MPLI: A Novel Modified Parametric Location Identification for AODV in MANET

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ABSTRACT
Wireless ad hoc network provides a short range communication medium for mobile devices. In such type of network the components satisfying the infrastructural needs are not presents and each functionalities needs to be performed by inbuilt elements of the nodes which let them work as a router. Routing is one of the key features performed by specifically designed light weighted protocols in these ad-hoc networks. It suffers from various issues includes route discovery, bandwidth management, congestion, location detection, energy effective operations, link handling etc. All of the above and many other functionality is mainly depends upon the position of the mobile nodes.

Over the past few years location based networking technologies is changed very abruptly along with a horizontal and vertical growth in number of applications and its users. This dynamic change in topologies makes the task more difficult to resolve it accurately and with limited number or parameters. This paper proposes a novel MPLI (Modified Parametric Location Identification) approach. Apart from only using the x and y coordinates, the suggested work added some more values which includes angle of arrival, time, distance and circular region quadrants for accurate detection. It also provides timely updates of positions so as to make the routing more robust and position aware so as to avoid data losses and connection termination due to mobility.

Keywords
MANET (Mobile Ad-Hoc Network), Routing, AODV, Location Identification, Parametric Detection, MPLI (Modified Parametric Location Identification)

1. INTRODUCTION
Wireless network refers to any type of computer network that is wireless, and is commonly associated with a Telecommunication network whose interconnections between nodes are implemented without the use of wires. Wireless telecommunication networks are generally implemented with some type of remote information transmission system that uses electromagnetic waves, such as radio waves, for the carrier and this implementation usually takes place at the physical level or levels of the network. A MANET is a self-organizing and self-configuring wireless ad-hoc network based on some mobility based characteristics. In such networks, the mobile devices perform functionality of router having various lightweight supporting routing protocols. The interconnection between the nodes is represented by their topologies and due to movable nature of nodes the dynamic modifications are applied on to it. These dynamic topology changes due to unconstrained bandwidth, node mobility, limited battery power etc. While the user concerns is only oriented towards communications and if it breaks loss of data occurs which causes reduction in user trust over the system and network.

User can start communicating any time any where needs a continuous support even in motion. This can be achieved by specialized mobility aware routing protocols whose primary aim is to serve location updates more frequently as the position changes. Such robust communication makes is familiar with different application areas such as healthcare, transportation, military, sciences, air buses, etc. As it is infrastructure less thus more support and functionality needs to be added to additional protocols embedded in those devices. But as this mobility is increased, the connection handling gets more difficult because of its frequently changing dynamically topological conditions. This change is mainly depends upon the position of mobile nodes. Managing these dynamic updates with continuous connection is considered as a critical research challenge.

Nodes of an ad hoc network relay on one another in forwarding a packet to its destination, due to the limited range of each mobile host's wireless transmissions. An ad hoc network uses no centralized administration. This ensures that the network will not cease functioning just because one of the mobile nodes moves out of the range of the others. Nodes should be able to enter and leave the network as they want. Because of the limited transmitter range of the nodes, multiple hops are generally needed to reach other nodes. Thus is been identified that measuring the accurate position of a mobile device in MANET is a complex problem and needs to be solved for improved performance and data delivery.

The problem of designing location update schemes to provide accurate destination information and enable efficient routing in mobile ad hoc networks appears to be more difficult than routing itself. The task of finding and maintaining routes in sensor and ad hoc networks is nontrivial since host mobility and changes in node activity because frequent unpredictable topological changes [1].The routing schemes working for position and location management comes under the position based routing and location aware routing which is identified using different protocols such as Ad hoc On-Demand Distance Vector (AODV), Optimized Link State Routing Protocol (OLSR) [2, 3].

The rest of the paper describes a brief study and suggests some of the improvements using a novel architecture for frequent position updates. Which describes in Section 2 gives a brief review of background of the topic, Section 3

containing the literature survey of the paper, Section 4 has the problem statement, Section 5 gives a proposed solution, Section 6 will provide the expected outcomes of the solution and Section 7 gives evaluation parameters.

2. BACKGROUND

In MANET node is continuously changing its position and the aim is to make the updates on real time as it moves. Also the communication in mobile ad-hoc network without infrastructure is based on basic functionalities of these nodes and if the node moves suddenly and data or communication fails to complete than losses of system will reduces the trusts. For location identification various approaches are suggested having their own advantages and disadvantages. Let us considered scenarios of communication in a MANET, where normally, every node is aware about its actual position using some coordinates of x and y positions and notifies this information to all its neighbors using a small location update packet of announcement [4]. So source broadcast its information and determines its destinations positions through various routing protocols or some location identification scheme such as global positioning system (GPS). Any additional information about the position update or change in location will definitely increase the location detection accuracy. It is required entity because if the actual positions is not measured and data is dropped due to change in topologies ten the number of users gets their communications terminated due to single node.

A node does not aware about the position of its neighbor and if it requires some location information then location identification is initiated. Source sends a packet location identification packet with some delays to its neighbor. Neighbor inserts the coordinates and let the packet forward to source node and a copy is further broadcasted. In this way final position of all the nodes is gets updated and sent to source node. The node having minimum delay is taken on be closest and the node is having maximum delays is considered at distant locations. But the problem is with the coordinate based detection mechanism having only two parameters x and y. Most of node is at closed distance but be on some heighted points which is not measured by existing location updates and is taken as a critical issues. Also the updating of location for sudden change in position and direction of motion of node is even not treated properly.

The node situated at the most “optimal” location introduces the smallest number of delay and, thus transmits the packet at earliest. The additional nodes detect this succeeding relaying and cancel their programmed transmission. On one hand side, the overall delay is amplified, but on the other hand side, the use of battery power can be concentrated considerably at the same time as well [5]. So while taking into consideration the above dilemma of dynamic node mobility and frequent updates this work proposes a novel model for real time location detection with larger accuracy of identification. The work takes some preliminary assumptions about the working area as a circular zone partitioned in four areas.

3. LITERATURE SURVEY

During the last few years there is a sudden growth in number of users operating wireless mediums on their mobile devices. Such mediums is depends upon the device locations for transmitting the signals. In case of mobile ad-hoc network the problem is gets denser because of zero infrastructure supports and less energy due to battery based systems. Various location based routing mechanism is suggested. Some of them related to this study is presented here as below:

In the paper given by the author of [6], suggest a multipoint relays (MPR) method which implements the flooding function based on some location parameters for wireless networks. The approach is capable of reducing the number of redundant re-transmission while diffusing a flooding packet during the entire network connection process. Here every node in the network selects one of the neighbour nodes as a Multipoint Relays (MPR) point. Such network will only transmit some location information by using flooding mechanism with a conditional block on maximum two hops neighbours.

In the paper [7] a Location-Aided Routing (LAR) protocol is proposed. The suggested approach decreases the overhead of route discovery mechanism by utilizing location information of each mobile node in a network. Mainly these processes of accurate identification of location are through a dedicated hardware device and mapping functions used by (GPS). The approach is based on two specific regions called as expected zone and forwarded zone from which the communication can be performed. It reduces the search space for a desired shortest route through its reduced discovery mechanism.

Some of the authors had also worked with random progress methods and nearest forward progress (NFP) using greedy approach as given by [8]. According to the approach the primary constraints will always based on geographic distance. S selects neighbouring node G that is closest to the destination among its neighbours. Only neighbours closer to the destination than S are considered. Otherwise, there is a lack of advance, and the method fails.

The aim is to perform overall route discovery with accurate location detection. The aim is to make the overhead reduction for location calculation in large number of nodes. A scenario based proof and a novel mechanism is given in [9]. Normally the source node requests to send data packets to a destination, then first it should get the position of the destination mobile node by contacting a position service which is accountable of mobile nodes position. This causes a connection and tracking problems most of the time and also a device dependent. But in MANET dependencies are avoided.

The solution of above problem with zero dependencies and reduced overhead is suggested by [10]. This scheme is the first position-based routing scheme, based on the notion of progress as the communication goes the location and mobile parameters might also changes. For a network scenario transmitting node S, the progress of a node A is defined as the projection onto the line linking Source (S) and Destination (D). In the Most Forward within Radius (MFR) scheme, the packet is forwarded to a neighbour whose progress is maximal and rejected the packets having minimal location updates. At the evaluation levels the approach is proving its efficiency.

A variant of the above suggested greedy method using GPS method is called the Geographic Distance Routing (GEDIR) scheme [11]. In this alternative, applied on other schemes as well, all neighbours are considered, and the message is dropped if the best choice for a current node is to return the message to the node the message came from.

The [12] Dynamic Source Routing (DSR) protocol is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two mechanisms: route discovery and route maintenance, which work together to allow nodes to discover and maintain source routes to arbitrary destinations in the ad hoc network [6].

According to the paper [13], variable-radius routing protocols for achieving higher throughout, smaller latency at a given traffic load, and/or lower power consumption in ad hoc networks is proposed. According to them forwarding method for routing in multi-hop networks that takes into account Raleigh fading and non-fading channels [14]. Candidate nodes, addressed in the data packet header, who successfully receive the data packet, return acknowledgments in consecutive order. The first neighbour to take action is the forwarding neighbour. Stateless routing schemes are localized schemes where nodes do not need to remember past transfer. All decisions are based on the position of neighbouring nodes, location of the destination, the position of the neighbouring node that forwarded the message in the preceding step, and the in order that arrives with the communication.

4. PROBLEM STATEMENT

In MANET the mobile nodes are free to move from one region to another and support dynamically changing topologies. These topological changes cause the network to suffer several issues which affects the communication between the pairs of nodes. The best routing mechanism causes this communication to survive in typical changing conditions and must be aware about the nodes locations to support the rest of the required functionalities. Thus location detection and management is a continuous task and must be added to the core functionality of standard routing protocols. Currently these location detection mechanisms will only perform the position detection on the basis of coordinate system by which accuracy on the identification is not measured. Some of the major factors affecting the location detection mechanism are routing overheads, interferences, asymmetric links, dynamic topologies, and all the above should be performed in energy efficient manner.

Thus there are some problems which remains unsolved by the existing mechanism of location based routing are addressed here.

Problem 1: Location detection is achieved by only using x and y coordinates positions which will not measures the correct positions always. Some additional parameters need to be added for more accurate results.

Problem 2: Frequent change in topologies and positions is not handled by existing routing mechanism. Thus dynamic decisions about the change in positions must be informed to entire nodes before selecting the best route to the destination.

Problem 3: Location and angle of the node for height based values and communication is not measured.

Problem 4: The identified range for communication is pre-empted to be square. But in actual network scenario it needs to be circular. So circular location detection schemes are not presents with above parameters.

Problem 5: Energy efficient communication is not achieved by existing mechanism and also the accuracy of detected location in dynamic condition is far away from actual positions. So less cost based dynamic position calculation needs to be performed.

Thus this work proposes a novel mechanism for accurate position calculation and updates using five parametric values and a proxy node for performing these operations. This central node will present at the centre location for the entire neighbour node and identifies the expected zone and forwarded zone in terms of circular quadrant.

5. PROPOSED APPROACH

An After studying the various existing location identification mechanism it is found out that some of the issues remains unaddressed is absence of which the location accuracy is not achieved. The accurate location information is used to reduce the flooding attacks. Normally if the location of the destination node is not known than the source node broadcast the location detection packets in every direction irrespective of the destination directions. If some location mechanism is working than flooding packets reduces which saves time and cost of network. This work proposes a novel mechanism for improving the detection accuracy by using proxy node. This node is a central node which is responsible for all the location management tasks. In the proposed approach a packet can just be sent to any intermediate node into the direction of the destination, making almost stateless routing feasible. In this way, nodes neither have to keep track of installed routes nor to store routing tables.

A further advantage of proposed mechanism by supporting geo-casting is to reduce energy requirements for the detections. The source node identifies the position of destination before transmitting the data. The location detection is based on some parameters which include: x coordinates, y coordinates, quadrant number, distance and angle of the node. From the above basic parameters the location mapping accuracy is increased by about 30 %. The existing mechanism only identifies the location for a node by only using coordinates and not considering the other parameters from which the accuracy is increased.

5.1 Protocol of Work

AODV (Ad-Hoc on Demand Distance Vector Routing): It is a reactive protocol used for MANET. The protocol is of type lightweight and is having different functionalities by which the location detection can be implemented practically and evaluations can be made.

The aim of this protocol is to provide node to node communication supporting wireless medium without any infrastructures. It is also capable of handling dynamic topologies which is most important factor of position changes of mobile nodes. Mainly it aims to reduce routing overhead, interference and provides energy efficient solutions for routing.

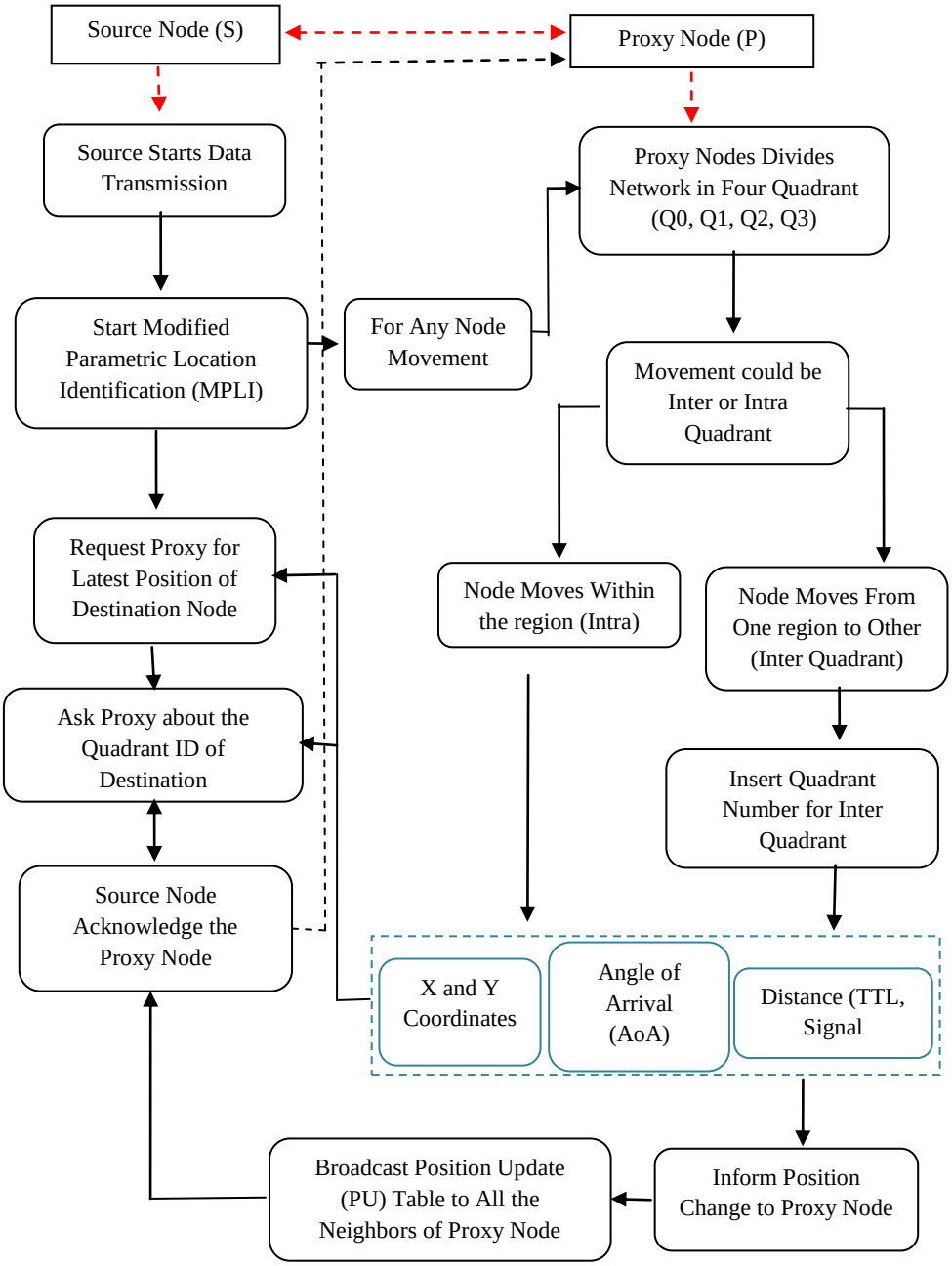

Fig 1: Proposed Modified Parametric Location Identification (MPLI) Approach for Location Identification in MANET

5.2 Description of Approach

Initially the source (S) wants to communicate with the destination (D) and hence the MPLI location detection starts working. Aim is to identify the accurate and real time detection. For any communication region there is a dedicated proxy for each them and hence as the request for location is reached then the proxy starts the location detection modules. S sends the request hello message to proxy for location of destination D. Also the proxies are mainly considered with location detection of any existing node in a network and position updation from the node is frequently identified and informed to every node within the same network.

Proxy node divides the overall network into four equal size circular quadrants (Q0, Q1, Q2, and Q3). Proxy is located at centre of these quadrants. Now proxy identifies the nodes motion between any two different quadrants termed as inter quadrant and if the motion is within the same quadrant is termed as intra quadrant movement. For inter quadrant the value of quadrant must be inserted in the hello packet. Now, first the quadrant is identified and then later on other parameters is detected which includes x coordinate, y coordinate, angle, distance based on TTL and signal strength.

Now as the positions parameters values is detected the actual location of the node is identified which later on inform to the requested node that is source. Now the source node acknowledges the proxy on this identified location message reception. Proposed protocol is also called as a Reactive Protocol and work as an on demand

routing protocol. In Reactive protocols, nodes only discover routes to destinations on-demand. Reactive protocols often consume much less bandwidth than proactive protocols, but the delay in determining a route can be substantially large. Proactive protocol is suitable for small network not for larger network because protocol need to maintains node entries for each and every node in the routing table. At the initial level of research work the approach is promising the strong presence in near future.

5.3 Mathematical Evaluations

5.3.1 Average Residual Energy

Let Pij and Ep be the energy required to route data packet from node i to node j and the energy required to calculate position by the node respectively then the energy consumed by the node in the network Ec is

$$Ec=\sum i=1 \text{to } n \; Pi+Ep$$

Let Ee be the total initial energy of a node and Ec is the energy consumed by the node in the network. Therefore the average residual energy of each node Er may be calculated as Er = Ee – Ec. Total energy consumed by the node in the network is equal to the energy required to route packet from one node to another node plus the energy required to calculate the position of the node. The average residual energy level of nodes and hence of the network is given by equation.

$$Ea= (\sum r=1 \text{ to } n \; Er)/n$$

Where n is the total number of nodes. The proposed protocol ensures less number of hop counts which in turn reduces Pij. This factor in turn increases the average residual energy level of each node and hence of the network. The lower computational complexity towards calculation of location information in making routing decision minimizes energy consumption per routing tasks.

5.3.2 Control Overhead Estimation for MPLI

With HELLO Packets, the number of control packets generated between all the nodes (N) in an ILCRP in simulation time (Tsim) is N. The HELLO packets generated between all the cluster heads(C) in Tsim is

$$C. (Tsim/Tref).\sum i=1 \text{ to } c \; Hij$$

Where Tref is the refresh period between each HELLO message. After Cluster formation, the number of control packets generated between all the nodes (n) in a cluster is n. (Tsim/Tref). Therefore for C clusters, control packets generated will be n.C. (Tsim/Tref)

Hence the total number of control packets generated in MPLI in Time Tsim is

$$N+ C. (Tsim/Tref).\sum i=1 \text{ to } c \; Hij + n.C. (Tsim/Tref)$$

Where

N – Total number of Nodes in the network

C – Number of clusters in the network

Tsim – Simulation Time

Tref – Refresh Period

Hij– no of Hop counts

n – Number of nodes in a cluster

5.3.3 Packet Delivery Ratio for MPLI

The maximum packet delivered per node is $\mu\sqrt{N}$ where μ the channel capacity is and N is the number of nodes.

6. EXPECTED OUTCOMES

At the primary level of work the approach is proving its authenticity and providing a deeper clarification towards solving the issues of existing mechanism. Analysis of suggested approach at the architectural view on different location dependencies parameters the suggested work seems to satisfies all the requirements in energy efficient parameters. Apart from frequently changing characteristics and their handling mechanism there are some more benefits seems to be provided by the approach. These are:

- Improved location identification in energy efficient manner
- Parametric calculation reduces overhead
- Circular quadrant will simulates actual routing and transmission conditions
- Angle and distance gives accurate measurement
- Less cost and time based evaluations
- Regular updates are provided for frequently changing positions
- Dynamic topology handling
- Monitored movement
- Directional routing reduces congestion

So many other expected results will prove its authenticity after practical implementation in near future.

7. EVALUATION PARAMETERS

In order to validate the proposed protocol and show its efficiency in future this work considers various parameters and uses them as a evaluation model for proposed approach. The scenario of nodes mobility is generated randomly based on random way point model where a mobile node moves to a new position and pauses there for time period between 0 to 3 seconds, then it move to another position. In such condition the identified parameters are:

7.1 End to End Delay

End to End Delay indicates the time taken for a packet to be transmitted across a network from source to destination. It shows that the end to end delay reduces if the exact locations of all the nodes are obtained. On increasing the mobility of the nodes, the delay increases due to reconfiguration of the clusters. The end to end delay also increases due to increases in the number of nodes.

7.2 Packet Delivery Ratio

It is defined as the ratio of total number of packets that have reached the destination node to the total number of packets originated at the source node. The location information of the nodes make the packets route loop free which results in high packet delivery ratio. On increasing the mobility i.e., speed of the nodes, the delivery ratio decreases since most of the nodes move away from each other.

7.3 Control Overhead

It is defined as the ratio of the number of control packets transmitted to the number of the data packets delivered. Usage of cluster based routing protocol for clustering and exact location information for route discovery reduces the control overhead in the network.

7.4 Residual Energy

It is the measuring factor used for identifying the energy basis requirement for transmitting the location updates from the destination to source node. It also represents the energy requirement for the proposed work in comparison with existing approaches.

8. CONCLUSION & FUTURE WORK

Network is growing exponentially in terms of user and type of services which it offers to satisfies the needs. Dynamic topology changes due to mobility of nodes causes sudden drops in network performance and sometimes even causes data drops. Motion is not planned or directional always so routing cannot be predefined. Location identification is the one of such requirement used for accurately identification of the mobile node position in terms of the existing coordinate system. Thus location or position detection plays a very important role in handling such dynamic behaviour of the network. There are various mechanism suggested over the last few years to handle this location management. But still some improvements over the residual energy based calculation and accuracy in detection is required. Considering the above factor, this work proposes a novel MLPI (Modified Parametric Location Identification) approach using five parameters. At the initial assessment criteria, the approach is proving its effectiveness and showing its strong presence between the existing location identification schemes.

Some problems and concepts that remain unaddressed might be solved in future. Such as with the help of Distance and Angle of a node, MPLI can identify the node which performs warm activity within the network. An IDS (Intrusion Detection System) in central node position can also be placed for intrusion identification. The authors are also planning to embed the source code in NS2 in near future.

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