MOBILE SINK PATH FORMATION TO EXTEND THE NETWORK LIFETIME IN WSN

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Abstract: Wireless Sensor Network (WSN) is a group of sensor nodes that is utilized to observe and record the several physical, environmental, and significant real time data.Data traffic obtained through the Base Station (BS) in WSN minimizes the energy of close sensor nodes as equated to other sensor nodes. This issue is called as hot spot issue in the WSN. But, the Mobile Sink (MS) is proposed for solving this hot spot issue in the WSN. MS is used to gather the modified information from the Cluster Head (CH) and it forward to the BS. This approach presents a Mobile Sink Path Estimation (MSPE) to extend the network lifetime in WSN. The major objective of this article is to designing a MS route to minimizing the energy utilization and delay. In this approach each CH has a threshold level of the load ahead of that if there is an inflow of data, then the node routinely forwards an Mobile Sink Route Request (MS_REQ) for assist from the MS. Depend on the requests received from all CH nodes; the MS evaluates the most appropriate region to move other position. We examine the function of MSPE approach by applying Network simulator. Simulation results demonstrate that the introduced MSPE approach has enhanced the residual energy and minimized the network delay.

Keywords: Cluster head, wireless sensor networks, mobile sink route, network load, energy efficiency.

I.INTRODUCTION

WSNs have wide spectrum of appliance by the sensor nodes which integrate supervising, data attainment, dispensation and data transmit operations are able to auto-configuration [1]. The advantages of WSNs like rapid preparation, precise observing, suitable respond, generally reach in environment, fault tolerance, besides it applied in forces, manufacturing, elegant house, farming meadow, and tragedy surveillance, nature observing, and healthcare, etc., [2].

In WSN, clustering concept is used for improve the scalability and energy efficiency. CHs have assists tasks like data collection, routing etc. In addition, the CHs in the neighboring area of the destination have a very high data relay load, which will lead to an early depletion on its energy [3]. The phenomenon of sensor nodes failing to send data because of the load is referred to as an energy hole. Energy efficiency is a significant characteristic of a routing approach for

necessitate improving the lifetime and enhancing the WSN function. A MS target is gathering observed information from sensing field and it reaches optimized WSN performance [4]. MS movement is a capable technique for enhancing system functioning. In the MS route, the MS can journey regarding the sensing field as well as prevent at certain locations to gather the details from the sensor nodes [5]. Utilization of the MS is minimized the network delay and life time enhancement [6]. Efficient MS Data Collection (EMDC), a solution to the "hot spot" issue in wireless sensor networks that uses the reinforcement learning approach. In this approach, the CHs to minimize the energy utilization and the MS is applied to gather the information from CH based on request reply created from CHs. This approach minimized the network overhead. However, this approach increases the network delay [7].

Self-managed grid-based data dissemination approach using the MS to equate the network load is discussed in [8].Here, the sensors are associated in to clusters and choose the CHs. Then the CH collects and communicates the observed the data to the BS by the MS. This MS is applied for minimizing the energy utilization.MS based energy saving network that reduces the energy utilization and improve the lifespan [9]. Here, the CH is chosen by the remaining energy and the energy utilized in the last round data communication. An efficient CH selection approach that minimizes the route length is described in [10]. MS established data distribution approach is utilized to degrade energy utilization.

The MS movement establishes on the information allocation frequency [11]. Multimedia information collection is obtained by utilizing MS assembly data from sensors. The MS trip position calculation established on virtual-grid scheme [12]. The sensor communicates the information to BS through in-between nodes. Rendezvous-based routing approaches which build a tree and build the rendezvous region in the network. The sensor transmits the information to the sink by the tree. The second method includes the sink sending a signal to the tree that indicates its position. After getting the sink's location from the tree, the sender node will then freely transport the data to the sink [13].

A technique to load balancing that is economical in terms of energy use makes use of multinomial regression analysis, which is a variant of the multinomial logistic regression method and incorporates the spatiotemporal characteristics of the information received from smart circumstances. This forecasting method is used for improving the network lifetime [14]. A multi-class classification resources allocation approach by co-operative development of support vector machine is permitting sub channels to re-claim the lacking co-operating QoS. This approach permits the resources through a co-operative progression of an SVM-by multi-class classification technique [15]. The regulation of traffic lights at high-traffic locations across the network is what the Dynamic Traffic Management system does. In order to provide improvements to the multipath routing, the Enhanced Node Selection Technique is used. This technique is in charge of the optimized node, which contributes to route identification and helps improve the quality of service provided by the WSN. At this point, choose the path based on the received signal strength at each node and the amount of energy that is still available [16].

II. PROPOSED SYSTEM

The WSN consists of numerous sensor nodes and these nodes are distributed randomly. These sensors observe the several ecological components, for example, humidity, temperature, pressure, light, smoke, etc. A WSN comprise arbitrarily distributed nodes with every node behaving as both CH nodes and

sensor nodes. This procedure is applied to adjust the network load by the MS. This approach, the MS formed the round path, angle path, square path and cone path in a WSN.

A. MS balance the CH Load

It is attained by the following property:

1. The sensor nodes are completely autonomous, battery-operated gadgets that let the MS travel between.
2. The BS and the other nodes, with the exception of the MS, are static.
3. A number of the WSN's nodes are randomly expanded over the topological region.

This strategy is separated into three phases:

A.1 Alert Message to MS

Every CH node whose congestion condition is satisfied alerts to the MS by applying MS_REQ message. The MS_REQ message holds an additional slot to illustrate the position of the node that is forwarding the MS_REQ.

Case 1: 50% of queue: Congestion at that particular location may have been caused, in part or in whole, by the condition in which at least half of the line was over its capacity to be served. Therefore, the node whose queue is 50% full will send out an MS_REQ that will broadcast its location coordinates to the network. If the queue is capable of holding up to 1000 packets at once, and if there are more than 500 packets already in the queue, and if there is extra data yet to come, then it will send out an MS_REQ message.

Case 2: 100% of queue: In this scenario, if a node's whole queue is full to capacity with packets, the node will send an MS_REQ message to the MS once the queue reaches capacity. It is likely that some of the nodes will be able to send MS_REQs to the MS after the congestion issue has been alleviated at that node.

A.2 Determination of Next Movement Point

The subsequent moving region is determined by using the total points collected from the various nodes and then spending those points on the total amount of MS_REQs. If there is a node that is broadcasting the MS_REQ, then the following node will plan its journey to the next movement point based on the position of the node whose MS_REQ is retrieved first. If there is a node that is not transmitting the MS_REQ, then the process will continue as normal. The node operation is shown in the algorithm 1, and the formula to determine the subsequent placement of the node is provided in the equation 1 that can be found below.

Line 1	**Algorithm**
1	For {sensor nodes 0 to N} {
2	If {Q_N>Q_{TH}} {
3	Send MS_REQ
4	Wait for MS to enter
5	Transmit data to the MS
6	}
7	exit

The next movement region is discovered by,

$$NxtPt = \frac{1}{m}\sum_{1}^{m}\sqrt{\left(x - x_m\right)^2 + \left(y - y_m\right)^2} \tag{1}$$

The selection of the subsequent movement zone is based on the average distances between the nodes that are geographically closest and have sent out an MS_REQ request for the MS to arrive.

A.3 MS Mobility to the Movement Region

The MS mobility to the next area is based on the predicted movement region for the following region, which was done before. The MS stores all of the MS_REQ values that are collected during mobility to the next point in its cache, and these values are only assessed once information is received from the MS end.

B. MS based Data Collection and Route Formation

When it comes to data transmission, the most important goal of this study is to implement the MS in order to cut down on the amount of energy used, the number of hops, and the latency.

B.1 MS Route (MSR) Formation

MSR is a tree structure, which relates sensor node to observe the surrounding information and then sensor node to communicate the details to the CH. The information is gathered by the MS from the CH, and then the MS passes it on to the BS. Figure 2 shows the MSR Formation.

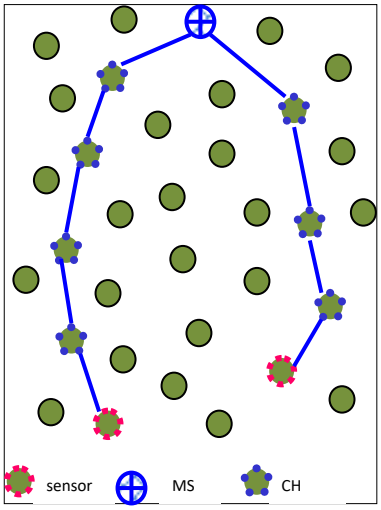

Fig. 1MSR Formation

The MS is located in the CH position, and it periodically passes the join message on to the MSR in order to link it. MS will send a beacon message out over the network, and this message will swiftly propagate throughout the network. Every sensor receives this message, and then, depending on its own results, it chooses whether or not it will connect to the MSR.

Since the CH energy is below the threshold value, the latency in the network, or the low value of the PRR, the CH nodes have ceased participating in the MSR. The formula for determining the minimum allowable energy input is shown below:

$$E_T = E > N_K * E_{ox} + N_{K-1} * E_{cx} \quad (2)$$

Where N_K →Average node count in N hop count, N_{K-1}→The average node count in N-1 hops count, E_{ox} →Energy exploitation for obtaining message, and E_{cx} →Energy exploitation for communicating message.

Looking for the MSR allows a data-transmitting sensor node to figure out how far away it is from both the base station and the mobile station. If there is just a short distance between the sensor and the BS, the sensor will choose to transmit data directly to the BS, whereas otherwise it will utilize the MSR. The sensor node determines the best choice of CH based on transmission range, Received Signal Strength (RSS), energy, Packet Received Rate (PRR), and hop count. It is clear that the MS is aware of its own speed and velocity. Now that it has reached the CH, the MS may begin collecting necessary data.The CH threshold (CH_{TH}) value is provided below for use in calculating the CH on MSR.

$$CH_{TH} = \left\{ PRR, \left[\begin{array}{l} \frac{\mathrm{IE} - P\,\mathrm{E}}{IE} \times \frac{\mathrm{Max}_{TR} - \mathrm{Pr}es_{TR}}{\mathrm{Max}_{TR} + \mathrm{Pr}es_{TR}} \times \\ 1 - \frac{\min RSSI}{\mathrm{Pr}es\,RSSI} \end{array} \right], count\ of\ \ hop \right\} \quad (3)$$

where, IE→Initial Energy, *PE*→Present Energy, Max_{TR}→Maximum Transmission Range, $Pres_{TR}$→Present Transmission Range, Min_{RSSI}→Minimum RSSI, and $Pres_{RSSI}$→Present RSSI.

B.2 MS Movement Shape

The Circle route, Square Route, the Diamond Route, and the Cone Route are the four options that are considered by the MS while planning the path to take in order to collect information from the observation area. These paths are minimizing both the energy utilization and delay.

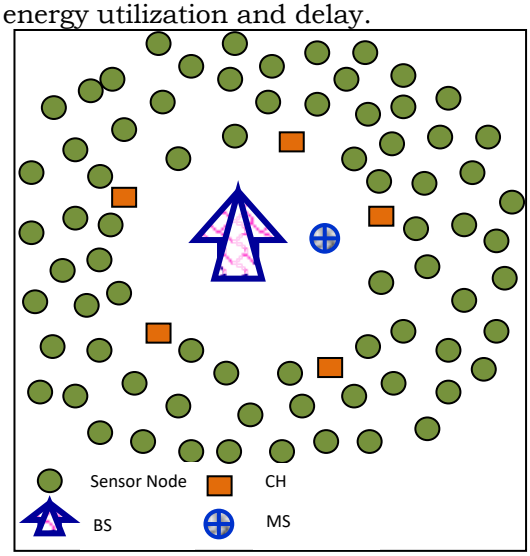

Fig. 2 MS moving circle shape

The MS motion is stable velocity also the MS is absolute the one time successively procedure then forward to collected information to BS. The MS stopping points are close to CHs. In this approach, the BS is positioned at the central region at a time the MS moving the circle path for collecting the data from the CH. The MS is moving toward the interior border of the sensor region, and the MS is comprised of the several stopping stages.

The BS approximately the ring is known as a BS transmission range (BTR). This ring border is being acted on by the MS, which also collects information from the observation area at multiple different stopping stages. As a result, the BS achieves the information sensible mode and minimized the latency. But, the ring border CH nodes energy is dead easily. In order to resolve this problem, we decided to pick the CH based on the node energy, memory, and transmission range. As a consequence of this, it lengthens the period of time a network can function properly and decreases the amount of congestion it experiences. The construction of a moving MS circle is shown in Figure 1, which takes place in a sensor field. The information gathered from the areas around the sensor nodes is monitored and analyzed here. Then the selected CHs are gathered information from the sensor nodes and the MS gets the details from the MS. Finally, the MS forward the collected information to the BS.

In a WSN, the sensors are responsible for sending data to the BS at a certain interval. In order to do this BS, you will need to apply MS, which are mobile that roam throughout a sensor field and gather information from CHs. However, the significance of the route design lies in the fact that the MS is able to cover the whole sensor area while simultaneously reducing the time. The BS in this case is located off to one side, therefore it is up to the MS to collect data from the surrounding sensor area and send it on to the BS. Figure 3 demonstrates the MS moving Diamond Shape and it collects the information from the several CHs.

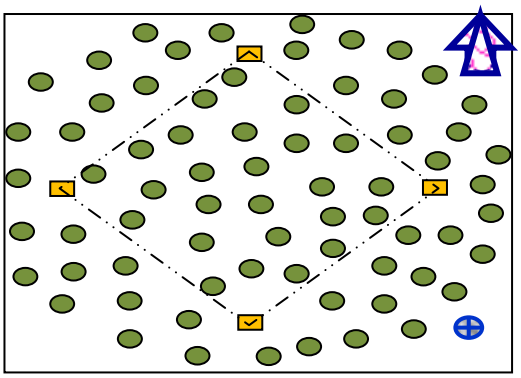

Fig. 3MS moving Diamond shape

Figure 4 illustrates the MS moving Square Shape. Here, the MS moving the square route and it gathers the information from CH then forward to the BS. Figure 5 shows the MS moving Cone Shape. Here, the MS form the cone shape and collect the data to CHs. The MS moving one CH to another CH immediately during gets the MS_REQ. Thus, minimizes the CH load in the network.

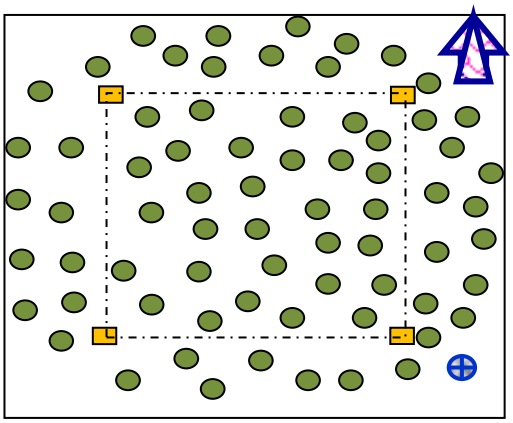

Fig. 4MS moving Square shape

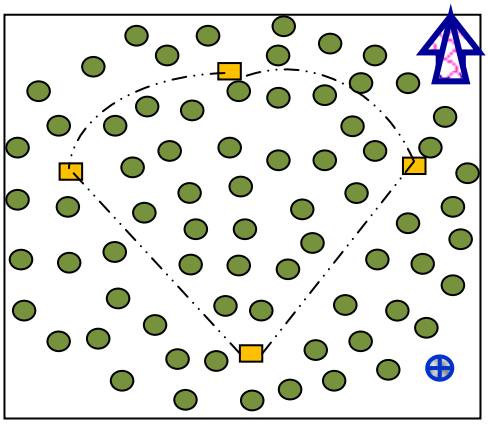

Fig. 5MS moving Cone shape

III. SIMULATION RESULTS

The simulation of the MSPE has 100 sensor nodes distributed in the simulation region 450×650m^2. The BS acts the owner of the network. The MS is moving based on CH request in the simulation region. In this approach sensor nodes are distributed randomly and their energy value is 10 joule. The traffic model like Constant Bit Rate is utilized for WSN. The operation of MSPE is evaluated through the parameters like delay and residual energy.Figure 6 illustrates that the EMDC and MSPE approach of residual energy based on simulation time.

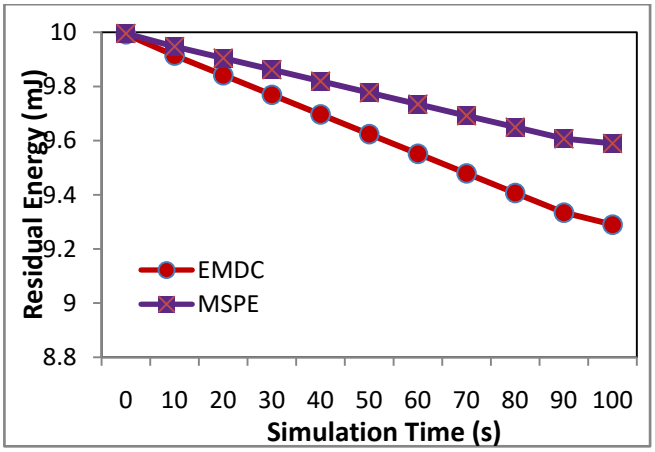

Fig. 6Residual Energy of EMDC and MSPE approaches

It can be seen from the above figure, MSPE approach using lesser energy equated to the EMDC approach. Since MSPE approach using MS to minimizes the CH energy utilization and minimizes the CH load in the network.Figure 7 indicates the delay value of EMDC and MSPE approaches based on simulation time.

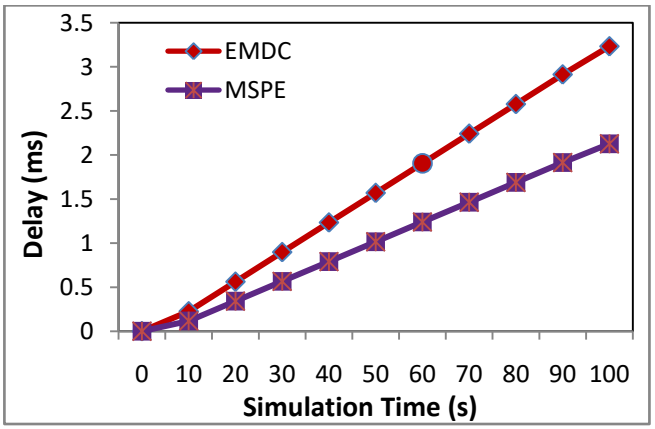

Fig. 7Delay of EMDC and MSPE approaches

The delay of EMDC approach has very high equated to the MSPE approach. Because, the MSPE approach form the various MSR to minimizes the delay and improve the routing efficiency.

IV. CONCLUSIONS

This approach solves the hot spot issues in the WSN by MSR formation to extend the network lifetime. MS is movement across the network, and thus helped to reduce the CH load in the WSN. The MS motion is stable velocity and the MS is absolute the one time succession procedure then forward to collected information to BS The significant concept is to MS gathers the information from CHs as per their demand to reduce the energy utilization and enhanced the network lifetime. The MS in a WSN used a variety of path types (circular, diamond, square, and cone) to build the optimal route. Using the network simulator, the MSPE

technique has been simulated and investigated, and the findings have shown that the network energy efficiency is high. The simulation outcomes illustrate that have a lesser delay and improve the energy efficiency. The significant application of this approach is to the agricultural field for improve the crop yields.

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