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Self-Configurable Clustering Mechanism for QOS Routing Protocol

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ABSTRACT

A suitable clustering algorithm for grouping sensor nodes can increase the energy efficient of WSNs. Energy saving optimization becomes one of the major concerns in the wireless sensor network (WSN). To prolong WSN lifetime as well as decreasing the created traffic, a new distributed self-Configurable Clustering Hierarchy (SCCH) mechanism is proposed. As wireless communication gains popularity, significant research has been devoted to supporting real-time transmission with stringent Quality of Service (QoS) requirements for wireless applications. QoS-Oriented Distributed routing protocol (QOD) to enhance the QoS support capability of hybrid networks. The proposed protocol has higher delivery ratio, shorter path length, less control packet overhead, and consumption.
Keywords: Energy Efficient, Routing Protocol, Wireless Sensor Networks, QoS-Oriented Distributed routing protocol (QOD).

I. INTRODUCTION

Wireless sensor networks (WSNs) consist of a large number of low-cost, low-power and intelligent sensor nodes and one or more sinks or base station (BSs). Those nodes are small in size and can perform many important function, including event sensing, information processing, and data communication. WSNs can be employed in wide military application and civilian scenarios. Due to various advantages such as ease of deployment, extended transmission range, and self-organization, WSNs have been replacing the traditional network.

The technology for sensing and manage includes electric and magnetic field sensors, radio-wave frequency sensors. Sensor is typically deployed in a high-density manner and in large quantities. One of the component of wireless sensor network an assembly of calculated or localized sensors, an interconnecting network, a central point of information clustering and a set of computing sources at the central point to handle data correlation, event trending, status querying, and data mining. Recently there arise some atypical hierarchical routings, which are variants of cluster-base routing and present special hierarchical architecture, including chain based, tree-based, grid-based, and area based routing. There exit several survey papers that present and compare the hierarchical routing protocol of WSNs from various perspective, but so far no work focuses on atypical hierarchical routing.

A typical hierarchical routing for WSNs. This provides a new perspective for readers to understand this kind of routing. As far as we know, it is the first time for atypical hierarchical routing to be sorted into four categories based on logical topologies. It is a first attempt to present a comprehensive review of atypical hierarchical routing protocols of WSNs. This review consists of several traditional and up-to date atypical hierarchical routing protocols with their characteristics, strengths, as well as weaknesses.

During the recent years, many energy efficient routing protocols have been proposed for WSNs. But in majority of them the mobility factor is not taken into consideration. In a WSN scenario there can be different types of mobility like the mobility of the nodes, sink mobility and the event or target mobility. Literature have shown that energy can be saved in a high level if sink mobility is achieved. In WSNs the criteria of designing routing etc depend on the application under consideration.

The sink mobility concept can be introduced in application like smart home environment or medical applications like patient monitoring without many complications. But the number of sinks to be introduced, the positioning of the sinks, the mobility or pathway of the sink, it's velocity, coverage area etc are the different factors which has to be determined with care to have efficient results by attaining better energy utilization.

II. METHODS AND MATERIAL

Proposed System

To develop SCCH (self-configurable clustering hierarchy) with the purpose of stabilizing clustered WSNs. The sensor nodes can start transferring data packet in the WSN based on the allocated TDMA schedule. The sensor node include CHs (cluster heads) consume energy. The CMs (cluster members) in the WSN need to wait for a data request (Data – Req) from their determined CH. If a CM does not received Data – Req, it will wait for the next frame to receive the request as it might be a temporary failure. The sensor nodes are deployed randomly over 1000* 1000 m2 surface area. The initial energy for each node is 1J equality.

Cluster head (CH) selection process is finished; all selected CHs broadcast a joinrequest message to the rest of nodes in the network. If a non-CH node receives many join request messages, the node would decide to join the cluster which is the closest to it. Those non-CH nodes that do not receive a join-request message are considered as isolated nodes.

The cluster-head aggregates the data of its members and transmits it to the sink node or to other nodes for further relaying. Since the sink is often far away, the clusterhead must spend significant energy for this transmission. For a member, it is typically much cheaper to reach the clusterhead than to transmit directly to the sink. The clusterheads role is energy consuming since it is always switched on and is responsible for the long-range transmissions. If a fixed node has this role, it would burn its energy quickly, and after it died, all its members would be "headless" and therefore useless. Therefore, this burden is rotated among the nodes. Specifically, each node decides independent of other nodes whether it becomes a cluster head, and therefore there is no signaling traffic related to cluster head election (although signaling traffic is needed for subsequent association of nodes to some cluster head). The protocol is round based, that is, all nodes make their decisions whether to become a cluster head at the same time and the no cluster-head nodes have to associate to a cluster head subsequently. The no cluster-heads choose their cluster-head based on received signal strengths. The network partitioning into clusters is time variable and the protocol assumes global time synchronization.

A. Optimal clustering

The optimal probability of a node being elected as a cluster head as a function of spatial density when nodes are uniformly distributed over the sensor field. This clustering is optimal in the sense that energy consumption is well distributed over all sensors and the total energy consumption is minimum. Assume an area A = M × M square meters over which n nodes are uniformly distributed. For simplicity, assume the sink is located in the center of the field, and that the distance of any node to the sink or its cluster head is ≤ d0. Thus, the energy dissipated in the cluster head node during a round is given by the following formula:

$$E_{CH} = L.E_{elec}\left(\frac{n}{k}-1\right) + L.E_{DA}\frac{n}{k} + L.E_{elec} + L.\epsilon_{f_s}\, d_{toBS}^2$$

Where k is the number of cluster, EDA is the processing (data aggregation) cost of a bit per report to the sink, and dtoBS is the average distance between the cluster head and the sink. Where Eelec is the energy dissipated per bit to run the transmitter or the receiver circuit, ∈ *fs* and ∈mp depend on the transmitter amplifier model we use, and d is the distance between the sender and the receiver. The energy used in a non-cluster head node is equal to:

Where ρ(x,y) is the node distribution. The energy dissipated in a cluster per round is given by,

$$E_{cluster} \approx E_{CH} + \frac{n}{k}E_{nonCH}$$

The total energy dissipated in the network is equal to:

$$E_{tot} = L.(2nE_{elec} + nE_{DA} + \epsilon_{f_s}\left(k.d_{toBS}^2 + n\frac{M^2}{2.\pi.k}\right))$$

The optimal construction of clusters is very important. That if the clusters are not constructed in an optimal way, the total consumed energy of the sensor network per round is increased exponentially either when the number of clusters that are created is greater or especially when the number of the constructed clusters is less than the optimal number of clusters. Our simulation results confirm this observation in our case where the sink is located in the center of the sensor field.

B. Routing Algorithm

The main purpose of routing is to bring packets efficiently to their destination. The capacity of the resulting end-to-end path directly depends on the efficiency of the routing protocol employed. Nodes in centralized solution need to know full network information to make decision; mobility or changes in activity status (power control) cause huge communication overhead to maintain the network information. Nodes in localized algorithm require only local knowledge (direct neighbors, 2-hop neighbors) to make decisions. Majority of published solutions are centralized, compared with other centralized solutions. At each round, each node decides would become a cluster-head based on the threshold which is calculated by the suggested percentage of cluster the whole network. In each round, each node chooses a random number between 0 and 1. If the number is less than a threshold, the node becomes a cluster for the current round.

$$T(n_i) = \begin{cases} \dfrac{p}{1 - p(r \bmod \frac{1}{p})} & if\ n_i \in G \\ 0 & otherwise \end{cases}$$

III. RESULT AND SIMULATION

Simulate a clustered wireless sensor network in a field with dimensions 1000m × 1000m. The total number of sensors n = 60.

The nodes, both normal and advanced, are randomly (uniformly) distributed over the field. This means that the horizontal and vertical coordinates of each sensor are randomly selected between 0 and the maximum value of the dimension.

Nodal deployment considered here is in random way. The clustering technique was implemented using SCCH mechanism. The cluster heads selection is mainly based on the two parameters. One is the distance from the centre of the grid and other is the residual energy of the node. Since here consideration is homogeneous network, all the nodes have the capability and chance to become a cluster heads. In this clustering mechanism two type class nodes select randomly cluster head node 0 and 34 is the act as cluster head in current round.

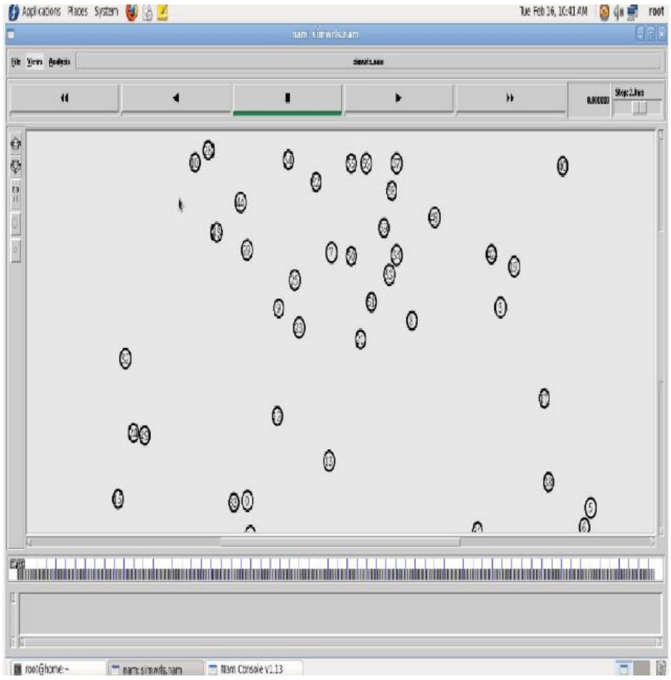

Figure 1 : Node Deployment

Node deployment initially 60 nodes simulated over the 1000*1000 meter. Node in blue colour belongs to second cluster. Node 50 act as base station denote red colour label.

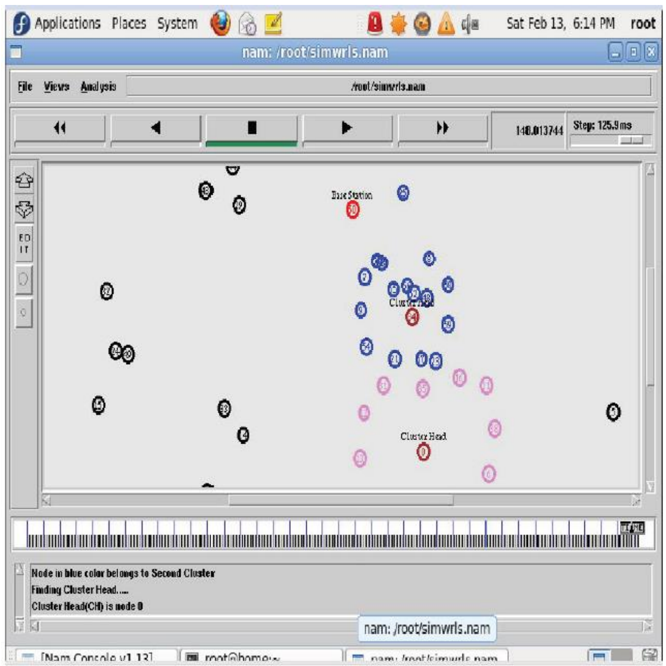

Figure 2 : Clustering Technique

In the figurer 1.2 the various colour represent the different nodes belonging to different cluster. It also shows that node 0 is the cluster head which wants to transmit the data to the base station.

IV. CONCLUSION

The attributes of WSNs and the characteristics of the environment within which sensor nodes are typically deployed make the routing problem very challenging. To prolong WSN lifetime as well as decreasing the created traffic, a new distributed self-configurable clustering (SCCH) mechanism is proposed. CHS (Cluster heads) are selected based on weight. Weight is determined according to the residual energy of each sensor and the regional average energy of all sensors in each cluster. The SCCH mechanism presented in this paper improves the cluster head selection process and solves the problem of node isolation. QoS Oriented Distributed routing protocol (QOD) to enhance the QoS support capability of hybrid networks. Mobility based segment resizing algorithm that adaptively adjusts segment size according to node mobility in order to reduce transmission time the simulation results revealed that the performance of the algorithms used in SCCH mechanism to improve the lifetime and stability of a network is more favorable than that of the algorithms used in other protocols.

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