Distance vector based prioritization approach toward wireless sensor network

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Abstract: **A Wireless Sensor Network consists of spatially distributed autonomous sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants. WSNs typically forward significant data promptly and efficiently from a number of distinct and geographically distributed sensors to the sinks. Many WSNs have to deal with routine sensing which results in a steady and continuous volume of data, while unusual events of particular interest may occur unexpectedly in which the related information will require fast transmission to the sink(s). The QOS (quality of service) of service is one of the major requirements of sensor networks. The proposed work is about to avoid the congestion over the network and to improve the quality of service. The proposed work is the concept of prioritization based on the location of nodes. The prioritization is given based on the distance from the nodes. The prioritization also takes care to avoid the starvation over the network.**

Keywords: **Wireless Sensor Network, Sensor, priority communication, Cellular wireless network, Topology.**

I. Introduction

A. Wireless Sensor Network

The emerging field of wireless sensor networks combines sensing, computation, and communication into a single tiny device. Wireless networks are broadly divided into infrastructure and infrastructure less network where infra structured network consists of wireless node with a network backbone and infrastructure less network consist with distributed, independent, dynamic topology, low-power, and task –oriented wireless node [1]. Cellular wireless network falls under the category of infrastructure network whereas ad-hoc and wireless sensor network (WSN) are the part of infrastructure fewer networks In ad hoc mode, the wireless devices integrated and communicated to each other by making an on-support dynamic wireless link [2].

WSN consists with hundred/thousand wireless node distributed with geographical area; all wireless nodes collect information and supply towards central node for further processing Recent advances wireless communications, and digital electronics have enabled the development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate un tethered in short distances [3].

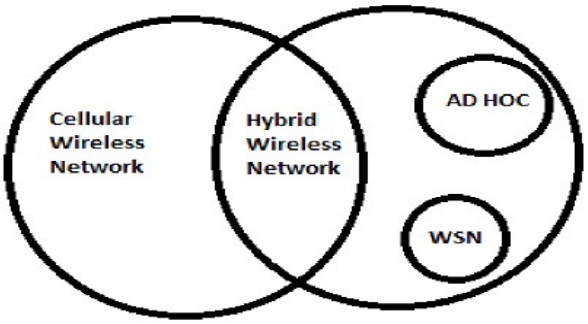

Figure 1.1: Classification of wireless network

These tiny sensor nodes, which consist of sensing, data processing, and communicating components, leverage the idea of sensor networks based on collaborative effort of a large number of nodes. Sensor networks represent significant improvement recent advances in wireless communications, and digital electronics have enabled the development of low-cost, low-power, multifunctional sensor nodes that are small in size and communicate unlettered in short distances. These tiny sensor nodes, which consist of sensing, data processing, and communicating components, leverage the idea of sensor networks based on collaborative ort of a large number of nodes. Sensor networks represent a significant improvement wireless sensor networks use small, low-cost embedded devices for a wide range of applications and do not rely on any pre-existing infrastructure. The vision is that these devise will cost less than $1. Sensors can be positioned far from the actual phenomenon, i.e., something known by sense perception. In this approach, large sensors that use some complex techniques to distinguish the targets from environmental noise are required. Several sensors that perform only sensing can be deployed. The positions of the sensors and communications topology are carefully engineered. They transmit time series of the sensed phenomenon to the central nodes where computations are performed and data are fused [4].

B. Sensor Node Design

The concept of wireless sensor networks is based on a simple equation:

Sensing + CPU + Radio = Thousands of potential applications

Conceptually, a sensor node consists of a power unit, sensing unit, processing unit and radio unit that is able to both transmit and receive data. Sometimes the sensor node also has a mobility unit as well as a localization unit e.g. a global positioning system (GPS).

- *Sensing*-The sensing unit consists of two subunits, one or a group of sensors and an analog - to- digital converter (ADC). The ADC converts analog signals from the sensors to digital signals, used by the processing unit [5]. The sensors are devices that respond to changes in the surroundings. The type of sensors being used on a sensor node depends on the application. The sensors can monitor speed, temperature, pressure, movement, humidity or vibrations to name a few.
- *Processing*-The processing unit, usually a low speed CPU with small storage capabilities, performs tasks like routing and processing of sensed data etc. The choice of processing unit also determines, to a great deal, both the energy consumption as well as the computational capability of a sensor node [6].
- *Communication*-The transmission between sensor nodes is wireless and can be implemented by radio, infrared or other optical media. Much of the current hardware for sensor nodes is based on radio link communication [7].
- *Power*-The power unit provides power to the other units and is typically a battery. Since the battery limits the amount of energy available to the node, this affects the lifetime of the node, thus in the end it also affects the lifetime of the sensor network. In many application scenarios, replacement or recharging (by e.g. solar cells or vibrations) of power resources is costly or even impossible [8]. The most power-consuming activity of a sensor node is typically communication. Hence, communication must be kept to an absolute minimum in order to maximize the lifetime of the sensor nodes. All activities involving communication (sending, receiving and listening for data) are power-consuming and one important way to save power is to have the communicating device turned off as much as possible.

C. Sensor applications

- *Sensor networks applications*-Sensor networks may consist of many different types of sensors such as seismic, low sampling rate magnetic, thermal, visual, infrared, and acoustic and radar, which are able to monitor.

A wide variety of ambient conditions that include the following [9]:

- Temperature
- Humidity
- Vehicular movement
- Lightning condition
- Pressure
- Soil makeup
- Noise levels
- The presence or absence of certain kinds of object
- Mechanical stress levels on attached objects
- The current characteristics such as speed, direction, and size of an object.

Sensor nodes can be used for continuous sensing event detection, event ID, location sensing, and local control of actuators. The concept of micro-sensing and wireless connection of these nodes promises many new application areas. We categorize the applications into military, environment, health, home and other commercial areas [10]. It is possible to expand this classification with more categories such as space exploration, chemical processing and disaster relief.

- *Military applications*-Wireless sensor networks can be an integral part of military command, control, communications, computing, intelligence, surveillance, reconnaissance and targeting (C4ISRT) systems. The rapid deployment, self-organization and fault tolerance characteristics of sensor networks make them a very promising sensing technique for military C4ISRT. Since sensor networks are based on the dense deployment of disposable and low-cost sensor nodes, destruction of some nodes by hostile actions does not affect a military operation as much as the destruction of a traditional sensor, which makes sensor networks concept a better approach for battlefields. Some of the military, Although satellite and airborne sensors are useful in observing large biodiversity, e.g., spatial complexity of dominant plant species, they are not fine grain enough to observe small size biodiversity, which makes up most of the biodiversity in an ecosystem . As a result, there is a need for ground level deployment of wireless sensor nodes to observe the bio-complexity. One example of bio-complexity mapping of the environment is done at the James Reserve in Southern California [11].

Three monitoring grids with each having 25– 100 sensor nodes will be implemented for fixed view multimedia and environmental sensor data loggers.

Flood detection: An example of flood detection is the ALERT system deployed in the US. Several types of sensors deployed in the ALERT system are rainfall, water level and weather sensors. These sensors supply information to the centralized database system in a pre-defined way. Research projects, such as the COUGAR Device Database Project at Cornell University and the Data Space project at Rutgers are investigating distributed approaches in interacting with sensor nodes in the sensor field to provide snapshot and long-running queries.

Precision Agriculture: Some of the benefits are the ability to monitor the pesticides level in the drinking water, the level of soil erosion, and the level of air pollution in real time.

- *Health applications*-Some of the health applications for sensor networks are providing interfaces for the disabled; integrated patient monitoring; diagnostics; drug administration in hospitals; monitoring the movements and internal processes of insects or other small animals; Tele monitoring of human physiological data; and tracking and monitoring doctors and patients inside a hospital Tele-monitoring of human physiological data: The physiological data collected by the sensor networks can be stored for a long period of time, and can be used for medical exploration The installed sensor networks can also monitor and detect elderly people's behaviour , e.g., a fall These small sensor nodes allow the subject a greater freedom of movement and allow doctors to Identify pre-defined symptoms earlier Also, they facilitate a higher quality of life for the subjects compared to the treatment centres. A ''Health Smart Home'' is designed in the Faculty of Medicine in Grenoble—France to validate the feasibility of such system Tracking and monitoring doctors and patients inside a hospital: Each patient has small and light weight sensor nodes attached to them. Each sensor node has its specific task. For example, one sensor node may be detecting the heart rate while another is detecting the blood pressure. Doctors may also carry a sensor node, which allows other doctors to locate them within the hospital.

II PROPOSED DESIGN

The proposed work is about to improve the protocol according to the location awareness. The work is about to assign the priorities to different nodes based on distance or some location factor. The work is about to assign the priorities to different areas

- The nodes communicating outside the clusters will be assigned the highest priority.
- The nodes present in same cluster with higher distance vector will also have higher priority
- The nodes within the innermost coverage will be assigned the lower priority.

The actual concept is that if some nodes is coming from distance node it is travelling from number of intermediate nodes and with each node communication it has to pay some transmission and forwarding energy. It means if the node with higher distance fails more energy will be wasted.

Let we have a inter cluster communication with 100 intermediate nodes and the forwarding energy is .1, receiving energy is .1 and transmitting energy is .1. The in case of communication loss the energy loss will be

Energy Loss =.1+100*.1+.1=10.2

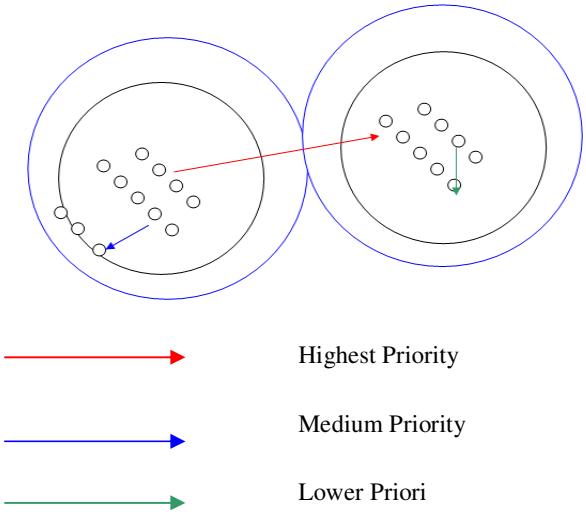

Fig 2.:cluster design

Let we have a communication within cluster with 10 intermediate nodes and the forwarding energy is .1, receiving energy is .1 and transmitting energy is .1. The in case of communication loss the energy loss will be

Energy Loss =.1+10*.1+.1=1.2

It means the communication from outside requires the more priority

A. Algorithm

The work is about the prioritization of the communication over the network at early stage. Here we have assign this prioritization based on the distance vector in the network. The basic idea of the proposed approach is

"More Distant Communication, Higher the Priority Will be"

Or

"Closer the Communicating Node, Lesser the Prioritization Level"

The complete work is divided in two main phases

i) Setup Phase:

- In this phase the actual prioritization is assigned over the network. As we have defined here the prioritization if based on the distance vector as well as type of data being transmitted over the network. Some of the common vectors that we have studied and defined while assigning the priorities to the network are given as under
- If the data is communicating between two different clusters, It will get the higher level of prioritization over the network.
- If the communicating distance between two nodes is higher or it is multihop communication, it will be assigned a medium level prioritization over the network.
- If there is direct communication between two nodes or the communication is of less distance it is assigned by low priority communication over the network.

ii) second phase:

- Now in the large sensor network we will divide it in the form of clustered approach. These clusters will be defined in terms of their geographical location.
- For performing the tunnelling for highest priority regions, we will create a location based priority assignment or the routing.
- A dedicated path will be assigned for highest priority clusters whereas data can be transmitted to other clusters from shared path.

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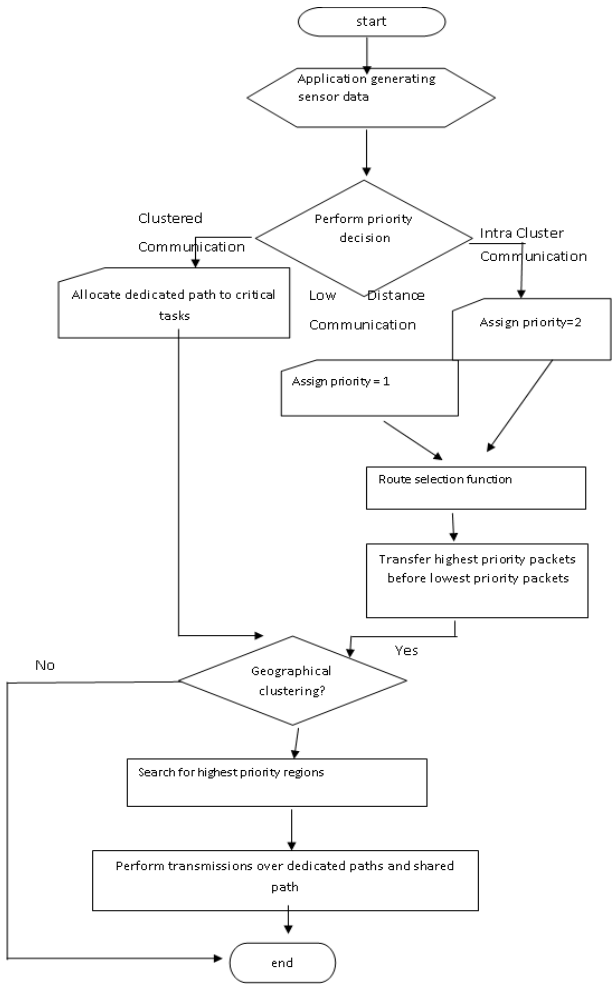
Fig 3: Flow chart of proposed work

III. Experimental Analysis

The analysis of the work is done under different parameters respective to different scenarios. The obtained results are



given as under:

The energy analysis in existing approach..

In existing approach, the chances of data loss in case of intercluster is 30% and intracluster is 10%

Table 1: Analysis Table of work

Specification	**Values**
Number of Clusters	5
Number of Nodes in each cluster	10
Number of communication intercluster	1000
Number of communication intracluster	1000
Energy loss on transmission	50 nJ
Energy Loss on Receive	50 nJ
Energy Loss on Forwarding	10 nJ
Avg Number of Intermediate nodes in intra network	2
Number of intermediate nodes in inter cluster	5

Total Communication =Communication within Cluster + Communication Inter Cluster

Communication Loss within Cluster = 1000 * 10/100 *50+ 1000*10/100 *50 + 1000*2*10/100*10
= 12000 nJ energy loss

Communication Loss Inter-Cluster = 1000 * 30/100 *50+ 1000*30/100 *50 + 1000*5*30/100*10
= 45000 nJ energy loss

Total Energy Loss = 45000 + 12000 =57000 nJ.

In Proposed approach, the chances of data loss in case of intercluster is 10% and intracluster is 10%.

Total Communication =Communication within Cluster + Communication Inter Cluster.

Communication Loss within Cluster = 1000 * 30/100 *50+ 1000*30/100 *50 + 1000*2*30/100*10
= 36000 nJ energy loss.

Communication Loss Inter-Cluster = 1000 * 10/100 *50+ 1000*10/100 *50 + 1000*5*10/100*10
= 15000 nJ energy loss.

Total Energy Loss = 36000 + 12000 =51000nJ.

VI. Conclusion

In this proposed work we have defined a distance vector based prioritization approach to resolve the congestion problem over the network at the early stage. According to the proposed approach we have split the communication in three major categories according to the distance vector. First is inter cluster communication, It is assigned higher priority as such kind of communication required higher energy requirement

Second is multihop communication and third is the direct communication between nodes.

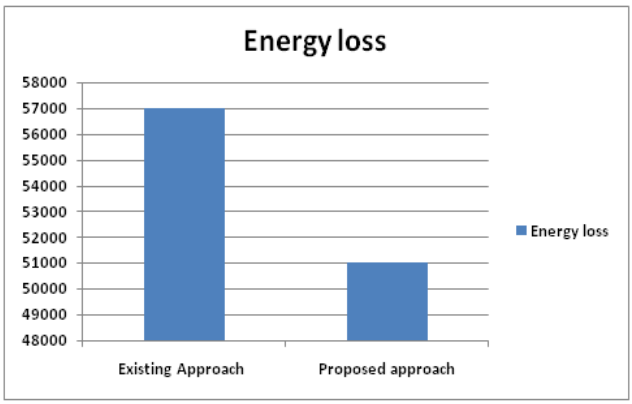


Fig 4:Result Graph

V. Future work:

In this, the complete work is performed under the congestion constraint. It this work we have resolved the congestion problem in a clustered wireless sensor network by using the concept of prioritization. But there is another critical problem in a network is security that also affects the communication throughput over the network. The work can be extended that can improve the communication in case of some attacks occur over the network. We can use some prioritization approach in such way that it can improve the network security and enhance the network throughput.

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