Role of Cooperation in Energy Minimization in Visual Sensor Network

Arifullah1, Sayed Umar2
Instituste of Busniess and Management Sciences
The University of Agriculture
Peshawar, Pakistan
arifullahms88@gmail.com
umerjus8online@gmail.com

Samad Baseer
Assistant Professor, Department of Computer System Engineering
University of Engineering and Technology
Peshawar,Pakistan
drsamadbaseer@uetpeshawar.edu.pk

ABSTRACT: *In the field of technology no any special encouragement in the tract of cooperation routing in visual sensor network (VSNs) has been carried out. Considering the deficiency of advanced break through in this field we have put forward Co-VSN routing scheme in VSNs and assimilated it with RASE protocols. Research experts have published many research papers which indicate towards the gist of these protocols in their paper partly. The counterfeit of these protocols have been used in different parameters. The result will cause the amendment of the stability of the network and reduced energy drainage in the VSNs. Enhancing the life span of network reduces the data losses thus improve in the life span of the network. The transmission of data studied in previous results focusing on channel condition without using cooperation method improved the quality of different packets at different channel. The use of operation and cooperation in this research reveals balance in the networking technology, enhances life time and stability of the network, over all 35% more improved results are predicted for the time being as compared to the previous strategies used in the VSNs[2].*

Keywords: Cooperation, Path Establishment Phase

Received: 10 August 2016, Revised 14 September 2016, Accepted 25 September 2016

1. Introduction

A Wireless Sensor Networkincludes large number of nodes installed in a large area to disclose the phenomenon of interest. It is an especial multiple-hop, adhoc and self effecting and organizing network. The development of smart sensors through Micro-Electro-Mechanical-System has fascinated the wireless sensor network worldwide. The sensors are not so costly as compared to traditional sensors because of their small sizes, limiting processing and computing resources. These sensors have the ability to measure and combine information from the environment and have the ability to transmit the collected data to certain users, based on some local decision process [1].

Largenumber of interconnected sensing devices in sensor networks have been studied extensively. Commonly the sensor networks are used for the monitoring purposes of inaccessible areas, large and remote places, homes, offices, highways and motorways. The next form of interest is to focus on visual sensors which could monitor these places in the form of videos and still images fitted in with enough processing power. stores, parking areas to monitor human activities are the examples of the application of this technology [2].

In visual sensor network (VSNs) the sensing process consist of smart cameras from different point and they capture from different angle, different shape ,and nowadays these are applied to a variety of public applications like security surveillance ,tracking ,environmental monitoring etc. A (VSNs) is normally equipped with low cost camera node and these are simply struck on wall poles and other different environment [3].

Sensor network consists of large number of sensing devices which can interconnect . These devices are equipped with enough power to process and support different image from local area. The use of (VSNs) are monitoring of very large area, far and remote, inaccessible and smart area like room in a building, home, office, airport ,highways, and games [4].

(VSNs) emerged as an important research area for distributed signal processing with unique challenges, in terms of performance allocations. In (VSNs) energy consumption is important and it must be kept low to extend the life of network ,because each cameranode is operated by battery power. Thus each layer of (VSNs) generates data to send or sensing process and transmission uses energy. Therefore, the optimized energy is important in this network for its life.

2. Related Work

Different protocols and techniques are used in energy minimization in visual sensor network (VSNs) by researcher. Some of them are given below.

In paper [1], authors propose data relevance dynamic routing (RASE) protocol which work on the basis of opportunist routing , and it try to keep balance between energy consumption and packet delay. For this purpose it use opportunist routing for next node selection.Routing path dynamically changes according to the condition.The conditions are channel availability and energy per node [5].

In paper [2], authors propose dynamic routing protocols which tries to keep balance between the energy consumption and packet delay in (VSNs), and the selection of relay node depends on the energy condition, path and also depends on data receive . This check the energy according to the change in the routing process [6].

In paper [3], Authors propose cooperation based routing protocol for underwater visual sensor network which is know as stochastic performance analysis with reliability and cooperation (SPARCO). This protocol works as cooperation in network.

In paper [4], Authors propose a cooperation underwater sensor network (Co-UWSN) which is a routing protocol for cooperative diversity. (Co-UWSN) is energy efficient and reliable with higher throughput. In this protocol relay and destination were selected to utilize the SNR process channel and also known as cost functions [7].

2.1 Motivation

According to the survey of literature, majority of the researchers did not usecooperation in visual sensor network .But researcher [3][4] usedcooperation in underwater visual sensor network . Researcher [1][2] used dynamic routing protocols for cooperation purpose . In this research we use cooperation in visual sensor network.

3. Cooperation

More energy spent at communications in visual sensor network therefore energy problems occur in network to overcome the problems .We use cooperation technique in different layer of network . In (VSNs) different nodes communicate with each in multiple paths and to selected efficient path which causes less energy cooperation technique is used [13].

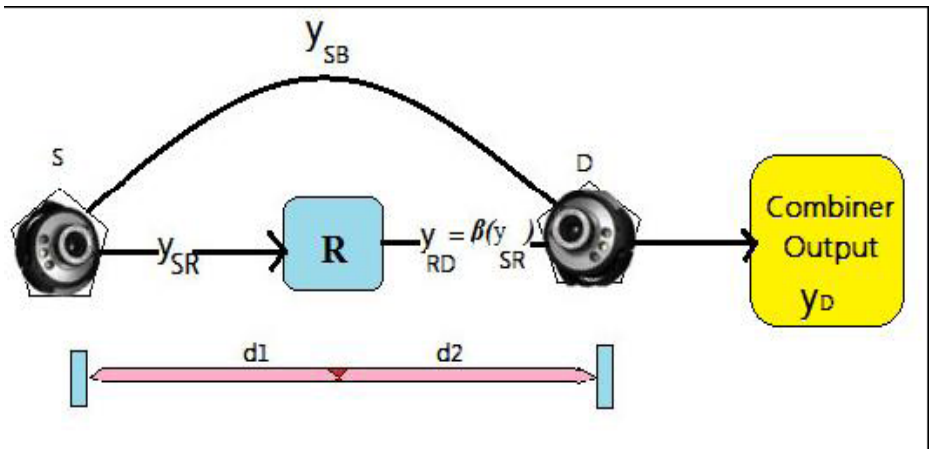

Figure 1. Node Relay for Co-operation

The figure 1 expresses the role of cooperationin the communication. Communications takes place in two steps. In first step ,the source transmit its information to both relay and destinations R,S .In second step if the data does not reach properly then relay sends the data to sik or destinations. In this process the quality of signal will be checked with the help of SNR threshold. Mathematically the signal at relay and destination can be expressed like as below:

$$f_{SD}(t) = h_{SD}v(t) + Z_S \quad (1)$$

$$f_{SR}(t) = h_{SR}v(t) + Z_R \quad (2)$$

$$f_{SD}(t) = h_{SR}v(t) + Z_D \quad (3)$$

Where i,j=0 m and G is the amplification factor using MRC, the signal at is given as:

$$f_D(t) = f_{SD} + f_{R1D} \quad (4)$$

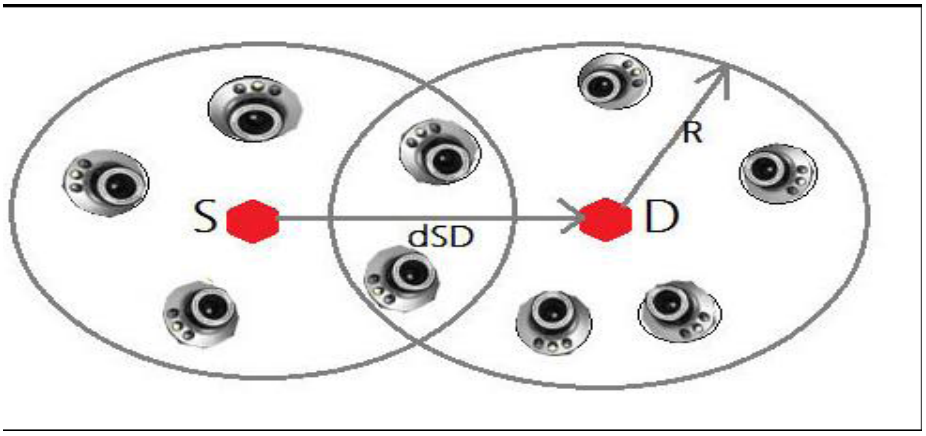

Figure 2. Cooperative Region

The relay fading coefficient are fSD, hSR and hRD and channel noises(t) will be Zs, ZR and ZD transmitted signal and S and D are transmission range which are also called cooperative region . And these relay transmission if and only if the reception at D and S if does not sent data properly in path establishment phase multi path established from source to sink .And there are two main phase in path establishment and their objective are first to identify of the next node or destination and other is the identification of relay node that works as cooperation for data retransmission and source node identifies its neighbors with and it will be found with the help of depth low than that of source node and it will be known as Forwarding Neighbor (FN) and it will be potential of candidates for the next hope of destinations and SPARCO algorithm used for selections of master node .master node select all those node which are lesser in depth and highest residual energy from others [7].

3.1 Cooperation Strategies

Most cooperation strategies involve two phases of operation, the coordination phase and the cooperative transmission phase. Coordination is needed in those systems since antennas are not located at a single terminal as in a MIMO system. This may result in system inefficiency, but the cost is often compensated by a significant diversity gain at high SNR. Coordination can be achieved by direct inter user communication or by the use of feedback from the destination based on many cooperation techniques have been proposed which obey the concept of relaying there are mainly three relaying protocols or Mathematical Model [8]. We use here some terms as followed:

- Amplify-and forward (AF)
- Decode-and-forward (DF)
- Compress and-forward (CF)

Amplify and forward "does not require complex processing " signal format relays and requires only scaling and retransmission of the received signal. Currently, relay nodes well designed system parameters for a two-hop AF system distributed relay a lot of AF in cooperative projects, which are selected according to the proposed selection. (AF) relaying popular cooperation protocol relay bus amplifies signals where received from the source and destination amplified sent signal. No decoding, such as wireless sensor networks require simple relay is suited well the system with units and therefore the traditional AF meter potential relays, time and channel resources in the relay nodes or where the frequency division or orthogonal channels are then distributed to(m+1)throughall meter relay to achieve order- source of help, (m + 1) and forward the selected relay diversity Systems.The mark error rate which forwards the information received from the sender during the stage and the floor during the project retransmit amplifies the signal. In doing so, the noise will also be amplified, which means a major drawback. The time delay decoding when re-encoding method is used to minimize[9].

3.2 Relay Strategy

In FA technique the relay node multiplies those signal which he received S_1 from amplifier factor α before forwarding them to destines node D and equation is YRD = β (Ysr) if p2 and p1 transmission power at S and R respectively then factor of β can be written as

$$\beta = \left(\frac{\sqrt{\Pr}}{\sqrt{P_S|Td(SR\ |\ +\ N(F)}}\right)$$

The relay channel state information is called gain and the relay gain assisted since the relay node requires estimating the instant feverous channel of S and R that effect the channeland the gain provide amplification to R to counter the effecting of channel fading and gain prevents R from the saturating from S-R link deeping fading . Energy per unit time is know as power. Therefore expressing the transmission power of S and R expressed like as:

$$\beta = \left(\frac{\sqrt{Er}}{\sqrt{Es\ |\ Td\ (\ SR\ |\ +\ N\ (F)}}\right) 2$$

Normally forwarding independent of time for that puropse and B can written as:

$$\beta = \left(\frac{\sqrt{Er}}{\sqrt{Es\ |\ Td\ (\ SR\ |\ +\ N\ (F)2}}\right.$$

Therefore the signal received at D in phase 2 can be written as:

$$Y_{SD} = \sqrt{P^T 2 H_{RD} B X_S N_{RD}}$$

$$Y_{RD} = \sqrt{P^T 2 H_{RD} B_{xS} N_{RD}}$$

Where the power is wirtten as P^T2 for R ,and S link and is different in wattage from PS and PR and the anlaysis of amplifer of the reciver [9].

3.3 Combining Strategies

At the final destination different technique are used for signals combining these are , Fixed Ratio Combining (FRC), Threshold Combining (TC), Maximum Ratio Combining (MRC).In fixed ratio combining equal weight are assigned to individual symbols and cooperation diversity as in the diversity of each incoming symbol equally contribute at the productions of receiving node and the channel is powerful to increase the robustnessagainst fading [10].

In case of adding toincoming signal he does not change the whole signal but make some changes at constant ratio due to which communications are charged with. And the ratio represents the average channel therefore it could not temporary effects the channel fading. In fixed ratio any signal are constant ratio .and it also does not change the whole transmission and it make better performanceachieved. Ration parameters which are defined with D_{SD}, and D_{YD}, he should represent the average quality of the channel and does not take account of the impact of temporary effects due to fading or in fixed ratio combining. Incoming signal are weighted at constant ratioand these signal does not change at the whole process of network and the ratio described with parameters like D_{SD} and D_{YD}, and the average channel quality it presents . We cannot take account of temporary influences of the channel due to fading or other effects.In FRC incoming signal are added rather than instead of adding and the are wighted withn a constant ration. And the ratio should reflect the average channel influence and quality due to shadowing and other effect. In case of relay node FRC will explain as [11].

$$yd = K_{1ySD} + K_{2\ yRD}$$

The combined output signal will present at the destination node or sink node k1 and k2 are weighted of the two links and expression can effect number of relay node .and the weights function of power channel efficient and ration expressed as.

$$K_1 \quad \frac{\sqrt{p_2{}^T hRD}}{NO}$$

The amplify and forward technique can weights ration of optimal value express as under.

$$\frac{K_1}{K_2} = \sqrt{\frac{P_1 h_{SD}}{P_1{}^T h_{SR}}}$$

In the value of optimal of weights ratio is 2:1 and show as where:

$$P = P_1 |hSD|^2 + p^T{}_2 |Hrd|^2$$

3.4 (CO-VSN) Proposed Algoritm:

For cooperationpurpose we design a new Protocols which is known as cooperation in visual sensor network.

In this sections of paper we present our cooperation protocols which is know as a C0- VSN. Given table 1 shows different parameters which tell about the simulations envirment.

Parameters	Values
Protocols	CO-VSN
Area	6000×8000
Initial node power	0.5J
Base stations location	CENTRE
Number of node	30
Transmission energy	0.00000001J × 50
Energy for reception (etx) energy	0.00000001J × 50
Energy for data aggregation	0.00000001J × 50
Network Rounds	6000×8000
Technique for combing	MRC
Relay technique	FRC

Table 1. Parameters

4. Results And Discussions

This part of paper tells about the simulation of the proposed protocol and its comparison with the RSE protocol. The simulation work is done using MATLAB200b. The network consists of 100 × 100 m2 environment and consist of 30 node with randomly deployed. Data are sent from source node destinations and source node to relay, relay to destinations .Simulations round consist of 200 to 600 rounds .Base stations consist in center of network. Cooperation strategies is used Amplify-and forward (AF) and combining technique FRC is used. Node initial energy power =0.5 j and energy for transmission =50*. 0001j. After the simulations and analyzing the plot, the following graphs are obtained. Major metrics of performance for all compared protocols are defined as follows.

5. Performance Metrics

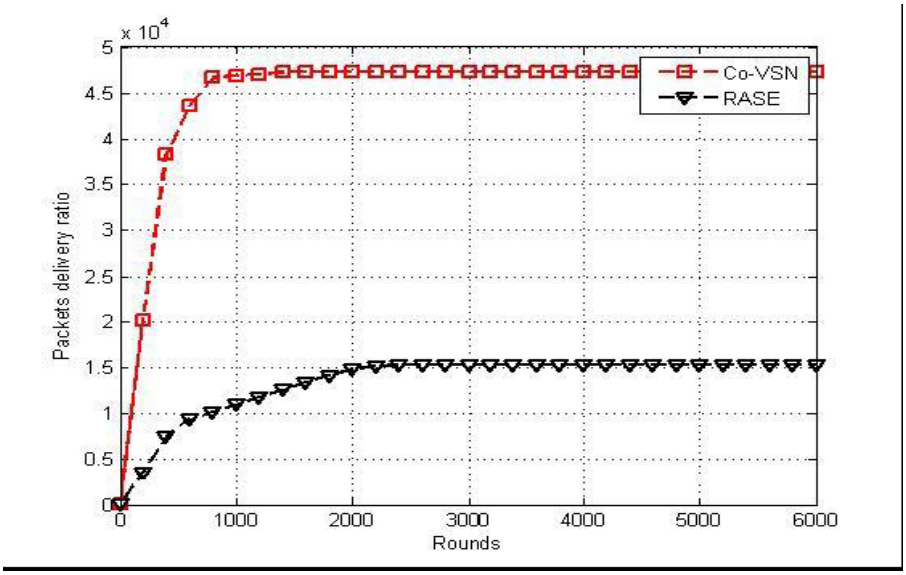

Figure A. Packet delivery

In this paper we have performed a series of simulations to measure the performance of proposed protocol (VO-VSN.)We compared it with the existing protocols RASE and protocols are evaluated for some key performance parameters that are:A Packet delivery ,B Alive node,C Path-Loss, D Residual Energy and Figure A , show the result between the two given protocols .The two protocols are (VO-VSN) and (RASE). The above result show that 36% of packet deliver properly sent from (CO-VSN) scheme and 24% packet are sent normally from (RASE). The above result show that cooperation working properly then other scheme. According to simulations 11% better result we get by using cooperation's in visual sensor network.

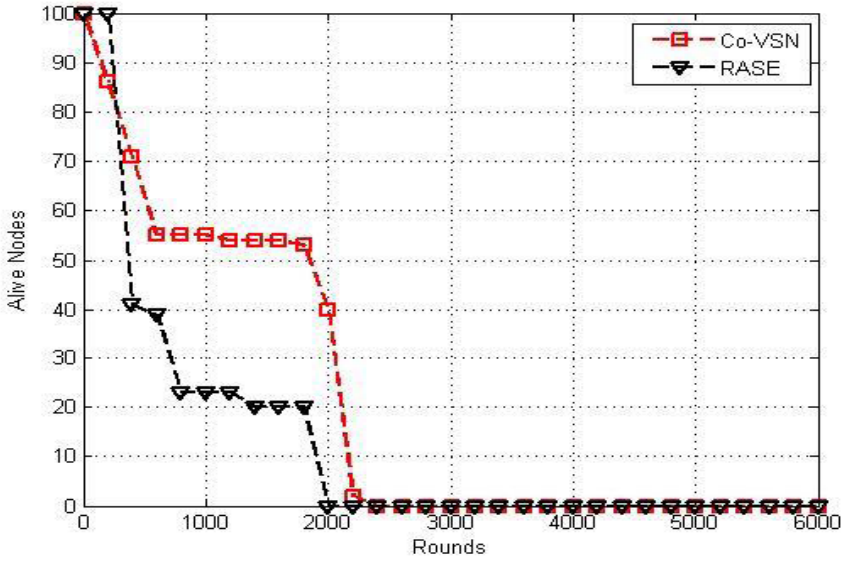

Figure B. Alive node in network

Figure B, shows a comparison of alive nodes in (RASE) with the(Co-VSN) the graph tells the story that number of alive node less in RASE then (Co-VSN) protocols .The alive node are collected from the start of network to the end of the network the graph B shows the alive node in present form according to the table more than 55 % of node dead in the RASE protocols and 32% node are dead in Cooperation in visual sensornetwork.

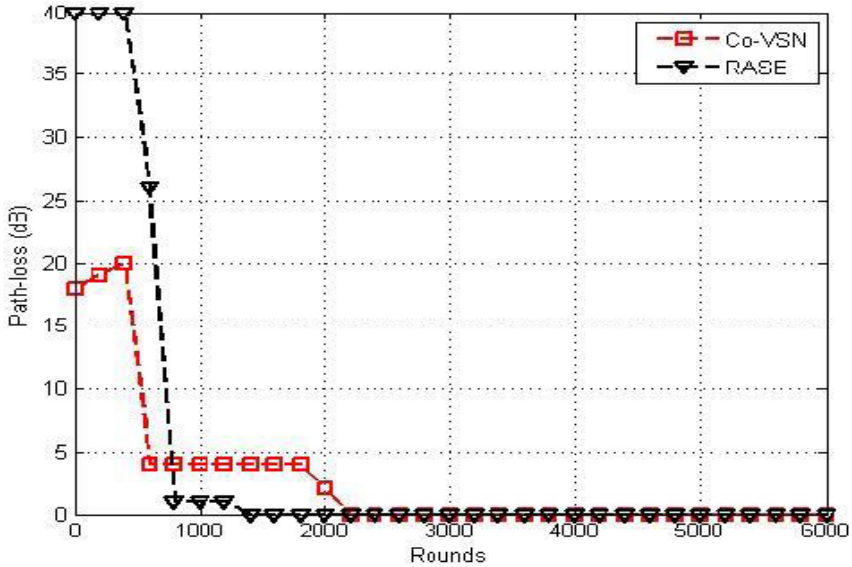

Figure C. Path-loss

The above figure C ,tells about the path loss in network .when data loss his path it's not reached his destinations. According to simulations result it show that the number of pathless occur in RASE protocols is more than Co-VSN protocols. Result show that more than 60 % of path loss occur in RASE and only 35% path loss occur in Co-VSN. It show the proper working of cooperation in VSNs he and it improve the path loss almost 35% reduce path loss in network.

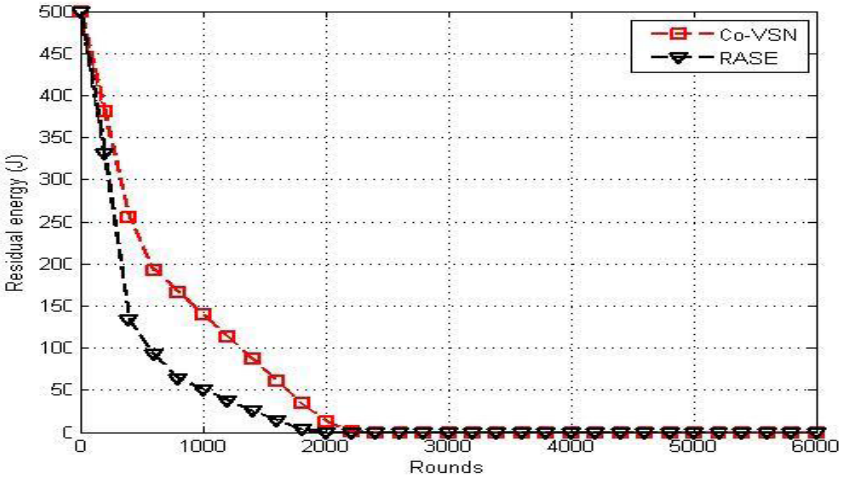

Figure D. Residual Network

The above graph in figure D shows the representation of energy consumption between the RASE and Co-VSN protocol in this research. The graph tells about the energy .And CO-VSN uses less energy because itsefficient forwarding of data to the neighbor node load balancing also achievedof effective weight implementation and for the purpose of which it utilizes cooperation and depth difference between data forwarders in the network to solve the issue of energy consumption. Total energy consumption between two different protocols and it shows the result that more than 32% energy is remaining in Co-VSN rather than RASE.

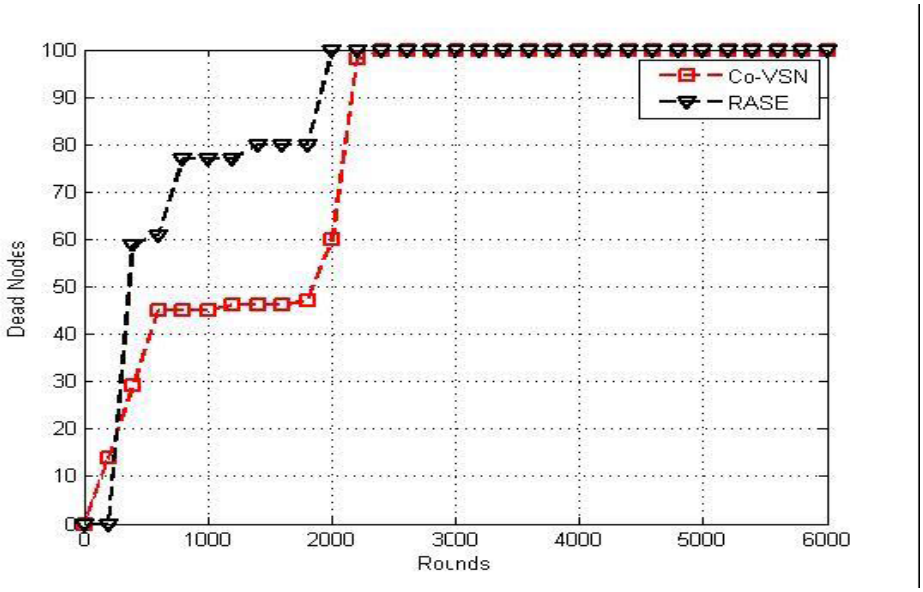

Figure D. No of Dead Node

Figure D ,The given graph tells about the dead node in the network .It compares between RASE and a CO- VSN and dead node are greater in RASE protocol.From the start of network to the end of the network these dead node are collected. According to the

simulations result more than 55 % of node dead in the RASE protocols and 32% node are dead in Co-VSN network. Hence it shows that cooperation is helpful is VSNs and gave 22 % more life to the network node.

6. Conclusion & Future Work

In this research we have proposed(CO-VSN)routing scheme in (VSNs) which enhance the stability of the network and reduce energy consumption in (VSNs) Improve the life time of network reduce packet loss, .The data forwarding in pervious network used without cooperation and focusing on channel conditions that enhance the quality of different packets at various channel different varies .The use of cooperations make able the load balancing in network and gave considerable and improve the network life time and stability.In future, our focus will be on energy consumption. Keeping energy consumption in mind we will implement energy harvesting concept.

References

[1] Neogy, S. (2015). Security Management in Wireless Sensor Networks. *In:* Cyber Situational Awareness, Data Analytics and Assessment (CyberSA), 2015 International Conference on (p. 1-4). IEEE.

[2] Yigitel, M. A., Incel, O. D., Ersoy, C. (2011). QoS-aware MAC protocols for wireless sensor networks: A survey. Computer Networks, 55 (8) 1982-2004.

[2] Yigitel, M. A., Incel, O. D., Ersoy, C. (2011). QoS-aware MAC protocols for wireless sensor networks: A survey. Computer Networks, 55 (8) 1982-2004.

[3] Yigitel, M. A., Incel, O. D., Ersoy, C. (2011). QoS-aware MAC protocols for wireless sensor networks: A survey. Computer Networks, 55 (8) 1982-2004.

[4] Misra, S., Reisslein, M., Xue, G. (2008). A survey of multimedia streaming in wireless sensor networks. *Communications Surveys & Tutorials, IEEE,*10 (4) 18-39

[5] Anastasi, G., Conti, M., Di Francesco, M., Passarella, A. (2009). Energy conservation in wireless sensor networks: A survey. Ad hoc networks, 7 (3) 537-568.

[6] Spachos, P., Hatzinakos, D. (2013, July). Data relevance dynamic routing protocol for wireless visual sensor networks. *In*: Digital Signal Processing (DSP), 2013 18th International Conference on (p. 1-6). IEEE

[7] Havary-Nassab, V., Shahbazpanahi, S., Grami, A., Luo, Z. Q. (2008). Distributed beamforming for relay networks based on second-order statistics of the channel state information. *Signal Processing, IEEE Transactions on,*56 (9) 4306-4316.

[8] Chen, J., Zhang, R., Song, L., Han, Z., Jiao, B. (2012). Joint relay and jammer selection for secure two-way relay networks. *Information Forensics and Security, IEEE Transactions on,* 7 (1) 310-320.

[9] Saleem, S., Rahman, A., Khan, I., Jan, S., Muhammad, T. (2015). Performance analysis of Amplify Quantize and Forward Relaying in Network Coded based system at various relay locations. *In*: Emerging Technologies (ICET), 2015 International Conference on (p. 1-6). IEEE.

[10] Chen, J., Zhang, R., Song, L., Han, Z., Jiao, B. (2012). Joint relay and jammer selection for secure two-way relay networks. *Information Forensics and Security, IEEE Transactions on,* 7 (1) 310-320.

[11] Zhang, W., Tang, J., Wang, C., De Soysa, S. (2010, March). Reliable adaptive multipath provisioning with bandwidth and differential delay constraints. *In*: INFOCOM, 2010 Proceedings IEEE (pp. 1-9). IEEE

[12] Saleem, S., Rahman, A., Khan, I., Jan, S., Muhammad, T. (2015, December). Performance analysis of Amplify Quantize and Forward Relaying in Network Coded based system at various relay locations. *In*: Emerging Technologies (ICET), 2015 International Conference on (p. 1-6). IEEE.

[13] Ahmed, Sheeraz, Javaid, Nadeem., Ahmad, Ashfaq., Ahmed, Imran., Durrani, Mehr Yahya., Ali, Armughan., Haider, Syed., Ilahi, Bilal (2016). SPARCO: Stochastic Performance Analysis with Reliability and Cooperation for Underwater Wireless Sensor Networks, *Journal of Sensors* 2016.

[14] Ahmed, S., Javaid, N., Khan, F. A., Durrani, M. Y. , Ali, A., Shaukat, A. , Sandhu, M. M., Khan, Z. A., Qasim, U (2015). Co-UWSN: cooperative energy-efficient protocol for underwater WSNs, *International Journal of Distributed Sensor Networks* 2015. 75.