International Journal of Engineering and Technical Research (IJETR)
ISSN: 2321-0869 (O) 2454-4698 (P), Volume-3, Issue-7, July 2015

Operative Data revelation protocol to enable multihop sensing on demand for wireless sensor network

Husna Jabeen, Suresh Chimkode, Anil kulkarni

***Abstract*— Wireless Sensor Networks (WSNs), leveraging data sinks mobility for data assembly has drawn extensive interests in recent years. Current researches either focus on planning a mobile sinks moving trajectory in advance to achieve optimized network performance, or target at collecting a small portion of sensed data in the network. In many application scenarios, mobile sink cannot move freely in the deployed area. Multihop Operative Data Revelation Protocol [MODRP] that is self-adaptive to various application scenarios which allow more flexibility to move over deployed area, and controls the flooded message among nodes and also enables multihop sensing communication on demand. The proposed protocol is implemented at large-scale statically deployed area. The proposed protocol is compared with small number of sensor nodes to more number of sensor nodes which effectively reduces control overheads and yield satisfactory performance in finding network parameters as packet delay, packet delivery ratio and throughput. The performance improvement is conducted using network simulator tool.**

***Index Terms*— wiresless sensor network, sink node, multihop, MODRP.**

I. INTRODUCTION

Wireless Sensor Networks (WSNs) have facilitated a broad scale of applications through networked low cost low-power sensor nodes, e.g., territory monitoring, precision agriculture [5], and forest fire detection. In these applications, the sensor network will control under few person intervention either because of the aggressive environment or high management convolution for manual safeguarding. Since sensor nodes have very less battery life. Energy economy is of paramount importance in the design of sensor network protocols. In networking wireless sensor network became hotspot area due to its wide range of applications. Wireless sensor network can be deployed at small-scale and large-scale based on application demand and the node configuration can done at static or dynamic routing. Using small-scale (WSN) deployment area communication become easy because there is less number of nodes, and all nodes are deployed nearer to each other hence communication becomes easy. Whereas in large-scale (WSN) [8] deployment area nodes are deployed at specified distance were each node is far away from each other hence the communication becomes quite difficult. Thus to overcome the multihop communication problem data revelation using mobile sinks introduces new challenges to sensor network applications. To better benefit from the sink's mobility, many research efforts have been focused on studying or scheduling movement patterns [4] of a mobile sink to visit some special places in a deployed area. In a typical wireless sensor network covering a large geographical area the range of the sensors' radio is in general quite short when compared to the network size. Thus, multi-hop communication is essential where nodes convey information packets between the source nodes and the sink(s). Because of the low-cost tiny devices the operation of the network is highly energy sensitive. Our solution is to overcome the limitation is of mobile sink(s) which is moving away from depleted areas. We are proposing the multihop operative data revelation protocol [MODR], will perform work on multihop sensing for (WSN) and also operatively revelate data using mobile sink nodes. Mobile sink moves to predetermined points stops for very short time and query each sensor node individually, where a source node share some descriptive information to the sink node and the objective of mobile sink nodes is to collect the data from the neighboring nodes, buffer the data and move forward to collect the data from other nodes. Sink node collect the data from all source node and send collected data to the user monitoring the geographical area.

Husna Jabeen, Department of Computer Science Engineering Guru Nanak Dev Engineering College Bidar, Karnataka, INDIA

Suresh chimkode, Assist. Professor of Department of Computer Science Engineering Guru Nanak Dev Engineering College Bidar, Karnataka, INDIA

Anil kulkarni, Assist. Professor of Department of Computer Science Engineering Guru Nanak Dev Engineering College Bidar, Karnataka, INDIA

II. RELATED WORK

Author Xinxin Liu et al [1] "SinkTrail: A Proactive Data Reporting Protocol for Wireless Sensor Networks" has worked with collaborators in the Green Seeker system [5] with one hop sensing. The author has proposed two protocols which are used for proactively report data among sink nodes and done the simulation results with one hop sensing. The author has evaluated performance with moving patterns of sink node and did the comparison with small-scale sensor node using SODD [sink oriented data dissemination] and TODD [two-tier data dissemination] approach. This work is further integrated with multihop sensing based on demand using proposed multihop operative data revelation protocol [MODRP] to enable large-scale multihop sensing on demand for wireless sensor network which allow much more flexibility to adapt diverse situation into the field.

Author M. Zhao and Y. Yang et al [2] "Relay Hop Mobile Data Gathering in Wireless Sensor Networks, "analyze the trade-off between energy saving and mobile data gathering by exploring a balance between the relay hop count of local data aggregation and the moving tour length of the mobile collector.

Author S. Basagni, A. Carosi, E. Melachrinoudis, C. Petrioli, and Z.M. Wang et al [3] considered Controlled Sink Mobility and advance planning of mobile sink moving path for Prolonging Wireless Sensor Networks Lifetime using MES algorithm and demons results with one mobile sink which achieved 95% of energy gain. But the performance of a network can also be achieved through multiple sink using proposed MODRP protocol with almost no constraint on the moving trajectory of mobile sinks, achieves much more flexibility to adapt to dynamically changing field situations while still maintains low communication overheads.

Author Nauman Israr and Irfan Awan et al [6] considered Multihop Clustering Algorithm for Load Balancing [MCLB] in Wireless Sensor Networks presented the multi hop routing algorithm for inter cluster communication. The algorithms was a multilayer multi hop routing algorithm which worked on the principle of divide and conquer and was performing good in terms of load balancing and energy efficiency. The algorithm was aimed at exploiting the redundancy property of the WSNs .It selects a small percent of nodes from the network and marks them as temporary cluster heads and uses these nodes to make the inter cluster communication multi hop. The problem with the algorithm was that it was selecting the temporary cluster heads randomly thus compromising occasionally on the area coverage of the network which it is monitoring.

Author Sanjeev Puri, and S.P. Tripathi et al [7] "Adaptive Scalable Cross Layer Framework for Multi-hop Wireless Sensor Networks" Proposed the adaptive scalable cross layer framework for multi-hop wireless sensor networks as a potential architecture for wireless sensor networks which supports cross layers design, energy management, modularity schemes, new adaptive protocols, self-stabilize, multi-scalable and security management. Lacking of standardized wireless sensor network specific protocol architecture was the prime motivation to investigate not only this issue so that plug-and-play and the software reusability of wireless sensor network protocols can be made handy.

Author Ms.Rubia.R et al [8] "A Survey on Mobile Data Gathering in Wireless Sensor Networks - Bounded Relay" introduces mobile data gathering technique which consist of one or more mobile collectors highly equipped with transceiver and battery. Mobile collectors work in short range of communication. Considerable research has proposed the Single Hop Data Gathering Problem (SHDGP) is used to achieve the uniform energy consumption the mobile Data Gathering algorithm is used to find the minimal set of points in the sensor network. It serves as data gathering points for mobile node. However the proposed work constraint to time/distance with respect to large scale deployment.

Author Santoshi Biradar et al [10] "Proactive Data Reporting of Wireless sensor Network using Wake up Scheduling Algorithm for Energy Efficiency" has extended sink trial protocol with sleep/wake up scheduling technique in wireless sensor network and performance were carried using sleep/wake up algorithm and discussed all its corresponding graphs using parameters energy consumption and overhead.

Rijin I.K1, Dr.N.K.Sakthivel et al [11] "Development of an Enhanced Efficient Secured Multi-Hop Routing Technique for Wireless Sensor Networks" proposed an Enhanced Efficient Secured Multi-Hop Routing Technique. The author has describe about different type of attack on Hybrid Multi-hop routing (HYMN) [12] which adversaries misdirect network routing traffic by identity deception technique through replaying information of routing. Using identity deception technique, the adversary can capable of performing hard-to identify and harmful attack against the data path, such as selective forwarding, sinkhole attacks, wormhole attacks and Sybil attacks

Yamuna Devi C R, S H Manjula et al [12] "Multi-hop Route Discovery Using Opportunistic Routing for Wireless Sensor Networks Energy" has proposed the Efficient Opportunistic Routing is one of the multihop routing protocol for wireless sensor networks. It makes use of the forwarders list of the node to choose the forwarding node to transfer the data towards the target. Priorities are assigned for the neighbors of a node to choose the forwarding node.

III. PROBLEM FORMULATION

The most challenging part of data revelation approach is to effectively handle the flooding of control messages introduced dues to sink nodes, which intern effects the energy consumption. Thus Multihop operative data revelation [MODR] protocol creates message repression policy to minimize the flooding of control messages hence the energy consumption problem would greatly reduced. The proposed protocol is implemented using network simulator tool. Conducting extensive comparison studies and simulations results with existing and proposed work

IV. MULTIHOP OPERATIVE DATA REVELATION [MODR] PROTOCOL ALGORITHM

The [MODR] protocol is proposed for sensor nodes to operatively revelate their data to the mobile sinks. The proposed algorithm also resolves the problem of flooding of control messages and simultaneously operates with multihop sensing. The algorithm proceeds as follows.

- A data revelation process starts from the time mobile sinks enter into the field. Sink node broadcast a control message which consist of message sequence number (msg.seqN) and hop count number (msg.hopC). Every node in a network compares the hop count distance with the mobile sink node.

- When mobile sink node move one step forward, if the hopcount distance is same as previous hopcount distance then discard the control message. If not means rebroadcast the message.

- The procedure is repeated until all the nodes completes data revelation process and terminates when either enough data are collected or there is no more data revelate in a certain period.

V. PERFORMANCE EVALAUTION

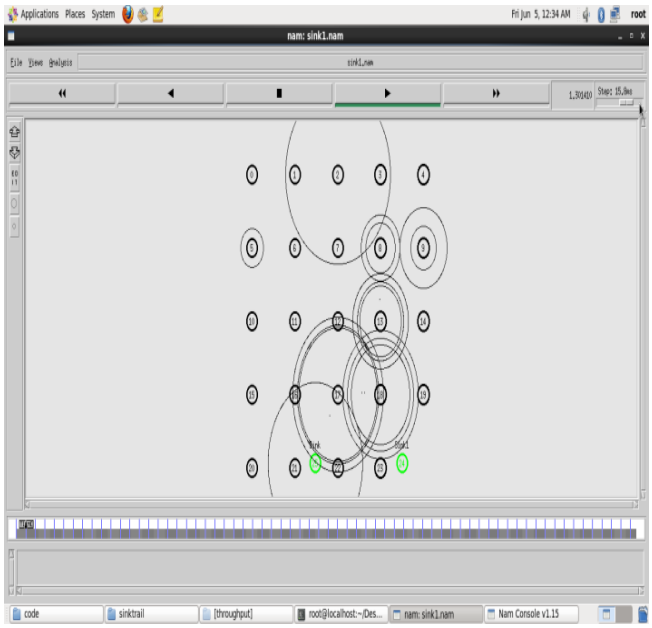
We study the performance of MODRP and implementation is carried out using computer simulation with network simulator2 (NS2). Nodes are deployed using gird topology. We compare the performance of MODRP using table no 2 and AODV using table no 3.

- Simulation can be done at large-scale wireless sensor network and the network is configured using grid topology where all nodes are statically deployed.
- Simulator tool ns-2.35: NS (version 2) is an object-oriented, discrete event driven network simulator developed at UC Berkely written in C++ and OTcl. NS is primarily useful for simulating local and wide area networks. The simulator basically consist of NAM (Network Animator), trace file, awk script file.NAM file is used to display the simulation animation of sensor nodes, trace file trace all processing data. NAM files and trace file is created when the "file.tcl" is executed. AWK script file is used to write all performance metric formulas. It is obvious that if the number of sensor node increases dimension criteria is also change. Dimension is change to 1460*736 for 36 and 49 nodes. Simulation setup tables are shown below.

Table 1 Simulation Setup

Simulation parameters	Simulation values
Channel type	Wireless channel
Propagation model	Two-ray ground
Network interface type	Phy/wireless phy
Interface queue type	Queue/drop tail/priqueue
Network dimension	1060*565 m
Queue capacity(in packets)	50
MAC protocol	IEEE 802.11
Simulation time	80
Antenna type	Omniantenna

Fig 1: simulation of 26 nodes using 2 mobile sink node



Likewise the same Simulation results are carried as shown in table no.2

Table 2.Comparision of mobile sink nodes with network parameters using MODRP protocol

No. of nodes	No. of sink node	Packet delay	Throughput	PDR
26	1	0.498	228.12	0.90
26	2	0.428	237.68	0.93
26	3	0.554	245.28	0.94
36	3	0.361	416.20	0.94
49	4	0.487	510.82	0.95

Table 3.Comparision of mobile sink nodes with network parameters using AODV protocol

No. of nodes	No. of sink node	Packet delay	Throughput	PDR
26	1	1.547	137.48	0.89
26	2	1898	146.36	0.94
26	3	2.254	124.82	0.93
36	3	1518	115.93	0.95
49	4	3.219	223.50	0.94

- We evaluate the performance according to the following matrices.

1. Packet Delay: The time taken for a packet to be transmitted from the source node to the destination node.

Fig 1: packet delay v/s number of sink nodes

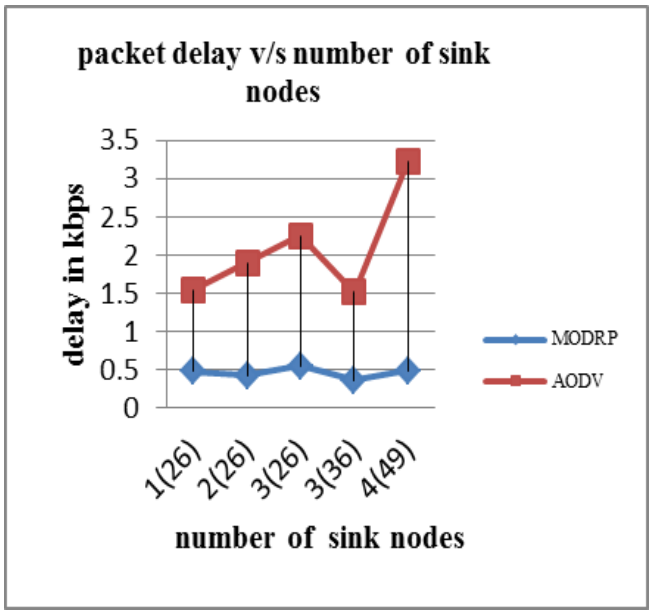


Fig.1 shows the comparisons of the packet delay v/s number of sink nodes between MODRP and AODV routing protocol. From the graph we can see that using AODV, as the number of node are increasing packet delay is also increased where as in proposed MODRP protocol packet is reduced as we increase the number of sink nodes.

2. Throughput: It is the ratio of received packets to the sent packets.

Fig.2. Throughput Vs v/s number of sink nodes

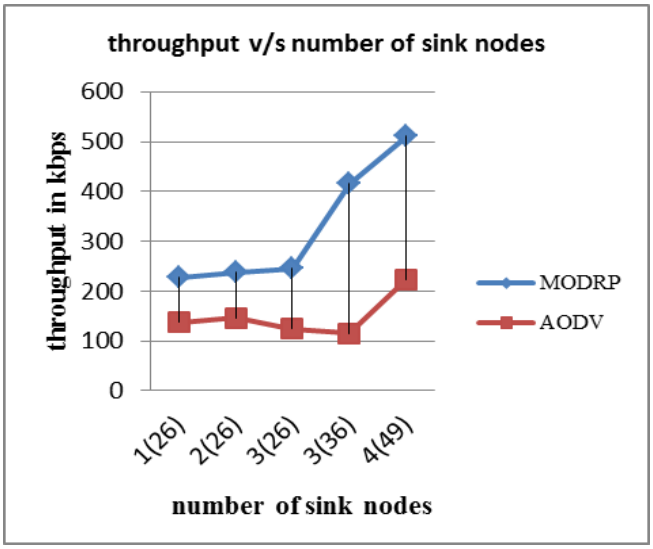


Fig.2. shows the comparisons of the packet delay v/s number of sink nodes between MODRP and AODV routing protocol. We know that throughput increment is affected by the network connectivity, by increasing number of sink nodes along with number sensor nodes, therefore from the graph we can see that using AODV routing protocol throughput increment is less as compare to proposed MODRP protocol.

3. Packet delivery ratio: The ratio of the number of packets received by the destination to the total number of packets sent by the source.

Fig.3. Packet delivery ratio Vs No, of sink nodes

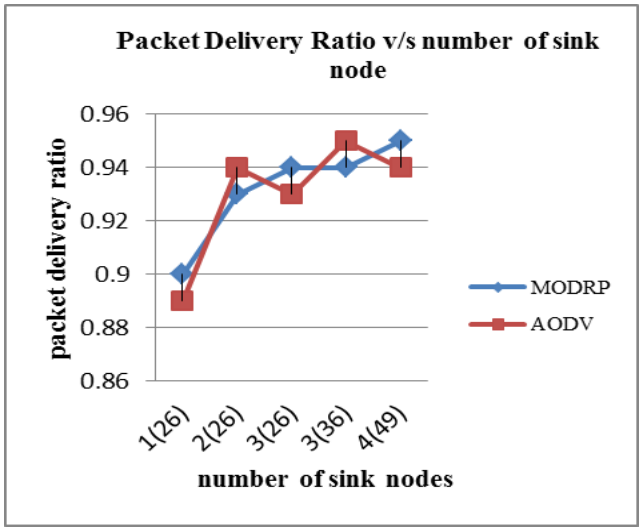


Fig.3. shows the shows the comparisons of the packet delay v/s number of sink nodes between MODRP and AODV routing protocol. Here if the throughput increases automatically packet delivery ratio also increases we can see that PDR is increased in MODRP protocol.

4. Calculating communication overhead introduced by the sink node for proposed MODRP protocol

Communication overhead introduced by sink node basically calculating as shown below

- **Data packets received:** it is define as the total number of packet received by each sink node which is sent from the source node
- **Routing packet:** routing packet is defined as packet is a process of the unit of data that is routed between source and destination of WSN.
- **Normalizing load:** it is define as the ratio of total number of routing packets sent to the total number of data packet received.

Normalizing load=Routing packet / data packet received

VI. CONCLUSION

Multihop operative data revelation [MODRP] protocol proposed for multihop sensing for data gathering in wireless sensor network and capable of tracking multiple mobile sink which effectively reduce control overheads. Thus proposed MODRP provides solution to overcome the problem of multihop communication among sensor node and allow prompt flexibility to adapt diverse situation into the field. We can observe from the results comparison of AODV and proposed MODRP protocol and yield satisfactory performance in finding network parameters as less packet delay, packet delivery ratio an achieving high throughput.

VII. FUTURE WORK

The present work is carried at large-scale statically deployed area by predetermined location, where all source nodes are static and mobile sink node is dynamic moving freely in a deployed area. Further the work can also be carried at dynamic based and can be proposed for any other application of wireless sensor network.

REFERENCES

[1] Xinxin Liu, Student Member, IEEE, Han Zhao, Student Member, IEEE, IEEE TRANSACTIONS ON COMPUTERS, VOL. 62, NO. 1, JANUARY 2013.

[2] M. Zhao and Y. Yang, "Bounded Relay Hop Mobile Data Gathering in Wireless Sensor Networks,"IEEE Trans. Computers, vol. 61, no. 2, pp. 265-277, Feb. 2012

[3] S. Basagni, A. Carosi, E. Melachrinoudis, C. Petrioli, and Z.M. Wang, "Controlled Sink Mobility for Prolonging Wireless Sensor Networks Lifetime," ACM/Elsevier Wireless Networks, vol. 14, pp. 831-858, 2007.

[4] A.A. Somasundara, A. Ramamoorthy, and M.B. Srivastava, "Mobile Element Scheduling for Efficient Data Collection in Wireless Sensor Networks with Dynamic Deadlines," Proc. IEEE 25th Int'l Real-Time Systems Symp. (RTSS), pp. 296-305, 2004.

[5] J. Solie, M. Stone, W. Raun, G. Johnson, K. Freeman, R. Mullen, D. Needham, S. Reed, C. Washmon, and P. Robert, "Real-Time Sensing and N Fertilization with a Field Scale GreenSeeker Applicator," Proc. Am. Soc. Agronomy, 2002.

[6] Nauman Israr And Irfan Awan "Multihop Clustering Algorithm for Load Balancing [MCLB] in Wireless Sensor Networks" Mobile Computing Networks and Security Research group I.J. of Simulation Vol. 8 No. 1 1473-804x Online 1473-8031

[7] Sanjeev Puri, and S.P. Tripathi "Adaptive Scalable Cross Layer Framework for Multi-hop Wireless Sensor Networks" Member,

IACSIT IACSIT International Journal of Engineering and Technology, Vol.3, No.3, June 2011.

[8] M. Ma and Y. Yang, "SenCar: An Energy-Efficient Data Gathering Mechanism for Large-Scale Multihop Sensor Networks," IEEE Trans. Parallel and Distributed Systems, vol. 18, no. 10, pp. 1476-1488, Oct. 2000.

[9] Ms.Rubia.R1, Mr.SivanArulSelvan2 A Survey on Mobile Data Gathering in Wireless Sensor Networks - Bounded Relay International Journal of Engineering Trends and Technology (IJETT) – Volume 7 Number 5- Jan 2014

[10] Santoshi P.Biradar, "Proactive Data Reporting of Wireless sensor Network using Wake up Scheduling Algorithm for Energy Efficiency", IJSRD - International Journal for Scientific Research & Development| Vol. 2, Issue 05, 2014 | ISSN (online): 2321-0613

[11] Rijin,I.K1,Dr.N.K.Sakthivel "Development of an Enhanced Efficient Secured Multi-Hop Routing Technique for Wireless Sensor Networks" International Journal of Innovative Research in Computer and Communication Engineering Vol. 1, Issue 3, May 2013

[12] Ahmed E.A.A. Abdulla, "HYMN: A Novel Hybrid Multi-Hop Routing Algorithm to Improve the Longevity of WSNs," IEEE Transactions on Wireless Communications, Vol. 11, pp. 7, July 2012