International Online Conference on Advanced Research in Biology, Ecology, Science and Technology
(ICARBEST'15)
Organized by
International Journal of Advanced Research in Biology, Ecology, Science and Technology (IJARBEST)
19th November 2015

Delay-Aware Data Collection Network Structure For WSN

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***Abstract*— Wireless sensor networks utilize large numbers of wireless sensor nodes to collect information from their sensing terrain. Wireless sensor nodes are battery-powered devices. Energy saving is always crucial to the lifetime of a wireless sensor network. Recently, many algorithms are proposed to tackle the energy saving problem in wireless sensor networks. There are strong needs to develop wireless sensor networks algorithms with optimization priorities biased to aspects besides energy saving.**

In this project, a delay-aware data collection network structure for wireless sensor networks is proposed based on Multi hop Cluster Network. The objective of the proposed network structure is to determine delays in the data collection processes. The path with minimized delay through which the data can be transmitted from source to destination is also determined. AODV protocol is used to route the data packets from the source to destination.

***Index Terms*— AODV, WSN, Delay time**

I. INTRODUCTION

A sensor node, also known as a mote is a node in a wireless sensor network that is capable of performing some processing, gathering sensory information and communicating with other connected nodes in the network. A mote is a node but a node cannot always be a mote. The main components of a sensor node are a microcontroller, transceiver, external memory, power source and one or more sensors. The controller performs tasks, processes data and controls the functionality of other components in the sensor node. While the most common controller is a microcontroller, other alternatives that can be used as a controller are a general purpose desktop microprocessor, FPGAs and ASICs. A microcontroller is often used in many embedded systems such as sensor nodes because of its low cost, flexibility to connect to other devices, ease of programming, and low power consumption.

A general purpose microprocessor has higher power consumption than a microcontroller, therefore it is often not considered a suitable choice for a sensor node. DSP may be chosen for broadband wireless communication applications, but in Wireless Sensor Networks the wireless communication is often modes i.e., simpler, easier to process modulation and the signal processing tasks of actual sensing of data is less complicated. Therefore the advantages of DSPs are not usually of much importance to wireless sensor nodes. FPGAs can be reprogrammed and reconfigured according to requirements, but this takes more time and energy than desired. Sensor nodes often make use of ISM band which gives free radio, spectrum allocation and global availability. The possible choices of wireless transmission media are Radio frequency (RF), Optical communication (Laser) and Infrared. Lasers require less energy but need line-of-sight for communication and are sensitive to atmospheric conditions. Radio frequency based communication is the most relevant that fits most of the WSN applications. WSNs tend to use license-free communication frequencies such as 173, 433, 868, and 915 MHz; and 2.4 GHz. The functionality of both transmitter and receiver are combined into a single device known as transceivers. Transceivers often lack unique identifiers. The operational states are transmitting,receive, idle, and sleep. Current generation transceivers have built-in state machines that perform some operations automatically.

Most transceivers operating in idle mode have a power consumption almost equal to the power consumed in receive mode. Thus, it is better to completely shutdown the transceiver rather than leave it in the idle mode when it is not transmitting or receiving. A significant amount of power is consumed when switching from sleep mode to transmit mode in order to transmit a packet Routing in a more narrow sense of the term, is often contrasted with bridging in its assumption that network addresses are structured and that similar addresses imply proximity within the network. Because structured addresses allow a single routing table entry to represent the route to a group of devices, structured addressing (routing, in the narrow sense) outperforms unstructured addressing (bridging) in large networks, and has become the dominant form of addressing on the Internet, though bridging is still widely used within localized environments.

II. EXISTING SYSTEM

Proactive type of protocols maintains fresh lists of destinations and their routes by periodically distributing routing tables throughout the network. It is also called as Table driven routing. The main disadvantages of such algorithms are:

1. Respective amount of data for maintenance.
2. Slow reaction on restructuring and failures.

Examples of pro-active algorithms are:

- DSDV (Highly Dynamic Destination-Sequenced Distance Vector routing protocol) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm. The main contribution of the algorithm was to solve the routing loop problem. Each entry in the routing table contains a sequence number, the sequence numbers are generally even if a link is present; else, an odd number is used. The number is generated by the destination, and the emitter needs to send out the next update with this number. Routing information is distributed between nodes by sending full dumps infrequently and smaller incremental updates more frequently.
- HSR (Hierarchical State Routing protocol) HSR maintains a hierarchical topology, where elected cluster heads at the lowest level become members of the next higher level. On the higher level, super clusters are formed, and so on. Nodes which want to communicate to a node outside of their cluster ask their cluster head to forward their packet to the next level, until a cluster head of the other node is in the same cluster. The packet then travels down to the destination node
- LCA (Linked Cluster Architecture) has "Linked Cluster" structure and was developed and maintained by a distributed algorithm that periodically reorganized the network in response to connectivity changes points out that the Linked Cluster Architecture (LCA) facilitates regional or net-wide broadcasts by identifying "broadcast centers" (clusterheads).

Reactive type of protocols finds a route on demand by flooding the network with Route Request packets. It is also termed as On-demand routing. The main disadvantages of such algorithms are:

1. High latency time in route finding.
2. Excessive flooding can lead to network clogging.

Flow oriented routing type of protocols finds a route on demand by following present flows. One option is to unicast consecutively when forwarding data while promoting a new link. The main disadvantages of such algorithms are:

1. Takes long time when exploring new routes without a prior knowledge.
2. May refer to entitative existing traffic to compensate for missing knowledge on routes.

Hybrid type of protocols combines the advantages of proactive and of reactive routing. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. The choice for one or the other method requires predetermination for typical cases. The below figure explains how routing takes place in Hybrid routing The main disadvantages of such algorithms are:

1. Advantage depends on number of nodes activated.
2. Reaction to traffic demand depends on gradient of traffic volume.

With Hierarchical type of protocols the choice of proactive and of reactive routing depends on the hierarchic level where a node resides. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding on the lower levels. The choice for one or the other method requires proper attributation for respective levels. The main disadvantages of such algorithms are:

1. Advantage depends on depth of nesting and addressing scheme.
2. Reaction to traffic demand depends on meshing parameters.

To improve the lifetime of WSN, nodes are organized into clusters [1], in which the cluster head (CH) collects and aggregates the data. A special node called mobile data collector (MDC) is used to collect the data from the CH and transfer it to the base station (BS). So far in the literature secure data collection in distributed WSN is considered. Here we propose and analyse three protocols for secure data collection in clustered WSN. The protocols authenticate the MDC and then transfer the encrypted data to MDC. The protocols show varying resiliency to compromised CH. The models used are Network model and Adversary model and it is of 2 types (1)An adversary which deploys a malicious MDC (2)An adversary which compromises separately a CH and an MDC. In Time stamp protocol, we present a simple authentication scheme called TSP. We use the tree-based key management scheme and time stamp for secure data collection. Our scheme not only identifies the malicious MDC, but also prevents the replay attack. The advantage is the data collected using MDC in clustered WSN is used to increase the network lifetime. The disadvantage is additional computational overhead.

[2] evaluates the effect of timing in data aggregation algorithms. In network aggregation and energy-efficient data propagation is done by processing data as it flows from information sources to sinks It includes: (1) the development of a timing model for periodic aggregation i.e. call cascading timeouts (2) a comparative performance study of different aggregation algorithms using extensive simulations. The goals of cascading timeout are Simplicity, Efficiency, No clock synchronization, Routing protocol independence Other Periodic (1) Aggregation Mechanisms are Periodic Simple: In

periodic simple aggregation protocols, all nodes wait a pre-defined amount of time, aggregate all the data received in that period, and send out a single packet. (2) Periodic Per-Hop: In this, once all data items are received from a node's children in the distribution tree, an aggregated packet is produced and sent onto the next hop. Each node uses a timeout for sending out packets in case their children's response is lost.

Simulation result shows that setting up the clock out timer based on a node's position in the aggregation tree results in a beneficial "cascading effect", yielding considerable energy efficiency, yet maintaining data accuracy and freshness**.** The disadvantage is continuous monitoring is involved. Wireless sensor networks with thousands of tiny sensor nodes [3], are expected to find wide applicability and increasing deployment in coming years, as they enable reliable monitoring and analysis of the environment. In this paper, we propose a hybrid routing protocol (APTEEN) which allows for comprehensive information retrieval. The nodes in such a network not only react to time-critical situations. Such a network enables the user to request past, present and future data from the network The protocol used here is APTEEN (**A**daptive **P**eriodic **T**hreshold-sensitive **E**nergy **E**fficient Sensor **N**etwork Protocol).In APTEEN once the CHs are decided, in each cluster period, the cluster head first broadcasts the following parameters: Attributes, Threshold, Count time and Schedule We use TDMA schedule such that each node in the cluster is assigned a transmission slot The main features of our scheme are : 1) By sending periodic data, it gives the user a complete picture of the network2) It offers a flexibility of allowing the user to set the time interval (TC) and the threshold values for the attributes.3) Energy consumption can be controlled by the count time and the threshold values. 4) The hybrid network can emulate a proactive network or a reactive network, by suitably setting the count time and the threshold values. The queries in a network like Historical query, One-Time query and Persistent Queries can be handled by some alternatives of a flat topology and a cluster-based approach. In a flat topology, each node satisfying the query conditions has to individually send the data to the requesting node.

Simulation results shows that our protocol is the first model that can handle all the three types of queries The disadvantage is it is not suited for network with uneven node distribution.

[4] presents and evaluates two principles for designing robust, reliable, and efficient collection protocols. The first is Datapath validation: a protocol can use data traffic as active topology probes, quickly discovering and fixing routing loops. The second is adaptive beaconing: by extending the Trickle Code Propagation algorithm to routing control traffic, a protocol sends fewer beacons while simultaneously reducing its route repair latency. This paper makes three research contributions. First, it describes two key mechanisms, adaptive beaconing and data path feedback, which enable routing layers to remain efficient, robust, and reliable in highly dynamic topologies on many different sensor platforms. Second, it describes the design and implementation of CTP, a collection protocol that uses these two mechanisms. Third, by evaluating CTP on 12 different test beds, it provides a comparative study of their behavior and properties. In Datapath Validation, every collection node maintains an estimate of the cost of its route to a collection point.. Using the data path to validate the topology in this way allows a protocol to detect possible loops on the first data packet after they occur. By using Adaptive Beaconing, fast recovery and low cost is achieved It id done by extending the Trickle algorithm to maintain its routing topology. Trickle is designed to reliably and efficiently propagate code in a wireless network. Trickle's basic mechanism is transmitting the version number of a node's code using a randomized timer.

The efficiency of these two techniques shows that the limitations of many wireless protocols can be addressed by integrating the data and control planes. The advantages are low cost and fast recovery and it is efficient in highly dynamic environments. The disadvantages are it places applicability borders in ad-hoc networks.

In [5], the efficient link scheduling for a multihop wireless network is studied to maximize its throughput. Efficient link scheduling can greatly reduce the interference effect of close by transmissions. Unlike the previous studies that often assume a unit disk graph model; we assume that different terminals could have different transmission ranges and different interference ranges. Using a mathematical formulation, we develop synchronized TDMA link scheduling that optimizes the networking throughput. Specifically, by assuming known link capacities and link traffic loads, we study link scheduling under the RTS/CTS interference model and the protocol interference model with fixed transmission power. For both models, we present both efficient centralized and distributed algorithms that use time slots within a constant factor of the optimum. We also present efficient distributed algorithms whose performances are still comparable with optimum, but with much less communications. In Network model, we assume that there is a set *V* of communication terminals deployed in a plane. Each wireless terminal is only equipped with *single* radio interface.. In Interference model, to schedule two links at the same time slot, we must ensure that the schedule will avoid the interference. Two different types of interference have been studied namely, primary interference and secondary interference. Primary interference occurs when a node transmits and receives packets at the same time. Secondary interference occurs when a node receives two or more separate transmissions. Here all transmissions could be intended or only one transmission is intended for this node.

The Advantages of this model is Throughput is maximized and the interference is avoided. The disadvantages are dealing with interference links is little difficult.

III. PROPOSED SYSTEM

The following are the different modules in the proposed system:

1. Node creation
2. Path determination
3. Data transmission
4. Calculation of delay time.

A wireless ad-hoc network is a decentralized type of wireless network. The network is ad hoc because it does not rely on a preexisting infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. Instead, each node participates in routing by forwarding data for other nodes, and so the determination of which nodes forward data is made dynamically based on the network connectivity. In addition to the classic routing, ad hoc networks can use flooding for forwarding the data. A network structure is formed with some number of nodes and each node is represented with a unique id or number. The source and the destination node is also determined.

The basic primitive for creating a node is

set ns [new Simulator]

$ns **node**

The instance procedure node constructs a node out of more simple classifier objects. $node entry returns the entry point for a node. This is the first element which will handle packets arriving at that node. The procedure $node id returns the node number of the node. This number is automatically incremented and assigned to each node at creation by the class.

After forming the network structure the path through which the data is forwarded from source to destination is determined. The node which resides closely to the source node is identified and the data rate for each node is calculated. Each node will have some different energy level. The next hop for each node is also identified. Each of the sensor node will have its own coverage area based on its energy level and bandwidth. Multipath routing consists of finding multiple routes between a source and destination node. These multiple paths between source and destination node pairs can be used to compensate for the dynamic and unpredictable nature of ad hoc networks.

There exist different routes for the same data to be transmitted from source to destination. After finding all these routes the data is transmitted from the source to destination. While data transmission some times packets may be lost and it occurs due to flooding. The energy of the node may be reduced by the process of flooding and delay in transmitting data to the next node may also occur. After data the packets through several intermediate nodes the data is transmitted to the destination node. If node S sends the same packet along all three paths, as long as at least one of the paths does not fail, node D will receive the packet.

While routing redundant packets is not the only way to utilize multiple paths, it demonstrates how multipath routing can provide fault tolerance in the presence of route failures. Since bandwidth may be limited in a wireless network, routing along a single path may not provide enough bandwidth for a connection. However, if multiple paths are used to route data, the aggregate bandwidth of the paths may satisfy the bandwidth requirement of the application. Also, since there is more bandwidth available, a smaller end-to-end delay may be achieved. Due to issues at the link layer, using multiple paths in ad hoc networks to achieve higher bandwidth may not be as straightforward as in wired networks. Transmissions from a node along one path may interfere with transmissions from a node along another path, thereby limiting the achievable throughput.

In data communications, the delay time is defined as the time taken by the nodes to transmit the data from source to the destination. Bandwidth-delay product refers to the product of a data link's capacity (in bits per second) and its end-to-end delay (in seconds). The result, an amount of data measured in bits (or bytes), is equivalent to the maximum amount of data on the network circuit at any given time, i.e. data that has been transmitted but not yet received. Sometimes it is calculated as the data link's capacity times its round trip time. A network with a large bandwidth-delay product is commonly known as a long fat network. The delay occurred in data transmission at each node is calculated. The energy level and bandwidth determines the data rate and delay. Considering the base station as the root of the network, the number of time slots required by the base station to collect data from all sensor nodes is

$$t(N) = \lceil \log_2 (N+1) \rceil$$

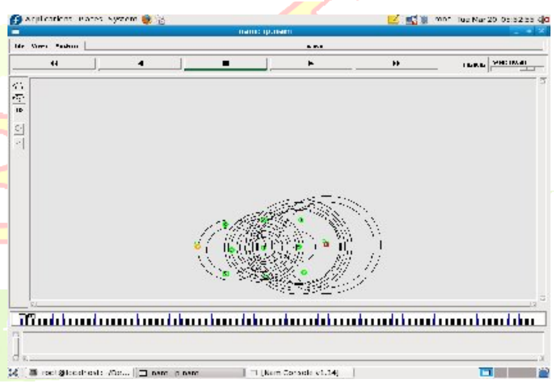

Fig.1. Path Determination

Fig.1. shows the possible routes for the data transmission between the sensor nodes.

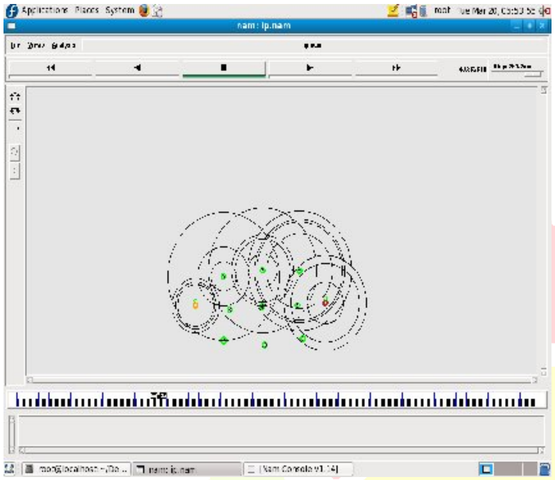

Fig.2. Data Transmission

Fig.2. describes the data transmission between the sensor nodes with minimized delay and low packet loss.

IV. CONCLUSION

Wireless sensor networks utilize large numbers of wireless sensor nodes to collect information from their sensing terrain. Wireless sensor nodes are battery-powered devices. Energy saving is always crucial to the lifetime of a wireless sensor network. Recently, many algorithms are proposed to tackle the energy saving problem in wireless sensor networks. There are strong needs to develop wireless sensor networks algorithms with optimization priorities biased to aspects besides energy saving. In this project, a delay-aware data collection network structure for wireless sensor networks is proposed based on Multi hop Cluster Network. The objective of the proposed network structure is to determine delays in the data collection processes. The path with minimized delay through which the data can be transmitted from source to destination is also determined. AODV protocol is used to route the data packets from the source to destination.

REFERENCES

[1] Solis and K. Obraczka, "The impact of timing in data aggregation for sensor networks," in *Proc. IEEE Int. Conf. Commun.*, Paris, France, Jun. 2004, vol. 6, pp. 3640–3645.
[2] A. Manjeshwar and D. P. Agrawal, "APTEEN: A hybrid protocol for efficient routing and comprehensive information retrieval in wireless sensor networks," in *Proc. 16th Int. Symp. Parallel Distrib. Process., (IPDPS 2002)*, Fort Lauderdale, FL, Apr. 2002, pp. 195–202
[3] R. Fonseca, O. Gnawali, K. Jamieson, S. Kim, P. Levis, and A. Woo, "The collection tree protocol," *TinyOS Enhancement Proposals (TEP)*, vol. 123, Dec. 2007.
[4] W.Wang, Y.Wang, X.-Y. Li, W.-Z. Song, and O. Frieder, "Efficient interference- aware TDMA link scheduling for static wireless networks," in *Proc. 12th Annu. Int. Conf. Mobile Comput. Netw., (MobiCom'06)*, Los Angeles, CA, Sep. 2006, pp. 262–273
[5] D. S. J. D. Couto, "High-Throughput routing for multi-hop wireless networks," Ph.D. dissertation, Dept. Elect. Eng. Comput. Sci., Massachusetts Inst. Technol., Cambridge, MA, 2004.
[6] S. Lindsey and C. S. Raghavendra, "PEGASIS: Power-efficient gathering in sensor information systems," in *Proc. IEEE Conf. Aerosp.*, Big Sky, MT, USA, Mar. 2002, vol. 3, pp. 1125–1130.
[7] A. Manjeshwar and D. P. Agrawal, "TEEN: A routing protocol for enhanced efficiency in wireless sensor networks," in *Proc. 15th Int. Symp. Parallel Distrib. Process., (IPDPS 2001)*, San Francisco, CA, Apr. 2001, pp. 2009–2015.