WIRELESS SENSOR NETWORK

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Contents

Introduction

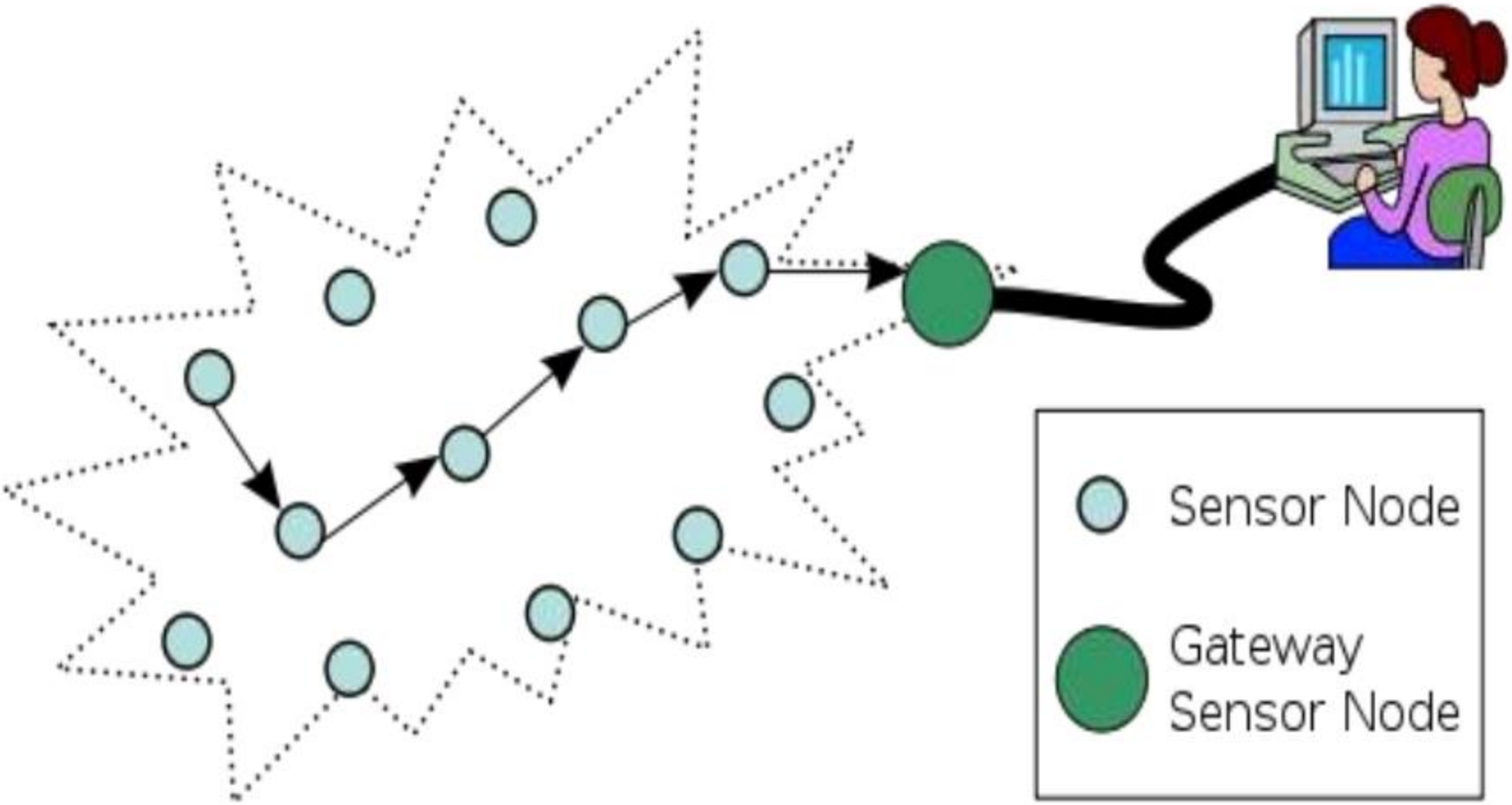
- A wireless sensor network (WSN) is a wireless network consisting of spatially distributed autonomous devices using sensors to cooperatively monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants, at different locations.

- A collection of sensing devices that can communicate wirelessly.

Wireless Sensor Networks(WSN)

- Even though wireless sensors has limited resources in memory, computation power, bandwidth, and energy.
- With small physical size. It Can be embedded in the physical environment.
- Self-organizing multi-hop ad-doc networks

Wireless Sensor Network Architecture



Architecture for a WSN

Special addressing requirement

- Local unique addresses
- Data-centric
- *Example: Each node has an unique number.*

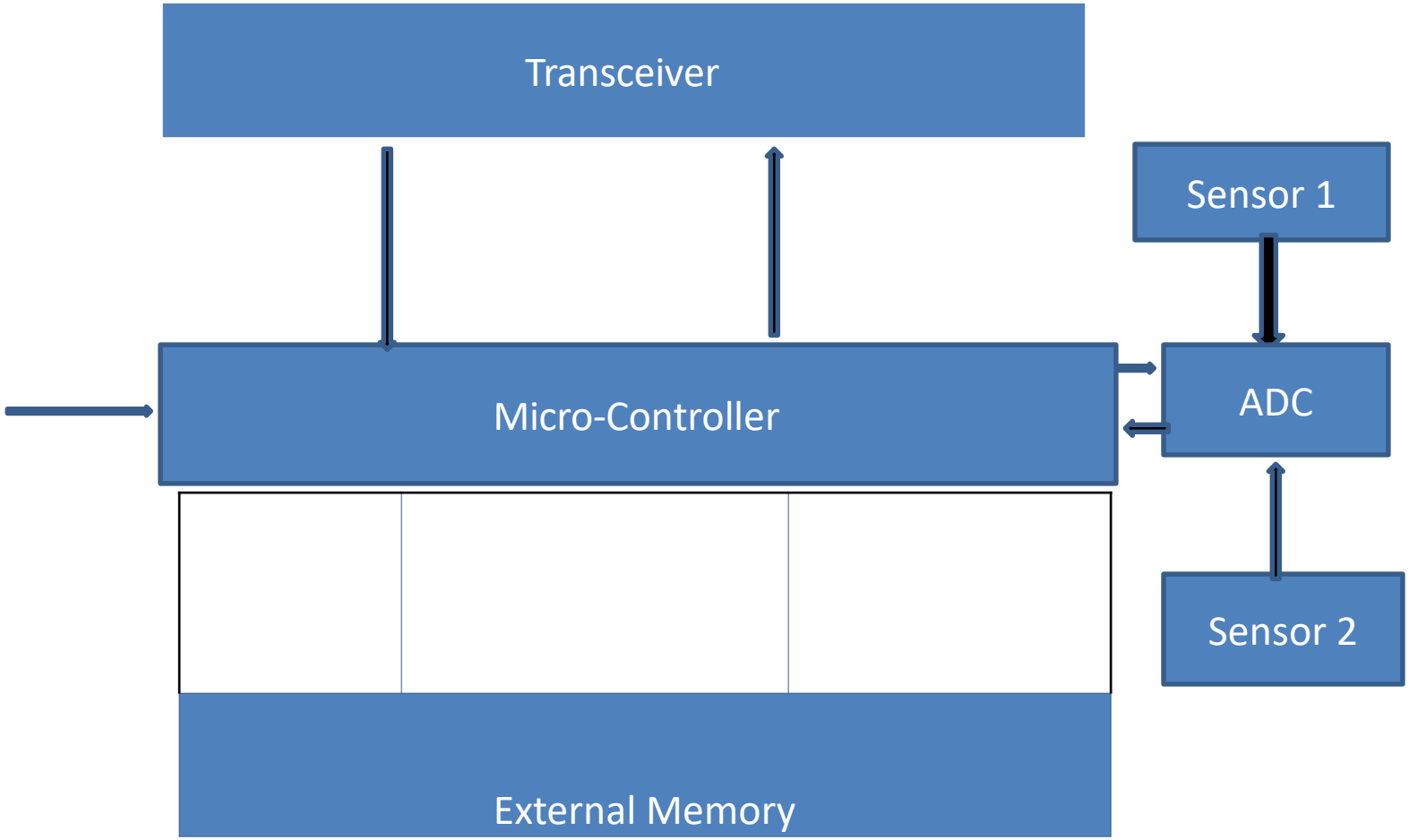
Attribute-based naming architecture

- Data is named by one or more attributes.
- *Example: Each node is distinguished by an attribute – GPS sensors are practical for this.*

Wireless Sensor Node

- sensor
  - A transducer
  - converts physical phenomenon e.g. heat, light, motion, vibration, and sound into electrical signals
- sensor node
  - basic unit in sensor network
  - contains on-board sensors, processor, memory, transceiver, and power supply
- sensor network
  - consists of a large number of sensor nodes
  - nodes deployed either inside or very close to the sensed phenomenon

Architecture of Sensor Node



Data Aggregation in WSNs

- Solves implosion and overlap problem
- Energy efficient

Wireless Sensor Network(WSN) vs. Mobile Ad Hoc Network (MANET)

	WSN	**MANET**
Similarity	Wireless	Multi-hop networking
Security	Symmetric Key Cryptography	Public Key Cryptography
Routing	Support specialized traffic pattern. Cannot afford to have too many node states and packet overhead	Support any node pairs Some source routing and distance vector protocol incur heavy control traffic
Resource	Tighter resources (power, processor speed, bandwidth)	Not as tight.

Characteristics

- Power consumption constraints for nodes using batteries or energy harvesting
- Ability to cope with node failures (resilience)
- Mobility of nodes
- Heterogeneity of nodes
- Scalability to large scale of deployment
- Ability to withstand harsh environmental conditions
- Ease of use
- Cross-layer design

Factors Influencing WSN Design

- Fault tolerance
- Scalability
- Production costs
- Hardware constraints
- Sensor network topology
- Environment
- Transmission media
- Power Consumption
  - Sensing
  - Communication
  - Data processing

Applications

- Military Applications
- Environmental Applications
- Health Applications
- Home and Office Applications
- Automotive Applications
- Other Commercial Applications

Advantages

- It avoids a lot of wiring .
- It can accommodate new devices at any time .
- It's flexible to go through physical partitions .
- It can be accessed through a centralized monitor

Disadvantages

- Lower speed compared to wired network.
- Less secure because hacker's laptop can act as Access Point. If you connected to their laptop, they'll read all your information (username, password.. etc).
- More complex to configure than wired network.
- Gets distracted by various elements like Blue-tooth .
- Still Costly at large.
- It does not make sensing quantities in buildings easier.
- It does not reduce costs for installation of sensors.
- It does not allow us to do more than can be done with a wired system

Design Challenges

- **Heterogeneity**
  - The devices deployed may be of various types and need to collaborate with each other.
- **Distributed Processing**
  - The algorithms need to be centralized as the processing is carried out on different nodes.
- **Low Bandwidth Communication**
  - The data should be transferred efficiently between sensors

Continued..

- **Large Scale Coordination**
  - The sensors need to coordinate with each other to produce required results.
- **Utilization of Sensors**
  - The sensors should be utilized in a ways that produce the maximum performance and use less energy.
- **Real Time Computation**
  - The computation should be done quickly as new data is always being generated.

Operational Challenges of Wireless Sensor Networks

- Energy Efficiency
- Limited storage and computation
- Low bandwidth and high error rates
- Errors are common
  - Wireless communication
  - Noisy measurements
  - Node failure are expected
- Scalability to a large number of sensor nodes
- Survivability in harsh environments
- Experiments are time- and space-intensive

Future of WSN

Smart Home / Smart Office

- Sensors controlling appliances and electrical devices in the house.
- Better lighting and heating in office buildings.
- The Pentagon building has used sensors extensively.

Conclusion

- WSNs possible today due to technological advancement in various domains
- Envisioned to become an essential part of our lives
- Design Constraints need to be satisfied for realization of sensor networks
- Tremendous research efforts being made in different layers of WSNs protocol stack

References

- I. F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, “Wireless Sensor Networks: A Survey”, Elsevier Computer Networks, volume 38, Issue 4, pp. 393-422, March 2002.
- Dr. Victor Leung, Lecture Slides on “Wireless Sensor Networks”, University of British Columbia, Canada
- D. Curren, “A Survey of Simulation in Sensor Networks”
- Wikipedia, [Available Online] http://en.wikipedia.org/wiki/Wireless_Sensor_Networks

Thank you!