Load Balancing Energy Efficient Protocol for Wireless Sensor Network

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Abstract: Wireless detector network is energy constraint network. The life of a network is outlined by the life of initial such that proportion of dying nodes. Load leveling may be method to equalize energy consumption of all nodes and this manner all nodes can degrade along. By load leveling, the life of the network doesn't rely solely on the lifetime of weak node but depends on the life all nodes within the network that helps to increase the lifetime of the network. during this paper, we tend to examine the proposed load leveling algorithms for wireless detector networks.

Load leveling will be accustomed extend the life of a detector network by reducing energy consumption. Load leveling exploitation clustering also can increase network quantifiability. Wireless detector network with the various energy levels nodes will prolong the lifetime of the network and additionally its liableness. We tend to discuss the improvement to be created for future planned load leveling schemes. This paper provided the reader with the idea for research in load leveling schemes for wireless detector networks

Index Terms - Wireless sensor network, aggregation, data precision, residual energy, network lifetime

1. INTRODUCTION

A wireless sensor network is defined as a group of a large number of sensor nodes which are low in cost; consume less power and multi-functional in nature. The Wireless sensor network is network that transfer physical parameter like pressure, temperature, humidity, sound pollution to a form that can easily measure, analysis and send all data to the central location i.e. server location. The element of sensor network includes the group of localized sensor, communication network, central location for data collection and group of sensor node. The every sensor node is used for the sense the physical parameter, process and communication on that parameter and sends related data to the central location. The Every sensor node has tendency to fail due physical condition, envirmental condition, software fail, hardware fail. The sensor nodes are highly distributed either inside or near by the system which is under study. These nodes are very small in size and consist of components for sensing, data processing and communication etc. The placement of these nodes can be random inside the system. It means that protocols of sensor networks and its algorithms must possess self-organizing abilities in inaccessible areas. A wireless sensor network (WSN) or sometimes called a wireless sensor and actor network (WSAN) are spatially distributed autonomous sensors to monitor physical conditions, such as temperature, pressure, sound etc. and to cooperatively pass their data through the network to a main location. The more modern networks are able to pass data in two ways i.e. bidirectional and they also enable control of sensor activity. The development of wireless sensor networks was started for the military applications like battlefield surveillance and today these sensor networks are used in many applications related to industry and consumer applications .This paper tries to explore the important applications of wireless sensor network.

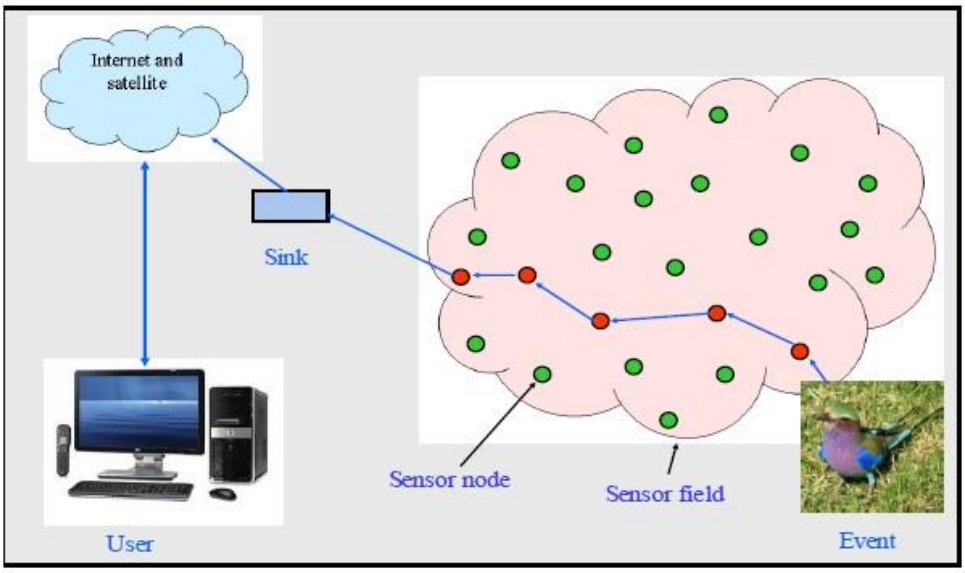

Fig 1: Basic Architecture of WSN

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Balancing load in WSN surveillance applications such as military, environmental, traffic etc, is important, since nodes with heavy load can exhaust node resources such as bandwidth, processing power, battery energy, and memory storage. Furthermore, if one of the heavily loaded nodes is congested, it can lead to packet loss and buffer overflow, resulting in longer end-to-end delay, leaving the network with a wide disparity in the energy level of the nodes, disconnecting or partitioning the network and degradation of network life.

The surveillance applications demand a load balancing routing protocol, since networks are expected to operate over a longer period of time in an unattended and hostile environment with minimal monitoring. The protocol should ensure that connectivity in a network is maintained as long as possible, and the energy status of the entire network should be of the same order. If nodes in the network consume energy more equitably, then the nodes in the center of the network continue to provide connectivity for longer, and the time to network partition increases. This leads to a more graceful degradation of the network, and is the idea of survivability of networks.

Hence, surveillance applications demands design and development of routing protocols whose objective is to dynamically distribute the load to multiple sensors, so that it leads to maximizing the network lifetime.

1.1 Classification of Routing Protocol

In general, routing in WSNs can be divided into flat routing, hierarchical routing, and location-based routing depending on the network structure. In flat routing, all nodes are typically assigned equal roles or functionality. In hierarchical routing, nodes will play different roles in the network. In location-based routing, sensor node‟s positions are exploited to route data in the network. A routing protocol is considered adaptive if certain system parameters can be controlled in order to adapt to the current network conditions and available energy levels. Furthermore, these protocols can be classified into multipath-based, query-based, negotiation-based, QoS-based, or coherent-based routing techniques depending on the protocol operation.

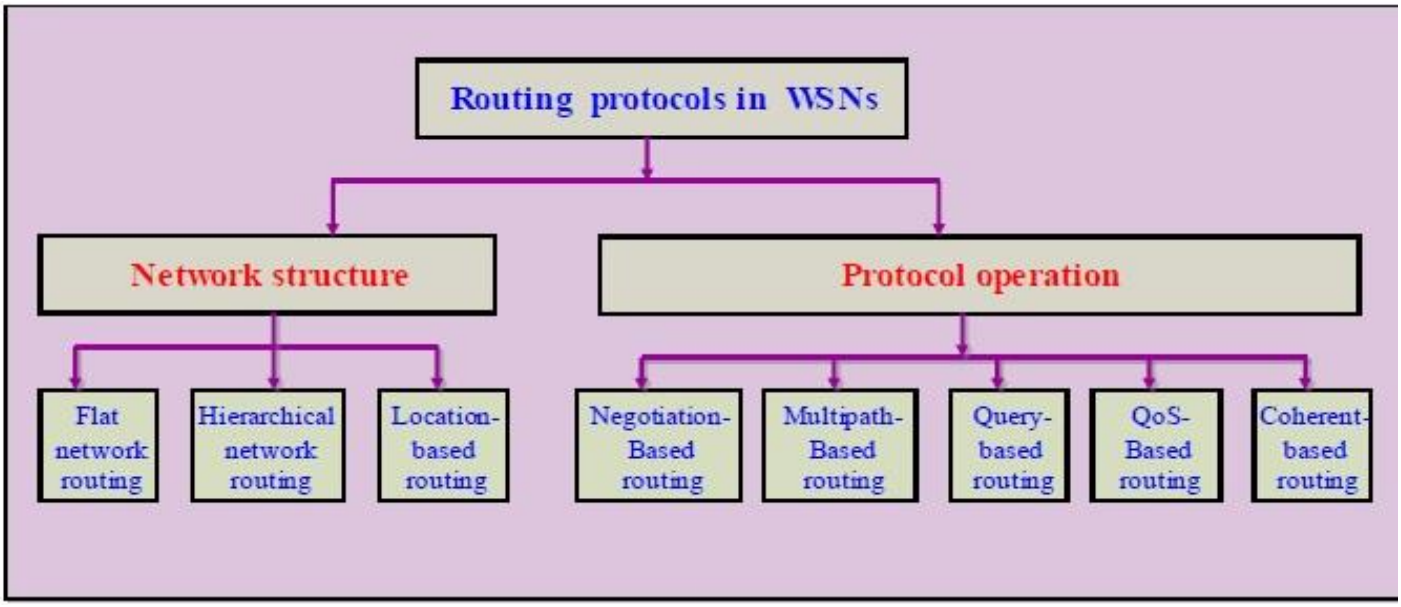

Fig 2: Classification of Routing Protocol in Wireless sensor Network

1.2 Application of Wireless sensor Network

WSNs are applied to wide range of applications [22, 23, 24] and these applications can be classified into two categories: monitoring and tracking as shown in Figure 1.6. Monitoring applications include indoor/outdoor environmental monitoring, health monitoring, power monitoring, inventory location monitoring, factory and process automation, and seismic and structural monitoring. Tracking applications include tracking objects, animals, humans, and vehicles. The idea behind these applications is that, densely deploying sensor nodes with capabilities of sensing, wireless communications, and computation in an unattended environment, will assist in measuring its ambient conditions, and obtaining the characteristics about phenomenon of interest surrounding these sensors, by transforming these sensed/gathered data into electrical signals that can be processed.

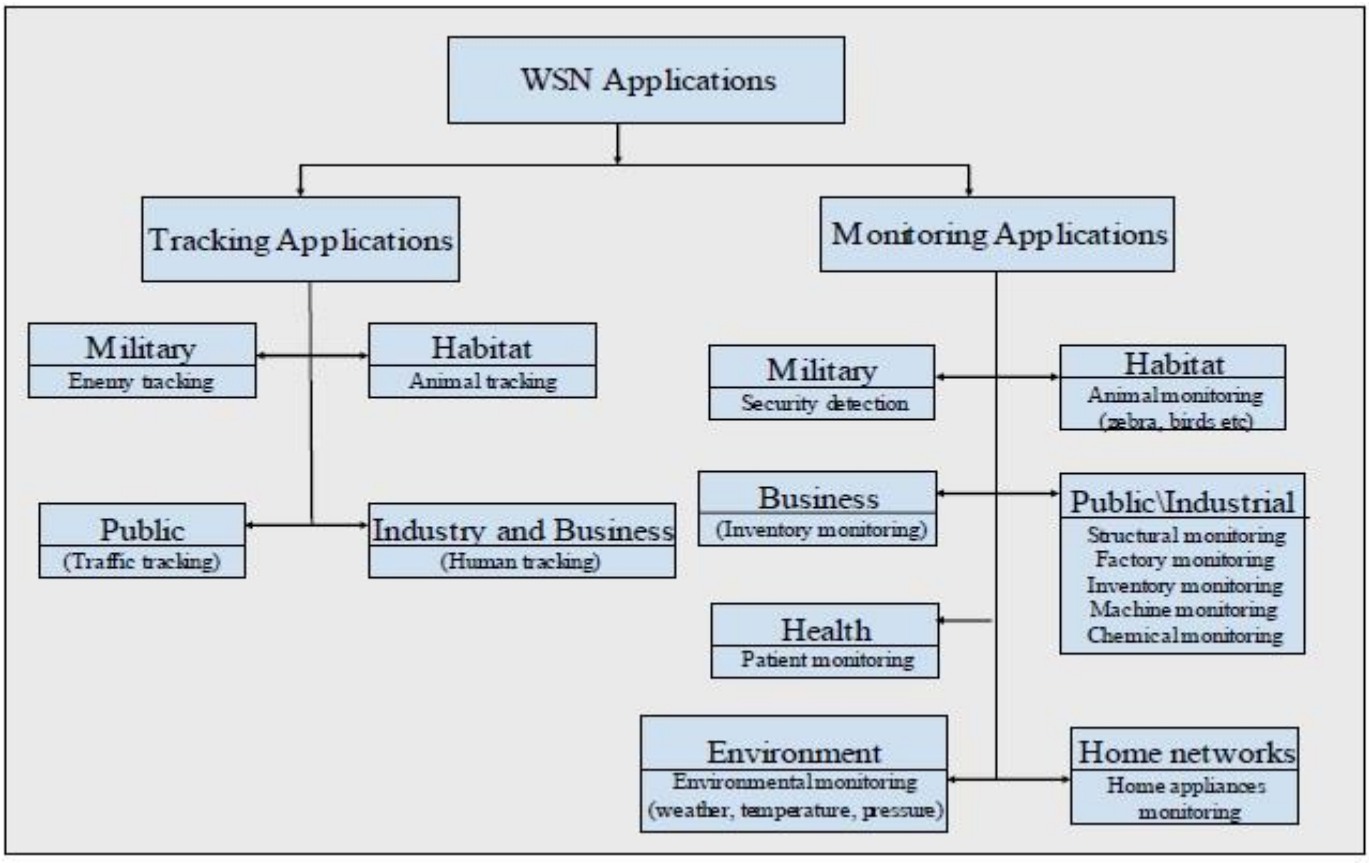

Fig 3: Application of Wireless sensor Network

2. RELATED WORK

In today's universe of figuring, data gathering is a quickly developing and testing field in the distinctive region such as cold and low-upkeep territories where ordinary approaches turn out to be exceptionally expensive [1]. Sensors give a low-evaluated and clear answer for these applications. These physical gadgets are little in size that is prepared to do gathering condition data like warmth, light or movement of an article. Sensors are sending in a straightforward model in the zone important to screen occasions and assemble information about the environment [1].

Systems administration of these unattended sensors is relied upon to majorly affect the viability of numerous military and common applications, for example, battle field perception, security and difficulty the board. Sensor bits in such frameworks are regularly disposable and expected to last until their vitality channel. In this manner, for sensor systems control is a deficient asset and for the span of a specific mission. It must be overseen shrewdly to expand the life of the sensor bits. The sensor systems seek after the model of a base station, where sensors transfer surges of information to the base station either like occasionally or dependent on activities. The control hub/base station might be statically designated in the encompassing region of the sensor, or it might be versatile so that it can move around the field and gather information from the system. In either case, the base station can't be come to emphatically by all the sensor bits in the system. The bits/hubs that are situated far from the base station will expend more vitality to transmit information than different hubs and along these lines will kick the bucket sooner [2].

In Wireless Sensor Network (WSN), it comprises of a conceivably substantial number of asset compelled sensor hubs what are more, few generally amazing transfer hubs. The sensor hub has a battery and a low-end processor, a constrained measure of memory, and a low power correspondence module prepared to do short range remote correspondence [3].

As sensor hubs are conveyed arbitrarily and have extremely constrained battery control, it is difficult to energize the dead batteries. That is the reason battery control is considered as a restricted asset in WSN and ought to be productively utilized. Sensor hub expends battery in detecting information, getting information, sending information and preparing information [4].

A sensor hub doesnt have enough capacity to send the data straightforwardly to the distant base station. In this manner, alongside detecting information the sensor hub go about as a switch to proclaim the information of its neighbor. The sensor hubs can be gathered into little bunches in an extensive sensor arrange. Each group has a bunch head to organize the hubs in the group. Bunch plan can build the lifetime of the sensor organize by making the bunch head, gather information from the hubs in the bunch, total it and send to the base station. An arbitrarily conveyed sensor arranges requires a bunch development convention to parcel the system into equivalent measured gatherings. There are two different ways to choose bunch heads: process the pioneer first and the bunch first. In the pioneer first methodology, at first group head is picked then the bunch is framed. In the bunch first approach, at first the group is framed and after that bunch head is chosen. Grouping has various favorable circumstances like it diminishes the measure of the steering table, monitor correspondence data transfer capacity, draw out system lifetime, decline the repetition of information bundles, lessens the rate of vitality utilization and so on. [5].

Ordinarily it is assumed that the hubs in remote sensor systems are homogeneous, however in reality, homogeneous sensor organizes scarcely subsist. Indeed, even homogeneous sensors have diverse abilities like distinctive dimensions of starting vitality, exhaustion rate, and so on. In heterogeneous sensor systems, an immense number of low-estimated hubs perform detecting, while a couple of hubs having tolerably more vitality, perform information separating, combination and transport. This prompts the exploration on heterogeneous systems where at least two kinds of hubs are considered. Heterogeneity in remote sensor systems can be used to prolong the lifetime and reliability of the network [6]

3. PROPOSED WORK

To meet the above application requirements and their routing objectives such as, load balancing, service differentiation and reliable and timely delivery service, three energy efficient routing protocols are proposed

- Load Balancing Dynamic Adaptive Routing (LBDAR) protocol
- Data Quality Aware Routing (DQAR) protocol
- Energy Buffer Aware Reliable Routing (EBARR) protocol

Whose objectives are detailed below:

1. Load Balancing Dynamic Adaptive Routing (LBDAR) protocol

The LBDAR is a reactive protocol which tries to ensure the uniform depletion of energy across the nodes, with an objective to increase the energy conservation and prolong the lifetime of sensor nodes. This protocol eliminates bottleneck of heavily involved nodes along the optimal path by computing new path for every data initiation. As compared to minimum hop routing and energy aware routing, the results of the LBDAR protocol demonstrate more uniform usage of nodes with efficient use of battery power. The network lifetime is increased by reducing the overloading of intermediate nodes by efficiently selecting them while routing. Since network lifetime is increased, the packet delivery ratio is comparatively high in the LBDAR.

2. Data Quality Aware Routing (DQAR) protocol

The DQAR protocol for service differentiation is developed with an objective to prioritize and provide reliability assurance to high priority packets compared to low and medium priority packets. The results demonstrate that protocol is more efficient in providing differentiated service to high priority data packets and achieve high data delivery ratio compared to multi path routing (MR) and minimum energy routing (MER). The DQAR also increases the network lifetime by ensuring uniform energy depletion across the nodes and hence achieves load balancing. Result also shows that, DQAR reduces end-to-end transmission delay of high priority packets by dynamically constructing shortest paths

3. Energy Buffer Aware Reliable Routing (EBARR) protocol

A novel QoS aware routing protocol, i.e., EBARR, is proposed to provide QoS in timeliness and reliability domains for critical packets generated in time critical application. The performance of EBARR is evaluated with respect to different combination of network and traffic control parameters and compared it with Multi constrained QoS multipath routing(MCMP) protocol. The results demonstrate that EBARR outperforms the MCMP protocol in achieving the desired performance for diverse data according to the priority specified by the sink. The EBARR also distributes the traffic load and thus achieves higher node energy efficiency which increases network lifetime. Results also prove that the EBARR meets both the challenges of reliability and timely delivery of critical data efficiently

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6. CONCLUSION

In this chapter we have discussed the proposed LBDAR protocol that ensures the survivability of WSNs. It is data-centric and reactive-protocol, used for remote-surveillance sensor network applications. It efficiently distributes the traffic load and ensures the uniform energy consumption in the network. By efficiently balancing the traffic inside the network, the network lifetime is significantly improved. Extensive simulation results show that the proposed LBDAR protocol is energy efficient with respect to extension of the lifetime of the sensor network substantially compared to other two methods mentioned.

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