Volume 7, Issue 3, March 2017 ISSN: 2277 128X

International Journal of Advanced Research in Computer Science and Software Engineering

Research Paper

Available online at: www.ijarcsse.com

An Enhanced Approach for a Multiagent Distributed Context Using Tree Topology and Transferable Belief Model

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Abstract: This paper makes continuation to add transferable belief model to a Multiagent distributed context using tree topology. Agents act as a node and gather data independently using graph with cycles. The cyclic structure improves better communication among mobile unit. Dynamic scenario is been considered where agents gather data that changes over time. A cyclic graph algorithm has been proposed to merge to basic belief assignment based on transferable belief model. The major utilization of transferable belief model is in sensor networks.

Keywords: Cyclic Graph Algorithm, Multiagent System, Transferable Belief Model, Tree Topology, AOMDV

I. INTRODUCTION

Data fusion plays an important in the text of Multiagent system where data coming from different sources is summarized in order to provide meaningful description of the surrounding context. The single agent pattern must not be sufficient when uncertain reasoning is been performed by entities of the system between which there is some distance either temporal or semantics. For such systems, a Multiagent aspect is been considered, where each agent is an autonomous intelligent subsystem. Each agent holds its own partial knowledge and accesses some computational resources. A Multiagent approach provides advantages such as larger range of task domain and higher robustness.TBM offers an idea of open world inference in DS Framework. The data is exchanged locally among agents using point to point topology [1].

The proposed system mainly concentrates to add on the transferable belief model to multiagent distributed context where distributed data is available based on tree topology. An agent acts as a node and gathers information using graph with cycles. The cyclic structure improves better communication among mobile units. Dynamic scenario is been considered where agents gather data that changes over time. Categorization is been done by means of distributed data fusion based on tree topology. The cyclic graph algorithm has been proposed to merge to basic belief assignment based on the transferable belief model. The data summarization gives the idea to gather the information coming from different sources to route to eliminate redundancy, minimize number of transmission and thus saves energy. An efficient data transfer model with tree structure is been provided.

II. RELATED WORK

An evidence based sensor coverage model is described based on the transferable belief model. The evidence based coverage model provides a generic mathematical abstraction of sensor coverage. Evidence combination is shown to improve significantly sensor coverage by utilizing collaboration about sensors [2]. A new framework for sensor reliability evaluation is presented in a classification problem based on evidence theory in [3]. Also a method for evaluating the reliability of sensor in a classification problem is been proposed based on the transferable belief model [4]. First it had developed a method for the evaluation of sensors. The method is based on finding the discounting factor reducing the distance between the pignistic probabilities computed from the discounted beliefs and the actual values of data. Next it had developed a method for assessing the reliability of several sensors that are supposed to work jointly and then their readings are summarized. The discounting factor are evaluated on the basis of minimizing the distance between the pignistic probabilities computed from the combined discounted belief functions and the actual values of data. The minimum spanning tree problem has been defined in [5]. Various topology control algorithms also use minimum spanning tree to build well connected sub graphs with provable cost relative to the optimum. Both centralized and distributed algorithms have been proposed to construct the topology in [6].They demonstrates its effectiveness through investigation of two clauses of distributed applications: Data gathering of sensor networks and data dissemination in divisible load scheduling. Also an in depth study of design and analysis of gossip algorithm has been taken forward for averaging in an arbitrarily connected number of nodes [7].It examines the averaging problem under the gossip constraint for an arbitrary networks and finds that the averaging time of the gossip algorithm depends on the second largest Eigen values of a double stochastic matrix characterizing the algorithm. A distributed algorithm has been proposed to build a minimal spanning tree that operates on both concurrently and asynchronously in [8].They are useful in store and forward packet-switching computer communication networks where there is typically no single sources of control. The two statistical models of locations is compared in [9] and an external knowledge is made from a set of observable random variable provided by body of sensors and arranged either in a Bayesian network or in a knowledgebase systems containing the actimetric profile. They introduced the correction corresponding to a

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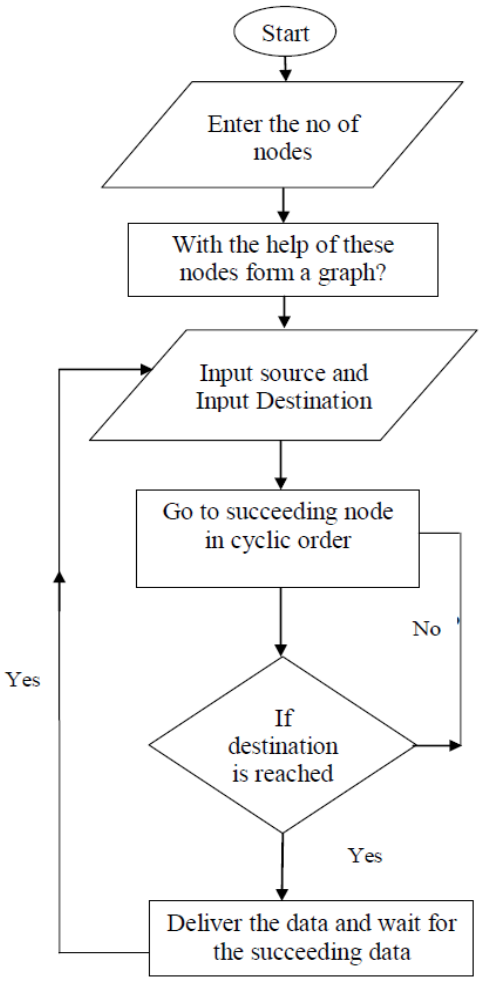
possible loss of the person's synchronization with the day versus night synchronizers to avoid false alarms. The problem of measuring the conflict between two bodies of evidence is been represented by belief functions in [10]. The system proposes to study the notion of conflict from different aspect. It starts by examining consistency and conflict. It then extends its basic scheme from basic to belief functions. It does not make any prior assumption about source independence and only consider such data.

The consensus problem with infinite time varying delays has been proposed for linearly coupled static network in [11]. At first it describes effective consensus ability index. Then by using graph theory it has been proved that under some mild conditions the network can realize consensus. The transferable belief model approach has been effectively used in target identification in [12].It shows that the transferable belief model solution can produce different from those reached with the classical likelihood based methods. The problem of coordinating multiple spacecraft to fly in tightly controlled formations is addressed in [13].It introduces a coordination architecture that subsumes leader-following, behavioural, and virtual-structure approaches to the Multiagent coordination problem. The motivation behind the interest of Multiagent system is that Multiagent approach provides several advantages such as larger range of task domains and higher flexibility. The data aggregation problem for Multiagent system is been investigation in [14] and static scenario is been considered where agents offer data that do not changes over time. In the proposed system complex interaction between each and every node is been provided with tree topology. An efficient data transfer model using node with tree structure is provided. In the paper cyclic graph algorithm is been proposed to merge basic belief assignment based on the transferable belief model.

III. PROPOSED METHODOLOGY

A Cyclic graph Algorithm has been proposed to meet to basic belief assignment based on transferable belief model. The basic objective of the proposed system is to develop an efficient tree topology in a Multiagent context and to develop proper path for routing. Tree topology describes better communication in static sensors and cyclic structure improves better communication among mobile units. Figure 1 shows flowchart for cyclic graph algorithm. At first node will be created. With the help of these nodes it will form a graph. After that it will input source and destination and go to next node in cyclic order. If destination is reached then it will deliver data and wait for next data. If destination is not reached then it will go to next node in cyclic order.



Flow Chart Cyclic Graph Algorithm

IV. SIMULATION RESULT

The implementation of research methodology is been done through NS2 simulation. As NS2 is been used to stimulate wireless sensor networks. The table I below shows the input parameters that are used in NS2.

Table I. Input Parameters Used

Sr No	Parameters	Description
1	Routing Protocol	AOMDV
2	Nodes	30
3	Agents	Udp and Sink
4	Bounded Region	500*500
5	Transmission	250m
6	Mac Layer	802.11

The wireless sensor network has been deployed 30 sensor nodes. AOMDV routing is used as a routing protocol. AOMDV routing protocol is been used as multipath is been taken into consideration. Among from these multiple path shortest path is been evaluated. Also UDP is as agent for source node and Sink is used as an agent for destination node. With the help of these input data nam file is been created. Figure 2 below shows the network transmission. In the Nam file, one node is selected as a source node and another node is selected as a destination node. In figure 2 below node 26 is selected as a source node and node 8 is selected as a destination node. Further cost is been calculated to generate optimal path. First it will check the normal cost and if it is high then it will goto next path. After that it calculates Euclidean distance formulae. The formulae which is used to calculate optimal cost is shown in equation below

$$\textbf{Euclidean Distance} = \sqrt{[(X_2 - X_1)^2 + (Y_2 - Y_1)^2]} * Traffic$$

In this formula, X and Y are the source and destination of the nodes. Traffic is the variable which will be calculated according to the distance between source and destination.

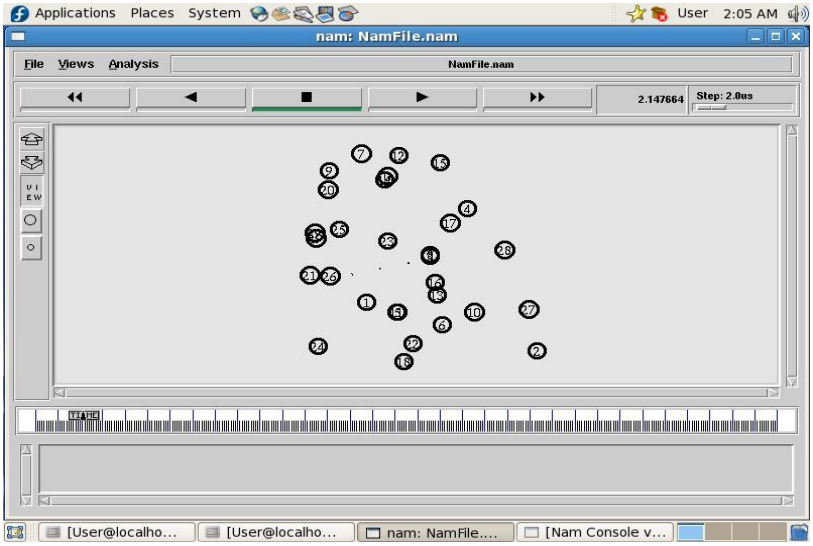


Figure 2 Network Transmission

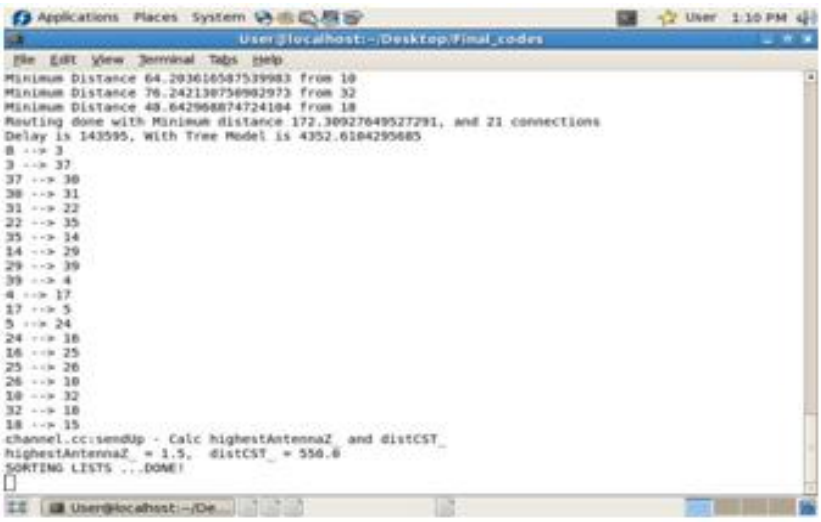


Figure 3 Trees Topological Module

Figure 3 shows tree topological module where it shows node connection having minimum distance. It checks how to transmit the data with minimum retransmission using tree topological belief model. After that it will find closest node from the source node. Then it will check this till the destination node. In figure 3 data range is 1.5 meters. Routing with

minimum distance is been calculated by using in figure 2, node 8 is selected as a source node and node15 is selected as a destination node. The shortest distance path is selected between these two nodes. In figure 3, the shortest path is 8-3-37-30-31-32-22-35-14-29-39-4-17-5-24-16-25-26-10-32-18-15.The nodes are arranged in a tree form so that the tree can parse. On the top of a tree is the node which is at minimum X and minimum Y co-ordinate. The tree would expand based on the location of nodes. The shortest path is mainly used in tree topology to find the optimal routing. Cyclic graph is been formed and the nodes follow that path. This path is shown in cyclic graph module. Figure 4 below shows cyclic graph module which shows shortest path in the nam output. Figure 4 shows that path which is the most likely shortest path. Further integration of tree topological module and cyclic graph module is been done and the graph is obtained from the output parameter. According to the optimal routing output parameters are evaluated. The output parameter is the network load combined graph. Figure 5 shows comparison between network load of optimized cost and network load of normal cost. In figure 5, X axis represents number of communication and Y axis represents network load. In network load combined graph, green line represents network load for optimized cost and red line represents network load for normal cost. In figure 5 it can be seen that network load of optimized cost as shown by green line is showing improvement as compared to normal cost as shown in red line. A model is used which is been able to handle more network load of optimized cost as a cyclic graph algorithm is been applied and Euclidean distance formulae by equation (1) is used to find the shortest path in tree topology. The table II below shows the values that are used in the graph above for comparison between network load of normal cost and network load of optimized cost.

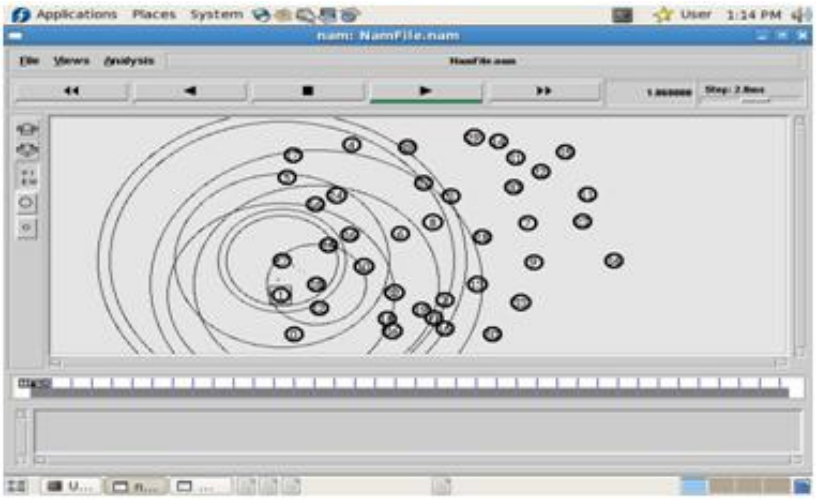


Figure 4. Cyclic Graph Algorithm

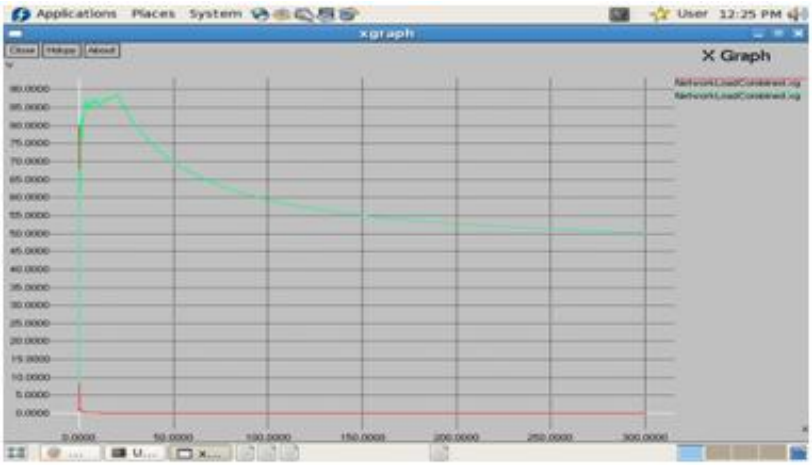


Figure 5. Network Load Combined Graph

[X-axis: No of Comm & Y-axis:Network Load]

Table II. Result

Network Load of Normal Cost		Network Load of Optimized Cost	
Communication Number	Network Load of Normal Cost	Communication Number	Network Load of Optimized Cost
0.001175	12.518519	0.001175	8.666667
0.001176	76.050000	0.001176	39.61900
0.001200	53.664091	0.001200	45.15789
0.001201	50.631104	0.001201	47.27272
0.001308	62.140744	0.001308	48.48356

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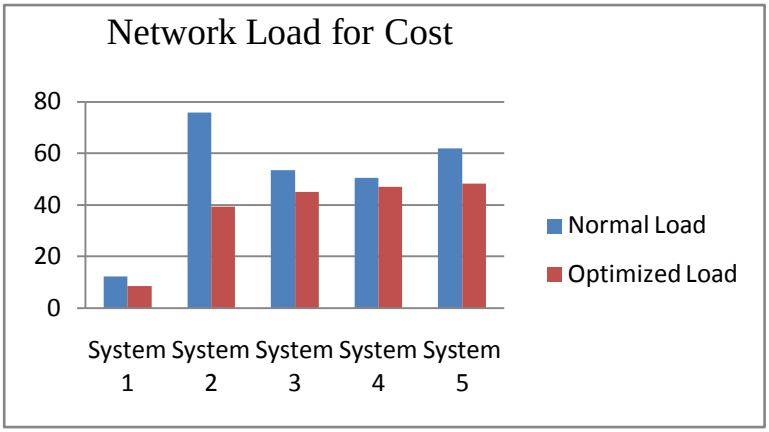

In table II above at point 0.001176 it can be seen that network load of optimized cost is less as compared to that of network load of normal cost. The network load of optimized cost is more efficient as compared to network load of normal cost as cyclic graph algorithm is applied and shortest path is been evaluated.

V. CONCLUSION

In the paper transferable belief model continues to add on to Multiagent distributed context based on tree topology. Dynamic scenario is been taken into consideration where agents offers data that changes over time. A cyclic graph algorithm has been constructed to meet to basic belief assignment based on transferable belief model. A Multiagent approach provides an advantage such as larger range of task domain and robustness. The optimal path is been evaluated with the help of cyclic graph algorithm. The network load of optimized cost is been improved with the help of cyclic graph algorithm.

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