An Efficient Data Collection Protocol in Wireless Networks

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ABSTRACT

The basic idea is to implement distribute scheme in wireless sensor networks. Each node in sensor networks are deployed in a random way, so that each node will cover all the patterns related to their region. In order to increase the lifetime of the networks node with similar range which cover similar patterns are grouped into single cluster, which can interchangeably share their resource with their neighbor for overhead reduction and load balancing. Due to energy drain in sensor nodes are grouped into similar cluster and all the cluster head communicate together to form a global aggregation among sensor nodes. These in turn decrease the energy usage for short transmission to reach the centre node with estimated contact probability.

KEYWORDS

Clustering, delay-tolerant networks, load balancing, wireless sensor networks.

1. INTRODUCTION

A Wireless ad-hoc network **(WANET)** is a self-configuring infra structure less network of mobile devices connected by wireless links. Each device in a WANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a WANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet.

1.1 DELAY TOLERANT IN SENSOR NETWORKS

The delay tolerant capability in sensor nodes fundamentally an opportunistic communication system, where communication link between sensor nodes establish temporarily, rendering it impossible to establish end to-end connections for data delivery from source node to the base station. In order to increase their transmission range, achieve efficient energy utilization and reduce communication delay. We propose group communication for sensor nodes with similar nodal contact probability and patterns, to overcome energy loss and delay during transmission of sensor nodes.

1.2 CLUSTER FORMATION

Cluster head selection in DTNs is done based on the nodal probabilities of the nodes. The node with highest nodal contact probability (threshold probability) is taken as the cluster head. Data from one cluster to another will be transmitted through the gateway nodes. Gateway nodes in DTNs are selected based on the nodal contact probability of nodes I one cluster with the nodes in the other cluster. A node in the same cluster transmits data from one node to another with their transmission range of all the nodes within the cluster. Nodes in the different cluster transmits data to another cluster depend upon the probability of nodal connectivity; direct transmission is also employed data from one node to another. Every gateway node constructs a cluster connectivity packet and distributes it to other gateway in the networks[8]. The cluster connectivity of the gateway comprises its cluster ID and a list of cluster to which it serve as gateway along with corresponding contact probability. Once the routing table is obtained, the routing is performed from a cluster to another cluster through single hop Inter cluster routing and Intra cluster routing.

1.3 LOAD BALANCING

Load balancing is an effective enhancement to the proposed routing protocol. The basic idea is to share traffic load among cluster members in order to reduce the dropping probability due to queue overflow at some nodes. Sharing traffic inside a cluster is reasonable, because nodes in the same cluster have similar mobility pattern, and thus similar ability to deliver data messages. Whenever the queue length of a node exceeds a threshold, denoted by Λ, it starts to perform load balancing. More specifically, it randomly transmits as many messages as possible to any node it meets, until their queues are equally long or the latter's queue becomes longer than Λ. Load Balancing in a cluster and among the clusters are done in either ways of Intra cluster load balancing ,Inter cluster load balancing.

2. LITERATURE SURVEY

Clusters are formed based on their nodal contact probabilities the probability of nodes meeting each other. Based on their nodal contact probability the threshold probability will be calculated , using which the clusters are formed and the gateways nodes are selected to route data from one cluster to another[1][2].

In [9] capacity and delay trade off mechanism, the capacity of the cell partitioned networks and analysis the delay of the capacity achieving relay algorithm. The packet are transmitted and routed according to the timeslot assign to each node without violating the physical constrains of the partitioned cell. The capacity region depends only on the steady-state user location distributaries. Hence, any markovian model of the user mobility which in steady state distribute users independently and the network yields uniformly over the same expression for mobile nodes.

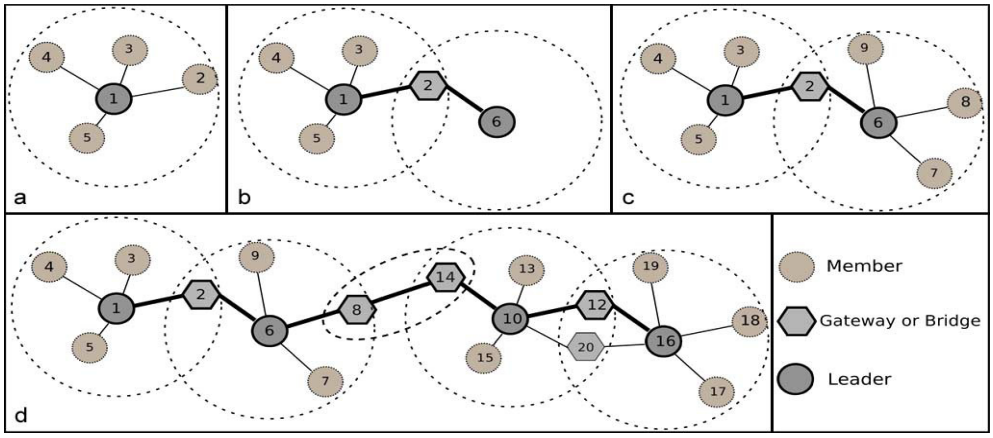

Figure 1: Topology diagram

A cluster-based self-organizing strategy is proposed for building a backbone among the mobile devices, detecting segmentation, and recovery [3][4]. In this approach, each mobile device is controlled by a multi-role agent, which performs these tasks efficiently based only on local interactions; role management allows the backbone reconfiguration when the nodes leave or arrive to the network yielding a complex global emergent behavior. [5] Energy saving is achieved by adapting the time interval and power of transmission after the network formation. The inconsistency problem exist both in member and gateway nodes. When two nodes in the same cluster may have two different gateways to another cluster in figure 1. A node may lose its gateway to an adjacent cluster because the gateway node has left. These inconsistency problem employing by synchronization mechanism where nodes exchange and keep only the most up to data information. The replication mechanism that routing protocols adopt to ensure delivery of the original packet to the sink is to transmit multiple copies of the same packet over different paths in order to recover from some path failures

Wireless networks are without a doubt one of the central issues in current research topics due to the harsh environmental conditions in which such networks can be deployed and their unique network characteristics, specifically limited power supply, processing and communication capabilities[6]. [7] Presented with many challenges and design issues that affect the data routing, a need for a fault tolerant routing protocol becomes essential. An algorithm to form the various paths from sender to destination will be provide [8][9].

Power Efficient Data Gathering and Aggregation Protocol (PEDAP) is another centralized clustering scheme. PEDAP organizes sensor nodes into a single minimum spanning tree. The minimum spanning tree is formed by Prim's algorithm. The original cost function used in Prim's algorithm is replaced by a function in terms of the geographical distance among sensor nodes and the sensor nodes' residual energy. The root of the tree structure will become the cluster head. Each node receives data from their child nodes, fuses the data with its own and transmits it to its parent node. Finally, the fused data will reach the cluster head and being forwarded to the base station. PEDAP can effectively reduce the total path length and reduce the number of connections to low energy nodes.

Data dissemination services embrace a wide variety of telemetric applications where data packets are generated at a remote server in the Internet. The quality of a data dissemination service is highly dependent on the availability of network infrastructures in terms of the access points[9]. The data dissemination services can be supported by the traditional cellular networks such as general packet radio service (GPRS) and third generation (3G). However, as cellular networks aim at offering ubiquitous network coverage, providing the data dissemination services by cellular networks can suffer from low transmission rate and high cost . An alternative is to make use of the existing wireless fidelity (Wi-Fi) based wireless local area networks (WLANs) which are deployed worldwide to provide high-speed Internet access for public and/or private communication hotspots.

The hostile deployment of sensor nodes at random position may not satisfy the requirement of the environment. Coverage can be enhancing using incremental sensor deployment and movement assisted sensor deployment. In incremental sensor deployment nodes is deployed one by one using location information of previously deployed information of the nodes. This algorithm is not scalable and is computationally expensive[10].

In self-configuring system location system, Nirupama Balusu et al . is a similar one. They use radio beacons of each sensor nodes depend upon their coverage range and better localization, they calculate sensor density after random deployment and then incrementally sensor are placed for uniform coverage. An automatic self spreading algorithm which automatically sensor are placed for uniform coverage after doing localization of sensor nodes is deployed[11].

3. PROPOSED WORK:

Algorithm:

If (Neighbor node!= NULL)

Then (collect all the neighbor details using RRP)

If (Transmission range & Energy > Neighbor node)

Then (select current node as group head between their neighbor nodes)

Else (Node with higher transmission and residual energy consider as group head)

Else (Current node is selected as cluster head if there is no neighbor nodes)

The data collected from separate nodes form a packet before transmitted to the sink. Each node which transmits their packet can have data specification through which data is analysis to where it is transmitted. Each node separately reaching sink for their collected data increase node energy level because sink may place far away from the distance, so data transmission can be done depend upon cooperation among sensor nodes. In order to overcome the energy loss data gathered from similar sensor are formed as a cluster. According to these algorithm each node is consider as a cluster initially after they transmit their information to their neighbor sensor node they analysis their properties with the node which collected from the sensor nodes through

request replay method. If the residual energy and their transmission range is higher then neighbor node then current node act as group head. Otherwise node which is having higher residual energy within that group selected as head node.

If (cluster head is higher residual energy and transmission range then its neighbor within group)

Then (collect all the sensed information from its neighbor)

If (sensed information contains replicated data)

Then (eliminate the replicate data)

Else (aggregate the collected information)

Else (transfer the collected data to base station)

After forming the cluster head neighbor node within that region transfer their collected sensed information to cluster head to avoid energy loss while transmitting individual sensed data to base station separately. We collected sensed information of all nodes with similar sensing patterns within that group. The group head aggregate all the sensed information after avoiding redundancy from the collected information from all sensor nodes within that group based on node contact probability. Any redundant information is collected in cluster head they verify all the sensor information from the collected sensor nodes then aggregate that into smaller packet because data transmission in sensor node is very minimum.

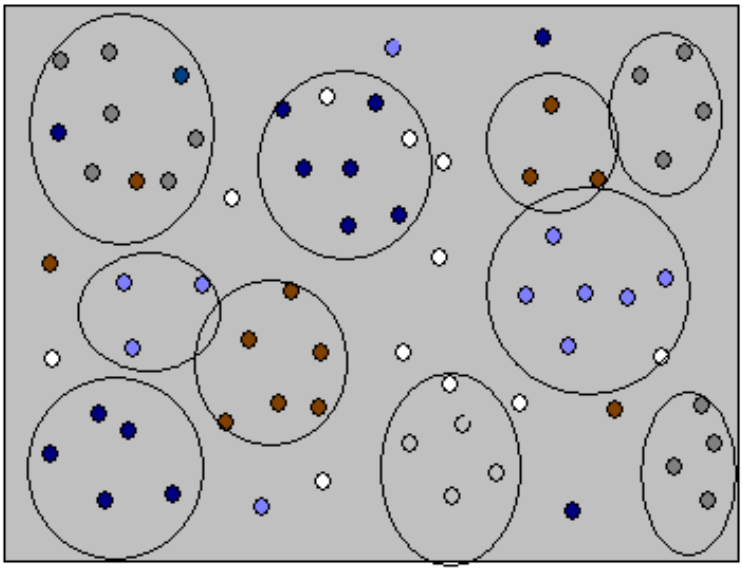

Figure 2 : Grouping sensor nodes with similar patterns

All the aggregated information is then transfer to base station. If the base station is not within the transmission region then cluster head use the relay node to transmit their collected information to sink or base station [12]. The node which is having higher transmission region is

consider as relay node it collect the aggregated information from group head or an sensor node and transmit the collected information to another relay nodes until collected aggregated information reaches the cluster head.

The network can be grouped into cluster based on several sensor nodes where their patterns of the nodes may vary from each other. But in these figure2 sensor nodes are grouped into cluster based on similar patterns the circle indicates the similar patterns are grouped together. Each sensor node within the group transmits their sensed information or data to their group head. The sensor nodes with high residual energy and transmission range is consider as cluster head, after transferring their local information with their neighbor nodes. The cluster head perform data aggregation on the data received from its member nodes and then transmit the aggregated data to next cluster head until it reaches the base station. So data are transfer in a multihop manner from one cluster to another in order to reach base station[13].

The network is modeled based on distributed connectivity of the graph G(V,E), where V is the finite set of nodes, and $(I,j) \in E$ represents a wireless link between node I and node j. the sensor nodes are deployed in random manner in order to receive efficient information from the sensor and also collect all the relevant information among the sensor region[13]. That is

$$\phi_i(t) = f((x(i,t),y(i,t)),R_i) \quad (1)$$

Where (x(I,t),y(I,t))is the position, R_i is the communication range of node i. if node j is a neighbor of node I, the relative function be expressed as

$$\phi_{j\text{-}i}(t) = g((x(j\text{-}i,t),y(j\text{-}i,t)),R_i ,R_j) \quad (2)$$

Where(x(j-I,t),y(j-I,t)) is the relative position from two neighbor nodes and Ri, Rj are the communication range of node I,j, respectively.

From these communication range between sensor nodes and cluster head transmission range is calculated. So data collected from each sensor can reach the cluster head within the transmission range or out side the transmission through multi hop is calculated. Collected data from group head aggregate their information and transmit to base station through relay nodes. These will reduces the energy usage and data dropping ratio among nodes.

4. PERFORMANCE ANALYSIS

The base station receives two types of data one from member nodes, this type of packet directly received from sensor nodes to the sink another approach of packet deliver from sink or a cluster head to another cluster head. Both the method able to sense the region related to their data. Packet delivery ratio of these approach increase gradually compare to another algorithm because here we collect the data of related sensing capacity of same nodal contact probability. These make transmission more efficient compare to all the method of data delivery.

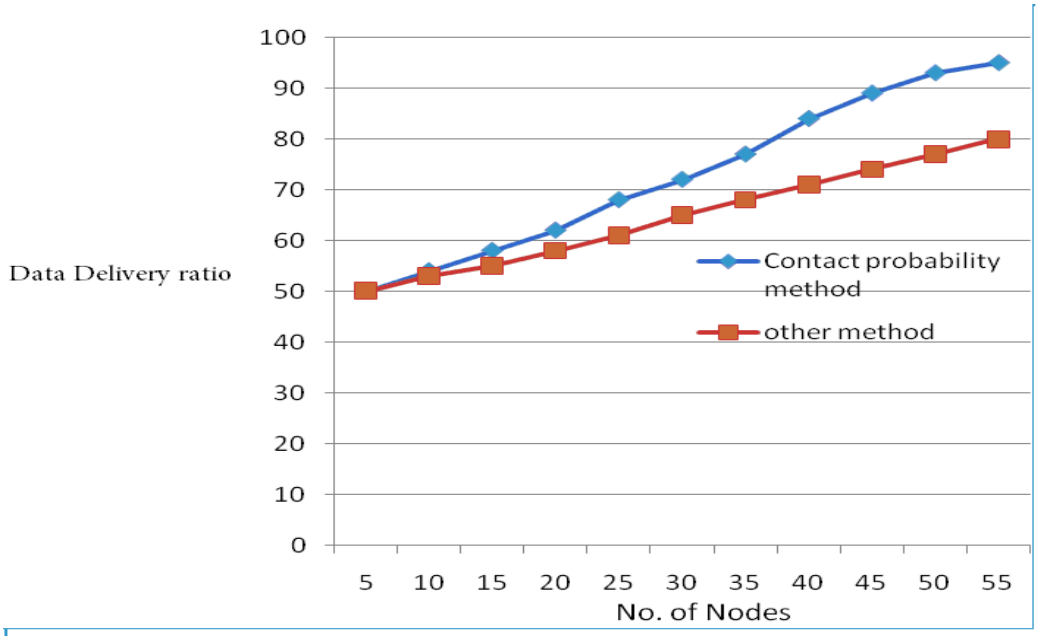

Figure 3 : Data delivery ratio at various stages

The data delivery ratio increases gradually compare to previous approaches these can be obtain from several data collection and transmitting the collected data from base station to sink with minimum delay. The aggregated data from various regions of similar pattern and contact probability gradually increase the data delivery ratio. All the data collected locally are transfer to another group aggregation of data with their similar pattern and contact probability. These aggregated data again send to another cluster to obtain a global aggregation. So that energy utilization of the sensor nodes decreases and increases the data delivery ratio of the sensor nodes.

In the existing work data dropping probability average values will be always more than 50 percentages. But when we are applying the algorithms that have been discussed above data dropping probability value will be reduced to below 50 percentages in figure 3. So that we can minimize the data dropping value with using this cluster based similar node probability. Every node has the maximum queue size, which varies from 20 to 100 during the simulation. Each node collects the sensed information from their location and transmits to cluster head. Cluster head aggregate all collected information without any redundancy. So packet drop or losing of data is reduced through nodal contact based on similar sensor pattern among sensor nodes increases overall delivery ratio. The delivery ratio due to load balancing, when the data or message in the queue almost full. It transmits data to other relay node to reach that aggregated information to sink or to the base station. These simulation result shows when number of sensor node in that region increase then dropping packet decrease through grouping of similar node pattern.

5. CONCLUSION

In this paper, we present two algorithm for efficient data aggregation and transmitting data to base station. We demonstrate that with different clustering algorthing based on grouping and data delivery ratio between sensor nodes. In these method of grouping sensor nodes with silimar patteren and transmitting aggregated data to base station with minimum delay is taken into consider. For efficient data delivery with minimum delay they used relay nodes with more transmission range to transmitting collected data efficiently to base ststion without any delay and packet loss. These also incorporate energy efficency by group of node and transmitting their aggregated result to the destinetion.

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