SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

19ECT312 – EMBEDDED SYSTEM DESIGN

III YEAR/ VI SEMESTER

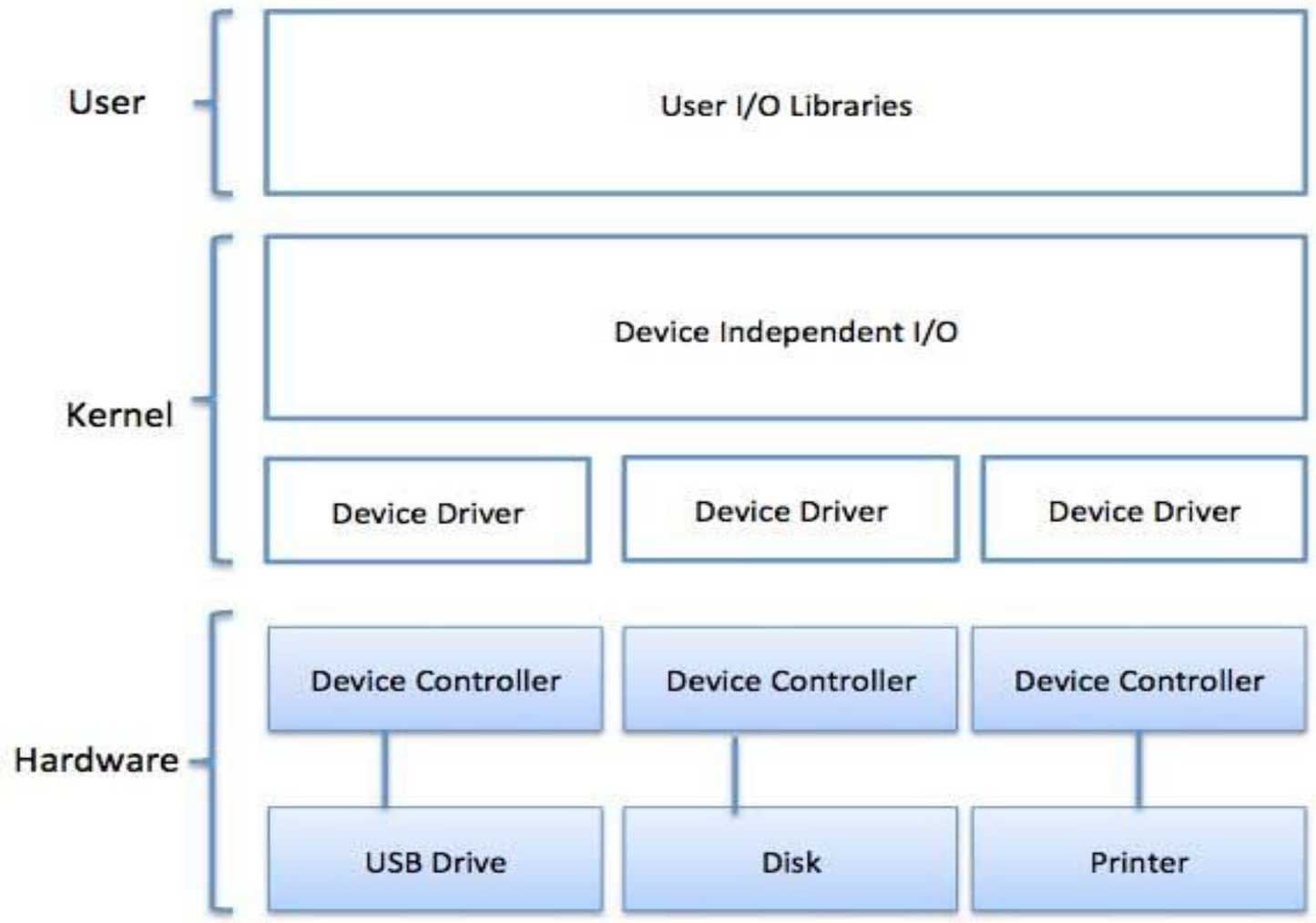
UNIT 4 : EMBEDDED OPERATING SYSTEMS & MODELING

TOPIC : Input /Output sub systems

INTRODUCTION

- Embedded systems are specialized computing systems designed to perform specific functions within a larger system or device.
- They are typically built into and dedicated to particular hardware, often with real-time computing constraints.
- These systems are prevalent in various applications, including consumer electronics, automotive systems, industrial machines, medical devices, and more. Embedded systems often operate in environments where reliability, efficiency, and low power consumption are critical.
- Examples:IoT devices, automotive systems , customer electronics

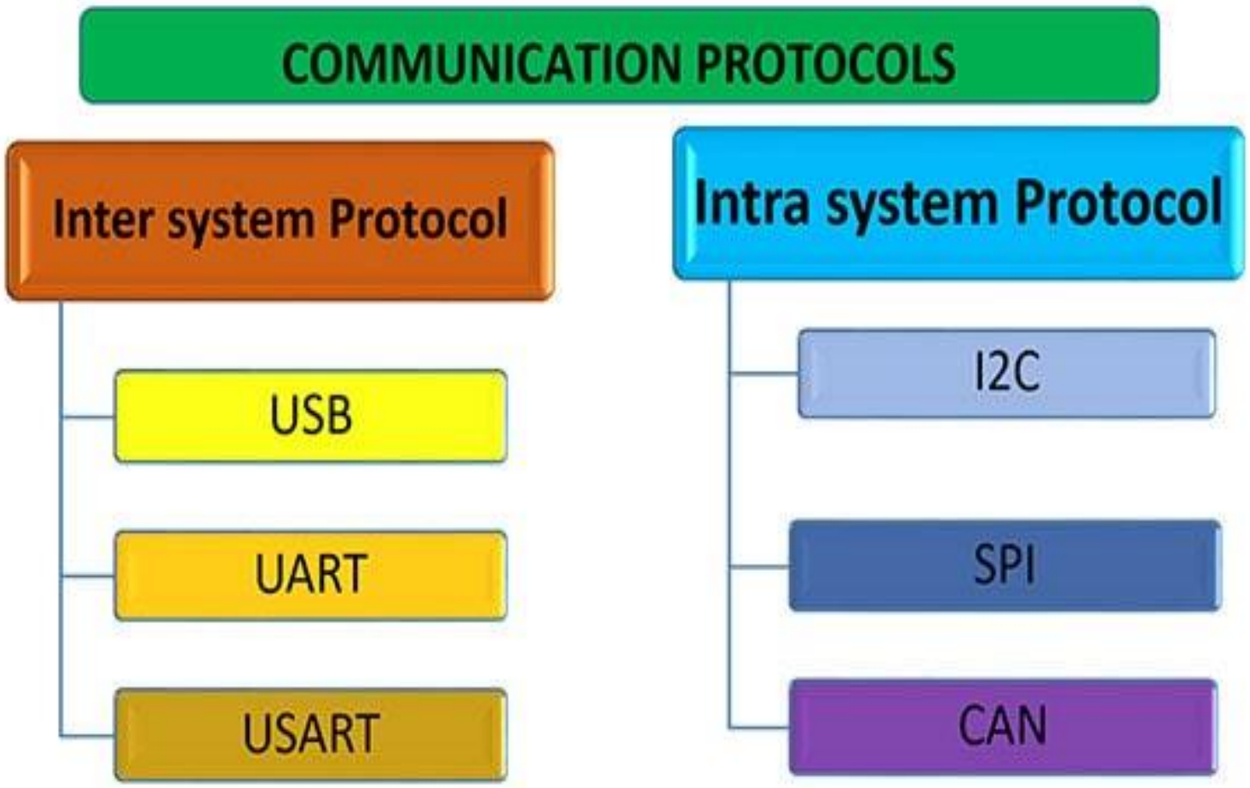
I/O sub system



COMPONENTS

- Processor Interfaces (GPIO, SPI, I2C, UART)
- Peripheral Controllers
- Device Drivers
- Interrupt Handling Mechanisms
- I/O control logic
- Bus Interface
- I/O Buffers and Caches

COMMUNICATION PROTOCOLS



REAL WORLD EXAMPLES

- Automotive systems
- Home Appliances
- Consumer Electronics
- Industrial Automation
- Healthcare Deviccs
- Aerospace & Defence
- Internet of Things
- Energy management systems

OUTPUT SUBSYSTEMS

- The output subsystem in an embedded system refers to the hardware and software components responsible for generating and delivering information or signals to external devices or users.
- It encompasses various output devices such as displays, actuators, audio devices, and communication interfaces.
- The output subsystem processes data received from the system's processing unit or other input sources and presents it in a usable format to fulfill specific requirements or user interactions.
- It plays a critical role in conveying information, providing feedback, and controlling external processes in embedded systems across a wide range of applications.

DESIGN CONSIDERATIONS

Factors influencing design choices are

- Power consumption
- Size Constraints
- Perfomance Requirements
- Cost considerations
- Environment conditions
- User experience
- Regulatory Compliance
- Interface Compatability

OUTPUT GENERATION PROCESS

- The output generation process in embedded systems refers to the sequence of steps involved in producing and delivering meaningful output to external devices or users based on processed input data

- It encompasses various stages, including interpreting input data, formatting it for the target output devices or interfaces, generating the appropriate output signals or actions, and providing feedback to users or external systems.

- The output generation process aims to effectively translate processed information into actionable outputs, ensuring that embedded systems fulfill their intended functions user requirements

TRENDS & DEVELOPMENT

- **Sensor Fusion and Multimodal Input:** Integration of multiple sensors and input modalities (such as touch, gesture, voice, and vision) to enhance user interaction and system functionality. Sensor fusion techniques combine data from various sensors to provide more accurate and robust input recognition.

- **Haptic Feedback**: Adoption of haptic feedback technologies to provide tactile sensations and enhance user experience. Haptic feedback allows users to receive touch-based feedback, such as vibrations or force feedback, enhancing the realism and intuitiveness of interactions with embedded systems

- **Gesture Recognition and Natural User Interfaces (NUI):** Advancements in gesture recognition algorithms and hardware enable intuitive interaction with embedded systems through hand gestures, body movements, or facial expressions. NUIs aim to create more natural and immersive user interfaces, reducing reliance on traditional input devices like keyboards and mice.

- **Wireless Connectivity and IoT Integration**: Increasing integration of wireless communication protocols (such as Wi-Fi, Bluetooth, Zigbee, and LoRa) to enable connectivity with other devices and IoT ecosystems. This facilitates seamless data exchange and remote control capabilities, enhancing the versatility and connectivity of embedded systems.

THANK YOU