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Wireless Sensor Networks (WSN)

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Abstract - **Wireless sensor networks are becoming very popular technology, it is very important to understand the architecture for this kind of networks before deploying it in any application. This work explores the WSN architecture according to the OSI model with some protocols in order to achieve good background on the wireless sensor network. The wireless sensor network (WSN) is a combination of sensing, computation, and communication into a single tiny device. A sensor network consists of an array of numerous sensor networks of diverse types interconnected by a wireless communication network. Sensor data is shared between these sensor nodes. The system extracts relevant information from the available data. It acts as information source, sensing and collecting data samples from the environment. Node can also act as information sink, receiving dynamic configuration information from other nodes or external entities. The end portion of a node can be an antenna. The WSNs need not communicate directly with the nearest high-power control tower or base station, but only with their local peers. The concept of WSN is based on a simple block sensing.**

Keywords— **Wireless, Layers, Cluster.**

I. INTRODUCTION

The concept of wireless sensor networks is based on a simple equation:
Sensing + CPU + Radio = Thousands of potential applications.
Wireless sensor nodes consist of Sensing, Computing, Communication, and Actuation and Power components. These components are integrated on a single or multiple boards, and packaged in a few cubic inches. A WSN usually consists of tens to thousands of nodes that communicate through wireless channels for information sharing and cooperative processing. Sensor nodes are responsible for self-organizing an appropriate network infrastructure, with multi-hop connections between sensor nodes. WSNs use small, low-cost embedded devices for a wide range of applications. They do not rely on any pre-existing infrastructure.

II. DEFINITION

"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."

III. OBJECTIVE

- Low Node Cost
- Low Power Consumption
- Self-configurability
- Scalability
- Adaptability
- Reliability
- Fault Tolerance
- QoS Support
- Communication Channel Utilization
- Security

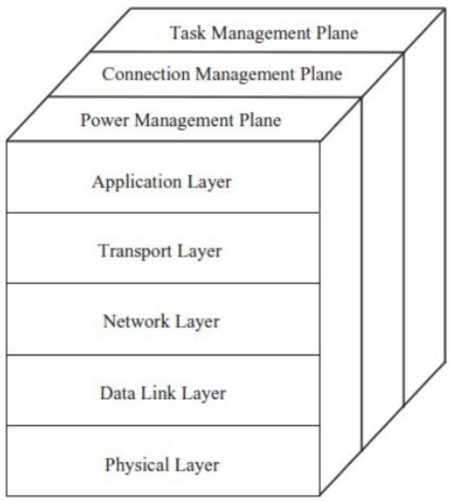
IV. SENSOR NETWORK ARCHITECTURE

Most common architecture for WSN follows the OSI Model. Basically in sensor network we need five layers:

1. **Application layer,**
2. **Transport layer,**
3. **Network layer,**
4. **Data link layer**
5. **Physical layer**.

Added to the five layers are the **three cross layers planes.** The three cross planes or layers are;

1. **Power management plane,**
2. **Connection management plane,**
3. **Task management plane.**



The cross plane layers are used to manage the network and make the sensors work together in order to increase the overall efficiency of the network.

V. CROSS LAYERS PLANES

1. Power management plane:
It is responsible for managing the power level of a sensor node for sensing, processing and communication.
2. Connection management plane:
It is responsible for configuration and reconfiguration of sensor nodes to establish or maintain network connectivity.
3. Task management plane:
It is responsible for task distribution among sensor nodes to improve energy and prolong network lifetime.

VI. WSN OSI LAYERS

1. Application layer:

Responsible for traffic management and provide software for different applications that translate the data in an understandable form or send queries to obtain certain information.

Sensor networks deployed in various applications in different fields, for example; military, medical, environment, agriculture fields.

2. Transport layer:

The function of this layer is to provide reliability and congestion avoidance. These protocols use different mechanisms for loss detection and loss recovery.

3. Network layer:

The function of this layer is routing. The major challenges are in the power saving, limited memory and buffers; sensor does not have a global ID and have to be self organized.

The basic idea of the routing protocol is to define a reliable path and redundant paths according to a certain scale called metric, which differs from protocol to protocol.

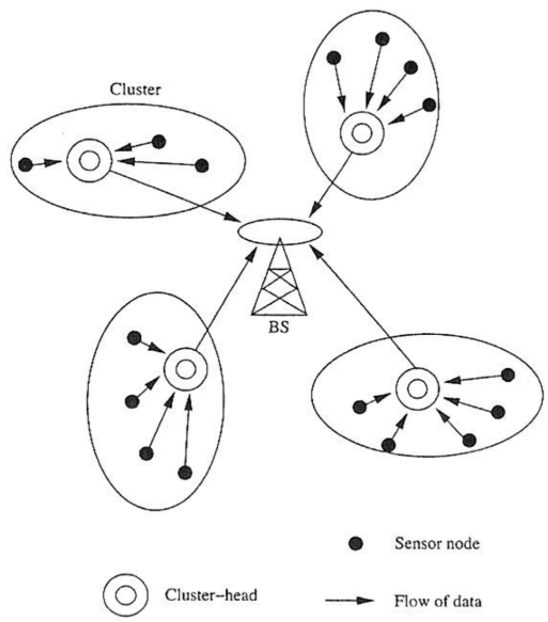
4. Data link layer:

Responsible for multiplexing data streams, data frame detection, MAC, and error control, ensures reliability of point–point or point– multipoint.

5. Physical Layer:

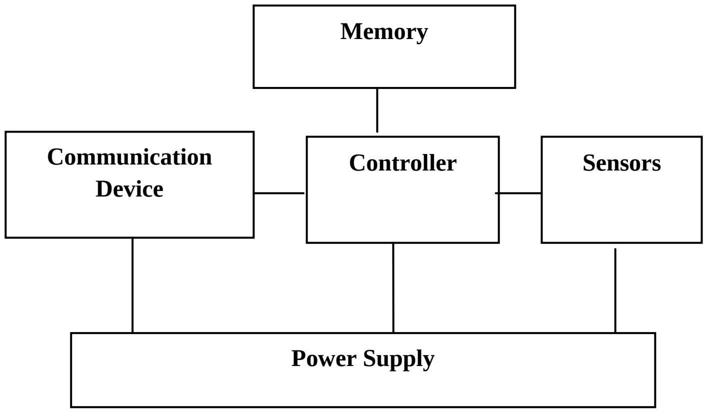
Can provide an interface to transmit a stream of bits over physical medium. Responsible for frequency selection, carrier frequency generation, signal detection, Modulation and data encryption.

VII. CLUSTER ARCHITECTURE



- Organizes the sensor nodes into clusters
- Each cluster is governed by a cluster-head
- Only heads send messages to a BS
- Suitable for data fusion
- Self-organizing

VIII. WSN COMPONENTS



Controller:

It collects data from the sensors, processes this data, decides when and where to send it, receives data from other sensor nodes, and decides on the actuator's behavior. It is the Central Processing Unit (CPU) of the node.

Memory:

Some memory to store programs and intermediate data; usually, different types of memory are used for programs and data.

The memory component is fairly straightforward. There is a need for Random Access Memory (RAM) to store intermediate sensor readings, packets from other nodes, and so on. While RAM is fast, its main disadvantage is that it loses its content if power supply is interrupted.

Sensors:

The actual interface to the physical world, devices that can observe or control physical parameters of the environment.

Without the actual sensors a wireless sensor network would be beside the point entirely. It is only possible to give a rough idea on which sensors and actuators can be used in a WSN.

Communication Device:

Turning nodes into a network requires a device for sending and receiving information over a wireless channel.

The communication device is used to exchange data between individual nodes. In some cases, wired communication can actually be the method of choice and is frequently applied in many sensor networks.

Power supply:

As usually no power supply is available, some form of batteries is necessary to provide energy.

Sometimes, some form of recharging by obtaining energy from the environment is available. The power supply is a crucial system component. There are essentially two aspects:

1. Storing energy and providing power in the required form;
2. Attempting to replenish consumed energy by "scavenging" it from some node-external power source over time.

IX. CHARACTERISTIC REQUIREMENTS

Lifetime:

- Nodes are battery-powered. Nobody is going to change the batteries. So, each operation brings the node closer to death.

To save energy:

- Acquire data only if indispensable.
- Use data fusion and compression.
- Transmit and receive only if necessary. Receiving is just as costly as sending.

Scalability:

WSN might include a large number of nodes, the employed architectures and protocols must be able scale to these numbers.

Data Collection:

- Centralized data collection puts extra burden on nodes close to the base station.

X. APPLICATIONS

Military applications:

Wireless sensor networks can be an integral part of military command, control, communications, computing, intelligence, surveillance, reconnaissance and targeting systems.

Environmental applications:

Some environmental applications of sensor networks include tracking the movements of birds, small animals, and insects; and monitoring environmental conditions.

Health applications:

Some of the health applications for sensor networks are providing interfaces for the disabled; integrated patient monitoring; diagnostics; drug administration in hospitals; monitoring the movements and internal processes of insects or other small animals; telemonitoring of human physiological data; and tracking and monitoring doctors and patients inside a hospital.

Home applications:

As technology advances, smart sensor nodes can be buried in appliances, such as vacuum cleaners, micro-wave ovens, refrigerators.

Industrial Applications:

Networks of wired sensors have long been used in industrial fields such as,

- Industrial sensing and control applications,
- Building automation,
- Access control.
- Managing inventory;
- Monitoring product quality
- Factory instrumentation;
- Vehicle tracking and detection;
- Machine diagnosis;
- Transportation.

XI. CONCLUSION

This paper conducts a survey of the Wireless Sensor Networks architecture. The use of wireless sensor technology in any application requires a good understanding of the network architecture. To introduce the necessary hardware prerequisites for building wireless sensor networks.

It has shown the performance and energy consumption of its main components such as, controller, communication device, and the sensors.

REFERENCES

[1] Weigle, M., Transport Protocol in WSN, in Virginia Technology/ Clemson workshop, 2005

[2] Buratti, C., Dardari, D., An Overview on Wireless Sensor Networks Technology and Evolution. Sensors, vol, 9: p., 6869-6896, 2009.

[3] Halawani, S., Khan, A., Sensors Lifetime Enhancement Techniques in Wireless Sensor Networks - A Survey. Journal of Computing, vol. 2, issue 5, May 2010.

[4] Mauri, K., Hännikäinen, M., Hämäläinen, T., A survey of application distribution in wireless sensor networks. EURASIP Journal on Wireless Communications and Networking, vol. 2005: p. 774-788, 2005

[5] N. Abramson, editor. *Multiple Access Communications – Foundations for Emerging Technologies*. IEEE Press, New York, 1993.

[7] Lu Yan, "Wireless Sensor Networks: Past, Present, and Future," IEEE Distributed Systems Online, vol. 7, no. 5, 2006.

[8] Iyer, Y. Gandham, S., Venkatensan, S., STCP: A Generic Transport Layer for Wireless Sensor Networks, proceeding of IEEE ICCCN 2005, San Diego, USA.