International Journal of Engineering Science Invention (IJESI)
ISSN (Online): 2319 – 6734, ISSN (Print): 2319 – 6726
www.ijesi.org ||Volume 7 Issue 4 Ver. II || April 2018 || PP 01-07

Mathematical Model for Selective Message Forwarding Schemes Using Stochastic Methods

Prof. Zeenath Sultana, Prof. Asra Sarwath, Prof. Syeda Faqera Fatima
Assistant.Professor, Department Of Computer Science And Engineering, Khwaja Banda Nawaz College Of Engineering , Gulbarga, Karnataka
Assistant.Professor, Department Of Computer Science And Engineering, Khwaja Banda Nawaz College Of Engineering ,Gulbarga, Karnataka
Assistant.Professor, Department Of Computer Science And Engineering, Khwaja Banda Nawaz College Of Engineering, Gulbarga , Karnataka

Abstract---*This Paper Represents Developing Of Selective Message Forwarding Schemes On Stochastic Tools . The Schemes Will Depend On Parameters Such As The Available Battery At The Node, The Energy Cost Of Retransmitting A Message.This Paper Also Represents Designing Suboptimal Schemes That Rely On Local Estimation Algorithms And Entail Reduced Computational Cost . The Forwarding Schemes Are Designed For Three Different Cases: 1) Transmitted Message Get Maximized The Importance Through Sensors; 2) When Sensors Maximize The Importance Of Messages That Have Been Successfully Retransmitted By At Least One Of Its Neighbors; And 3) When Sensors Maximize The Importance Of Messages That Successfully Arrive To The Sink. The Results Contribute To Identify The Variables That, When Made Available To Other Nodes, Have A Greater Impact On The Overall Network Performance.*

Keywords: *Mdp , Sis*

Date of Submission: 24-03-2018 Date of acceptance: 09-04-2018

I. Introduction

In Wireless Sensor Networks , Sensor Nodes Batteries Cannot Be Easily Refilled And Lifetime Of All Sensor Nodes Is Finite . In Order To Enlarge The Life Time Of The Network And Optimizing The Overall Network Performance , Sensor Nodes Could Weigh Up : 1)Potential Benefits Of Transmitting Information And 2)Cost Of The Subsequent Communication Process . Once Quantifying The Cost On Benefits Of Communication Process Energy Can Be Saved By Making Intelligent Driven Decision About Message Transmission. Selective Forwarding Schemes Involves Discarding The Low Priority Messages And Forwarding High Priority Messages In Order To Save Energy In Future . In Order To Make A Decision, Sensors Will Take Into Account Factors Such As The Energy Consumed During The Different Node States, The Available Battery, The Importance Of The Received Message, The Statistical Distribution Of Such Importance, Or The Behavior Of Their Neighbors.

In Design Of Selective Forwarding Schemes We Are Proposing A Mathematical Model ,That Is , Markov Decision Process(Mdp) For Solving Stochastic Sequential Decision Problem. It Has Been Used As A Tool To Find A Trade-Off Between The Energy Savings Of Data Aggregation And The Transmission Delay To Balance The Energy Saving Of Low-Power Sensor States

And The Efficiency Of The Sensing, Receiving And Transmitting Processes Or To Optimize A Reward Function Combining Power Consumption, Throughput And Delay . Our Schemes Is Content - Driven : It Is Used To Decide Whether Transmit Or Discard A Message So That Priority Of All The Transmitted Messages Is Maximized .

Generalizing The Model To Allow The Use Of Information From Other Nodes, And Analyzing The Impact Of Using Non-Local Information In The Network Behavior Are The Main Goals Of This Paper. To Do So We Develop Optimum Forwarding Schemes For Three Different Scenarios: 1) When Sensors Maximize The Importance Of *Their Own* Transmitted Messages ; 2) When Sensors Maximize The Importance Of Their Messages That Are Actually *Retransmitted* By Their Neighbors; And 3) When Sensors Maximize The Importance Of The Messages That Successfully

Arrive To The Sink.

The Optimal Forwarding Scheme Is Fairly Simple: The Decision Maker Must Compare The Importance Of The Received Message With A Time-Variant Threshold. On The Other Hand, Although The

Paper Has A Strong Theoretical Component, The Results Are Also Useful From A Practical Point Of View. Because Not Only Can They Provide Basic Guidelines For The Design Of Future Systems, But Also The Developed Schemes Can Eventually Be Incorporated Into Many Existing Routing Protocols.

2.Existing System:

A Mobile Object (Car) Is Traveling Along A Path And At Some Time And Location (For Example, T0) It Decides To Take A Sample Of The Sensor Field, I.E., Collect Sensor Data From ―Nearby‖ Sensor Nodes. The Larger Circle Denotes The Sampling Region. Each Sensor In That Region Will Consequently Be Activated And Reply With Its Locally Sensed Data. As The Mobile Object Continues Its Travel, It Reaches Another Location At Time T1 From Which It Initiates Another Sampling Task. A New Broadcast-Based Sensor Data Gathering Mechanism, As Introduced .The Mechanism Is Optimized For The Purpose Of Sensor-Field Data Sampling By A Mobile Object. It Is Called Band-Based Directional Broadcast Since It Uses The Concept Of Bands Created By Partitioning The Sampling Region Using Multiple Concentric Circles . These Bands Are Used To Help Control The Direction Of Data Flow Of Sensor Data Packets, Without The Need For Sensor Nodes Having Any Sophisticated Directional Antenna

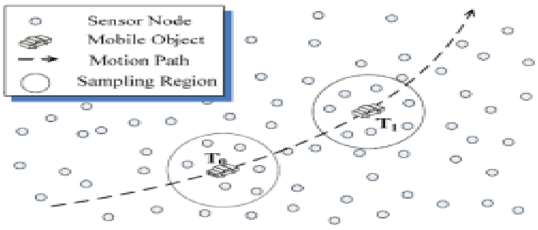


Figure 1: Sensor Field Sampling

There Are Two Important Conditions That Increase The Chances For Packet Collisions At A Receiver Node. The First Condition Is A Large Volume Of Broadcast Activity Within The Vicinity Of The Receiving Node; And The Second Condition Is That These Broadcast Events Occur Within A Short Time-Frame. In This Band-Based Scheme Prunes Many Of The Rebroadcast Packets, It Is Expected To Also Reduce Opportunities For Packet Collisions. Intuitively, Less Broadcasts/Rebroadcasts Will Lead To Fewer Collisions. In This Band-Based Broadcast Scheme Can Handle Packet Collisions By Scheduling Sensors In Different Bands To Begin Their Initial Broadcasts At Different Times. Using Such A Band Scheduling Technique Introduces An Explicit Time Drift Between Packets Sent By Nodes In Two Different Bands, Which Consequently Weakens The Impact Of The Second Condition For Forming Packet Collisions.

A. Band Based Directional Broadcast

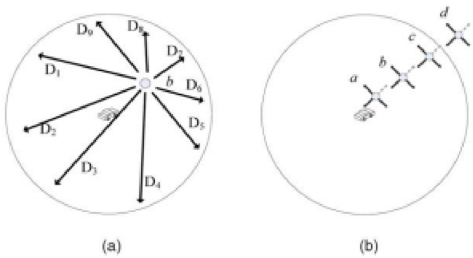


Figure 3: Broadcasting Sensor Data

When Sensor Data Receive The Request From The Mobile Object Then The Sensor In The Sampling Region Will Immediately React By Broadcasting Their Sensed Data. However, A Fundamental Problem Here Is That Broadcast Does Not Consider Direction, And Left Unchecked Would Flood An Excessively Large Geographic Region. Considering Fig.3(A) As An Example, Sensor B Will Flood Its Reply In All Directions, Illustrated By The Nine Different Arrows Shown In The Figure3(B). Note That Although It Is Not Explicitly Shown, This Flooding Could Even Extend Beyond The Intended Sampling Region. A Closer Look At The Flooding Situation Is Provided In Fig.3 (B) Note That Only Some Of The Sensor Nodes And Their Broadcast/Rebroadcast Are Depicted. To Simplify The Presentation Of The General Idea, Initially Assume That The Mobile Object Is Static. As Desired, Sensor B's Response Will Be Rebroadcast By Sensor A And Received By The Mobile Object; But B's Packet Will Also Propagate To Other Sensor Nodes, For Example, C, Or Even Node D, Which Is Outside Of The Sampling Region

II. Sensor Protocol:

When A Sensor Node Receives The Sis, It Calculates Its Own Band Number Based On The Signal Strength Of The Received Signal And The Mapping Function Attached To That Signal. A Sampling-Initiation Signal (Sis) Is A Message Broadcast By A Mobile Object In Order To Initiate The Gathering Of Locally Accessible Sensor Data Within A Given Sampling Region. The Signal Is Represented As A 3-Tuple, Sis = (St_Id, Mo_Id, Bmf), Where St_Id Is A Unique Identifier For The Sampling Task, Mo_Id Is The Identifier Of The Mobile Object, And Bmf Is A Band Mapping Function That Maps Signal Strength To Band Number (I.E., Bmf(Sis_ Strength) ! Band_ Number). Each Sensor Node That Receives The Signal Can Use The Mapping Function To Determine Its Own Band. The Bmf Function Is Pre-Calculated Before The Sampling Signal Is Issued By The Mobile Object, And It Is Based On The Size Of The Target Sampling Region, The Desired Total Number Of Bands, And The Characteristics Of The Mobile Object's Transmitter. A Generic Implementation Of This Function Is Shown Below:

Band Number = 1 When $\Lambda_1 \leq$ Sis _Strength $< \Lambda_0$

I When $\Lambda_i \leq$ Sis _Strength $< \Lambda_i$-1

N When $\Lambda_n = 0 \leq$ Sis _Strength $< \Lambda_{n-1}$

Any Sensor That Receives The Sis With A Signal Strength Less Than Λ_{n-1} Views Itself As Being Outside Of The Sampling Region. Consequently, This Sensor Would Not Reply To This Sis And Not Rebroadcast Packets Intended For This Sis.

Demerits Of Existing System :

In This Case, Some Sensor Data Packets May Lose In Terms Of Reaching The Mobile Object. The Packet Loss And Energy Consumption Will Be Increased . In Band-Based Approach There May Not Always Be A Next-Hop Node Located In The Same Band, Or Lower Band, And This Will Stop The Propagation Of Sensor-Data Packets.

III. Proposed System:

A. **Optimal Selective Forwarding**

To Develop A Selective Message Forwarding Schemes, The Schemes Will Depend On Parameters Such As The Available Battery At The Node, The Energy Cost Of Retransmitting A Message, Or The Importance Of Messages. The Forwarding Schemes Are Designed For Three Different Cases:

1. When Sensors Maximize The Importance Of Their Own Transmitted Messages,
2. When Sensors Maximize The Importance Of Messages That Have Been Successfully Retransmitted By At Least One Of Its Neighbors,
3. When Sensors Maximize The Importance Of Messages That Successfully Arrive To The Sink.

The Results Contribute To Identify The Variables That, When Made Available To Other Nodes, Have A Greater Impact On The Overall Network Performance.

B. Markov Decision Process

The Tuple Defined By ($\mathcal{S}$,, $\mathcal{P}$, r), Where $\mathcal{S}$ Is The Set Of States, $\mathcal{A} = \{0, 1\}$ Is The Set Of Possible Decisions (Actions), $\mathcal{P}$ Is The Transition Probability Measure Given By (3) And r Is The Reward Function, Has The Structure Of A Mdp. Moreover, Since The Action Set $\mathcal{A}$ Is Finite, An Optimal Policy Exists And It Is Markovian. This Means That There Is An Optimal Policy Such That, At Any Time k, The Decision Rule Depends Only On The State $\mathbf{S}k$ [12]. Therefore, The Sensor Does Not Need To Store The State History To Make Optimal Decisions.

A Forwarding Policy $\mathbf{\Pi}$\{D1 , D2,…….\} At A Given Node Is A Sequence Of Decision Rules, Which Are Functions Of The State Vector; I.E.,

$$D_K = D_K(S_K) = D_K(E_k, Z_k) \qquad (1)$$

The Available Energy At Time K Recursively As

$$E_{k+1} = E_k - D_k C_{1,K} - (1 - D_k) C_{0,K} \qquad (2)$$

The Transition Probability P (S_{k+1}| S_k, D_k) Can Be Expressed As

$$P(S_{k+1} \mid S_k, D_k) = (D_k P_{1,K}(E_k - E_{k+1} \mid Z_{k+1}) + (1 - D_k) P_{0,K}(E_k - E_{k+1} \mid Z_{k+1})) P_{k+1}(Z_{k+1}) \qquad (3)$$

Where D_k =1

$$P_{1,K}(E_k - E_{k+1} \mid Z_{k+1}) P_{k+1}(Z_{k+1}) \qquad (4)$$

$$\text{Where } D_k = 0,\ P_{0,K}(E_k - E_{k+1} \mid Z_{k+1}) P_{k+1}(Z_{k+1}) \qquad (5)$$

The Reward At Time K For A Node That Decides To Transmit A Message Will Be

$$R_k = X_k Q_k U(E_k - C_{1,K}) \qquad (6)$$

The Reward Function Considers Three Different Measures:

1. *Global Success Index*
Since Each Message Must Travel Through Several Nodes Before Arriving To Destination, The Message Transmission Is Completely Successful (Q_k = 1) If The Message Arrives To The Sink Node, And Zero Otherwise.

2.*Local Success Index*
If The Transmitting Node Has No Way To Know If The Message Arrives To The Sink, The Global Success Index Is Not Accessible. However, It May Be The Case That The Transmitting Node Can Know If The Neighboring Node Receiving The Message Forwards It To Other Nodes Or Not (By Listening To The Channel, Or Because The Neighboring Node Returns A Confirmation Message).The Local Success Index Is Q_k = 1 If A Neighboring Node Forwards The Message, And Zero Otherwise.

3. *Zero-Order Success Index*
As A Degenerate Case, It Can Take Any Transmission As Successful, So That Q_k =1 In Any Case. This Amount To Say That Every Node Maximizes The Importance Of Its Own Transmitted Messages. To Design The Selective Forwarder Will Be Given By The Accumulated Importance Of All Messages Successfully Transmitted By The Nodes. Accordingly, The Total Reward Up To Time K Is Defined As

$$\mathbf{T_k=\sum_{i=0}^{k} Diri =\sum_{i=0}^{k} Diqixiu\ (Ei\text{-}C1,I)} \quad \mathbf{(7)}$$

The Selective Forwarding Policy Is Chosen In Order To Maximize The Total Expected Reward, Defined As

$$E\{T\infty\}= E\ \{Limit\text{->}\infty\ Tk\ \} \quad (8)$$

Theorem 1: Let { Z_k, K ≥ 0}Be A Statistically Independent Sequence Of Importance Values And E_k The Energy Process Given By (2). Consider The Sequence Of Decision Rules In The Form

$$\mathbf{D_k=U(Q_k(E_k,Z_k)X_k–M_k(E_k,Z_k)} \quad (9)$$

Where, Q_k (E_k ,Z_k) = E { Q_k U (E_k - $C_{1,K}$)|E_k , Z_k } (10)

And Threshold

$$\mathbf{M_k\mu_k(E,Z_k)=E\{\Lambda_{k+1}(E\text{-}C_{0,K})\text{-}\Lambda_{k+1}(E\text{-}C_{1,K})|Z_k\}} \quad (11)$$

$$\mathbf{\Lambda_k(E)=(E\{\Lambda_{k+1}(E\text{-}C_{0,K})+E\{(Q(E,Z_k)X_k\text{-}M_k(E,Z_k))\}U(E))} \quad (12)$$

With (Z) + = U (Z) Z For Any Z
The Auxiliary Function

$$\mathbf{\Lambda_k(E)=\sum_{i=k}^{\infty} E\{Diqixiu(Ei\text{-}C1,I)|Ek=E} \quad (13)$$

Theorem 1 Is General And Holds For An Energy Cost And Importance Distribution, But It Does Not Provide A Clear Intuition About The Impact Of The Available Energy And The Distribution Of x_k On The Design Of The Optimal Forwarding Scheme.

4.Performance Analysis:
Implementation Of Optimal Selective Forwarding Technique For Energy Saving In Wireless Sensor Network In The Real World Is Quite Hard. Hence, The Preferred Alternative Is To Use Some Simulation Software Which Can Mimic Real-Life Scenarios. Though It Is Difficult To Reproduce All The Real Life Factors, Most Of The Characteristics Can Be Programmed Into The Scenario.

IV. Methodology:

We Analyze The Performance Of Selective Forwarders In Different Scenarios Through Simulations. First, We Describe Some Common Features Of The Experimental Setup.

1) We Have Used A Simple Deterministic Energy Model Given By Three Constant And Known Parameters: (A) EI, Energy Spent On Idle States; (B) ER, Energy Spent On Receiving Or Sensing A Single Message; And (C) ET, Energy Spent On Transmitting A Single Message. Energy Values Are Set To ET = 4, ER = 1 And EI = 0.
2) Nodes Are Homogeneous And Their Initial Level Of Battery Is The Same Except For The Sink, Which Has Unlimited Power Supply. Nodes Keep Working Until Their Batteries Expire. The Network Dies When All The Sink Neighbors Have Died.
3) Sources Are Selected At Random. Nodes Are Assumed To Have Identical Transmission Radii. They Can Communicate Only If They Are Within Mutual Transmission Range. Under This Assumption And By Listening To The Channel, Nodes Are Able To Update Their Information Estimates.
4) To Evaluate The Behavior Of The Developed
Schemes, Different Types Of Selective Nodes Are Implemented. *Non-Selective Sensor* (NS). The Sensor Does Not Censor Any Message. *Adaptive Selective Transmitter* (At), Which Uses The Zero-Order Success

Index. *Local Selective Forwarder* (Lf). It Computes The Forwarding Threshold According To Considering The Local Success Index. *Global Selective Forwarder* (Gf), Which Uses The Global Success Index.

5) Performance Is Assessed In Terms Of The Importance Sum Of All Messages Received By The Sink, The Mean Value Of The Received Importance, The Number Of Receptions At The Sink, And The Number Of *Generated* Messages (The Latter Amounts To Measure The Network Lifetime).
6) Experimental Results Are Averaged Over 50 Different Topologies With Different Traffic Patterns.

V. Simulation Environment:

Networks With Arbitrary Topologies:

To Analyze The Behavior Of Selective Forwarders In A More Realistic Scenario, We Simulate A Network Of 140 Nodes Scattered In A Square Field With Corners (0,0) And (L,L), With L = 150. Nodes Are Denser Deployed Near The Sink, Tailing Off Towards The Edges. Nodes Report The Information To A Unique Sink, Located At (L,/2). Fig. 3 Illustrates A Sketch Of The Sensor Network Deployment. Each Node Generates Importances Following An Exponential Distribution With Different Mean, Whose Values Were Randomly

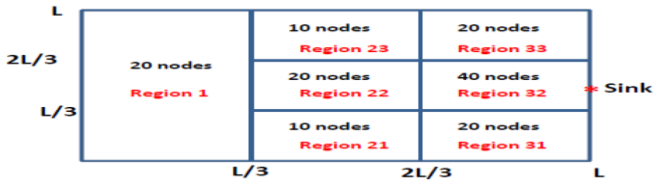
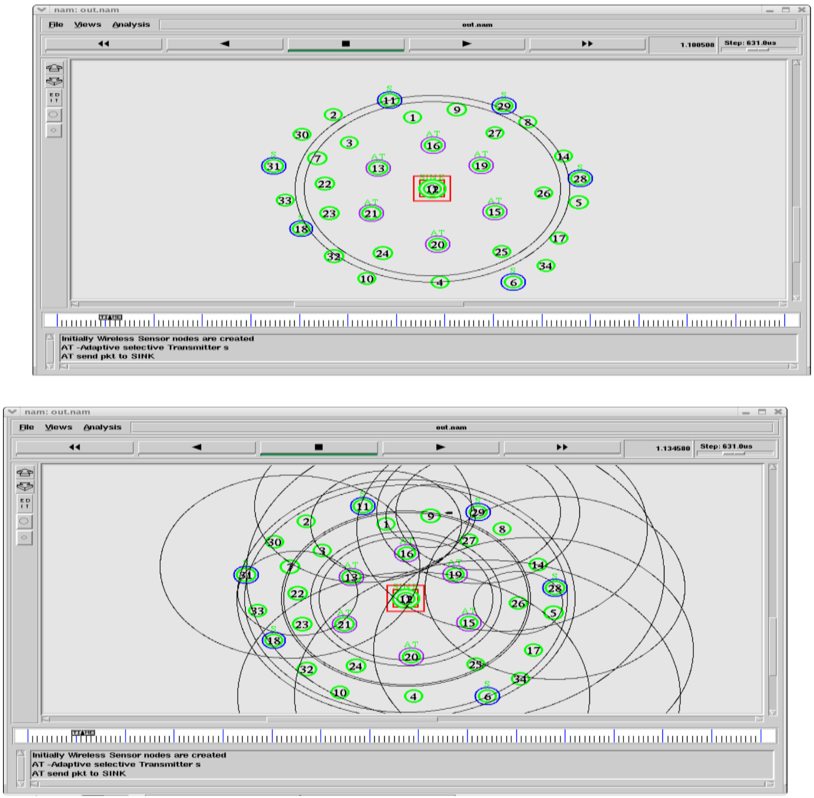


Fig. 3. Sensor Network deployment sketch.

Generated From Another Exponential Distribution With Mean 2. Messages Are Equally Generated In The Three Regions And Node Batteries Are Charged To 1500 Units.Results Are Averaged Over 20 Different Topologies, Where The Average Depth Of The Network (Number Of Hops Required To Reach The Edges From The Sink) Is 7. We Have Also Analyzed The Threshold Values In Different Regions Of The Sensor Field For The Same Setup.



Images: Selective Forwarding Technique Design In Ns2

VI. Results And Analysis:

A. Evaluation Results:

In The Creation Of WSN With Mobile Sink, It Has To Initialize The Simulator Parameters. Such As, Number Of Nodes, Mobile Sink, Sampling Region Radius. The Mobile Object's Movement Was Based On A Random Way Point. Communication Model With Collision, Communication Model Without Collision. First Create The Nodes In Wireless Network Including Mobile Sink Node. The Mobile Sink Will Select The Sampling Region. In This Paper, Two Communication Models Were Described. In The Communication Model Without Collision The Success Rate Of Communication Between Sensor To Sensor Communication Models. In The Communication Model With Collision The Packet Collision Were Detected At The Receiving Side, There Was A Packet Collision, Those Packets Are Discarded

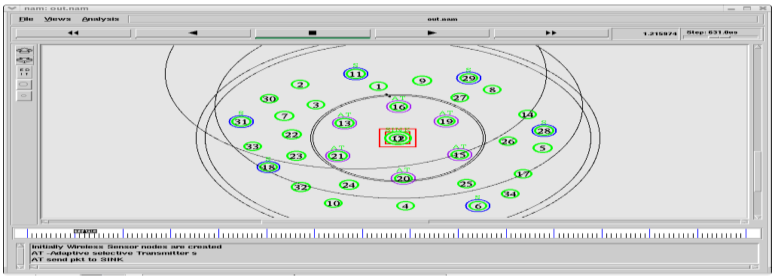
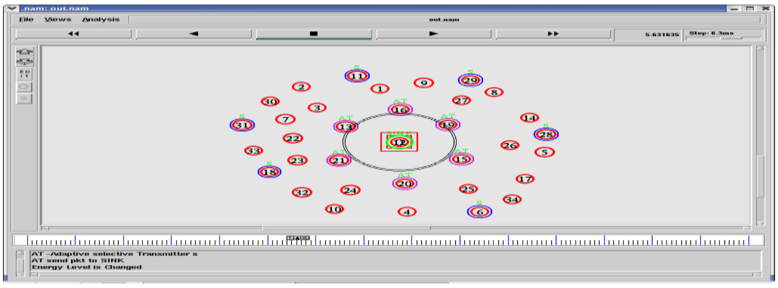


Image: Optimal Selecting Forwarding Operation

In Above Simulation Scenario, After Creations Of Nodes In Network Its Start Optimal Selective Forwarding Operation.



Images. Energy Level Of Nodes Is Changed

In This Simulation Scenario, It Is Representing That After Energy Level Is Getting Changed It Used Broadcast Packets Successfully To Sink Here Some Nodes Is In Red Color Representing Their Energy Level Is Changed & Some Nodes Energy Is Saved Through Energy Sharing From Neighbours Nodes Which Represented Other Color Through Which It Send Packet Successfully & Reduce The Packet Loss .Mobile Sink Broadcast The Sis To Sensor Node. It Has Three Tuples St_Id, Mo_Id, Bmf. Sensor Node Computes The Band Number Using Bmf Function. Sensor Nodes Send The Response Message With ―Location Stamp‖ To Mobile Sink. If, Bs < Br Sensor Node Discard The Message.

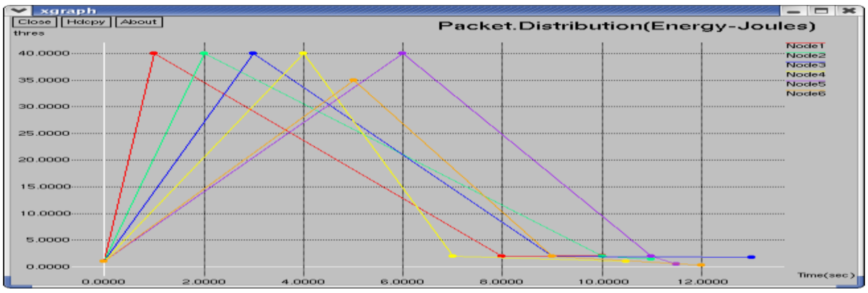


Image. Performance Result Of Proposed Technique

VII. Conclusion & Future Work:

This Paper Has Introduced Several Selective Message Forwarding Policies To Save Energy And Extend The Lifetime Of WSN. Messages, Which Were Assumed To Be Graded With An Importance Value And Which Could Be Eventually Discarded, Were Transmitted By Sensor Nodes According To A Forwarding Policy, Which Considered Consumption Patterns, Available Energy Resources In Nodes, The Importance Of The Current Message And The Statistical Description Of Such Importance's. Interestingly, The Structure Of The Optimal Scheme Was The Same In All Three Cases And Consisted Of Comparing The Received Importance To A Forwarding Threshold. The Expression To Find The Optimum Of The Threshold Varies With Time And Is Slightly Different For Each Scenario. The Developed Schemes Were Optimal From An Importance Perspective, Efficiently Exploited The Energy Resources, Entailed Very Low Computational Complexity And Were Amenable To Distributed Implementation, All Desirable Characteristics In WSN. The Three Schemes Have Been Compared Under Different Criteria. From An Overall Network Efficiency Perspective, The First Scheme Performed Worse That Its Counterparts, But It Required Less Signaling Overhead. On The Contrary, The Last Scheme Was The Best In Terms Of Network Performance, But It Required The Implementation Of Feedback Messages From The Sink To The Nodes Of The WSN. Numerical Results Showed That For The Tested Cases The Differences Among The Three Schemes Were Small -With Schemes Two And Three Performing Evenly. From A Practical Perspective, This suggests that the Second Scheme, Which Is Just Slightly More Complex Than The First One, Can Be The Best Candidate In Most Practical Networks (Especially In New Deployments). Similarly, From A Modeling Point Of View, The Results Indicate That When Nodes Have Access To Non-Local Information, Information Of First Order Neighbors May Be Enough.

Future Work:

In This Paper, The Sampling Region Is Scheduled Into Number Of Bands Using Band Based Technique. In Band-Based Approach There May Not Always Be A Next-Hop Node Located In The Same Band, Or Lower Band, And This Will Stop The Propagation Of Sensor-Data Packets. In This Situation, This Condition Is Disallowed (If The Node's Band Number Is Less Than Or Equal To The Packet's Band Number, The Node Will Rebroadcast That Packet; Otherwise The Node Discards The Packet) In Particular Sensor Node. It Will Forwarded To Out Of The Sampling Region, Each Sensor Node Maintain The Routing Table. If Route Is Available Forwarded The Packets To Neighbor Node; Otherwise The Node Does Not Forward The Packets. In This Way Band Based Optimal Selective Forwarding Algorithm And Dynamic Source Which Can Reduce The Packet Loss And Also Reduce Energy Consumption.

Biolography:

[1]. Arroyo- Valles. R, Marques. A.G, And Cid-Sueiro .J, ―Optimal Selective Forwarding Energy Saving In Wireless Sensor Networks,‖ Ieee Trans .Wireless Communications, Vol. 10, No. 1, Jan. 2011.

[2]. Arroyo-Valles.R, Marques.A.G, And Cid-Sueiro .J, ―Optimal Selective Transmission Under Energy Constraints In Sensor Networks,‖ Ieee Trans.Mobile Computing, Vol. 8, No. 11, Pp. 1524–1538, Nov. 2009.

[3]. Arroyo-Valles .R, Marques .A. G, And Cid-Sueiro .J, ―Energy-Efficient Selective Forwarding For Sensor Networks,‖ In Proc. Workshop On Energy In Wireless Sensor Networks (Wewsn'08), In Conjunction With Dcoss'08, June 2008.

[4]. Arroyo-Valles .R, Marques .A. G, And Cid-Sueiro .J, ―Energy-Aware Geographic Forwarding Of Prioritized Messages In Wireless Sensor Networks,‖ In Proc. 4th Ieee Int'l Conf. On Mobile Ad-Hoc And Sensor Systems ,Oct. 2007.

[5]. David B. Johnson, David A. Maltz Josh Broch ,‖ Dsr: The Dynamic Source Routing Protocol For Multi-Hop Wireless Ad Hoc Networks,‖ Ieee Trans.Mobile Computing, Vol. 11,Jul 2001.

[6]. Li.J And Shatz S.M, Kshemkalyani D. ―Mobile Sampling Of Sensor Field Data Using Controlled Broadcast,‖ Ieee Trans. Mobile Computing, Vol 10,No 6. June 2011.

[7]. Munir .A And Gordon-Ross .A, ―An Mdp-Based Application Oriented Optimal Policy For Wireless Sensor Networks,‖ In Proc. 7th Ieee/Acm Int'l Conf. On Hardware/Software Co Design And System Synthesis (Codes+Isss '09), Pp. 183–192.

[8]. Tian .S, Shatz S.M, Yu .Y, And Li.J, ―Querying Sensor Networks Using Ad-Hoc Mobile Devices

Prof.Zeenath Sultana, Prof. Asra Sarwath ,Prof. Syeda Faqera Fatima "Mathematical Model for Selective Message Forwarding Schemes Using Stochastic Methods" International Journal of Engineering Science Invention (IJESI), vol. 07, no. 04, 2018, pp 01-07