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RESEARCH ARTICLE

A Rendezvous Based Sensory Data Collection with Re-clustering Technique

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Abstract – A Wireless Sensor Network applications include a set of isolated urban areas deployed with sensor nodes for monitoring environmental parameters. In urban area vehicles viz (buses, vans, cars, etc) are used as to carry the mobile sinks to collect the sensory data effectively which provides the ideal infrastructure. Existing approach include only single hop transfer, which transfer data directly from sensor nodes (SNs) to Mobile sinks(Ms).Main drawback of this approach is energy exhaustion that leads to decreased network lifetime. Our proposed system is to reduce the overall network overhead and minimizing the energy exhaustion by using multihop technique. It gives balanced energy consumption network lifetime during data retrieval process.

Index terms: WSN, Routing, Network overhead, Energy consumption, Multihop, Data retrieval, cluster head re-election, mobile sink

I. INTRODUCTION

A large class of monitoring applications involves a set of urban areas (e.g., urban parks or building blocks) that need to be monitored with respect to environmental parameters (e.g., temperature, moisture, pollution, and light intensity), surveillance, fire detection, etc. In these environments, individual monitored areas are typically covered by isolated "sensor islands," which makes data retrieval rather challenging since mobile nodes cannot move through but only approach the periphery of the network deployment region. A main reason of energy spending in WSNs relates with communicating the sensor readings from the sensor nodes (SNs) to remote sinks. These readings are typically relayed using ad hoc multihop routes in the WSN. A side effect of this approach is that the SNs located close to the sink are heavily used to relay data from all network nodes; hence, their energy is consumed faster, leading to a no uniform depletion of energy in the WSN. This result in network disconnections and limited network lifetime a mobile sink (MS) moving through the network deployment region can collect data from the static SNs over a single hop radio link when approaching within the radio range of the SNs or with limited hop transfers if the SNs are located further. This avoids long-hop relaying and reduces the energy consumption at SNs near the base station, prolonging the network lifetime.

1.1 Existing method

In Wireless Sensor Networks (WSN) applications involve a set of isolated urban areas (e.g., urban parks or building blocks) covered by sensor nodes (SNs) monitoring environmental parameters. Mobile sinks (MSs) mounted upon urban vehicles with fixed trajectories (e.g., buses) provide the ideal infrastructure to effectively retrieve sensory data from such isolated WSN fields. Single-hop transfer of data from SNs that lie within processing, buffering, and delivering tasks. These nodes run the risk of rapid energy exhaustion resulting in loss of network connectivity and decreased network lifetime.

1.2 Problem definition

A main reason of energy spending in WSNs relates with communicating the sensor readings from the sensor nodes (SNs) to remote sinks. These readings are typically relayed using ad hoc multihop routes in the WSN. A side effect of this approach is that the SNs located close to the sink are heavily used to relay data from all network nodes; hence, their energy is consumed faster, leading to a non-uniform depletion of energy in the WSN. This results in network disconnections and limited network lifetime. Network lifetime can be extended if the energy spent in relaying data can be saved.

1.3 Our Proposed Approach

Our Approach is re-elect cluster head and RNs periodically through this we can achieve high network lifetime and also reduce the collision of data, protocol aims at minimizing the overall network overhead and energy expenditure associated with the multihop data retrieval process while also ensuring balanced energy consumption among SNs and prolonged network lifetime. This is achieved through building cluster structures consisted of member nodes that route their measured data to their assigned cluster head (CH). Builds a clustering structure on top of the sensor network. That way, high data aggregation ratios are possible.

II. PHASES

2.1 Topology Formation

- Deployment of sensor nodes, neighborhood node and region estimation in WSN. Logical topology is about the how data is transmitted between nodes
- Bus logical topology: signals travel from one network device to all other devices on network
  - Required by bus, star, star-wired physical topologies

2.2 Cluster head and Rendezvous node Election

Based on node deployment each node sends the CH ELECTION Packets to its neighbor for electing the Cluster Head. Rendezvous node election process should be takes place based on nodes which are nearer to the mobile sink. It will act as a intermediary between cluster head and mobile sink. The large-scale deployment of WSNs and the need for data aggregation necessitate efficient organization of the network topology for the purpose of balancing the load and prolonging the network lifetime. Clustering has proven to be an effective approach for organizing the network in the above context. Besides achieving energy efficiency, clustering also reduces channel contention and packet collisions, resulting in improved network throughput under high load. The clustering algorithm in constructs a multisided cluster structure, where the size of each cluster decreases as the distance of its cluster head from the base station increases, slightly modify the approach of to build clusters of two different sizes depending on the distance of the CHs from the MS's trajectory. Specifically, SNs located near the MS trajectory are grouped in small- sized clusters while SNs located farther away are grouped in clusters of larger size.

2.3 RNs Picking

RNs guarantee connectivity of sensor islands with MSs, hence their selection largely determines network lifetime. RNs lie within the range of traveling sinks and their location depends on the position of the CH and the sensor field with respect to the sinks trajectory. Suitable RNs are those that remain within the MS's range for relatively longtime, in relatively short distance from the sink's trajectory and have sufficient energy supplies.

- A large number of RNs implies that the latter will compete for the wireless channel contention as soon as the mobile robot appears in range, there by Resulting in low data throughput and frequent outages.

- A small number of RNs implies that each RN is associated with a large group of sensors. Hence, Rns will be heavily used during data relays, their energy will be consumed fast and they will be likely to experience buffer overflows.

2.4 CHs addition to RNs

CHs located far from the MS trajectories do not have any RNs within transmission range. An important condition for building intercluster overlay graphs is that Chs with no attached RNs, attach themselves to a CH u with nonempty Ru set so as to address their clusters' data to you. The description of the intercluster overlay graph building procedure can be found in Appendix C, available in the online supplemental material. It is noted that our approach typically requires a single MS trip to collect (through the receipt of BEACON messages) the information needed to execute the setup phase. Clustering starts upon the completion of the first MS trip. The RNs' selection process commences immediately afterward (the information needed for the execution of this phase, i.e., the number of beacons, their receipt time, and signal strength is also collected during the first MS trip). All these phases complete in reasonably short period of time, typically within the time interval between two successive bus trips. As soon as the setup phase finalizes, sensory data collected at CHs from their attached cluster members are forwarded toward the RNs following an intercluster overlay graph. The selected transmission range among CHs may vary to ensure a certain degree of connectivity and to control interference.

2.5 Data gathering and forwarding to Rns

The steady phase of Mobi Cluster protocol starts with the periodic recording of environmental data from sensor nodes with a temporary routing. The data accumulated at individual source nodes are sent to local CHs (intra cluster communication) with a Topology Control period (typically, Tc is a multiple of Tr).CHs perform data processing to remove spatial-temporal data redundancy, which is likely to exist since cluster members are located maximum two hops away. CHs then forward filtered data toward remote CH they are attached. Alongside the inter cluster path, a second-level of data filtering may apply.

2.6 Liaison between Rns and mobile sinks

The delivery of data buffered to RNs to MSs. Data delivery occurs along an intermittently available link; hence, a key requirement is to determine when the connectivity between an RN and the MS is available. Communication should start when the connection is available and stop when the connection no longer exists, so that the RN does not continue to transmit data when the MS is no longer receiving it. To address this issue, use an acknowledgment-based protocol between RNs and MSs. The MS, in all subsequent path traversals after the setup phase, periodically broadcasts a POLL packet, announcing its presence and soliciting data as it proceeds along the path. The POLL is transmitted at fixed intervals Tpoll (typically equal to Tbeacon). This POLL packet is used by RNs to detect when the MS is within connectivity range. The RN receiving the POLL will start th reply control packet, D reverts the anchored path and applies DFR with anchors.[7] Once S receives from D a packet with the anchored path, S stores this path in its route cache . Transmitting data packets to the MS. The MS acknowledges each received data packet to the RN so that the RN realizes that the connection is active and the data were reliably delivered. The acknowledged data packet can then be cleared from the RN's cache.

III. PROTOCOLS USED

3.1 MOBI CLUSTER PROTOCOL (MCP)

DSR is a reactive routing protocol which is able to manage a MANET without using periodic table-update messages like table-driven routing protocols do. DSR was specifically designed for use in multi-hop wireless ad hoc networks. Ad-hoc protocol allows the network to be completely self-organizing and self-configuring which means that there is no need for an existing network infrastructure or administration. For restricting the bandwidth, the process to find a path is only executed when a path is required by a node (On-Demand-Routing). In DSR the sender (source, initiator) determines the whole path from the source to the destination node (Source-Routing) and deposits the addresses of the intermediate nodes of the route in the packets. Compared to other reactive routing protocols like ABR or SSA, DSR is beacon-less which means that there are no hello-messages used between the nodes to notify their neighbors about her presence. DSR is based on the Link-State-Algorithms which mean that each node is capable to save the best way to a destination. Also if a change appears in the network topology, then the whole network will get this information by flooding.

3.2 ADVANTAGES

Reactive routing protocols have no need to periodically flood the network for updating the routing tables like table-driven routing protocols do. Intermediate nodes are able to utilize the Route Cache information efficiently to reduce the control overhead. The initiator only tries to find a route (path) if actually no route is known (in cache). Current and bandwidth saving because there are no hello messages needed (beacon-less).

IV. Cluster head and RNs re-election

After some time the energy of the CHs will be low, because exhaustion of energy will increase due to consecutive sensor readings. So cluster head and RNs re-election will be happen periodically, through this we can achieve high network lifetime, reduce the node failure and also reduce the collision of data. Passive Clustering algorithm are based on residual energy, random selection etc. But the random selection may not give optimize number of cluster head and do not guarantee the efficient way of selecting cluster head. Cluster head is selected based on the threshold distance R. The nodes outside the No Coverage Region (NCR) are also eligible for becoming CLUSTER HEAD (CH), but all nodes that are outside the NCR are not selected as cluster head. Only nodes within the value R can be selected as CH. Initially one node is selected as a cluster head randomly which satisfy the NCR constraints.

4.1 System Model

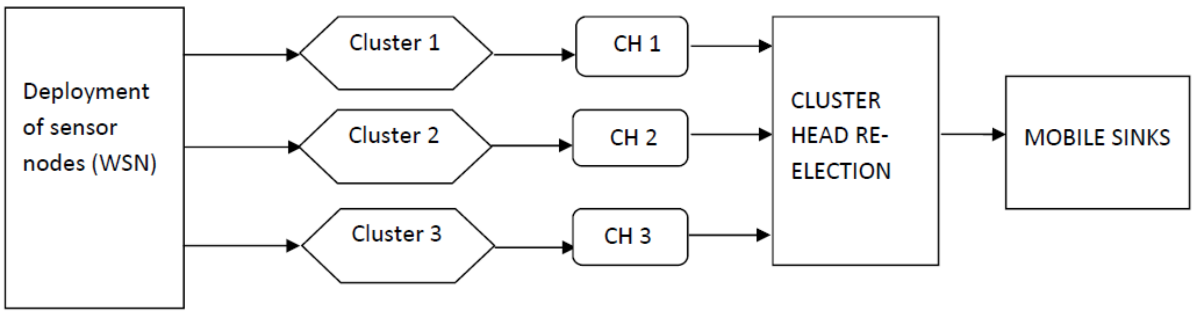


Fig 4.1 Sensor readings and Transmission

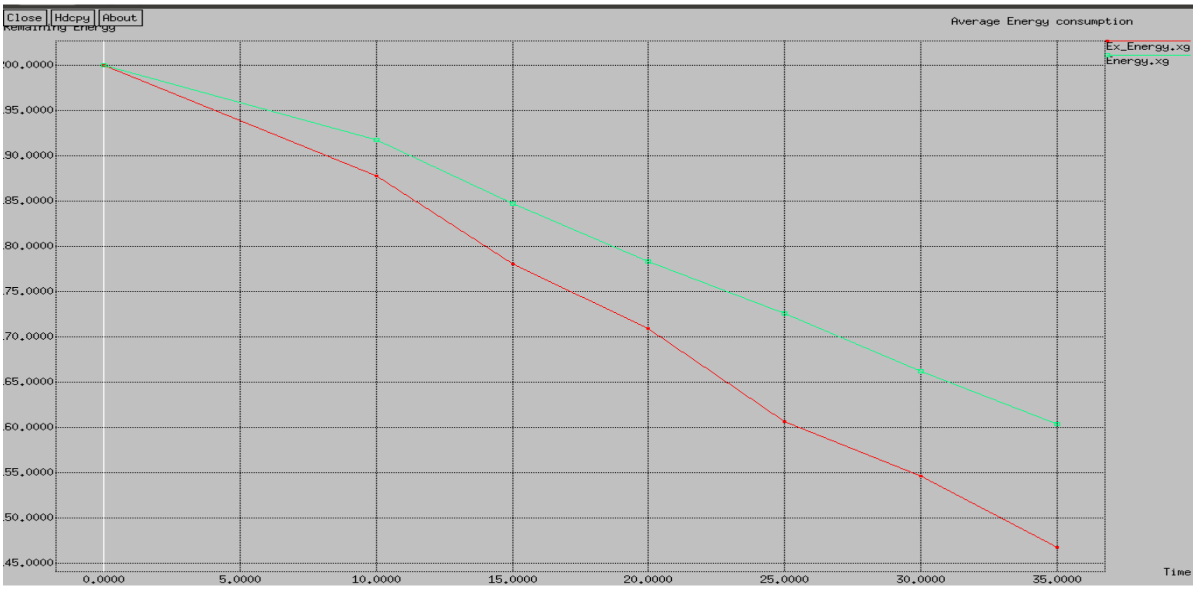
4.2 Enhancement

We address the problem of cluster node failure . When a cluster node fails because of energy depletion we need to choose alternative cluster for that particular region. In periodical time each sensor node in the cluster should possess the next cluster head re-election(shown in 4.1) based on energy to avoid node failure. The freshness of the received anchored path.-A mobile sink (MS) moving through the network deployment region can collect data from the static SNs over a single hop radio link when approaching within the radio range of the SNs or with limited hop transfers if the SNs are located further. This avoids long-hop relaying and reduces the energy consumption at SNs near the base station, prolonging the network lifetime.

V. SIMULATION RESULTS

A number of rendezvous-based approaches have been proposed which either assume a fixed MS trajectory or determine that trajectory according to some energy-related optimization criteria. As MobiCluster assume that MS moves on a fixed trajectory, a fair comparison of this protocol with other proposals should only consider the efficiency of routing structures for transferring data from SNs to RNs. In the simulation tests, we compare our method with the solutions proposed in [24] and [20] which also assume fixed MS trajectory.[2] In these tests, MobiCluster and the protocols in [20] and [24] have been extensively evaluated with respect to several performance parameters. First, the three protocols are compared in terms of the network lifetime, the average residual energy as well as the variance of this energy across the network. Then, the protocols are compared in terms of the overall number of outages, i.e., the number of data packets cached in RNs, yet, not delivered to the MS due to buffer overflows, packet collisions or the movement of the MS away of the RNs' transmission range. Finally, the third group of tests concerns the total generated traffic as well as the network throughput of these protocols, i.e., the packets delivered to the MS over those sent from the RNs.

5.1 Reduced energy consumption through re-clustering.



5.1 Average Energy Consumption

VI. CONCLUSION

The MobiCluster protocol that proposes the use of urban buses to carry MSs that retrieve information from isolated parts of WSNs. MobiCluster mainly aims at maximizing connectivity, data throughput, and enabling balanced energy expenditure among Sns.The connectivity objective is addressed by employing MSs to collect data from isolated urban sensor islands and also through prolonging the lifetime of selected peripheral RNs which lie within the range of passing MSs and used to cache and deliver sensory data derived from remote source nodes. Increased data throughput is ensured by regulating the number of RNs for allowing sufficient time to deliver their buffered data and preventing data losses. Unlike other approaches, MobiCluster moves the processing and data transmission burden away from the vital periphery nodes (RNs) and enables balanced energy consumption across the WSN through building cluster structures that exploit the high redundancy of data collected from neighbor nodes and minimize intercluster data overhead.

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