Cluster Size And Cluster Head Selection Using Hybrid Techniques In Wireless Sensor Networks

Project report Submitted for the degree of

Bachelor of Technology

In

Electronic And Communication Engineering

By

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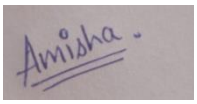
Declaration

I declare that work done in btech report titled **"Cluster Size And Cluster Head Selection Using Hybrid Techniques In Wireless Sensor Networks"** given At Juit ,waknaghat is a actual record of the work done under the guidance of Dr. Naveen Jaglan **.**

(

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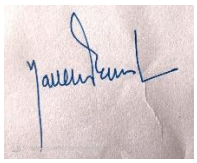

Name of Supervisor:
Dr. Naveen Jaglan
Date:

Head of the Department/Project Coordinator

Acknowledgement

I would thank and express gratitude to my dissertation Guide **Dr. Naveen Jaglan**, Electronic& Communication Engineering Department, **Juit ,waknaghat** for his virtuous direction, inspiration, , guidance, appreciation and moral boosting, which were the intermediary factors in completion of my dissertation work.

The cooperation and support extended by the faculty members and Head of E&CE department is gratefully acknowledged. I thank whole heartedly our supervisor for his enormous academic guidance and great motivational efforts.

LIST OF ABBREVIATIONAND ACRONYMS

List of Symbols

A

ACO	ANT COLONY OPTIMIXATION

C

CH	Cluster head

G

GWO	Grey wolf optimization

L

LEACH	Low energy adaptive clustering hierarchy

Q

QoS	Quality of service

T

TDMA	Time division multiple access

W

WSN	Wireless sensor network

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Abstract

The lifetime of wireless sensor network is very crucial to look for. Many techniques are formulated and deployed for the same.This is a project Report in which we discussed ANO and GWO as our previous approaches and then further continued with smart message. To transfer data over a network in an efficient way. The basic method used to achieve this is by clustering of nodes and traversing a smart message through the network. Smart Message provides an edge over other methods as it improves security as data to be transfered is not traversed throughout the network, instead address of desitination is fetched. This method is very much usefull in cloud networks, servers, etc.

Chapter 1

1)INTRODUCTION

WSN

WSN battery life is very crucial to look for .It is dedicated sensor that monitor various changing scenarios of nature, military field ,also used in medical ,malls and also checks pollution levels, etc.

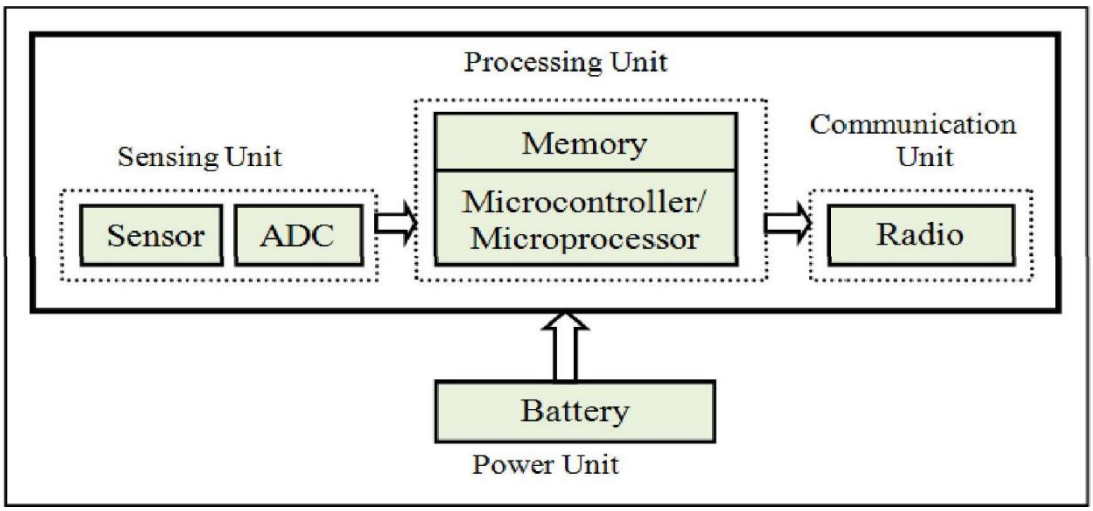


Figure 1.1 : Component of sensor Node

sensor play these roles:

1 Sensing node
2 Relay Node
3 Sink Node plays AS base station

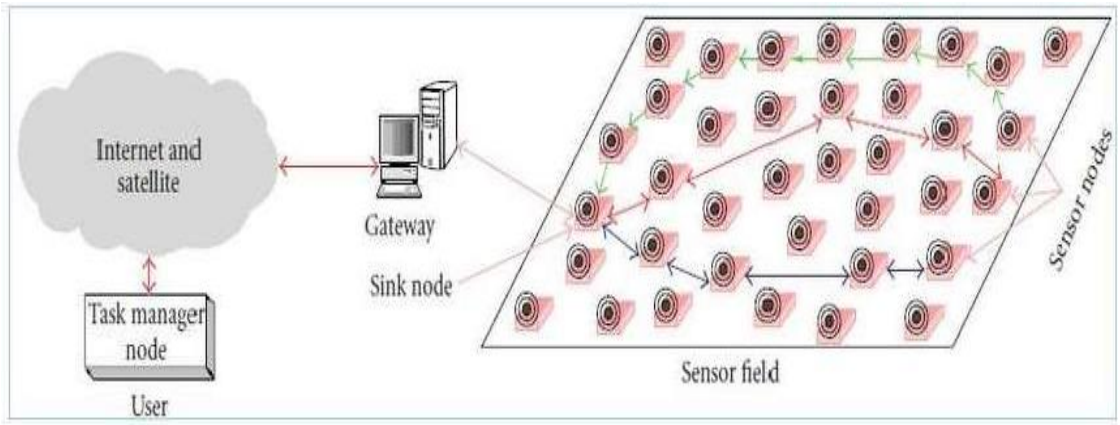


FIgure 1.2 : Deployment of WSN

1. 2 Architecture of wsn

1 : communication model

IT is based on the OSI architectural model and also referred to sensor network Communication Architecture. It include the 5layer and 3 cross planes. These layers help in the carrying out of the sensors together to improve network effectiveness.

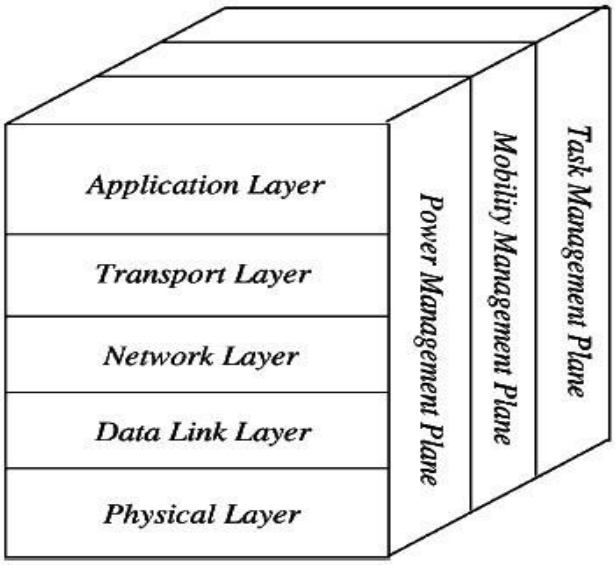


Figure 1 .3 : communication Architecture model of wsn

I) **application layer :** It is responsible for running network traffic.

II) **Transportlayer:** It functions to sustain consistent operation and avoid problem s of blockage.

III) **network layer:** It performs routing

IV) **Data link layer:** address the collision troubles between nodes.

V) **physical layer:** It provides an perimeter for process of transfer the bit streams above (physical) medium.

VI) **vertical planes**: it oversees power, movement and distributions of task among sensor node.

.2 WSN :topologiees

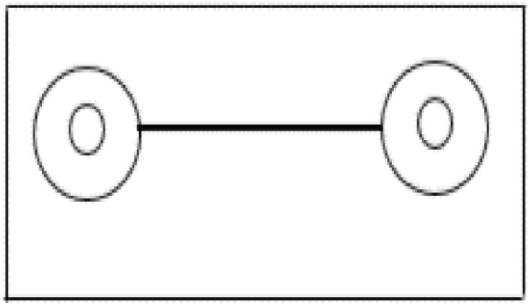


Figure1.4:point to point

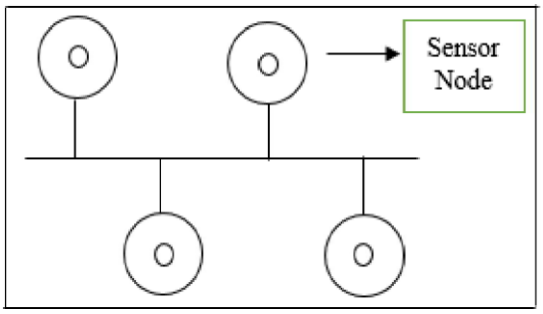


Figure 1.5: bus

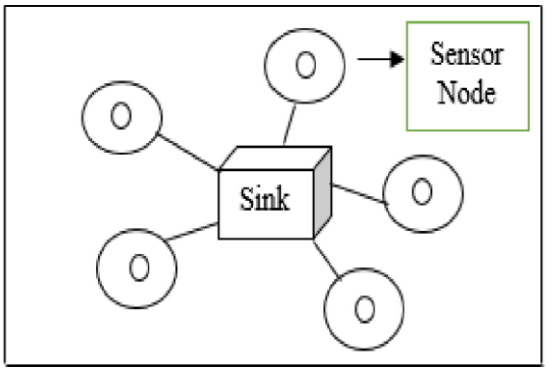


figure 1. 6 : star

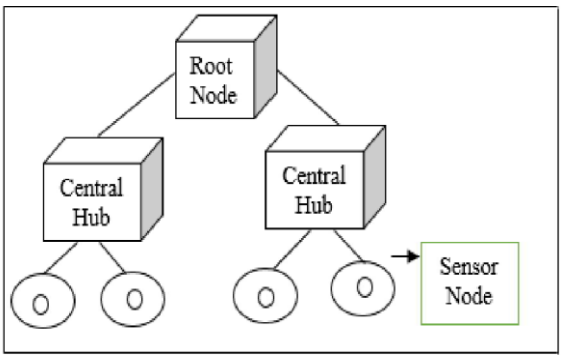


figure 1. 7: tree

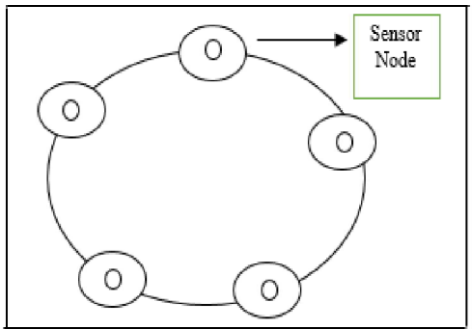


figure 1 .8 : ring

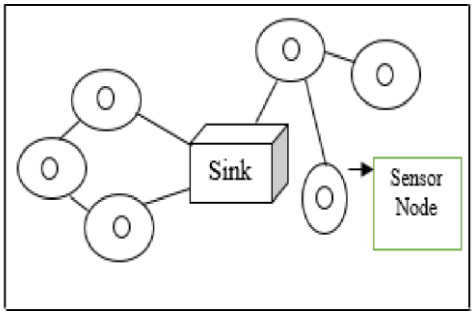
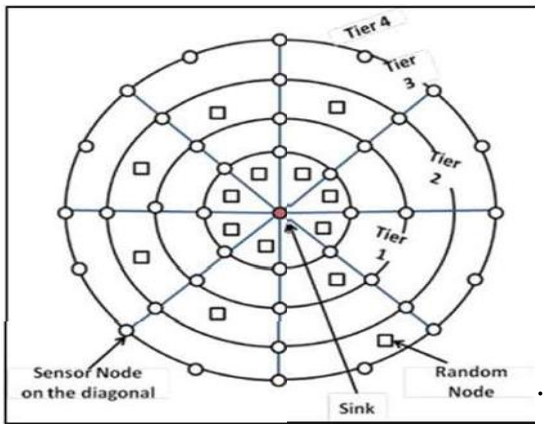


figure 1. 9: mesh



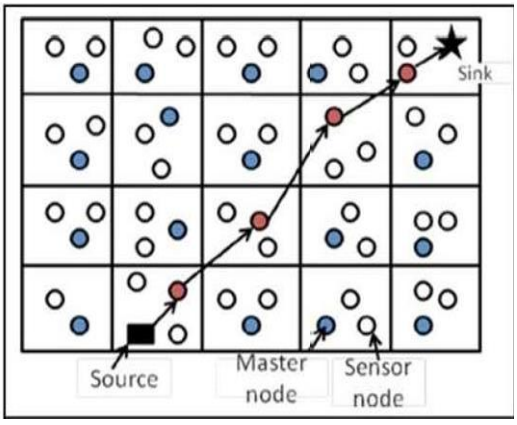
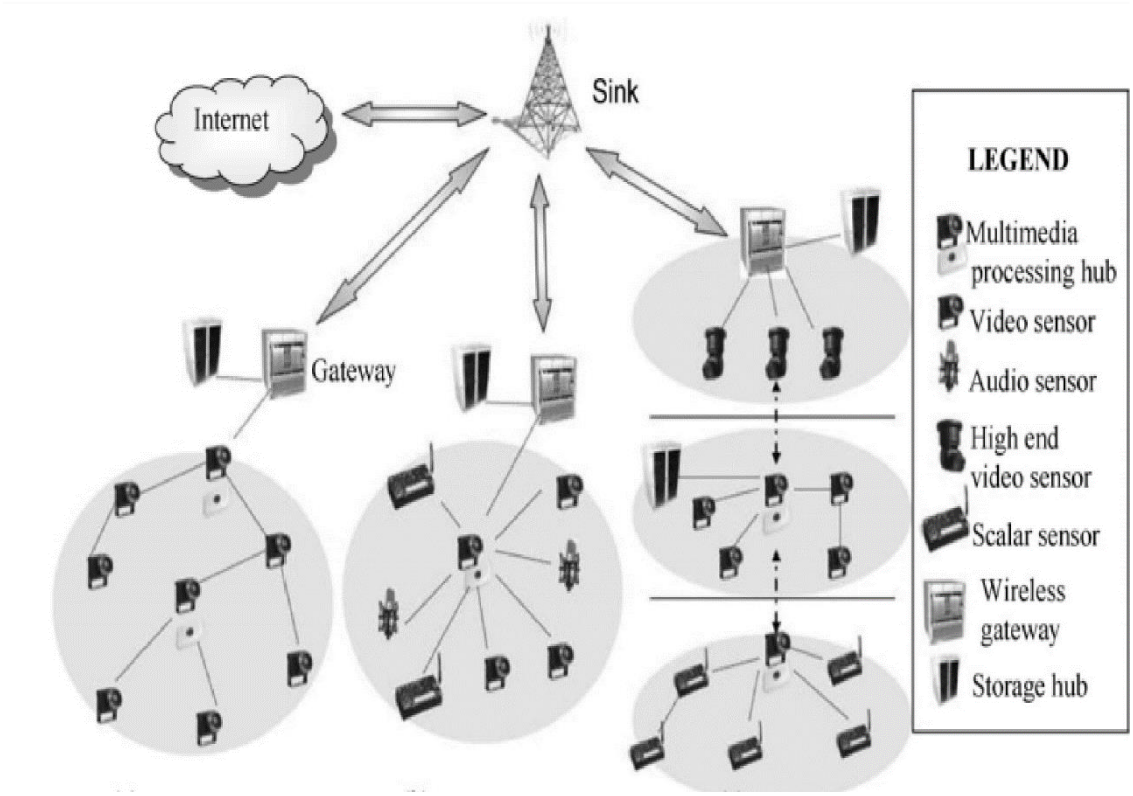


figure 1 .10: circular figure 1.11 grid



(a) (b) (c)

singletier flat, homogeneous sensor, distributed processing, centralized STorage

singletier clustered, heterogeneous SEnsors, centralized processing, centralized storage

Multi-tier, Heterogeneous Sensors, Distributed Processing, distributed storage

Figure 1 .12 : reference Architecture of wsn

1. 3 wsn :characteristic

The four characteristic

- scalability
- Task Orientation,
- Light - Weighting
- Energy

motivation

For weather conditions, pressure ,temperature and getting various conditional stats of animal habitat wsn battery life become important.

Problem formulation and statement

selection of the effective CH and cluster size using GWO with ACO approach.Then further studying smart message technique.

problem with end to end data transfer

- They complete very slowly
- multiple routing as per network topology is not there in traditional methods.
- End to end data transfer donot allow network processingin a way to resuce size of data transferred by nodes.

objective

To see various energy efficient techniques on various parameters in wsn. To propose and validate the technique .

Summary

In this thesis, WSN routing, topology, and application are introduced. Different applications, topology, and routing of WSN. WSNs are networks comprising of tiny

sensors nodes (wireless in nature) capable of transmitting data within the network via the sink.

CHAPTER -2

2. 1 research done

1	Song &Zheng 2018 Energy efficiency optimization for w power sn with nonortogonal multiple access.	Particle swarm optimiszation	Limitation in QoS
2	Kadarala et	Ant colony optimization	Energy efiicient technique and chooses particular path.
3	Fouladlou &Khademzadeh 2017	GENETICS ALGO	COMPARED WITH NATURE BASED ALGO
4	Z.Hong et		Results
5	Mohajeraanj& gharavian	ACO based evaluated routing algo exten lifetime in wsn	also increase effiency.

6	Hammoud and newman 2015		IT IS A TYPE OF SLEEP WAKE SCHEDULING WHICH IS CLUSTER BASE ROUTE OPTIMIZATION ALGO.
7	Mirajalili et al. 2014	Gwo	
Studied many more research paper for references and information			

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SMART MESSAGE LITERATURE SURVEY

- **Smart Message**

I bring up with the idea of design and implementation of SM, a computing platform based on content based naming, self routing, execution migration .a SM migrate to node instead of end to end data transfer between the two nodes of interst.

2. 2 summary

GWO

GWO CONTAINS 4 TYPES:ALPHA ,BETA,DELTA AND OMEGA

. The main features of SM model is:

- It high flexibility in occurrence of dynamic network configuration.

- security Domain : As data to be transferred is not send over the network, but remains with smart message data section only.
- Efficient as clustering is done, so routing time reduces adversely and battery life in nodes improves as all nodes are not doing work of smart nodes.

SM uses in network processing and message passing, so It has benefit of in-node computation as per content and topology based routing.

CHAPTER 3

proposed Approaches and Algorithms

3. 1 introduction

- **GWO :** There are four kind Alpha, Beta, Delta and Omega.
- **TABU Search Mechanism:** It looks for the particular required condition from one budding solution y to an enhance solution y' in the locality of y till the stoping condition is reached.it is a metaheuristic approach which Is based on local search.
- **Smart message:** it only executes nodes of interest which is named by the properties they follow and it is a user defined distributed approach.

  Also, better routing and efficiency of nodes of network, nodes are divided into :

1. **Dumb Nodes** : Only sends and recieve data to communicate with routing section of Smart Message.
2. **Smart Nodes** : Real time graph information updated at Smart Nodes (stores address/link/IP to working nodes connected to Smart Node in system).

Instead of storing information of whole network, it only stores information till next smart node in network and dumb nodes connected to it

3. 2 proposed methodology

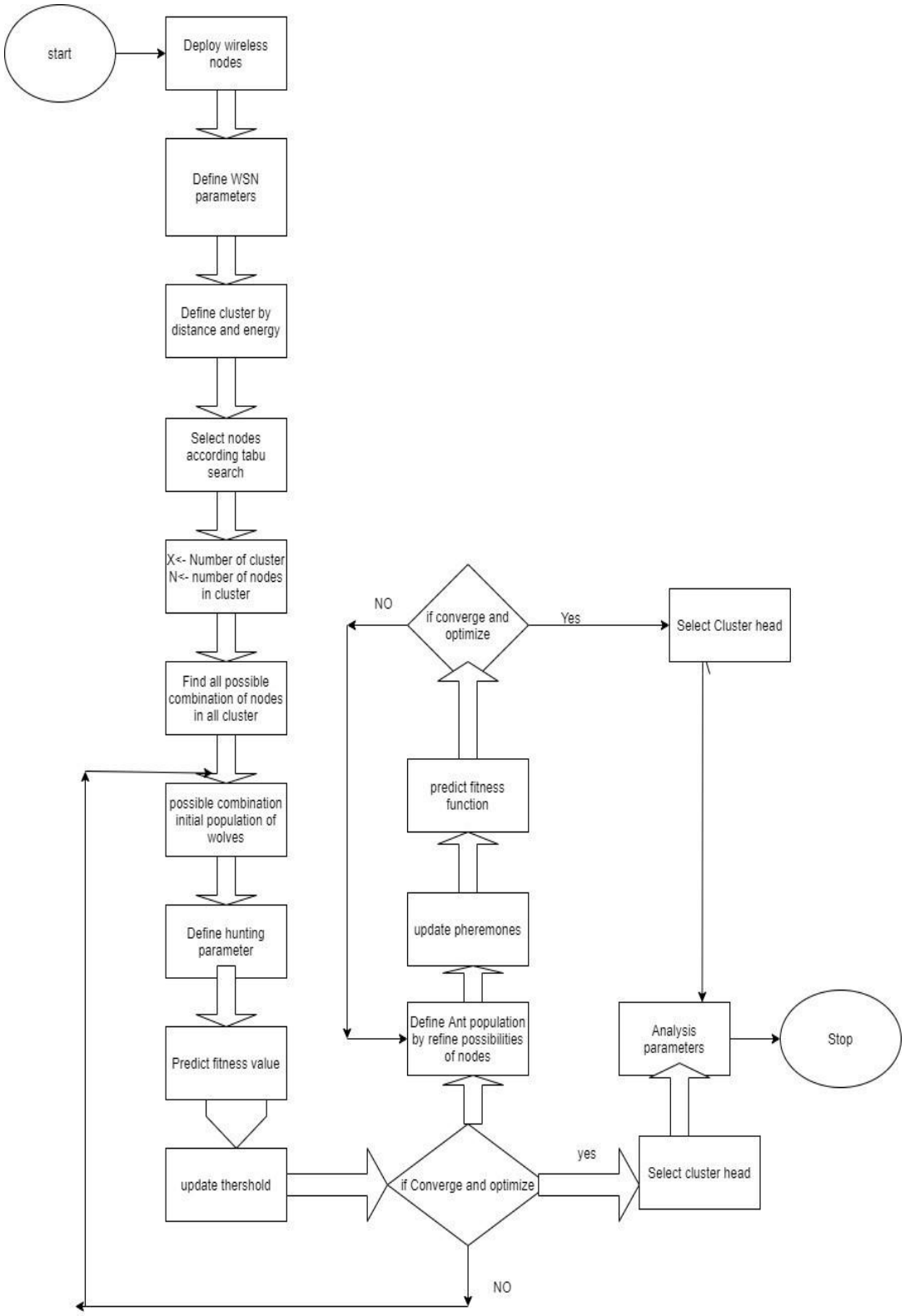


Figure 3.1: Flow Design

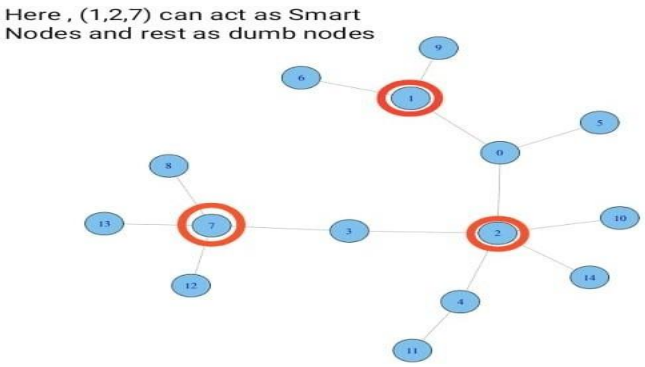
Algo 1 gwo aco discussed previously

Algorithm 2 : tabu search mechanism

Hybrid Mechanism
Using GWO & THE Tabu Search for Cluster Head
Selection dicussed preivously

Smart Message :

1. **Data Section :** Consists of a required sized memory for storing variables and computational values used by code section and routing section while communicating with nodes in a network.
2. **Code Section :** Consist of a code which is used to verify node of interest, communicating with nodes by sending and receiving some data and manage routing section for traversing network.
3. **Routing Section :** Consist of an routing algoritm which uses clustering. Here network is divided into smart nodes(cluster heads) and dumb nodes. Routing section only traverse till smart nodes and then by use of data of smart nodes it easily finds address of desired node.



Working :

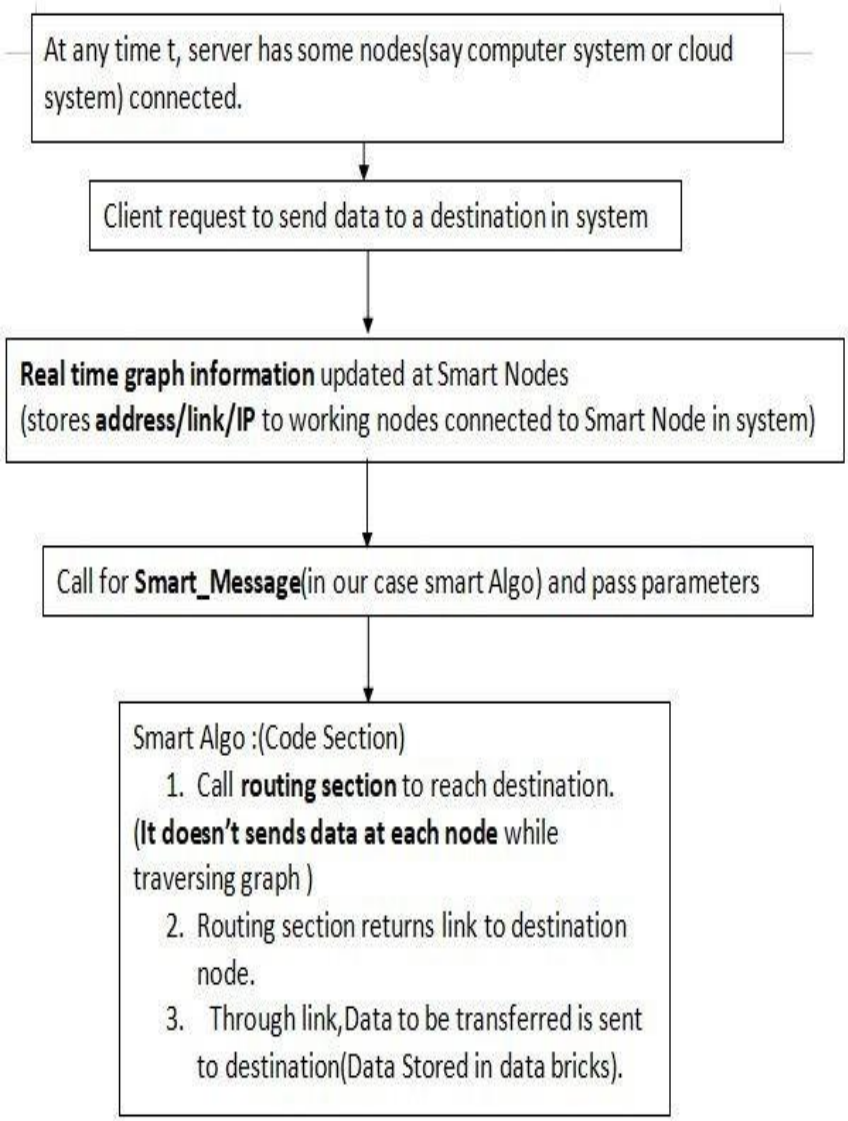
We assume a network system . Let each node of system act as a dumb node i.e. it takes some input and give outputs. On the basis of data received by code section of SM, it computes its desired destination for delivering a secure message.

Say, Client order's his requirement by inputting his message with desired location in graph/network. The code section evaluates it's destination by sending and receiving data from nodes. The path it follows will play a vital role while traversing the nodes of closed graph. This time can be effectively reduced if each node contains the

real-time data of connected path along with updated failure points in the whole network. For that say nodes are transformed into Smart Nodes.

By making each node as a smart node (node containing complete graph path data and updated real-time failure nodes data. It will compute complete accurate path.) will lead to reduction of time elapsed for reaching its destination with avoiding of failure paths. For this, we have to tradeoff with cost of updating data at each node and maintaining them. This is vertical scaling. To compensate or reduce the cost, instead of making all nodes as smart nodes, one can make limited central nodes for computing exact path and leaving rest as dumb nodes. This will lead to increase in time in comparison of asking all nodes smart but reduce cost and and memory. Moreover, making few smart and dumb nodes (clustering) will increase battery efficiency of system or nodes in wsn .

Flow chart of smart message:



Various methods used :

- **smart_node_data_update :** Updates information of dumb nodes and smart nodes data connected to a smart node. It takes reference to the smart nodes for traversing the network and store realtime updated data of graph in smart nodes at an instant. Any basic routing method can be used.

```
void smart_node_data_update(struct node* add_1,struct node* add_2)
{
struct node* header;
struct node*temp;
//first for add_1
int i=0;
header=add_1->link1;
while(header!=NULL)
   {
      if(header->state==0)
      {
         break;
      }
      temp=header;
      add_1->ptr_to_nodes[i]=header;
      header=temp->link;//pints to next node
      i++;
   }
```

```
  header=add_1->link2;
  temp=header;

  while(header!=NULL)
  {
     if(header->state==0)
     {
        break;
     }
     temp=header;
     add_1->ptr_to_nodes[i]=header;
     header=temp->link;//pints to next node
     i++;
  }
 add_1->siz=i;
  i=0;
header=add_2->link1;
temp=header;

  while(header!=NULL)
  {
     if(header->state==0)
     {
        break;
     }
     temp=header;
     add_2->ptr_to_nodes[i]=header;
     header=temp->link;//pints to next node
```

```
        i++;
    }
    header=add_2->link2;
    temp=header;

    while(header!=NULL)
    {
        if(header->state==0)
        {
            break;
        }
        temp=header;
        add_2->ptr_to_nodes[i]=header;
        header=temp->link;//points to next node
        i++;
    }
    add_2->siz=i;
}
```

- **smart_Algo** : This is smart message function. It takes inputs of inital node id(where request is generated), final node id(destination node), data to be transferred.

```
int Smart_Algo(struct node* start_add,int dest_id,int data_to_txn)
{
struct node* header=start_add;
struct node* temp=start_add;
while(header->link->id!=dest_id)
{
```

```
header=header->link;
if(header->nature==1)
{
temp=recurssive(header, dest_id);
if(temp!=NULL)
{temp->storage=data_to_txn;
cout<<"Data Transferred"<<endl;
goto xyz;}
else
{
cout<<"Data not Transferred ! Due to server down!"<<endl;
goto xyz; }}
if(header==NULL)
{
cout<<"Server Down, querry will be updated later on."<<endl;
goto xyz;
}
}
header=header->link;
header->storage=data_to_txn;
cout<<"Data Transfered"<<endl;
xyz: return(0);
}
```

- **recurssive** : smart_Algo consists of an routing section called recurssive. this take initial node id and final node id and returns link to destination to smart_Algo. No information

of data to be transferred is shared with the routing section. This method routes as per the required way dicussed above.

```
struct node* recurssive(struct node* start,int dest_id)
{
struct node* header=start;
struct node* temp=start;
int i= start->siz;
int j=0;
int nature;
while(j<i)
{
if(start->ptr_to_nodes[j]->id==dest_id)
{
return(start->ptr_to_nodes[j]);
}
j++;
}
j=0;
Int topology = 0
while(j<i)
{
nature=start->ptr_to_nodes[j]->nature;
if(nature==1)
{
topo=start->ptr_to_nodes[j]->topology;
if(topo==1)
{temp=recurssivetopo1(start->ptr_to_nodes[j],dest_id);
if(temp==NULL && j<i-1)
```

```
continue;
else
return(temp);}
if(topo==2)
{temp=recurssivetopo2(start->ptr_to_nodes[j],dest_id);
if(temp==NULL && j<i-1)
continue;
else
return(temp);}}
else if(j==(i-1))
{    return(NULL); }
j++;}}
```

Here, recurssivetopo1 and recurssivetopo2 are topology based routing methods(used for illustration through implementation of algorithm in phase 2)

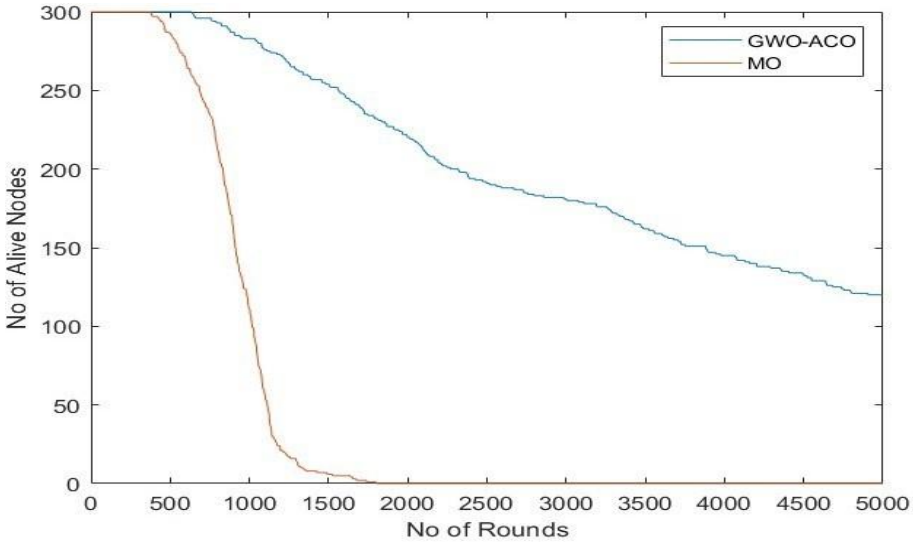
Summary

Usedvarious approaches like GWO and ACO which selects cluster head and cluster size .a proposed hybrid model which optimizes CH selaection using GWO with the help of tabu search in next phase optimization of CH is done by ACO.It achieves energy efficiency to new level so it can utilize real world scenerios for increasing battery life.

Chapter 4

Results and discussion for same:

experimental analysis done



Figur e 4. 1: a comparison on the alive node

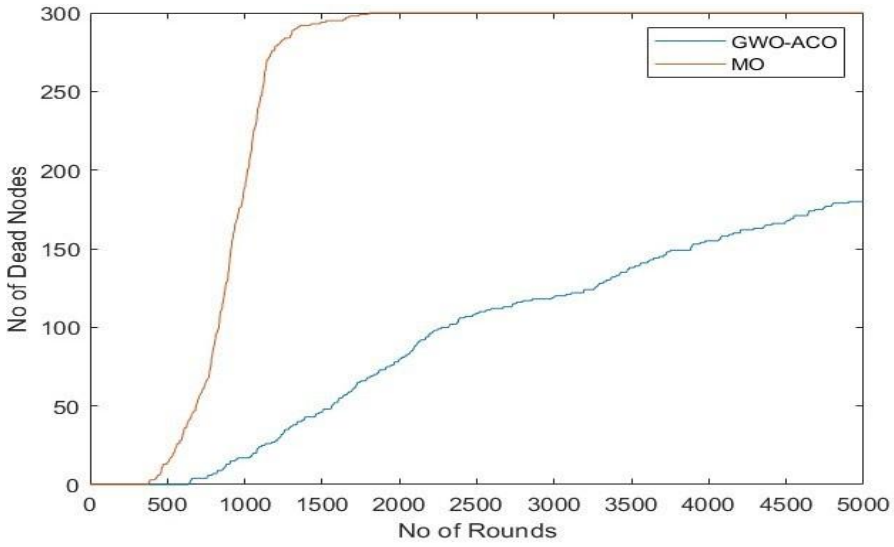


figure 4. 2: comparison using the dead node in unlike round of the packets

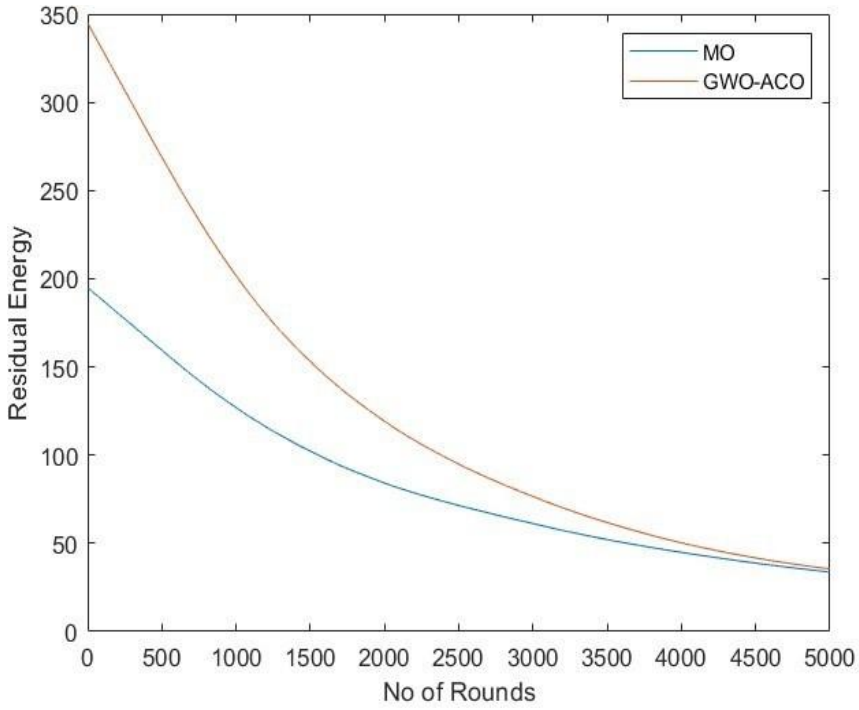


Figure 4. 3: evaluation on residual energy in diverse rounds of packets

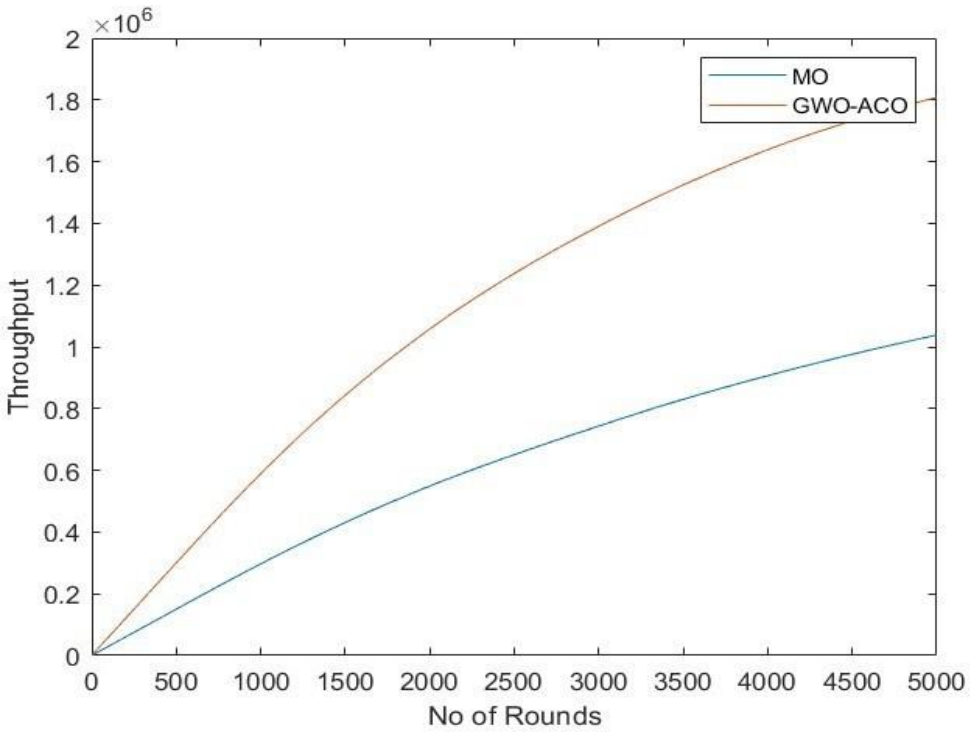


Figure 4.4: comparison of throughput in different round of packets

In above results we saw various graphs in which it resulted that GWO ACO providethroughput which leads to better QoS.IT IS ENERGY EFFICIENT .

WE saw no. of nodes are alive after certain rounds. And compared both techniques.

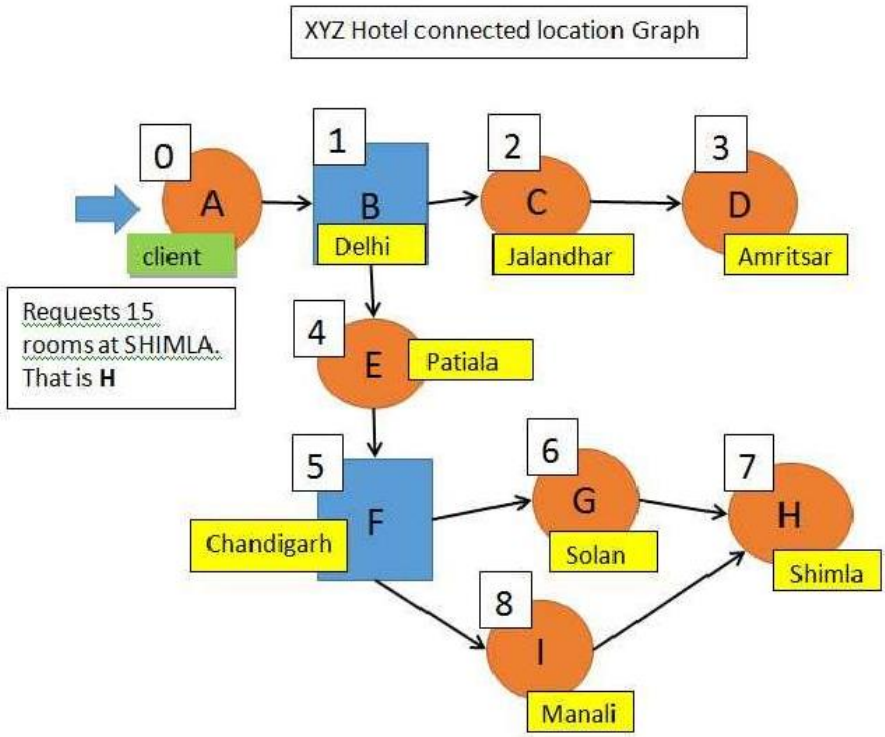
Smart message results:

Implementation of Algorithm

- **Platform used :**

We have implemented the algorithm on a predefined unidirectional network on a C++ platform (in our case : CODE BLOCKS).

- **Assumed uni-directional network graph :**



- Assumed network of Hotel Franchise server.

- Task is to book 15 rooms at ‘H’ hotel.
- Here topology based routing takes place as per network configuration
- B Smart node uses Diff Routing Algorithm as per its network topology of Dumb nodes connected to it.(in our case recurssivetopo1)
- F Smart node uses Diff Routing Algorithm as per its network topology of Dumb nodes connected to it.(in our case recurssivetopo2)
- All the nodes flags and parameters are preset.
- Each node has its own data storing capacity as per type of node.

Outcomes of Algorithm Code

- **Case 1 :** All nodes are active and no breakage in network

```
Updated Data in smart nodes.
NO. of nodes connected to B smart node : 4
ID Of Connected nodes :
2
3
4
5
NO. of nodes connected to F smart node : 4
ID Of Connected nodes :
6
7
8
7
Data Transferred
Checking data at Destination Location
15
Process returned 0 (0x0)   execution time : 0.100 s
Press any key to continue.
```

- **Case 2 :** Either of Node G or Node I are offline(still data gets transferred as no path loss)

```
Updated Data in smart nodes.
NO. of nodes connected to B smart node : 4
ID Of Connected nodes :
2
3
4
5
NO. of nodes connected to F smart node : 2
ID Of Connected nodes :
6
7
Data Transferred
Checking data at Destination Location
15
Process returned 0 (0x0)   execution time : 0.052 s
Press any key to continue.
```

- **Case 3 :** Both Node G and I are off (here data couldn't be transferred and after some time may get lost at smart node)

```
Updated Data in smart nodes.
NO. of nodes connected to B smart node : 4
ID Of Connected nodes :
2
3
4
5
NO. of nodes connected to F smart node : 0
ID Of Connected nodes :
Data not Transferred ! Due to server down!
Checking data at Destination Location
0
Process returned 0 (0x0)   execution time : 0.042 s
Press any key to continue.
```

LINK for Code :

https://drive.google.com/file/d/1o64-VgLDJlNGM4vfzVaQUOnmOYcIR8lf/view?usp=sharing

Visaualisation

•**Restaurant system** of a Franchise: Here ordering a item and making that order reach its desired branch. Here say due to any cause a branch is closed then that node act as failure node while now order needs to be traversed to nearest branch to reduce order cost. In this system central branch or head branch can act as a smart node containing data of complete system and failure nodes.

•**Cab systems** for finding free and booked cabs: Here booked cabs may act as a failure node. Here, a central server can act as smart node for monitoring rest of the nodes.

CHAPTER 5

Conclusion

Conclusion

- Efficient method of transferring data over a network between nodes.
- Implementable on servers and cloud networks.
- Gwo aco and smart message techniques study with result
- If used in WSN, it can effectively reduce battery efficiency because use of
  - Clustering
  - Topology based routing.
- Secure(as data is not leaked at each nodes and remains safe with smart message)
- Supports in n/w processing and overcome heterogeneity problems in vast networks.

future Scope

.Smart message has greater scope.

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