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A Survey of Energy Efficient Routing Protocols for Self Configurable Wireless Sensor Networks

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Abstract*—Energy optimization is a major constraint in designing and developing a routing protocol for Wireless Sensor Networks (WSNs) due to their limited resources. This survey paper focuses on the enhancement of lifetime of WSNs by reducing the energy utilized for data gathering and data aggregation of sensed data to be traversed from a source node to a destination node by reviewing various energy efficient routing protocols along with the QoS requirements. The first energy efficient hierarchical cluster based routing protocol in WSNs is LEACH (Low Energy Adaptive Clustering Hierarchy). In LEACH protocol, cluster head are elected each round without any consideration to the residual energy available with each node.
Keywords*—Wireless Sensor Networks, Energy Optimization, Routing, QoS, Lifetime.

I. INTRODUCTION

In recent years Wireless Sensor Network (WSN) are fast developed due to their light weight and ease of operation. WSNs are capable of self-organising in case of any node or link failure. WSNs can be deployed in large numbers and finds it use in many real time applications. The figure 1. Defines the various components of Wireless sensor Network (WSNs).

II. APPLICATIONS

WSNs are used when constant monitoring / sensing and detection of events is required.

A. Military Field
1) Battle Field Surveillance and Monitoring,
2) Guidance systems and intelligent Missiles.
3) Detection of Attack by Weapons of mass destruction such as nuclear, chemical, biological.

B. Environmental
1) Forest Fire and flood detection
2) Weather Monitoring

C. Patient Monitoring and Diagnosis
1) For Monitoring heart rate, blood pressure,
2) Doctor is altered on detection of an anomaly in patient monitoring
3) Prevents wrong diagnosis
4) Correctly identify allergies.

D. Commercial
1) Used in Oven, refrigerator, vacuum Cleaner to interact with each other and be remote controlled.
2) Lighting, Music and Ambience in the room can be automatically controlled.
3) Temperature and airflow can be automatically controlled.
4) Warehouse: The inventory control is performed by installing sensors on the products to track the movement.

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III. ROUTING CONSIDERATIONS FOR WSNS

Various key parameters are to be considered while developing a routing protocol for WSNs.

A. Network Dynamics

WSNs are being wireless can be either mobile or fixed nodes based on the application sector used.

B. Scalability

The proposed routing protocol should be well suited for enlargement in the network size if required.

C. Energy Consumption

WSNs are battery powered devices which cannot be recharged when required, so the designed protocol should consume less power.

D. Data Fusion

Sensor nodes transmit their sensed data to their neighbouring nodes for further data processing called data fusion where the redundant data are suppressed.

E. Network Lifetime

The lifetime of a node is effectively determined by its battery life. The main loss of life is due to data transmission, reception and processing.

F. QoS

To obtain network performance QoS parameters such as reliability, life time, and latency should be fulfilled by the routing protocol.

G. Coverage Area

This is defined by the number of nodes alive per unit defined time period.

H. Data Fusion

Sensor nodes transmit their sensed data to their neighbouring nodes for further data processing called data fusion where the redundant data are suppressed.

I. Packet size

It is a predefined factor which determines the energy and time required for data transmission and processing between the transmitter and the receiver.

IV. ENERGY EFFICIENT ROUTING PROTOCOLS IN WSNS

The routing protocols in WSNs are classified into four main categories.

A. Network Structure

Flat and hierarchical based protocols. In case of Flat, all the nodes in the network are equally involved in the data sensing & data gathering process. But in case of Hierarchical, sensor nodes are grouped into clusters and one node is elected as cluster head which has the responsibility of data gathering & data processing.

B. Communication model

Query-based protocols, Coherent, Non-Coherent based protocols and Negotiation –based protocols. All these protocols are used identify the neighbouring nodes for data transmission and processing.

C. Topology based

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Location based and Agent based protocols. These protocols are used to identify the neighbouring nodes location for easy transmission. Incase of Location based each node is aware of its neighbouring node and in case of agent based, the sensor uses a agent to identify its neighbour.

D. QoS based

It is used to achieve certain set of parameters in order to meet the network performance.

V. FIGURES

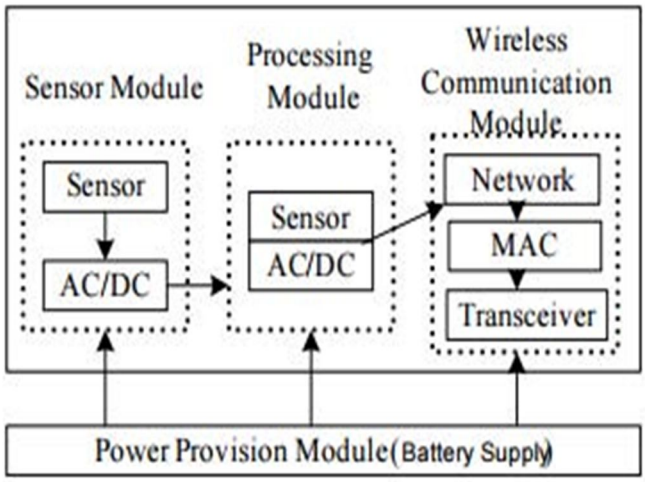


Fig.1. Components of WSN

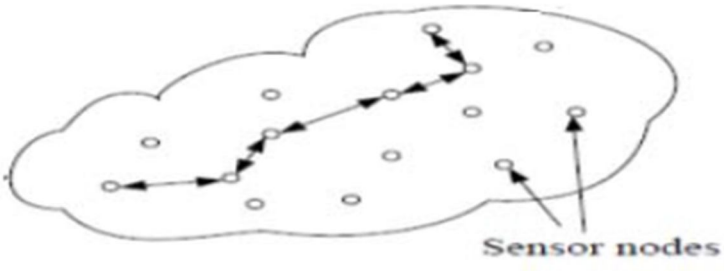


Fig. 2 Random deployment of sensor Nodes

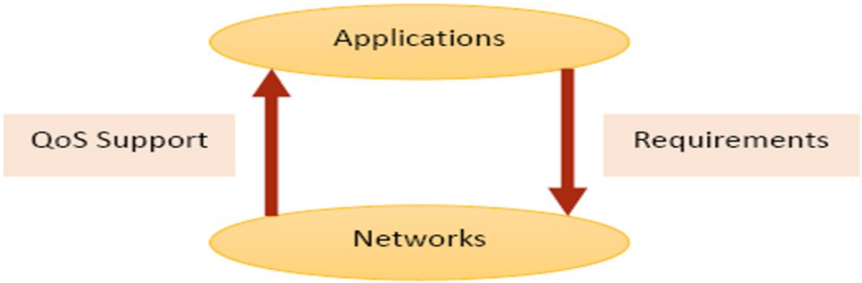


Fig. 3. QoS Model

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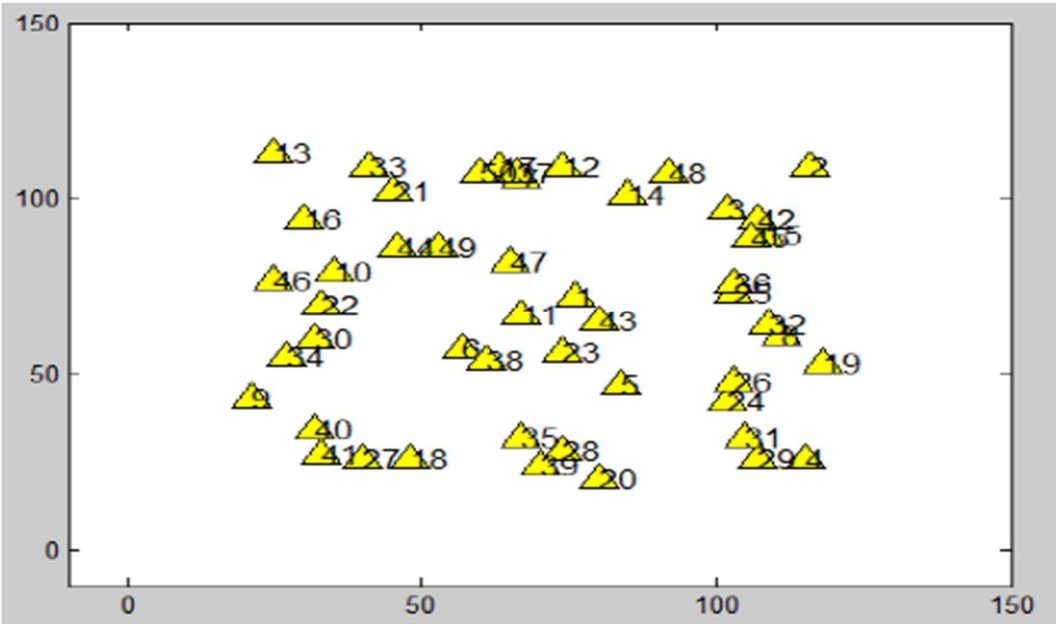


Fig. 4. Deployment of 50 sensor nodes in random

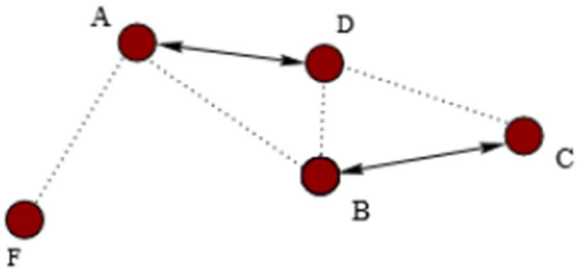


Fig.5 Node Topology

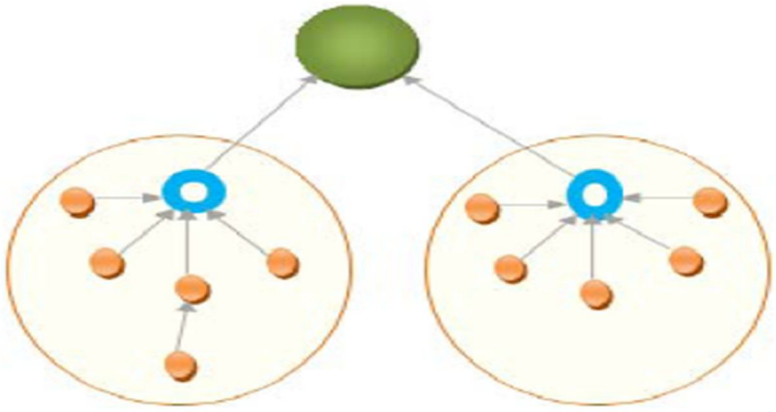


Fig. 6. Existing method of cluster selection to minimize energy

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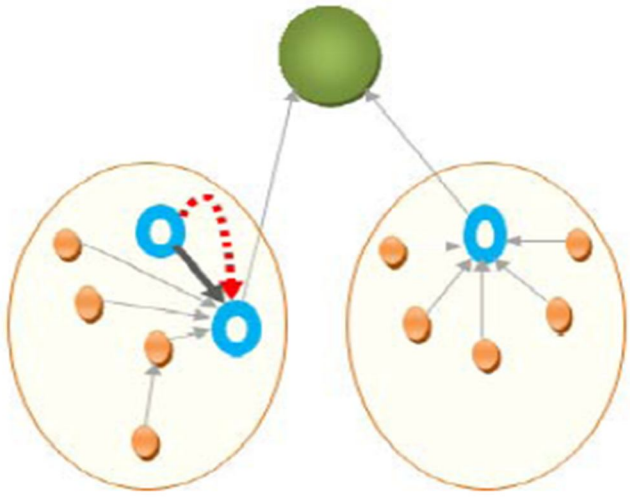


Fig. 7. Proposed method of Head selection to minimize energy and to enhance life time

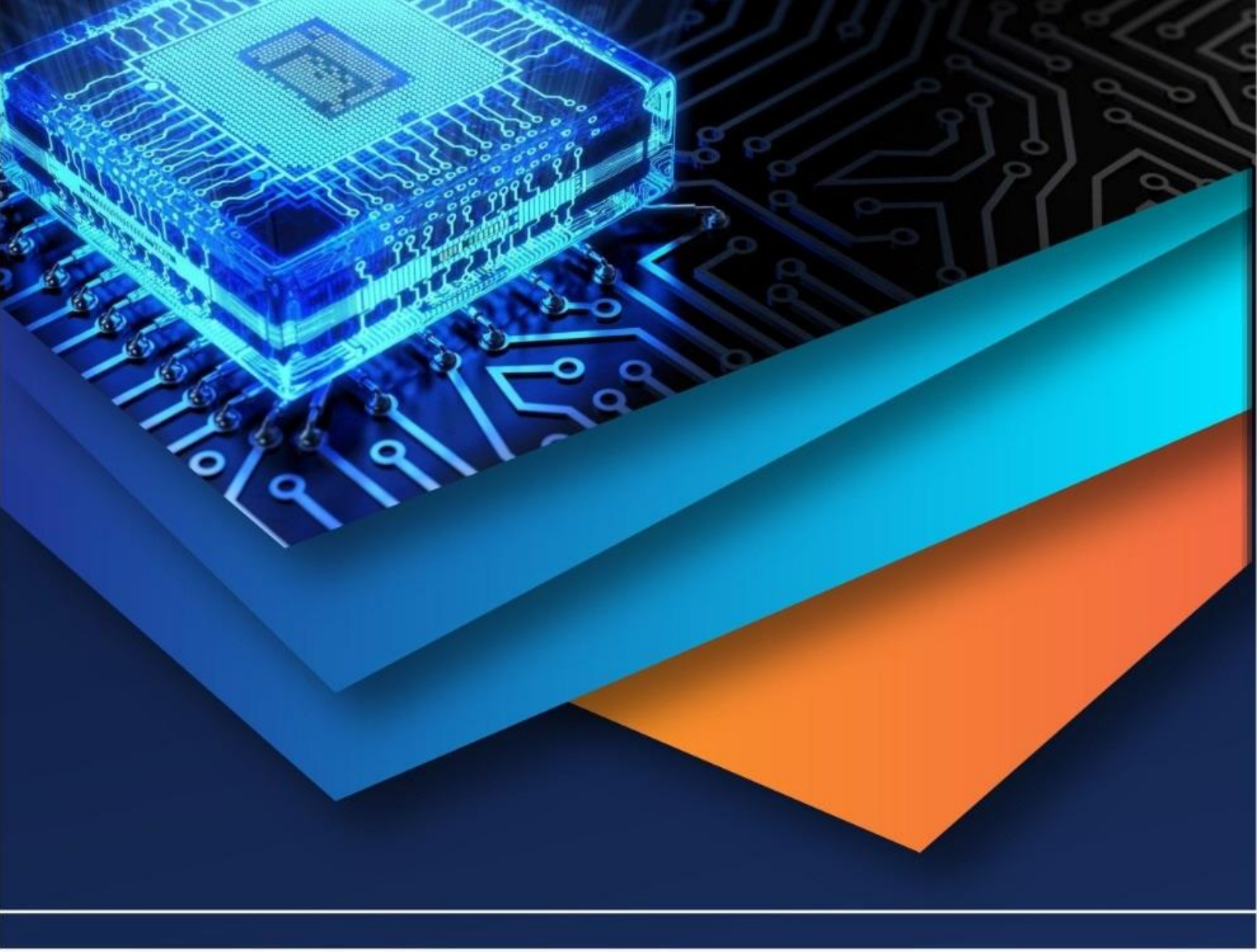
VI. CONCLUSIONS

Wireless Sensor Networks are powered by the limited capacity batteries which cannot be recharged as and when needed. These property impose a most challenging phase to the development of routing protocols. Here we focused on the various parameters to be considered while developing a routing protocols along with the types of routing protocol model available. By combining any two of the proposed models along with satisfying the QoS constraint will definitely provide a way to design and develop a energy efficient routing protocol which minimize the energy used and enhance the network life time.

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