Comparison on Various Protocols by using Qos Parameters in Wireless Sensor Networks

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Abstract
In recent days, the radio signals mingled with both high-quality and low-quality frequency links. The motes face failure from the radio frequency interferences in noisy environment and consume more energy for packet transmission. To overcome the higher power consumption problems, a system with the Efficient and Reliable Routing protocol (EAR) that achieves reliable, scalable performance with minimization of redundancy routes and compromise of energy. This project describes that how to identifying good radio frequency links with minimum amount of energy utilization for data-aggregation with higher rates of data transmission at variable motes in wireless sensor networks. The EAR protocol dynamically determine and maintain the routes based on four parameters namely Expected path length, Weighted combination of distance traversed, Energy levels and Link transmission success history. The best routes with shortest path and good Radio Frequency links with least energy is identified by the link score. Control overheads in EAR are low of packet delivery ratio, packet latency and minimal energy consumption while operating in a noisy wireless environment. Efficient and Reliable routing protocols achieve reliability, energy efficiency and scalability in wireless message delivery.

Keywords
Energy efficiency, hop count, reliable routing, routing protocol.

I. Introduction
A network that is formed when a set of small sensor devices that are deployed in an “Ad-hoc fashion” no predefined routes, cooperate for sensing a physical phenomenon. A Wireless Sensor Network (WSN) consists of base stations and a number of wireless sensors.

In addition to one or more sensors, each node in a sensor network is typically equipped with a radio transceiver or other wireless communications device, a small microcontroller, and an energy source, usually a battery. The envisaged size of a single sensor node can vary from shoebox-sized nodes down to devices the size of grain of dust, although functioning 'motes' of genuine microscopic dimensions have yet to be created.

The cost of sensor nodes is similarly variable, ranging from hundreds of dollars to a few pence, depending on the size of the sensor network and the complexity required of individual sensor nodes.

Size and cost constraints on sensor nodes result in corresponding constraints on resources such as energy, memory, computational speed and bandwidth.

The large sensor network normally constitutes a wireless ad-hoc network, meaning that each sensor supports a multi-hop routing algorithm (several nodes may forward data packets to the base station).

II. Existing System
In Fixed power sensor networks are face node failures due to, Radio Frequency (RF) interference from environmental noise and energy constraints. Fixed-power transceivers networks have cheaper motes with variable-power RF interference but may be more prone to communication disruptions. Routing protocols in terms of packet delivery ratio, packet latency, and scalability and energy consumption while operating in a noisy wireless environment where network traffic, link disruptions and node failure rates are high. Routing protocols for this network must overcome these problems to achieve reliability, energy efficiency and scalability in message delivery. In Noise environment, to identify the good RF (radio-frequency) links for routing.

III. Related Work
The Dynamic Source Routing protocol (DSR) is a simple and efficient routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. DSR allows the network to be completely self-organizing and self-configuring, without the need for any existing network infrastructure or administration. The protocol is composed of the two main mechanisms of "Route Discovery" and “Route Maintenance", which work together to allow nodes to discover and maintain routes to arbitrary destinations in the ad hoc network [3].

In GBR, hop-counts to the hub are computed for each node and the difference between a node’s hop count and that of its neighbour is the gradient of that link. Gradients are thus established from nodes to the hub and all messages will flow in the direction of the greatest gradient. Thus, packet routing is similar to distance-based techniques utilised by several existing protocols [4].
In GRAdient Broadcast (GRAB), a new set of mechanisms and protocols which is designed specifically for robust data delivery in face of unreliable nodes and fallible wireless links. GRAB builds and maintains a cost field, providing each sensor the direction to forward sensing data. GRAB controls the width of the band by the amount of credit carried in each data message, allowing the sender to adjust the robustness of data delivery [5].

In Ad hoc On Demand Distance Vector Routing (AODV), Route discovery in AODV is on-demand and follows a route request/route reply query cycle. is similar to DSR except that each node maintains a routing table with only one entry for each destination [6].

In EAR we propose an Efficient and Reliable routing protocol (EAR) that routes messages to one or more hubs for data-aggregation applications. EAR takes into account the expected path length and a weighted combination of distance traversed, energy level and past performance of an RF link for its routing decisions. Control overheads in EAR are low. To achieve the packet delivery ratio, packet latency, and energy consumption in noisy environment [1].

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IV. Design of EAR

A. Setup Phase

When a hub is powered on, it broadcasts an Advertisement (ADV) packet indicating that it wants to receive RPT packets. When a neighbouring node around the hub receives this ADV packet, it will store the route to the hub in its routing table .Nodes do not propagate the ADV packet received. When a node is powered on, it delays for a random interval of time before starting an initialisation process. In Fig..1 shows a node starts the initialisation process by broadcasting a Route Request (RREQ) packet asking for a route to a hub. When a hub receives a RREQ packet, it will broadcast a Route Reply (RREP) packet. Similarly, when a node receives a RREQ packet, it will broadcast a RREP packet if it has a route to a hub. Otherwise, it will ignore the RREQ packet. Nodes do not propagate RREQ packets. When a node receives a RREP packet, it will store the route in its routing table. When it has at least one route to the hub it skips the initialisation process. By introducing random delay for each node to begin initialisation process, a portion of nodes will receive a RREP packet before they have begun their initialization process. This enables faster propagation of routes and saves on the amount of control packets generated in the setup phase. A node may store more than one route to the hub. A route in the routing table is indexed using the next hop node's ID - that is the ID of the neighbouring node. A node keeps only one route entry for a neighbour that has a route to the hub even though that neighbour could have multiple routes to the hub. For each route entry in the route table, only the best route is stored. The selection of best routes is described next.

B. Route Selection Phase

Ideally, the best route is the shortest as it incurs the lowest latency and consumes the least energy. In an actual environment, the performance of an RF link varies with physical distance and the terrain between nodes and should be accounted for in routing decisions. In EAR, shortest routes are initially admitted into the routing table based on hop-count. As RPT packets flow through these links, less desirable ones will start to exhibit high packet loss rate and are eventually blacklisted and omitted from the routing table. Links that are omitted from the routing table may be re-admitted again only after a period of time. Some RF links are affected by temporary external disruption and should be given the chance to be readmitted. This allows for adaptiveness. The mechanism uses a sliding window that keeps track of the last N attempts to route packets on a specified link. If a link fails to relay all packets in the last N consecutive attempts, then it will be blacklisted and omitted from the table. A metric,Fig.1 LinkScore ,is defined as LinkScore = (PE × WE +PT × WT), where PE – energy level of the next hop node (0.0 to 100.0), WE– assigned weight for PE (0.0 to 1.0), PT – transmission success rate (0.0 to 100.0) and WT– assigned weight for PT (0.0 to 1.0). Weights, WE and WT, may be determined empirically but their sum must equal 1. For example, in a low noise environment, the probability of successful transmission is higher. In this scenario, WE = 0.7 and WT = 0.3 may be chosen allowing routing decisions to focus more on energy conservation in path selection. Conversely, in a noisy environment, WT = 0.7 and WE = 0.3 could be chosen instead, giving higher emphasis to the selection of high reliability paths over energy conservation. LinkScore then takes on a value from 0 to 100 and a higher value indicates a better link.

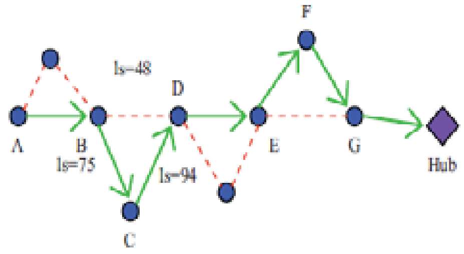

Fig.1: Illustration of forwarding based on LinkScore metric.

An arbitrary value is initially assigned to PT as the link performance is unknown. PT rises (or drops) when subsequent packet transmissions succeed (or fail). PE starts at 100 and drops as a node consumes its energy resources. LinkScore is used when there are two links of different routes with the same hub distance competing to be admitted to the routing table. When a new link is received and the routing table is full, link replacement is initiated. The search ignores blacklisted links and targets the link with the lowest LinkScore to be replaced. When there is more than one entry with the same LinkScore, the entry with the longest length is chosen to be replaced. This worst route is then compared against the incoming route and the shorter route is admitted into the routing table. If there is a tie in route length, then the route with the higher LinkScore is admitted. Since each node stores and maintains the best available RF links in its routing table, packets travel on the best route from a node to a hub at the given time. Since the routing table contains only one entry to the next hop node, its size scales slowly with network size and multiple hubs.

C. Data Dissemination

Sensor nodes generate RPT packets at periodic intervals or sleep, waiting for some event to happen. An RPT packet contains information of interest to network users and has two fields in its header: ExpPathLen and NumHop Traversed. The first field is the expected number of hops the packet will have to traverse before it reaches the hub. It is defined as: ExpPathLen = NH × α, where $0.0 < \alpha \leq 1.0$, NH is the number of hops from this node to the hub for the route selected. The route selected need not be the shortest but ExpPathLen is bounded by the network diameter. A is an assigned weight such that $0.0 < \alpha \leq 1.0$ since the minimum number of hops to reach the hub is at least 1.

NumHopTraversed is the distance a packet has traversed and is initialised as 0. The packet is forwarded to the next node in the route. When the next node receives the packet, it will increment NumHopTraversed by one and compare it with ExpPathLen. The algorithm is as follows: By assigning $\alpha >> 0.0$, a packet may favour a route with better performing links rather than just the shortest route (Fig.1). If the number of hops that a packet has traversed exceeds the expected number, there must be changes in the network topology. During this period of instability, the packet will take the shortest route to the hub. To prevent potential deadlocks from occurring, a variable BufUtilLvl is used at each node to store the current utilisation level of the packet output buffer. A threshold value, BLThreshold, is defined where BLThreshold < Bmax (max size of buffer). If BufUtilLvl is greater than BLThreshold, the packet will be relayed on the shortest route to the hub. This buffer control mechanism ensures that new packets will not be injected when the buffer is almost full and there will always be at least one buffer space for transit packets to be routed.

D. Route Update

Sensor nodes continually update "best" routes in the routing table. Instead of explicit control packets, EAR uses the handshaking mechanism at the MAC layer. Route information is piggybacked onto both RTS and CTS packets. Nodes in blue have received updated route information from either node X's RTS or node Y's CTS packet or both. RTS and CTS packets have to be received and processed by all nodes as part of the collision avoidance mechanism employed by the MAC protocol. Hence, utilizing RTS-CTS handshaking instead of separate DATA-ACK would result in more current route information for a node. As an example, EAR can use S-MAC (Sensor -MAC) that has energy saving mechanisms. S-MAC uses the same four-way handshaking mechanism as IEEE 802.11 to achieve reliable link-to-link transmission. One of the energy-saving mechanisms known as Overhearing Avoidance specifies that nodes upon hearing a RTS or CTS packet that is not addressed to them will go into sleep mode. Periodically exchanging routing information between nodes is costly in terms of energy consumption and bandwidth usage.

Piggybacking route information onto existing RTS and CTS packets incurs additional energy consumption as the packet size increases. However, no extra packets need be generated and additional costs are negligible compared to the cost incurred in relaying explicit route information (control) packets.

V. Simulation

Here we use the simulator as GloMoSim (for Global Mobile Information System Simulator) for the purpose of to show the demonstration of networks based results [2]. A scalable simulation environment called GloMoSim that effectively utilizes parallel execution to reduce the simulation time of detailed high-fidelity models of large communication networks. GloMoSim is a scalable simulation library for wireless network systems built using the PARSEC simulation environment. GloMoSim also supports two different node mobility models. Nodes can move according to a model that is generally referred to as the "random waypoint" model. A node chooses a random destination within the simulated terrain and moves to that location based on the speed specified in the configuration file. It is flexible with pure wireless environmental.

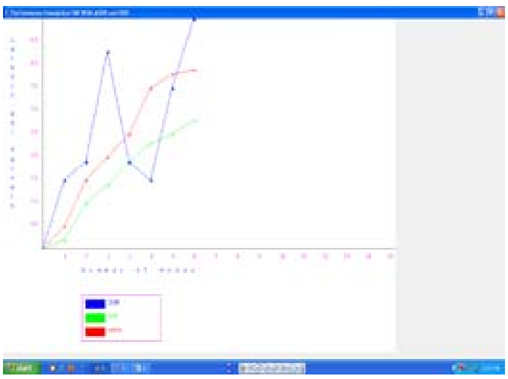

Fig. 2: Illustration of Packet Delivery Ratio results

After reaching its destination, the node pauses for a duration that is also specified in the configuration file. The other mobility model in GloMoSim is referred to as the "random drunken" model. A node periodically moves to a position chosen randomly from its immediate neighboring positions. The frequency of the change in node position is based on a parameter specified in the configuration file. In the simulation, all nodes generate data packets that are routed to the hub located in the centre of the WSN. The routing protocols are subjected to a series of tests to evaluate their performances in a realistic WSN environment that is compounded with noise and node failures. We simulated network sizes from 50 to 400 nodes with 10% and 50% active source nodes. Every node except the hub takes on a random noise factor between 10% and 50%. The noise factor specifies the probability that packets to be received by that node are corrupted or lost. Also, 50% of randomly selected nodes fail at random times within the simulation duration. Results were averaged over 30 runs each with a different seed. As the results of simulation to fulfill the during Message delivery Fig..2.like, Packet delivery ratio (PDR), Packet latency, Energy Consumption, Fault Tolerance and Scalability.

Packet transmission by EAR protocol is performed for achieving good radio frequency link with minimal energy utilization for data aggregation with higher rates of data transmission at variable motes in sensor networks. This was done by three continues modules, Formation of Adhoc networks, Routing through EAR protocol and Performance Evaluation. The Adhoc networks were formed by fixed number of node with variable capabilities. The routing is based on the four parameters namely Expected path length, Weighted Combination of distance traversed, Energy levels and Link transmission success history. The performance Evaluation made on the existing protocols. When comparing EAR with the protocols AODV and DSR, the packet delivery ratio is about 40 % higher than AODV. The latency is low when compare to DSR. In Fig.3.this method of packet transmission using EAR achieves competively against existing routing protocols in terms of packet latency and scalability and lower energy consumption while operating in a noisy wireless Environment.

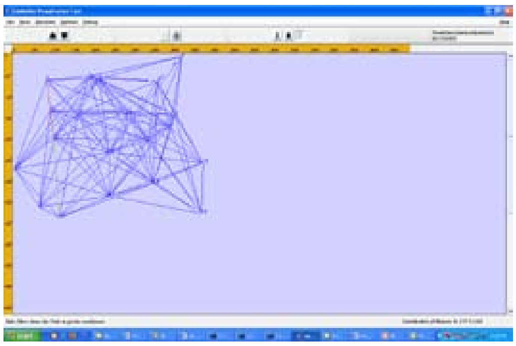

Fig.3: Simulation Results Shows of the Routing The Packets.

VI. Conclusion

In network with a singly centrally-located hub, neighboring nodes to the hub received more packets than other nodes. During the transmission, duplication of packets may be sent to the unauthorized node in networks. The future work will be targeted to overcome such security problems while packet transmission. The system can be further improved by higher data rates with minimal bandwidth. The energy drained during packet transmission can be reduced by incorporating clustering approach.

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