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A REFINEMENT IN EXPLOITING DATA GATHERING USING LOCALIZATION

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ABSTRACT

In Wireless Sensor Networks (WSNs)data transfer is achieved through the intermediate nodes by hopping, while minimising the hop count, the utilisation of energy and time latency of an individual node are minimised. The main idea behind this paper involves data accuracy in collection of data from a sensor node to the Base Station (BS) and to reduce the energy consumption which will proportionally increase the speed. The technology in Data Gathering (DG) composes distribution of sensor nodes in an environment, Mobile Sink (MS) for collecting data from a Cluster Head (CH) among the nodes. The data from a distant sensor node reaches the CH via relay nodes then transmits to MS and to BS. The main issues behind this technology is, from which node the data is acquired is not known by BS, time latency in aggregation of data and energy consumption of node due to relaying of data. In order to overcome such issues, a new concept in networking called Localisation is implemented, where the position information about the sensor node is gathered by the BS with the help of Beacon nodes, which helps to improve efficiency in collection of data, reduces time latency and energy consumption of a sensor node, in addition a polling scheme is implemented to reduce the relaying of data from the sensor nodes. A value added scheme to minimize the error in acquired data from a sensor node to CH and to eliminate buffering problems Cache optimization is implemented in proposed work.

***Index Terms**-Beacon Scheduling, Polling scheme, Energy Consumption Management, Cache optimization.*

1. INRODUCTION

Recent scientific research in Data communication Engineering mainly focus on effective data gathering from a distant node to a destination, it is achieved by increasing the speed of data transfer from one to another nodes. Wireless Sensor Networks consist of few or several sensor nodes which are resource constrained. Some sensor nodes gather data from external environments and send information such as temperature, humidity and light to the sink. The information is sent hop by hop (intermediate nodes) until the sink is reached. However, data traffic is a problem in WSN due to high energy faster data transfer can be achieved by reducing the time latency and energy consumption. The main issue in communication is life time of a network, it is based on energy and speed of the data transfer, when the energy becomes weak the strength of the signal also weaken, proportionally the speed. If any one of the factor is improved in the performance all the other factors are proportional so that the overall performance can be improved. The factor to get improved is speed that is it can be increased by achieving localization concept. Localization is to determine the physical co-ordinates of the sensor nodes deployed in the environment, many queries about localization that why it is used? A common but meaningful answer is using Localization the information about the node can be gathered by the receiver so that data can be easily retrieved from the node, when comparing in analysis the overall speed in gathering data is improved. The formal approach in DG measures the Speed and Energy with respect to time and which makes the life time of a network to an extent.

2. LOCALIZATION

In order to determine the physical coordinates of a group of sensor nodes in a wireless sensor network and use of Global Positioning System (GPS) is unrealistic, therefore, sensors need to self-organize a coordinate system for that purpose Localization concept is used. It is used to report data about a sensor node distributed in an environment that is geographically meaningful. Localization involves in three main phases they are Distance Estimation, Position Computation and Localization Algorithms. The distance estimation is to manipulate the relative distance between the nodes, by measuring the intermediate distance between the nodes using shortest path algorithms, a tree formation is computed to get the relative distances between nodes in a cluster [1][2]. The distance estimation is done by two schemes one is Range based and the other is Range free based. The popular methods for estimating the distance between two nodes are Received Signal Strength Indicator (RSSI), time-of-arrival (ToA) or time-difference-of-arrival (TDoA), Angle-of-Arrival (AoA) these approaches are followed to implement Range based scheme.

Under Range free scheme anchor based method is used to implement Range free scheme they are Approximate Point In Triangle (APIT), Centroid localization, DV-Hop localization and Amorphous localization are used. The key difference between Range based and Range free are in Range based needs extra hardware to find the location and measure the distance between the sensor nodes, but in Range free scheme the location of a sensor node is determined by number of hop counts the data is employed so called Average Hop Size (AHS). When a sensor node is dropped out from a airplane in any unknown place, where and what data should be gather by it is not identified by the BS, with the help of GPS the location of the sensor can be identified but it is cost effective one. In order to reduce the cost factor and to identify the location precisely we move to localization concept.

The use of localization yields an innovative research in remote nodes when the DG is much more possible, at unknown places. The parameters such as humidity, temperature, evolution of animals and people of a particular area, battle field surveillance, identifying age of a building, monitoring health and medical applications many more applications where localization is used.

3. RELATED WORK

First the implementation of localization with sensor networks will enhance the speed of collecting data from a distant node. Second energy optimization is a majorthing , should be minimised.

Miao Zhao et al [8],[11] proposed polling scheme which is based on remaining battery power of a sensor node which act as a leader of a cluster. These aspects are important features of enhancement work.The first category has uncontrollable mobility, in which the mobile collector either moves randomly or along a fixed track, an uncontrolled mobility has the mobile nodes to move along straight lines to collect data in the vicinity of the lines, radio-tagged zebras and whales were used as mobile nodes in a wild area. In Networked Info Mechanical (NIM's) systems, [4],[5],[6]where mobile collectors can only move along fixed cables between trees to ensure that they can be recharged any time during the movement. A common feature of these approaches is that they generally have high stability and reliability. The second category has controlled mobility, in which mobile collectors can freely move to any location in the field and its trajectory can be planned for specific purposes, Within this category, the schemes can be further divided into three subclasses. In the first subclass, the mobile collector is controlled to visit each sensor or traverse the transmission range of each sensor and gather the sensing data from them within single hop transmissions and scheduling of mobile elements to ensure no data loss due to buffer overflow. While these approaches minimize the energy cost and balance energy consumption among different sensors by completely avoiding multihop relays, they may result in long data gathering latency especially in a large-scale sensor network.

In the second subclass, mobile collectors gather data from the sensors in the vicinity via multihop transmissions along its trajectory. In this scheme, along each moving line segment, the sensors forward packets to the mobile collector in a multihop fashion. The last subclass includes the approaches that jointly consider data transmission patterns and moving tour planning in utilizing ultrawide band (UWB) communications for data gathering in WSNs. In [8] proposes data gathering scheme that jointly considers the full utilization of concurrent data uploading and tour length minimization. In the scheme, multiple sensors can simultaneously upload data packets to the mobile collector in a single hop, which efficiently shortens data uploading time. In [7] proposes different caching algorithms ex. LRU, LFU and LFU-min to implement the elimination of error rate in acquiring the data from sensor node to CH, which will optimize the energy considerations and reduce the buffer overflow when replication of data is produced.

4. ENERGY OPTIMIZATION

The mobile collector has the freedom to move to any location in the sensing field, it provides an opportunity to plan an optimal tour for it. when the energy supply of sensors is not sufficient or the data gathering service is somewhat delay-tolerant, the storage nodes are not necessarily be placed at the positions of sensors, which may bring more flexibility for the tour planning. However, such special devices would incur a significant amount of extra cost. In addition each sensor node is equipped with solar plates which is used in small electronic devices which will power up the battery source will reduce the energy degradation.

The energy is most probably consumed during transfer of data from one node to other and while sensing the fields. The optimization of energy in devices will vary based on distances between sensor nodes and aggregation of data storage. Depending on type of data energy will vary drastically. An added advantage of Polling scheme will improve energy efficiency for a sensor node. The balancing of energy within the sensor nodes meets a performance up gradation under different sensing field.

5. POLLING SCHEME

Polling scheme is based on replacement of task of a cluster head, in which the job of a CH is replaced by another sensor node. The polling scheme proposes Least Recently used (LRU) scheduling algorithm where each node in a cluster must employ as a CH which was least used. Since the last sensor node must have significant energy to employ as a CH, there is a sharing of task mutually to achieve energy optimisation. The mobile collector starts its tour from the static data sink, which is located either inside or outside the sensing field, collects data packets at the Polling Points (PPs) and then returns the data to the data sink. Since the data sink is the starting and ending points of the data gathering tour, it can also be considered as a special PP. We refer to this scheme as the polling-based mobile data gathering scheme. In practice, there are several reasons that the relay hop count should be bounded. First, a sensor network may be expected to achieve a certain level of energy efficiency system wide.

For instance, if each transmission costs one unit of energy and the energy efficiency of 0.33 energy unit/packet is expected, each packet should be forwarded from its originating sensor to the data sink in no more than three hops on average Second, the bound is necessary due to buffer constraint on the sensors. Since the PPs need to buffer the locally aggregated data before the mobile collector arrives, it is not desirable to associate too many sensors with a PP. Otherwise, the buffer of the PP may not be able to accommodate all the data packets. For example, consider a sensor network with an average node degree of four. If a sensor is selected as a PP and the local relaying is constrained within two hops, there will be up to 17 sensors affiliated with this PP. Therefore, the buffer capacity of the PPs and the sensor density impose a limit on relay hops

6. CACHE OPTIMIZATION

Under Service discovery between the sender and receiver, Cache optimization plays a vital role in saving energy and response time of a sensor node. If an Mobile Terminal (MT) is located along the path in which the request packet travels to an Access Points (AP), and has the requested data item in its cache, then it can serve the request without forwarding it to the AP. In the absence of caching, all the MTs' request should be forwarded to the appropriate APs [14]. To deliver a quality of service between the nodes, the availability of space in memory is used consistently to maintain the speed in networks, which in turn enhances the life time of a network.

Sunho Lim et al [13] proposed two cache algorithms, admission control and a cache replacement policy. When implementation of Cache optimization in sensor networks the cluster head will collect the data from sensor nodes, it may happen that missing of data is possible in CH buffer, so in order to avoid such missing up of data, cache optimization in CH is implemented.

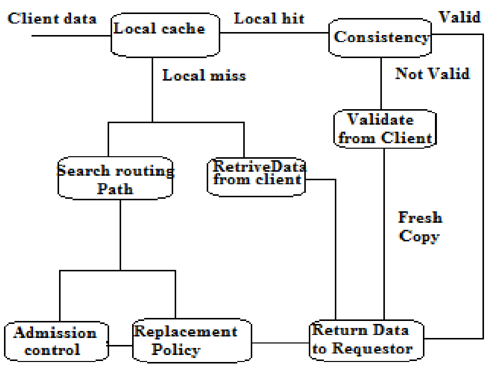


Fig.1

Cache Replacement

Cache replacement: When fresh data item is arrived for caching and if cache space is full then the cache replacement algorithm is used to locate one or more cached data items to take out from the cache place [7]. The cache replacement process involves in two steps: First, if the cached data items become obsolete, these items will be avoided to make free space for newly arrived data item. If there is no enough cache space after all remaining items are removed, cache replacement will go to the next step, in second step when one or more cached data items will be dropped out from the cache space according to some criteria. The different cache replacement algorithms used for the mechanisms are LRU, LRU-MIN etc.

Least Recently Used (LRU): It is one of the most widely used cache replacement algorithm, which selects the objects based on the least recently used information. LRU maintains a hash table for the previously accessed data. On head of the table the most recently used data is placed and in the tail of the table the least recently used data is stored. When a new data is added to cache, it is added to the tail of the table. Whenever a new cache hit occurs the access time of the requested data is upgraded and it is moved into the head of the list. when the cache is full, it simply drops out the tail element of the list.

LRU_MIN: LRU MIN uses a technique called least recently used data item with minimal number of page replacements. LRU-MIN is similar to LRU. LRU-MIN maintains a sorted list of documents in the hash table based on the least recently used information i.e. based on the time, the document was previously used.

The only difference between LRU and LRU-MIN is the method of selecting the document for the replacement. [7] Whenever cache needs to replace the document, it searches the entire document from the tail of the hash table and selects the data items only by which have equal or greater size than newly arrived data item size. If entire cached documents are smaller than the new document, the searching is repeatedly verifying for the first two documents greater than half the size of the new document. The process of making half the size and double the number of documents to be removed is repeated if large enough documents can still not be found for replacement.

Least frequently used (LFU): LFU selects the document that has been accessed for few times. It is realized by maintaining a reference count for each file. Every time a cache hit happens, the reference count of a file requested is increased. In some cases of a cache miss and this is not enough for free the space in cache, the file with the lowest reference count is replaced.

*Cache consistency***:** The cache consistency strategy keeps the cached data items synchronized with the original data items in the data source. The given figure shows while giving the resources the algorithm provides the output for different input.

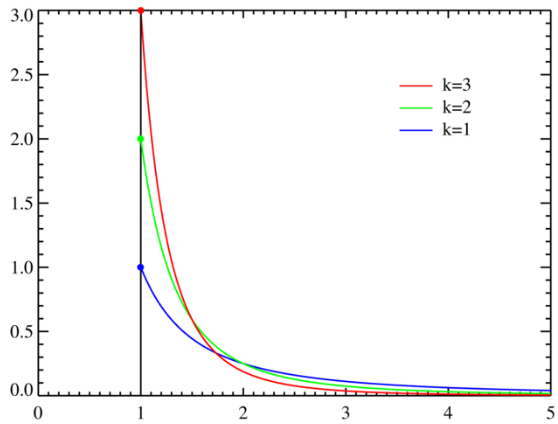
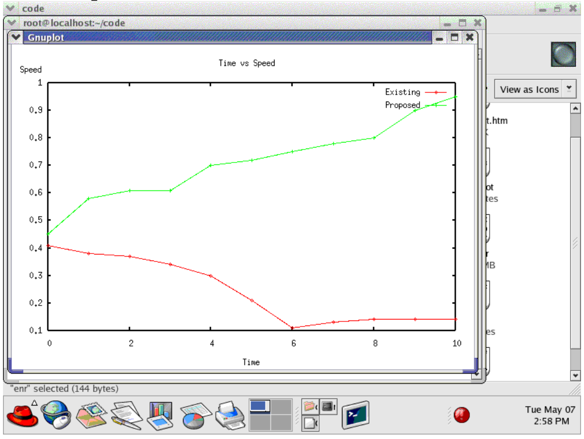


Fig.2 Comparision results of LRU, LFU, LRU-MIN

When comparing the outputs of different algorithms, LRU-MIN gives an optimised solution for several inputs.

7. EXPERIMENTAL RESULTS

The obtained evaluation values of both Existing and proposed work is measured in terms of increasing energy consumption while number of user increases, the comparison graph shows actual result in localising a sensor node. When the employment of a single node consume a certain amount of energy in the same way when more nodes are employed in a trajectory the total energy consumption are made average, in the way a sensor node moves in the field has more energy consumption. To balance the energy consumption, search tree algorithm is implemented to localise a node in the field, hence the proposed work will show greater performance than the previous one.



8. RESULT AND DISCUSSIONS

This paper concludes that with the help of localization we enhance the speed of data gathering and energy optimization for such type of both static and mobile nodes, up to a certain level, the caching up of data from one cluster head to other will helps in reducing data loss and error rate, where the analysis will result in improve the performance of existing work. The enhancement of this work is focussed on service discovery in Mobile-ad hoc networks using the concepts behind this idea.

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