

**FULL NAME: ADELINO T. RACUSA**

**EMBEDDED SYSTEM** - a specialized computer system designed to perform specific tasks.

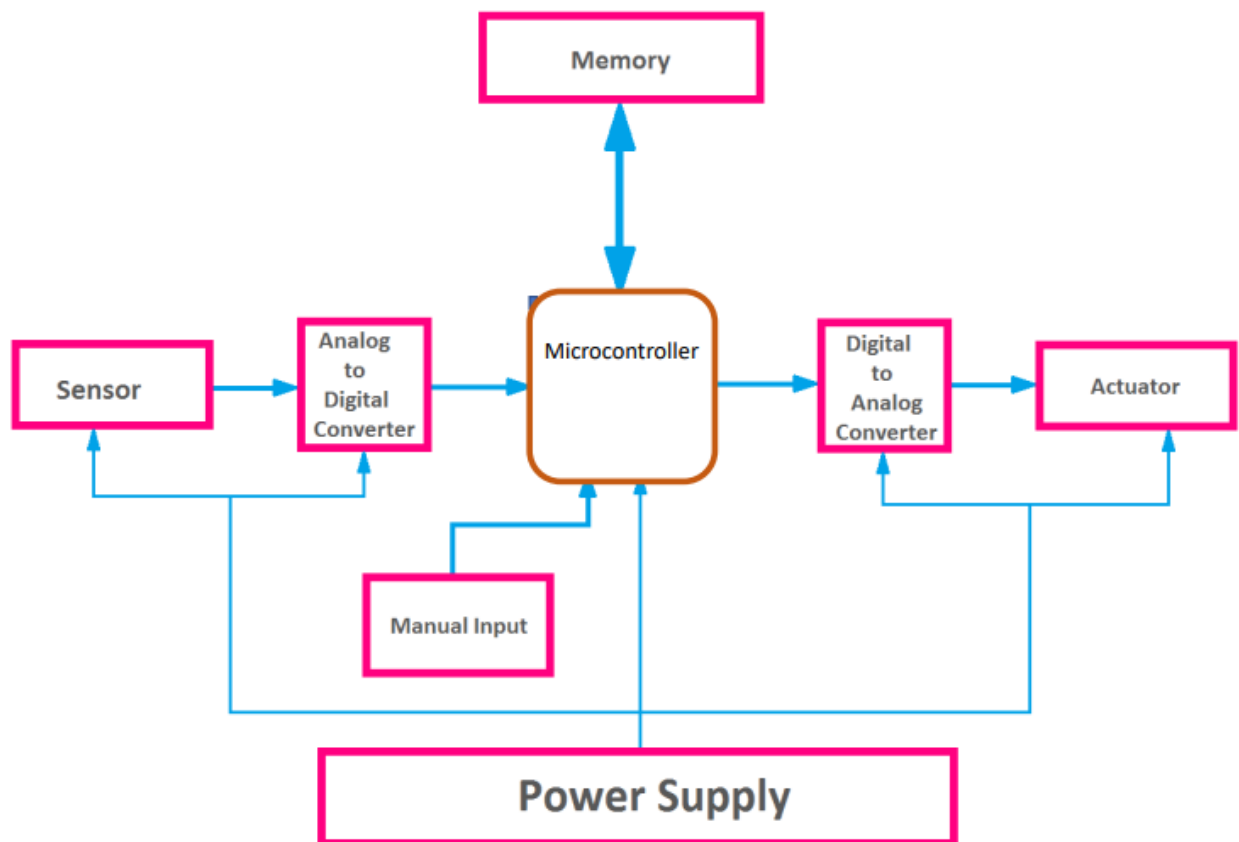
**MICROCONTROLLER** - has all the essential components of a computer system integrated onto a single chip. Low power consumption

**MICROPROCESSOR** - a central processing unit (CPU) that requires external components such as memory and I/O devices to function. Higher power consumption due to more extensive architecture.

#### **REAL-LIFE APPLICATION OF EMBEDDED SYSTEMS**

- Traffic Management
- Medical Care
- Airplane Traffic Controller
- Consumer Electronics
- Industrial Automation
- Building Management System
- Location Mapping

#### **BLOCK DIAGRAM OF EMBEDDED SYSTEMS**



**PARALLEL INPUT & OUTPUT** - refers to the method of exchanging data between the embedded system and external devices using a parallel interface.

**REAL-TIME SYSTEM** - a computer system or software that is designed to respond to events and process data in a time-critical manner.

**SENSORS** - devices that detect and measure physical phenomena or environmental variables and convert them into electrical signals.

**APPLICATION (ROM):**

- **FIRMWARE STORAGE:** ROM is commonly used to store firmware, which includes the program code that controls the embedded system's operation. It provides a reliable and permanent storage medium for critical software components.
- **BOOT LOADERS:** Boot loaders, responsible for initializing the system and loading the operating system, are often stored in ROM. This ensures that the bootloader remains intact and cannot be modified by unauthorized sources.
- **SYSTEM CONFIGURATION DATA:** ROM is useful for storing configuration data, such as calibration parameters, default settings, and system-specific information that needs to be retained even during power cycles.

**MEMORY SHADOWING** - refers to the practice of duplicating the content of a memory region in different address spaces. This duplication is typically done to enhance system performance and flexibility by providing faster access to the duplicated memory content.

**ADVANCED PARALLEL INPUT & OUTPUT TECHNIQUES** - refers to the practice of duplicating the content of a memory region in different address spaces. This duplication is typically done to enhance system performance and flexibility by providing faster access to the duplicated memory content.

**SYNCHRONOUS TRANSMISSION** - no gap between data as they share common clock. Sending and receiving data occur at the same rate at the same time.

**ASYNCHRONOUS TRANSMISSION** - has gap between data due to start and stop bit feature. Sending and receiving are done at different rates.

## **CLASSIFICATION OF EMBEDDED SYSTEMS (ENUMERATION)**

1. Based on Functionality
  - a. Standalone Systems
  - b. Networked Systems
2. Based on Performance
  - a. Real-Time Systems
    - i. Hard Real-Time
    - ii. Soft Real-Time
  - b. High Performance Systems
3. Based on Size and Complexity
  - a. Small Scale Embedded Systems
  - b. Medium Scale Embedded Systems
  - c. Large Scale Embedded Systems
4. Based on Industry/Domain
  - a. Automotive Embedded Systems
  - b. Medical Embedded Systems
  - c. Industrial Embedded Systems
  - d. Consumer Electronics Embedded Systems

## **ROLE OF INPUT-OUTPUT IN EMBEDDED SYSTEMS (ENUMERATION)**

1. Data Acquisition
2. Control
3. Communication

## **COMMON SERIAL COMMUNICATION (ENUMERATION)**

1. UART
2. SPI
3. I2C
4. CAN
5. RS-232
6. USB

## **TYPES OF SENSORS**

1. Temperature Sensors
2. Pressure Sensors
3. Humidity Sensors
4. Motion Sensors
5. Light Sensors
6. Proximity Sensors
7. Accelerometers

8. Gyroscopes
9. Gas Sensors
10. Biosensors
11. Position Sensors
12. Vibration Sensors
13. Sound Sensors

#### **SENSORS COMMON WORKING PRINCIPLES**

1. Resistive – resistance based on measured quantity
2. Capacitive – changes in capacitance
3. Optical – light changes in intensity, reflection, or absorption
4. Piezoelectric – mechanical stress or pressure
5. Magnetic – changes in magnetic field
6. Ultrasonic – use sound waves to detect
7. Chemical – use chemical reactions and interaction to detect

#### **PLATFORMS**

- Arduino UNO Rev3
- Arduino MEGA2560
- Arduino UNO R4 Minima
- Arduino UNO R4 Wifi
- Raspberry Pi 3 Model B
- Raspberry Pi 4

#### **KEY CHARACTERISTICS OF RTOS**

- Real-Time Responsiveness
- Preemptive Multitasking
- Deterministic Behavior
- Interrupt Handling
- Deterministic Timing
- Reliability and Fault Tolerance

#### **ACRONYMS**

- MCU – Microcontroller Unit
- SoC – System on a Chip
- RTOS – Real-Time Operating System
- IDE – Integrated Development Environment
- SDK – Software Development Kit

- GPIO – General Purpose Input/Output
- I2C – Inter-Integrated Circuit
- SPI – Serial Peripheral Interface
- PWM – Pulse Width Modulation
- ADC – Analog-to-Digital Converter
- DAC – Digital-to-Analog Converter
- ISA – Industry Standard Architecture
- PCI – Peripheral Component Interconnect
- UART – Universal Asynchronous Receiver-Transmitter
- SPI – Serial Peripheral Interface
- CAN – Controlled Area Network
- RS-232 – Recommend Standard 232
- USB – Universal Serial Bus
- MOSFET – Metal Oxide Semiconductor Field Effect Transistor
- ROM – Read-Only Memory
- RAM – Random Access Memory
- PROM – Programmable Read-Only Memory
- EPROM – Erasable Programmable Read-Only Memory
- EEPROM – Electrically Erasable Programmable Read-Only Memory
- SCADA – Supervisory Control And Data Acquisition
- PLC – Programmable Logic Controller