

Sampling Sensor Fields Using Mobile Object Band Based Approach

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ABSTRACT: The idea of using mobile objects to gather samples from a sensor field has been recently proposed. A key challenge is how to gather the sensor data in a manner that is energy efficient with respect to the sensor nodes that serve as sources of the sensor data. An algorithmic technique called Band-based Directional Broadcast is introduced to control the direction of broadcasts that originate from sensor nodes. The technique is studied by simulations that consider energy consumption and data deliverability. The goal is to direct each broadcast of sensor data toward the mobile sink, thus reducing costly forwarding of sensor data packets. Using directional antennas to conserve bandwidth and energy consumption wireless sensor networks has attracted much attention of the research community in recent years. Very few researches has focused on applying directional antennas to broadcasting. In this paper, we propose a virtual link reduction (VLR) based broadcasting protocol for ad hoc wireless networks using directional antennas. Simulation results show that VLR outperforms most existing omnidirectional and directional broadcasting schemes in the sense that its normalized transmission cost and redundancy are significantly reduced. Based on the results we conclude that VLR is more bandwidth and energy –efficient.

KEYWORDS: Sensor data sampling, mobile object, directional broadcast, virtual link reduction sensor networks.

1. INTRODUCTION

Recently, the concept of employing mobile objects to query a sensor network has been proposed [1, 5, 6]. Applications can exploit this mobility to dynamically sample a sensor field. Mobile objects is travelling along a path, and at some specific time (T_0) it decides to take a sample of the sensor field, i.e., collect sensor data from near-by sensor nodes. The larger circle denotes the sampling region. Each sensor in that region will consequently be activated and reply with its locally sensed data. As the mobile object continues its travel, it reaches another location at time T_1 from which it initiates another sampling task. There are two interesting features associated with the task of sensor field data sampling. First, due to the mobility of the sampling object, there are many options for selecting a sampling region, as opposed to the static sampling region associated with a static sink. Second, it is possible to employ commonly existing mobile objects, for example taxis or buses, to help increase the coverage of the sensor field. So, it is possible to deliberately choose a mobile object and finely tailor its sampling regions to optimize a sampling task. However, there are also challenges that arise from using these mobile sinks to gather sampled sensor data. One challenge is in controlling the process that sensors use to the mobile sink scenario since a sensor-data packet can reach the mobile object as long as the object is within transmission range of some broadcast, or re-broadcast, of that packet. However, one fundamental problem with using broadcast for gathering sensor data is that broadcast does not consider direction, and left unchecked would flood an excessively large geographic region. Note that this flooding could even extend beyond the intended sampling region, which means it suffers from very low energy efficiency.

In this paper, we present a new broadcast-based data gathering mechanism optimized for the purpose of sensor field data sampling. We call the approach Band-based Directional Broadcast since it uses the concept of bands, created by partitioning the sampling region by multiple concentric circles. These bands are used to help control the direction of data flow for sensor data packets, without the need for sensor nodes to have any sophisticated directional antenna.

II. RELATED WORK

2.1 Existing System

Simple Flooding (SF) and Counter-based Broadcast (CB). The timer and counter were set to 3 and 10, respectively, for the latter algorithm. Simple Flooding and Counter-based Broadcast were selected for the comparison study because those techniques, like our approach, satisfy some base conditions in terms of being suitable for sensor sampling applications. They do not require sensors to be location-aware; they do not rely on the construction of routing tables; and they do not depend on any specialized hardware.

2.2 Proposed System

2.2.1 Virtual Link Reduction

Virtual Link Reduction (VLR) based broadcasting protocol for ad hoc wireless networks using directional antennas. Based on 2-hop neighborhood information, VLR does not rely on any location or Angle-Of-Arrival (AOA) information. VLR is a localized or distributed protocol and it achieves full delivery. VLR operates on top of any existing broadcast routing protocols.

In VLR, No node rebroadcasts a given packet more than once. No physical link is actually reduced, but if a packet has already been forwarded to the end node of the current link, the packet is not forwarded anymore, that is, this link is virtually reduced. To evaluate the performance of the proposed VLR based protocol, we conduct extensive simulation, for simplicity, assuming that there is no packet collision, no channel contention and no mobility.

III. OVERVIEW & ARCHITECTURE

Broadcast is to be generally avoided in sensor networks due to the problems associated with message flooding, there are significant advantages to using this basic mechanism, especially for the application at hand, sensor field sampling: broadcast is simple and does not require that sensor nodes be configured with special dedicated hardware; broadcast can be initiated immediately after receiving the sampling task since it requires no routing table or tree setup; and broadcast can naturally handle the mobile sink scenario since a sensor-data packet can reach the mobile object as long as the object is within transmission range of some broadcast, or rebroadcast, of that packet. The primary problem with using broadcast for gathering sensor data is that broadcast does not consider direction, and left unchecked would flood an excessively large geographic region. Note that this flooding could even extend beyond the intended sampling region, which means the omni-directional broadcast suffers from very low energy efficiency.

3.1 Architecture

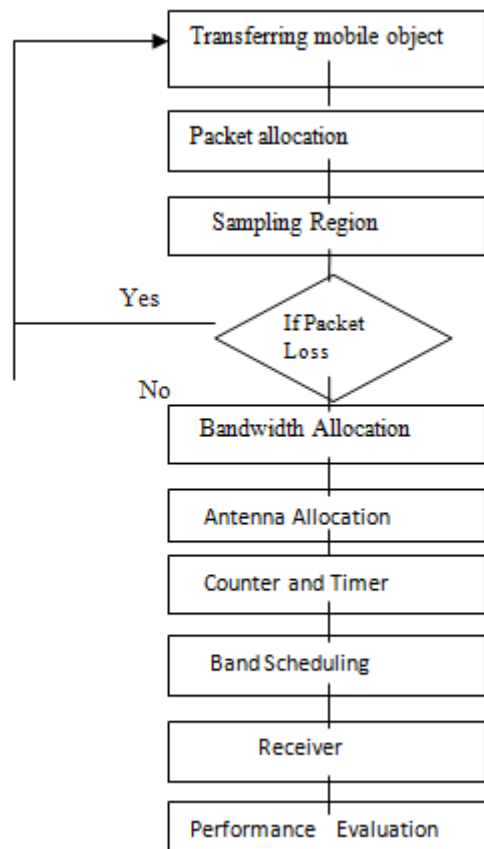


Figure 1: Architecture Diagram

3.2 Transferring Mobile Object

A location-based service is a specialized, multi-tiered Internet GIS application delivered across the wired/wireless Web to the stationary/mobile users. The location of the mobile devices or built-in vehicles can be determined by using GPS, or mobile network triangulation. Their location is transmitted to the LBS server through the wireless communication interface, from the device itself, or from a mobile positioning center of the mobile network.

3.3 Packet Allocation

Set of Mobile object information is allocated into Data information the Set of Data Information is Converted into Packet. Each packet have a Set of information, Each Packet have ID and Sequence Number. The Packet have a Length of Packet, Data Information, Bit Streams etc. A packet is a basic unit of communication over a digital network. A packet is also called a datagram, a segment, a block, a cell or a frame, depending on the protocol. When data has to be transmitted, it is broken down into similar structures of data, which are reassembled to the original data chunk once they reach their destination.

3.3.1 Counter and Timer

It is believed that there is an inverse relationship between the number of times a packet is received at a node and the probability of the node being able to reach additional areas on a rebroadcast. So, in Counter-based Broadcast, a node maintains a counter and a timer for each unique packet it receives. The timer is used to control how long the node holds a packet before considering rebroadcasting of the packet. When the timer expires, the node checks how many duplicate copies of this specific packet have been received. If this number exceeds a previously assigned threshold, the packet is dropped; otherwise, a rebroadcast is initiated. In general, for a dense network, nodes will be less likely to rebroadcast packets, in comparison to sparse network's. Counter-based Broadcast is inherently slow in terms of reaction time due to the need to wait for timer expiration before any rebroadcasts.

3.3.2 Total Result Receiver

Another factor related to energy consumption of sensor networks is packet reception. The trends for the studied protocols are similar to those for packet sending except that the y-scale now ranges up to 450 K total receiving packets. This is quite natural since one packet sent can cause multiple packet receptions. However, using our approach, the reception of a packet does not necessarily result in a packet being sent.

3.4 Band Scheduling

Our next operation includes the band scheduling feature. The results are plotted in using the optimal inside out band scheduling method. We observed significant improvement in especially when we deployed more bands. For example, the 6-band configuration shows about a 100 percent improvement over the result without band scheduling; for the 11-band configuration there is almost a 200 percent improvement. The curves for simple flooding and Counter-based Broadcast are reproduced again to show comparison.

3.5 Receiver

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IV. CONCLUSION

We proposed a simple, energy-efficient protocol to aid sensor-field sampling by a mobile object. The protocol exploits the concept of bands to limit the propagation of sensor data broadcasting, providing a form of directional broadcast based on software control. Methods for defining and using bands were presented. Extensive simulations under two communication models were conducted to evaluate the performance and trade-offs of our band-based scheme. The first communication model assumed no collisions and a binary sensor-to-sensor communication model. The second communication model assumed collisions, and a decay communication model. The simulations indicated that the band-based scheme is quite efficient in directional broadcast, and moreover, performs much better than default omnidirectional broadcast. Compared with DSP, which outperforms most existing broadcasting protocols in terms of efficiency, quality and/or reliability, LR achieves much lower redundancy, transmission cost and consequently conserves bandwidth and energy consumption. As for future work, we plan to make mathematical analysis to see whether the number of forward directions of is within a constant factor of an optimal one. In addition, simulations on realistic networks where there exist channel contention, packet loss and node mobility are on the way.

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