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Data Aggregation Approach to Improve the Network Lifetime in wireless sensor networks

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***Abstract*—** The core part of Wireless Sensor Networks [WSNs] is typically sensor nodes which have the ability to carefully collect sensory information, sense, consistently process the sensitive information and communicate efficiently with other connected nodes in the established network. The network lifetime will generally depend upon these sensor nodes, which normally consist of non-rechargeable batteries. Sometimes it processes unnecessary information with high energy consumption. If more energy consumption occurs, the network lifetime is decreased. So, how to efficiently implement the wireless sensor networks to progressively improve the network lifetime is the main aim of this proposed method. In this, a mobile element based data gathering technique is used. In this method, a tinybee is typically sent from a mobile element and comes back to the mobile element with aggregated information. Hence, the tour length of the mobile element is reduced and energy can be efficiently used than the present system. Subsequently, it decreases the delay and improves the network lifetime.

***Keywords*—**Wireless sensor networks, Energy, Data collection, Sensor, Network Lifetime (key words)

I. INTRODUCTION

Wireless Sensor Networks (WSNs) is increasingly gaining affect in our everyday lives and exceptionally fascinating innovation connected to various applications. This remote system comprising of spatially dispersed independent gadgets utilizing sensors to screen physical or natural conditions and that collaborates to make a large scale network with a great many hubs covering an extensive region. WSNs can perceive, gather and process the observed information with collaboration and send to the base station. The sensor node made up of various components such as sensing unit, processing unit, transceiver and power unit. The power unit plays a major rule because it decides the network life-time.

The fundamental components of sensor nodes are a transceiver, one microcontroller, non-removable battery and data storage devices. Traditionally, the organization of sensor nodes in WSNs is more expensive due to the broad area covered by sensor nodes geographically. Moreover, the reliable data typically collected by the sensor nodes are forwarded and routed to the base station either directly or through neighbouring sensor nodes. In such a scenario, each sensor network is capable of providing with service within their coverage area. It can equally extend the service to faraway nodes through multi-hop communication. In sensor networks, data are assembled from sensor nodes and are sent to the base station conventionally called as the sink node. All the sensor nodes are typically energy constraint. Hence, the effective way of energy consumption acquires an extremely significant role to improve the network life time in wireless sensor networks.

There are three phases in data gathering: sensing, processing and transferring. The sensing unit monitors and senses the data from the location sensor is conveyed and afterward, the data can be prepared to stay away from the repetition and finally transferring the data to the base station. The information can be handed-off utilizing two strategies: (1) Single-hop communication (2) Multi-hop communication.

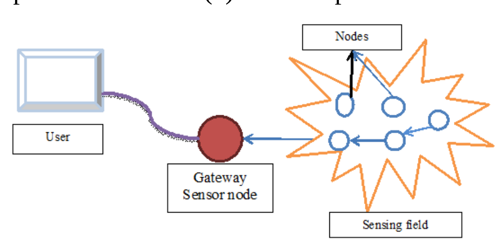

Figure 1: Basic Wireless Sensor Network Architecture

The main problem of WSNs is the efficient utilization of energy. The sensor network consists of a lot of sensors which can be conveyed in the sending field. It expends more energy.

The delay is another major problem. The mobile collector is a dynamic node that acts as an intermediate node to delivery data from sensor nodes to base stations. The mobile collector collects data from sensors and passes to Base station. A substantial measure of data can be accumulated at the same time from multiple sensors can decrease the energy utilization which is a major task in WSNs. In this manner the equalization among these two is necessary. The sensor hubs have restricted battery life. In this way, the sensor hubs must be revived or charged habitually. Along these lines, it expands more energy. In a combat zone application, the base station is far from the mobile collector. Hence, the delay is expanded for passing information from mobile collector to Base Station [BS].

This paper is staged into V Sections. In section II, Related Literature is discussed. In section III, mobile element based data gathering technique is discussed using tinybee. In section IV Experimental results and section VI Conclusions.

II. RELATED WORK

Mario Di Francesco, Sajal K. Das, Giuseppe Anastasi[1] have emerged as an effective solution for a broad range of applications. In Present WSN architecture contains of static nodes which are densely deployed over a sensing area. Latterly, several WSN architectures based on Mobile Element (ME) have been proposed. A large portion of them abuse portability to address the issue of information gathering in WSNs. In this article we initially define WSNs with MEs and provide a comprehensive taxonomy of their architectures, based on the role of the MEs. At that point we present an overview of the data collection process in such a scenario, and identify the corresponding issues and challenges. In conclusion, we compare the underlying approaches and solutions, with hints to open problems and future research directions.

Feng Wang and Jiangchuan Liu[2] have proposed issues and challenges in WSNs. The author also describes the various applications in WSNs. Collection of various data gathering from sensor node is one of applications in wireless sensor networks. Those are the motivation for this project. The major issue of wireless sensor networks is energy consumption. The main energy consumption occurs when unnecessary data have been collected by the sensor node and the increase the length node. This causes the delay and requires high-level energy. In this article, we proposed a mobile element based data gathering approach to decrease the delay and improve the network life time in WSN.

Kaoru Ota and Mianxiong Dong[3] have proposed the data aggregation technique by considering only static sink. In this scenario the delay over the network increases by considering only static sink. The length of the whole network is also increases. In our proposed method, we consider both mobile agent based server and small, tiny bee sensors. This will decrease the delay and improve the whole network lifetime. Mobile agent based method approaches better performance in terms of execution time and power consumption.

Diwakar et al[4] Presented an Energy efficient level based clustering protocol. The author also proposed an energy efficient routing protocol for residual energy of each node and distance from the node to the base station node. This developed model presented by using MATLAB Simulation. In this scenario the algorithm doesn't exist on the route length of the each node. This will cause the more energy and delay will increase. Wherever in our proposed method calculates the residual energy of each node is calculated by reducing the path of the each node in efficient manner. It will decrease the delay, and energy utilizes in efficient manner.

Velmani et al[5] have been proposed a cluster based formation tree. In this approach cluster selection and cluster head are formed to process the data from the sensor nodes. In this scenario, every time, the routing tale will be updated by considering the user information. The role of co-ordinate clusters is reduced by creating the cluster heads. The cluster heads gather the data from the co-ordinate cluster and sends to the base station. This will less consume more energy and delay increases by movement of all nodes within in the clusters and sink nodes. The proposed method collects all the sensor information and reduced the tour length of the nodes to increase the network life time in efficient manner.

Alia sabra and Khalil a[6] Presented survey on Hierarchical cluster based directing conventions for remote sensor systems. The author audited the various leveled based directing plan utilizing homogeneous, heterogeneous and multi-hop classifications. The creators broke down execution of the decreased energy consumption and enhance organize a lifetime. In presented system, we mobile elements reduces the tour length of the network and decrease the delay of the networks. The proposed algorithm gives the best results than the existing algorithm.

Ramesh Rajagopalan and Pramod K.Varshney[7] have displayed a complete review of information accumulation algorithm in remote sensor systems. The greater part of the works centers around the improvement of critical execution estimates, for example, organize a lifetime, information inactivity, information precision, and energy utilization.

III. METHODOLOGY

A large portion of the data gathering framework just uses the static servers yet here in this methodology, we are utilizing the concept of mobile server i.e. the server is mobile. The server meanders around the system. The proposed method uses Mobile Element to collect the accumulated data from sensors. In this technique, the sensors are conveyed in an organization field. The sensor detects the information and procedures the assembled information and accumulated the information. The mobile component can be utilized the collected information from the sensor in a detecting field by utilizing portable operators called as Tiny Bess. On the off chance that the Mobile Element needs to make a trip to every sensor to collect information then the delay will be increased. Therefore The ME dispatches the tiny bee with the end goal to gather information from sensors. Subsequently, to gathering information from sensors, it returns to the ME with aggregated information. Along these lines, there is a decreased movement of ME. Therefore, the energy can be efficiently utilized by reducing the tour length of Mobile Element. The proposed network architecture is as shown the below diagram consists of a mobile element, convergent node, tiny bees and base station. The tiny bees send the information to the convergent node and convergent node forwarded to the mobile element with collected information. The Mobile element finally sends the collected information to the base station.

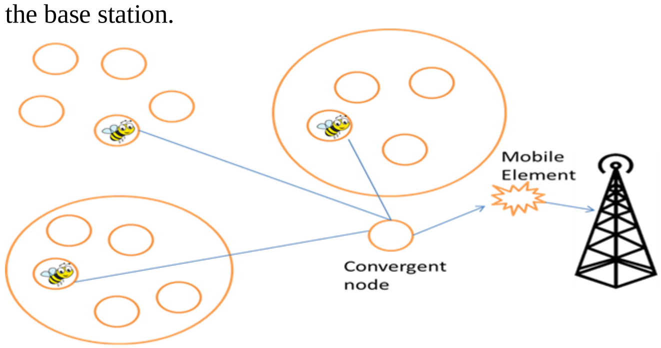

Figure 2: System Architecture

Clearly, the proposed method has followings stages after creating the network topology and cluster formation.

Optimal Clustering: optimal clustering is a vital role to achieve energy consumption in wireless sensor networks. If more number of clusters while keeping equal processing, load on Cluster Head [CH], will increase the overall communication overhead. As a result, the overall energy consumption gets increased. In contrast, if the number of clusters is less, then it will results in a large size of each cluster. In a large, sized cluster, the father nodes need more energy to transmit data to its respective CH. Therefore, cluster size cannot be too big or too small, an optimal cluster size needs to be chosen. Ultimately, there will be an optimal number of clusters. Forming optimal number of clusters improves network lifetime, energy efficiency, and scalability.

Process of the Roving Element (RE): The RE has the four processes in total: *MoveAround, SpawnTinyBee, SendRREQ and GetTinyBEE.* Generally, the RE keeps running a function *MoveAround* to walk around sensor nodes until the end of a network, while a function *SpawnTinyBee* is called to dispatch TinyBee to a sensor node periodically for some intervals. Then, the robot records the location of the node where it dispatched TinyBee. This information is used later in a function *SendRREQ* to broadcast an RREQ message when the sink node reaches the end of the network. Finally, the base station ready to receive one TinyBee with aggregated data from the sensor node by invoking a function *GetTinyBe.*

Process of tinyBee: TinyBee has the four process executed on a sensor node: *Migrate, CollectData, Head2RE and AggregatedData.* After being created and dispatched by the RE, TinyBee runs a function *Migrate* to move on a neighboring CH node according to a deterministic itinerary. Once TinyBee visits a CH sensor node, it runs a function *CollectData* to gather data from the visited CH node. After collecting data, *Migrate* method runs again to migrate from CH node to CH node. These two procedures are repeated in order until TinyBee finishes its itinerary where TinyBee returns to a starting node. After completing its tour length, TinyBee stays on the present point until a route to the convergent node is formed by checking a routing table of the node. As soon as TinyBee follows the route, it runs *Head2RE* method and migrates from CH node to CH node until reaching the convergent node. When getting to the convergent node, a function *AggreatedData* is invoked. This function uses all TinyBees to collaborate with each other, so that all data in aggregated successfully. Finally, one of the TinyBees is selected and sent back to the RE with the aggregated data.

Processes of CH Sensor Nodes: A CH sensor node transmits and receives TinyBee as well as a RREQ message. Since TinyBee already has its own itinerary to collect data, the CH node simply sends it to the next node according to the itinerary after executing TinyBee code. If the CH node is the end point of the itinerary, it keeps TinyBee until receiving an RREQ message. After receiving an RREQ message, if the node is the destination indicated in the RREQ message, it transmits TinyBee like a conventional data packet. Otherwise, the node looks up its own routing table and checks a route to the destination. If the node has the route to destination, the RREQ message to all its neighboring nodes. The remaining energy on a node would be checked before updating a routing table on each node. In addition to the above mentioned routines, a sensor node has to undertake a special procedure when it is selected as the convergent node by the base station. Specifically, one of the outer nodes in the network executes this procedure since the base station selects a node from the outer nodes whenever the base station reaches the end of the network. After a node is selected as a convergent node by the base station, the convergent node receives data containing the location of nodes where the base station dispatched TinyBee. Then, the convergent node broadcasts an RREQ message to find a route to these nodes. As soon as it successfully dispatched by the base station, the convergent node transmits one TinyBee with aggregated data to the base station.

IV. SIMULATION SETUP AND RESULTS

The experiments for the evaluation of the proposed plan have been completed using the network simulator ns-2. The simulation scenario is set up the network topology within the area x and y dimensions are (3000, 3000). For this, we have to use the dynamic sensor routing protocol. Mobile Elements are responsible for detecting the concurrent node and sending data to the base station.

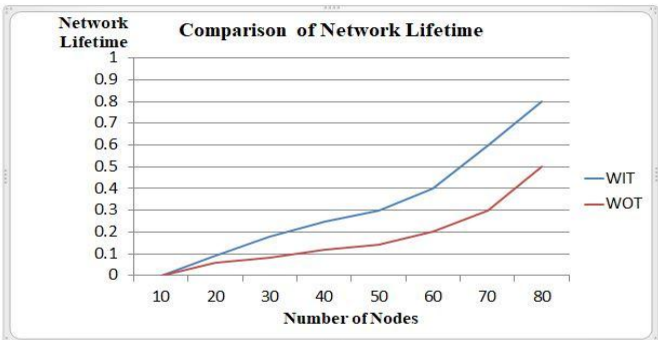

Figure 3: Comparison of Network Lifetime with Existing system.

The proposed plan is compared with the normal mobile element based on data gathering approach which reduces the delay and improves the network lifetime as a result of less energy consumption. The Mobile Element gathers the aggregated data along with tiny bees and the data is sent to the base station by reducing the tour length of Mobile Element [ME]. The proposed plan increase the network lifetime compared to existing methods.

Figure 3 shows the comparison of network lifetime with existing system. In this the numbers of nodes are taken in horizontal, x-axis and the network lifetime is taken in vertical y- axis. Clearly our proposed method with in tinybee increases the network lifetime when compared to the existing system.

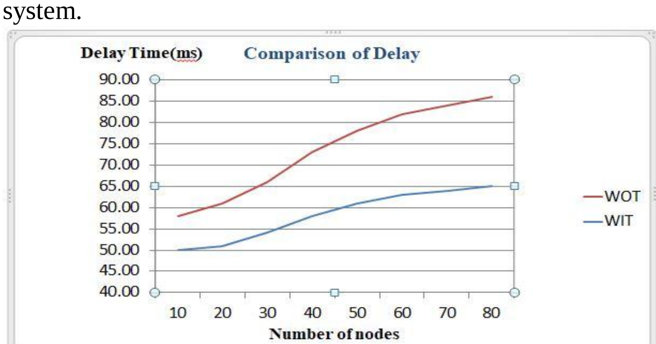

Figure 4: Comparison of Delay with Existing system

The above figure shows comparison of delay between the without using the tinybee and within tinybee. The delay is measured by calculate the difference between at time sender sends the packets and at time receiver receives the packets. As from the results our proposed method decreases the delay when compared to the existing system.

V. CONCLUSION AND FUTURE SCOPE

The proposed method introduces the mobile element based data gathering technique with tiny bees. The Mobile Element that collects data from deployed sensors while it moves around the network. For this, the tour length is reduced and decreases the delay. The proposed plan effectively increases the network lifetime by utilizing less energy consumption. The simulation results determine our proposed method is effective when compared to the existing method. The proposed work is determined based on delay and energy. The future scope is expanded to this in large-scale networks by considering sufficient parameters.

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