CHAPTER 2

LITERATURE SURVEY

2.1 INTRODUCTION

Many research works have been carried out in the past (Yang et al (2009)) on node’s trust, node reputation and node’s cooperation for achieving successful packet forwarding and packet delivery among the mobile nodes in (Bangnan et al (2003) and Bharathi et al (2012)) Mobile Ad hoc Networks (MANETs). In addition, several research challenges using packet forwarding approach, flooding based approach, bundle delivery approach in different layers were analyzed in this literature survey. Hence, In this literature review, few important works has been analyzed and cited.

2.2 WORKS ON NODE COOPERATION IN MANETs

The first literature review held in this research work are node cooperations in MANETs. There are many works (Chen X and Murphy Al (2001)) proposed in the past, Among them, Quansheng Ghan et al (2012) proposed an authentication and topology control schemes for analyzing the throughput in mobile ad hoc networks. Their proposed authentication and topology control scheme have improves the throughput. Also, their Simulation results show that this scheme can substantially improve throughput in MANETs with Cooperative Communication. Chung-Ming Huang et al (2008) exposed the challenges in opportunistic network through node mobility as well as unpredicted time in of node interaction
Sonja Buchegger & Le Boudec (2002) proposed a protocol called CONFIDANT that identifies misbehavior nodes. Their work is purely based on selective altruism and utilitarianism. They also aimed in detecting and isolating the misbehaving nodes in cooperative communication in MANETs. The performance analysis of DSR between CONFIDANT is compared with regular defenseless DSR. But, this proposed work recognizes the special requirements of mobile ad-hoc network in terms of node cooperation, robustness, and fairness.

Weifeng Su et al (2008) presented the new multi-relay selection decode-and-forward scenario to increase the efficiency of bandwidth with full diversity order without relaying through the intermediate nodes while the source nodes were transmitting the messages and information to the destination nodes.

In addition, Zehua Wang et al (2012) focused on few issues in wireless link quality to make the wireless links as good as possible. Their proposed model was compared with AODV and other protocols such as Lightweight Proactive Source Routing protocol. But the knowledge of entire network structure was unable to update to the source and intermediate nodes because of the nodes’ mobility and thereby the system performance is degraded to the maximum extent.

Wang et al (2010) proposed a topology transform based on global trust model that ensures an improved recommended trust among mobile nodes in term of packet delivery ratio.

Another researcher Mohamed Elsalih Mahmoud & Xuemin Shen (2010) proposed a novel incentive mechanism to stimulate node’s cooperation in multi-hop wireless networks. Fairness can be achieved by using credits to
reward the cooperative nodes. The overhead is significantly reduced by using a Cheating Detection System (CDS) to secure the payment.

Jin-Hee Cho & Ananthram Swami (2011) elaborated the trust management and trust evaluation in multidisciplinary concepts like economics, sociology, philosophy, autonomic computing, organizational management and networked communication. Many trust management schemes were also suggested in the past to detect misbehaving nodes, selfish nodes as well as malicious nodes. They also concentrated on reliability, timeliness and integrated message delivery to intended next hop but still they couldn’t achieve to evaluate the trust.

An Extended Opportunistic Routing (EXOR) in Multihop based wireless network was proposed by Biswas S and Morris R (2005). ExOR possess the challenges such as the nodes that receive each packet must agree their identities and choose one forwarder. Thus, ExOR chooses the forwarder with the lowest cost to the ultimate destination. ExOR operates on batches of packets in order to reduce the communication cost of agreement.

See-Kee NG & Seah WKG (2010) proposed a game theory approach to achieve collusive networking behavior in wireless multi-hop network. This model builds on recent work in the field of Economics on the theory of imperfect private monitoring for the dynamic Bertrand oligopoly and adapts it to the wireless multi-hop networks. This proposed model derives conditions for collusive packet forwarding, trusted routing broadcasts and packet acknowledgments under a lossy wireless multi-hop environment.

Blazevic et al (2001) introduced ‘Terinode’ for wide-area mobile ad hoc network which is very useful for public environment. This Terinode positioning is obtained through either GPS or a relative positioning method. Mobility management also uses the self-organized virtual regions.
Terminodes employ a form of virtual money called ‘nuglets’ as an incentive to collaborate.

Opportunistic network as a subclass of Delay-Tolerant Network where communication opportunities are intermittent was proposed by Chung-Ming Huang et al (2008) where the path is highly unstable and it may change or break at any time. Therefore, in order to make communication possible in an opportunistic network, the intermediate nodes may take custody of data during the blackout and forward it when the connectivity resumes.

Lu Yan & Stephen Hailes (2008) proposed a model called Tit-for Tat (TFT) and Grim Trigger based game theory which is used for achieving cooperative message transmission. Sarper Gokutruk & Ozgur Gurbuz (2008) discussed the COMAC (Cooperative Medium Access Control protocol) which enables the node cooperation using IEEE 802.11g by making use of overheard packets from neighbouring nodes of the sender node.

Hanguan shan et al (2011) proposed a optimal grouping strategy for efficient node selection based on greedy algorithm for MAC Protocol refinement. The Novel cross layer MAC protocol differentiates the beneficial cooperation from unnecessary cooperation.

A recursive algorithm to solve the optimization problem as well as to improve the achievable packet delivery rate and increase the transmission cost in cooperative networks was presented by Elzbieta Beres & Raviraj Adve (2010).

Sangman Moh & Chansu Yu (2011) proposed a medium access control (MAC) algorithm, called Cooperative Diversity MAC (CD-MAC), which exploits the cooperative communication capability to improve robustness in wireless ad hoc networks. In CD-MAC, each terminal
proactively selects a relay for cooperation and allows to transmit simultaneously in mitigating interference from nearby terminals and thereby improving the network performance. For practicability, CD-MAC is designed based on the widely adopted IEEE 802.11 MAC.

Buttyan & Hubaux (2003) focused on stimulating packet forwarding. Their mechanism approach is based on a counter called nuglet counter in each node which is decreased when the node sends its own packet or increased when the node forwards a packet and required to remain always positive. Besides stimulating packet forwarding, the proposed mechanism encourages the users to keep their nodes turned on and to refrain from sending a large amount of packets to distant destinations.

Alex Fridman et al (2012) presented a software library that aids in the design of mobile ad hoc networks (MANET) referred OMAN. The OMAN design engine works by taking a specification of network requirements and objectives, and allocates resources which satisfy the input constraints and maximize the communication performance objective.

Kun Wang & Meng Wu (2012) proposed a global punishment-based repeated-game model to investigate the equilibrium conditions of packet forwarding strategies when the whole network is in a cooperative state. Simulation results show that the proposed game model with punishment mechanism can promote node forwarding probability.

Guopeng Zhang et al (2012) proved that there exists a unique Nash Bargaining Solution (NBS) of the game and proposed a fast Particle Swarm Optimizer (PSO) algorithm to solve this issue. Simulation results show that the NBS-based incentive strategy achieves social optimality, i.e., all cooperative nodes could achieve significant rate-gains in comparison with
direct transmission. They also concentrated the rewarding scheme to improve the performance of the source node.

An analysis of mathematical trust models using different ways to detection information passed in ad hoc network was presented by Reinaldo B Braga et al (2013). They also compared and evaluated the performance of these models using a grid simulator platform. Besides that, they choose the most accurate trust model among the evaluated ones to propose a reactive trust-based mechanism to detect and punish malicious nodes in ad hoc grid environments.

A model for ad hoc network where nodes can communicate in random source destination pairs was proposed by Matthias Grossglauser & Tse David (2002). The evaluation of the per-session throughput for applications with loose delay constraints, changes the time-scale of packet delivery. Under this assumption, the per-user throughput can increase dramatically when nodes are mobile rather than fixed.

Xu Li et al (2011) proposed a novel mobility prediction based hello protocol called ARH (Autoregressive Hello protocol). Each node predicts its own position by an ever-updated auto regression-based mobility model and neighbouring nodes predict its position by the same model. ARH evolves along with network dynamics, and seamlessly tunes itself to the optimal configuration on the fly using local knowledge.

Stoleru et al (2011) presented a Mobile Secure Neighbour Discovery (MSND) that offers a measure of protection against wormholes by allowing participating mobile nodes to securely determine their neighbours. They proved that the security properties of their protocol demonstrate its effectiveness through extensive simulations and a real system evaluation employing Epic motes and iRobot robots.
The broadcast schemes that reduce the overhead associated with flooding was presented by Sanaa Alwidian et al (2013). In this scheme, a node selects a subset of its neighbours for forwarding the packet being broadcast to additional nodes. Their simulation results show that the routing protocols will reduce the overhead for both low and high mobility substantially as compared with the well-known and promising AODV routing protocol.

Marcin Seredynski & Pascal Bouvry (2012) analysed the case where the reputation system is not present in the network. They influenced with two factors namely the development of cooperation and the network size as well as the type of participating nodes which are analysed using evolutionary game theory.

Many work pertaining to collusion in peer-to-peer has been proposed. Among them, Gianluca Ciccarelli & Renato Lo Cigno (2011) proposed the literature survey on P2P systems security with specific attention to collusion, as well as to find out how they resist to such attacks and what solutions can be used,

A service differentiation based incentive mechanisms was proposed by Yufeng Wang et al (2011) in P2P networks. Their idea was to punish or to reward the node. They also illustrated the punisher’s average payoff in punishment-based scheme which is almost same as the ideal but unfeasible case of reward-based scheme.

Laneman et al (2004) developed an algorithm to measure robustness of the transmissions to fading, focusing on the high Signal-to-Noise Ratio (SNR) regime.
Chen & Chan (2010) proposed MobiCent, a credit-based incentive system for DTN. While MobiCent allows the underlying routing protocol to discover the most efficient paths, which is incentive compatible. using this idea, the packet delivery time is reduced.

Chen & Zhong (2010) proposed the first incentive scheme which uses the combination of game theoretic and cryptographic techniques. They formally proved that if INPAC is used, then following the protocol faithfully is a sub game perfect equilibrium. In order to make INPAC more practical, they provided an extension that achieve two improvements namely (a) an online authority is no longer needed and thereby reducing the computation and communication overheads.

Zhong et al (2005) proposed routing protocol to address various challenges in wireless ad-hoc networks. Corsac also applies efficient cryptographic techniques to design a forwarding protocol to enforce the routing decision, such that fulfilling the routing decision is the optimal action of each node in the sense that it brings the maximum utility to the node.

Yao & Zhong (2014) designed the first cheat-proof scheme for cooperative relay in cognitive radio networks. They rigorously proved that using this scheme, selfish users have no incentive to cheat. Results of extensive simulations demonstrate that the scheme suppresses cheating behavior and thus improves the system throughput in face of selfish users.

Guan et al (2008) discussed the impact of topology control on network capacity by introducing a new definition of the expected capacity that is first analyzed in the perspective of cross layer optimization. An optimistic conclusion indicates that topology control with stable node degree renders the capacity not to decrease with the increase of the number of nodes
present in the network. The analytical results in this paper provides a
guideline for the design of topology control schemes

Wang et al (2011) proposed a new Proactive Source Routing (PSR)
protocol that has a very small communication overhead but it provides nodes
with more information than distance-vector based protocols. The value of the
source routing protocol includes (i) better control of path selection by the
source nodes for congestion avoidance, load and energy consumption
balancing, and bypassing untrusted areas, (ii) alleviation of IP forwarding at
intermediate nodes, and (iii) support for opportunistic data forwarding.

In addition, PSR complements DSR as a proactive counterpart to
provide responsive data transportation services in heavily loaded networks.
their simulation results shows that PSR achieves performance similar to
OLSR and DSDV, but with only a small fraction of the communication
overhead This work was motivated by the need of providing source routing to
support opportunistic data forwarding in MANETs.

Zhong et al (2003) proposed Sprite which is a simple, cheat-proof,
credit based system for stimulating cooperation among selfish nodes in
mobile ad hoc networks. This system provides incentive for mobile nodes to
cooperate and report actions honestly. Compared with previous approaches,
this system does not require any tamperproof hardware at any node.
Simulations and analysis show that mobile nodes can cooperate and forward
each other’s messages, unless the resource of each node is extremely low.
They also modeled the essential component of our system as the receipt-
submission game, and proved the correctness of our system under this model.

Wang et al (2011) proposed a new routing protocol named PSR
for ODF in mobile ad-hoc networks. PSR is featured by proactive source
routing, loop free, and extremely small routing overhead. Compared to
existing routing protocols, there is no need to timestamp routing updates in PSR and the update messages are harmoniously integrated into the tree structure, so that the overhead can be significantly reduced. Performance results shows that PSR clearly outperforms other routing protocols, including DSDV and OLSR.

2.3 WORKS ON TRUSTWORTHY BASED COOPERATIVE COMMUNICATIONS

There are many works (Laneman JN & Worenell GW (2004)) pertaining to trust and cooperative based (Liu et al (2007)) communication. But, some of the work has been survey and cited in this literature review.

Among them, Feng Li & Jie Wu (2010) proposed an reduced uncertainty model that directly reflect a node’s confidence in the sufficiency of its past experience and how the collection of trust information affects uncertainty in nodes’ opinions. After defining a way to reveal and compute the uncertainty in trust opinions, the mobility was exploited as one of the most important characteristics of MANETs, to efficiently reduce uncertainty and to speed up trust convergence.

Nosrattina et al (2004) discussed a technique in wireless cooperative communication that allows single antenna mobiles to share their antennas to achieve the benefits of multiple antenna systems. Various signaling schemes for cooperative communication are presented for system design with practical inferences and requirements. Also they were discussed about coding schemes for non-cooperative systems. Moreover, open problem in the development of design criteria specifically for codes optimizes the performance of coded cooperation.
Marcela Mejia et al (2009) proposed several models for representing trust which is suited to a particular context and leads to different procedures for computing and propagating trust. The goal of their research is to study and analyze the most representative approaches for mobile ad hoc networks. They also aimed to obtain a qualitative comparison of the modeling approaches according to the three basic components of a trust model such as information gathering, information scoring as well as ranking and action execution.

Wu et al (2006) motivated the cooperative communication in mobile ad hoc networks transmitting independent copies of a packet to generate diversity. They analyzed the performance that includes an analytical study in terms of approximation ratio and a simulation study of the average size of the extended dominating set derived from the proposed algorithms.

A trust-based message propagation and evaluation framework to support the effective evaluation of information sent by peers in VANET was presented by Zhang et al (2013). The trust opinions were collected and weighted by the trustworthiness of the peers modeled using a combination of role-based and experience-based trust metrics. The trust-based message evaluation allows each peer to evaluate the trustworthiness.

Srinivasan et al (2005) addressed the issue of user cooperation in mobile ad hoc networks and assumed that nodes are rational, i.e., their actions are strictly determined by self-interest, and that each node is associated with a minimum lifetime constraint. For the given lifetime constraints and the assumption of rational behavior, they are able to determine the optimal throughput. They define this to be the rational Pareto optimal operating point and then proposed a distributed and scalable acceptance algorithm called Generous TIT-FOR-TAT.
The virtual currency and reputation mechanisms which are commonly adopted in online communities to boost participation was discussed by Bogliolo et al (2012). Their work focused on investigating combined use of virtual currency and reputation based incentives in the specific context of a community of users with Wi-Fi enabled devices capable of establishing ad-hoc connections. Their paper also presents a cooperation incentives framework for User Centric Networks (UCNs) which is based on the joint application of trust management and virtual currency mechanisms.

Sundararajan & Shanmugam (2010) developed a game theory based node cooperation model that observes the behaviour of an intermediary node (selfish neighbours) while forwarding packets for others on a route between a source and a destination. It also allows formal study and analyses the impact of selfish behaviour on the system performance.

Basit Qureshi et al (2012) proposed a decentralized framework and the related algorithms for trust based information exchange and social interaction among users based on the dynamicity aware graph relabeling system. In contrast to the existing implementations of social networks based on a client/server paradigm, their proposed framework utilizes a lightweight trust model for identifying trustworthy users and aims in creating communities of trusted users. Simulation results shows the effectiveness of the proposed framework compared with the traditional dynamicity aware graph relabeling system algorithm.

Pushpita Chatterjee et al (2012) proposed a game theoretic routing model and Secure Trusted Auction oriented Clustering based Routing Protocol (STACRP), to provide trusted framework for MANET. Two auction mechanisms procurement and Dutch are used to determine the forwarding cost-per-hop for intermediate nodes. Their model is lightweight in terms of
computational and communication requirements but yet powerful in terms of flexibility in managing trust between nodes of heterogeneous deployments.

Marco Fiore et al (2010) addressed the open issue by proposing a fully-distributed cooperative solution which is robust against independent and colluding adversaries. Results show that their protocol can thwart more than 99% of the attacks under the best possible conditions for the adversaries with minimal false positive rates.

Li et al (2010) Proposed a Protocol on-demand multipath distance vector (AOMDV) which is able to discover multiple loop-free paths as candidates in one route discovery. These paths are evaluated by two aspects: hop counts and trust values. Several experiments have been conducted to compare these protocols and this results show that AOTDV improves packet delivery ratio and mitigates the impairment from black hole, grey hole and modification attacks.

Hui Xia et al (2011) proposed the trust evaluation mechanism with detailed influencing factors that uses AHP to successfully construct a fully trust hierarchical model with corresponding mathematical description and derivation rules. Analysis and simulation results show that their model (AHPS trust) is more effective than the existing model (CFS trust) along with 10% proportion of malicious nodes in the network.

A new game theoretic trust model called Distributed Emergent Cooperation through Adaptive Evolution (DECADE) was presented by Marcela Mejia et al (2012). In DECADE, each node seeks individually to maximize its chance to deliver their own packets successfully. So that the cooperation among rational nodes and the isolation of selfish nodes appear as an emergent collective behaviour. DECADE includes a sociability parameter
that encourages nodes to interact among them for faster learning and adaptability.

Jie Zhang (2012) presented a trust-modeling framework for message propagation and evaluation in vehicular ad hoc networks. In their framework, peers share information regarding road condition or safety. More specifically, their trust-based message propagation model collects and propagates peers’ opinions in an efficient, secure, and scalable way by dynamically controlling information dissemination. Experimental results show that their proposed trust-modeling framework promotes network scalability and system effectiveness which are the two essentially important factors for the popularization of vehicular ad hoc networks in information propagation and evaluation under the pervasive presence of false information.

Thanigaivel et al (2012) proposed the trust based routing mechanism TRUNCMAN that isolates Non-Cooperative node during the path discovery process itself which defends against many network layer attacks. Being a Trust based routing protocol TRUNCMAN initiates a NON-Cooperative movement against a malicious node and advertise that to all the nodes in the network as a social welfare.

A pre-standardization approach for trust and/or reputation models in distributed systems was presented by Félix Gómez Mármol & Gregorio Martínez Pérez (2010). A global comparison has been done for the most relevant models against these conditions, and an interface proposal for trust and/ reputation models has been proposed.

A computational trust model inspired by stereotypes in real-life was proposed by Xin Liu et al (2012). They introduced a stereo type that contains certain features of agents and an expected outcome of the transaction. When
facing a stranger an agent derives its trust by aggregating stereotypes matching the stranger’s profile.

Sarma Dhulipala et al (2012) proposed a Heuristic Approach based Trust Worthy Architecture for WSN that considers the challenges of the system and focus on the collaborative mechanism for trust evaluation and maintenance. Their proposed Architecture is capable of fulfilling critical security, reliability, mobility and performance requirements for reliable communication while being readily adaptable to different applications. The simulation results of this proposed architecture outperformed the recent trust worthy architecture using the analysis of the performance requirements such as communication overhead, memory requirements and energy consumption.

Cai-Nicolas Ziegler & Jennifer Golbeck (2007) presented two frameworks for analysing the correlation between interpersonal trust and interest similarity. The obtained empirical results for applying the two frameworks on two real, operational communities, which suggest there is a strong correlation between both trust and interest similarity.

2.4 WORKS ON REPUTATED MESSAGE COMMUNICATIONS IN MANETS

Many research work have been proposed in the past (Larson P (2001)) for reputed message transmission in MANETs. But none of them have addressed the problem of reputation in MANETs.

Among them, Kayshyap Balakrishnan et al (2005) proposed the TWOACK and S-TWOACK schemes to detect and mitigate the effect of selfish nodes by overcome the deficiencies in reputation systems. Also to distinguish the genuine route failure from misbehaving nodes, they provided considerable reduction of routing overhead.
Ze Li & Haiying Shen (2012) presented a reputation system that evaluates node behaviors through reputation values and uses a reputation threshold to distinguish trustworthy nodes and untrustworthy nodes in MANETs. A price based system that uses the virtual cash to control the transactions of a packet forwarding service. The game theory is used to analyze the cooperation incentives provided by the system with no cooperation incentive strategy. In addition to this an incentive mechanism is included to provide high node cooperation. Also the performance evaluation was made between these two systems and an integrated system to detect selfish nodes to establish node reputation in MANETs.

A Secure and Objective Reputation based Incentive Scheme (SORI) in mobile Ad hoc Networks was proposed by He et al (2004). In order to encourage the packets forwarding and discipline selfish behaviour of mobile nodes. The features of our SORI are that the reputation of a node is quantified by objective measures through neighbour monitoring and the propagation of reputation is secured by one-way hash chain based authentication scheme. The selfish nodes are punished and virtual currency based incentive scheme is used to participate the selfish nodes into the communications.

The system that allows the selfish nodes to participate by awarding incentives was proposed by Fan Wu et al (2013). They also discussed how to make an incentive based on the probabilistic routing protocol. It using probabilistic routing protocol, how the incentives are provided to selfish nodes to cooperate in communications.

Marti et al (2000) proposed a Dynamic Source Routing (DSR) misbehavior using Watchdog and Pathrator mechanisms. The Watchdog mechanism identifies the misbehavior activities and Pathrator avoid the identified misbehaving nodes from the routing to establish the reputation. The
misbehaving nodes are not transmitting the packets to the next node, the watchdog listening these and inform to Pathrator. The Pathrator recognized this node’s misbehavior and make arrangement to deliver the packets via the reputed nodes.

Liu et al (2007) presented a TWOACK based routing misbehavior detection scheme to mitigate the misbehavior and any adversaries are there in desired route. The TWOACK scheme contributed to the traffic congestion and routing path. It overcomes the route failures and find the genuine routing to reach the reputation.

The use of a self-policing mechanism based on reputation to enable mobile ad hoc networks to keep functioning despite the presence of misbehaving nodes was proposed by Buchegger & Boudec (2005). Once a misbehaving node is detected, it is automatically isolated from the network. Further they classify the features of such reputation systems and presented the possible implementations of each of them. They also explained the way of using second-hand information while mitigating contamination by spurious ratings.

A distributed scheme to counter the selfish nodes and to enforce cooperation in pure mobile ad hoc networks was described by Soltanali et al (2007). The proposed scheme is a combination of reputation based and currency based scheme which mitigates selfish nodes and improves the cooperation among them. The proposed scheme neither needs central control nor a priori trust between nodes. The proposed scheme detects selfish nodes accurately. This scheme increases the throughput of well-behaving nodes and decreases selfish nodes’ throughput.

Mehdi Seyrafi & Nasrollah Charkari (2012) proposed SHAPARS which is an efficient subjective logic based reputation system to detect and
isolate selfish nodes in mobile ad hoc networks. This prevents selfish mobile nodes from hiding their selfishness by moving around in the network.

A new cooperation enforcement protocol for a hybrid routing protocol called AntTrust was proposed by Ikram Allam et al (2012). The main idea of the protocol AntTrust is to build a multiagent of agents. They proved two main types of agents namely the first mobile agent called Ant is responsible, for establishing paths and the second mobile agent referred to as AntRectifier is issued by a node whenever a change in the network topology is detected. The protocol AntTrust tends to solve both problems of transmission delays and routing overhead. This new protocol uses the nodes’ reputation to forward packets through the most reliable nodes. The main idea of the protocol is to provide an effective mechanism to measure the reputation of other nodes of the network and to punish all nodes which do not collaborate into the network.

Kun Yu & Xiaobing Chen (2012) proposed a mechanism to the mobile nodes with lower reputation value while receives less benefit and suffers from a new problem of second-ordered free riding. To mitigating the problem of refused a new selfish behavior is incorporated in the communication which is important to improve the cooperation in ad hoc networks.

A combination of pricing and reputation-based mechanisms targeted at generating higher incentive for cooperation among nodes was introduced by Lotfi Froushani et al (2011). The reputation-based part of the mechanism guarantees proper cooperation among sources. In addition, the pricing-based mechanism is added to ensure cooperation of relay nodes. In their approach, a multi-player game is defined with continuous strategy set and payoffs which lead to a more practical model.
Tingting Chen et al (2011) proposed the first reputation system that has rigorous analysis and guaranteed incentive compatibility in a practical model.

Dong Hao et al (2012) proposed the game theory approach to analyse the collusion in selective forwarding attacks. They introduced put forward a sub-route oriented punish and reward scheme in the proposed multi-attacker repeated colluding game. Also by static and dynamic analysis of this colluding attack game, they found the sub-game equilibriums which indicate the attackers’ optimal attack strategies. Based on the analysis result, they are able to establish security policies for multihop wireless networks that threaten and detect the malicious insider nodes which collude with each other to launch the selective forwarding attacks.

A new trust model for adopting the technology to calculate eigen vectors of trust rating and recommending metrics was proposed by Xinxin Fan et al (2012). This algorithm would make these two reputation values established an interrelated relation of reinforcing mutually. Extensive experimental results confirm the efficiency of their trust model against the threats of exaggeration, collusion, disguise, Sybil and single-behaviour.

Dipali Koshti & Suprya Kamoji (2011) discussed two techniques namely Reputation based technique and Credit based technique used to detect selfish nodes in MANET. They also discussed two algorithms which are based on reputation based technique and one algorithm based on credit based techniques.

Shenlong Chen et al (2012) proposed a novel and effective recommendation verifying scheme to deal with dishonest recommendation. In Recommendation Verifier, tackling dishonest recommendation problem is modelled as the trials in reputation management court. The novelty of their
proposal is that it does not merely depend on majority rule but introduces time verifying mechanism to reduce the false positives and false negatives caused by deviation detection. Experimental results prove that the proposed scheme is both effective and lightweight in alleviating the influence of different types of dishonest recommendation attacks.

Mohammad Hossein Manshaei et al (2013) presented a selected set of works to highlight the application of game theory in addressing different forms of security and privacy problems in computer networks and mobile applications. In this literature survey, our goal understood the various problem in trust based communication so that this proposed works solve the above said issues.

Martin Schütte et al (2006) outlines important attacks and summarizes popular approaches to design secure MANET protocols in order to detect selfish and malicious nodes and to enforce cooperation.

Jakobsson et al (2003) proposed a micro-payment scheme for multi-hop cellular networks that encourages collaboration in packet forwarding by letting users benefit from relaying others’ packets. At the same time as proposing mechanisms for detecting and rewarding collaboration, we introduce appropriate mechanisms for detecting and punishing various forms of abuse. It show that the resulting scheme – which is exceptionally light weight makes collaboration rational and cheating undesirable.

Zhong et al (2003) system provides incentive for mobile nodes to cooperate and report actions honestly. Compared with previous approaches, our system does not require any tamperproof hardware at any node. Furthermore, It present a formal model of our system and prove its properties. Evaluations of a prototype implementation show that the overhead of our system is small. Simulations and analysis show that mobile nodes can
cooperate and forward each other’s messages, unless the resource of each node is extremely low.

Ben salem et al (2003) proposed an incentive mechanism that is based on a charging/rewarding scheme and that makes collaboration rational for selfish nodes. By leveraging on the relative stability of the routes, this solution leads to a very moderate overhead.

Lee et al (2007) presented signature-seeking drive (SSD), which is a secure incentive framework that stimulates cooperative dissemination of advertising messages among vehicular users in a secure way. Unlike existing incentive systems, SSD does not rely on tamper-proof hardware or game-theoretic approaches but leverages a public key infrastructure to provide secure incentives for cooperative nodes. With a set of cooperative packet dissemination designs are proposed, the author also demonstrated that SSD which is robust in both incentive and security perspectives.

2.5 ENERGY CONSUMPTION IN MOBILE ADHOC NETWORKS

Many works related to energy consumption have been proposed by many researchers in the past (Faruk Mahmudur Rahman & Mark Georgery (2011)) to reduce energy consumption in MANETs. But in this literature review few works have been surveyed and cited here.

Among them, Al-Gabric et al (2010) proposed an approximation algorithm by setting double weights to enhance the lifetime of node via directed graph. The objective of AODV based energy model is to find less energy consumption based shortest routing path to prolong the network lifetime.
A new cooperative approach to reduce the energy consumption without compromising the throughput performance maximizing the cost efficiency was proposed by Tie Luo et al (2012). Hao Zhu and Guohong Cao (2006) proposed the exploitation of providing through direct link based good channel quality between the sender and receiver. The MAC layers relay enabled Distributed Coordination Function (rDCF) was proposed to achieve the quality through the impact of spatial reuse and simple randomized algorithm in multi hop transmission.

Hiroki Nishiyama et al (2012) proposed the impact of topology control which receives much attention in stationary sensor networks for effective minimization of energy consumption which reduces interference, and shortening end-to-end delay as well as the transience of mobile nodes in Mobile Ad hoc Networks (MANETs).

A new communication paradigm which represents effective resource sharing among cooperative nodes was proposed by Thanongsak Himsoon et al (2007). The device lifetime by exploiting cooperative diversity in a energy depleting network. The optimization problem was formulated to determining the power allocation as well as relay locations. The energy of the devices is increased 12 times over the non-cooperative network.

Gang Xu et al (2011) presented a paper on design and implementation of policy that enforce four mechanism to trust the communication. In such mechanism each application or protocol has an associated policy. Two instances of an application running on different nodes may engage in communication only if these nodes enforce the same set of policies for both the application and the underlying protocols used by the application.
Xin Liu et al (2012) proposed a stereo trust which is a computational trust model inspired by stereotypes as used in real-life. A stereotype contains certain features of agents and an expected outcome of the transaction. When facing a stranger, an agent derives its trust by aggregating stereotypes matching the stranger’s profile.

Alan Holt & Chi-Yu Huang (2013) proposed the increment of energy cost using mobile agents operating in wireless LAN. This energy consumption includes source, relay and destination energy consumptions. Faruk Mahmudur rahman et al (2011) proposed the Quadrant based Intelligent energy control multicast algorithm which balances the traffic uniformly across four intermediate nodes among any quadrant increases the nodes’ lifetime. The algorithm ensures the packet reception acknowledgement notification and also the guaranteed packet delivery.

Pushpalatha et al (2009) proposed a trust based energy aware routing model in MANET. During route discovery, node with more trust and maximum energy capacity is selected as a router based on a parameter called ‘Reliability’. Route request from the source is accepted by a node only if its reliability is high. Otherwise, the route request is discarded. This approach forms a reliable route from source to destination thus increasing network lifetime, improving energy utilization and decreasing number of packet loss during transmission.

Dhiraj Nitnaware & Ajay Verma (2010) proposed the Energy Based Gossip (EBG) routing protocol that derives from the AODV protocol, uses Gossip technique based on the remaining energy of each node. The results of EBG algorithm is compared with AODV protocol by using NS-2 as the simulation tool. The simulation results show that energy consumption due to routing packets and routing overhead reduced can be reduced up to 10% to 30% using the new routing method.
Sadek et al (2009) proposed the analytical and numerical results reveal that for small distance separation between the source and destination, direct transmission is more energy efficient than relaying. The results also reveal that equal power allocation performs as well as optimal power allocation for some scenarios. The effects of the relay location and the number of employed relays on energy efficiency are also investigated in this work. Moreover, there are experimental results conducted to verify the channel model assumed in the article.

Kadloor & Adve (2010) formulated a related convex optimization problem that provides an extremely tight upper bound on performance and show that selection is, almost always, inherent in the solution. This also provides a heuristic to find a close-to-optimal relay assignment and power allocation across users supported by a single relay. Simulation results using realistic channel models demonstrate the efficacy of the proposed schemes, but also raise the question as to whether the gains from relaying are worth the additional costs.

Pi-chengshih & Tei-Wei Kuo (2009) proposed a distributed algorithm and its realization to maximize the minimum residual energy of all the nodes for each multicast, where no global information is assumed to be efficiently maintained at any node. A transient multicast tree is established on demand and derived based on the autonomous decisions of intermediate nodes. We prove that the derived tree is loop-free and theoretically optimal in the maximization of minimum residual energy. The performance of the proposed protocol was evaluated over NS2 with a series of simulations for which have very encouraging results.

Jun-Hu et al (2011) proposed the MANET routing protocols represents the different performance in mobile networks scenarios. To know the better protocol in different mobile network models, four mobility models
are proposed for simulating different scenarios of mobile ad hoc networks. Also a byte-based energy consumption evaluation methodology is introduced for the protocol assessment. The experiment built upon mobility models show that TORA can cause too much energy consumption on large-sized network and is fit for the mobile ad hoc network with low node mobility, while AODV, DSR, and especially DSDV perform well on energy consumption for the mobile ad hoc network with high node mobility.

2.6 SUMMARY

There are many contributions that are involved in thesis work with respect to cooperative, trusted, reputed communications and energy consumption of mobile nodes in mobile ad hoc networks. First this work focuses on cooperative packet delivery among mobile nodes in the MANET. In many researchers proposed their own view and model to reach their goal about cooperation in mobile ad hoc networks. The various schemes and protocols were proposed for neighbour node discovery, identification of selfish nodes and cooperative nodes. From this analysis, the new and established schemes and protocols are used for the cooperative communications. Second, this research focuses on by introducing the new incentive scheme to participate the selfish nodes to attain the highly cooperation in an opportunistic mobile ad hoc networks. In third, the trust and reputation based communication is focused to preventing unauthorized third party to participate in communication and also to establish the node’s reputation in MANET. Fourth, the energy consumption is focused to reduce the energy consumptions among the mobile nodes which lead the establishment of the entire network lifetime while cooperative and reputed communications occurs. Finally, the architectural framework has been proposed that provides different new and established techniques for cooperative, trusted and reputed communication in mobile ad hoc networks.