ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

Study of Different Mobility Schemes to Provide Improvement in Wireless Sensor Network with Detection of Node Clones

Neha Sen

M.E Student, Dept. of Computer Engineering, Vidyalankar Institute of Technology, Mumbai, Maharashtra, India

ABSTRACT: Wireless Sensor Network (WSN) consists of tiny sensing devices which co-operate and communicate with each other to perform certain tasks. These are generally deployed in hostile environment where an adversary may capture nodes, replicate them and use it for its own purpose. If the clone nodes remain undetected, it can disrupt the network functions making it vulnerable to attacks. Hence false data can be injected or the legitimate data can be taken out. Thus to detect the clone nodes is the fundamental problem in WSN. The objective of distributed node clone detection is to detect clone nodes with minimum communication and storage overhead. Mobility models of MANET have been still research area in mobile computing and in wireless network with lots of mobility algorithms to design the efficient mobility model. This paper focused on study of five different techniques such as cTRUST Aggregation scheme, mobility modelling for cyber physical system, Mobility Aware Loose Clustering, Efficient Flooding Scheme, and Network Coding based relay scheme and their comparison.

KEYWORDS: cTrust, clustering, flooding, delay, overhead, throughput, network coding, MANET etc.

I. INTRODUCTION

WSN are vulnerable to various attacks where nodes are deployed in a high density, in hos- tile surroundings making it easy for an adversary to capture them. Nodes are distributed in the network, thus an adversary can place the clone nodes of a compromised node at a different location from the original node acting as a legitimate node of that network. The clone node is having the legitimate keys and ID to communicate with other nodes and can participate in all network activities. Thus detection of node clones in the network in a distributed way is required to make the network functions without any attackers interception.

Mobility scheme plays the important role in designing the different mobility models for mobile ad hoc network (MANET). Many mobility models have been developed such as random walk mobility model, random direction mobility model, random waypoint mobility model, reference point group mobility model and realistic mobility model. There are many environments are designed to effectively run the mobility scheme that are cyclic mobile ad hoc network, cluster, cyber physical system and network coding.

This paper, discusses five different mobility schemes such as cTRUST Aggregation scheme, mobility modelling for cyber physical system, Mobility Aware Loose Clustering, Efficient Flooding Scheme, and Network Coding based relay scheme. These mobility schemes provide the better capacity-throughput-delay tradeoffs, more reliability, reduce overhead, less power consumption, accuracy, robust and secure etc.

But these method also have some problem so to overcome such problems improve version of mobility scheme is proposed here to detect clone nodes with minimum communication and storage overhead.

- **BACKGROUND**

Many studies on mobility models have been done to develop the mobility scheme in recent past years. Such schemes are:

ctrust scheme handle trust establishment and aggregation issues and also used to aggregate distributed trust information in decentralized and highly dynamic cMANET environments and provide More accuracy, efficiency, scalability and

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

robustness and achieve the aggregation accuracy of 90%. Mobility modelling environment for VANET and Network Robot with different mobility model such as RWP and the RPGM for cyber-physical system is presented with the higher performance in terms of packet delivery, energy consumption and delay. Clustering algorithm divides the large network into smaller virtual subsets. It works in two phase that is initial phase in which nodes are divided into groups and in the later phase efforts are made to maintain the structure created in first phase and result in the more stable in dynamic environment. A mobility-assisted scheme called efficient flooding scheme is provided to achieve the high probability of trust convergence. In result this method shows how performance is improve in terms of throughput, delay, packet loss, trust ratio and packet sent. The network coding based relay scheme for static network and for mobile network using two-hop and flooding scheme for different mobility models to improve the performance in terms of good put-delay tradeoffs.

This paper introduces five mobility scheme ie cTRUST Aggregation scheme, mobility modelling for cyber physical system, Mobility Aware Loose Clustering, Efficient Flooding Scheme, and Network Coding based relay scheme. these are organizes as follows. **Section I** Introduction and background. **Section II** discusses literature review and related work. **Section III** discusses existing methodologies. **Section IV** discusses comparisons between different mobility schemes. **Section V** proposed method. Finally **section VI** Conclude this review paper.

II. LITERATURE REVIEW AND RELATED WORK

In research literature, many mobility models have been studied to provide various mobility schemes and improve the performance in terms of capacity-throughput-delay tradeoffs, more reliability, reduce overhead, less power consumption, accuracy, robust and secure.

Huanyu Zhao et al. [1] have proposed the aggregation scheme called cTrust is used to aggregate distributed trust information in decentralized and highly dynamic cMANET environments. The cTrust aggregation scheme achieves fast and lightweight trust rating aggregation. Trust graph used to represent the cMANET system features and trust relationships which combine the snapshot graphs and trust relationships into a directed trust graph.

Mohannad A. alharthi et al. [2] has proposed the modelling mobility for cyber physical system such as VANET and Networked Robot using different mobility models such as Random Waypoint and the Reference Point Group Mobility model with the use of various simulation tools.

V.V. Neethu et al [3] has proposed the Mobility Aware Loose Clustering method to select high transmission nodes as cluster heads which results in lower number of clusters as a single cluster head can cover large area. Stable cluster organization is important in MANET as it reduce the high overhead produce during cluster maintenance.

Sindhuja. M. et al. [4] has proposed the efficient flooding scheme that leads speed-up trust convergence and high authentication probability respectively by reducing uncertainty.

Yi Qin et al. [5] has proposed the methods as network coding based relay Scheme for static network and two hop relay scheme and flooding scheme for mobile network. PNC Scheme has been studied which is designed based on the channel state information (CSI) and network topology.

III. EXISTING METHODOLOGIES

Many mobility schemes have been implemented over the last several decades. There are different methodologies that are implemented for different mobility models i.e cTRUST Aggregation scheme, mobility modelling for cyber physical system, Mobility Aware Loose Clustering, Efficient Flooding Scheme, and Network Coding based relay scheme.

- **cTrust Distributed Trust Aggregation Algorithm:** In the initial stage of an evolving cMANET which preset direct trust at direct trust information and indirect trusts are needed. The distributed trust aggregation algorithm gathers trust ratings to any node in a network. In this algorithm, each trust path is aggregated to MTP with the highest trust rating toward destination. Indirect trust information will be added to trust tables and updated as the aggregation process [1]. Algorithms involve following steps 1: Initialize local trust tables, for each time slot search node belong to cMANET. 2: Find node *i* direct trust neighbor set at *i* current state then normalize transition probability. 3: Determine target node *j* by transition probability and Send trust table request to node j. 4: Receive incoming trust tables. 5: Relax each trust table entry by trust value iteration

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

function update next hop nodes. 6: If receive any trust table request from other nodes, send trust table back.

- **Mobility modelling for cyber physical system**: Two types of mobility modelling can be done under the VANET and Robot. Simulation under VANETs uses real mobility traces since they are clearly more accurate than random models. Real traces can be hard to collect in order to be used in simulation. Microscopic models emulate the behaviour of individual vehicles independently. Mobility modelling under robotic network offers advanced and detailed models of communications as well as network protocols and routing. However, there is a need for models of physical robotics and their dynamics within the surrounding environment. This need is realized by existing robotic simulators, which model various components of robotics, including mechanical parts such as wheels and legs, engines, sensors, and actuators [2].
- **Mobility Aware Loose Clustering:** Taking high transmission power and mobility of nodes into consideration, a mobility aware loose clustering is developed. The proposed clustering algorithm aims to make highly stable clusters by prolonging cluster lifetime in highly mobile environment. Proposed algorithm works in three phases: Initial phase: In this phase, each node discovers its bidirectional neighbours by sending hello packets. Middle phase: In this phase, every L node calculates the mobility of the node with respect to each of the H nodes in the My−bidirnneighbor table and assigns the minimum mobile node as the cluster head. Final phase: Cluster formation phase [3].
- **Efficient Flooding Scheme:** Flooding is one of the most basic and important operations in MANET. Traditional flooding scheme suffer from extra redundant messages, resource contention, and signal collision. This causes high protocol overhead and intrusion to the existing traffic. The proposed flooding scheme is based on only one-hop neighbour's information. Efficient flooding algorithm has two steps. 1: The number of forwarding nodes in each step should be minimized. 2: The time complexity for forwarding nodes computation should be low, which is O (nlogn), where n denotes the number of neighbours of a node [4].
- **Network-Coding-Based Relay Scheme with two-hop and flooding scheme:** This scheme is used for the static network and algorithm consists of following steps. 1: The source node combines the k original packets and generates $(1 + \varepsilon)$ k packets according to NC. Afterward, it transmits the packets to $(1 + \varepsilon)$ k nearest nodes (relays) as multi-unicast. 2: All the relay nodes in one cell are separated into some groups, and each group includes G nodes. The nodes belonging to the same group transmit packets to the next cell simultaneously. Afterward, the nodes in the next cell employ PNC, and finished when all the packets are transmitted to the nearest cells around the destination cell. 3: All the packets in the nearest cells around the destination cell will be transmitted to the destination node as "many-to-one" transmission, which is called converge-cast. Two-hop relay scheme use only two phases such as source to relay (S→R) and relay to destination (R→D). But R→R phase is not allowed. The flooding scheme has three phases as S→R, R→R and R→D [5].

IV. COMPARISONS BETWEEN DIFFERENT MOBILITY SCHEMES

Ctrust distributed aggregation scheme runs in cMANET that shows the average trust path length, aggregation accuracy, convergence time, average trust table size for random trust topology and scale free trust topology with the less overhead and the 90% accuracy. It performs well in more network size and complexity [1].

Mobility modelling for cyber physical system depends on the various objects that are being simulated and the objects are network nodes, vehicles and robots that generate more reliable physical models [2].

Mobility Aware Loose Clustering is more stable in dynamic environment than LVC. Clustering has been done to ease functioning of network. Overhead can be hello packet overhead, cluster structure formation and cluster maintenances. But cost of reclustering is more [3].

Efficient Flooding Scheme shows the performance analysis in terms of delay, number of packet sent, number of packet loss and trust ratio. By using this scheme delay and packet loss has been reduced, number of packet sent is more ant trust is more because of more secure and reliable [4].

Network Coding based relay scheme gives the analysis for static network and mobile networks with different mobility models. Static networks give better throughput-delay tradeoffs and network coding with mobile networks enhances the performance using the random id and random walk mobility models [5].

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

Following table shows the comparisons between different mobility schemes:

Disadvantages	Advantages	Mobility scheme
The ctrust algorithm proved to be worst for the scale free topology than random topology.	Message overhead in cTrust method is minimum and trust information spreads fast in cMANET. Convergence time is increase as the network capacity increase. More accuracy, efficiency, scalability and robustness.	cTRUST Aggregation scheme
During the modeling of CPS several challenges are arises such as heterogeneity of cyber physical system and actual modeling of system.	This provides the better realistic modeling of mobility with cyber physical system. Provide the faster movement of packets with less energy consumption.	mobility modelling for cyber physical system
Cost is more for high power node. It takes more time in forming the cluster and selecting the cluster head every time when node moves out of its proximity.	This method reduces the overall overhead. More stable than any other algorithm in dynamic environment. It offers better performance than LVC algorithm.	Mobility Aware Loose Clustering
The only drawback is that this efficient flooding scheme is proposed for the one-hop neighbour information.	Time complexity is less. It decreases the packet drop and improves the reliability. It reduces the number of forwarding node and also reduces the uncertaintity.	Efficient Flooding Scheme
This proposed method gives better performance only for random i.id mobility model than any other mobility model. And for static network it is not be proved good as compare to mobile network.	Proposed scheme provides the better network capacity as for goodput-delay tradeoffs. Using the two-hop and flooding scheme with the proposed method for mobile network under random i.i.d mobility model additionally enhances the performance.	Network Coding based relay scheme for static network and two-hop scheme for mobile network

TABLE 1: Comparisons between different mobility schemes

V. PROPOSED METHODOLOGY

The proposed work is a node clone detection system for sensor networks, which will be capable of detecting node clone attack in a distributed way and enhance mobilty. To improve the overall performance of a system, it includes energy efficient routing of packet through a node that contains energy level above predefined threshold level.

Normally to detect the clone node process check by value functionality is implemented but in this work, the method implementing is DHT process with the help of which one can detect clone nodes. Distributed Hash Table,

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Website: www.ijircce.com

Vol. 5, Issue 5, May 2017

DHT-based protocol is a fully decentralized, key-based caching and checking system constructed to catch the cloned nodes. Chord is used to implement Distributed Hash Table. It forms an overlay network upon a physical sensor network. Each node is placed at a Chord co-ordinate responsible for a segment of a periphery. Each node possesses the information of its direct predecessor and successor nodes in the Chord ring. The Chord protocol supports just one operation: given a key, it maps the key onto a node. Depending on the application using Chord, that node might be responsible for storing a value associated with the key. Chord uses consistent hashing to assign keys to Chord nodes. The consistent hash function assigns each node and key an m-bit identifier. Identifiers are ordered on an identifier circle modulo 2*m*. Key k is assigned to the first node whose identifier is equal to or follows (the identifier of) k in the identifier space. This node is called the successor node of key k, denoted by successor(k). If identifiers are represented as a circle of numbers from 0 to 2^m-1, then successor(k) is the first node clockwise from k.

To start a detection round, initiator node that is assumed to be a powerful node broad- casts an authentication message containing a random seed. Each node after receiving the message verifies the signature of initiator. If it is valid, it stores the random variable seed and generates a claiming message for its neighbor. This claiming message is forwarded to a destination node according to DHT-based routing. If the destination node receives two different location claims for the same ID, it becomes the witness node and broadcasts the evidence in the network. Thus each node will stop communicating with that node ID, revoking it from further activities.

Energy is a scarcer resource, which is provided by a limited battery power. All the sensors should have enough energy to support clone detection and normal operations of sensors including data collection and transmitting/receiving information. Thus clone nodes should be detected and routing of messages should be done in an energy efficient way which will help to prolong the network lifetime. I.e. nodes having energy greater than threshold will participate in detection round and nodes having energy less than threshold will not participate in detection phase saving its own transmission energy as most of the energy is required for transmission, but will store the claiming messages coming for it.

VI. CONCLUSION

Thus clone nodes will be detected in a distributed way using a DHT-based detection protocol. Hence the proposed work considers the routing of message in an energy efficient way which considers the energy to route the messages which will help in increasing the network lifetime. With this implementation, the clone node will be detected. It also increases efficiency of the system which eventually makes it energy efficient system.

ACKNOWLEDGMENT

I would like to express my gratitude and appreciation to all those who helped me to complete this paper. A special thanks to my guide, **Prof. Rinku Shah** whose help, stimulating suggestions and encouragement helped me in writing this paper.

REFERENCES

1. Huanyu Zhao, Xin Yang, Xiaolin Li, "cTrust: Trust Management in Cyclic Mobile Ad Hoc Networks", *IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY*, Vol. 62, No. 6, July 2013.
2. Mohannad A. Alharthi, Abd. Elhamid M. Taha, "Modeling Mobility for Networked Mobile Cyber-Physical Systems", *ACM*, 10.1145/2593458.2593468, April 2014.
3. V. V. Neethu, Awadhesh Kumar Singh, "Mobility Aware Loose Clustering for Mobile Ad hoc Network", *ELSEVIER*, 1877-0509, June, 2015.
4. Sindhuja M, Selvamani K, Kannan A, Kanimozhi S., "Mobility Assisted Uncertainty Reduction in MANETS Using Forward Node Optimization", *ELSEVIER*, 1877-0509, April, 2015.
5. Yi Qin, Feng Yang, Xiaohua Tian, Xinbing Wang, Hanwen Luo, Haiquan Wang, Mohsen Guizani, "Optimal Configuration of Network Coding in Ad Hoc Networks", *IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY*, VOL. 64, NO. 5, May, 2015.

BIOGRAPHY

Neha Sen is currently pursuing her Masters in Computer Engineering from Vidyalankar Institute of Technology, Mumbai. She received her Bachelor's in Engineering (B.E.) degree in Computer Engineering from Mumbai University in the year 2013, from Vidyalankar Institute of Technology Mumbai, Maharashtra, India.