Accounting nodes life expectancy by introducing Helper nodes in traditional WSN

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Abstract: The scope of the wireless communications in the recent years going to increase it is the way of constructing small sized, low power and inexpensive sensor devices that posses high-speed sensing, computational and communication capabilities.

In this paper combination of hybrid hierarchical network topology and use of different communication techniques for Transmission (sleep & wait) and Reception/Listening (Low Power Listening). Energy efficient, energy conservation and hence improve sensor battery life is the main motive behind our work.

In our proposed system, we setup intermediate nodes (parent nodes) in our system, so as to prevent direct communication between a sensor and Sink node, thus preventing large wait times for transmission.

I. INTRODUCTION

Wireless Sensor Networks (WSNs) is a network which acts in the sensing environment. A wireless sensor network contains hundreds of thousands of sensor nodes to monitor the physical or environmental things, such as temperature, pressure, volume, vibration, or pollutants and motion to cooperatively pass all data to a fix location where is data is ready for analysing[1]. This fix location is called sink or base station acts like an interface between users and the network.

The various sensor nodes in a wireless sensor network (WSN) are have limited, storage power, capacity, processing speed and communication bandwidth[3]. They have to sent all the physical and environment information to the base station again and again ,in this process they suffer lost of energy or their backup power lost very quickly.

II. OBJECTIVE

In wireless sensor network the energy consumption is the most important issue that dominates wireless sensor network due to its direct influence on the network life.

There are following objectives of our research:

- A deep study to provide an overview of sensor networks with overcome the problem of energy Conservation in the network.
- Implementation of proposed work.
- Design and implement a new procedure based mechanism to improve the life time of sensor node
- Comparative Analysis in the form of graph.

III. PROBLEM FORMULATION

Because energy is such a limited resource in wireless sensor networks, the primary concerning wireless sensor network MAC protocols is energy efficiency. To design a MAC protocol that is as energy efficient as possible, one first has to identify the sources of wasteful energy consumption in wireless MAC protocols.

Following are the sources of energy wastage:

1). Idle listening: A node generally cannot predict when another node wants to communicate with it. Therefore, a node has to be ready to receive a message from any the node will have its radio turned on in receive mode for nothing.

2). Collisions: When two nodes try to send a message to the same node at the same time, there is a good chance that neither message will be received by the intended recipient. This means that energy will have been spent on sending and receiving messages with out any useful result.

3). Overhearing: The wireless medium is by its nature a broadcast channel. This means that when one node sends a

message, all nodes in its vicinity will receive the message, even when the message is of interest to only a single node. If the nodes that have no save energy.

4). Control packet overhead: MAC protocols usually send short messages for signaling purposes. For example, after a message has been successfully received, many MAC protocols send a short acknowledgement back to the sender. Although these packets are useful for robustness, sending them does consume energy without conveying useful information at the application level and must therefore be considered overhead.

IV. METHODOLOGY

The considered system architecture relies on three types/roles of sensor nodes:

- **Sensing nodes (or sources)** that sense certain physical parameters and transmit the relevant information towards other nodes in the infrastructure.
- **Communication (or relay)** nodes that, wirelessly, receive readings from sensing nodes (or other communication nodes) and relay them upstream towards the final recipient of such information.
- **Sink** nodes that are the final recipients of the sensed information. Sink nodes are typically connected to conventional computing equipment for complex processing of the accumulated readings.

V. PROCEDURE FOR OUR PROPOSED WORK

Step 1: -**Initialization**: - Initialize the simulation environment. Fixed Position Sink and Helper Nodes are deployed. Sink is assigned black color, and helper nodes are assigned distinct colors.

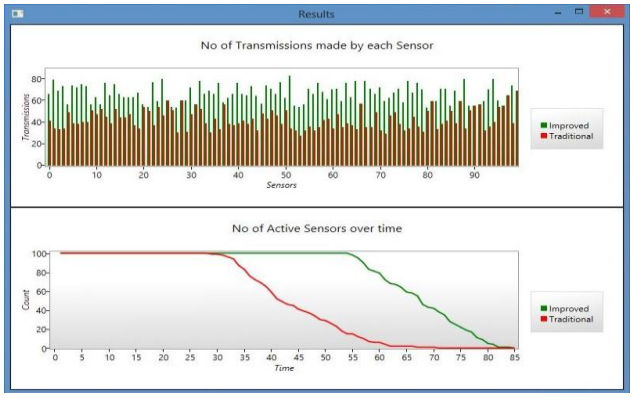
Step 2: -**Deployment**:- Randomly 100 sensors nodes are deployed in the system, with a minimum separation distance of 30 units with existing nodes, so as to avoid physical proximity and collision.Initially nodes will be black and hollow triangles.

Step 3: -**Registration**: - Each node registers itself to closest available governing node (helper or sink). Node will take color of its governing node, and will be filled, denoting it has sufficient energy for transmission.Governing nodes will be updated with a number, which shows how many sensors are registered under it. It is displayed inside the corresponding rectangular blocks of governing nodes.

Step 4: -**Simulation**: - Accounting is kept for calculations made at each step, and changes that have occurred. Environment is set automatically simulate continuous transmissions between sensor nodes and governing nodes. Simulation is made for both Traditional (Sink-Sensor only) WSN and Improved (Sink + Helper - Sensor) WSN. As simulation proceeds, sensors will begin to lose power, and will one by one deplete to Death. The dead sensors are represented as hollow triangles. Thus with progress in simulation, sensors can be seen converting from filled to hollow triangles on the simulation environment screen. Simulation will continue until all the sensors are dead.

Step 5: -**Plotting**: - After Simulation Ends, collected data is plotted into form of graphs to visually analyze and present the gain achieved in various factors. Two graphs are potted:- Active Sensor graph, which shows no of active sensors at each step of simulation and the No of transmissions graph, which shows transmissions made by each sensor in the system using available quota of energy.

VI. COMPARISON & RESULT ANANLYSIS



1. Active Sensor Graph

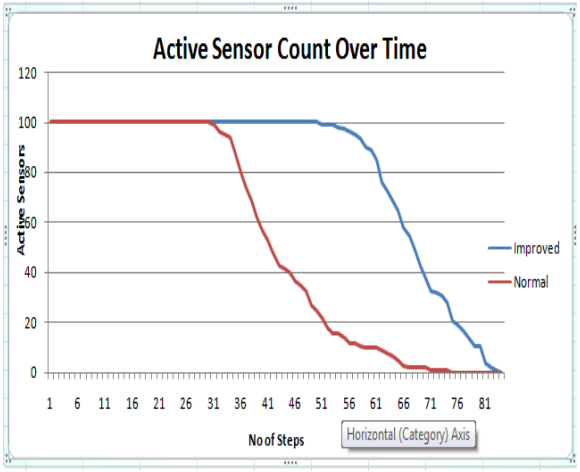
Graph is plotted against number of active sensors (having sufficient power to complete at least 1 transmission) over a period of time/ no of steps/ no of transmissions done.

- **X-axis** represents no of steps/transmissions done in the network.
- **Y-axis** represents the number of active sensors.

There are two curves being plotted, one for normal WSN (Traditional - Red) and one for Our Proposed WSN (Improved – Green)

Explanation of Graph:-

1) **Traditional** – The number of active sensors remains 100% (100 sensors in this case) till x=31, that means the network is stable and fully active till 31 transmissions by each sensor.
   Then there is a gradual fall till x=71, sensors batteries are depleting one by one.
   For X>71 no of active sensors is zero. No sensors are active now, the network is dead.
2) **Improved** – The number of active sensors remains 100% till x=55, that means the network is stable and fully active till 55 transmissions by each sensor.
   Then there is a gradual fall till x=85, sensors batteries are depleting one by one.
   For x>85 no of active sensors is zero. No sensors are active now, the network is dead.



2. Transmissions made by each sensor

This graph is plotted against number of transmission made by sensors over sensor id.

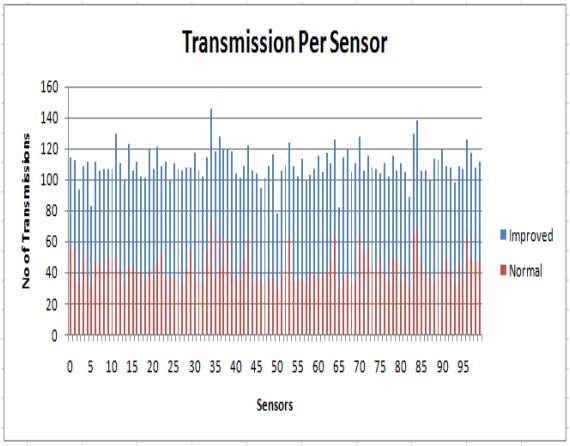
- **X-axis** represents the sensor id.
- **Y-axis** represents the number of transmission made by a particular sensor.

There are two bars being plotted for each sensor, one for normal WSN (Traditional - Red) and one for Our Proposed WSN (Improved – Green)

Explanation of Graph:-

Consider Sensor id=1, the green bar represents 66 transmissions were made in our proposed system , and the red bar represents 40 transmission were made in traditional WSN.

Consider sensor id=99, the green bar represents 70 transmissions were made in our proposed system , and the red bar represents 39 transmission were made in traditional WSN.



VII. CONCLUSION

With the evidence of comparison graphs and simulation results, we can conclude that our proposed system has been successful in conserving Sensor's energy and extend their work lifespan as compared to a simple WSN.

Intermediate Parent Nodes successfully perform their act of Data collection, sensor management thus dividing the role of Sink Node among them, preventing the situation of long waiting periods for sensors for data transmission. Parent Nodes have enabled Sink to issue accurate data requests and being served by sensors nodes, by implementing sensor registration system and maintaining a list of registered sensors and active sensors.

VI. Advantages and Sacrifices

1. Advantages

- Presence of Intermediate Nodes (regulatory authority) ensures minimum waiting time, minimum overhearing, and a much more organized form of communications.

1) A cut in distance because of availability of nearby Parent Nodes, cuts the amount of power required to boost the transmission signal.

2) Intermediate nodes enables registration system, so the sensor nodes do not wander anonymously and a list of active nodes is maintained at corresponding parent node, also making it easy to find and issue an exclusive data request for a particular sensor node.

2. Sacrifices

1) Additional Hardware in form of Parent Nodes is required. With hardware becoming increasingly

cheaper and affordable, additional should not be a big concern.

2) Multiple communication techniques require improved OS and MAC to present in Network Devices

3) Additional Synchronization and monitoring System/Software is required in Sink Node for managing Intermediate nodes.

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