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Data Communication with Geographic Routing Using LPSR in Wireless Sensor Network

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Abstract:

A wireless sensor network is a large aggregation of sensor motes with boundary of power supply and constrained computational capability. Due to the restricted transmission range and large density of sensor motes, packet forwarding in sensor networks is usually performed through multi-hop data transmission. Geographic routing is the technique to deliver a message to a node in a network over multiple hops. The problem of geographic routing is that packets may be routed to a dead end. This is called as void problem. The void may be a calamity area where all sensors are destroyed, or it may be a bay where the sensors cannot survive. Once a packet is routed to the dead end, it cannot continue further. Our existing method, hybrid source routing protocol (HSR) can effectively avoid the void, to ensure data transmission. Furthermore, due to mobility of the nodes more energy is consumed. So in the proposed system a new technique lightweight proactive source routing (LPSR) protocol is considered. A Statistical result shows that when compared to the existing method there is less energy consumption, less overhead and high network lifetime in the proposed system.

Keywords : **geographic routing, PSR, Void, HSR.**

1. INTRODUCTION

The emerging field of wireless sensor networks combines sensing, computation, and communication into a single tiny device. Through advanced mesh networking protocols, these devices form a sea of connectivity that extends the reach of cyberspace out into the physical world. As water flows to fill every room of a submerged ship, the mesh networking connectivity will seek out and exploit any possible communication path by hopping data from node to node in search of its destination. While the capabilities of any single device are minimal, the composition of hundreds of devices offers radical new technological possibilities. The power of wireless sensor networks lies in the ability to deploy large numbers of tiny nodes that assemble and configure themselves. Usage scenarios for these devices range from real-time tracking, to monitoring of environmental conditions, to ubiquitous computing environments, to in situ monitoring of the health of structures or equipment. While often referred to as wireless sensor networks, they can also control actuators that extend control from cyberspace into the physical world.

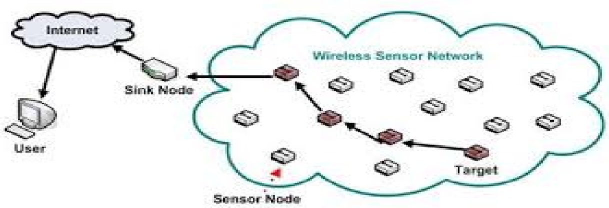

Fig 1.1 Data Communication

Fig 1.1 illustrates that the Current wireless systems only scratch the surface of possibilities emerging from the integration of low-power communication, sensing, energy storage, and computation. Future devices will continue to be smaller, cheaper and longer lasting. Generally, when people consider wireless devices they think of items such as cell phones, personal digital assistants, or laptops with 802.11. These items costs hundreds of dollars, target specialized applications, and rely on the pre-deployment of extensive infrastructure support. In contrast, wireless sensor networks use small, low-cost embedded devices for a wide range of applications and do not rely on any pre-existing infrastructure. Wireless sensor network (WSN) consists of sensor nodes capable of collecting information from the environment and communicating with each other via wireless transceivers. The collected data will be delivered to one or more sinks, generally via multi-hop communication. The sensor nodes are typically expected to operate with batteries and are often deployed to not-easily-accessible or hostile environment, sometimes in large quantities. It can be difficult or impossible to replace the batteries of the sensor nodes. On the other hand, the sink is typically rich in energy. Since the sensor energy is the most precious resource in the WSN, efficient utilization of the energy to prolong the network lifetime has been the focus of much of the research on the WSN.The communications in the WSN has the many-to-one property in that data from a large number of sensor nodes tend to be concentrated into a few sinks. Since multi-hop routing is generally needed for distant sensor nodes from the sinks to save energy, the nodes near a sink can be burdened with relaying a large amount of traffic from other nodes.

Geographicrouting (alsocalled **georouting** or **position-basedrouting**)is a routing principle that relies on geographic position information. It is mainly proposed for wireless networks and based on the idea that the source sends a message to the geographic location of the destination instead of using the network address. . Geographic routing requires that each node can determine its own location and that the source is aware of the location of the destination. With this information a message can be routed to the destination without knowledge of the network topology or a prior route discovery. There are various approaches, such as single-path, multi-path and flooding-based strategies (see for a survey). Most single-path strategies rely on 2 techniques: **greedy forwarding** and **face routing**. Greedy forwarding tries to bring the message closer to the destination in each step using only local information. Thus, each node forwards the message to the neighbor that is most suitable from a local point of view. The most suitable neighbor can be the one who minimizes the distance to the destination in each step (Greedy). In this Paper we introduced Lightweight proactive source routing (PSR) protocol . PSR can maintain more network topology information than distance vector (DV) routing to facilitate source routing.PSR has much smaller overhead than other routing protocols and also reduces the energy consumption. The delay time is decreased and delivery ratio, average hop is increased in the proposed work.

II.RELATED WORKS

In [1] Cadger F., Curran K., Santos J., and Moffett S. Proposed the method for "A survey of geographical routing in wireless ad-hoc networks". Geographic routing protocols have been designed for a variety of applications ranging from mobility prediction and management through to anonymous routing and from energy efficiency to QoS. Geographic routing is also part of the larger area of context-awareness due to its usage of location data to make routing decisions and thus represents an important step in the journey towards ubiquitous computing. Ad-hoc networks are typically decentralized and do not feature dedicated devices with defined roles such as routers or switches. Instead all participating nodes act as both routers and end-users. As devices are limited by their radio range ad-hoc networks typically employ strategy known as multi-hopping in which a source node will send a message to the destination by passing it to a series of intermediate node. Although ad-hoc networks have the potential for use in a wide range of application scenarios as diverse as battlefield communications and smart home environments, they also have some drawbacks. However, if a routing void, called local minimum, is encountered resulting from the random distribution of sensor nodes, the greedy algorithm in geographic routing will fail, and ultimately data transmission also fails in such situation.

In [2] Huang.P, Wang.C, and Xiao.L introduces an Improving End-to-End Routing Performance of Greedy Forwarding in Sensor Networks .Greedy forwarding is a simple yet efficient technique employed by many routing protocols. It is ideal to realize point-to-point routing in wireless sensor networks because packets can be delivered by only maintaining a small set of neighbors' information regardless of network size. It has been successfully employed by geographic routing, which assumes that a packet can be moved closer to the destination in the network topology if it is forwarded geographically closer to the destination in the physical space. however, may lead packets to the local minimum where no neighbors of the sender are closer to the destination or low quality routes that comprise long distance hops of low packet reception ratio. To address the local minimum problem, we propose a Topology Aware Routing (TAR) protocol that efficiently encodes a network topology into a low-dimensional virtual coordinate space where hop distances between pair wise nodes are preserved. Based on precise hop distance comparison, TAR can assist greedy forwarding to find the right neighbor that is one hop closer to the destination and achieve high success ratio of packet delivery without location information. Further, it improves the routing quality by embedding a network topology based on the metric of expected transmission count (ETX). ETX embedding accurately encodes both a network's topological structure and channel quality to nodes' small size virtual coordinates, which helps greedy forwarding to guide a packet along the optimal path that has the fewest number of transmissions.

In [3] Noh.Y, Lee.U, Wang.P, Choi.B.S.C, and Gerla.M , introduce a Void aware pressure routing for underwater sensor networks. Underwater mobile sensor networks have recently been proposed as a way to explore and observe the ocean, providing 4D (space and time) monitoring of underwater environments. The main challenge of pressure routing in sparse underwater networks has been the efficient handling of 3D voids. In this respect, it was recently proven that the greedy stateless perimeter routing method, very popular in 2D networks, cannot be extended to void recovery in 3D networks. Available heuristics for 3D void recovery require expensive flooding. It proposes a Void-Aware Pressure Routing (VAPR) protocol that uses sequence number; hop count and depth information embedded in periodic beacons to set up next hop direction and to build a directional trail to the closest sono buoy. Using this trail, opportunistic directional forwarding can be efficiently performed even in the presence of voids. The contribution of VAPR has two folds: 1) a robust soft-state routing protocol that supports opportunistic directional forwarding; and 2) a new framework to attain loop freedom in static and mobile underwater networks to guarantee packet delivery. Extensive simulation results show that VAPR outperforms existing solutions. Beyond that, routing void problem still exists around those established regions, and that no further scheme is proposed to solve this problem.

In[4]Trajcevski.G,Zhou.F,Tamassia. R, Avci.B,Scheuermann.P, and Khokhar.A , studies the Bypassing holes in sensor networks using Load-balance vs. latency. This work addresses the problem of geographic routing in the presence of holes or voids in wireless sensor networks. It postulates that, once the boundary of the hole has been established, relying on the existing algorithms for bypassing it may cause severe depletion of the energy reserves among the nodes at (or near) that boundary. This, in turn, may soon render some of those nodes useless for any routing (and/or sensing) purposes, thereby effectively enlarging the size of the pre-existing hole. To extend the lifetime of the nodes along the boundary of a given hole, the proposed scheme has two heuristic approaches which aim at relieving some of the routing load of the boundary nodes. Towards that, some of the routes that would otherwise need to bypass the hole along the boundary should instead start to deviate from their original path further from the hole. The proposed approaches not only increase the lifetime of the nodes along the boundary of a given hole, but also yield a more uniform depletion of the energy reserves in its vicinity.

In [5] Wang.X, Wang.J, Lu.K, and Xu .Y, introduce a novel geographic K-any cast routing for wireless sensor networks. To efficiently archive and query data in

Wireless Sensor Networks (WSNs), distributed storage systems, and multilink schemes have been proposed recently. However, such distributed access cannot be fully supported and exploited by existing routing protocols in a large-scale WSN. To address this challenging issue and propose a distributed Geographic K-Any Cast Routing (GKAR) protocol for WSNs, which can efficiently route data from a source sensor to any K destinations (e.g., storage nodes or sinks). To guarantee K-delivery, an iterative approach is adopted in GKAR where in each round, GKAR will determine not only the next hops at each node, but also a set of potential destinations for every next hop node to reach. Efficient algorithms are designed to determine the selection of the next hops and destination set division at each intermediate node. To analyze the complexity of GKAR in each round and also theoretically analyze the expected number of rounds required to guarantee K-delivery.

In[6]Subhas Chandra Mukhopadhyay C, introduces Wearable Sensors for Human Activity Monitoring. An increase in world population along with a significant aging portion is forcing rapid rises in healthcare costs. The healthcare system is going through a transformation in which continuous monitoring of inhabitants is possible even without hospitalization. The advancement of sensing technologies, embedded systems, wireless communication technologies, nano technologies, and miniaturization makes it possible to develop smart systems to monitor activities of human beings continuously. Wearable sensors detect abnormal and/or unforeseen situations by monitoring physiological parameters along with other symptoms. Therefore, necessary help can be provided in times of dire need. It reviews the latest reported systems on activity monitoring of humans based on wearable sensors and issues to be addressed to tackle the challenges.

In [7] Gang Wang.F and Guodong Wang.S introduce an Energy-Aware Geographic Routing Protocol for Mobile Ad Hoc Networks. Mobile Ad Hoc Networks (MANET) are characterized by multi-hop wireless link sand resource constrained nodes. To improve network lifetime, energy balance is an important concern in such networks. Geographic routing has been widely regarded as efficient and scalable. However, it cannot guarantee packet delivery in some cases, such as faulty location services. Moreover, greedy forwarding always takes the shortest local path so that it has a tendency of depleting the energy of nodes on the shortest path. The matter gets even worse when the nodes on the boundaries of routing holes suffer from excessive energy consumption, since geographic routing tends to deliver data packets along the boundaries by perimeter Routing. An Energy-Aware Geographic Routing (EGR) protocol for MANET that combines local position information and residual energy levels to make routing decisions. In addition, the prediction of the range of a destination's movement to improve the delivery ratio. The simulation shows that EGR exhibits a noticeably longer network lifetime and a higher delivery rate than some non-energy-aware geographic routing algorithms, such as GPSR, while not compromising too much on end-to-end delivery delay.

In[8] Dejing Zhang.M and Enqing Dong.S introduce a Virtual Coordinate-Based Bypassing Void Routing for Wireless Sensor Networks. To solve the routing void problem in geographic routing, high control overhead and transmission delay are usually taken in wireless sensor networks. Inspired by the structure composed of edge nodes around which there is no routing void, an efficient bypassing void routing protocol based on virtual coordinates is proposed. The basic idea of the protocol is to transform a random structure composed of void edges into a regular one by mapping edge nodes coordinates to a virtual circle. By utilizing the virtual circle, the greedy forwarding can be prevented from failing, so that there is no routing void in forwarding process from source to destination and control overhead can be reduced. Furthermore, the virtual circle is beneficial to reduce average length of routing paths and decrease transmission delay. Simulations show the proposed protocol has higher delivery ratio, shorter path length, less control packet overhead, and energy consumption.

In [9] Wang.J, Dong.E, Qiao.F, and Zou.Z introduce Wireless sensor networks node localization via leader intelligent selection Optimization algorithm. A node localization algorithm based on the Received Signal Strength (RSS) measurements,the Leader Intelligent Selecti on (LIS) optimization algorithm in Wireless SensorNetwork(WSN).TheLIS optimization algorithm is proposed based on the idea of biological heuristic. By designing a simple animal group leader se lection mode, a leader candidates' group is searched by the leader searcher, and an optimal individual is selected from the group as the leader which is the global optimal solution of the optimization problem by evaluating each leader candidate's ability. In order to accelerate the leader's campaign and the evolutionary rate in the later period of LIS, the simple Minimum Mean Square Error (MMSE) algorithm or the Centroid algorithm is adopted to obtain an initial coordinate as the initial leader of LIS algorithm using the information of the anchor node coordinates and the ranging findings. By considering fully the distance factor, an improved objective function is defined, so the node localization problem in WSN could be transformed into a nonlinear unconstrained optimization problem. The proposed LIS algorithm is used to solve this problem, and the obtained solution is the estimated value of the WSN node's coordinates. Compared with the Artificial Bee Colony (ABC) algorithm, the Particle Swarm Optimization (PSO) algorithm and the Genetic Algorithm (GA), the proposed LIS algorithm is better than the others in accuracy and calculation complexity.

In [10] Zhang.S, Li.D, and Chen.J introduce a link-state based adaptive feedback routing for under water acoustic sensor networks. Underwater Acoustic Sensor Networks (UASNs) have recently been attracted significant attention from both academia and industry for resources exploration and for scientific data gathering in underwater environments. The important characteristic of a UASN is that most underwater acoustic sensor nodes have a certain beam width and a three dimension direction, which is ignored by the existing underwater routing protocols. This characteristic will reduce the network connectivity and cause a large number of asymmetric links, so it will lead to sharp decline of the existing protocol performance. it develops a routing protocol to tackle this problem in UASNs .A link detection mechanism is employed to get link state information and an adaptive routing feedback method is adopted to make full use of the underwater asymmetric link and save energy. It was proposed a time-based priority forwarding mechanism and utilize downstream node table to prevent flooding, and a credit-based routing table update mechanism is adopted to avoid energy consumption caused by frequent update of routing table. The proposed protocol is comparedwitharepresentative routing protoc ol for UASNs.

In [11] Chen.M, Wan.J, Gonzalez.S, Liao.X, and Leung.V.C.M introduce a survey of recent developments in home M2M networks. Recent years have witnessed the emergence of Machine-To-Machine (M2M) networks as an efficient means for providing automated communications among distributed devices. Automated M2M communications can offset the overhead costs of conventional operations, thus promoting their wider adoption in fixed and mobile platforms equipped with embedded processors and sensors/actuators.Itsurvey M2M technology for applications such as healthcare, energy management and entertainment. In particularly examine the typical architectures of home M2M networks and discuss the performance tradeoffs in existing designs. The investigation covers quality of service,Energy efficiency and security issues. Moreover, the review of existing home networking projects to better understand the real-world applicability of these systems.

III.SYSTEM ARCHITECTURE

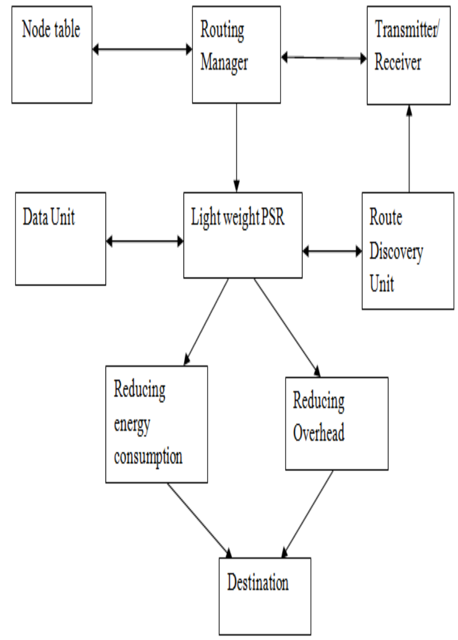

Fig 3.1 illustrates that the architecture of the proposed system. It considers data unit as a Source. The packet is transferred from data unit to Route Discovery Unit via Light weight Proactive Source Routing Protocol. Here Route Discovery Unit is used to discover the neighbor node location. Then the Receiver receives the packet and transmitted to the routing manager. the routing manager save this information and sent to the node table to find the destination location. Then the node table consists of the information about the list of destination location and number of hops to reach that destination. The packet collects this information retransmits to routing manager and the packet deliver to the desired

destination via light weight PSR protocol. Here the proposed protocol checks if any void occurs during data transmission and also reduce the overhead and energy consumption. Finally it achieves the destination without void problem.

IV.SIMULATION RESULTS

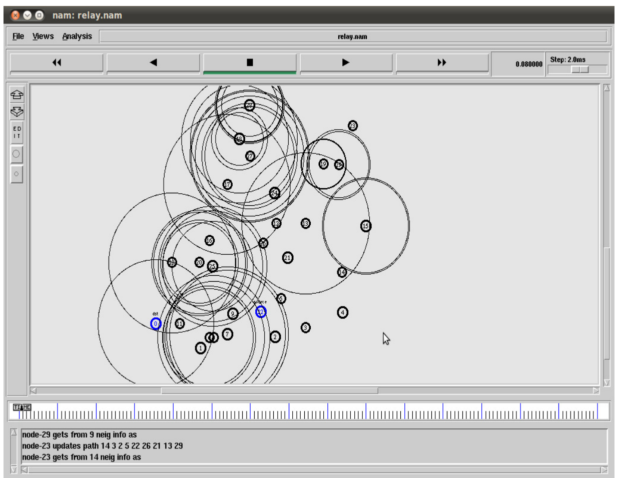

Fig 4.1 Path Update

Fig 4.1 illustrates the path update of node. Each node in the network updates its own routing path with node table. Consider node 22 as a source and a node 0 as the destination. The data is transferred from source to destination.

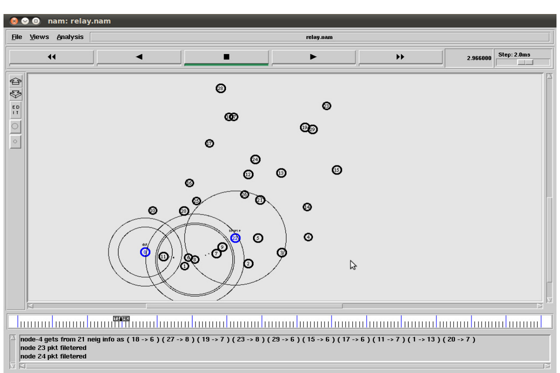

Fig 4.2 exchange neighbor information

Fig 4.2 illustrates the node exchange the neighbor information from source to destination and destination to source. The message is transfer between sources to destination using the neighbor information. Lightweight proactive source routing can avoid the void and ensure the data transmission.

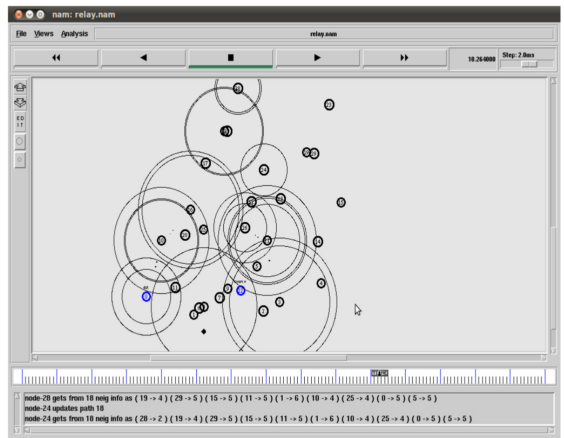

Fig 4.3 packets filtered when overhead occurs

Fig 4.3 illustrate that the packet will be filtered when overhead occurs during data communication. Node 22 sent the packet via node 9.but node 9 contains numerous packets for transmission. so source has to wait for its turn. then the overhead will be occurred.LPSR omit the node 9 and also filter the packets of Node 9.

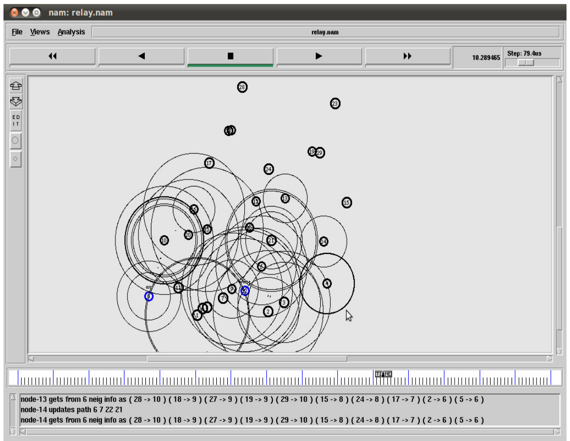

Fig 4.4 Check Other Neighbor Nodes

Fig 4.4 illustrate that the each neighbor node of source and destination will be checked for low overhead transmission. Here overhead will occurs the same process will be followed.

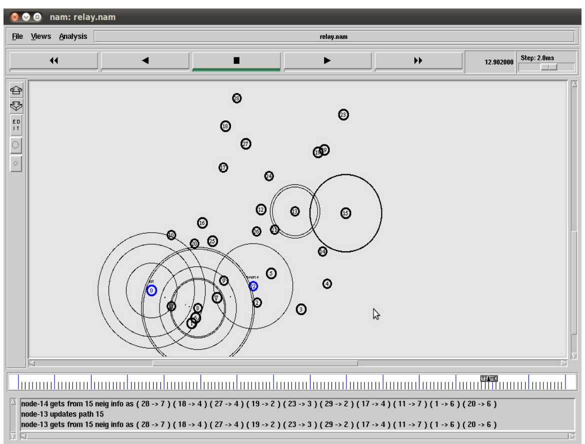

Fig 4.5 Data Communication

Fig 4.5 data communication illustrate that the data communication occurs without overhead. Finally the data is transferred from source to destination

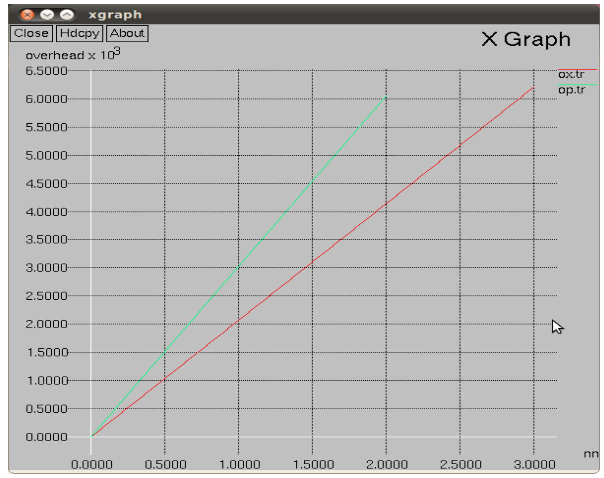

Fig 4.6 Comparison of Overhead

Fig 4.6 shows that comparison of the existing and proposed system overhead using LPSR. The overhead is reduced for the proposed system when compared to the existing system

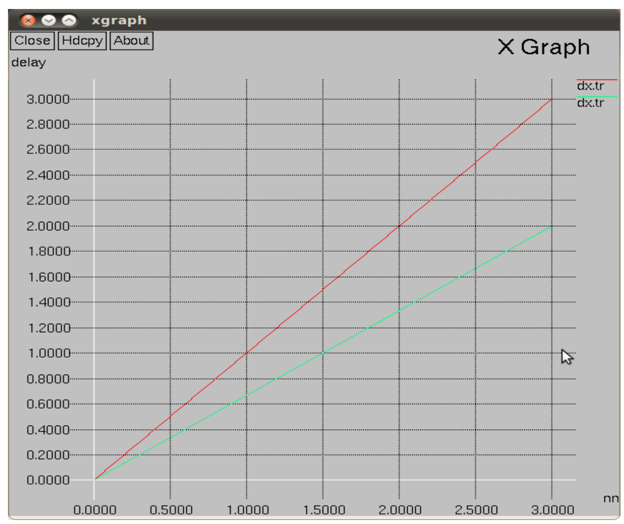

Fig 4.7 Comparison of Delay

Fig 4.7 shows that comparison of the existing and proposed system delay time using LPSR. The delay time is low for the proposed system when compared to the existing system.

V.CONCLUSION

The proposed lightweight proactive source routing protocol has a very smaller communication overhead. In such method each node in the wireless sensor network consists of node tables. Such table contains the each node and its neighbor node location with distance. Every node has a full topology of the wireless sensor network which is useful to discover the route .periodic information exchange is used to update such table. Simulations show the LPSR has advantages in terms of average delivery ratio, transmission delay, and lower control overhead also reduces the energy consumption. Future work will be to make proposed protocol comprehensive to common applications.

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