sensor node locations 3-D space that is constrained within the layer area. Whereas the original beacon nodes are randomly distributed and constrained in 1st layer only.

$x_i \in$ *{0, max value of x-y plane}*

$y_i \in$ *{0, max value of x-y plane}*

$z_i \in \{ n \times d - \partial , n \times d - \partial \}$

where,
d - distance between the layers.
n - number of layer.
∂ - small deviation.

As the nodes in the network are randomly generated, some specific situation can appear like isolated nodes or beacons in a corner. on the edge of the cubical grid a sensor node will hear half less beacons than another one in the centre that decrease the overall efficiency. For overcome these type of situations every simulation is ran several times (6 to 10), and a mean value is taken out of the results. The simulation is performed by taking 1/3rd of the total nodes as beacon nodes. We have compared the parameters with a standard Center of Gravity (COG) method. The total time calculated here is the combined simulation time of both the proposed one and the COG method. Giving, an estimation of how much time this proposed algorithm will take to execute.

A. Performance Analysis :

Calculation of percentage of Success of proposed algorithm :

$$Per_{success} = 100 - \frac{\sum d_i}{N - n} * 100$$

Where d_i – deviation between the actual location of nodes and the estimated location
N – total number of sensor nodes in the network (considering the first layer contains only beacon nodes).
n – number of nodes per layer

B.Error Analysis:

The error is calculated using:

$$d_{error} = \sqrt{(x_a - x_c)^2 + (y_a - y_c)^2 + (z_a - z_c)^2}$$

Where x_a, y_a, z_a - are actual sensor node location

x_c, y_c, z_c - calculated values of sensor node location

Due to the many of involved parameters (number of nodes, communication range, number of anchor nodes, etc.) here its not worth to make them all vary at the same time.

Table 1: Scalability Effect on the performance

Nodes use	Anchor nodes	Communication Range (meter)	% Success in proposed method	% Success in COG method	Total time (sec)
60	20	5	71.52	41.1	0.1246
150	50	5	81.05	42.88	0.3157
300	100	5	76.08	42.27	2.1595
600	200	5	92.48	42.85	4.6488
900	300	5	92.03	43.6	12.383
1200	400	5	92.10	43.2	25.158

Here, in Table 1 we can clearly see that as the number of nodes is increased the performance of the algorithm improves by 10% - 30%. Whereas, in COG method the performance improves very less by 5% - 15%. For 20 anchor nodes the performance of success is around 60%,

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

as the no of anchor nodes are increased the success rate rises above 90%..

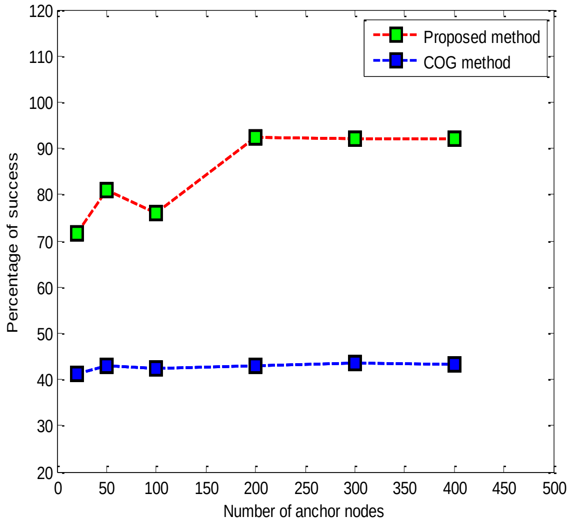


Figure 6: Anchor nodes vs Percentage of success

It supports the fact that as the number of beacon nodes in the network increases the calculated location values becomes more close to the original location.

	Beacon nodes
	Original node locations
	Calculated locations with proposed algorithm
	Calculated locations using COG method

For simulated output Node specifications . fig- 7 shows the sensor network nodes that are used to generate the simulated output.

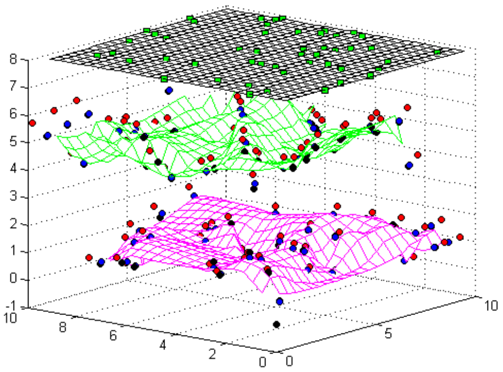


Figure 7: Simulation done by 50 anchor nodes, total No. of 150 nodes

The beacon nodes are distributed throughout the first layerand the remaining other sensor nodes are randomly distributed to respective layers with equal node densities. The uneven horizontal mesh corresponds to the surface beneath.

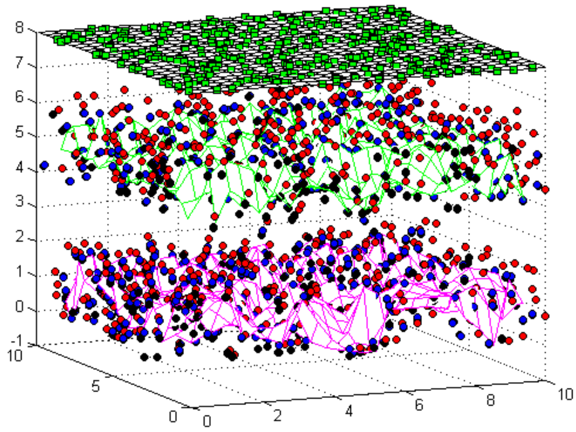


Figure 8: Simulation for total no. of 1200 nodes.

Table 2: Effect of Radio Range

No of nodes per layer	Radio Range (m)	% Success in proposed method	% Success in COG method	Total time(sec)
100	4	84.5420	43.7133	1.6868
100	5	92.2343	45.7739	1.1823
100	6	91.5365	41.6044	2.7104
100	8	91.0383	43.2958	5.3518

As our application is mainly aimed towards the rescue operations so the performance is analysis for the variations in radio range. the simulated results shows Table- 2. The above simulation is carried out taking the inter layer length 3m. here the proposed method uses both the range-free and range-based strategies there is not much performance variation. As in case of COG method initial state when the radio range is very less the performance of COG is quite high with intermediate radio ranges the success rate varies between 25%-50%, when the range of the anchor nodes increases one layer of sensor nodes are affected by multiple layers of beacon nodes above it giving it a increasing success rate.

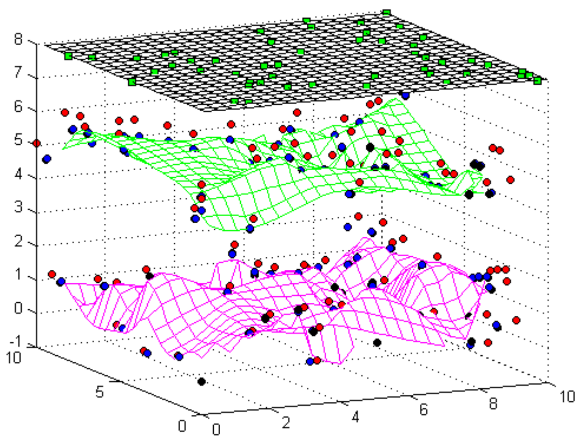


Figure 9: Simulation done taking 150 nodes with radio range 5m

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

with respect to the number of sensor nodes as for single layer information of location from multiple layers of beacon nodes are processed cause increased simulation time.

Table 3: Noise Effect , varying standard deviations.

Radio Range (m)	Noise Factor (SD)	% Success in proposed method	% Success in COG method	Total time(sec)
5	0.005	93.8913	42.8119	0.4139
5	0.010	81.8357	42.2915	0.2664
5	0.015	80.4317	43.8930	0.2624
5	0.020	67.1297	46.1883	0.2770
5	0.025	57.3315	41.8075	0.2765

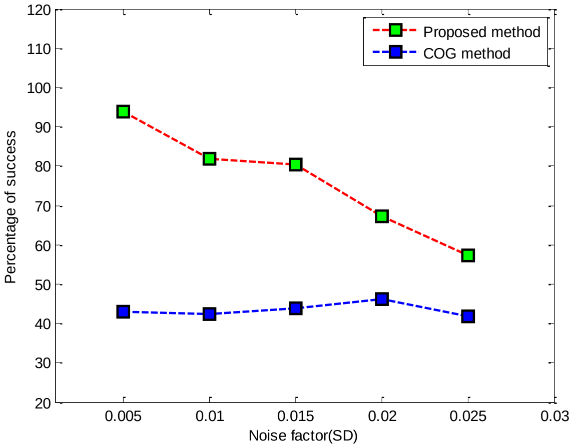


Figure 10-Noise factor vs Percentage success

The noise here is considered to be Gaussian Noise with mean μ =0 and standard deviation σ .Here, we can clearly see that the noise has direct impact on accuracy. Here we can see that the noise value increases the success rate of the proposed scheme varies between 55% - 95%. Though the success rate drops but still it gives better results than other methods.

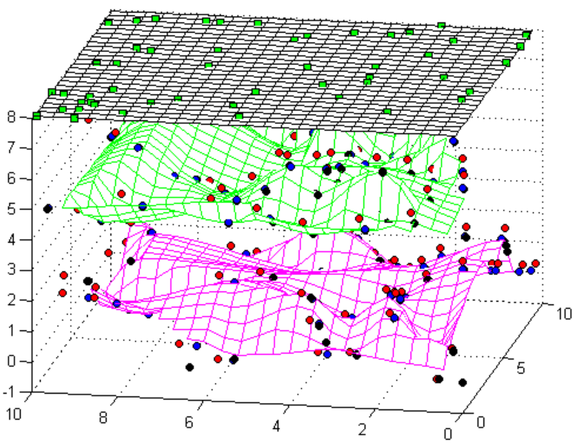


Figure 11: Simulated output taking 150 nodes & standard deviation of 0.005

In COG the noise has very less impact because of the nature of COG yields the value. In COG method considers the mean of all the locations so a localization error tends to deviate the calculated values very less.

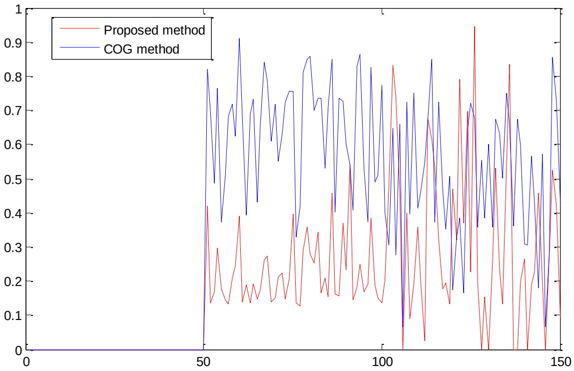


Figure 12: Error deviation vs number of nodes

In the above figure all the beacon nodes are aware of their own location information .here then up to 50 nodes no error in location information. Other layers correspond to 50-100 and 100-150 to layer 2 and layer 3 respectively. In Results the error is comparatively less in layer 2 than in layer 3. Here a relative localization scheme the error continues to propagate to lower layers.

Table 4: Distance Effect between the layers

Radio Range (m)	Distance Between Layers	Success in proposed method	% Success in COG method	Total time(sec)
5	2.0	93.768	44.073	0.4970
5	2.5	89.467	41.320	0.8079
5	3.0	87.645	42.291	0.7038
5	3.5	92.038	35.624	0.6523
5	4	82.808	32.107	0.5486

Here, the distance between the layers is varied keeping the radio range constant. The effect of interlayer spacing does not affect much of success rate but for the COG method it varies at a considerable mount.

IV. CONCLUSION

The literature survey work has shown that an optimal algorithm has not been defined yet, that employ both the strategies (range-free & range-based) , and this cause to find a new algorithm on the specific condition with respect to the size of the network and for the deployment methods and the expected results. Localization algorithms should be designed to achieve low variance as well as low bias as far as possible; Meanwhile, it requires to be scalable to very large network sizes without dramatically increasing energy consumption or computational requirements. We

ISSN (Online) : 2278-1021
ISSN (Print) : 2319-5940
International Journal of Advanced Research in Computer and Communication Engineering
Vol. 3, Issue 7, July 2014

have proposed and demonstrated an algorithm that successfully localizes nodes in a sensor network with noisy distance measurements and also The equations for the proposed algorithm were carried out in MATLAB. Simulations showed the relationship between noise and ability of a network to localize itself, at highly noisy environments. The performance stays above 50% i.e. half of the available nodes can be localized with good approximation. We also have depicted the effect of scalability on the performance of the algorithm. Can see in results that as the scalability of the network increases with the number of beacon nodes; the performance of the algorithm goes high above 90%. The areas estimated may be easily adjusted by changing the system parameters which makes the proposed algorithm flexible. Moreover, with one of the methods proposed, the Bounding cube. This creates major developments that have been proposed in this thesis which improves significantly to increase the localization accuracy. They do not require much more computational costs and perfectly match the distributed algorithm's requirements. Continuing further, the proposed algorithm operates in a distributed manner by executing the algorithm in different sensor nodes. The propagating trend of the localization procedure provides wave-spreading like characteristic in this algorithm. The proposed algorithm performed very well on the MATLAB simulating environment. We recommend the use of sensor nodes with following characteristics: A dedicated high speed timer is required by RSS ranging.The microcontroller in the sensor nodes is expected to perform additional tasks at moreover; a higher performance processor is highly suggested. These sensor nodes should be capable of performing hybrid localization by introducing the fusion of both range-free ranging and received signal strength RF ranging. Finally, due to the varying scenarios where localization processes come into play, it has been and will continue being an important research field to be explored.

V. REFERENCES

[1] Liu D. et al., (2013), Analysis of Wireless Localization in Nonline-of-Sight Conditions, ieee trans. veh. technol vol., 62(4).
[2] AkyildizI.F.et al., (2005), Underwater Acoustic Sensor Networks: Research Challenges, Ad Hoc Networks Journal.
[3] He T.et al., (2003), Range free localization schemes in large scale sensor networks, ACM/IEEE 9th Annu. Int. Conf. Mobile Computing and Networking.
[4] Shang Y.et al., (2003), Localization from mere connectivity, 4th acm international symposium on mobile ad hoc networking & computing.
[5] Niculescu D.et al., (2003), DV Based Positioning in Ad hoc Networks, Journal of Telecommunication Systems.
[6] Bulusu N.et al., (2000), GPS-less Low Cost Outdoor Localization for Very Small Devices, IEEE Personal Communications Magazine, 7(5), 28-34.
[7] Lazos L. et al., (2004), SeRLoc: Secure range-independent localization for wireless sensor networks, In ACM Workshop on Wireless Security (WiSe).
[8] Stoleru R. et al., (2004), Probability grid: A location estimation scheme for wireless sensor networks, In IEEE International Conference on Sensor and Ad Hoc Communications and Networks (SECON).
[9] Niculescu D.et al.,(2003), Ad Hoc Positioning System (APS) using AoA, infocom.
[10] Savvides A.et al., (2001), Dynamic ne-grained localization in ad-hoc networks of sensors, Proc. MobiCom.
[11] Singh S. et al., (2013), Design Of Wireless Sensor Network Node On Zigbee For Water Level Detection, 3(8).
[12] Rubén G.C. et al. (2013), Use of ARIMA mathematical analysis to model the implementation of expert system courses by means of free software OpenSim and Sloodle platforms in virtual university campuses, Expert Systems with Applications, 40(18), 7381-7390.
[13] Kumar K.S. et al., (2011), Real time face recognition using adaboost improved fast PCA algorithm, arXiv preprint arXiv:1108.1353 .
[14] Kumar K.S. et al., (2011), Generating 3D Model Using 2D Images of an Object, International Journal of Engineering Science.
[15] Singh N. et al., (2012), Semantic Image Retrieval by Combining Color, Texture and Shape Features, In the Proceedings of the International Conference on Computing Sciences, pp. 116-120.
[16] BijalwanA. et al., (2013), Examining the Criminology using Network Forensic, 8th National Conference USCSTC.
[17] Bijalwan V. et al., (2014), KNN based Machine Learning Approach for Text and Document Mining, International Journal of Database Theory and Application, 7(1), 61-70.
[18] KumariP. et al., (2010), rakshita- A Novel web based Approach for Protecting Digital Copyrights Using Public Key Digital Watermarking and Human Fingerprints, International conference on methods and models in computer science.
[19] Nishant S. et al., (2012), semantic image retrieval using multiple, international Conference on Advanced Computer Science & Information Technology, pp. 277-284.
[20] Gupta J.P. et al., (2013), Human Activity Recognition using Gait Pattern, International Journal of Computer Vision and Image Processing, 3(3), 31 – 53.
[21] Crespo R.G. et al., (2012), Dynamic, ecological, accessible and 3D Virtual Worlds-based Libraries using OpenSim and Sloodle along with mobile location and NFC for checking,International Journal of Interactive Multimedia & Artificial Intelligence, 1(7).
[22] Kumar K.S. et al., (2010), Sports Video Summarization using Priority Curve Algorithm, International Journal on Computer Science & Engineering.
[23] Bijalwan, Vishwanath, Sanjay Singh, and Ashish Kumar. "analysis &design of joint phy-mac model of ieee 802.15. 4."
[24] Gandotra, Neha, VishwanathBijalwan, and ManoharPanwar. "coexistence model of zigbee& ieee 802.11 b (wlan) in ubiquitous, network.