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# Review Paper on DRINA Protocol

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**Abstract:** Wireless sensor network is a collection of large number of sensor nodes which are deployed in an environment measuring various parameters like humidity, temperature and pressure. In wireless sensor networks, routing of data in non-aggregated manner can lead to more energy consumption. To have energy conservation, aggregation of data is effective as it raise data accuracy, remove data redundancy and also reduce communication load. In this paper we have reviewed DRINA (Data Routing for In-Network Aggregation) which is a cluster based approach for data aggregation. It reduces cost of communication and saves energy consumption by building of routing tree, increasing overlapping routes and removing redundant data.

**Keywords:** DRINA, wireless sensor networks, in-network aggregation, energy consumption, routing tree.

## I. INTRODUCTION

Wireless sensor network is a collection of thousands of low power sensing device called sensor nodes. These sensor nodes are located in the environmental and physical condition to measure various physical parameters such as temperature, lightning condition, pressure, vehicular movement, humidity etc. Sensor nodes collect information from environment which is being monitored and sends it to the base station by single or multi-hope communication. Application areas of wireless sensor network are huge like habitat monitoring, health monitoring, military surveillance, target tracking, home applications and a many more. Figure1 shows a basic architecture of sensor network where a data generated by sensor node depending on its sensing mechanism is transmitted to base station [1].

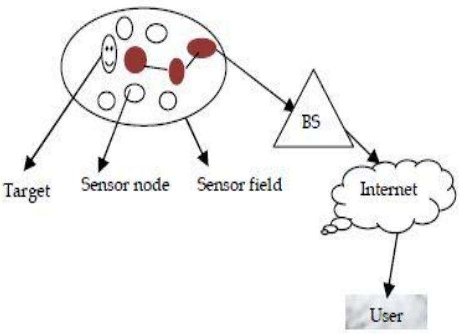


Figure1 [2] Architecture of the Sensor network

The sensor nodes sense, collect and process the information of targets in monitoring area and forward it for processing and analyzing. The basic components of a sensor node are:

(a) Sensor and actuator - an interface to the physical world designed to sense the environmental parameters like pressure and temperature.
(b) Controller - is to control different modes of operation for processing of data.
(c) Memory - storage for programming data.
(d) Communication - a device like antenna for sending and receiving data over a wireless channel.
(e) Power Supply- supply of energy for smooth operation of a node like battery.

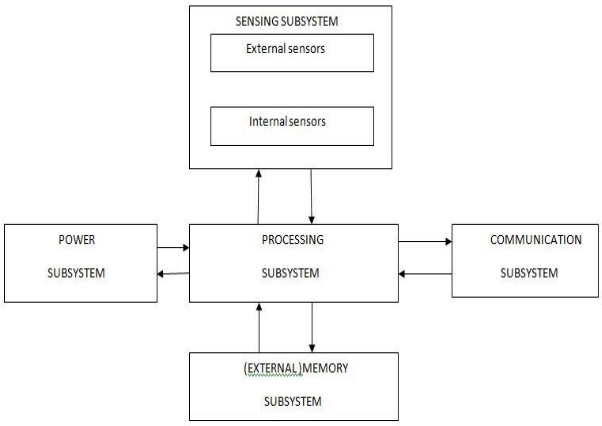


Figure2 [3] A wireless sensor node

The characteristics of sensor nodes are as follows:

a) Resource Constraint
b) Unknown topology before deployment
c) Unattended and unprotected once deployed
d) Unreliable wireless communication[3]

Sensor networks are devices with limited energy so it's important to conserve it. The process of communication consumes much more energy as compared to sensing and processing of data. Therefore routing protocols are designed for energy conservation in a particular process.

In a sensor network, the intermediate nodes functions only in data forwarding not in data processing. The routing process becomes easier if intermediate nodes are involved in data processing and themselves make local decisions. In –network aggregation task of processing is divided among all intermediate nodes. In this data from various sensors is processed in combined way while being forwarded towards the sink node. In-network aggregation process sends only the aggregated information, thus helps in reducing cost, overall bandwidth and power required for communication. It is a technology that increases the lifetime of networks.

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Many algorithms were proposed such as SPT (shortest path tree algorithm), GIT (greedy incremental tree) and many more but they were not practical because of high communication cost [4].

## II.CONVENTIONAL PROTOCOLS

They are classified as tree-based approach, structure-less approach and cluster-based approach

**A. Shortest Path Tree Algorithm (SPT)**: it is a tree based approach which depends on node arrangement. Each node collects the information and forwards it to the sink node via shortest path between nodes. In case two dissimilar routes overlap for two unlike source nodes, data aggregation occurs [5].

**B. The Greedy Incremental Tree (GIT):** it is also a tree based approach which is based on direct diffusion approach .It sets an energy efficient path and greedily connects other sources to the set path. With the shortest path in tree data is routed and if a new branch is formed new aggregation point is selected. In this approach routing tree cost is more [6]

**C. Tiny Aggregation (TAG) Service**: in this the collaborator nodes know the predefined time for collecting data. The sleeping time for each node is set according to the waiting time. Large message are required for tree structure [7].

**D. Information Fusion Based Role Assignment (InFRA) algorithm**: it is a cluster based approach and nodes are arranged into cluster. One node is chosen as cluster head and sets route up to sink node. It raises data fusion and information related to occurrence of an event is flooded through network. As communication cost is high scalability of algorithm is limited [8].

In dynamic environment topological changes and node failures are common, so efficient delivery of data becomes a major challenge in sensor networks. Thus, routing protocol used in in-network data aggregation should have characteristics such as large number of overlapping routes, minimum messages for routing tree set-up and continuous data transmission. To achieve these characteristics, recent approach DRINA (Data routing for in-network aggregation) was presented. However, DRINA needs an investigation in some network performance parameters like average throughput, end to end delay, ratio of packet delivery and average energy consumption [5]

## III. DRINA: DATA ROUTING FOR IN-NETWORK AGGREGATION FOR WSN

The DRINA algorithm is a cluster based technique. It main focus is to build a routing tree and to find shortest path that connects all source nodes to sink maximising the data aggregation. A cluster is formed, when data is send from source to sink node. Then cluster head is chosen. This cluster head aggregates data from remaining nodes in cluster and forms the shortest path up to sink node. Cost of communication and routing tree is less for DRINA. To build routing tree in DRINA following roles are considered:

(a) Collaborator: it detects an event and sends the data collected to coordinator node.
(b) Coordinator: it aggregates the data from collaborator and sends it to sink node.
(c) Relay: it is an interior node and forwards data to sink node.
(d) Sink: it receives data from collaborator and coordinator nodes. [9]

## IV. PHASES OF DRINA ALGORITHM

There three phases of DRINA algorithm:

**A. Constructing Hop tree:** it is a tree constructed from sensor to sink node. The distance is computed from all nodes to sink node in hops.HCM (hop configuration message) is send by sink node to all other nodes via flooding. There are two fields in HCM message: one is node ID for node identification and other is Hop to Tree field which stores the distance in hops from the node where HCM message is produced.
Initial value of Hop to Tree is 1 at sink node and infinite at all other nodes. This value is forwarded by sink node to all network nodes which compare their value with this one and store the smaller of the two values. The ID field is also updated. The HCM messages are also relayed with new values and this continues till whole network is configured.

**B. Formation of Cluster:** in this phase cluster is formed and cluster head is selected. For nodes that are detecting same event leader election algorithm begins. At beginning coordinator node is close to sink node in hops whereas in other events leader node is close to established route. If there is a tie between two nodes then one with smallest ID or with more energy will be leader. The advantage of it is that information collected by nodes which sense same event is aggregated at a point called aggregation point and is much efficient [10]

**C. Formation of Router and Hop Tree Updates:** In this phase from coordinator to sink node a routing tee is established. The coordinator node sends REM (route establishment message) to its neighbour node to form routing tree. The neighbour node is the one nearest to cluster head in hops. This node continues sending REM message to its neighbour node and the process continues till a path is established between leader and sink node. The path is shown in figure 3.

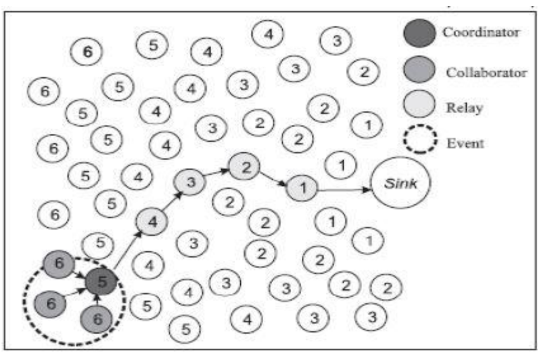


Figure3 [11] Router Tree from Leader to Sink Node

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From source to sink node routes are created by selecting nearest neighbour at each hop. Nearest neighbour are chosen as follows:

1. in case of one event , the node close to sink in hops is chosen.
2. for more than two events , the neighbour node is the one that takes to the closest node which is a part of established route. It is shown in figure below

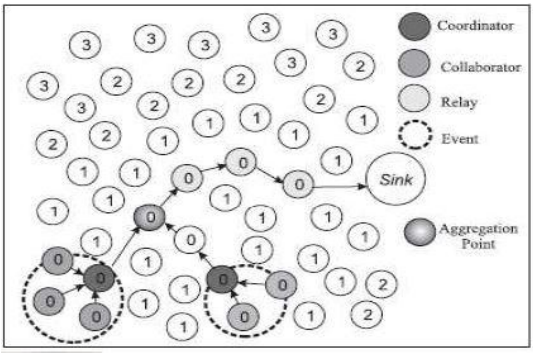


Figure4 [11] an Established Route to Previous Route

When route formation is done, hop tree is updated. Based on new formed route, the hop to tree values of all member nodes is restored. Relay nodes which are part of newly formed route help in this process.

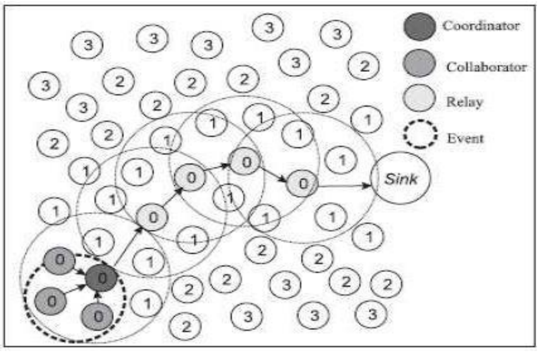


Figure5 [11] Hop Tree Updation

**Fault repair mechanism**: Drina also has a fault repair mechanism to overcome disruptions in communications. It has ACK based route repair mechanism. The data packet is send by relay node whenever wants to forward data to its next hop node. It sets timeout for transmission of each data packet and waits for acknowledgement.

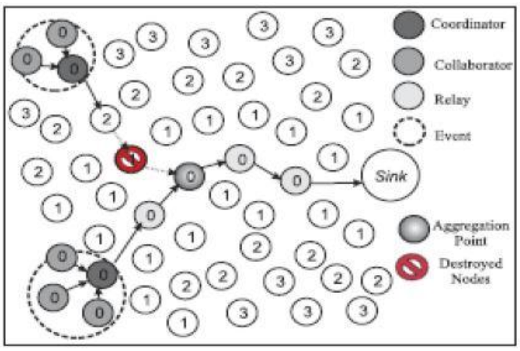


Figure6 (A) [12] Area with Destroyed Node

If no acknowledgement is received then it considers the particular node as failed one and selects new node.When this route repair mechanism is applied a partial new path is reconstructed. [12] When this route repair mechanism is applied a partial new path is reconstructed.[12]

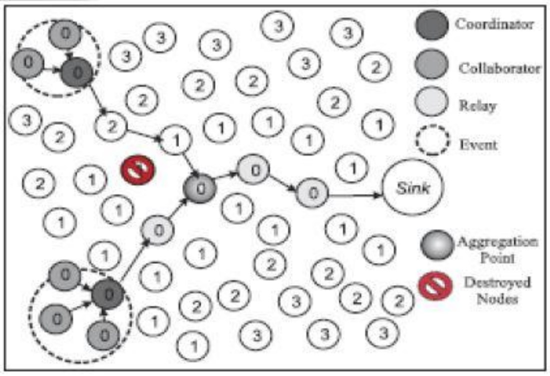


Figure6 (b) [12] Repaired path

Thus, DRINA conducts the route repair mechanism because of which it provides reliable communication in dynamic environments.

## V.CONCLUSION

As DRINA supports in-network aggregation it provides better throughput packet delivery ratio and end to end delay. It performs well with route repair mechanism and has certain features such as maximum number of overlapping routes, less messages for building routing tree, high aggregation rate and reliable transmission. Also security is a key factor in any network so DRINA helps in achieving two basic goals of security which are authentication and confidentiality. Thus, implementing DRINA in sensor networks can improve lifetime of network by reduction in energy consumption.

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