International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

COPY RIGHT

IJIEMR Transactions, online available on 21st Jun 2019. Link :http://www.ijiemr.org/downloads.php?vol=Volume-08&issue=ISSUE-06

Title: **AODV FOR ANALYSIS OF VANET BASED PATHLOSS MODEL IN HETNET**

Volume 08, Issue 06, Pages: 348–354.

Paper Authors

SMITHA SHEKAR, DR. S K YADAV, DR. SIDDARAJU
JJT University ,Rajasthan, India

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper As Per UGC Guidelines We Are Providing A Electronic Bar Code

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

AODV FOR ANALYSIS OF VANET BASED PATHLOSS MODEL IN HETNET

[1] SMITHA SHEKAR B, [2]DR. S K YADAV, [3]DR. SIDDARAJU
[1]Research Scholar, Department of Computer Science & Engg, JJT University ,Rajasthan, India
[2]Research Director, Department of Computer Science & Engg. JJT University ,Rajasthan, India
[3]Prof. & Head, Dr. A.I.T,Department of Computer Science & Engg, Bengaluru, India
[1] smithashekar_b@yahoo.co.in,[2]drskyadav@hotmail.com,[3]siddaraju.ait@gmail.com

Abstract— Key challenges of VANET communication has extended this research towards finding a suitable pathloss model for communication involving various technologies within the Heterogeneous Networks(HetNets) using AODV routing protocol. This paper presents a holistic approach in finding the best path loss model integrated with AODV and other wireless technologies including VANETs, Wi-Max and UMTS for urban-highway scenario. The designed HetNet model is simulated using a comprehensive tool- QualNet v7.2. The statistical results obtained from comparison of four path loss models(Free space, Two ray, Cost 231, Okumura-Hata)are verified and inferred accordingly with respect to network parameters: uni-cast messages sent and received, throughput, end to end delay and jitter.

Keywords— AODV, HetNets, Okumura-Hata model, Path loss model, QualNet, VANET.

I. INTRODUCTION

Vehicular Adhoc Networks is a specialized and a unique class of Mobile Adhoc Networks. It is based on IEEE 802.11p standard used exclusively to represent vehicular communication. This paper has introduced VANET as an important technology in the designed Heterogeneous Network along with Wi-Max and UMTS, for seamless connectivity and interoperability.Routing and propagation of signal in wireless communication contributes towards interference-less communication in networks.Path loss also known as path attenuation is defined for electromagnetic waves. These waves when propagated through any medium or space there will be some power density reduction. This phenomenon is termed as path loss. It is essential to include path loss for the link budget design of any communication apparatus. Path_loss may occur due to various effects such as reflection, refraction, diffraction and scattering. The elements of path loss include atmospheric losses, which mainly occur due to absorption of electromagnetic waves by water vapor and gases, free space loss, multipath fading loss etc.During wireless transmission of information between two or more points, data loss occurs between sender and receiver[1]. This is termed as "propagation-path_loss". By definition, "Path-loss is the unwanted reduction in power density of the signal which is transmitted". Path-loss is considered as one of the important factor in the comparative analysis of a signal being transmitted from sender to receiver through the medium. It describes the signal attenuation (reduction in the strength of signal) between a transmit and a receive antenna. The

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

performance achieved with respect to signal strength is the major concern in the design and analysis of wireless communication.

"Outdoor propagation path loss models and Indoor propagation path loss models", are used as a measuring strategy to predict signal-strength based on certain mechanism like, signal penetration into buildings, attenuation, free space loss, fading and multipath .The path-loss can be measured in Urban-Highway scenario using out-door propagation model where the transmitter-receiver separator distance 'd', is larger for irregular terrain. This measured data can be used to predict signal strength based on hypothetical data.The basic path-loss phenomenon is depicted in Fig.1. The signal strength reduces with respect to distance(d) between transceiver and receiver.

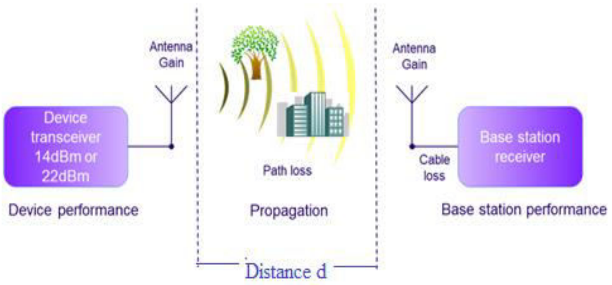

Fig. 1. Path loss phenomenon

The proposed work, focus on the necessity of analyzing the heterogeneous network, which is an integration of different technologies(Wi-Max, UMTS and VANETs) for a communication model with the best routing protocol and a suitable path loss model. At present, many path loss models have been proposed for VANET communication and all these path loss models are used in different communication protocols. However until now, an effective study of different path loss models when integrated with Adhoc On-demand Distance Vector(AODV) routing protocol has not been performed. AODV routing protocol was established as the most effective routing protocol for VANET [2], hence it is required to analyze the different path loss models for it. This may be helpful for an interference-less communication between nodes(vehicles) with seam-less connectivity among the wire-less technologies. Heterogeneous network is a collection of many networks, which is an important part of cellular network[3]. A Cellular network is a network with different set of frequencies used by a cell to avoid interfaces. Uneven distribution in traffic leads to heavy loads of data to fewer nodes. To meet the mobile data demands, a combination of cells have to be considered so that the data could be transferred to all the cells evenly for better load balancing. The heavily loaded areas have to be identified and those nodes are to be transferred to light or idle nodes using uni-path routing mechanism.

II. Related Work

The information transferred between different points that are not connected through an electrical connectivity is referred to as wireless-communication[4]. Radio-waves are considered for transmission of messages. Due to factors, such as refraction, reflection, diffraction and scattering , power density of the signal called path loss may occur. Path_ loss is caused by different obstacles within the transmitter and receiver. The authors had reviewed different path loss models: 1. Okumara 2. Hata 3.Cost 231. Real time scenarios of urban, sub-urban and rural areas were analyzed and surveyed for both outdoor and indoor propagation models. Different parameters like, antenna-height of the mobile station, distance between transmitter-receiver and base-station antenna height were analyzed.The radio wave propagation models plays a major role in radio network design and interference planning[5]. Now a days, the wireless networking is becoming a vital tool for the communication among the people at workplaces and home. These wireless communication models are described on the basis of path loss, probability of error, signal-strength, BTS and MS antenna gain. The factors of communication are calculated by using various models namely Hata, Okumura and Cost-231, etc. These factors of communication may vary in urban , sub-urban and rural areas. The various models are used in the calculation of factors

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

depends mainly on parameters like antenna heights of the transmitter and receiver, the distance between them, etc. All the models have different formulas for calculating path loss, probability of error, signal strength, BTS(Base Transceiver Station) and MS(Mobile Station) antenna gain.For any wireless network emerging technologies, the radio propagation was essential with suitable design, deployment and management strategies[6]. The mechanism for radio propagation depends on: 1.Terrain, 2. Frequency of operation, 3.Velocity of mobile terminal, 4. Interface sources and so on. The analysis could be performed on a mathematical model for the prediction of signal coverage, high data rate and antenna-gain. Designing a path loss model for both fixed and mobile radio systems was the suggested idea through this research and this could be obtained depending on proper antenna height to cover the area of a system.

III. Simulation Setup for the Designed Terrain Model Showing Heterogeneity

The simulation is performed by using Qualnet v7.4 tool. Vehicular communication occurs in heterogeneous network scenario such as—Wi-Fi, Wi-MAX and UMTS. Vehicles have the capability to connect to other vehicles through VANET, and can also connect with the other wireless network infrastructure such as—Wi-Fi, Wi-MAX and UMTS located in their vicinity. These wireless networks can be used as intermediated hops to connect other vehicles. Scenario description for the designed terrain model of heterogeneous network with wireless technologies is illustrated and taken from [2].

A. *Overall System Architecture*

Fig.2, illustrates the overall system architecture used for simulation. The reactive routing algorithm AODV routing protocol is used for vehicular communication, such that, the vehicles navigate in a heterogeneous network environment communicating with various technologies. Due to congestion, interference, reflection, refraction, diffraction, scattering, signal attenuation, multi-path fading etc., there may be data loss, during the process of communication or accessing the various technologies may be very slow or not accessible or due to high-rise in buildings, the signal penetration might decrease the signal strength or Line Of Sight path problem may occur, due to which communication may halt and so on.

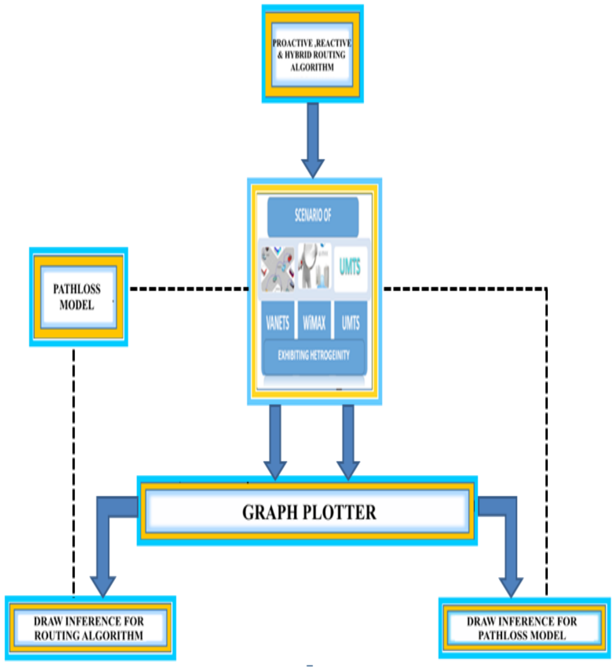

Fig. 2. System Architecture

The graph plotter collects the simulation statistics generated by QualNet v7.4 simulator(.tsv file), for analyzing the performance of different path loss models for the best routing protocol- AODV, among AODV, OLSR and LANMAR routing protocols. AODV is suggested the best after analyzing the results for uni-cast messages sent & received, throughput, end to end delay and jitter , obtained by simulating the terrain model using QualNet v7.4 simulator. Four empirical path loss models are used in simulation study are- Free space, Two ray, Cost 231, Okumura-Hata models. These empirical models are equated accordingly, from several measured result. The results obtained from these models are accurate. In Qualnet v7.4 the path-loss model is built within the algorithm used.

B. *Simulation set up details*

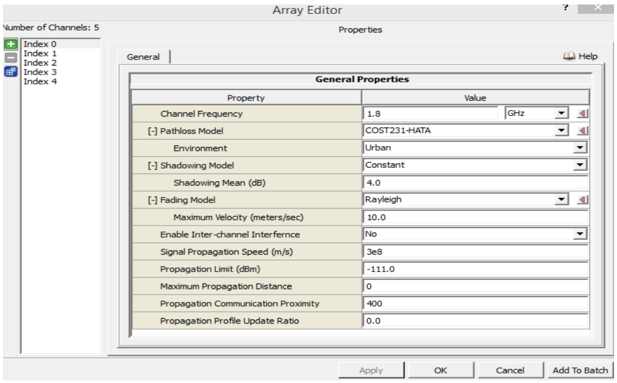

Figure 3(a). Simulator User Interface (Cost 231)

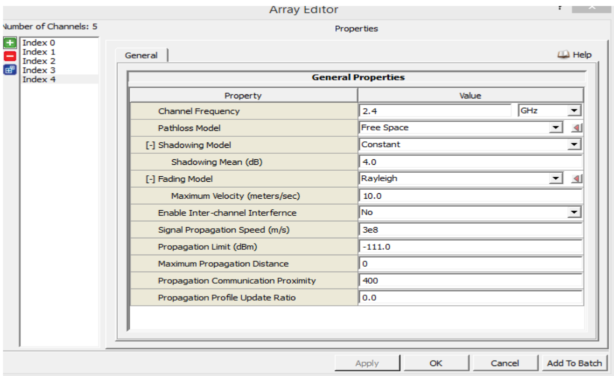

Figure 3(b). Simulator User Interface (Free Space)

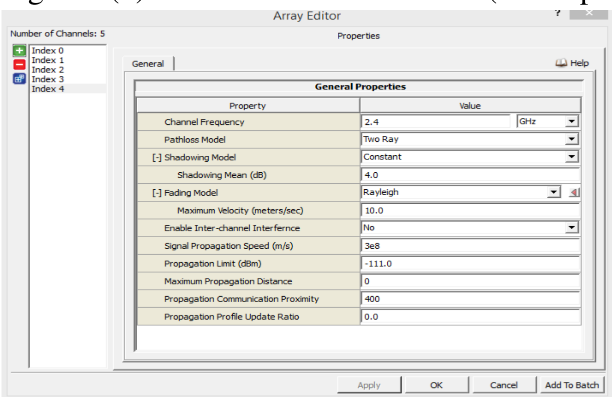

Figure 3(c). Simulator User Interface (Two ray)

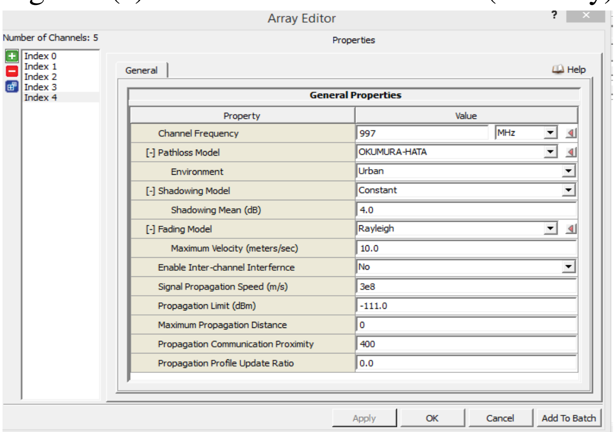

Figure 3(d). Simulator User Interface (Okumura-Hata)

The figures Fig. 3(a), Fig. 3(b), Fig. 3(c) and Fig. 3(d) describes the QualNet v7.4 simulator User Interface utilized for performing simulation for different path loss models namely: Cost 231, Free space, Two ray and Okumura-Hata that are integrated with AODV routing protocol.The Outdoor propagation model, specially empirical path loss models considered in this research work, use mathematical equations from several measured results. The actual need for simulating VANETs with an urban-highway scenario using QualNet v7.4 simulator was to analyze a designed terrain model with heterogeneity by choosing AODV routing protocol. Fig. 4(a) shows the terrain model designed in with tall buildings, connecting roads, junctions, cross roads, bas stations, traffic poles and vehicles communicating with various wireless technologies(Wi-Fi, Wi-Max and UMTS). Fig(b) shows the communication in HetNet scenario that is analyzed with different path loss models (Cost 231, Free space, Two ray and Okumura-Hata). Simulation parameters considered are given in Table I.

TABLE I. Simulation parameters

Parameter Name	**Parameter Value**
Terrain Size	3000*3000m
Number of nodes	63
Radio type	802.11p, CCH, SCH
Mobility model	Directional/Flag way point
Channel frequency	5.86GHz and 5.89GHz
Traffic type/Packet size	CBR/512 bytes
Routing protocol	AODV
Environment	Urban-Highway
Path loss models	Cost 231, Free space, Two ray and Okumura-Hata
Propagation model	Urban model
Simulation time	400 secs

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

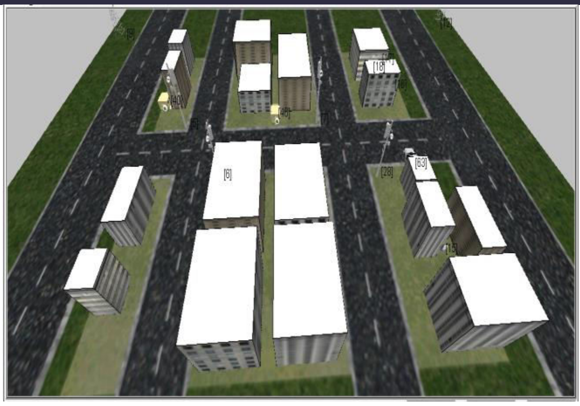

Fig.4(a). Terrain Model of HetNet

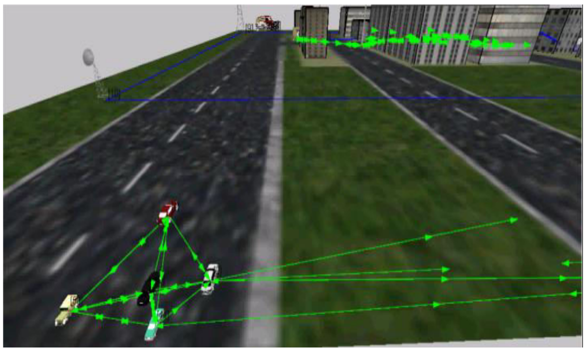

Fig. 4(b). Communication in HetNet scenario

IV. Results and Discussions

All the four path loss models for VANETs participating in heterogeneity, are analyzed and subsequently compared when integrated with AODV routing protocol.

Comparison between all the Path Loss models

After selecting the suggested routing protocol for routing – AODV, four different path loss models(Cost 231, Free space, Two ray and Okumura-Hata) are anlyzed for the parameters, unicast messages sent & received, throughput,end to end delay and jitter.The resulting statistics obtained after simulation are plotted as graphs using d3.js.

A. Uni-cast messages sent

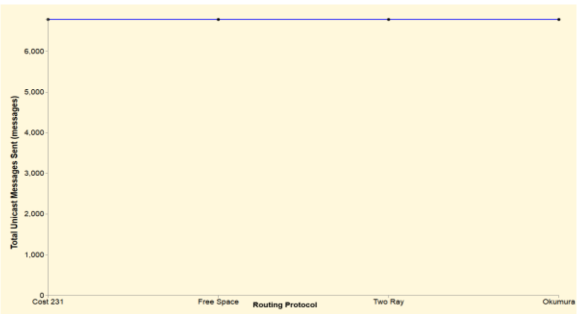

Figure 5(a). TOT_UNI messages sent

Fig. 5(a) illustrates the total uni-cast messages sent by the different nodes during the simulation run for all the four path loss models, integrated with AODV routing protocol. It is clear that, all the four path loss models have generated same number of messages i.e. 6783.

B. Uni-cast messages sent

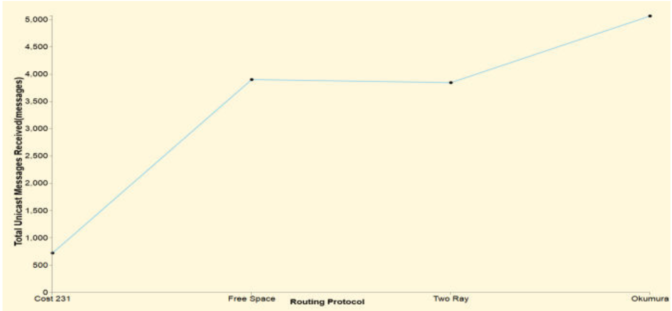

Figure 5(b). TOT_UNI messages received

Fig. 5(b) illustrates the total uni-cast messages received by different destination nodes for all the four path loss models integrated with AODV routing protocol. Here, the Okumura-Hata model exhibits highest number of messages received by the destination nodes, with 5066.45 messages and the cost 231 path loss model exhibits the lowest number of messages received by the destination nodes with 722.333 messages. The performance of free space and two ray models is almost similar

C. Throughput

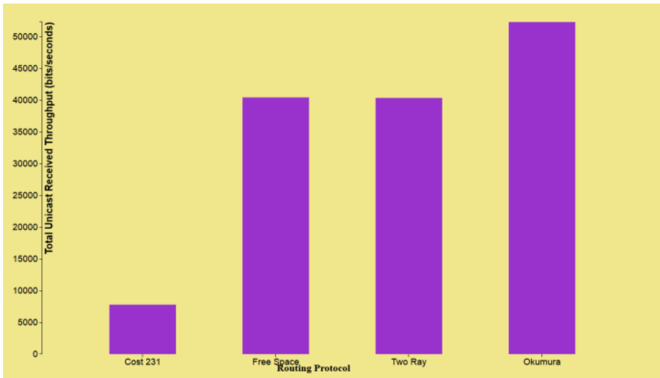

Figure 5(c). Received throughput

Fig. 5(c) illustrates the uni-cast received throughput at different destination nodes for all the four path loss models integrated with AODV routing protocol. The Okumura-Hata path loss model provides the best performance with 52310.2 bps, and the cost 231 path loss model provides the least

International Journal for Innovative Engineering and Management Research
A Peer Revieved Open Access International Journal
www.ijiemr.org

performance in-terms of received throughput, i.e. 7789.56bps. The performance of two ray and free space models remain almost same in-terms of received throughput.

D. End-to-end delay(E2E delay)

Figure 5(d). End to end delay

Fig. 5(d) illustrates the average end to end delay at different destination nodes for all the four path loss models integrated with AODV routing protocol. Here, cost 231 path loss model exhibits worst performance in-terms of E2E delay. The Okumura-Hata model provides the best performance in-terms of E2E delay of 4.33368 per unit time. The free space and two ray models provide average performance with respect to E2E delay.

E. Jitter

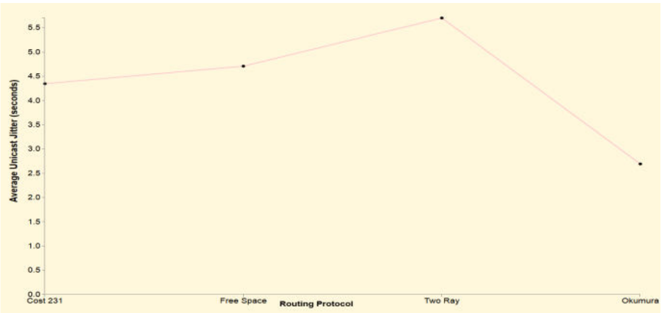

Figure 5(e). Jitter

Fig. 5(e) illustrates the average uni-cast jitter experienced by different destination nodes for all the four path loss models integrated with AODV routing protocol. The Okumura-Hata path loss model exhibits the best performance with 2.6911 ps and two ray path loss model exhibits the worst performance in-terms of average uni-cast jitter. The performance of free space and cost 231 path loss models in-terms of average jitter is also disappointing.

V. CONCLUSION

This paper presented a overview on different empirical path loss models. The contemporary work in the literature for utilizing path loss models for VANET routing protocols was described. The requirement of analyzing the performance of AODV routing protocol when integrated with different path loss models-Cost 231, Free space, Two ray and Okumura-Hata models was highlighted with comparison. The Okumura-Hata model provides the best performance, and cost 231 model provides the worst performance in-terms of total number of messages received by the destination nodes, average end to end delay, average jitter and average throughput. The two ray and free space cost models do not exhibit encouraging results. Based on the simulation exercise carried out in this paper, it can be concluded that, the Okumura-Hata model is the most suitable path loss model to be integrated with the AODV routing protocol for the designed terrain model with heterogeneity.

References

[1] Smitha Shekar B and Dr. Siddaraju, "A Survey on Routing Protocols , Path loss Models and Communication Technologies for Heterogeneous Networks", International Journal of Emerging Technology & Advanced Engineering (ISSN 2250-2459, ISO 9001:2008 Certified Journal), vol. 8, pp. 150-155, January 2018.

[2] Smitha Shekar B, "A Simulative Analysis of Routing protocols for a VANet based Heterogeneous Network Scenario", International Journal of Renewable Energy Exchange, ISSN:2321-1067, Volume 4, Issue Special, 2017, PP 90-98.

[3] Mathew Ann Bittu and Joseph Sumy, "A Novel Approach for Load Balancing In Heterogeneous Cellular Network", International Journal of Innovative Research in Science, Engineering and Technology, vol. 3, pp. July 2014.

[4] Pooja Rani, Vinit Chauhan, Sudhir Kumar, Dinesh Sharma , "A Review on Wireless Propagation Models", International Journal of Engineering and Innovative Technology , vol. 3, pp. 256-261, May 2014.

[5] Randeep Singh Chib ,Yuvraj Singh , Sandeep Singh, Rakesh Gupta, "Performance & Evaluation of Propagation Models for Sub-Urban Areas", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, vol. 4, pp. 607-614, February2015.

[6]Yuvraj Singh, "Comparison of Okumura, Hata and COST- 231 Models on the Basis of Path Loss and Signal Strength", International Journal of Computer Applications (0975 – 8887),vol. 59, pp. 37-41 , December 2012.