Home Assignment-1

2300032163
G. Sreehitha.

1) Generation	key characteristics	Examples.
First	8-bit microprocessors, simple hardware, assembly language	Digital telephone keypads, stepper motor control units.
second	16-bit microprocessors, more complex	Data acquisition, SCADA system.
Third	32-bit microprocessor, DSPs, ASICs	Robotics, multimedia devices.
Fourth	64-bit microprocessors, multi-core processors, network.	smartphone, IOT devices, autonomous vehicles.

Evolution:

- Increased processing power.
- Miniaturization.
- Connectivity.
- Software complexity.
- Specialization.

2) Role of Embedded System in modern healthcare:

Embedded system are vital for precision, efficiency, real-time monitoring in health care.

- Medical Devices
- Diagnostics.
- Wearables
- Telemedicine.

They improve patient care, reduce human error, and promote preventive health care through continuous monitoring and data analytics.

3) Challenges in Embedded System:

- Resource Constraints.
- Real-time Requirements.
- Power consumption.
- Security
- Realiability.

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Addressing the challenges:

- Efficient Algorithm & Data structure
- Real-time operating system

- Power Management Technique.
- Security Measures.
- Robust Design & Testing

4) Impact of processor types on embedded systems:

- MCUs: Low power, cost-efficient, used in wearables and home automation.
- MPUs: High performance for multi-task, ng, used in robotics and infotainment.
- DSPs: optimized for signal processing, used in telecom and medical imaging.
- ASICs: Custom-designed for efficiency, used in GPUs and cryptographic systems.
- FPGAs: Flexible with parallel processing used in AI and aerospace.

5) Power consumption is critical in embedded systems due to:

- Battery life
- Thermal management
- Energy costs
- Environment Impact

Addressing power consumption involves:

- Low power components
- Power management techniques.
- Efficient algorithms.
- Careful hardware design.

6) Role of Embedded system in Automobile Industry:

Applications:

- Engine control
- Advanced Driver Assistance Systems.
- Infotainment systems
- Safety features.
- Autonomous driving.

Benefits:

- Improved safety
- fuel efficiency
- Driving Experience
- Innovation.

7) Future Trends in Embedded systems:

- AI & ML Integration.
- 5G connectivity.
- Security Environment
- Edge computing
- Low-power system.

8) Real-time performance ensures timely and predictable responses to events

Significance:

- Critical Applications
- Reliability
- Efficiency.

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9) Security is vital to protect sensitive data and ensure system integrity against cyber threats.

Strategies:

- Encryption.
- Authentication
- Secure Boot
- Firmware updates
- Harms

16) Comparison of ASICs & PLDs:

- Design flexibility
  - → ASICs: Low flexibility, custom-designed
  - → PLDs: High flexibility, reconfigurable
- Performance:
  - → ASICs: High performance, optimized
  - → PLDs: Low performance, but adequate for many uses.
- Application suitability:
  - → ASICs: Best for high-volume, specialized tasks.
  - → PLDs: Ideal for prototyping & adaptable design.

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11) Applications:

- Consumer Electronics.
- Automotive
- Health care
- Industrial Automation
- Telecommunication
- Aerospace & Defense.

12) Embedded system Design Process - Requirements,

- System specification
- Hardware Requirements.
- Interface Requirements.
- Testing & validation Criteria.

13) Comparisons of ASICs & PLDs:

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- Performance

→ ASICs: High performance, optimized

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- Application suitability:

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14) Applications:

- Consumer Electronics
- Automotive
- Healthcare
- Industrial Automation
- Telecommunication
- Aerospace & Defense

15) Embedded System Design Process -

Requirements:

- System Specification.
- Hardware Requirements.
- Software Requirements.
- Interface Requirements.
- Testing & validation criteria.

16) First Generation: simple, task-specific systems.

Ex: Home appliances.

Second Generation: Multi-tasking systems with real-time capabilities

Ex: Automotive control.

Third Generation: IoT, AI, cloud-connected devices.

Ex: Smart homes.

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Fourth Generation: Advanced systems with cloud, AI and edge computing.

Ex: Autonomous vehicles.

17) Key-Characteristics of Medium-scale:

- Complexity
- Processing power
- Memory
- Cost
- Applications.

18) Major Design challenges:

- Real-time constraints.
- Power consumption
- Memory limitations.
- Hardware-software Integration.
- Security
- Testing & Debugging

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19) Selection criteria for choosing an processor in Embedded system:

- Performance
- Power Consumption
- Cost
- Memory Requirement
- Connectivity
- Real-Time capabilities

20) Embedded systems in Automotive Industry:

- Engine control
- Advanced Driver Assistance systems.
- Infotainment systems.
- Safety features.
- Autonomous vehicles.

21) Role of Architecture Design in Embedded System:

- System structure
- Performance optimization.
- Scalability.
- Reliability and safety.
- Cost of efficiency.

22) GPPs: versatile, but may be less efficient for specific tasks.

DSPs: optimized for specific task, offering higher performance and efficiency.

Architecture Design:

- Performance
- Power efficiency
- Resource utilization
- Real-time requirements

23) Role of PLPs:

1. customization
2. flexibility
3. Integration
4. Prototyping.

Major challenges:

- Real-time constraints.
- Resource limitations.

24) Applications of Embedded Systems in Automotive Industry:

- Engine control units: optimize engine performance.
- Advanced Driver Assistance Systems, support safety features like collision avoidance and lane assistance.

25) General-purpose processors:

- Versatile, used for multitasks.
- Less optimized for specified functions.

Domain-specific processors:

- Tailored for specialized tasks
- High efficiency & performance for targeted applications.

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