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RESEARCH ARTICLE

Optimal Node Selection Using Broadcasting Algorithm in Mobile Adhoc Network

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Abstract— In optimal node selection using broadcasting algorithm in mobile Adhoc network it finds the nearest optimal node for forwarding messages and the consequent optimal node for receiving and transferring messages and continues up to its Destination Node. Using 1-hop neighbour information, the Sender-based broadcasting algorithm searches local optimal minimum number of forwarding nodes in the lowest computational time complexity O(n log n), where n is the number of neighbour's. This optimality only holds for a subclass of sender-based algorithms. Sender-based broadcasting algorithm reduces the time complexity of computing forwarding nodes to O(n). A simple and highly efficient Receiver-based broadcasting algorithm is used to broadcast the same message when nodes are uniformly distributed, the probability of two neighbour nodes are exponentially decreases when the distance between them decreases or when the node density increases. Receiver-based broadcasting algorithm can be fine in selecting a lowest minimum number of required broadcasts.

Key Terms: - MANET; Mobile computing; Broadcasting

I. Introduction

Mobile computing is a form of human computer interaction by which an expected to be transported during normal usage. Mobile computing has three aspects: mobile communication, mobile hardware, and mobile software. The first aspect addresses communication issues in ad-hoc and infrastructure networks as well as communication properties, protocols, data formats and concrete technologies. The second aspect is on the hardware, e.g., mobile devices or device components. The third aspect deals with the characteristics and requirements of mobile applications.

"Mobile computing" is a generic term that refers to technologies that allow you to take your computer with you. In the past, this was limited to notebook computers and similar hardware that allowed you to physically bring your computer along. Today, however, this can be extended to software and web solutions that allow you to bring your computing experience without the bulky hardware. Today an overview is going on several different mobility technologies and offers some possibilities for their use. It's an ever-changing world out there. Your competitors are already using these technologies

There are three basic genres of mobile computing. The first uses mobile computers. These are computers or similar devices that are designed for mobile use. They include notebooks, PDAs, and mobile phones. The second genre is remote connection. This type of mobility allows you to connect to your computer from remote locations and work as though you were sitting in front of it. The final type of technology is known as Desktop

Virtualization. With this technology you take your software with you and recreate your computing experience on any available hardware.

Mobile Computing: A technology that allows transmission of data, via a computer, without having to be connected to a fixed physical link. Mobile voice communication is widely established throughout the world and has had a very rapid increase in the number of subscribers to the various cellular networks over the last few years. An extension of this technology is the ability to send and receive data across these cellular networks. This is the principle of mobile computing.

Mobile data communication has become a very important and rapidly evolving technology as it allows users to transmit data from remote locations to other remote or fixed locations. This proves to be the solution to the biggest problem of business people on the move - mobility. In this article an overview of existing cellular networks and CDPD technology details which allows data communications across these networks is given.

II. System Analysis

2.1 *Existing System*

The simplest broadcasting algorithm is flooding, in which every node Broadcasts the message when it receives it for the first time. Using flooding, each node receives the message from all its neighbours in a collision-free network. Therefore, the broadcast redundancy significantly increases as the average number of neighbour's increases. High broadcast redundancy can result in high power and bandwidth consumption in the network.

Moreover, it increases packet collisions, which can lead to additional transmissions. This can cause severe network congestion or significant performance degradation, a phenomenon called the broadcast storm problem. Consequently, it is crucial to design efficient broadcasting algorithms to reduce the number of required transmissions in the network. A flooding algorithm is an algorithm for distributing material to every part of a connected network. The name derives from the concept of inundation by a flood. Flooding algorithms are used in systems such as Usenet and peer-to-peer file sharing systems. There are several variants of flooding algorithm: most work roughly as follows.

- Each node acts as both a transmitter and a receiver.
- Each node tries to forward every message to every one of its neighbors except the source node.

This results in every message eventually being delivered to all reachable parts of the network. Real-world flooding algorithms have to be more complex than this, since precautions have to be taken to avoid wasted duplicate deliveries and infinite loops, and to allow messages to eventually expire from the system.

2.2 *Proposed System*

In sender-based algorithms, the broadcasting nodes select a subset of their neighbours to forward the message. The proposed broadcasting algorithm is one of the best sender-based broadcasting algorithms that use 1-hop information. A broadcasting algorithm reduces the number of broadcasts and achieves local optimality by selecting the minimum number of forwarding nodes with minimum time complexity O (n log n), where n is the number of neighbours.

The proposed system shows that this optimality only holds for a subclass of sender- based broadcasting algorithms employing 1-hop information and prove that the proposed sender-based algorithm can achieve full delivery with time complexity O (n).

- An algorithm selects n forwarding nodes in the worst case, while this proposed algorithm selects 11 nodes in the worst case. The new sender-based algorithm results in fewer broadcasts than does in this algorithm.
- All these interesting properties are achieved at the cost of a slight increase in end-to-end delay. Thus, the first proposed algorithm is preferred to an algorithm when the value of n is typically large, and it is important to bind the packet size.

III. System Design

The sender-based broadcasting algorithms can be divided into two subclasses. In the first subclass, each node decides whether or not to broadcast solely base on the first received message and drops the rest of the same messages that it receives later. The existing system falls in this subclass and achieves local optimality by selecting the minimum number of forwarding nodes in the lowest computational time complexity.

Definition 1 (Bulged Slice): As illustrated in Fig. 4.1, a bulged slice around A as the intersection area of three circles with radius R and centers A, M, and N, where length of AM = R, length of AN=R and length of MN=R are defined. Note that in any bulged slice AMN, it has MAN = PI/3 i.e., 60 degrees.

Definition 2 (Right/Left Bulged Slice): As shown in Fig. 4.2, let A and B be two points such that 0 < AB R and AMN be a bulged slice around A. Suppose that the point B is on one of the arcs AM or AN of the bulged slice AMN. In this case, AMN is called the right bulged slice of B around A if it contains the PI/3 clockwise rotation of point B around A and is called its left bulged slice around A otherwise.

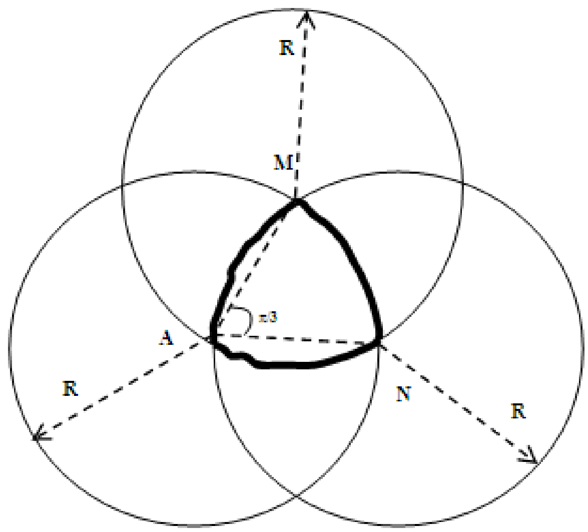

Fig.4.1 A bulged slice around A

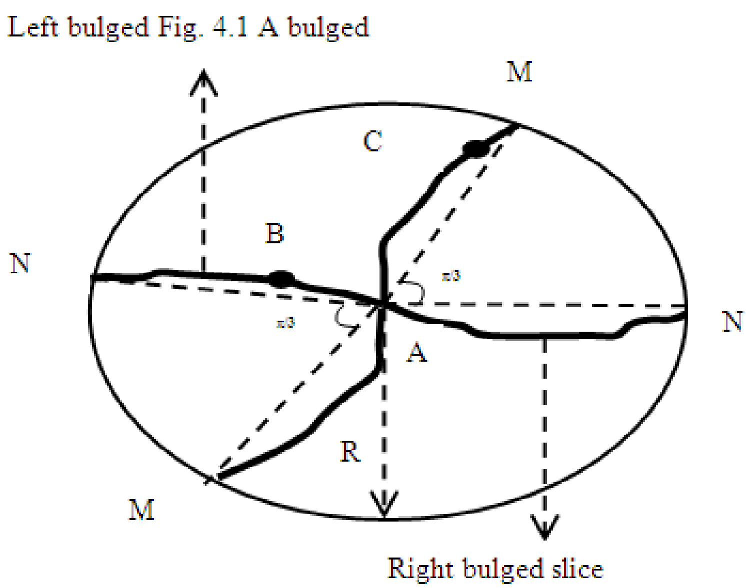

Fig. 4.2 Left Bulged Slice of B and Right Bulged Slice of C around A

Definition 3 (Bulged Angle): Let B1 and B2 be two bulged slices around A. The bulged angle (B1, B2) is defined to be equal to 0 2PI if B2 is a counter clockwise rotation of B1 around A.

Definition 4 (B-Coverage Set): A subset of neighbors of NA is called a B-coverage set of NA if any nonempty bulged slice around A contains at least one node from the set. A bulged slice is empty if there is no node inside it.

Definition 5 (Slice-Based Selection Algorithm): A forwarding node selection algorithm is called a slice-based selection algorithm (or slice-based algorithm) if for any node NA, it selects a B-coverage set of it.

IV. ALGORITHMS

4.1 ***Sender-Based Algorithm:*** **T**he basic structure of the proposed sender-based broadcasting algorithm. As shown in Definition 1, each node schedules a broadcast for a received message if the node is selected by the sender and if it has not scheduled the same message before. Clearly, each message is broadcast once at most by a node, which is similar to the algorithm. In this algorithm each node may only schedule a broadcast when it receives a message for the first time. In contrast, in Definition 1, a broadcast schedule can be set at any time. For example, a message can be dropped after the first reception but scheduled for broadcast the second time. Clearly, the main design issue in Definition 1 is how to select the forwarding nodes.

This module proves that in a collision-free network, Definition 1 can achieve full delivery if it uses a slice-based selection algorithm to select the forwarding nodes. This module proves that in a collision-free network, Definition 1 can achieve full delivery if it uses a slice-based selection algorithm to select the forwarding nodes

4.2 ***Slice-Based Selection Algorithm*****:** This module (Definition 2) shows the proposed slice-based selection algorithm. Suppose that node N_A uses the proposed algorithm to select the forwarding nodes from its neighbours Let us assume that N_A stores all of its neighbour's IDs and locations in an array of length n, where n is the number of neighbours. The algorithm selects the first node N_{S1} randomly from the array.

The first node can also be selected deterministically by, for example, selecting the node that is the farthest away from N_A. Let $LB_A(P)$ and $RB_A(P)$ denote the left bulged slice and right bulged slice of P around A respectively. Suppose that N_{Si} is the last node selected by the algorithm. To select the next node, the algorithm iterates through the array and selects the node N_{Si+1} such that it is inside the slice $LB_A(Si)$, $_A(LB_A(Si),LB_A(Si+1))$ 0, and

N_B inside $LB_A(Si)$:

$_A(LB_A(Si),\boldsymbol{L}B_A(B))\ _A(LB_A(Si),\boldsymbol{R}B_A(S_{i+1}))$

If there is no such node, the algorithm selects N_{Si+1} such that
N_B inside $C_{A,R}$:

$_A(LB_A(Si),\boldsymbol{R}B_A(S_{i+1}))\ _A(LB_A(Si),\boldsymbol{R}B_A(B))$

The algorithm terminates by selecting the last node N_{Sm} if N_{Sm} is inside $LB_A(Si)$, or $N_{S1}$is inside $LB_A(S_m)$, or $S_{m+1} = S_l$. This module proves that the proposed slice-based selection algorithm will select at most 11 nodes.

4.3 ***Receiver-Based Algorithm*****:** This module (Definition 3) shows a general approach used in several receiver-based broadcasting algorithms. The proposed receiver-based broadcasting algorithm employs this approach. Clearly, the main design challenge of this algorithm is to determine whether or not to broadcast a received message. A trivial algorithm is to refrain broadcasting if and only if all the neighbours have received the message during its defer period.

Although this algorithm is simple to implement, it has limited effect in reducing the number of redundant broadcasts. Suppose NA's defer time expires at t0. Using the above strategy, node NA will broadcast if some of its neighbours (at least one) have not received the message by t0. However, this broadcast is redundant if all such neighbours receive the message from other nodes after time t0. This scenario typically occurs when to is small compared to the maximum defer time

4.4 ***Responsibility-Based Scheme*****:** This module implements the proposed RBS. The main idea of this Algorithm is that a node avoids broadcasting if it is not responsible for any of its neighbours. A node $\mathbf{N_A}$ is not responsible for a neighbour $\mathbf{N_B}$ if $\mathbf{N_B}$ has received the message or if there is another neighbour $\mathbf{N_C}$ such that $\mathbf{N_C}$

has received the message and $\mathbf{N_B}$ is closer to $\mathbf{N_C}$ than it is to $\mathbf{N_A}$. Suppose $\mathbf{N_A}$ stores IDs of all its neighbours that have broadcast the message during its defer period. When executed by a node $\mathbf{N_A}$,

The Algorithm first uses this information to determine which neighbours have not received the message. It then returns false if and only if it finds a neighbour $\mathbf{N_B}$ that has not received the message and length of **AB** length of **BC**. For any $\mathbf{N_A}$**'s** neighbour $\mathbf{N_C}$ that has received the message. The output of RBS determines whether or not the broadcast is redundant.

This algorithm proves that, each node broadcasts a message at most once. Therefore, broadcasting will eventually terminate. By contradiction, suppose there is at least one node that has not received the message after the broadcasting termination. Let us consider the set

A= {($\mathbf{N_X}$;$\mathbf{N_Y}$)| $\mathbf{N_X}$ and $\mathbf{N_Y}$ are neighbours; $\mathbf{N_X}$ has received the message; and $\mathbf{N_Y}$ has not received the message},Suppose $\mathbf{N_S}$ is the node that initiated broadcasting, and $\mathbf{N_T}$ is a node that has not received the message. The network is connected; thus, there is a path between $\mathbf{N_S}$ and $\mathbf{N_T}$. Clearly, it can find two neighbour nodes $\mathbf{N_B}$ and $\mathbf{N_A}$ along the path from $\mathbf{N_T}$ to $\mathbf{N_S}$ such that $\mathbf{N_B}$ has not received the message, while $\mathbf{N_A}$ has. Consequently,

($\mathbf{N_A}$,$\mathbf{N_B}$; thus, **0**. As a result, the system has

($\mathbf{N_{A'}}$,$\mathbf{N_{B'}}$) s.t. **($\mathbf{N_{A'}}$,$\mathbf{N_{B'}}$) A'B' XY $\overline{\textbf{(1)}}$**

Clearly, $\mathbf{N_{A'}}$ has not broadcast since $\mathbf{N_{B'}}$ has not received the message. Therefore, there must be a node $\mathbf{N_{C'}}$ such that $\mathbf{N_{C'}}$ has received the message and length of C'B' < length of A' B' less than or equal to R. This result contradicts (1), since **($\mathbf{N_{C'}}$, $\mathbf{N_{B'}}$)**.

V. Results and Discussions

5.1 *Performance Evaluation*

Average Number of Nodes Selected by the Proposed Sliced-Based Algorithm:

It proved that the proposed forwarding-node selection algorithm selects 11 nodes in the worst case. In practice, the number of selected nodes is typically less than 11. To avoid the complexity of mathematical analysis, it uses a simulation to find the average number of selected nodes. For a given number of neighbours 1 < n <160, randomly put n points inside a circle with radius R. Then ran the proposed selection algorithm and obtained the number of selected nodes. To get the average number of selected nodes, it ran simulation 106 times for each given n.

The average number of selected nodes is less than six and approaches five when n increases. Note that the proposed sliced-based selection algorithm does not necessarily select a B-coverage with a minimum number of nodes. V It is worth mentioning that shows the average number of selected nodes by the source node (the node that initiates the broadcasting). For the rest of broadcasting nodes, the average number of selected nodes is at least one less than that for the source node because of the optimization technique introduced.

Probability of Broadcast Using the Proposed RBS:

Suppose that the proposed receiver-based algorithm is used for broadcasting in the network. Assume that node NB receives a message from NA for the first time. It uses simulation to confirm this theoretical result. For the simulation, two nodes NA and NB are considered with distance 0 < d < R from each other. Uniformly placed nodes with density ∂ inside the network and checked whether or not NB was required to broadcast the message. The simulation results for several values of d, and R.

Performance of Proposed Sender-Based and Receiver-Based Algorithms:

The main objective of efficient broadcasting algorithms is to reduce the number of broadcasts. Therefore, the ratio of broadcasting nodes over the total number of nodes as the metric to evaluate the performance of the proposed broadcasting algorithms is considered. Using the ns-2 simulator, this metric against two parameters: transmission range and node density are evaluated. The average ratio of broadcasting nodes for 100 separate runs. The performance of the proposed algorithm is compared with the performance of the Edge Forwarding algorithm.

Using the Edge Forwarding algorithm, each node divides its transmission coverage into six equal-size sectors and decides whether or not to broadcast based on the existence of forwarding nodes in some overlapped areas. The Algorithm shows that the number of redundant broadcasts using their broadcasting algorithm is significantly lower than that of previous notable broadcasting algorithms. As proved earlier, the proposed sender-based algorithm has lower computational complexity and selects fewer forwarding nodes than this algorithm.

The simulation results indicate two interesting facts. First, the proposed sender based algorithm does not require more broadcasts than the proposed broadcasting algorithm. Second, the number of broadcasts using RBS is significantly lower than the number associated with the other implemented algorithms.

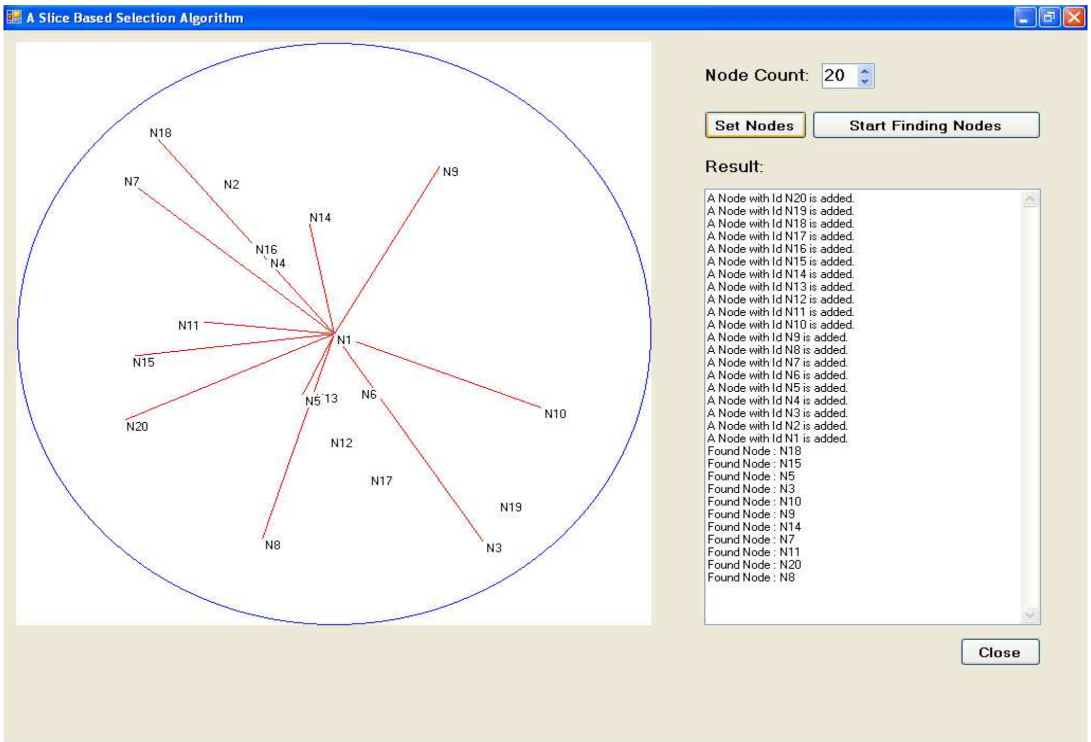

Fig 5.1 Slice based selection Algorithm.

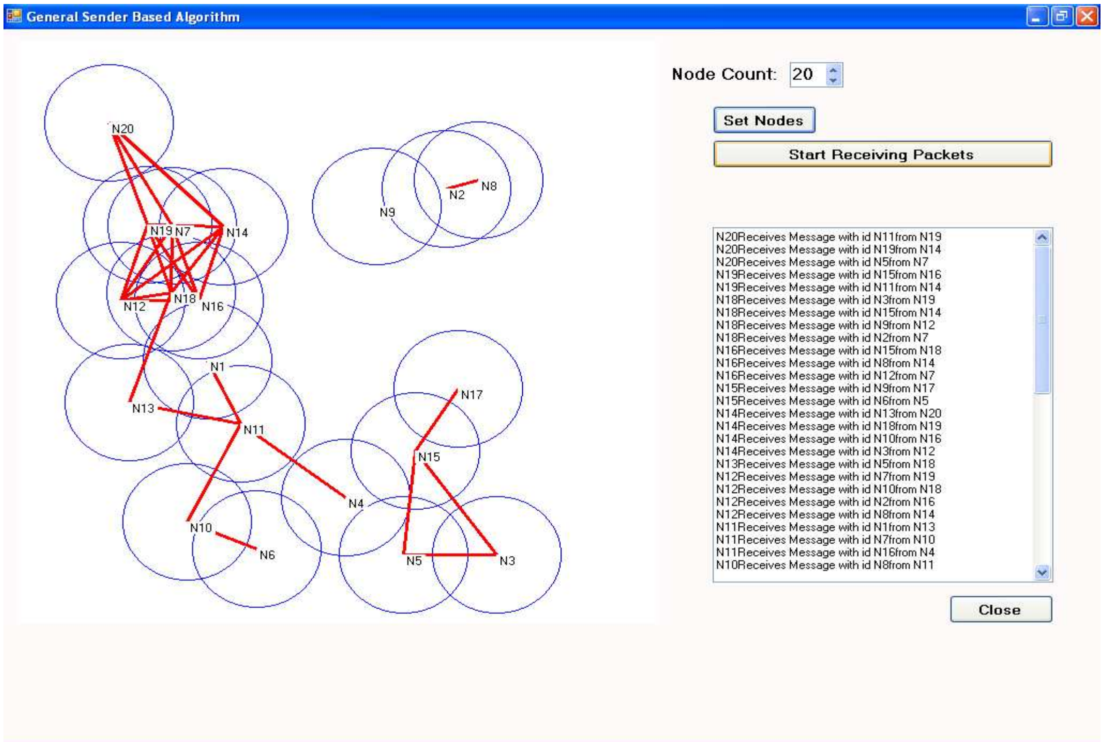

Fig 5.2 General Sender based Algorithm

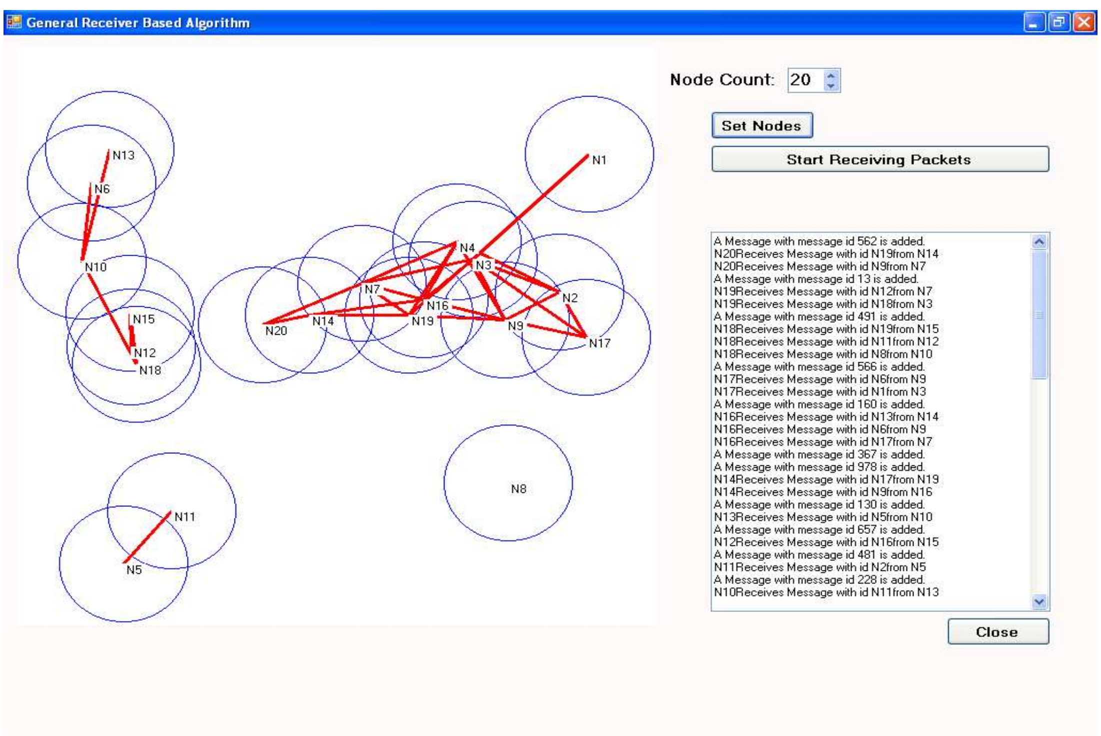

Fig 5.3 General Receiver based Algorithm

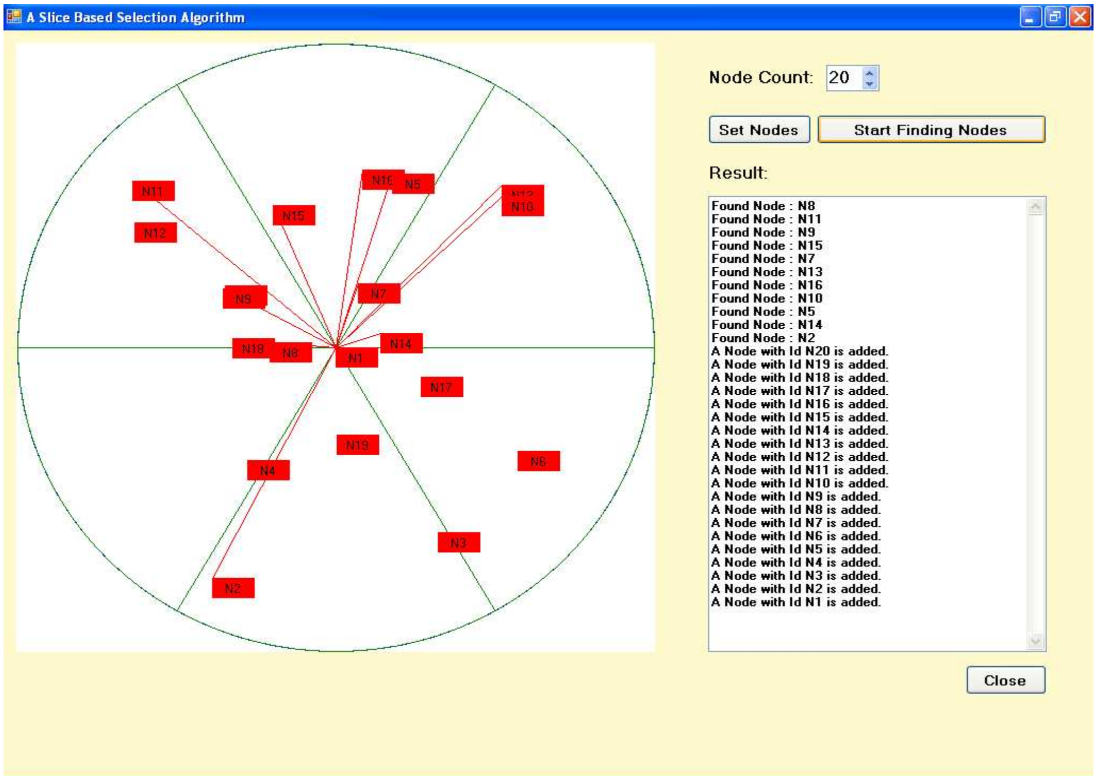

Fig 5.4 Slice based Sender Algorithm

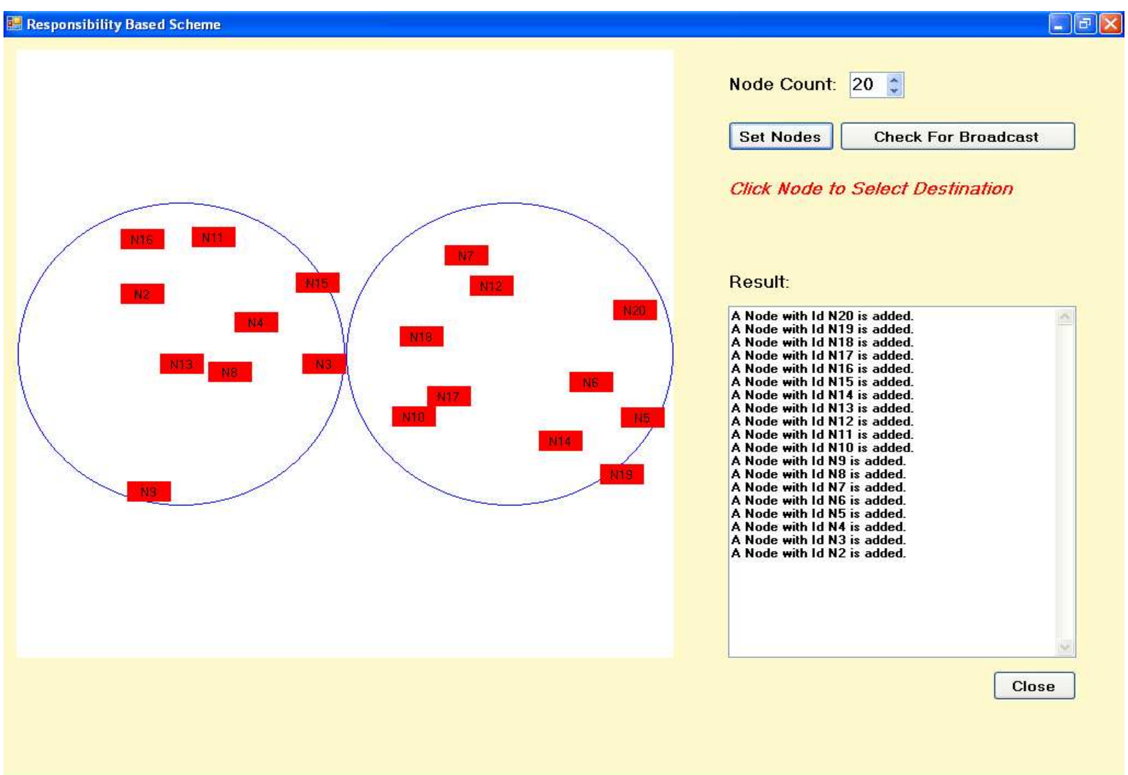

Fig 5.5 Responsibility Based Scheme

VI. CONCLUSION AND FUTURE ENHANCEMENTS

An efficient broadcasting algorithm for ad-hoc network using improved mechanism in worst case scenario is developed. In particular, a slice based sender algorithm and RBS based receiver algorithm to address the broadcasting problem is proposed. It proves the correctness of the algorithm and demonstrated the effectiveness. The proposed algorithms provide powerful broadcasting especially when the number of nodes in more in transmission ranges of sender node. At present the application works well in network environment. Any node with .Net framework installed can execute the application and process the broadcasting algorithms.

The underlying mechanism can be extended to any / all kind of systems and even in multi-platform like Linux, Solaris and more. The system is planned to extend the services can be given as input to IBM architecture also. The new system eliminates the difficulties in the existing system. It is developed in a user-friendly manner. The system is very fast and any transaction can be viewed or retaken at any level. It reduces the time to analyze the broadcasting algorithm.

The new system become useful if the below enhancements are made in future.

- The application can be web service oriented so that it can be further developed in any platform.
- The application if developed as web site can be used from anywhere.
- The algorithm can be further improved so that nodes count is reduced for broadcasting in the worst case.

The new system is designed such that those enhancements can be integrated with current modules easily with less integration work.

REFERENCES

[1] Funke.S, Kesselman.A, Meyer.U, and Segal.M,(2006) "A Simple Improved Distributed Algorithm for Minimum CDS in Unit Disk Graphs," ACM Trans. Sensor Networks, vol. 2, no. 3, pp. 444-453.

[2] Liu.H, Wan.P, Jia.X, Liu.X, and Yao.F ,(2006) "Efficient Flooding Scheme Based on 1-Hop Information in Mobile Ad Hoc Networks," Proc. IEEE INFOCOM.

[3] Ni.S, Tseng.Y,Chen.Y, and Sheu.J (2005) , "The Broadcast Storm Problem in a Mobile Ad Hoc Network," Proc. ACM MobiCom '99, pp. 151-162.

[4] Sasson.Y, Cavin.D, and Schiper.A, (2003) "Probabilistic Broadcast for Flooding in Wireless Mobile Ad Hoc Networks," Proc. IEEE Wireless Comm. and Networking Conf. (WCNC '03), pp. 1124-1130.

[5] Chang.R and Lee.R,(2000) "On the Average Length of Delaunay Triangulations," BIT Numerical Math., vol. 24, pp. 269-273.

[6] Clark.B, Colbourn.C, and Johnson.D,(1990) "Unit Disk Graphs," Discrete Math., vol. 86, pp. 165-177.

[7] Garey.M and Johnson.D, (1990) "Computers and Intractability: A Guide to the Theory of NP-Completeness". W.H. Freeman.

[8] Halpern.J, Bahl.P, Wang.Y, and Wattenhofer.R,(2005) "A Cone- Based Distributed Topology-Control Algorithm for Wireless Multi-Hop Networks," IEEE/ACM Trans. Networking, vol. 13, pp. 147-159.

[9] He.T,Huang.Z, Blum.B, Stankovic.J, and Abdelzaher.T, (2003)"Range-Free Localization Schemes in Large Scale Sensor Networks," Proc. ACM MobiCom '03, pp. 81-95.

[10] Hua. Y. Cai, K., and Phillips.A,(2005) "Leveraging 1-Hop Neighborhood Knowledge for Efficient Flooding in Wireless Ad Hoc Networks," Proc. 24th IEEE Int'l Performance, Computing, and Comm. Conf. (IPCCC '05), pp. 347-354.

[11] Johnson.J. and Maltz.D, (1996) "Dynamic Source Routing in Ad Hoc Wireless Networks," Mobile Computing, T. Imielinski and H.F. Korth, eds., Kluwer Academic Publishers.

[12] Keshavarz-Haddad.A, Ribeiro.V, and Riedi.R,(2007) "DRB and DCCB: Efficient and Robust Dynamic Broadcast for Ad Hoc and Sensor Networks," Proc. Fourth Ann. IEEE Conf. Sensor, Mesh and Ad Hoc Comm. and Networks (SECON '07).

[13] Khabbazian.M and Bhargava V.K (2008), "Localized Broadcasting with Guaranteed Delivery and Bounded Transmission Redundancy," IEEE Trans. Computers, vol. 57, no. 8, pp. 1072-1086.

[14] Lou.W and Wu.J,(2004) "Double-Covered Broadcast (DCB): A Simple Reliable Broadcast Algorithm in Manets," Proc. IEEE INFOCOM '04, pp. 2084-2095.

[15] Peng.W and Lu.X,(2000) "Mobility Management and Its Applications in Efficient Broadcasting in Mobile Ad Hoc Networks '00, pp. 129-130.

[16] Perkins.C,(2004) "Ad Hoc on Demand Distance Vector (AODV) Routing", IETF Internet draft, work in progress.

[17] Feng.W Sun.M and Lai.T,(2001) "Broadcasting in Ad Hoc Networks Based on Self-Pruning," Proc.

IEEE Global Telecomm. Conf. (GLOBECOM ’01), pp. 2842-2846.

[18] Wan.P, Alzoub.Ki, and Frieder.O(2002),“Distributed Construction of Connected Dominating Set in Wireless Ad Hoc Networks,” Proc. IEEE INFOCOM ’02, vol. 3, pp. 1597-1604.

[19] Wattenhofer.R, Li.L, Bahl.P, and Wang.Y,(2001) “Distributed Topology Control for Power Efficient Operation in Multihop Wireless Ad Hoc Networks,” Proc. IEEE INFOCOM ’01, pp. 1388-1397.

[20] Wu.J and Li.H, “On Calculating Connected Dominating Set for Efficient Routing in Ad Hoc Wireless Networks,” Proc. Third Int’Workshop Discrete Algorithms and Methods for Mobile Computing andComm. (DIAL-M ’99), pp. 7-14, 1999.

