Mobile Relay Assisted in Data Collection Model

K. Anjali and Mr. V.Udhaya Kumar

Abstract: **The throughput capacity of Wireless Sensor Networks can be increased by achieving a large data collection rate, where multiple mobile relays are deployed to collect data from static sensors and forward them to a static sink. Based on the mobile-relay-assisted data collection (MRADC) model, the throughput capacity can be increased using mobility parameters. If the number of relays is less than a threshold, then the throughput capacity can be linearly increased with more relays. Otherwise, if the number is greater than the threshold, then the throughput capacity becomes constant. The capacity gain over a static WSN depends on the transmission range and the impact of interference.**

Keywords: **Wireless Sensor Network, Mobile Relay Assisted Data collection, Rendezvous Point, Dump Point, Base Station, Mobile Relay**

I. INTRODUCTION

WIRELESS sensor networks (WSNs) are an important technology that can enhance the capability of monitoring and interacting with the physical world. A typical WSN consists of a *static* sink (base station) and many *static* sensors, where each sensor is battery powered. Usually, after collecting data from the environment, a sensor sends the data to the sink using multihop transmissions. Although such a scheme has been widely deployed and can enable low-data-rate applications, it is difficulty to support high-data-rate applications because each sensor has limited radio resources and energy supply.

To improve the performance of data collection, several approaches have been proposed, including *data fusion*, *heterogeneous architecture,* and *use of mobile device bs*.With data fusion, correlated data obtained by neighboring sensors can be compressed before being forwarded to the sink. In heterogeneous architecture, powerful sensors with larger energy capacity and stronger communications capability are deployed to reduce the energy consumption of regular sensors and to increase the data collection rate. Using mobile devices, data can be relayed from a sensor to the sink using less number of hops.

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The performance of data collection in WSNs with mobile devices. Different types of mobile devices have been introduced, including mobile sensors, mobile sinks, and mobile relays . A mobile sensor is enabled with both mobility and sensing ability. A mobile sink, similar to the static sink, is the final destination of data collected by sensors. A mobile relay stores data for a certain duration and will forward these data to a sink at a later time.

Based on *mobile-relay-assisted data collection* (MRADC) in WSNs. Starting from , many MRADC models The MRADC model, in which one static sink, n static Sensors, and k mobile relays are deployed in the network area. First group the n sensors into $k + 1$ clusters ($C0, C1, C2, \ldots, Ck$). In cluster $C0$, sensors send their data to the sink using multihop transmissions without the help of mobile relays. For each cluster Ci ($i > 0$), a mobile relay is assigned, and this relay periodically travels between two specified locations. The first location is chosen such that the mobile relay can forward stored data to the sink in one hop. The second location is inside Ci, at which the mobile relay can collect data from cache nodes that are sensors within one hop to the second location. Moreover, the cache nodes can store data from other sensors when they are not forwarding data to the mobile relay. Based on the proposed MRADC model, the throughput capacity of large-scale WSNs using a constructive approach, which can achieve a certain throughput by choosing appropriate mobility parameters, such as the traveling speed, traveling distance, and other timing parameters. If k is less than threshold $\hat{k}$, then the throughput capacity can be linearly increased with the increase in k. On the other hand, if $k > \hat{k}$, then the throughput capacity is a constant, and the capacity gain over a static WSN depends on the transmission range and the impact of interference.

II. SYSTEM DOMAIN

a. Existing system

Wireless sensor networks (WSNs) are an important technology that can enhance capability of monitoring and interacting with the physical world. A typical WSN consists of a static sink (base station) and many static sensors, where each sensor is battery powered. Usually, after collecting data from the environment, a sensor sends the data to the sink using multihop transmissions. To improve the performance of data collection, several approaches have been proposed, including data fusion, heterogeneous architecture, and use of mobile devices. With data fusion, correlated data obtained by neighboring sensors can be compressed before being forwarded to the sink. In heterogeneous architecture, powerful sensors with larger energy capacity and stronger communications capability are deployed to reduce the energy consumption of regular sensors and to increase the data

collection rate. Using mobile devices, data can be relayed from a sensor to the sink using less number of hops.

Disadvantage

- Difficult to achieve large data collection rate because sensors have limited energy.
- Requires high complexity to achieve high throughput capacity.

b. Proposed System

To improve connectivity in sparse WSNs, to reduce the latency of each packet, to maximize the total amount of data gathered during the lifetime of a WSN and to enhance the energy efficiency of a WSN, MRADC model is proposed.

Based on the MRADC model, the achievable throughput capacity of large-scale WSNs using constructive approach is developed. It achieves a certain throughput by choosing appropriate mobility parameters.

In this MRADC model, consider one In this MRADC model, consider one static sink, n static sensors, and k mobile relays. Sensors are first grouped into k +1 clusters ($C0, C1, C2, \ldots Ck$). Cluster $C0$ is located around the sink, and sensors in $C0$ send their data to the sink using multihop transmissions without relay.

Other cluster $C\,i$ ($0 < i \leq k$), a mobile relay is assigned, and this relay can travel between two specified locations, i.e., a *rendezvous point* (RP) that is inside Ci and a *dump point* (DP) that is one hop away from the sink. To collect data in $C\,i$, sensors first send their data to *cache nodes*, which are sensors within one hop to the RP. The cache nodes can send data to the mobile relay when it stops at the RP. Finally, the mobile relay can deliver data to the sink when it stops at the DP.

Advantages

- Increases transmission range
- Achieves large data collection rate
- Improves throughput performance

Four states of a mobile relay

1) ***Travelling state****:*
In this state, the mobile relay is travelling between RP and the DP. The duration of this state depends on the average traveling speed of a relay and the distance between the RP and the DP.

2) ***Waiting state:***
When the mobile relay arrives at an RP, it may wait until the cache nodes collect a sufficient amount of data from other sensors. The duration of this phase is *Tw*.

3) ***Harvesting state:***
In this phase, a mobile relay stops at the RP and is receiving data from the cache nodes. The duration of this state is *Th*.

4) ***Dumping state:*** In this phase, a mobile relay stays at the DP and is sending the stored data to the sink. The duration of this phase is Td.

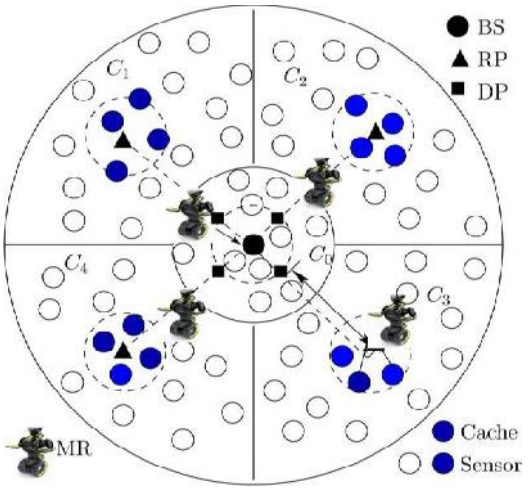

Fig. 1. System model of MRADC with k =4.

III. MODULES

Develop an analytical framework to investigate the throughput capacity of large-scale WSNs with MRADC. First address the system models, including the transmission model, the network model.

a. MRADC Model

In our MRADC model, consider one static sink, n static sensors, and k mobile relays. Sensors are first grouped into k+1 clusters ($C0, C1, C2, \ldots, Ck$). Cluster $C0$ is located around the sink, and sensors in $C0$ send their data to the sink using multihop transmissions without mobile relay.

b.Transmission Module

Consider a particular protocol model. Specifically, let r be the one-hop transmission range, and let $(1+\Delta)r$ be the interference range. Then, a transmission from node ni to node nj is successful if and only if

$$|ni - nj| \leq r$$

$$|nq - nj| \geq (1+\Delta)r$$

where nq represents any node that is simultaneously sending. In this paper, assume that r is a constant and that the successful transmission data rate is fixed to W bits per second, which is also a constant.

c. Network Module

In this network model, consider that n ($n \to \infty$) static sensors are deployed in a unit circle area (the radius of which is $1/\sqrt{\pi}$) randomly following a Poisson point process. A static sink is located at the center of the circle. Note that a unit circle area to simplify the analysis; in reality, sensors can be deployed in an arbitrary region.

The unit circle area is divided into two parts, i.e., the *central circle* with radius $r0$ and a *ring*. Sensors located in the central circle are grouped into cluster $C0$. Since $n \to \infty$, with high probability, the number of nodes in $C0$ is

$$N0 = \pi r02n$$

The ring area is partitioned into k sensor with the same shape, sensors in the same sector are grouped into a cluster. The number of nodes in each ring cluster is the same

$$Ni= (1/k)(n-N0)(i>0)$$

Consider that all DPs are on a circle whose center is the sink and whose radius is r. similarly, RPs are on a circle whose center is the sink and whose radius is r+ l. Moreover, the DP and the RP of the same relay are on a line that include the center of the circle. Therefore, the travelling distance of each mobile relay is l.

To collect data from sensor, apply the time division multiple access (TDMA) for communication between sensors.

IV. CONCLUSION

The throughput of WSNs with mobile relays.First proposed a new MRADC model, in which multiple relays with controlled mobility. Based on this model ,the achievable throughput capacity of large-scale WSNs using a constructive approach, which can achieve a certain throughput by choosing appropriate mobility parameters. If the number of relays is less than a threshold, then the throughput capacity can be increased with more relays. On the other hand, if the number is greater than the threshold, then the throughput capacity is a constant, and the capacity gain over a static WSN depends on the transmission range and the impact of interference.

V. FUTURE ENHANCEMENT

Further analyze the throughput bounds introduced in which define new parameters that can help to derive the throughput capacity. To prove the achievable throughput capacity with respect to k . Finally, summarize the parameters to implement the MRADC model, such as the location of the RP and the traveling speed.

VI. REFERENCES

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