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Honey Bee Optimization based Zone Divided Wireless Sensor Network

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Abstract: **WSN is major field among researches to get better and enhanced life time for network and calculate route for routing more accurately to get better results. Now researchers are moving towards routing with feed forward methods as taking more and more parameters like residual energy, distance from base station etc. in recent works researches are using the no of sensors present for the particular sensor node to route data up to base station. Here we are proposing modified algorithm which uses Honey Bee Optimization (HBO) for routing to get optimized results.In Wireless Sensor Network (WSN) have many protocols like UCMR, UCA, and UCR etc. These are designed for enhance the performance of energy efficiency. In this paper we proposed clustering algorithm named as Unequally Clustered Multiple Routing (UCMR) by using HBO. Simulation result of proposed UCMR improve lifetime over UCR, LEECH, UCA.**

Keywords - : (HBO) Honey bee optimization, UCMR, UCR, UCA, energy parameters.

1. INTRODUCTION:

A wireless sensor network[1] is recent development in making energy efficient giving new direction to deploy these networks in application like surveillance, industrial monitoring, traffic monitoring, cropping monitoring , crowd monitoring etc. There are large no of sensors nodes are used to sense, collect and transmit the data. The basic concept of clustering is used to improve the network lifetime using proposed UCMR algorithm. All the sensor nodes consist of sensor, actuator, memory and a processor sensor nodes are allow to communicate through a wireless media. The wireless media may be radio frequency, infrared etc., having not any connection. All the nodes are deploy randomly in wireless network and they can communicate through a wireless media . These nodes are deployed in a random fashion and they can communicate among themselves to make an ad-hoc network[2]. If the node is not able to communicate with other through direct link, i.e. they are out of coverage area of each other, the data can be send to the other node by using the nodes in between them. This property is referred as multi-hoping. All sensor nodes work cooperatively to serve the requests. Generally WSNs are not centralized one as there is peer-to-peer communication between the nodes[3]. So there is no requirement of prior established infrastructure to deploy the network. WSN gives flexibility of adding nodes and removing the nodes as required. But this gives rise to many drastic changes to deal with in the network topology such as updating the path, or the network tree, etc. In a WSN the node that gathers the data information refers to sink[4]. The sink may be connected to the outside world through internet where the information can be utilized within time constraints. The well known problem in using these networks is limited battery life. This is due to fact that the size of a sensor node is expected to be small and this leads to constraints on size of its components i.e. battery size, processors, data storing memory, all are needed to be small. So any optimization in these networks should focus on optimizing energy consumption[5,6]. In WSN a lot of sensed data and routing information has to be sent which often have some time constraints so that the information can be utilized before any mishap occurs, e.g. industrial monitoring, machinery monitoring, etc. The energy power consumption is much higher in data communication than internal processing. So energy conservation in WSN is needs to be addressed. Caching is a technique which provides faster data access in any computing system[7,8]. With the discovery of cache the accessibility of data has been increased as it stores data to be needed in future and can be retrieved rapidly. Caching has made its impact in the Wireless sensor networks also.The traffic in Wireless Sensor Network depends on number of queries generated per mean time. As stated before the sink injects the query into the Wireless Sensor Network and sensor nodes responds to the query accordingly. They either respond as a query reply or further floods the query to the downstream nodes. Ultimately the sensor node having the result of the injected query will reply to the sink node through some routing protocol. A sensor node also aggregates the replies to a single response which saves the number of packets to send back to the sink node.

A Wireless Sensor Network may consist of multiple sinks. Consider a scenario where more than one sink generates the same query into the Wireless Sensor Network. For such a scene each sink will have its own path developed to the source node which is somehow not required or there can be a way which avoids this. For handling such issues caching comes into picture. To realize the helpfulness of the using caching consider a tree of multiple levels and think of there leaf nodes are communicating to a common child internal node rather than the root node[9]. Means we can cache the results in some intermediate nodes such that each sink will not have to communicate directly to the source node. This obviously saves time and avoids obsolete data traffic in the network. Caching could reduce a lot of data traffic and hence helps in saving response time and energy consumption[10]. Wireless Sensor Networks are prone to

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node failure due to power loss. In order to provide reliable service through the network, the network should be self adjusting and must have adaptable properties as required from time to time. A bottleneck node may encounter failure due to limited battery life. In such case the network protocol should be intelligent enough to handle such failures and keeps the network operational[14]. In WSN network proposed UCMR algorithm is used which uses Honey Bee Optimization (HBO) in order to minimize the energy consumption of network and improve the network lifetime. In wireless sensor network concept of honey bee optimization is used .In honey bee optimization technique is used to optimize the nodes .Various steps are performed for optimization. First different type of parameters are defined like network coverage, base station, no of nodes, initial energy, distance etc .After this uniformly distributed deploying of sensors as per to the environment given in the base station and placing of sink in the area. After that implementing honey bee optimization for routing up to base station then run algorithm for defined period of time and plot various with different parameters.

The remaining paper is organized as following steps : section (2) explain the overview of Honey Bee Optimization, section (3) brief the proposed methodology, section (4) describe the simulation of parameter, section (5) proposed algorithm in detail, section (6) analyses the performance of the algorithm with simulation results and section (7) shows the simulation result.

1. OVERVIEW OF HUNNY BEE OPTIMIZATION:

Honey Bee Optimization is technique used to optimize the sensor nodes deploy at the different places There are various steps to perform the process of optimization by flow chart can be explained below :

Step 1. Deployment of nodes: In HBO firstly nodes are deployed in the network.

Step 2. Distance location matrix: After deployed nodes in network generate a distance location matrix to find out distance from base station .

$$d = \sqrt{\left(x_2 - x_1\right)^2 + \left(y_2 - y_1\right)^2} \quad \text{.....(1)}$$

Step 3. HBO based CH selection: Apply Honey Bees Optimization for selection of cluster head .In HBO different steps perform for optimization. Firstly initialize parent bees and find out fitness value of p bees. Secondly HBO position changes and keeps it into child bees and again finds out the fines value of c bees. If fitness value of child is better than parent it will replace by c bees again find out the fitness value. This means is that CH optimized. CH are best cluster head are find out by this process.The fitness value can be determined by using

FITNESS VALUE

$$= \sum_{i=1}^{i=nodes} \sqrt{\left(CH_{xi} - X_i\right)^2 + \left(CH_{yi} - Y_i\right)^2}$$

.....(2)

Where CH is cluster head and X_i and Y_i is location .

Step 4. Clustering using Dijkstra's algorithm: clustering is routing technique used to reduce the energy consumption. Dijkstra's shortest path algorithm is used for interaclustering and intraclustering transmission. It is used to find out the shortest path.

Step 5. Intra an inter clustering: The communication of all nodes takes place by using honey bees optimization. Select one node for sending data it will find out the distance from all CH and it will select the distance which is minimum from the main node and find out the transmitting and receiving energy. Data will reach to the each CH and this is calls clustering communication. The transmitting energy is :

$$E_{Tx}\left(l*d\right) = \begin{cases} l*E_{elec} + l*E_{fs}*d^2, d \prec d_o \\ l*E_{elec} + l*E_{mp}*d^4, d \geq d_o \end{cases}$$

.....(3)

$$E_{Rx} = l*E_{elec} \quad \text{.....(4)}$$

Step 6. Parameters evaluation: This process of optimization takes place for no of rounds. If no of round completed it will evaluate parameters for plotting the energy consumption according to number of round

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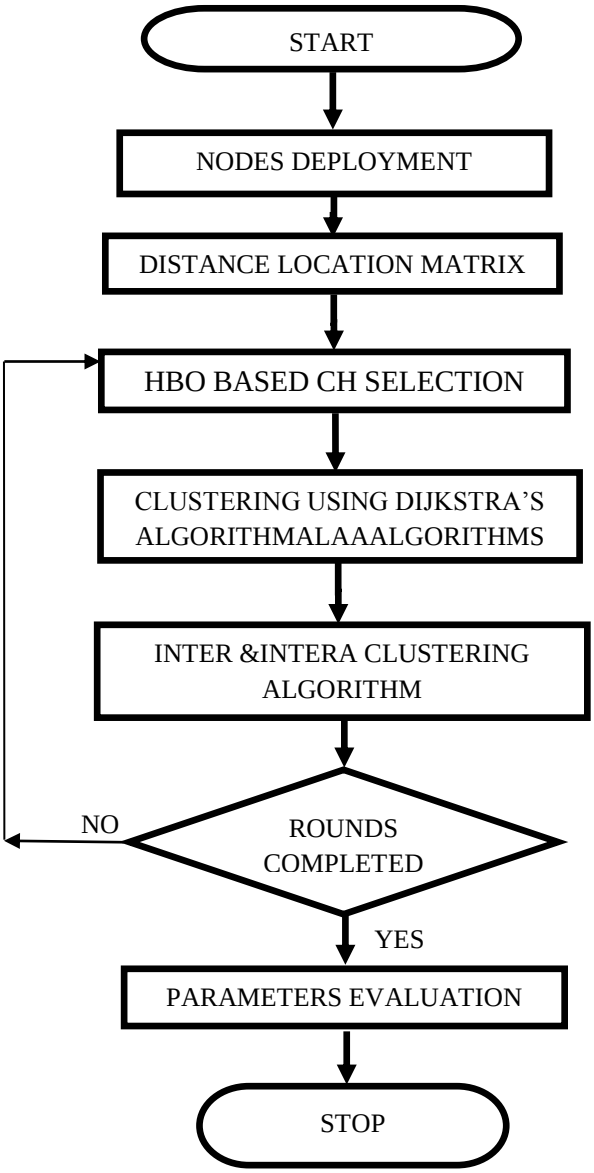

2. Related Work :

In wireless sensor network many clustering algorithms have been proposed in the past few years to improve network life time[10] .Various type of clustering algorithms like UCA (unequal clustering head), UCR (unequal clustering algorithm), LEECH used to improve the life time .LEACH is first algorithm used in the network .It is assumed that all nodes have necessary processing capabilities and abe to coordinate intra cluster transmission to aggregation of data and perform long distance transmission to the sink node . However the distribution of cluster heads is uneven which results in unbalanced energy consumption and partitioning in the network .I am using proposed UCMR to improve the energy efficiency of network .

3. Proposed Methodology:

In methodology used for proposed work is applying the HBO (Honey Bee Optimization) for improve energy efficiency .the result of proposed work will be evaluating by using MATLAB2014 simulator .Matlab is used in academic and research as well as industrial applications. The objective of my work is firstly uniformly distributed deploy of sensor nodes as per to the environment goven in the base paper and placing of sink in the area .Implement HBO for routing up to base station and run algorithm for defined period of time and plot various with different parameters .

4. SYSTEM MODEL:

To solve the network, assume a wireless network consist of various nodes 'N' and the it accept many assumption through the network.The RF energy analytical model of transreciever unit inn sensor nodes is given in [1].The energy spent for transmitting '1' bits over a distance 'd' is

$$E_{Tx}(l*d) = \begin{cases} l*E_{elec} + l*E_{fs}*d^2, d \prec d_o \\ l*E_{elec} + l*E_{mp}*d^4, d \geq d_o \end{cases}$$

Where E_{elec} is energy consumed to transmit or receive a bit, E_{fs} is transmitter energy for free space, E_{mp} is transmitter amplifier energy for multi path and $d_o = \sqrt{E_{fs} \setminus E_{mp}} = 87m$ as in[2]. While receiving '1'bits, radio consumes energy of

$$E_{Rx} = l * E_{elec}$$

5. PSEODO CODES FOR HONEY BEES OPTIMIZATION:

The algorithm for cluster set-up phase is given by :

```
for  k = 1 to k = clusters
    for i=1 to i=bees
        Pci = Ran[ss]
end for
for i=1 to i=bees
        PFi = FF[Pci]
end for
for j=1 to j=generation
for i= 1 to i=bees
       CCi=Rand[ss]
end for
for i=1 to i=bees
       CFi =FF[cci]
end for
       for i=1 to i=bees

if Cfi > Pfi

       Pci=Cci

end if

end for

end for

end for
```

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6. SIMULATION OF PARAMETERS:

In this section, the performance of proposed UCMR is implemented with matlab is evaluated .The various simulation parameters are listed in Table given below.

TABLE 1. SIMULATION PARAMETERS

Parameters	Value
Network coverage	200×200m
BS location	100m ,220m
N	100
Initial Energy	1J
Eelect	50nJ/bit
Efs	10pJ/bit/m4
Emp	.0013pJ/bit/m4
Do	87m
Eda	5nJ/bit
Data packet size	4096 bits
Control packet size	200 bits

The simulation parameters shown in fig 2. Life time is important parameter to evaluating the performance .the proposed algorithm which justified that the life time is better as compare to ucmr and leach and uca .

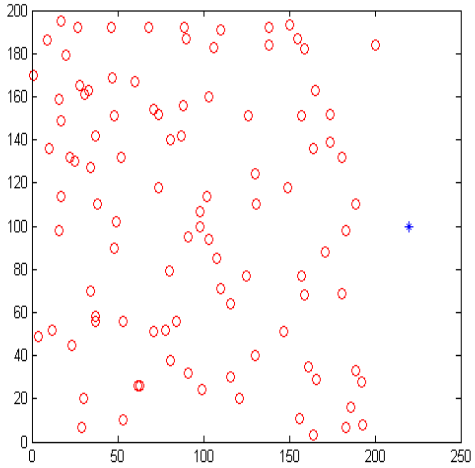

Fig.1 Proposed UCMR protocol deployed networ

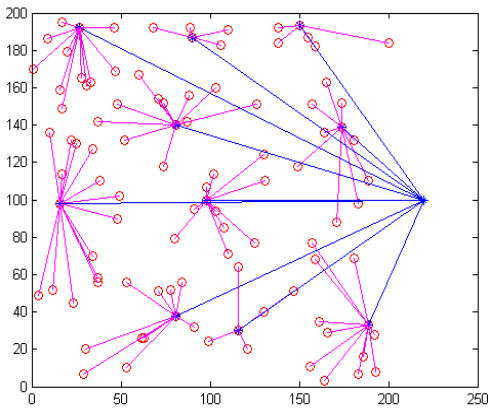

Fig.2.Nodes communication

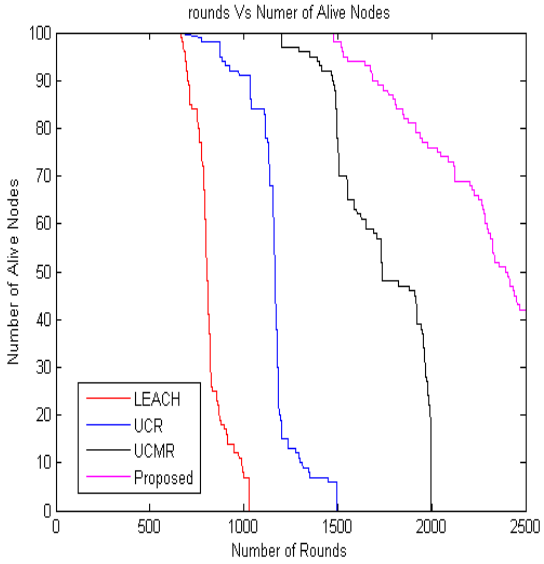

Fig 3 1.Number of alive nodes comparison

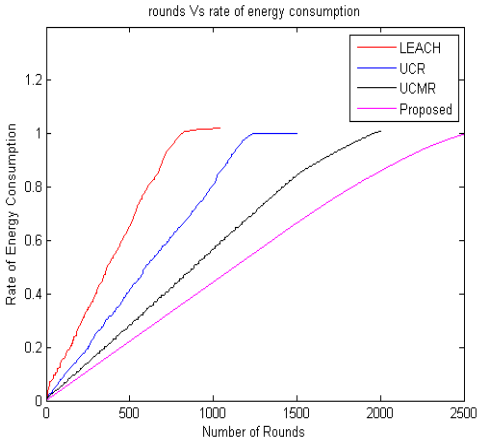

Fig 4 .Network energy comparison

7. CONCLUSION:

In this we will compare the energy consumption of LEECH, UCR, UCMR and proposed mechanism. The reason to increase life time of network as compare to other protocols. After the first node dead the energy is more evenly distributed than LEECH, UCR ,UCMR.In Fig.4 it clears that energy consumption of a node per round in proposed network is lesser than LEECH, UCR, UCMR. So proposed algorithm is simple as well as uses various parameters such as energy, no of neighbour nodes and position of sensor nodes to select CH which improve the network lifetime.Simulation results shows that PROPOSED UCMR extend the life time of network over UCR LEECH protocol respectively.

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