ENHANCED ENERGY OPTIMIZED REACTIVE TREE BASEDROUTING PROTOCOL FOR INTELLIGENT TRANSPORT SYSTEM (ITS) USING WIRELESS SENSOR NETWORK

KIRTHIKA.R *1
*1 Full time Research scholar, Department of MCA,
BIT Campus,Anna University, Tiruchirappalli.

NALINI.S*1
*1 Assistant Professor, Department of MCA,
BIT Campus,Anna University, Tiruchirappalli.

Dr.A.VALARMATHI2
*2 Head and Assistant Professor, Department of MCA,
BIT Campus,Anna University, Tiruchirappalli.

Abstract

In Indian traffic being non-lane based and chaotic is largely different from the western traffic. Thus, Intelligent Transport Systems (ITS) used for efficient traffic management in developed countries and it cannot be used as it is in India. ITS techniques have to undergo adaptation and innovation to suit the contrasting traffic characteristics of Indian roads. The focus, however, has been given to the routing protocols which might differ depending on the application and network architecture. Routing is very challenging in WSN due to complexity in building a global addressing scheme, handling resources, positioning sensor nodes etc. Reactive routing protocols perform a global-search on-demand route discovery process that requires significant control traffic. The core issue in most of the tree based routing protocols of WSN is that the energy conservation for topology formation in case of regular node die and rebuilding of routing table. This greatly influences the life time of the network.

Keywords: *Wireless sensor networks, ITS, Sensor nodes, Reactive Routing Protocol.*

I .Introduction

Wireless sensor network (WSN) is widely considered as one of the most important technologies for the twenty-first century. A WSN typically consists of a large number of low-cost, low-power and multifunctional wireless sensor nodes with sensing wireless communications and calculation capabilities. Due to the severe energy constraints of large number of densely deployed sensor nodes, it requires a suite of network protocols to implement various network control and management functions such as management, node localization and network security. Worldwide road traffic congestion is a recurring problem. Wireless sensor network is a collection of nodes organized into a co-operative network. Wireless sensor network is application-driven and mission-critical. The adoption of wireless sensor networks have enabled various applications such as target field imaging, intrusion detection, weather monitoring, security and tactical surveillance, distributed computing, detecting ambient conditions such as temperature, movement, sound.

II.Literature Survey

In [1], Suchetana Chakraborty et al. introduces the concept of k-*strip* length coverage along the road, which ensures a better sensing coverage for the detection of moving vehicles.An Adaptive sleep – Wake up scheduling of sensors have been proposed in this paper for data collection. Issues are on the increased scalability effect and packet delivery is less. In [2], Zhang et al. proposed IDDR, a multi-path dynamic routing algorithm which is based on the concept of potential in physics. Constructs a virtual hybrid potential ûeld. IDDR separates packets of applications with different QoS requirements according to the weight assigned to each packet, and routes them towards the sink through different paths, improve the data ûdelity for integrity-sensitive applications as well as reduce the end-to-end delay for delay-sensitive ones. Issues are New coming packets will be driven out of the shortest paths to ûnd other available resource, constructing virtual hybrid potential ûeld is expensive. In [3], the routing protocol aims to simultaneously consider energy efficiency and security to avoid routes that are inefficient and risky. Because energy efficiency and security are two different problems, ETARP takes a novel approach of factoring both using the notion of expected utility. ETARP discovers and selects routes on the basis of maximum utility with incurring additional cost in overhead compared to the common AODV (Ad Hoc On Demand Distance Vector) routing protocol.ETARP can keep the same security level while achieving more energy efficiency for data packet delivery. Issues are ETARP, it has a disadvantage requiring information about node locations to improve energy efficiency. Furthermore, it depends on encryption which can be a heavy computation cost for sensor nodes. In [4], Juan Luo et al. emphasized on minimizing energy consumption and maximizing network lifetime for data relay in one-dimensional (1-D) queue network. Following the principle of opportunistic routing theory, multihop relay decision to optimize the network energy efficiency is made based on the differences among sensor nodes, in terms of both their distance to sink and the residual energy of each other. Issues are the initial average voltage on router is estimated as 2.847V. In future the proposed routing algorithm should be extended to sleep node prolonging the lifetime of the network. In [5], the model integrates four layers in the network operation: 1) application (node location); 2) network (routing); 3) medium access control (MAC); and 4) physical layers. The location of the mobile nodes is embedded in the routing operation after the route discovery process. The location information is then utilized by the MAC layer transmission power control to adjust the transmission range of the node.This is used to minimize the power utilized by the network interface to reduce the energy consumption of the node(s). The model employs a mechanism to minimize the neighbor discovery broadcasts to the active routes only. Issues are control Packets should be minimized more. In [6], Jinfang Jiang et al. developed two multipath routing algorithms that can be applied in underwater environments to collaboratively transmit data information. They ûrst divide the 3D underwater network into small cube spaces, and then macroscopically transmit data packets as unit of small cube spaces by selecting one optimal sensor node as next hop node in one small cube space.The selection process depends on the sensor nodes' capability which relies on the node's residual energy, transmission delay, and path loss, etc. Issues are an efficient detour mechanism should be explored to avoid the void area. In [7], the shortcut tree routing (STR) protocol is proposed that provides the near optimal routing path as well as maintains the advantages of the ZigBee tree routing such as no route discovery overhead and low memory consumption. The main idea of the shortcut tree routing is to calculate remaining hops from an arbitrary source to the destination using the hierarchical addressing scheme in ZigBee, and each source or intermediate node forwards a packet to the neighbor node with the smallest remaining hops in its neighbor table. Issues are Average number of dropped packet is 28.08 which could be further reduced and End to end delay is high. In [8], Delaney et al. focused on the development of a route stability framework, whereby currently used metrics are adapted to promote routes that achieve greater stability in highly dynamic network conditions.The central concept introduces neighborhood heuristics (NHs), a method of combining a sensor's routing metric with those of its neighbors to highlight both the quality of the current route and the quality of the routing options available to the sensor. The additional information afforded by the new combined metric allows sensors to choose good quality routes that can better maintain quality despite the degradation of an upstream link. Issues are Suffers from communication overhead. In [9], a General Self-Organized Tree-Based Energy-Balance routing protocol (GSTEB) is proposed which builds a routing tree using a process where, for each round, BS assigns a root node and broadcasts this selection to all sensor nodes. Subsequently, each node selects its parent by considering only itself and its neighbor's information, thus making GSTEB a dynamic protocol. Simulation results show that GSTEB has a better performance than other protocols in balancing energy consumption, thus prolonging the lifetime of WSN. Issues are when the data collected by sensors cannot be fused, GSTEB offers another simple approach to balancing the network load.In fact, it is difficult to distribute the load evenly on all nodes in such a case. Even though GSTEB needs BS to compute the topography, which leads to an increase in energy waste and a longer delay. In [10], Hongkun Li aims at designing link/path metrics leading to minimize the end to end delay. A generic iterative approach was proposed to compute the multi-radio achievable bandwidth (MRAB) for a path.The MRAB is then combined with the EED to form the metric weighted end-to-end delay (WEED). Issues are channel assignment is static, hence unable for a node to switch dynamically to other channels. Increased delay on increased input rate. In [11], Channel assignment is static, hence unable for a node to switch dynamically to other channels. It leads to increased delay based on increased input rate. Issues are (i) coordination of nodes is random and (ii) energy consumption is high.

III. Network Architecture

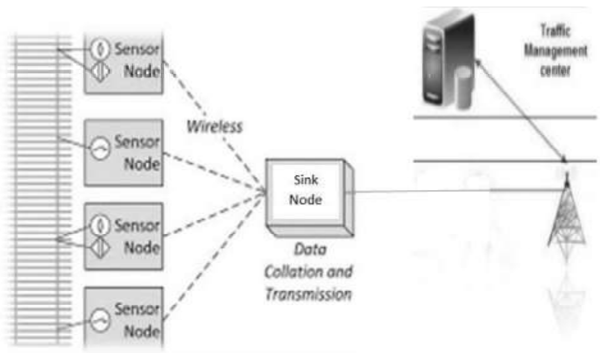

Fig 1: System Architecture

The fig 1 diagram depicts the architecture of ITS system. The main objective of this study is to design and develop a novel enhanced tree based routing protocol for traffic management sensor stream application. RRP enables deployment to efficiently support sensor-to-root traffic. This analysis also identifies the issues such as data collection from the sensors deployed for traffic sensor stream application, energy level of sensors during routing table updating and broadcasting. The key idea of the proposed routing protocol includes generation of optimized tree topology which includes discovering local data correlations in each parent approximating the sensor readings. The designing of novel protocol includes dynamic self-configured tree based routing protocol optimizing the energy consumption during on demand routing table construction and an innovative approach is inbuilt to handle cluster head failure prolonging the lifetime of network.

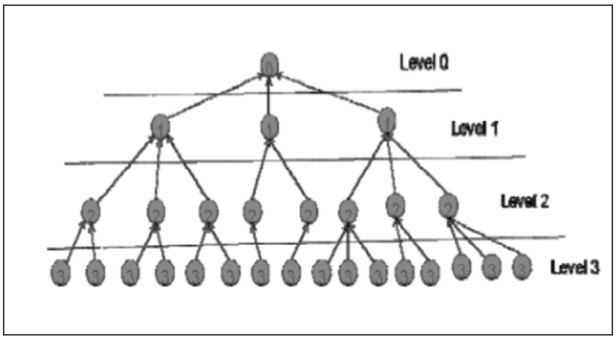

Fig 2: Tree Structure

The methodology consists of three different phases. They are

I. Tree formation phase

II. Data collection and data transmission phase

III. Purification Phase

Fig 2. Represents the tree formation of the sensor nodes.

A.Tree Formation Phase:

The tree formation phase has the following steps:

Step 1: In tree formation phase, first base station broadcast an initial init message which contains the information about the position of each base station and level distance, when any node gets this message it first calculates the Euclidian distance from the base station. And according to that distance assign a level to itself

Step 2: After assigning level, each node broadcast the join request (join_req) packet as which contains the node id and level of the node.

Step 3: When any node listens a join request, it first checks its parent and the level of the join_req. If the parent of the node is null or level is higher than or equal to the node itself then node discard this join_req packet, otherwise the node checks its node degree if the node degree is greater than or equal to the degree constrain and also discard the request, otherwise response with a positive acknowledgement (join_ack).

Step 4: The requested node joins the node from which it gets the first acknowledgement and as a child node to itself, then the parent node adds this node to its child list and increase the node degree count by 1.

Step 5: Step 2-4 are repeated until wholethe tree has been formed.

B. Data collection and data transmission phase

Step 6: Each node sends its child list to its root node. According to the child list, the root node sends a TDMA schedule to its child node. In its schedule the child node can send its data to the root node.

Step 7: If the child node has the data then it forward its data to its parent node in its time slot (TDMA slot) otherwise it sends a nack data to its parent node. CSMA/CA approach id used by the node to send the data.

Step 8: The parent node aggregates its data with child data and send it to its parent node. Finally, the node near to the base station sends the collected data to the base station

C. Purification phase

This phase handles the several situations such as When there is failure or movement of the parent or child node and energy level of the nodes exists.

Step 9: When a node moves from one location to another location, its change its position. There are two possibilities regarding the movement of the node. The node either move within the same level or one level above or below When the position of the node will get change it localizesitself by localization algorithm. After calculating its position, node calculates its distance from the base station and re-calculates its level.

Step 10: If the level changes re-join operation is executed.

IV.Conclusion

From this we conclude that enhanced energy optimized tree based routing protocol for Intelligent Transport System (ITS) using wireless sensor network technologies advance transportation safety and mobility and enhance productivity by integrating advanced communications technologies into transportation infrastructure and into vehicles. ITS encompasses a broad range of wireless and traditional communications-based information and electronic technologies. Many benefits exist for further deployment and continued development of ITS technologies. As well as it provides innovative services relating to different modes of transport and traffic management and enable several users to be well informed and make harmless, more coordinated and 'smarter' use of transport networks.

References

[1] Suchetana Chakraborty, Sandip Chakraborty, Sushanta Karmakar, And Sukumarnandi, "Adcross:Adaptive Data Collection From Road Surveilling Sensors", IEEE Transactions on Intelligent Transportation Sytems, vol. 15 no. 5, pp 1103-116, october 2014.

[2] J.Zhang, F.Ren, S. Gao, H.Yang and C.Lin, "Dynamic Routing For Data Integrity And Delay Differentiated Services In Wireless Sensor Networks", IEEE transactions on Mobile Computing, vol. 14, no. 2, pp. 328-343, February 2015.

[3] Pu Gong, Thomas M. Chen and Quanxu, "ETARP: An Energy Efficient Trust-Aware Routing Protocol For Wireless Sensor Networks" Journal Of Sensors, vol. 2015, Article ID: 469793, 2015.

[4] Juan Luo, Jinyu Hu and Di Wu and Renfa Li, "Opportunistic Routing Algorithm For Relay Node Selection In Wireless Sensor Networks", IEEE Transactions on Industrial

Informatics, vol. 11, no. 1, pp. 112-121, February 2015.

[5] Marwan Al-Jemeli, And Fawnizu A. Hussin, An Energy Efûcient Cross-Layer Network Operation Model For IEEE 802.15.4-Based Mobile Wireless Sensor Networks", IEEE Sensors Journal, vol. 15, no. 2, pp. 684-692, February 2015.

[6] Jinfang Jiang, Guangjed Han, Lei Shu, and Joel J.P.C. Rodrigues, "Geographic Multipath Routing Based On Geospatial Division In Duty-Cycled Underwater Wireless Sensor Networks", Elsevier – Journal of Network and Computer Applications, vol. 59, pp. 4-13, 2016.

[7] Taehong Kim, Hoon kim, Jinyoung Yang, Seong-Eunyoo and Daeyoung Kim, "Neighbor Table Based Shortcut Tree Routingin Zigbee Wireless Networks", IEEE Transactions on Parallel And Distributed Systems, vol. 25, no. 3, pp. 706-716, March 2014.

[8] Declan T. Delaney, Russell Higgs, And Gregory M. P. O'Hare, "A Stable Routing Framework For Tree-Based Routing Structures In WSNs", IEEE Sensors Journal, vol. 14, no. 10, pp. 3533-3547, October 2014.

[9] Zhao Han, Jie Wu, Jie Zhang, Liefeng Liu and Kaiyun Tian "A General Self-Organized Tree-Based Energy-Balance Routing Protocol For Wireless Sensor Network", IEEE Transactions on Nuclear Science, vol. 61, no. 2, pp. 732-740, April 2014.

[10] Hongkun Li, Yu Cheng, Chi Zhou And Weihua Zhuang "Routing Metrics For Minimizing End-To-End Delay In Multi-Radio Multi-Channel Wireless Networks", IEEE Transactions on Parallel And Distributed Systems, vo. 24, no. 11, pp. 2293-2303, 2013.

[11] Degan Zhang, Guang Li, Ke Zhang, Xuechao Ming and Zhao-Hua Pan, "An Energy-Balanced Routing Method Based On Forward-Aware Factor For Wireless Sensor Networks", IEEE Transactions on Industrial Informatics, vol. 1, no. 1, pp. 766-773, February 2014.

★★★