



## Performance Evaluation of Dynamic Source Routing Protocol in Smart Environment

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### ABSTRACT

The digital revolution of the last decade has created major successes in the field of integral communication technologies and people have changed the way to live, communicate and work. Cities are transforming from static infrastructure to dynamic infrastructure and buildings to dynamic smart cities. Mobile Ad-hoc network is making its presence in almost every aspect of life including its broad applications in the home, healthcare, transportation, building, government services, medical services, business, agriculture, etc. In this paper, we present the performance of the Dynamic Source Routing protocol by introducing the new designed enhanced technique. Our technique removes the Stale route present in the network and enhances performance. Also, the packet drop rate and latency are reduced. And the quality of service is also meet for various applications.

**Key words:** AODV, DSR, Energy Efficiency scheme, IoT, Identification management, MANET, VANET.

### 1. INTRODUCTION

Mobile Ad-hoc network (MANET), is revolutionizing our world with trillions of sensors and actuators by creating a smart environment around us. It will connect all, animate and inanimate things that lead to revolutionary changes. Ubiquitous sensing abilities offer shared information to develop a common operating picture. In any application, wireless brings the physical world very close to the digital world that can be implemented by leveraging fog computing. It enables many objects (devices) to act as smart things. Objects are connected using different network media. Today, physical devices, vehicles, home appliances, industrial machines, and wearable devices, all are parts of wireless. Two major common properties of these devices are ideal connectivity and enormous data transfer. And for transmitting data we require good and efficient routing protocols in the network. The connections bring lots of problems in the network, and it requires a good routing mechanism [1]. The smart environment is at the position of the prominence of almost everything people use as consumers. People as consumers are using many smart things (devices) ranging from home equipment to Amazon echo. Smart environment integrates various types of sensors, devices, and nodes having the capability to communicate with each other without the intervention of human. Objects enabled with MANET technology have been embedded with smart capabilities through the use of various tools and technologies like sensors, RFID and many other forms of embedded computing.

There has been a lot of upliftment in wireless technology over the last few decades but still many drawbacks remain left like Short Battery Lifetime, Power Consumption Problem, Issue of Adaptation, More Overhead, security, privacy, authentication, connectivity, jamming, attacks, blocking, spoofing, data tampering, low data receiving rate, high drop rate, etc. Many protocols have been used to overcome all these shortcomings within the smart environment, but these protocols have their own drawbacks. To transmit data quickly and safely within the network, those protocols should be used which obtain structure change of network topology. Enhancement in Routing protocols will develop a secure, efficient and better application in a smart environment. Integration of MANET Protocol in the IoT environment can also solve above-mentioned problems up to a certain extent. This paper present MANET protocol which can be used in various IoT application.

If the problems of MANET routing protocols are reduced, then we will be able to develop a safe, efficient and better application in a smart environment. There are some drawbacks that need attention [2].

- There are still many problems in routing protocols like data rate, delay problem, battery lifetime, less delivery ratio, high drop rate, more overhead, etc.
- When the path becomes invalid, there must be some scheme to provide the quick establishment of the path in the network.
- Adaptation issue is the major problem here.
- When changing topology, there should be a mechanism that automatically provides another path to send data when the main route is blocked in the network.
- Routing protocol needs to implement security to protect against attack.
- Frequent disconnection, controlling overhead and handling dynamic connectivity is a major issue to be solved.

### 2. APPLICATIONS OF MOBILE ADHOC NETWORKS IN SMART ENVIRONMENT

We see various devices together and communicating with each other. An example is a house where refrigerators, mobile devices, TVs, tablets, game consoles, PCs are connecting to the internet. Application of MANET is shown in social networking, toll collection, and contactless payment, travel, and tourism industry, library applications, Healthcare industry, access management. Contrary to the dominant paradigm (human to human interaction) in the current

network the MANET paradigm presents a new pattern of thought that indicates that any device, identified with a unique ID will be assumed as interconnected [3]. And such, internet of thing has been presented a mixture of the Emerging Technologies and internet such as real-time localization, near- field communication, and embedded sensors as a way to deliver everyday devices into smart objects [4]. The various recommendations for MANET security have been proposed in [5]. Location privacy, lightweight computations [6], effective malicious node identification, self - stabilization, secure route establishment are some important issues in the network.

**Military Application:** In Defence Operation, Information sharing between soldiers is an important issue for effective combat. But, in the hostile sector, there is a very difficult process for building infrastructure, most of which, communication infrastructure has always become the first target of the enemy. Hence creation and maintaining communication infrastructure is the essential issue of a military operation. However, using a mobile ad-hoc network or smart network can be safe to communicate in hostile areas, because there is no need for creating infrastructure here. The second problem in a military operation is unpredictable positions of soldiers of and Enemies [7]. Here it is difficult to predict the mobility and location of troops because of various events in the war. Sometimes it causes recreation of Infrastructure to maintain connections and also it requires many changes in network topology between soldiers. The mobile network creates a flexible topology, so it promises durable Communication on unpredictable troops. In defense Operation, Information sharing between soldiers is an important issue for minimal casualties and effective combats. Military Application: Reconnaissance of opposing forces and terrain, Battlefield surveillance, Battle damage assessment, Equipment, and ammunition, Monitoring friendly forces.

**Medical & Healthcare Applications:** In the medical & Healthcare applications, the IoT promises to solve various issues which are related to medical discoveries on incurable diseases. Most of the Healthcare devices are linked wirelessly through mobile and Ad Hoc Network. In medical, MANET is used in identification management (IDM). In IDM each thing (device or user) needed to have a Unique Identification and it ensures identity and information safety. MANET is used in IDM Framework. The proposed IDM Framework is shown in the paper [8] [9]. The intention behind building a smart environment is to improve the efficiency of services and improve the quality of life by using urban Technologies to meet the needs of the citizen. The data are collected processed and analysed by integrating Sensors with real-time monitoring. Due to low-cost communication, Actuators and sensors are used for the smart cities. For example in medical, communication technologies are used to link the whereabouts to the health, meditation and patient statistics. Identity management essentially approaches in wireless, which is used in [10] medical application

**Vehicular Network:** The vehicular network uses a similar mechanism as MANET. VANET usually linked to the internet using APs using WLAN (wireless local area network) Technology such as Bluetooth, WiMAX, Wi-Fi. Hence IoT or WSN play an important role in this area. VANET application: Prevention of Disaster scenarios, Evacuation emergency, Proximity, and correlation analysis,

Traffic flows, Congestion, Mobile sensor networks through vehicle communications, Road congestion avoidance, Intelligent transportation systems, Post-accident information, Improvement of driver decision-making, Dissemination of warning messages, Prevention of traffic accidents[11].

**Smart City:** The main objective of MANET is to make things dynamic and convenient. Devices can exchange information using wireless technology and provides many convenient services. For example, echo enabled Alexa devices and much other wireless-enabled smart devices provides owner many facilities like turning on and off indoor and outdoor electronic devices like lights, water heater remotely and hand free [12].

### 3. RELATED STUDIES

To improve the performance of the protocol, R.Bhuvaneshwari et al [13] designed an ESRS (Energy Efficiency scheme for source routing) technique. They used ns2 simulator and represent the improved result. Authors in [14] came up with a method to update using pre-emptive link break prediction using RSS (received signal strength indicator). Link break is predicted and the threshold is defined by a particular value. The designed method enhances the performance in term of delay etc. Enhancement in existing dynamic source routing is done by G. Reddy [15]. He added a link break prediction method to the conventional method and this method helps to notify link breakage information. Authors in [16] propose wider error notification, timer-based route discovery and negative route caches to avoid cache pollution & minimize stale cache entries. Conclusion represent 10 to 60% enhancement. The drawback of this method is that the freshness of route is not considered. Authors in [17] proposed LFPQR (link failure prediction QoS routing) Protocol. The movement, position, mobility, and power level of nodes represent the link breakage. The proposed method provides the best solution compared to conventional AODV protocol. For Routing purpose DSR protocol is developed by Maltz, Johnson, and brochures [18]. T.J. Giuli, S.Marti [19] proposed a method to secure MANET by using misbehaviour detection algorithm. This method has two main drawbacks. First, it can't give a guarantee of authentication and integrity of routing messages. And second, it is not feasible to find out some types of misbehaving in the network (due to the difficulty to distinguish between transmission failures and other kinds of failures). David B. Johnson proposed distributor cache table to maintain the knowledge required for cache updates. Authors have also shown the performance of protocols in a military operation. Authors took different simulators with many environmental parameters. In such kind of operations, due to unforeseen circumstances, the traffic of node and density of network can be increased suddenly and insignificantly. Apart from this, to preserve battery power and to prevent an attack from the enemy, each node has an insufficient transmission range. Thus, the protocol should have a good mechanism for managing this type of sudden change in the network [20].

#### 4. DYNAMIC SOURCE ROUTING PROTOCOL IN SMART ENVIRONMENTS

MANET is a special type of wireless network in a smart environment. It does not have any infrastructure or base station. Every node is acting as a router. If any node wants to send data to somebody, it receives the data and forwards like a router. This type of networks is used in emergencies cases, where we cannot go for constructing any fixed infrastructure. In MANET routing is a difficult task. The primary purpose of the routing protocol is to find the effective and correct path between mobile nodes so that the packets can be sent within the time.

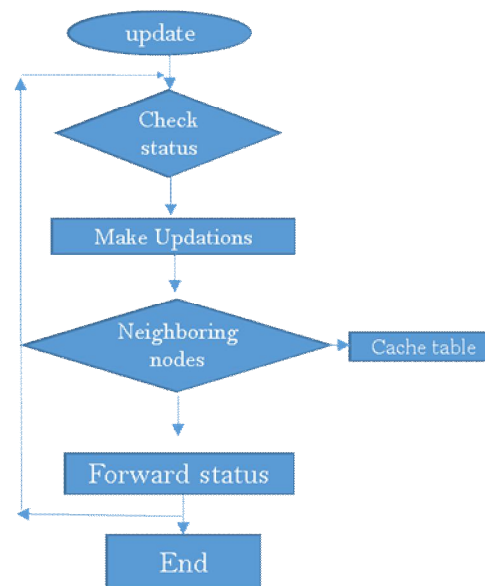
The basic two types of routing are Proactive and Reactive routing. In proactive, every node keeps on updating its own routing tables regularly at periodic interval [21]. The benefit is that the routing table shows the latest information but the major disadvantage is all the nodes are battery operated, a battery of every individual node is wasted even though there is no data transfer. In reactive protocols, Route Discovery process starts only when it needs to send data. DSR protocol is reactive routing protocol, designed to control the bandwidth used by data utilized in MANET, by preventing the periodically updating packets used in the proactive routing protocol. This protocol does not contain any routing data. This only search the way when it has to send data. There is no exchange of routing information from time to time. The purpose of this protocol is to reduce the traffic overload. This protocol uses the concept of source routing and it detects route whenever necessary and needed. In source routing, the source detects all the nodes which are included in the way to send data to the target node and the path is stored in the packet header in the source node. Route creation and maintenance are two important steps here. DSR store a newly discovered route in each node cache. When a node needs to transmit a packet, it first checks the cache, whether the path is available or not. If the path is available, then RREQ (Route request) is transmitted to all neighbours. RREQ received by all its neighbours. Every node whoever receives the route request message does three things, first it check whether the ID is new or not, if it is new then neighbours node check whether the destination address matches with its own address or not, if it matches then it give reply, if the address does not match & RREQ is new message then every node append its own address and broadcast that message further that is called flooding. Here the basic principle is every outgoing packet will have a piece of complete route information from the source to the destination. And the Neighbours which have a path to the target node will transmit an RREP (Route Reply) to the sender node. Similarly, the path is searched and the packets are transmitted to the target node.

#### 5. DESIGN, IMPLEMENTATION, AND RESULT

Awareness about mobility in the on-demand route maintenance is delayed because cached route break information is not notified to a node unless it uses the path to transmit data. Cached route is classified into various categories, pre-active ( if path is not used), active (if path is being used), post active (if path was used earlier, but is no longer active) it's not important to find out whether a path is active or post active, but these terms clarify the issue of

cache staleness. Until these paths are used, stale pre-active and post active path will not be detected. Pre-active and post active routes are an important source of cache staleness in the network. If a node finds a node/ link failure, it informs all neighbours nodes, which contains that link for cache updating. Any node that detects link failures is also required to have information about which nodes have cached the broken link and also need to accurately notify such nodes. This goal of cache updating becomes challenging due to fast propagation of routing information and mobility condition of the network. To make the cache updating work easier we need to keep track of topology propagation state (means which node has cached which link). The nodes present in cache table stores the paths and also keep track of two types of information for each path. First is which neighbours have learned which links through route reply. And second is how will routing information is synchronized among nodes. Every node requires information during path discoveries and packets transmission. We have designed four modules. Route Request (Request propagation), Route maintenance, Message transfer, cache update.

So, we have designed a new method using the route cache updating method. Our technique removes the Stale route present in the network and increases performance. Also, the packet drop rate and latency are reduced. And the quality of service is also meet for various applications. Figure 1 shows Cache updating flow chart.

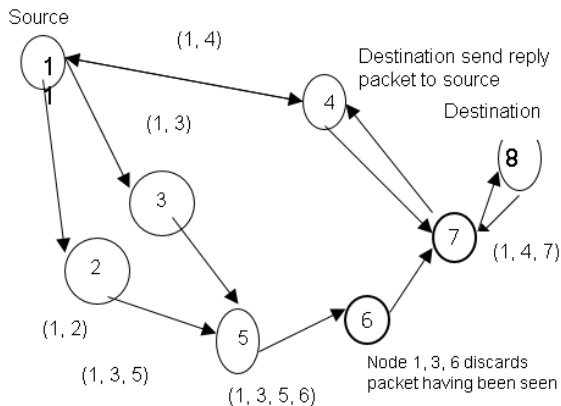


**Figure1:** Cache updating flow chart

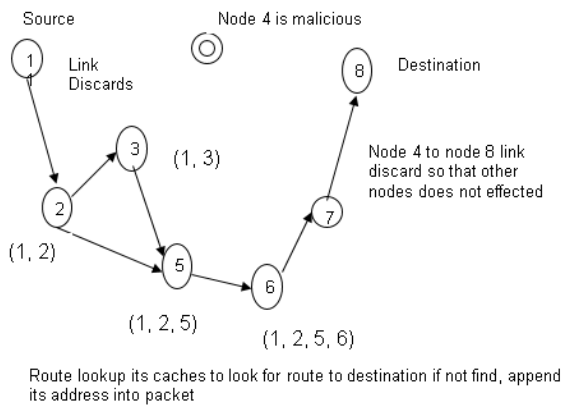
This flow chart of message transfer for DSR represents the Module for Cache Updating. It represents how the cache table is updated when any node as the misbehaving /malicious node is detected. Due to failure of the node so that the corrupted data can't be sent from the source to other nodes and the design algorithm confirms whether any link is failed due to the misbehaving node then it makes updating in cache table and informs adjacent nodes. Simulation Parameter taken for implementation is shown in below Table1. Figure 2 and Figure 3 are showing the Basic and enhance DSR Packet transmission respectively.

**Table1: SIMULATION PARAMETER**

Simulation Parameters	Values
Mac Type	802.11
Traffic Agent	CBR
Environment Size	800*800
Interface queue	Queue/DropTail/PriQueue
Routing Protocol	DSR
Number of Nodes	100
Mobility Model	Random Waypoint Model
Ns-2 Version	ns-2.35
Network Type	Wireless

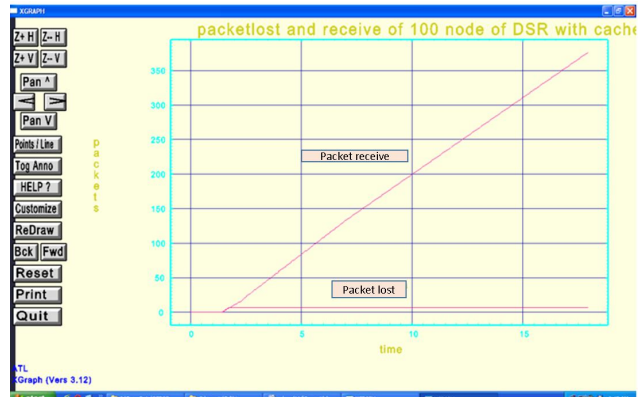


**Figure 2: Basic DSR Packet Transmission**

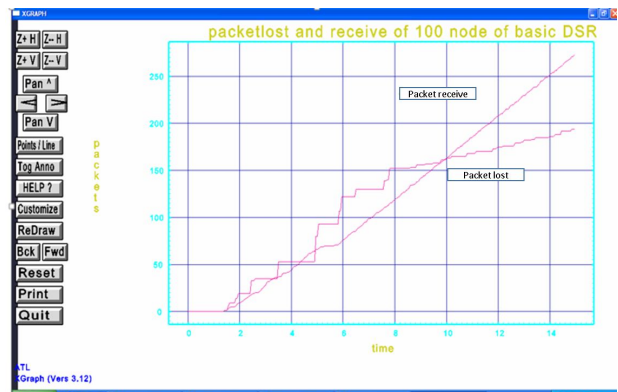


**Figure 3: Enhance DSR Packet Transmission**

We carried out a simulation on mobile Ad Hoc Network by using ns2. It gives a highly modular platform for wireless and wired simulations supporting different routing types, traffic, protocols, network elements. It contains the NAM (network animator) tool. NAM is used for visualization. Trace graph tool is used for plotting graph. Graphs in figure 4 and figure 5 representing packet received and packet lost for 100nodes of the Enhance and Basic DSR respectively.



**Figure 4: Represent packet received and lost for 100nodes of the Enhance DSR**



**Figure 5: Represent packet received and lost for 100 nodes of the basic DSR**

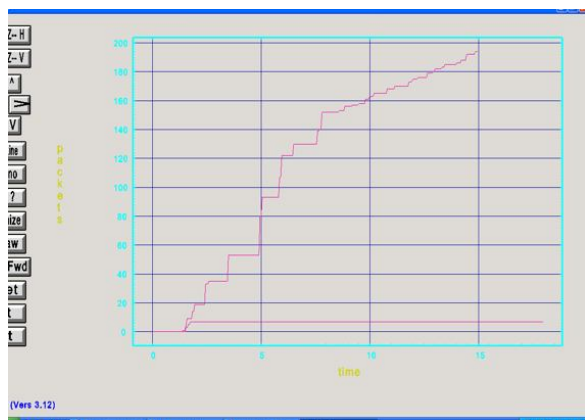
**Comparison Graph**

Figure 6 and figure 7 showing the comparison of packet received and packet loss of 100 Nodes with Basic DSR and Enhance DSR.



**Figure 6: Comparison of Packet Received of 100 Nodes with Basic DSR and Enhance DSR**





**Figure 7:** Comparison of Packet drop of 100 Nodes with Basic DSR and Enhance DSR

## CONCLUSION

In this paper, we have taken the Dynamic Source Routing protocol for enhancement purpose in IoT scenario. The proposed method is designed in such a way that it can identify malicious nodes present in the network and improves the delivery ratio of data. Updating routing tables also removes the problem of stale route present in the network. Like other applications, here is definitely scopes for enhancement like Bidirectional route information between initial and goal node can be implemented in future, key agreement establishment can be done. Encrypted data transmission without any interruption etc.

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