

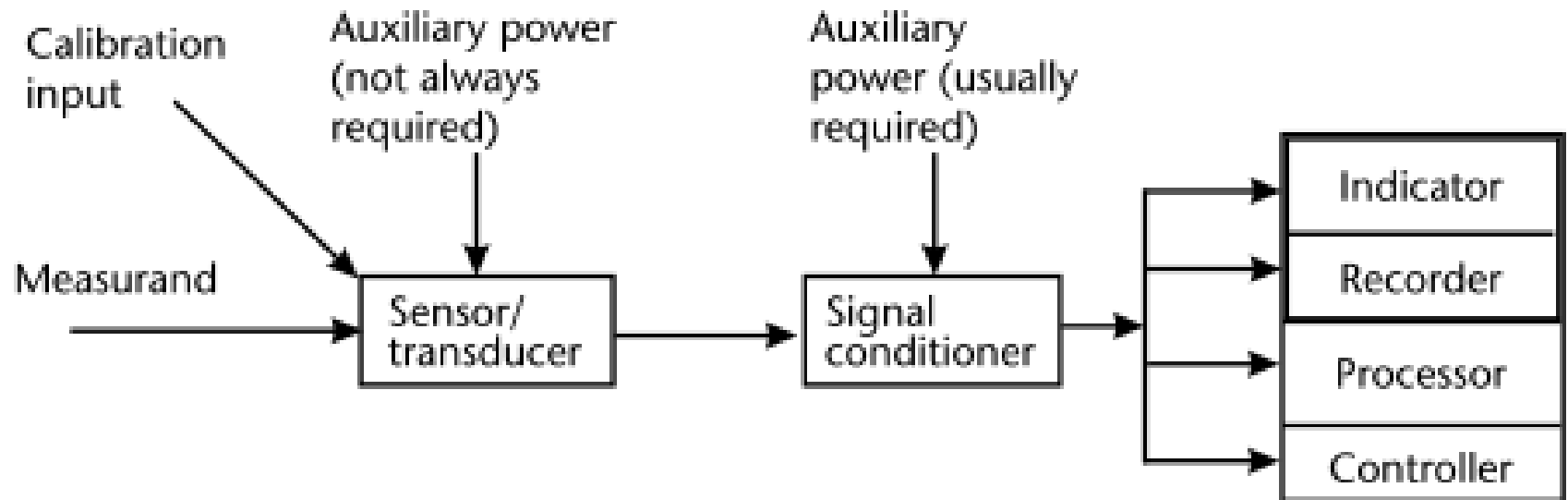
ICE 4071: Industrial Internet of Things (IIoT)

Lecture 11: Smart Sensors

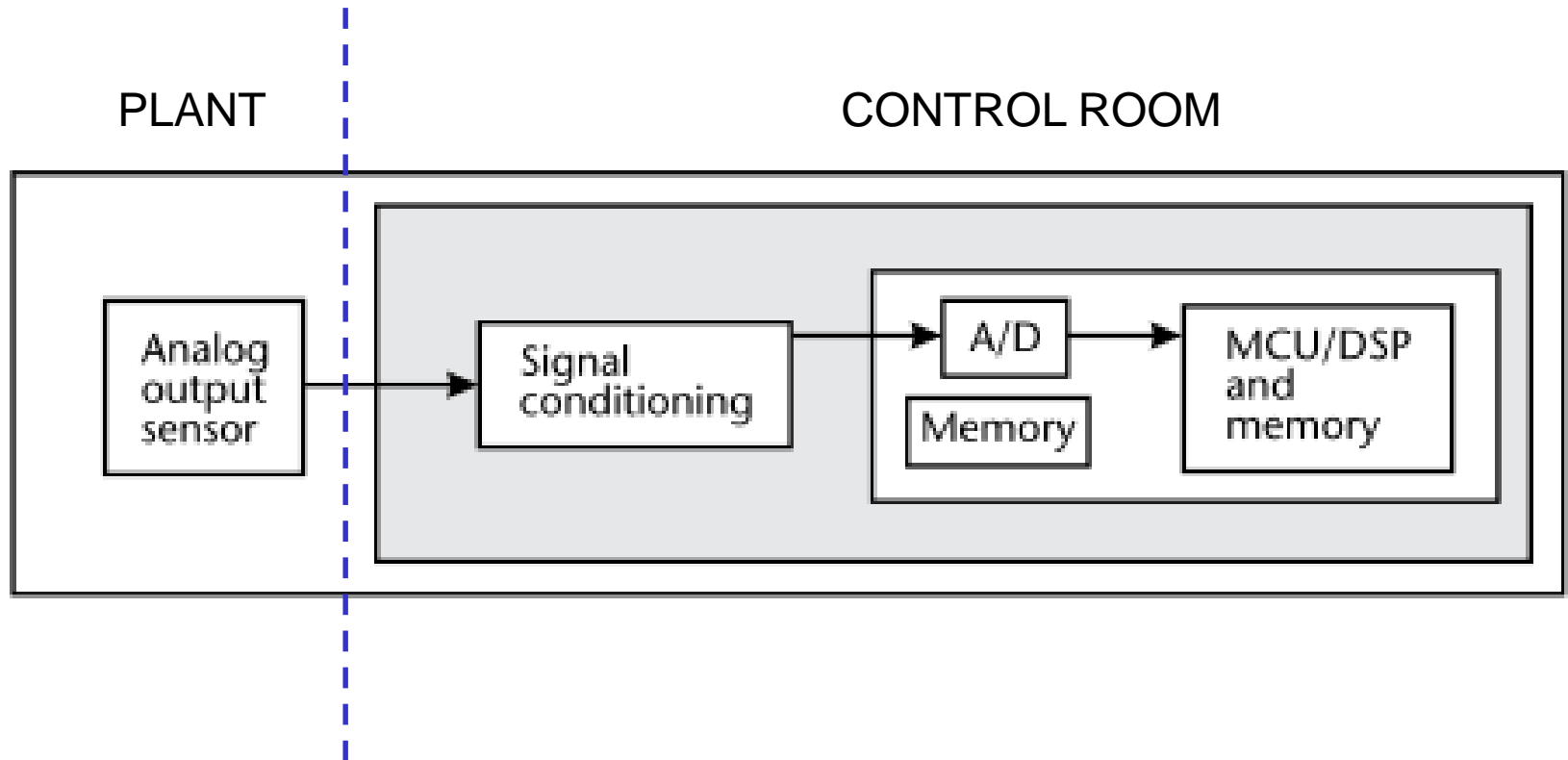
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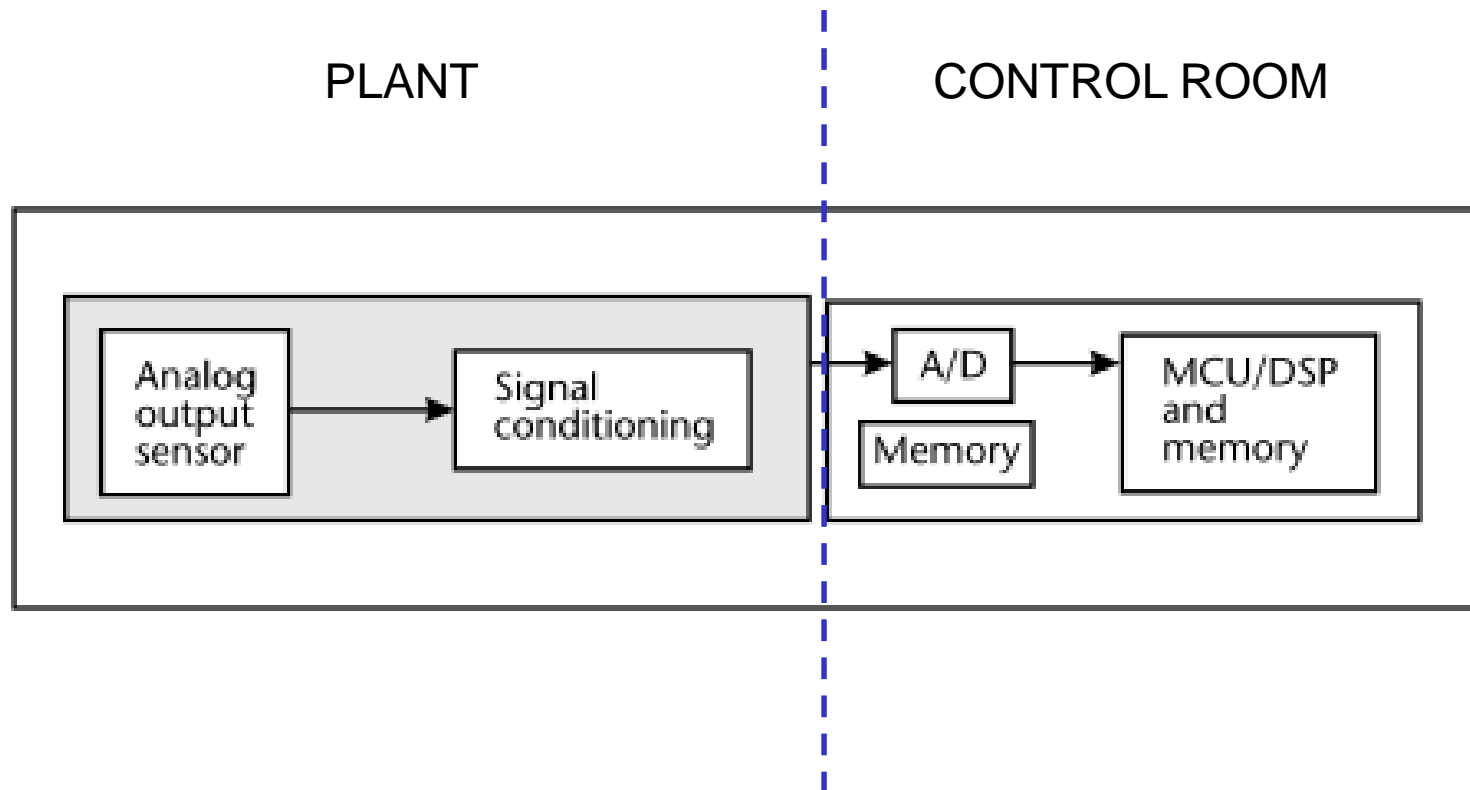
General Sensing System



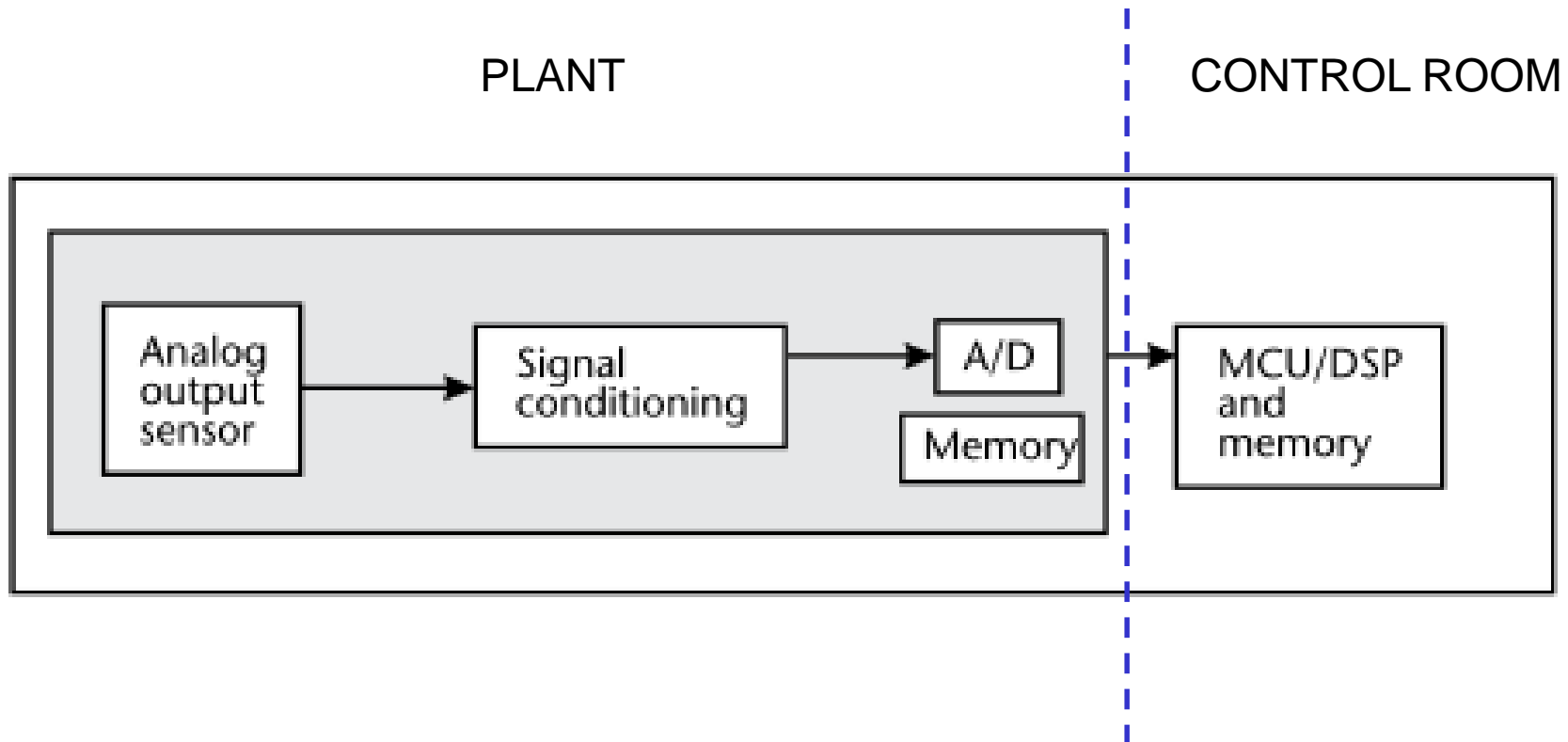
Level 0 – Traditional Sensing



Level 1 – Transmitters



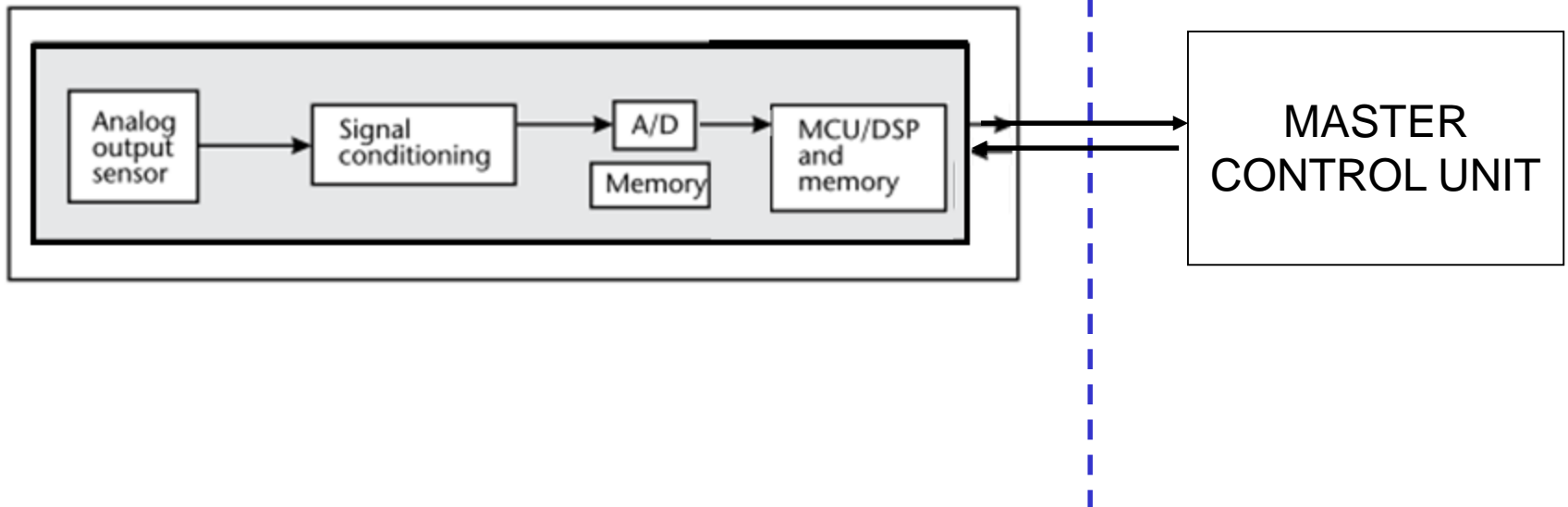
Level 2 – Digital Data Transmission



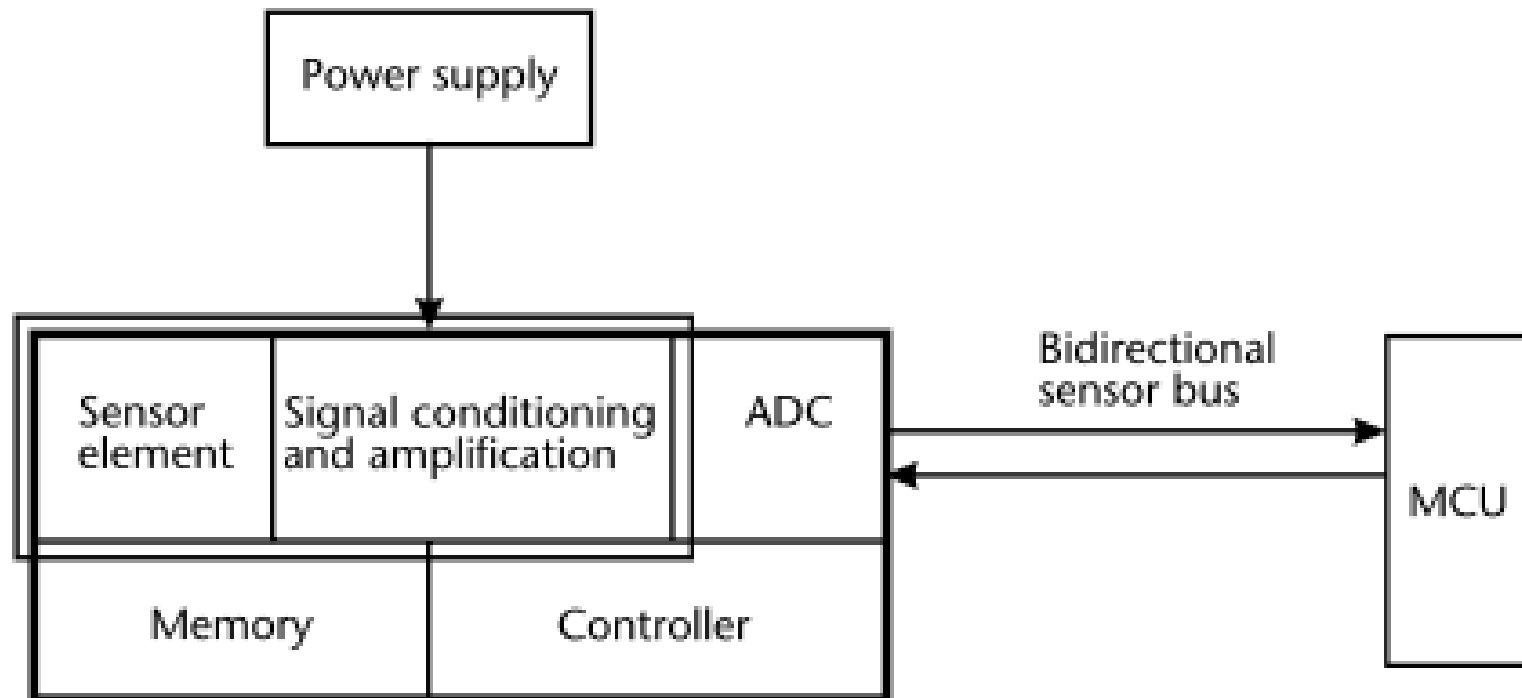
Level 3 – Smart Sensors

PLANT

CONTROL ROOM



Level 3 – Smart Sensors



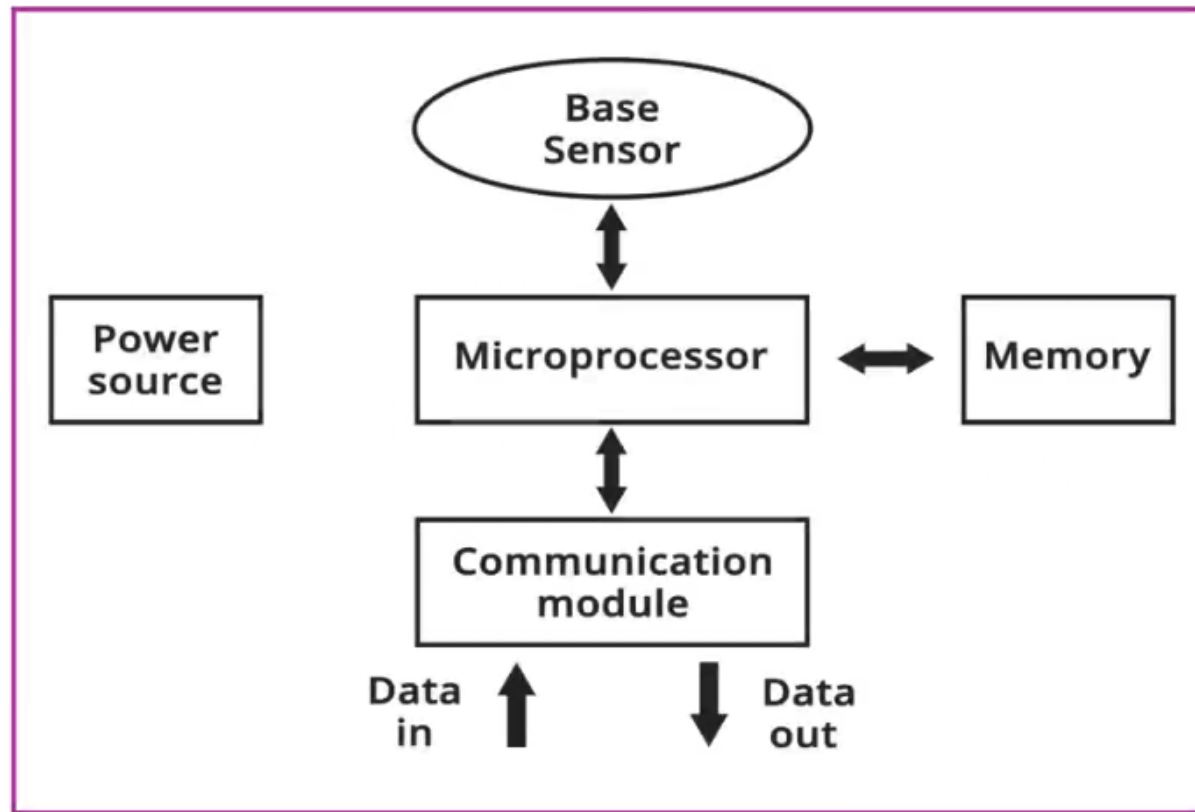
Level 3 – Smart Sensors

A SMART sensor is made of 5 main components:

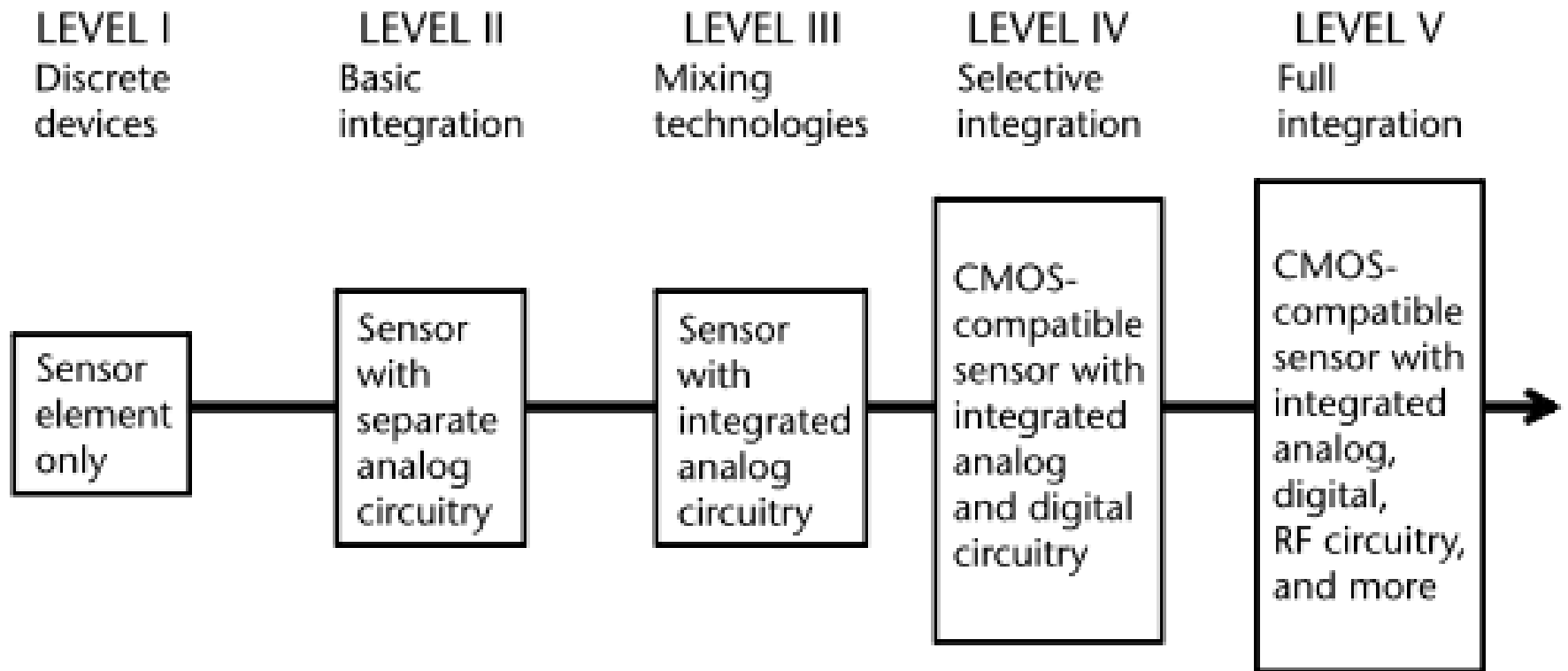
- Controller: processes the data, is capable of executing code;
- Memory: store programs and intermediate data; its organization is established by the controller;
- Sensors and actuators: the interface to the physical world; monitors and controls parameters of the environment;
- Communication: ensures the collaboration of the nodes; is wireless;
- Power supply: offers the energy for all the other components; batteries usual no rechargeable, sometimes with possibilities to obtain energy from the environment;

Level 3 – Smart Sensors

Smart sensor



Level 3 – Smart Sensors



Smart Sensors

- A smart sensor combines traditional sensor capabilities with digital technology to provide enhanced functionality and data processing capabilities.
- These sensors are designed to collect and transmit data more efficiently and intelligently compared to traditional sensors.



Characteristics and features

- Data Processing:
 - Smart sensors have embedded microprocessors and software that allow them to process data locally.
 - This can involve filtering, analyzing, and even making decisions based on the sensor's input.
 - This reduces the need for transmitting raw data to a central processing unit, saving bandwidth and energy.
- Connectivity:
 - Smart sensors are often equipped with communication interfaces like Wi-Fi, Bluetooth, Zigbee, or cellular connectivity.
 - This enables them to send data to other devices or cloud-based platforms for remote monitoring and control.

Characteristics and features

- Self-Monitoring:
 - Smart sensors can monitor their own health and performance.
 - They can detect issues such as calibration drift, low battery levels, or malfunctions and can send alerts or notifications when maintenance is required.
- Real-Time Feedback:
 - They can provide real-time feedback and alerts based on the data they collect.
 - For example, a smart environmental sensor might send alerts about air quality changes or temperature fluctuations.

Characteristics and features

- Adaptive Functionality:
 - Some smart sensors can adjust their sampling rates or measurement parameters based on changing conditions.
 - This adaptability ensures that they provide accurate data in various situations.
- Energy Efficiency:
 - Smart sensors are often designed to be energy-efficient, with power-saving modes and the ability to wake up when needed.
 - This helps extend the sensor's battery life.
- Integration:
 - Smart sensors are used in various applications, including industrial automation, environmental monitoring, healthcare, and home automation. They can integrate seamlessly into existing systems and platforms.

Characteristics and features

- Analytics:
 - The data collected by smart sensors can be used for advanced analytics and machine learning applications, enabling insights and predictions based on historical data.
- Cost-Effective:
 - While smart sensors may have a higher initial cost compared to traditional sensors, they often provide cost savings over time due to improved efficiency and reduced maintenance needs.