**GROUP P**

**CAT 1**

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1. **Challenges in Localization:**
2. Signal Interference and Multipath Propagation: Obstacles, complex reflections, and presence of noise effect led to inaccurate location estimation of signals.
3. Environmental Factors: Due to the factors influencing the localization such as weather condition and physical barriers as well as other environmental factors.
4. Energy Constraints: Aggregation nodes normally incorporate sensor nodes and due to energy constraint, the latter is normally characterized by limited battery power hence it is always difficult to guarantee localization was done with precision for a relatively long time.
5. Scalability: While creating large-scale networks, localization procedures are designed to be efficient and not computationally expensive when implemented.
6. Cost: Dependent on the size of the network, calculating accurate localization at the hardware and algorithm level can be costly.
7. Mobility: Overlapping is the second reason which makes a significant impact on the overall efficiency of the system The issue that arises with moving nodes is that they require constant updates to new location information. Non-Line-of-Sight (NLOS).
8. Conditions: Distortions occur during localization since signals emitted do not move in straight paths because of barriers within the environment.
9. **IEEE 802.15.4 MAC Protocol:**

IEEE 802.15.4 MAC is a protocol for wireless, low data rate and low power WPAN to establish an asynchronous communication. It provides the right of access to the wireless medium, channel activation and control, and the provision of a ‘system’ for guaranteeing data delivery.

1. **Sensor Node Clustering in WSNs:**

***Concept:***

In WSNs clustering is a process of division of sensor nodes into clusters. Every cluster has a specific leader, called a cluster head, that is charged with this process, as well as control of communication with other cluster heads or the base station.

***Benefits:***

* Energy Efficiency: Cuts power requirements because each cluster has to send information to the base station only and not all the nodes.
* Scalability: Makes the network more scalable as it deals with small regional clusters.
* Data Aggregation: A cluster head can combine data from nodes and sends only the aggregated data to the base station; in this way, bandwidth consumption is optimized.
* Load Balancing: This assists in sharing the communication load in a network which can have an effect on increasing the lifetime the network.

1. **Four Operational Modes of the Radio Transceiver:**

* Transmit Mode: This transceiver transmits data to other nodes.
* Receive Mode: The transceiver waits for the data over the channel.
* Idle Mode: The transceiver is on it is just not transmitting or receiving, this mode consumes less power than the active modes.
* Sleep Mode: The transceiver is placed in an off state to reduce the power consumption and uses a low power state; it can only wake up and become active.

1. **Two Routing Protocols in WSN:**

* ***LEACH (Low-Energy Adaptive Clustering Hierarchy):***

A tiered architecture where nodes are grouped into groups and each group leader gathers data from nodes and transmits it to the base station selected often in an attempt to conserve energy.

* ***Directed Diffusion:***

Is an architectural style of communications with a heavy concentration on data where data is referred to by the attributes it holds and associated values. Any node that wants data sends interests and data is flowed through the network based on these interests hence efficient communication.