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SENSOR DEPLOYMENT AND SCHEDULING FOR TARGET COVERAGE PROBLEM IN WIRELESS SENSOR NETWORKS

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Abstract

Network lifetime plays an integral role in setting up an efficient wireless sensor network. The objective of Sensor Deployment and Scheduling for Target Coverage Problem in Wireless Sensor Networks is twofold. The first one is to deploy sensor nodes at optimal locations such that the theoretically computed network lifetime is maximum. The second is to schedule these sensor nodes such that the network attains the maximum lifetime. Thus, the overall objective of this project is to identify optimal deployment locations of the given sensor nodes with a pre-specified sensing range, and to schedule them such that the network lifetime is maximum with the required coverage level. Since the upper bound of the network lifetime for a given network can be computed mathematically, we use this knowledge to compute locations of deployment such that the network lifetime is maximum. Further, the nodes are scheduled to achieve this upper bound. MANET has the feature the cross layer integration of geographic routing with contention based MAC for relay selection and load balancing, as well as a mechanism to detect and route around connectivity holes (Rainbow). ALBA and Rainbow together solve the problem of routing around a dead end without overhead---intensive techniques such as graph planarization and face routing. The protocol is localized and distributed, and adapts efficiently to varying traffic and node deployments. Through extensive ns2 based simulations, we show that ALBA and Rainbow significantly outperforms other converge casting protocols and solutions for dealing with connectivity holes, especially in critical traffic conditions and low density networks. The performance of this system is also evaluated through experiments in an outdoor test bed of TinyOS motes. Our results show that it is an energy efficient protocol that achieves remarkable performance in terms of packet delivery ratio and end to end latency in different scenarios, thus being suitable for real network deployments.

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Introduction

A Mobile Adhoc NETwork (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet. MANETs are a kind of Wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network.

Mobile Adhoc Networks has become one of the most prevalent areas of research in the recent years because of the challenges it pose to the related protocols. MANET is the new emerging technology which enables users to communicate without any physical infrastructure regardless of their geographical location, that's why it is sometimes referred to as an infrastructure less network. The proliferation of cheaper, small and more powerful devices make MANET a fastest growing network. An ad-hoc network is self-organizing and adaptive. Device in mobile ad hoc network should be able to detect the presence of other devices and perform necessary set up to facilitate communication and sharing of data and service. Ad hoc networking allows the devices to maintain connections to the network as well as easily adding and removing devices to and from the network. Due to nodal mobility, the network topology may change rapidly and unpredictably over time. The network is decentralized, where network organization and message delivery must be executed by the nodes themselves.

Message routing is a problem in a decentralize environment where the topology fluctuates. While the shortest path from a source to a destination based on a given cost function in a static network is usually the optimal route, this concept is difficult to extend in MANET. The set of applications for MANETs is diverse, ranging from large-scale, mobile, highly dynamic networks, to small, static networks that are constrained by power sources. Besides the legacy applications that move from traditional infrastructure

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environment into the ad hoc context, a great deal of new services can and will be generated for the new environment. MANET is more vulnerable than wired network due to mobile nodes, threats from compromised nodes inside the network, limited physical security, dynamic topology, scalability and lack of centralized management. Because of these vulnerabilities, MANET is more prone to malicious attacks.

2. Literature Survey

2.1 EVALUATING PERFORMANCE OF REAL AD-HOC NETWORKS USING AODV WITH HELLO MESSAGE MECHANISM FOR MAINTAINING LOCAL CONNECTIVITY

This author says about AODV reactive routing protocol, when a node requires a route, it initiates a route discovery procedure broadcasting Route Request (RREQ) messages. When a node receives a RREQ, if it has a valid route entry to the demanded destination or it is the destination itself, it creates and sends a Route Reply (RREP) message back to the originator node. Every node maintains route entries with next hop information that expire after a specified time if the path becomes inactive. When a link breaks along an active path (i.e., a path where data are being transmitted), the upstream node that detects this break creates a Route Error (RERR) message which reports the set of destinations that are now unreachable and sends it to precursor nodes. The source of the active path may start a new route discovery phase or intermediate nodes may locally repair the route. Mobile ad-hoc network (MANET) technology is an essential piece in the path towards a ubiquitous Internet. MANET routing protocol parameter configuration should be further analyzed since it may significantly impact network performance. MANETs have several particular features that limit the achievable performance of data communications, such as node mobility, radio link problems, energy constrained operation and the lack of infrastructure itself.

Link failure Detection Mechanisms

How a routing protocol maintains local connectivity information is a key factor on network performance. An AODV node that is a part of an active route may periodically broadcast local Hello messages.

2.2 THE IMPACT OF NODE'S MOBILITY ON LINK-DETECTION BASED ON ROUTING HELLO MESSAGES

This author says about Ad hoc On-Demand Distance Vector Routing (AODV) and Optimized Link State Routing (OLSR),

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propose the use of periodic messages (Hello messages) to detect neighbor nodes. After receiving the first Hello message from one of its neighbors, a node starts the link sensing task by setting up a sensing timer. Each time a new Hello message is received from the same neighbor, the sensing timer is restarted and the link duration is prolonged. If the sensing timer expires, it indicates a long time interval without receiving a Hello message and, consequently, the link is considered broken. The transmission frequency of the Hello messages and the expiration value of the sensing timer truly depends on node's mobility: if the nodes are moving quickly and the Hello messages are rarely transmitted, the neighbor nodes can be in communication range but they are not detected; in the same scenario, if the expiration value of the sensing timer is too high, a link is sensed broken too late. [3]

2.3 AN ADAPTIVE QUORUM-BASED ENERGY CONSERVING PROTOCOL FOR IEEE 802.11 AD HOC NETWORKS

This author says about the IEEE 802.11 Power Saving Mode; a host must wake up at every beacon interval, to check if it should remain awake. Such a scheme fails to adjust a host's sleep duration according to its traffic, thereby reducing its power efficiency. The essence of these protocols is a quorum-based sleep/wake-up mechanism, which conserves energy by allowing the host to sleep for more than one beacon interval, if few transmissions are involved. The proposed protocols are simple and energy-efficiency.

Power Saving Modes in IEEE 802.11 DCF

Time is divided into consecutive beacon intervals. At the beginning of each beacon interval, hosts will contend to send a beacon frame, which is used for clock synchronization. Each host generates a random delay and waits for the duration of that delay. A host will cancel the random delay timer before it has expired, if a beacon is received from another host. Otherwise, it will send a beacon also MAC layer protocols. A more detailed description of previous works can be found in Section 3. Routing layer power saving protocols concentrates on finding the path with minimum power consumption, or on maintaining minimum power transmission. Transport layer energy efficient protocols try to reduce power consumption by reducing retransmitting packets.

CHAPTER 3

SYSTEM REQUIREMENTS

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3.1 HARDWARE REQUIREMENTS

Processor : Pentium IV (2 MHz) Processor
RAM : 1 GB
Hard Disk : 80GB
Keyboard : Standard key keyboard

3.2 SOFTWARE REQUIREMENTS

Operating System : Windows Family.
Coding Language : TCL And C++
Simulator : NS2 (Network Simulator 2).

CHAPTER 4

Existing System

The hello message is sent to all the nodes, and those which send the acknowledgement back as response is considered to be the Neighboring nodes. This takes more energy consumption and as well as the time taken to identify the neighboring node is more on demand neighbor discovery, though saves the energy level. The reactive Hello protocol enables Hello messaging only when it is demanded using a Hello request-reply mechanism, but increases delay due to additional packet exchange before communication. The event-based Hello protocol enables only active nodes (i.e., those either sending or receiving data packets) to broadcast Hello packets based on a threshold called an activity timer. However, a threshold that is set too high rarely reduces the Hello messaging overhead, whereas a low threshold results in local connectivity information loss. Thus, there is an outstanding need to effectively suppress unnecessary Hello messaging while minimizing the risk of losing local connectivity information.

4.1 Disadvantages of Existing

Due to energy consumption and network overhead, an adaptive Hello interval to reduce battery drain through practical suppression of unnecessary Hello messaging. Based on the event interval of a node, the Hello interval can be enlarged without reduced detectability of a broken link, which decreases network overhead and hidden energy consumption. On demand neighbor discovery, though saves the energy level. This method increases the time interval for maintaining the neighbor or routing table, when the nodes are enormously high in number. At these situations, on demand neighbor discovery is less efficient as it transmits the hello message only after the requirement is confirmed.

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ARCHITECTURE

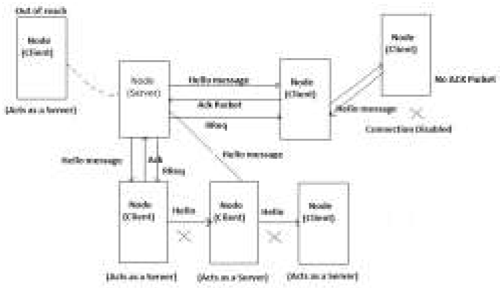

Figure 4.2 Architecture

CHAPTER 5

PROPOSED SYSTEM

In this project, to reduce the energy consumption and network overhead, the hello message sending for already existing nodes in the Routing table is restricted, since however it's clear that, the node is already present in neighboring area. Instead the hello message is sent only to the nodes, which are newly joined. This saves the time to identify the neighboring nodes, especially whenever the nodes are high in number. The time interval is measured on one node for sending and receiving the packet. Based on the time interval the neighbor discovery is done by sending the hello message. It reduces the network overhead and traffic upon sending the hello message for neighbor discovery periodically for a particular amount of time without even knowing the usage of that particular node.

5.1 ADVANTAGES OF PROPOSED

1. Reduces the energy consumption, as unnecessary sending of hello messages drains the battery on mobile phones. The method is attempts to save the energy.
2. This technique reduces the risk level and network overhead.
3. It suppresses the unnecessary hello messages.

CHAPTER 6

MODULES

These are modules will be going to implement

- Node Generation Phase.
  - Route Request Phase.
  - Route Reply Phase.
  - Traceability - Monitoring and Identification Process.

6.1 Node Generation Phase

In this module, the Number of nodes that is to be created is obtained from the user and the specific node is assigned a separate IP Address. The position of the node is decided randomly and placed in random position.

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Figure 5.4: Node Creation

6.2 Route Request Phase

In this phase, the client node sends the route request to the nodes, which is currently present in the neighbour table in order to send the packets to the nodes. The neighbour table maintenance is done based on the filtering that is mentioned in the below phases.

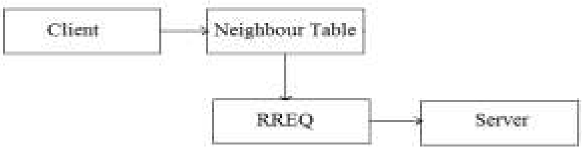

Figure 5.5: Route Request

6.3 Route Reply Phase

In this module, the route request that is being sent on the above phase is carried to the corresponding node. Once the corresponding receives the route request, it sends back the acknowledgement as route reply. Once a particular node (Server) sends the route reply, that particular node is stored in the neighbour table.

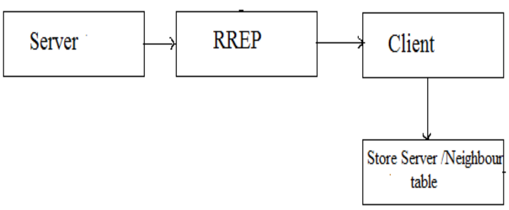

Figure 5. Route Reply

6.4 Traceability-Monitoring and Identification Process

This process is part of route request and reply propagation of our proposed design. In this module, target node generates the route reply packet and sends it via reverse of discovered path towards source node. After sending the RREP (), sender node of the RREP () monitors the forwarding nature of its downstream neighbour node through promiscuous mode. The request or the hello message is filtered in order the send the message in an adaptive and efficient way. The efficient way is carried out by filtering the nodes based on its action. That is, only the nodes which are in action(either sending or receiving) is taken in to consideration and the hello message packets are sent to the corresponding nodes. The rest of the nodes are left unsent.

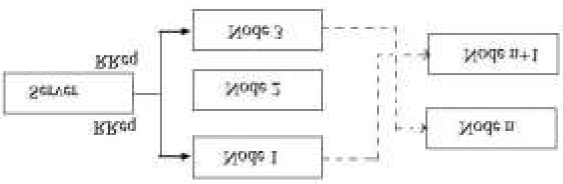

Figure 6: Monitoring and Identification

It identifies the malicious nature of its downstream neighbour node, examining the 2hop ID and Node list field of the forwarded

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RREP (), Based on the inference, the sender node decides the malicious behavior and broadcasts an alarm message. In order to avoid intentional rumors of maliciousness, we have added here alarm acceptance concept. Using alarm acceptance message, upstream neighbour nodes that already process RREP () endorse the validity of the alarm message. In this way, intentional rumors are avoided.

CHAPTER 7

Conclusion

In this project work, an efficient technique for adaptive Hello message sending is proposed in order to reduce the unwanted battery drain and network delay through eliminating the unwanted hello messages to the neighboring node. The technique is implemented in MANET for efficient network throughput and long battery life of a device. Based on the event interval of a node, the Hello interval can be enlarged without reduced detectability of a broken link, which decreases network overhead and hidden energy consumption. The nodes are scanned frequently in order to check whether the links got broken. Accordingly the Neighbor table is continuously altered. Since the nodes are not stationary in MANET. A node which is at one particular location at this time moves continuously. The hello message is sent to the neighbor nodes, each time the nodes move from one location to another location. The filtration process is handled in such a way that, the Hello messages are not sent to all the nodes, rather it is sent only to the nodes are currently in action. The rest of the nodes are considered to be inactive, and hence the power lasts for long time without draining. The proposed an efficient data collection scheme called MASP for wireless sensor networks with path-constrained mobile sinks. In MASP, the mapping between sensor nodes and subsinks is optimized to maximize the amount of data collected by mobile sinks and also balance the energy consumption. MASP has good. A heuristic based on genetic algorithm and local search is presented to solve the MASP optimization problem. In addition, to design a communication protocol that supports MASP and adapts to dynamic topology changes. To reduce the computational complexity, we develop two practical algorithms, a zone partitioning-based solution and a distributed solution (MASP-D). Minimizing the total energy consumption may not lead to the maximum network lifetime, we also plan to study the subsink selection problem with network lifetime maximization as the optimization objective as future work.

8. FUTURE WORK

For future work, plan to validate the proposed schemes on different scenarios with various movement trajectories of mobile sinks.

Considering that minimizing the total energy consumption may not lead to the maximum network lifetime, we also plan to study the subsink selection problem with network lifetime maximization as the optimization objective as future work.

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