Development of Efficient Scheduling for Mobile Sink in Wireless Sensor Networks with delay constraint

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***Abstract:** In a past few years research functionality in wireless sensor network grown up in very impressive manner because of potential application in many areas. Wireless sensor networks for big scale contains multiple numbers of sources and multiple number of sink. This plays an important role in performing applications. So for that in this research we will focus importance on the main problem of sink arrangement for minimizing time delay in worst case as well as increasing the lifespan of wireless sensor network. Here we suggest to anatomy interconnected framework for calculating the junction sink mobility, routing detail. We talk over the causes of subproblems and introduce effective result for them. Then we combine all these results and propose polynomial optimum time algorithm for the actual problem. From this result, we will display merits of involving nodes (mobile sink) and effect of network argument or parametric quantity. (Example: multiple of sensors, sinks and time delay bound) on network lifespan. As we know Wireless sensor network nodes are battery dependent devices which gather data from the environment & send this (information)data to the sink node for further computational processing leading to the dissipation of energy in batteries The batteries are non rechargeable or it may be difficult to replace or recharge in certain environments. These problems results to design a new algorithms for energy efficiency of nodes In a typical conditions the sensor nodes shows many to one communication with the sink, resulting in faster energy depletion of the nodes the vicinity of the sink which is commonly called as the energy deficiency hole problem or the hot spot problem, & hence in this situation the mobility of the sink can help in balancing of energy dissipation of the sensor* **nodes** *In wireless sensor network when information data hold up by working sink it should be bounded. Our outcomes shows that proposed algorithm can work better compared to previous methods and give results when there are obstacles occur in remote places like example: lake, mountain, hill stations etc in the extended area of wireless sensor network. Further directive antennas can increase the transfer chain which* **increase to** *smaller hops and low number of routing delay. Finally the proposed work is analysed in terms of numerical studies and simulations are conducted to validate via MATLAB.*

***Index terms:** Delay bound, Sleep-wake scheduling, Time to live, Node-in route, and Route discovery*

I. INTRODUCTION

One of the important networks in the increasing research area is wireless sensor network for matured of planting and wireless sensing communication methods, Usually mobile sink has to collect data from source node by travelling around it has to deliver data to the user & for sensor networks deployed in remote battle field or mission of surveillance Or to places where it is difficult to get signal in remote areas

This type of networks carries function neglecting for more time duration at the same time energy considerations. Wireless sensor networks are collection of data in the form of unit (it is also find as sink node or gate way or base station) and huge number of mobile sensor nodes which senses and watch to the physical world therefore its capacity to allow fundamental interaction in between network and its nearby physical environment. This will manage the real-time environment in working function such as agriculture and surrounding perception, active spaces, process observing, fantastic life monitoring, healthcare monitoring, defence department, military surveying applications, industrial management, home automation, protection over a security inventory tracking, smart spaces can be managed.

The delay guaranteed to schedule and flow control in WSN are important for delay-sensitive applications in WSN, where data delivery is required in a timely manner e.g packet is sent if they are not received in a specified period or deadline. So we defined scheduling policy by denotation of the constant region, namely the strained constant region in which stabilizes the network with end to end delay & the resulting policy that guarantees delay constraints [1]

Mainly WSN Node includes of Four Basic Units such as Sensing unit, Power unit Transceiver unit, & Processing unit, and out of all these the proposed work is related to Transceiver unit that is, it acts as a transmitter as well as the receiver. It mainly communicates with mobile sink with another mobile sink, Basically, mobile sink (Base Station) is also moving node but has the capacity to acts as Gateway between sensor node & central monitoring task manager through internet or WIMAX like Technologies The challenges are bandwidth, Energy, Traffic, Packet Ratio, Channel loss & Delay

This proposed work where the sink moving freely saving energy of battery & that extended network lifespan of wireless sensor networks where delay of information happened by moving sink can be restricted.. [2]

II. RELATED WORK

In [1] in this paper author proposes sink mobility to enhance the lifespan of the network in WSNs where the time delay of information data happened by moving sink must be restricted. By referring a combinable complexness of this source of problem most preceding proposal offers to concentrate on a heuristic rule and capable of being optimal algorithm reside storage. In this paper, author proposed Delay bounded sink mobility (DESM) for analysing this joined sink mobility with routing time delay, routing overhead, throughput, and to discuss spontaneous sub problems and demonstrate effective result for various trajectories. Then popularize these result and advice algorithm which used as combined- time optimal protocol for the beginning trouble of problem. In pretending, authors display the merits of involving a mobile sink and the effect of network argument like the multiple numbers of sensors, the delay restriction, etc. on the overall network lifespan.

(Delay of data). The delay of data means time spent throughout the mobile sink placing from one sink place to the next sink place. & calculate the declared algorithms using three different trajectories of the sink, are:

1] Linearity of trajectory: in this assume that sink travelling between the predefined routes for example carrying motor (vehicle) sink moves between the paths travelled across the remote area.

2] Boundary trajectory: This trajectory shows that it is the most effective path to combine data in a dull network

3] Arbitrary requirement trajectory: This trajectory shows that there is a small condition control over the distribution of sink places, for example in a conflict area, some limitations of this paper are,

The above paper system backup supports individual sink based scheduling system strategy, & due to that Scheduling overhead is enhances in generalized scheduling methods, the system backup also supports low size wireless sensor networks only as far as the proposed work is concerned. Current work is extended to multiple networks with multiple sinks by using some optimal algorithms.

In [2], according to this paper Author used anycast forwarding algorithm to reduce time delay and increase the lifetime of the wireless sensor networks but anyway sleep-wake scheduling result in significant delays because the node which is transferring require to waiting for its next hop relay node to wakeup grow. In this paper, authors select a sleep wake scheduling methodology to optimize delay when radio is & waiting for the signal to arrive on forwarding strategy for minimizing the considered and results shows that some heuristic solutions to end (source node) to(destination node) end delay

In [3], according to this Paper, scheduling algorithms for TDMA transmissions in multi-hop wireless sensor networks namely specifies the fewest length of the node with the assigning conflict-free of slots in which each node is activated at least once. This is based on the consideration that there are a number of individual streams with point-to-point communication in the network. In wireless sensor networks, however, often data are transmitted through the sensor nodes to small central data gatherers together called as sinks. The scheduling main trouble is so for to define the low length of the node with the difference -free appointment of parts according to which the data packets generated at each every node to reach their destination nodes. The difference node transmissions are estimated based on disturbance graph, which is differ from properly connected graph because of the broadcast quality of wireless transmissions network.

In [4]This paper presents delay measuring which is valuable for multiple reasons, e.g, unnatural information delay detection, & control of real-time condition of the network system, This paper proposes a measuring of network architectural product by distributed air sniffers, which support efficient time delay measuring, and no need clock synchronization at the sensing nodes. In this paper, Author proposes design architecture which used for time delay measuring that uses sniffer in sensor networks. Also, determine that design architecture gives an efficient path for time delay observing and unnatural time delay catching. Furthermore, Authors designed heuristic algorithms for Disturbances takes place due to placement in evaluated the network architecture. Using some optimum calculations and output simulation results, Authors detected that their proposed architecture goes increasing to observing correct time delay and it is efficient in displaying remote area unnatural time delays.

In [5] According to this paper, as the advancement of WSN nodes having larger capacity of communication accepting challenge and sensing abilities, to maximize the lifespan of the network using TDMA based novel algorithm The larger data transmission of the channel in which is sharing of big data leads to delay related problems. The results of disturbance become valuable when coincident transmissions are takes place according to increase lifespan of wireless sensor network capacity which consists of multiple sinks. In such a system, performing a large throughput and less time delay is hard. Authors propose other methodology that uses disturbance conjunction methodology to make low disturbance effects in Sensor Networks (WSNs). In this methodology a number of the transmitter (nodes) collectively encodes their signals to receiving nodes such that (disturbing) signals are isolated and reduced. Calculated output exhibited that compares with TDMA algorithms, the suggested methodology importantly increases the operation of the WSN by eliminating the time delay and larger throughput

III. PROBLEM STATEMENT

Wireless Sensor Networks (WSNs) poses redoubtable design challenges in Dynamic network topologies, Bandwidth, delay strained links, power strained procedure, Network traffic patterns, communication area, storage & processing energy strains, and. In papers [3][12][14], they do not consider delay for the consideration of the receiving sink node is also with power restriction. We propose a sink node route planning in order to reduce or reduction of information delay during movement of sink node considering energy dissipation rather than static sinks. Our methods also can satisfy the constraints of the network environment and reduce the delay of packets caused by insufficient space available in storage these new-types of sensor networks are largely affected by application requirements, challenges and characterized by various resource factors in terms of bandwidth, available dissipation of energy, communication latency and computational capabilities. Routing is one of the important considerations in design of WSNs, more especially under energy constraints; with the exchange of routing control packets increasing power-consumption from the small, non-rechargeable and hard to replace batteries. Thus, it is very important to design efficient algorithms for routing & achieving the purpose of getting data quickly and sending to the destination sink node

IV. PROPOSED WORK

Extended Sink Scheduling Data Routing Algorithm

(ESSDR): It provides a mathematical formulation to have multiple nodes chosen to collect data and arranged in a fixed topology pattern like linear, square or circular fashion within the non hierarchical network. The Sink will traverse the sites and collect the data. The approach overcomes the disadvantages of Geographic Forwarding routing and increases the overall network lifespan because the nodes have to transfer the data towards the sink site. The Sink will be responsible for collecting the data and then send it to the controlling station. increasing existing work to occupy sensor networks with number of sinks by throughout multiple sink multiple site algorithm and also the propose work uses node deployment algorithm responsible for network formation which improves scheduling, the proposed system also uses route security algorithm which can detect multiple nodes at multiple locations to collect data regularly

Route Discovery Algorithm (RDA)

It is found that this algorithm works on purely random decision Propagation, but it improves in the propagation efficiency through the recorded the nodes traversed so far. Particularly, RDA attaches to "node-in-route" (NIR) area to the header of each every share portion. Consider that this area is blank. From the source node to propagate it shares portion to the next hop, the id of the demanding stream node is included in the not in route (NIR field). Nodes incorporated in NIR are prohibited from the conscious decision pick at the next hop. This promises no repetitive propagation & it will be distributed to a different mobile node in each step of random propagation, increasing to the good propagation efficient organization

Geographic Forwarding algorithm

(Finds the multiple routes from source node to Destination node) ---input:

1) coverage field ,Source node, Destination node, and TTL (Time to live (TTL) is the multiple number of hops that a pocket is allowed to transfer previous dispose of being Discarded by a router) is input
2) The source node is collected by the available Routing table.
3) The closed nodes are checked which will fall within the coverage field of the source node.
4) Then the closed node list is examined & checked that is it consist of Destination node or not. If it is true then process will be stopped & Destination node is reached to correct place otherwise it transfer to step5 ---output
5) The closed node is fined by compared the NIR field with the Neighbor node List and then generates a new generated node list then this new node comes in the form of intermediate node.
6) The range value of TTL (Time to live) is decreased at that time the TTL value is checked.
7) When TTL not becomes to zero the current intermediate node becomes source node and Process is repeated from Step1
8) If TTL becomes zero then routing is stopped.GFA finds the number of routes from source node to destination node. Which Computes the trust and then pick a route which has highest trust (which Sends/receives the first packet)

Node Deployment Algorithm

Deployment of Node Algorithm is responsible for formation of network by randomizing the placement of the nodes within the limits (X_{min}, X_{max}, Y_{min} Y_{max}).X_{min}, it is the minimum value of x end point X_{max}, it is the maximum value of x end point. Y_{min} it is the minimum value for the y end point and Y_{max} is the maximum value of y end point.

Node Deployment places the nodes in the network and also generates a matrix known as Node Deployment Matrix which is of order N*3, Where N is the multiple of nodes in the Network. The first column will be Node ID, Second column is the x position for the node and Third Column is the y position for the node. The proposed methods namely Multi Sink Multi Site Algorithm, Node Energy Balancing using Category and Sleep Nodes will be compared with SSDR and Geographic routing using the following parameters

Source node end to destination node end Delay: it is defined as the time taken for the PREQ (Path request) to move from the source node to destination node and then send back the PREP (Path reply) from destination node to source node

$$E2E\ DELAY = t_{stop} - t_{start}$$

Where t_{stop} = this is the time required at which PREP (Path reply) is received t start = This is the time required at which PREQ (Path request) is send

Number of Hops

It is the number of intermediate links available from the source Node to destination node (signal in terms of bandwidth) is called number of hops

Energy dissipation

The energy consumed for delivering the number of packets from the (point) source node to (point) destination node in total network. The total energy consumption is given as follows

The energy consumed by the i^{th} link given by

$E_C = 2\, E_{tx} + E_{amp}\, d^r$

E_{tx} = *energy consumed for data transmission*

E_{amp} = *energy consumed for data generation*

d = total distance between two intermediate nodes

γ = *environment factor*

$0.1 \leq \gamma \geq 1$

The Standard environment factor

Number of Alive Nodes

This is defined as the count of total number of of nodes whose battery level of energy is greater than or it may equal to B/4 Where B is defined as battery level of initial point

Number of Dead Nodes

This is defined as the count of number of set nodes whose energy of battery level is less than B/4.Where B is starting Battery level

Residual Energy

The Residual Energy is computed using the equation

$$RE = \sum_{i=1}^{l} RE_i$$

Where,

l = *number of nodes*

RE_i = Re*sidual Energy of specfic node i*

Routing Overhead

The routing overhead gives the measure of how much amount of control packets are required to send the fixed set of data packets with delay consideration

R_O= 2*N hops/N data * D

Where N hops = Number of hops required

N data = total Number data available

D= information that caused Delay

Throughput is defined by using the following eqation

$$\text{Throughput} = \frac{\text{Number of packet received at destination}}{\text{Unit time}}$$

The Lifetime ratio is defined by using the following equation

$$\text{Lifetime ratio} = \frac{\text{Total alive nodes (number present)}}{\text{Total (dead nodes) number available}}$$

V. RESULTS AND DISCUSSIONS

Simulation Set up – Geographic Forwarding Algorithm The simulation is performed under window 7 environment on MATLAB 2010.

The following table gives all the detailed information of algorithm

Table No 1

Sl No	Parameter Name	Parameter value
1	Source Node	9
2	Destination Node	36
3	Transmission Range	40
4	Initial Energy of Nodes	9999 mJ
5	Energy Required for Transmission	20 mJ
6	Energy Required for Amplification	10 mJ
7	Attenuation Factor	0.7
8	Number of Nodes	100

Output Results

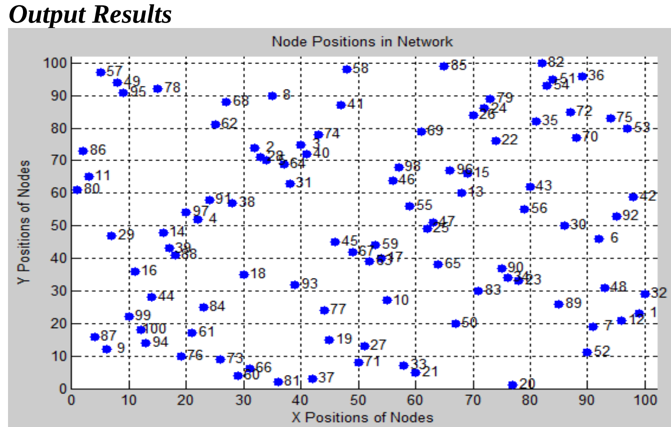

Fig1: Node Deployment Algorithm

Fig 1: shows the Node Deployment Algorithm Output. As shown in the fig the nodes are spread in a 100* 100 area. Each Node (sink or source) is given a unique ID and there are 100 nodes in the network

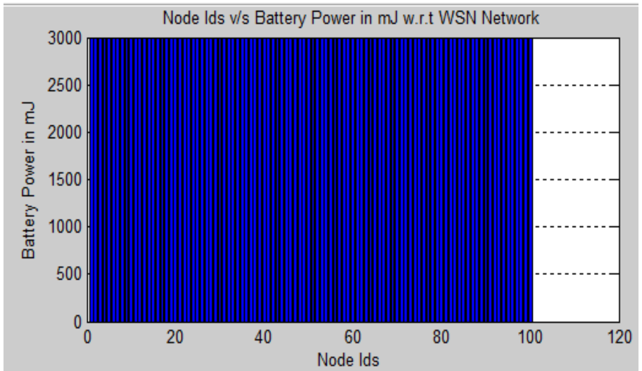

Fig2: Node Ids v/s Battery Powers

Fig 2 shows the Node Ids on the x axis namely Node1 to Node 100 and y axis is having 3000 Mj

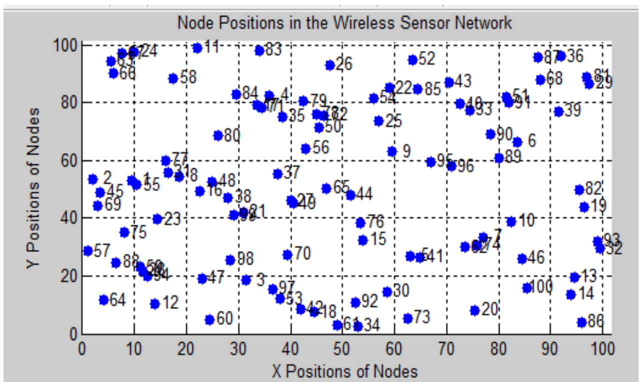

Fig 3: Node Deployment Algorithm

Fig 3 shows the output of Node Deployment algorithm. As shown in the figure Node1 to Node 100 are deployed in the area of 100*100 m

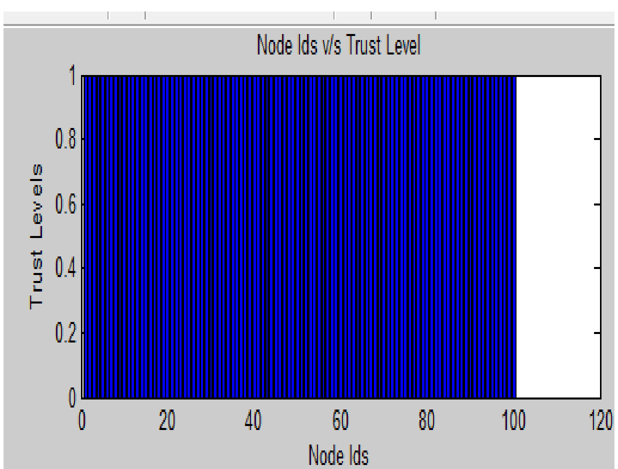

Fig 4: Trust Levels Algorithm

Fig 4 shows the output related to Trust Level algorithm. As diagram there are 100 nodes and then trust level has a value of 1.

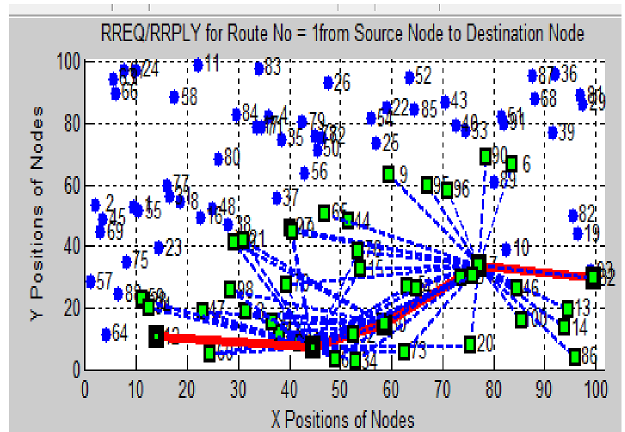

Fig5: Route1 Information

Fig 5 shows the route1 information which has the RREQ/RRPLY. As shown in the fig RREQ is represented in the blue color and then RRPLY is in the format of Red Color.

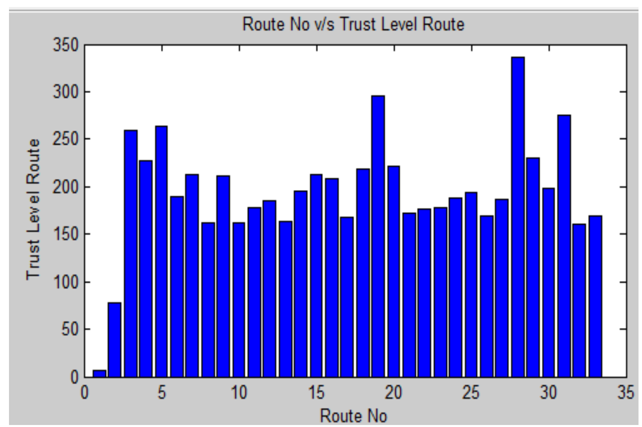

Fig 6: Route Trust Level

Fig 6 shows the number of routes and there Aggregated trust levels in the network

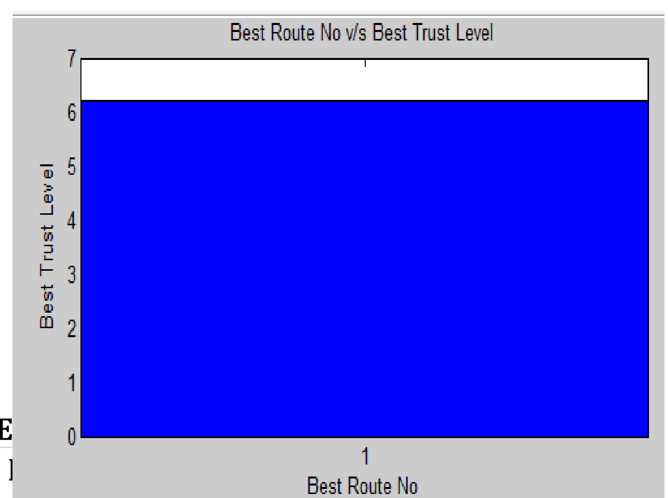

Fig 7: Best Route Trust Level

VI. CONCLUSION

In this proposed paper, for accessing Multiple number Mobile Sinks (MNMS) in WSN with information delay constraint the novel designed protocol called as Multi Sink Multi-Site Algorithm is used to build a combined framework to detect the mobility of the sink problem in WSNs with delay related problems even considering energy consumption to increase the overall network lifetime.

We presented network mathematical calculations that consist of different types of trajectories of issues with respect to sink nodes based on sink scheduling, bounded delay, data routing, and energy consumption and so on. The formulation is general and it can be increased to many more dull remote networks. Therefore, we discussed a number of related sub problems and designed related heuristic algorithms to find the best optimum solution within the proposed framework, we use to apply optimization methods that maximize the lifespan of the WSN subject to the delay related constraints, we demonstrated that our network architecture proves to be accurate in time delay observing and is efficient in denoting unnatural time delays. As future work, we plan to expand our test bed for a maximum scale calculation of our measuring techniques. Hence we are increasing current work to occupy networks with a number of Sinks by using Some combined & generalized Optimal Algorithm like Multi Sink Multi-Site algorithm, Route Security Algorithm & E-SSDR algorithm to increase the Network lifespan For future work, if the mobile sink node fails to reach the sub sink in given time, then it can be consider that the sub sink which has the highest energy will act as mobile sink, & it is ready to collect data and move in the desired path to reach the target sink node.

For future work, if one of the mobile sink nodes fails, then the mobile sinks with highest energy will be collecting data to reach the target nodes to retain its throughput & network lifetime.

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