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Analyzing the Impact of Signal Strength and Network Size on Energy Consumed In MANET´s

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ABSTRACT: The Aim Of This Project Is To Study The Impact Of Changing The Signal Strength And Network Size On Energy Consumed Under Aodv Routing Protocol In Mobile Ad Hoc Network(MANET´s) Using Fuzzy Logic.From Simulation Results, We Found That The Effect Of Network Size And Signal Strength By Using Fuzzy Logic Minimized The Energy Consumption In Transmit Mode , Receive Mode And Idle Mode.

KEYWORDS: Ad Hoc Networks, Energy Consumption, AODV , Fuzzy Logic, Qualnet Simulator.

I. INTRODUCTION

Energy Consumption: Is The Amount Of The Power Consumed In A Process Or In A System. There Are Many Factors That Effect On The Energy Consumed In The System.Mobile Ad Hoc Networks (MANET): Consist Of Wireless Nodes That Form A Communications Network Among Themselves Without A Fixed Infrastructure. In MANET, A Node May Either Function As An End Node Or As A Router Forwarding Data Packets Between End Nodes.There Are Two Main Consumers Of Energy On A MANET Node, Namely, The Central Processing Unit And The Radio (Transmitter/Receiver). A Mobile Node Not Only Consumes Its Battery Energy When It Is Actively Sending Or Receiving Packets, But It Also Consumes Battery Energy When Idle And Listening To The Wireless Medium For Any Possible Communication Requests From Other Nodes.

Indeed, When A Destination Node Is Out Of Reach Of The Source Node, The Connectivity Between The Two Stations Is Maintained By The Intermediate Stations, Which Means That Every Node Belonging To The Chosen Route Must Stay In Active Mode Until The Communication Is Concluded. Therefore, The Energy Constraint Is A Critical Issue For Such A Network, And A Lot Of Works Have Focused On How To Optimize The Energy Consumption And Keep The Same Level Of Network Efficiency. These Works Was Principally Interested On Analyzing The Impact Of Changing The Signal Strength And Network Size (Number Of Nodes) On The Energy Consumed Under AODV Routing Protocol In Mobile Ad-Hoc Networks (MANET's) Using Fuzzy Logic And Qualnet Simulator.

II. RELATED WORK

Aodv Routing Protocol:AODV (Ref [1] [2].) Is Based On Two Principal Processes: Route Discovery And Route Maintenance. When A Node Wants To Establish A Communication With Another One Without Predefining The Route, It Starts The Procedure Of Route Discovery: The Source Broadcasts To Its Neighbors‟ A Packet Called RREQ (*Route Request).* This Packet Will Register The List Of Nodes Visited During The Propagation Through The Network. Any Intermediate Node Which Receives This Request For The First Time Broadcasts It In Its Turn To Its Neighbors‟, Until The Packet Arrives To The Destination Node. This One Answers By A Packet Called RREP *(Route Reply)* In Recursive Diffusion Towards The Source, And In This Way, The Shortest Route Is Found Between The Two Nodes. The Route Maintenance Procedure Is Needed During The Communication Time Because Of Topology Changes.

The Loss Of A Route Can Be Announced By A RERR Message (*Route Error*). An Intermediate Node Can Try To Repair This Route Before Sending A RRER Packet. If This Attempt Fails, Then, It Sends A RERR To The Source And The Invalid Route Will Be Destroyed In The Routing Tables Of The Intermediate Nodes. With AODV, Each Node In The Network Maintains The List Of Its Immediate Neighbors, By Periodic Exchange Of Small Sized Packets, Called *HELLO* Messages.

E-Aodv: Energy-Consraint On Aodv[3]:The Ad Hoc Networks Suffer From Energy Constraint Since A Mobile Station Uses A Limited Capacity Battery. Therefore, The Performances Of Such A Network Become Closely

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Related To Its Effectiveness In Terms Of Energy Conservation. The Key To Achieve These Objectives Resides In The Development Of Optimized Routing Protocols As Those Proposed In [5], [6], [8]. Indeed, The Traditional Routing Is Based On The Intuitive Goal: Choosing The Shortest Ways. This Is Not Always The Best Choice, Since In General, The Same Nodes Will Be Chosen For Several Communications As It Is The Case Of Node G In Figure 1. Consequently, This Node Will Spend Its Energy Resources More Quickly Than The Others And Will Be The First To Die. The Problem Resides In The Fact That The Terminal Will Not Be Used For Its User's Applications, But Only As A Router For The Other Users. To Take This Energy Constraint Into Account, A Simple Approach Based On Local Decisions Can Be Adopted. While Searching A Route, Each Node Uses Local Information About Its Own Battery To Decide Whether To Take Part Or Not In The Route Selection Process. Thus, A Node Whose Battery Is Exhausted Can Preserve Its Remaining Energy By Refusing To Relay Packets Which Are Not Intended To It. This Is Called A Local Approach, Since The Decision Of A Node Is Only Based On Its Own State And Does Not Require Global Information About The Entire Network, Neither About Its Neighbors. The Principle Is To Modify Both Of The Route Discovery And The Route Maintenance Procedures, In The Following Way:

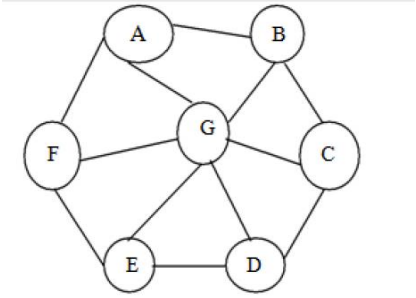

Fig.1: An example ad hoc topology. Node G will participate in all communications between A-D, B-E and C-F.

A. Route Discovery

When A Source Node Wants To Reach A Destination Node, It Starts The Route Discovery Process And Broadcasts The Route Request Packets (RREQ), As In AODV. But When An Intermediate Node Receives This Request, There Is An Additional Step That It Has To Do Before Sending The Packet: It Must Compare Its Remaining Energy With A Certain Threshold. If It Finds That Its Energy Level Exceeds The Threshold Value, It Rebroadcasts The Request To All Its Neighbors. In The Other Case, The Node Concludes That Its Remaining Energy Is Not Enough Anymore To Route The Others" Packets. Therefore, The Node Rejects The RREQ Packets And Ignores The Request. As Soon As The Destination Receives The First RREQ Packet, It Transmits A RREP Towards The Source. The Treatment Of These RREP Packets By The Source Is Identical To That Of AODV. The Example Of Figure 2 Shows The Difference Between The Route Established By AODV And The Modified AODV. In This Network, We Can Note That With The Modified AODV, The Route Chosen Between The End Nodes S And D Is Longer Than That Built With The Original AODV. In Fact, With AODV, Node 2 Must Participate In The Communication Despite Its Weak Battery. The New Modifications Allow This Node To Remain Alive For A Longer Time.

B. Route Maintenance

The Maintenance Of The Route Becomes Necessary When The Energy Resources Of Certain Nodes On The Road Become Lower Than The Fixed Threshold. During A Communication, Each Intermediate Node Supervises The Decrease Of Its Energy Level. Once The Remaining Energy Reaches The Threshold, The Node Must Send A RRER Packet To The Source In Order To Launch A New Route Discovery Process. In The Same Way, The Maintenance Of The Road Is Made When The Connections Between Two Or Several Nodes On The Route Are Lost Because Of Their Movements. In This Case, The Protocol Proceeds Just As In AODV: A New RRER Packet Is Returned, And The Route Is Removed From The Routing Tables.

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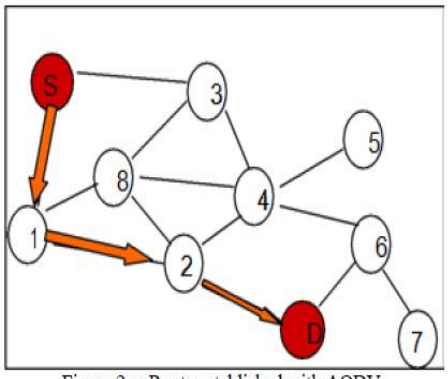

Figure 2.a: Route established with AODV.

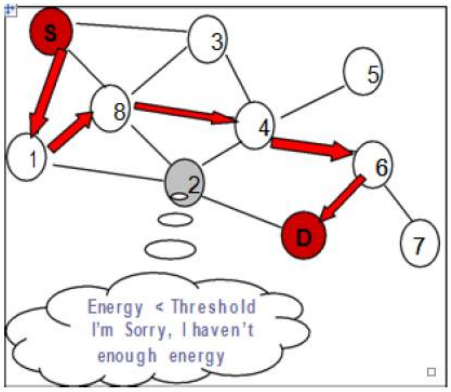

Figure 2.b: Route established with E-AODV

Fuzzy Logic

Fuzzy Logic Has Two Different Meanings. In A Narrow Sense, Fuzzy Logic Is A Logical System, Which Is An Extension Of Multi Valued Logic. However, In A Wider Sense Fuzzy Logic (FL) Is Almost Synonymous With The Theory Of Fuzzy Sets, A Theory Which Relates To Classes Of Objects With Unsharp Boundaries In Which Membership Is A Matter Of Degree. In This Perspective, Fuzzy Logic In Its Narrow Sense Is A Branch Of FL. Even In Its More Narrow Definition, Fuzzy Logic Differs.

Both In Concept And Substance From Traditional Multivalued Logical Systems.

We Might Be Added Is That The Basic Concept Underlying FL Is That Of A Linguistic Variable, That Is, A Variable Whose Values Are Words Rather Than Numbers. In Effect, Much Of FL May Be Viewed As A Methodology For Computing With Words Rather Than Numbers. Although Words Are Inherently Less Precise Than Numbers, Their Use Is Closer To Human Intuition. Furthermore, Computing With Words Exploits The Tolerance For Imprecision And Thereby Lowers The Cost Of Solution.

Another Basic Concept In FL, Which Plays A Central Role In Most Of Its Applications, Is That Of A Fuzzy If-Then Rule Or, Simply, Fuzzy Rule. Although Rule-Based Systems Have A Long History Of Use In Artificial Intelligence (AI), What Is Missing In Such Systems Is A Mechanism For Dealing With Fuzzy Consequents And Fuzzy Antecedents. In Fuzzy Logic, This Mechanism Is Provided By The Calculus Of Fuzzy Rules. The Calculus Of Fuzzy Rules Serves As A Basis For What Might Be Called The Fuzzy Dependency And Command Language (FDCL). Although FDCL Is Not Used Explicitly In The Toolbox, ItIs Effectively One Of Its Principal Constituents. In Most Of The Applications Of Fuzzy Logic, A Fuzzy Logic Solution Is, In Reality, A Translation Of A Human Solution Into FDCL.

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III. METHODOLOGY

The Implementation In Fuzzy Logic

In Fuzzy Logic We Should To Specify The Inputs,The Outputs And The Fuzzy Logic Rules.

1) The Inputs And Its Ranges: (There Aretwo Inputs For Fuzzy Logic).The Inputs Are:

A. Signal Strength.

B. Number Of Nodes.

The Ranges Of Signal Strength As Shown In Following Table:

Signal strength	Network size	E.C in T.M	E.C in R.M	E.C in I.M
Low	Low	Low	Low	High
Low	Medium	Low	Low	High
Low	Max	Low	Low	High
Medium	Low	Low	Low	High
Medium	Medium	High	High	High
Medium	Max	High	High	Low
High	Low	Low	Low	High
High	Medium	Low	High	Low
High	Max	High	High	Low

Table: The Rule In Fuzzy Logic.

Signal strength	
5 dbm-10 dbm	Low
10 dbm-20 dbm	Medium
20 dbm-30 dbm	High

Table: The Range Of The Signal Strength.

The Range Of Network Size (Number Of Nodes) As:

No. of node	
20 – 30	Low
30 – 40	Medium
40 – 50	Max

Table: The Range Of Number Of Nodes

2) The Fuzzy Logic Output Is The Energy Consumption In The Network And The Range For The Energy Is As Shown:

E.C	range
75-85	Low
85 – 95	Medium
95 – 100	High

Table : The range of the energy consumption.

We Will Study The Output Of The Fuzzy Logic Energy Consumption, In 3 Operational Modes. These Modes Are:

Transmitting Mode.

Receiving Mode.

Idle Mode.

3) Fuzzy Logic Rules: The Fuzzy Rule Will Be As Shown In The Following Table:

Then We Implemented In Qualnet Simulator And We Got The Result As We Will Show In The Next Section.

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IV.SIMULATION

Qualnet:Is A State-Of-The-Art Simulator For Large, Heterogeneous Networks And The Distributed Applications That Execute On Such Networks. The Following Qualnet Features Provide A Unique Capability For Accurate, Efficient Simulation Of Large-Scale, Heterogeneous Networks.

Qualnet Ability:

Qualnet Enables Users To:
Design New Protocol Models
Optimize New And Existing Models
Design Large Wired And Wireless Networks Using Pre-Configured Or User-Designed Models
Analyze The Performance Of Networks And Perform What-If Analysis To Optimize Them [17].
Using Qualnet Simulator In Our Study Of The Impact Of Signal Strength And Network Size On Energy Consumption By Changing The Factor And Record The Result According To Change Of These Factors.
The Factors That We Used In Qualnet Simulator Is As Following:
The Rang Of Signal Strength Is [5 Dbm To 20 Dbm]
The Range Of Network Size Is [20 To 50 Nodes]
The Routing Protocol Used Is[AODV Protocol]
The Simulation Time Is [300 Sec]
The Pause Time Is[30 M Sec]
The Range Of Speed Is [0 10]
The Traffic Used Is [CBR]
The Mobility Is [Random]
The Energy Mode Is [Generic]

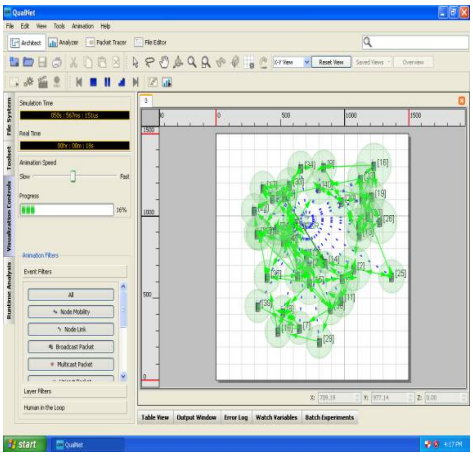

Figure :Qualnet Simulator With Our Scenario.

V. RESULTS

We Studied The Impact Of The Changing The Signal Strength And Network Size On The Energy Consumed In 3 Operating Modes:

1. Transmitting Mode
2. Receivingmode
3.Idlemode.

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And Wegot The Following Results

1) Transmitting Mode The Result Was As Shown In Followingfigure:

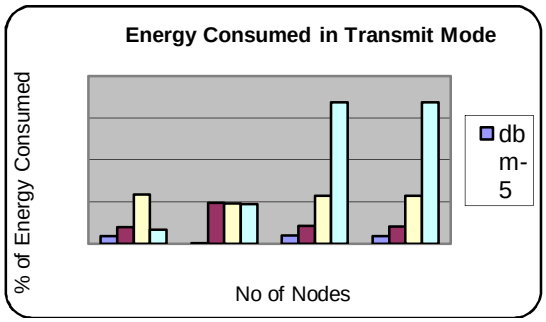

Figure: The Total Energy Consumption In Transmit Mode.

The Figure Shows The Total Energy Consumed In Transmit Mode. From The Figure We Can Observe That The Optimal Situation Is When The Number Of Nodes Equals 30 Nodes ,In This Case We Observed That The Energy Consumption Is Minimum Value.

2) Receiving Mode The Result Was As :

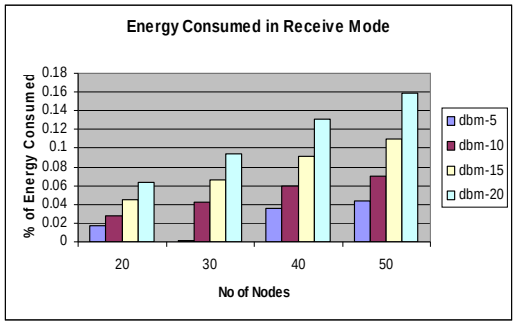

Figure: The Total Energy Consumption In Receiving Mode.

In Receiving Mode Also We Can Considered That The Optimum State It Is When The Number Of Nodes= 30 Nodes. In This State The Energy Consumption Was In Acceptable Range.

3)In The Idle Mode : The Result Was :

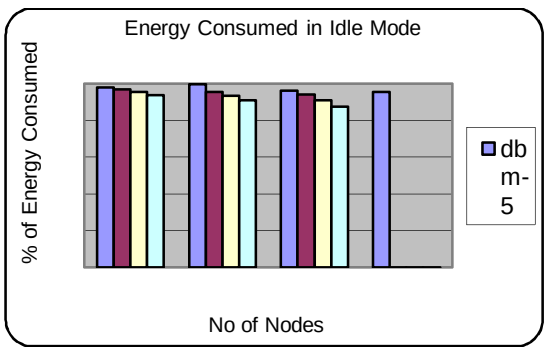

Figure: The Total Energy Consumption in Idle Mode

The Energy Consumed In Idle Mode Is Very High Therefore, It Is Better To Completely Shut Down The Transceiver Rather Than Leave It In The Idle Mode When It Is Not Transmitting Or Receiving.

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VI. CONCLUSIONS

From The Above Results, We Observed That The Effect Of Network Size And Signal Strength BY USING FUZZY LOGIC Energy Consumption .Is Minimized In Transmit Mode , Receive Mode And Idle Mode With Any Mobility Model And Any Routing Protocols, The Network Consumes More Energy If The Traffic Used Is CBR. By Cons, Energy Consumption Varies For Other Traffic According To The Mobility Model Used And Depending On The Routing Protocol Studied.. We Have Seen That AODV Consume More Energy In Idle Mode Compared With The Transmitting And Receiving Modes.

REFERENCES

[1]. Elizabeth M. Royer And Charles E. Perkins, *"An Implementation Study Of The AODV Routing Protocol"*, Proceedings Of The IEEE Wireless Communications And Networking Conference, Chicago, IL, September 2000.
[2]. Charles E. Perkins, Elizabeth M. Royer And S. Das, "Ad-Hoc On Demand Distance Vector Routing (AODV)", Draft-Ietfmanet-Aodv- 05.Txt, March 2000.
[3]. Implementation And Performance Evaluation Of An Energy Constraint AODV Routing Dinesh Kumar Dwivedi, Akhilesh Kosta, Akhilesh Yadav.
[4]. MATLAB® User's Guide Fuzzy Logic Toolbox J.-S. Roger Jang, Ned Gulley.
[5]. Chansu Yuben Lee Hee Yong Youn, *"Energy Efficient Routing Protocols For Mobile Ad Hoc Networks"*, Department Of ECE. Cleveland State University, 2003.
[6]. Ya Xu, John Heidemann, And Deborah Estrin, *"Adaptive Energy-Conserving Routing For Multihop Ad-Hoc Networks"*, USC-ISI Research Report 527, October 12, 2000.
[7]. Qualnet Simulator, 2000, 2001 By Scalable Network Technologies, Inc. 11022 Santa Monica Blvd., Suite 260 Los Angeles, California, 90025.
[8]. M. Sidi-Mohammed Senouci, « *Applications De Techniques d'Apprentissage Dans Les Réseaux Mobiles* », Doctorate Thesis, Université De Pierre Et Marie Curie, Octobre 2003.
[9]. E. M. Daly and M. Haahr, "Social network analysis for routing in disconnected delay-tolerant MANETs," in Proc. ACM Int. Symp.on Mobile Ad hoc Networking and Computing, Montreal, QC, pp. 32–40, Sept. 2007.
[10]. . A. B. Altamimi, and T. A. Gulliver, "A new routing protocol using mobile social network," Int. J. Wireless and Mobile Comput., vol. 7, no. 3, pp. 1–11, July 2012.
[11]. T. Spyropoulos, K. Psounis, and C. Raghavendra, "Spray and wait: An efficient routing scheme for intermittently connected mobile networks," Proc. ACM SIGCOMM Workshop on Delay Tolerant Networking, Philadelphia, PA, pp. 252–259 , Aug. 2005.
[12]. Bhed Bahadur Bista, "Improving Energy Consumption of Epidemic Routing in Delay Tolerant Networks," 10th International Conference on Innovative Mobile and Internet Services in Ubiquitous Computing, pp. 278–283, 2016.