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TNLIQ: Trust Validation in Ad-Hoc Networks using Dynamic Location Identification to ensure QoS

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Abstract- MANET system is a sort of remote system, is self-designing frameworks less system gadgets are associated by remote. The gadgets of MANET organize is allowed to move freely toward any path that is the reason connecting with whatever other gadgets is effectively done. Each must forward movement random to its own particular utilize, and consequently be a switch. The essential objective of Mobile specially appointed system is every gadget to consistently keep up the data required to appropriately course movement. This paper discuss about the path loss in ad-hoc environment to compute path to destination. Current location and identified location to identify attacker node to ensure QoS. The packet loss is reduced and results of RREQ utilization is calculated using network scenarios.

Keywords: MANET, Energy efficiency, Link Failure, AODV, Dalwi-AODV

I. INTRODUCTION

A portable specially appointed system comprises of versatile hosts furnished with remote specialized gadgets. The transmission of a versatile host is gotten by all hosts inside its transmission extend because of the communicate idea of remote correspondence and omni-directional reception apparatus [1]. In the event that two remote hosts are out of the transmission extends in the impromptu systems, other versatile hosts situated between them can forward the messages, which successfully assemble associated systems among the portable host in the conveyed zone. The system topology may change quickly and capriciously after some time, on the grounds that the hubs are versatile. Such a system may work in an independent form, or might be associated with the bigger Internet. MANETs have certain attributes like Bandwidth-compelled, variable limit joins, Energy obliged Operation, Limited Physical Security, Dynamic system topology and Frequent steering refreshes. MANET architecture with N1 as source and N9 as destination as shown in figure 1.

In IoT, the nodes are energy constrained. The routing for an IoT application is a tedious task. The success level of routing is measured based on QoS parameters [2]. 6LoWPAN plays a major role in IoT routing. In 6LoWPAN routing, the nodes are act as node as well as routers [3]. The proposed technique computes location of the node dynamically using local positioning system (LPS) [4].

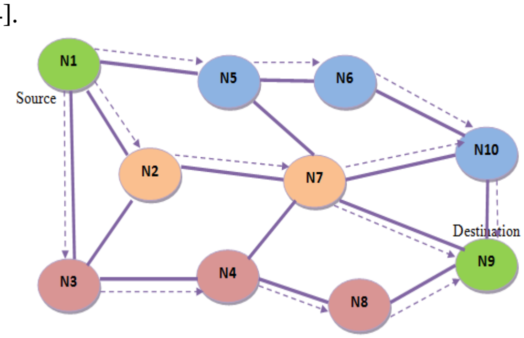

Figure 1 MANET Network Scenario

The gateway nodes act as the sink nodes. Sensor/ end nodes are not capable of communicating with the internet directly. However, relay nodes are used as intermediate nodes to communicate with the internet. In a smart home environment, the CCTV cameras are used for surveillance. The camera nodes are connected with the power line to communicate with internet. These nodes are used to validate the data sent by the sensors. This phase is termed as a trust validation. The location information of the sensor is used as the parameter to validate trust. The location of the sender node is computed dynamically in the location computation phase. The computed position of the node is compared to actual position of the node. Quality of Service is assured by identifying trusted parts namely topology construction, Trust validation and data transmission [5].

II. Topology construction

The Network topology construction for IoT varies from Application to Application. In a smart home environment, the sensors are fixed in various locations. Sink node/gateway node acts as cluster head for sensor nodes [6]. The sensor nodes are termed as end nodes; it senses the data and forwards it to the parent node or directly to gateway node. The end nodes are resource constrained nodes. So they are not connected directly to the internet, instead they are connected through the gateway (g_i) [7].

III. Location Identification

The Relay node acts as intermediate node between end nodes. The relay node is not a router node. For example, the Surveillance camera with Power Line Communication (PLC) can act as a relay node. The node with PLC is not energy constrained so they are directly connected to the internet. In smart home environment, most of the nodes are static (mesh under routing) [8]. The physical location of the nodes are identified and stored in the gateway. The message forwarding in mobile network is different from 6LoWPAN forwarding. In mobile network the routers acts as intermediate node, whereas in 6LoWPAN the node itself acts as router [9].

The location information of the end node calculated in two different environment namely in-door and out-door. The location in in-door is computed by the Received Signal Strength Indicator (RSSI) value. Out-door location is computed using reference node information [10]. The RRSI value measured by the gateway gives the received power level further it need to be converted into power consumed dBm. It can be easily converted into received power by applying offset to compute the correct value. The obtained RRSI is converted by the processor into analog-to-digital (ADC) [11].

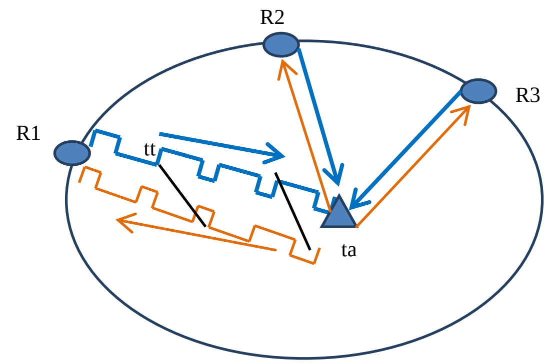

Figure 2 Location of Target Node

Where R1, R2, R3 are the reference nodes, TA is the Target of source node, tt is the transmitted wave, rt is the receiver wave. In the above scenario as shown in figure 2, the distance is taken as 2 m/km. The 20 different $RRSI_{ij}$ (i=1,2,3,….10 & j=1,2,3,….10) values are computed for 10 different distance (k=1,2,3,….10) for three different reference / gateway nodes as given equations below. The average RRSI value (PL) is measured using i th node at the ith location with distance d. IoT uses two major physical link protocol as shown in the table 1. The received signal strength of protocols are different from the frequency used in the protocol.

Table 1 Physical Layer Protocol

	Protocol 1	Protocol 2
Protocol	802.11n	802.11ac
Frequency	2.4 GHz	5 GHz
Bandwidth	20/40 GHz	40/80/160 GHz
Modulation	MIMO, OFDM	MIMO, OFDM
Indoor	230 ft	115 ft
Outdoor	820 ft	-

$$RSSI_{ij} - 10n \log10 \log10(d) + A$$

$$(i = 1,2,3 \ldots n;\ j = 1,2,,,n)$$

$$AveRSSI_{ij} = \frac{1}{N} \sum_{i=1}^{n} RSSI_{ij}$$

$$\overline{PL}\,(d_i) = \sum_{j=1}^{20} RSSI_{ij}$$

(i=1,2,…….10; j =1,2,…..20)

$$Y = Z * X\,(d_0 = 1)$$

$$X = \left[\frac{\overline{PL}\,(d_0)}{\eta} \right];$$

$$Z = \begin{bmatrix} 1 & -10 * \log_{10}(d_1) \\ 1 & -10 * \log_{10}(d_2) \\ 1 & -10 * \log_{10}(d_{10}) \end{bmatrix}$$

$$Y = \begin{bmatrix} \overline{PL} & (d_1) \\ \overline{PL} & (d_2) \\ & \vdots \\ \overline{PL} & (d_{10}) \end{bmatrix}$$

IV. PATH LOSS in a FREE SPACE (PL_{FS})

The location computed form RRSI is not accurate because of Path loss and it varies from indoor to outdoor. The path loss in the free space (PL_{FS}) is the fraction of distance from the gateway node and the wavelength of the communication technology [12] (BLE, Wi-Fi.. etc). The wavelength of communication technology is the fraction of frequency and velocity of the wave. The constant value is depending on the frequency measure and distance measure. When the frequency is measured in Hertz (Hz) and distance in meter (m) then the value of constant is 92.45 [13].

$$PL_{FS} = \frac{4\pi^2 d^2}{\varphi}$$

Where, d is the distance from the transmitter, φ is signal wavelength, f is the signal frequency, c is the speed of the light in vacuum ($2.99*10^8$)

$$PL_{FS} = 10 \log_{10}\left(\left(\frac{4\pi df}{c}\right)\right)^2$$

$$PL_{FS} = 20 \log_{10}\left(\frac{4\pi df}{c}\right)$$

$$PL_{FS} = 20 \log_{10}\left(\frac{4\pi}{c}\right) + 20 \log_{10}(d) + 20 \log_{10}(f)$$

When the distance (d) is measured in Kilo meter (Km) and frequency (f) measured in gigahertz (GHz), the path loss in free space is calculated as in equation. The value accrued in that equation is given as input for next equation to compute the path loss, whereas the value of frequency f and distance d depends on communication used in the physical layer.

$$20 \log_{10}\left(\frac{4\pi}{c}\right) = 92.45$$

$$PL_{FS} = 20 \log_{10}(d) + 20 \log_{10}(f) + 92.45.$$

V. TNLIQ ALGORITHM

Step 1 Identify the network Topology
Step 2 Position and quadrant of the neighbour nodes are calculated by the received radio signal.
Step 3 Sender node chooses one node from each quadrant for RREQ propagation.
Step 4 Steps 2 and 3 are continued till the destination reached.
Step 5 Destination node constructs RREP and uni-cast to the source node

Whenever a node needs to communicate with other node, the communicating node termed as source node. The communicated node is termed as destination node. The nodes acts as routers to establish a connection are termed as intermediate nodes. The source node initiates the path discovery process by sending RREQ control packet. The control packet reached the destination via intermediate nodes. The destination node responds to the RREQ by sending RREP control packet. The source node receives RREP control packets through intermediate nodes via different paths.

Numerical data are implemented with different scenarios and the performance is estimated. Network is assumed. Bandwidth is assumed to be 4 Mbps and it is denoted in percentage. Based on packet size and the available bandwidth, time delay is calculated. Bandwidth is denoted in percentage. Based on packet size and the available bandwidth, time delay is calculated. The source and destination are identified.
The following formula used to find the energy level in each node [14].

Energy (E) = Power × time

That is, when a node is transmitting or receiving a packet, the energy consumption is directly proportional to transmitting or receiving power and the transmitted time [15].
The time is calculated as

Time = 8 × Packet size/Bandwidth

Substituting equation below

Etx = Ptx x 8 x Packet size /Bandwidth

Erx = Prxx 8 x Packet size /Bandwidth

Where Etx and Erx are energy consumed when packet is transmitted and received respectively.
Ptx and Prx are power consumed when packet transmitted and received respectively.

The energy consumed when nodes are forwarding a packet is equal to the sum of transmitting and receiving the packet,
Et = Etx + Erx

According to proposed algorithm the path with minimum delay is chosen, among the 5 available paths S-F-E-D has the minimum delay of 20. So the path is chosen and the power is taken into consideration. In the path S-F-E-D the minimum power, so the power is transmitted from node A to node F using WPT technique. Then the data packets are forwarded in the path.

VI. CONCLUSION

The main idea of TNLIQ is to provide QoS in MANET routing. QoS-AODV is utilizing the shortest path and providing communication with minimum end-to-end delay. AODV chooses the shortest with sufficient energy and provides communication without link-failure in spite of energy shortage. AODV has no link failure due to energy shortage but there is a significant delay. In TNLIQ, both delay and link failures are reduced in spite of energy shortage as energy is transferred to the required node using WPT. Ultimately, the TNLIQ enhances the QoS in MANET.

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