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A Survey: Energy Efficient Routing Techniques in Mobile Wireless Sensor Network

Nagashri K [1], Manjunath C R [2]
Department of Computer Science and Engineering [1] & [2]
Jain University, Bangalore
Karnataka - India

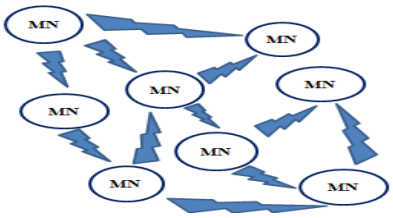
ABSTRACT

Energy and reliability of mobile nodes are the two important facets in a wireless sensor network and in real time monitoring applications. Sensor nodes with mobility have sparse energy resource thus achieving energy efficiency during routing has become a demanding need in Mobile Wireless Sensor Network. The recent advancements in mobile wireless sensor networks (MWSNs) has caught much attention as it offers great advantages in monitoring varied environmental niche by sensing physical processes. In this study, we surveyed the available energy-efficient routing techniques like LEACH with mobility aware, Hybrid multipath routing, Latency and Reliability-aware Geographic routing and routing protocol based on dynamic slot reservation protocol. In this paper comparative study is carried out based on different considerations for routing protocols which can affect specific application requirements and Mobile WSN in general.

Keywords:- Mobile Wireless Sensor Networks (MWSNs), Energy-efficient Routing Protocol, LEACH, Hybrid multipath routing, Latency and Reliability-aware Geographic routing, dynamic slot reservation protocol

I. INTRODUCTION

A sensor node with mobility has an energy looming crisis as its critical aspect. Certainty of nodes which repeatedly proclaim their ubiquity and being cognizant to discover neighbouring nodes for exchanging of data will consume enormous energy in mobile sensor applications. A mobile remote sensor system is an aggregation of small sensor hubs and in this manner it comprises of three essential segments: a detecting subsystem which does information procurement from the physical encompassing environment, a preparing subsystem and a remote correspondence subsystem [1]. In a dynamic wireless sensor network, nodes with mobility cause poor connectivity. Hence maintaining energy and steady relativity plays a vital role in Mobile WSN. Energy efficient routing protocols are required to visualize on how energy consumption could be reduced to achieve maximum network lifetime. Thus, their requirements are unique for each application. A best exemplar being the routing protocols designed for a health application differs with environmental application or a military application protocol respectively. This paper briefly compares various energy efficient routing protocols for MWSNs by considering different metrics.



MN- Mobile Nodes
Fig 1: Movement of Mobile nodes in a Mobile- WSN

II. BACKGROUND

The outline of directing conventions in Mobile WSNs is impacted by numerous testing variables. The elements like Node sending, Energy contemplations, Data conveyance model, Node heterogeneity, Fault resilience, Scalability, Network dynamic, Transmission media, Connectivity, Coverage, Data conglomeration, Quality of administration, Energy proficiency must overcome before productive correspondence can be accomplished in Mobile WSNs. Node organization in Mobile WSNs will be in a random way. Deployment of nodes will be scattered which includes group of application and influences the execution of the directing convention. The arrangement can be either deterministic or randomized. In deterministic organization, the portable sensor nodes are physically put and information is steered through pre-decided paths. In arbitrary energy node sending, the energy sensor nodes are scattered haphazardly making a

foundation in a specially appointed way. Sensor nodes can go through their restricted supply of vitality performing reckonings and transmitting data in a remote situation. In a multi-hop WSN, every node assumes a double part as information sender and information switch. The breaking down of some sensor nodes because of energy depletion can bring about critical topological changes and may oblige rerouting of clusters and rearrangement of the system.

III. ANALYSIS OF ENERGY EFFICIENT ROUTING PROTOCOLS IN MOBILE-WSN

The mobility of nodes raises a challenge to design an energy efficient routing protocol. Many different approaches are introduced to solve the routing problems in Mobile WSN. Hence four different energy efficient routing techniques is been analysed and few parameters are considered for comparison.

A. M-LEACH (Protocol with Mobility):

The study conducted by Nguyen et al., [2] introduces an energy efficient clustering algorithm which adds feature to the existing LEACH protocol. As we probably aware of LEACH (Low-Energy Adaptive Clustering Hierarchy), a grouping based convention that minimizes energy scattering in sensor systems. LEACH beats traditional using so as to adaptive clusters and rotating cluster- heads, permitting the vitality necessities of the framework to be circulated among every one of the sensors. LEACH has the limit perform neighborhood figuring in each gathering to lessen the measure of data that must be transmitted to the base station. LEACH utilizes a CDMA/TDMA MAC to lessen between group and intra-cluster striking. LEACH helps in supporting versatile nodes furthermore in lessening the utilization of the system assets in every round. LEACH- C (Centralized) convention is like LEACH in operation aside from cluster arrangement. In LEACH – C cluster head choice is done at Base station. Author said about burdens of LEACH. The proposed convention is M-LEACH where elements like group head versatility, part hub amid one round, current remaining battery force and the quantity of nodes per cluster is considered and thus are included M-LEACH. To encourage the outline of group calculation, they have made a few suppositions. They are, all the sensor hubs or nodes are homogenous in physical attributes, all the sensor hubs are area mindful and base station is stationary. The measures of information which is exchanged to the base station and the quantity of active sensor hubs are checked. Along these lines the outcomes demonstrate a critical decrease in system energy utilization contrasted with LEACH. LEACH-C and LEACH-M contrasted and their exhibitions in NS2 simulator.

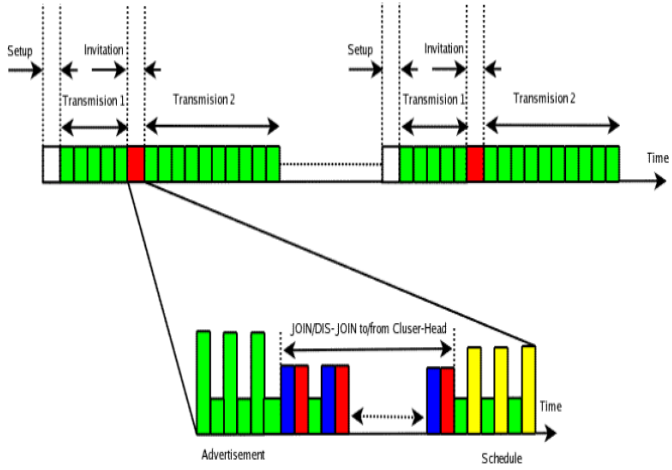


Fig 2: M- LEACH

B. A Novel hybrid multipath routing algorithm:

Getsy S Sara, Kalaiarani R, NeelavathyPari. S and Sridharanhave [3] proposed a novel hybrid multipath routing algorithm where an efficient clustering technique is included. Here, if a node is having high surplus energy, good transmission range and least mobility such node is selected as a cluster head. During routing mechanism, energy performance is improved by incorporating energy aware selection mechanism and maximal nodal surplus energy estimation technique. To achieve less dissemination of energy, they have designed a multipath hybrid routing protocol with efficient clustering technique in mobile sensor network OMNeT++ simulator is used for implementing this algorithm. Thus they concluded that the fusion head is selected based on Bayes' rule which chooses the node with highest surplus energy, least mobility, better transmission range and incorporate hybrid routing concept. Fusion nodes are chosen by energy aware selection mechanism to route the data to the destination node. Therefore, list of routes consist multipath with maximal nodal residual energy. If there is a failure of link and breakage of routes, discovery of new route can be avoided. Hence this paper proposed an algorithm which guarantees a better longer network lifetime and better packet delivery ratio with less energy consumption.

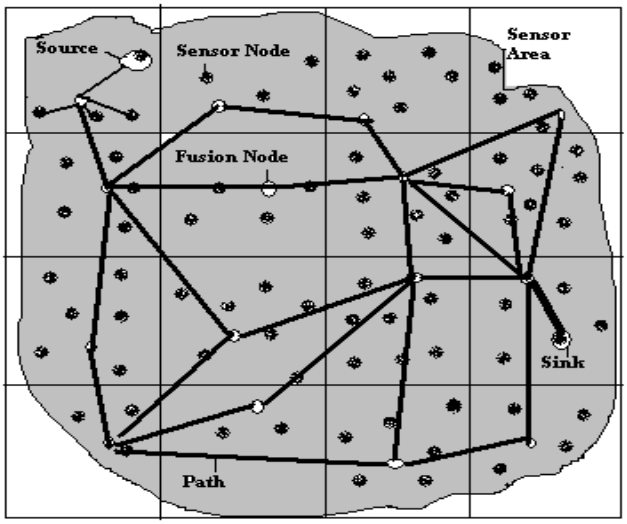


Fig 3: Formation of boundary in MWSN

C. Latency and reliability-aware geographic routing:

A hierarchical cluster based routing scheme called latency and reliability-aware geographic routing (LRGR) is proposed by Yuan Rao, Chang-an Yuan, Zhao-hui Jiang, Lei-yang Fu, Jun Zhu[5]. Here, considering node mobility the cluster is formed. To ensure reliable delivery, LPGR introduces mobile prediction and energy aware based clustering and inter-clustering routing scheme.

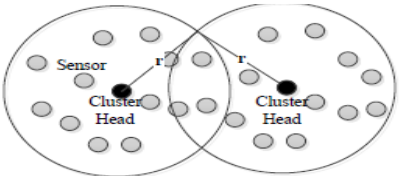


Fig 4: Result of Cluster Head

Thus, author has put up a next problem by stating that how to enhance LRGR in case of error-prone wireless channel.

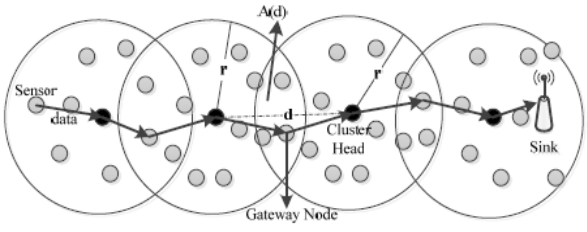


Fig 5: Multi-hop forwarding in LRGR

This scheme aims at maintaining latency – delivering the packets and reliability- guarantee to the sink for mobile-wireless sensor network. Author proposed two critical routing metrics, forwarding progress metric taking into account the position and sojourn time of adjacent cluster heads with the connectivity between two adjacent cluster head. Simulation is implemented using NS2.3S.LRGR compared with VIBE.

D. Energy Aware routing approach:

This routing protocol is proposed by Sujeeth Nanadan M, Padmalaya Nayak and G Ramamurthy [6]. This protocol uses dynamic TDMA schemes by using both the local and global fusion algorithm to provide a path from source to base station which consumes less energy. The QoS affecting factor are jitter, throughput, bit error, error rate, bit rate and packet dropping, mobility, energy, scalability, security, delay and robustness. Basic assumptions made are all the nodes having similar capabilities, the sensor network is densely deployed all the nodes are static, the base station is mobile, cluster heads are 2 – 5% of the sensor nodes with the help of algorithm, author provided QoS in-terms of longitivity of the network by reducing battery consumption at various stages and QoS in-terms of data redundancy and bandwidth of the network by implementing local and global data fusion algorithm. They have proposed a sensor network model consisting of two region of interest to find an optimal path for base station and to collect data from the entire sensor field. The steps involved in proposed Algorithm are Leveling, Sectoring, Clustering, Path planning and Priority Assignment. Here, a predefined slot is assigned for each super cluster head.

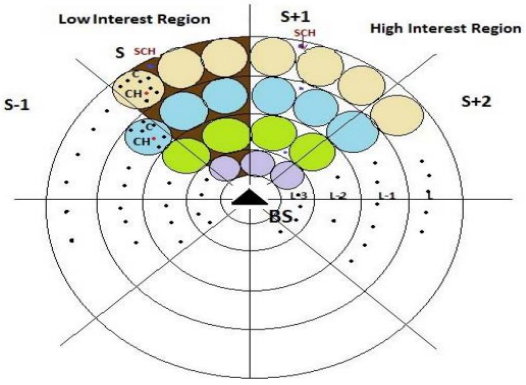


Fig 6: Sensor Field after Leveling and clustering

As the complete sensor field is divided into high internet and low internet region, priority is assigned to the super cluster head which belongs to high interest region. Simulator NS2 is planned to analyse the performance measures. While finding the path, base station which is mobile can collect the information from super cluster head. SCH (high interest region) takes over the slot from

SCH (low interest region) and thus reaches the message to the base station according to the criticality of the event.

IV. APPLICATIONS

Uses of Mobile Wireless sensor system are comparative, for example, environment observing or reconnaissance. Normally the nodes comprise of a radio transceiver and a microcontroller fuelled by a battery. And additionally some sort of sensor for recognizing light, warm, stickiness, temperature, and so on. There are numerous sensors which can be implanted in an excess of structures like dividers, machines and so forth to screen the progressions. Sensor systems have a mixture of utilization [10]. Apparatus Monitoring - Wireless sensor nodes can be mounted on different parts of hardware and plant to advance early blame location and examination. Their little size and independence empowers their arrangement in areas that are generally hard to get to. The sensor nodes can't just screen their own yield additionally work together with neighbouring nodes to focus the well-being of the general machines and give early notices of potential disadvantages. There are numerous different regions where sensor systems assume key part, few of them are creature following, vehicle following, Weather observing, Medical Care, Seismic Detection and so forth. Versatile WSNs are utilized as a part of numerous logical and social applications like in diminish calamity and track vehicular [11][12][13]. Contingent upon the way of the applications, there is a need of sending the movement with high unwavering quality and real time packet deliver towards the Sink. As there will be a successive change in the system topology, an extraordinary test emerges to give solid and constant cluster convey to the Sink [14].

TABLE I. COMPARISON TABLE FOR ENERGY EFFICIENT ROUTING PROTOCOLS IN MOBILE- WSN

Routing approach	*Mobility aware-LEACH*	*Hybrid multipath Routing*	*Latency And Reliability-Aware Geographic Routing*	*Energy aware routing*
Type of network	Cluster based	Cluster based	Hierarchical Cluster based	Cluster based
Path finding approach	Broadcast	Multiple path forwarding	Multi-hop forwarding	Multi-hop forwarding
Type of Sensor nodes	Homoge-neous, Location aware	Mobile	Location aware	Static
Position of Base station	Stationary	Mobile	Stationary	Mobile
Level of Energy efficiency	High	High	Medium	Medium
Initiator	Cluster-member node	Source node	Source node	Source node

V. CONCLUSION

In Mobile wireless sensor network and real time applications, finding energy efficient and reliable routes has turn into the most critical viewpoint. The up degree of reliability use gets to be confused in mobile sensor arranges because of the change of neighbouring nodes with time. Therefore, mobility brings about more energy utilization drained on redesigns and movement of area data. In this overview paper, we have concentrated on the diverse proficient directing methodologies and contrasted and distinctive measurements like level of energy efficiency, position of base station, initiator (which may be base station, sink or intermediate node) which initiates the routing approach, kind of sensor node and system. Subsequently, mobile WSN ought to concentrate all the more on energy efficiency issues.

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