Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 3, Issue. 8, August 2014, pg.423 – 434

REVIEW ARTICLE

Data Dissemination Approaches for Roadside Content Delivery Systems in VANET: A Review

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Abstract -- Data dissemination or diffusion service is the process of distributing a certain amount of information to the users such as vehicle drivers or mobile users especially in wireless networks. It also plays a significant role in numerous applications of Vehicular Ad hoc Networks (VANETs). Data Dissemination problem has been addressed by many researchers so far in many contexts. This paper presents the study on data dissemination models for Roadside content delivery systems in Vehicular Ad hoc Networks (VANETs) with prescribed results.

Keywords -- VANET, Wireless Communication, Data Dissemination, Signal-to-Noise Ratio (SNR), Threshold based policy, Delay-Tolerant Scenario (DTS)

I. INTRODUCTION

A literature review or assessment should consider the significant points about present knowledge including substantive results, as well as hypothetical and procedural contributions for particular problem. It should be written by someone. The data dissemination services can be supported by the traditional cellular networks such as satellite based broadcasting, FM-radios, General Packet Radio Service (GPRS) and cellular-3G. Cellular Networks can suffer from low transmission rate and high cost [1].

Wi-Fi Infostations [2] are the ideal alternative for deploying location-aware information services to vehicle passengers. Individual Infostations could be placed at key locations such as freeway exits into a city, and at street corners near the places of interest [3]. Typically, each Infostation serves as Access Points (APs) for a particular coverage area and has a potential to accept the vehicle users for network [4]. The review describes summaries various applications of Infostations in different disciplines.

In the rest of the paper, Section 2 describes the review about the Wi-Fi infostations in general perspective. Data dissemination approaches for Wi-Fi Infostations are reviewed and also tabulated in Section 3. Finally, conclusion about this study is given in Section 4.

II. Wi-Fi INFOSTATIONS - A REVIEW

In 2000, Richard H. Frenkiel et al reviewed the major advantages and some constraints that are faced by the Mobile Infostations Network. The constraints of wireless data systems were cleared by using an architecture called Infostations, which maximize the capacity of wireless data system thereby reduce the cost of the services in one dimensional system model also it maximizes the capacity and minimizes the message delay in two-dimensional system model. On the other hand, Infostation Networks have some issues associated with the coexistence of Infostations with other systems which are derived from unpredictable nature of the connection among the terminals [5].

In 2002, Dave Cavalcanti et al proposed Wireless data Communication system based on the every time everywhere model. The Water filling communication theory is also used to increase capacity and coverage, reduce the packet delay. In the model, information is available simultaneously for the vehicles at different places. Results showed the improvement in capacity, coverage and the amount of information transmitted while using a one dimensional model [6].

In 2003, Tara Small et al proposed Shared Wireless Infostation Model (SWIM) to solve capacity-delay tradeoff practical problem of Wireless ad hoc networks by increasing the storage requirements. A Biological Information Acquisition System is used to demonstrate this model. The parameters named as Time steps (t), Cumulative distribution Function F (t), Number of data deliveries, Direction Vector are used to evaluate SWIM. The result revealed that SWIM significantly decreases average delays and are well-suited for delay-tolerant applications [7].

In 2004, Bazil Taha Ahmed et al proposed a General two-slope Propagation Model for Cigar-Shaped W-CDMA Infostations in Rural Highway Zones. The throughput of the system is computed by Lognormal Shadowing Technique and the expected value of Signal to Noise Ratio is also determined. The Parameters Break point distance, Separation distance, number of users and the Bit Rate were used to analyze the performance of W-CDMA. Results reveal that Bit-Rate reduction provides extensions in the Infostation's Coverage area. After this process, more number of Vehicles can access the content from Infostations very easily [8].

In 2008, Rezwana Karim has done Comparative study of different systems such as VANET, 3G and Infostations for distributing data in vehicular network. The study revealed that the design of Infostation Network with higher bandwidth is required for Vehicular Network in Wireless Communication [9].

In 2008, Bazil Taha Ahmed et al analyzed the performance of Single, Double and Triple Frequencies Infostation Networks based on the Two-slope propagation loss model which is used to calculate the Statistics of the Signal-to-Noise and also the Signal-to-Interference Ratio of Infostation Network. From the experiment, the effect of the first-slope parameters (s1 and r1) is lower than the effect of the second-slope parameters (s2 and r2) and also the Triple frequencies network has a higher effective range (814m) than the single frequency network (319m) [10].

In 2011, Dave Cavalcanti et al evaluated the capacity of the infostations using Quicking theory Based One-Dimensional Model. In this study, the mechanisms which affect the capacity of Infostations Network such as frequency reuse aspect, modulation schemes are completely analyzed and evaluated. The computational results showed that the proposed model achieves high throughput and less delay time while a reduced coverage (Smaller Cluster size N=1) and higher-level modulation are used [11]. The finding of the above Literature is listed in Table 1.

TABLE I: STUDY OF Wi-Fi INFOSTATIONS

PROPOSED APPROACH	APPLICATION(S)	AUTHOR	YEAR	RESULT
Modified Mobile Infostation (MMI) System [6]	Fixed Infostation System Network	Dave Cavalcanti et al	2002	Throughput is improved from 69% to 72% while increasing the distance between Mobile User (MU) and Mobile Infostations (MI).
Shared Wireless Infostation Model (SWIM) [7]	Infostations in different key points within a University Campus.	Tara Small and Zygmunt J.Hoas	2003	Latency is reduced from 70% - 65% and the response time is improved by increasing the number of data deliveries.

General Two-Slope Propagation Model (GTSP Model) [8]	W-CDMA Rural highway Cigar Shaped Infostations	Bazil Taha Ahmed et al	2004	Performance of the Infostation is degraded from 80% - 72% when the distance is increased from 300m to 400m.

III. DATA DISSEMINATION APPROACHES FOR WI-Fi INFOSTATIONS - A REVIEW

In 1999, An Intelligent transmission protocol called WINMAC is proposed by Gang Wu et al for Infostations in order to handle channel allocation and access, adaptive transmission rate adjustment and retransmissions of packets. It utilizes TDMA/TDD channel structure and Rate Switching Algorithm (RSA) for data dissemination. The parameters such as time slots and three transmission rates (250 kbps, 1mbps and 2mbps) were used to evaluate the model. The Results revealed that it provides better data dissemination when compared to others [12].

In 2003, Wing Ho Yuen et al proposed the data diversity technique to solve the issue of noncooperation between nodes in the context of content distribution in mobile Infostation Networks. In wireless communications, data diversity refers to the exploitation of variations in the signal strength over spatial, time, frequency domains due to multipath fading. Results pointed out that content dissemination with data diversity is more efficient in terms of the parameters throughput and fairness [13].

In 2003, Wing Ho Yuen et al proposed an alternative user strategy to rectify the issue of noncooperation among vehicles and also to increase the delivery rate of file dissemination in highway Mobile Infostation Networks [14]. It requires the absolute minimal cooperation among vehicle users in the form of Social Contract Communication. This functionality increases the performance of the Highway Mobile Infostation Networks than user strategy. The performance of the model is evaluated by using the parameters Node density, Vehicle Mobility, and the number of disseminated files and compared to existing user strategy. Results clearly revealed that Alternative User Strategy improved the performance and working capacity of Highway Mobile Infostation Networks than old user strategy.

In 2003, Wing Ho Yuen et al evaluated four transmission strategies named as a non-adaptive strategy, a random node in range strategy, a closest node in range strategy and the closest node strategy for the Mobile Infostation Networks. Transmission rate is computed by using the parameter Signal to Inference Ratio (SIR) to evaluate the performance of these strategies. Random node in range strategy and closest node in range strategies were operated based on Rate Adaptation Transmissions. Closest node in range strategy selected the closest node strategy to choose the best data dissemination channel for Infostations. While comparing the non-adaptive strategy with all other strategies, results show that non-adaptive strategy provides superior performance than the others [15].

In 2004, Furuzan Atay and Christopher Rose implemented Threshold based policies to study the performance of Mobile Infostation Networks. These policies are the best for infostation network studies and also implemented as a distributed and scalable protocol. Average packet delay and throughput are used to analyze the threshold based policy and resorted to network simulations for evaluation. The results revealed that threshold based policies remarkably increased the throughput per node or vehicle even though in the increased pattern of delay [16].

In 2004, A.A.Bertossi et al considered several On-line approximation algorithms for the server allocation with bounded simultaneous requests arising in isolated Infostations. Each request is characterized by a bandwidth rate. For the simultaneous requests, the sum of bandwidth is assigned to the server at the same time for efficient content delivery. On-line approximation algorithms with generalization techniques provide constant solutions for the server allocation problem [17].

In 2006, Helal Chowdhury and Juha-Pekka Makela proposed a mathematical framework called two throughput-distance relationship models to compute the statistics such as the average throughput and transferred information while a mobile user crossing the coverage area of the Infostation. The performance of the model is analyzed using WLAN Standards IEEE 802.11b and IEEE 802.11g. The numerical results showed that the travelling angle as well as the underlying technology used in Infostation is the impact of increasing average throughput and performance [18].

In 2006, Gowri Rajappan et al proposed Mobile Infostation Network Technology (MINT) which is a collection of an Adaptive physical layer, Idea of super user, the high-throughput physical (PHY) layer and Medium Access Control (MAC) layer technologies for Infostation Networks. Among them an adaptive physical layer determines power levels with different modulation schemes and idea of super user allows preferential use of high data rate link and the high throughput layer technologies allow priority based bandwidth allocation scheme. The parameters signal to noise ratio, capacity in bps/Hz,

throughput level and number of users are used to access the model. The results revealed that MINT achieved high capacity and better performance in mobile infostation networks compared to existing methods [19].

An Infostation Network Based on Multi-Agent System was proposed by Ivan Ganchav et al, in May 2007 to Provide Wireless mServices for mobile users at different Key points around University Campus. The number of Wireless Communication standards such as IEEE 802.11 WLAN (Wi-Fi), IEEE 802.15 WPAN (Bluetooth) and IEEE 802.16 WMAN (WIMAX) are utilized for building the system to deliver mobile services to mobile Users. It satisfies the request of users even though in out of coverage. It effectively provides high data dissemination rate for the intermittent Coverage of Infostations. The service "Private Chat across an Infostation" is analyzed by using both thin-agent and the thick agent approaches. Among these two approaches, thick agent approach is not acceptable since the infostation is overloaded and overhead of communication [20].

In 2007, Ilias Leontiadis et al proposed an opportunistic event dissemination protocol for Vehicular Networks. The Opportunistic cache and replay mechanisms are used to deliver the notifications to new subscribers in the area of throughout of the publication interval. It was simulated using realistic Vehicular Traces and results are compared to standard epidemic protocol in terms of message delivery to measure overhead and delivery in various scenarios [21].

In 2008, Laura Galluccio et al proposed Energy efficient protocols to design efficient infostation systems for rural areas to improve the data dissemination process. These protocols have the functionalities to decrease the cost of the devices and also increase the energy Infostation. The main goal of them is to reduce the cost of the devices as well as increase the energy of the rural infostation systems. The parameters Maximum probability of neighbor communication success P (max), Power consumption constraint c* and Time variations TCycle are used to evaluate the method. The results clearly showed that the designer of energy efficient rural infostations is better when compared to generic wireless mobile networks [22].

In 2008, Ivan Ganchev et al presented an Infostations based multi agent system for facilitating a car parking locator service provision within University Campus [33]. A multi agent approach was adopted as the most suitable approach to structure the systems. In order to facilitate flexible and adaptable service provision, Intelligent Agents reside within each of the three tiers system Architecture. This service allows registered mobile users to gain information regarding available parking spaces in the University campus and reserve best suits for them while entering the campus [23].

In 2008, Stanimir Stoyanov et al proposed a Distributed eLearning Centre (DeLC) approach to develop Infostation-Based eLearning architectures for distance education. It has three levels of architectures named as eLearning Service Level, Scenarios Model Level, and Agent & Service Level and adopts the ideas suggested in the MDA (Model Driven Architecture) Specification under OMG (Object Management Group) certification. The resultant Infostation-Based Network architecture provides mobile access to electronic services (eServices) and electronic content (eContent) for users equipped with mobile wireless devices via a set of Infostations deployed in key points around a University Campus [24].

In 2009, Mohsen Sardari et al proposed Rate Less Codes scheme for collaborative content distribution from Roadside Units to Vehicular Networks. In this scheme, the vehicles on the road are divided into two groups of collector and carrier nodes per source. The collector nodes have the opportunity to recover the source message from a large distance. Parameters such as Decoding Distance and Deployment Capacity are also introduced for performance evaluation. The effect of finite buffer constraint in the dissemination problem in a VANET is the first study [25].

In 2009, S.Stoyanov et al proposed an agent oriented Middleware architecture to support the context of aware mobile eLearning services for a distributed Infostation based network in the University Campus. It works based on the two categories named as Agents which are suitable for examining the dynamic changes and Services which are used for the realization of business functionality. These agents are implemented in the JADE framework using the possibilities for Wi-Fi and Bluetooth Communications. To evaluate middleware architecture, Proog-of-Concept testbed environment is used for various service applications in different scenarios. The result revealed that agent oriented middleware architecture is very useful for Infostations to provide eLearning services than others [26].

In August 2009, Wing Ho Yuen et al proposed the Opportunistic Cooperation (OC) process to rectify the issue of noncooperation among nodes in the context of content distribution in mobile Infostation Networks. All nodes have a common interest of receiving particular files (K) which are cached in the Infostations with the absolute minimal cooperation among users to increase the rate of file dissemination. The OC process selects the diversity techniques called as data and multiuser diversities to evaluate the Opportunistic Cooperation in Mobile Infostation Networks by using the parameters capacity, time, transmit

range. Simulation results showed that the issue of non cooperation in Mobile Infostation Networks is significantly solved by OC process [27].

In 2009, Liang Hao et al proposed a cross-layer resource allocation scheme for efficient message dissemination in Rural Infostation Systems. By tuning the network layer resource allocation parameter p and the link layer resource allocation parameters NR and βU, the performance requirements for direct transmission services of relay nodes can be guaranteed. The performance of message dissemination service is also improved properly by choosing the resource allocation parameters. The efficiency of the proposed scheme is evaluated and validated by simulations environment [28].

In 2010, Stanimir Stoyanov et al proposed two Formal Models (Static Model, Dynamic Model) for solving the problem of optimal resources deployment in Infostation Network with the minimum overhead and less computation time to satisfy user requests for resources. These models are based on an adaptation of the Overlay-Graph Model which has been used for searching of computer program structures with optimal time behavior. Some initial ideas are discussed by using these models for solving the problem of optimal deployment of resources. The number of RG-Graphs and two Optimization techniques were used to search and allocate resources for the individual nodes in the Infostation Network. Among them Global Optimization Technique with Dynamic Model generate the best result compared to others [29].

In 2010, Hao Liang and Weihua Zhuang proposed a two-level (Network level, Packet level) Co-operative data dissemination approach for Roadside Wireless Infostations. The approach efficiently allocates the available resources of the Roadside Infostations to the vehicles by processing its network level data dissemination service. Packet level cooperation service is used in the model to increase the data dissemination of Roadside Infostations. Among them, network level cooperation service achieved the best data dissemination service in terms of the parameters time interval and the number of packets. Simulation results showed that the two level approaches improved the throughput of roadside Infostations than Single level approach [30].

In 2010, V.kone, et al introduced two analytical data dissemination models (push model, pull model) for examining the density of Infostations in highway scenario [10]. These models deal with the understanding of high level trends for infostations density and the impact of content settings. The Mathematical parameters such as Penetration Ratio and Lifetime have been used to evaluate the Models. Final Results support the hypothesis of vehicle to vehicle distribution based on intermittent connectivity in the infostations. And also showed that Push Model yield the best result compared to others in terms of Parameters [31].

In 2010, Laura Galluccio et al proposed an analytical framework for characterization of stability conditions of Infostation systems. It depends on diffusion theory. The upload and collection process of data which is generated by moving vehicle node in remote area. Results revealed that analytical framework is more useful to design a stable Infostation Network compared to others in communication Paradigms [32].

In 2011, Yifan Li et al proposed a Distributed Hierarchical cooperation formation algorithm for recovering the improper cooperation between Access Points (APs) and Mobile Users (MUs) in Mobile Infostation Networks. The merge and split mechanisms are used in the model to achieve the stable hierarchical cooperation among APs and MUs. The method is investigated using different system parameters such as Mobile Users (MU), Access Points (AP), and Expected Payoff to prove the effectiveness of the proposed algorithm [33].

In 2011, Marcel C. Castro et al proposed a Delay-Tolerant Scenario (DTS) for file sharing applications in rural area Infostations. An opportunistic approach is exploited in the scenario. In order to support communications, two peer-to-peer (P2P) schemes (Bamboo, Georoy) are merged to prove their applicability and usefulness of a DTN scenario. Replication of resources is used to improve the lookup performance and the network can be dynamically connected with the help of a Data Mule. Simulation results showed the suitability of the schemes and allowed for deriving interesting design guidelines to provide the effectiveness of file sharing applications in Rural Area Infostations efficiently than others [34].

In 2011, Stanimir Stoyanov proposed a Software Development Approach to develop Context-Awareness Provision of m-Learning Systems for Wireless Infostation Networks. Based on the ideas suggested by the Model Driven Architecture (MDA) under Object Management Group (OMG) Certification, the middleware is developed to achieve Context Awareness. So, it aims at the development of a Service-Oriented and Agent Based architecture which are the two types of Infostation's Middleware Architecture. It is implemented in JADE framework. Iteratively, It has been examined and tested in Simulation Environment. The Simulation results revealed that the proposed approach showed better performance improvement in the development of mLearning Systems [35].

In 2012, Uche A.K.Chude okonkwo proposed geometrical-based method for the characterization of Ultra-wide-Band Infostation in Time scale domain. The carrier frequency independent method is used for computing wideband channel responses. It was compared to Doppler shift method based on the parameter time-variation in the channel. The Model yields a more reliable measure of frequency dispersion than Doppler shift in the UWB infostation channel. Results showed that the frequency dispersion of the channel depends on the frequency but not on the bandwidth whereas time dispersion depends on Bandwidth but not on the frequency. The estimation of the frequency offset using time-scale domain wideband model is more accurate than frequency offset estimated by narrowband models [36].

In 2012, Zhan lin Ji et al proposed an intelligent, light-weight, and distributed Java platform based Spring-like framework for the provision of mobile services (mServices) to the Infostation-Based mLearnig environment. The Integration of JADE and DROOLS platforms help the system to work in a distributed and more intelligent manner. It is the benefit of being independent on any JAR file and also particularly suited to resource limited mobile application design compared to spring. When compared to traditional teaching and learning strategies, it can also offer more holistic learning experience [37].

In 2012, Hao Liang et al proposed an Online Resource Allocation (ORA) algorithm to solve an optimal resource allocation problem for on-demand data delivery in high speed trains of cellular/infostation integrated networks. It was demonstrated that the proposed resource allocation algorithm improved the total reward of delivered services over the existing approaches such as FIFO, EDF and RAPID. The performance of the proposed algorithm is evaluated based on a real high-speed train schedule. Compared to other approaches, the proposed algorithm can significantly improve the quality of on-demand data service provisioning over the trip of a train [38].

In 2013, Abdulmalik Alhammad et al proposed a Context-Aware on-street Parking System which combines the concept of context-awareness and an Infostations (IS) for locating and reserving space in parking zone. Three tier parking system is designed to capture VANET architecture whereas wireless DSRC protocol used for communication among different vehicles. Vehicles can request and reserve preferred parking space using wireless capabilities which are still moving. Totally, it is very useful to overcome unawareness of drivers who didn't know the available parking zones and related parking policies [39].

In 2013, Vinod Kone et al proposed Starfish Data Scavenging Protocol with Unicast and Broadcast infostations for disseminating Location Aware Content to Mobile Users on the move. In the experiments, Round Robin and Signal Strength Ratio (SNR) scheduling Algorithms are used for testing the Unicast data dissemination process whereas Broadcast Data Rates 6, 12 and 24 Mbps and also different modulation schemes are used such as BPSK, QPSK, and 16-QAM are used to test the Broadcast Data Dissemination process. From the experiments, it is proved that Data Scavenging Protocol is much better than others [40].

In 2013, Yifan Li et al proposed a Hierarchical Cooperation Formation Model for downlink data transmission to achieve high Performance in Mobile Infostation Networks. It has two levels of Cooperation namely the upper-level cooperation which makes use of the infostation communication paradigm and lower-level cooperation which utilizes the communication among mobile users. These levels of Cooperation work to obtain Stable Cooperation Structure for both infostations and Mobile Users. Mobile Users (M) is assigned to N Infostations. Parameters Payoff μ_m, Mobile Users $M\mu_m$ and Cooperation Level are used to calculate the Cooperation among the mobile users. The effectiveness of the HCF Model is investigated using the parameter throughput [41].

In 2013, Wing Ho Yuen et al evaluated the effect of vehicle or node mobility in highway mobile Infostations Networks by considering two traffic scenarios (forward and reverse) with constant moving of nodes in each highway segment. The performance of these two scenarios are analyzed in different speed using parameters like expected number of connections, node mobility, transmit range (r), and connection time limit (c). The experimental results clearly revealed that the expected fraction of connection time or expected number of connections in Queuing Terminology is independent of the observer node speed in reverse traffic. In forward traffic, the fraction of connection time is increased with an observer speed that improved the performance of the Mobile Infostation Network [42].

In March 2014, Julian.P et al proposed a Routing Algorithm, Nano Ad hoc On-demand Distance Vector (NAODV), which is the integration of AODV Routing Algorithm and Nanotechnology used to improve the dissemination throughput, Routing protocol performance and reduce the packet delay of the Infostation Networks. The Infostations collect the Information coming from nanomachines and take decision for an appropriate action in Routing through AODV Routing tables and also act as a buffer in storing the data packets. The TN (Transmitter Nano) and RN (Receiver Nano) are used for sending and receiving data in Infostation Network. The performance of the Algorithm was tested in simulation using NS 2 and their communication costs also measured. Nano-AODV (NAODV) Algorithm is better than AODV protocol in terms of throughput [43].

In 2014, T.Ganesan and Dr.N.Rajkumar proposed Enhanced Nano Ad hoc On demand Distance Vector (ENAODV) Protocol which is integration of the Clustering Technique and NAODV protocol. In MANET, Nanotechnology is constituted by using two kinds of nano mechanisms for sending and receiving data in Infostations. In E-NAODV routing protocol, the clustering tree is used in which a cluster head collects data from mobile nodes and sends the data to the sink node after the data aggregation process is over. Compared with optimized model, the enhanced model reduces overall communication costs and energy consumption and behaves well in various aspects in the same simulation Scenario [44]. Summarization of the study about Data dissemination in Infostations is tabulated in Table 2.

TABLE II: STUDY OF DATA DISSEMINATION APPROACHES FOR WI-Fi INFOSTATIONS

Proposed Method	**Application**	**Author**	**Year**	**Result**
WINMAC Transmission Protocol [12]	Terminals in Infostation systems	Gang Wu et al	1999	Throughput is improved from 26% to 50% by increasing data rate from high rate to hyper rate.
Data Diversity Technique in Random Strategy [13]	Mobile Infostation Networks	Wing Ho Yuen Et al	2003	For Greedy Strategy E [Ti] = 50 µs, Throughput = 0.70. For Random Strategy E [Ti] = 25 µs, Throughput = 0.81.
Alternative user Strategy and Sophisticated Mobility Model [14]	Non cooperative Highway Mobile Infostations Networks	Wing Ho Yuen et al	2003	Data dissemination throughput is increased from 72% to 78% by increasing the number of files of interest to all users
Threshold Based Policies [16]	Mobile Infostation Networks	Furuzan Atay and Christopher Rose	2004	Under light load, Packet Delay is 30% minimized. So the Throughput is 15% increased. Under heavy load, Packet Delay is 20% minimized. So the Throughput is 10% increased.
Several Online Approximation Algorithms [17]	Wireless Infostations Network.	A.A.Bertossi et al	2004	Provide different solutions for lot of Servers Allocation in Infostations by the factor of 2-4 to minimize the overall completion time for all the requests.
Throughput Distance Relationship Mathematical Framework Model [18]	Trans mission Range of an Infostation Networks	Helal Chowdhary et al	2006	Throughput is improved to 82% by increasing the amount of information and the Velocity of User.

Mobile Infostation Network Technology (MINT) [19]	Mobile Infostation Networks	Gowri Rajappan et al	2006	In the single user case, MINT has less MAC overhead than IEEE 802.11n and so outperforms it. For more users the MINT MAC outperforms IEEE 802.11n due to multiuser gain. So, MINT MAC provides good data dissemination throughput than IEEE 802.11n.
Infostation Based Multi Agent Approach [20]	Infostations for University Campus	Ivan Ganchev	2007	According to the data delivery rate, Proposed approach achieves totally 80 – 85% Data dissemination throughput which is 20% high when compared with existing approach.
Opportunistic Event Dissemination Protocol [21]	Infostations Based Vehicular Networks	Ilias Leontiadis and Cecilia Mascolo	2007	Delivery ratio throughput is improved from 0.78 to 0.85 by increasing data delivery rate and reducing unwanted Broadcasts.
Energy Efficient Protocols [22]	Infostation Systems In Rural Areas	Laura Galluccio et al	2008	Energy level is improved from 64% to 75% by increasing the Maximum Probability of neighbor communication P(MAX), Power Consumption Constraint c* based on Time Variations.
Infostation Based Modified Multi Agent Approach [23]	Car Parking Locator Service Within University Campus.	Ivan Ganchev et al	2008	Location Parking Service is improved from 69% to 75% by increasing the Data delivery rate.
Distributed eLearning Centre (DeLC) Approach [24]	Infostation Based Vehicular Ad Hoc Networks	Stanimir Stoyanov et al	2008	ELearning usage percentage is increased from 73% to 88% by increasing Resources r, Mobile Users (MU).
Rate Less Codes Scheme [RLCS] [25]	Infostation Based Vehicular Networks	Mohsen Sardari et al	2009	Response Time is reduced from 500 µs to 300 µs. Throughput is improved from 80% to 86%.
Agent Oriented Middleware Architecture [26]	Distributed Infostation based Networks	S.Stoyanov et al	2009	Throughput is improved from 64% to 82% by increasing the number of Agents.
Opportunistic Cooperation process [27]	Mobile Infostation Networks	Wing Ho Yuen et al	2009	Throughput is increased from 0.67 to 0.78 by increasing the data delivery rate from 77% to 85%.
Cross Layer Resource Allocation Scheme [28]	Infostations deployed in Rural Areas	Hao Liang et al	2009	Throughput is 0.83 for Optimal Parameters (*pop*=0,*Nop* *R* = 2) for *BR* = 2. After increasing parameters like (*pop* = 0.0025, *Nop R* = 6) for *BR* = 6, throughput is 0.89.
Two Formal Models (Static Model, Dynamic Model) [29]	Infostation Networks	Stanimir Stoyanov et al	2010	If only 20 information resources are deployed on two infostations then the number of possible deployments is more than 10^6

Two Level (Network Level, Packet Level) Cooperative Data Dissemination Approach [30]	Roadside Wireless LANs (or) Roadside Infostations	Hao Liang et al	2010	By increasing resources r, and Cooperative transmission rate t, throughput is improved.
Two effective Simple Analytical Multi hop Dissemination Models (Push Model, Pull Model) [31]	Infostation Networks	Vinod Kone et al	2010	Throughput is improved from 60% to 73% for 30 km Vehicle traces and 85% to 92% for 15 km Vehicle Traces.
Analytical Framework [32]	Wireless Infostation Networks	Laura Galluccio et al	2010	Delivering Capacity of Files (1500 – 2000 files) is improved from existing approach (1000-1500 files). So throughput is improved from 37.5% to 50% by increasing the nodes.
Distributed Hierarchical Cooperation Formation Algorithm (DHCF) [33]	Mobile Infostation Networks	Yifan Li et al	2011	Latency is reduced from 60% to 30%. So, throughput is improved in the case when Unit cost of MU Cooperation is n=0.05
Delay Tolerant Scenario [34]	Infostations Wireless Networks in Rural Areas.	Marcel C.Castro et al	2011	Lookup delay of Packets for Bamboo is smaller compared to Georoy already at a network size of about 100 nodes.
Software Development Approach [35]	eLearning Systems within Wireless Infostations Networks	Stanimir Stoyanov et al	2011	Throughput is increased to 86% by increasing transmission data rate r (6-24), and resources (r1 to r50).
Time Scale Domain Geometrical based Method [36]	Ultra Wide Band Infostation Channel	U.A.K. Chudeo konkwo et al	2012	Channel response throughput is improved to 83% by Comparing the increased values of Frequency Ranges (3.1 – 3.6 GHz and 5.0 – 5.5 GHz and also 10.0-10.5 GHz) and decreased Time variations Tc.
Intelligent Light-Weight Framework [37]	Infostation Based mLearning Environment	Zhan Lin Ji	2012	Throughput is improved from 63% to 72% by introducing the Multi Agent System.
An Online Resource Allocation Algorithm [38]	High Speed Trains in Cellular/Infostation Integrated Networks	Hao Liang and Weihua Zhuang	2011	Throughput of delivered services is improved from 0.52 to 0.68 by increasing the total reward of delivered services.
Context Aware on Street Parking System [39]	Wireless Infostation Networks	Abdul Malik Alhammad et al	2013	Throughput is increased from 0.78 to 0.84 by reducing packet delay and increasing transmission rate from 6 Kbps to 12 Kbps.

Data Scavenging Protocol [40]	Starfish Unicast and Broadcast Infostations	Vinod Kone et al	2013	**Before Scavenging:** Raw data (MB) received per Vehicle at 6 Broadcast data rate is 5.1, at 12 is 7.1 and also at 24 is 5.7. **After Scavenging:** Raw data (MB) received per Vehicle at 6 Broadcast data rate is 9.4, at 12 is 16.3, and also at 24 is 18.9.
Hierarchical Cooperation Formation Model [41]	Mobile Infostation Networks	Yifan Li and Dusit Niyato.	2013	Throughput is Increased from 0.49 to 0.78 by increasing the Cooperation between Users from 0.05 to 0.2.
Nano Ad hoc On Demand Distance Vector (NAODV) Protocol [43]	Mobile Ad hoc Networks and Infostations	Julian.P and Smiline Arokya Pradeepa.J	2014	Speed is improved at the rate of 10^-9 Per Second by measuring Overhead, end to end delay and Packet Loss.
Enhanced Nano Ad hoc On Demand Distance Vector (ENAODV) Protocol [44]	Wireless Infostation Networks	T.Ganesan and Dr.N.Raj kumar	2014	Throughput is improved from NAODV (0.67), O-NAODV (0.78) to E-NAODV (0.89). Average delay is reduced from NAODV (20.05), O-NAODV (15.5), to E-NAODV (12.1) by increasing the delivery ratio of data and reducing Packet Delay.

IV. CONCLUSION

Data dissemination plays a vital role in Infostation based Vehicle Ad Hoc Networks for providing location aware information services such as digital versions of restaurant menus, Shopping-mall maps, transportation Schedules, grocery store circulars, and movie trailers from Infostations to Vehicles. In this paper, various data diffusion approaches and their effectiveness have been studied. This is not enough for Vehicular Communication system because it is developing day by day. In future, this study will help the researchers to contribute number of approaches for effective data dissemination in roadside content delivery systems of Vehicular Ad hoc Networks (VANETs).

REFERENCES

1) B.B.Chen and M.C.Chan, "MobTorrent:A framework for mobile Internet Access from Vehicles," in proc. IEEE INFOCOM'09, Apr.2009 PP.1404-1412.

2) A.L.Iacono and C.Rose, "Infostations: New Perspectives on Wireless Data Networks", In Book Next Generation Wireless Networks, The International series in Engineering and Computer Science Vol.598, Springer US Publisher, 2000.

3) Vinod Kone, Haitao Zheng, Antony Rowstron, Greg O' shea and Ben Y. Zhao, "Measurement Based Design of Roadside Content Delivery Systems", IEEE Transactions on Mobile Computing, Vol. 12, No 6, June 2013.

4) H.Zhu, X.Lin, M.shi, P.Ho and X.Shen, "PPAB: A Privacy Preserving authentication and billing approach for metropolitan area sharing networks", IEEE Transactions on Vehicular Technology, Vol.58, No.5, pp.2529-2543, Jun.2009.

5) Richard H. Frenkiel, B. R. Badrinath, Joan Borràs, Roy D. Yates , "The Infostations Challenge: Balancing cost and ubiquity in delivering wireless data"**,** IEEE Personal Commun., 2000.

. 6) Dave Cavalcanti, Djamel Sadok,Judith Kelner, "Mobile Infostations : A Paradigm for Wireless data communications", IEEE International conference on wireless and optical communications; ISBN: 088986344x, pp441-446, 2002.

7) Tara Small, Zygmunt J. Haas, "The Shared Wireless infostation model: a new ad hoc Networking Paradigm or Where there is a whale there is a way", Proceedings of the 4th ACM international symposium on Mobile ad hoc networking and computing, New York, USA, 2003.

8) Bazil Taha Ahmed, Miguel Calvo Ramon, Leandro De Haro-Ariet, "The Performance of W-CDMA Highways Infostations", In RADIOENGINEERING Journal, Vol. 13, NO 1, ISSN:1210-2512, pp 42-44, April 2004.

9) Rezwana Karim, Department of Computer Science, Rutgers University, "VANET: Superior system for content Distribution in Vehicular Network Applications", IEEE Transactions on Mobile Computing, 2008.

10) Bazil Taha Ahmed, Miguel Calvo Ramon, "Infostations for highway cigar-shaped cells", Computer Communications Vol.32, Issue 4, pp730-735, Elsevier Science publishers, Netharlands, March 2009.

11) Dave Cavalcanti, Djamel Sadok, Judith Kelner, "Capacity study of an one-dimensional mobile infostations network" IEEE Transactions on Mobile Computing, 2011.
12) Gang Wu,Churng-wen chu, Kevin wine, James Evans and Richard Frenkiel, "WINMAC: A Novel Transmission protocol for Infostations", IEEE VTC'99, Houstan, May 1999.
13) Wing Ho Yuen, Roy D.Yates, Siun-Chuon Mau, "Non cooperative Content Distribution in Mobile Infostation Networks", IEEE wireless communications and networking, Vol.2, ISBN: 0-7803-7700-1, March 2003.
14) Wing Ho Yuen, Roy D. Yates, Siun Mau, "Exploiting Data Diversity and Multiuser Diversity in Noncooperative Mobile Infostation Networks**",** IEEE INFOCOM Conference, Vol.3, pp.2218-2228, 2003.
15) Wing Ho Yuen, Roy D.Yates WINLAB, Rutgers University, "Poster: Optimum Transmit Range and Capacity of Mobile Infostation Networks", Mobile computing and communications Review, Vol. 7, No.3, pp 45-47, 2003.
16) Furuzan Atay and Christopher Rose, "Threshold-based Policies in Mobile Infostation Networks" IEEE wireless communication and networking conference, Vol.4, pp 2353-2358, 2004.
17) A.A.Bertossi, M.C.Pinotti, R.Rizzi, P.Gupta, "Allocating Servers in Infostations for bounded Simultaneous requests", J.Parallel Distrib. Comput. 64 (2004) 1113 – 1126.
18) Helal Chowdhury, Juha – Pekka Makela, Kaveh Pahlavan, "On the Random Crossing of an Infostation Coverage", Vehicular Technology Conference, IEEE, Vol.64, pp 1-5, 2006.
19) Gowri Rajappan, Joydeep Acharya, Hong bo liu, Narayan Mandayam, Ivan seskar, Roy Yates, "Mobile Infostation Network Technology", *Proc. SPIE* 6248, Wireless Sensing and Processing, doi:10.1117/12.665982; May 12,2006.
20) Ivan Ganchev,stanimir stojanov,Mairtin O'Droma,Damien Meere, "An Infostation- Based Multi Agent system supporting Intelligent Mobile services across a university Campus", Journal of computers, 2007.
21) Ilias Leontiadis, Cecilia Mascolo, "Opportunistic Spatio-Temporal Dissemination System for Vehicular Networks", MobiOpp'2007.
22) Laura Galluccio, Alessandro Leonardi, Giacomo Morabito and Sergio Palazzo, "Timely and Energy-Efficient Communications In Rural Infostation Systems", IEEE Transactions on Mobile Computing, 2008.
23) Ivan Ganchev, Mairtin O'Droma, Damien Meere, "Intelligent car parking locator service", International Journal Information Technologies and Knowledge, Vol. 2, 2008.
24) Stanimir Stoyanov, Ivan Ganchev, Ivan Popchev, Mairtin O' Dromo, "An Approach to the Development of Infostations – Based eLearning Architectures", IEEE April 22, 2008.
25) Mohsen Sardari, Faramarz Hendessi and Faramarz Fekri, "DMRC: Dissemination of Multimedia in Vehicular Networks Using Rate less Codes", IEEE 2009.
26) S.Stoyanov, V.Valkanova, I.Ganchev, M. O' Droma, H.Zedan, "Agent-Oriented Middleware for Mobile eLearning Services", IEEE 2009.
27) Wing Ho Yuen, Siun-Chuon Mau and Roy.D.Yates, "Existence of Data and Multiuser Diversities in Non cooperative Mobile Infostation Networks", IEEE Transactions on Mobile Computing, Vol 8, No. 8, pp.1117-1131, August 2009.
28) Hao Liang, Weihua Zhuang, "Cross-Layer Resource Allocation for Efficient Message Dissemination in Rural Infostation Systems**"** Proceedings of the 28th IEEE conference on Global Telecommunications, USA, ISBN:978-1-4244-4147-1, pp 1109-1114, 2009.
29) Stanimir stayanov, Ivan Ganchev, Ivan popchev, Ivan Dimitrov, "Request Globalization in an Infostation Network", Comptes rendus de l' Academic bulgare des sciences, Tome 63, No 6, 2010.
30) Hao Liang and Weihua Zhuang, "Cooperative Data Dissemination via Roadside WLANs", IEEE, Volume 50, Issue 4, pp 68-74, 2010.
31) Vinod Kone, Haitao Zheng, Antony I. T. Rowstron, Ben Y. Zhao, "The Impact of Infostation Density on Vehicular Data Dissemination" MONET 2010.
32) Laura Galluccio, Giacomo Morabito, Aris L. Moustakas, Sergio Palazzo," Opportunistic Communications in Infostation Systems: Delay and Stability Analysis.**"** GLOBECOM, 2010
33) Yifan Li, Ping Wang, Dusit Niyato and Wenjie Zhang, "On Hierarchical Cooperation Formation in Mobile Infostation Networks", IEEE 2011.
34) Marcel C.Castro, Laura Galluccio, Andreas Kassler and Corrado Rametta,"Opportunistic p2p communications in Delay-Tolerant Rural Scenarios", Volume 2011,
35) Stanimir Stoyanov, Ivan Ganchev, Damyan Mitev, Vladimir Valkanov, Mairtin O'Droma, "Service-oriented and Agent-Based Architecture supporting Adaptable, Scenario-Based and context-aware Provision of Mobile e-Learning Services", ISSN 2150-7988 Volume 3 (2011) pp771-779.
36) U.A.K.Chude-okonkwo, R.Ngah, CH.Y.Leow, T.Abd Rahaman. "Time-scale Domain Characterization of Time-varying Ultrawideband Infostation Channel", RADIOENGINEERING, Vol 21, No.2,June 2012
37) Zhanlin Ji, Damien Meere, Ivan Ganchev, Mairtin O' Droma**, "**Implementation and Deployment of an Intelligent Framework for Utilization within an Infostation Environment." JSW, 2012

38) Hao liang, "Efficient on demand data service delivery to high speed trains within infostations network", communications Magazine, IEEE volume 30, Issue 4, ISSN: 0163-6804, pp 780-791, April, 2012.
39) Abdulmalik Alhammad, Francois Siewe, Ali Hilal Al-Bayatti, "An Infostation-Based Context-Aware On-street Parking System", computer systems and Industrial Informatics (ICCSII), International conference on DOI: 10.1109/ICCSII.2012.6454358, IEEE conference publication 2013.
40) Vinod Kone, Haitao Zheng, Antony Rowstron, Greg O' shea and Ben Y. Zhao, "Measurement Based Design of Roadside Content Delivery Systems", IEEE Transactions on Mobile Computing, Vol. 12, No 6, ISSN:1536-1233, pp 1160-1173, June 2013.
41) Yifan Li, Ping Wang, Dusit Niyato, Zhu Han, "A hierarchical cooperation formation model for downlink data transmission in mobile infostation networks". IEEE Wireless Communications, Vol.20, issue 3, ISSN:1536-1284, June 2013
42) Wing Ho Yuen, Roy.D.Yates, Chi Wan Sung, " Effect of Node Mobility on Highway Mobile Infostation Networks" Proceedings of the 6th ACM workshop on modeling analysis and simulation of wireless and mobile systems, New York, USA, ISBN:1-58113-766-4, pp 82-91 September 19, 2013
43) Julian.P, Smiline Arokya Pradeepa.J, "Performance Enhancement Using NAODV Algorithm In Manet", International conference on Global Innovations in computing technology, International Journal of Innovative Research in Computer and Communiation Engineering, 6-7 March 2014.
44) T.Ganesan, Dr.N.Rajkumar, "Data Transmission through Nano Machines using the Clustering Tree for Mobile Ad hoc Network", International Journal of Engineering and Technology (IJET) ISSN : 0975-4024 Vol 6 No 2 Apr-May 2014.

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