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Load Based Reliable Routing In Multi-Sink Sensor Networks

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Abstract : *Wireless sensor networks, is always a challenging field with few foremost criteria like energy, distance, load etc .A wireless sensor networks can be described as a collection of spatially distributed autonomous sensors, which are widely used in many fields to gather sensitive information and then forwarded to an analysis centre. But still there are many problems in traditional single sink based sensor network. The main problem is the energy of the sensor's near the sink or on the critical path consumes too fast causing unbalance energy consumption. Due to heavy energy consumption the single sink based network causes the breakdown of the whole network. So, over here, we are implementing a new routing algorithm, reliability based path selection approach in multi sink sensor networks. We will also prove that the result of this algorithm is optimum than the traditional method to enhance the life time of Wireless sensor networks.*

Keywords : *Beacon Signal, Multi-Sink, Optimum Path, Routing Protocol, Wireless Sensor Network.*

I. INTRODUCTION

Basically we use the sensor nodes to measure the changes in physical or environmental behavior like temperature, sound, pressure, pollution etc. After that we convert it into a type of signal which can be read by a dedicated system for further processing. Sensor nodes are small, low cost, low power, multifunctional devices which comes together to form a network. The Sensor nodes are generally powered by inexpensive batteries in expectation of serving for a long period [1]. It is widely used by many of our daily essential fields [3] like agriculture, environmental monitoring, military, intelligence etc. In such application several thousand of sensor node might be deployed over a huge monitoring area. So the area or diameter of the region might be very high up to several kilometers, in such cases scalability of network will be very high.

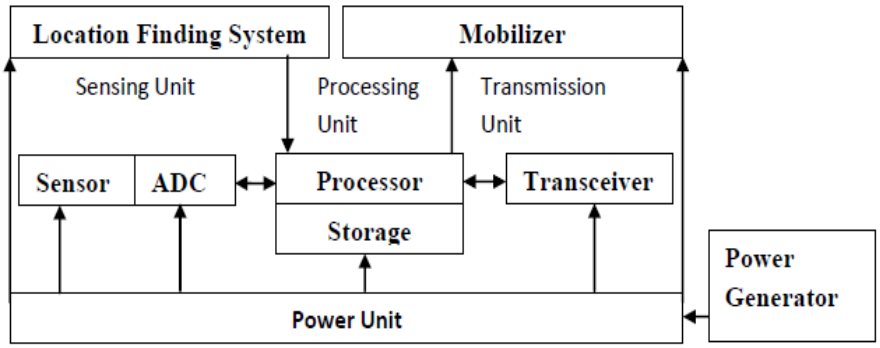


Figure 1. Components of Sensor node.

Fig.1 Shows the schematic diagram of components of a sensor node which contains sensing, processing transmission, mobilizes, position finding system and power unit. The basic function of sensor nodes is sensing, communication and computing. In traditional single sink based network all the data is transmitted to only one sink node, so the sensor nodes near to the sink have more workload then other nodes. The nodes near to the sink consume more energy and deplete quickly. In large scale network with a large number of sensor nodes, multiple sink nodes should be deployed, not only to increase the manageability of the network but also to reduce the energy dissipation at each nodes [2]. As we know that in wireless sensor networks (WSNs) all nodes are connected to their neighbor nodes by point to point connection using TCP/IP protocol. So first of all we have to look the advantages of multi sink networks over the traditional single sink networks.

The multi sink nodes are used to avoid the breakdown of whole network due to the failure of any single sink nodes in traditional single sink based network. In Multi sink network if a sink node stop working due to any reason then data must be transmitted through other sinks with the help of different paths.

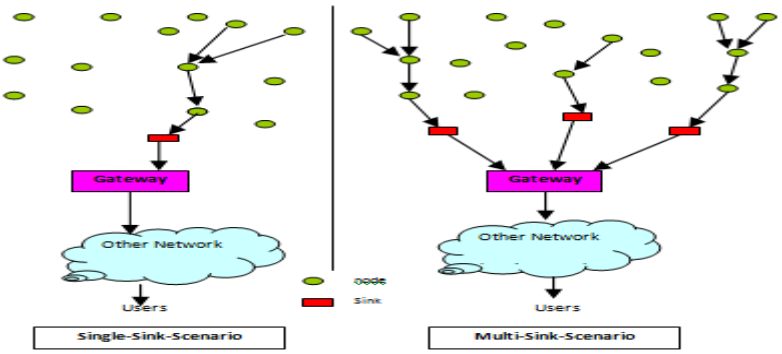


Figure 2. Different Architecture of single and multi sink networks**.**

Fig.2 Shows the different system architecture of single and multi sink sensor networks. In this regards route selection for any instance is the main challenge in multi sink wireless networks. So, data routing is play a vital role in WSNs The design of routing protocols in WSNs is influenced by many challenging factors like, node deployment, scalability, network dynamics, connectivity, data aggregation, node/link heterogeneity, coverage, transmission media etc. The routing protocols in WSNs are classified into three main categories namely, proactive, reactive and hybrid protocols depending upon how the source finds the destination route. In proactive all routes are computed before they are needed, while in reactive protocols routes are calculated on demand basis. In hybrid protocols use a combination of both.

In addition to the above, it can be classified in the following categories depending on the architecture of WSNs protocols [4].

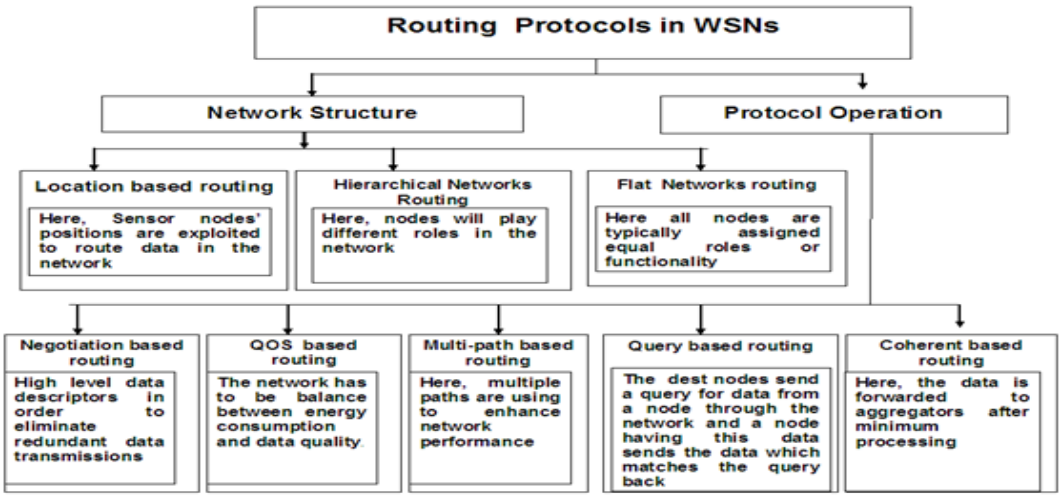


Figure 3. Different Routing Protocols in Wireless sensor networks.

When sensor nodes are static, it is preferable to have a table driven routing protocols rather then using reactive one. In reactive protocols a lots of energy consumed to find the route and its setup. So, for increasing the lifetime of network by balancing the energy consumption among the senor nodes, the reliable path selection for a node in multi sink network is the main challenge for us.

1.1. BEACON SIGNAL

In this regards the actual location of different sensor nodes and sink nodes is very vital issue to calculate the actual distance between them, now a days Beacon signal widely used for this purpose. Today, beacons are primarily radio, ultrasonic, optical laser or other types of signals that indicate the proximity or location of a device or its readiness to perform a task.

It makes wireless system more intelligent and human like. A beacon signal also carries several critical, constantly changing parameters such as power supply, relative address, location, timestamp, available bandwidth, pressure etc. Basically the base station periodically broadcast one beacon signal per second to identify wireless subscriber in a given area. In rest of the paper is organized as follows, in section 2 we discuss the related research works, in section 3 we introduce our main proposed path selection algorithm, in section 4 we compare our method with previous method. Section 5 concludes simulation, 6 contain conclusion and section 7 contain references.

II. RELATED WORKS

In optimal path scheme over WSNs network each node follows specific nodes to relay data according to some criteria in order to maximize network lifetime. In WSN energy consumption should be well managed to maximize the network lifetime [6], [7]. To prolong the lifetime of sensor networks recent work mostly focus on multiple sink sensor network [2] and different type of routing technique [4], [5]. There are many location based routing protocol that provide path from source to destination in terms of QoS parameter [8].With the help of multi path routing algorithm packets should be send from source to destination using more then one possible path to avoid node failure [9]. We are focusing on lifetime issue, location issue [2], [10] etc. In most of the previous load balancing work they have consider the transmission cost and Energy level [11] to find the optimum path from source to destination in Multi sink Wireless sensor networks.

III. PROPOSED WORK

Over here we are work with two main parameters; actual distance and load as our key issue for the path selection in multi sink wireless sensor networks with a scenario that all the sensor nodes have the same energy level at the beginning level when they are deployed. As we know with the help of beacon signal and active scan [12] we can get the actual location, current load of sensor nodes and sink nodes in a given range of area. The load is measure as pending amount of traffic in a node's queue, which already committed to forward its neighbor. The high traffic load causes a data queue over flow in the sensor nodes, resulting in loss of important information [13] and also quickly consumption of power. So load in the nodes can directly effect to the lifetime of the network [14], [15].Consider a sensor network consist of m number of sinks i.e. m number of independent path from source to sink. Path i and path i+l may have or have not equal numbers of intermediate nodes.

For Path $P_i = (N_{1i}, N_{2i}, \ldots\ldots, N_{ki})$

Similarly, for path $P_{i+l} = (N1_{i+l}, N2_{i+l}, \ldots, Nk_{i+l})$

$P_m = (N1_m, N2_m \ldots\ldots\ldots, Nn_m)$.

$\therefore$ So, total number of nodes in the network is,

$N = \sum_{i=1}^{m}$ Number of nodes in i^{th} path.

Among all those nodes in different path they have different traffic load and distance between them.

Now over here, we try to calculate the reliability factor (R_{factor}) path wise, and chose the minimum R_{factor} value for the reliable path selection.

To calculate R_{factor} ,

For every path for i=1 to m

$$R_i = \sum_{s=1}^{k} d(x_s, x_{s-1}) \times L_s$$

Where $d(x_{s,} x_{s-1})$ is the actual distance between two immediate neighbor nodes and L_s is the actual traffic load of a particular node in the same path. K denotes total number of nodes in each path from source to destination and m denotes total number of paths in the network.

After calculating all the R_{factor} , we chose the path which contain minimum R_{factor} from all the paths as reliable and efficient one.

ALGORITHM:

Began:
Consider the network for n number of nodes and m number
of sinks such that each nodes have Same energy level
With different traffic load and distance.

For every path i=1 to m

Evaluate R_{factor} as Σ Intermediate distance × load

If i==1 then

Min_R_{factor} = R_{factor}

Else, if R_{factor} < Min_R_{factor} then

Min_R_{factor} = R_{factor}

i=i+1

End for

Select Min_R_{factor} as optimum

path from source to sink.

End

In this regards if two or more then two paths contain same R_{factor} then, we chose the path which have the minimum distance between Sink and its immediate neighbor in the same path.

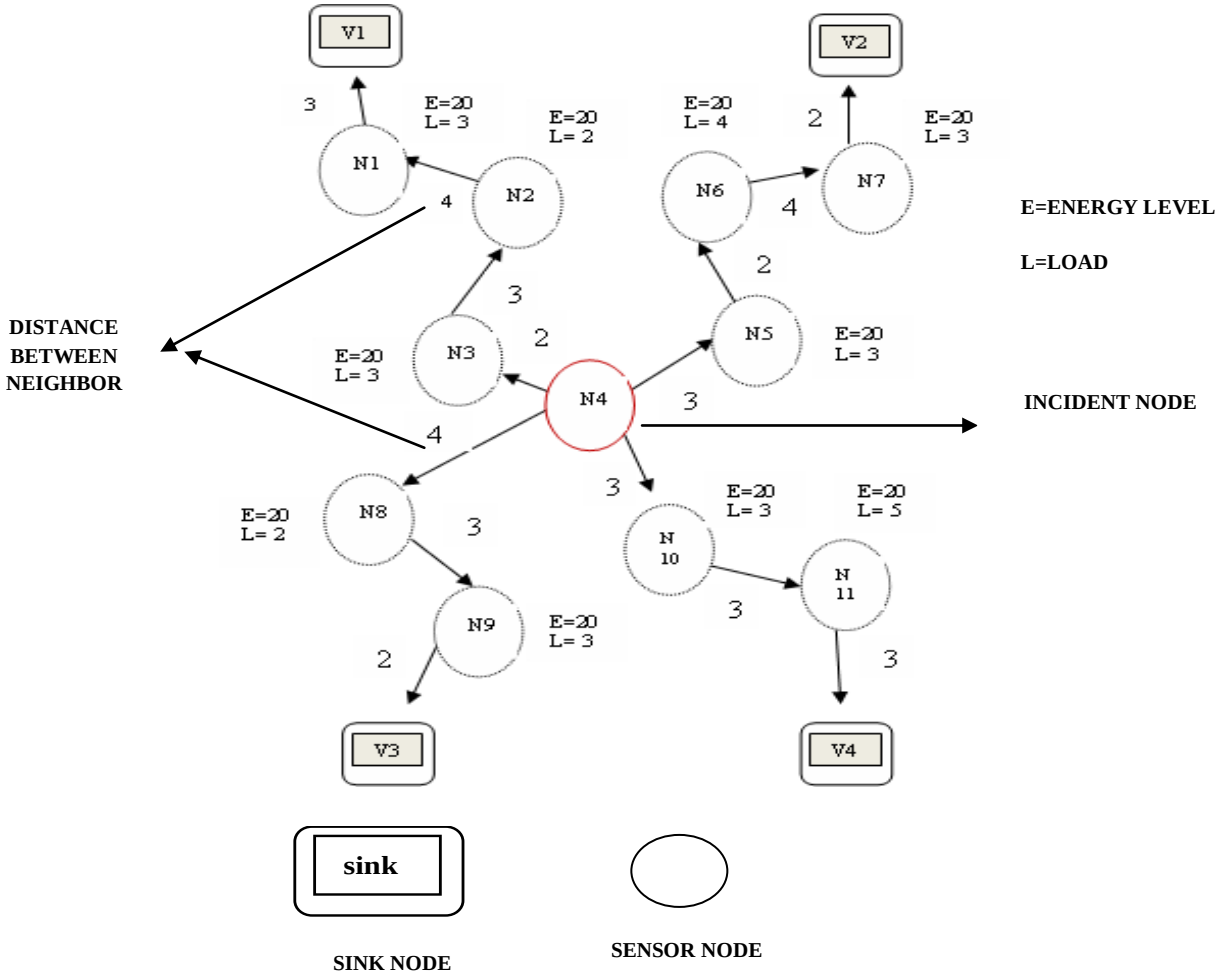


Figure 4. A Multi sink scenario for Path Selection

IV. COMPARISON

From the above given simulation Fig. 4, we can say that, if a sensor node N_4 sense few incident at any moment then it have four option / path to forward the data to the sink V_1,V_2,V_3,V_4. But our challenge is to find the optimum one for it. So we consider the situation and calculate the R_{factor} for each of four path one by one and then finally chose the optimum one among them.

So, according to previous priority based routing [11] ,we get N_4 to V_4 is the optimum path.
Now we try to implement the load factor as our new implementation and as a result we get a new optimum output as follows. We consider a random load for a situation in the above given Fig 4. Finally try to find the optimum path with the consideration of load factor.
According to our scenario,

R_{factor} for each path wise,

R_{factor} for the path one N_4 to V_1 is

$\left(R_{factor1}\right)$ = [(2* 3)+(3*2)+(4*3)] = 24 (where 2,3,4 are distance between sensor nodes N_3-N_4,N_2-N_3 and N_1-N_2 and 3,2, 3 are the load of nodes N_3,N_2,N_1)
Similarly,

$\left(R_{factor_2}\right)$ = [(3*3)+(2*4)+(4*3)] =29

$\left(R_{factor_3}\right)$ = [(4*2)+(3*3)] = 17

And,

$\left(R_{factor_4}\right)$ =[(3*3)+(3*5)] =24

So from the above given data we can easily select the minimum R_{factor} is 17 for the path N_4 to V_3.

Now the optimum path has been changed. Now we can say that with the traffic load consideration the path will change.

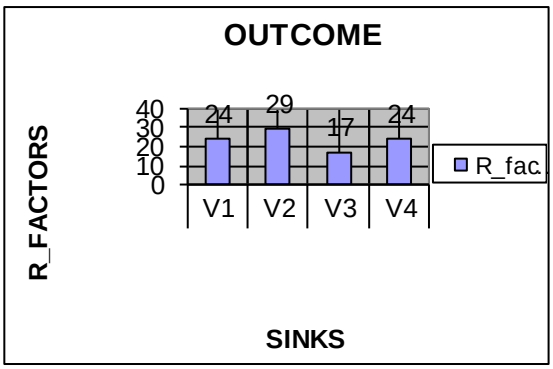
V. SIMULATION

This work has been simulated with the help of Mat lab 8.1 version, with same initial energy level and a random distance for all the nodes. We run it for a network size ranging from 10 to 50 nodes. The performance results presented here in tabular format for the above given Fig. 4, for different situations, each scenario comparing the route selection criteria. In each scenario with different instances, we get different optimum route.

Input for the above given scenario

LOAD FOR N_4-V_1	3	2	3
LOAD FOR N_4-V_2	3	4	3
LOAD FOR N_4-V_3	2	3	NA
LOAD FOR N_4-V_4	3	5	NA

R_factor's out come.



Output Table:

SINK	V_1	V_2	V_3	V_4
R_{factor}	24	29	**17**	24

VI. CONCLUSION

In this paper we are providing a reliability based path selection approach in Multi sink wireless sensor networks. Using Multi sink sensor technology .Over here we overcome the problems of single sink based sensor networks and tried efficiently utilization of energy resource for the sensors. At different scenario with different parameters e.g. distance and traffic load we chose different path to efficiently utilize the resources and it also help us to prolong the lifetime of the sensor networks.In our future work we will implement this algorithm with different platform in multi sink sensor networks to prove its better efficiency

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