

# **FUNDAMENTALS OF MICROPROCESSOR SYSTEMS**

# **MODULE OUTLINE**

- 1. HISTORICAL BACKGROUND**
- 2. THE MICROPROCESSOR**
- 3. MICROPROCESSOR SYSTEMS**
- 4. PROGRAMMABLE SYSTEMS AND DEVICES**
- 5. APPLICATIONS OF MICROPROCESSORS**
- 6. DESIGN OF MICROPROCESSOR SYSTEMS**
- 7. MICROPROCESSORS VS MICROCONTROLLERS**

# **1. HISTORICAL BACKGROUND OF THE MICROPROCESSOR**

- **INVENTED BY Dr MARCIAN EDWARD “Ted” HOFF IN 1969.**
- **Ted HAD JOINED INTEL IN 1968**
- **OTHER INVENTORS ASSOCIATED WITH INTEL 4004 ARE:**
  - **STANLEY MAZOR (US ENGINEER)**
  - **MASATOSHI SHIMA (JAPANESE ENGINEER)**
  - **FEDERICO FAGGIN (US PHYSICIST)**

# 2. THE MICROPROCESSOR

- **CONTROLLING UNIT OF O MICROCOMPUTER**
- **LAI D OUT IN A SILICON CHIP**
- **CAN CARRY OUT:**
  - **LOGICAL OPERATIONS**
  - **CALCULATIONS**
  - **HANDLING DATA**
  - **RUN PROGRAMS**

# **3. MICROPROCESSOR SYSTEMS**

## **3.1. CONVENTIONAL COMPUTER SYSTEMS**

- **KNOWN AS CENTRAL PROCESSING UNIT (CPU) AND HAS THE FOLLOWING FEATURES:**
  - **ASSOCIATED WITH STORED PROGRAM COMPUTER**
  - **CONTROL UNIT – CLOCKED SEQUENTIAL MACHINE**
  - **ARITHMETIC AND LOGIC UNIT (ALU)**

# 3. MICROPROCESSOR SYSTEMS - contd

## 3.1. CONVENTIONAL COMPUTER SYSTEMS – contd

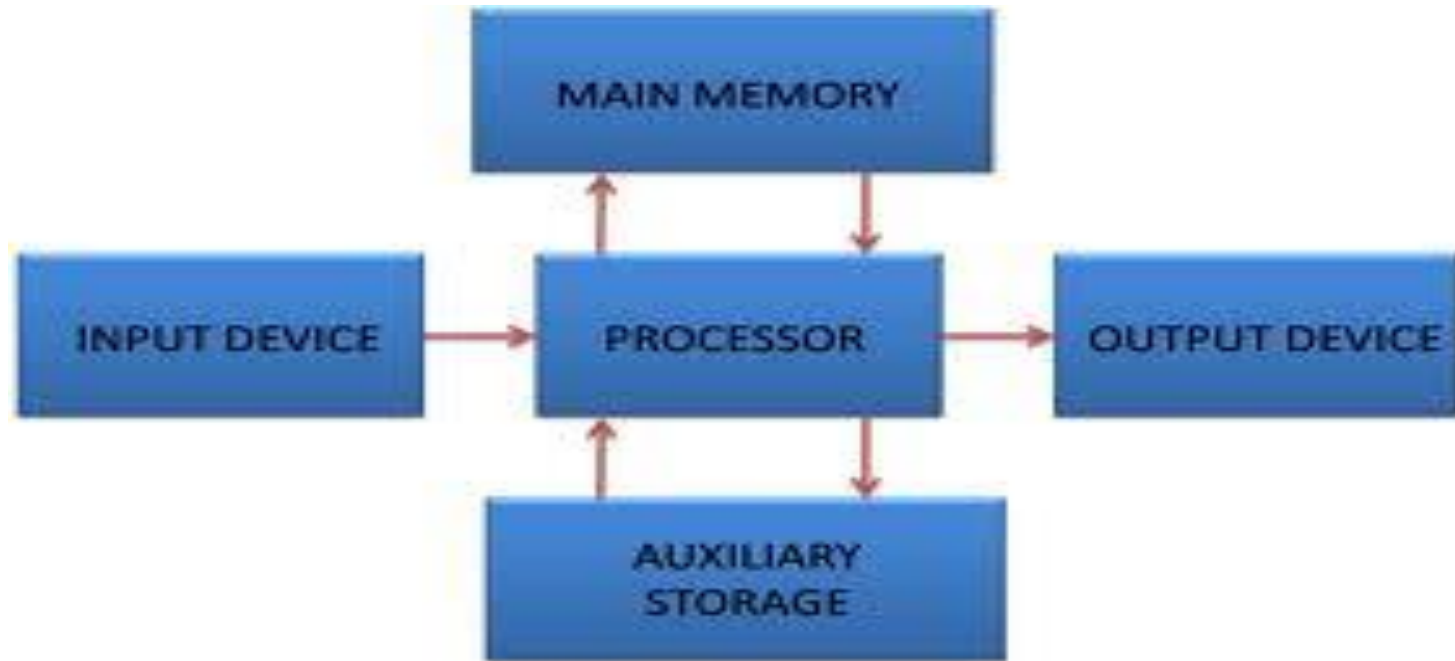


Figure 1: Schematic Diagram of a Computer System

# 3. MICROPROCESSOR SYSTEMS - contd

## 3.1. CONVENTIONAL COMPUTER SYSTEMS – contd

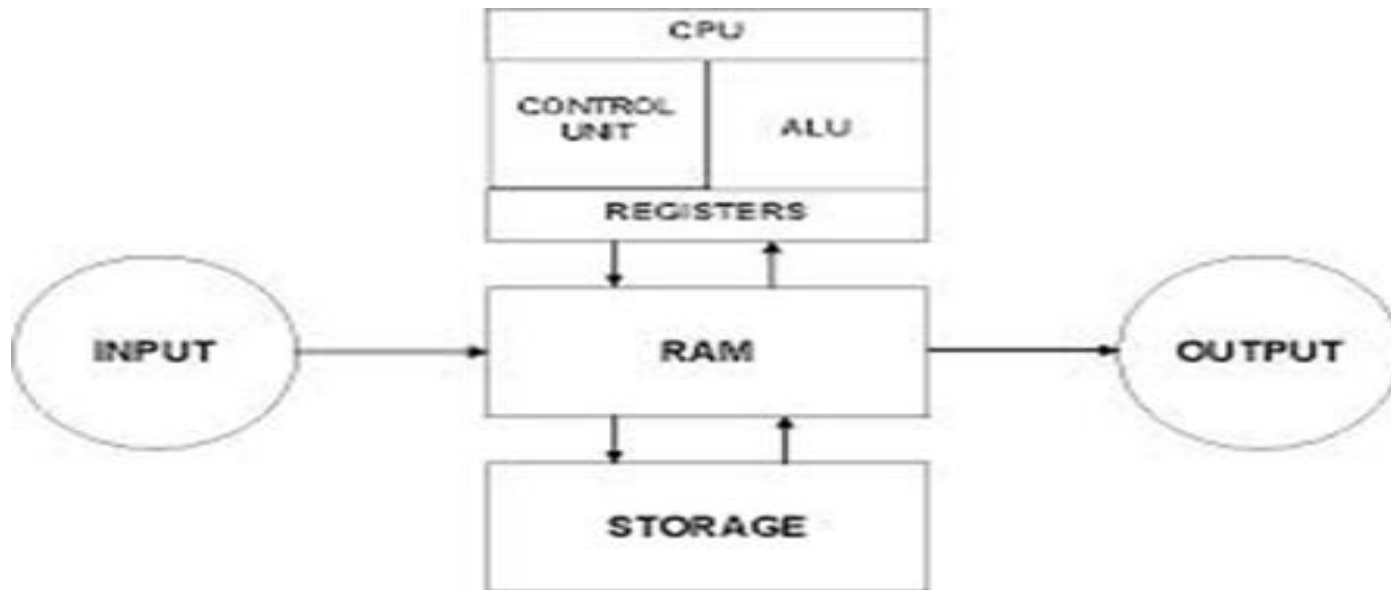


Figure 2: Schematic Diagram of a Computer System with CPU Details

# **3. MICROPROCESSOR SYSTEMS - contd**

## **3.2. THE MICROPROCESSOR**

- **MICROPROCESSOR TECHNOLOGY CLOSELY LINKED TO IC TECHNOLOGY**
- **SSI:  $\leq 12$  GATES INTEGRATED**
- **MSI: 13 – 99 GATES INTEGRATED**
- **LSI:  $\geq 100$  GATES INTEGRATED**

# **3. MICROPROCESSOR SYSTEMS - contd**

## **3.2. THE MICROPROCESSOR - contd**

- **INTERFACES WITH PERIPHERAL ICs:**
  - ♦ **READ-ONLY MEMORY (ROM) WHICH KEEPS DATA EVEN IF POWER IS OFF**
  - ♦ **READ WRITE MEMORY (RWM) – TEMPORARY DATA STORAGE**
  - ♦ **SPECIAL ICs - EPROM**
- **VLSI – MILLIONS OF TRANSISTORS INTEGRATED IN A SINGLE CHIP**

# **3. MICROPROCESSOR SYSTEMS - contd**

## **3.3. BUSSED STRUCTURE OF A MICROPROCESSOR SYSTEM**

- **BUS – GROUP OF CONNECTIONS OF COMMON FUNCTION**
- **TYPES OF BUSES:**
  - ◆ **ADDRESS BUS - UNIDIRECTIONAL**
  - ◆ **CONTROL BUS - UNIDEIRECTIONAL**
  - ◆ **DATA BUS - BIDIRECTIONAL**
- **REGISTERS ARE PRIMARY DATA STORAGE IN THE CPU**

# **3. MICROPROCESSOR SYSTEMS - contd**

## **3.3. BUSSED STRUCTURE OF A MICROPROCESSOR SYSTEM - contd**

- **REGISTERS ARE PRIMARY DATA STORAGE IN THE CPU**
  - ◆ **OPERATIONAL REGISTERS**
  - ◆ **STORAGE REGISTERS**
- **SPEED – IN MHz or GHz**
- **n BIT – MAINLY DEFINED THE DATA BUS SIZE AND GENERAL PURPOSE REGISTER WIDTH**

# **4. PROGRAMMABLE SYSTEMS AND DEVICES**

## **4.1. APPLICATION PROGRAMS**

- MACHINE LANGUAGE**
- ASSEMBLY LANGUAGE USES MNEMONICS**
- HIGH-LEVEL LANGUAGE, e.g.: C++, Java, C#, Python, ...**
- HIGH-LEVEL LANGUAGE DO BENEFIT OF APIs FROM OPERATING SYSTEMS**

# **4. PROGRAMMABLE SYSTEMS AND DEVICES**

## **4.2. PROGRAMMABLE PERIPHERAL ICs AND DEVICE CONTROLLERS**

- INPUT AND OUTPUT DEVICES NEED TO INTERFACE WITH  $\mu$ P**
- INTERFACES ARE DEVICE CONTROLLERS**
- THESE ARE PROGRAMMED FOR SYNCHRONISATION**

# **4. PROGRAMMABLE SYSTEMS AND DEVICES**

## **4.3. PROGRAMMABLE LOGIC DEVICES**

- ARRAYS OF GATES AND FLIP-FLOPS**
- PROGRAMMED TO REDUCE  
PRODUCTION COST OF PERIPHERALS**
- MAKE USE OF BOOLEAN ALGEBRA AND  
DIGITAL ELECTRONICS.**

# 5. APPLICATIONS OF MICROPROCESSORS

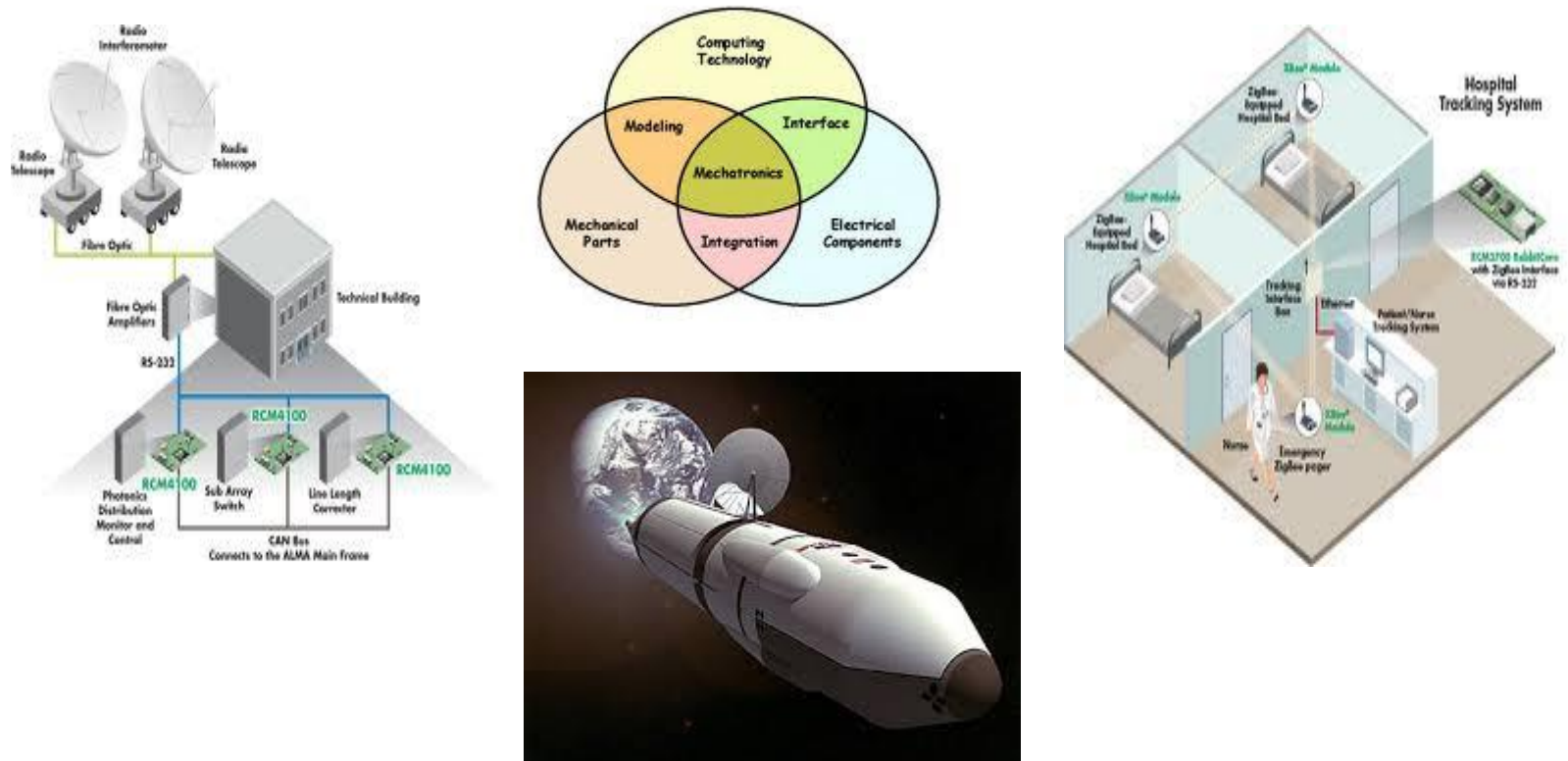


Figure 3: Microprocessors Applications

# **6. DESIGN OF MICROPROCESSOR SYSTEMS**

- DEFINITION OF THE PROBLEM**
- SYSTEM ANALYSIS – USER SPECIFICATION REQUIREMENTS**
- SYSTEM ARCHITECTURE**
- DETAILED DESIGN**
- IMPLEMENTATION**
- TESTING, TESTING, TESTING**
- COMMISSION OF THE SYSTEM**

# **7. MICROPROCESSOR VS MICROCONTROLLER**

- **MICROPROCESSOR NEEDS PERIPHERALS**
- **MICROCONTROLLER IS A MINICOMPUTER ON A SINGLE CHIP**