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RESEARCH ARTICLE

STUDY OF LOCALIZATION SCHEME WITH SINGLE MOBILE ANCHOR NODE

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Abstract: Various localization methods based on mobile anchor nodes have been proposed for assisting the sensor nodes to determine their locations. However, none of these methods attempt to optimize the trajectory of the mobile anchor node. Accordingly, this paper presents a path planning scheme, which ensures that the trajectory of the mobile anchor node minimizes the localization error and guarantees that all of the sensor nodes can determine their locations. The obstacle-resistant trajectory is also proposed to handle the obstacles in the sensing field. Later this path planning algorithm is adjusted so that it suits most of the effective localization algorithms. The performance of the proposed scheme is to be evaluated through a series of simulations with the ns-2 network simulator.

Keywords: PPL, WSN, Beacon, NAM, TCL, mobile anchor, Localization

INTRODUCTION:

Algorithm Description

In this section, we describe the Path Planning Based Localization (PPL) [1] with regard to single mobile anchor in WSN environment. This algorithm is typically a range based distributed algorithm.

This system presents a path planning scheme, which ensures that the trajectory of the mobile anchor node minimizes the localization error and guarantees that all of the sensor nodes can determine their locations. The obstacle-resistant trajectory is also proposed to handle the obstacles in the sensing field. In the localization scheme, a single mobile anchor node moves randomly through the sensing field broadcasting periodic three beacon messages containing its current coordinates. The locations of the individual sensor nodes are determined by exploiting the fact that the perpendicular bisector of a chord of a mobile anchor passes through the center of the circle twice. The obstacle resistant trajectory is solved through virtual beacon point generation.

Node Configuration Setting

The sensor nodes are designed and configured dynamically, designed to employ across the network, the nodes are set according to the X, Y, Z dimension, which the nodes have the direct transmission range to all other nodes.

Localization algorithm

In the localization scheme, a single mobile anchor node moves randomly through the sensing field broadcasting periodic beacon messages containing its current coordinates. it is assumed that the communication range over which a sensor node can detect broadcasts from the mobile anchor node is bounded by a circle and the sensor node is located at the center of this circle. As the anchor node moves through the sensing field, it broadcasts its coordinates periodically, and each sensor node chooses appropriate locations of the anchor node (called *beacon points*) to form chords of its communication range.

Mobile Anchor Path Planning Scheme

If **three beacon points** are obtained on the communication circle of a sensor node, it follows that the mobile anchor node must pass through the circle on at least two occasions. The distance between two successive vertical segments of the anchor trajectory (i.e. the resolution of the anchor trajectory) is specified as $R-X$, where R is the communication radius of the mobile anchor node and X is set in the range As a result, the mobile anchor node will pass through the circle more than three times

Obstacles-Resistant Trajectory

In a realistic environment, obstacles may appear in the sensing field and thus obstruct the radio connectivity between the anchor node and the sensor nodes during this occasion the sensor node identifies its location through virtual beacon points.

TCL Script. (path.tcl)

TCL Script **(path.tcl)** which we are using defines all nodes and all required parameters.

```
set val(chan)   Channel/WirelessChannel                              ;# channel type

set val(prop)   Propagation/TwoRayGround                       ;# radio-propagation model
```

```
set val(netif)  Phy/WirelessPhy                                  ;# network interface type
set val(mac)    Mac/802_11                                      ;# MAC type
set val(ifq)    Queue/DropTail/PriQueue                         ;# interface queue type
set val(ll)     LL                                               ;# link layer type
set val(ant)    Antenna/OmniAntenna                              ;# antenna model
set val(ifqlen) 512                                              ;# max packet in ifq
set val(nn)     67                                               ;# number of mobile  nodes
set val(rp)     AODV                                            ;# routing protocol
set val(x)      4300                                             ;# X dimension of topography
set val(y)      2500                                             ;# Y dimension of topography
set val(stop)   20.0                                             ;# time of simulation end
set ns [new Simulator]
set topo       [new Topology]
$topo load_flatgrid $val(x) $val(y)
create-god $val(nn)
#Open the NS trace file
set tracefile [open path.tr w]
$ns trace-all $tracefile
$ns use-newtrace
set namfile [open path.nam w]
$ns namtrace-all $namfile
$ns namtrace-all-wireless $namfile $val(x) $val(y)
```

```
set chan [new $val(chan)]                                              ;#Create wireless channel
```

NAM file Network Animator File

(path.nam)

When a simulation is finished, NS produces one or more text-based output files that contain detailed simulation data, i.e **path.nam** if specified to do so in the input Tcl (or more specifically, OTcl) script. The data can be used for simulation analysis (two simulation result analysis examples are presented in later sections) or as an input to a graphical simulation display tool called Network Animator (NAM). NAM has a nice graphical user interface similar to that of a CD player (play, fast forward, rewind, pause and so on), and also has a display speed controller. Furthermore, it can graphically present information such as throughput and number of packet drops at each link, although the graphical information cannot be used for accurate simulation analysis.

Location Details (location anchor1)

Another text based file is generated after end of simulation which gives the desired location of all nodes. Like Source, Neighbor, SX-Pos, SY-Pos, Distance (d)

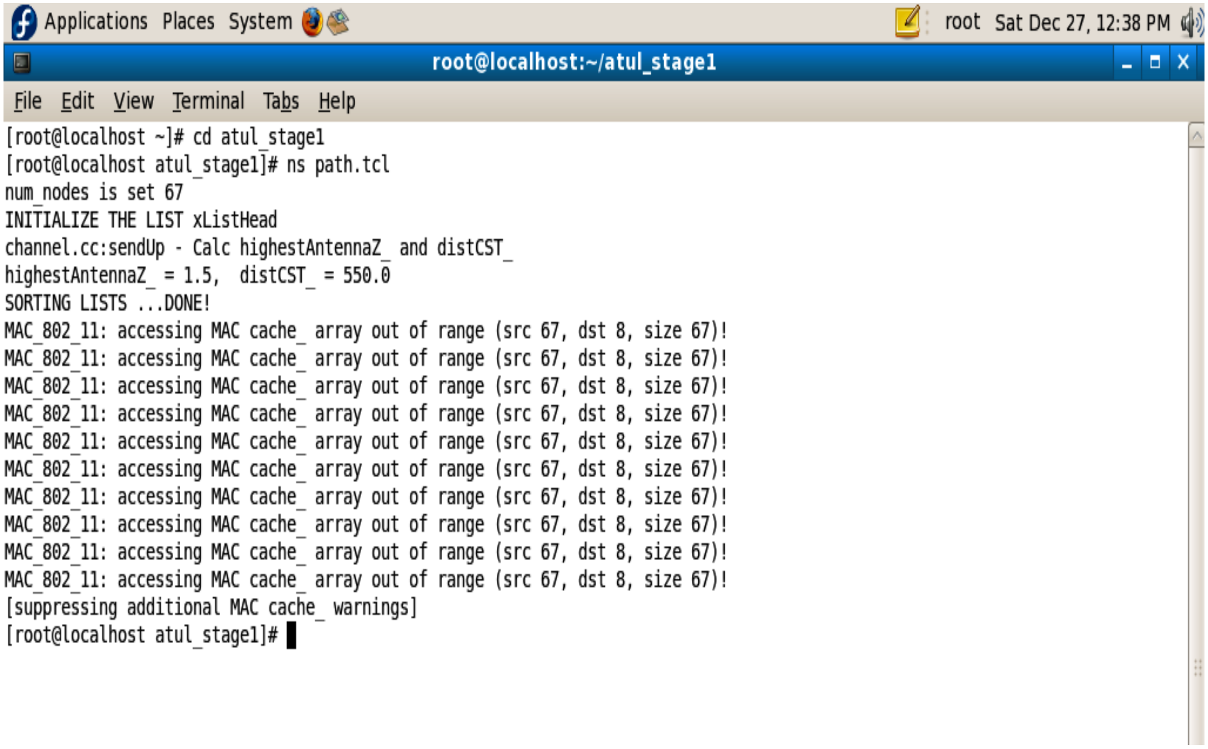
Result

We use the NS-2 simulator for examining our desired results we get following output.

Steps 1. - After run the TCL script **(path.tcl)** in terminal by command   we get fig 1.

Step 2.- Secondly execute **path.nam** NAM file NAM file (Network Animator File) we get   fig 2

Step 3. - Finally after completion the Simulation with desired time the Location **Details   (location-anchor1)** file is generated and result shown below. In fig 3



```
[root@localhost ~]# cd atul_stage1
[root@localhost atul_stage1]# ns path.tcl
num_nodes is set 67
INITIALIZE THE LIST xListHead
channel.cc:sendUp - Calc highestAntennaZ_ and distCST_
highestAntennaZ_ = 1.5,  distCST_ = 550.0
SORTING LISTS ...DONE!
MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
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MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
[suppressing additional MAC cache_ warnings]
[root@localhost atul_stage1]# █
```
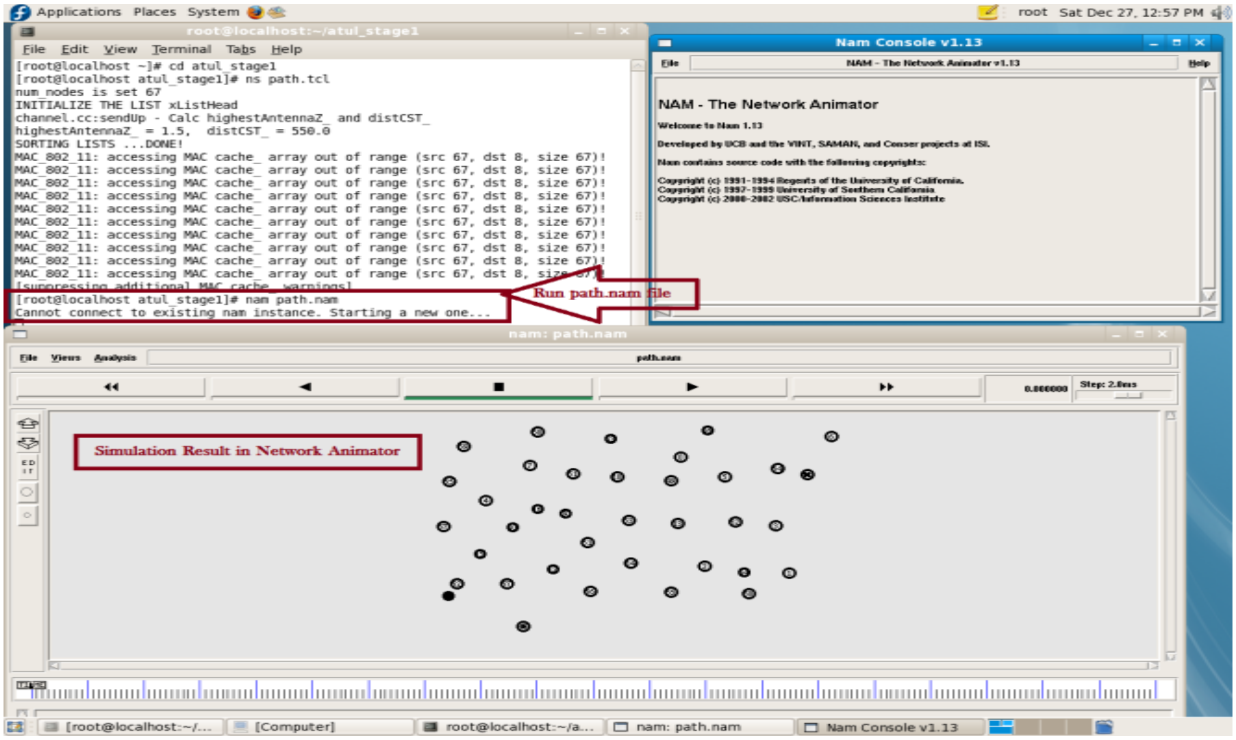

Fig1. Step 1 result



```
[root@localhost ~]# cd atul_stage1
[root@localhost atul_stage1]# ns path.tcl
num_nodes is set 67
INITIALIZE THE LIST xListHead
channel.cc:sendUp - Calc highestAntennaZ_ and distCST_
highestAntennaZ_ = 1.5,  distCST_ = 550.0
SORTING LISTS ...DONE!
MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
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MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
MAC_802_11: accessing MAC cache_ array out of range (src 67, dst 8, size 67)!
[suppressing additional MAC cache_ warnings]
[root@localhost atul_stage1]# nam path.nam
Cannot connect to existing nam instance. Starting a new one...
```

NAM - The Network Animator

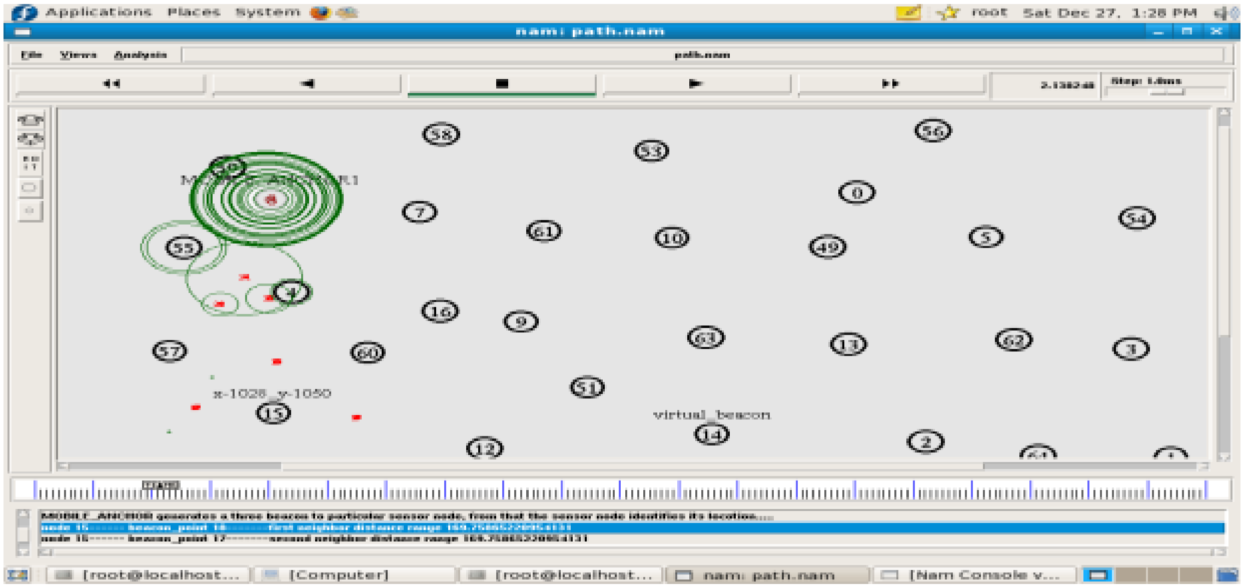
Welcome to Nam 1.13

Developed by UCB and the VINT, SAMAN, and Conser projects at ISI.

Nam contains source code with the following copyrights:

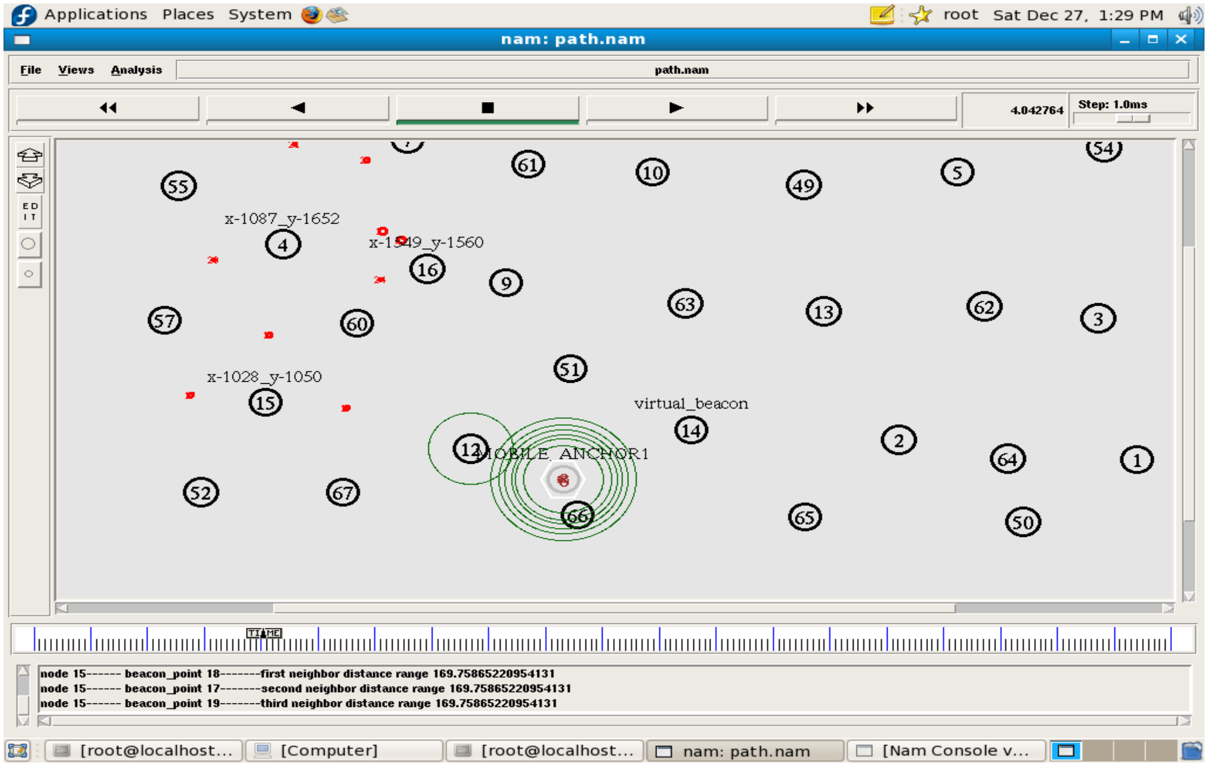
Copyright (c) 1991-1994 Regents of the University of California.
Copyright (c) 1997-1999 University of Southern California
Copyright (c) 2000-2002 USC/Information Sciences Institute

Fig2. Step 2 result



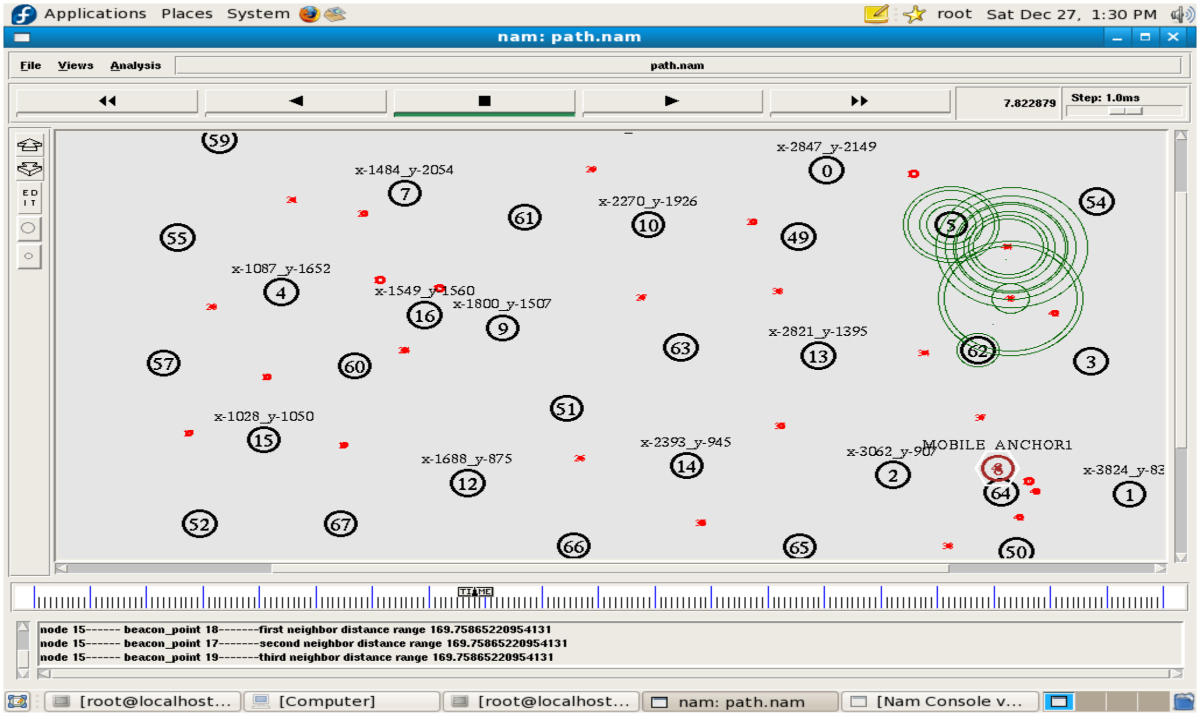
```
MOBILE_ANCHOR generates a three beacon to particular sensor node, from that the sensor node identifies its location....
node 15------ beacon_point 18-------first neighbor distance range 169.75865220954131
node 15------ beacon_point 17-------second neighbor distance range 169.75865220954131
```

Fig3. Movement of Mobile Anchor Node



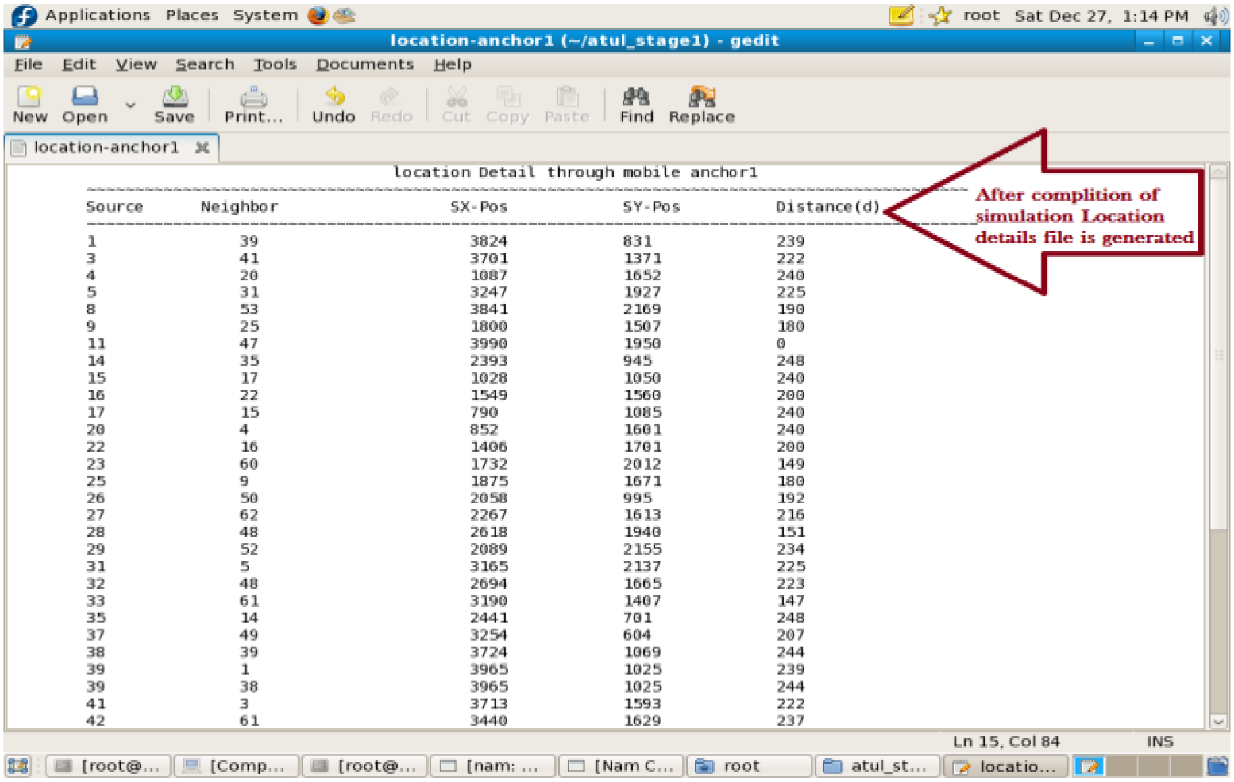
```
node 15------ beacon_point 18-------first neighbor distance range 169.75865220954131
node 15------ beacon_point 17-------second neighbor distance range 169.75865220954131
node 15------ beacon_point 19-------third neighbor distance range 169.75865220954131
```

Fig3. Mobile Anchor Node with Beacon points



```
node 15------ beacon_point 18-------first neighbor distance range 169.75865220954131
node 15------ beacon_point 17-------second neighbor distance range 169.75865220954131
node 15------ beacon_point 19-------third neighbor distance range 169.75865220954131
```

Fig3. All Nodes with Beacon points and X-Y points



```
                          location Detail through mobile anchor1
     ------------------------------------------------------------------------------------------------
     Source      Neighbor                     SX-Pos           SY-Pos          Distance(d)
     ------------------------------------------------------------------------------------------------
     1               39                        3824             831             239
     3               41                        3701             1371            222
     4               20                        1087             1652            240
     5               31                        3247             1927            225
     8               53                        3841             2169            190
     9               25                        1800             1507            180
     11              47                        3990             1950            0
     14              35                        2393             945             248
     15              17                        1028             1050            240
     16              22                        1549             1560            200
     17              15                        790              1085            240
     20              4                         852              1601            240
     22              16                        1406             1701            200
     23              60                        1732             2012            149
     25              9                         1875             1671            180
     26              50                        2058             995             192
     27              62                        2267             1613            216
     28              48                        2618             1940            151
     29              52                        2089             2155            234
     31              5                         3165             2137            225
     32              48                        2694             1665            223
     33              61                        3190             1407            147
     35              14                        2441             701             248
     37              49                        3254             604             207
     38              39                        3724             1069            244
     39              1                         3965             1025            239
     39              38                        3965             1025            244
     41              3                         3713             1593            222
     42              61                        3440             1629            237
```

After complition of simulation Location details file is generated

Fig 4. Location-anchor1 file

Conclusion:

After simulating the Localization Scheme with Single Mobile Anchor Node localization technique on Network Simulator (version 2.32) widely known as NS2 [11], a scalable discrete-event driven simulation tool.

Building high performance WSN network systems requires an understanding of the behavior of sensor network and what makes them fast or slow. In addition to the performance analysis, we have also evaluated the proposed technique in measuring, evaluating, and understanding system performance. The final but most important step in our experiment is to analyze the output from the simulation. After the simulation we obtain animation which shows the movement of single mobile anchor node along with the snake type dynamic movement and various beacon points. With the help of that we will identify the location of all nodes finally the location details file generated which contains the Source, Neighbor, SX-Pos, SY-Pos, Distance(d) .

Thus we conclude that the Localization Scheme with Single Mobile Anchor Node were studied and verified the desired output.

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