

Performance Analysis of Shortest Best Path Tree-Based Decentralization Mechanism with Bandwidth Consumption in Wireless Sensor Networks

Manjuparkavi.R¹, Kumaresan.A², Aishwarya.M³, Dr.M.Senthil⁴, Vijayakumar.K⁵

P.G. Student, Department of CSE, S.K.P Engineering College, Tiruvannamalai, Tamil Nadu, India¹

Associate Professor, Department of CSE, S.K.P Engineering College, Tiruvannamalai, Tamil Nadu, India²

P.G. Student, Department of CSE, S.K.P Engineering College, Tiruvannamalai, Tamil Nadu, India³

Professor, Department of CSE, S.K.P Engineering College, Tiruvannamalai, Tamil Nadu, India⁴

Associate Professor, Department of CSE, S.K.P Engineering College, Tiruvannamalai, Tamil Nadu, India⁵

ABSTRACT: In this paper, we propose Shortest Best Path Tree-Based Decentralization Mechanism (SBPTDM) which reduces the bandwidth consumption by utilizing partial paths. Energy consumption, Reliability, Security, Computation cost are some of the constraints in Wireless Sensor Network (WSN) where Security and Privacy are the major constraints. To enhance Security in WSN, a mechanism called Steiner Tree Based Decentralization Mechanism (STDM) is available in which using Minimum tree structure can significantly reduce the number of nodes in data transmission. Other demerits in this method are the difficulty to retain the properties. Such as degree and angle condition, a local Steiner point insertion or deletion which may have global effects, requiring the relocation of several other Steiner points, bandwidth consumption of the partial paths is very high. so, we propose STDM in order to provide Security in data transmission with minimum number of nodes along with a new algorithm called Shortest Best Path Tree-Based Decentralization Mechanism(SBPTDM) which reduces the bandwidth consumption through utilizing partial paths already recognized for receiver nodes. SBPTDM algorithm is a dispersed algorithm with cost in the same order as the sum of the shortest path tree (SPT) and Greedy algorithm.

KEYWORDS: Wireless Sensor Networks, Steiner Tree-based Decentralization Mechanism (STDM), Shortest Best Path Tree based Decentralization Mechanism (SBPTDM), AODV (Adhoc on Demand Vector) protocol, bandwidth consumption.

I. INTRODUCTION

A Wireless Sensor Networks (WSN) consists of many sensors, They are small-lightweight wireless node to observe the environment or system by the measurement of physical factors [1] such as Temperature, pressure, humidity, etc... To enhance the security in wireless sensor networks, here we Used the mechanism called Steiner tree based decentralization mechanism (STDM). Data privacy is to share the information to the trusted users for high security. A Steiner tree is also called as Minimum weight tree connecting a designated set of vertices called terminals. Decentralization Mechanism is enhancing the privacy by dividing and distributing the data along with different paths from source to sink in STDM. STDM uses Steiner tree structure for the WSN and a decentralization mechanism for the data transmission. This section discusses the working of Steiner tree construction, decentralization and STDM along with their algorithms. The decentralization mechanism is given in Algorithm where, source S partitions the data D and forwards these partitions through its neighboring nodes which route to the sink T . When these partitions reach T , it decrypts them after the number of partitions received is equal to some threshold value t sent by S . It then checks these

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

decrypted data with the Cyclic Redundancy Check for errors. STDM applies Steiner tree and decentralization mechanisms over WSN. The source node S collects the location information of all the nodes first and also constructs its new Steiner tree. Network Simulator (Version 2), commonly known as NS2, is simply an event driven simulation tool that has proved of use in learning the active character of communication networks. Simulation of wired as well as wireless network tasks and procedures (e.g., routing algorithms, TCP, UDP) can be prepared by NS2 [1]. In common, NS2 supplies users by means of identifying such network protocols and suggesting their equivalent activities. Due to its elasticity and modular temperament, NS2 has gets steady recognition in the networking research community. The group of researchers and developers in the area are persistently working to keep NS2 strong and adaptable. AODV is a direction-finding protocol, and it agreement with direction counter organization. Route counter information have to kept back yet for short-lived routes, such as are produced for the moment store reverse paths towards nodes initiating RREQs. AODV uses the subsequent fields by means of each route table entry: target IP Address, target series Number, applicable Destination series digit flag, Other state and steering flags (e.g., applicable, unacceptable, repairable, being restored),system Interface, Hop Count (number of hops needed to reach destination),Next Hop, List of predecessors, duration (finishing or deletion time of the route)

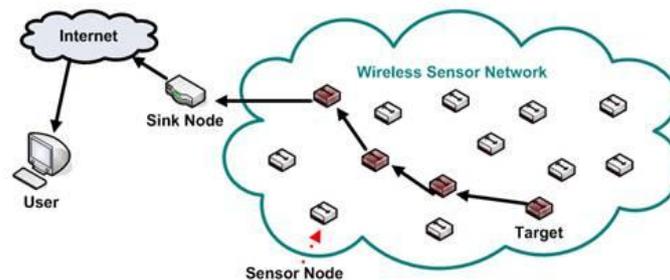


Figure: 1. Wireless Sensor Networks

II. RELATED WORK

In this paper, we investigate arbitrary and deterministic node exploitations for large-scale WSNs in the following performance metrics: coverage, energy utilization, and message transmit delay [2]. We consider three competitors: a consistent random, a square network, and a prototype based Tri-Hexagon Tiling (THT) node employment. A simple energy model is formulated to study energy consumption for each employment approach. Using fundamental geometry we suggest a novel approach for calculating the relative frequency of exactly k -covered ends, which uses k -coverage maps, for both a open area grid and THT. To form and accordingly manage the worst-case delay of a given WSN we construct ahead the so-called sensor network Calculus (a recent methodology introduced in [3]). Finally, we examine tradeoffs between these performance metrics for each employment approach to demonstrate which approach is preferable under factors, e.g., the number of nodes. The major concept after this plan is to observation each multicast tree as a set of unicast paths and to situate simply the multicast source and destination nodes on the links of their multicast tree [4]. This paper shows that despite this constraint, the cost of the created multicast trees is not essentially higher than the cost of the trees formed by extra algorithms that do not enforce the constraint and therefore involve all nodes beside the data path of a tree to contribute in routing over the tree and in the preservation of the tree. The establishment of pair wise keys between communicating Neighbor nodes in sensor networks is a demanding difficulty due to the unsuitability of public-key cryptographic methods for the resource-constrained stages of sensor networks [5] and as well due to exposure of physical captures of sensor nodes by an opponent/enemy. we propose a new location-adaptive key establishment system which is considered as an enhanced substitute to the path key concern stage of bootstrapping protocol in a sensor network. Our proposed scheme offers significantly enhanced network connectivity evaluated to that for the path key concern. Furthermore, our method has improved trade-off between communication transparency, computational overhead, network connectivity and resilience against node capture attack than the path

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

key. We studied the algorithmic complexities of the problem of finding an best complete Steiner tree for a specified set of terminals and a complete graph with a length occupation on the edges [6]. We showed that this difficulty is NP-complete and MAX SNP-hard, even when the lengths of the edges are restricted to either 1 or 2. But the lengths of edges are any 1 or 2, and then we gave 85 estimate algorithms for the problem. It would be interest to know if our 85 - approximation algorithm for MIN-FSTP (1, 2) can be further improved, and if there is an approximation algorithm within a constant ratio For MIN-FSTP (i.e., the FSTP without any constraint on the length function). We study the problem of energy utilization minimization in wireless sensor networks (WSNs) under uncertainty in sensor node created traffic [7]. To consider traffic ambiguity because WSNs planned for observation and examining the applications typically operate in *event-driven* and *query-driven* methods for which the node generated interchange from instance to instance. The complexity is originated as a two-stage stochastic linear series with recourse where the purpose is to minimize the sum of the energy cost finished on the carried traffic and the normal power cost of blocked traffic, under the limitation of a fixed energy budget at each node. The stochastic programming formulation lends to the concern of two approaches for managing the randomly created traffic: a deterministic approach in which all future created random traffic are controlled by the relation flows determined for the small traffic, and a stochastic approach wherever the link flows are personalized as the node created traffic changes. Numerical outcomes demonstrate that, evaluated to the deterministic approach, the stochastic approach provides up to 10% savings in network-level energy utilization and this is achieved lacking a loss in received records quality. The network level energy reserves translate to a extended network lifetime.

III. STDM

The planned STDM merges the two ideas of Steiner tree and the decentralization method and provides a better Privacy security once compared to some of the existing Approaches. The Steiner tree structure of the network in WSN helps in capable data communication with minimum hops [8]. It helps in achieving decreased communication overhead. The decentralization method, functional to the data being transmitted, helps in privacy of data against privacy hits where, an enemy cannot attain the absolute data and communication patterns still when it negotiates one of the transmitting nodes. STDM approach avoids an enemy as of tracing back to the source node. This paper gives the performance of STDM in data communication with esteem to path diversity, energy utilization, consistency, and communication transparency and computation costs [8] STDM uses Steiner tree formation for the WSN and a decentralization mechanism for the data communication. We converse the functioning of Steiner tree structure, decentralization and STDM alongside through their algorithms.

A. Steiner Tree Construction

Consider a WSN, $V = (G, E)$, where G is a set of nodes and $E \subseteq V^2$ is the set of communication relations, as shown in Figure 3. Let S be the source node [8]. There be a pair $(x; y) \in E$ i.e., x is able to communicate with y . Hence, the region set of x , $N(x)$, is held to hold all the nodes apart from x that have an edging or a communication relation with x .
 $N(x) = y \neq x \wedge (x; y) \in E$

B. Decentralization Mechanism

The decentralization mechanism is given in Algorithm 2 where, source S partitions the data D and forwards these partitions through its neighboring nodes which route to the sink T . When these partitions reach T , it decrypts them after the number of partitions received is equal to some threshold value t sent by S . It then checks these decrypted data with the Cyclic Redundancy Check for errors.

C. Steiner Tree-based Decentralization Mechanism (STDM)

STDM applies Steiner tree and decentralization mechanisms over WSN. The source node S first collects the location in formation of all the nodes and constructs its Steiner tree. The node S sends a data D to the node $N25$, by partitioning it into $D1$ and $D2$, through its neighboring nodes $N22$ and $N13$ respectively by encrypting them along with the encrypted

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

CRC code. These nodes use their Steiner structures to transmit the data. At node N_{25} the received number of partitions is checked with the threshold value obtained from S and decrypted. The decrypted data is then checked with the decrypted CRC value to obtain the data accuracy.

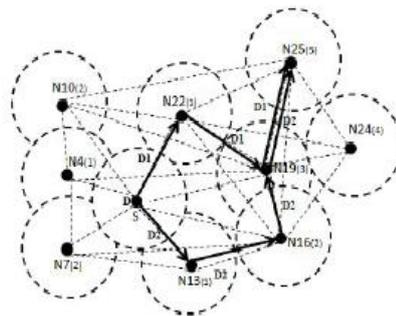


Figure 2: STDM for privacy protection

IV. SBPTDM

To overcome the bandwidth consumption in Steiner tree, we proposed a new algorithm called Shortest Best Path Tree based Decentralization Mechanism (SBPTDM) algorithm. The SBPTDM algorithm decreases bandwidth utilization by utilizing partial paths previously recognized for receiver nodes. The error ratio in application layer will be greatly reduced by employing forward error correction code like CRC or Hamming. The SBPTDM algorithm is circulated algorithms with cost in the identical organize as the sum of the shortest path tree (SPT) and Greedy algorithm.

A. Shortest path tree (SPT)

Consider a connected, undirected network with one special node, called the source (or root). Associated with each edge is a distance, a nonnegative number. The objective is to find the set of edges connecting all nodes such that the sum of the edge lengths from the source to each node is minimized. We call it a *shortest-paths tree* (SPT) rooted at the source [10]. In order to minimize the total path lengths, the path from the root to each node must be a shortest path connecting them. Otherwise, we substitute such a path with a shortest path, and get a “lighter” spanning tree whose total path lengths from the root to all nodes are smaller. Shortest-paths trees are not necessarily unique. Figure 4 gives two shortest-paths trees rooted at vertex a for the graph from Figure 3. Take a look at the paths from a to e . In Figure 4(a), it goes from a to g , and then g to e . In Figure 4(b), it goes from a to b , b to d , and then d to e . Both of them are of length 7, which is the length of a shortest path from a to e . Notice that the total edge weight of two shortest-paths trees may not be the same. For example, the total edge weight of the shortest-paths tree in Figure 4(a) is 18, whereas that of the shortest-paths tree in Figure 4(b) is 17.

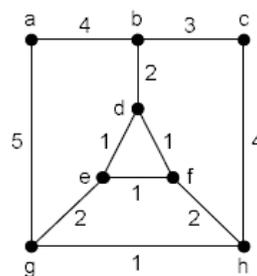


Figure 3: A weighted graph

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

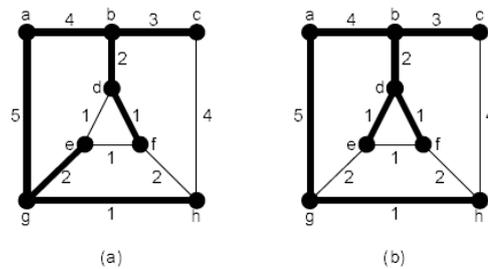
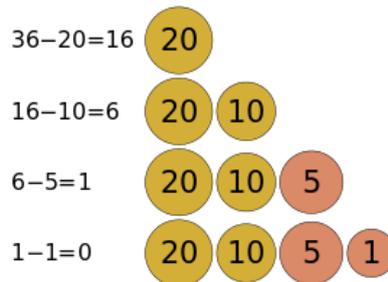


Figure 4: A shortest-paths tree rooted at vertex *a* for the graph from Figure 3.

B. GREEDY ALGORITHM

A greedy algorithm is an algorithm that follows the problem solving heuristic of building the nearby best choice at each stage with the expectation of discovering a global optimum. In many problems, a greedy approach does not in wide-ranging construction of an optimal solution, but nevertheless a greedy heuristic may surrender locally best solutions that estimated a global best solution in a sensible time. In general, greedy algorithms have five components:

1. A applicant set, from which a result is created
2. A collection purpose, which select the best applicant to be added to the result
3. A possibility role, that is used to establish if a applicant can be used to supply to a result
4. An purpose function, which give a value to a result, or a partial result, and
5. A solution task, which will specify when we have exposed a complete result



Greedy algorithms establish least amount number of coins to give while building change. These are the steps an individual would take to follow a greedy algorithm to signify 36 cents by only coins with values {1, 5, 10, 20}. The coin of the highest value, less than the remaining change owed, is the local best possible.

V. SIMULATION RESULT

This section presents simulation result of “Steiner tree based decentralization mechanism” when compared with normal AODV. It is implemented in NS2 software .NS2 is an object oriented, distinct event driven network simulator developed at UC Berkeley, written in C++ and OTcl. NS2 is useful for suggesting local and wide area networks.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

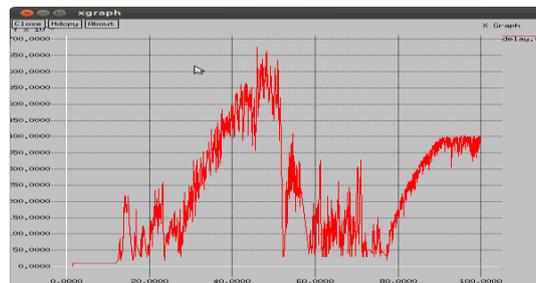


Figure 5. Average delay graph.

A. Average Delay: Figure 5 represents average delay that has been calculated by using normal AODV protocol. AODV protocol [10] is normal protocol and the delay is also normal but it is slightly higher than STDM. In our proposed STDM approach, we find the shortest path between the nodes. So the delay is very less compared to the AODV protocols.

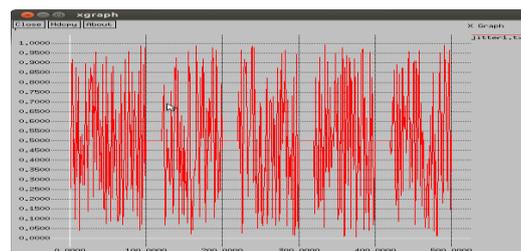


Figure 6: Average Jitter graph

B. Jitter: Figure 6 represents jitter that has been calculated by using normal AODV protocol. AODV protocol is normal set of rules and the interruption is also normal but it is slightly higher than STDM. In our proposed STDM approach, we find the shortest path between the nodes. So the jitter is very less compared to the AODV protocols.

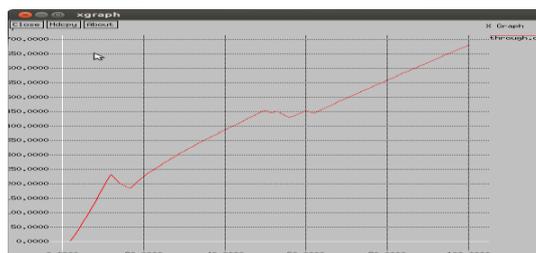


Figure 7: Average Throughput graph

C. Throughput: Figure 7 represents throughput, that is, whole number of packets sent from sender and how many packets are received to the receiver [11]. In AODV, the packet loss is high, so throughput is low. In STDM, the packet loss is very less, so throughput is higher. Thus, we maximized the throughput compared to AODV.

VI. DISCUSSION

The wireless sensor network has many constraints such as average delay, energy spend, and protection. It is really necessary to consider these constraints before designing any sensor networks. Nodes communication and data transmission take much power and consume more energy. So, PBA technique is proposed to consume less energy and also enhance high protection compared to normal AODV protocol.

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

A. AODV Protocol: The AODV protocol is just used when two endpoints do not have a applicable on the go route to each other. When link splits, rerouting will obtain place by AODV protocol [12]. It is completed by the function of nodes that can keep track of connectivity to neighbors using available data link or network layer methods. In every break time, 2ms, 4ms, 6ms, 8ms, and 10ms, the average delay and energy spent are less. Throughput and PDR are high.

Protocol	Delay	Jitter	Throughput
AODV	Higher	Higher	Lower
STDM	Lower	Lower	Higher

Table 1: Comparison of AODV protocol and STDM.

B. STDM: To overcome all the shortcomings of above protocols, we are finding shortest path between the sources and sink nodes. So, it achieves quickly the destination even if attacker is Present. So, this STDM approach is effective compared to the AODV protocol .Here the delay and jitter are very less .The throughput is very high. The discussion is shown in Table 1.

VII. CONCLUSION

Power conservation and security are the main challenges in WSN. In this paper, we proposed a scheme called Steiner Tree based Decentralization Mechanism (STDM) which aims at the privacy of sensed data and data transmission along shortest path. STDM achieves a better performance over protecting privacy of the sensed data when compared to some of the existing mechanisms. The Steiner tree structure of the network results in minimum number of nodes for data transmission and the decentralization mechanism protects the data against privacy attacks. The decentralization mechanism over Steiner tree results in high path diversities and hence, reduces the possibilities of occurrence and success of the privacy attacks. The simulation results show that STDM is efficient in terms of energy consumption, reliability, communication overhead and computation cost when compared to the existing security approaches for WSN.

REFERENCES

- [1]. Power Conservation and Security Enhancement in Wireless Sensor Networks: A Priority Based Approach P. Sivakumar, K. Amirthavalli, and M. Senthil Hindawi Publishing Corporation International Journal of Distributed Sensor Networks Volume 2014, Article ID 319587, 7 pages <http://dx.doi.org/10.1155/2014/319587>
- [2]. Node Deployment in Large Wireless Sensor Networks: Coverage, Energy Consumption, and Worst-Case Delay Wint Yi Poe, Jens B. Schmitt
- [3] Schmitt, J. B., and Roedig, U. Sensor Network Calculus - A Framework for Worst Case Analysis. In Proceedings of the International Conference on Distributed Computing in Sensor System (DCOSS05) (June 2005), pp. 141–154.
- [4].Restricted Dynamic Steiner Trees for Scalable Multicast in Datagram Networks Ehud Aharoni and Reuven Cohen, Member, IEEE
- [5]. A Location-Adaptive Key Establishment Scheme for Large-Scale Distributed Wireless Sensor Networks Ashok Kumar Das Department of Computer Science and Engineering International Institute of Information Technology, Bhubaneswar 751 013, India Email: iitkgp akdas2006@yahoo.co.in
- [6].The full Steiner tree problem Chin Lung Lua , Chuan Yi Tangb;* , Richard Chia-Tung Leec A Department of Biological Science and Technology, National Chiao Tung University, Hsinchu 300, Taiwan, ROC b Department of Computer Science, National Tsing Hua University, Hsinchu 300, Taiwan, ROC c Department of Computer Science and Information Engineering, National Chi-Nan University, Puli Nantou Hsien 545, Taiwan, ROC Received 29 August 2002; received in revised form 11 February 2003; accepted 14 February 2003 Communicated by D.-Z. Du
- [7].Energy Consumption in Wireless Sensor Networks under Varying Sensor Node Traffic Abraham O. Fapojuwo^{1,2}, Chi K. Tse¹ and Francis C.M. Lau¹ ¹Department of Electronic and Information Engineering, The Hong Kong Polytechnic University, Hong Kong. ²Department of Electrical and Computer Engineering, The University of Calgary, Calgary, Alberta, Canada.
- [8].Performance Analysis of Steiner Tree-based Decentralization Mechanism (STDM) for Privacy Protection in Wireless Sensor Networks B. Sathish Babu, Jayashree N, and Pallapa Venkataram International Journal of Network Security, Vol.15, No.5, PP.331-340, Sept. 2013
- [9] Shortest-Paths Treesꣳ Bang Ye Wu Kun-Mao Chao
- [10] V. M. Gayathri, S. Raichal, and R. Nedunchelian, "Comparison of AODV and DSDV protocols based on energy consumption International Journal of Distributed Sensor Networks 7 and QoS performance," International Journal of Engineering and Technology, vol. 5, no. 3, pp. 2837–2841, 2013.
- [11] M. Sharma and A. K. Shaw, "Transmission time and throughput analysis of EEE LEACH, LEACH and direct transmission protocol: a simulation based approach," Advanced Computing, vol. 3, no. 5, pp. 97–104, 2012.
- [12] C. Perkins, E. Belding-Royer, and S. Das, "Ad hoc on-demand distance vector (AODV) routing," Tech. Rep. RFC 3561, 2003.