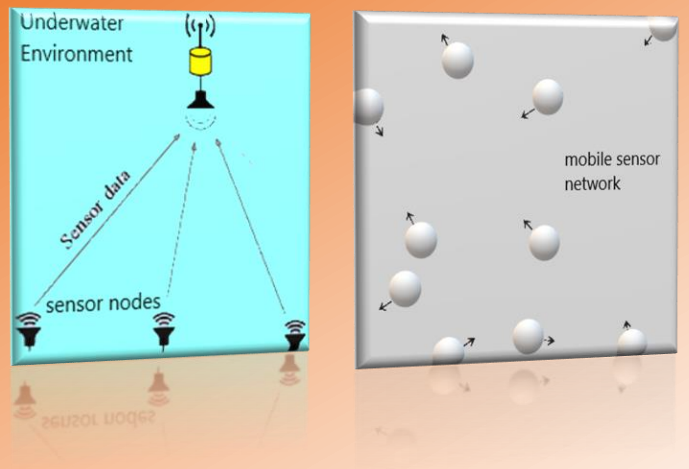
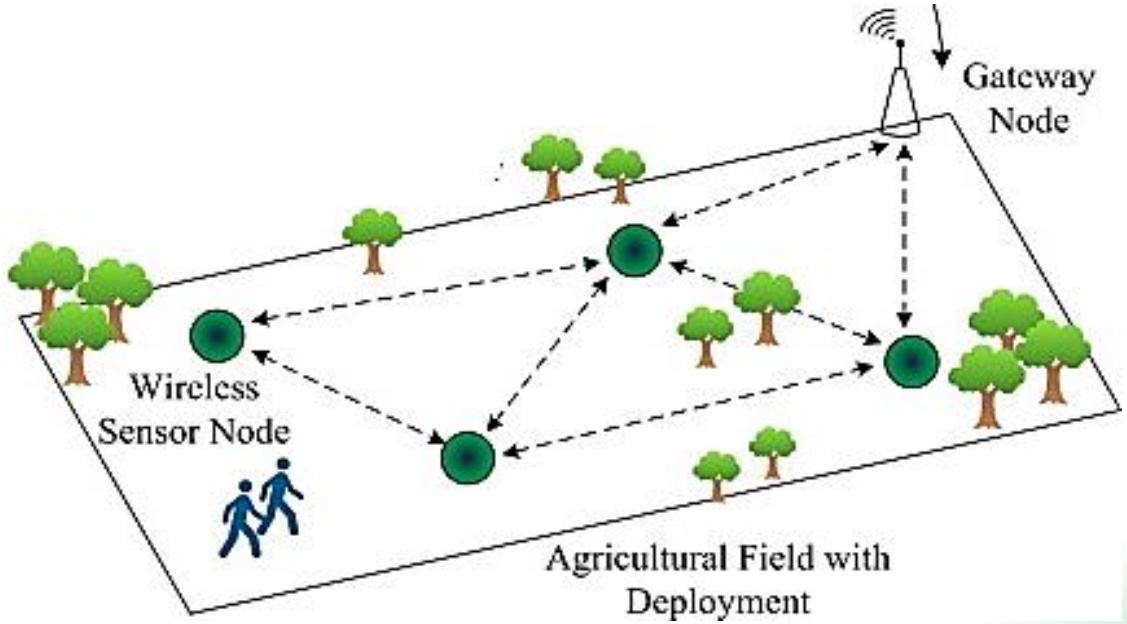


Coverage in Wireless Sensor Networks



Dr. Sunandita Debnath
IIIT Vadodara

Introduction to Wireless Communication

"Stay Connected Anywhere Anytime"

Dr. Sunandita Debnath, VITCC

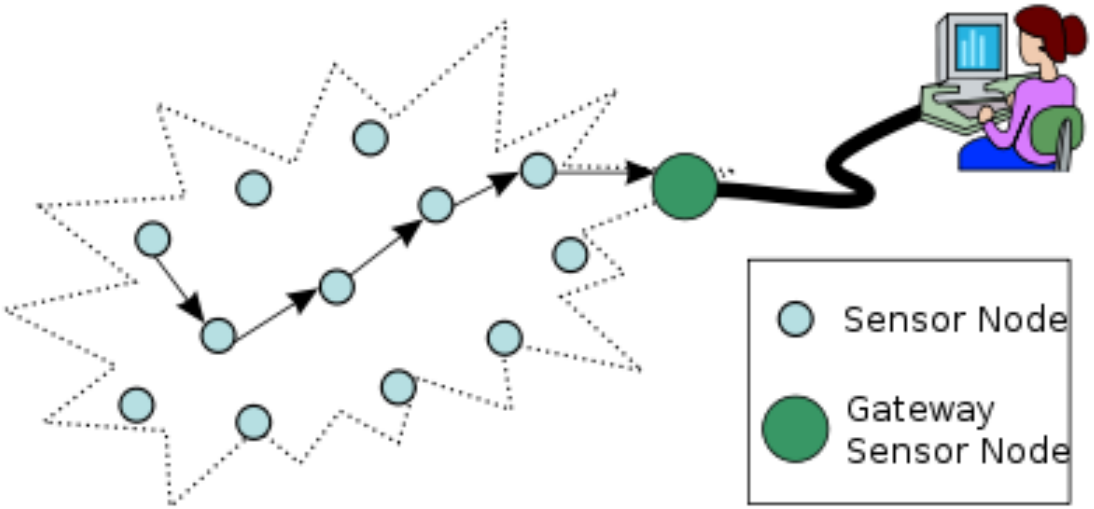
Application includes:

- *Cellular communication (i.e. Voice and data communication)*
- *Satellite Communication (GPS, Television Broadcasting and Radio Broadcasting, Internet etc.)*
- *Monitoring different environmental phenomenon (e.g. temperature, humidity, underwater environment)*
- *Body area networks (i.e. implanted devices on patient body)*
- *RFIDs*
- *IoT applications (e.g. smart Home and Offices)*

Challenges:

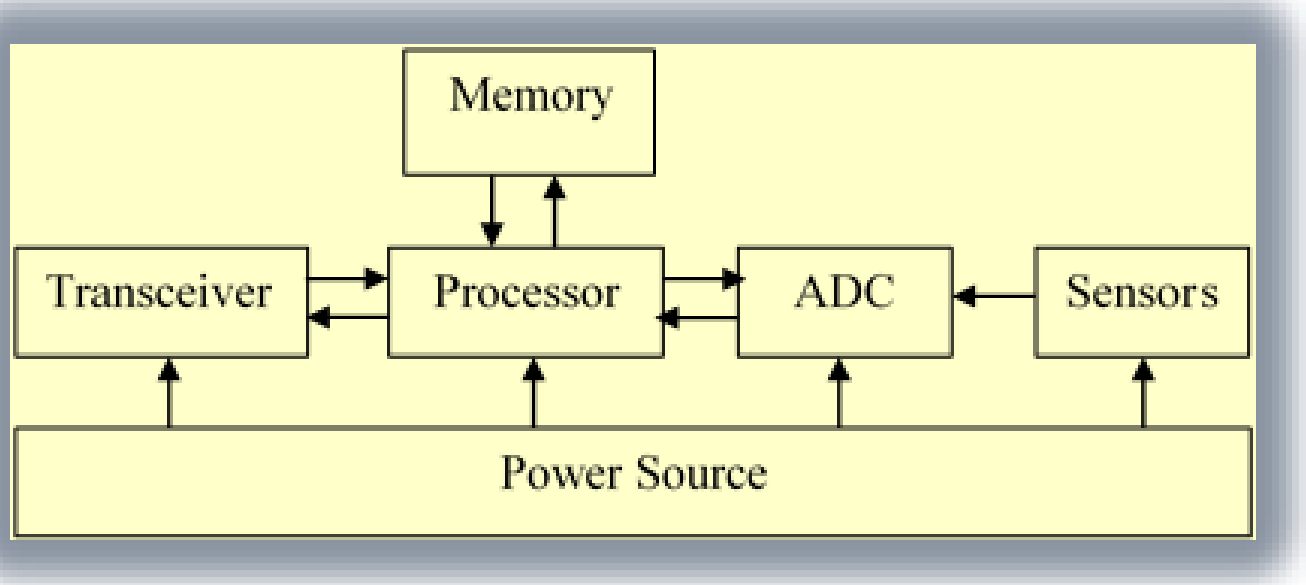
- *Network support for user mobility*
- *Maintaining QoS (quality of service) over unreliable links*
- *Connectivity and Coverage*
- *Cost efficiency*

Introduction to wireless sensor networks



Aim / Goal

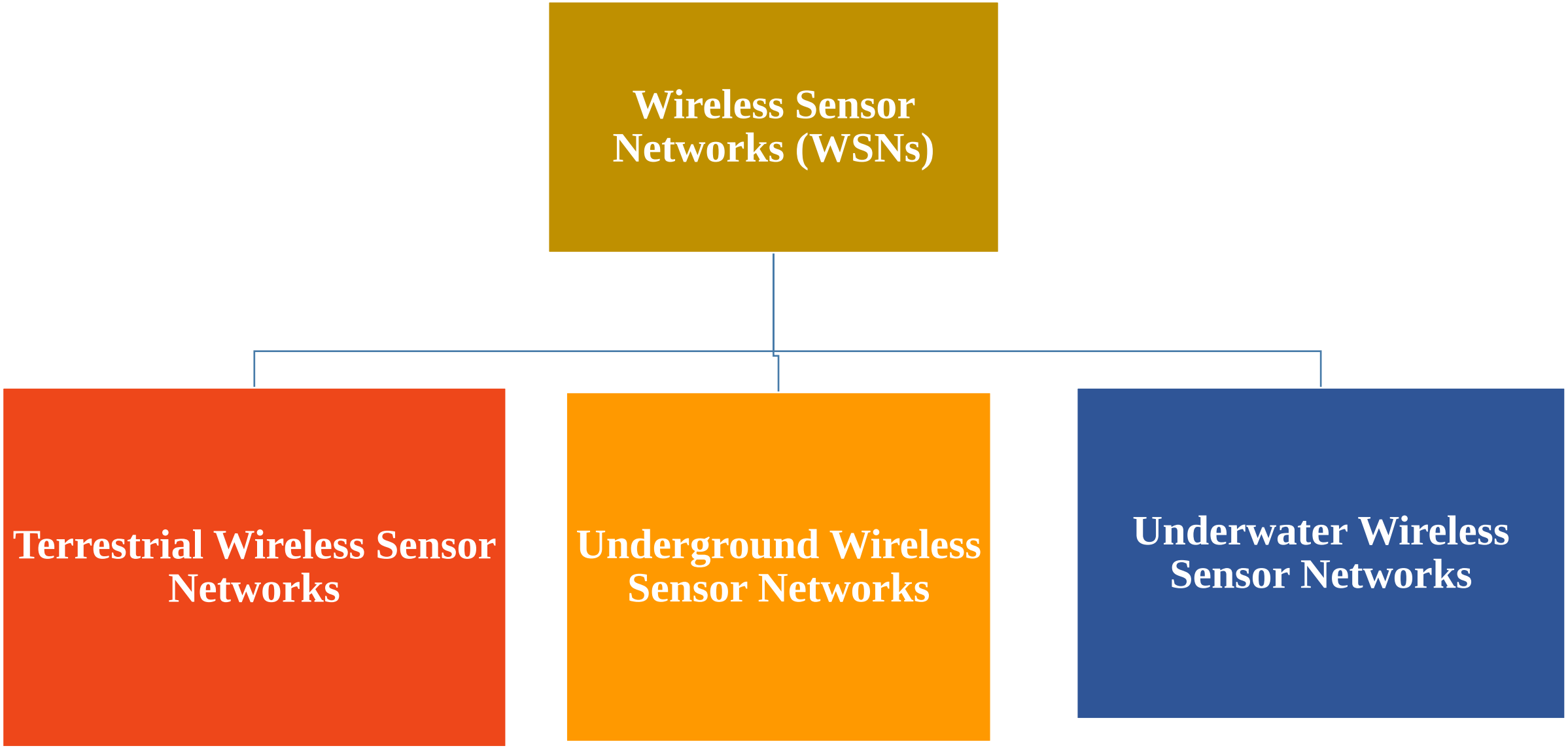
1. *Coverage*
2. *Connectivity*

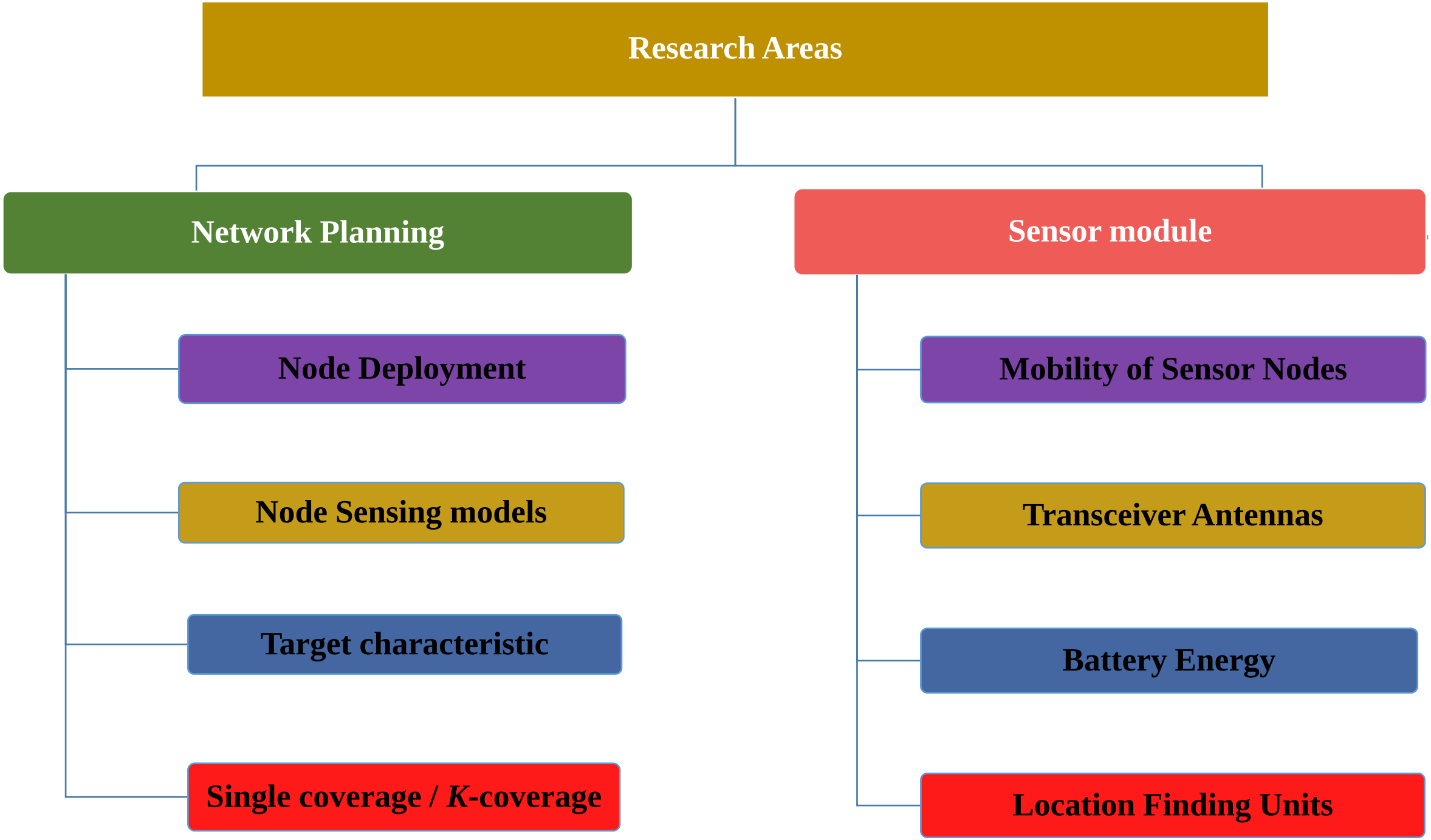


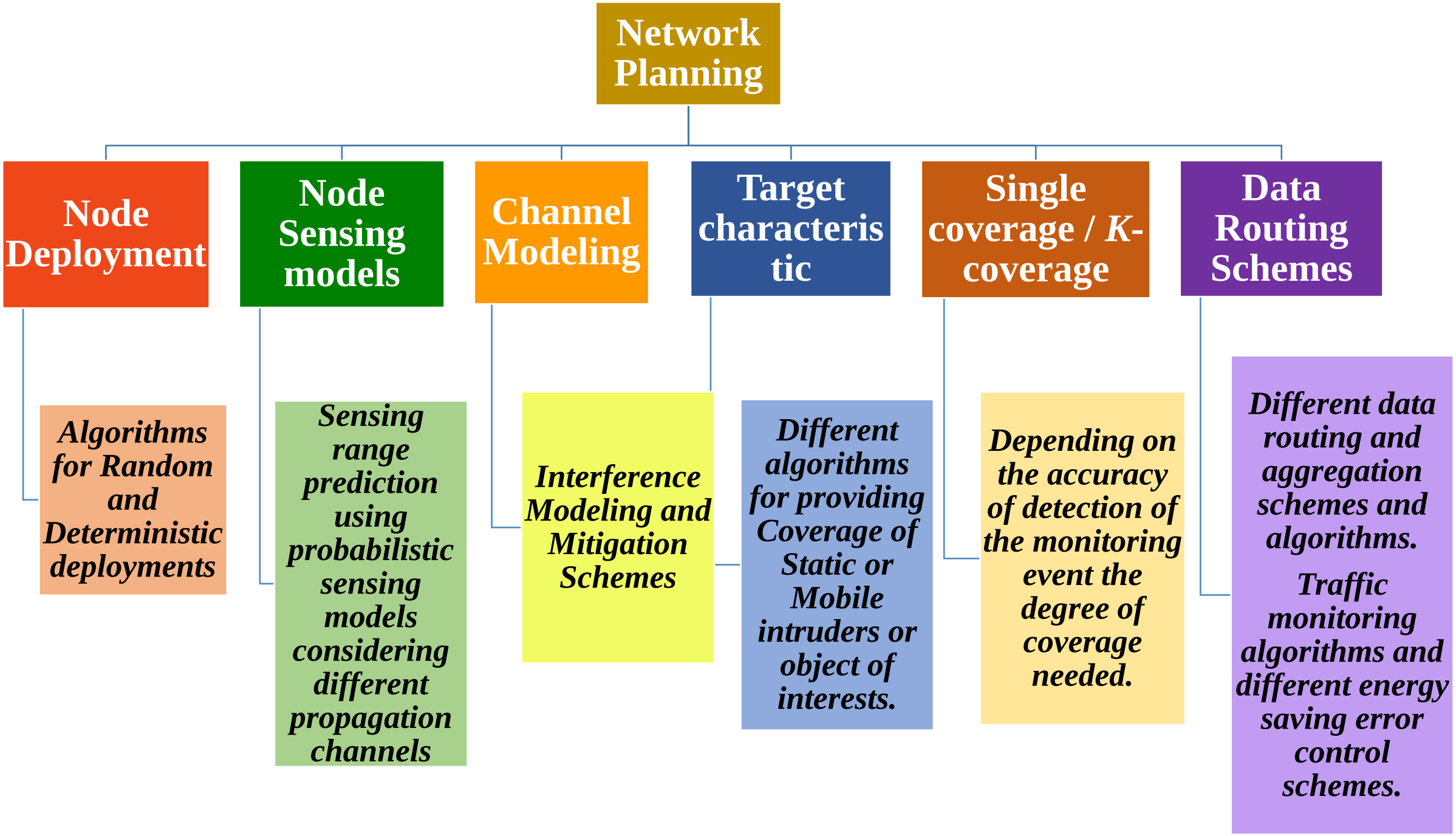
Basic block diagram of a typical sensor node

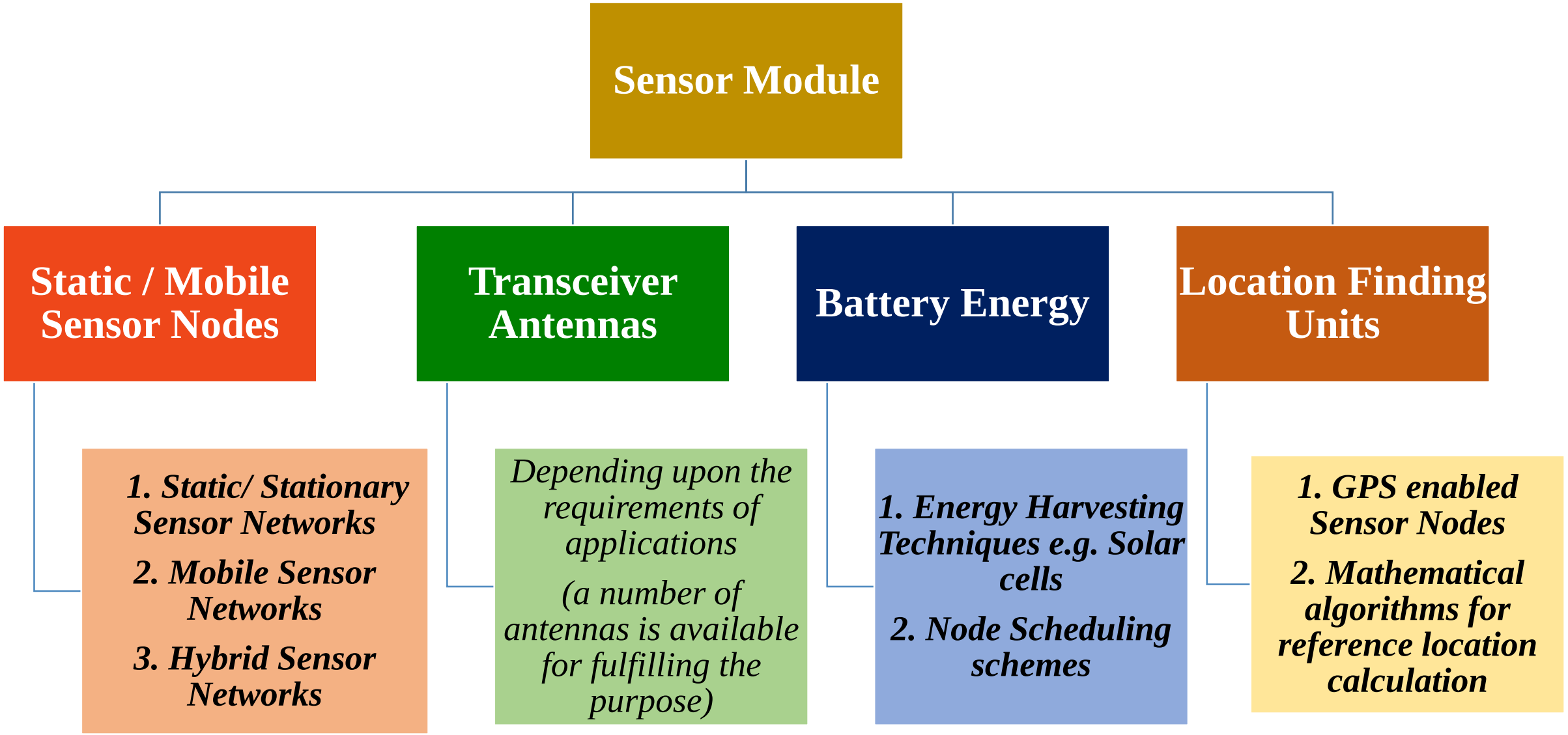
A typical sensor node consists of :

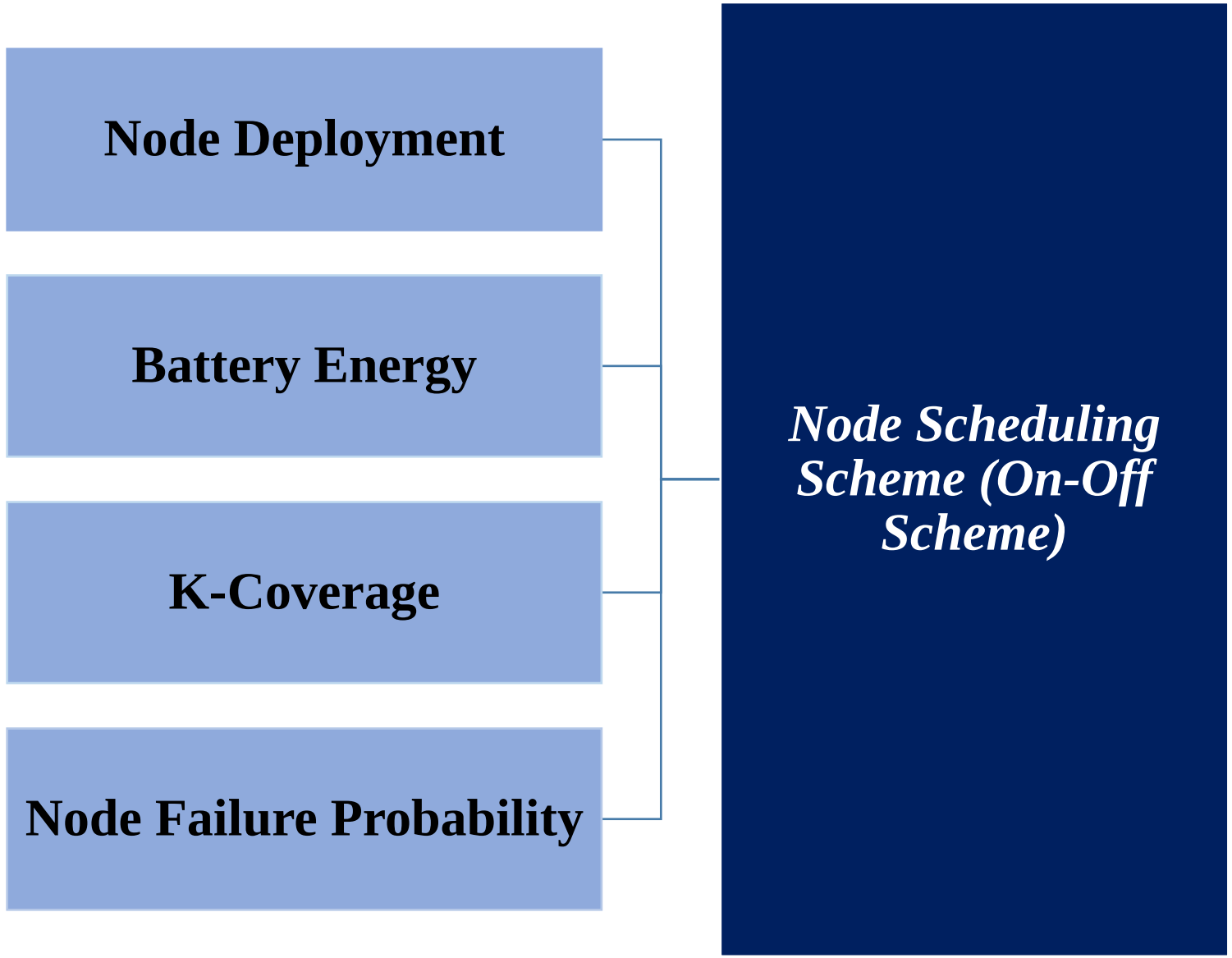
- Sensing unit (consist of many sensors)
- Processing unit
- Transceiver unit
- Power supply unit
- Memory unit
- Location finding unit (optional)
- Mobilizer (optional)

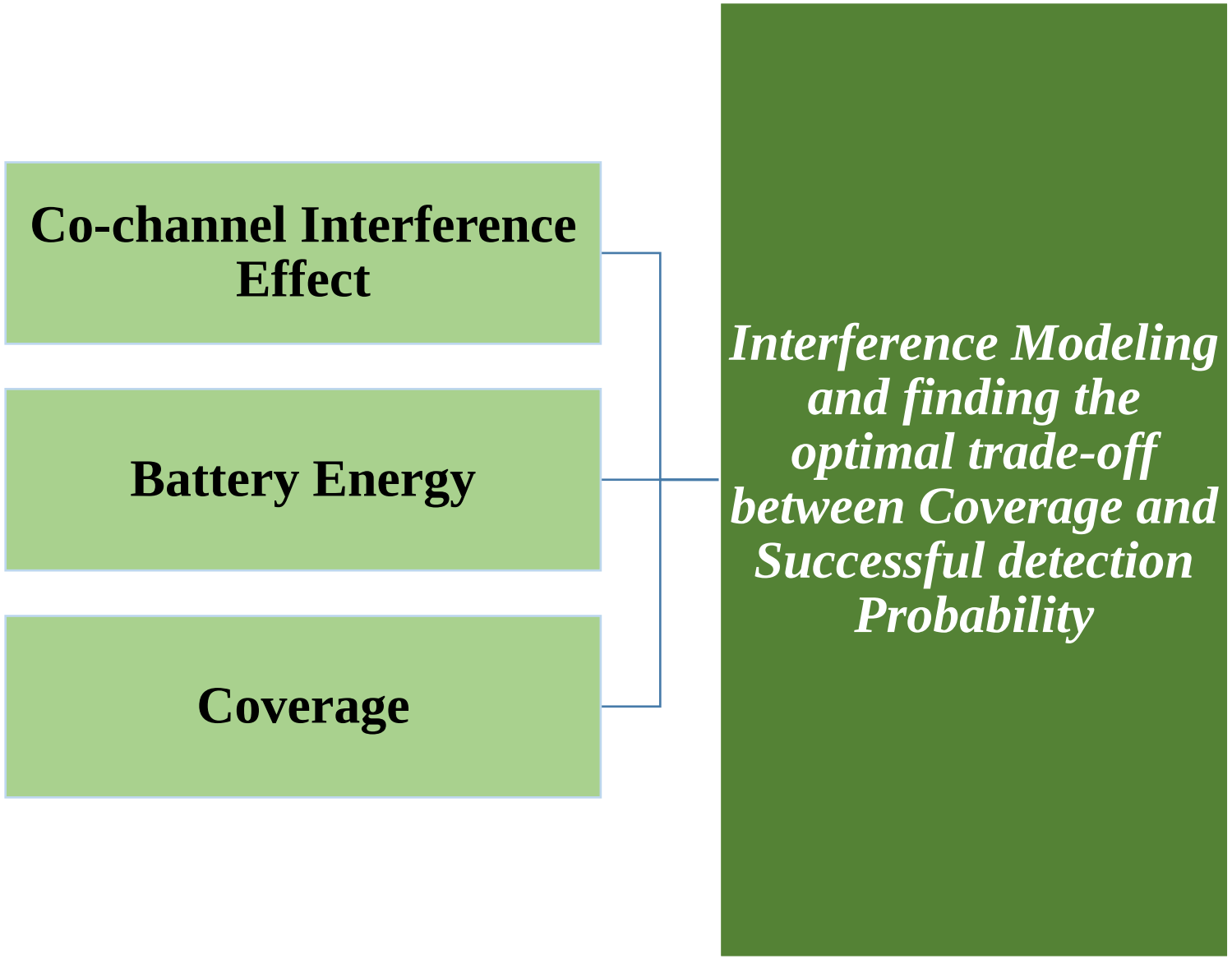

Wireless Sensor Networks (WSNs)
Terrestrial Wireless Sensor Networks
Underground Wireless Sensor Networks
Underwater Wireless Sensor Networks

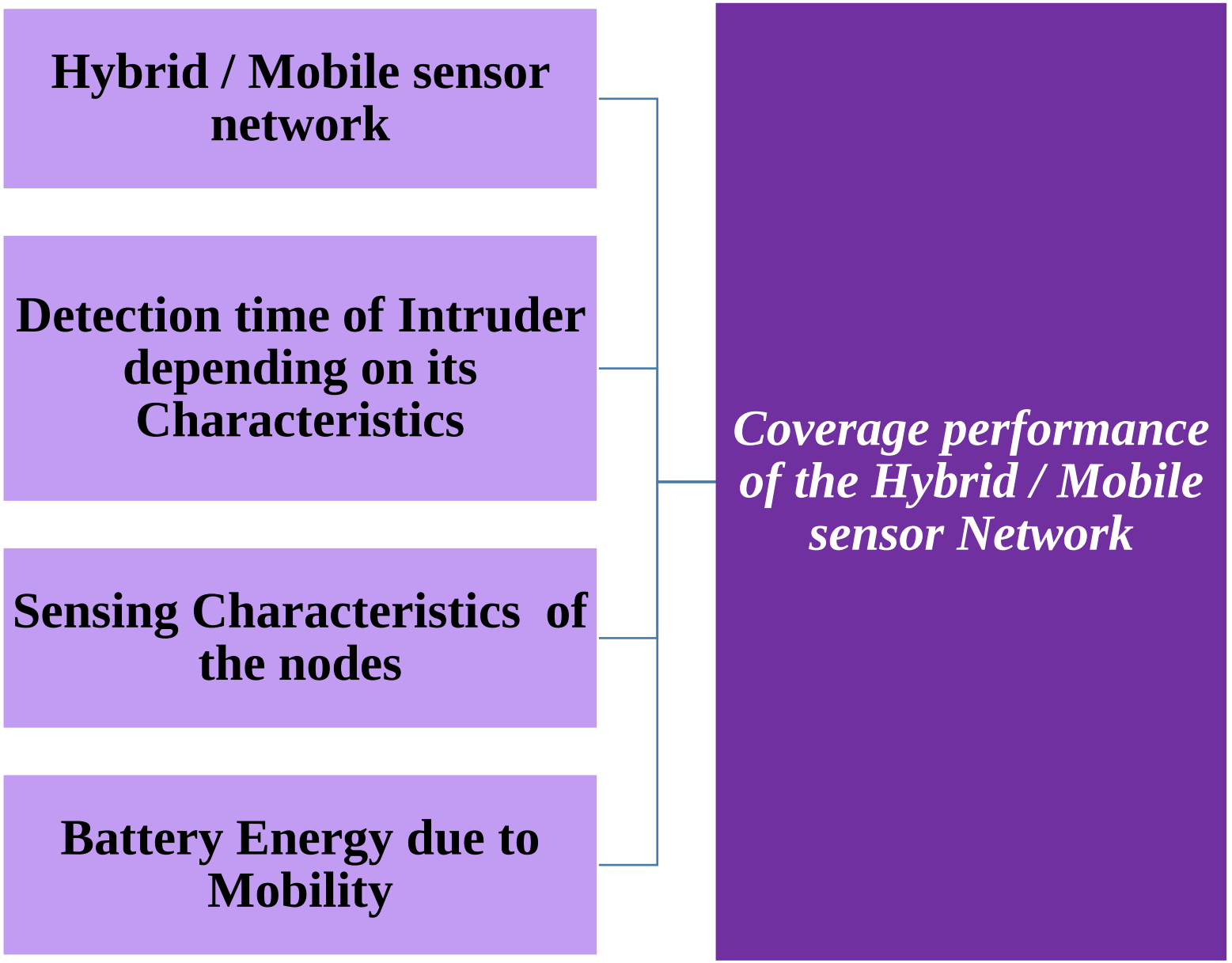

Research Areas
Network Planning
Sensor module
Node Deployment
Node Sensing models
Target characteristic
Single coverage / K-coverage
Mobility of Sensor Nodes
Transceiver Antennas
Battery Energy
Location Finding Units

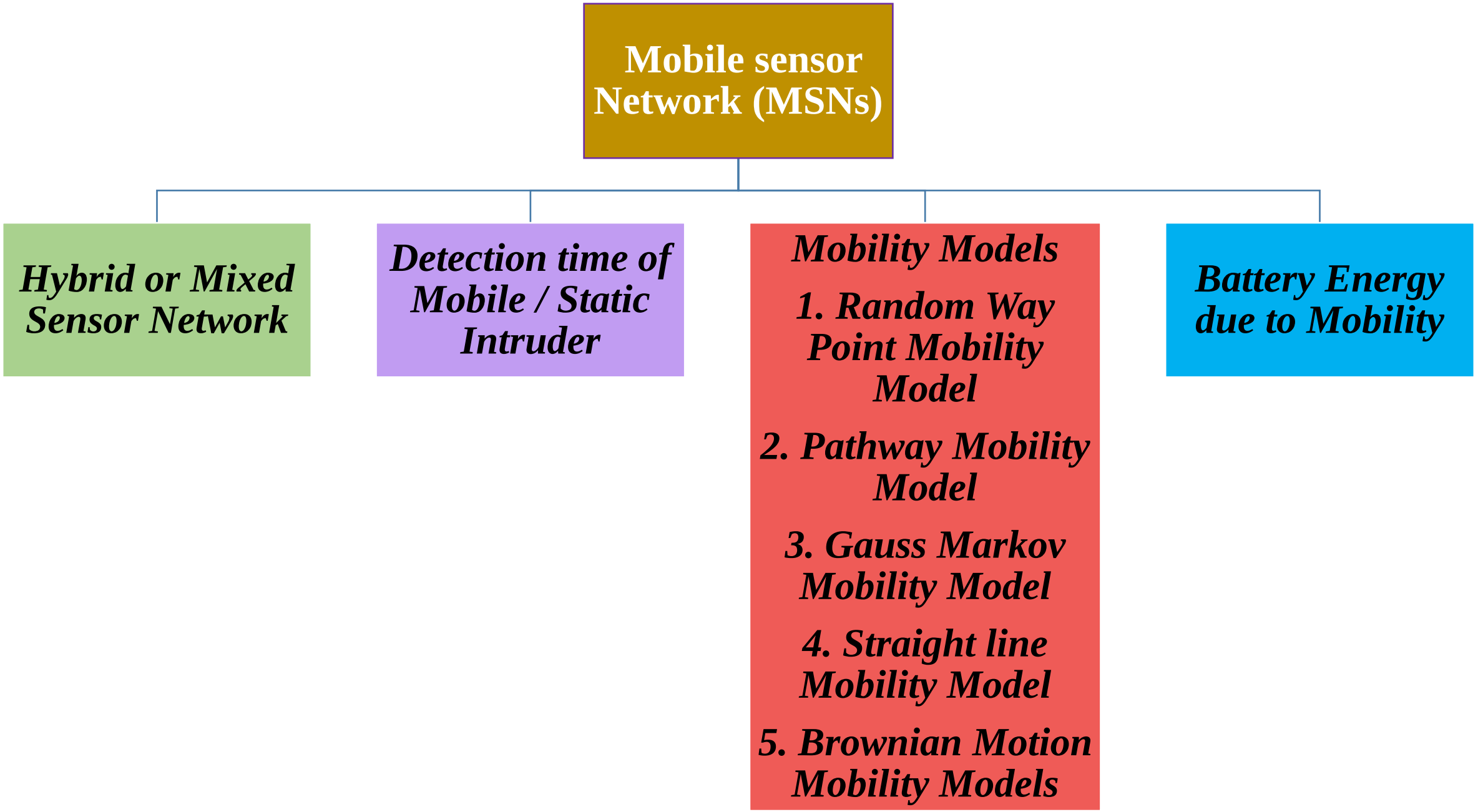

Network Planning
Node Deployment
Node Sensing models
Channel Modeling
Target characteristic
Single coverage / K-coverage
Data Routing Schemes
Algorithms for Random and Deterministic deployments
Sensing range prediction using probabilistic sensing models considering different propagation channels
Interference Modeling and Mitigation Schemes
Different algorithms for providing Coverage of Static or Mobile intruders or object of interests.
Depending on the accuracy of detection of the monitoring event the degree of coverage needed.
Different data routing and aggregation schemes and algorithms.
Traffic monitoring algorithms and different energy saving error control schemes.


Sensor Module
Static / Mobile Sensor Nodes
Transceiver Antennas
Battery Energy
Location Finding Units
1. Static/ Stationary Sensor Networks
2. Mobile Sensor Networks
3. Hybrid Sensor Networks
Depending upon the requirements of applications
(a number of antennas is available for fulfilling the purpose)
1. Energy Harvesting Techniques e.g. Solar cells
2. Node Scheduling schemes
1. GPS enabled Sensor Nodes
2. Mathematical algorithms for reference location calculation


Node Deployment
Battery Energy
K-Coverage
Node Failure Probability
Node Scheduling Scheme (On-Off Scheme)


Co-channel Interference Effect
Battery Energy
Coverage
Interference Modeling and finding the optimal trade-off between Coverage and Successful detection Probability


Hybrid / Mobile sensor network
Detection time of Intruder depending on its Characteristics
Sensing Characteristics of the nodes
Battery Energy due to Mobility
Coverage performance of the Hybrid / Mobile sensor Network


Mobile sensor Network (MSNs)
Hybrid or Mixed Sensor Network
Detection time of Mobile / Static Intruder
Mobility Models
1. Random Way Point Mobility Model
2. Pathway Mobility Model
3. Gauss Markov Mobility Model
4. Straight line Mobility Model
5. Brownian Motion Mobility Models
Battery Energy due to Mobility