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Assignment-05 (BOE405)

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(Q1) Explain smart sensors

Ans. :— ☆ Smart sensors are advanced electronic devices that go beyond simply detecting or measuring a physical quantity. ☆ Unlike standard sensors which only convert physical changes (like temperature, pressure, or light) into electrical signals, smart sensors have built-in microprocessors and additional electronics.

→ This allows them to pass process information, make decisions, and communicate with other devices or systems.

Key Features of Smart Sensors:

★ Integrated Processing: Smart sensors contain a microprocessor or microcontroller, enabling them to analyze and process the data they collect before sending it out.

★ Self-Calibration: They can automatically adjust their own settings to maintain accuracy over time, reducing errors caused by changes in temperature or other environmental factors.

★ Self-Testing: These sensors can check their own health and detect faults, which helps in maintaining reliability and reducing maintenance needs

★ Communication: Smart sensors can send and receive data, often using digital communication protocols. This makes them suitable for networked environments and the Internet of Things (IOT).

Ans. ① :—
(contd—)

* **Multi-Sensing:** Some smart sensors can measure several different variables at once, such as temperature and humidity, or pressure and acceleration.

How Smart Sensors Work:

* A smart sensor typically includes:

* **Sensing Element:** Detects the physical change (e.g., temperature, pressure).

* **Signal conditioning:** Amplifies, filters, or otherwise prepares the signal for processing.

* **Analog-to-Digital Converter (ADC):** converts the analog signal from the sensor into digital data.

* **Microprocessor:** Processes the digital data, performs calculations, and make decisions.

* **Memory:** Stores data and programs.

* **Communication Interface:** Allows the sensor to exchange data with other devices or systems.

Applications:

Smart sensors are widely used in:

* **Industrial automation** for monitoring and controlling processes.

* **Smart cities** for traffic management, public safety, and environmental monitoring.

* **Healthcare** for patient monitoring and diagnostics.

* **Consumer electronics** for smart home devices.

Q2 Discuss the architecture of smart sensors.

Ans :- Smart sensors are built with several parts working together.

* Sensing element : Detects the physical change (like temperature or pressure).

* Amplifier : Makes the sensor signal stronger.

* Sample and hold : Keeps the signal steady for a short time.

* Analog multiplexer : Chooses which signal to process if there are many.

* Analog-to-digital converter (ADC) : changes the analog signal to digital numbers.

* Compensation circuits : Fix errors caused by temperature or other changes.

* Processor : Does calculations and decisions.

* Memory : Stores data.

* Serial communication : Lets the sensor talk to other devices.

Q3 Explain the components of smart sensors

Ans :- Smart sensors have these main parts :

* Sensing element : Detects changes (like temperature, pressure).

* Signal conditioning : Makes the signal better (amplify, filter, linearize).

* Data acquisition system : Collects and processes data.

* Multiplexer : Selects one signal out of many.

Ans ③ :- ☆ Processor: Makes decisions and processes
(contd-) data.

☆ Memory: Stores information

☆ Communication: Sends and receives data with other devices.

(84) Explain the characteristics of smart sensors

Ans.:- Smart sensors have special features:

☆ Self-calibration: They can check and fix their own errors

☆ Self-testing: They can test themselves to see if they are working right.

☆ Self-communication: They can send and receive data.

☆ Computation: They can do math and calculations.

☆ Multi-sensing: Some can measure more than one thing at the same time.

(Q5) Discuss the smart sensor application of traffic control, public safety, digital signage, EV charging and Wifi in smart cities!

Ans.:- ☆ Traffic control: Smart sensors count cars and control traffic lights to reduce jams.

☆ Public Safety: Sensors with cameras and microphones can detect accidents or crimes and alert authorities.

☆ Digital signage: Smart signs show information or warnings and can change messages quickly.

Ans. (5.) :-
(contd.)

* EV charging : sensors help manage electric vehicle charging stations and billing.

* WiFi : sensors in streetlights provide public WiFi and help with city communication.

(Q6) Explain the use of smart sensor in industrial robots.

Ans. :- Smart sensors in robots help them :

* Sense objects : Detect if something is in front or if they are holding an object.

* Measure force : Know how much force they are using.

* Detect collisions : stop if they bump into something for safety.

* See and recognize : Use cameras (vision sensors) to find and pick up objects.

(Q7) Discuss the use of smart sensors in electric vehicle.

Ans. :- Smart sensors in electric vehicles are used for :

* Battery monitoring : Check battery health and swelling.

* Inertial measurement : measure how the car is moving (speed, direction, tilt).

* Safety : Detect clashes or problems and trigger safety systems.

* Wireless monitoring : Send data about the car's condition to a computer :-

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(Q8) explain the application of smart sensors in smart cities.

Ans :- Smart sensors help cities in many ways:

* Water management : Detects leaks in pipes.

* Energy management : Smart meters track electricity use.

* Waste management : Tell when garbage bins are full.

* Traffic and parking : Help find parking spots and manages traffic.

* Pollution control : Monitor air quality.

* Street lighting : Lights turn on/off based on activity and report faults.

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