A GAME AND CLUSTER BASED TOPOLOGY CONTROL IN HWSN

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ABSTRACT: In HWSNs, improving quality of service is an endless process due to large number of issues and challenges. Data congestion in a sensor network is one of the very important issues, which directly affects the quality of service of whole network. Network traffic, alternate path routing and reliable data transport are few factors, which can be used to control the contention. In this thesis efforts are made to improve the quality of service in heterogeneous wireless sensor networks by assessing and controlling the data congestion and contention. These problems are overcome using our proposed work.

IndexTerms **- HWSN, Topology, congestion control, QOS.**

1. INTRODUCTION

1.1 NETWORKING:

In Information technology, networking is the construction, design, and use of a network, including the physical (cabling, hub, bridge, switch, router, and so forth), the selection and use of telecommunication protocol and computer software for using and managing the network, and the establishment of operation policies and procedures related to the network.

1.2 TOPOLOGY :

Network Topology. Computers in a network have to be connected in some logical manner. The layout pattern of the interconnections between computers in a network is called network topology. . There are a number of different types of network topologies, including point-to-point, bus, star, ring, mesh, tree and hybrid.

1.2.1 Bus topology :

A bus network is a network topology in which nodes are directly connected to a common linear (or branched) half-duplex link called a bus.

1.2.2 Star topology :

· A star topology is a network topology in which all the network nodes are individually connected to a central switch, hub or computer which acts as a central point of communication to pass on the messages.

1.2.3 Mesh topology :

A mesh network is a local network topology in which the infrastructure nodes (i.e. bridges, switches and other infrastructure devices) connect directly, dynamically and non-hierarchically to as many other nodes as possible and cooperate with one another to efficiently route data from/to clients.

1.2.4 Ring topology:

A ring network is a network topology in which each node connects to exactly two other nodes, forming a single continuous pathway for signals through each node - a ring. Data travels from node to node, with each node along the way handling every packet

1.2.5 Tree topology:

A tree network, or star-bus network, is a hybrid network topology in which star networks are interconnected via bus networks. Tree networks are hierarchical, and each node can have an arbitrary number of child nodes.

1.3 SENSOR :

A sensor is a device that detects and responds to some type of input from the physical environment. The specific input could be light, heat, motion, moisture, pressure, or any one of a great number of other environmental phenomena.

1.4 HETEROGENEOUS WIRELESS SENSOR NETWORKS:

Heterogeneous Wireless Sensor networks (HWSNs) are the key to gathering the information, which is a new class of networking technology in which collection of nodes is organized into a cooperative network. Each node consists of processing capability (one or more micro controllers, CPUs or DSP chips), may contain multiple types of memory (program, data and flash memories), have a RF transceiver, usually with a single or omni directional antenna, a power source (e.g., batteries and solar cells), and accommodate various sensors and actuators.

HWSNs are low-cost, low-power, multi-functional miniature sensor devices, which can observe and react to changes in physical phenomena of their surrounding environments. When networked together over a wireless medium, these devices can provide an overall result of their sensing functionality. Wireless sensors are equipped with a radio transceiver and a set of transducers through which they acquire information about the surrounding environment. When deployed in large quantities in a sensor field, these sensors can automatically organize themselves to form an ad hoc multi-hop network to communicate with each other and with one or more sink nodes.

2. EXISTING SYSTEM

In wireless networks, network topology may change at any time. Therefore, topology control is one of the effective methods to get and keep the desired topology performance. The most existing topology control methods assume that nodes are altruistic. Although there are some game-based topology control schemes to stimulate cooperation between nodes, they only consider a single objective (e.g., energy consumption or network lifetime), which cannot be adaptive to the variation of demand on topology performance. To address these weaknesses, we present the notion of link lifetime and model the multi objective weight sum of any link as the function with respect to transmission power, link delay and link lifetime. Then the proposed game-based localized multi-objective topology control ensures that the desired topology property exists in resulting topology, in which the presented Improved LOCAL-Improvement Algorithm (LDIA) algorithm not only stimulates nodes' cooperation on topology control operation and ensures network's convergence to a steady state, but also has the better performance with respect to executing time and communication overhead than a classic algorithm, i.e., LDIA. Finally, the simulation results show that, by employing appropriate weight values, when compared with some typical schemes considering only energy efficiency, the proposed scheme is the most efficient in regard to average link delay and link lifetime. When compared with a typical scheme considering only network lifetime, the proposed scheme has advantage over average link lifetime, but it is slightly worse in terms of average link delay. Although the proposed scheme is less efficient in terms of average transmission power, where the shortage may be alleviated by adjusting weight values, it satisfies diversified demands for applications due to its flexibility.

2.1 DISADVANTAGES

- Network Congestion is high
- Congestion control is moderate.
- Quality of service parameter is low.

3. PROPOSED WORK

3.1 THREE LAYER SYSTEM (3–LS) MODEL TO IMPROVE QoS IN WSNs

Routing in sensor networks is also very challenging due to several characteristics that distinguish them from contemporary communication and wireless ad hoc networks. First of all, it is not possible to build a global addressing scheme for the deployment of sheer number of sensor nodes. Therefore, classical IP-based protocols cannot be applied to sensor networks. Second, contrary to typical communication networks; almost all applications of sensor networks require the flow of sensed data from multiple regions (sources) to a particular sink. Third, generated data traffic has significant redundancy in it since multiple sensors may generate same data within the vicinity of a phenomenon. Such redundancy needs to be exploited by the routing protocols to improve energy and bandwidth utilization. Fourth, sensor nodes are tightly constrained in terms of transmission power, on-board energy, processing capacity and storage thus requiring careful resource management. Almost all of the routing protocols can be classified as data-centric, hierarchical or location based although, there are few distinct ones based on network flow or QoS awareness.

3.1.1 LAYER 1: HHCC

In 3–LS, the first layer is named as Hop-by-Hop Congestion Control (HHCC). This layer receives data packets from any heterogeneous network and dynamically adjusts the transmission rate of data packets by sensing the congestion degree. For this it calculates the node ranks of each downstream node using the parameters, buffer overhead, Hop count and MAC -overhead. When the node rank crosses a threshold value T, the sensor node will set a congestion bit in every packet it forwards.

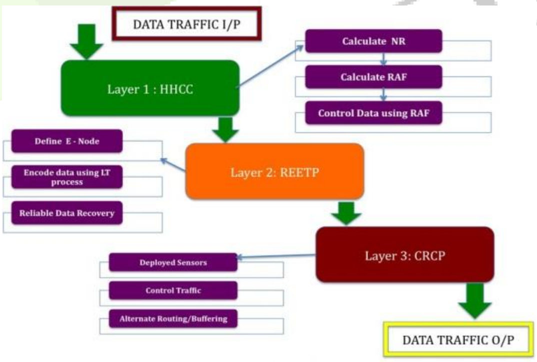

Fig .3.1 system model

If the congestion bit is set, the downstream node calculates the rate adjustment feedback based on the rank and propagates this value upstream towards the source nodes. The source nodes will adjust their transmission rates dynamically based on this feedback. The output of this layer may be fed to 2nd layer of this prototype if further processing is necessary, otherwise here the output is highly efficient in terms of contention control only.

3.1.2 LAYER 2 : REETP

Layer 2 of the 3–LS is named as Reliable Energy Efficient Transport Protocol (REETP). This layer is taking input from the output of the 1st layer, if it is required. REETP has the objective to improve the energy efficiency by improving the reliability of data in the channel. For this, REETP is using the data encoding techniques. In this first of all, the sensors will be flooded in the whole required sensing area. Using the E–node calculation algorithm efficient nodes will be elected, which form a near optimal coverage with set with largest area and highest residual energy level. These nodes are called as E-nodes and responsible for sending and receiving the encoded packets and so transmission of the data.

In REETP transmission system, a data source first groups data packets into blocks of size n. Then the source encodes these blocks of packets, and sends the encoded blocks into the network. The data packets are forwarded from the source to the sink block by block, and each block is forwarded to an E-node. In each E-node relay, the sender first estimates the number of packets needed to send for the E-node to reconstruct the original packets. This number is called as "Max Packet". Within the Max Packet, the sender pushes the encoded packets to the network fast. When the packet is reached, the sender slows down pack transmission, waiting for a positive feedback from the E-node. After receiving encoded packets, the receiver tries to reconstruct the original data packets. If the reconstruction is successful, it sends back a positive feedback. Upon the reception of a feedback, the sender stops sending packets, while the E-node encodes the original data packets again and relays them to the next E-node until the sink is reached. The output of this layer has good quality of service, as the channel of the network is contention free and highly reliable. This data stream is useful for the reception, otherwise for more improvement the traffic may again fed to the third layer.

3.1.3 LAYER 3: CRCP

The third and last layer of the 3–LS is CRCP; on the name of the protocol used in this layer, i.e., Changing Routing for congestion control protocol. In this protocol, once again a congestion detection and control mechanism is applied but in this case instead of rate adjustment the route of data will be changed using the given algorithm. For the detection of congestion at this stage HHCC can be directly called. At this stage channel efficiency of the network is improved by introducing storage strategies at each node or transceiver. If inevitably congestion occurs due to contention of over fed data from the upstream node, it is adjusted in the local buffer at each node up to a level. If the buffer capacity will be full, congestion bit will be set in HHCC, which will change the route of one E-node to another E-node. The output stream from this stage is the desired output of the proposed system model. This is giving high quality data transmission channel for heterogeneous wireless sensor networks.

3.2 ADVANTAGES:

- Reduce congestion
- Improve Quality of Service
- Reduction of power consumption

4. APPLICATIONS

4.1 Area Monitoring

Area monitoring is a common application of HWSNs. In area monitoring, the HWSN is deployed over a region where some phenomenon is to be monitored. A military example is the use of sensors to detect enemy intrusion; a civilian example is the geo-fencing of gas or oil pipelines. When the sensors detect the event being monitored (heat, pressure), the event is reported to one of the base stations, which then takes appropriate action (e.g., send a message on the internet or to a satellite). Similarly, HWSNs can use a range of sensors to detect the presence of vehicles ranging from motorcycles to train cars.

4.2 Air Pollution Monitoring

HWSNs are deployed in several cities to monitor the concentration of dangerous gases for citizens.

4.3 Forest Fires Detection

A network of sensor nodes can be installed in a forest to control when a fire has started. The nodes will be equipped with sensors to control temperature, humidity and gases, which are produced by fire in the trees or vegetation. The early detection is crucial for a successful action of the firefighters; thanks to HWSNs, the fire brigade will be able to know when a fire is started and how it is spreading.

4.4 Greenhouse Monitoring

HWSNs are used to control the temperature and humidity levels inside commercial greenhouses. When the temperature and humidity drops below specific levels, the greenhouse manager must be notified via e-mail or cell phone text message, or host systems can trigger misting systems, open vents, turn on fans, or control a wide variety of system responses.

4.5 Landslide Detection

A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide. And through the data gathered it may be possible to know the occurrence of landslides long before it actually happens.

4.6 Machine Health Monitoring

HWSNs have been developed for machinery condition-based maintenance as they offer significant cost savings and enable new functionalities. In wired systems, the installation of enough sensors is often limited by the cost of wiring. Previously inaccessible locations, rotating machinery, hazardous or restricted areas, and mobile assets can now be reached with wireless sensors.

4.7 Water/Wastewater Monitoring

There are many opportunities for using WSNs within the water/wastewater industries. Facilities not wired for power or data transmission can be monitored using industrial wireless I/O devices and sensors powered using solar panels or battery packs.

4.8 Landfill Ground Well Level Monitoring and Pump Counter

HWSNs can be used to measure and monitor the water levels within all ground wells in the landfill site and monitor leach ate accumulation and removal. A wireless device and submersible pressure transmitter monitors the leach ate level. The sensor information is wirelessly transmitted to a central data logging system to store the level data, perform calculations, or notify personnel when a service vehicle is needed at a specific well.

5. OUTPUT:

5.1 NETWORK CONSTRUCTION:

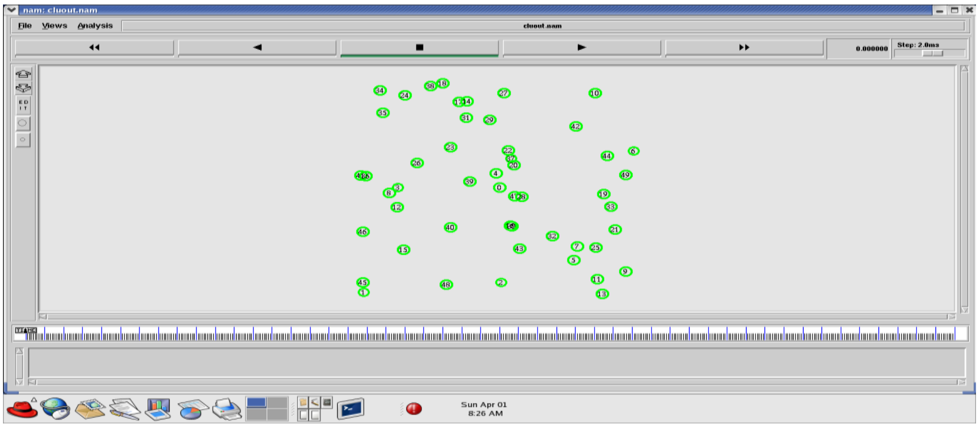

Fig.5.1 network construction

5.2 DATA TRANSMISSION:

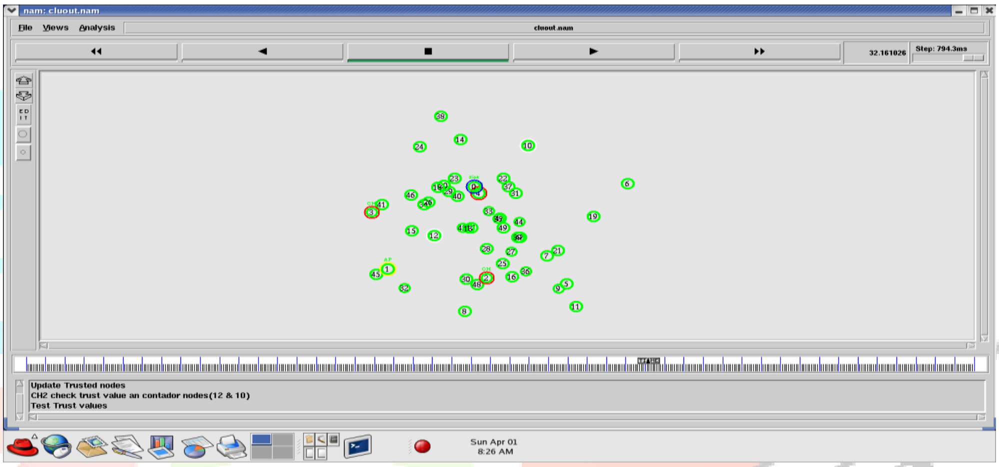

Fig.5.2 data transmission

5.3 TRUST VALUE CALCULATION OF THE NETWORK:

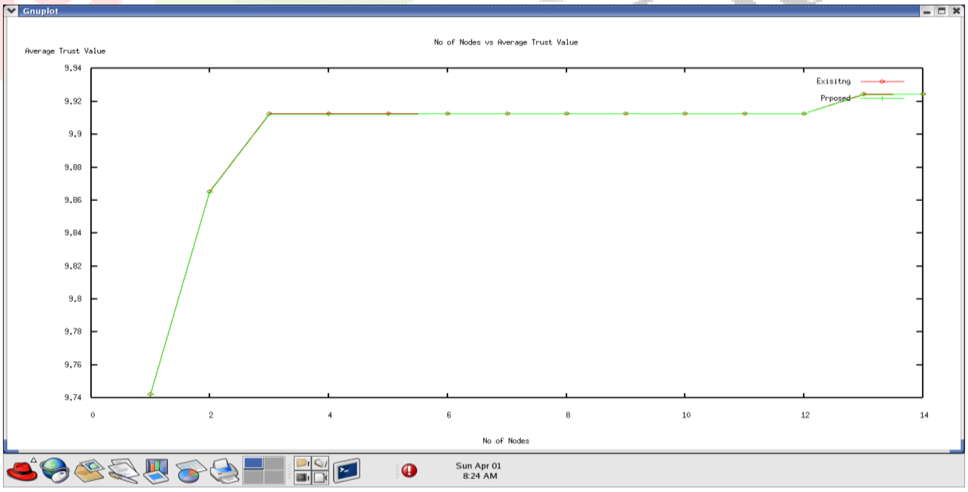

Fig 5.3 trust value calculation of the network

5.4 LOSS CALCULATION OF THE NETWORK:

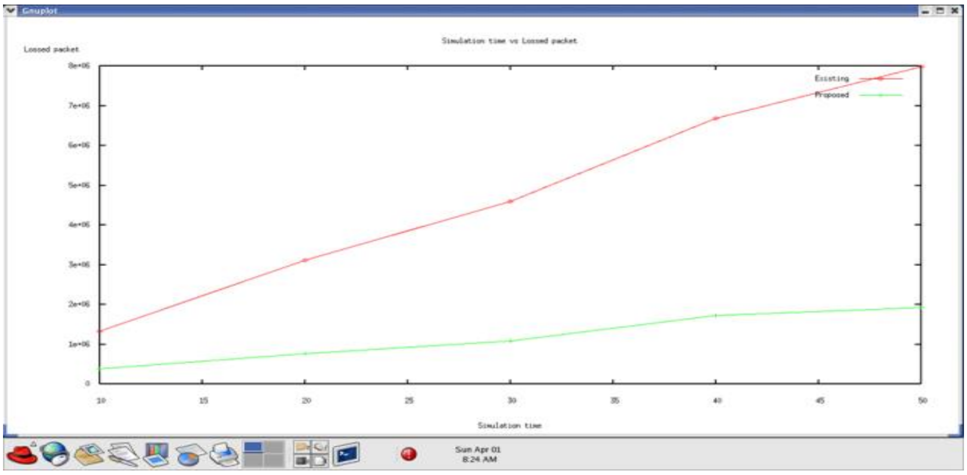

Fig.5.4 loss calculation of the network

5.6 RECEIVED PACKETS CALCULATION OF THE NETWORK

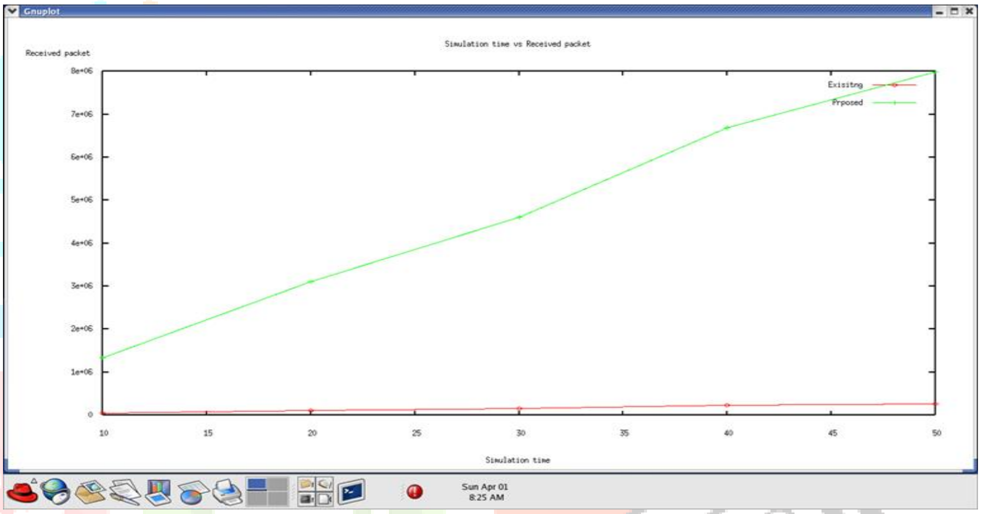

Fig.5.6 recevied packets calculation of the network

5.7 THROUGHPUT CALCULATION OF THE NETWORK:

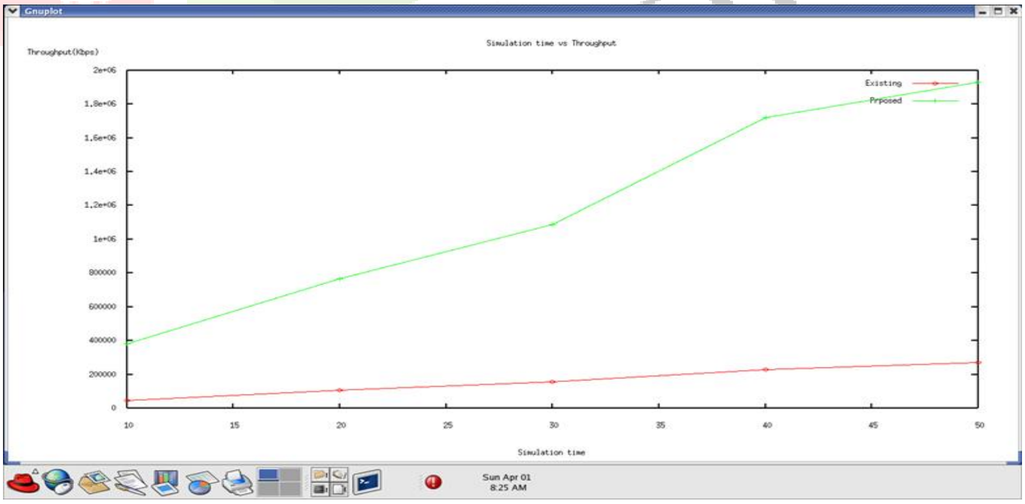

fig.5.7 throughput calculation of the network

6. CONCLUSION

This thesis has focuses on new transport and congestion control paradigms for the improvement in quality of service of class of heterogeneous wireless sensor networks. These networks are embedded in the real world and interact closely with the physical environment in which they are located. Such networks must be designed to effectively deal with the network's dynamically changing resources, including energy, bandwidth, processing power, node density, and connectivity. Importantly, these sensor networks must be designed to be responsive to such changing conditions while supporting a wide range of traffic demands from sensors.

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