International Journal of Control Theory and Applications

ISSN : 0974-5572

Volume 10 • Number 33 • 2017

Secured Rough Fruit Fly Algorithm for Data Transmission in WSN

Uma. M[a] and Senthilkumar A[b]

[a]Department of Computer Science, Research Scholar , Bharathiar University Coimbatore, Tamilnadu, India

E-mail: uma.mca2010@gmail.com

Department of Computer Science, Assistant Proffesor , Arignar Anna Govt. Arts College Namakkal , Tamilnadu, India

E-mail: senthilkumarmca76@gmail.com

Abstract: The leading significant technology in network is WSN and it has energetic field of research. In WSN so for multipath routing algorithm is utilized to transfer the from source node to destination. In multipath routing the opposition can certainly pin point the routing algorithm, thought the packet sent in network can be chopped to drop the information of packets, at the same phase it needs to concentrate on overlapped that had been computed by multipath routing in node disjoined or edge disjoined. To enriched packet transmission in wireless sensor networks it is important to concentrate on security and energy preserve. In this paper we propose a Secured rough fruit fly algorithm(SRF), based on rough set theory it group the consistency and inconsistency of nodes. In the resulting Consistency nodes, the packet to be transferred is secured using RC6 algorithm then cluster head is selected with maximum energy with node selection algorithm, through the cluster head the packets are transferred with fruit fly algorithm to find the minimum path between source node and destination node. Hence the packet communication using proposed algorithm is more reliable and energy consumed.The enhanced effectiveness and performance of the proposed secure and energy preserve data transmission modal is shown in simulation result.

Keywords : *Wireless Sensor Network, Rough Set Theory, Clustering, RC6 cryptography Algorithm, fruit fly algorithm.*

1. INTRODUCTION

In WSN network contains more number of nodes. These nodes are the agent to collect the information from the environment and communicate through the wireless transceivers. The collected information is send to the base station travelling through multi hop communication.Network coverage area is often much larger then radiorange of single node(s), so in order to reach somedestination node can use other nodes as relays. This type ofcommunication is known as multi-hop routing in wirelesssensor networks[16].To enhance the life time of battery in a node they are chargedthrough battery power3 [3]. At times it come to beactuallyproblematic to exchange the node in a hostile environment when thenode is dead. This disturbs the network performance, since the energy of node is considered to be valuableresource in the WSN, the maximum energy of the sensor node is spend in transmitting and receiving the data from source to destination, hence therefore it is important to design the routing algorithm to maximize the life of network in WSN. Rough set theory is one of the technique to maximize the energy of node through which the consistency and in consistency of node can be analyzed Rough set theory is a proposed by Poland scholar Z.Pawlakin twentieth Century 80 for theoretical analysis of data. The theory can analyze and process the imprecise, inconsistent and incomplete information, rough set, as a great potential and effective knowledge acquisition tool and the attention of artificial intelligence researchers [10]. It is essential to safeguard the sensitive data transferred over the WSN. Different methods have been considered to accomplish secure communication in the WSN. Cryptography techniques ensures the security of data inthe WSN.The basic requirements of security in WSN such as Data Authenticity-integrity, Data Confidentialityand Availability are achievedby using RC6 cryptographic algorithms. The influences ofcryptographic security on the sensors have been studied interms of obstacles such as sensor energy, memoryrequirement and time delay[5].Secure routing protocols and cryptography provides theprotection against the security in WSN. Rivest et al.(1998) proposed RC6 block cipher based on RC5symmetric key approach [5].RC6 can encrypt 128-bit data blocks byusing 128, 192, or 256 bit keys [5]. RC6 can supportvarious word/key sizes and number of rounds and it canbe defined as RC6-w/r/b where w stands for bit size ofword, r stands for the number of rounds, and b stands for key size in bytes [5].

The remaining of this paper is structured as follows. Section II gives a brief overview of cluster formation and cluster head selection. Section III presents the application of fruit fly algorithm and optimize routing. SectionIV presentsthe main applications of RC6 security mechanism. Section V shows the experimental result is provided to evaluate the proposed approach and also provide a review and comparison with currently availablealgorithm based on their capabilities and functionalities. Finally, Section VI concludes the paper.

2. CLUSTER FORMATION

2.1. Rough K- Means Clustering

In WSN, the technique used network for routing is vitallyimportant. Clustering algorithm is a fundamental level routing algorithm in WSN, which split upall nodes in the network into related various levels by certain rules or methods. A number ofadjacent nodes create a cluster and then select a cluster head in all cluster; the remaining nodes are the member in cluster. The cluster head nodes are in authority for the nodesconnection and routing. The remaining member nodes turn off the transmitter and sleep to enhance the aim of energy protection when they are idle.The clustering protocol as a hierarchical protocol is more extensive than the there types of protocols.The following considerations should be in the designing of clustering algorithms: the selection of CH, formation of well-balanced clusters, secure communication, application dependent protocols,synchronization, in data communication and data aggregation.

LEACH protocol (Low-Energy Adaptive Clustering Hierarchy) is presented by Heinzelman in 2000, and wheels describes its operation, the formation of cluster and data transmission, using the random selection method to select the cluster head is defined in every wheel, there- fore the energy load of the whole network can be as- signed to each node to prolong the network cycle[11]. They are few disadvantages in LEACH protocol such as The Cluster head is generated by random method, so in some time inefficient node may be selected as cluster head and the selection not considering the transmission distance and the node remain energy, leading the uneven energy consumption for different nodes.The communication between cluster head and sink node is using the single hop model, and it will make the node far from the sink node dead in earlier time[11].

To solve the above problem, HEED, TEEN, PEGASIS, EEUC were all recognized some improvement on LEACH protocol, but they still followed with uneven energy consumption.

To enhance the protocol with low energy consumption clustering routing protocol, it also can be described as the two steps such as forming the cluster and transmitting the data in rough set clustering. Rough set theory is a proposed by Poland scholar Z.Pawlakin twentieth Century 80 for theoretical analysis of data. The theory can analyze and process the imprecise, inconsistent and incomplete information, rough set, as a great potential and effective knowledge acquisition tool and the attention of artificial intelligence researchers [10]. In rough set theory, information system referred as a data table. Attribute refers to the equivalent object on this list, the equivalent object for research, the whole table are all attributes of the object of values.An information system is a table with observations (called objects) as rows, features(called attributes) as columns and discrete values as entries.

$$\text{Information system as I} = (U, A),$$

U refers to a nonempty finite sets, where U is the set of nodes in a domain, A refers to non-emptyset ofattribute properties which are used to define nodes; the properties of the elements in the set are defined, such as a: $U \rightarrow V_a$, for every a € A the set V_a is called as the value set of a.For any subset of attributes $P \subseteq A$ and subset of objects $X \subseteq U$, the indiscernible relation is defined as

$$\begin{aligned} \text{IND}(P) &= \{(x, y) \in U \mid \forall a \in P, \\ a(x) &= a(y)\} \end{aligned} \tag{1}$$

If only considering a subset of attributes P but not considering other attributes, twoobjects capacity be indiscernible with each other, then we say they are indiscernible. Theequivalence class of IND(P) is denoted as $[x]p$, which means that $\forall y \in [x]\, p$, (x, y) areIndiscernible to each other. There is two kind of attribute conditional attribute and decision attribute $A = C \cup D$ the decisional attributes D refers to which domainandnode belongs to. The conditionalattributes C refers to all other attributes except decisional attributes.lower andupper approximations are defined as

$$PX = \{x \in U \mid [x]\, p \subseteq X\} \qquad (2)\ \text{(lower approximation)}$$

$$PX = \{x \in U \mid [x]p \cap X \neq \varnothing\} \qquad (3)\ \text{(upper approximation)}$$

$$POS(A) = PX \qquad (4)\ \text{(Positive Region)}$$

$$BOS(A) = PX - PX \qquad (5)\ \text{(Boundary region)}$$

$$NEG(A) = U - POS(A) - BOS(A) \qquad (6)\ \text{(Negative region)}$$

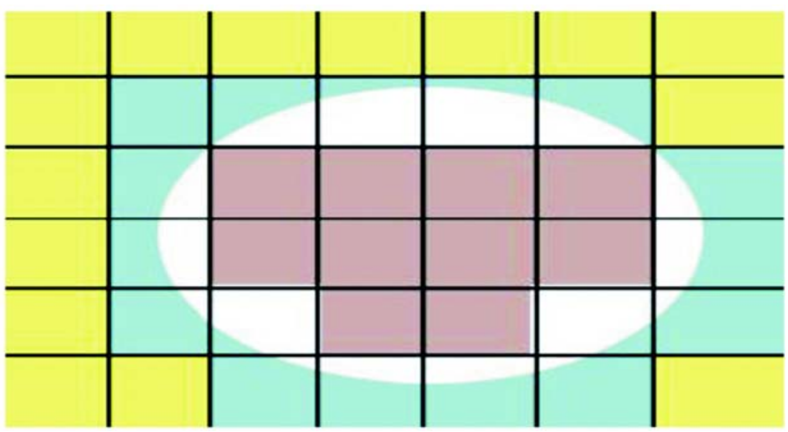

Figure 1: Separation of Region in Rough Set K Means theory

→ lower Approximation

\+ → Upper approximation

→ Positive Region

→ Boundary Region

→ Negative Region

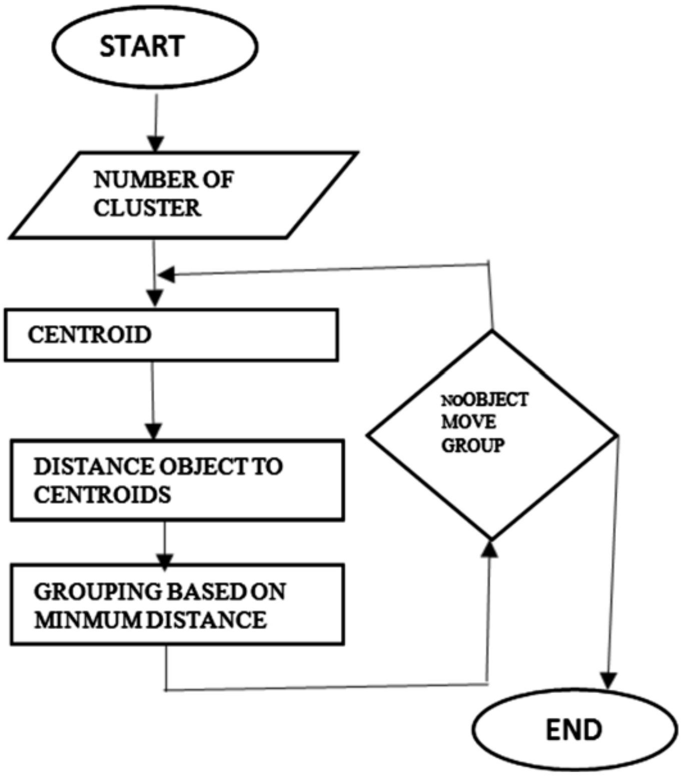

Figure 2: Flow diagram of Rough K Means

The following table represents the attribute condition of the node selected from the Rough K means algorithm. Based on the condition attribute the node in the base station is separated as the consistency cluster. The condition attribute is based on energy, signal strength geographical position. The value 1 in the decision attribute represent the true for condition so the node is set in lower approximation and the value 0 represent the false so the node is set in upper approximate in the cluster formation.

Table 1
Specification to select cluster head using Rough K – Means theory

	energy(y1)	*Communication Costs(y2)*	*Signal strength(y3)*	*geographical position (y4)*	*Decision D(d)*
*a*1	1	0	1	0	0
*a*2	1	0	0	1	0
*a*3	0	0	0	1	0
*a*4	0	1	1	0	0
*a*5	1	0	1	1	1
*a*6	1	1	1	1	1
*a*7	1	1	0	1	1
*a*8	1	0	1	1	1

Algorithm 1: Rough K-Means Clustering Algorithm

Input : Dataset of n objects with *d* features, number of clusters K and values of parameters W_{lower}, W_{upper}, and epsilon.

Output : Lower approximation $\underline{U}(K)$ and Upper approximation $\underline{U}(K)$ of K Clusters.

Step 1 : Randomly assign each data object to one lower approximation $\underline{U}(K)$. By definition (property 2) the data object also belongs to upper approximation $\underline{U}(K)$ of the same Cluster.

Step 2: Compute the Cluster Centroid C_j

$$\text{If } \underline{U}(K) \neq \varnothing \text{ and } \underline{U}(K) - \underline{U}(K) = \varnothing$$

$$C_j = \sum_{x \in \underline{U}(K)} \frac{x_i}{|\underline{U}(K)|}$$

$$\text{Else If } \underline{U}(K) = \varnothing \text{ and } \underline{U}(K) - \underline{U}(K) \neq \varnothing$$

$$C_j = \sum_{x \in \overline{U}(K) - \underline{U}(K)} \frac{x_i}{|\overline{U}(K) - \underline{U}(K)|}$$

Else

$$C_j = W_{lower} \times \sum_{x \in \underline{U}(K)} \frac{x_i}{|\underline{U}(K)|} + W_{upper} \times \sum_{x \in \overline{U}(K) - \underline{U}(K)} \frac{x_i}{|\overline{U}(K) - \underline{U}(K)|}$$

Step 3: Assign each object to the lower approximation $\underline{U}(K)$ or upper approximation $\underline{U}(K)$ of cluster *i* respectively. For each object vector *x*, let $d(X, C_j)$ be the distance between itself and the centroid of cluster C_j.

$$d(X, C_j) = \min_{1 \leq j \leq K} d(X, C_j)$$

The ratio $d(X, C_i) / d(X, C_j)$, $1 \leq i, j \leq K$ is used to determine the membership of *x* as follow: If $d(X, C_i) / d(X, C_j) \leq$ epsilon, for any pair (i, j), the $x \in \overline{U}(C_i)$ and $x \in \overline{U}(C_j)$ and *x*will not be a part of any lower approximation. Otherwise, $x \in \underline{U}(C_i)$, such that $d(X, C_i)$ is the minimum of $1 \leq i \leq K$. In addition $x \in \overline{U}(C_i)$.

Step 4: Repeat Steps 2 and 3 until convergence.

2.2. RC6 security Algorithm

Cryptography and secure routing protocols provides the defense against the security in WSN [23].Rivest et al. (1998) proposed RC6 block cipher based on RC5 symmetric key approach [5].

RC6 can encrypt 128-bit data blocks by using 128, 192, or 256 bit keys [5]. RC6 can support various word/key sizes and number of rounds and it can be defined as RC6-w/r/b where w stands for bit size of word, r stands for the number of rounds, and b stands for key size in bytes [5]. The most fundamental difference between RC6 and RC5 is that RC6 uses an extra multiplication operation to perform bit rotations in each word.

Algorithm 3: RC6 Security Algorithm

Input: Plaintext stored in four w-bit input registersA, B, C, D

200 rounds

32-bit round keys S [0,…., 43]

Output: Ciphertext stored in A, B, C, D

Procedure:

B = B + S [0] //Pre-whitening

D = D + S [1]

for i = 1 **to** 20 **do**

{

$t = (B \, x \, (2B + 1)) <<< 5$

$u = (D \, x \, (2D + 1)) <<< 5$

$A = ((A \, t) <<< u) + S[2i]$

$C = ((C \, u) <<< t) + S[2i + 1]$

$(A, B, C, D) = (B, C, D, A)$

}

A = A + S [42] //Post-whitening

C = C + S [43]

2.3. Node selection algorithm (NSA)

In the NSA phase, the N nodes available in the region of consistent node. Then, the special node is selected in each cluster using game theory. At a specific instant of time the power available in each node is determined. Then, the node with maximum power is selected as the special cluster head. The selection of cluster head is discussed in Algorithm 2.

Algorithmic 2: Node selection algorithm

Input : Battery power of all the nodes in each cluster// (stored in two arrays A[ ] and B[ ])

Output : Special cluster head is calculated, //having highest power energy

Step 1: SN ← A[1]; //SN : Special Node

Step 2: **for** i = 2 to **do**

//M: maximum no of nodes in domain 1

//N: maximum no of nodes in domain 2

Step 3: **if** A[i] > N **then**

SN = A[i];

Step 4: end if

Step 5: end for

Step 6: Return SN;

Repeat the above steps for domain 2, considering the array B[ ] instead of A[ ] and N instead of M.

2.4. Fruit fly Algorithm

The Fruit Fly Optimization Algorithm was invented by Prof. Pan, a scholar of Taiwan [16]. This is the finest method for gathering global optimization based on the searching behavior of the fruit fly. The sensory observation of the fruit fly is better than that of other species, especially the sense of smell and vision. The olfactory organ of a fruit fly can gather various smells from the air, and even a food source 40km away. Afterwards, the fruit fly flies to the food, uses its acute vision to find the food and where its fellows gather, and then it flies in that direction [16]. The fruit fly algorithm can be implemented to transfer the data from cluster head to base station.

The characteristics of fruit fly in searching for food are reduced to several necessary steps and procedure

1. The random initial position of a fruit fly swarm is as shown in the right

   Init X_axis; Init Y_axis

2. Random direction and distance of searching for food using the sense of smell of a fruit fly individual.

$$Xi = X\_axis + \text{Random Value}$$

$$Yi = Y\_axis + \text{Random Value}$$

3. As the location of food cannot be known, the distance (Dist) to theorigin is estimated before the decision value of smell concentration (S)A new evolutionary computation - Fruit fly optimization algorithmis calculated; this value is the reciprocal of distance[16].

$$Disti = \sqrt{(X_{i2} + Y_{i2})}$$

4. The smell concentration decision value (S) is substituted in the smellconcentration decision function (also known as the Fitness function) towork out the smell concentration (Smelli) in the position of the fruit flyindividual[16].

$$Smelli = Function(Si)Smellbest$$

5. Determine the fruit fly with the maximum smell concentration amongthe fruit fly swarm (seek for the maximum value) [16]

$$[bestSmell\ bestIndex] = max(Smell)$$

6. Retain the best smell concentration value and x, y coordinates, here thefruit fly swarm flies toward the position by vision[16]

$$X\_axis = X(bestIndex)$$

$$Y\_axis = Y(bestIndex)$$

7. Enter into iterative optimization, repeat execution steps 2-5, and judgewhether the smell concentration is better than the previous iterativesmell concentration, if yes, execute Step 6.[18]

Algorithm 3: Fruit Fly Algorithm

Input: Location of source and destination of node

Maxit // maximum number of iteration

Sizep // distance of node

Output: Minimum path to the destination

Step 1: $i = 0; \text{if}(\ i < \text{size}\ p)$

Init X_axis; Init Y_axis

Step 2: $Xi = X\_axis + \text{Random Value}$

$Yi = Y\_axis + \text{Random Value}$

Step 3: $Disti = \sqrt{(X_{i2} + Y_{i2})}$

$Smelli = Function(Si)$

Step 4: $[bestSmell] = max(Smell)$

$X\_axis = X(bestIndex)$

$Y\_axis = Y(bestIndex)$

$bests = S(bestindex);$

$Smellbest = bestSmell$

Step 5: if $i <$ maxgen

par = par + increased amount

else Xbestp(p) = X_axis;

Ybestp(p) = Y_axis;

Step 6: if bestSmell > Smellbest

X_axis = X(bestindex);

Y_axis = Y(bestindex);

bests = S(bestindex);

Smellbest = bestSmell;

Step 7: Xpestp ,Ybestp

Repeat step 1 - 7

3. PROPOSED MODAL

The details of the proposed Secured rough fruit fly algorithm (SRF) algorithm. The proposed SRF algorithm logically consists of three steps: First step, to find the consistence node (lower approximation) by applying Rough K-Means, since node may contain inconsistent to base station,with the resultant consistency node using special node selection algorithm the cluster head is selected with high energy. Second step, the packet to be transferred is secured using RC6 algorithm. Finally packets have been secured and send through cluster head by applying the fruit fly clustering algorithm.

Algorithm 4: Secured rough fruit fly algorithm (SRF)

Input : n number of nodes and m number of base station,

$$N = \{n_1, n_2, \ldots, n_n\} \text{ and}$$

$$B = \{b_1, b_2, \ldots, b_m\},$$

T – Timing for cluster head changing

S the data contained in a node,

N number of register to access the data,

Output : Special cluster head is calculated, and secured data transmission //having highest power energy

Do

Step 1 : Calculate cluster, using Rough K-Means(N, K) to Calculate the

Upper Approximation $\overline{R}\,N \leftarrow \{n \in U \mid [n]_m \cap N \neq \Phi\}$

Lower Approximation $\underline{R}\,N \leftarrow \{n \in U \mid [n]_m \subseteq N\}$

Boundary Region $BND_m(n) \leftarrow \cup\, \overline{R}\,N - \cup\, \_\, N$ //according to Algorithm 1.

Step 2 : DoCompute keys = RC6(S) // according to algorithm 3

Step3 : Energy of all the nodes in Lower approximation // (stored in arrays _ Ni[ ])

for $i = 1, 2, \ldots m$

SCHN $\leftarrow \underline{R}\,N_i[1]$;

//**SCHN :** special Cluster head node

for j = 2 to M**do**

//**M:** maximum no of nodes in domain i

if $\underline{R}\,N_i[j] >$ SCHNthen

SCHN = A[i];

end if

end for

SCHN

Step 4: Do compute x axis and y axis // according to \ algorithm 4

Sent S through SCHN

Step 5: Repeat the steps 1 – 4 for T = timing in hours

4. EXPERIMENTAL RESULTS

The Matlab is used as the simulation platform, and the experiment parameters are showed as follows Table 2

Leach is the one of the most commonly referred to select the cluster head in clustering algorithm. In leach the cluster head is selected randomly since there is chance to select the unstable cluster head. Unstable cluster head means the node which has been selected as cluster head with low energy, since the node may die early before the transmission complete so overlapping of the data transmission will occur in LEACH algorithm

Table 2
Experimentation parameters

Paramter	*Value*
Sensor area	(0,0) – (400, 400) m
Node initial energy	10 J
Node number	200
Station position	(20, 200) m
Efs	20 pJ/bit × m^{-2}
Emp	0.013 pJ/bit × m^{-4}
Data packet	500 B

The response distribution load balancing clustering algorithm (RDCA) is clustering algorithm. The algorithm is improved form of Leach algorithmthe RDCA no need toknow the location of the nodes in advance, but only according to the local topologyinformation rapidly elect cluster head and divided the cluster allowing to the cost function. The process of load balance performance is performed in this algorithm and smaller protocol. Related with LEACH protocol, it can decrease energy consumption and extend the networklifetime. The one drawback in RDCA algorithm is that it select the cluster head based on topology, since it has the chance to select the cluster head near base station , since its does not consider the information about of node , as we know the node near the base station will loss lot of energy due to traffic of node is high near base station

Radial basis function (RBF) is the algorithm with centralized and location-based clustering algorithm, which suitablefor small-scale WSN. Clustering results calculated by the base station. When the base station collects theremaining energy and the location data of all nodes in the network is set up RBF neuralnetwork then,calculate the probability of each node becomes a cluster head. In RBF it select the cluster head based on the probability of each node , when the node with probability with low energy is selected since energy is not consider in probability

In proposed method Secured rough fruit fly algorithm (SRF), the selection of cluster head is based on the energy of node, since it increases the life time of the network and though is transfers the packet with minimum path calculation to save the residual of energy in node. Packets transferred is secured using the security algorithm.

Using the simulation the result of the proposed algorithmis shown

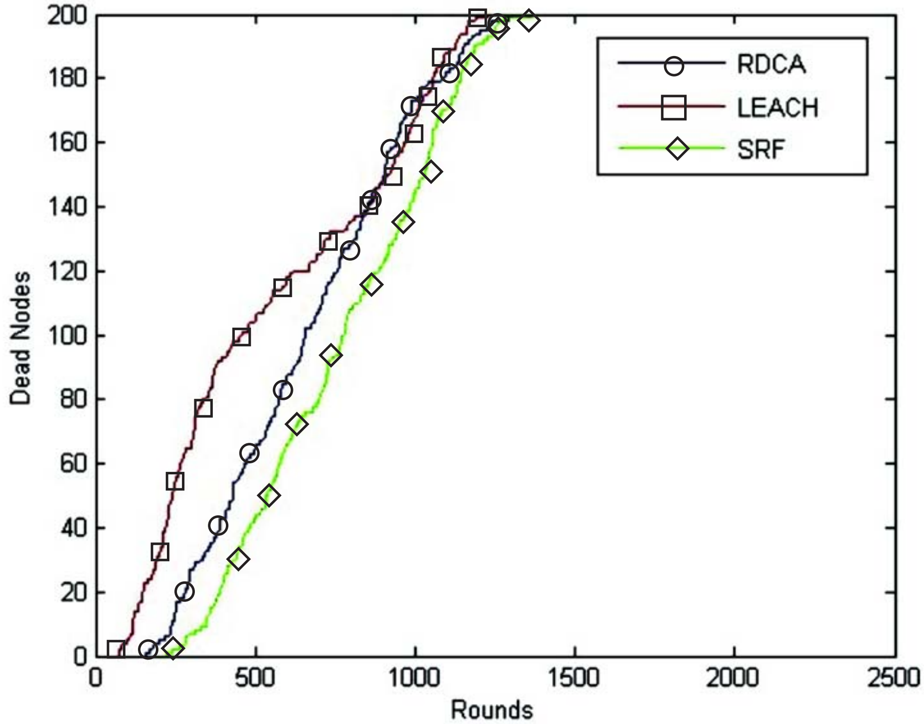

Figure 3: Calculation of Dead node according to the number of nodes

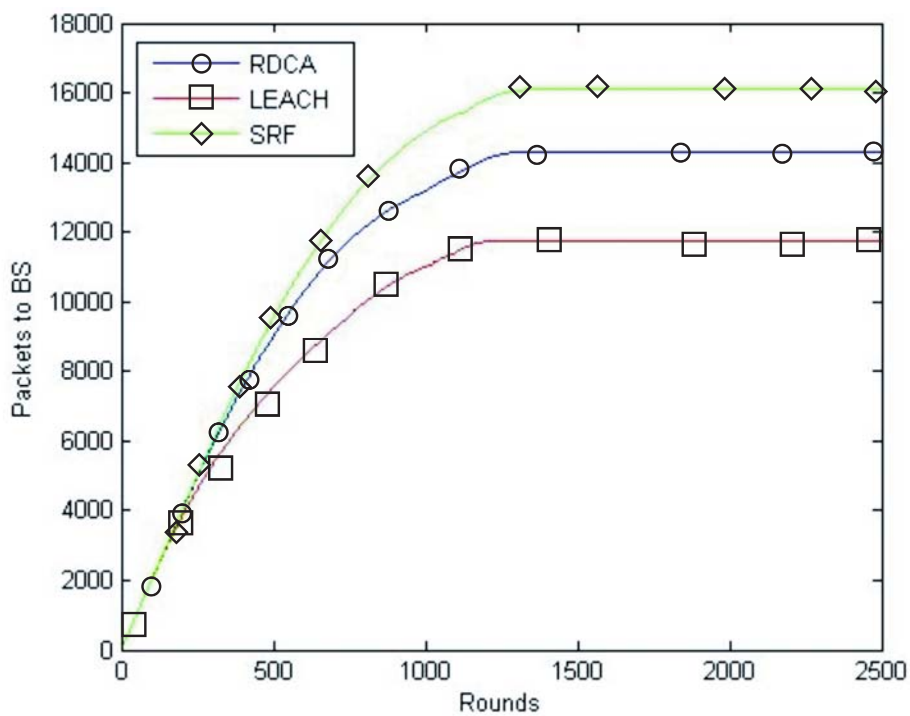

Figure 4: Packet transformation towards base station and rounds

In the figure 3 it show the number of rounds of the packet transmission and the capacity of node energy till it alive. The leach algorithm makes the node energy to dead at the 800 rounds of the packet transmission and the RDCA makes the node to be dead in 1000 rounds and SRF transfers the packet till the 1200 rounds and node is dead in 1200 rounds

In the figure 4 it shows the calculation of the packet transmission in more number of rounds. The Leach protocol transfers the packet 8000 in 2500 rounds. The RDCA transfers the 10000 packets in 2500 rounds and SRF transfers the 12000 packets in 2500 rounds

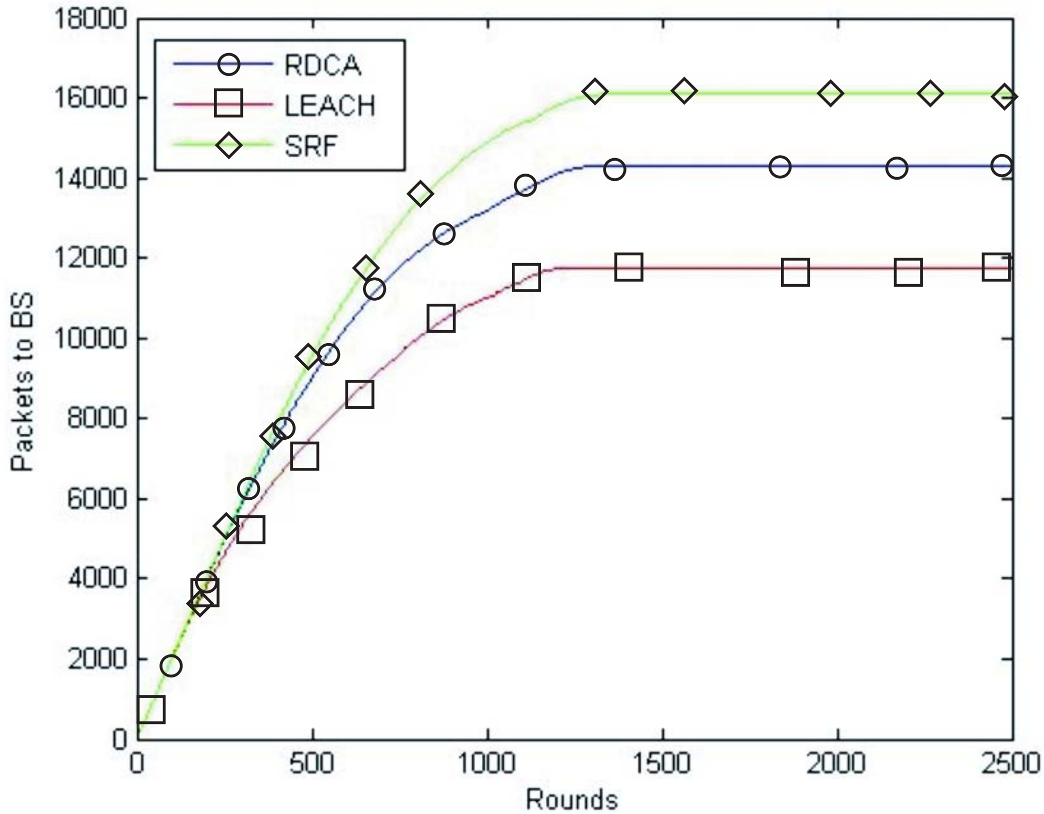

Figure 5: Calculation of cluster formation and rounds

In the figure 5 it shows the formation of cluster head based on timing , leach algorithm form the minimum number of cluster compare to other two algorithm. RDCA form the minimum number of cluster compare to SRF.

In the figure 6 shows the packet transformation towards the cluster head. The packet transferred $6x10^4$ Is transferred by leach algorithm. Compared to leach algorithm the packet transferred by RDCA is $8x10^4$ The packet transferred by SRF is $11x10^{4.}$

In figure 5 show the result of alive nodes in more number of nodes. The node are alive still the 1100 rounds in leach protocol. In RDCA the nodes are alive till the rounds ends with 1200. In SRF the nodes are till alive with 1300 rounds

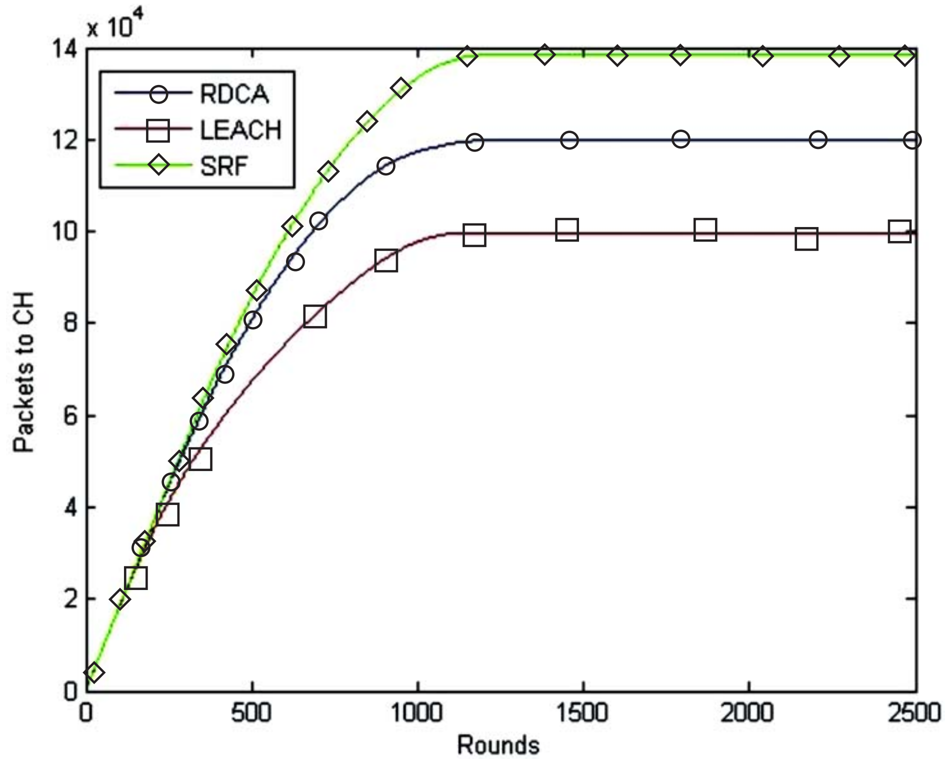

Figure 6: Packet transformation towards the cluster head and rounds

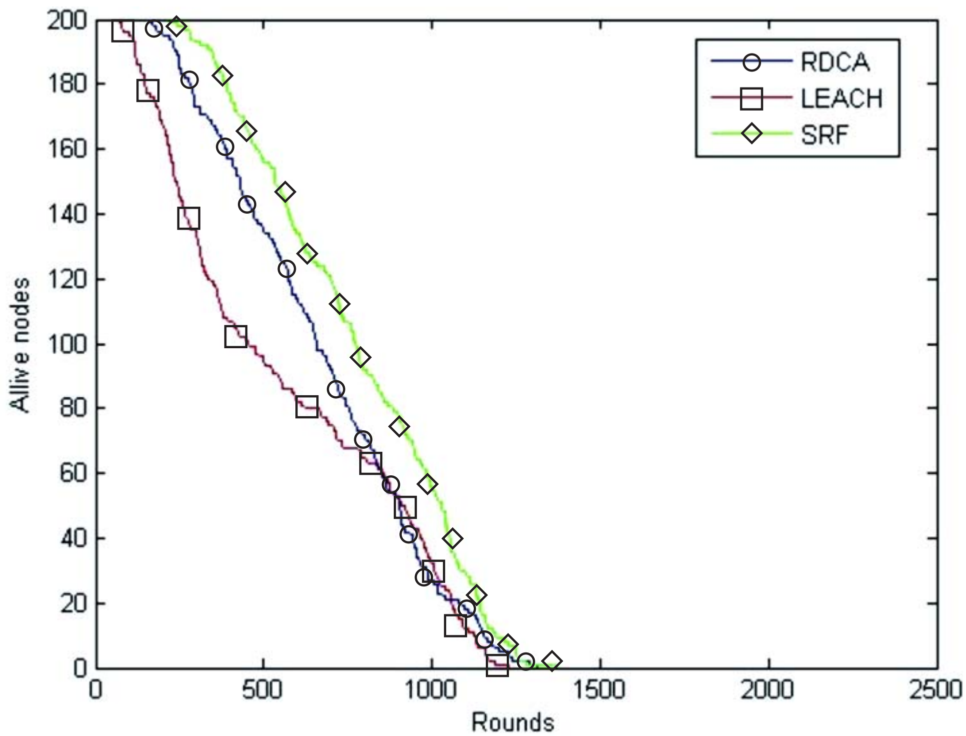

Figure 7: Calculation of alive node according to the number of nodes

5. CONCLUSION

The proposed model focused on sharing the data over WSN with further security and energy capable through cluster head.SRFalgorithm important goal is to extended the lifetime of the WSN by evenly allocating the workload with input data secure. To achieve this goal, the algorithm is focused on selecting proper CHs from existent sensor nodes, and transmission of packet with secured.

REFERENCES

[1] Peng-Wen *Chen ,Wei-Yuan Lin, Tsui-Hua Huang,Wen-Tsao Pan "Using Fruit Fly Optimization Algorithm Optimized GreyModel Neural Network to Perform Satisfaction Analysis for E-Business Service"*Appl. Math. Inf. Sci. **7**, No. 2L, 459-465 (2013)

[2] Mindi Lu , Yongquan Zhou , Qifang Luo and Kang Huang "An Adaptive Fruit Fly Optimization Algorithm Based on Velocity Variable"International Journal of Hybrid Information Technology Vol.8, No.3 (2015), pp.329-338

[3] Rashmi Mahidhar, Archana Raut, "A Survey On Scheduling Schemes With Security In Wireless Sensor" NetworksProcedia Computer Science 78 (2016) 756 – 762

[4] P.Anuja and Dr.S.Raju "Energy Efficient, Lifetime Improving And Secure Periodic Data Collection Protocol For Wireless Sensor Networks"International Journal on Computational Science & Applications (IJCSA) Vol.6, No. 3, June 2016

[5] Shailesh N. SisatShrikant J" Security and Privacy in Wireless Sensor Network Using RC6 Algorithm "International Journal of Advanced Engineering Research and Science (IJAERS) Vol-3, Issue-5 , May- 2016] ISSN: 2349-6495

[6] Lala Septem Riza, Andrzej Janusz, Christoph Bergmeir, Chris Cornelis,Francisco Herrera , Dominik S´ lezak , José Manuel Benítez "Implementing algorithms of rough set theory and fuzzy rough set theory in the R package 'RoughSets", Information Sciences 287 (2014) 68–89

[7] Mrs. Anasuya. N. Jadagerimath , "Battery Capacity Management in Wireless Sensor Network Rechargeable Sensor Nodes "International Journal Of Engineering And Computer Science ISSN:2319-7242 Volume - 3 Issue -9 September, 2014 Page No. 8129-8135

[8] Fengmei Liang, Liyuan Zhang, Peng Sun, "Study on the Rough-set-based Clustering Algorithm for Sensor Networks" Buletin Teknik Elektro dan Informatika,Vol. 3, No. 2, June 2014, pp. 77~90 ISSN: 2089-3191

[9] Kun Yang Ruifen Yu , "The Transmission of the Combination of Rough sets and Fuzzy Kohonen Clustering Network Technology Based on GPS Data under Large Data Environment "3rd International Conference on Management, Education, Information and Control (MEICI 2015) "

[10] Shan Zhong, Guihua Wang, Xiaohui Leng, Xiaona Wang, Lian Xue, Yue Gu , "A Low Energy Consumption Clustering Routing Protocol Based on K-Means" Journal of Software Engineering and Applications, 2012, 5, 1013-1015 December 2012 (http://www.SciRP.org/journal/jsea)

[11] Sayani Chandra, Ipsita Saha, Poojarini Mitra, Bidyutmala Saha, Sinthia Roy "A Brief Overview of Clustering Schemes Applied on Mobile Ad-hoc Networks" , Volume 5, Issue 2, February 2015 ISSN: 2277 128X International Journal of Advanced Research in Computer Science and Software Engineering

[12] Shanthi D L "International Journal of Advanced Research in Computer Science and Software Engineering ",Volume 3, Issue 11, November 2013 ISSN: 2277 128X International Journal of Advanced Research in Computer Science and Software Engineering

[13] Shruti Prabha ShaktawatO.P Sharma , "Node Deployment Models and their Performance Parameters for Wireless Sensor Network: A Perspective "International Journal of Computer Applications (0975 – 8887) Volume 88 – No.9, February 2014

[14] Muhammad arshad , mohamad Y. Aalsalem, farhan A.Siddiqui , "Energy Efficient Cluster Head Selection In Mobile Wireless Sensor Networks "Journal of Engineering Science and Technology Vol. 9, No. 6 (2014) 728 – 746

[15] Uros M. Pesovic, Joze J. Mohorko, Karl Benkic, Zarko F. Cucej "Single-hop vs. Multi-hop – Energy efficiencyanalysis in wireless sensor networks "Telekomunikacioni forum TELFOR

[16] Wen-Tsao Pan "A new evolutionary computation - Fruit fly optimization algorithm2010"